The Effect of the UK's Smoke Free Law on Smoking Prevalence, Tobacco Related Hospital Admissions and NHS Expenditure – A Discussion Seven Years following the Public Smoking Ban

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The consumption of tobacco is a widely researched and discussed area, particularly in terms of health effects. This dissertation aims to add to current and past literature by discussing the impact the smoke free legislation has had on smoking prevalence, tobacco related hospital admissions and consequently NHS expenditure on tobacco related diseases. Particular analysis will be given in terms of age, gender and occupational classification. The methodology and data used is discussed, giving limitations and reference to the quality. The results present the data between years 1974 and 2013, giving interpretation to the trends found. In conclusion, this dissertation finds that smoking prevalence has been largely uninfluenced by the introduction of the smoking ban and hospital admissions due to tobacco related diseases are yet to decline.

1. Introduction

There is extensive research and literature on the health effects of tobacco and consumption of cigarettes. There is additional research on how different tobacco control measures have influenced health and consumption, however, there are limited studies that focus on the effects the smoking ban in the UK had on tobacco consumption and National Health Service (NHS) expenditure. Therefore, the first objective of this paper it to analyse how trends in smoking prevalence have changed pre- and post-smoking ban. Secondly, the number of tobacco related hospital admissions will be assessed in light of the smoking ban, and the final objective is to study whether the smoking ban has impacted NHS expenditure on such diseases. The economic burden of tobacco has been estimated to cost society £13.74 billion per year, this includes: loss of productivity, healthcare costs, cessation services and help from councils in cleaning up (Department of Health, 2011). A combination of tobacco control measures, such as imposing higher taxes and restricting public smoking, is needed in order to reduce tobacco consumption and the negative health effects (Jones *et al*., 2015). Raising tobacco taxes was used primarily to deter consumption, whereas the introduction of the smoking ban in 2007 aimed to reduce the harmful effects of Second Hand Smoke (SHS). It has been shown that raising taxes has been one of the most effective means of deterring consumption amongst the younger and less well off people in society (Gilmore *et al*., 2013), and the smoke-free law has reduced the number of incidents of hospital admissions due to SHS (Department of Health, 2011). Various cohorts within society are affected differently. Jones *et al*. (2015) acknowledges there will be differential impacts from the smoking ban, dependant on age, gender and pre-ban levels of tobacco consumption.

This paper aims to isolate the effect the smoking ban has had on smoking prevalence, hospital admissions and in turn NHS expenditure on tobacco related diseases. To achieve this, I will firstly review current and past literatures to assess changing consumption patterns of tobacco, associated cost to the NHS and appraise the success of previous tobacco control measures. Section 3 will then go on to discuss the methodology used in this study, evaluating the data and any limitations associated with it. Following this, the results are presented in Section 4, with particular focus on age, gender, occupational classification and hospital admissions. The results are discussed and interpreted accordingly. Section 5 concludes the findings of this study including any limitations found. It states that smoking prevalence has been largely unaffected by the introduction of the smoking ban, however, the incidence levels from SHS exposure, especially amongst children, has fallen. Hospital admissions due to tobacco related diseases are yet to decline. Finally this paper suggests that further research needs to be undertaken to accurately assess the monetary burden tobacco consumption has on the NHS.

2. Literature Review

The aim of this Section is to provide an overview of the academic literature that assesses the impact different tobacco control measures have had on both cigarette consumption and NHS expenditure, with emphasis on the smoking ban. A focus will be placed on different cohorts; gender, age and occupational group. This Section will provide evidence from previous studies to examine these effects.

2.1 Overview of tobacco consumption within England

Tobacco consumption is a major preventable cause of death in countries all over the world (World Health Organisation (WHO), 2004). Specifically, within the UK, the highest impact on the NHS is through behavioural factors; poor diet, alcohol consumption and smoking (Scarborough *et al*., 2011). This insinuates that, through national policies aiming to alter individuals' behaviours, such as a smoking ban, a substantial saving to the NHS can be made. WHO (1998) estimated worldwide that tobacco would be responsible for 10 million deaths per year between the decades 2020 – 2030. Consequently policies to reduce tobacco consumption have been a major focus for all countries.

The UK follows similar tobacco consumption patterns to other developed nations. Specifically, within England, deaths from tobacco account for more than the next six most preventable causes of death combined, which includes drug use, road accidents, other accidents and falls, preventable diabetes, suicide and alcohol abuse (Department of Health, 2011, p.5). In 2009 smoking accounted for 81,400 deaths and cost the NHS approximately £50 million per week (Department of Health, 2011, p.5). This shows that tobacco consumption is a huge problem within the UK, both to the consumer, secondary consumers through SHS (secondhand smoke) and to the nation financially. From the mid 20th Century onwards, varying degrees of tobacco consumption control programs have been implemented, such as: restricting advertising, regulation measures, cessation services, fiscal policy of taxation and the national smoking ban. The US Surgeon General stated that:

> *"the mission of comprehensive tobacco control programs is to reduce disease, disability, and death related to tobacco use, a comprehensive approach has been established as the guiding principle for eliminating the health and economic burden of tobacco use*." (US Department of Health and Human Services, 2000)

The most influential and widely debated measures include fiscal policy changes and the national ban, both discussed in detail as follows:

2.2 Smoking ban on Tobacco Consumption

The ban on smoking in public places, as a measure to reduce consumption of tobacco, has been favoured not only from the health care specialists and policy makers but also by the public in large. Chollat-Traquet (1996) acknowledged that among the public there is an agreed consensus that they have the right to breathe air that is not contaminated with the harmful effects of tobacco smoke. Since July 2007, smoking has been prohibited throughout the UK in all enclosed and substantially enclosed work and public places. A 'substantially enclosed' area means premises or structures with a ceiling or roof (including retractable structures such as awnings) and where there are permanent openings, other than windows or doors, which in total are less than half of the area of walls (Health Act 2006). This policy was implemented in order to create a smoke free workplace and smoke free public areas, whilst encouraging cessation among current smokers.

Tobacco smoke has proven to be carcinogenic to humans (International Agency for Research on Cancer, 2004) and contains 43 known cancer-causing agents (WHO, 1998), thus, causing the harmful effects of SHS. Scientific evidence has shown that exposure to SHS causes death, disease and disability (WHO, 2005). The primary aim of the smoking ban was to protect non-smokers from the harmful effects of SHS, with a secondary intention of encouraging current smokers to quit or to reduce the consumption of cigarettes (Jones *et al.*, 2015). The smoking ban has proven to be successful in reducing the number of hospital admissions for heart attacks due to a smoke free environment (Bauld, 2011). There has also been a 70% reduction between 1996 and 2007 in SHS exposure among children, which may partially be attributable to media campaigns leading up to the smoking ban (Bauld, 2011). The Health and Social Care Information Centre (HSCIC) have also published data showing an 18% decrease in smoking related hospital admissions among adults aged 35 and over between the years 2004/05 and 2012/13. The percentage of deaths caused by smoking, however, has been unchanged since 2005 (Lifestyle Statistics, Health and Social Care Information Centre, 2014).

Smoking and consumption patterns differ between cohorts, causing policies to have a higher impact within specific groups. Tobacco consumption is highest among lower socio-economic groups, typically in semi-skilled manual labour jobs, it is also most popular among 20-24 year olds; there is, however, a converging level of incidence of smoking between genders (Royal College of Physicians, 2000). Previous research of the effect the smoking ban has had on different cohorts is summarised below.

2.2.1 Impact of Smoking Ban Within Cohorts

Jones *et al*. (2015) evaluates the impact of the smoking ban in the UK on active smokers and discovers that there were limited short-run effects on both total level of smoking and smoking prevalence. The 'short-run effect' means that the smoking ban has a time lag effect. As it has only been in place for a limited number of years, the benefits from cessation may not be fully realised, thus prohibiting a long run measure.

a) Age and Gender

Jones *et al*. (2015) reveal that gender and age play a role in differing consumption patterns. Their results show that differences in the patterns of consumption are more evident in the cohort 18-34. Among males, those who do smoke do so more intensively but with fewer males smoking overall, whereas females within this cohort consume less cigarettes throughout their lifetime but are less likely to break the habit (Jones *et al*., 2015). When the smoking ban came into place, in 2007 there was a significant increase in the number of people who reported trying to quit, amounting to 300,000 (Glasper, 2011). Further studies have shown, however, that consumption of tobacco has not been affected by the smoking ban, indicating that those particular individuals failed to quit.

