Smoking, Social Class and Gender: The Diffusion of the Tobacco Epidemic among Older Adults in Ireland

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under the supervision of
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Declaration

I declare that this thesis is entirely my own work. It has not been submitted to this or any other institution for degree or publication.

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For my Dad

Abstract

Background: Half of all regular smokers die from smoking-related diseases. In Ireland, smoking is the highest cause of preventable mortality, representing almost one in five deaths each year. The spread of tobacco can be described using the diffusion model of the tobacco epidemic, which provides a framework for differences in smoking behaviour. The interrelation of gender and social class, mediated by age and life experience, is critical for understanding the diffusion of tobacco in high-income countries.

Methods: Secondary analysis of TILDA data collected from 8504 Irish older adults was conducted and the independent relationships of age, gender and social class with smoking were examined. A multinomial regression model was used to examine the relationships collectively, including the interaction effects of age with gender and social class.

Results: Age, gender and social class were all independently related to smoking, with younger respondents, males and those with low social class being more likely to smoke. Men were much more likely than women to have previously smoked and the odds increase with age for men and decrease with age for women. Among older age groups, gender had a stronger effect on smoking than social class, but among younger age groups, social class had a stronger effect than gender.

Conclusions: The findings supported the existence of the diffusion model of the tobacco epidemic and previous research that lower social class women are more likely to smoke and less likely to quit. Further research into psychosocial factors, clustered health behaviours and cessation among older people using longitudinal analysis or structural equation modelling may be useful. Improved targeted cessation interventions for less successful subgroups may be of benefit, helping to achieve public health targets and reduce inequalities in smoking.

KEYWORDS: Smoking; tobacco epidemic; older adults; social class; gender; Ireland.

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Abbreviations

CAPI	Computer-Aided Personal Interview
CATPCA	Categorical Principal Components Analysis
CSO	Central Statistics Office
DOH	Department of Health and Children
FCTC	Framework Convention on Tobacco Control
HSE	Health Service Executive
IHRA	International Harm Reduction Association
ISSDA	Irish Social Science Data Archive
NPAS	National Positive Ageing Strategy
NRT	Nicotine Replacement Therapy
OHCHR	Office of the High Commissioner for Human Rights
SCQ	Self-Completion Questionnaire
SES	socioeconomic status
SHS	second-hand smoke
SLÁN	Survey on Lifestyle and Attitudes to Nutrition
SNI	Berkman and Syme Social Networks Index
TASC	Think-tank for Action on Social Change
TILDA	The Irish Longitudinal Study on Ageing
TPPA	Trans-Pacific Partnership Agreement
TRIPS	Agreement on Trade-Related Aspects of Intellectual Property Rights
TTD	Treatment of Tobacco Dependence
TTIP	Trans-Atlantic Trade and Investment Partnership
WHO	World Health Organization

Introduction

Tobacco is the largest single cause of preventable death and chronic disease worldwide, killing half of its persistent users (David, Esson, Perucic and Fitzpatrick, 2010). Globally, around a billion people smoke and half of these will die prematurely, a rate of 8 million people per year by 2030 if current trends persist (WHO, 2012). In Ireland, smoking is the highest cause of preventable mortality, representing 5,200, or almost one in five, deaths each year (DOH, 2013a).

Lopez, Collishaw and Piha's diffusion model of the tobacco epidemic (1994) has been used to describe variation in smoking behaviours between demographic groups and countries around the world. The influence of gender and social class are particularly salient aspects of the diffusion of tobacco, which can be examined through the lens of age and ageing. While adolescence is a particularly critical period for smoking initiation, the temporal context and unique culture of each generation are highly relevant. Today's older people were exposed to smoking before the harms to health were fully understood and more recently, experienced the introduction and escalation of tobacco control. The interrelation of gender and social class, mediated by age and life experience, is critical for understanding patterns of smoking prevalence in high-income countries.

In many high-income countries, smoking is now far more prevalent among lower social classes, despite strong tobacco control policies (David et al., 2010). Smoking perpetuates disadvantage by contributing to health inequalities, as well as being a financial burden and intensifying the stigma related to poverty. Smoking is also becoming increasingly popular among women, particularly lower social class women and it is suggested that lower social class and female smokers are less likely to quit smoking successfully (Hiscock, Judge and Bauld, 2011). It is hoped that research into smoking and particularly quitting behaviours will provide more insight into those groups most vulnerable to smoking and most resistant to cessation.

While the diffusion model is a well-established framework, Ireland presents a distinct social, cultural and economic context, particularly in regard to changes in society, class structure, gender roles and the economy in the last hundred years (Barry, 2003; Redmond and CSO, 2000). An examination of the smoking epidemic and social class in Ireland with a particular focus on older people has not yet been conducted. Investigations such as this may also contribute to the growing body of research intended to help achieve the Tobacco Free Ireland target of a smoking prevalence lower than 5% by 2025.

This study will examine the smoking behaviour of older adults in light of their gender and social class, using their age to provide insight into the diffusion of tobacco in Ireland. The

study will also identify the types of older people related to different smoking behaviours, thereby placing themselves at risk of smoking-related diseases. Secondary quantitative analysis of a large sample of older adults will be conducted to achieve these aims as it enables the systematic evaluation of the relationships between age, gender, social class and smoking behaviour for respondents who have lived through multiple stages of the tobacco epidemic. In interpreting the results, attention will be paid to the social context, the history of the tobacco epidemic in Ireland and the life stage of respondents during different phases of the diffusion model.

Chapter 1: Literature Review

1.1 Introduction

Morbidity and mortality caused by smoking have been among the greatest challenges to health in the last century, and contribute to health inequalities. Smoking spread in a similar way to innovations, affecting different subgroups differently across the world (Rogers, 1983). In high-income countries, smoking is now far more prevalent among lower social classes, despite strong tobacco control policies. Smoking rates among men and women have also changed over the last hundred years. Smoking was initially dominated by men but in recent years it has become increasingly common among women, even more than men for some groups.

Age plays a role in how people are influenced by smoking-related issues, as each generation has experienced smoking, tobacco control policy and cigarette marketing differently. Notably, today's older people were exposed to smoking before the harms to health were understood. The interrelation of gender and social class, mediated by age and life experiences, is critical for understanding patterns of smoking prevalence in high-income countries. Relatively little research has been conducted on the smoking habits of older people. Therefore, this study investigates the relationships between gender, age, social class and smoking behaviour among Irish older people.

1.2 Smoking as a Priority Public Health Issue

Tobacco is the largest single cause of preventable death and chronic disease worldwide, killing half of its persistent users (David et al., 2010). It has been known since the mid-80s that among smokers aged 35-69, the mortality rate is three times that of non-smokers (WHO, 1997). Globally, around a billion people smoke and half of these will die prematurely, a rate of 8 million people per year by 2030 if current trends persist (WHO, 2012). Smoking, along with 6 other risk factors including alcohol misuse, obesity and lack of exercise, contributes to 60% of the European disease burden (DOH, 2013a).

As well as contributing to chronic conditions, smoking also increases economic burdens on healthcare systems due to smoking-related morbidity (WHO, 2012). Governments have a duty to respond to threats to the health of their citizens and a need to reduce healthcare expenditure, both of which are fulfilled by attempts to reduce smoking (OHCHR and WHO, 2008). Increasing understanding of addiction and cessation is counter-balanced by the wealth and influence of the tobacco industry and its interests in making profit from tobacco products (David et al., 2010). In 2003, the Framework Convention on Tobacco Control (FCTC), the first international legal convention on a

health issue, was developed by the World Health Organization (WHO) as an "evidence-based treaty that reaffirms the right of all people to the highest standard of health" (WHO, 2003). To date, there are 168 signatories, ostensibly committed to reducing smoking through tobacco control.

Tobacco control policies have been successful in contributing to a denormalisation of smoking, decreasing social acceptability, raising awareness of the hazards of smoking and ultimately reducing smoking rates (Graham, 2012). This has been achieved through a mixture of public media campaigns, minimum age restrictions, increased taxation, and smoke-free public spaces and workplaces. These multiple factors have played an important role in reducing overall smoking prevalence and second-hand smoke exposure. But while the successes of denormalisation are evident, the "policy-induced stigma" of smoking only serves to perpetuate class division (Graham, 2012). The remaining smokers disproportionately belong to lower social classes, feeding into the discourse of the "weak-willed," disadvantaged smoker, which may lead to harmful responses rather than prompting cessation (Graham, 2012).

In more recent decades, tobacco control has begun to adopt harm reduction, human rights and equity approaches to address social inequalities in smoking (Graham, 2012; IHRA, 2010; OHCHR and WHO, 2008). While the best outcome for health is for smokers to quit "immediately, completely and forever," a pragmatic harm reduction approach seeks to minimise the dangers of smoking for people unable or unwilling to stop (IHRA, 2010). This approach may involve setting a quit date, cutting down to quit, quitting for a period of time, and the use of nicotine replacement therapy (NICE, 2013). Harm reduction interventions may be valuable for older people who may have been smoking for a long time and may have higher nicotine dependency (Hall et al., 2008).

However, tobacco control in general is being impeded. Progress under the FCTC has been complicated by conflicting EU directives, such as the trademarks directive, and international trade agreements that allow tobacco corporations to sue governments for adopting tobacco control measures. Tobacco corporations have already invoked the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) and North American Free Trade Agreement (NAFTA) to prevent the adoption of standardised packaging in Canada, Norway and Uruguay (ASH, 2012). The adoption of the Trans-Pacific Partnership Agreement (TPPA) and Trans-Atlantic Trade and Investment Partnership (TTIP) will present further barriers to tobacco control measures, if tobacco is not excluded (ASH, 2012). Cigarettes are a unique product in that when used as intended, they kill half of their users (ASH, 2012). However, groups lobbying for the right to smoke, such as the US Smokers' Association, argue that the "repression" of smoking is contrary

to "personal liberty." To date, there is no ratified human right nor legislative right (e.g. US constitution (Graff, 2008)) to support the right to smoke.

As well as the power imbalance between individuals and the tobacco industry, there are imbalances in society that increase the tendency of certain groups to smoke. Various studies have shown that low education, low income, gender, age and poor mental health, for example, are related to smoking (e.g. Ensminger et al., 2009; Graham et al., 2006; McGee and Williams, 2006). These inequalities undermine the human right to health, which governments have a duty to protect from third-parties through regulation and to actualise through taking proactive measures (OHCHR and WHO, 2008). The scale and seriousness of the problem, the vulnerability of certain groups and the state's role as guardians of the right to health make smoking a priority public health issue (OHCHR and WHO, 2008). The spread of this tobacco epidemic and its related health and social inequalities can be conceptualised using a diffusion model.

1.3 The Diffusion Model of the Tobacco Epidemic

There are wide global disparities in the uptake, normalisation, marketing, cessation and regulation of tobacco and the spread of tobacco use across the world can be described using insights from epidemiology and the diffusion of innovations. Lopez, Collishaw and Piha's widely-accepted diffusion model of the tobacco epidemic (1994) provides a conceptual framework of patterns of tobacco use among different groups on a national and international scale. This four-stage model involves trends in prevalence and smoking-related mortality.

Stage I marks the beginning of the tobacco epidemic and is characterised by relatively low smoking prevalence and consumption among men and almost negligible use among women (Lopez et al., 1994). Smoking-related morbidity and mortality are not yet noticeable and tobacco control policies have not been developed. This phase lasts for one or two decades before progressing to Stage II. For UK and Ireland, this stage occurred at the beginning of the 20th century, but many low-income nations are currently in Stage I (Graham, 2009).

In Stage II, smoking prevalence among men rises rapidly to peak between 50-80% of the male population (Lopez et al., 1994). The prevalence of smoking among women increases sharply but remains lower than for men. The "respectable," "early adopters" are mainly high status persons, notably physicians, with higher social status, upward social mobility and education (Pampel, 2006; Rogers, 1983). Early adopters are most open to innovation and act as role models for the majority, decreasing uncertainty about the new innovation of smoking (Rogers, 1983:249–251). As smoking spreads to the masses, it is less

associated with prestige, so that over the following two or three decades, it is not widely differentiated between social classes. Rates of lung cancer deaths begin to increase among men and tobacco control policies are weak, since knowledge of the harms of tobacco smoking are not yet fully understood or disseminated (Lopez et al., 1994). In the 1950s UK, for example, smoking was considered prestigious and prevalence across all classes increased, peaking at 80% for men in 1950 (Peto et al., 2000). During the 1960s, public attitudes had already begun to change and prevalence among men was falling, as the UK entered Stage III (Graham, 2009).

Stage III is defined by a decline in smoking, particularly among men. Many middle-aged and older men become ex-smokers as the consequences of smoking are realised, and the peak in female prevalence is considerably lower than for men; in the UK, female prevalence peaked at around 50% in 1970 (Peto et al., 2000). However, while many men, high status males in particular, quit smoking rapidly, the decline is less steep for women and reaches a plateau so that their prevalence rates are relatively similar (Lopez et al., 1994). Further, a social differential in smoking begins to emerge, with smoking rates in lower socioeconomic groups declining later and slower than their counterparts (Graham, 2009). This phase is also marked by high rates of lung cancer, particularly for males. In response to smoking-attributable mortality, tobacco control policies are developed and implemented, primarily focussing on the denormalisation of tobacco through public awareness campaigns and smoke-free public spaces.

During the final stage, prevalence and consumption continue to slowly but steadily decline for both men and women, more so for higher social classes than for disadvantaged groups (Lopez et al., 1994). Male mortality rates peak, while female mortality continues to grow due to the lag in peak tobacco use. Tobacco control policies are strengthened as smoking is increasingly denormalised and cessation is increasingly sought and encouraged. Many high-income nations are in this advanced stage of the epidemic, while lower-income nations lag several decades behind (Lopez et al., 1994).

1.3.1 The Diffusion Model and Gender

While high-income nations are currently experiencing Stage IV, low-income countries have not yet seen peak smoking prevalence or mortality. In these countries, the potential for dramatic rises in smoking among women poses huge public health risks. Currently, the number of female smokers in low-income nations remains low (e.g. 7% of women and 40% of men in Zambia; 2% of women and 29% of men in India), but if these countries continue on their present trajectory, there could be large increases in the coming decades (Pampel, 2006). In fact, women have been referred to as the "sleeping giant of the tobacco market" by tobacco industry analysts (Hammond, Daniel and White, 2012).

From the popularisation of snuff and pipe-smoking in Europe in the 17th century (EB, 2014), smoking was primarily a male domain, and until well into the 20th century, it was extremely controversial for women to smoke (Amos and Haglund, 2000). The cigarette rolling machine was invented in 1880 and used industrially by American Tobacco Company from 1890, leading to an explosion of inexpensive cigarette smoking (EB, 2014). Men initially suffered from a rapid rise in smoking as it was seen as a normative and masculine habit, leading to extremely high rates of lung cancer (e.g. in UK, 446 per 100,000 men aged 55-74) and other smoking-related conditions that peaked during the 1970s (Peto et al., 2000). Today's older people may have experienced smoking in the context of these gender divisions, which changed rapidly through the post-war era.

The tobacco industry capitalised on changing gender roles to present smoking as a symbol of emancipation for women (Amos and Haglund, 2000). Over the decades, marketing became more sophisticated, reflecting themes such as being equal to men (feminism), being like men (masculine), being able to attract men (glamorous), being your own woman (emancipation), and being a unique woman (individuality) (Amos and Haglund, 2000). Just as these marketing techniques have been (and still are) successful in the West, they are now being used in mid- and low-income countries. Ironically, smoking was sold to generations of women as a symbol of liberation and power (Amos and Haglund, 2000), but has, for some, perpetuated social inequalities that they were seeking to avoid (David et al., 2010; Graham, 2012).

1.4 Social Gradient of Smoking

As well as a differential between high and low income countries, the social inequalities related to smoking within countries are pervasive and complex. The diffusion model recognises that the highest status people were the first to adopt and subsequently abandon the new innovation of smoking, while for the lowest status people in the latter stages of the model, the significant harms caused by smoking persist. In the UK and US, for example, inequalities in smoking have increased since the 1970s, during decades in which the income gap between rich and poor has also widened (Graham, 2009).

Social class can be considered the interaction between social, cultural and economic background and status (Scott, 2002). In contrast to the more transient socioeconomic status, social class is based on social, cultural and economic background, which remains more stable and can be transmitted across generations (Rubin et al., 2014). This causes differential access to social, economic, cultural and symbolic capital, thereby playing a profound role in the construction of identity and behaviours (Rubin et al., 2014). Social class is often measured using education, income, occupation, and material possessions, which are well-established indicators for distinguishing life chances (Scott, 2002).

In recent decades, smoking has been associated with many indicators of low social class, including education, low household income and occupation type, as well as gender, age, ethnicity, poor mental health, recent immigration, single parenthood and homelessness (David et al., 2010). For example, in England, the lowest income groups had smoking rates of 37% compared to 15% in the highest income groups (Graham, 2012) and similar results have been found throughout Europe (Huisman, Kunst and Mackenbach, 2005).

As well as being more likely to take up smoking, those belonging to lower socioeconomic classes are more likely to die from smoking-attributable conditions (David et al., 2010). The financial demands of smoking have even greater consequences among those on lower incomes, since resources that could be used for housing, education, nutrition or healthcare are not available. Access to and utilisation of healthcare is also less prevalent among lower socioeconomic groups, a principle called the "inverse care law" (Kotz and West, 2009), which reinforces the health and social inequalities associated with smoking. Tobacco and poverty are involved in a vicious cycle, in which the most disadvantaged are more likely to smoke, thus exacerbating their disadvantage due to poorer health and increased expenses (Thomas et al., 2008).

Indeed, the greater the inequality the higher the tendency to smoke. Those experiencing multiple disadvantages are more likely to smoke than someone who is less disadvantaged. A study of low socioeconomic status among English smokers used occupation, neighbourhood deprivation, lone parenthood, car access, housing tenure, income and unemployment to investigate these effects (Hiscock, Bauld, Amos and Platt, 2012). Around 80% of the smokers sampled reported disadvantage on a least one of these factors. Not only was a higher likelihood of smoking associated with increasing disadvantage, but the gradient became steeper with each additional indicator (Hiscock et al., 2012). While only 15% of those with none of these disadvantages smoked, 60% of those with six or seven of the low SES indicators smoked.

Similarly, research in Ireland has suggested that limited economic resources and "enduring economic and social difficulties" are to blame for this steep differential (Layte and Whelan, 2009). Measures of disadvantage and deprivation (including a lack of adequate heating, owning a waterproof coat, and the ability to "make ends meet") accounted for almost a third of the differential in smoking between those with manual and non-manual occupations.

Health behaviours are often clustered, so smokers are more likely to make other unhealthy lifestyle choices, such as excessive drinking, a lack of exercise or poor nutrition (Brugha et al., 2009). The relationship between health behaviours and class is complex and concerns more than the ability to purchase the means to good health; indeed, smoking is

expensive (Pampel, Krueger and Denney, 2010). The stress paradigm suggests that the immediate pleasure of smoking is used to cope with adverse conditions. Decision-making may be more focused on the present, as there are fewer opportunities and reasons to be optimistic about the future.

The complex web of causality related to smoking may be disentangled using insights from a life course perspective. This approach recognises that experiences and conditions during childhood and adolescence have enduring influences and outcomes in later life (Pampel, Mollborn and Lawrence, 2014). More specifically, an advantageous position in childhood facilitates the accumulation of further advantages and opportunities, widening, as well as perpetuating, social inequality (Pampel et al., 2014). This hypothesis has been supported in studies showing a graded relationship between the extent of the disadvantage experienced and increasing chances of smoking (e.g. Lindström et al., 2013). However, most research conducted on smoking and cumulative disadvantage involves young adults or the general population with no particular focus on older people or how poverty during the life course may translate to smoking behaviours in later life.

1.4.1 Social gradient and gender

Women belonging to lower social classes are particularly vulnerable to smoking (Graham and Der, 1999). Certain domestic pathways experienced by women, such as early motherhood, single parenthood and non-cohabitation, add to the cumulative disadvantages of having low social class (Graham, 2009; Graham et al., 2006). In a UK study, women who had disadvantaged childhoods, left school early, became mothers at a young age and lived on low incomes had a smoking prevalence of almost 70% (Graham et al., 2006). This multiple disadvantage effect has also been found among African American women in Chicago (Ensminger et al., 2009). Further, psychosocial factors, such as poor mental health, lack of autonomy, low social support, and a history of sexual or domestic abuse or violence, are also known to be related to smoking in lower class women (Greaves and Hemsing, 2009).

A qualitative study into lower social class women's perceptions of smoking reported that women smoke in order to strengthen their social ties and manage the anger and stress caused by living in poverty, relationships and raising children, often on their own (Stewart et al., 2010). Smoking has also been described as a reward and in relation to weight management, as well as the "luxury" of taking space for themselves (Dedobbeleer, Béland, Contandriopoulos and Adrian, 2004). In fact, while men are likely to have stronger addictions, women are more likely to cite smoking as a coping strategy to deal with stress (Flandorfer, Wegner and Buber, 2010).

Besides being influenced by psychosocial and economic factors and gender roles, medical research has suggested that smoking-related conditions may manifest differently for women and they may be more seriously affected (Greaves and Hemsing, 2009). This unequal health burden on certain social groups may be lessened through various targeted tobacco control measures. The main areas for intervention are smoking initiation, second-hand smoke (SHS) exposure and cessation. In each of these areas, subgroups of social class and gender suffer from differential vulnerability.

1.5 Smoking Initiation

Nearly 90% of smokers started when they were children and smoking has been termed a "paediatric disease" (Myers, 1999). Smoking initiation in all social classes most often occurs during adolescence, but lower social class adolescents are more vulnerable to begin to smoke (David et al., 2010; Hiscock et al., 2012; Huisman et al., 2005; Levin, Dundas, Miller and McCartney, 2014; Moore, Roberts and Tudor-Smith, 2001). More specifically, smoking among low social class teenagers may relate to less resistance peer pressure, underestimating the hazards of smoking, poor mental health, poor school performance or attendance, and stressful social problems (David et al., 2010).

Early initiation is also associated with worse health outcomes, including higher risk of smoking-related health conditions throughout the life course and higher nicotine dependence making it harder to quit in later life (Chen and Jacques-Tiura, 2014). Adolescence has been a critical period for initiation since smoking became widespread, and it is likely that today's older people started smoking in their adolescence when tobacco control was minimal and smoking was normative.

1.5.1 Initiation and gender

Throughout much of Europe, female adolescents and young adults are now smoking more than males (Chen and Jacques-Tiura, 2014; Levin et al., 2014; Moore et al., 2001). Studies suggest that aspects of social class, exposure to others' smoking and poor mental health are salient predictors of smoking among young women. For example, low maternal education, early motherhood, high level of anxiety and having a partner who smoked were associated with smoking among women in New Zealand (McGee and Williams, 2006).

