

Older but Not Wiser- Smokers and Passive Smoking Belief

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Abstract:

In recent years the proportion of people who smoke in developed countries has reached a plateau, even though countries like the UK continue to run anti-smoking campaigns. We aim to inform UK policy makers about the effects of anti-smoking campaigns by looking at the beliefs that smokers and non-smokers have about the dangers of passive smoking, with particular interest in whether these beliefs vary amongst smokers of different ages. We envisage two groups of potential smokers. There are the altruists, who are less likely to start to smoke once they are fully aware of the dangers of passive smoking; and there are the non-altruists for whom the effects of passive smoking are an irrelevancy. We hypothesise that anti-smoking campaigns have managed to dissuade the altruists of later generations from ever starting to smoke, but are having no effect on the behavior of the non-altruists and hence the plateau. The older smoking altruists are then captive to their smoking behavior and have to rationalize their smoking behavior by downplaying the effects of passive smoking. Using data from the Health Survey for England we find strong evidence that it is the older smokers who are less prone to believe in the dangers of passive smoking whilst younger smokers essentially have the same beliefs as non-smokers: a young uneducated smoker is more aware of the dangers of passive smoking than a highly educated older smoker. This conclusion is robust to a number of sensitivity analyses. We conclude that the main effect of current campaigns is the continuing deterrence of potential young altruist smokers.

Key Words: Smoking, Passive Smoking, Public Health Campaigns, Smoking Belief, Smoking Policy.

Introduction and Background

Smoking is known to be both bad for the health of the smoker and for those who breathe passive smoke. The health costs to smokers from deaths and lost working hours in England are estimated to be around £2.7bn (Action on Smoking and Health, 2008), with some 107,000 British people dying in 2007 from smoking-related diseases including cancers (Peto et al., 2010, Taylor et al., 2007 and Stayner et al., 2007). An estimated 86% of lung cancer deaths in the UK are caused by smoking, whilst smoking also increases the risks of upper aero-digestive tract (oral cavity, nasal cavity, nasal sinuses, pharynx, larynx and esophagus), pancreas, stomach, liver, bladder, kidney, cervix, bowel, ovary (mucinous) and myeloid leukemia (Secretan, 2009). These estimates include the effects of passive smoking, with the link between passive smoking and lung cancer being established over fifty years ago (Doll and Hill, 1950, Wynder 1950, Mills, 1950, Levin and Gerhardt, 1950 and Schrek et al, 1950). Specific to passive smoking, it is estimated that exposure in the home causes approximately 11,000 deaths in the UK each year from lung cancer, stroke and ischemic heart disease (Jamrozik et al., 2005).

The UK government has for decades run anti-smoking campaigns to highlight the health effects of smoking, with the campaign cost growing from £6.18m in 1999-2000 to £22.70m in 2005-2006 (Parliament, 2007). This campaign has included tobacco taxation, advertising bans, a quitting helpline known as ‘NHS stop smoking service’ and health warnings on cigarette packets. An important question with regards to the effectiveness of the health campaign is i) whether smokers are able to disbelieve what they are told in these campaigns and ii) whether they can keep smoking even if they do believe these campaigns. This paper considers this question by looking at the believed effects of passive smoking on a sample of over 6000 smokers and non-smokers in 2007 residing in England. This is an important year for the UK smoking campaign, given that since 2007 there has been no decrease in the proportion of the population who smoke (General Lifestyle Survey, 2009). The main question is then whether smokers believe the detrimental effects of passive smoking to be of a lesser magnitude than non-smokers. We are particularly interested in finding out whether younger cohorts of smokers have different beliefs in comparison to older cohorts of smokers. One would expect it to be harder for the younger cohorts to be willfully

ignorant of the effects of smoking given they have been exposed to campaigns touting the dangers of smoking for a longer proportion of their lives. We will differentiate between beliefs on the effects of passive smoking on adults and children.

Consistent with the recent experimental literature on selfless and reciprocal behavior (Fehr and Schmidt, 2002; Andreoni and Miller, 2002; Phelps, 2001), we envisage the existence of two different types of potential smokers: altruists and non-altruists. The altruists have strong ‘other-regarding’ preferences and are very reluctant to inflict harm on others (Andreoni and Vesterlund, 2001; Visser et al., 2011; and Kumru and Vesterlund, 2010). As a result, an addicted altruist finds it hard to live with the belief that he is harming others and we would hence expect altruists to be reluctant to believe in large passive smoking effects. That is, we argue that altruists distort their beliefs and selectively process information to rationalize their actions (for examples of models and empirical evidence on this self-delusion mechanism, see Benabou and Tirole, 2006; Rabin 1995; and Konow, 2000). We would also expect this group to never start smoking in the first place if they can be told early enough about the effects of their habits on others and internalize them prior to making the decision to smoke.

The non-altruists do not care about the harm they do to others, and we expect the health campaign to be irrelevant to their behavior. We would expect this group to be able to believe the information about passive smoking more readily, but simply not let it affect their decision to start smoking.

There are two major implications of this envisioned dichotomy in the population of potential smokers. The first major implication is that anti-smoking campaigns that highlight the dangers of passive smoking will run out of people susceptible to the message. This implication fits the stylized fact in the literature on smoking that the number of smokers no longer declines after some point, but remains constant: the estimated number of smokers in the UK decreased from 27% of the British population in 1998 (Bridgewood et al, 2000) to 21% in 2007 (Robinson and Lader, 2008). However, since 2007 the smoking rate has remained stable (Office of National Statistics, 2011). This is despite the completion of Smoke free legislation in the UK by July 1 2007 and nearly a quarter of a million people setting a quit date through the National Health Service Stop Smoking Services Between April and September 2006

(of which the majority received free nicotine replacement therapy). It is noteworthy that a similar plateau has been found in most other developed countries. For example, the US has not experienced a significant decrease in their proportion of smokers since 2002¹, whilst Canada only experienced a 1% decrease between 2005 and 2009².