A study carried out by Jones *et al*. (2015) examined the success of the smoking ban in relation to the differential timing the legislation was legalised within England (1st July 2007) and Scotland (26th March 2006). It was quasi-experimental, exploiting variation over time and between different cohort groups, using data from the British Household Panel Survey. The main findings from the study were that the introduction of the smoking ban in both countries had limited effects on smoking prevalence and total level of smoking in the short run. Cohorts were affected differently, though. The results showed that the ban may have caused the number of cigarettes smoked among older men to decrease by 1.4 cigarettes a days, but among male moderate smokers consumption increased by 1.6 cigarettes a day; whilst the corresponding coefficients for females were not statistically significant (Jones *et al*., 2015). Other figures have shown that across the English population, 26% of people aged 16-24 smoked in 2009; over recent years this rate has begun to decline, though (Department of Health, 2011). This supports the idea of the short run effect in the Jones *et al*. (2015) paper, as younger cohorts are deterred from smoking thus decreasing smoking prevalence levels in future years. Allender *et al*. (2009) agree that the smoking ban is subject to time lags, thus, having a limited short run effect on prevalence figures and hospital admissions, especially among younger cohorts.

b) Occupational Classification

Consumption patterns and cessation rates have been shown to vary dramatically between occupational groups. It has been found that there is a strong relationship between smoking and occupation, with prevalence rates being twice as high among those in routine and manual occupations to those in managerial and professional occupations (Department of Health, 2011). A study on the patterns and predictors of tobacco consumption among women found that in Britain cessation rates among the poorest groups has changed little across two decades whilst in the better off socio-economic cohorts, the cessation rate has more than doubled within the same time frame (Graham and Der, 1999). This is supported in a more recent study that claims "smoking-related death rates are two to three times higher in low-income groups than in wealthier social groups" and tobacco control programs are thus targeting this group due to the high tobacco consumption (Department of Health, 2011, p.17).

c) Pre Ban Average Daily Consumption of Cigarettes

Jones *et al*. (2015, p.190) states that "trends of smoking differ substantially according to the pre-ban average daily consumption", indicating that the ban may only have a significant effect on heavy smokers consuming more than twenty cigarettes a day, and insignificant effect on lighter smokers. De Chaisemartin *et al*. (2011) and Anger *et al*. (2011) agree that the smoking ban hasn't reduced smoking in the whole population; they do find, however, that consumption for social smokers, who frequently visit bars and restaurants, has been reduced. Callinan *et al*. (2010) provide further support that a smoking ban has little or no effect on active smokers, but they find that it does reduce the effects of passive smoking. The outcome of this study showed no consistent evidence of a decrease in smoking prevalence that was attributable to the ban, but did provide support for the argument that there was a reduction in hospital admissions for cardiac events as well as an improvement in general health as a result of reduced SHS (Callinan *et al*., 2010). Furthermore, Irvine *et al*. (2011), predict that, smokers may now consume their cigarettes within a shorter period of time, making their consumption more intense, than if they were able to smoke in any environment prior to the ban.

2.3 Fiscal Measures to Reduce Tobacco Consumption

Alongside the national smoking ban, the government has used fiscal measures of taxation on tobacco products to reduce the level of consumption. WHO (2004, p.37) stated that "for tobacco control to succeed, a comprehensive mix of policies and strategies is needed, if resources are limited efforts should focus first on raising tobacco prices through increased taxes". Within the EU, the UK has some of the highest priced tobacco products available, as the government tries to deter purchases

(Department of Health, 2011); this has been used in conjunction with other policies alongside the smoking ban to reduce consumption. WHO (2004) reported that for every 10% increase in cigarettes taxes, there is approximately a 4% reduction in consumption, which clearly demonstrates the inverse relationship between tobacco consumption and tobacco taxes.

There is an abundance of literature on the price elasticity of demand for tobacco, some of which is summarised here. As previously discussed the highest prevalence rates are among the younger and lower occupational groups, with WHO (2004) realising that minorities, young persons and low-incomes are the most responsive to price increases. This is further supported in a paper by Gilmore *et al*. (2013, p.1317), who state that "raising tobacco taxes and prices is one of the most effective means of reducing tobacco use, particularly in the young and the less well off – who are known to be the most price sensitive". A study carried out in 2006 showed that under the impact of rising taxes, consumption of both duty-paid and smuggled tobacco has fallen in volume terms per smoker since 1990 (Duffy, 2006). Gilmore *et al*. (2013) look beyond the current changing consumption of tobacco in relation to price and determined an overshifting pricing strategy, where prices are increased on top of tax increases, causes consumers to move from a premium brand to a lower brand and may undermine the public health impacts of the tax increases. It is important to note that tobacco tax accounts for only 3.6% of government receipts (Royal College of Physicians, 2000), inferring that the government is primarily focused on the health implications of deterring tobacco consumption, as opposed to the monetary rewards. A study in the city of Jaipur, India supports these findings. The government of Rajasthan increased tax from 20-40% on all tobacco products from 1st April 2011, with the results summarising that on average a 10% increase in price of cigarettes led to a 8% reduction in consumption within that state (Singh *et al*., 2012). However, they also found that 64% of cigarette users consumed the same amount of tobacco (Singh *et al*., 2012), indicating that once consumers were already addicted price became less of a deterrent. This is further supported by a study in the US, as they conclude there is insufficient evidence to justify that raising cigarette taxes will significantly reduce cigarette consumption among adults and believe that at best a tax increase of 100% will decrease smoking by as little as 5% among smoking adults (Callison *et al*., 2014). Notably, the pool of adult smokers within this year are more likely to have a strong preference towards continuing to smoke, as a they have already been subjected to significant increases in tobacco taxation and continue to partake, but the study does, however, conclude that raising taxes on cigarettes gets a higher response rate from younger cohorts and deters consumption (Callison *et al*., 2014).

2.4 Smoking: Costs to the NHS

From what has been previously mentioned, it is irrefutable that the national smoking ban in 2007 was brought in to lessen the damaging effects of SHS and increase the cessation rate amongst smokers, thus improving the health of the nation. Due to smoking imposing such a large burden on population health and NHS resources, it is important to quantify this burden to help prioritise the limited NHS resources (Allender *et al*., 2009). It is apparent that there has been a fall in consumption of tobacco since the 1990's due to a combination of tobacco control measures. This is reflected in NHS expenditure as the cost of smoking in 2006 was estimated to be 13% lower than if smoking had remained at 1996 levels (Callum *et al*., 2011). In 2006/07 alone, treating smoking-related illnesses cost the NHS approximately £2.7 billion, amounting to over £50 million every week (Department of Health, 2011). A comprehensive study carried out by Callum *et al*. (2011) broke down the costs to the NHS of tobacco attributable diseases in terms of consultations, overnight stays, prescriptions and costs of treating the disease, where the diseases caused by smoking are thought to be those with a causal link, i.e. not diseases which are exacerbated by smoking. The results show that, using 2006 unit costs, in 1996 the burden to the NHS amounted to £3.09 billion compared to £2.70 billion in 2006 which can be accounted for by the decrease in prevalence rates (Callum *et al*., 2011). This study is limited purely to diseases caused by individuals smoking and doesn't take into account the effects of passive smoking, maternal smoking during pregnancy nor the cost to society of informal care and loss in productivity. Parkin (2011) estimated that 60,837 (19.4% of all new cancer cases) are attributable to tobacco; that is 36,537 (23%) of cancers in men and 24,300 (15.6%) of cancers in women, and 86% of total lung cancer diagnosis is due to exposure to tobacco smoke. It is reported that the smoking ban has contributed to fewer children being exposed to SHS at home, thus reducing preventable expenditure of the NHS (Department of Health, 2011).

2.5 Summary

It is evident that the smoking ban has had a minimal effect on smoking prevalence rates amongst the UK population. Smoking prevalence has decreased over the last decade; nevertheless the contribution of the smoking ban is minimal in comparison to fiscal measures. Despite, smoking fatalities being amongst the most preventable causes of death, there has been no notable decrease amongst smoking related diseases, particularly among those aged below 35. However, the level of incidence from SHS has decreased, specifically in the hospitality industry and among children. Prevalence rates are highest among the younger cohorts, i.e. those between 18-34 years of age, and in lower occupational groups, thus making them the target of new policies. It is to be noted that there is a significant time lag when

analysing hospital admissions and disease burden, as a sufficient number of years has not yet passed to calculate the long run effect of changing smoking habits.

3. Methodology

The aim of this Section is to provide a clear understanding of the methodology used in this paper, discussing the data and any limitations that arise from it. This paper is a comparative case study, looking at tobacco consumption patterns before and after the smoking ban came into place. It further explores the effect the ban has had on tobacco related hospital admissions and how it has, in turn, impacted NHS expenditure. The years 1974 to 2013 have been studied where possible, giving an extensive period for a time-series analyses to be conducted.

Time-series is used to provide a platform to extrapolate trends alongside a log-linear model to calculate trend growth both pre- and post-smoking ban. Furthermore, paired t-tests have been used to determine whether the null hypothesis, i.e. that the mean level of smoking prevalence is equivalent amongst both male and females, can be rejected or accepted. To support these quantitative findings, literature from reports, studies and other publications will be used in conjunction to provide both context and further evidence to any conclusions drawn.

The data for this study has been taken from two organisations, The Office of National Statistics (ONS) and The HSCIC. ONS published data from the Opinions and Lifestyle Survey (OPN), General Lifestyle Survey (GLF or sometimes referred to as the GLS) and the General Household Survey (GHS, formally known as the GLS). These surveys have provided continuous data on the economy, population and society from private households since 1971. The ONS is an independent producer of statistics, thus reducing the possibility of bias. Due to the surveys being conducted for over 40 years, survey questions have been adapted in terms of both content and design to make it more relevant to the year in question, however, not affecting the results received. The GLF and GHS have been continuously used for legislative purposes, to give public bodies a more accurate way of analysing new legislations, such as the smoking ban (Office for National Statistics, 2013b). HSCIC publishes data from both the Health Survey for England (HSE) and the Hospital Episode Statistics (HES), both of which are used in this study. The HSCIC is a non-departmental public body sponsored by the Department of Health that provides information and data about health and social care (Health and Social Care Information Centre, 2015). The HSCIC has been providing information to the NHS since 1991 allowing it to run as efficiently and effectively as possible (Health and Social Care Information Centre, 2015).

