

Abstract

This study was undertaken to examine the prevalence of bronchitis (cough with phlegm) symptoms in teenagers who either smoked cigarettes on a regular basis (active smokers) or were non-smokers but who are exposed to passive smoking (passive smokers) in the home. The study was undertaken in 1995 and repeated in 1998. The 1995 study was a cross sectional questionnaire survey of smoking habits in secondary school children aged 13-14 years and was undertaken as part of the ISAAC questionnaire survey. Thirty representative and randomly selected schools from throughout the Republic of Ireland took part in the study. In the 1995 study, 3066 students completed a questionnaire on their current smoking habits and symptoms of cough and phlegm. We found that 634 (20.7%) of these young teenagers actively smoked cigarettes with significantly more females smoking than males with 23.3% of girls compared to 17.6% boys (p = 0.0001). We found that 46.3% of non-smoking children were exposed to smoking in the home (passive smokers) with parental smoking accounting for most of the passive smoking. Bronchitis symptoms were more commonly reported in active smokers compared to non-smokers with an odds ratio of 3.02 (95% CI 2.34-3.88)(p< 0.0001) or in passive smokers compared to those not exposed to smoking with odds ratio of 1.82 (95% CI 1.32-2.52) (p< 0.0001). The 1998 study showed similar results for smoking habits, passive smoking and prevalence of bronchitis symptoms as with the 1995 study. These results document that increased bronchitis symptoms occur in teenagers exposed to active or passive smoking.

Introduction

Cigarette smoking is the major known environmental risk factor for the development of chronic obstructive pulmonary disease (COPD) and the prevalence of and mortality of COPD reflects the smoking history in a given population¹. While, the natural history of chronic bronchitis is not clearly understood, COPD usually presents in the 4th or 5th decade of life in smokers and patients may experience a chronic cough with phlegm for many years after commencing significant daily cigarette consumption². With objective lung function measurements there is a strong dose-response relationship between the amount of cigarettes smoked and the rate of yearly decline in pulmonary function^{2,3}. Smoking is also associated with increased episodes of acute bronchitis in children especially among girls³. The Royal College of Physicians Report on smoking in 1992 from the United Kingdom showed that older teenage smokers have higher rates of cough or phlegm of between two and six times that of non-smokers and that with quitting smoking may not lead to elimination of symptoms⁴. Active smoking for as short a period as one year was enough to produce cough or phlegm symptoms in young teenagers⁵.

Lung growth and development in children are adversely affected by passive smoking exposure. Jarvis et al. have estimated that in children whose parents smoke the dose of nicotine inhaled is equivalent to the children themselves actively smoking 30-80 cigarettes a year⁶. Passive maternal smoking to baby either in-utero or in infancy has subsequently been shown to be associated with decreased lung function in children of school going age and that this effect may persist into adulthood^{7,8}. Parental passive smoking is also associated with higher rates of lower respiratory tract infections, middle ear problems and hospital admission especially in early childhood⁹. The 1992 Environmental Protection Agency report on passive smoking from the United States has shown increased levels of either cough or phlegm symptoms in children exposed to parental smoking¹⁰. The prevalence of the combined symptoms of cough and sputum (bronchitis) in active or passive smokers is less certain. This study was undertaken to examine the prevalence of bronchitis in teenagers who either smoke regularly (active smokers) or in non-smokers who are exposed to passive smoking (passive smokers).

Materials and Methods

The study population included school children within the Republic of Ireland aged 13-14 years. Two similar studies were undertaken, the first in the Spring of 1995 and the second in the Spring of 1998.

In the first study children were selected initially to take part as the National Irish centre for the International Study on Asthma and Allergies in Children (ISAAC) study specifically designed to examine for prevalence of asthma, rhinitis and eczema in children aged 13-14 years. Details on the ISAAC study questionnaire¹¹ and the results from the Irish survey in 1995 have been reported¹². As part of our study extra questions on active and passive exposure smoking habits were included in the questionnaire. The basic sampling frame consisted of all post primary schools (n=624) throughout the Republic of Ireland excluding special disability schools and schools with less than 40 pupils of this age group because of the impracticalities of administering the survey. The schools included in the survey were selected by stratified random sampling based on school size, composition (gender) and by Health Board Region to ensure regional diversification. From each school, classes with the greatest proportion of 13-14 year olds were selected (Junior Certificate 2 Classes).