One of the reasons that smoking has increased among teenaged girls might be related to the rise of "feminine" cigarettes marketed to them (Hammond et al., 2012). The packaging of these products attempts to embody ideals of sophistication, glamour and weight reduction and are often slim, flavoured, "light" or "low tar" cigarettes that appeal to adolescents, particularly teenaged girls (Hammond et al., 2012; Manning, Kelly and Comello, 2009). These special varieties can mislead smokers into believing that their

particular brand of cigarettes is less harmful than others (Hammond et al., 2012). However, restrictions on cigarette flavours and standardised packaging may combat this (Hammond et al., 2012; Wakefield, Hayes, Durkin and Borland, 2013).

1.6 Smoking Cessation

Not only are the consequences of smoking prolific and deadly, but the addictive nature of tobacco presents significant challenges to quitting for all smokers, including older people who may have been smoking for long periods. Smoking behaviours are affected by the social and material context and mediated by psychosocial factors and as a result, members of lower social classes are more likely to begin smoking and less likely to quit (David et al., 2010; Hiscock et al., 2012; Hiscock et al., 2012). Several studies have found no significant differences between quit attempts by social grade, but the success of the quit attempts was highly associated with social class (Hiscock et al., 2012; Kotz and West, 2009; West, McEwen, Bolling and Owen, 2001). Kotz and West (2009) also found no significant differences in use of cessations services including medications and NHS Stop Smoking Services.

There are a multitude of reasons, both instrumental and psychosocial, that may explain the differential in quitting. There may be barriers to affordable cessation services and aids, such as Nicotine Replacement Therapy or counselling services, as well as limited knowledge about the methods available and how to access them (David et al., 2010). In addition, the method of referral and delivery of cessation services may not be effective for all groups (Hiscock et al., 2012). For example, in the UK, the National Health Service "Stop Smoking Services" reach only 8% of smokers (Hiscock et al., 2012). The move towards the Treatment of Tobacco Dependence (TTD) focuses on managing nicotine addiction and promotes clinical intervention, such as nicotine replacement therapy, which when taken correctly, has been shown to improve chances of quitting by 50-70% (Brugha et al., 2009). However, lower social class smokers are less likely to adhere to recommended treatment, such as taking the required dosage (Hiscock et al., 2012).

Psychosocial disadvantages may include lower self-efficacy, greater perceived barriers to success, higher levels of stress in daily life, less optimism about future health, hazardous, boring or strictly controlled working conditions, and higher levels of nicotine addiction (David et al., 2010; Pampel et al., 2010). Further, smokers from disadvantaged communities often experience multiple personal and social problems, such as poor mental health, drug abuse, homelessness or social exclusion. Smoking and quitting are very closely tied to peer-groups and social clusters, and the lower numbers of non-smokers in socially disadvantaged groups may be a barrier to achieving the momentum to quit (David et al., 2010). They may be faced with a lack of social support in their quit attempt, as social

norms may be less permissive of quitting. There have also been suggestions that education provides the individual with cultural, intellectual and psychosocial resources that promote alternative coping mechanisms to smoking (Huisman et al., 2005).

Low income has also been associated with having a short future time perspective, or forward-looking temporal horizon (Jones, Landes, Yi and Bickel, 2009). This is "the window of time in which an individual is capable of perceiving and planning" and in which anticipated outcomes can influence current choices (Jones et al., 2009). This concept is critical to understanding the seemingly irrational behaviour of addicted persons, including cigarette smokers, when they are aware of negative future consequences (Bickel, Kowal and Gatchalian, 2006). For example, having a shorter future temporal horizon was significantly related to fewer quit attempts (Hall et al., 2012). One study has found shorter future time perspectives to be significantly related to lower income, which may partially explain negative health behaviours (Jones et al., 2009). This may reflect the stressful and unstable living conditions that require more immediate attention and are not conducive to making longer term plans, as well as a more fatalistic attitude about controlling their own health (Pampel et al., 2010). This insight could have enormous potential for cessation interventions.

1.6.1 Cessation and gender

In many high income countries, there are quitlines and other cessation services available through national health organisations. Reid, Pipe, Riley and Sorensen (2009) found that men and women had different attitudes and experiences of smoking cessation, with women being more likely to use the medications, services or techniques recommended and accept more assistance than men. However, women seem to have less success quitting than men. The observation that men tend to smoke more heavily and have higher addiction, yet quit more successfully than women suggests that there may be different psychosocial factors at work (Flandorfer et al., 2010).

In Reid et al.'s telephone survey (2009), women were more likely to report concerns about others' health, the negative effects of smoking on their image, pressure from smoking bans and making a life change (including having a baby), as reasons for their quit attempts. Men in the same study were more likely to cite concerns about their long-term health and pressure from co-workers. While the oversimplification that women are affected by social relationships and men are affected by work may not hold true, this finding requires further clarification (Annandale and Hunt, 2000).

Gender differences were also found in temporal horizons. Delay discounting is a measure of temporal horizon and designates the reduction in reward that an individual is willing to accept if the reward is immediate rather than delayed (Jones et al., 2009). Smokers have

been found to discount hypothetical and real money, real cigarettes and hypothetical health at a higher rate than non-smokers (Bickel et al., 2006). Delay discounting was found to be higher in male smokers compared to male non-smokers and women, while future time perspective (described above) was found to be significantly shorter for female smokers than female non-smokers and men (Jones et al., 2009). This implies that while female smokers may not plan as far into the future, male smokers might be more willing to trade future outcomes for immediate gains (Jones et al., 2009).

Some research suggests that there is a differential response to cigarette price increases according to gender. Raising prices in the US was found to prompt much faster declines among low income women compared to high income women (Balbach, Herzberg and Barbeau, 2006; Levy, Mumford and Compton, 2006). However, the side effect of this policy may be to increase hardship for those who do not quit (Greaves and Hemsing, 2009). Worldwide the effects are less clear and there is no well-established consensus (Dedobbeleer et al., 2004; Thomas et al., 2008).

The hazards of smoking while pregnant for the foetus have been well-known for decades. Pregnancy provides a leverage point for cessation and smoking rates among pregnant women have been found to be lower in Canada (10% compared to 18.1% overall) and America (17.3% compared to 30.6% overall) (Greaves and Hemsing, 2009). Quit attempts during pregnancy have been found to be particularly successful, particularly if there is a supportive and accommodating partner (Greaves and Hemsing, 2009).

1.6.2 Cessation and Social Support

Social support and social isolation have been strongly associated with smoking. Quit attempts have been found to be more successful when the smoker has social support, both in general and specific to the quit attempt (Hiscock et al., 2012). Lower social class has been associated with smaller social networks, thus reducing potential to receive support while quitting. It has been suggested that short-term success may be related to active social support, whereas passive support, such as non-contact with smokers, may predict long-term success (Hiscock et al., 2012). However, the lower proportion of non-smokers in disadvantaged groups may not provide quitters respite from smoke exposure. Where smoking is normative, engaging in smoking may widen social networks and strengthen relationships.

Stewart et al. (2010) describe a successful pilot cessation programme for low social class women that integrates peer and professional support, education on smoking, nutrition and self-care, yoga, crafts, and other activities, designed to provide a holistic support package. Instrumental supports such as childcare, meals and transport were provided and the programme was delivered in a non-judgmental way conducive to building supportive

relationships. Although this programme was at pilot stage, there were positive results in terms of smoking reduction and cessation, social networks and other health behaviours (Stewart et al., 2010). A similar programme may be useful for older people, whose quit attempts may be hindered by a lack of support, loneliness or social isolation, particularly among widow(er)s and those who never married (Kamiya, Doyle, Henretta and Timonen, 2013).

1.7 Older People and Smoking

The link between social class, gender and smoking cannot be fully understood without reference to age as a key variable known to be associated with smoking. Age is an indicator of life stage and is related to attitudes, concerns and life experiences, as well as being connected to the social and historical context experienced by the individual. Relatively few studies have been conducted on the social aspects of smoking among older adults and the importance of quitting among older adults is sometimes underestimated (Morgan et al., 1996). Older people are already at a higher risk of suffering from chronic conditions and comorbidity, a risk which is increased by smoking (Zbikowski et al., 2012). Health management for older people is often complicated by polypharmacy and long-term prescriptions. There may be perceptions among healthcare providers that encouraging older people "to give up established habits is inappropriate," and among older people that they have already irreparably damaged their health (Moy, Crome, Crome and Fisher, 2011).

However, the health and quality of life of older people can improve as a result of quitting smoking (Moon, Kang, Jitpitaklert and Kim, 2012; Zbikowski et al., 2012). People of any age who stop smoking can avoid most of their subsequent risk of lung cancer (Peto et al., 2000). It has been suggested that even among adults aged 65 or older, risk of mortality from lung cancer, all-cause cancers, COPD, respiratory diseases, cardiovascular diseases and all-cause mortality returns to the same rate as non-smokers after 5 years (Chang et al., 2014).

Further, older people can quit successfully, and some studies suggest that cessation outcomes among older people are similar to middle-aged and younger adults (Moy et al., 2011; Zbikowski et al., 2012). A cessation intervention used by Vetter and Ford (1990) improved quit rates among older people and even among those who continued to smoke, 50% reduced their consumption (Moy et al., 2011). Morgan et al. (1996) described an office-based intervention delivered by clinical and office staff, specifically targeted to midlife and older smokers. This intervention doubled quit rates compared to the control group. In a different study of quit attempts by older women, 21% of the respondents were abstinent at 3-year follow-up (Schroeder, Lawlor, Montaner and Ebrahim, 2006). Most of

these women were lighter smokers at baseline, supporting the theory that remaining smokers at older age are "hardened smokers."

Indeed, Hall et al. (2008) found that respondents aged 50 and over had higher dependence on tobacco than those under 50. However, they also reported less stress, better moods and better mental health than younger smokers, which may aid their quit attempts and suggests that mood management may be less important for older smokers (Moon et al., 2012). As well as the potential for improving the health of current older smokers, an increased comprehension of older people who are resistant to quitting may provide insights for cessation services more generally.

1.8 The Irish Context

1.8.1 Smoking and Tobacco Control in Ireland

Around a million people in Ireland smoke tobacco products, with more than 5,200 people dying of smoking-related diseases each year (DOH, 2013a). Smoking is the highest cause of preventable death in Ireland, representing almost one in five deaths and placing Ireland second highest in the EU15 for smoking-related mortality (DOH, 2013a). In 2012, the overall prevalence rate was 22% (DOH, 2013c), declining from 29% in 2007 (Morgan et al., 2008). The Department of Health has reported that between 6 and 15% of the healthcare budget, or €1-2 billion, is spent on treating tobacco-related disease (DOH, 2013a). As well as the millions of Euro spent each year on smoking-attributable conditions, there are productivity losses due to absenteeism and premature death.

Smoking in Ireland seems to follow the general trends seen in other high income countries. In 2007, smoking was generally more common among younger people and lower social classes (Brugha et al., 2009). Lower class groups (SC 5-6) smoked more than higher class groups (SC 1-2) at all ages for women and among 30-44 year olds and those aged 65 and over for men. Lower social class women aged 18-29 had by far the highest prevalence; 56% of these young women smoked, compared to 28% of those in the highest social classes (Brugha et al., 2009). There were also large differences between higher and lower class men (SC 1-2: 31%, SC 5-6: 44%), but lower class women were the only group to have increased their rates of smoking between 2000 and 2007 (Brugha et al., 2009). There were also much higher smoking rates among unemployed people (49%) and those with a long-term sickness or disability (44%) compared to the overall population (29%).

Overall, more men than women smoked (31% of men compared to 27% of women) but men also reported more successful quitting (23%) than women (16%) between 2002 and 2007 (Brugha et al., 2009). Findings from SLÁN 2007 suggest that female smokers were

more concerned about gaining weight if they stopped smoking than men (Brugha et al., 2009). Further, more women (33%) and members of lower social classes (33%) anticipated that it would be harder to deal with stress without smoking than men (23%) and members of higher classes (22%). Smokers were also 2-3 times more likely to suffer from anxiety or other forms of psychological distress, factors more common among women (Brugha et al., 2009).

The difficulties of certain subgroups with quitting is cause for concern as the social, cultural, financial and other legislative changes surrounding smoking do not seem to be sufficient. Smoking prevalence is generally declining in Ireland, and decreased from 33% in 1998 to 29% in 2007 (Morgan et al., 2008). However, very little change occurred between 2002 and 2007 and tobacco control stalled in this period (Brugha et al., 2009). Ireland fell from first place in 2005 to second in 2007 in the European ranking for tobacco control after failing to follow up the workplace smoking ban in 2004 with additional tobacco control measures, as in the UK (Brugha et al., 2009).

At present, Irish tobacco control measures include smoke-free workplaces, minimum pack sizes, a ban on point of sale advertising, and minimum age restrictions, which were introduced in compliance with FCTC and EU guidelines. Cessation services are widely available and media campaigns to encourage quitting are prominent at regular intervals. For example, a recent campaign featured lung cancer sufferer Gerry Collins, who recently passed away, encouraging other smokers to quit. The HSE-run Quitline and website, Quit.ie, assists smokers to develop a personalised quit plan, involving preparing for the quit date, information on the health benefits of quitting, calculations of the savings, and tips on managing cravings. Nicotine replacement therapy has been available free of charge to medical card holders when prescribed by a GP since 2001, but this information may not be widely known (Brugha et al., 2009). Despite these measures, rates of smoking are remain high in lower class groups, particularly among younger women, reinforcing health inequalities.

A renewed commitment to tobacco control in Ireland resulted in an updated tobacco control policy called Tobacco Free Ireland. Its main commitment is to reduce the smoking rate to less than 5% of the population by 2025 (DOH, 2013c). This is set in a context of a new national framework for improved health and wellbeing 2013-2025, Healthy Ireland (DOH, 2013a). Its goals include reducing health inequalities and protecting the public from threats to health and wellbeing. In the domain of smoking, the target is to reduce both smoking prevalence and initiation by 1% per year to create a tobacco-free Ireland (DOH, 2013a).

The Tobacco Free Ireland policy document, underpinned by the WHO FCTC, sets out its recommendations under the WHO MPOWER themes (DOH, 2013c). In order to meet these targets, policy aims to Monitor tobacco use and prevention policies, Protect people from tobacco smoke, Offer help to quit tobacco use, Warn about the dangers of tobacco, Enforce bans on tobacco advertising, promotion and sponsorship, and Raise taxes on tobacco products (DOH, 2013c). These recommendations include smoke-free schools, universities, playgrounds and public spaces including parks in order to protect children and young people from SHS. Further, standardised cigarette packaging is anticipated to be introduced in 2015 (pending EU approval), with the possibility of a ban on smoking in cars where children are present in the near future.

1.8.2 Ageing and Smoking in Ireland

Tobacco is stated as an area for action (2.1.4) in the National Positive Ageing Strategy (NPAS) (DOH, 2013b). This falls under the second goal to "support people as they age to maintain, improve or manage their physical and mental health and wellbeing," and specifically, to "prevent and reduce disability, chronic disease and premature mortality as people age" via policy to "reduce associated lifestyle factors" (DOH, 2013b). Further, one of the Healthy Ireland goals is to "increase the proportion of people who are healthy at all stages of life" (DOH, 2013a). The development of the Healthy Ireland framework is complemented and informed by the Irish Longitudinal Study on Ageing (TILDA), which provides the opportunity to improve understanding of health behaviours in later life. The first wave of TILDA was conducted in 2009-2011 and revealed that 18.3% of those aged 50 and older smoked (Normand et al., 2011). TILDA exclusively surveyed adults aged 50 and over, providing a larger older adult sample than SLÁN in a more recent context.

1.8.3 Transformed Social Contexts

Older people have witnessed dramatic changes in the domains of work, the household, diet, technology, healthcare, welfare, government and smoking throughout their lifetimes. Factors acting at different phases of the life course contribute to the cumulative experience of each person, which can have strong influences on health behaviours (Ben Schlomo and Kuh, 2003). This is particularly relevant for smoking, since each generation may have had different experiences of tobacco diffusion. This life course perspective involves approaching health behaviour as a product of interconnected stages of childhood, adolescence, young adulthood, mid-life and older age, and emphasising the complex interaction of biological, behavioural and psychosocial factors (Arber and Cooper, 2000; Ben Schlomo and Kuh, 2003). Models of cumulative disadvantage described above (1.4) use insights from a life course perspective in that each stage of life is affected by all of the preceding ones.

Considering the life course will not only help to unravel the many interrelated factors that affect smoking behaviour, but may aid interpretation of the age, period and cohort effects that may be related to the diffusion model of the tobacco epidemic. A potential age effect is that people are more likely to stop smoking as they get older, as suggested by the cessation of higher social class smokers in young adulthood and mid-life (Hiscock et al., 2011). However, period effects may also be relevant (Bell and Jones, 2013), since the present phase in the history of smoking is dominated by tobacco control policies and these external influences could be causing increased quitting. Further, the older generations may have lived through multiple periods of the tobacco epidemic, for example, peak smoking prevalence in the 1950s and 1960s followed by peak mortality from lung cancer in the 1980s, which may have influenced to their attitudes about smoking.

Cohort effects are caused by specific age groups experiencing the same conditions at the same time, resulting in a "historical-social conscience" or collective identity shared by each generation (Arber and Cooper, 2000). Today's older people, sometimes termed "baby-boomers," may have been growing up, becoming adults or having children during periods of peak smoking prevalence and mortality, and this would affect each age group differently. Even though age, period and cohort effects are impossible to distinguish in practice, patterns of smoking in older people may offer insight into the diffusion model (Bell and Jones, 2013).

The general applicability of the diffusion model has been generally established across Europe (Pampel, 2006), and previous work examining cumulative effects of disadvantage on smoking behaviour, particularly for women, has been conducted in the UK (Graham et al., 2006). However, Ireland presents a distinct sociocultural context in that it did not experience the demographic transition from high birth and death rates to low birth and death rates like the rest of Europe (Normand et al., 2011). Ireland experienced consistently high emigration, high marital fertility, low non-marital fertility and low marriage rates until the 1950s. In this period, the population was falling, but post-war economic changes led to economic growth in the 1960s, reduced emigration and increases in marriage (Redmond and CSO, 2000).

Ireland's policy of protectionism during WWII failed to take advantage of the post-war economic boom (Barry, 2003). Despite trade liberalisation in the late 1950s and EU accession in 1973, Ireland's per capita income did not progress beyond 60% of the UK's until 1985 (Barry, 2003). The population in general suffered from periods of poverty, high unemployment and emigration, particularly in the 1970s and 1980s, which were also marked by the Troubles. However, in the 1990s, the Celtic Tiger increased per capita income from 61% of EU15's in 1987 to 97% in 2000 (Barry, 2003). However, this period

was also characterised by growing inequality and irresponsible fiscal policy, resulting in the recent recession (TASC, 2014).

There have also been numerous cultural changes. For example, in the 1990s, Ireland became increasingly multicultural, with higher immigration, particularly from the more recently acceded members of the European Union (Redmond and CSO, 2000). At the same time, the influence of the Catholic Church declined and Ireland experienced increasing diversification of religious orientations.

The population was heavily influenced by the emancipation of women (Redmond and CSO, 2000). The participation of women in the workforce became increasingly normalised, although until 1973, married women were not permitted to work in the civil service. Working patterns have moved away from 40-hour weeks towards increasingly flexible and insecure part-time contracts, disproportionately held by women (Annandale and Hunt, 2000). While flexible working conditions have facilitated the possibility of women balancing work and domestic life, part-time jobs are frequently lower paid and require less education than full-time positions (Graham, 2000). Over this period, there was a shift in industry away from agriculture towards services, technology and tourism (Redmond and CSO, 2000).

In the 1950s, Ireland was a mainly rural society with only 40% of the population living in towns with populations of over 1,500, but there was also a higher ratio of women living in urban areas, contributing to low marriage rates. In 1946 in Dublin City, there were 839 males per 1,000 females but the lowest ratio was found in Dun Laoghaire where there were only 730 men per 1,000 women (Redmond and CSO, 2000). However, by the 1990s, 60% of the population lived in towns and the ratio between men and women was much more equal (Redmond and CSO, 2000). This unusual gender distribution and low marriage rates may lead to higher levels of social isolation among today's older people.

There have been increases in self-employment and this, coupled with increasing participation of women in the workforce, has blurred the distinction between the home and work environments, traditionally the domains of women and men respectively (Annandale and Hunt, 2000). With the legalisation of divorce in 1994, the household as a domestic unit has become more dynamic with the possibility of divorce and remarriage and increases in single parenthood (Redmond and CSO, 2000). In the 1996 census, 87,800 were enumerated as separated or divorced, but this had risen to over 300,000 by 2011 (CSO, 2011). Marriage has clear protective links with better health and lower smoking rates, while previously married people are more likely to smoke (Nystedt, 2006).

The population became increasingly educated over the 20th century. In 1946, 35,000 children aged 15 or under were employed and rates of primary and secondary education

were low. Secondary education became more accessible in 1967 with the introduction of the Free Education Scheme and raising the school leaving age to 15 in 1972. Around this time there was large expansion in third-level institutions, especially in the technological sector. Women became increasingly educated, with more girls than boys at secondary and tertiary level (Redmond and CSO, 2000). During this period, women have come to occupy jobs at every level, including the presidency in 1990 by Mary Robinson, and 1997 by Mary McAleese. However, older women did not benefit from improvements to the education system to the same extent as younger women. Further, women's occupations are often "downgraded" after childbirth, meaning that many more women are employed below their education level (Annandale and Hunt, 2000).

These socioeconomic factors and changes in gender roles may have implications for smoking behaviours in older adults. Today's 80 year olds were born in the 1920s-30s, and would have been teenagers during the Second World War, young adults in the 1950s depression, in midlife during the Troubles and in their retirement during the Celtic Tiger (Barry, 2003). Their life experiences are likely to be different from those born in the 1960s boom, who were adults at the beginning of the Celtic Tiger and in midlife during the current recession. The associated period and cohort effects may have significant influences on older people's attitudes and health behaviours, including smoking.

1.9 The Current Study

The areas of smoking and quitting are complex, with a multitude of influences that reach across the life course. Previous research has found strong associations between social class, gender, age and smoking, which can be described using the diffusion model of the tobacco epidemic, as outlined by Lopez et al. (1994). The temporal aspect of the model plays an important role, and each phase provides a specific context in which individuals experience the phenomenon of smoking. Older people have experienced a range of smoking diffusion stages, each one potentially influencing their behaviour and attitudes to smoking. While the diffusion model is a generally accepted conceptual framework (Graham, 2012, 2009; Lopez et al., 1994; Pampel, 2006), Ireland presents a distinct social, cultural and economic context that requires closer inspection. An examination of the smoking epidemic and social class in Ireland with a particular focus on older people has not yet been conducted.

While smoking research is prolific, older people are relatively rarely focussed on in their own right. Research on smoking among older people may be of benefit as older people can quit smoking successfully and be assisted by cessation interventions; they may benefit further from a more targeted approach. Social isolation and support may be relevant factors for smoking in general and in particular for cessation. Investigations into smoking

habits among older adults may also contribute to the growing body of research intended to help achieve smoking prevalence of 5% or less by 2025.