3.1 Measurement of the Proportion of Smokers within Different Cohorts

The OPN, GLF and GHS provided data for the different cohorts studied in this paper, namely age, gender and occupational classification. Both the OPN and GLF use a randomised method to select participating households, giving equal chance of each household being selected across Britain. From those selected there is only a 60% participation rate; this is, however, still representative of the nation after the sample has been weighted (Office for National Statistics, 2013c). Estimates from the year 2000 onwards are weighted, meaning the sample results are scaled to population size and demographics to provide an accurate representation of the whole population. There is a minor different in the survey approach of the OPN and GLF. The GLF interviews all members of the randomly selected households aged 16 and over, whereas the OPN just interviews one member aged 16 or over. Nevertheless, it has been shown there is no significant difference in results stemming from the slight variation in method.

3.2 Measurement of Current Smokers Perceptions of the Smoking Ban

Data obtained from the HSE has been used to demonstrate individuals' perceived success of the smoking ban and the most favoured reasons for smokers wanting to quit, thus helping to isolate the impact of the smoking ban over other tobacco control measures. The HSE uses multi-staged stratified sampling to select households to conduct face-to-face interviews, self-completion questionnaires, clinical measurements, diaries, physical measurements and CAPI to obtain the information needed. In order to gain information on the 'perceived success' of the smoking ban, smokers were interviewed six months before and after the smoking ban came into place. This allowed disparities to be calculated between intentions and actions pre- and post-smoking ban.

3.3 Measurement of NHS Hospital Admissions and Primary Diagnosis

Data on the number of tobacco related hospital admissions was taken from the HES. Numerical estimates for the number of smoking-attributable admissions was calculated 'using risk ratios for diseases associated with smoking-attributable fatalities…with additional risk ratios for non-fatal diseases attributable to smoking' (Lifestyle Statistics, Health and Social Care Information Centre, 2013, p.83). It is important to note that the data included private patients in NHS hospitals, however, it didn't account for private patients in private hospitals and only those that are resident in England.

3.4 Limitations

Throughout the surveys used, there is potential that some of the figures and statistics obtained have been underestimated. Firstly, on average, consumption is rounded down to the nearest five or ten

cigarettes consumed. Secondly, underestimation in prevalence arises between those aged 16 and 17 as individuals are influenced by the presence of other family members who may disapprove of cigarette consumption within their household. As a result the 'smoking section' of the interview is given as a self-complete questionnaire to complete in private. Finally private patients in private hospitals are excluded from the number of hospital admissions. In this study to be regarding as a heavy smoker, twenty or more cigarettes have to be consumed per day.

A significant limitation of this methodology is isolating the effect the smoking ban has compared to other tobacco control measures. Many factors contribute to changes in smoking prevalence such as finance, health, national policies and personal circumstances. Furthermore, determining whether a tobacco related disease is the primary cause from smoking or is merely exacerbated by smoking is difficult to differentiate.

4. Results and Interpretation

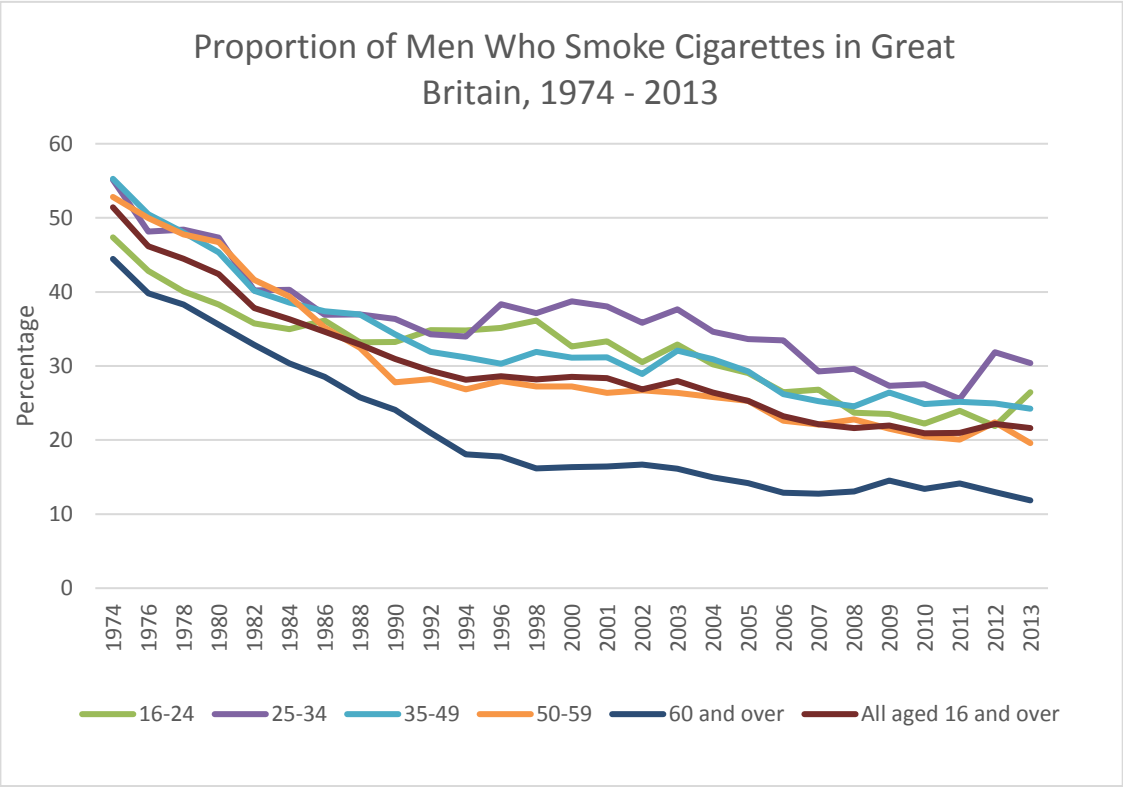
In this Section, a summary of time series data from years 1974-2013 on smoking prevalence between gender, age and occupation are discussed and interpreted, followed by a section on perceived reasons for wanting to quit smoking. This addresses the first objective stated in Section 1. Following this, NHS hospital admissions related to smoking will be presented and interpreted to address the second objective. Subsequently, to address the third objective, analysis will be undertaken to see if there is any correlation between the first two objectives and NHS expenditure.

Section 4.1: Statistics on the Proportion of Smokers by Gender and Age

Figure 4.1 shows the percentage of men who smoke cigarettes in Great Britain between 1974 and 2013. It is evident that there has been a substantial decline in smoking prevalence among men in all age groups since 1974. It becomes apparent that the group aged 60 years and over has had a consistently lower proportion of men smoking compared to any of the other age groups, whereas the cohort of 25-34 year-olds has had the highest smoking prevalence on average. The age group seeing the largest decline in smoking prevalence between 1974 and 2013 was the one classified as 'aged 60 and over', with a 72.73% decline, followed by ages 50-59, 35-49, 25-34 and, lastly, 16-24 with a 44.68% decrease. From when the smoking ban came into place throughout the UK in 2007, Table 4.1 shows percentage declines and average annual percentage declines for both pre- and post-smoking ban within cohorts. There has been only a minor decrease in smoking prevalence amongst men in cohorts post-ban, the largest difference being the 50-59 year olds with an average annual decrease of 1.52%. However, in accounting for all persons aged 16 and over there has been an average annual 0% change

in proportion of men who smoke cigarettes between 2007 and 2013. Smoking prevalence is shown to be declining at a decreasing rate as the pre-ban growth rate was -3.5% compared to a post-ban rate of -0.2%. This has also been discovered in other studies, where it has been found that rates of smoking have declined over the past few decades, but that there has been a relatively small decrease in smoking prevalence since 2007 (Department of Health, 2011).

Figure 4.1: **Proportion of Men Who Smoke Cigarettes in Great Britain, 1974-2013**



Source(s): Office for National Statistics, 2013b

Note(s): 1. Weighted data are only available for 2000 < t
2. Data on cigarette use were collected on a 2Y-basis for t < 2000
3. Estimate t < 2005 are based on a fiscal Y rather than a calendar Y
4. Estimates for 2004 and 2005 both include the period 01/01/05 to 31/03/05 due to a change in a survey period from a fiscal Y to a calendar Y
5. Estimates for 2006 to 2011 include longitudinal data
6. Weighted bases are given to the nearest thousand

Figure 4.2 shows the percentage of women who smoke cigarettes in Great Britain. Similarly to men, it is evident that there has been a substantial decline in smoking prevalence amongst women between 1974 and 2013, however, the peak prevalence rate in 1974 never exceeded 49%, unlike the male equivalent of 55%, both being in the 35-49 age group. Amongst women, the 60 and overs cohort shows that a significantly smaller proportion of females in that age group smoke cigarettes, never exceeding 26%. It is noteworthy that this same female cohort, 60 and overs, has the largest percentage decrease in smokers between the years 1974 and 2013, calculated to be 61. 54%. Age group 50-59 closely follows this, and then 35-49, 25-34 respectively and lastly 16-24 with a 51.22% decrease. From 1986

onwards, the higher aged cohorts begin to show a sharper decline in smoking prevalence than those aged between 16 and 34. Smoking norms prior to the 1980's, show that over 50% of men smoked and over 40% of women smoked specifically in the year 1972 (Royal College of Physicians, 2000), this coincides with a time when adverse health effects weren't fully realised.

