Life events and change in health behaviours at midlife: an analysis of data from the National Survey of Health and Development.

Basaruddin Ahmad

Thesis submitted for the Degree of Doctor of Philosophy of the University College London

Department of Epidemiology and Public Health
University College London

2008

Abstract.

Aim. Limited evidence exists on the effects of life stress on behaviour change, especially amongst middle aged people. This study aims to assess the impact of life stress from stressful life events and being diagnosed with chronic diseases on change in smoking, alcohol use, diet, and physical activity in a national sample of middle aged people.

Method. This study used data from 3 waves of the MRC National Survey of Health and Development when the sample was aged 36, 43 and 53 years. A change was defined as the change in the status of particular health behaviour between two consecutive waves (age 36 and 43 years, and age 43 and 53 years). The changes in health behaviours (outcomes) examined were stopping smoking, smoking relapse, increased risk of having an alcohol drinking problem, increased alcohol consumption, change in dietary behaviour (index score), increased physical activity and decreased physical activity. Stressful life events and health related life events were assessed using scores derived from a stressful life events inventory. Diagnosis of a medical condition was the self reported diagnosis of 5 chronic conditions: hypertension, angina, heart attack, stroke, and diabetes. Associations were assessed at age 43 years, 53 years, and the aggregate of both observations at ages 43 and 53 years. The influence of three social support factors: perceived support, social network, and social participation, and demographic factors: sex, social class, and education level on the association were also assessed.

Results. The analysis found that stressful life events was associated with greater odds of smoking relapse in the ex-smokers and lower odds of increased physical activity in the cohort members who were not physically active at baseline. Health related life events were found to be associated with lower odds of increased physical activity.

Being diagnosed with at least one medical condition was associated with greater odds of stopping smoking in current smokers, lower odds of smoking relapse in ex-smokers, and increased physical activity. It was also found to be associated with improved diet behaviour in the men. The social support factors were found to influence the effects of the life stressors in some of the associations.

Conclusion. Life stress from life events experience does influence health behaviours change amongst a middle aged national sample. However, particular life stress from health related life events, specifically, from being diagnosed with a chronic medical condition can motivate health protective behaviour change. Social support factors buffer the effect of life stress to some extent.

Acknowledgements.

A number of people were, either directly or indirectly, involved in producing this thesis and their assistance, support, and guidance are very much appreciated. First I would like to thank my supervisors, Professor Richard Watt and Dr. Marcus Richards, who have guided and supported me throughout the study. I would also like to thank the members of staff of MRC NSHD and MRC HNR in Cambridge for their assistance with the data. I am very grateful to Emeritus Professor Aubrey Sheiham for his contributions in this study and his ideas. A special thank to Professor Martin Hobdell, who helped with proof reading and whose line in an email increased my motivation to be a teacher. I will always remember the support from friends in Room 309 between 2004 and 2007, and misses those late evening discussions. I would like to dedicate this work to my late father, who will be missed dearly and my mother, for her encouragement. Last, but not least, I am indebted to my wife, Mas; and my children; Azra, Ahmad, Yusuf, Imran, and Hanna who had to put up with me during the ups and downs over the years.

I dedicate this work to;
My mother and late father,

Contents.

List of figures.

List of tables.

Abbreviations.

DOMC: Diagnosis of a medical condition.

E: Education level at age 26 years.

GOF: goodness of fit.

HRLE: health related life events

HRLES: health related life events score.

HREMS: health related emotional score.

HRLCS: health related life change score.

LE: Life events.

LES: Life events score.

EMS: Emotional score – always refers to the score at age 43 years.

LCS: Life change score – always refers to the score at age 43 years.

LRT: Likelihood ratio test.

MC: diagnosis of a medical condition.

NS: Not significant.

OR: odds ratio

ORs: odds ratios

p: p-value

PSUP: Perceived support.

SC: Social class.

SLE: Stressful life events.

SNET: Social network.

SP: Social Participation.

CHAPTER 1

Introduction.

Health behaviour research has a long history, but is still a very relevant topic in Public Health because of its' relationship with chronic diseases. The evidence that links health behaviours and chronic diseases, such as smoking and lung cancer, diet and heart diseases, alcohol use and liver cirrhosis has been accumulating in the literature since the early 21st century (Doll and Hill, 1954; Garceau, 1964; Morris et. al., 1977). However, more evidence from epidemiological data, which refined the causal relationships, had emerged after the 1980s with the advance of sophisticated research design (Institute of Medicine, 2001) and availability of data from longitudinal studies such as the Framingham Heart Study (Wilson, 1994; Bhargava, 2003). Health behaviours are among the common risk factors that contribute to the development of chronic diseases together with several other factors such as stress, trauma, hygiene, psychosocial, and genetic make-up (WHO, 2005; Sheiham and Watt, 2000). Health damaging behaviours such as smoking, excessive alcohol use, eating a diet with high fat or sugar content, and low in fibre content; and a sedentary lifestyle, increase the risk of developing various chronic diseases like cardiovascular disease, stroke, cancer, chronic respiratory diseases, diabetes, and oral health problems (Smiths et. al, 1989; Wannamethee and Shaper, 1992; Austoker, 1994; Morris, 1994; Todd et. al., 1995; Ziegler et. al., 1996; Erens and Primatesta, 1999; Shaper and Wannamethee, 2000; Sheiham and Watt, 2000; Britton and Marmot, 2004; Commission of the European Communities, 2005; WHO, 2003, 2005; Roerecke, et. al., 2007). These diseases are a burden to many nations because they contribute to the increase in preventable deaths and the morbidity of the population at all societal levels, although the people in the lower socioeconomic groups are the most affected (Department of Health, 1998; Strong et. al. 2005; WHO, 2005). Using data from selected underdeveloped, developing and developed countries, Strong et. al., (2005) estimated that 72% of the global burden of disease in the population in the year 2005 were related to chronic diseases such as cardiovascular diseases (30%), cancer (13%), chronic respiratory diseases (7%), diabetes and other chronic diseases (9%). The age specific death rates from diseases in adults under 70 years of age were projected to increase from 15 million in the year 2005 to 17 million in the year 2015. Chronic diseases also affect the economy of family units as well as the whole of society through the high cost of health care and reduced the quality of life of those afflicted (Subramanian et. al., 2002; WHO, 2005). It was projected that chronic diseases will be the leading cause of the increase in loss of a healthy life (measured using disability –adjusted life years, DALYs) from 305 million years in the year 2005 to 349 million years in the year 2015 in people between age 30 and 59 years (Strong et. al., 2005). People in their midlife are the most affected group because many chronic diseases start to manifest themselves at around this age (WHO, 2005). In summary, health behaviour research is important today because of the impact of chronic diseases on the health of the population.

The health behaviour literature is currently, voluminous compared to two decades ago, when there were few structured entities such as departments and programs devoted to the study of health behaviour (Gochman, 1997a). Apart from the literature that existed at that time, which associated health behaviours with health as mentioned earlier, many studies focussed on the prevalence and trend within the population such as the report of the General Household Survey of the UK by the Office of National

Statistics (http://www.statistics.gov.uk/ssd/surveys/generalhouseholdsurvey.asp), the determinants of health, and need for care (Gochman, 1997b). There is also literature on the determinants of health behaviour practice such as personal, family, social, cultural, education, and socioeconomic factors. Other literature discussed the link between social class and variation in health behaviour and the health gradient (Marmot et. al., 1987; Department of Health and Social Security, 1980; MacIntyre, 1986; Blaxter, 1990). Another focus of health behaviour research has been on the intervention to bring about change in health behaviours (Marcus et. al., 2000; Rigotti et. al., 2002). Knowledge from the theories of behaviour change research was used in some of the intervention studies such as in Sheeran et. al., (2002) and Giles et. al., (2004). The focus on behaviour change is important because there are benefits from changing to a healthful behaviour. For example, in a systematic review on the effect of smoking cessation, it has been shown that the mortality risk was 36% lower in people who had stopped smoking compared to those who continued to smoke (crude RR= 0.64, 95%CI: 0.58, 0.71), (Critchley and Capewell, 2003).

Much of the current understanding about the process of change in health behaviours are related to theories such as the Health Belief Model (Rosenstock, 1974), Theory of Planned Action (Ajzen, 1985, 1991), and Stage of change Model (Prochaska and DiClemente, 1984). Various factors, such as the intention to change, the benefit and barriers to change, and self-efficacy have been identified but the extensive research in, and discussion about these theories has focussed on the process of change and there is a lack in the explanation of why people change their behaviour.

A range of reasons for change in health behaviours is mentioned in the literature, but with little reference to the theories of behaviour change. The most common reason was health factors and life stress (Lader and Meltzer, 2002). While stressful life events, such as financial problems, job stress, and relationship problems were linked to change in health damaging behaviours, health related life events such as illness were linked to health protective behaviour change (Lader and Meltzer, 2002; McKee et. al., 2003; Falba et. al., 2005; Schutte et. al., 2006). However, the evidence for the association above is still lacking from studies on the general population. There are more reports on the effect of life stress in studies on change in alcohol use and smoking behaviour but fewer on diet and physical activity behaviours. Few had reported the association between life stress and healthful behaviour change (Perreira and Sloan, 2001) or the impact of being diagnosed with a chronic medical condition. There is also little evidence from prospective studies. This study, therefore, aimed to add to our understanding about the association between life stress and change in health behaviour by addressing the gap in the current evidence.

To achieve this aim, the study analysed longitudinal data from a nationally representative sample of subjects - the MRC National Survey of Health and Development of the UK (1946 cohort). The data were from three surveys when the cohort members were aged 36, 43, and 53 years, in the year 1982, 1989, and 1999 respectively. The purpose was to assess whether there was any evidence contained in the data supporting the association between life stress that originated from stressful life events and four behaviours: change in smoking habits, change in the pattern of alcohol consumption, change in dietary behaviour, and change in physical activity behaviours. The next chapter presents the review of the literature on these topics, then the hypothesis, aims, and objectives of the study. The methods of analysis are presented in Chapter 3 and then followed by the results of the descriptive analyses of the data in Chapter 4. Chapters 5, 6, 7, and 8 present, in order, the results of the analyses of each of the health behaviours: smoking, alcohol consumption, diet, and physical activity. The last chapter presents the discussion of the results, the conclusion and recommendations for future research.

CHAPTER 2

Literature review.

2.1 Introduction.

This chapter begins with the review of the literature on health behaviours. It first reviews the definition of health behaviours and outlines the definition used in this study and then examines the changes in health behaviours in the general population. Next, it explores the factors that influence change, looking at a few models that explain behaviour change and discusses the reason for change in health behaviours. The review then explores the literature relating to stressful life events. It starts by looking into issues relating to life events research and then reviewed the literature that linked stressful life events and (chronic) medical conditions to change in health behaviours. Lastly, a summary of the review is presented, followed by the aims, hypothesis, and objectives of this study.

2.2 Health behaviours.

2.2.1 Definition.

Health behaviour has been referred to as the individual contribution to the maintenance, restoration and improvement of health (Gochman, 1997a). This particular definition by Gochman (1997a) included both tangible and intangible elements. The former could be something that people act upon or avoid from doing either consciously or voluntarily such as smoking or limiting alcohol consumption. The intangible elements could include cognitive elements such as belief, expectation, motive, values, perception, and emotions that can impact on health pathways that can be observed and measured indirectly (Gochman, 1997a). Glanz et. al., (2002, 2007) supported this definition, but claimed that the definition put more emphasis on individuals. Instead they suggested that the definition of health behaviours could be broadened to include the actions of not just individuals, but also groups and organisations. This, they suggested, included the collective actions that potentially determine or affect the direction of health behaviours of people at large such as social change, health directed policy, and coping skills (Glanz et.al., 1996, 2002). For example, a change in policy that prohibits smoking in public places that influences the decision to stop smoking. But behaviours that are performed to comply with the law such as not smoking in hospitals or lack of resources such as not smoking or drinking because of imprisonment; rather than those that are undertaken on an individuals' own initiatives, do not belong to this definition. Health behaviours that are performed with the intention to restore, maintain, or improve health are known as 'health directed behaviour'. Thus, any behaviour that is carried out with the intention of preventing the development of diseases or ill health is health behaviour; for example, stopping smoking (Kasl and Cobb, 1966).

All the definitions mentioned earlier seemed one-sided, where the emphasis was on the 'healthful effect' of an action; that is, health behaviours are actions that are undertaken with the intention of gaining better health. The definitions gave little consideration to the actions that are harmful to health like starting to smoke or doing less exercise. A definition that offered a balance, which discriminated between the behaviours that have a health protective effect and those that have health damaging effects, was given in Matarazzo (1984). He described health behaviour in terms of 'behavioural pathogens' (for example: smoking) or behavioural immunogens (seeking treatment). Continuously practising various protective health behaviours, such as refraining from smoking, eating a healthy diet, exercising, drinking alcohol sensibly, tooth brushing, and engaging in protected sexual activity and so on, over long periods of time are referred to as having a 'healthy lifestyle' (Ogden, 2007). But most people are unlikely to practice all the healthful behaviours (Glanz and Maddock, 2007).

The term health behaviour or health related behaviour is also referred to as health risk factors in research relating to chronic diseases. This includes tobacco use, alcohol consumption, physical activity, diet, and oral health behaviour, sexual practices, disease screening (Sheiham and Watt, 2000; IOM, 2001; WHO, 2003, 2005a; Strong et. al., 2005). For the purpose of this study and throughout this thesis, the term health behaviours refers to smoking, alcohol use, diet and physical activity.

2.2.2 Trends in health behaviour.

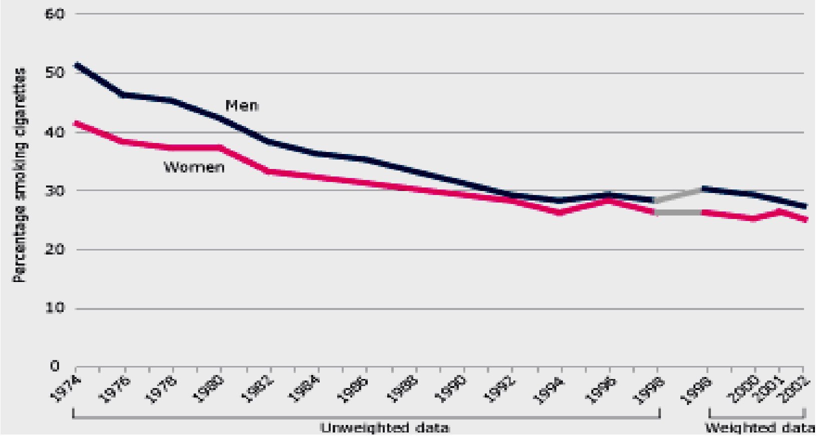
2.2.2.1 Introduction.

This study aimed to examine the changes in health behaviours using a dataset of the general UK population over a period of 17 years between 1982 and 1999 during which there were already changes in health behaviours taking place over this period. The purpose of the review here was to give some brief background information about the types of changes that were taking place in the general population from where the data came from and at the time when the data were collected. It was also limited to assessment of the trends and distributions of the practise of four health behaviours examined in this study: smoking, alcohol use, diet, and physical activity.

2.2.2.2 Smoking behaviour.

The data from the General Household Survey shows that the prevalence of cigarette smoking was declining since the 1970s (Figure 2.1; Stapleton, 1998; Bridgwood et. al., 2000; Rickards et. al., 2004; Jarvis and Wardle, 2006). There were more men than women who smoked, but the gender gap was narrowing because more women had taken up smoking since the 1950s (Stapleton, 1998; Rickards et. al., 2004). This was related to the social acceptability of women smokers and the decline in the prevalence of smokers among middle aged men between the 1980s and 1990s (McNeill et. al., 1988; Stapleton, 1998). More smokers were from the lower socioeconomic group and less educated (Jarvis, 1994; Bergen and Caporaso, 1999; Emmons et. al., 1999; Jarvis and Wardle, 2003, 2006). This review found little information about the trend in stopping smoking and smoking relapse during the period of interest. The rate of stopping smoking increased with age and it was estimated that about 4% of people between 40 and 50 years old stopped smoking annually (Stapleton, 1998). Stopping smoking was greater among the affluent than the poor (Jarvis and Wardle, 2006). Relapse rates were high; nearly half of those who attempted to stop had relapsed within a year (National Statistics, 2005).

Figure 2.1. Prevalence of 'current smoker' status between 1974 and 2002. Source: Rickards et. al., (2004).

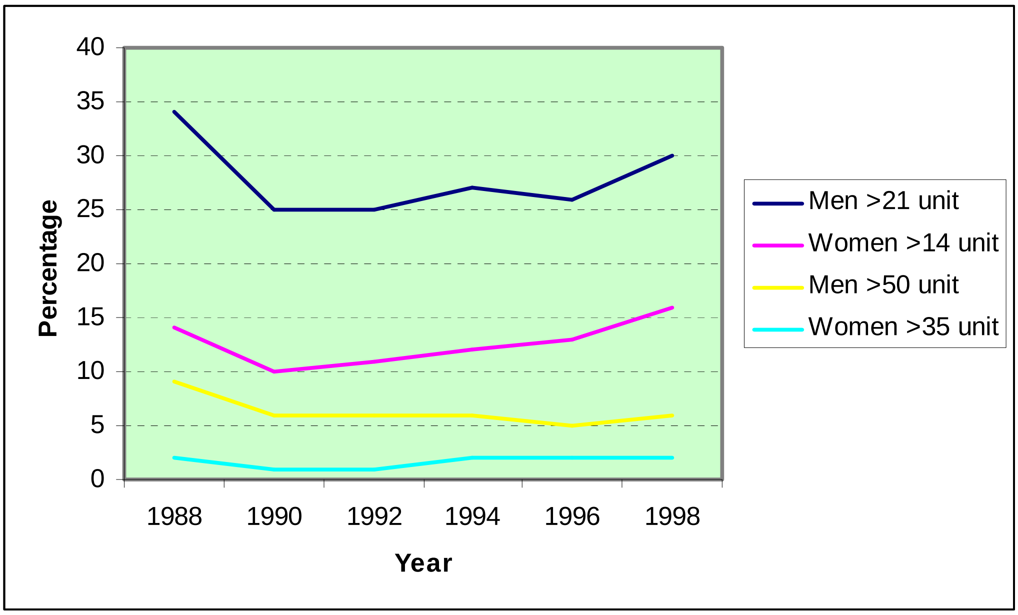


2.2.2.3 Alcohol behaviour.

The data from the General Household Survey showed that between the years 1978 and 1982, there was a decrease in the proportion of men who were classified as heavy drinkers (measured using the quantity-frequency classification) from 25% to 21% (OPCS, 1984). Later surveys showed that the proportion of men drinking more than the weekly-recommended level increased to 23% in 1989 (Smyth and Browne, 1992). The proportion continued to increase to 29% in 2000 (Walker et. al., 2001). For women, the trend based on similar measures as in men, showed an increase from 5%, 7%, and 17% in 1982, 1989, and 2000 respectively. Alcohol consumption decreases with age (Kemm, 2003), but between the years 1990 and 1998 there was a slow increase in the number of middle aged people who drank more than the current recommended limit (Figure 2.2). The survey data also showed that men drank more than women and were more likely to be heavy drinkers (Kemm, 2003). The numbers of people who drank more than the recommended limit were similar for those who were employed, unemployed, or economically inactive from 1984 to 2000 (Smyth and Browne, 1992; Walker et. al., 2001). Alcohol consumption was higher among the higher social classes than the lower social classes, but problem drinking was more prevalent in the lower social classes (Rickards et. al., 2004; Alcohol Concern, 2003). The trends mentioned above were based on alcohol data from the General Household Survey, which saw some changes in the current health messages and data collection.

The facts above were based on the then current alcohol drinking recommendations at the respective times at which the surveys were carried out. These had changed in 1995 from a weekly recommendation of a maximum of 28 units per week for men and 21 units per week for women (Department of Health, 1995) to maximum intake of 3-4 units per day for men and 2-3 units per day for women (Department of Health, 1995). The way alcohol was assessed in the General Household Survey has changed slightly (Kemm, 2003). From 1978, the quantity-frequency measure was used. It assessed whether a subject drank alcohol, the types of alcoholic drinks, the frequency of drinking in the past 12 months (response measured as: none, once or twice in a year, 6 months, a month, or a week; 3 - 4 times a week, or most days), and the amount drank on each occasion for each type of drinks during the last 12 months (measured using pints, glasses, singles for beer, wines and spirits groups respectively). From 1990, the measure of frequency of drinking in the past 12 months was changed to: none, once or twice a year, once every two months, once or twice a month, once or twice a week, 3-4 days a week, 5-6 days a week, and almost everyday; and the quantity of consumption was changed to the amount drunk in any one day. From 1988 the survey included subjects aged 16 and 17 years, then from 18 years and over. Kemm (2003), in his study on the trends in alcohol consumption by birth cohort using the data from the General Household Survey claimed that the changes mentioned above were minor and not likely to have caused major discontinuities in the trends. Alcohol consumption was also measured differently between countries. The UK and Ireland used alcohol units (1 unit = 8.0 grams of 100% ethanol) while in other countries used the number of drinks such as the US. There is also variation in the definition of the quantity of alcohol for 1 drink, from 6 grams in Austria to 20 grams in Japan, which complicates comparison of studies between countries (Meyerhoff et. al., 2005).