Active Smokers	Survey (n)	Total number (%)	Males (%)	Females (%)	
	1995 (n=3066)	634 (20.7%)	[248 (17.6%)	386 (23.3%)	p= 0.0001]
	1998 (n=2580)	491 (19.0%)	[194 (16.6%)	297 (21.0%)	p= 0.0048]
Passive Smokers	Survey (n)	Total number (%)	Males	Females	
	1995 (n=2432)	1096 (45.1%)	[535	561	p= NS]
	1998 (n=2089)	989 (47.3%)	[455	534	p= NS]

n = number in survey who answered the question NS = not significant

The identical survey questionnaire, methods, age groups and schools were included in the second study carried out 3 years later in the Spring of 1998. The questionnaires used in both studies were self administered under supervision by the researchers on each occasion. School registers were checked for absentees on the day of survey and provision made for completed questionnaires from these students to be returned by post. Strenuous efforts were made to follow up students who were absent on the day the questionnaires were administered. In addition to the core ISAAC questions on asthma and other allergic conditions, we also included questions on cough, and phlegm cigarette smoking habits and exposure to passive smoking in the home. Children were asked a specific question Have you ever smoked a cigarette? If the answered YES, then how often do you smoke nowadays were classified as current smokers but those that had ceased smoking or never smoked were classified as current non-smokers. The specific question used to define a student with passive smoking exposure to tobacco was Does anyone you live with smoke cigarettes regularly at home. If YES, who smokes (mother, father/ guardian/ other person).

This study was approved by the Ethics committee, of Federated Dublin Hospitals Group, Dublin.

Statistical Methods

Prevalence figures are given as a percentage of the total sample that responded. The analysis of the data used the combined male and female data and looked for differences between the total smokers and total non-smoking children and for gender difference between these groups. Data were analysed using the Pearson chi-squared (x²) statistic test for contingency tables. The exact p value is given for each x² value. OR denotes the odds ratio which is equal to 1 when there is no gender or smoker effect. The exact 95% confidence interval is given after the value. All the computations were done using the STATXACT 4 package which is statistical software for exact non-parametric inference.

The non-smoking children from each study were examined for exposure to passive smoking in the home environment and with bronchitis symptoms. Children who did not answer this question were excluded from the analysis. Differences between those exposed to smoking in the home (passive smokers) and those not exposed (non-passive) were analysed using the same statistical methods.

	Year	Active smokers Number (%)	Non-smokers Number (%)	OR (CI)	p value
Bronchitis (Cough with Phlegm)	1995	128 (20.2 %)	188 (7.7 %)	3.04 (2.34 - 3.88)	p <0.0001
	1998	93 (18.9 %)	157 (7.5 %)	3.79 (2.15 - 3.83)	p <0.0001

Results

In 1995 survey 3066 (89.7%) of the 3418 students surveyed responded to the smoking and cough and phlegm questions in the survey. In the 1998 survey 2580 (87.7%) of 2942 students responded in a similar manner. In the 1995 study 2432 teenagers were non-smokers of whom 1096 were exposed to passive smoking in the home. Of this number parents made up 92.1% of the passive smoking. In the 1998 study, 2089 teenagers were non-smokers of which 989 were exposed to passive smoking and 88.9% of the passive smoking was accounted by parental smoking, the remainder was due to other relatives in both studies.

The gender data for the two study years (1995 and 1998) are shown in Table 1. They were slightly more females recruited in each study which reflects the gender balance of this population aged 13-14 years in the Republic of Ireland. In 1995 20.7% of the young teenagers actively smoked and the figure was slightly down at 19.0% in 1998. More females smoked than males in both studies.

In the initial study from 1995, the prevalence of bronchitis symptoms (cough with sputum) were more commonly reported in the active smokers than the non-smoking group and a similar degree of cough and phlegm symptoms was reported in the 1998 study (Table 2). This shows that the association is reproducible in the young Irish teenage population examined three years apart. Bronchitis symptoms were reported in equal degrees in both males and females (results not shown).