Table 4.2: **Percentage Decline in Smoking Prevalence by Gender, Pre-and Post-Smoking Ban, Great Britain, 1974-2013**

Age Group	Decline 1974 - 2006 (-%)	Average Annual % decrease 1974 - 2006 (-%)	Decline 2007 - 2013 (-%)	Average Annual % decrease 2007 - 2013 (-%)
MEN				
16 - 24	44.68	1.40	3.70	0.62
25 - 34	40.00	1.25	-3.45	-0.58
35 - 49	52.73	1.65	4.00	0.67
50 - 59	56.60	1.77	9.09	1.52
60 and over	70.45	2.20	7.69	1.28
All aged 16 and over	54.9	1.72	0.00	0.00
Trend growth rate: all aged 16 and over	3.50		0.20	
WOMEN				
16 - 24	39.02	1.22	20.00	3.33
25 - 34	44.68	1.40	13.04	2.17
35 - 49	48.98	1.53	13.04	2.17
50 - 59	54.17	1.69	9.52	1.59
60 and over	53.85	1.68	16.67	2.78
All aged 16 and over	48.78	1.52	15.00	2.50
Trend growth rate: all aged 16				

Source(s): Office for National Statistics, 2013b

Note(s): 1. Weighted data are only available for 2000 < t
2. Data on cigarette use were collected on a 2Y-basis for t < 2000
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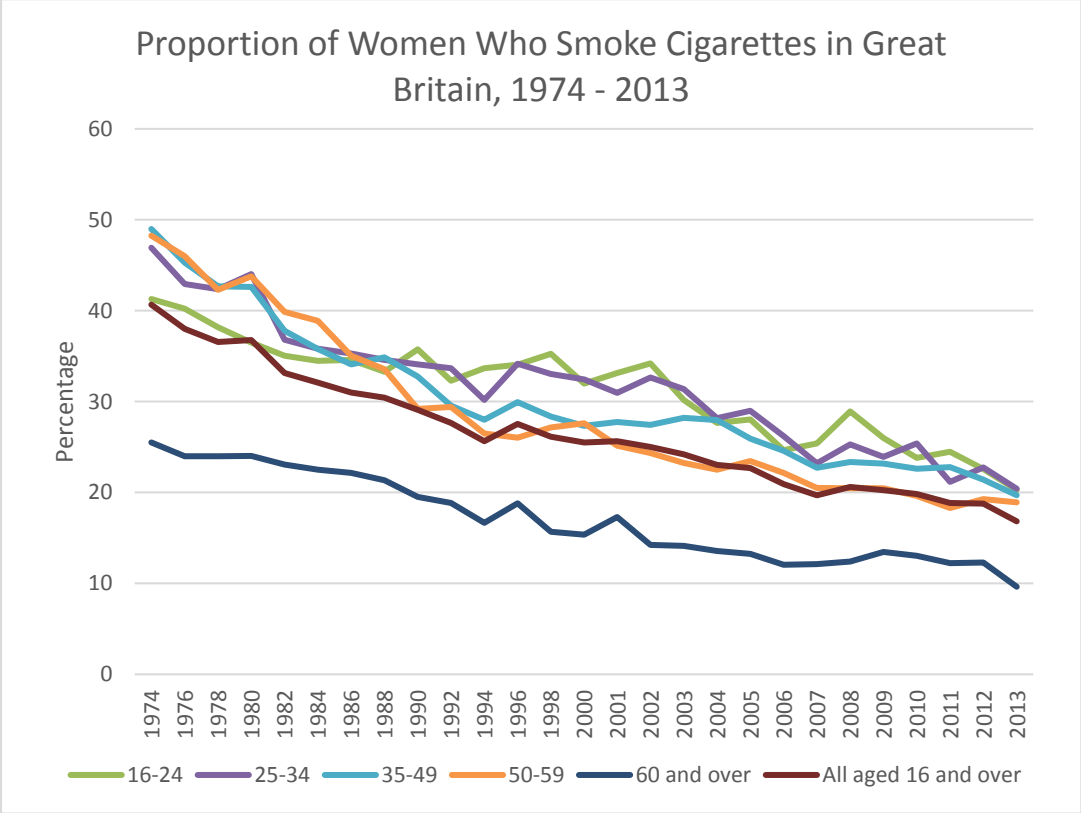
4. Estimates for 2004 and 2005 both include the period 01/01/05 to 31/03/05 due to a change in a survey period from a fiscal Y to a calendar Y
5. Estimates for 2006 to 2011 include longitudinal data
6. Weighted bases are given to the nearest thousand

From when the smoke-free legislation came into place, the effect on female prevalence rates has been greater than that of males, showing a 15% overall decrease for all females aged over 16 and a 2.5% annual average decrease. The largest decrease is amongst the youngest female cohort 16-24, where the prevalence level decreased at an increasing rate with the average annual decline going from 1.22% to 3.33%. This same age group amongst males showed the smallest change since the smoking ban. Despite smoking prevalence declining within this age group across both genders, it is still the cohort with the highest percentage of smokers. Consequentially, with the time-lag effect, a burden will be placed on the NHS, as persons within this age group are the most susceptible to becoming addicted to nicotine (Department of Health, 2011). When comparing both male and female trend growth rates, the smoking ban has had a much greater effect on females, as prevalence rates have fallen by 2.6% compared to the male equivalent of 0.2%, despite the pre-ban trend growth rate being similar across both genders. This indicates that the female consensus about smoking is more uniform across all ages, and it may be inferred that the decline in smoking among females will fall further in years to come as fewer individuals resist inaugurating the addictive habit.

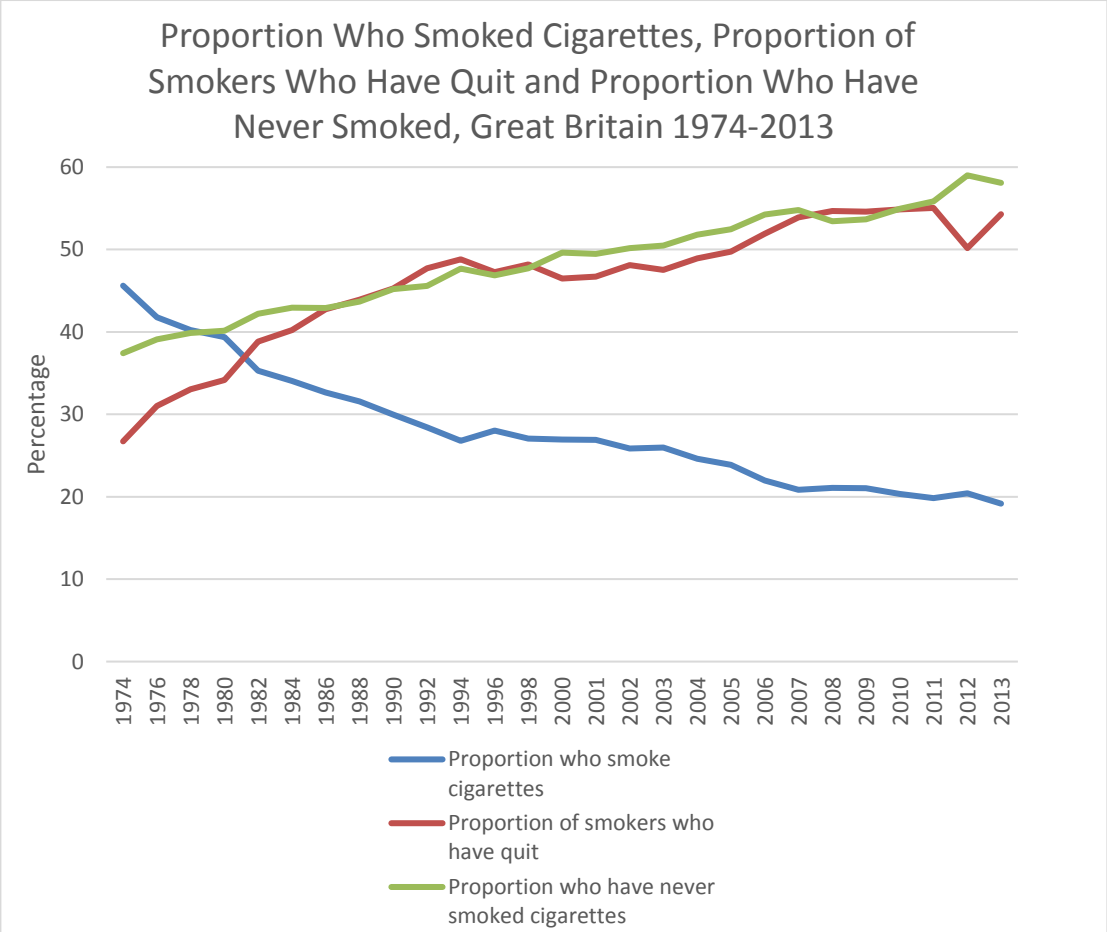
Figure 4.2: **Proportion of Women Who Smoke Cigarettes in Great Britain, 1974-2013**



Through running a paired t-test, the null hypothesis, i.e. that the mean smoking prevalence levels of men is equal to women, can be rejected. The paired t-test results show that men have a higher smoking prevalence (32.90 $\pm$ 7.80) compared to females (29.08 $\pm$ 5.59). Furthermore, pre smoking

ban a t-value of 6.7912 with 19 degrees of freedom (df) is given at a 95% confidence interval, resulting in a two-tailed p-value of 0.0001. As it is less than 0.05 (0<p<0.05), the results are statistically significant allowing the null hypothesis to be rejected. Similarly, post-smoking ban, the male smoking prevalence (21.62 $\pm$ 0.52) is higher than that of women (19.26 $\pm$ 0.48) and a t-value of 4.6588 with 6 df at a 95% confidence level, the two tailed p-value (0.0035) is less than 0.05 (0<p<0.05) meaning the results are statistically significantly different, thus also rejecting the null hypothesis post-smoking ban.