Figure 2.2: The proportion that drank over the weekly recommended limit in men and women at midlife age between 1988 and 1998 (Data source: Bridgewood et. al., 2000).



1988:Age 25-44 years, 1990-1998: Age 45-64 years.(unit per week)

2.2.2.4 Diet behaviour.

2.2.2.4.1 Dietary pattern.

Dietary pattern has been used in the past two decades in nutritional epidemiology to investigate the role of food and nutrition in the development of diseases (Waijers et. al., 2007). It is a summarised measure of various diet behaviours where various types of foods, the amount consumed, frequency of eating, nutritional consumption, and other dietary related information are condensed into a single score or index. Such a measure considers dietary behaviour in a holistic manner rather than a single dietary component, which assess the role of individual nutrients or food (Willet, 1998). There are several methods of dietary patterning in the literature and they have been discussed in several reviews (Newby and Tucker, 2004; Kant 1996, 2004; Waijers et. al., 2007). In brief, there are two approaches of dietary patterning (Waijers et. al., 2007).

One approach is to use empirical methods such as statistical correlation analysis to group the different diet and eating behaviours. Martikainen et. al., (2003), for example, carried out cluster analysis on the diet data of the subjects in the Whitehall II study and classified the dietary pattern as ‘Very healthy diet’, ‘Moderately healthy diet’, ‘French diet’, ‘Sweet unhealthy diet’, ‘Unhealthy diet’, and ‘Very unhealthy diet’. In another study, Mishra et. al., (2006) carried out factor analysis on the diet data from the National Survey of Health and Development and found three dietary patterns for the women, which were identified as: fruit, vegetables, dairy; ethnic foods and alcohol; and meat, potatoes and sweet foods. They also found two patterns for the men: ethnic foods and alcohol, and mixed. Another approach to dietary patterning incorporates current theoretical nutritional knowledge in the process of deriving a diet score or index from the various dietary components (Waijers et. al., 2007). Knowledge about the range of health benefits from various foods, nutrition, or eating behaviours, such as the recommended daily amount and frequency of eating, were used as guidelines to set cut-off levels when allocating scores for a particular component. The Diet Quality Index (Patterson et. al., 1994) predefined the scores of each of the components, which included total fat, saturated fatty acids, cholesterol, fruit and vegetables, complex carbohydrates, protein, sodium, and calcium, by allocating lower scores for healthier diet behaviour and greater scores for less healthy behaviour. For example, 5 or more servings of fruit and vegetables were given score = 0, 3 - 4 servings: score = 1, and 0 - 2 servings: score = 2. The total score was generated by aggregating the scores from each of the components. Examples of other indeces are the Healthy Eating Index (Weinstein et. al., 2000), Healthy Food Index (Osler et. al., 2001), Mediterranean Diet Score (Trichopoulou et. al., 1997), and Dietary Guidelines Index (McNaughton et. al., 2008). The number of dietary components, methods of scoring, and predefined scores varies between the indeces mentioned. Waijers et. al., (2007) discussed this approach of dietary patterning in greater detail.

The current review found several reports that applied dietary patterning in studies on the impact of diet on health outcomes such as cardiovascular mortality (Seymore et. al., 2000; McCullough et. al., 2000) and cancer (Harnack et. al., 2002). There was little application of dietary patterning in the study of the trends and patterns in a population over time. The reports on dietary trend and pattern have, in the past, been based on single dietary components, such as fat and, fruit and vegetables consumption. The following review focussed on the trends in change of 5 types of diet behaviours: breakfast eating behaviour, consumption of types of milk, and bread; consumption of fruit and vegetables, and fat intake (percentage of energy from fat). These diet behaviours are the components for the diet behaviour score, which was used in this study.

2.2.2.4.2 Trends in eating breakfast behaviour.

There was little information about the trend of eating breakfast in the literature. There was no report on the trend of eating breakfast in the National Food Survey, but it did report that there was little difference in the amount of breakfast cereal consumed between different income groups (DEFRA, 2001).

2.2.2.4.3 Trends in milk consumption.

The report of the National Food Survey showed a decreasing trend in the consumption of whole milk and an increasing trend in the consumption of semi-skimmed milk between the years 1987 and 1999 (Figure 2.3) (DEFRA, 2001). However, consumption of skimmed milk did not change much over the same period. Examination of the data from the National Food Survey 2000 (DEFRA, 2001) showed a similar pattern in the whole milk consumption among the middle aged population, but there was an increasing pattern in the consumption of skimmed milk (Figure 2.4).

Figure 2.3. Pattern of wholemilk, semi-skimmed milk and fully skimmed milk consumption from 1975 to 2000. Source: DEFRA, 2001.

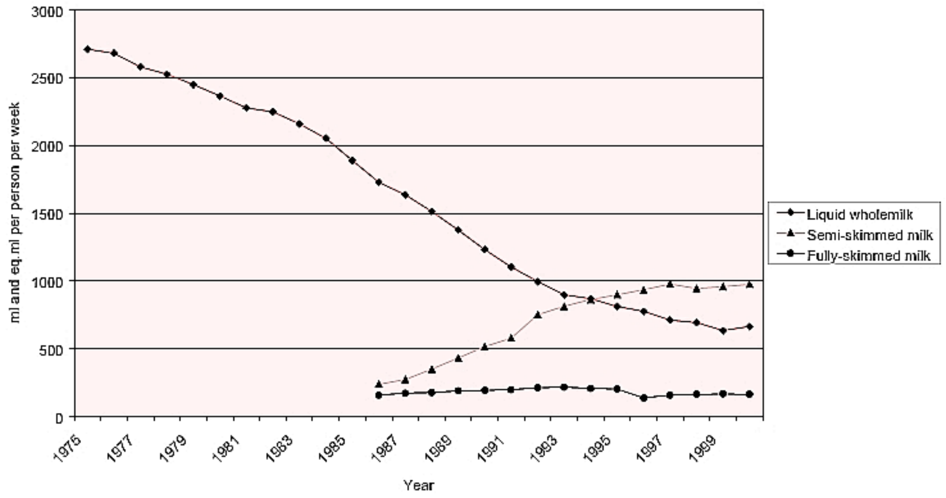
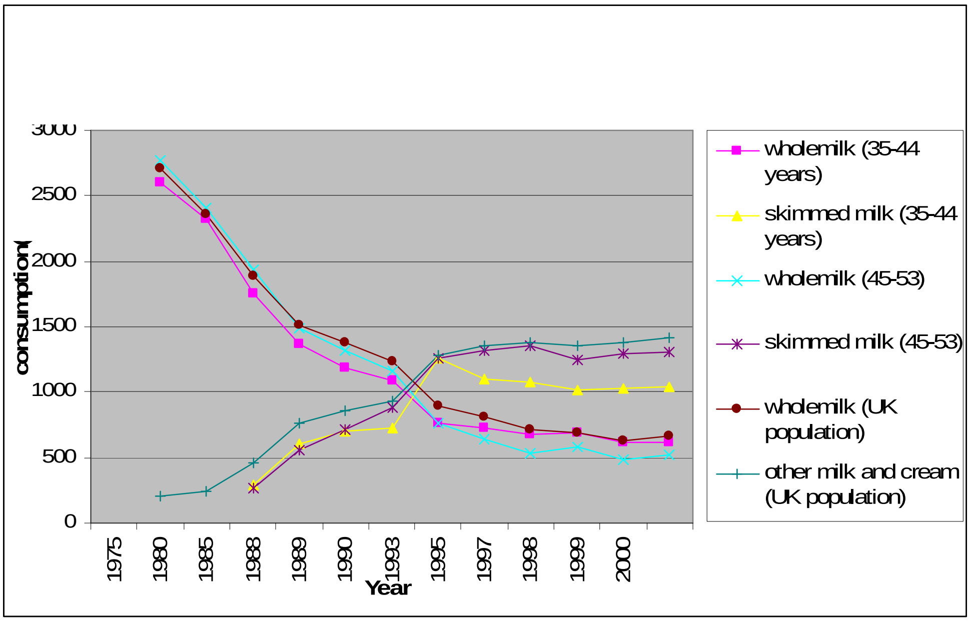


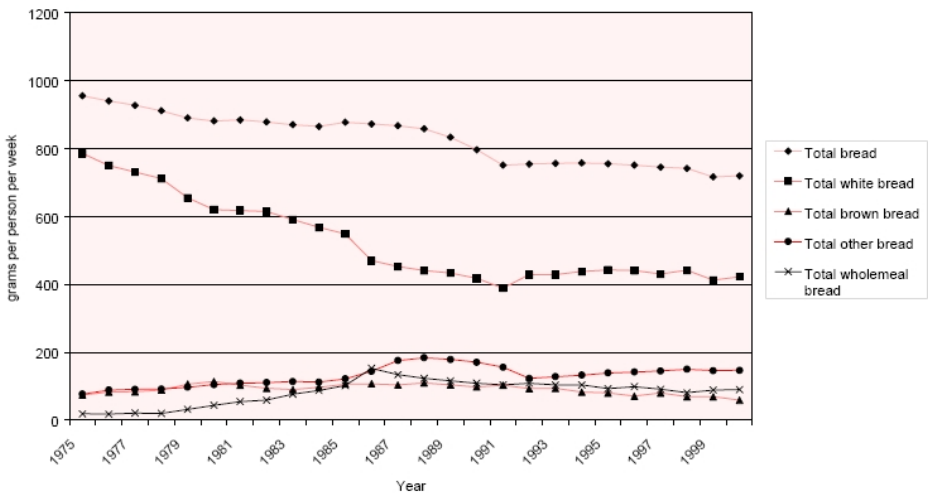
Figure 2.4: Milk consumption (ml per person per week) in middle aged UK population between 1975 and 2000. (Datasource: DEFRA, 2001).



2.2.2.4.4 Trends in bread consumption.

Large varieties of non-traditional breads have been introduced into the UK market, such as the French, naan, garlic, pitta, ciabatta breads, and bagels (DEFRA, 2001). However, between 1975 and 2000 there was a slow decline in total bread consumption due to a decline in white bread consumption, but it has remained stable at slightly more than 700 grams per week per person from 1991 (Figure 2.5). The consumption of brown, wholemeal, and other types of bread has increased slightly over the same period.

Figure 2.5. Pattern of varieties of bread consumption from 1975 to 2000. Source: DEFRA, 2001.



2.2.2.4.5 Trends in fruit and vegetables consumption.

It was reported in the National Food Survey 2000 that there was little variation in the vegetable consumption in the general UK population between 1975 and 1999 (Figure 2.6) (DEFRA, 2001). There was, however, an increasing pattern in fruit consumption (Figure 2.7). It was observed that the consumption of fruits and vegetables in the middle aged population of the UK was similar to that of the general population (Figure 2.8).

Figure 2.6: Vegetables consumption from 1975 to 2000. Source DEFRA, 2001.

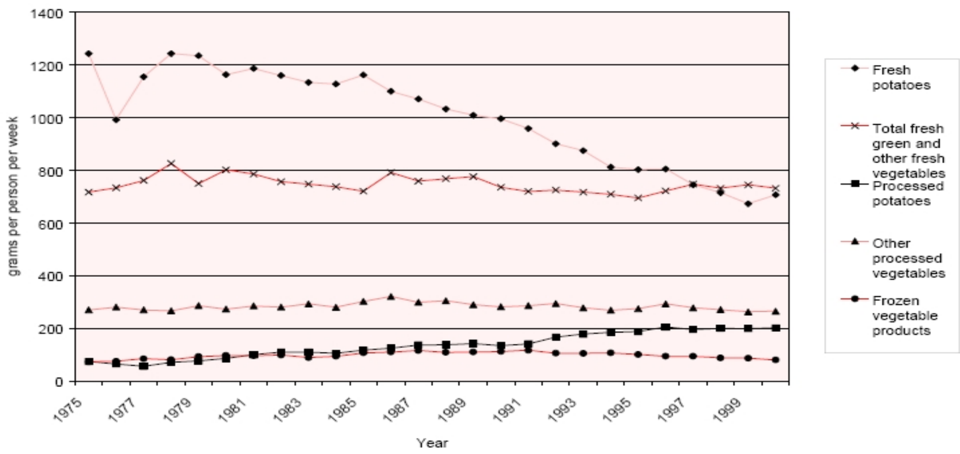
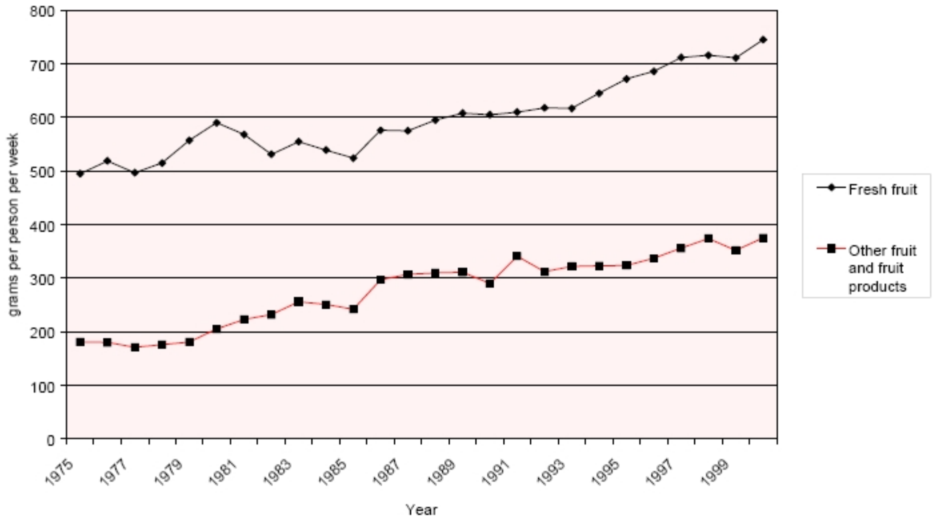


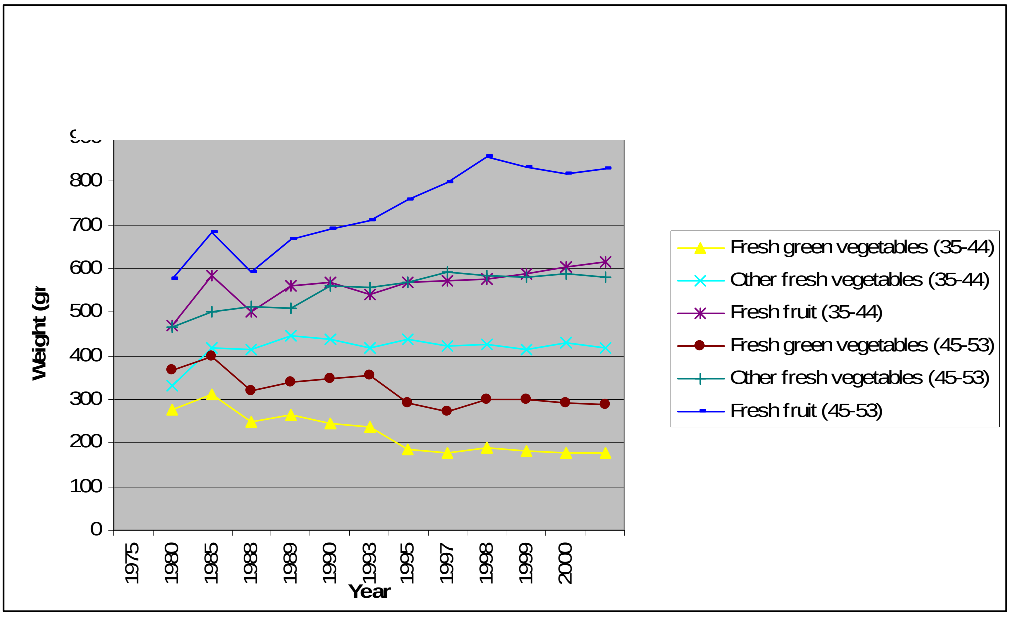
Figure 2.7: Fresh fruit consumption from 1975 to 2000. Source: DEFRA, 2001.



2.2.2.4.6 Trend in fat consumption (percentage of energy from total fat intake).

Fat consumption, measured as the percentage of energy from total fat intake, is reported to have been declining slowly from the middle of 1970s (Gregory et. al., 1990; Stephen and Sieber, 1994; Henderson et. al., 2003). Consumption, based on similar measures, peaked at 40% in the 1970s; then declined to 38% in the mid-1980s and down to 34% by the year 2000.

Figure 2.8: Fruits and vegetables consumption in the middle-aged population (Datasource: National Statistics, 1999; DEFRA 2001).



2.2.2.4.7 Pattern in diet behaviours.

Less healthy diets, such as consuming more whole milk and a high fat diet with less fruit and vegetables, and fibrous bread like wholemeal bread have been found to be associated with lower social class status (James et. al., 1997; DEFRA, 2001; Wardle and Steptoe, 2003). Consumption of skimmed milk did not vary by income groups (DEFRA, 2001). It was unlikely that the price determined the type of milk consumed, because the prices of various types of milk were similar (DEFRA, 2001).

2.2.2.5 Physical activity behaviour.

There appear to be few reports about the trend of physical activity in the UK population. Some information about physical activity participation was available from the Sports and Leisure report of General Household Survey in 2002 (Fox and Rickards, 2004). It was shown, for example, that there was a small fluctuation in the proportion of people who participated in at least one sport between 1987 and 2002. Participation during the 4 weeks before the interview (including walking) increased from 61% in 1987 to 65% in 1990 and had been maintained at this level until 1996; it then declined to 59% in 2002. However, these figures included the participation in non-vigorous sports such as snooker and billiards, which made up a substantial proportion of the activities (11% in 1996 and 9% in 2002). The proportion was also lower when walking was excluded (46% in 1996 and 43% in 2002). The decrease in the proportion of the population that walks was the reason for the decrease in participation between 1996 and 2002. The figures in the Sport and Leisure report were slightly lower than the figures in the report of a study of the 1958 birth cohort sample. In 1991, 68% of the cohort members, for example, were active in the past 4 weeks (4 times or more) and the proportion decreased slightly to 67% in 1999 (Parson et. al., 2005). Parson et. al., (2005) reported that the proportion of cohort members who changed their physical activities were stable where there were similar proportions (33%) who increased and decreased their physical activity over the same period. Men were more likely than women and the more affluent were more likely than the less affluent, to participate in physical activity, but participation decreases with age (Livingstone et. al., 2003; Fox and Rickards, 2004).

2.2.3 Summary.

The review above showed that there was a healthy trend in the general UK population, whereby more people engaged in health protective behaviour over two decades between the years 1980 and 2000. The reports show that there were decreasing numbers of cigarette smokers, more sensible alcohol consumption, and improvement in the diet such as consuming less fat, and more fruit and vegetables. However, there was little change in physical activity. More men than women engaged in health damaging behaviours such as smoking, drinking excessive alcohol and eating less healthy diet, but more women did less physical activity. Less affluent people were more likely to engage in health damaging behaviours and more affluent people were more likely to engage in protective behaviours. In another study it was reported that better social support, such as the social network, was positively related to healthy health behaviours practices (Gottlieb and Green, 1984; McKee et. al., 2003).

It was not clear from the literature what factors explain the trends in health behaviours reviewed above. A logical explanation is that fewer people started to engage in unhealthy behaviour. There were, for example, fewer people who started to smoke after the age of 20 years old (Stapleton, 1998). The number of people who had changed their behaviour can also explain the trends. More people, for example, stopped smoking as they got older (Hyman et. al. 1996; Stapleton, 1998). But, this is slightly more complicated than it might at first seem, because there can be both healthful and adverse changes. Healthful change, or health protective behaviour changes, are changes that are beneficial to health, such as stopping smoking, drinking more sensibly, eating a healthy diet, and doing more physical activity. Adverse changes, or health damaging behaviour changes, are changes that are harmful to health, such as taking up smoking or relapse in smoking, drinking alcohol more than the recommended limit, consuming more fatty food or less fibrous foods, and doing less physical activity. Thus, it can be argued that the healthy trend in health behaviours (as those mentioned in the earlier review), were because there was a greater number of people who had undergone health protective behaviour change, than those who had undergone health damaging behaviour change.

There is a large volume of literature that discusses the process of health behaviour change, but few reports explain the reasons behind the change, especially when it comes to reports about the general population. These are reviewed in the next sections.