This first major implication rationalizes recent findings on the cost effectiveness of various smoking campaigns (Niederdeppe, et al 2011, Leshner et al., 2009, Durkin, et al 2009 and Wong and Cappella, 2009). The main finding from these studies is that recent campaigns reduce smoking by discouraging people from initiating the habit.

The second major implication, which we will directly test, is that beliefs about the dangers of passive smoking vary by age amongst the group of smokers. This is a novel and so far untested hypothesis that augments the literature on what determines beliefs about smoking. This literature includes the early work of McKennell and Thomas (1976) on consonant smoking, as well as the more recent literature on how smoking beliefs vary by socio-economic status (Kenkel, 1991, Siahpush et al., 2006 and Finney Rutten et al., 2008) and personal traits (Klesges et al, 1998, Reimer et al 2010 and Wood et al. 2008). In accordance with this literature, we account for individual characteristics when looking at the differential attitudes amongst smokers and non-smokers, and in particular pay attention to the possibility of reverse-causality (i.e. the possibility that those people who truly believe passive smoking is not so bad are more likely to become smokers and less likely to quit). This means our strategy is based on comparing the beliefs of adults from within the same household, so any traits that are shared by members of a household (such as level of information or common attitudes) are accounted for in the regressions.

The next section introduces the data utilized in our work. Next, the methodology and results are documented. The paper concludes with a discussion.

¹ Data from the Centre for Disease Control and Prevention highlight that in 2009 the proportion who smoked in the US was 20.6%. In 2007 and 2004 these figures were 20.8% and 20.9% respectively. In 2003 the same figure was 21.6%. In 2002, this was almost 1% higher (22.5%).

² Data from the Canadian Tobacco Use Monitoring Survey highlight that the proportion who smoked in Canada was 19% in 2005 with the proportion falling to 18% in 2008 and remaining at that level in 2009.

Data and methods:

The Health Survey for England (HSE) began in 1991 and is an annual survey designed to monitor trends in England's health. The unit of survey is the household, and information is collected from both adults and children. Information is collected through a combination of a face-to-face interview, a self-completion questionnaire and a medical examination conducted by a qualified nurse. Using the Postcode Address File as a sampling frame, the HSE is considered to be representative of England (Erens et al., 2001).

For our purposes, the 2007 HSE survey is ideal as it contained a new module of questions on 'belief of and attitudes to health', which is administered using a self-completion paper questionnaire. In addition, as discussed, it is the year that represents the plateau in the decline of the UK's smoking rate. Of particular interest is the component relating to smoking which gathers information from participating adults on their belief of the health effects associated with passive smoking. In addition, specific questions are asked with respect to the effects of smoking on adults and children. We restrict the sample to adult's beliefs, as children cannot be expected to have had the 'opportunity for smoking awareness'. Once non-response adults are excluded, our sample size is 6145 persons. For the questions pertaining to adults we create a number of dependent variables, which take the value of 1 or zero. Specifically these questions are:

- 1) How much, if at all, do you think breathing in other people's smoke affects the health of adults exposed to it – (Just a little, a fair amount or a great deal = 1 not at all, don't know = 0)
- 2) In what ways would you say breathing in other people's smoke affects the health of adults – Causes breathlessness (Yes= 1, No=0)
- 3) In what ways would you say breathing in other people's smoke affects the health of adults – Causes coughing (Yes= 1, No=0)
- 4) In what ways would you say breathing in other people's smoke affects the health of adults – Causes wheezing (Yes= 1, No=0)

- 5) In what ways would you say breathing in other people's smoke affects the health of adults – Causes people to get asthma or makes asthma worse (Yes= 1, No=0)
- 6) In what ways would you say breathing in other people's smoke affects the health of adults – makes people more prone to chest infections or bronchitis (Yes= 1, No=0)
- 7) In what ways would you say breathing in other people's smoke affects the health of adults – makes people less fit than they used to be (Yes= 1, No=0)
- 8) In what ways would you say breathing in other people's smoke affects the health of adults – makes people more likely to suffer from cancer (Yes= 1, No=0)
- 9) In what ways would you say breathing in other people's smoke affects the health of adults – makes people more likely to suffer from another serious illness such as heart attack or stroke (Yes= 1, No=0)

Along with these nine binary outcome variables, a tenth outcome is defined by aggregating the responses of questions 1 through nine above. In this case, a value of nine indicates the highest level of belief about the dangers of passive smoking for adults. Similarly we consider identical questions that relate to children and again produce an aggregate outcome. That is, for each question 1 through 9 above an identical question was asked that replaced the word 'adult' with 'children'. Furthermore we define a measure of total belief regarding the dangers of passive smoking as the sum of all 18 underlying questions. Therefore, in total we have 18 distinct belief questions that take on the value of 1 or zero, as well as three derived aggregate belief outcomes.

Methods

In order to assess whether or not smokers on average are less likely to believe the dangers associated with passive smoking in comparison to non-smokers we consider the following regression:

$$ks_{ih} = a_h + b_1 s_{ih} + c' x_{ih} + e_{ih} \quad (1)$$

where i and k index the individual and the household; ks represents belief about the dangers of passive smoking; s denotes an indicator variable for whether someone smokes or not; and x is a vector of additional controls (employment, education, age and female)³. α_h represent household fixed effects and thereby captures tangible characteristics within the household such as income and the number of children, as well as less tangible characteristics such as shared beliefs about the dangers of passive smoking intra household.