Figure 4.3: **Proportion Who Smoked Cigarettes, Proportion of Smokers Who Have Quit and Proportion Who have never Smoked, 1974-2013**



Source(s): Office for National Statistics, 2013b
Note(s): 1. Weighted data are only available for 2000 < t
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5. Estimates for 2006 to 2011 include longitudinal data
6. Weighted bases are given to the nearest thousand

Figure 4.3 gives a summary of the proportions of the population in relation to smoking prevalence in three different categories: proportion that smokes, proportion that has quit and proportion that has never smoked. Post 1982, it is clear to see that both the proportion of smokers who have quit and the

proportion of those who have never smoked cigarettes are substantially higher than the proportion of those who smoke cigarettes. This coincides with the negative health effects of smoking being publicised; making the public more aware of the health burden smoking creates. Between 1974 and 2013, the overall decline in the proportion that smoke cigarettes has fallen by 58.7%, and the percentage of those that have never smoked has increased by 56.76% in the same time period. After the smoking ban, the percentage of persons who have never smoked has increased by 5.45% and the percentage of those that smoke has fallen by 4.76% over the last 5 years shown in Figure 4.3. Contrary to what has been found earlier, it could be inferred that although the relative percentage changes are small, there has been a positive effect on smoking prevalence since the smoking ban came into place, as a higher proportion of the population ceases smoking or never starts in the first place. Since the smoking ban came into place, there is an upward trend in the proportion of the population who never start smoking, which may now only be realised due to the time lag effect and younger generations being the most influenced. Both De Chaisemartin *et al*. (2011) and Anger *et al*. (2011) have found that although smoking *per se* has not declined throughout the whole population with the introduction of the smoking ban, there has been an increased demand for smoking cessation services among heavy smokers and consumption rates amongst 'social smokers' has decreased.

4.2 Statistics on the Proportion of Smokers by Socio-Economic Classification and Smoking Status

The socio-economic variable, 'occupation', discussed in the literature review, is further explored here to help quantify whether occupation influences smoking prevalence. Table 4.2 shows smoking status by occupation and Figure 4.4 shows the proportion of smokers who have quit by occupation. 'Managerial and professional occupations' are thought to be those that often work in large organisations, have a professional qualification or are self-employed, 'intermediate occupations' are those primarily in services, sales or clerical, whereas 'routine and manual occupations' consist mainly of tradesmen. It is clear to see that the lowest occupational group of 'routine and manual occupations' has a significantly larger percentage of smokers, at 29%, compared to the highest occupational group 'managerial and professional occupations' at 14%. Evidently, the number of persons that have never smoked in the highest occupational group is considerably greater than that of the other two occupations. This may be due to social norms within each classification, as prevalence levels are highest amongst lower occupational groups making it more acceptable to smoke with your peers. Graham *et al*. (1999) revealed that there was a strong socio-economic correlation with consumption of tobacco; smokers with educational qualifications had a mean consumption of almost three cigarettes less than those with no qualifications. To further support this, an OPCS study found that the proportion of women who smoke more than 20 cigarettes a day changes from 41% in the lowest socio-

economic group to 23% in the highest (Office of Population Census and Surveys, 1996), thus highlighting differences in socio-economic norms. However, it is interesting to note the uniformity in the percentage of 'ex-smokers' across all three occupational statuses, not deviating from 22-23%. A prominent factor contributing to socio-economic inequalities is the percentage of those that have 'never smoked' within each classification.

Table 4.3: **Cigarette Smoking Status by Occupational Classification, Great Britain, 2013**

Cigarette Smoking Status by Occupational Classification, Great Britain, 2013

	Managerial and professional occupations (%)	Intermediate occupations (%)	Routine and manual occupations (%)
Smoker	14	18	29
Ex-smoker [1]	22	22	23
Never smoked [2]	63	59	48
Weighted base (000s) [3]	14,248	8,505	11,910
Unweighted sample	3,330	2,000	2,800

Source(s): Office for National Statistics, 2013b

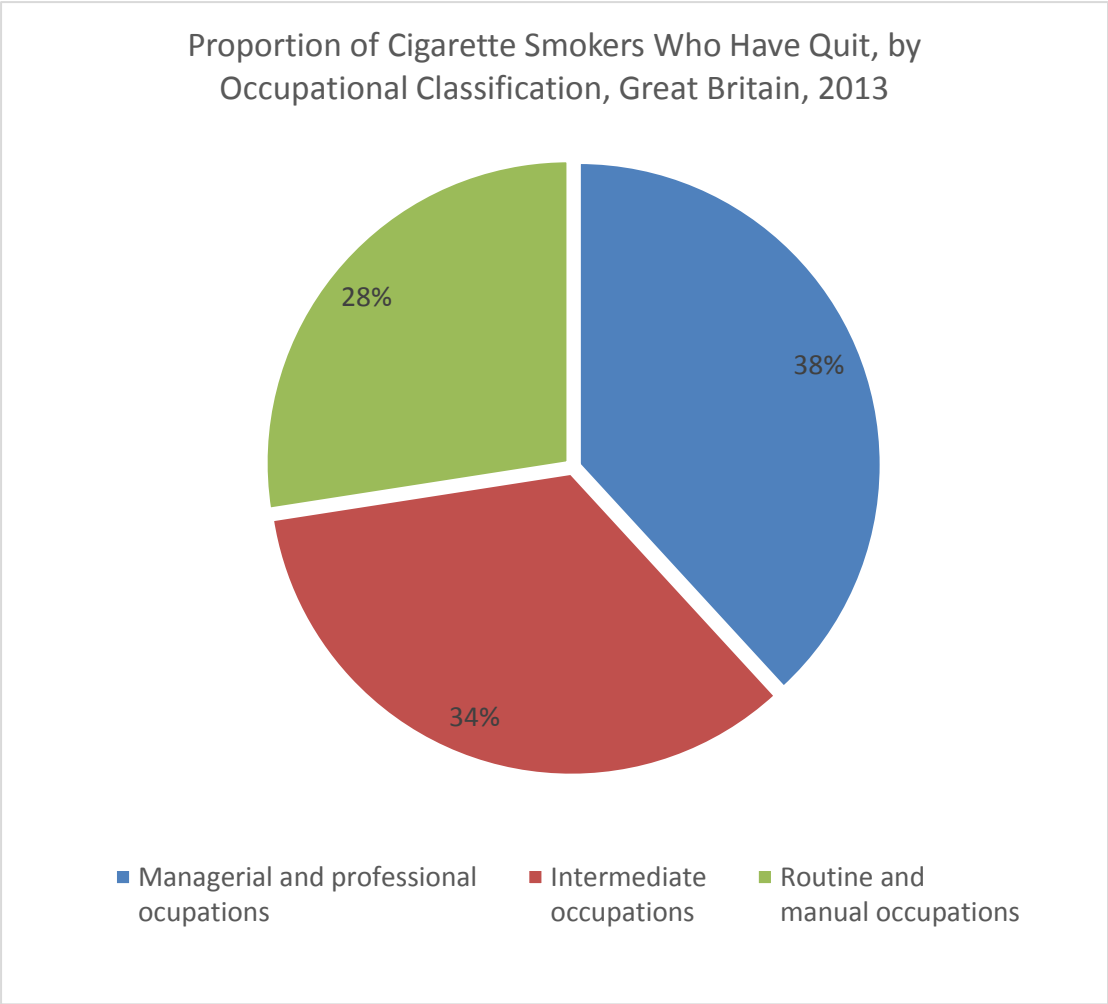
Note(s): 1. The group 'ex-smoker' contains those who said that they do not smoke cigarettes nowadays, but who have smoked cigarettes regularly in the past

2. The group 'never smoked' contains people who said that they do not smoke cigarettes nowadays, and those that have never smoked cigarettes regularly

3. Weighted biases are given to the nearest thousand

Figure 4.4 looks further into the proportion of smokers who have quit by occupational classification. It is important to note that Figure 4.4 is representative of the proportion of all ex-smokers subcategorised into occupational classification, whereas Table 4.2 is occupational classification subcategorised into proportions of current smoking status, hence the different percentages shown. Figure 4.4 shows that 'managerial and professional' occupations have the highest quit rate at 38%, which is significantly higher than those in 'routine and manual' occupations. It has been shown that within Britain between the 1970's and 1990's, the cessation rate among those in higher socio-economic class almost doubles, whereas amongst the poorest groups cessation rates have changed very little (Graham *et al*., 1999).