2.3 Change in health behaviours.

2.3.1 Models for behaviour change.

Understanding the factors that influence behaviour change is much linked to the theories on behaviour change. Many models have been proposed and discussed in the literature. For example, there are the Health Belief Model (Rosenstock, 1974), Theory of Reasoned Action (Azjen and Fishbein, 1980), Theory of Planned Action (Azjen, 1985, 1991, 2002), Social Cognitive Theory (Bandura, 1986), and Stage of Change Model (Prochaska and DiClemente, 1984). These models and many others have been discussed and reviewed (Shumaker et. al., 1998; Conner and Norman, 1998; Glanz et. al.. 1996; 2002). Hence, this review will not go into the details of the models, but instead will provide an overview.

2.3.1.1 Health Belief Model (HBM).

The Health Belief Model (Rosenstock, 1974) hypothesises that the likelihood of making a change in relation to a particular disease is dependent upon two factors: the perceived susceptibility to, and seriousness of the consequences of the disease and; the belief that the benefit is greater than the difficulty in overcoming the barriers to taking an action that can prevent or reduce the risk of getting the disease (Janz and Becker, 1984). The factor *cues to action* was added since it was felt that there was the need for a trigger to initiate the decision making process (Janz and Becker, 1984) and self efficacy was included as a measure to assess the ability to take the action (Glanz et. al., 2002). The model also included variables such as demographic, socio-psychological, and structural factors that can affect individual perception and indirectly influence health behaviours (Janz and Becker, 1984).

2.3.1.2 Theory of Reasoned Action (TRA) and Theory of Planned Behaviour (TPB).

Both TRA (Azjen and Fishbein, 1980) and TPB (Azjen, 1985, 1991, 2002) emphasise the role of social relationships in the models. They posit that whether or not a person will take an action depends on the degree of intention and an action is more likely to occur when the intention is greater. The intention is based on two beliefs.

1. The belief that taking a particular action will result in the desired outcome behaviour, for example 'stopping smoking will improve health'.
2. The belief about the approval of other people who are close to the person. This element stresses the importance of the support and approval of a social network in motivating health behaviour change.

TPB was developed as an improved version of TRA, with the addition of perceived control, which is the individual's perception about the ability to make a change that has a direct influence on the intention.

2.3.1.3 Stage of change model.

The Stage of Change Model (Prochaska and DiClemente, 1983) focuses on the dynamic continuum in the process of change. Change is assumed to be moving in a cyclical process of:

1. Pre-contemplation: not planning to make any changes,
2. Contemplation: considering to make a change,
3. Preparation: initiate change by making small changes,
4. Action: fully engaged in the newly adopted behaviour,
5. Maintenance: maintaining the new behaviour over time, and
6. Relapse: returning to the old behaviour.

At each stage, individuals make different evaluations about a particular behaviour and the current circumstances. During the contemplation stage, for example, there might be an evaluation of the problems that can be anticipated in relation to making a change, and during preparation stage there can be evaluation of how to fully adopt a new behaviour.

2.3.1.4 Social Cognitive Theory.

Social Cognitive Theory (Bandura, 1986) model assumes that a change is determined by the understanding about the risk of a behaviour and how the risk can be reduced by taking a certain action or actions. The model proposes that there is a dynamic interaction between the behaviour, the individual, and the environment. Therefore, the behaviour can be learned from, or influenced by, various circumstances such as the home, social circumstances, and the living or working environments, through observation and reinforcement. There are three sets of cognitive constructs in the model (Schwarzer and Fuchs, 1998);

1. *Situation-outcome expectancies* – this evaluates the risk of developing a condition or disease,
2. *Action-outcome expectancies* – this considers whether an action will prevent a disease, and
3. *Self-efficacy* – this is the expectancy of the capability to carry out the action.

2.3.1.5 Summary.

In summary, all the theories assume that the decision making process for changing health behaviour involves a series of evaluation of the respective factors specified in each model. Each theory emphasises different factors in the models, but there are some similarities: both the susceptibility factor in the HBM and the situation-outcome expectancies in the SCT factors, for example, evaluate the risk of developing an undesired condition and, self efficacy and perceived control assess the perception of the ability to carry out an action. Self-efficacy, which was introduced by Bandura (1977) into the SCT, was also adapted into the HBM as well. These models for behaviour change elaborated at length the factors and process of change. However, there has not been much explanation and discussion about the reasons for change.

Some discussion in cues to action in the HBM can be implied, as the reason for making a change.

2.3.1.6 Cues to action.

There are various reasons why people make a change in their health behaviour and it is important to know why they do so. In Public Health, for example, this information can be used in future planning or assessing the impact of public health messages. For instance, if the healthy trend is related to a particular health promotion activity, then it can be continued and improvised. If a specific health promotion activity is found not to be having any impact, then it is important to know why people do not respond and what are the factors that prevented them from doing so. The latter information can then be used to formulate a better program.

Health messages, in the example above, can be in any form. Policies, such as the banning of smoking in public places, the work place, and hospitals; health campaigns, such as Health for the Nation (Department of Health, 1992), and sensible drinking recommendations (Department of Health, 1995) are a few examples. In this situation, the health messages could have acted as a cue that triggered changes in health behaviours in some members of the population. A cue, for that matter, can be referred to as the reason for change. The health messages about the advantages of engaging in a healthy lifestyle and the risks of health damaging behaviours may provide the necessary information that leads to the change in attitude and thus motivated change in health behaviour.

The concept of a cue that triggers the decision-making process was introduced by Hochbaum (1958) and applied in Health Belief Model (Rosenstock, 1974), but was not applied in other models, such as those mentioned earlier. Some discussions about the cues were found in reviews on Health Belief Model like in Rosenstock, (1974), Janz and Becker (1984), Strecher and Rosenstock (1997), and Janz et. al., (2002). However, there were no further details about the kinds, roles, and impact of cues and how they operate to affect the change process. Rosenstock (1974) attributed the lack of interest in the subject to the difficulty in avoiding recall bias when examining the effect in a retrospective study, since people who had a change in health behaviour are more likely to recall the circumstances that led to the action, compared to those who did not. West (2006) argued that the operation of cues must satisfy a rational link between the cues and the behaviour change. Stopping smoking, for example, because of an illness like cardiovascular diseases can be rationally explained by the fact that smoking behaviour increases the risk of developing the disease or, change in the diet by diabetic individuals – because of the fact that further consumption of an uncontrolled diet increases the risk of complications from the condition. However, the rational is less convincing, for example, if the change is brought by an illness, which was actually flu or a cold. The link could be indirect, such as through the relationship with family members, relatives or cohabitation. Stopping smoking, for example, was found to cluster among household members (Chandola et. al., 2004). It could be that this was because the rest of the family members also stop smoking as a show of support for a family member who is quitting or that they had gained awareness from the experience of the particular family member. West (2006) also claimed that cues are the '*immediate situational determinants*' whereby it is only effective within a short time span and do not have lasting effect; thus, limited in use. The low rate of cessation after 18 months of active intervention to stop smoking (Wilkes and Evans, 1999) could suggest that a medical condition, as a cue, has a short term effect. However, there has been no specific study to confirm or deny this claim.

Few kinds of cues have been examined and the findings are less than conclusive. Harrison et. al., (1992), in their meta-analysis study of the constructs of the Health Belief Model, had excluded the cues to action due to lack of empirical study. Harris et. al., (1982) assessed the degree to which a symptom operates as a cue to adhering to the regimen for the treatment of type II diabetes, has on behaviour change, but Janz and Becker (1984) claimed that the item was more likely a measure of severity. Postcard reminders were initially found to have no effect on people's belief to seek influenza vaccination in a study (Larson et. al., 1979), but it was then found to be effective in another study (Larson et. al., 1982). Cerkoney and Hart (1980) reported that counselling, which was assumed to operate as a cue, predicted treatment compliance in diabetic patients, but the retrospective study design and arbitrary scoring of variables by the researcher limited the strength of the study (Janz and Becker, 1984). Social influence was found to be effective in predicting the intention to seek a cognitive function test relating to Alzheimer disease among elderly people, but the author was not able to ascertain whether the cue was from the mass media, physician or family members (Werner, 2003). In another study, cues like a doctor's advice, media campaign, symptoms, personal experience, or the experience of someone close were found not to be significant in prompting testicular self-examination (McClenahan et. al., 2007). Many of these studies were limited by the retrospective study design with small and non-random samples and very few have used population data.

To summarise, a cue can be the reason that motivates change in people. Evidence to support the effectiveness of cues was not convincing. This review found that little research has been undertaken to explore other types of cues than those suggested by Rosenstock (1974), and Janz and Becker (1984). There was also a limited number of reports that described the reasons for changing health behaviour among people in the general population.

2.4 Reasons for change in health behaviour.

A range of reasons for health behaviour change can operate as cues that lead people to change their health behaviours, such as health, financial, family, and life events. In the National Statistics Report of 2002 (Lader and Meltzer, 2003) on smoking behaviour in the UK, it was stated that about 86% of the survey participants had mentioned health as the reason for wanting to stop smoking. This included the anticipation of better health (68%), the thought that it would reduce the risk of associated diseases (30%), and current health problems (16%). Other non-health reasons were financially related, such as not being able to afford to maintain the habit, considering the habit as a waste of money, being pressured by the family, or concerned about the health effect on their children. It was also reported that about 48% of the subjects had the support from family members like spouse, parents, and children to stop smoking (Lader and Meltzer, 2003). People can also change their behaviour in a show of support for others who are trying to change (Chandola et. al., 2004). Several stressful life circumstances, such as health, or legal problems, and the death of someone close, have all been reported to be the reason for a reduced consumption of alcohol (Schutte et. al., 2006). Stressful situations have also been linked to health damaging behaviour change. Ex-smokers in the General Household Survey for example, who relapsed had attributed their change in behaviour to a stressful life (Lader and Meltzer, 2003). Other reasons given for smoking relapse were: fond of the habit, missed smoking, and unable to cope with the cravings. Life stress and social influences like friends' alcohol consumption were reportedly to be the reason for increasing alcohol consumption (Abbey et. al., 1993).

It was not very clear how much of an impact on behaviour a cue has in a population such as a media campaign that targets the general population. For example, a number of health promotion programmes were carried out in the UK in the 1990s:

- For physical activity, there was the 'Active for Life' campaign that ran a three years media campaign from 1996 to 1998 (Hilsdon et. al., 2001).
- The diet campaign in the 1990s was led by the publication of the dietary reference values that recommended the amount of fat and fibre intake by The Committee of Medical Aspects of Food Policy in 1991 (Parson et. al., 2005).
- The information from The Committee of Medical Aspects of Food Policy report was used in the following years in the Health for the Nation document and 'Balance of Good Health' (1994) campaign, which sets a target for fat and fibre intake (Parson et. al., 2005).
- The recommendation to increase fruit and vegetables consumption to 5 portions a day in 1994 (Department of Health, 1994).

Despite the public health messages, the physical activity campaign only managed to increase the awareness of the benefit of physical activity, but not an actual change in physical activity (Hillsdon et. al., 2001). Another study also reported not much change in physical activity and diet among the 1958 British cohort members, who were exposed to the health messages above, between the years 1991 and 1999, (Parson et. al., 2005). For smoking behaviour, policies were introduced in the UK ever since the behaviour was associated with lung cancer (Doll and Hill, 1954) in the 1950s, such as the prohibition of smoking in public places, taxation, banning of tobacco sales to under age children, and advertising (TSO, 1998).) It was claimed that these health messages were well accepted and had helped people to stop smoking (Lader and Meltzer, 2002); but the empirical evidence to show the contribution of health messages is lacking.

To conclude, there are various reasons for changing health behaviour. The contribution of health promotion as a cue to change was not clear. Clearer evidence was that most of the reasons for change in health behaviours were individually based and related to stressful life events, which included health and non-health related events. The next section presents more literature that links stressful life events and change in health behaviours.

2.5 Stressful life events.

2.5.1 Introduction.

This section first presents some background on life events research. This is followed by the review of the literature that links stressful life events and change in health behaviours, and medical conditions and change in health behaviours with the focus on the reports from observational studies.

2.5.2 Defining life events and its related issues in life events research.

2.5.2.1 Definition of stressful life events.

This review has found that there are several definitions in the literature for stressful life events, which reflect the characteristic of the event - usually in a negative context (Dohrenwend, 2006). According to Dohrenwend (1973), there are two ways in which life events can be described as stressful. The first, is when there is an undesirable life occurrence that results in *disturbances of emotions* (Brown and Birley, 1968). This concept was applied in studies that focus on the impact of life occurrences on the psychological outcomes in individuals, for example, in schizophrenia and depression (Brown and Birley, 1968; Birley and Brown, 1970). Another concept focussed on the amount of readjustment or *life change* that is needed to adapt or cope with the occurrences that are perceived to be negative or stressful (Dohrenwend, 1973). This approach was consistent with studies on coping behaviour (Stone and Neale, 1984; McCrae and Costa, 1986) and those that quantified the effects of life events in a form of a scale, such as the Social Readjustment Rating Scale (Holmes and Rahe, 1967). Both concepts are linked to the issue of quantifying life events, which is discussed later in this section.

Stressful life events have also been defined as the occurrences that disrupt or can be anticipated to disrupt the activities of individuals (Holmes and Rahe, 1967; Dohrenwend and Dohrenwend, 1969). The emphasis of this definition is on the amount of disruption caused by a particular event on a person’s behaviour or routine. This definition avoids the interpretation of the meaning of a stressful life event to a person, which can be very complex when specifying an event and defining its relevance and significance for a single person (Brown, 1989).

The definition of life events as a 'discrete, situational occurrences with a clear, objective onset and relatively short duration' (Liem and Liem, 1984) emphasised the time frame of the incident. Dohrenwend and Dohrenwend, (1984a) proposed that life events studies should consider events that are proximal to the outcome of interest rather than events that occurred in the distant past. Receiving the news that someone close has just died has more impact on current life stress, whereas death in the distant past can effect an adult's behaviour only to the extent that it becomes embedded in that person (Dohrenwend and Dohrenwend, 1984b). However, Anderson and Stanich (1996) argued that the effect of a special event can extend over the rest of an adult's life, regardless of when it happened. Some studies examined this issue empirically by assessing the reliability of recall period.

The recall period for life events in earlier studies, has ranged from six months, to 1 or 2 years, and even up to 5 years or more (Tausig, 1986; Goldberg and Comstock, 1980; van Os and Jones, 1999; Wethington and Kessler, 1986; Gottlieb and Green, 1984; Wethington, 2000; Andersson and Stanich, 1996). There is an issue of reliability with longer recall periods in relation to memory lapse. A more distant event is less likely to be recalled, but an event with a significant impact that occurred in a distant past may still be recalled compared to an event with low impact, but which occurred in the near present (Dohrenwend, 1984; Paykel, 1987). Many studies have shown that life events that are recalled within the past 12 months have a good reliability (correlation 0.7 or higher) (Thurlow, 1971; Steele et. al., 1980; Paykel, 1987; Kessler and Wethington, 1991) and only a few have found low reliability (Jenkins et. al., 1972; McDonald et. al., 1972). However, life events that were recalled after more than 12 months were reported to have low reliability (Thurlow, 1971). The decay rate in life events recall have been reported to be between 4% to 5% per month for studies that used self report questionnaires and 1% to 3% per month for the interview method (Paykel, 1987).

Other descriptions for stressful life events in the literature include ‘adverse events’, ‘life stress’, ‘life crises’, ‘socially undesirable events’, and ‘fundamentally important environmental incidents’ (Meyer, 1951; Holmes and Rahe, 1967; Dohrenwend and Dohrenwend, 1969, 1984; Gottlieb and Green, 1984; Mueller et. al., 1977). A few examples of life events are: illness, job problems such as being demoted or at risk of losing a job, financial problems, moving to a new place, and relationship problems. More examples are presented in Appendix 2.1.

2.5.2.2 Quantifying life events.

Methods of quantifying or making an inventory of life events, as a way of indicating the amount of stress imposed on an individual (Dohrenwend, 2006), vary from a simple checklist to rating of events based on their severity or simply recording their important characteristics. An example of a checklist is found in Meyer (1953), where a simple ‘life chart’ that listed the number and types of stressful life events, was used to examine the relationship between life stress and physical illness. In the study, life events were found to cluster preceding the onset of a disease.

A similar method, where the number of life events from a checklist was aggregated and used as a total number or assumed score, have been used in other studies, such as those by Gottlieb and Green (1984), Billings and Moos (1984), Lin et. al. (1986), and van Os and Jones (1999). One limitation of this method is related to the fact that life events are not equal (Paykel, 1983) and thus, do not have additive values (Brown and Harris, 1978). It is, for example implausible to assume that the stress from being ill is equal to losing a job or to having relationship problem. Another problem with this method is that there may be a cancelling effect between events. Veenstra et. al., (2006), for example, found that financial and job related events were related to an increased alcohol consumption, but network related events were associated with decreased consumption. By including these events in the same measure (score) disregards the fact that they have contrasting effects (i.e. the effect of one event is cancelled out or diluted by the effect of another). Another limitation of such a checklist of events is that there is lack of clarity over the relevance of a particular life event to the outcome of interest. A respondent of self reported questionnaire may report an event based, merely, on the occurrence or because of the meaning of the event. However, there can be a range of interpretations of what a particular event might be and some events might be reported regardless of their significance to the outcome of interest. This issue, referred to as *intracategory variability,* is discussed later. Some studies have used a weighting method to account for events that are thought to be more significant by giving a greater score relative to other events that was considered to be less significant (see: Gottlieb and Green,1984 as an example). This method, which was used to derive a continuous score for the purpose of using it in factor or path analyses, also has limited advantage, because of similar problems to those mentioned earlier and also because this type of score is correlated with the number events experienced (Paykel, 1983). Nevertheless, this simple aggregate or count method was claimed to be adequate as a measure of life change (Morrisey, 1980; Rahe, 1974).

Other studies have used scales to quantify the amount of life change that is needed to adjust to stressful occurrences. The Social Readjustment Rating Scale (Holmes and Rahe, 1967), for example, used a method whereby a respondent is requested to rate 43 life events in a checklist in reference to an event (marriage), which was given a fixed value. Other examples of similar types of scales are the Psychiatric Epidemiology Research Interview (PERI) Life Events Scale (Dohrenwend et. al., (1978), which used a similar approach of referring 101 events in a checklist to marriage, and the Scaling of Life Events (SLE) (Paykel et. al., 1971), which requested the respondent to give a score between 0 and 20 for each event. A different approach was used in van Os and Jones (1999) to quantify life change. The study on the National Survey of Health and Development cohort members generated a life change score by allocating a score to each type of response to the life change question for each of the 17 life events items [No event (score = 0), had the event, but no life change (score = 1), had the event, which caused some life change (score = 2), and had the event, which caused significant life change (score = 3)] and then aggregating them.

Besides life change, a change in emotion has also been used to quantify the effect of life events occurrences. Disturbance in emotions, for example, has been assessed by asking respondents about the state of their feelings at the time when the event occurred (van Os and Jones, 1999). The authors in that study derived a score that reflected the level of change in the emotions in a similar way to the life change score mentioned earlier.

2.5.2.3 Intracategory variability.

Another issue in life events research is intra-category variability, where life events have been generalised into a broad checklist of categories (Dohrenwend, 2006). Examples are health, illness, interpersonal, family, work and finance; and many more (Gottleib and Green, 1984, Tausig, 1986; Mattlin et. al., 1990). More examples on the different categories of life events used in other studies are presented in Appendix 2.1. Dohrenwend (2006) had used the findings from another study (Dohrenwend, et. al., 1990) to illustrate that the actual experience reported as a positive response to a particular event in a checklist, varied greatly. He found, from that study, that illness, as a category of life events, might include a range of medical conditions from a typical flu to life threatening conditions such as a heart attack. There were further illustrations: a report of the death of someone close may include the death of a close friend who was contacted regularly, with whom contact had been lost a long time ago, or who was no longer close; and losing a job can be the result of termination of employment due to the business closing down, sacking because of non-performance at work, or relieved from work due to incapacity to work because of illness. Each of the examples above shows that there is a lack of clarity in the actual event or circumstances that could have occurred, which might lead to the problem of reliability and validity of the measure.

The problems of reliability, such as the unreliability of recall and susceptibility to recall bias, can affect the dose/response relationship between exposure and outcome. Other problems are criterion validity, which is related to the use of a third party to validate an occurrence, and construct validity, which is related to the contribution of individual psychological or behavioural factors to the occurrence of life events and its effects in undermining the operation of life events as environmental stressor. A more detailed discussion on this topic can be found in Dohrenwend (2006).

2.5.3 Life events research.

2.5.3.1 Introduction.

Despite the shortcomings in how life events are quantified, research on life events has expanded greatly since the 1960s (Holmes and Rahe, 1967; Paykel, 1983; Dohrenwend, 2006) It has been studied in many aspects such as the biological, epidemiological, social, and psychological and physical health aspects (Tosevski and Milovancevic, 2006). These are reviewed only briefly here because they were not within the scope of this present study.