In order to ascertain whether the beliefs about passive smoking differ within the groups of smokers, we add an interaction to equation (1):

$$ks_{ih} = \alpha_h + (\beta_1 + \beta_2'(age_i - 20))s_{ih} + \chi'x_{ih} + \varepsilon_{ih} \quad (2)$$

Now, the effect of smoking on beliefs differs by age and our main hypothesis is that β_2 is negative and that interaction term captures a lot of the variation in smoking beliefs. We take (age-20) because it allows us to interpret the level effect (β_1) as the aggregate difference in beliefs of smokers of age 20 in comparison to non-smokers aged 20.

Results

The ‘total smoking belief’ sums the nine adult and nine child passive smoking belief questions, which means that 18 indicates beliefs that are in line with the actual real dangers of passive smoking. Figures 1 through 3 present histograms of the distribution of the total smoking belief amongst the general population, the general non-smoking population and the general smoking population. It is notable from these distributions that smokers in general believe that the dangers of passive smoking are less in comparison to non-smokers.

³ For all our models that contain household fixed effects the controls specifically are i) employment (the categories included are; in employment, unemployed, retired, other economically inactive), ii) education (the categories included are; degree or equivalent, higher education below degree, GCE A level equivalent, GCE O level equivalent, CSE other grade equivalent, foreign or other qualification, no qualification, full time student) iii) ethnicity (the categories included are; white, mixed, Asian or Asian British, Black or Black British and Chinese or other Ethnic group iv) age (in years) and gender (1=male). When we exclude the household effects, as well as these control we add equalised household income, number of children and household size.

Table 1 presents the results pertaining to regressions on total passive smoking beliefs. Columns 4 and 5 present the results emanating from the regressions described in equations 1 and 2 respectively (Fixed Effects regressions). Columns 2 and 3 are identical to the models described in equations 1 and 2 with the exception that the household effects are excluded (OLS regressions).

Table 2 documents the estimates for all our 18 passive smoking belief measures, showing only the coefficients on i) smoking status and ii) smoker-(age-20) interaction. The results are derived from models with the same controls as those documented in Table 1. Again, we present four different sets of results; OLS, OLS with smoker-(age-20) interactions, FE, and FE with smoker-(age-20) interactions.

We also consider two sets of sensitivity analyses. The first is akin to the results in Table 2 with smoking status changed to a variable defined as the number of cigarettes smoked daily. The second results are akin to the specifications documented in Table 2 with the exception that they are derived using non-linear estimators. The results presented in these analyses do not alter the conclusions drawn from our work, and so for brevity are not discussed here. These can be found in Appendix A and B.

****Insert Table 1 around here****

From Table 1 it is clear that total smoking beliefs are strongly and negatively related to smoking status when smoker-(age-20) interactions are excluded from the model. From column 2 we see that ignoring household effects and age-interactions, the average smoker believes in 3.5 less dangers of passive smoking than the average non-smoker. When we allow for household heterogeneity (column 4), this negative effect reduces to -2.0. Once smoker- (age-20) interactions are included in Table 1, the picture is very different. The OLS impact of smoking status on beliefs is more than halved (-1.337). In our preferred specification that includes fixed effects and smoker-

(age-20) interactions (column 5) we find that the average 20- year-old smoker has the same beliefs about the dangers of passive smoking, all else equal⁴.

Now we turn to the age-smoking interactions themselves. The OLS results from column 3 suggest that a 60-year old smoker believes in 3.36 less dangers of passive smoking than a 20-year old smoker ($=40*0.084$) compared to non-smokers. The FE model, which is our preferred specification, gives even higher estimates with respect to the belief gap between smokers of different ages: a 40-year old smoker believes in 2.72 less dangers than a 20-year old smoker ($=20*0.136$). Additionally, a 60-year old smoker believes in -5.44 less dangers of passive smoking than a 20-year old smoker. It is important to note that no such gradient exists amongst the non-smokers: elderly and young non-smokers have equal beliefs about the advertised dangers of passive smoking.

Continuing to Table 2 it is clear that if we ignore the smoker- (age-20) interaction, regardless of how we measure passive smoking beliefs, smokers are less likely to believe in the dangers of passive smoking than non-smokers, all else equal. These results are documented in columns 2 (entitled OLS) and columns 3 (entitled FE). Once smoker- (age-20) interactions are included in the model, the results are very different. Specifically, it is now clear that the significance of the smoking variable was being driven by heterogeneity in passive smoking beliefs that is directly related to the age of the smoker. Considering columns 3 and 5, these interactions are always negative and usually significant, whereas the smoking status variable is now positive and mostly not significant. Therefore, where the smoking status variable is now not significant, the results imply that there is no gap in beliefs between a 20-year smoker and the rest of the population. Additionally, given that for most questions the smoker- (age-20) interaction is significant and negative, we can infer that the older the smoker, the less they believe about the dangers of the associated passive smoking. This holds regardless of whether we look to the OLS (column 3) or the FE model (column 5).

****Insert Table 2 around here****

⁴ It is worth noting that if we were to accept a 10% significance level here, our results imply that a 20 year smoker actually has 1.3 units *more* than the general non smoking population, all else equal.