Objectives

Through an examination of the differences between men and women, older adults of different age groups and members of different social classes, the current study seeks to:

- establish the extent to which the diffusion model of the tobacco epidemic is evident among older adults in Ireland
- identify the smoking behaviours of different groups of older people

When interpreting the results, attention will be paid to the social context, the history of the tobacco epidemic in Ireland and the life stage of respondents during different phases of the diffusion model. Age will be a particularly important factor in these interpretations. The second aim looks to the present and future rather than the past in order to highlight groups that may potentially benefit from targeted interventions to help them quit smoking.

Chapter 2: Methodology

2.1 Introduction

This study will examine the smoking behaviour of older adults in light of their gender and social class, mediated by their age, to provide insight into the diffusion of tobacco in Ireland. The study will also identify the types of older people most likely to smoke and least likely to quit, thereby placing themselves at risk of smoking-related diseases. Secondary quantitative analysis of a large sample of older adults was conducted to achieve these aims as it enabled the systematic evaluation of the relationships between these predictors for a large number of respondents. The aims are concerned with overall patterns that may offer partial explanations rather than full understanding of a small number of cases (De Vaus, 2002).

2.2 TILDA

The Irish Longitudinal Study on Ageing (TILDA) is a major multi-institutional, multi-disciplinary research project, led by Trinity College Dublin, designed to provide a wealth of high quality data relating to ageing and older people in Ireland. People aged 50 or older and their partners of any age were eligible to take part and were selected via probability sampling (detailed below). The study collected information on the economic, health and social aspects of the respondents' lives, and measures were selected to be compatible with international research.

TILDA seeks to build capacity in age-related research in Ireland by improving the quality of ageing research, harmonising with international ageing studies, providing a comprehensive data source for age-related issues, and making the anonymised dataset openly available. TILDA is also concerned with promoting ageing as a key societal issue, giving older people a voice in the public domain and promoting the realisation that ageing issues can have society-wide affects. To meet this objective, TILDA reports have been widely disseminated and there was a comprehensive national publicity campaign.

2.2.1 Design

The aims of TILDA were best met using a quantitative, systematic survey that can allow evaluation of connections between variables to take place, potentially identifying causal relationships (De Vaus, 2002). It facilitates nomothetic examinations that result in partial explanations for groups of cases, in this case older people. This suits the approach of the current study, as the specified predictor variables are not expected to account for all of the variation.

Longitudinal studies such as TILDA provide the potential to establish causality, which is particularly valuable for observational research, which has no control group. However, only Wave 1 is available at the current time, as Wave 2 is due for public release in September 2014. Despite the lack of a temporal dimension, Wave 1 provides comprehensive baseline data and can function as a standalone cross-sectional research, as in the current study.

The strengths of TILDA include its extensive range of topics and interdisciplinary and collaborative focus. TILDA was informed by a variety of experts in an attempt to develop a comprehensive data source for examining the complex web of causality surrounding ageing issues. The international and inter-disciplinary inputs have contributed to an extremely valuable resource with a large sample and a good quality sampling procedure. This enables the study of relatively small population sub-groups and provides vast potential for secondary research.

2.2.2 Access and Ethical Approval

TILDA data was accessed for the present study via application through the Irish Social Science Data Archive (ISSDA), as part of Ireland's EU Structural Funds Programme, hosted by University College Dublin. Public access to the data has several ethical dimensions, including protecting the anonymity and confidentiality of participants, ensuring that informed consent extends to secondary analysis and using the data as fully as possible to justify the demands placed on the respondents.

This study utilised the publicly-available anonymised main dataset. Relevant ethical considerations for this secondary research include using the anonymised data responsibly, reporting the findings accurately, and evaluating the implications of the conclusions (De Vaus, 2002).

Ethical approval for TILDA to be conducted was sought and granted by the ethical committee of Trinity College Dublin and informed consent was gained from participants. Ethical approval to conduct this secondary analysis was granted from the Trinity College Dublin Research Ethics Board on 9th June 2014.

2.2.3 Data Collection

Data collection was conducted during 2009-2011. Three modalities of data collection were employed: a Computer-Aided Personal Interview (CAPI) conducted face to face by trained interviewers; a Self-Completion Questionnaire (SCQ) administered via paper and pencil survey; and health assessments performed by a qualified healthcare professional. The CAPI was the core part of the survey and the SCQ and health assessments were encouraged but optional. The health assessment part of TILDA was not used in this study.

CAPI was selected as a data collection method due to the extent of the routing used in the questionnaire (skipping questions depending on respondents' answers). The CAPI was conducted by around 100 interviewers who were trained over a three-day briefing session and the interviews took around 90 minutes. To improve response rates, an incentive of €20 was rewarded to respondents on completion of the CAPI questionnaire, although giving incentives of this nature can be methodologically controversial (ESRC, 2014). The SCQ was presented in a printed booklet and was left with respondents for them to complete privately, due to the sensitive nature of the content.

2.2.4 Sampling and Participants

The TILDA design report describes the target population as "persons aged 50 or over living in residential addresses in the Republic of Ireland, and their spouses or partners of any age."

The well-established Economic and Social Research Institute (ESRI) RANSAM system, based on the Geodirectory was used as a sampling frame (see (Whelan, 1979). Clusters of RANSAM-generated addresses were selected using socio-economic and geographic stratification to aid representativeness and they were weighted in proportion to the estimated number of eligible persons per household. In total, the sampling procedure resulted in an equal probability sample, or epsem, using multi-stage selection, clustering of addresses to aid administration, and stratification to improve representativeness (Kenny et al., 2010).

Bias was introduced due to variations in response rates across participants with different characteristics. Respondents who had low socioeconomic status and low education and were unemployed, unmarried and male were less likely to respond, as expected from previous research (Galea and Tracy, 2007). Because some of these characteristics are of primary interest to this study, there is potential for the analysis to be distorted by the non-responders.

2.3 Sample Profile

The target sample size was a minimum of 8,000 and the final sample size was 8,504. The target response rate for eligible households was 60% and the attained response rate was 62.0%. A profile of the sample is provided in Table 2.1.

55.6% of respondents were women (n=4724), which is slightly higher than reported in the 2011 Census[1] (51.9%, n= 661,046) (CSO, 2011). In general, there are fewer respondents

[1] Census figures calculated based on a minimum age of 50, as the original minimum age in TILDA is unknown. For full comparison of Census data, see Appendix 1.

with increasing age and the proportions remain similar to the Census figures for 2011, apart from the 80 and older group. TILDA includes fewer numbers of the "older old," possibly due to difficulty in recruiting this demographic and the non-sampling of care institutions and hospitals.

In terms of education, the TILDA sample is fairly equally divided between those who have achieved primary, secondary and tertiary education. However, the census reports far lower number of people with third level education (17.0%, n= 216,686). TILDA's more educated sample can be explained by the higher likelihood of more educated people to participate in research (Galea and Tracy, 2007).

Variable	n	%
Gender		
Female	4724	55.6
Male	3780	44.4
Age		
50 or younger	663	7.8
51-54	1288	15.2
55-59	1649	19.4
60-64	1393	16.4
65-69	1196	14.1
70-74	963	11.3
75-79	714	8.4
80 or older	626	7.4
Mean	*63.0*	-
Standard Deviation	*9.4*	-
Education		
Primary or less	2521	29.7
Secondary	3431	40.4
Tertiary	2548	30.0
Marital Status		
Married	5966	70.2
Separated/divorced	552	6.5
Widowed	1195	14.1
Never married	791	9.3
Total	**n= 8504**	

TABLE 2.1: SAMPLE PROFILE SHOWING GENDER, AGE, SMOKING STATUS, EDUCATION LEVEL AND MARITAL STATUS FOR TILDA 2011 RESPONDENTS. N=8504.

The TILDA sample is also dominated by married respondents who comprise 70.2% of the sample (n=5966) and relatively few separated/divorced and never married respondents (6.5%, n=552; 9.3%, n=791). This pattern is less extreme in the census data, which reports only 63.6% married respondents, 8.4% separated or divorced respondents and a much higher 13.8% never married respondents. This may be due to the sampling technique (the selection of households) and the increased likelihood of married people to participate in research (Galea and Tracy, 2007).

Weights for TILDA responses were provided with the dataset, but they were not used. This study aims to examine relationships between predictors that are also key weighting variables so weighting the dataset may distort the relationships under investigation and complicate analysis.

2.4 Variables

The variables in this study were used to examine the smoking behaviour of older adults in relation to their age, gender and social class. While some variables, such as gender, were unproblematic, the measures used to represent social class had complications, such as a high number of missing values. The variables utilised in this study are described below, along with their issues and solutions.

2.4.1 Smoking status

Smoking status (BEHsmoker) was derived from two variables: "have you ever smoked ... daily for a period of at least one year?" (BH001) and "do you smoke at the present time?" (BH002). The former isolates never smokers while the latter distinguishes between current and past smokers. Being a smoker is defined as smoking a tobacco product daily for a least a year, disregarding occasional and social smokers as non-smokers. There are strengths and weaknesses to this, as utilising more specific categories about smoking habits would provide more subgroups, although the analysis may have been obscured by "borderline" smokers. The simplicity of this approach instead focusses on those smokers most at risk of developing smoking-related health conditions, that is, daily, established smokers. There is only one missing value for this variable, leaving 8503 valid responses.

2.4.2 Age

Respondents were asked their month and year of birth and this was converted to their age assuming that they were born on the first of the month stated. This avoids the anonymity issue of recording their whole date of birth. The target sample was adults aged 50 or over and their spouses of any age. There were therefore a number of respondents younger than 50, who were bottom-coded to 49. There were 329 respondents aged between 24 and 49. Age was also top-coded to 80, and there were 629 respondents aged 80 or over. A categorical age variable revealed that 183 respondents were aged between 85 and 89 and 51 respondents were aged 90 or older. While there is an extensive upward range in the sample, there are very few "older old," which may explain why they were top-coded. Age was used as a scalar variable for the analysis.

2.4.3 Social Class

Compared to the previous variables, social class is harder to measure and the variables used in TILDA had a large number of missing variables. A number of complementary aspects of social class were investigated to find the most suitable resolution.

Social Class CSO/Occupation

To measure social class, TILDA utilised the CSO occupation classification scheme used in the 2006 Census, which aims to "bring together persons with similar social and economic statuses on the basis of the level of skill or educational attainment required" (CSO, 2006). Occupation type was recoded under eight categories, including "other" and "farmers," which was added to TILDA because, without knowing the acreage, farmers could not be accurately categorised. However, farming involves such a wide range of job types it may not represent a distinct or cohesive group. There were also ambiguities with self-employed people.

The variable SESsocial_class is derived from two variables measuring the respondent's current occupation if still working and past profession if retired. However, there are a large number of missing values where the question was either not applicable to the respondent or the respondent refused to answer. This amounted to 38.6% overall, 28.9% for male respondents and 46.4% for female respondents (see Table 2.2).

However, 40.6% of women answered non-applicable and 5.7% did not answer, while around 14% of men belong to each of these categories. The differences in missing values

		Male	Female	Total
Professional Workers	Count	188	83	271
	% within Gender	5.0%	1.8%	3.2%
Managerial & Technical	Count	715	882	1597
	% within Gender	18.9%	18.7%	18.8%
Non-manual	Count	269	742	1011
	% within Gender	7.1%	15.7%	11.9%
Skilled Manual	Count	507	237	744
	% within Gender	13.4%	5.0%	8.7%
Semi-Skilled	Count	407	369	776
	% within Gender	10.8%	7.8%	9.1%
Unskilled	Count	154	135	289
	% within Gender	4.1%	2.9%	3.4%
Farmers	Count	446	86	532
	% within Gender	11.8%	1.8%	6.3%
Not Applicable	Count	532	1919	2451
	% within Gender	14.1%	40.6%	28.8%
Unknown/ Refused	Count	561	271	832
	% within Gender	14.8%	5.7%	9.8%
Total	Count	3779	4724	8503
	% within Gender	100.0%	100.0%	100.0%

TABLE 2.2: CROSSTABULATION OF THE CSO SOCIAL CLASS MEASURE AND GENDER SHOWING NOT APPLICABLE AND REFUSED RESPONSES.

by gender suggest that this is not random non-response, particularly as "not applicable" includes those who were unemployed, disabled, in education, and performing home duties, which may be particularly common among women of this cohort. The CSO recommends classifying the household based on the occupation of the head of the household or principal earner, but the occupation of the spouse was not recorded so this procedure cannot be followed.

Despite the popularity of this traditional measure, its extremely high non-response rate makes using it in this form problematic. The levels of missing cases are so high that types of simple imputation (e.g. imputing the mode/mean, imputing predicted values from regression) and more complex methods, such as multiple imputation, would not be appropriate.

Education

Respondents were asked the highest level of education they have completed. Education level was recorded under eight categories, and recoded into primary or less, secondary and tertiary, due to the small subgroups (Kamiya et al., 2013). While education is an important factor of social class and related to smoking behaviour, this measure accounts mainly for school-age and young adult education and may capture later-life learning or less traditional accomplishments less accurately.

Some respondents were affected by the 1967 Free Education Scheme, which waived fees in participating secondary schools and provided free school transport, especially in rural areas, in a bid to reduce social inequalities (Kamiya et al., 2013). More children who were school-aged in or after 1967 achieved secondary education compared to those who were already adults [$\chi^2(2)=621.3$, $p<.001$; $\lambda=.068$] (See Appendix 2). This change may have influenced the way that education relates to social class for this cohort.

Wealth and Income

Respondents reported their sources of income, outgoings and transfers to children, and a number of variables were derived and published with the TILDA dataset. However, as is common with financial information, there was a large proportion of missing values (see Table 2.3). This makes these variables very problematic as the high level of non-random non-response introduces immeasurable bias.

Although the literature suggests using housing tenure and car ownership as proxy measures of wealth (Currie et al., 2008; Graham et al., 2006), both of them are missing responses for over a quarter of cases. Further, 85.8% of those who answered reported that they or their spouse owns a house, so this indicator may not be very discerning. Instead, medical insurance was pursued as an approximate measure of wealth.

Variable	Missing
Total household income [INCtotalhousehold]	26.2%
Gross total assets [INCASSassets]	51.5%
Weekly household disposable income [INCASSETSweeklyHHdisy]	55.4%
House ownership	26.7%
Car ownership	26.8%

TABLE 2.3: PERCENTAGE MISSING VALUES FOR HOUSEHOLD INCOME, TOTAL ASSETS, DISPOSABLE INCOME, HOUSE OWNERSHIP & CAR OWNERSHIP.

		Less than €2000	€2000 - €10000	€10,000 - €15,000	€15,000 - €25,000	€25,000 - €35,000	€35,000 - €50,000	€50,000 - €70,000	€70,000 - €90,000	€90,000 - €12,0000	More than €120,000	Total
Medical card	Count	255	324	742	1036	456	278	64	18	7	17	3197
	%	70.2%	68.1%	86.5%	71.6%	47.1%	26.6%	10.3%	7.7%	5.0%	13.8%	50.9%
No coverage	Count	41	62	47	127	133	144	84	19	2	3	662
	%	11.3%	13.0%	5.5%	8.8%	13.7%	13.8%	13.6%	8.1%	1.4%	2.4%	10.5%
Private insurance	Count	67	90	69	284	380	625	471	198	130	103	2417
	%	18.5%	18.9%	8.0%	19.6%	39.2%	59.7%	76.1%	84.3%	93.5%	83.7%	38.5%
Total	Count	363	476	858	1447	969	1047	619	235	139	123	6276
	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

TABLE 2.4: CROSSTABULATION OF INCOME AND TYPE OF MEDICAL INSURANCE WITH CELL FREQUENCIES AND COLUMN PERCENTAGES. ***N=6276, $\chi^2(18) = 2041.1$, P <.001; Λ =.37, P <.001***

There is a clear relationship between income and whether the respondent held a Medical Card, had private medical insurance or was not covered. Income was recoded into groups and a Chi-squared cross-tabulation revealed a strong relationship between income and medical insurance [$\chi^2(18)=2041.1$, $p<.001$; $\lambda=.37$]. Those with modest incomes were much more likely to have Medical Cards (68.1%-86.5% of those in the groups earning under €25,000) and those with higher incomes are much more likely to have private insurance (76.1%-93.5% of those in the groups earning over €50,000). However, those earning between €25,000 and €50,000 were the most likely to have no insurance. Around 13.6% of respondents in these groups had no cover, compared to an average of 10.5%.

Despite almost all over 70s being eligible for the Medical Card, there is a clear relationship between income and the type of medical insurance held. Further, there is some theoretical basis for using this measure in connection with social class, since the purchasing of private insurance is one possible manifestation of the future-oriented health behaviours typical of higher social classes (Pampel et al., 2010).

Father's Occupation

An attempt was made to represent the respondents' class when they were growing up, so self-reported wealth when the respondent was aged 14 and their fathers' occupation were investigated. Respondents reported whether their family was financially well-off, about average, or poor when they were 14 years old. Respondents were asked to recall their father's occupation at this age and the CSO social class classification scheme was used to categorise their answers. The two measures were moderately related to each other [$\chi^2(16)=1136.7$, $p<.001$; Cramer's $V=0.26$] and to the respondents' own occupation [Self-reported wealth $\chi^2(12)=329.1$, $p<.001$; Cramer's $V=0.18$; Father's occupation $\chi^2(48)=1432.7$, $p<.001$; Cramer's $V=0.22$] (see Appendix 3).

The self-reported measure of adolescent wealth is direct not inferential, but relies on the respondents' perceptions so could be subject to selective memory or bias (De Vaus, 2002). Further, people tend to compare themselves to their closest neighbours rather than comparing to the population overall. On the other hand, using the CSO occupation scheme to measure social class is problematic (as above) and there were some missing values for father's occupation (4%, n=345). Both variables were retained for further investigation.

Social Class Index Construction

The described variables violated the assumptions of logistic regression modelling by exhibiting strong interrelationships. A tabulation of Chi-square results and their measures of effect size shows the degree to which they were related (see Appendix 4). For this reason, a dimension reduction approach was employed to create an appropriate measure

that would be somewhat representative of social class and suitable for use in the logistic regression model. The single-dimension component developed was used for the rest of the analysis, as a summary class variable is sufficient when the exact aspect of social class does not have key importance (Pampel et al., 2010).

Nonlinear Principal Components Analysis

Nonlinear Principal Components Analysis (PCA) was used to construct a social class measure.[2] The objective of PCA is to reduce a number of variables to a smaller number of uncorrelated variables that represent the original data as closely as possible (Linting, Meulman, Groenen and van der Koojj, 2007). Linear PCA requires that the relationships between the variables are linear and that all of the variables used can be sensibly scaled to a numeric level (Linting et al., 2007). However, this is often not found in complexities of society and human behaviours so nonlinear PCA was developed to analyse ordinal and nominal variables and deal with nonlinear relationships between them. For this analysis, the nonlinear PCA programme in SPSS (developed by the Data Theory Scaling System Group) called CATPCA was used.

In nonlinear PCA, the components are not nested so the researcher must specify the number of components (Linting et al., 2007). Scree plots are an accurate and established indicator of the optimal number and were created to examine the Eigenvalues produced with different numbers of components. The Kaiser criterion, including all components with an Eigenvalue over 1, is sometimes used, but tends to advise too many components in nonlinear PCA. In the scree plots shown (Figure 2.1), the elbow consistently suggested that one component would be most suitable, and in this case, the Kaiser criterion concurs. Nonparametric bootstrapping and parallel analysis are more accurate methods to establish optimal component number but they were not used in this analysis (Linting et al., 2007).

Transformation plots were used to assess the quantified variables, compare different methods of quantification, examine the (non)monotonicity of the quantifications and select the most appropriate level for each variable. This was an iterative process in conjunction with the other assessments that were required and the principle that the most restrictive level should be chosen if there is only a small difference between solutions. For example, multiple nominal levels were investigated for car ownership, house ownership and marital status, but this did not improve the overall model, so the more restrictive nominal level was used. The final analysis levels are shown in Table 2.6.

[2] Multiple Correspondence Analysis was considered as a method to reduce the variables to suitable components (see Appendix 5). However, it was not ideally suited to the data and the monotonic and ordinal properties of the variables required further examination.

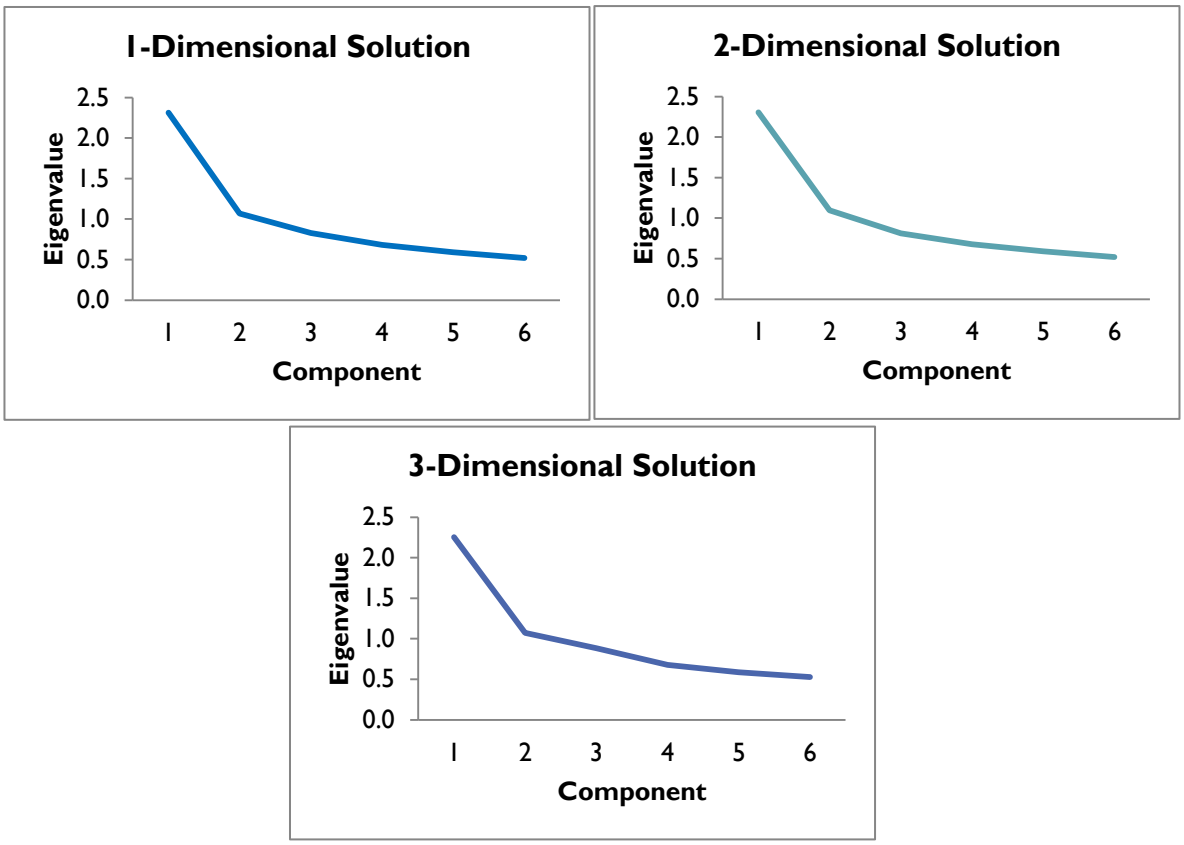

FIGURE 2.1: SCREE PLOTS INDICATING EIGENVALUES FOR COMPONENTS 1-6 FOR A ONE-, TWO- AND THREE-DIMENSIONAL CATPCA SOLUTION ON SOCIAL CLASS-RELATED VARIABLES FROM TILDA.