Figure 4.4: **Proportion of Cigarette Smokers Who Have Quit, by Occupational Classification, Great Britain, 2013**



Source(s): Office for National Statistics, 2013b

Note(s): The proportion of cigarette smokers who have quit is the proportion of all those who said that they have smoked cigarettes regularly, who do not currently smoke.

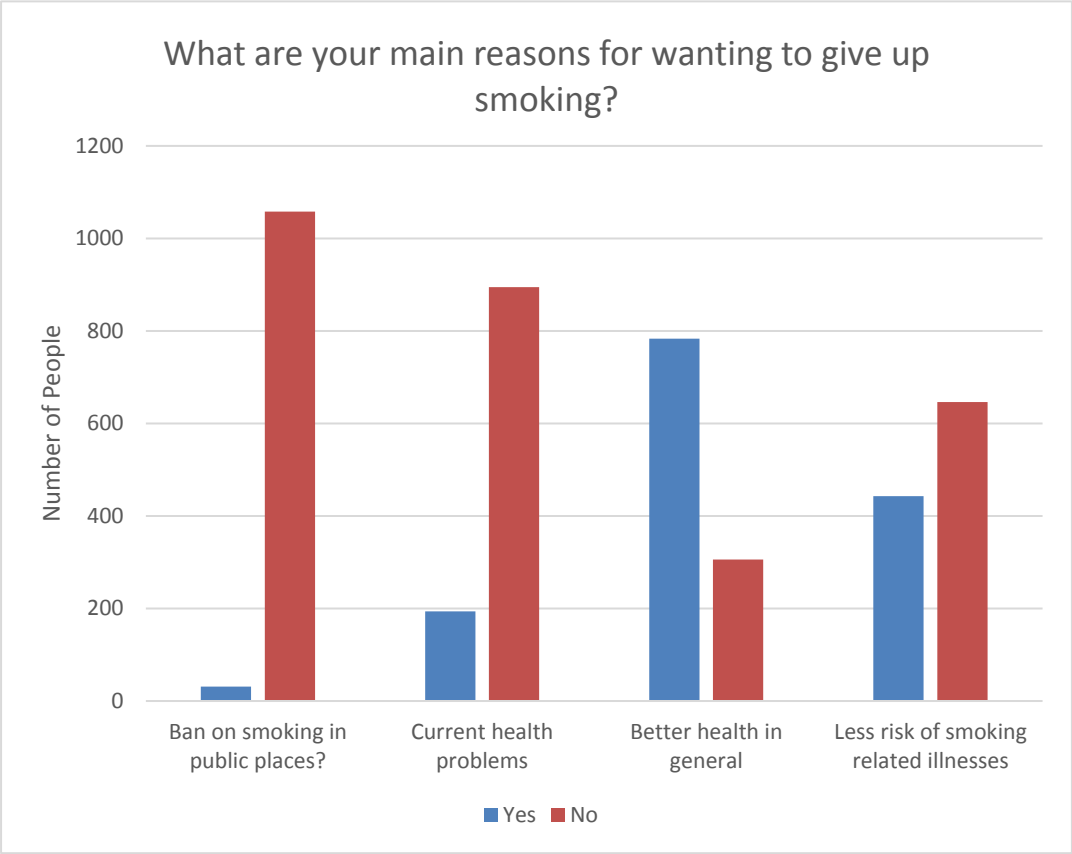
4.3 Statistics on the Perceived Success of the Smoking Ban

In 2013, the HSE produced data on the attitudes to smoking. When 1,089 smokers were presented with the theoretical question 'what are your main reasons for wanting to give up smoking?' out of the nine possible answers[1], Figure 4.5 graphically represents only four of these, as they are the most relevant to this paper. It becomes apparent that the smoking ban was the least motivational reason for smokers wanting to give up, with 1,058 people voting 'no' as their answer. The most popular

[1] The nine possible answers were: Due to a current health problem? For better health in general? For less risk of smoking related illnesses? Due to the ban on smoking in public places? Due to family/friends? Financial main reason? Worried about the effect on children? Worries about effect on other family members? Other? (Health Survey for England, 2007)

reason for wanting to give up smoking was for 'better health in general', with 783 people stating this aspect as being the primary reason. The reason 'less risk of smoking related illnesses' was the most evenly split question, resulting in 646 people answering 'no' and 443 answering 'yes'. This shows that the impact of the smoking ban was minimal in encouraging cessation amongst current smokers in comparison to improving general health. These findings are consistent with Jones *et al*. (2015, p.175) as they also conclude that 'the introduction of the public smoking bans in England and Scotland had limited short-run effects on both smoking prevalence and the total level of smoking'. Importantly, emphasis on 'the short run' must be placed, as benefits from cessation may not be fully realised, thus highlighting the time-lag effect once again.

Figure 4.5: **What are your main reasons for wanting to give up smoking?**

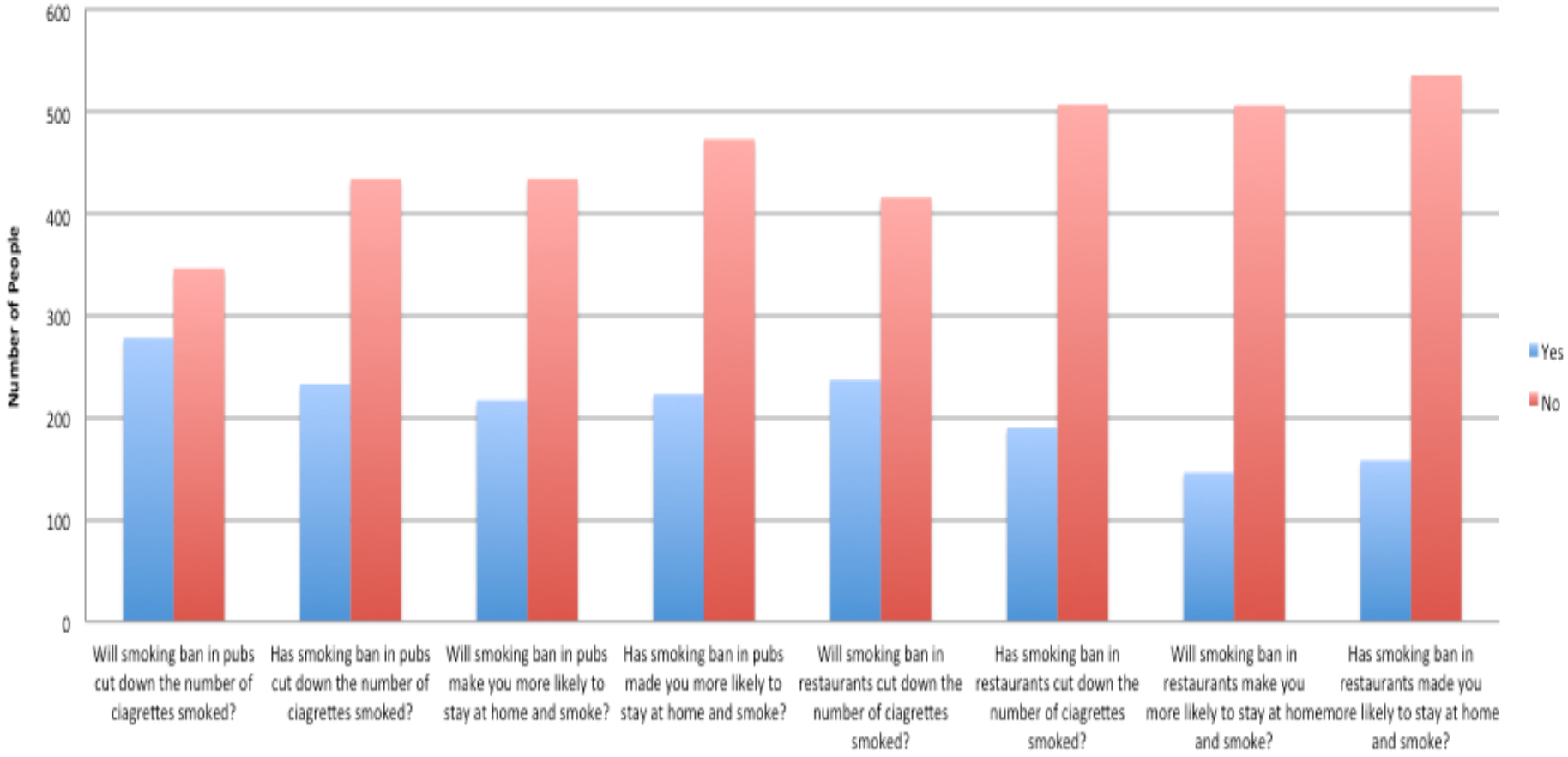


Source(s): Health Survey for England, 2013

Figure 4.6 gives an indication on individuals' perceptions about the success of the smoking ban the year it was brought in in 2007. The valid cases were asked various questions pre-smoking ban and a follow up of these questions was asked post-smoking ban, all of which are presented in Figure 4.6. As is evident from the results, the smoking ban hasn't caused more people to stay at home and smoke, neither has it caused the majority of regular smokers to cut back the number of cigarettes smoked. Despite smokers being more inclined to smoke at home and in the car, it has been shown that there

have been fewer incidents of children being exposed to smoke at home (Department of Health, 2011), thus helping to reduce the number of SHS hospital admissions. It is important to recognise that the smoking ban in pubs has had a higher impact than in restaurants. These self-reported changes in tobacco consumption pre- and post-smoking ban, alongside the reduction in SHS, may have influenced the number of smoking related hospital admissions. Section 4.4 looks further into this.