Looking to the preferred model in Table 2 (FE with age-interactions), the results imply that there is no belief gap between a twenty-year-old smoker and a 20-year old non-smoker, with the exception of child question 4⁵. Considering the forty and sixty year old smokers for the adult general belief question (maximum belief equals nine), the results imply a belief gap of -1.6 and -3.12 units less respectively with the non-smokers of those ages. The same figures for the child general belief questions are -1.16 and -2.32. For the individual adult and child questions, we find that the forty-year-old smoker always believes the dangers of smoking to be less in comparison to the general population aged 40. Specifically, this range is between -10% and -16% for the adult questions and between -1% and -14% for the child questions (if we exclude child question 4 the range is between 6% and 14%). The same figures for the sixty-year-old smokers are between -20% and 32% and -1.5% and -28% (if we exclude child question 4 the latter range is between -12% and -28%) for the adult and child questions respectively. Similarly an eighty-year-old smoker believes the dangers are far less in comparison to the general population. In this case, the individual adult questions suggest a gap in beliefs of -30% and -48%! The same figures for the child questions are -3% and -42% (if we exclude child question 4 the latter range is between -18% and -42%).

****Insert Table 3 around here****

Table 3 highlights some of the main points emanating from our work by documenting the gap in beliefs between two particular groups of individuals based on the results from our preferred specification (column 5 Table 1). Descriptions of our illustrative groups are provided in columns 1 and 2, with the corresponding belief gap documented in column 3. Table 3 re-iterates our findings from Table 2- the older our smoker is the less they believe the dangers of smoking to be. In addition, Table 3 highlights that this gap in beliefs is not offset by education. Specifically, a 50-year old smoker with a degree still believes the dangers of smoking to be 7% milder than a 30

⁵For child question 4 the results imply that a 20-year old smoker has 0.128 units of belief *more* than the general population. If we include significance at the 10% level three additional questions imply that the 20-year-old smoker knows *more* than others, which is in line with the idea that they are non-altruists.

year old who has a GCE A level. For a 70 year old with a degree the gap in beliefs is much larger – that is, 22%. Interestingly, even when we consider a 30-year old smoker with no qualifications, there is still a significant gap in beliefs between this group and smokers who are over 50 years with a GCE A-level. Specifically, there is almost a 20% gap in beliefs between smokers who are 30 years with no education and smokers of 70 years with a GCE A level.

Conclusions and Discussion

This paper found that smokers on average have more positive beliefs about passive smoking than non-smokers do, and that this effect is entirely due to older smokers who believe in far fewer dangers of passive smoking than older non-smokers. In comparison, young smokers believe in just as many (if not more) dangers of passive smoking than non-smokers.

These findings support our hypothesis that younger smokers, having been exposed to anti smoking campaigns for a longer proportion of their lives, are more likely to be non-altruists. That is, they are aware of the dangers of passive smoking but this does not influence their behavior. Older smokers on the other hand are more likely to be altruists: they were less aware of the dangers of passive smoking when they began to smoke and now addicted. In order to marry their smoking behavior to their altruistic beliefs, the older smoker dismisses the dangers of passive smoking or simply fails to absorb this information. As a result of the changing composition of the group of smokers by age, there is a belief gap about the dangers of passive smoking that increases by the age of the smoker. Importantly, this gap in beliefs is not offset by education. That is, younger smokers with no qualifications believe in more passive smoking dangers than older smokers with quite advanced education. Hence we can dismiss the alternative hypothesis that the belief gap is due to a lack of cognitive ability. We also fail to find the same belief gap amongst non-smokers, where young and old have similar beliefs. These findings are robust to alternative measures of smoking (see appendix A) or non-linear estimators (see appendix B).

Our results are in line with experiential economic research that highlights distinct social preference types (Fehr and Schmidt, 2002; Andreoni and Miller, 2002; Phelps, 2001; Visser et al., 2011; and Kumru and Vesterlund, 2010). In our case, we

hypothesized that younger altruists self-select out of smoking whilst some older altruists became addicted before they were fully aware of the dangers of passive smoking. Our findings fit the theories of Benabou and Tirole (2006) who observe that distortion in beliefs is a useful strategy to compensate for incomplete will power.

What does this mean for public health campaigns? It would suggest that the current public health campaigns in the UK are useful by preventing potential altruist smokers from taking up the habit, but are ineffective in changing the minds of the locked-in older smokers or in preventing the younger cohorts of non-altruists from starting to smoke. From that point of view, the way to dissuade more young individuals from taking up the habit would require more than just information.

Table 1: Results from Aggregate Passive Smoking Belief Regression
Individuals=6145, Families= 4039

Dependant Variable	OLS	OLS with smoker-(age-20)	FE	FE with smoker-(age-20)
<i>Smoker</i>	- 3.481***	-1.337***	-2.056***	1.297*
<i>Age*Smoker</i>		-0.084***		-0.136***
<i>Age</i>	- 0.065***	-0.047***	-0.015	0.007
<i>Gender</i>	- 1.298***	-1.290***	-1.260	-1.236***
<i>Employed</i>	0.567*	0.544*	0.274	0.148
<i>Unemployed</i>	- 0.238	-0.357	-0.744	-0.967
<i>Retired</i>	0.209	0.060	0.156	0.039
<i>Other Economically inactive</i>	Reference Case			
<i>Degree or equivalent</i>	3.985***	4.024***	3.615***	3.566***
<i>Higher Education</i>	3.894***	3.863***	3.043***	3.028***
<i>GCE A Level</i>	2.452***	2.456***	2.159***	2.134***
<i>GCE O Level</i>	2.884***	2.855***	2.315***	2.312***
<i>CSE or equivalent</i>	1.648***	1.451***	1.573**	1.370***
<i>Foreign or other qualification</i>	1.472***	1.388*	0.390	0.368
<i>No Qualification</i>	Reference Case			
<i>White</i>	Reference Case			
<i>Mixed</i>	-0.063	0.032	-1.711	-1.592
<i>Asian or Asian British</i>	- 1.246***	-1.175***	-0.786	-0.725
<i>Black or Black British</i>	- 3.971***	-3.847**	-1.012	-0.952
<i>Chinese or other Ethnic Group</i>	- 2.678***	-2.726**	0.573	0.106
<i>Equivalized Income</i>	0.001**	0.001**	N/A	N/A
<i>Household Size</i>	0.109	0.137	N/A	N/A
<i>Number of Children</i>	0.597***	0.556***	N/A	N/A
<i>R Squared</i>	0.110	0.114	0.389	0.390