As described previously, some of the variables had an extremely high rate of missing values. While statistical techniques often use pairwise exclusion of missing values, nonlinear PCA was selected (in part) because of its more sophisticated treatment of missing values. This enabled the occupation type and household income variables to be included, which were both theoretically relevant. Having large numbers of missing values introduces bias because non-responders are often different from those who completed the survey. However, using these variables in conjunction with a variety of other measures lessens this effect and increased the reliability to some extent.

One treatment of missing values in nonlinear PCA is to exclude only the missing value itself while using the rest of the variables for that respondent, called "passive" treatment. This has the advantage of retaining as much information as possible without estimating or imputing any data. Another option is to include the missing values as a separate category. This is appropriate only when the missing values have a distinct quantification that separates them as a group from the other categories. After examination, missing values were all treated passively.

Variables were selected with a theoretical basis to represent social class (see 1.4). The variables examined initially were:

1. Education
2. Occupation
3. Household Income
4. Type of Medical Insurance
5. Car Ownership
6. House Ownership
7. Father's Occupation
8. Self-reported wealth at adolescence

During analysis, the variance accounted for (VAF) for each variable is the main criterion for selection (Linting et al., 2007). The total VAF across all the components (communality) was examined and variables with a total VAF of 0.25 or lower were iteratively rejected. A total VAF of 0.25 translates to 25% of the variables' variance being used by the components, which can be considered "fair," according to (Comrey and Lee, 1992:243). Variables included in the final component are shown in Table 2.6.

The Final Component: Social Class

The final component accounted for 48.2% of the variance[3] and had a Cronbach's alpha of 0.79. The final component is displayed in Table 2.5. The component loads the most strongly on education and type of medical insurance. These variables are all theoretically related to social class and there are no known fundamental measures of social class missing (Currie et al., 2008; Graham et al., 2006; Rosemary Hiscock et al., 2012; Rubin et al., 2014). The high missing values, while managed using passive exclusion, may still affect the analysis, but overall this component can be considered somewhat representative of social class, and will be referred to as such. A higher score indicates a higher social class (See Table 2.6).

	Component Loading	VAF	Strength
Education	.840	.706	Excellent
Type of medical insurance	.800	.640	Excellent
Total household income	.701	.491	Very good
Occupation type	.635	.403	Very good
Car ownership	.620	.384	Good
Father's occupation type	.520	.271	Fair

TABLE 2.5: COMPONENT LOADING, VAF AND STRENGTH ACCORDING TO COMREY & LEE (1992)

[3] 2.894 Eigenvalues ÷ 6 variables = 48.2% (Linting, Meulman, Groenen and van der Koojj, 2007)

	Education	Medical insurance	Household income	Occupation type	Car ownership	Father's occupation type
High score				**Professional**		**Professional**
				Managerial/technical		Managerial/technical
	Tertiary	**Private**	**Over €70,000**	Non-manual	**Two +**	Non-manual
	Secondary	Not covered	€70,000 - €35,000	Skilled manual	One car	Never worked
	Primary	Medical card	€35,000 - €15,000	Farmer	No cars	Skilled manual
			Under €15,000	Semi-skilled manual		Semi-skilled manual
				Unskilled manual		Farmer
Low score						Unskilled manual
Level of Analysis	Ordinal	Nominal	Ordinal	Nominal Spline (2,2)	Nominal	Nominal Spline (2,2)
Missing Values	Passive	Passive	Passive	Passive	Passive	Passive

TABLE 2.6: ORDER OF CATEGORIES, LEVEL OF ANALYSIS AND TREATMENT OF MISSING VALUES FOR VARIABLES INCLUDED IN FINAL COMPONENT

The social class measure was created as standardised scores, so the mean is 0.00 and the standard deviation is 1.09. Its range is 4.06 (-2.06, 2.54) and its slight positive skew of 0.19 (SE=0.03) is evident in the histogram (Figure 2.2). The kurtosis value is -1.00 (SE=0.05), which has a moderate effect on the distribution. Logistic regression does not assume a normal distribution, so these small violations of normality are not problematic.

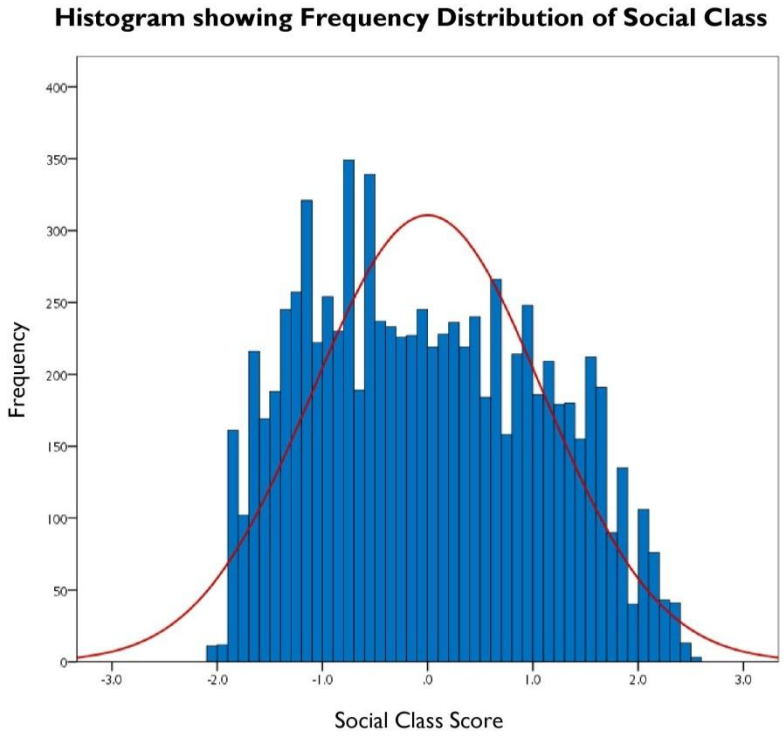

FIGURE 2.2: HISTOGRAM SHOWING FREQUENCY DISTRIBUTION OF SOCIAL CLASS WITH NORMAL DISTRIBUTION LINE.

2.4.4 Social Isolation

An adapted Berkman and Syme Social Networks Index (SNI) (1979) was used to control for social isolation in the model of social class, gender, age and smoking. Four sources of social contact were summed to produce a single score with a maximum of 4. Being married, having some close friends or relatives, attending a religious group meeting at least once a month and belonging to another type of group all scored one point. Although Berkman and Syme (1979) found that being married and having close friends are stronger measures of social networks than membership of different groups, their weighting procedure was not accessible[4] so Loucks et al.'s simple sum (2006) was used instead.

SNI: Marital Status

70.2% of respondents were married or cohabiting (n=5966) and of the remaining 29.8%, around half were widowed (n=1195), 9.3% were never married and 6.5% were separated or divorced. Almost a fifth of the women were widowed, confirming the trend of women outliving their husbands. In fact, where only seven women aged 50 or under were widowed, 72.3% of women aged 80 or older were widowed (n=259) [$\chi^2(21)=1386.2$, $p<.001$; $\lambda=.12$]. The married respondents scored 1 point on the Social Networks Index.

SNI: Close friends and relatives

Respondents were asked how many of their children they feel very close to (if they had children), how many relatives they feel close to, and how many close friends they have. This derived variable was provided with the TILDA dataset and having fewer than 3 close friends or relatives was given a score of 0 (n=127, 1.5%). 98.5% of respondents reported having more than two close relationships.

SNI: Religious groups

Respondents were asked how often they attend religious services. Around two-thirds of the sample went to church or another religious service at least once a month (69.0% valid, n=5557), scoring one point. There were 5.3% missing values for this variable.

SNI: Other groups

Respondents were asked if they participate in any groups such as a sports club, social group, church-connected group, self-help or charitable body, community group or day care centre. The sample was fairly evenly split, with 47.5% (n=4041) reporting participating in a group, scoring one point.

[4] The Social Networks Index was developed as part of Berkman's doctoral dissertation and was later published in a book- Berkman & Syme (1979) "Social networks, host resistance, and mortality: a nine-year follow-up study of Alameda County residents." See also Berkman and Breslow (1983).

SNI Index

Scores were summed where 0 and 1 represent being the most socially isolated, 2 represents moderately isolated, 3 is moderately integrated and 4 is socially integrated (Loucks, 2006). While around two thirds of respondents scored 3 or 4 (66.6%), around a quarter of respondents were moderately isolated (26.6%) and 6.9% were socially isolated (n=553) (see Table 2.7).

Social Networks Index	Frequency	Percent
Most isolated	553	6.9
Moderately isolated	2139	26.6
Moderately integrated	3289	40.9
Socially integrated	2070	25.7
Total	8051	100.0
Missing	*453*	*5.3*

TABLE 2.7: FREQUENCY TABLE FOR THE SOCIAL NETWORKS INDEX WITH VALID PERCENTAGES AND MISSING VALUES.

2.5 Analysis

Analysis was conducted using IBM SPSS Statistics 21 (IBM Corporation, 2012). The data was initially checked for outliers, missing data and sub-group sizes and recoded appropriately. In keeping with the literature, significance was set at $p<0.05$ but due to the controversy around significance testing, measures of effect size were reported throughout (Tabachnick and Fidell, 2007). These measures of association will be used to distinguish relevant from trivial findings, since the large sample presents a risk of Type I error.

To develop a social class index for this dataset, dimension reduction was conducted using CATPCA 1.1 (2.4.3). This programme was developed by the Data Theory Scaling System Group (DTSS), Leiden University, and is provided with the SPSS package. Berkman and Syme's Social Networks Index was calculated by summing scores (2.4.4).

In order meet the aims of the study, analysis was organised into two phases to firstly, assess independent relationships between each predictor and the outcome, and secondly, examine the nature of these relationships and their interactions.

First, Chi-square cross-tabulations were run to investigate sub-group relationships using cell frequencies, column percentages and standardised residuals. Scalar variables were recoded into groups to conduct these cross-tabs, despite the loss in specificity, because this method revealed more information about the relationship than simply comparing sub-

group means. Lambda could not always be calculated due to the proportions of subgroup sizes and its reliance on the mode, so Cramer's V or Phi were used as appropriate.

Then, multinomial logistic regression models were used to investigate the relationships of the predictors with smoking status and subsequently to control for social isolation to improve confidence in these relationships. Multinomial logistic regression is suited to predicting a discrete outcome (smoking behaviour) from a combination of categorical and scalar variables on a probabilistic basis (Tabachnick and Fidell, 2007). Further, independent variables need not be normally distributed, linearly related or have equality of variance between subgroups.

However, minimum cell counts are required for accurate Chi-square goodness of fit tests and adequate power and to avoid complete separation and failure of convergence (Tabachnick and Fidell, 2007). Logistic regression also assumes that the respondents are independent of each other and there is an absence of outliers and multicollinearity. Cross-tabulations were used to examine excessively strong relationships between predictors and multicollinearity diagnostics were run using linear regression models (see Appendix 6) (Field, 2009). Logistic regression coefficients were plotted to examine the linearity of the predictors with the Logit (see Appendix 7) (Norušis, 2012).

The models involved multiple interaction effects between predictor variables. Age, in particular, was anticipated to interact with other variables and moderate their effect on the odds of smoking. The age of the respondents represent not only physical age or life stage, but the experiences of the period and cohort that may influence smoking behaviour. Stepwise regression was used to verify if any extraneous interaction effects exist; specifically, backwards stepwise was used to ensure that suppressor effects were not overlooked (Field, 2009).

Although odds ratios are easy to comprehend, interaction effects can be more complex to interpret, due to the way the coefficients interact, the differing range and units of the variables and potentially opposing signs or directions of the parameters, particularly if there is more than one interaction effect. Therefore a graphical approach based on simple slopes was used to explicate the relationships of the predictors (Aiken, West and Reno, 1991). This involved plotting the regression equation for selected values and subgroups to visually display the roles of each parameter in turn within the equation.

The dataset, materials and rationale for the following analysis has been described and the results of this analysis are outlined in the next chapter.

Chapter 3: Findings

3.1 Introduction

The aims of this study were to investigate the diffusion model of the tobacco epidemic among older adults in Ireland and identify the smoking habits of particular groups of older people. The analysis and findings below are organised into two stages in an effort to understand the stated aims:

1. Are gender, age and social class independently related to smoking among older people in Ireland?
2. How do gender, age and social class interact with smoking among older people in Ireland?

3.2 Are gender, age and social class independently related to smoking in older people in Ireland?

3.2.1 Is gender related to smoking?

In total, 18.4% of the respondents reported currently smoking (n=1564) and although around 18% of both female and male respondents are current smokers, there are significant differences in current, past and never smoking between them [$\chi^2(2)=226.2$, $p<.001$, $\lambda=.082$]. While many more women have never smoked (50.5% of women compared to 35.7% of men), more men have smoked in the past (46.1% of men compared to 31.1% of women) (see Table 3.1). In summary, men and women report similar levels of current smoking but far more men than women were former smokers. Because of the fundamental influence of gender on smoking, gender differences in the relationships of age and social class with smoking will also be examined.

		Male	Female	Total
Current smoker	Count	687	877	1564
	% within Gender	18.2%	18.6%	18.4%
Past smoker	Count	1742	1471	3213
	% within Gender	46.1%	31.1%	37.8%
Never smoker	Count	1350	2376	3726
	% within Gender	35.7%	50.3%	43.8%
Total	Count	3779	4724	8503

TABLE 3.1: CROSSTABULATION OF CURRENT, PAST AND NEVER SMOKERS BY GENDER.

3.2.2 Is age related to smoking among older adults?

The age of the respondent also has a clear relationship with smoking status [$\chi^2(6)$= 128.4, p<.001, Cramer's V=.087] (see bottom of Table 3.2). Almost a quarter of all respondents under 55 are current smokers (23.7%, n=463) but this decreases with age so that only one in ten of those aged 75 and over are current smokers (10.7%, n=144).

For past smokers, the relationship is in the opposite direction. Around a third of those under 55 have been smokers in the past (32.0%, n=624), and this increases with age up to 43.3% (n=580) among those aged 75 and older. The proportion of never smokers stays fairly constant across these age groups.

However, when the age groups are split by gender a different pattern emerges (see Table 3.2, Figure 3.1). There was a stronger relationship between age and smoking for men [$\chi^2(6)$=92.8, p<.001, Cramer's V=.111] than women [$\chi^2(6)$=85.9, p<.001, Cramer's V=.095].

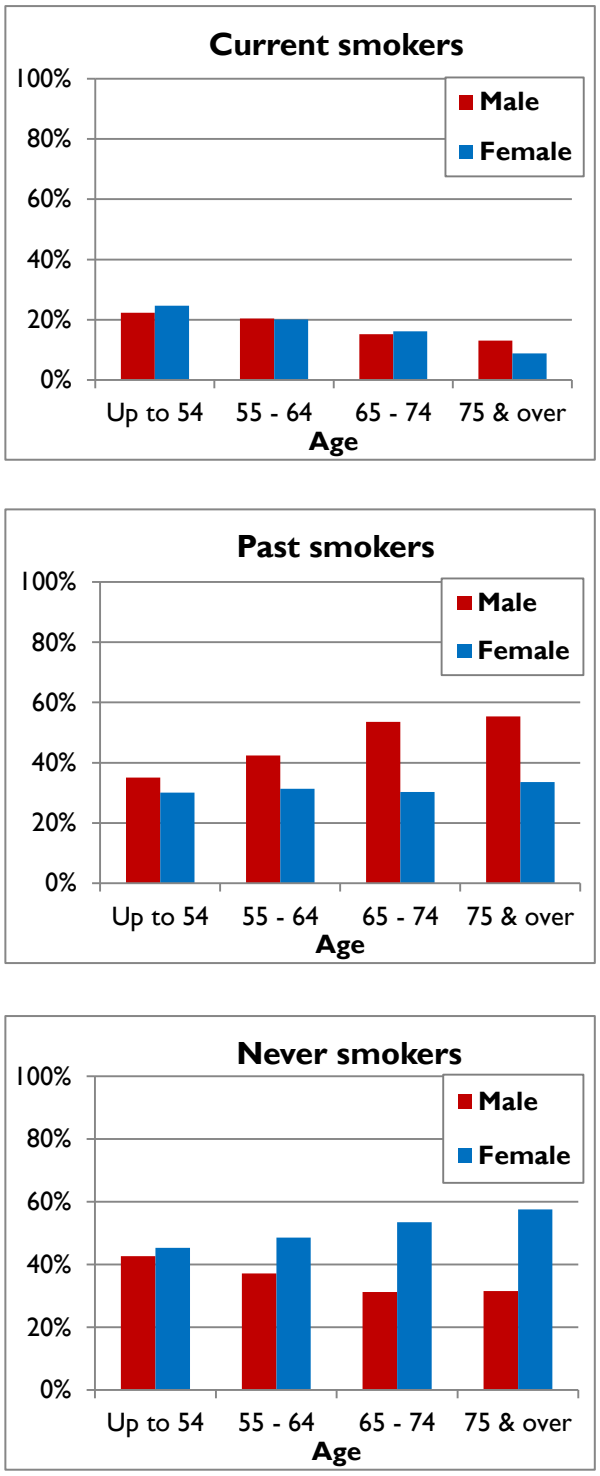

FIGURE 3.1: CROSSTABULATION OF CURRENT, PAST AND NEVER SMOKERS BY GENDER.

For current and past smoking, the directions of the relationships were similar for male and female respondents but they were different in magnitude. For men, current smoking decreased from 22.3% among those under 55 to 13.1% among those aged 75 and over. However, almost a quarter (24.7%, n=293) of women aged under 55 reported current smoking and this decreased to 8.9% (n=66). The gradient for decreasing current smoking rates was steeper for women than men, implying that age has a stronger relationship with current smoking for women than for men.

	Age	Up to 54	55 - 64	65 - 74	75 & over	Total
Male						
Current smoker	Count	170	276	162	78	686
	% within age	22.3%	20.4%	15.2%	13.1%	18.2%
Past smoker	Count	267	573	571	330	1741
	% within age	35.0%	42.4%	53.6%	55.4%	46.1%
Never smoker	Count	325	502	333	188	1348
	% within age	42.7%	37.2%	31.2%	31.5%	35.7%
Total	Count	762	1351	1066	596	3775
Female						
Current smoker	Count	293	339	177	66	875
	% within age	24.7%	20.0%	16.2%	8.9%	18.6%
Past smoker	Count	357	530	331	250	1468
	% within age	30.1%	31.3%	30.3%	33.6%	31.1%
Never smoker	Count	538	822	585	428	2373
	% within age	45.3%	48.6%	53.5%	57.5%	50.3%
Total	Count	1188	1691	1093	744	4716
Total						
Current smoker	Count	463	615	339	144	1561
	% within age	23.7%	20.2%	15.7%	10.7%	18.4%
Past smoker	Count	624	1103	902	580	3209
	% within age	32.0%	36.3%	41.8%	43.3%	37.8%
Never smoker	Count	863	1324	918	616	3721
	% within age	44.3%	43.5%	42.5%	46.0%	43.8%
Total	Count	1950	3042	2159	1340	8491

TABLE 3.2: CROSSTABULATION OF CURRENT, PAST AND NEVER SMOKERS BY AGE GROUPS AND SPLIT BY GENDER

More women have never smoked compared to men, and this is true across the range of age groups. For those aged under 55, there are fairly similar rates of male (42.7%) and female (45.3%) never smokers, but among older respondents men and women diverge so that among respondents aged 75 and over, male (31.5%) and female (57.5%) have never smokers. For those aged 75 and over, almost 70% of men have ever smoked (68.6%, n=408), while only 42.5% of women have ever smoked (n=316) (see Table 3.3).

In terms of being a smoker in the past, the gradient is much steeper for men than for women. While for women the proportion of past smokers suggests a slight increase across age groups, it increases dramatically for men. 35.0% (n=267) of male respondents under 55 are past smokers but this rises to 55.4% (n=330) of men age 75 and over. Of those who have ever been regular smokers, 80% of men and women in the oldest age group have quit smoking (see Table 3.3). However among those aged up to 54, there is a

	Age	Up to 54	55 - 64	65 - 74	75 & over	Total
Male						
Ever smoked	Count	437	849	733	408	2427
	% within age	57.3%	62.8%	68.8%	68.5%	64.3%
Quit smoking	Count	267	573	571	330	1741
	% within ever smoked	61.1%	67.5%	77.9%	80.9%	71.7%
Total	Count	762	1351	1066	596	3775
Female						
Ever smoked	Count	650	869	508	316	2343
	% within age	54.7%	51.4%	46.5%	42.5%	49.7%
Quit smoking	Count	357	530	331	250	1468
	% within ever smoked	54.9%	61.0%	65.2%	79.1%	62.7%
Total	Count	1188	1691	1093	744	4716
Total						
Ever smoked	Count	1087	1718	1241	724	4770
	% within age	55.7%	56.5%	57.5%	54.0%	56.2%
Quit smoking	Count	624	1103	902	580	3209
	% within ever smoked	57.4%	64.2%	72.7%	80.1%	67.3%
Total	Count	1950	3042	2159	1340	8491

TABLE 3.3: CROSSTABULATION OF EVER SMOKERS AND QUITTERS BY AGE AND SPLIT BY GENDER WITH COLUMN PERCENTAGES

marked difference between the genders with 61.1% of men but only 54.9% of women having quit.

Prevalence rates of smoking are different among men and women and change according to the age of the respondent. Men and women in the youngest age group were fairly similar to each other but in the older age groups the differences between them increased. Men in the older age groups are much more likely to be ex-smokers and older women are much more likely to have never smoked.

3.2.3 Is social class related to smoking?

The social class index developed from the dataset (described under Methodology 2.4.3) was used to examine differences in smoking behaviour across difference social class groups. The social class index consisted of standardised scores (mean=-0.0006, median=-0.078, standard deviation=1.09). For this part of the analysis, social class was recoded into four groups: less than 1 standard deviation below the mean (low social class), between 1 SD below and the mean (low-average), between the mean and 1 SD above (high-average), and more than 1 SD above the mean (high social class).

A moderate relationship between social class and smoking was found [$\chi^2(6)=179.8$, $p<.001$, Cramer's V=.103] (see bottom of Table 3.4). The strongest association was found between social class and current smoking, indicated by the large magnitude of the

standardised residuals. 24.8% of those with low social class currently smoked (n=472, std. res.=6.5), compared to 10.3% of those with high social class (n=192, std. res.=-8.1). The higher the social class score, the fewer respondents are current smokers. There are smaller residuals for ex-smokers, suggesting a weaker relationship. The highest social class group has the highest proportion of ex-smokers (40.5%, n=752, std. res.=1.9), but the other social class groups have similar rates to the sample overall (37.8%).