	Year	Passive smokers Number (%)	Non passive-smokers Number (%)	OR (CI)	p value
Bronchitis (Cough with Phlegm)	1995	108 (9.9%)	72 (5.7%)	1.82 (1.32 - 2.51)	p = 0.0001
	1998	92 (9.3%)	63 (5.8%)	1.66 (1.27 - 2.35)	p = 0.0033

In the 1995 study the odds ratios for cough with phlegm was 3.02 (95% CI.2.34 - 3.88) (p < 0.0001). The result for the 1998 study was similar with the odds ratios for cough with phlegm being 2.88 (95% CI.2.15 - 3.83) (p < 0.0001).

In the non-smoking teenagers the prevalence of bronchitis symptoms in the children exposed to passive smoking in the home was significantly higher than those not exposed in both the 1995 and the 1998 studies (Table 3). Bronchitis symptoms were reported in equal degrees in both males and females (results not shown).

Discussion

This study has shown a high level of active and passive smoking rates with associated increased bronchitis symptoms in young Irish teenagers. The 1997-98 Irish Health Behaviour in School Age Children Survey showed the smoking prevalence rate for children aged 12-14 years at 19% for both males and females¹³. The overall rate in 1998 in our study of 13-14 year old teenagers was similar at 19% but this was down from 20.6% in 1995. While the downward trend in teenager smoking is welcome the reason underlying it is unclear but it may be a reflection of current national anti-smoking strategies. However, the continued high level of smoking in young teenagers has occurred even though sales of cigarettes are legally restricted in Ireland. The reason for this is unclear, however, a high level of parental smoking may play an important factor as it has been shown to be associated with increased levels of adolescent smoking⁴.

In 1995 and 1998 studies a much higher smoking level was found in girls than boys compared to Irish Health Behaviour in School Age Children Survey¹³. The reason for this difference between the studies is unclear but it may be a reflection of the more national and higher response rate in our two studies.

Our study has also highlighted a reproducible association of bronchitis symptoms in Irish teenagers who actively smoke or in non-smokers exposed to passive smoking, and that this occurs as young as 13-14 years in this study. It is likely that some of the smokers are also exposed to passive smoking in the home and this may have an additive effect on bronchitis symptoms development. Adults who smoke cigarettes and cigars have a higher level of bronchitis symptoms¹⁴. In addition the risk of developing bronchitis symptoms, in adults, increases with the number of cigarettes smoked such that for smokers of half to one pack per day the risk for developing bronchitis is 40-50% and at 2 packs per day the risk is 70-80%¹⁴. Therefore the findings in our study of increased bronchitis symptoms in both active smokers and in non-smokers passively exposed to smoking support the role of a direct effect of tobacco smoke exposure on respiratory health in these young children. It also raises the concern for the subsequent development of COPD as they become older. Of concern too is the risk of subsequent lung cancer development from passive smoking exposure in childhood. One sixth of lung cancer cases in non-smoking adults can be attributed to cigarette smoke exposure in childhood and adolescence¹⁵. The increase in female smoking is also of concern as airway function ill-effects associated with tobacco exposure are more prominent in females¹⁶. In addition, exposure to maternal smoking to the child in-utero or in infancy can lead to subsequent adverse lung function effects in later life^{7,8}.

However, in our study we did not show any significant gender difference for bronchitis symptoms in either the active smokers or those non-smoking children exposed to passive smoking. This suggests that the development of bronchitis symptoms is not solely a gender problem. The mechanisms underlying the development of bronchitis with smoking exposure are not clear but decreased mucociliary clearance, goblet cell hypertrophy or hypersecretion of mucous may play a role leading to subsequent COPD development¹.

In this study there is also a small background level of bronchitis symptoms reported in non-smokers not exposed to smoking. This is similar to that found in other similar communities^{14,17}. The cause for this is unclear but may be due to other factors such as exposure to domestic and atmospheric pollutants or recurrent respiratory chest infections which are common in childhood¹.

The finding from this study of high levels of smoking in young teenagers suggests that future national anti-smoking strategies in the young should be focused on primary school children as a preventative measure to combat smoking initiation which once started is difficult to quit even in young teenagers because of the addictive component to the drug¹⁸. In addition, most adult smokers take up the habit before 20 years of age.^{4,18}

The results from this study of significantly increased levels of bronchitis in young teenage smokers refutes the misconception that bronchitis develops many years after starting the smoking habit¹. It will be of great interest to see how these symptoms progress with time with these teenagers as they get older. In addition, the higher level of bronchitis symptoms in non-smoking children exposed to passive smoking is also of concern and would support the public health advice that no smoke exposure is best.

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