Table 2: Results from all passive smoking belief measures
Individuals=6145, Families= 4039

Dependant Variable	OLS Y	OLS with smoker-(age-20) Y		FE §	FE with smoker-(age-20) §	
	Smoker	Smoker	Smoker*age	Smoker	Smoker	Smoker*age
<i>Total Beliefs</i>	-3.481***	-1.337***	-0.084***	-2.056***	1.297*	-0.136***
<i>Total Beliefs (Adult Questions)</i>	-2.154***	-0.622***	-0.060***	-1.437***	0.608	-0.078***
<i>Total affect of breathing in passive smoke for adults</i>	-0.085***	-0.143***	-0.003***	-0.039***	0.027	-0.005***
<i>.... causes breathlessness in adults</i>	-0.146***	-0.056	-0.005***	-0.106***	0.027	-0.005***
<i>.... causes coughing in adults</i>	-0.123***	-0.055	-0.005***	-0.115***	0.023	-0.005***
<i>.... causes wheezing in adults</i>	-0.111***	-0.019	-0.005***	-0.048	0.088	-0.006***
<i>.... causes and aggravates asthma in adults</i>	-0.136***	-0.051	-0.005***	-0.101***	0.045	-0.006***
<i>....causes chest infections or bronchitis in adults</i>	-0.125***	-0.011	-0.006***	-0.108***	0.113*	-0.008***
<i>....makes adults less fit than they used to be</i>	-0.129***	-0.028	-0.006***	-0.107***	0.053	-0.006***
<i>....makes adults more likely to suffer from cancer</i>	-0.236***	-0.112***	-0.006***	-0.174***	0.020	-0.007***
<i>...raises adults risk of a repeat heart attack or stroke</i>	-0.122***	-0.031	-0.005***	-0.084***	0.092	-0.007***
<i>Total Beliefs (Adult Questions)</i>	-1.326***	-0.714**	-0.024**	-1.017***	0.688	-0.058***
<i>Total affect of breathing in passive smoke for children</i>	-0.062***	-0.121*	-0.006***	-0.036**	-0.009	-0.001
<i>.... causes breathlessness in children</i>	-0.108***	-0.055	-0.002*	-0.061**	0.028	-0.003
<i>.... causes coughing in children</i>	-0.092***	-0.055	-0.002	-0.081***	0.016	-0.003**
<i>.... causes wheezing in children</i>	-0.099***	-0.007	-0.004***	-0.041	0.128**	-0.007***

<i>.... causes and aggravates asthma in children</i>	-0.136***	-0.056	-0.003**	-0.097***	0.046	-0.005***
<i>....causes chest infections or bronchitis in children</i>	-0.145***	-0.060	-0.004***	-0.129***	-0.005	-0.004***
<i>....makes children less fit than they used to be</i>	-0.185***	-0.109***	-0.003**	-0.102***	0.062	-0.006***
<i>....makes children more likely to suffer from cancer</i>	-0.093***	-0.028	-0.003**	-0.056*	0.089	-0.005***
<i>...raises a child's risk of a repeat heart attack or stroke</i>	-0.114***	-0.030	-0.003***	-0.085***	0.107*	-0.007***

Note: Indicates 'passive smoking', Total Beliefs relates to the aggregate of the eighteen smoking beliefs questions, total beliefs (adult question) is the aggregate of the nine passive smoking belief questions related to adults, total belief (child questions) is the aggregate of the nine passive smoking belief questions related to children, Total affect of breathing in passive smoking for adults (children) relates to question 1 above.

§ Controls are included for household fixed effects as well as the individual's age, sex, ethnicity and education

Y Controls are included for household fixed effects as well as the individual's age, sex, ethnicity and education as well as household income, number of children and household size

*** significant at 1% level ** significant at 5% level *significant at 10% level

Table 3: Gaps in beliefs concerning the dangers of passive smoking, based on our results from our preferred specification that considers total gap in smoking beliefs as the dependent variable (see column 5 Table 1).

Group 1	Group 2	Belief Gap Between Group 1 and Group 2
Aged 30, Smoker	Aged 30 Non Smoker	-1.36
Aged 50 Smoker	Aged 50 Non Smoker	-4.08
Aged 70 Smoker	Aged 70 Non Smoker	-6.80
Aged 30 Smoker	Aged 50 Smoker	-2.72
Aged 30 Smoker	Aged 70 Smoker	-5.44
Aged 30 Smoker with a GCE A Level Equivalent (in comparison to no qualification)	Aged 50 smoker with a Degree	-1.29
Aged 30 Smoker with a GCE A Level Equivalent (in comparison to no qualification)	Aged 70 Smoker with a Degree (in comparison to no qualification)	-4.00
Aged 30 Smoker with no qualification	Aged 50 Smoker with a GCE A Level	-0.59
Aged 30 Smoker with no qualification	Aged 70 Smoker with a GCE A Level	-3.31