High social class is associated with never smoking; the higher the social class score, the more respondents have never smoked. Almost half of those in the highest social class

Smoking	Social Class	Low social class	Low-average	High-average	High social class	Total
Male						
Current	Count	219	241	146	81	687
	% in class	26.0%	20.5%	15.3%	10.0%	18.2%
Past	Count	391	538	431	382	1742
	% in class	46.5%	45.8%	45.0%	47.3%	46.1%
Never	Count	231	395	380	344	1350
	% in class	27.5%	33.6%	39.7%	42.6%	35.7%
Total	Count	841	1174	957	807	3779
Female						
Current	Count	253	314	199	111	877
	% in class	23.8%	23.2%	15.9%	10.6%	18.6%
Past	Count	325	392	384	370	1471
	% in class	30.6%	28.9%	30.6%	35.2%	31.1%
Never	Count	484	649	672	571	2376
	% in class	45.6%	47.9%	53.5%	54.3%	50.3%
Total	Count	1062	1355	1255	1052	4724
Total						
Current	Count	472	555	345	192	1564
	% in class	**24.8%**	**21.9%**	**15.6%**	**10.3%**	**18.4%**
	Std. Residual	6.5	4.2	-3.1	-8.1	
Past	Count	716	930	815	752	3213
	% in class	**37.6%**	**36.8%**	**36.8%**	**40.5%**	**37.8%**
	Std. Residual	-0.1	-0.8	-0.7	1.9	
Never	Count	715	1044	1052	915	3726
	% in class	**37.6%**	**41.3%**	**47.6%**	**49.2%**	**43.8%**
	Std. Residual	-4.1	-1.9	2.7	3.5	
Total	Count	1903	2529	2212	1859	8503

TABLE 3.4: CROSSTABULATION OF CURRENT, PAST AND NEVER SMOKERS BY SOCIAL CLASS WITH STANDARDISED RESIDUALS AND COLUMN PERCENTAGES AND SPLIT BY GENDER WITH COLUMN PERCENTAGES

group have never smoked (49.2%, std. res.=3.5), compared to only 37.6% of those in the lowest social class group (n=715, std. res.=-4.1). Overall, low social class is associated with currently smoking, while higher social class is associated with quitting and having never smoked.

When examined by gender, differences between men and women are apparent. The relationship between social class and smoking seems to be stronger for men [$\chi^2(6)=99.1$, $p<.001$, Cramer's V=.115] than for women [$\chi^2(6)=92.7$, $p<.001$, Cramer's V=.099] (see Table 3.4). For men, rates of never smoking extend from 27.5% in the lowest social class to 42.6% in the highest social class but the difference for women is not as great (45.6%-54.3%). The rates of men and women currently smoking in each social class are very similar, except for the lowest social group, in which more men (26.0%) smoke than women (23.8%).

Previous smoking appears to have a negligible relationship with social class when viewed in relation to current smokers and never smokers. However, the number of quitters as a percentage of those who ever smoked was calculated, revealing large differences by social class (see Table 3.5). Among high social class men, over 80% of those who have ever smoked have now quit (n=382) but in the lowest social class group, only 64.1% have quit (n=391). Similarly, over three quarters of high social class women who have ever smoked have quit (76.9%, n=370) while little over half of women in the lowest social group have quit (56.2%, n=325). This suggests a strong relationship between social class and quitting.

Smoking	Social Class	Low social class	Low-average	High-average	High social class	Total
Male						
Ever smoked	Count	610	779	577	463	2429
	% within age	72.5%	66.4%	60.3%	57.4%	64.3%
Quit smoking	Count	391	538	431	382	1742
	% within ever smoked	64.1%	69.1%	74.7%	82.5%	71.7%
Total	Count	841	1174	957	807	3779
Female						
Ever smoked	Count	578	706	583	481	2348
	% within age	54.4%	52.1%	46.5%	45.7%	49.7%
Quit smoking	Count	325	392	384	370	1471
	% within ever smoked	56.2%	55.5%	65.9%	76.9%	62.6%
Total	Count	1062	1355	1255	1052	4724
Total						
Ever smoked	Count	1188	1485	1160	944	4777
	% within age	62.4%	58.7%	52.4%	50.8%	56.2%
Quit smoking	Count	716	930	815	752	3213
	% within ever smoked	60.3%	62.6%	70.3%	79.7%	67.3%
Total	Count	1903	2529	2212	1859	8503

TABLE 3.5: CROSSTABULATION OF EVER SMOKERS AND QUITTERS BY SOCIAL CLASS AND SPLIT BY GENDER WITH COLUMN PERCENTAGES

The overall relationships between social class and smoking described above were replicated in both genders to some extent, but there were some differences between men and women. There was a stronger relationship between smoking and social class for men than for women with regards to both current and never smoking. Quitting was strongly associated with social class for both genders.

Summary

Is gender related to smoking?

Yes. While current smoking rates between men and women are very similar, more women were never smokers and more men were ex-smokers.

Is age related to smoking?

Yes. People in the youngest age group were more likely to be current smokers than people in the older age groups. But the effect of age on smoking depended on the gender of the respondent. When comparing older and younger respondents, there were larger differences in current smoking for women and past smoking for men. Older women were more likely to have never smoked than younger women but older men were less likely than younger men.

Is social class related to smoking?

Yes. Low social class is associated with currently smoking, while higher social class is associated with quitting and having never smoked.

The relationship between social class and smoking depended on gender. While current smoking was similar between men and women, more women had never smoked and fewer female smokers had quit.

These relationships are their interactions require further investigation using a model, under stage 2.

3.3 How do gender, age and social class interact with smoking?

It has already been established that social class, age and gender are related to smoking for this sample. Using logistic regression modelling, these relationships will be more fully examined to identify the strength and direction of these main relationships and their interaction effects.

Smoking behaviour as a function of gender, age and social class was modelled using multinomial logistic regression. The predictors were examined for multicollinearity and linear relationships with the Logit (see Appendices 6 & 7). Age was rescaled so that 50 years old was 0 and social class was a standardised score, centred on the mean (0).

The final model involved gender, age and social class and interactions terms for age with gender and age with social class. The model classified 50.6% of the cases correctly and the Nagelkerke r^2 was 0.11. Parameter estimates are displayed in Table 3.6.

The baseline -2 Log Likelihood for the model was 16985.6, improving to 16146.1 for the final model [$\chi^2(10)=839.5$, $p<.001$]. The Goodness of Fit statistics were not significant, finding no significant differences between the observed and predicted values [Pearson $\chi^2(15500)=15568.8$, $p=.347$, Deviance $\chi^2(15500)=15586.4$, $p=.311$]. However, the Goodness of Fit statistics should be treated with caution due to the high number of empty cells (15131 or 65.0%). This may be due to using scalar variables and the inevitability of producing empty cells for unlikely covariate patterns (Field, 2009). The analysis can proceed with caution, ensuring the coefficient standard error does not become unreasonably large. In fact, the standard error remained within ±0.1.

The estimated equations were:

$$logit = ln\left(\frac{\pi(x)}{1-\pi(x)}\right) = \beta_0 + \beta_1 x_1 + \cdots \beta_k x_k + \varepsilon$$

where π(x) is the conditional mean of Y given x, β_k is the coefficient of x_k, β_0 is the constant and ε is the error.

*logit (current) = -0.25 -0.06(age) -0.09(male) + 0.04(male*age) -0.79(social class) +0.02(social class*age)*

*logit (past) = -0.34 -0.01(age) +0.24(male) + 0.04(male*age) -0.16(social class) +0.01(social class*age)*

(Norušis, 2012)

Informed by a simple slopes approach (Aiken et al., 1991), the functions of the logit (above) were plotted for selected subgroups at specific values to aid interpretation of the interaction effects and provide a graphical depiction of the relationships (see Figures 3.2 A-D and 3.3 A-D). The selected values for age were 50, 60, 70 and 80 years old and for social class were 0 (mean), -2 (2 standard deviations below the mean), 2 (2 standard deviations above the mean).

3.3.1 Comparison between current smokers and never smokers

The odds ratio for the main effect of age is 0.94 (95% CI=0.93, 0.95), which means that for each increasing year in age, the odds of being a current smoker decreases. Although the odds ratio is close to 1, the effect occurs for each increasing year, amounting to a rather large effect. However, age is also involved in two interaction effects, so the effect of age is not uniform for all respondents.

	β *(SE)*	95% CI (lower)	Odds Ratio	95% CI (upper)
Current smoker vs Never smoker				
Constant	-0.25 *** *-0.066*			
Age	-0.06 *** *-0.005*	0.93	**0.94**	0.95
Male	-0.09 *-0.104*	0.74	**0.91**	1.12
Female	0			
Age*Male	0.04 *** *-0.007*	1.02	**1.04**	1.05
Age*Female	0			
Social Class	-0.79 *** *-0.052*	0.41	**0.46**	0.5
Age*Social Class	0.02 *** *-0.004*	1.01	**1.02**	1.02
Past smoker vs Never smoker				
Constant	-0.34 *** *-0.06*			
Age	-0.01 * *-0.004*	0.99	**0.99**	1
Male	0.24 ** *-0.087*	1.07	**1.27**	1.5
Female	0			
Age*Male	0.04 *** *-0.005*	1.03	**1.04**	1.05
Age*Female	0			
Social Class	-0.16 *** *-0.042*	0.79	**0.86**	0.93
Age*Social Class	0.01 ** *-0.003*	1	**1.01**	1.01

Reference category: never smoker. *** p<.001, ** p<.01, *p<.05

Note: R^2 = 0.094 (Cox and Snell), 0.108 (Nagelkerke). Model $\chi^2(10)$=839.5, p<.001.

TABLE 3.6: PARAMETER ESTIMATES- B-COEFFICIENTS, STANDARD ERROR, SIGNIFICANCE AND ODDS RATIOS WITH 95% CONFIDENCE INTERVALS.

The odds ratio for male respondents is 0.91 (95% CI=0.74, 1.12), with female as the reference category, although the coefficient is not significant. Initially, this would suggest that males have lower odds of being current smokers than women, but the interaction effect between age and gender acts in the opposite direction (OR 1.04, 95% CI=1.02, 1.05). For each increasing year, men are more likely to be current smokers compared to women. This reflects the differences found under 3.2.2, where the rates of men and women currently smoking diverge in older age groups. For example, around one fifth of men and women aged 55-64 smoked (20.4%, 20.0%), but 13.1% of men and 8.9% of women aged 75 and older smoked. This effect acts in opposition to the main effect of age for men, representing the flatter gradient for men's likelihood of smoking decreasing with age.

The function of the logit(current) was plotted to visually represent and verify this interpretation. Figure 3.2A shows the effect of age in the model for people with average social class (when social class=0 and social class*age=0). With increasing age, the likelihood of smoking increasingly differs between the genders; the gradient for female respondents is much steeper than the gradient for males. Age has a stronger effect against smoking on women than it does on men.

The odds ratio for social class is 0.46 (95% CI=0.41, 0.50), meaning that for every one-unit increase in social class score, the odds of being a current smoker are approximately halved. Since each unit represents 1 standard deviation on the social class index, the range is relatively small (4.6), but it is still a powerful effect. There is also an interaction effect between age and social class. The effect of age (which makes current smoking less likely in older people) is weakened with higher social class, and doubly so for men, as mentioned. This effect seems to suggest that with increasing age, higher class men are more likely to currently smoke, in contrast to the decreasing likelihood for women and lower class men.

For respondents aged 50 years old (age=0), the differences between the genders are constant and non-significant (OR=0.91, 95% CI=0.74, 1.12). There is a steep social gradient, with those with a lower social class score being much more likely to be current smokers than those with a higher social class score (see Figure 3.2B). In fact, a 50 year old respondent with the lowest social class score has around 35 times higher odds of smoking than a 50 year old respondent with the highest social class score (OR=0.46, 95% CI=0.41, 0.50)[5].

When comparing male and female respondents, the overall trend is a decrease in the likelihood of current smoking with increasing age. However the magnitude of this effect is much stronger for women than it is for men (see Figures 3.2C-D, presented on the same

[5] Range of social class=4.6, $OR^{range}=0.46^{4.6}=0.028$. Reciprocal=35.6.

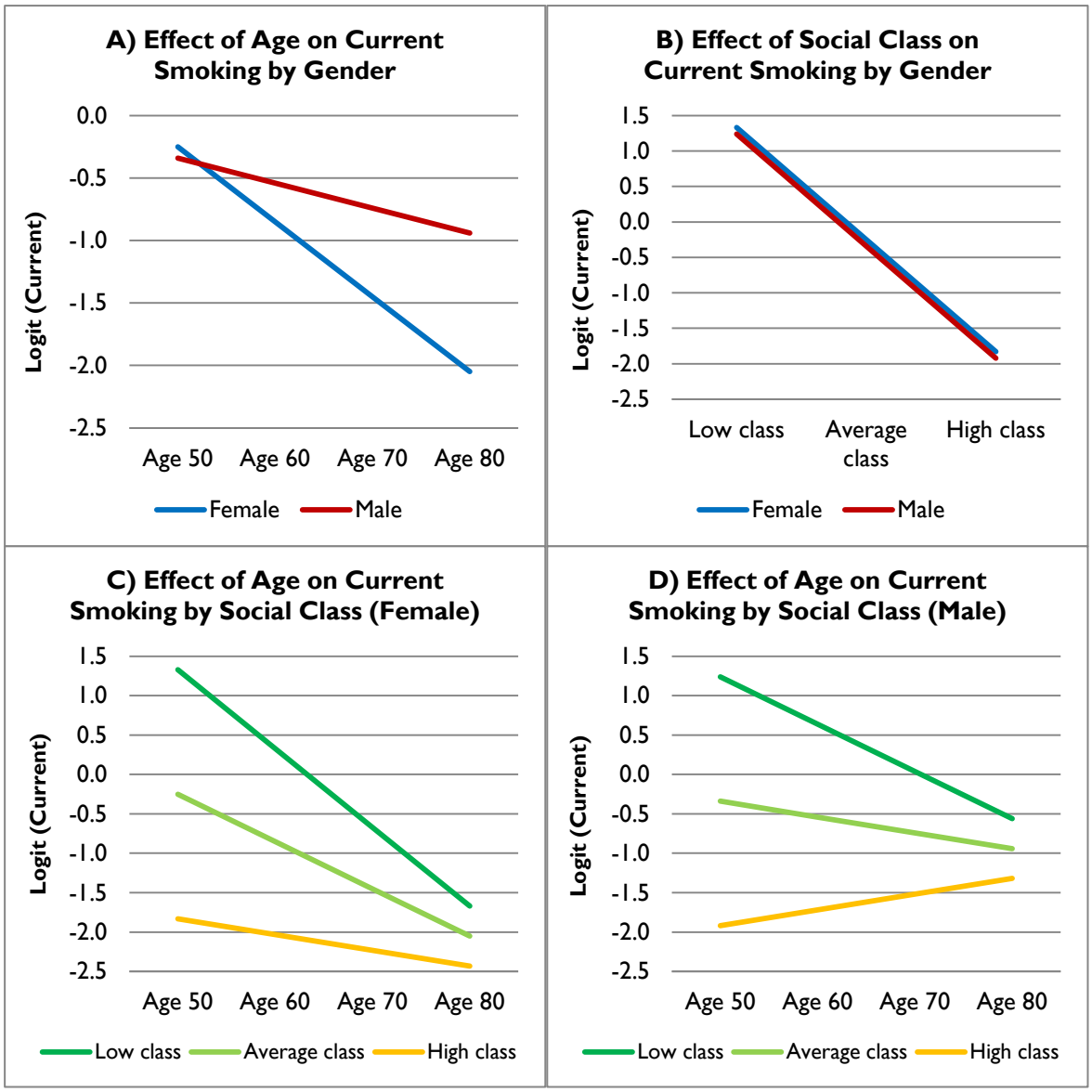

FIGURE 3.2 A, B, C, D: SIMPLE SLOPES PLOTS OF THE CURRENT LOGIT OF THE LOGISTIC REGRESSION MODEL. VALUES SELECTED FOR SOCIAL CLASS ARE -2, 0 & 2, WHERE 0 IS THE MEAN.

scale). This decrease is present in female respondents across the range of social classes and appears even stronger for women of low social class.

The decrease in likelihood of smoking among older respondents exists for men and is stronger in those with the lowest social class scores. However, in contrast to all other subgroups, older men with higher social class are more likely to be current smokers than younger high class men.

3.3.2 Comparison between past smokers and never smokers

The prevalence of past and never smoking among men and women were shown to differ widely, and as expected, the predictors in the model affect them in different ways. The main effect of gender suggests that men are around a third more likely to be past smokers than women (OR=1.27, 95% CI=1.07, 1.50). At age 50, this difference is constant across all social classes with 50 year old men consistently more likely to be past smokers than women (see Figure 3.3B).

However, this difference is increased by the interaction between age and gender, so that with increasing age, men are even more likely to be past smokers compared to women. The odds ratio for the main effect of age is 0.99, which suggests a small decrease in

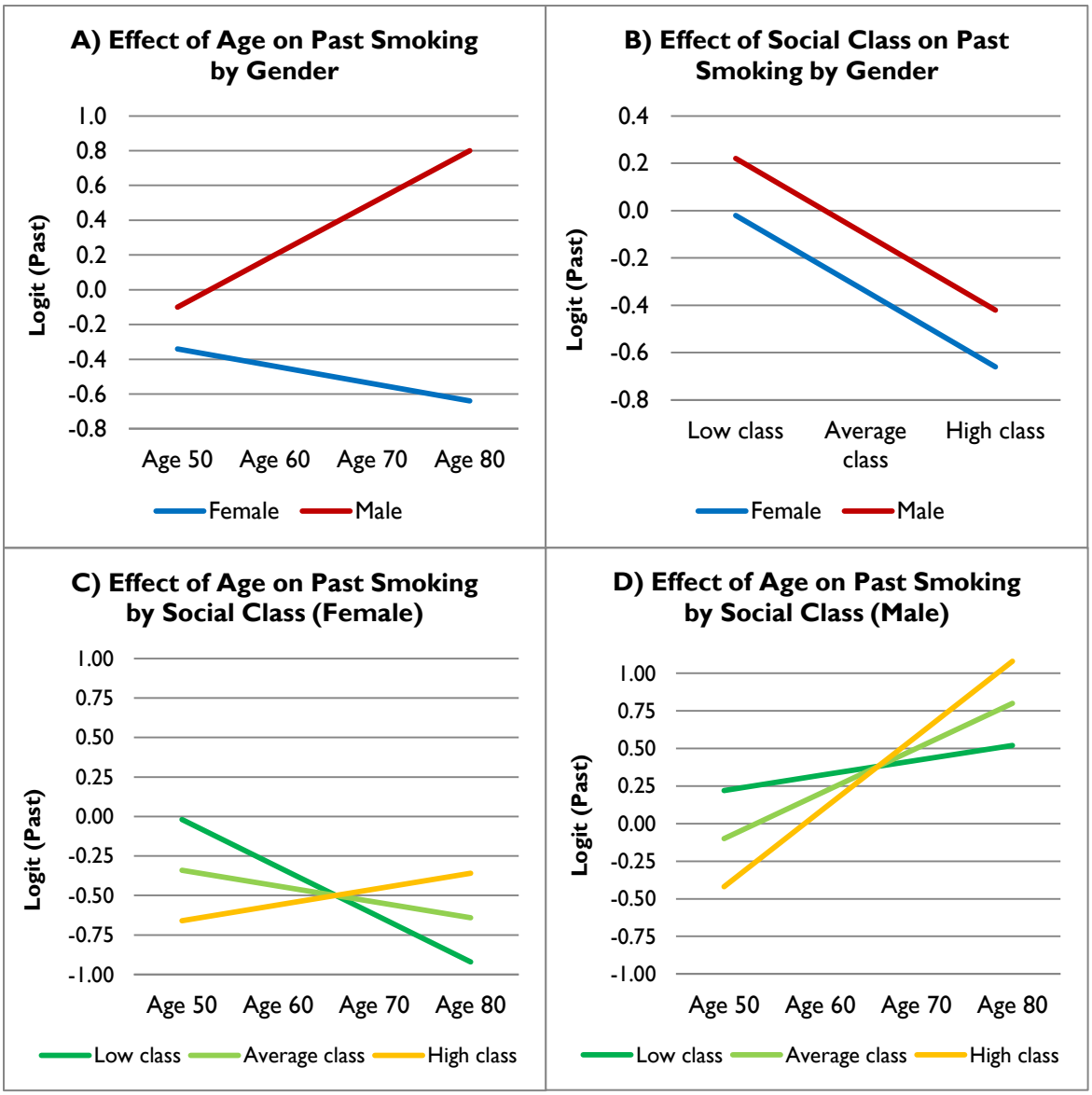

FIGURE 3.3 A, B, C, D: SIMPLE SLOPES PLOTS OF THE PAST LOGIT OF THE LOGISTIC REGRESSION MODEL. VALUES SELECTED FOR SOCIAL CLASS ARE -2, 0 & 2, WHERE 0 IS THE MEAN.

likelihood of current smoking with increasing age. This suggests that for women, the odds of being a smoker in the past decrease slightly with increasing age, but for men they increase to a large extent, as shown in Figure 3.3A.

As social class increases, the odds of being a past smoker are reduced (OR=0.86, 95% CI=0.79, 0.93), but with increasing age, this effect is weakened (OR age*social class=1.01, 95% CI=1.00, 1.01). In fact, in older age groups, higher class respondents are more likely rather than less likely to have been smokers previously. Similarly, with increasing social class, the decreasing odds of being a past smoker associated with age disappear and are even reversed (OR age*social class=1.01, 95% CI=1.00, 1.01).

These effects can be seen in Figure 3.3 C & D. Men across each social class were more likely to be past smokers with increasing age, but particularly those with high social class scores, among whom a very strong effect can be seen. However, among women, this increase in likelihood of previous smoking is evident only for those with high social class, who follow a similar trend to lower class men. Female respondents with average or below average social class scores are less likely to have been smokers in the past. There are large decreases in odds of past smoking between 50 year old and 80 year old women with low social class scores.

3.3.3 Controlling for social isolation

A relationship between social class and smoking has been established, but confidence in this relationship can be increased by controlling for another factor known to be related to smoking; social isolation. Therefore, the Berkman and Syme Social Networks Index (SNI) was added to the model to test the authenticity of the relationships between smoking, gender, age and social class. SNI was strongly and independently associated with smoking, and the other predictors remained fairly constant. (For full information, including the relationship between SNI and smoking, parameter estimates and coefficient graphs, see Appendix 8).

When modelling current smoking and never smoking, the main effect of social class was weakened (OR=0.52 compared to 0.46 in previous model, 95% CI=0.47, 0.58). This effect over a 1-unit increase means that the odds of respondents with the lowest social class scores smoking are around 20 times higher than those with the highest scores[6]. The influence of gender in the model increased (OR=0.87 compared to 0.91 in previous model, 95% CI=0.70, 1.08), although it was not significant to p=0.05. Age and its interaction effects stayed the same. The changes in the social class coefficient may indicate a partial

[6] Range of social class=4.6, $OR^{range}=0.52^{4.6}=0.049$. Reciprocal=20.2.

interpretation relationship, where social isolation mediates the effect social class to a small extent.