Figure 4.6: Individuals perceptions on whether the smoking ban has been successful on cutting back the number of cigarettes they smoke, and whether it has been successful, 2007



Source: Health Survey for England, 2007

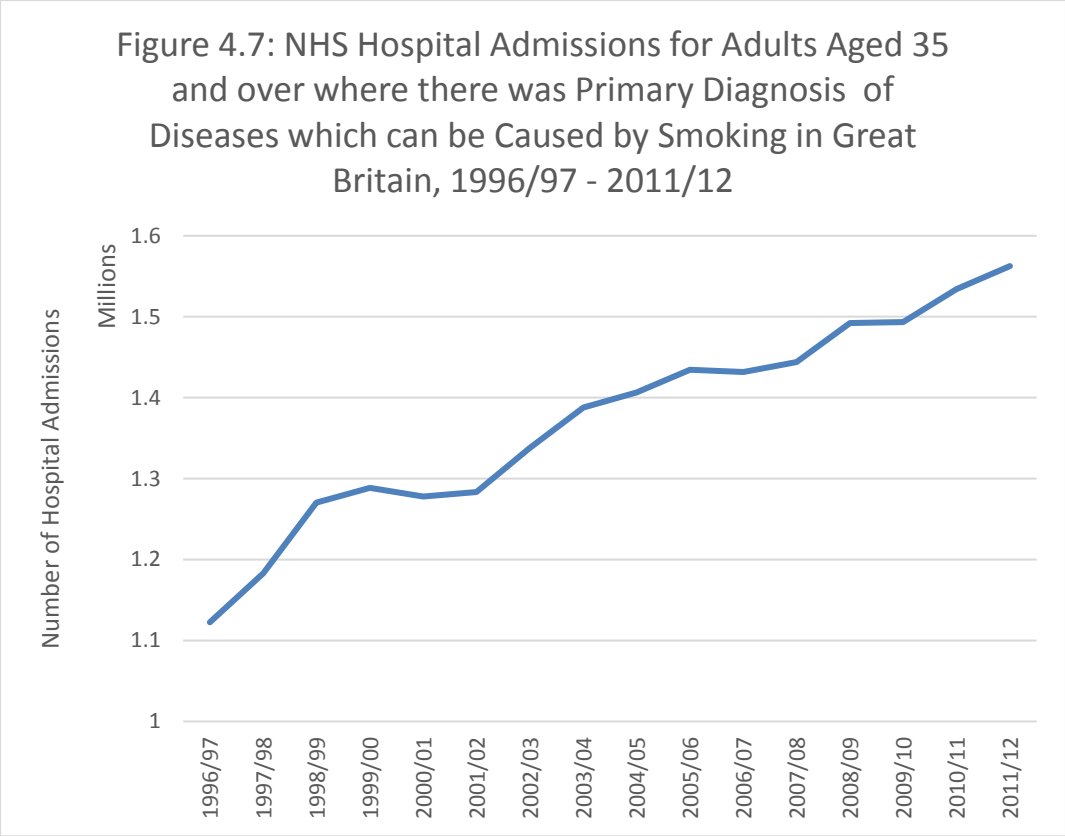
4.4 Statistics on NHS Hospital Admissions

Analysing the number of NHS hospital admissions attributable to smoking from 1996/97 to 2011/12, will help provide further analysis on the success of the smoking ban. Figure 4.7 shows that despite smoking prevalence levels decreasing within this time space, there has been a 40% increase in the number of hospital admissions caused by smoking in adults aged 30 and over. Even when taking into account the changing population in Britain, that is 58.17 million mid-1996 (Office for National Statistics, 2004) and 63.3 million in mid-2011 (Office for National Statistics, 2013a), the number of hospital admissions has risen from 1.93% to 2.47%. This could be due to the time-lag effect, and the health benefits from the decrease in prevalence levels hasn't been fully realised yet as smokers predating 2007 still need substantial healthcare. Allender *et al*. (2009) also encountered similar limitations, claiming that it is difficult to compare healthcare cost estimates year on year, as methodological differences such as changes in resident population prohibit easy comparison. Only ages 35 and over are presented in Figure 4.7, as this is the age where most damaging health effects are realised.

Table 4.3 shows in greater depth the two main types of disease attributable to smoking at primary diagnosis: cancers and respiratory diseases. The number of cancers is consistently higher than the number of respiratory disease across all the years shown in Table 4.3. However, of the total number of cancer deaths and respiratory deaths, the percentage attributable to smoking is smaller among cancer deaths, reaching 29% in 2009, compared to 35% for respiratory diseases (Department of Health, 2011). Cancers attributable to smoking have increased by 50.28% from 1996 to 2012 whereas the respective increase in respiratory diseases is 80.25%. However, since the smoking ban came into place, the number of cancers attributable to smoking is increasing at a substantially decreasing rate; represented by the trend growth falling from 2.9% to 0.7%. This may provide evidence that the smoking ban, alongside other tobacco control policies, has been successful in reducing the number of hospital admissions attributable to smoking. Contrary to that, the number of respiratory diseases is increasing at an increasing rate, shown by the trend growth going from 3.7% pre-ban to 6.1% post-ban. This may be due to the time lag from when the smoking ban came into effect or to the advancement in technology in detecting such diseases. Despite the number of cancers attributable to smoking being higher than that of respiratory disease, the overall treatment cost is substantially higher for the latter – amounting to 24% compared to 16% for cancer (Callum *et al*., 2011). The hospital admissions represented in Table 4.3 includes those affected by SHS. There is sufficient evidence to show that involuntary smoking, through SHS, is a direct cause for lung cancer in humans (International Agency for Research on Cancer, 2004), thus affecting the number of hospital

admissions. The smoking ban has had a positive impact on the levels of passive smoking, yet in 2008 lung cancer was the third most common type of cancer among women (Cancer Research UK, 2011). In regard to hospital admissions it is important to consider how the population has increased between the years 1996/97 to 2011/12 from 58.17 million (Office for National Statistics, 2004) to 63.3 million (Office for National Statistics, 2013a) respectively. Consequentially, these figures indicate that smoking, relative to population increases, has caused a smaller percentage of hospital admissions.

Figure 4.7: **NHS Hospital Admissions for Adults Aged 35 and over, where there was a Primary Diagnosis of Diseases, which can be Caused by Smoking in Great Britain, 1996/97 – 2011/12**



Source(s): Lifestyle Statistics, Health and Social Care Information Centre, 2013

Note(s): 1. The data include private patients in NHS Hospitals (but not private patients in private hospitals)

2. Figures are presented for adults aged 35 years and over except for admissions Age related cataracts where patients must be 45 years and over and admission for hip fracture where patients must be aged 55 years and older due to risk rations only being available for these age groups
3. The figure excludes people whose gender was unknown or unspecified and whose country of residence was not confirmed as England
4. The primary diagnosis is the first of up to 20 (14 from 2002-03 to 2006-07 and 7 prior to 2002-03) diagnosis fields in the Hospital Episode Statistics (HES) data set and provides the main reason why the patient was admitted to hospital
5. Figures exclude admissions for cervical cancer whose gender was specified as male

Table 4.3: **NHS Hospital Admissions for Adults Aged 35 and over for Cancers and Respiratory Diseases Caused by Smoking in Great Britain, 1996/97 – 2011/12**

NHS Hospital Admissions for Adults Ages 35 and Over for Cancers and Respiratory Diseases Caused by Smoking in Great Britain, 1996/97-2011/12

Year	Number of cancers which can be caused by smoking	Number of Respiratory diseases which can be caused by smoking
1996/97	224432	142268
1997/98	253268	139481
1998/99	265331	163532
1999/00	276897	166146
2000/01	274216	152154
2001/02	273228	161897
2002/03	283503	168838
2003/04	287919	189903
2004/05	294443	195817
2005/06	317774	197908
2006/07	324936	201578
Pre Ban Trend Growth (%)	2.9	3.7
2007/08	322570	203693
2008/09	332229	232078
2009/10	330513	231384
2010/11	327447	260819
2011/12	337291	259286
Post Ban Trend Growth (%)	0.7	6.1