Appendix A: Results from specifications with Number of Cigarettes Smoked Daily
Individuals=6145, Families= 4039

Dependant Variable	OLS Y	OLS with Cigarettes Daily -(age-20)		FE §	FE with Cigarettes Daily -(age-20)	
	Cigarettes Daily	Cigarettes Daily	Cigarettes Daily - (age-20)	Cigarettes Daily	Cigarettes Daily	Cigarettes Daily - (age-20)
<i>Total Beliefs</i>	-0.184***	-0.055*	-0.005***	-0.159***	0.055	-0.0069***
<i>Total Beliefs (Adult Questions)</i>	-0.111***	-0.029*	-0.003***	-0.071***	0.028	-0.0038***
<i>Total affect of breathing in passive smoke for adults</i>	-0.012***	-0.006***	-0.0002***	-0.004**	0.002	-0.0002**
<i>.... causes breathlessness in adults</i>	-0.009***	-0.000	-0.0003***	-0.007***	0.002	-0.0004***
<i>.... causes coughing in adults</i>	-0.009***	-0.000	-0.0003***	-0.007***	0.001	-0.0002**
<i>.... causes wheezing in adults</i>	-0.006***	0.003	-0.0004***	-0.005**	0.005	-0.0003***
<i>.... causes and aggravates asthma in adults</i>	-0.009***	-0.001	-0.0003***	-0.008***	0.001	-0.0003***
<i>....causes chest infections or bronchitis in adults</i>	-0.009***	0.012	-0.0004***	-0.008***	0.001	-0.0003***
<i>....makes adults less fit than they used to be</i>	-0.009***	0.000	-0.0003***	-0.008***	0.004	-0.0005***
<i>....makes adults more likely to suffer from cancer</i>	-0.014***	-0.005***	-0.0003***	-0.011***	0.002	-0.0004***
<i>....raises adults risk of a repeat heart attack or stroke</i>	-0.009***	-0.000	-0.0003***	-0.007***	0.006	-0.0005***
<i>Total Beliefs (Adult Questions)</i>	-0.073***	-0.025	-0.0018***	-0.057***	0.027	-0.0032***
<i>Total affect of breathing in passive smoke for children</i>	0.001	-0.055*	-0.0047***	-0.002***	-0.000	-0.0000
<i>.... causes breathlessness in children</i>	-0.005***	0.000	-0.0002**	-0.003	0.002	-0.0002*

<i>.... causes coughing in children</i>	-0.005***	-0.001	-0.0002**	-0.006***	-0.001	-0.0002
<i>.... causes wheezing in children</i>	-0.005***	0.002	-0.0003***	-0.004	0.005	-0.0003***
<i>.... causes and aggravates asthma in children</i>	-0.007***	-0.000	-0.0002***	-0.005***	0.002	-0.0003***
<i>....causes chest infections or bronchitis in children</i>	-0.008***	0.000	-0.0002***	-0.007***	0.000	-0.0003***
<i>....makes children less fit than they used to be</i>	-0.010***	-0.005**	-0.0002***	-0.007***	0.002	-0.0004***
<i>....makes children more likely to suffer from cancer</i>	-0.006***	-0.001	-0.0002***	-0.005**	0.004	-0.0003***
<i>....raises a child's risk of a repeat heart attack or stroke</i>	-0.006***	-0.000	-0.0002***	-0.006***	0.005	-0.0004***

Note: Indicates 'passive smoking', Total Beliefs relates to the aggregate of the eighteen smoking beliefs questions, total beliefs (adult question) is the aggregate of the nine passive smoking belief questions related to adults, total belief (child questions) is the aggregate of the nine passive smoking belief questions related to children, Total affect of breathing in passive smoking for adults (children) relates to question 1 above.

§ Controls are included for household fixed effects as well as the individual's age, sex, ethnicity and education

Y Controls are included for household fixed effects as well as the individual's age, sex, ethnicity and education as well as household income, number of children and household size

*** significant at 1% level ** significant at 5% level *significant at 10% level

Appendix B Non Linear Models (Tobit⁶ for Aggregate Questions, Otherwise Logit)

Individuals=6145, Families= 4039

Dependant Variable	Pooled Y	Pooled with Cigarettes Daily -(age-20) Interactions Y		FE §	FE with Cigarettes Daily -(age-20) Interactions §	
	Smoker	Smoker	Smoker*age	Smoker	Smoker	Smoker*age
<i>Total Beliefs</i>	-2.156***	-0.625***	-0.060***	N/A	N/A	N/A
<i>Total Beliefs (Adult Questions)</i>	-2.157***	-0.625***	-0.060***	N/A	N/A	N/A
<i>Total affect of breathing in passive smoke for adults</i>	-0.237***	-0.150***	-0.004***	0.085	-0.031	-0.0059
<i>.... causes breathlessness in adults</i>	-0.103***	-0.033	-0.003***	-0.109***	-0.000	-0.0046**
<i>.... causes coughing in adults</i>	-0.097***	-0.042*	-0.002***	0.113***	-0.007	-0.0045**
<i>.... causes wheezing in adults</i>	-0.074***	0.006	-0.003***	-0.041	0.089*	-0.0056***
<i>.... causes and aggravates asthma in adults</i>	-0.103***	-0.035	-0.003***	0.093***	0.023	-0.0049**
<i>....causes chest infections or bronchitis in adults</i>	-0.091***	0.012	-0.004***	0.094***	0.093**	-0.0077***
<i>....makes adults less fit than they used to be</i>	-0.092***	-0.005	-0.004***	0.092***	0.033	-0.0052***
<i>....makes adults more likely to suffer from cancer</i>	-0.194***	-0.096***	-0.004***	0.164***	-0.008	-0.0068***

⁶ The Tobit results are not shown for the aggregate panel outcomes as they suffer from bias owing to the incidental parameters problem. The censored (Tobit) regression is often used in health models when the dependent variable is restricted to a given range. However, there is evidence in the econometric literature that the Tobit model performs poorly when the distributional assumptions of the model are not satisfied. For example, Tobit estimates are inconsistent in the presence of heteroskedasticity or if the error term does not satisfy normality (Greene, 2008). In the modeling conducted for this study, in using our linear models, there is no few case where the predictions extend beyond the valid range. Therefore to avoid making additional parametric assumptions on the model, the linear regression is considered satisfactory.