An example of biologically related research is the study that explored the physiological pathways that link life events to the development of a medical condition. These were demonstrated in the psychoneuroimmunological model, for example, that health can be compromised by stress through the disturbance of normal functioning of cellular immune response by cortisol, which binds to the receptors of the central nervous system resulting in more cortisol production (Dallman et. al., 2004; Glaser, 2005). Based on this model, it was suggested that chronic stress, such as in the situation of having *more stressful life events*, is more harmful to the body's resistance than acute stress, because of the continuous production of cortisol (Phillips et. al., 2005; Tosevski and Milovancevic, 2006).

There are few epidemiological studies on stressful life events. But one in particular, found in the literature, was a study of a US population by Goldberg and Comstock (1980). The authors reported that more life events were reported by the more educated than the less educated subjects in their sample. However, the 'stressful' events in their study had included events that are less likely to be experienced by people in the less advantaged group such as vacation, school change, and job change or promotion. The men were more likely than women to report five or more events, but there was no difference between the sexes when reporting at least one event. In contrast to the study above, other studies have reported that women had more life change following life event occurrences than men (Dohrenwend, 1973) and poorer women had more life events (Gottlieb and Green, 1984). Life events were also found to be negatively related to the presence of a positive social network in men and women (Gottlieb and Green, 1984).

2.5.3.2 Life events and health.

Studies on life events and health can be broadly classified into the effects on psychological and physical health. There are many studies that have reported associations between life events and psychological health such as depression, post-traumatic stress disorder, schizophrenia, anxiety, and unipolar and bipolar disorders (Dohrenwend and Dohrenwend, 1974; Brown and Harris, 1978a, 1989; Kasl, 1984; Billings and Moos, 1984; Lin et. al., 1986; Holmes, 1989a; Breslau, 2002; Brugha, 2003; Paykel, 2003).

Stressful life events have also been found to be associated with physical health. Early studies reported the association between marital problems and the development of a thyroid condition (Canon, 1929). Another author reported that events such as a change in residence, deaths in the family, and environmental influences tended to cluster prior to the onset of a physical illness (Meyer, 1953). Other authors have reported associations with various medical conditions such as abdominal pain, disorders in menstruation, multiple sclerosis, myocardial infarction (Brown and Harris, 1989b), facial pain (Auerbach et. al., 2001), asthma (Sandberg et. al., 2004), back pain (Lampe et. al. 1998), coronary heart diseases (Phillips et. al., 2005; Rafanelli et. al., 2005) and even death (Phillips et. al., 2007). There is also a growing interest in the effect of life stress on oral health (Newton and Bower, 2005). For example, it was suggested in a study that stress from life events was involved in periodontal destruction (Croucher et. al., 1997). In case of the relationships above, the life events operated as a risk factor that affects the health outcomes directly. It is also possible for life events to affect health outcomes indirectly, such as through the relationship with health behaviours (Shuval, 1981). This relationship is central to this study and it is reviewed in the next section.

2.5.3.3 Life events and health behaviours.

This review found that there was relatively little interest in the literature in the relationship between stressful life events and health behaviours. Searches using the search engines such as PsychINFO, Medline, Ovid, PubMed and Google Scholar that combined the terms stressful life events, life events, or life stress and, each of the health behaviours examined in this study found few reports that specifically examined the relationship. However, a considerable number of studies were found for the association with change in health behaviours.

An example of a study that examined the relationship between life events and alcohol use is the report by Dawson et. al., (2005), who examined the relationship between life events and alcohol consumption using cross sectional data from the National Epidemiologic Survey in the US. They used the information about 12 life events that had occurred in the past 12 months before the survey interview and generated two measures of life events: a score, which was the total number of events, and four categories of life events, which were derived from factor analysis: health related, social stress, job stress, and legal stress. Alcohol consumption was estimated from the information about frequency and quantity of consumption. It generated several outcome measures, which included: average daily intake, overall frequency of drinking, frequency of heavy drinking (>5 drinks) and moderate drinking (≤ 5 drinks); and usual and largest quantity of drinks consumed. In summary, the authors found that, with the exception of health events, all other life events measures were found to be positively associated with all alcohol outcome measures except for overall frequency of drinking (no association) and moderate drinking (inverse association). The frequency of heavy drinking increased by 13% to 24% for every increase in the number of events reported. Social, job and legal stresses were found to be associated with an increase in the frequency of consumption and amount consumed. Health events were found to be associated with a decrease in alcohol consumption in moderate drinkers. The effects of the life events were found to be greater in males than females.

Other studies such as Cooper et. al., (1992) found a positive association between the number of negative events and drinking problems, and the buffering effect of social support factors on the effect of life events and alcohol use. Another study reported a similar association in that the number of life events was associated with drinking problems and the association remained significant even after adjusting for social support factors (Welte and Mirand, 1995). Current heavy drinking and drinking problems were reported to be associated with the life events score, which was derived from the Scaling of Life Events (Paykel et. al., 1971), health related events such as having someone close admitted into the hospital, job related events, marital problems, and death of someone close (Cole et. al., 1990; Cooper et. al., 1992; Jose et. al., 2000; King et. al., 2003; Dawson et. al., 2005). Other events such as divorce in men, financial events, and health events were associated with abstinence from drinking (Krause, 1991; Jose et. al., 2000). Having more events, which included financial problems, health problems, loneliness, and difficulty to get out of home, was associated with less drinking (Welte, 1998).

This review, however, found that there is very few observational studies assessing the association between life events, and smoking, diet, and physical activity. Only Gottlieb and Green, (1984) have reported associations between life events (score) and alcohol use and physical activity in one cross sectional study. The authors suggested the behaviours had been used as a mean of coping with stressful situations.

Although there were only a few studies found in this search that examined the relationship between stressful life events and health behaviours, there was substantial evidence for the association between life events and change in health behaviours.

2.6 Life events and change in health behaviour.

2.6.1 Introduction.

The current review found several studies that investigated the association between life events analysis and change in health behaviours in the general population. Several reports relating to alcohol use and smoking behaviours were found, but there were a limited number of studies for diet and physical activity. The review below was limited to observational studies of the relationship between life events and change in health behaviour. It included studies that examined both life events (as categories) and specific events. The review also focuses on studies that reported absolute change in health behaviours rather than gradual change where possible. The prime purpose of some of the studies that were carried out to examine relationships were other than those between life events and change in health behaviours, such as Gottlieb and Green (1984) and Schutte et. al., (2006). In such cases, this review presents the information that was relevant to this present study only.

2.6.2 Life events and change in smoking behaviour.

One of the early studies that reported associations between stressful life events and change in health behaviours was that by Gottlieb and Green (1984). The authors used data from the National Survey of Personal Health Practices and Consequences in the

US that consisted of a random sample of the general population aged 20 – 64 years, to examine the effects of social structure on lifestyle, health practises, and health status. Their data included nine items on life events that had been experienced in the past 5 years, which were weighted and used to generate a life events score, and five health behaviour practices: smoking, exercise, alcohol use, weight control and sleep. The results on smoking behaviour showed that more life events were related to *smoking initiation* in both men and women. Smoking initiation was related to the subject's social network, such as marital status and church attendance. They also reported that having more life events was related to *stopping smoking* in women and that a better social network was related to stopping smoking. However, this review observed that, because only the data from the first of two waves of the surveys were used, the analysis for smoking initiation had compared the smokers with the never-smokers, and for the analysis of smoking cessation, current smokers were compared with former smokers. This is a less reliable method to assess the change in smoking behaviour (or any other health behaviours for that matter) compared to a follow up method such as in longitudinal studies. The authors also reported that life events were negatively correlated with a health behaviours index, which was a composite measure of the 5 health behaviours.

Another study in the US, using longitudinal data from a community sample of the Americans' Changing Lives Study, was carried out to examine whether change in smoking status, as a response to stress, was different between the sexes (McKee et. al., 2003). The data were collected from two interviews conducted in 1986 and 1989. The mean age of the subjects at baseline was 48 years (SD = 14.8 years). Life events in the past year before the second interview were categorised into interpersonal loss such as death of a close friend or relative, divorce, financial problems, moving to a new place, and life threatening illness or injury. Smoking outcomes were: smoking relapse, maintained abstinence, and continued smoking. The results of the study showed that the subjects who had adverse health events, which included life threatening illness and injury, were less likely to continue smoking (unadjusted OR= 0.35, 95%CI: 0.17, 0.74) and those with financial events were more likely to continue smoking (unadjusted OR= 2.1, 95%CI: 1.03, 4.16) in the second wave. Continued smoking was more likely in women who had health events (OR= 6.2, 95%CI: 1.12, 34.37). For smoking relapse, it was reported that financial events (unadjusted OR= 3.6, 95%CI: 1.66, 1.73) and moving to a new residence (unadjusted OR= 2.9, 95%CI: 1.52, 5.41) were associated with greater odds of relapse while interpersonal loss events (death of someone close, divorce) were related to lower odds of relapse (unadjusted OR = 0.41, 95% CI: 0.19, 0.91). It was also reported that the subjects who had lower social support were less likely to relapse. The authors concluded that the effect of life events, specifically financial problems, on ex-smokers' ability to maintain abstinence was greater in women than men.

Further evidence with regard to the effects of life events on health behaviours change was reported by Falba et. al., (2005) who investigated the impact of stress from job loss and change in smoking behaviour. The data were from two waves (one in 1992 and the other in 1994) of the Health and Retirement Survey - a longitudinal study of a nationally representative sample of the US population aged between 51 to 61 years. The life stressor in this study was involuntary job loss due to layoff or business closing down. Change in smoking status was defined as change in the status between the two waves. The study did not find any association between job loss and stopping smoking by the time of the second wave. But, they did find an association between job loss and smoking relapse. The subjects in their study who had suffered involuntary job loss were more than twice as likely to relapse between the two waves (OR= 2.4, 95%CI: 1.16, 5.12).

In the UK, a study was carried out on a random sample of men aged 40 to 59 years in England, Wales, and Scotland as part of the British Regional Heart Study to examine the impact of non-employment on change in smoking, drinking, and body weight (Morris et. al., 1992). Data collection for the first wave of the prospective study was carried out between 1978-80 using an interview method, and the second wave between 1983-85 using postal questionnaires. The data of the study included the employment status over 5 years before and after the first wave, smoking, alcohol consumption, and physical activity. The study did not find any evidence of stopping smoking following non-employment. However, the result showed that non-employment due to illness was reportedly an important factor for stopping smoking in men.

This review of the literature also found few studies that examined the relationship between diagnosis / having a medical condition and change in smoking behaviour. The evidence from both cross sectional and longitudinal studies suggested that there was a greater likelihood of stopping smoking in people who had had chronic diseases. There was no evidence that a medical condition was associated with smoking relapse.

A cross sectional study in the US examined whether an understanding about the risk of cardiovascular diseases and its related risk factors could influence smoking cessation among less affluent people (Hymann et. al., 1996). The sample was selected at random from community clinics populations (mean age 41 years). The medical events were self-reported diagnosis of cardiovascular disease, hypertension, diabetes, and hypercholesterolemia, and change in smoking status were obtained from the history of current and past smoking status. The study showed that stopping smoking was more likely in smokers who had had hypertension, compared to those without hypertension (OR = 1.3, 95%CI: 1.04, 1.67) and also more likely in smokers who were diagnosed with heart disease than those who were not so diagnosed (OR = 1.5, 95%CI: 1.10, 1.93). Being diagnosed with diabetes was not found to be related to stopping smoking. It was also reported that most subjects had expressed an increased desire to stop smoking had they known the impact of smoking on heart disease.

A more recent investigation of the relationship between the diagnosis / having a medical condition and change in smoking behaviour was reported in a cross sectional study in Germany (John et. al., 2006). The study consisted of a sample of non-institutionalised and randomly selected nationally representative population aged 18 to 79. It examined the relationship between the number of circulatory disorders and being a current smoker. The data on smoking and circulatory disorders was collected using a self-completed questionnaire. One of the classifications of medical conditions used in the study was the central circulatory disorders, which included hypertension, myocardial infarction, angina, heart failure, other coronary diseases, stroke and other vascular diseases. The authors found that the odds of being a current smoker (compared to ex-smoker) was lower in subjects with 2 or more central circulatory disorders than those without any circulatory disorders (OR= 0.6, 95%CI: 0.43, 0.83). This result suggests that smokers who had two or more medical conditions were more likely to have stopped smoking. The study also reported that subjects who had consulted a physician in the past 12 months had lower odds of being a current smoker, but those who had smoking cessation counselling had greater odds of being a current smoker.

This review found only one longitudinal study on the effect of a medical condition on smoking behaviour. Salive et. al., (1992) examined whether the diagnosis of myocardial infarction, or stroke, or cancer by a physician was related to changes in smoking behaviour. The authors followed up 1259 elderly people over 65 years in the US and compared the smoking status of the subjects in the study after 3 and 6 years to their status at baseline. The authors reported that medical conditions were associated with increased rates of stopping smoking at both follow-ups after 3 years (OR= 1.7, 95%CI: 1.1, 2.7) and 6 years (OR= 2.3, 95%CI: 1.6, 3.4).

2.6.3 Life events and change in alcohol drinking behaviour.

A number of studies have examined the relationship between stressful life events and change in alcohol drinking behaviour in the general population. An overview of the relationship has been reported by Veenstra et. al., (2006). The authors searched in the Medline for literature from non-drinking problem populations from the period of 1990 to 2005. They excluded articles with a limited age range. They found 12 cross sectional studies and 4 longitudinal studies that fitted their criteria. Four of the cross sectional studies reported associations between higher life events experience and an increase in alcohol use. The reports from another 5 studies were less clear about the association between specific life events and alcohol use. Another 3 studies did not find any association. These studies, however, did not investigate change in alcohol use, but the relationship with the status of consumption. Some of the studies have already been mentioned in Section 2.5.3.3. Veenstra et. al., (2006) also found that health events and financial events were related to decreased alcohol consumption and that events related to the social network were related to an increased alcohol consumption. It can be concluded from the overview in Veenstra et. al., (2006) that although there was evidence for the relationship, the problem of intra-category variability may underlie findings in that life events, when categorised or operated independently, may have a contrasting effect on alcohol use. Two of the studies found in Veenstra et. al., (2006) are reviewed in detail below.

Brennan et. al., (1999) examined the effect of life stressors on drinking behaviour and vice versa in a community sample aged 55 to 65 years in the US. They analysed the data from 3 surveys using cross-lagged model. Alcohol consumption was measured based on the quantity (largest amount in the past month), frequency (frequency of consuming large amount of alcohol in the past week based on a Likert scale), and drinking problem (based on 17 questions of the Drinking Problem Index (Finney et. al., 1991)). The stressors were life events categories: negative life events (number of non-health related life events in the past 12 months), chronic health stressors (number of current and diagnosed medical conditions, such as cancer, high blood pressure, diabetes, breathing trouble, and back pain), financial stressors, and spouse stressors. In the analysis of the *effect of stressors on alcohol use*, it was found that a reduced alcohol consumption was associated with more health stressors in women and financial stressors in men. A reduced frequency of alcohol consumption was found to be associated with: more financial and health stressors in women and; financial stressors in men. An increased drinking problem was associated with: increased life stressors, and more negative life events, in women and spouse stressors in men. In the analysis of the *effect of alcohol use on life stressors*, the authors did not find that having more drinks or more frequent drinking was associated with an increase in the number of life events experience. But instead, their results showed that more frequent drinking predict fewer negative events, health stressors and financial stressors.

An example of a study where the main objective was not to examine the relationship between stressful life events and change in health behaviours, but which included some information about the relationship between such life events and health behaviours is that of Schutte et. al., (2006), which was also not reviewed in Veenstra et. al., (2006). The report in Schutte et. al., (2006) was based on the same study described above (Brennan, 1999). The objective of the study was to explore the factors that predicted remission from an alcohol drinking problem without formal treatment in an older community sample aged 55 to 65 at baseline. The participants in the longitudinal study in the US were asked if each of the events in the checklist had occurred and whether the events were the reason for them to reduce their drinking. The authors reported that the events; health and legal problems, death of someone close, and negative life events had led to a reduction in drinking in treated and untreated subjects who achieved remission from drinking problems. The study also found no effect in respect of social support where it was reported that the availability of help from family and friends, to change drinking behaviour, was not different between those who did and did not remit from drinking problem. Two further reports from the same study by Brennan et. al., (1999) had been used to assess whether drinking pattern in the past predicted late life drinking problems (Moos et. al., 2004) and the coping approaches used by the subjects in the study (Moos et. al., 2006).

In another longitudinal study in the US, Romelsjö et. al. (1991) used the data from the general population aged 20 years and over in 1965 to examine the association between stressful life situations and changes in alcohol consumption. The information on alcohol consumption was collected during surveys in 1965 and 1974 using a self-completed questionnaire and the information on life events that occurred between 1966 and 1973, which were collected in the survey in 1974. Monthly alcohol consumption was calculated from the information about the frequency and number of drinks (equivalent to 10 grams of 100% ethanol) per week. Change in alcohol consumption was the difference in consumption between the two waves and those with the difference of 5 drinks or less were excluded from analysis. Analysis was carried out on a log scale and the results were presented as the percentage of change per unit increase in exposure variable. Twelve life event items (sexual problems, other marital problems, divorce, problems with steady date, deaths of spouse, parents, in-laws, close relative, or close friend; self or spouse's job problem or losing a job; financial problems and deterioration of neighbourhood) were used to generate 3 event scores: event score 1 (12 items), event score 2 (10 items – excluded items related to job), and event score 3 (excluded items related to job and spouse). Many significant results were found in this study (Romelsjö et. al., 1991) as opposed to the claim in Veenstra et. al., (2006) that only divorce was associated with an increased alcohol consumption. The result of the analysis showed that *increased* alcohol consumption by more than 5 drinks per month in men was associated with divorce (32%), financial problems (21%), and event score 1 (6%) for subjects aged 20 to 44 years and; event score 3 (-9%) and death of friend (-26%) for subjects aged 45 to 64 years (negative sign indicated a decrease in consumption). For women, an increased alcohol consumption was associated with event score 1 (3%). An increased consumption, by more than 30 drinks per month, was associated with event score 1 (3%), divorce (17%) and problems with a steady date (40%) for men; and event score 1 (4%), event score 2 (6%), event score 3 (5%), financial problems (20%), and sexual problems (21%) for women. A decreased alcohol consumption by more than 30 drinks per month was found to be associated with a problem with steady date in men (-24%) and death of spouse (-24%) in women.

Other studies reviewed in Veenstra et al. (2006) also reported similar result in the effect of life events among older people. A report of a longitudinal study (Glass et. al., (1995) showed that decreased alcohol consumption was associated with a hospital admission and admission into nursing homes in men, and admission into nursing homes in women. Increased alcohol consumption was associated with moving to another place and death of a friend in women, and hospitalisation in men. Another report (Pereira and Sloan, 2001) found that divorce, retirement, and death of a spouse in men were associated with increased consumption of alcohol while a diagnosis of chronic conditions, such as heart disease and diabetes, admission into hospital and divorce among problem drinkers was associated with decreased consumption. The study of Morris et. al., (1992) that was mentioned in Section 2.6.2 did not find any association between job loss in the past year and increased alcohol consumption. Another study reported no association between death of husband in the past years and change in alcohol consumption (Wilcox et. al., 2003).

This review found a limited amount of research on the effect of specific health events on change in alcohol consumption. A study of a small Japanese population (n = 126) was carried out to examine changes in alcohol consumption in diabetic patients (Kobayashi and Kazuma, 2005). The data of the cross sectional survey were collected using both a self-completed questionnaire and an interview. Participants in the study were selected from outpatients who attended diabetic clinics and had been diagnosed with diabetes more than 6 months ago, but who did not have another serious illness or mental disorder, before the diagnosis or history of alcohol dependency. Alcohol consumption was measured based on the quantity and frequency of consumption of various alcoholic drinks including Japanese alcoholic drinks. A change in alcohol consumption was the difference in the status between the time of diagnosis and the time of the investigation. The mean time between the diagnosis and investigation was 9.5 years (SD = 7.8 years) (range: 0 to 26 years). This study, which was based on data from 65 subjects who consumed more than 200grams alcohol per week at the time of diagnosis, reported that 63% had reduced their alcohol consumption to less than 200grams of alcohol per week. It was also reported that acute conditions present at the time of the diagnosis of diabetes were associated with a reduction in consumption ($p= 0.03$) and similarly awareness of retinopathy being a consequence of diabetes ($p<0.01$). However, this study seemed to be limited by the sample population and small number of subjects.

2.6.4 Life events and change in dietary behaviour.

This review found little evidence for the relationship between life events and change in the diet from an observational study. Searches in the literature did not find any report that is directly relevant to this topic. However, there was one study that examined the impact of death of a husband on health and health behaviours and had reported a relevant relationship (Wilcox et. al., 2003). The cross sectional study was carried out in an older US population age 50 to 79 years. Among other objectives it assessed the impact of being recently widowed in the past year at baseline, and change in health behaviours after 3 years, which included smoking, alcohol consumption, diet and physical activity. The results showed that there was a significant association only with a change in diet. Recently widowed subjects were found to have consumed less fruit and vegetables relative to women who were still married, but the change was small.