When examining the predicted parameters for past smoking, the same pattern can be seen as for the previous model. The coefficients of the predictors stay fairly constant, although the main effect of age is not significant. The odds ratio for social class is reduced from 0.86 to 0.90 (95% CI=0.82, 0.98).

A conceptualisation of the interrelationships can be found in Figure 3.4, where solid lines represent main effects and broken lines represent interaction effects. This shows the interaction effects moderating the direct relationship between a predictor and the outcome and the priority of age in these interrelationships. The diagram shows social isolation as an independent factor with no interactions with the other predictors.

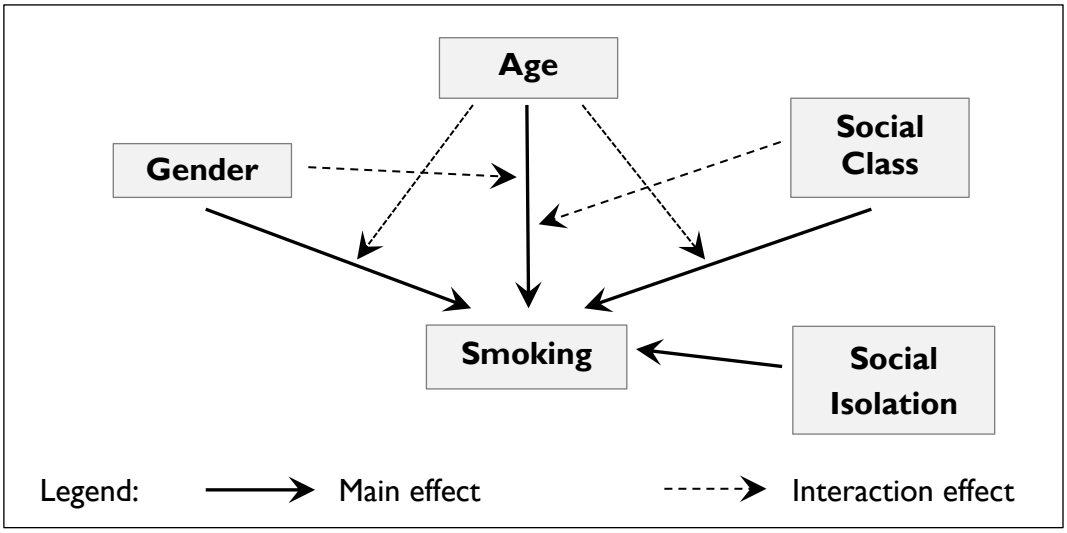

FIGURE 3.4: DIAGRAM OF MAIN AND INTERACTION EFFECTS BETWEEN PREDICTORS AND OUTCOME.

Summary

How are gender, age and social class related to smoking among older people in Ireland?

Overall, men were more likely to smoke than women, younger respondents were more likely to smoke than older respondents, and lower social class respondents were more likely to smoke than higher social class respondents.

The odds of being a current smoker decrease with increasing age, but the effect is much stronger for women than it is for men.

Among the younger respondents, men and women were equally likely to smoke, but at the older end of the sample, men generally have a higher likelihood of currently smoking than women.

Men are more likely than women to have previously smoked and the odds increase with age for men and decrease with age for women.

Lower social class respondents were much more likely to smoke than higher class respondents.

Social class was strongly related to the likelihood of being an ex-smoker but the direction of the relationship depended on age.

Among older age groups, gender has a stronger effect on smoking than social class, but among younger age groups, social class has a stronger effect than gender.

Do these relationships remain when controlling for social isolation?

Yes. When controlling for social isolation, the relationships between social class, gender, age and smoking change very little.

Social isolation had an independent effect on smoking; increased social isolation was associated with higher smoking prevalence.

These findings and their relation to the diffusion model of the tobacco epidemic and their implications for older people will be discussed in the next chapter.

Chapter 4: Discussion

4.1 Introduction

Through an examination of men and women of different social classes, using their age to provide a chronological aspect, the current study sought to establish the extent to which the diffusion model of the tobacco epidemic is evident among older adults in Ireland. The discussion of the findings below involves the social context, the history of the tobacco epidemic in Ireland and the life stage of respondents during different phases of the diffusion model. The analyses strongly supported the existence of the epidemic model in the Irish context.

The second aim was to investigate smoking behaviours among different groups of older people in relation to their gender, age and social class. Key groups were identified and the resulting implications were explored. Following a discussion of the findings, the current study was evaluated and implications for future work were outlined.

4.2 The Diffusion Model of the Tobacco Epidemic

The data was analysed to examine the extent to which the diffusion of tobacco can be traced in older adults. The TILDA respondents were not born during the initial phase of the diffusion model, so focus will be limited to the second, third and fourth stages.

4.2.1 Stage II

During Stage II of the model, there was very high smoking prevalence among both men, peaking at around 50-80%, and women, among whom smoking had not yet peaked (Lopez et al., 1994). In this period, there were relatively few quitters and low mortality rates. This stage was expected to have occurred around 1940-1960 in Ireland, when today's 80 year olds were adolescents and young adults. Since adolescence is a particularly key period for smoking initiation, the social context of stage II is expected to have had a large influence on this cohort.

The analysis revealed that among respondents aged 75 or older, almost 70% of men and just over 40% of women reported smoking during their lifetimes. These high smoking rates and the differences between male and female respondents of this age correspond to the smoking prevalence anticipated by the model. While it is not known when the respondents smoked, adolescence and young adulthood are the most common life stages. Further, the oldest high class male respondents were more likely to smoke than younger high social class men, reflecting the prestige conferred on smokers during this phase of the

tobacco epidemic, where the highest status groups were the most likely to smoke (Lopez et al., 1994).

4.2.2 Stage III

In the decades that followed, smoking prevalence began to decline, although the decline was much faster for men than for women (Lopez et al., 1994). Stage III was marked by increasing mortality and a large number of smokers quit, particularly middle-aged and older men. This is reflected in the Irish data, as over half of all the men aged 75 and over were ex-smokers (55.4%, n=330). Of the 70% of men in this age group who had ever smoked, 81.0% stopped smoking by 2009. Similarly, 79.1% of the women in this age group who had ever smoked are now ex-smokers, although the period in which respondents stopped smoking is unknown.

Stage III is hypothesised to have occurred in Ireland around 1960-1990, when the oldest respondents were mature adults and the youngest respondents were experiencing childhood, adolescence and young adulthood. As the dangers of smoking became known, the next generation of men smoked less. Analysis found that only 55% of male respondents aged up to 55 had ever smoked, a considerable reduction from almost 70%. However, for women, smoking was still gaining popularity and 54.8% of women aged up to 55 had ever smoked, an increase compared to the previous generation. This supports the diffusion model, which anticipated that peak smoking prevalence for women would lag one or two decades behind men. In general, male respondents in their 50s smoked less than those in their 70s and female respondents in their 50s smoked more than their older counterparts.

During this period, a social gradient began to emerge, with higher social class smokers quitting earlier and faster than low social class smokers, who continued to smoke. This can be seen in the analysis. Among the older respondents, men with higher social class were more likely to be former smokers and less likely to be current smokers than men with lower social class. However, high social class men in their 50s were much less likely to be ex-smokers and less likely to currently smoke than those with lower social class. This suggests that although there were declines in male smoking during stage III of the epidemic, these declines were disproportionately experienced by higher social class men.

This pattern can also be seen among the female respondents. Among female respondents in the older age groups, higher social class was associated with being an ex-smoker and being less likely to currently smoke than women with lower social class. However, the likelihood of being a current or former smoker was far lower for women than it was for men of this age. Like men, high social class women in their 50s were much less likely to

currently smoke and have previously smoked than those with lower social class. In this age group, however, the smoking prevalence of men and women was very similar.

4.2.3 Stage IV

The final stage of the epidemic is characterised by a continued decline in smoking, particularly among the most advantaged groups. Stage IV is expected to have occurred from the 1990s until the present, when the youngest respondents were adults about to enter midlife and the oldest respondents were already in their 60s. For male respondents, the younger age groups had a lower prevalence of ever having smoked compared to older respondents, supporting an overall decline. For women on the other hand, the number of those who have ever smoked increased in the younger age groups. This fits the theory that smoking among women peaked in the 1970s when these respondents were adolescents and began to decline with the next generation. However in this cross-sectional study, it is difficult to identify an overall decline, since in general, younger respondents smoked more than older respondents and the strength of age effects are unclear, as described below.

Overall, the findings support the model of the tobacco epidemic in an Irish context. Further, when controlling for social isolation, the relationships between social class, gender, age and smoking remained almost unchanged. This reinforces the support for the previously described relationships between social class, age, gender and smoking behaviour, providing further evidence for the diffusion model in Ireland.

4.3 Smoking in Particular Groups of Older People

4.3.1 Age

All of the gender and class subgroups saw a reduction in current smoking with increasing age, except for higher class men, among whom the likelihood of currently smoking was higher with increasing age. In general, the number of quitters increased with increasing age. This is a positive sign that large numbers of older smokers had quit (although they may have died), thus reducing their risks of developing smoking-related diseases. Higher rates of cessation may be related to period effects (e.g. increased restrictions on smoking, rising prices of cigarettes), cohort effects (e.g. increasing awareness of the harms to health, smoking-related mortality among peers, developing a smoking-related condition) or age effects (related to the physical ageing process or changes in life stage) (Bell and Jones, 2013). This is not helped by the lack of information as to when exactly respondents stopped smoking. These ambiguities could potentially be clarified by using a longitudinal dimension to the research.

4.3.2 Gender

Overall, the prevalence of current smoking was around 18% among older men and women, but there were significant differences between men and women regarding former smokers and never smokers. Around half of the women in the sample had never regularly smoked (50.3%, n=2376), whereas almost half of the men in the sample were ex-smokers (46.1%, n=1742). This supports the observation that during the last century in general, smoking was a male domain.

The significantly different patterns of smoking between men and women suggest that their smoking behaviours, including initiating, quitting and avoiding smoking, may be influenced by different factors. This may reflect the changes in gender roles and attitudes to smoking that have occurred throughout the last 80 years (Redmond and CSO, 2000). An 80 year old respondent was a teenager in the 1940s, when male smoking rates soared and it was beginning to be acceptable for women to smoke. It is therefore unsurprising that more men than women in their 80s have smoked during their lifetimes. However, a 50 year old respondent was a teenager during the 70s, a period of high unemployment, emigration and political turmoil (Barry, 2003). During this period it was more socially acceptable for women to smoke and the smoking rates for both genders had reached a plateau at a similar level (Lopez et al., 1994). This may explain why men and women in their fifties have fairly similar proportions of current, former and never smokers. Younger female respondents had a higher likelihood of ever having smoked than older women, and this trend can be seen in even younger women in other datasets, as young women overtake men in smoking (Graham, 1996; Graham et al., 2006).

4.3.3 Social Class

A significant relationship was found between social class and smoking, particularly among current smokers and never smokers. Lower social class respondents were more likely to currently smoke and less likely to have never smoked than higher class respondents. This was widely supported by the literature (David et al., 2010; Huisman et al., 2005; Hiscock et al., 2012). The likelihood of lower social class women smoking decreases steeply with age, reflecting the way that smoking spread from men to women and higher classes to lower classes over several decades, so lower social class women, as the lowest status group, were the last to adopt smoking (Pampel, 2006). Among 80 year olds, women of all classes were less likely to smoke than men of all classes, but among 50 year olds, lower social class women were the most likely group to currently smoke.

However, overall, the analysis suggested that social class is more strongly related to smoking for men than for women. There was a large difference in having ever smoked between the lowest social class men (72.5%) and the higher social class men (57.4%),

which appeared less strongly among women (54.4%-45.7%). The strong influence of social class on the men in this cohort's smoking behaviour may be explained with historical reference to the spread of smoking. The high social class "early adopters" were mainly men, followed by men of all classes, among whom smoking was extremely prevalent. Decades later, high social class men were the first to begin to quit smoking. While smoking among women was also associated with social class, the differing gender roles gave vast numbers of men the opportunity to smoke more freely than women (Flandorfer et al., 2010). For today's young adults, however, the trend is reversed, so that smoking is more popular among lower social class women than men (Brugha et al., 2009).

While today's higher social class young adults are more likely to abstain from smoking, at least in part due to the health risks (Brugha et al., 2009), many of the older adults in this sample were adolescents before the health hazards of smoking were widely known. This further supports the diffusion model, as the negative social gradient associated with smoking did not fully emerge until Stage III in the 1970s and 1980s (Lopez et al., 1994). In this cohort, the social gradient in smoking initiation has existed in both directions, but the much stronger social gradient concerning cessation has been consistently in favour of the least disadvantaged.

4.3.4 Cessation

Analysis revealed a disparity in cessation rates between higher and lower social class adults. While the higher social class smokers are more likely to have successfully quit smoking, lower social class smokers are more likely to have continued to smoke. As these adults continue to age, it may become even harder for them to quit, as they will have been smoking for a longer time, possibly increasing their physiological dependence and reinforcing their psychosocial relationships with smoking (Hall et al., 2008; Schroeder et al., 2006). Indeed, those still smoking in older age may already be those who have had the most difficulty with quitting.

In every age group and across social classes, there were proportionally more male quitters than female quitters. For example, 50 year old lower social class women are around as likely to smoke as men of the same age, but less likely to quit. These findings corroborate literature suggesting that men are more successful at quitting than women (Greaves and Hemsing, 2009; Jones et al., 2009; Reid et al., 2009). Research has also suggested that men smoke more heavily than women and tend to have higher nicotine addictions than women, while psychosocial factors are more likely to play a larger role for women (Flandorfer et al., 2010; Reid et al., 2009). Despite women being more willing to accept help to manage the addiction (Reid et al., 2009), they are more likely to fail. This brings attention to the

medical emphasis on TTD, which has been successful in improving quit rates, but nonetheless is not a complete solution, especially for women.

A combination of TTD and psychosocial supports, particularly to avoid social isolation, may be more helpful for older women, but the precise nature of these supports requires further investigation. The need for improved cessation services targeted towards older people, particularly women and particularly lower social class, is particularly salient when considering the increasing numbers of lower social class women who smoke (Brugha et al., 2009).

4.3.5 Social Isolation

The addition of Social Networks Index to the regression model barely changed the relationships between the other predictors. The slight reduction in odds ratios for social class may indicate a weak mediating relationship, as social class became slightly less important when social isolation as added. Social isolation had a strong independent relationship with smoking, in which increased social isolation was associated with higher smoking prevalence. It is thought that social isolation reduces the potential for support, both during quit attempts and the stresses of daily life (Hiscock et al., 2012). Stewart et al. (2010) piloted a successful cessation programme that involved promoting social networks and peer-support during quit attempts. The current findings suggest that older people in Ireland may benefit from such a programme, as their smoking behaviour was linked to social isolation. However, the details of the relationship between smoking, cessation and social isolation would require further investigation, particularly in sub-groups of older adults.

4.3.6 Societal Changes

The effects of both social class and gender on smoking behaviour depend on the age of the respondents. Among older age groups, gender has a stronger effect on smoking than social class, but among the younger old, social class has a stronger effect than gender. This may reflect demographic changes during this period whereby gender equality has increased but social inequalities have also increased. Gender roles have become increasingly liberalised since the beginning of the last century, with increasing female participation in the labour market, education and public office, as well as smoking (Redmond and CSO, 2000). The last decades, however, have seen increasing social inequality alongside increasing wealth (TASC, 2014). Poverty and disadvantage have become more relevant social divisions than gender, and this can be seen in smoking behaviour.

4.4 Evaluation of the Present Study

This study into smoking among older people was conducted against the backdrop of the recent Tobacco Free Ireland targets to reduce smoking to 5% by 2025, the Healthy Ireland goal of improving health at all ages and the National Positive Ageing Strategy, which involves reducing lifestyle causes of chronic disease among older people (DOH, 2013a, 2013b, 2013c). While the benefits of quitting smoking are already known, this work highlights the reduced chances of quitting among women and lower social class groups. The current study attempts to explain patterns in smoking behaviours among older adults in the distinct Irish context using the diffusion model of the tobacco epidemic.

There are several methodological considerations to take into account when evaluating the present study. TILDA used a large population sample of older people, with a total of 8504 respondents selected via probability sampling. Although generalising to the population is not the primary aim of the current study, the data benefitted from good quality random sampling (De Vaus, 2002). Non-response bias was a consideration (see 2.3), but sample weights could not be used.

The TILDA dataset provided a variety of relevant variables and most importantly distinguished between never, former and current smokers. However, there were a high number of missing values on several key social class variables. While this was taken into consideration throughout analysis and the issue was partially addressed using CATPCA, the study could benefit from a more sophisticated treatment of missing values that may either compensate for missing responses or shed more light on the differences between the missing-not-at-random groups and the participants who responded.

There was also some information that was not available in the dataset. While ethnicity has been shown to be relevant to smoking behaviours in previous, TILDA asked only about nationality. Only around 5% of respondents reported being non-Irish and 90.4% of the data was missing. Further, a focus on nationality among older adults while Ireland's history of large scale immigration began in the 1990s may not be appropriate.

There was also a lack of information about peer smoking and smoking within respondents' social networks. While it is unrealistic to expect such a lengthy and comprehensive survey to include such specific questions about smoking, the level of exposure to and support from other smokers would have been relevant and useful to examine. Similarly, examining the level of addiction may also have exposed the relationships between class, gender and smoking, as men and lower social classes have been found to have higher levels of addiction (David et al., 2010).

Overall however, the use of an aggregate measure of social class has some benefits. Methodologically, the issues of missing values and strong interrelationships between the predictors were reduced. The social class index represents aspects of the respondent's life course, and involves their education (achieved around adolescence), their father's occupation (giving insight into their upbringing), their own occupation (related to status in adulthood) and various measures of income and property (household income, car ownership and medical insurance). Including this combination makes the index represent more than just income, taking it away from socioeconomic status and towards social class (Rubin et al., 2014). On the other hand, subsequent analysis could benefit from examinations of each of these facets separately to clarify the specific mechanisms that affect smoking.

Smokers tend to die younger than non-smokers, so in this older cohort, there may be fewer current smokers available to sample. (Hospitals, prisons and care institutions were also not sampled.) Since those in lower social classes are more likely to smoke, tend to smoke more heavily (Rosemary Hiscock et al., 2012) and have lower utilisation of relevant healthcare services (David et al., 2010), it seems likely that more lower class people will have died from smoking compared to high class people, and may therefore be underrepresented in the study. Attempts at weighting may not be appropriate for the issue, since it is not a problem with sampling, but a form of genuine non-random variation. For this study, it should simply be noted that the specificity of the age group means neglecting smokers who died young.

4.5 Implications and Future Research

While the analysis provides insight into the relationships between social class, gender, age and smoking behaviours, the importance of psychosocial factors must not be underestimated. Further research into the effect of these factors on smoking behaviour, as well as their differential manifestation in different sub-groups would be of benefit. For example, poor mental health, in particular depression and anxiety, is known to be related to smoking (Brugha et al., 2009; McGee and Williams, 2006), but cannot be assumed to be a predictor like social class. Rather it more likely mediates the influence of social class on smoking behaviour. Similarly, smoking is also related to poor nutrition, lack of exercise and high alcohol intake, but poor health behaviours are often co-occurring outcomes of the same predictors rather than directly causing each other (Pampel et al., 2010). Further investigation into the complex interrelated factors that affect smoking behaviour could be achieved with structural equation modelling (SEM), which allows interrelationships between multiple dependent and independent variables to be examined (Tabachnick and Fidell, 2007).

Since TILDA is a longitudinal project, the addition of the second wave of data may help to identify patterns in quitting. Preliminary findings indicate that 16% of Wave 1 smokers had quit by 2014, resulting in an overall current smoking rate of 16.5% (TILDA, 2014). However, the data is not currently available (anticipated September 2014) so the quit rates of each subgroup are unknown.

There are over 200,000 older smokers in Ireland, who are rarely encouraged to quit, but can benefit from doing so (Moy et al., 2011; CSO, 2011; Zbikowski et al., 2012). The current study has identified lower class older people, and particularly women, as a group that could benefit from further assistance with quitting. Previous research has shown that older people can quit successfully but may find this harder to due higher addiction and a longer period of habitual smoking (Hall et al., 2008). While the present emphasis is on treatment using NRT, successful cessation may require more attention on psychological and social factors for some people. More research into such treatments may be productive.

4.6 Conclusion

This study has established that the diffusion model of the tobacco epidemic is evident among older adults in Ireland. While historically men were more likely to smoke and suffer from smoking-attributable diseases, women increasingly likely to smoke and less likely to quit. Although having quit smoking is more common among older people, lower social class and female smokers as less likely to give up smoking, even into older age. Further research into psychosocial factors, clustered health behaviours and cessation among older people using longitudinal analysis or structural equation modelling may be useful. Improved targeted cessation interventions for less successful subgroups may be of benefit, helping to achieve the aims of Tobacco Free Ireland, Healthy Ireland and the National Positive Ageing Strategy and reduce inequalities in smoking.