<i>...raises adults risk of a repeat heart attack or stroke</i>	-0.084***	-0.007	-0.003***	-0.061*	0.065	-0.0054***
<i>Total Beliefs (Adult Questions)</i>	-1.329***	0.032	-0.006***	N/A	N/A	N/A
<i>Total affect of breathing in passive smoke for children</i>	-0.136***	-0.075***	-0.002***	-0.063*	0.048	-0.005***
<i>.... causes breathlessness in children</i>	-0.099***	0.004	-0.0045***	-0.052	0.062	-0.005**
<i>.... causes coughing in children</i>	-0.092***	-0.022	-0.0025***	0.080***	0.032	-0.0047**
<i>.... causes wheezing in children</i>	-0.095***	0.053*	-0.0062***	-0.042	0.179	-0.0100***
<i>.... causes and aggravates asthma in children</i>	-0.138***	-0.027	-0.0039***	0.086***	0.073	-0.0071***
<i>....causes chest infections or bronchitis in children</i>	-0.140***	-0.021	-0.0045***	0.122***	-0.001	-0.0051***
<i>....makes children less fit than they used to be</i>	-0.181***	-0.037	-0.0066***	0.110***	0.108**	-0.0099***
<i>....makes children more likely to suffer from cancer</i>	-0.086***	0.035	-0.0053***	-0.055	0.124***	-0.0085***
<i>...raises a child's risk of a repeat heart attack or stroke</i>	-0.107***	0.032	-0.0061***	-0.073**	0.132***	-0.0100***

Note: Indicates 'passive smoking', Total Beliefs relates to the aggregate of the eighteen smoking beliefs questions, total beliefs (adult question) is the aggregate of the nine passive smoking belief questions related to adults, total belief (child questions) is the aggregate of the nine passive smoking belief questions related to children, Total affect of breathing in passive smoking for adults (children) relates to question 1 above.

§ Controls are included for household fixed effects as well as the individual's age, sex, ethnicity and education

Y Controls are included for household fixed effects as well as the individual's age, sex, ethnicity and education as well as household income, number of children and household size