2.6.5 Life events and change in physical activity.

A review of the literature indicated that there was little evidence for the relationship between life events and change in physical activity. For example, Wilcox et. al., (2003) did not find any significant change in physical activity following the death of a spouse. This topic has yet to receive much attention in the literature although it has been suggested that physical activity buffers the impact of life stress (Brown, 1991).

2.7 Summary.

The relationship between life events and change in health behaviours is an important research topic. The current understanding about the relationship can be partly attributed to knowledge from the theories of behaviour change, which have played some role in influencing a healthy trend in the population, for instance in the UK. However, the theories of behaviour change have been guided by the demand for effective and efficient ways to bring about change in people's behaviour through intervention, hence the focus on the factors that can be controlled or manipulated. In consequence there is a lack of focus on factors that cannot be controlled such as life events. This review found that there was substantial evidence for the effect of life events on people's health behaviours. In fact, some studies have suggested that life events were the reasons for, and had operated as cues, that triggered the process of change in health behaviours.

The public health interest in life events studies is related to their role in health and disease, and how they are linked to other factors such as health behaviours that affect health (Day, 1984). Life events have been used as one of the measures of stress and currently, there is on-going discussion about the methods to quantify their effects. This review has uncovered a complex, and quite diverse, evidence base on the influence of life events on behaviour change.

There are two types of changes that have been associated with stressful life events: health protective (healthful), and health damaging (harmful) behaviour changes. In summary, this review has found that evidence for the association between stressful life events and change in health behaviours were consistent in many of the studies (Table 2.1).

Many of the studies reviewed above were consistent in reporting the operation of life events as negative stressors that have detrimental effects on peoples' behaviour. Stressful life events were reported to be the reasons for harmful changes, such as smoking initiation or relapse, increased alcohol consumption, and overeating, such as snacking and the consumption of junk food that contains high fat, salt and sugar. In this instance, it is possible that smoking, alcohol drinking, and eating behaviours are used to alleviate stress (Shuval, 1981; DiClemente and Prochaska, 1985; Aldkofer and Thurau, 1991; Ng and Jeffery, 2003; Glass et. al., 1995; Steptoe et. al., 1998; Fouquereau, 2003; King et. al., 2003; Moos et. al., 2004; Jennison, 1992; Oliver and Wardle, 1999; Freeman and Gil, 2004; Dallman et. al., 2005). Although it was claimed that health damaging behaviours aggravate more stress (Booker et. al., 2004, p389), there are other evidences that suggested on the contrary. For example, a study reported that increased frequency of heavy drinking does not lead to more stressful events (Brennan et. al., 1999).

This review also found that certain events were associated with health protective behaviour change. Health related events (categories) and financial problems, for example, were found to be associated with smoking cessation and reduced drinking (McKee et. al., 2003; Brennan et. al., 1999; Schutte et. al., 2006). There was also evidence for healthful changes following a medical event. There was an increased likelihood of stopping smoking, for example, after the diagnosis with a medical condition, such as cardiovascular diseases and hypertension (John et. al., 2006). The operation of life stressors in this situation is different to that of a negative stressor. The diagnosis of a medical condition by health professionals could have been followed by counselling or another intervention that was aimed at increasing awareness about the consequences of the particular disease and risk of continuing to practice the relevant health behaviour, which would then change the attitudes towards the health damaging behaviours and motivate people to change. It is likely that people are more motivated to reduce the risk of further deterioration of the current health condition and anticipate better health after they had experienced a serious illness (Perkins-Porras et. al., 2006). It is also possible that financial difficulty leaves people with less money to spend on smoking or drinking (Lader and Meltzer, 2003). Healthy changes can also be the result of a show of support for someone close or carried out for the benefit of family members in the household (Chandola et. al., 2004).

It was also found from the literature that certain life events were associated with both health protective and health damaging behaviour changes. Divorce, for example, was found to operate as a negative stressor (Romelsjö et. al., 1991), as well as a motivator for healthful behaviour change (Pereira and Sloan, 2001). In the latter study, divorce was not perceived as a negative event, probably because the end of a marriage might have brought relief to a chronically strained relationship (Andersson and Stanich, 1996).

This review of the literature also found a gap in the knowledge concerning the relationship between stressful life events and behaviour change. First, although the evidence for the association was strong in some studies, the total number of studies was small. The research related to smoking and alcohol use is still growing, but for diet and physical activity, there is still only limited information in the area. Much of the evidence for the association presented in this thesis was carried out in the US and only very limited number of studies were based on the UK population. Many of the studies had reasonably large samples, but there were a few with very small samples (e.g. Kobayashi and Kazuma, 2005). The age of the participants in the studies varied, from older, mixed aged from midlife to older, and mixed aged from young adult to older subjects. No study has been carried out on a sample where the subjects are of the same age. People of the same age are more homogenous in terms of exposure to life experience, and have less variation due to cohort effects compared to a sample with a wide age range. A mixed age sample can affect the distribution of the number of life events experienced. For instance, certain life events are more likely to occur at a later age than a younger age. Chronic diseases, for example, like type II diabetes, hypertension and cardiovascular diseases usually start to manifest themselves from middle to old age; hence, it is likely that more events will be reported in older than younger subjects. Overall, the evidence for the associations of interest to this study were substantial for the effect of non-health related life stress, but limited for the effects of health related life events and medical conditions. The evidence was also strong for change in smoking and alcohol drinking behaviours, but limited for dietary change and physical activity. It was observed that many of the studies examined specific life events, such as death, job loss, and divorce, while others had used a broad category of events like health event, illness, or financial events. Many of the latter had used a measure based on a simple count of the number of life events experienced, or a measure based on weighted outcomes, such as those by van Os and Jones (1999), and Gottlieb and Green (1984). This review also observed that most studies were specific to a particular health behaviour and only a few studies included data on multiple health behaviours such as that by Wilcox et. al., (2003). The intention of this present study has been to bridge some of the gaps noted above.

Table 2.1. Summary of studies on the relationship of life events and change in smoking, alcohol use, and diet.

Authors	Description of study.	Results.
Gottlieb and Green (1984)	Cross sectional study of population sample aged 20 – 64 years. Measures: life events score (weighted) from 9 event items in the past 5 years Outcome: smoking, exercise, alcohol use.	More life events was associated with smoking initiation in men and women and, stopping smoking in women.
McKee et. al., (2003)	Longitudinal study of community sample. 2 waves: 1986 and 1989. n = 1512. Mean age: 48 years. Categorised life events in past 12 months: interpersonal loss events; financial problem; move to a new residence; life-threatening illness or injury. Outcomes: stopping smoking, maintained smoking, smoking relapse, maintained abstinence	Change in residence, adverse financial events was associated with smoking relapse. Health events were associated with stopping smoking. Health events were related to less likelihood of relapse.
Falba et. al., (2005)	Longitudinal study of population sample. N = 3052. Life events between 2 surveys in 1992 and 1994. Life events: job loss in the past year. Outcome: smoking relapse and intensity.	Job loss was associated with smoking relapse (unadjusted OR= 2.5, 95%CI: 1.20, 5.14). No association between job loss and stopping smoking. (Stopping smoking was significantly associated with onset of medical condition: cancer, heart disease in adjusted model to assess the impact of job loss on stopping smoking)
Morris et. al., (1992)	Longitudinal study of random sample. N= 6057. Measures: various categories of employment.	Job loss related to illness was associated with stopping smoking. No association between job loss and smoking change. No association between job loss and alcohol consumption.
Salive et. al., (1992)	Longitudinal study on older (over 65 years) community sample. N = 1259. Stressors: medical condition that developed between surveys: diagnosis of myocardial infarction, stroke, cancer between the surveys. Smoking change after 3 and 6 years.	Stopping smoking was found to be associated with diagnosis of medical condition: stroke, myocardial infarction, cancer. No association between the medical conditions and smoking relapse.

…continued from previous page.

John et. al., (2006)	Cross sectional study of random sample aged 18-79 years. N = 3778. Two or more medical events related to circulatory disorder, retrospective smoking status.	Two or more medical condition was associated with less odds of continued smoking.
Hyman et. al., (1996)	Cross sectional study of community sample, mean age 41 years. N = 547. Stressors: diagnosis of cardiovascular diseases, historical smoking statuses.	Hypertension and cardiovascular diseases were found to be associated with stopping smoking.
Brennan et. al., (1999)	Longitudinal study of community sample women aged 55- 65 years. N= 1562. Data collected at baseline, and after 1 and 4 years. Assess changes in frequency, amount and drinking problem. Stressors: negative life events, chronic health stressors, financial stressors, and spouse stressors	Spouse stressors in men, and more negative life events in women were associated with increased drinking problem was associated with financial stressors. Financial problem in men and, health related events and financial problem in women was associated with decreased consumption.
Romelsjö et al. (1991)	Longitudinal study of general population aged over 22 years. N= 4864. Change in alcohol consumption over 5 drinks or more between two waves. Three types of life events scores and specific life events.	Increased consumption was associated with divorce, financial problems, and many of the scores.
Glass et. al., (1995)	Longitudinal study of general population aged 65 and older. N = 2040.	Increased consumption was associated with death of friend and moving away from friends in women. Decrease consumption was associated with admission into a hospital or nursing homes for women and admission into nursing homes in women.
Pereira and Sloan (2001)	General population aged 51 to 61 years, longitudinal data. N= 4834	Increased consumption – divorce, retirement, death of spouse in men Decreased consumption – diagnosis of medical condition, hospital admission, divorce in problem drinker,

… continued from previous page.

Schutte et. al., (2006)	Longitudinal study of community sample aged 55 to 65 years. N = 1291. Subjects were asked if health, legal death, and negative events had influenced reduction in drinking.	Reduced drinking was associated with health, legal, death of someone close.
Kobayashi and Kazuma, (2005)	Retrospective cross sectional survey from clinical population aged 20-69 years. N = 126. Change in alcohol consumption between the time of diagnosis and time of survey.	More people who were diagnosed with diabetes at had reduced alcohol consumption. Acute condition at time of diagnosis was associated with reduction in consumption.
Wilcox et. al., (2003)	Cross sectional study of women aged 50-79 at baseline. N=73925. Stressor: recently widowed. Assessed change in smoking, alcohol consumption and diet.	Recently widowed subjects were associated with decreased fruit and vegetables consumption compared to married women.

2.8 Aims and objectives.

2.8.1 Aims.

The aims of this present study were to investigate the relationship between life stress and midlife changes in health related behaviours, namely; smoking, alcohol consumption, diet and physical activity. The term *life stress* in this thesis refers to stressful life events, health related life events, and the diagnosis of a medical conditions.

2.8.2 Hypothesis.

The study was planned to test two hypotheses: first, it was hypothesised that midlife people in the general population who experience a greater level of stress from life events would be more inclined to make health damaging behaviour changes. Second, midlife people who experience greater health events are more inclined to make health protective behaviour changes. Related to the health events, it was also hypothesised that people at midlife who were diagnosed with a medical condition were more likely to make a healthful change.

2.8.3 Objectives.

This section presents only the general objectives of the study. The detailed objectives are presented in the relevant results chapters. The objectives were to;

1. Examine all the variables including the component variables used in the study,
2. Examine the distribution of subjects who had changed their health related behaviours and their distribution by demographic and social factors,

3. Assess whether there was any relationship between life stress and health protective and health damaging behaviour changes,
4. Assess whether social support factors have any influence on the relation found in (2) above,
5. Obtain an aggregated estimate of the effect of life stress on the relationships after adjusting for the effects of the social support and demographic factors if they were found to have significant influence.

CHAPTER 3

Methods.

3.1 Introduction.

The main aim of this study was to investigate whether there is any relationship between life stress at midlife and change in health behaviours, in particular, smoking, alcohol use, diet, and physical activity, and to use data from a general population to assess the strength of the evidence for such a relationship. A nationally representative, longitudinal birth cohort sample, for which data were already available, was used in order to achieve the aim of this study. The data came from the National Survey of Health and Development, using three 'waves' of data: the first when the cohort members were aged 36, the second when they were 43, and the third when they were 53 years old.

Change in health behaviours was studied at age 43 years, by examining the change between age 43 and 36 years, and at 53 years, by examining the change between age 53 and 43 years. The aggregated change was examined by examining the change that occurred between age 36 and 53 years.

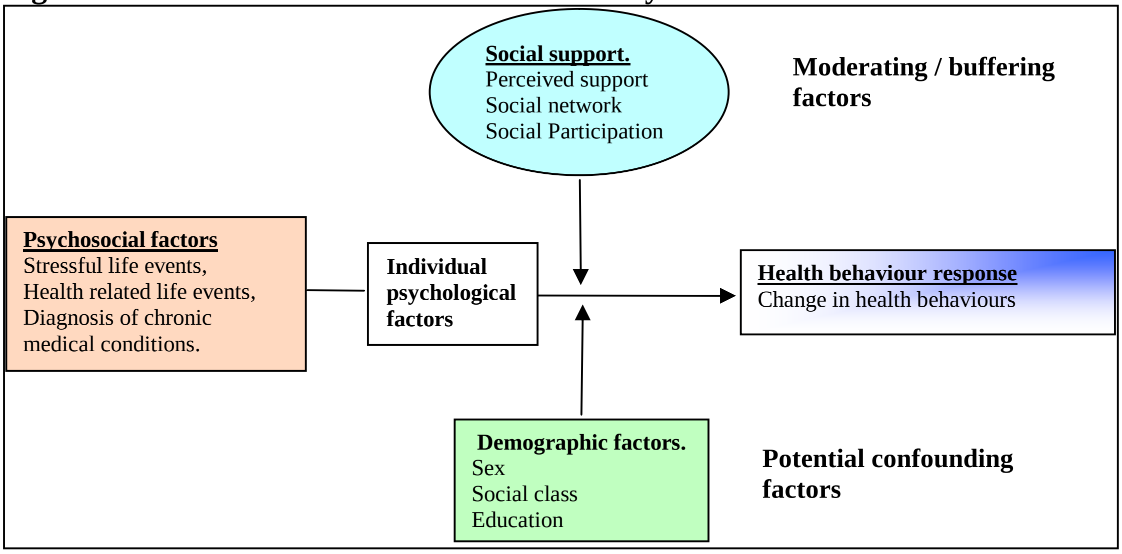
The theoretical frameworks of interest in this study are presented in the next section. This is followed by a description of the background to the data that were used to examine the hypothesis. An explanation of how the variables were derived from the data is presented in the next section and then this is followed by an introduction to the datasets used for the analyses. The last section describes the strategy for the analyses and the statistical methods employed.

3.2 The theoretical frameworks of the study.

The theoretical framework for the relationship between psychosocial factors and health behaviours in this study is concerned with health pathways which is part of a larger model that describes the development of health such as the social determinant for health (Brunner and Marmot, 2006); stress-disease model (Locker, 1989), and psychosocial pathways to health model (Martikainen et. al., 2002). Psychosocial factors can influence health via two pathways (Martikainen et. al., 2002). One pathway involves the mediation of material factors, which put an individual at greater risk of developing an illness. This pathway assumes that stresses, such as those that originate from losing a job, can lead to loss of income, this, in turn, limits access to the basic material necessities of life, such as shelter from cold or hot weather, appropriate clothing, or healthy food, which then affect individuals by reducing their body resistance and exposing them to higher risk of developing illnesses. However, this pathway was not seen as part of the psychosocial process (Martikainen et. al., 2002). A psychosocial process operates when the exposure to the psychosocial factors causes a psychological change in an individual such as the feelings of loss of self-esteem or increased anxiety. The process continues to trigger a psychobiological stress response (fight or flight), which can affect health (Brunner and Marmot, 2006). The process can also increase the susceptibility to diseases through physiological changes or /and trigger a coping mechanism that modifies behaviour which can be protective or damaging to health (Locker, 1989; Martikainen et. al., 2002).

This study focused on the evidence from the general population for the relationship between psychosocial factors and health behaviours, hence the use of a sample that was representative of the general population. The theoretical framework is presented graphically in Figure 3.1. Specifically this study examined the effects of a psychosocial factor - life stress from life events, on change in health behaviours. It was assumed that the occurrence of these life events generated life stress, which then initiated the psychosocial response (Locker, 1989; Martikainen et. al., 2002). Under these circumstances it is thought that some people respond by adopting a behaviour that they believe can buffer the effect of stress (DiClemente and Prochaska, 1985). It is believed that an individual's background, such as social class and level of education, and the support they receive from the people around them, may have some influence on the how people response to life stress.

Figure 3.1: Theoretical framework of this study.



3.3 The National Survey of Health and Development (NSHD).

3.3.1 Background.

There are currently 5 birth cohort studies in the UK. This present study used data from the first birth cohort: the Medical Research Council (MRC) National Survey of Health and Development (NSHD), which began at the birth of the participants in the study in 1946. The other birth cohorts are: the National Child Development Study (1958), British Cohort Study (1970), Millennium Cohort Study (2000), and Avon Longitudinal Study of Parents and Children (ALSPAC) (1991) (the number in brackets denotes the year of birth for the cohort) (Wadsworth et. al., 2003a, Golding et. al., 2001; www.cls.ioe.ac.uk).

Many papers have described the history, background, and methodological issues relating to the NSHD (Wadsworth, 1987; 1991; Wadsworth et. al., 2003a; 2003b; 2005, Atkins et. al., 1981). The present summary of the background is based on these reports. In 1946, a study was commenced to investigate the issues surrounding child-birth, such as the cost, care, and specialist care, in order to address the decline in the fertility rate in the UK (Wadsworth et. al., 2003a). The sample included all registered births in areas where the local authorities had agreed to participate (n = 15, 416) who were born in England, Wales and Scotland, during the week of March 3rd to 9th in 1946.

The NSHD was set up in 1948 to further address the policy questions and changes in society. A smaller sample was selected from the earlier study, but excluded the multiple birth (n = 180) and births out of wedlock (n = 672). The sample was selected at random with stratification from the available sample pool, where all the children whose parents were from the non-manual and agricultural background; and one in four children whose parents were from manual backgrounds were included into the study (Figure 3.2). The final NSHD sample consisted of 5362 subjects; 2547 females and 2815 males. Data collections in the survey were initially carried out by health visitors, school nurses, doctors, and teachers either at home or school until the subjects were 19 years old, after which it was carried out by trained research nurses either by visiting the subjects at home or through postal questionnaires. Since then the study has continued to follow up the cohort members until the present day (Wadsworth et. al., 2003a).

3.3.2 Follow up and response rate.

There are over 30 follow-ups from the age of 2 to 53 years (Wadsworth et. al., 2005). Figure 3.3 and Table 3.1 summarises the number of subjects who had been lost over the years and those who were still in contact with the MRC NSHD at midlife. Over the years, the number of subjects who have been participating in the survey has been declining due to loss at follow-ups. At age 4 years (1950), 8 years (1961), and 35 years (1981) there were, respectively, 4695, 4307, and 3538 members who were still in contact with the MRC. Midlife follow-ups were in the years 1982, 1989, and 1999 at the ages of 36, 43, and 53 years respectively, with 3322, 3262, and 3035 subjects still in contact. The number of subjects still in contact with the MRC, up to the year 1999 (n = 3035), was greater than the number who participated in the 1999 survey (n = 2988), because they were contacted for purposes other than the survey. The loss of cohort members in the study over the years was the result of death, emigration, temporary and permanent refusal to participate, and difficulty in tracing subjects because of name or address changes. An attempt to minimise the loss of subjects was introduced when the cohort members were 16 years of age, when they were sent birthday cards with a request to reply with their current address and name.

Figure 3.2: NSHD sample at age 36, 43 and 53 years.