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Appendices

Appendix 1: Sample Description compared to Census 2011

	Census *(2011)*		TILDA *(2009-2011)*	
	n	**%**	**n**	**%**
Gender				
Female	661,046	51.9	4724	55.6
Male	612,041	48.1	3780	44.4
Age				
50-54	274,386	21.6	1622	19.1
55-59	244,522	19.2	1649	19.4
60-64	218,786	17.2	1393	16.4
65-69	173,638	13.6	1196	14.1
70-74	131,190	10.3	963	11.3
75-79	102,036	8.0	714	8.4
80 or older	128,529	10.1	626	7.4
Education				
Primary or less	370,493	29.1	2521	29.7
Secondary	576,934	45.3	3431	40.4
Tertiary	216,686	17.0	2548	30.0
Missing	*75,426*	*5.9*	*4*	*0.0*
Marital Status				
Married	809,056	63.6	5966	70.2
Separated/divorced	106,592	8.4	552	6.5
Widowed	181,242	14.2	1195	14.1
Never married	176,197	13.8	791	9.3
Total		**1,273,087**		**8,504**

Appendix 2: Crosstabulation of Education and Age

Age is split by older or younger than 18 in 1967

		Age		
		54 or younger	**55 or older**	**Total**
Primary or less	Count	711	1807	2518
	% within age	17.1%	41.8%	29.7%
	Std. Residual	-14.9	14.6	
Secondary	Count	1964	1465	3429
	% within age	47.2%	33.9%	40.4%
	Std. Residual	6.9	-6.8	
Tertiary	Count	1488	1053	2541
	% within age	35.7%	24.3%	29.9%
	Std. Residual	6.8	-6.7	
Total	Count	4163	4325	8488

Appendix 3: Father's occupation, wealth at adolescence & respondent's occupation

Crosstabulation of Father's occupation and self-reported wealth at adolescence

[$\chi^2(16) = 1136.7$, $p < .001$; Cramer's V = 0.26]

Father's Occupation		Self-reported wealth at adolescence: Pretty well off	About average	Poor	Total
Professional	Count	107	164	10	281
	% wealth	12.4%	2.9%	.6%	3.4%
	Std. Residual	14.2	-2.2	-6.2	
Managerial and Technical	Count	236	512	39	787
	% wealth	27.4%	9.1%	2.3%	9.6%
	Std. Residual	16.8	-1.4	-9.6	
Non-manual	Count	84	489	74	647
	% wealth	9.8%	8.7%	4.4%	7.9%
	Std. Residual	1.9	2.0	-5.0	
Skilled Manual	Count	125	1248	354	1727
	% wealth	14.5%	22.2%	21.3%	21.2%
	Std. Residual	-4.2	1.6	.1	
Semi-skilled Manual	Count	42	581	200	823
	% wealth	4.9%	10.3%	12.0%	10.1%
	Std. Residual	-4.8	.5	2.5	
Unskilled Manual	Count	19	747	491	1257
	% wealth	2.2%	13.3%	29.5%	15.4%
	Std. Residual	-9.9	-4.1	14.7	
Farmer	Count	42	339	188	569
	% wealth	4.9%	6.0%	11.3%	7.0%
	Std. Residual	-2.3	-2.7	6.7	
Never Worked	Count	205	1554	308	2067
	% wealth	23.8%	27.6%	18.5%	25.3%
	Std. Residual	-.9	3.3	-5.5	
Total	Count	860	5634	1664	8158
	% wealth	100.0%	100.0%	100.0%	100.0%

Crosstab of respondent's occupation and self-reported wealth at adolescence

[$\chi^2(12) = 329.1$, $p < .001$; Cramer's V = 0.18]

Occupation Type		Self-reported wealth at adolescence			Total
		Pretty well off	About average	Poor	
Professional	Count	59	179	33	271
	% wealth	10.5%	5.0%	3.1%	5.2%
	Std. Residual	5.5	-.6	-3.0	
Managerial and Technical	Count	268	1104	225	1597
	% wealth	47.7%	30.7%	21.3%	30.6%
	Std. Residual	7.3	.1	-5.5	
Non-manual	Count	113	730	168	1011
	% wealth	20.1%	20.3%	15.9%	19.4%
	Std. Residual	.4	1.2	-2.6	
Skilled Manual	Count	29	494	221	744
	% wealth	5.2%	13.7%	20.9%	14.3%
	Std. Residual	-5.7	-.8	5.7	
Semi-skilled Manual	Count	43	518	210	771
	% wealth	7.7%	14.4%	19.9%	14.8%
	Std. Residual	-4.4	-.6	4.3	
Unskilled Manual	Count	3	171	115	289
	% wealth	.5%	4.8%	10.9%	5.5%
	Std. Residual	-5.0	-2.0	7.4	
Farmer	Count	47	400	85	532
	% wealth	8.4%	11.1%	8.0%	10.2%
	Std. Residual	-1.4	1.7	-2.2	
Total	Count	562	3596	1057	5215
	% wealth	100.0%	100.0%	100.0%	100.0%

Crosstab of respondent's occupation and Father's occupation

[$\chi^2(48) = 1432.7$, $p < .001$; Cramer's V = 0.22]

		Father's Occupation								
		Prof	**Man/tech**	**Non-man**	**Skilled**	**Semi**	**Unskilled**	**Farmer**	**Never**	Total
Professional	Count	39	50	34	45	15	18	18	46	265
	% in Father	23.6%	9.4%	8.0%	4.3%	3.1%	2.6%	5.2%	3.5%	5.3%
	Std. Residual	10.3	4.1	2.5	-1.4	-2.1	-3.1	.0	-2.8	
Managerial and	Count	79	288	166	309	130	131	101	331	1535
Technical	% in Father	47.9%	53.9%	39.2%	29.3%	26.6%	18.6%	29.4%	25.1%	30.5%
	Std. Residual	4.0	9.8	3.3	-.7	-1.6	-5.7	-.4	-3.5	
Non-manual	Count	32	110	118	245	105	108	47	205	970
	% in Father	19.4%	20.6%	27.9%	23.2%	21.5%	15.3%	13.7%	15.6%	19.3%
	Std. Residual	.0	.7	4.0	2.9	1.1	-2.4	-2.4	-3.1	
Skilled Manual	Count	4	26	45	207	89	146	45	151	713
	% in Father	2.4%	4.9%	10.6%	19.6%	18.2%	20.7%	13.1%	11.5%	14.2%
	Std. Residual	-4.0	-5.7	-1.9	4.7	2.4	4.6	-.5	-2.6	
Semi-skilled	Count	7	41	46	170	96	188	43	153	744
Manual	% in Father	4.2%	7.7%	10.9%	16.1%	19.6%	26.7%	12.5%	11.6%	14.8%
	Std. Residual	-3.5	-4.3	-2.1	1.1	2.8	8.2	-1.1	-3.0	
Unskilled	Count	3	6	11	60	38	90	21	48	277
Manual	% in Father	1.8%	1.1%	2.6%	5.7%	7.8%	12.8%	6.1%	3.6%	5.5%
	Std. Residual	-2.0	-4.3	-2.5	.3	2.1	8.2	.5	-2.9	
Farmer	Count	1	13	3	19	16	23	69	383	527
	% in Father	.6%	2.4%	.7%	1.8%	3.3%	3.3%	20.1%	29.1%	10.5%
	Std. Residual	-3.9	-5.7	-6.2	-8.7	-4.9	-5.9	5.5	20.9	
	Count	165	534	423	1055	489	704	344	1317	5031
Total	% in Father	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Appendix 4: Tabulation of Chi-square results for social class-related variables

	Gender	Age	Occupation	Income	Education	Medical Ins.	House Own.	Car Ownership	Father's Occ.	Urban or Rural
Gender		$\chi^2(2)=20.6$, p<.001, Cramer's V=0.05	$\chi^2(6)=620.2$, p<.001, Cramer's V=0.35	$\chi^2(3)=39.7$, p<.001, Cramer's V=0.08	$\chi^2(2)=41.0$, p<.001, Cramer's V=0.07	$\chi^2(2)=20.0$, p<.001, Cramer's V=0.05	$\chi^2(3)=3.8$, p=0.51, Cramer's V=0.03	$\chi^2(2)=109.3$, p<.001, Cramer's V=0.13	$\chi^2(5)=7.1$, p=0.214, Cramer's V=0.03	$\chi^2(2)=1.7$, p=0.435, Cramer's V=0.01
Age	$\chi^2(2)=20.6$, p<.001, Cramer's V=0.05		$\chi^2(12)=107.1$, p<.001, Cramer's V=0.10	$\chi^2(6)=601.8$, p<.001, Cramer's V=0.22	$\chi^2(4)=708.8$, p<.001, Cramer's V=0.20	$\chi^2(4)=2345.2$, p<.001, Cramer's V=0.37	$\chi^2(2)=16.8$, p<.001, Cramer's V=0.05	$\chi^2(4)=688.1$, p<.001, Cramer's V=0.24	$\chi^2(10)=75.5$, p<.001, Cramer's V=0.07	$\chi^2(4)=3.5$, p=0.485, Cramer's V=0.01
Occupation	$\chi^2(6)=620.2$, p<.001, Cramer's V=0.35	$\chi^2(12)=107.1$, p<.001, Cramer's V=0.10		$\chi^2(18)=642.8$, p<.001, Cramer's V=0.23	$\chi^2(12)=2105.4$, p<.001, Cramer's V=0.45	$\chi^2(12)=671.7$, p<.001, Cramer's V=0.25	$\chi^2(6)=160.7$, p<.001, Cramer's V=0.20	$\chi^2(12)=342.1$, p<.001, Cramer's V=0.21	$\chi^2(30)=1310.7$, p<.001, Cramer's V=0.23	$\chi^2(12)=608.4$, p<.001, Cramer's V=0.24
Income	$\chi^2(3)=39.7$, p<.001, Cramer's V=0.08	$\chi^2(6)=601.8$, p<.001, Cramer's V=0.22	$\chi^2(18)=642.8$, p<.001, Cramer's V=0.23		$\chi^2(6)=973.8$, p<.001, Cramer's V=0.28	$\chi^2(6)=1788.7$, p<.001, Cramer's V=0.38	$\chi^2(3)=201.8$, p<.001, Cramer's V=0.21	$\chi^2(6)=1149.2$, p<.001, Cramer's V=0.35	$\chi^2(15)=204.6$, p<.001, Cramer's V=0.11	$\chi^2(6)=159.9$, p<.001, Cramer's V=0.11
Education	$\chi^2(2)=41.0$, p<.001, Cramer's V=0.07	$\chi^2(4)=708.8$, p<.001, Cramer's V=0.20	$\chi^2(12)=2105.4$, p<.001, Cramer's V=0.45	$\chi^2(6)=973.8$, p<.001, Cramer's V=0.28		$\chi^2(4)=1412.3$, p<.001, Cramer's V=0.29	$\chi^2(2)=99.0$, p<.001, Cramer's V=0.13	$\chi^2(4)=805.8$, p<.001, Cramer's V=0.26	$\chi^2(10)=988.4$, p<.001, Cramer's V=0.25	$\chi^2(4)=100.1$, p<.001, Cramer's V=0.08
Medical Insurance	$\chi^2(2)=20.0$, p<.001, Cramer's V=0.05	$\chi^2(4)=2345.2$, p<.001, Cramer's V=0.37	$\chi^2(12)=671.7$, p<.001, Cramer's V=0.25	$\chi^2(6)=1788.7$, p<.001, Cramer's V=0.38	$\chi^2(4)=1412.3$, p<.001, Cramer's V=0.29		$\chi^2(2)=329.0$, p<.001, Cramer's V=0.23	$\chi^2(4)=1254.7$, p<.001, Cramer's V=0.32	$\chi^2(10)=226.0$, p<.001, Cramer's V=0.12	$\chi^2(4)=93.7$, p<.001, Cramer's V=0.07
House Ownership	$\chi^2(3)=3.8$, p=0.51, Cramer's V=0.03	$\chi^2(2)=16.8$, p<.001, Cramer's V=0.05	$\chi^2(6)=160.7$, p<.001, Cramer's V=0.20	$\chi^2(3)=201.8$, p<.001, Cramer's V=0.21	$\chi^2(2)=99.0$, p<.001, Cramer's V=0.13	$\chi^2(2)=329.0$, p<.001, Cramer's V=0.23		$\chi^2(2)=584.2$, p<.001, Cramer's V=0.31	$\chi^2(5)=59.7$, p<.001, Cramer's V=0.10	$\chi^2(2)=76.9$, p<.001, Cramer's V=0.11
Car Ownership	$\chi^2(2)=109.3$, p<.001, Cramer's V=0.13	$\chi^2(4)=688.1$, p<.001, Cramer's V=0.24	$\chi^2(12)=342.1$, p<.001, Cramer's V=0.21	$\chi^2(6)=1149.2$, p<.001, Cramer's V=0.35	$\chi^2(4)=805.8$, p<.001, Cramer's V=0.26	$\chi^2(4)=1254.7$, p<.001, Cramer's V=0.32	$\chi^2(2)=584.2$, p<.001, Cramer's V=0.31		$\chi^2(10)=131.9$, p<.001, Cramer's V=0.11	$\chi^2(4)=113.1$, p<.001, Cramer's V=0.10
Father's Occup.	$\chi^2(5)=7.1$, p=0.214, Cramer's V=0.03	$\chi^2(10)=75.5$, p<.001, Cramer's V=0.07	$\chi^2(30)=1310.7$, p<.001, Cramer's V=0.23	$\chi^2(15)=204.6$, p<.001, Cramer's V=0.11	$\chi^2(10)=988.4$, p<.001, Cramer's V=0.25	$\chi^2(10)=226.0$, p<.001, Cramer's V=0.12	$\chi^2(5)=59.7$, p<.001, Cramer's V=0.10	$\chi^2(10)=131.9$, p<.001, Cramer's V=0.11		$\chi^2(10)=1023.8$, p<.001, Cramer's V=0.25
Urban or Rural	$\chi^2(2)=1.7$, p=0.435, Cramer's V=0.01	$\chi^2(4)=3.5$, p=0.485, Cramer's V=0.01	$\chi^2(12)=608.4$, p<.001, Cramer's V=0.24	$\chi^2(6)=159.9$, p<.001, Cramer's V=0.11	$\chi^2(4)=100.1$, p<.001, Cramer's V=0.08	$\chi^2(4)=93.7$, p<.001, Cramer's V=0.07	$\chi^2(2)=76.9$, p<.001, Cramer's V=0.11	$\chi^2(4)=113.1$, p<.001, Cramer's V=0.10	$\chi^2(10)=1023.8$, p<.001, Cramer's V=0.25	

Appendix 5: Multiple Correspondence Analysis

Multiple Correspondence Analysis was initially considered as a method to reduce the variables to suitable components. However, it was not ideally suited to the data or the objective and most solutions involved removing variables of theoretical interest. The category plots revealed that some variables have monotonic interrelationships and the ordinal properties of some variables deserve further investigation using nonlinear principal components analysis.

MCA is primarily used for nominal variables as an equivalent procedure to Principal Components Analysis and provides multiple nominal loadings for each variable, with the quantifications differing on each component. MCA should not be used for variables that should retain their category order, so variables with ordinal properties are not suitable for MCA. The measurement level of a variable is set by the researcher and their interpretation, not merely the way the data was recorded. Some of the current variables of interest could be considered to have ordinal properties in themselves but their relationship to the components need not necessarily retain their original order. Therefore, MCA was investigated as one potential analysis method.

MCA was run with twelve variables initially and was iteratively adjusted to find the optimum solution. This involved assessing the number of components, the variables included, outliers, treatment of missing values and the level of analysis of each variable, as well as examining category, transformation and object plots for any other features. During this process, 26 cases were rejected as outliers and variables with insufficient loading statistics were removed one at a time until the minimum component loading was at least 0.25 (cite). To reach this criterion, all but five of the variables were removed, leaving car ownership, household income, medical insurance cover, marital status and house ownership. This solution produced an Eigenvalue of 4.68 with two components, as suggested by scree plots and biplot clusters. However, with so few variables and similar top-loading variables on both components, the interpretability of this solution is low.

Variable	1	2	MEAN
Car ownership	.87	.85	.86
House ownership	.68	.65	.67
Marital status	.62	.02	.32
Medical insurance cover	.29	.23	.26
Total household income 4 groups	.30	.17	.23

The solution with the highest total Eigenvalue (5.48) used nine variables and formed two distinct components. The first component accounted for the most variance, with an Eigenvalue of 3.20 (Cronbach's alpha =.77). The first component loaded the most strongly on car ownership, house ownership, marital status, followed by medical insurance and income, suggesting that overall the factor is related to wealth or affluence. The second component had an Eigenvalue of 2.28 (Cronbach's alpha =.63) and loaded strongly on car ownership and house ownership only. House ownership loads higher on component two than component one, but the second component is not conceptually distinct from the first component, rather it is similar but more limited. This solution accepted low component loadings that are not normally acceptable.

Dimension	1	2	Mean*
Car ownership	.72	.70	.71
House ownership	.45	.64	.54
Marital status	.55	.11	.33
Medical insurance cover	.43	.12	.27
Total household income	.42	.08	.25
Age started working	.21	.24	.23
Occupation	.15	.18	.16
Number of children	.18	.09	.13
Father's occupation	.09	.12	.11
Active Total	**3.20**	**2.28**	**2.74**

** Descending order*

Multiple Correspondence Analysis is not ideally suited to the data or the objective. While there are permutations that achieve acceptable statistics and account for an adequate amount of variance, the components are not easily interpretable or particularly useful as a reduction of social class variables. Most solutions involve removing variables of theoretical interest. The category plots revealed that some variables have monotonic interrelationships and the ordinal properties of some variables deserve further investigation using nonlinear principal components analysis.

Appendix 6: Assumption Testing- Multicollinearity Diagnostics

The variables were examined for strong interrelationships. A moderate Pearson correlation was found between age and social class [r=-0.37, p<.001]. This means that age and social class share 13.9% of their variance (a medium amount). Despite the relatively

high correlation between age and social class for this sample, the multicollinearity diagnostics are very acceptable.

Multicollinearity diagnostics were produced by running the model specifications through linear regression (Field, 2009, p. 297). Extracts from the output are shown in Figure 6. The coefficients of all three variables were significant to p<.001 in the model and the tolerance and VIF statistics gave no cause for concern. The Eigenvalues ranged between almost zero and 2.7, and the highest condition index was 7.9. While there is some variation, the values lie within acceptable limits, for example the largest condition index is well below 30 (Tabachnick and Fidell, 2007). The variance proportions are also satisfactory, with no two variables sharing a high level of variation on the same eigenvalue.

Collinearity Statistics		
Model	**Tolerance**	**VIF**
(Constant)		
Age	.858	1.166
Social Class	.860	1.162
Gender	.997	1.003

			Variance Proportions			
	Eigenvalue	**Condition Index**	*(Cons)*	**Age**	**Social Class**	**Gender**
1	2.694	1.000	.01	.03	.00	.01
2	1.035	1.614	.00	.01	.78	.00
3	0.228	3.436	.02	.85	.20	.09
4	.043	7.915	.97	.11	.02	.90

FIGURE 6: MULTICOLLINEARITY DIAGNOSTICS- EXCERPTS OF LINEAR REGRESSION MODEL

Appendix 7: Assumption Testing- the Linearity of the Logit

A key assumption for logistic regression is the linearity of the Logit with the predictor variables. This assumption was tested by plotting the coefficients of the variables, which had been recoded into groups of equal intervals (Norušis, 2012, p. 49). From these plots, it is evident that the relationships between the continuous predictors and the Logit are not linear. Solutions considered included transforming the variables using low order polynomials or fractional polynomials (Royston and Altman, 1994), recoding the predictors into categorical variables, or leaving the variables in their present state and interpreting accordingly.

Age is a concrete measurement while social class is already abstract, so transforming social class was preferable to transforming age. Due to the nature of the non-linearity, social class was replaced with its square root and this improved the linearity of the relationships between the Logit and the predictors. A comparison of the resulting graphs can be found in below. While the relationships are not perfectly linear there is some improvement. The model was re-run using the square root of social class.

Collinearity was re-tested with the new variable, and the diagnostics were not quite as good before. Similarly, the classifying power of the model was slightly reduced, and the majority of the model statistics stayed the same. The parameter estimates altered and the standard error for most of the parameters increased, but remained within an acceptable range (see below). Overall the models were very similar, but the difference for one parameter was extreme with an adjusted odds ratio of 0.085. The small range of social class values produced by the transformation makes interpretation more difficult and apart from one exception, the model remains very similar. Therefore, the original model will be used and examined in more detail.

Parameter estimates for model using square root transformation of social class

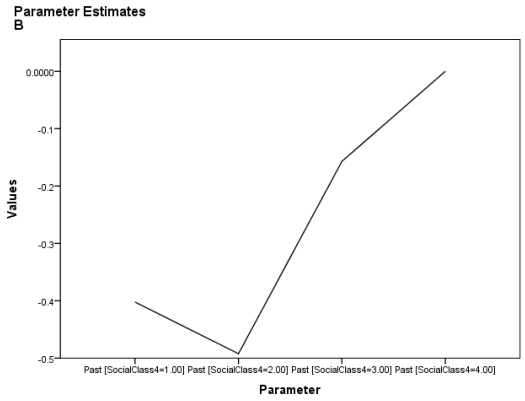
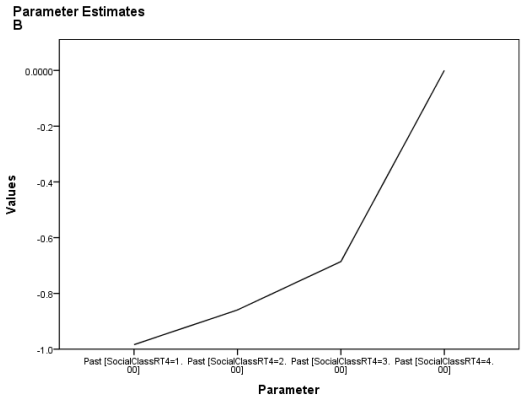
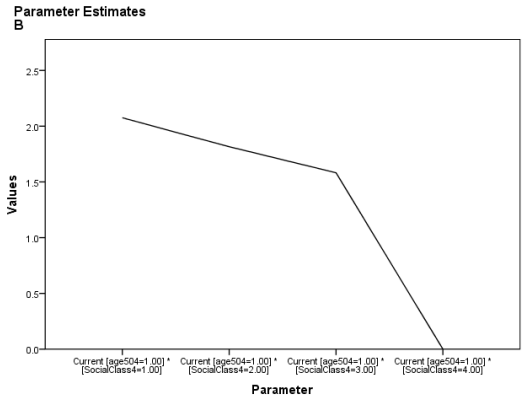
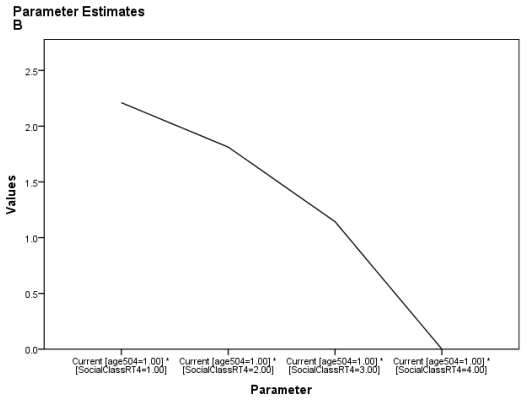
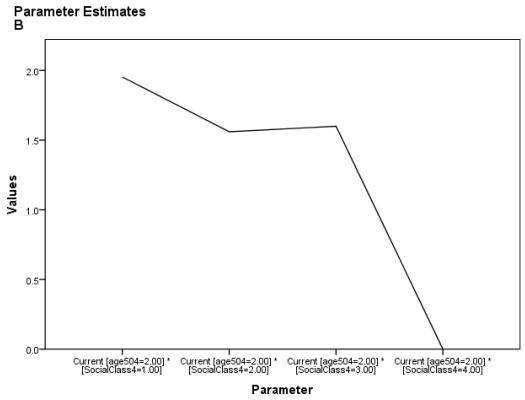
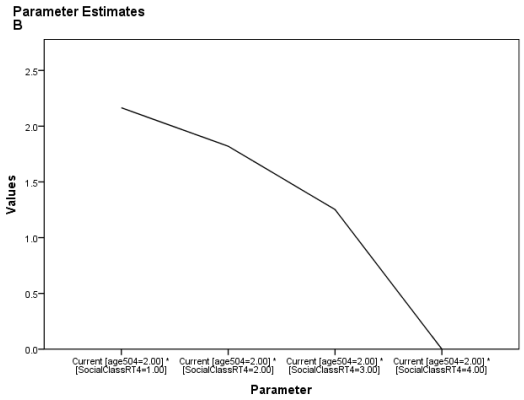
Parameter Estimates

Smoker[a]		B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp (B)	
								Lower Bound	Upper Bound
Past	Intercept	.492	.233	4.454	1	.035			
	SocialClassRT	-.535	.134	15.834	1	.000	.586	.450	.762
	[sex=1]	.236	.087	7.444	1	.006	1.266	1.069	1.501
	[sex=2]	0[b]	.	.	0	.	.	.	.
	age50	-.044	.012	12.997	1	.000	.957	.934	.980
	age50 * SocialClassRT	.023	.008	9.256	1	.002	1.024	1.008	1.039
	[sex=1] * age50	.036	.005	45.619	1	.000	1.037	1.026	1.047
	[sex=2] * age50	0[b]	.	.	0	.	.	.	.
Current	Intercept	3.566	.257	191.953	1	.000			
	SocialClassRT	-2.462	.157	245.270	1	.000	.085	.063	.116
	[sex=1]	-.088	.104	.710	1	.399	.916	.746	1.124
	[sex=2]	0[b]	.	.	0	.	.	.	.
	age50	-.150	.016	92.283	1	.000	.861	.835	.887
	age50 * SocialClassRT	.055	.011	26.972	1	.000	1.056	1.035	1.078
	[sex=1] * age50	.036	.007	25.231	1	.000	1.037	1.022	1.051
	[sex=2] * age50	0[b]	.	.	0	.	.	.	.