*** significant at 1% level ** significant at 5% level *significant at 10% level

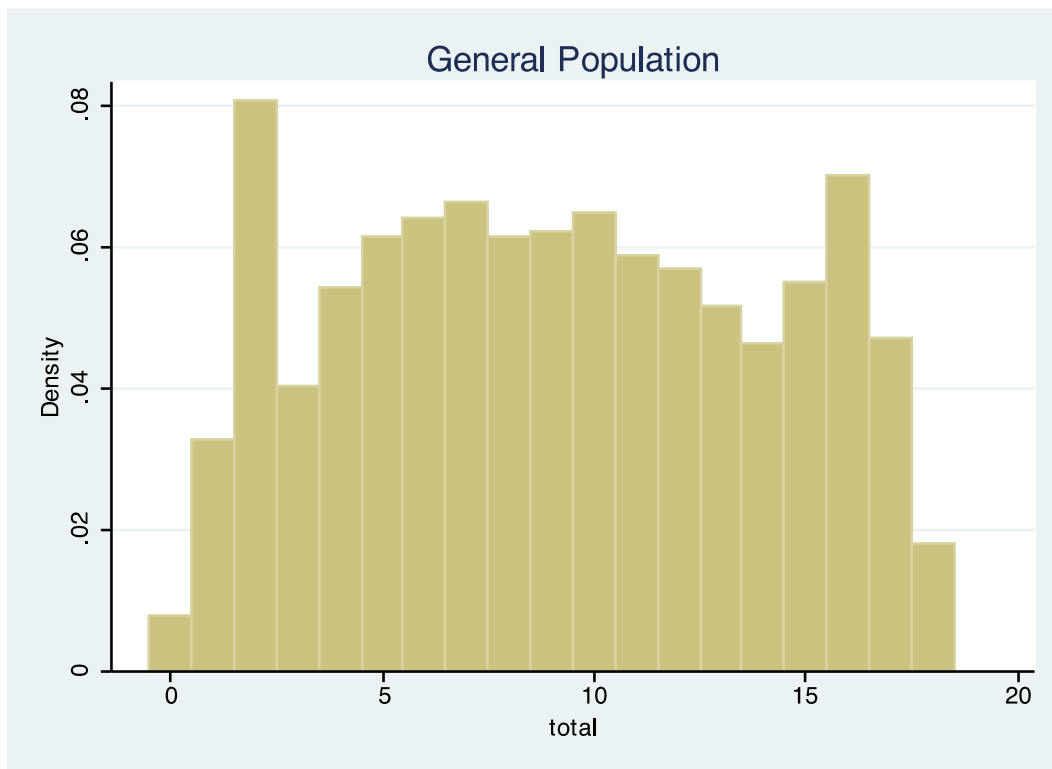
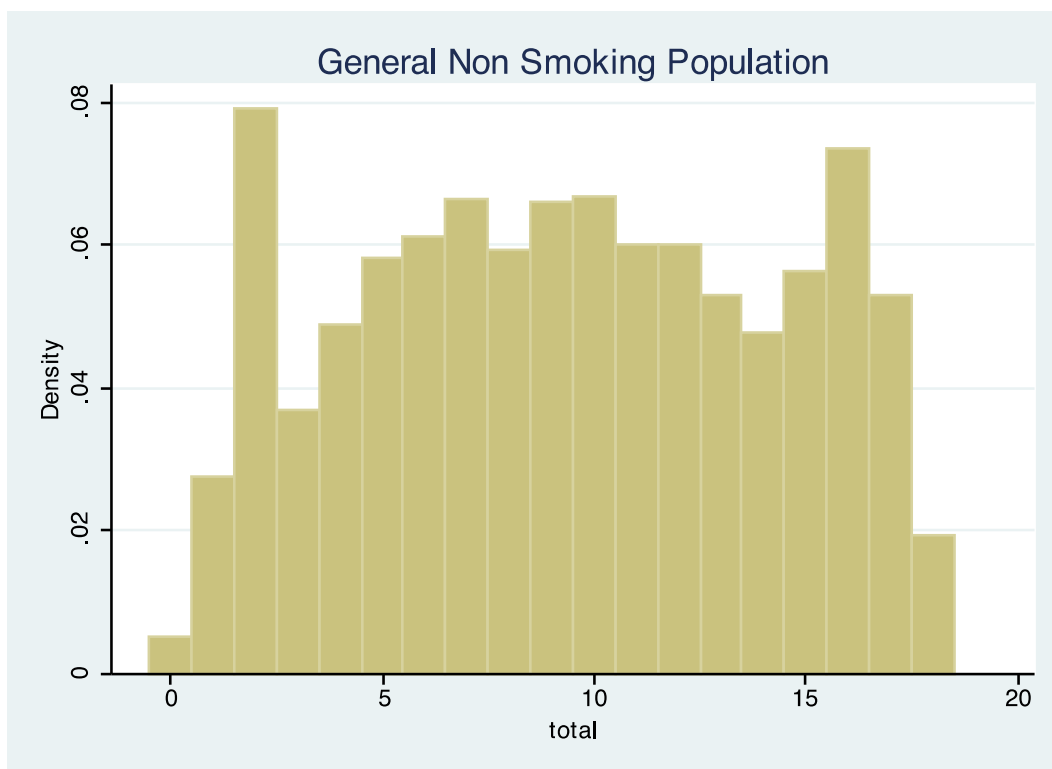
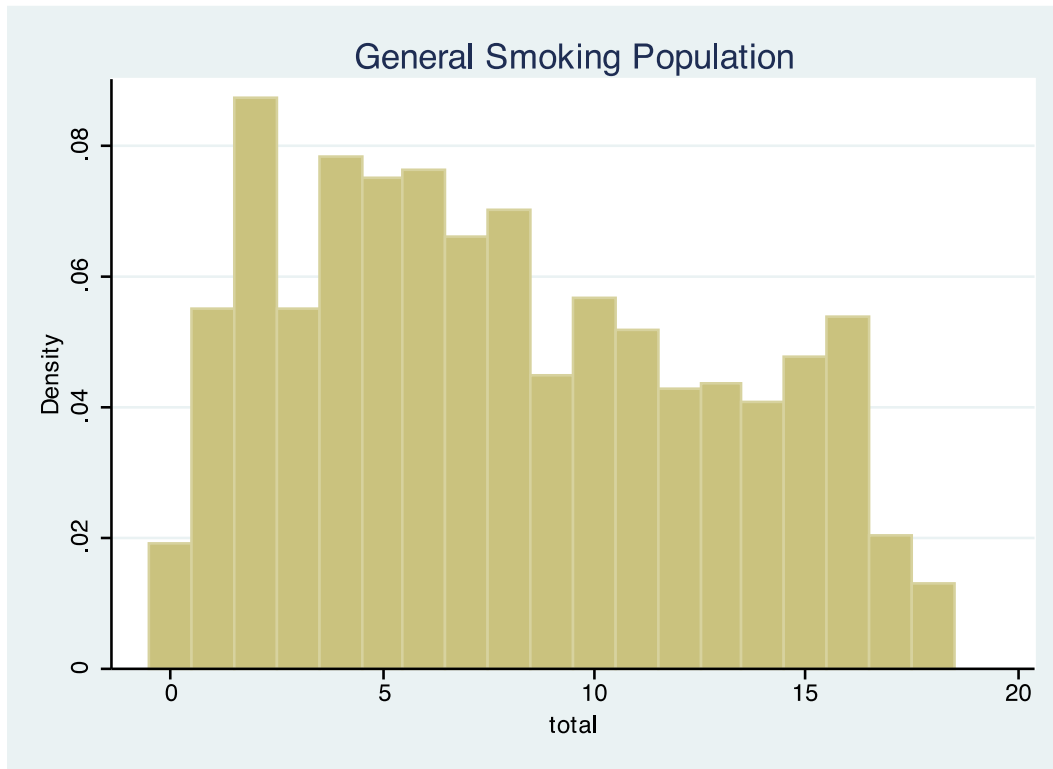
Figure 1: Total Smoking Beliefs Across the General Population**Figure 2:** Total Smoking Beliefs Across the Non Smoking Population

Figure 3: Total Smoking Beliefs Across the Smoking Population

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