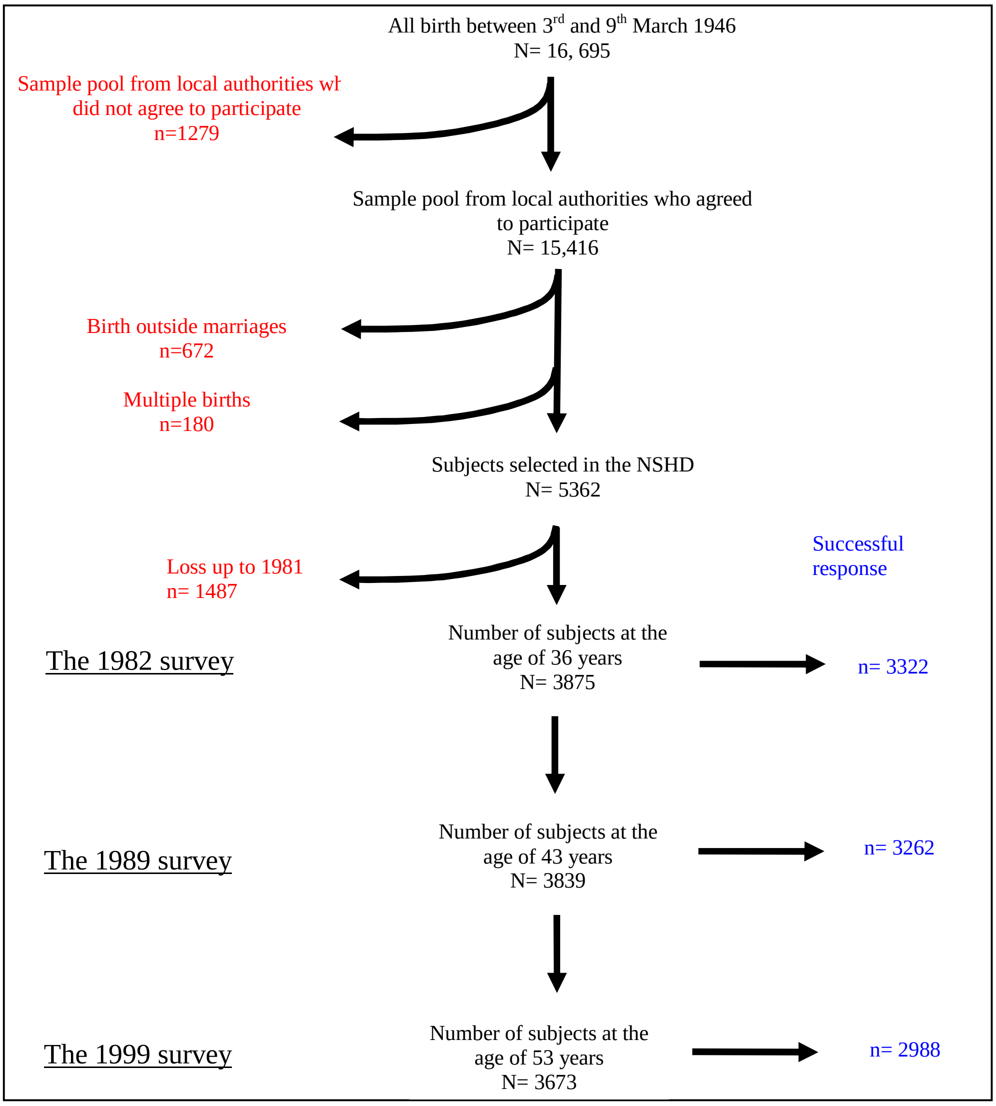


Table 3.1: Summary of sample; from Wadsworth et. al. (2005).

Age (years)	Cumulative lost N	Current loss N	Successfully contacted n	Proportion from the available population %	Proportion from total sample %
36	1487	553	3322	85.7	62.0
43	1523	577	3262	85.0	60.8
53	1689	638	3035#	82.6	56.6

 # included contacts through means other than the particular survey - their data was not available for this study.

3.3.3 Representativeness.

The NSHD sample was not comprehensively representative of the adult population in the UK. There are a few factors that differentiate it from the current UK population of the same age group. The sampling method excluded people who were born outside of wedlock or who were from the multiple births, hence there is no representation from these subpopulations. The composition of the UK population has changed compared to the time when the sample subjects were recruited due to the migration in and out of the UK, and as a result the increase in the variation of ethnic backgrounds in the country. Because, the sample was comprised of mainly Whites, it lacks the representation of the current UK population. Another factor that could have affected the representativeness of the sample was the pattern of loss to follow up; for example, when more members who were lost belong to a particular background, such as lower educational attainment or lower social classes (Wadsworth et. al., 2003). There have been few studies carried out to examine the representativeness of the NSHD in this aspect, which compared it to the general UK population (Wadsworth, 1987; Wadsworth et. al., 1992, 2005). The most recent study compared the sample at ages 43 and 53 years to the UK census data from the 1991 (Wadsworth et. al., 2005). The study reported no differences in the distribution of cohort members by the sex but there was over representation of the cohort members who were employed, homeowners, from social class I and II, and widows. There was under representation of members in the social class III (non-manual), IV and V; men who were educated, and single subjects who were never married, separated, or divorced. Some of the differences mentioned were not statistically significant and where the differences were significant, they were small. In addition, comparison was also made to the national population sample, whose age ranged from of 16 years and over and, not the specific age range. Despite the differences mentioned, the authors claimed that the 1946 cohort still represents the national UK population fairly well (Wadsworth et. al., 2005).

3.3.4 The data for this study.

The data for this study were from the three waves already listed above: 1982, 1989, and 1999 surveys when the subjects were 36, 43, and 53 years old respectively. Most of the information in these surveys was collected by research nurses through interviews. Some information, such as the diet and alcohol data, was from self-completed questionnaires. The variables in this study were selected from the questionnaires of these respective surveys. The variables for health behaviours were smoking status, amount of alcohol consumed and questions related to drinking behaviour (the CAGE questions), various diet data, and physical activity status. The demographic data included were sex, social class, and education level. Life stress data were obtained from a list of stressful life events and the questions related to five chronic medical conditions: bronchitis, diabetes, heart problems, hypertension, and stroke. Also included were variables related to social support; the perceived support, social network, and social participation in various activities. Details of these variables are described in the next section.

The variables available for this study are summarised in Table 3.2. Some of the variables were not available from all three waves of data examined. This was because some of the information were condensed, expanded, or modified in the latter surveys. For example, the way alcohol consumption was measured at age 36 years was different to ages 43 and 53 years. The number of life events items was extended from 8 items at age 36 years to 17 items at age 43 years, but the depth of questioning was condensed at age 53 years. The range of social support and relationship questions were also modified. This inconsistency in the availability of similar data at the three ages resulted in an inability to carry out the same analyses at age 43 and 53 years.

Table 3.2: The availability of variables from the three data waves.

Variables	Age 36 years	Age 43 years	Age 53 years
Health behaviours			
Smoking (cigarette)	√	√	√
Alcohol consumption			
Amount consumed*	x	√	√
CAGE questions*	x	√	√
Diet diary*	√	√	√
Physical activity	√	√	√
Demographic			
Sex	-	√	√
Social class		√	√
Education		√	√
Life events			
Number of items	-	17	17
Effect on feeling		√	x
Effect on life change		√	x
Social support			
Perceived support	-	√	√
Social network		√	√
Social participation		x	x
Medical conditions			
Bronchitis	x	x	√
Diabetes	x	x	√
Heart problems	x	x	√
Hypertension	x	x	√
Stroke	x	x	√

√: data available, x: data not available, *self reported, - :Not applicable.

3.4 The variables.

3.4.1 Source of data.

The data were received from the MRC NSHD in SPSS (portable) format and were converted into STATA format for data cleaning, generating new variables, and analyses. Some variables were converted into SPSS format for certain descriptive analysis. Three datasets were formed from the data of the three surveys. One was for the analysis at age 43 years, one for the analysis at age 53 years, and another was the aggregate of the former two (aggregated data). The variables used in the analysis at age 43 and 53 years were derived from the data of the respective ages except the health behaviours variables, which were derived from the data of two consecutive surveys (age 36 and 43 years and, age 43 and 53 years). For the analysis of the aggregated data, the dataset for age 43 and 53 years were merged into a 'long' form in STATA. Only the variables that were available in both datasets at age 43 and 53 years were included in the aggregated dataset.

3.4.2 Demographic data.

The demographic variables included in the analysis were the sex, social class, and education level. The social class data were based on the cohort members' last occupation and for women living with a spouse, their social class was based on their partner's social class (Kuh and Wadsworth, 1993, Richards et. al., 2003a; Richards et. al., 2004). These social class data consisted of 6 levels of social classes according to the Registrar General social class classification (Bartley, 2004). For the purpose of this study, the cohort members were re-classified into decreasing ordinal categories: social class I and II, social class III non-manual, social class III manual, and social class IV or lower (Table 3.3). There were 11% missing social class data at age 36 and 43 years and, 7% in at age 53 years. To minimise data loss, and since there was little change in the social status at midlife, the missing data from one particular survey were replaced with the data from the earlier or later survey if they were available. The choice was to use the data from the survey which was closer to that missing data. For example, if the missing data were from age 43 years and both data from age 36 and 53 years were available, the data from age 36 years was used to replace the missing data. Nine percent of missing data were replaced at age 36 years, 6% at age 43 years, and 4% at age 53 years.

The education level was the highest education attained at age 26 years and was originally recorded using the Burnham scale (DES, 1972). In the present study it was reclassified into 3 ordinal categories: no education, ordinary or vocational education, and A-level or university education (Table 3.4) (Richards et. al., 2002).

Table 3.3: Social class classification.

Categories in this study	Registrar general social class classification
I-II	I-II
III-NM	III-Non-manual
III-M	III-Manual
IV-V	IV-V

Table 3.4: Re-classification of education level.

Burnham Scale	Education categories
None	None
Vocational course, proficiency only Sub GCE or sub Burnham C GCE O level or Burnham C	Ordinary and vocational education
GCE A level Burnham A2 First degree or equivalent Higher degree, masters Higher degree, doctorate	A-level and university education

3.4.3 The variables for health related behaviour.

3.4.3.1 Smoking behaviour.

Smoking behaviour was assessed using data on cigarette smoking at ages 36, 43, and 53 years. The status was recorded as: *never-smokers* – those who had never smoked before, *current smokers* – those who were smokers at the time of survey, and *ex-smokers* – those who had stopped smoking. Change in smoking habit was defined as the change in the smoking status between two consecutive surveys. Cohort members were classified as those who had stopped smoking or those who had experienced a smoking relapse. Table 3.5 summarises the definition used in this study. The cohort members, for example, who were the current smokers at age 36 years and became ex-smokers at age 43 years survey were categorised as had *stopped smoking at age 43 years* and, the members who were the ex-smokers at age 36 years and then became current smokers at age 43 years were classified as had experienced a *smoking relapse at age 43 years*. The variables for *stopped smoking at age 53 years* and experienced a *smoking relapse at age 53 years* were derived in a similar manner.

Table 3.5: Summary of the definition of change in smoking behaviour.

Change in smoking status		**Baseline status**		**Subsequent status**
Stopped smoking at age 43 years	=	Current smoker at age 36 years	and	Ex-smoker at age 43 years
Stopped smoking at age 53 years	=	Current smoker at age 43 years	and	Ex-smoker at age 53 years
Relapsed smoking at age 43 years	=	Ex-smoker at age 36 years	and	Current smoker at age 43 years
Relapsed smoking at age 53 years	=	Ex-smoker at age 43 years	and	Current smoker at age 53 years

3.4.3.2 Alcohol drinking behaviour.

Change in alcohol behaviour was assessed using two types of alcohol related data that were available from the NSHD survey at age 43 and 53 years. There were, first, the CAGE questions that assessed the risk of having an alcohol problem and second, the amount of alcohol consumed in the past 7 days before the interview. Alcohol consumption data at age 36 years were part of the diet diary and were measured differently to their measurement at ages 43 and 53 years. The CAGE questions were not part of the questionnaire until age 43 years. Because of these, change in alcohol drinking behaviour at age 43 years cannot be assessed.

3.4.3.2.1 The CAGE questions.

The CAGE questions were part of a self completed questionnaire of the NSHD. Subjects were asked to indicate their drinking behaviour from 4 statements: whether or not in the past year they had:

1. felt the need to reduce their drinking,
2. felt annoyed by the criticism on their drinking,
3. felt bad or guilty about their own drinking habit, and
4. ever had to have a drink first thing in the morning to get rid of a hangover (Appendix 3.1).

Because the CAGE questions were asked for the first time at age 43 years, the survey at that age asked the cohort members whether they ever have these experiences before and whether they had similar experience in the past year before the interview. The number of observations in the latter set was low but this was because the cohort members who had not had the relevant drinking experience in the first set of questions did not answer the respective question in the second set. To minimise data loss, data from the first set of question was used to replace the missing data of the respective question.

CAGE score is a measure that assesses the risk of having a drinking problem (Ewing, 1984). Two score points or more indicates higher risk of having an alcohol problem. The score had more than 70% sensitivity and 80% specificity to detect a drinking problem (Bush et. al., 1987; Buchsbaum et. al., 1991). For the purpose of this study, CAGE scores were derived for each age 43 and 53 years by allocating one point for each positive answer (yes) and zero point for a negative answer (no). The scores were aggregated to give the score for the respective year. People in the NSHD cohort were categorised into: high risk of having an alcohol problem (total CAGE score ≥ 2) and low risk of having an alcohol problem (score < 2).

Because of the small number of subjects who were at high risk of having an alcohol problem, a healthful change in alcohol behaviour cannot be examined with sufficient power. Hence, only health adverse changes were examined in this study. This is detailed in Chapter 4. The change in alcohol behaviour based on the CAGE score was defined as the change from being in the low risk category at age 43 years to high-risk category at age 53 years (Table 3.6)

3.4.3.2.2 Amount of alcohol consumed.

The amount of alcohol consumed in the past 7 days at age 43 and 53 years were from the self-completed questionnaire (Richards et. al., 2005, 1999 survey questionnaire) (Appendix 3.2). The cohort members were asked about the alcoholic drinks that were grouped under the following categories: beers, wines, and spirits, and the amounts were measured using the number of half pints, glasses, and units, respectively; which was equivalent to 1 alcohol units (9.0g of alcohol, DoH 1995). The average daily consumption of alcohol was obtained by aggregating the amount consumed from each category and dividing it by 7 days. For descriptive purposes, the cohort members were classified as ‘had no drinks’, ‘light drinkers’, ‘moderate drinkers’, and ‘heavy drinkers’, based on a modified classification described in an earlier study (Richards et. al., 2005). There was no information about abstainers in the data of this study.

This study used the cut-off point from the sensible drinking recommendation (DoH, 1995) to classify the cohort members into those who drink within the recommended limit (4 units or less per day for the men and 3 units or less per day for the women) and those who drink over the recommended limit (more than 4 unit alcohol per day for the men and more than 3 unit alcohol per day for the women). The cut-off was chosen based on a report which concluded that a daily alcohol consumption that exceeds 4 unit alcohol for men and 3 units for women significantly increases the risk of illness and death from various medical condition such as stroke, cancer, accidents, and hypertension (DoH, 1995). For the purpose of analysis, the cohort members were categorised as drinking within or over the daily recommended limit. The number of cohort members who drank over the recommended limit at age 43 years was small, hence no analysis for healthful change in alcohol consumption at age 43 years was carried out. An adverse change in alcohol consumption was defined as the change from drinking within the recommended limit at age 43 years to over the recommended limit at age 53 years (Table 3.6).

Table 3.6: Summary of the definition of changes in alcohol drinking behaviour.

Change in alcohol behaviour		Baseline status at age 43 years		Subsequent status at age 53 years
Risk of having a drinking problem				
Increased risk at age 53 years	=	Low risk*	and	High risk**
Alcohol consumption based on the recommended amount				
Increased consumption at age 53 years	=	Drank within the limit	and	Drank over the limit

**CAGE score ≤ 2; **CAGE score >2.*

3.4.3.3 Dietary data.

3.4.3.3.1 Components of dietary data.

The dietary information for this study was from a diet diary at age 36, age 43 and 53 years, which were collected by research nurses. During the interview the cohort subjects were asked to recall their diet in the past 2 days before the interview. Then, they were requested to complete the diet diary for the next 5 days and to return the diary by post. The information in the diary included the meals, between meal snacks, and drinks with examples of how to describe the foods. If the food or drinks were not listed, the cohort members were asked to provide the details such as the recipe, brand, place of purchase or receipts of purchase so that the research staffs can identify the food. From 1989, the diet diary included black and white photographs of the portion sizes of 15 common dishes to help with description of the amount of food consumed (Price et. al., 1995). Information from the diet diary was then coded into food codes and weights for every item of food and drink recorded. This was done manually for the diet diary at age 36 years and using an in-house computer program - Diet In Data Out (DIDO) for the later surveys. The food codes were obtained from standard tables (Paul and Southgate, 1978; Wiles et. al., 1980; Holland et. al., 1988), unpublished work of the MRC's Dunn Nutrition Unit, Cambridge for the individual recipe provided, and manufacturers (Braddon et. al., 1988; Price et. al., 1995). More information about the diet data can be found in Braddon et. al., (1988), Price et. al., (1995), Price et. al. (1997) and Mishra et. al., (2003).

This study used information from five diet behaviours: breakfast, types of breads and milk, fruit and vegetables, and energy from fat. The data on ***breakfast*** behaviour was based on the regularity of taking breakfast in 3 days. The data was readily available in the form of frequency of taking breakfast, which was scored as follows: always (score = 3), sometimes (some days, but not all days) (score = 2), and never had breakfast (score = 1).

The data on ***bread*** were available in the form of average weight consumed per day (grams) for each type of bread, which is shown in Table 3.7. However, only information about the types of bread was used for the purpose of this study. Scores were given according to healthiness (based on fibre content) of the different types and mixed types of bread consumed as shown in Table 3.8.

The data on ***milk consumption*** were available in the form of the average amount consumed per day (ml) for each type of milk: whole milk, skimmed milk, semi-skimmed milk and Soya milk (Table 3.7). For this study, only information about the types of milk was used. Healthier types and mixed types of milk consumed were given a higher score, as shown in Table 3.9.

The range of ***fruit and vegetables*** is presented in Table 3.7. Data were readily available for this study in the form of average weight of fruit and vegetables consumed per day (gram). This information was converted into *food portions* by dividing the total amount consumed by 80 grams (= 1 portion) to give the number of portions consumed per day. Legumes consumption was limited to a maximum of 80grams per day and fruit juices were limited to 1 portion (150ml) per day (Food Standards Agency, 2005; Department of Health, 1991). The total number of portions of fruit and vegetables consumed was obtained by aggregating the portions from each component above. A score was given according to the total portions of fruit and vegetables consumed per day as shown in Table 3.10.

Table 3.7: The types of breads, milk, fruit, and vegetables.

Types of Food/ beverages	Types / Varieties	Description
Bread	Wholemeal	All types, including rolls and toasted.
	Granary	All types, including rolls and toasted.
	Brown	All types, including rolls and toasted.
	Indian	All types of Indian bread like naan and chapattis
	White	All types, including rolls and toasted.
	Other	Other types of bread
Milk and milk beverages	Skimmed	Skimmed milk and beverages made with skimmed milk
	Semi-skimmed	Semi-skimmed milk and beverages made with semi-skimmed milk
	Whole milk	Whole milk and beverages made with whole milk
	Soya	Soya milk
Fruit (80g/portion)	Fresh	All types of fresh fruit.
	Canned and cooked	All types of canned and cooked fruits.
	Dried	All types of dried, raw or cooked versions;
	Juices	All types of juice including sweetened and unsweetened, fresh and canned; 150g/portion (Food Standards Agency and the Department of Health); maximum of 1 portion/day applies.
Vegetables 80g/portion	Vegetables	All types and cooking method including vegetable juice and soups.
	Vegetable dishes	Mixed vegetables dishes of all types including soups.
	Mixed salad	All types of salad excluding the potato or pasta versions.
Legumes	Legumes	All types including baked beans, hummus and dhal.

Table 3.8: The scoring method for the types of breads.

Type of bread consumed	Score
Wholemeal only.	**3**
Some brown or granary, some wholemeal.	**2.5**
1. Brown or granary only, 2. some white and some wholemeal, 3. some white, some brown, or granary, some wholemeal.	**2**
Some white, some brown or granary.	**1.5**
White only.	**1**

Table 3.9: The scoring method for the types of milk.

Type of milk consumed	Score
Skimmed only.	**3**
Some skimmed and some semi-skimmed.	**2.5**
Semi-skimmed only.	**2**
Some whole milk and some semi-skimmed.	**1.5**
Whole milk only.	**1**

The data on ***fat*** consumption for this study were readily available in the form of the percentage of energy derived from fat. A score was given according to the percentage of energy from fat intake as shown in Table 3.10.

Table 3.10: Scoring method for fruit and vegetables consumption and percentage of energy from fat intake per day.

Score	Total portions of fruit and vegetables per day.	Percentage of energy from fat (%)
1	<2.0	≥ 45.0
2	2.0 -3.4	40.0 – 44.9999
3	3.5 – 4.9	35.0 – 39.9999
4	5.0 – 6.4	30.0 - 34.9999
5	≥ 6.5	≤ 29.9999

3.4.3.3.2 Diet behaviour score.

Diet behaviour score is a recent method of dietary patterning, which was developed by the MRC NSHD. The score is based on the current dietary guidelines and cut-off values such as the recommendations to eat 5 portions of fruit and vegetables a day, decrease fat intake and increase fibre intake. These guidelines are those that were used in the Department of Health (DoH) in their health promotion activities (DoH 1991, 1994, 2007). The rational for choosing types of food instead of nutrient content is because people shop for, and consume foods and not nutrient (Waijers et. al., 2007), although there may be some consideration given to the nutrient content in the process. The dietary behaviour measurement also included two macronutrients components – fat (milk and energy from fat) and carbohydrate (bread) to provide overall balance as suggested in Waijers et. al. (2007).