Source(s): Lifestyle Statistics, Health and Social Care Information Centre, 2013

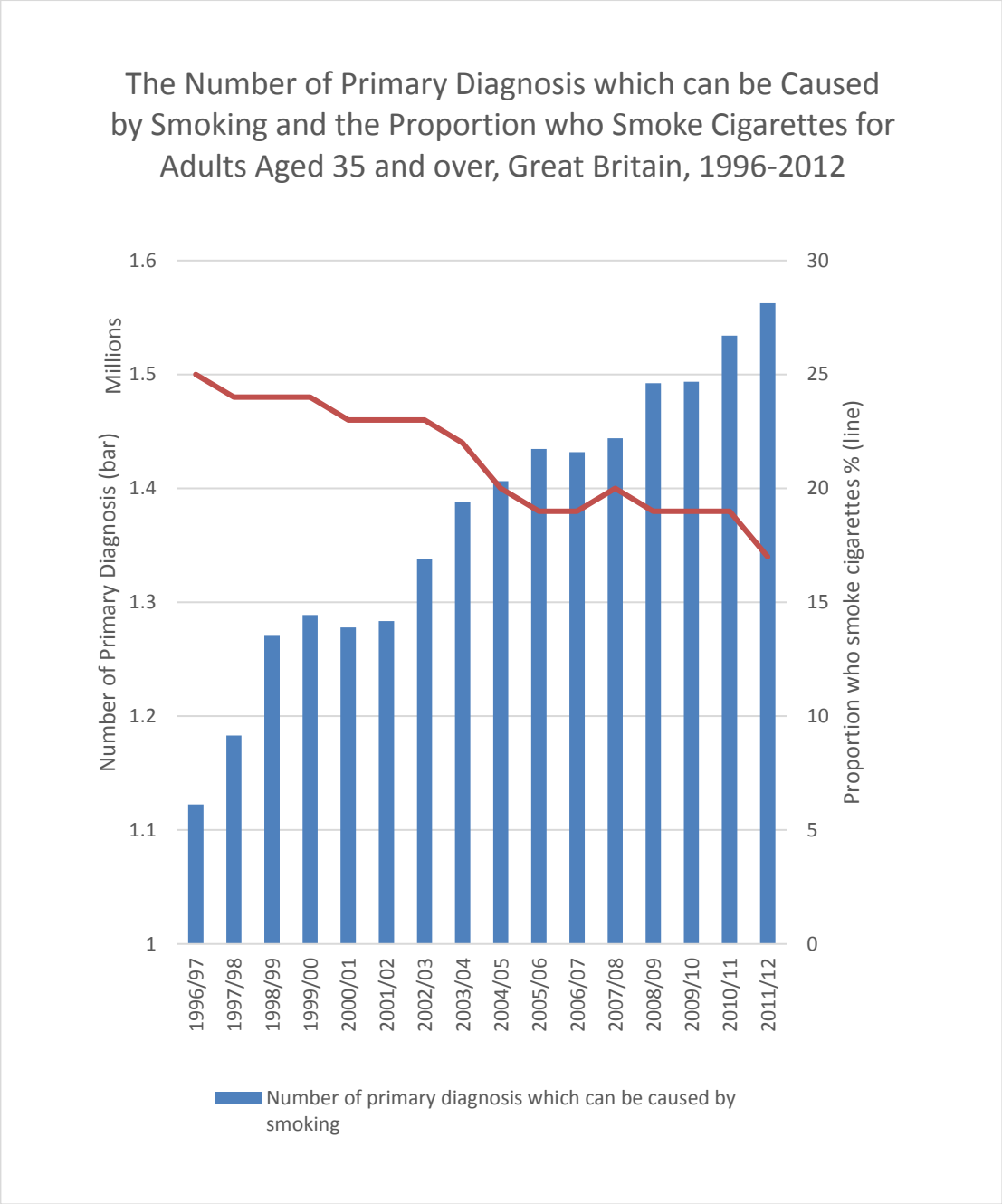
Note(s): 1. The data include private patients in NHS Hospitals (but not private patients in private hospitals

2. Figures are presented for adults aged 35 years and over except for admissions for age related cataracts where patients must be 45 years and over and admissions for hip fracture where patients must be aged 55 years and older due to risk ratios only being available for these age groups
3. The figure exclude people whose gender was unknown or unspecified and whose country of residence was not confirmed as England
4. The primary diagnosis is the first of up to 20 (14 from 2002-03 to 2006-07 and 7 prior to 2002-03) diagnosis fields in the Hospital Episode Statistics (HES) data set and provides the main reason why the patient was admitted to hospital.
5. Figures exclude admissions for cervical cancer whose gender was specified as male

4.5 Analysis on Primary Diagnosis and Cigarette Consumption

To aid comparing levels of smoking prevalence to hospital admissions, Figure 4.8 shows the correlation between these two aspects in person's aged 35 and over.

Figure 4.8: **Number of Primary Diagnosis, which can be caused by Smoking and the Proportion of cigarette smokers aged 35 and over, Great Britain, 1996-2012**



Source(s): Lifestyle Survey, Health and Social Care Information Centre, 2013a and Office for National Statistics, 2013b

Figure 4.8 uses the same data as Figure 4.7 alongside statistics on prevalence levels from ONS. This graph demonstrates that the proportion of the population, above 35 years of age, who smoke cigarettes, has decreased by almost 10% over the last 16 years and yet the number of cases of primary diagnosis attributed to smoking has risen by 39%, thus regardless of the number of smokers falling, the cost the NHS incurs is yet to diminish. This could be due to more advanced technology being available to treat and detect tobacco related diseases. Allender *et al*. (2009) also found that the

prevalence of smoking is decreasing, though less in recent years; total health care costs are increasing despite fewer persons smoking, though. This is attributed to the time-lag effect from the smoking ban being implemented. Studies dedicated to finding the NHS cost of smoking have realised that direct comparisons from year to year are increasingly hard to estimate as price and type of treatment change, alongside incidence levels, all of which have to be accounted for in the allocated NHS budget for smoking (Scarborough *et al*., 2011). The minimal decrease, of 2%, in the proportion that smoke cigarettes can be partially explained by the time lag-effect. In this instance the survey was taken five years post-smoking ban and smokers within the age category, of 35 years and over, are most likely to be already addicted and therefore less likely to change their smoking habits regardless of the smoke-free legislation. A majority of current smokers become addicted before turning 18 (Lifestyle Statistics, Health and Social Care Information Centre, 2013), thus, indicating that current smokers presented here have been addicted for over a decade and are more likely to be a burden to NHS services.

Section 4.6: Summary

Overall, there has been a significant decrease in smoking prevalence since 1974. Nowadays, amongst the population, it is more common not to smoke than to smoke. This indicates that policy implementation in general has worked; it appears, however, that the smoke-free legislation itself has had minimal impact. Following 2007 there has been a negligible impact on smoking prevalence, particularly in males, as there has been a 0% change in overall cigarette consumption post-smoking ban. Figure 4.5 gave further indication that the smoking ban had little or no impact in causing cessation amongst current smokers. Despite smoking prevalence levels decreasing, the level of hospital admissions attributable to smoking is yet to decline. This could be due to the time-lag effect, as the health benefits from the overall decreasing level of prevalence haven't yet been realised. However, the NHS is currently experiencing the health repercussions from those that previously or currently smoked. This may allow the conclusion to be drawn that in the near future, prevalence levels will decrease further causing a decrease in the number of hospital admissions.

5. Conclusion

In analysing the time-series data presented in Section 4, it can be concluded that the smoking ban has had a minimal to no effect on overall prevalence of smoking. The smoke-free legislation has had a differential affect dependent on various cohorts. Females have been more sensitive to the changes in smoking legislation, specifically those aged between 16 and 24, whereas this same cohort amongst males shows an insignificant decline in smoking prevalence. In an occupational classification context, the smoking ban appears to have had more of an impact on those in a higher classification. Those in

‘managerial and professional’ occupations appear to be more inclined to stop smoking compared to those in ‘routine and manual occupations’. Overall there has been a substantial decline in smoking prevalence since 1974, however, the contribution of the smoke-free legislation appears to be minimal with the proportion of the population who still smoke being largely unchanged since 2007.

From studying smokers’ perceptions on the introduction of the smoking ban, it becomes apparent that the smoke-free legislation is an insignificant reason for current smokers to want to quit. A majority of current smokers said the primary reason they would wish to quit is for improvements in general health, not just a reduction in risk of tobacco related diseases. From the survey conducted pre- and post- smoking ban, it also becomes evident that smokers’ intentions to smoke less are significantly different to their actions to do so. This allows for the conclusion that the smoking ban has had little or no causal affect in decreasing consumption of tobacco.

In terms of the number of hospital admissions, it is conclusive that despite the smoking prevalence levels falling since 1996, the number of hospital admissions related to smoking is yet to decline. However, since the smoking ban came into place in 2007 the rate of hospital admissions amongst ages 35 and over is increasing at a decreasing rate, showing potential delayed effects of the ban. This could be due to a time lag, and the health benefits from the cessation of smoking will not be realised until further research is carried out in future years.

Due to limitations of the data, further analysis and research is needed to draw more satisfactory conclusions. There is limited data available for the cost in healthcare attributable to smoking-related diseases, thus, making it difficult to draw accurate conclusions about the cost to the NHS. Every patient has different treatment plans and healthcare support, thus, making it inaccurate to generalise a treatment cost of a tobacco related disease. A further limitation in this study is the various methods in accounting for whether smoking is the cause for disease or merely exacerbates it, demonstrating the complex relationship between factors affecting individuals’ health. Additionally, future research could be carried out into regional and ethnical cohorts, giving the study a geographical and cultural dynamic. Finally, it would be beneficial to carry out this study amongst future generation in order to reduce the time-lag effect from the smoking ban.

This study adds to current and past literature by collating statistics dating back as far as 1974, with a focus on analysing smoking trends pre- and post-smoking ban within the UK. This study provides a foundation on which cohorts have the highest smoking prevalence levels, thus, indicating which

population sub-groups tobacco control programs should target in the future to reduce overall tobacco consumption. This study attempts to isolate the impact the smoking ban has had on current smokers by asking their reasons behind wanting to quit, something which current literature has previously linked in with other tobacco control measures. Finally, this study correlates the changes in smoking prevalence levels to the number of tobacco related hospital admissions and in turn NHS tobacco related expenditure.

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