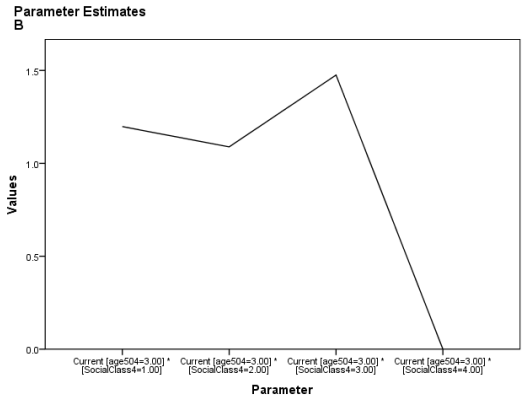
a. The reference category is: Never.

b. This parameter is set to zero because it is redundant.

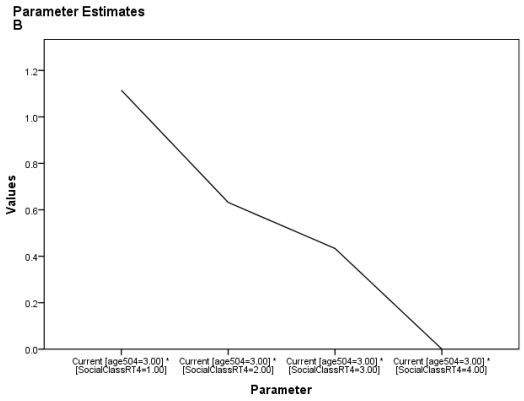
Comparison of coefficient plots: Standardised social class v square root transformation of social class

Original	Transformed
Past: Social Class	Past: Square root of Social Class
	
Current: Age 1*Social Class	Current: Age 1*Square root of Social Class
	
Current: Age 3* Social Class	Current: Age 2*Square root of Social Class
	

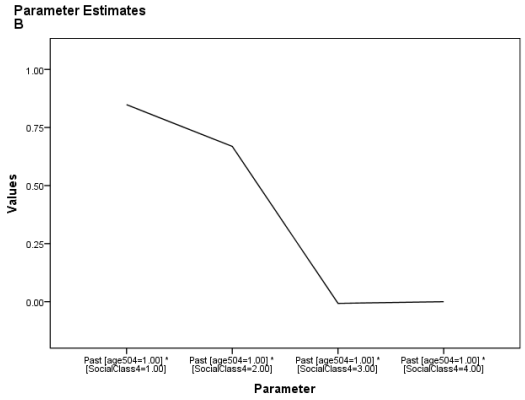
Current: Age 3* Social Class



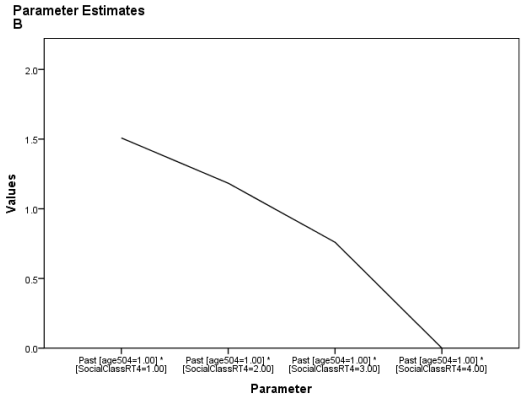
Current: Age 3*Square root of Social Class



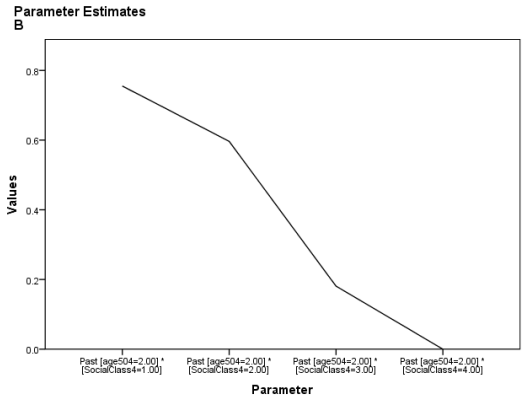
Past: Age 1*Social Class



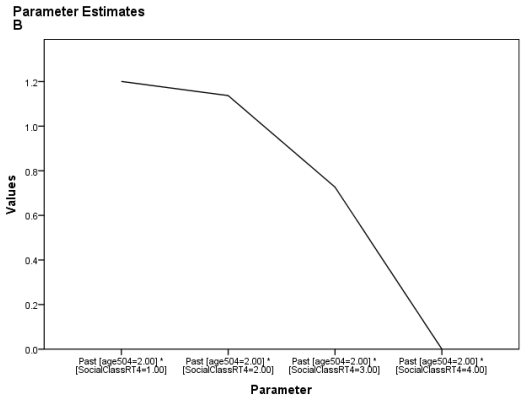
Past: Age 1*Square root of Social Class



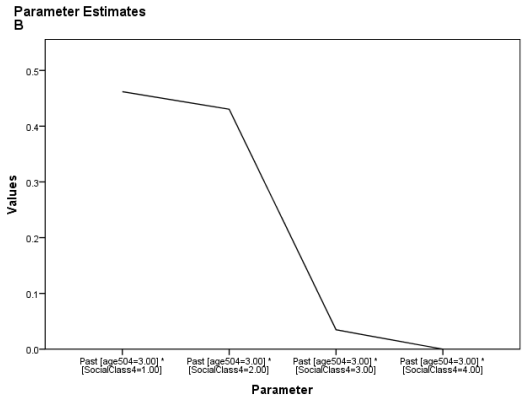
Past: Age 2* Social Class



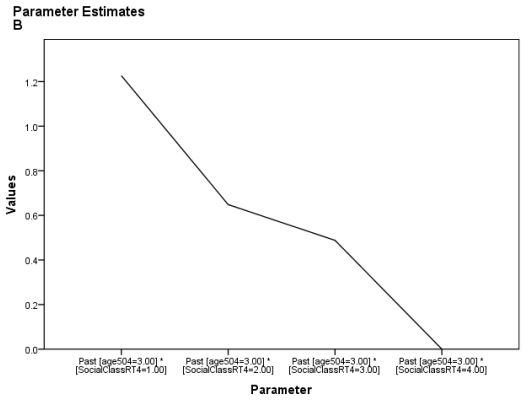
Past: Age 2*Square root of Social Class



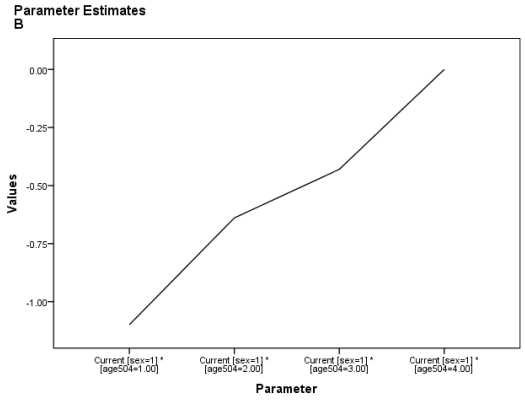
Past: Age 3* Social Class



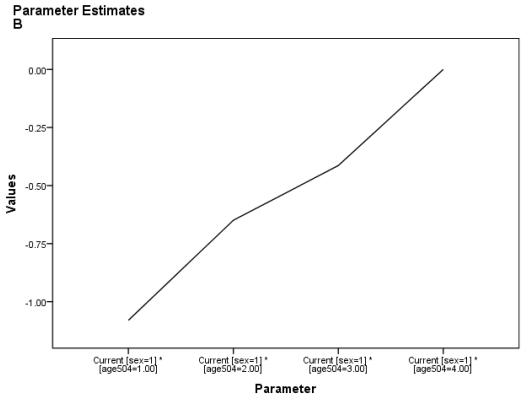
Past: Age 3*Square root of Social Class



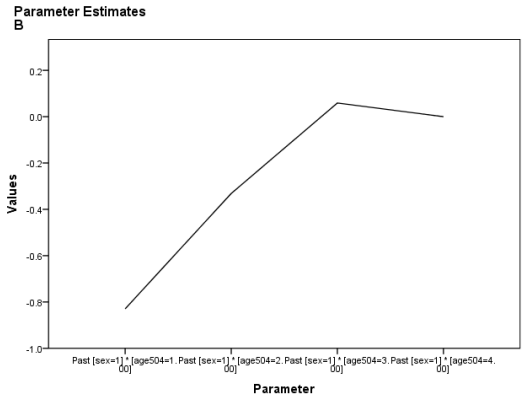
Unchanged- Current: Gender*Age



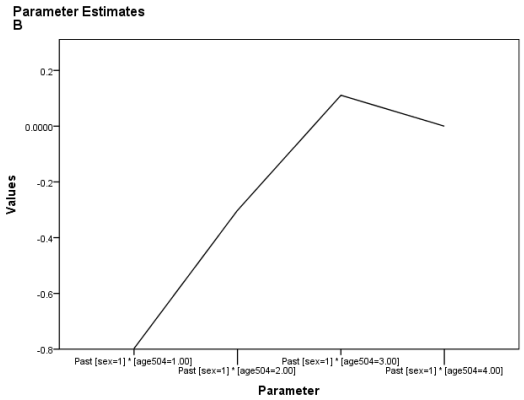
Unchanged- Current: Gender*Age



Unchanged- Past: Gender*Age



Unchanged- Past: Gender*Age



Appendix 8: Logistic Regression Model involving the Social Networks Index

Social isolation and smoking in the current sample

Social isolation known to be a predictor of smoking, so this was first verified for the current sample using the Berkman-Syme Social Networks Index. A cross-tabulation was run to see if social isolation was related to smoking in this particular sample and a significant relationship was found [$\chi^2(6)=410.4$, $p<.001$, Cramer's $V=0.16$] (see below).

The most isolated groups had a much higher prevalence of current smoking (38.5% compared to 18.2% overall, standardised residual 11.2), while the most integrated groups had a very low rate of smoking (8.8%, std. res. -10.1). Conversely, over half of the most socially integrated group have never smoked (53.6% compared to 44.4%, std. res. 6.3), while only 28.9% of the most isolated group have never smoked (std. res. -5.5). There is less variation in the proportion of past smokers in groups with different social integration. However, the most isolated group has the smallest prevalence of past smokers (32.5%, std. red. -1.9), suggesting that this group is less likely to quit smoking than other groups.

When comparing genders, there is a similar prevalence of male and female current smokers across most social integration groups, except for the most isolated group, in which the male smoking rate is a particularly high 42.4% (std. res. 8.7). The rate of male and female never smokers follows a similar gradient across the social groups, but the female never smoking rate is consistently higher than the male. The rate of male past smoking increases with increasing social integration, but the rate of female past smoking fluctuates a small amount and suggests a slight decrease with increasing social integration.

Crosstabulation of SNI and smoking

Social Networks Index		Most isolated	Moderately isolated	Moderately integrated	Socially integrated	Total
Total						
Current smoker	Count	213	555	518	182	1468
	% within SNI	38.5%	25.9%	15.8%	8.8%	18.2%
Past smoker	Count	180	798	1251	779	3008
	% within SNI	32.5%	37.3%	38.0%	37.6%	37.4%
Never smoker	Count	160	786	1519	1109	3574
	% within SNI	28.9%	36.7%	46.2%	53.6%	44.4%
Total	Count	1950	3042	2159	1340	8491
Male						
Current smoker	Count	98	221	225	89	633
	% within SNI	42.4%	24.9%	15.9%	9.1%	18.0%
Past smoker	Count	80	394	674	461	1609
	% within SNI	34.6%	44.3%	47.6%	47.1%	45.8%
Never smoker	Count	53	274	518	429	1274
	% within SNI	22.9%	30.8%	36.6%	43.8%	36.2%
Total	Count	231	889	1417	979	3516
Female						
Current smoker	Count	115	334	293	93	835
	% within SNI	35.7%	26.7%	15.7%	8.5%	18.4%
Past smoker	Count	100	404	577	318	1399
	% within SNI	31.1%	32.3%	30.8%	29.1%	30.9%
Never smoker	Count	107	512	1001	680	2300
	% within SNI	33.2%	41.0%	53.5%	62.3%	50.7%
Total	Count	322	1250	1871	1091	4534

Modelling the relationship

SNI was added to the model to test the authenticity of the relationships between smoking, gender, age and social class. The final model involved gender, age, social class, social networks and two interactions terms; age and gender, and age and social class. The baseline -2LL for the model was 16429.0, improving to 15386.9 for the final model [$\chi^2(16)= 1042.0$, $p<.001$]. The Goodness of Fit statistics were not significant [Pearson $\chi^2(15426)=15494.9$, $p=.346$, Deviance $\chi^2(15426)= 15164.6$, $p=.932$], but there were a lot of empty cells, as before (15293, 66.0%). The model classified 50.8% of the cases correctly and the Nagelkerke r^2 increased to 0.14. Parameter estimates are displayed below.

When SNI was added to the model, the other predictors remained fairly constant. The relationships between the other predictors can be seen in the graphs below (compare with Figures 3.2 C-D and 3.3 C- D, with SNI at reference category).

SNI was a powerful predictor of current smoking. The odds of the most isolated respondents smoking was almost six times higher than for the most socially integrated (OR=5.93, 95% CI=4.52, 7.80, SE=0.14). The second most integrated group is almost twice as likely to currently smoke as the most integrated group (OR=1.9, 95% CI=1.57, 2.30).

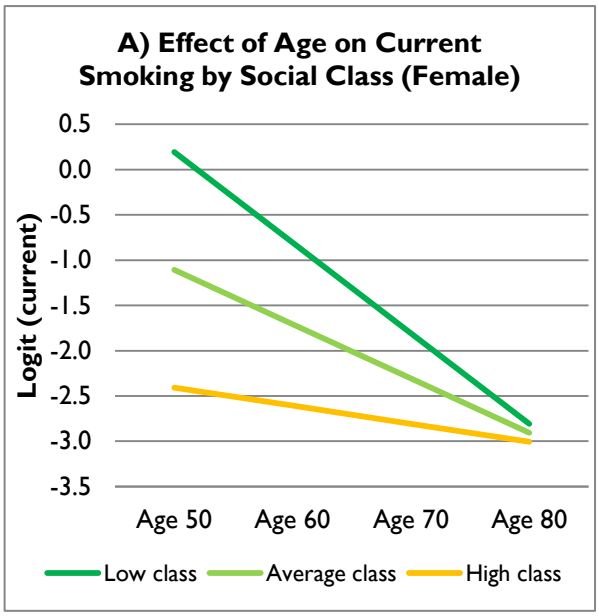
The effect of social isolation on previous smoking is significant but not as strong as for current smoking. The odds of the most isolated respondents smoking was 1.72 (95% CI=1.35, 2.19) compared to the most integrated group. The difference in likelihood between the most integrated and the second most integrated group was 1.23 (95% CI=1.09, 1.39).

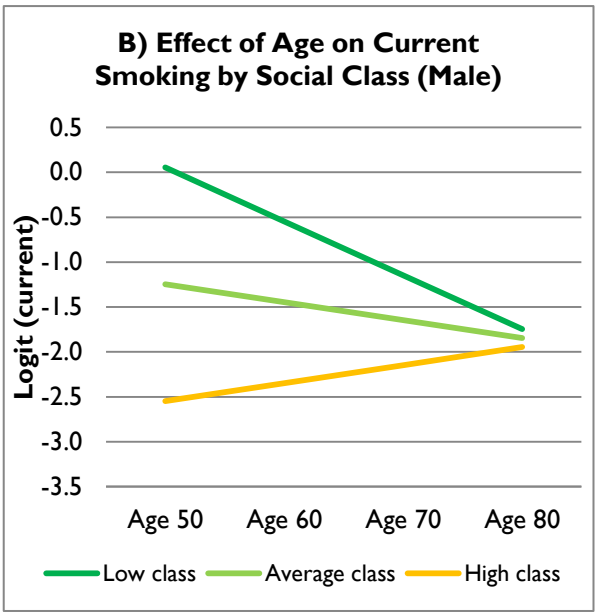
Parameter estimates for the model with SNI

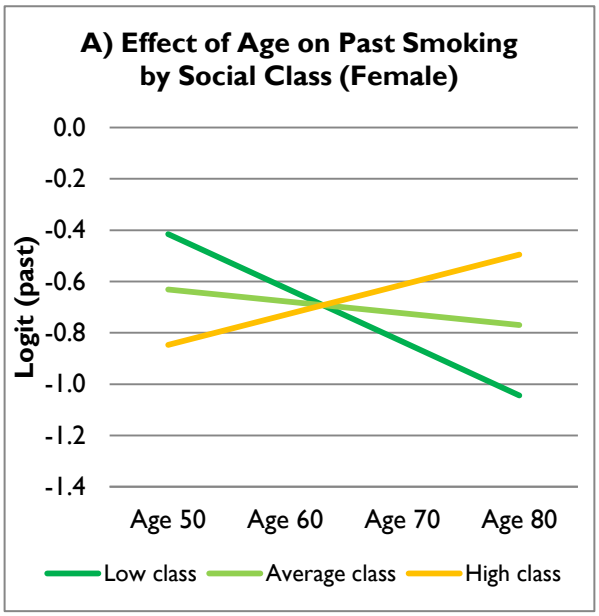
	β *(SE)*	95% CI (lower)	Odds Ratio	95% CI (upper)
Current smoker vs Never smoker				
Constant	-1.11 *** *(0.103)*			
Age	-0.06 *** *(0.005)*	0.93	**0.94**	0.95
Male	-0.14 *(0.11)*	0.70	**0.87**	1.08
Female	0.00			
Male*Age	0.04 *** *(0.007)*	1.03	**1.04**	1.06
Female*Age	0.00			
Social Class	-0.65 *** *(0.054)*	0.47	**0.52**	0.58
Social Class*Age	0.02 *** *(0.004)*	1.01	**1.02**	1.03
Most isolated	1.78 *** *(0.139)*	4.52	**5.93**	7.80
Moderately isolated	1.26 *** *(0.102)*	2.90	**3.54**	4.32
Moderately integrated	0.64 *** *(0.097)*	1.57	**1.90**	2.30
Socially integrated	0.00			
Past smoker vs Never smoker				
Constant	-0.63 *** *(0.076)*			
Age	0.00 *(0.004)*	0.99	**1.00**	1.00
Male	0.23 * *(0.09)*	1.05	**1.26**	1.50
Female	0.00			
Male*Age	0.04 *** *(0.005)*	1.03	**1.04**	1.05
Female*Age	0.00			
Social Class	-0.11 * *(0.044)*	0.82	**0.90**	0.98
Social Class*Age	0.01 ** *(0.003)*	1.00	**1.01**	1.01
Most isolated	0.54 *** *(0.123)*	1.35	**1.72**	2.19
Moderately isolated	0.46 *** *(0.073)*	1.37	**1.58**	1.82
Moderately integrated	0.21 *** *(0.063)*	1.09	**1.23**	1.39
Socially integrated	0.00			

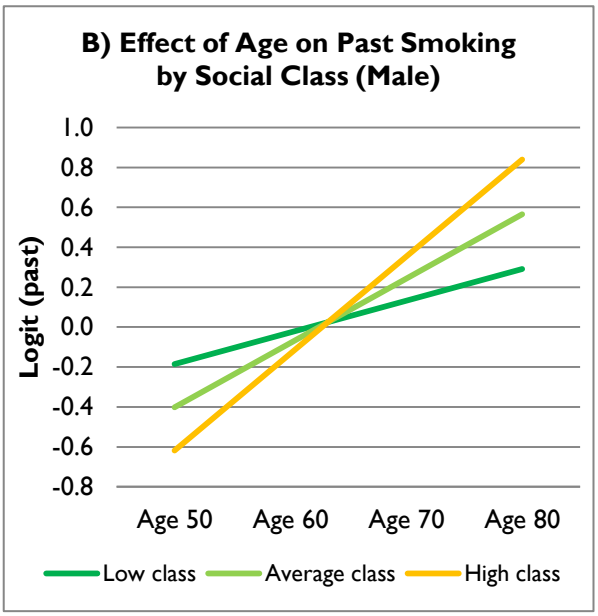
Reference category: Never smoker. *** p<.001, ** p<.01, *p<.05

Note: R^2 = 0.122 (Cox and Snell), 0.139 (Nagelkerke). Model χ^2 (16)=1042.0, p<.001.


A) Effect of Age on Current Smoking by Social Class (Female)
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
Logit (current)
Age 50
Age 60
Age 70
Age 80
Low class
Average class
High class


B) Effect of Age on Current Smoking by Social Class (Male)
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
Logit (current)
Age 50
Age 60
Age 70
Age 80
Low class
Average class
High class


A) Effect of Age on Past Smoking by Social Class (Female)
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
Logit (past)
Age 50
Age 60
Age 70
Age 80
Low class
Average class
High class


B) Effect of Age on Past Smoking by Social Class (Male)
1.0
0.8
0.6
0.4
0.2
0.0
-0.2
-0.4
-0.6
-0.8
Logit (past)
Age 50
Age 60
Age 70
Age 80
Low class
Average class
High class

Appendix 9: Search Strategy

This study concerned the smoking behaviours of older adults in Ireland with respect to the diffusion model of the tobacco epidemic, which involves age, gender and social class. Many searches were conducted in order to identify a reasonable number of relevant results using combinations of the terms below:

1. Smoking OR tobacco OR cigarette
2. Epidemic OR diffusion OR spread OR dispersion
3. Older adult OR elderly OR senior* OR geriatric OR aged
4. Ireland OR Irish OR Irish context OR "Republic of Ireland"
5. Gender OR sex OR women OR men
6. Social class OR "socioeconomic status" OR "socioeconomic position" OR income OR education OR wealth OR poverty OR disadvantage OR deprivation OR prestige
7. Also: "health behavio*r"

Searches were adapted to each database to utilise each controlled vocabulary appropriately. Results were limited to those in English and published after 1995. Databases searched included PubMed, Science Direct, PsychInfo, ProQuest, as well as using Google Scholar and stella.catalogue.tcd.ie. Key journals were examined, namely *Tobacco Control; Journal of Epidemiology & Community Health; Social Science & Medicine;* and *Drug and Alcohol Dependence*. Bibliographies of key articles were used to find further relevant research and specific policy documents were sought out. Searches were conducted between May and July 2014.