Diet behaviour scores were generated for each age: 36, 43 and 53 years. The score was derived from the 5 diet behaviours described earlier, where each component was scored by allocating a higher score to healthier dietary behaviour, and a lower score for less healthy dietary behaviour. Cohort members with one or more component variables missing were excluded. A score for a particular age was generated by summing up the scores from each of the components.

3.4.3.3.3 Dietary change index.

Dietary change index was the *difference in the dietary behaviour score* between two consecutive ages. Two variables for each age 43 and 53 years were generated:

> Dietary change index at age 43 years = dietary behaviour score at age 43 years – diet behaviour at age 36 years, and
>
> Dietary change index at age 53 years = dietary behaviour score at age 53 years – dietary behaviour at age 43 years.

A positive dietary change index signifies an improvement in the dietary behaviour and a negative value signifies a worsening of the dietary behaviour. The dietary change index at both ages showed a reasonably normal distribution.

3.4.3.4 Physical activity.

The variables for change in physical activity were derived from the information about the frequency of participation in physical activity in the past 4 weeks before the survey interview at age 36, 43, and 53 years. The information at age 36 years was obtained from the questions that asked cohort members to indicate the type and frequency of activities from a checklist of 25 activities in the preceding month. These were open ended questions at age 43 years (Richards et. al., 2003b). Cohort members were asked to list the type of sporting or leisure activities (the questionnaire gave a few examples such as such as football, badminton, jogging, dancing, and yoga) that they participated in the past month and frequency of the activities. Similar information was obtained at age 53 years: the cohort members were requested to indicate the type of non-work related physical activity they participated in and the frequency of the activity in the past 4 weeks before the interview. In all three waves the frequency of participation was recorded as none, less than 4 times a month, and more than 4 times a month. Appendix 3.3 gives the details about the questions from the surveys. For reasons of simplicity, and as a crude measure of fitness, these were categorised as *less active* (no activities or less than 4 times in the previous month), and *more active* (more than 4 times in the previous month) (Wannamethee et. al., 1998). Other information related to fitness and intensity of physical activity, such as the length of activity at each session and whether the activities made them sweat or make them out of breath, were not integrated into this study.

Two variables for change in physical activity were generated for the 43 and 53 year-old age cohorts. An *increase in physical activity* was a change from the less active category in a preceding survey, to a more active category in a succeeding survey. A *decrease in physical activity* was a change from the more active category, in a preceding survey to a less active category in a succeeding survey. Table 3.11 summarises the definition for the change in physical activity at age 43 and 53 years.

Table 3.11: Summary of the definition of change in physical activity.

Change in physical activity		Baseline status		Subsequent status
Increased physical activity at age 43 years	=	Less active at age 36 years	and	More active at age 43 years
Increased physical activity at age 53 years	=	Less active at age 43 years	and	More active at age 53 years
Decreased physical activity at age 43 years	=	More active at age 36 years	and	Less active at age 43 years
Decreased physical activity at age 53 years	=	More active at age 43 years	and	Less active at age 53 years

3.4.4 Life stressors.

This study examined the effect of three life stressors on change in health behaviour, namely: stressful life events, health related life events, and diagnosis of a medical condition. The former two were derived from the questions on life events in the surveys at age 43 and 53 years and the latter was derived from the questions on medical conditions in the survey at age 53 years.

3.4.4.1 Items of life events.

The MRC NSHD team developed the life events questions. There were 17 items of life events at both age 43 and age 53 years, and the cohort members were asked, by the research nurses, about each event in a structured interview. To explore whether an item of life event was experienced or not, cohort members were asked: *'During the last year … have you developed or found out you have a serious illness or handicap?'* or *'…has your spouse or partner had a serious accident or illness, or received a serious injury, or been assaulted?'*. The response to the questions was recorded as 'yes', 'no', or 'no spouse/partner/children' where relevant. Table 3.12 gives an account of the context of other life events asked about in the survey. The full life events questionnaire used in the survey at age 43 and 53 years are given in Appendix 3.4. It is important to note that similar questions were asked at both age 43 and 53 years. The cohort members were asked two further questions for each item in the survey at age 43 years if the answer to the life events experience was affirmative. First, they were asked to describe the feeling at the time of occurrence, *"when this happened or when you found out about it were you…"* and to respond by choosing: *'fairly calm', 'shocked but able to cope'* or *'rather overwhelmed'*. Then, they were asked to describe the impact the event had had on them: *"as a result of this have you had to change your way of life"* and, to choose the response as 'had no life change', 'life has somewhat changed', or 'has greatly changed life'. The two follow up questions were not asked at age 53 years. This present study excluded 2 of the items at age 43 years and 1 item at age 53 years. The number of observation for item (7), which was a follow up question to item (6), at age 43 and 53 years was small. Item (10) at age 43 years had no observation. These were excluded from the analysis.

Table 3.12: Life events items in the NSHD survey at age 43 and 53 years.

1. **Developed serious illness or handicap.**
2. **Affected by accident or injury for a month or more.**
3. Experienced assault or robbery or attempted robbery.
4. Had job lost or anticipated it.
5. Experience work or career crises or disappointment.
6. Moved house.
7. Moving away from friends*.
8. **Spouse or partner had accident, injury or been assaulted.**
9. Spouse had job lost or had anticipated it.
10. Spouse or partner had work or career crises or disappointment.
11. Had disagreement with spouse or partner.
12. **Experienced difficulty with children or concerned for their health or behaviour or other reasons.**
13. **Friends, relatives or someone close had serious accident, illness or injury.**
14. **Friends, relatives or someone close died**.
15. Disagreement with friends, relatives or someone close.
16. Loss contact with friends, relatives or someone close.
17. Experienced other disappointment or upset.

**part of item 6 in the 1989 survey but listed as separate item in the 1999 survey.*
Note. Items in bold are categorised as the health related events.

3.4.4.2 Stressful life events.

To examine the effect of stressful life events, three variables based on scores, similar to those described by van Os and Jones (1999), were generated at age 43 years. They were: life events score, emotional score, and life change score. Because there was no follow up question on the ‘feeling’ and ‘life change’ only one variable was generated for the analysis at age 53 years, the life events score.

3.4.4.2.1 Life events score (for each age 43 and 53 years).

The life events score was derived from the question on whether an event was experienced. For each life events item a score was allocated according to whether the event had occurred (score = 1) or not (did not occur = 0). The number of life events was then aggregated. There were 15 items at age 43 years (score range: 0 – 9 unit) and

16 items at age 53 years (score range: 0 – 10 unit). The variables were ordinally categorised as 0, 1, 2, and 3 units or more by combining those with 3 or more events into one category.

3.4.4.2.2 Emotional score (for age 43 years only).

Emotional score was derived from the question about the feeling at the time of occurrence of the life events. Scores were allocated for each response in the following manner:

0 = no event,

1 = event occurred but was fairly calm,

2 = event occurred, was shocked but able to cope,

3 = event occurred and was overwhelmed by it.

The score from each item was then aggregated (score range: 0 – 21 units). The emotional score was categorised into 5 categories by grouping those with score of 4 units or more into one category (score category: 0, 1, 2, 3, and 4 units score or more).

3.4.4.2.3 Life change score (for age 43 years only).

Life change score was derived from the question about whether life had changed following the life events. Score '0' was allocated if there was no event, score = 1 if an event had occurred but had no life change, score = 2 if an event had occurred and had somewhat changed life, and score = 3 if an event had occurred and had greatly changed life. The score from each life event was aggregated (score range 0 – 13 units). Four categories were generated, 0, 1, 2, and 3 units or more.

3.4.4.3 Health related life events.

The life events items in the questionnaire (section 3.4.4.1) were selected into the health related life events category based on the 'health events' described in Tausig (1986). They were;

1. had serious illness,
2. had been affected by injury or accident,
3. had a spouse who had accident or injury,
4. had difficulty with children because of their health or behaviour,
5. had someone close who had accident or illness, and
6. had someone close who died in the past year.

Three variables were derived to examine the effect of health related life events at age 43 years;

1. the health related life events score,
2. health related emotional score, and
3. health related life change score.

Only one variable was generated at age 53 years: the health related life events score. The variables were generated in the same manner as the stressful life events but limited to the 6 items above. *Health related life events scores* for age 43 and 53 years (range 0-5 unit) and *health related life change score* (range: 0-11 unit) were categorised into ordinal variables with 3 levels (0, 1, 2 or more events) by combining those with 2 units or more into a single category. *Health related emotional score* ranged from 0 to 11 units and was categorised into an ordinal variable with 4 levels (0, 1, 2, and 3 score units or more).

3.4.4.4 Diagnosis of a chronic medical condition.

The health related life events above included a range of health events but many were not related to an individual’s illness. Because the type of illness was also not specified there was a potential problem of intra-category variability, as described earlier (Dohrenwend, 2006). Intervention studies showed that people improved their health damaging behaviours following chronic medical events (Hyman, 1996, Wilkes and Evans, 1999; Kobayashi and Kazuma, 2005), but little is known about such changes in the general population. To examine whether an individual’s health status can affect change in health behaviour, this study investigated the likelihood of change after having developed at least one of the following five chronic medical conditions;

- hypertension,
- stroke,
- diabetes,
- angina, and
- heart attack.

The data was available from the survey at age 53 years. The survey asked if the cohort members had any of the medical conditions listed above. Following a positive response, they were asked if the particular medical condition was diagnosed by a health professional and, the age when the diseases manifested. The actual questions in the survey are given in Appendix 3.5. The cohort members were included in this study if their medical condition developed at age 36 years or later and it was diagnosed by a doctor or health professional. Two variables were generated from this information. One was to identify cohort members who were diagnosed with at least one medical condition between age 36 and 43 years (inclusive), and the other was to indicate those who were diagnosed with at least one medical condition between age 44 years and 53 years (inclusive).

3.4.5 Social support factors.

Social support has an important role in buffering the impact of stress. People with better social support cope with stressful situations more effectively than those with less support (Cohen and Wills, 1985; Lin et. al., 1999). It is possible that how people respond to stress in terms of health behaviour depends, in part, on the social support they have. This study assessed the influence of social support on the effect of life stress on change in health behaviour. Three aspects of social support, which represented the binding – bonding – belongingness continuum of support structure (Lin et. al., 1999), were assessed: the perceived support, social network, and social participation.

3.4.5.1 Perceived support.

Perceived support was the *'perception of the availability of support when it is needed'* (Lin et. al., 1999). The variable for the perceived support factor in this study was derived from the question which asked the cohort members whether they thought that they would get any help from friends, relatives, or neighbours during a crisis. Their response were recorded (and scored) as 'would always get help' (score = 3), would often get help' (score = 2), and 'would get help sometimes' / 'had no one to help' (score = 1) (Appendix 3.6). The last two responses were combined due to the small number of observations. This variable was generated for each age: 43 and 53 years. In the analysis, the variable was treated as a decreasing ordinal variable.

3.4.5.2 Social network.

S*ocial network* factor in this study reflected the degree of relationship between an individual and the people with close social linkage. It was a slightly different measure to the size of network (Lin et. al., 1999; Huurre et. al., 2006) in that in addition to the number of people within the social network it accounted for the degree of closeness with the people in the network and the frequency of contact. It was derived using information from 3 questions on social relationship with family and friends. One question assessed the number of friends or relatives they regularly talked to and with whom they socialised. Another question asked about the number of friends and relatives, who they can visit, or be visited by without prior invitation. The responses to both questions were recorded (and scored) as: ‘had no friend or relative’ (score = 0), ‘1 or 2 people’ (score = 1), ‘3 to 5 people’ (score = 2), ‘6 to 10 people’ (score = 3), ‘11 to 15 people’ (score = 4), and ‘more than 15 people’ (score = 5). The third question assessed the frequency of meetings between cohort members and friends and/or relatives in a month. The responses were recorded (and scored) as: never (score = 0), 1 to 2 times/ month (score = 1), 3 to 5 times/ month (score = 2), 5 to 10 times/ month (score = 3), 11 to 15 times/ month (score = 4), or more 15 times/ month (score = 5) (Appendix 3.6).

The social network variable was the mean of the summative score of the 3 components mentioned. It was computed using the ‘*alpha’* command in STATA 7.0. The variable was generated for each age 43 and 53 years and showed a moderate reliability (α = 0.67 and α = 0.58 respectively). They were categorised into 4 decreasing ordinal levels: 5, 4, 3, and 0 - 2.

3.4.5.3 Social participation.

The *social participation* factor in this study referred to the degree of interaction between an individual and other people through their involvement in social activities (Bynner and Parsons, 2003), which was modified from the community ties factor of Lin et. al. (1999). The variable was derived using the information about the participation in social activities at church, playschools, nurseries, schools, local government, trade unions, voluntary work, sports club, adult education, and other organisation. In the survey, social participation was assessed by two measures: the level and frequency of participation in the activities mentioned. Cohort members were requested to respond by indicating their level of participation as: does not participate in the activity, participates in the activity passively, or helps in running the activity. The frequency of participation was recorded as ‘weekly’, ‘monthly’, and ‘less often’ (Appendix 3.6). The variable was generated by allocating a score according to the level of participation and frequency of participation of each activity as shown in Table 3.13. The scores from all 8 activities were then aggregated (range: 0 – 27 unit) and categorised into 3 ordinal categories (0= score 0, 1 = score range 1- 4, and 2 = score range 5-27). The variable was generated for age 43 years only.

Table 3.13: Scoring allocation for the social participation variable at age 43 years.

Level of participation	Frequency of participation	Score
Do not belong to the activity	-	0
Belong to the activity	Less than once a month	1
	Monthly	2
	Weekly	3
Help to run the activity	Less than once a month	2
	Monthly	4
	Weekly	6

3.5 Statistical methods.

3.5.1 Analysis strategy.

The association between life stress and change in health behaviour was examined at;

1) Age 43 years,

2) Age 53 years and;

3) The aggregated data of age 43 and 53 years (aggregated data).

Table 3.14 summarises the variables used in each of the analysis above. The first strategy was to describe the variables in the dataset and the variables derived from them (Objective 1). The results of the descriptive analysis are presented in Chapter 4, except for the health behaviour variables, which the results are described in Chapters 5, 6, 7, and 8.

The analyses were carried out to examine the association between each of the outcome variables and every life stressors variables in Table 3.14 (Objective 2). If a significant association was found, a further analysis was carried out to assess the influence of potential covariate factors (Objective 3). An adjusted estimate of the effect of life stress was then obtained using a model that included the significant social support and demographic factors (Objective 4). Potential covariates that were not significant were excluded from the adjusted model since they do not improve the fit of the model (Hosmer and Lemeshow, 2000).

Table 3.14: The set of variables for analysis at age 43 and 53 years.

	Independent variables	Outcome variables
Variables for analysis at age 43 years	**Life stressors.** ***Stressful life events*** - life events score - emotional score - life change score ***Health related life events*** - health related life events score - health related emotional score - health related life change score ***Diagnosis of a medical condition*** **Potential covariates**. ***Social support factors*.** Perceived support Social network Social participation ***Demographic factors*** Social class Education Sex[1]	**Smoking change.** - Stopping smoking[1] - Smoking relapse[1] **Diet change.** - Diet change index[2]. **Physical activity change.** - Increase physical activity[1] - Decrease physical activity[1]
Variables for analysis at age 53 years	**Life stressors.** ***Stressful life events*** - life events score - emotional score - life change ***Health related life events*** - health related life events score - health related emotional score - health related life change ***Diagnosis of medical condition*** **Potential covariates**. ***Social support factors*.** Perceived support Social network ***Demographic factors*** Social class Education Sex[1]	**Smoking change.** - Stopping smoking[1] - Smoking relapse[1] **Alcohol related change.** -increased risk of having a drinking problem[1] - increased drinking[1] **Diet change variables** - Diet change index[2]. **Physical activity change** - Increase physical activity[1] - Decrease physical activity[1]

All variables are ordinal unless specified. [1]dichotomous variable, [2]continuous variables.

3.5.1.1 Analysis at age 43 and 53 years.

To achieve the first objective of this study, which was to examine and describe all the variables, descriptive analyses were carried out to obtain the descriptive statistics of each of the variables. This included the variables that form the variables used in the analysis. Appropriate statistical tests such as Pearson chi-squared test, Fisher's exact test, t-test, and ANOVA were used in the analyses. Preliminary analysis was performed to determine whether sex was a moderator on the effect of life stressors on change in health behaviours. The presence of an interaction would suggest that the analysis should be carried out separately by sex. *Logistic regression* analysis (Model 1) was used to assess the association between the life stressors and change in smoking, alcohol drinking, and physical activity behaviours while *linear regression* analysis was used for change in diet behaviour (Model 5) (objective 2). Models 1 - 4 were logistic regression models and, Models 5 – 8 were linear regression models that were used to obtain estimates for the associations. The moderating and modification effects of the social support factors and moderating effects of demographic factors were assessed using a multivariate logistic and linear regression analysis (Models 2, 3, 6, and 7). The influences of each of these factors in the associations found in objective 2 were examined using the likelihood ratio test (objective 3). Lastly, an estimate of the effect of the life stressors on change in health behaviours, which was adjusted for the social support and demographic factors, were obtained (objective 4). Multivariate models such as Model 4 and 8, which were built manually based on a similar principle to the forward stepwise selection method with the $p \geq 0.1$ to remove a variable and $p \leq 0.05$ to add new variables, were used for the purpose. The goodness of fit of the final model of the effect of the life stressors was assessed by examining the influential observations and tested with Pearson Goodness of fit chi-squared test.

$log\ (y) = \alpha + \beta_1(x_1)$ ... *Model 1,*

$log\ (y) = \alpha + \beta_1(x_1) + \beta_2(x_2)$ … *Model 2*

$log\ (y) = \alpha ++ \beta_1(x_1) + \beta_2(x_2) + \beta_3(x_1.x_2)$ … *Model 3*

$log\ (y) = \alpha + \beta_1(x_1) + \beta_i(x_i) \ldots + \beta_j(x_j) + \beta_{1j}(x_1.x_j)$ … *Model 4*

$y = a + b_1x_1$ … *Model 5*

$y = a + b_1x_1 + b_2x_2$ … *Model 6*

$y = a + + b_1x_1 + b_2x_2 + b_3x_1.x_2$ …*Model 7*

$y = a + b_1x_1 + b_ix_i \ldots + b_jx_j + b_{1j}(x_1.x_i) \ldots$ …*Model 8*

[y = behaviour change variables,

x_1 = measures for stressful life events, health related life events, diagnosis of medical condition,

x_2 = social support factors, demographic factors,

x_3 = measures for the social support factors].

3.5.1.2 Analysis of the aggregated data.

For the analysis of aggregated data, the variables that were available at both at age 43 and 53 years were combined in a 'long' format in STATA, where there can be multiple observations at different ages per individual. The variables available in the analysis are shown in Table 3.15. Change in alcohol drinking behaviour was not analysed in the aggregated data because data were available at age 53 years only. Only the life events score, health related life events score, and diagnosis of a medical condition were included in the aggregated data. The social participation variable was excluded.

Table 3.15. The variables in the aggregated data.

	Independent variables	Outcome variables
Variables available in the aggregated data.	**Stressful life events** - life events score **Health related life events** - health related life events score **Diagnosis of a medical condition.** **Potential covariates.** ***Social support factors*.** Perceived support Social network ***Demographic factors*** Social class Education Sex[1]	**Smoking change.** - Stopping smoking[1] - Smoking relapse[1] **Diet change variables** - Diet change index[2]. **Physical activity change** - Increase physical activity[1] - Decrease physical activity[1]

All variables are ordinal unless specified. [1] dichotomous variable, [2] continuous variables.

The analysis strategy was similar to the analysis at age 43 and 53 years. Preliminary analysis was carried out to determine the modification effect of sex on the life stress variables. Only one interaction was found in the analysis for the association between life stressor and change in diet behaviour. This is explained in the respective chapter. The analysis to assess the association between change in smoking and physical activity behaviour, and the life stress variables was carried out using the logistic regression with random effects (or multi-level logistic regression). For change in the dietary behaviour, the association was examined using the cross sectional time-series linear regression model with random effect using the maximum likelihood estimation method. The influence of social support and demographic factors were examined using the likelihood ratio test or Wald’s test where appropriate. The adjusted estimates of the life stressors were obtained by manually adding and excluding each of the factors with probability of 0.1 for inclusion in the final model. The variables in the final model was compared to that obtained using stepwise forward model selection method for consistency. The relative difference in the estimate was used to asses the reliability of the estimates. The method compared coefficients from different quadrature points and if the relative difference in the estimates were greater than 0.01%, then the logistic regression with the generalized estimating equation (GEE) and robust standard error was employed to obtain a more reliable estimate.

3.5.2. Significance level and software.

Significance level was set at 5% for all statistical tests used throughout the analyses. The analyses were carried out mostly in Stata 7 (1984-2001). Stata 9 (1996-2007) (post hoc analysis), and SPSS 14.0 (1989-2005) (certain descriptive analysis) were also used in some of the analyses.

3.5.3 Power of study.

This study did not carry out post hoc power calculation on the result of the analysis. Assessing the strength of a study in terms of statistical power after a study had been completed can be misleading and irrelevant (Smith and Bates, 1992; Hoenig and Heisey, 2001, Simon, 2006). Instead this study presents the results with a point estimate of effect for an exposure variable (odds ratio and regression coefficient) together with the confidence interval, which is a preferred approach in an observational study (Smith and Bates, 1992; Altman et. al., 2000; Simon, 2006).

The next chapter will present the result of the descriptive analysis of the data.

CHAPTER 4

Descriptive results.

4.1 Introduction.

This chapter describes the variables used in this study and assesses the relationships between them. First it describes the sample and demographic distribution across the 3 waves. Then the variables of the data used for analysis at age 43 years, 53 years and aggregated data are described. These descriptions include all the raw data that were used to generate the variables in the analysis, but excludes the results of descriptive analysis of the health behaviour variables, which are described in the respective chapters for smoking, alcohol drinking behaviour, diet, and physical activity.

4.2 Sample and response rates.

This study used the data from 3 surveys when the cohort subjects were aged: 36, 43 and 53 years in the years 1986, 1989 and 1999 respectively. Table 4.1 summarises the distribution of the NSHD sample by sex, social class, and highest level of educational attained at age 26 years for each wave. The number of cohort subjects who maintained their participation in the NSHD survey continued to decline each time from the previous surveys. From the original sample of 5362, there were 3322 (62.0%), 3262 (60.8%), and 2988 (55.7%) subjects who had responded at age 36, 43, and 53 years respectively (see Figure 3.2). Nevertheless, the percentage of response from the available sample was high at 86%, 85%, and 83% respectively. There were 2990 cohort members who participated in both surveys at ages 36 and 43 years and, 2807 participated in both surveys at ages 43 and 53 years.

4.3 Distribution by demographic factors.

Table 4.1 presents the distribution of the sample by sex, social class, and educational level for age 43 and 53 years. Similar data at age 36 years were not used in the analysis. The descriptive analysis showed that the proportions of men and women were similar at both ages 43 and 53 years. Because of the sampling method, there were more cohort members from the higher social classes compared to lower social classes. There were also more educated cohort members than less educated members. The distributions of cohort members between the 2 waves were also not very different by social class and educational levels.

4.4 Health behaviour variables.

Each of the variables concerned with change in health behaviours used in this study was derived from 2 consecutive waves. The raw data that were used to generate the health behaviours data are described below.

Table 4.1: Distribution of cohort members by sex, social class and education at age 43 and 53 years.

	Age 36 years (N = 3322) n (%)	**Age 43 years** (N = 3262) n (%)	**Age 53 years** (N = 2988) n (%)
Participated in 2 consecutive surveys	**2990 (55.8)**		
		2807 (52.3)	
Sex [N (%)]	**Not applicable**	**3262 (100)**	**2988 (100)**
Men		1635 (50.1)	1468 (49.1)
Women		1627 (49.9)	1520 (50.9)
Social class [N (%)]	**Not applicable**	**3130 (96.0)**	**2890 (96.7)**
I-II		1382 (44.2)	1269 (43.9)
III-Non manual		723 (23.1)	654 (22.6)
III-Manual		568 (18.2)	516 (17.9)
IV-V		457 (14.6)	451 (15.6)
Education [N (%)]	**Not applicable**	**3075 (94.3)**	**2822 (94.4)**
A level / university		1075 (35.0)	1001 (35.5)
Ordinary / vocational		859 (27.9)	781 (27.7)
None		1141 (37.1)	1040 (36.9)

4.4.1 Smoking and physical activity variables.

Data about cigarette smoking and physical activity were available for more than 99% of the cohort members in the 3 waves (Table 4.2). There data have been readily coded when they were made available for this study. The results of the descriptive analysis are presented in the chapters 5 (smoking) and 8 (physical activity).

Table 4.2: Numbers of observations in the smoking and physical activity data at ages 36, 43 and 53 years.

	Age 36 years (N = 3322) n (%)	**Age 43 years** (N = 3262) n (%)	**Age 53 years** (N = 2988) n (%)
Smoking	3318 (99.9)	3252 (99.7)	2988 (100)
Physical activity	3309 (99.6)	3262 (100)	2986 (99.9)

4.4.2 Alcohol behaviour variables.

Data relating to alcohol drinking for this study were from the surveys at age 43 and 53 years only. Data for the CAGE questions at both ages 43 and 53 years and for the amount of alcohol consumed at age 43 years were available from more than 90% of the cohort members. Data for the amount of alcohol consumed at age 53 years were available from only 75% of the cohort members.

Slightly more than 80% of the cohort members had a CAGE score = 0, at both ages 43 and 53 years (Table 4.3). Less than 10% scored 2 or more. The cohort members were then categorised into those who scored 1 or less and 2 or more of the CAGE score. The latter category indicated a high risk of having an alcohol problem. Another measure for alcohol behaviour was the amount of alcohol consumed. For the purpose of description, the men were categorised into 5 levels on the amount of alcohol drunk and the women into 4 levels (see section 3.4.3.2.2). At both age 43 and 53 years, the majority of cohort members were light and moderate drinkers (between 0.1 to 4 alcohol units per day for men and 0.1 to 3.0 alcohol units per day for women). There was a 5.6% decrease in the proportion of men who drank more than 4.1 alcohol units at age 53 years compared to age 43 years. For the women, there was a small increase (1.3%) in those who drank more than 3.1 alcohol units or more at age 53 years than at age 43 years.

Table 4.3: Descriptive of alcohol data at ages 43 and 53 years.

Alcohol drinking behaviour	**Age 43 years** (N = 3262) n (%)	**Age 53 years** (N = 2988) n (%)
CAGE score [N (%)]	**3148 (96.5)**	**2786 (93.2)**
0	2542 (80.7)	2237 (80.3)
1	341 (10.8)	331 (11.9)
2	192 (6.1)	156 (5.6)
3	65 (2.1)	51 (1.8)
4	8 (0.3)	11 (0.4)
Amount consumed (unit alcohol /day) [N (%)]	**3175 (97.3)**	**2779 (92.7)**
Men [N (%)]	**1601 (50.4)**	**1387 (49.9)**
0*	227 (14.2)	190 (13.7)
0.1 – 1.0 (very light drinkers)	471 (29.4)	406 (29.3)
1.1 – 2.0 (light drinkers)	373 (23.3)	353 (25.5)
2.1 – 4.0 (moderate drinkers)	314 (19.6)	328 (23.7)
4.1 or more (heavy drinkers)	216 (13.5)	110 (7.9)
Women [N (%)]	**1574 (49.6)**	**1392 (50.1)**
0*	465 (29.5)	344 (23.4)
0.1 – 1.5 (very light drinkers)	771 (49.0)	714 (52.0)
1.51 – 3 (light drinkers)	242 (15.4)	237 (17.3)
3.1 or more (moderate/heavy)	96 (6.1)	101 (7.4)

**had no drink in the past 7 days before interview.*

4.4.3 Diet behaviour variables.

The components that were used to make up the diet behaviour score are described in Table 4.4. The data showed that the majority of the cohort members ate regular breakfast and only a small proportion did not eat breakfast. Most of the cohort members consumed mixed types of breads. More than a third of cohort members consumed white bread only at age 36 years (40%), but this figure decreased to slightly less than a third at age 43 and 53 years (31%). Consumption of wholemeal bread only was low and fluctuated between the 3 age group waves. Consumption of other types of bread did not show much change or a clear pattern in the 3 waves. There was less variation in the choice of milk consumed at age 36 years and the majority of cohort members drank whole milk only (88%). More cohort members had consumed semi-skimmed milk at age 43 years (35%) and the proportion continued to increase at age 53 years (62%). The consumption of skimmed milk increased at age 43 years compared to age 36 years but did not change much after that.

There was a less clear pattern in the proportion of cohort members showing an increased consumption of fruit and vegetables in all 3 waves. The largest proportion consumed less than 3.4 portions at age 36 and 43 years. There was 13.9% increase in the proportion of cohort members who consumed 6.5 or more portions at age 53 years compared to age 43 years. A shift in the trend of fat intake was also observed in the 3 waves. There were increasing proportions of cohort members who had decreased the intake of fat based on the percentage of energy consumed from fat. The proportion of cohort members with the highest fat intake (≥ 45%) decreased to 2% at age 53 years compared to 9% at age 36 years and those whose intake was 29.99% or less increased from 6% at age 36 years to 27% at age 53 years. The pattern of consumption of bread, milk, fruit and vegetables, and energy from fat among the cohort members as described above were consistent with the general UK population as mentioned earlier in the literature review. Analysis showed that the dietary behaviour score and each of the dietary behaviour components of the three respective age groups were significantly and positively correlated, but the strength of the correlation was either low or moderate (Table 4.5). Correlations between components were consistently low for each age. Negative correlations were found between the score for breakfast, and milk consumption and the percentage of energy from fat intake at age 36 years, but they were not significant.

Table 4.4: Descriptive of the component variables for diet behaviour score at ages 36, 43 and 53 years.

	Age 36 years (N = 3322) n (%)	**Age 43 years** (N = 3262) n (%)	**Age 53 years** (N = 2988) n (%)
Diet behaviour components [N (%)]	**2411 (72.6)**	**2256 (69.2)**	**1768 (59.2)**
Breakfast			
❖ Never	115 (4.8)	138 (6.1)	62 (3.5)
❖ Sometimes	662 (27.5)	623 (27.6)	349 (19.7)
❖ Always	1634 (67.8)	1495 (66.3)	1361 (76.8)
Bread [N (%)]	**2377 (71.6)**	**2249 (69.0)**	**1705 (57.1)**
❖ Wholemeal only	103 (4.3)	126 (5.6)	65 (3.8)
❖ Some brown or granary, some wholemeal	78 (3.3)	108 (4.8)	85 (5.0)
❖ 1.Brown or granary only, 2. some white and some wholemeal, 3. some white, some brown, or granary, some wholemeal	633 (26.6)	778 (34.6)	544 (31.9)
❖ Some white, some brown or granary	604 (25.4)	520 (23.1)	463 (27.2)
❖ White only	938 (39.5)	688 (30.6)	525 (30.8)
❖ None	21 (0.9)	29 (1.29)	23 (1.4)
Types of milk [N (%)]	**2428 (73.1)**	**2280 (69.9)**	**1770 (59.2)**
❖ Skimmed only	37 (1.5)	239 (10.5)	169 (9.6)
❖ Some skimmed and some semi-skimmed	0 ()	148 (6.5)	197 (11.1)
❖ Semi-skimmed only	251 (10.3)	805 (35.3)	1100 (62.2)
❖ Some whole milk and some semi-skimmed	0 ()	257 (11.3)	198 (11.2)
❖ Whole milk only	2140 (88.1)	831 (36.5)	106 (6.0)
Fruit and vegetables (portions) [N (%)]	**2428 (73.1)**	**2280 (69.9)**	**1772 (59.3)**
❖ <2.0	868 (35.8)	597 (26.2)	231 (13.0)
❖ 2.0 -3.4	951 (39.2)	825 (36.2)	469 (26.5)
❖ 3.5 – 4.9	436 (18.0)	525 (23.0)	441 (24.9)
❖ 5.0 – 6.4	121 (5.0)	207 (9.1)	288 (16.3)
❖ ≥ 6.5	52 (2.1)	126 (5.5)	343 (19.4)
Percentage of energy from fat (%) [N (%)]	**2428 (73.1)**	**2280 (69.9)**	**1776 (59.4)**
❖ ≥ 45.0	211 (8.7)	205 (9.0)	35 (2.0)
❖ 40.0 – 44.9999	761 (31.3)	666 (29.2)	196 (11.0)
❖ 35.0 – 39.9999	901 (37.1)	829 (36.4)	497 (28.0)
❖ 30.0 - 34.9999	416 (17.1)	411 (18.0)	571 (32.2)
❖ ≤ 29.9999	139 (5.7)	169 (7.4)	477 (26.9)

Table 4.5: Correlations between diet behaviour score and component variables.

	DBS	Breakfast	Bread	Fruit and vegetables	Milk	PEF
Age 36 years						
DBS	-					
Breakfast	0.6 [c]	-				
Bread	0.2 [c]	0.1 [c]	-			
Fruit and vegetables	0.6 [c]	0.1 [c]	0.2 [c]	-		
Milk	0.3 [c]	-0.0 [ns]	0.1 [c]	0.1 [c]	-	
PEF	0.6 [c]	-0.0 [ns]	-0.1 [a]	0.1 [b]	0.2 [c]	-
Age 43 years						
DBS	-					
Breakfast	0.6 [c]	-				
Bread	0.3 [c]	0.1 [c]	-			
Fruit and vegetables	0.7 [c]	0.2 [c]	0.3 [c]	-		
Milk	0.5 [c]	0.1 [b]	0.2 [c]	0.2 [c]	-	
PEF	0.6 [c]	0.0 [ns]	0.1 [c]	0.2 [c]	0.3 [c]	-
Age 53 years						
DBS	-					
Breakfast	0.6 [c]	-				
Bread	0.3 [c]	0.1 [c]	-			
Fruit and vegetables	0.7 [c]	0.2 [c]	0.3 [c]	-		
Milk	0.4 [c]	0.0 [ns]	0.1 [c]	0.2 [c]	-	
PEF	0.6 [c]	0.1 [c]	0.1 [c]	0.2 [c]	0.3 [c]	-

DBS: diet behaviour score, PEF: Percentage of energy from fat intake.
a: ($p<0.05$), b: ($p<0.01$), c: ($p<0.001$), ns: not significant.

4.5 Life stress variables.

4.5.1 Life stress variables at age 43 years.

4.5.1.1 Life events items at age 43 years.

Table 4.6 lists the life events items and the number of cohort members who had reported the experience. Death (35%) and illness (25%) of someone close was the most reported events and own illness (3%) was the least reported. Thirty-eight percent of members who had moved house reported that they had moved away from friends. There was no observation for the item ‘had spouse or partner had a work crisis’. More men than women had life events relating to job lost, work crisis, or death of someone close (p<0.05); and more women had reported having events relating to the spouse's job loss, disagreement with the spouse or concerns about the children (p<0.05).

Table 4.6: Number of subjects and life events items at age 43 years.

Life events	N	n (%)
Have serious illness or handicap	3246	89 (2.7)
Affected by accident or injury for a month or more	3245	173 (5.3)
Had been assaulted or robbed or attempted robbery	3242	96 (3.0)
Had job lost or anticipating it	2968	258 (8.7)*
Had work or career crises / disappointment	3208	239 (7.5)*
Had moved house	3247	265 (8.2)
Moved away from friends	236	89 (37.7)
Spouse or partner had accident, illness, injury or been assaulted	2805	208 (7.4)
Spouse or partner had lost job anticipating it	2798	220 (7.9)*
Spouse or partner had work or career crises / disappointment	0	-
Have disagreement with spouse or partner	2811	235 (8.4)*
Have difficulty or concerned with children's health, behaviour or other reasons	2795	529 (18.9)*
Someone close had serious accident, illness or injury	3244	827 (25.5)
Someone close had died	3246	1133 (34.9)*
Had disagreement with someone close	3245	333 (10.3)
Loss contact with someone close	3243	261 (8.1)
Have other disappointment or upset	3213	218 (6.8)

Health events are indicated in italics. There was no observation for spouse's work crises, hence was excluded from the life event score. See Appendix 4.1 for distribution by the sexes.
**p<0.05 for differences between the sexes.*

4.5.1.2 Stressful life events at age 43 years.

Twenty five percent of the cohort members had no life event and 75% (95% CI: 73%, 76%) had at least 1 life event in the past year before the interview at age 43 years. The distribution of the measures for stressful life events are presented in Table 4.7. Most of the cohort members had 1 life event (life events score) but there was no clear pattern in the distribution of cohort members as the number of events increased. There was also no clear pattern in the distribution of cohort members as the emotional score and life change score increased.

4.5.1.3 Health related life events at age 43 years.

Descriptive analysis found that 61% (95% CI: 59%, 63%) of members had at least 1 health related life event. The proportion of cohort members decreased with the increase in the health related life events experience (Table 4.7). No particular pattern was observed in the distribution of cohort members in health related emotional score but a less clear decreasing pattern was found in life change score.

4.5.1.4 Diagnosis of a medical condition at age 43 years.

Only 3% of cohort members were diagnosed with at least one medical condition between ages 36 and 43 years (n = 88) (Table 4.7). High blood pressure was the most commonly diagnosed medical condition (2.4%), followed by 4 other medical conditions: angina, diabetes, heart attack, and stroke (each affected less than 1% of subjects).

4.5.2 Life stress at age 53 years.

4.5.2.1 Life events items at age 53 years.

Table 4.8 lists the life events items and number of cohort members who had events at age 53 years. Death (41%) and illness (34%) of someone close were also the most reported events, followed by concern for their children's welfare (18%). Four percent of the cohort members had been robbed in the past year before the interview. Among members who had moved house, 27% reported that they had moved away from their friends. There were more men who had work related events ($p<0.05$), and more women who reported that their spouse had problems at work ($p<0.05$).

Table 4.7: Distribution of the measures of stressful life events, health related life events, and diagnosis of a medical condition; at age 43 and 53 years.

Type of life stress	Measures	Age 43 years n (%)	Age 53 years n (%)
Stressful life events	***Life events score* [N (%)]**	**3254 (99.8)**	**2988 (100)**
	0	815 (25.1)	607 (20.3)
	1	1016 (31.2)	809 (27.1)
	2	691 (21.2)	639 (21.4)
	3 or more	732 (22.5)	933 (31.2)
	***Emotional score* [N (%)]**	**3216 (98.6)**	Not applicable
	0	815 (25.3)	
	1	561 (17.4)	
	2	616 (19.2)	
	3	637 (19.8)	
	4 or more	587 (18.3)	
	***Life change score* [N (%)]**	**3220 (98.7)**	Not applicable
	0	815 (25.3)	
	1	1439 (44.7)	
	2	439 (13.6)	
	3 or more	527 (16.4)	
Health related life events	***Life events score* [N (%)]**	**3248 (99.6)**	**2988 (100)**
	0	1263 (38.9)	936 (31.3)
	1	1221 (37.6)	1081 (36.2)
	2 or more	764 (23.5)	971 (32.5)
	***Emotional score* [N (%)]**	**3224 (98.8)**	Not applicable
	0	1263 (39.2)	
	1	586 (18.2)	
	2	693 (21.5)	
	3 or more	682 (21.2)	
	***Life change score* [N (%)]**	**3204 (98.2)**	Not applicable
	0	1240 (38.7)	
	1	1375 (42.9)	
	2	339 (10.6)	
	3 or more	250 (7.8)	
Diagnosed with medical condition	**N (%)**	**2915 (89.4)**	**2827 (94.6)**
	No medical condition	2827 (97.0)	2343 (82.9)
	At least one	88 (3.0)	484 (17.1)
	High blood pressure	70 (2.4)	431 (15.2)
	Angina	22 (0.8)	61 (2.2)
	Heart attack	6 (0.2)	10 (0.4)
	Stroke	4 (0.1)	13 (0.5)
	Diabetes	14 (0.5)	43 (1.5)

Table 4.8: Number of subjects and life events items at age 53 years.

Life events.	N	n (%)
Have serious illness or handicap.	2986	183 (6.1)
Affected by accident or injury for a month or more.	2986	226 (7.6)
Have been assaulted or robbed or attempted robbery.	2987	118 (4.0)
Had job lost or anticipating it.	2986	318 (10.7)*
Have work or career crises / disappointment.	2985	288 (9.7)*
Have moved house.	2988	184 (6.2)
Moved away from friends.	184	50 (27.2)
Spouse or partner had accident, illness, injury or been assaulted.	2473	269 (10.9)
Spouse or partner had lost job anticipating it.	2474	227 (9.2)*
*Spouse or partner had work or career crises / disappointment**.*	2473	202 (8.2)*
Have disagreement with spouse or partner**.	2473	168 (6.8)*
Have difficulty or concerned with children's health, behaviour or other reasons*.	2606	476 (18.3)*
Someone close had serious accident, illness or injury.	2972	1001 (33.7)
Someone close had died.	2980	1213 (40.7)
Have disagreement with someone close**.	2979	284 (9.5)*
Loss contact with someone close**.	2979	209 (7.0)
Have other disappointment or upset.	2987	412 (13.8)*

*Health events are indicated in italics.*p<0.05 for differences between the sexes. See Appendix 4.1 for distribution by the sexes. **excluding those who reported having no spouse, relative or children.*

4.5.2.2 Stressful life events at age 53 years.

Twenty percent of the members had no life event in the past year and 80% (95% CI: 78%, 81%) had at least 1 life event. The pattern of the life events score was similar to that at age 43 years, where there was no clear pattern in the proportions as the number of life experiences increases (Table 4.7). There was no variable for the emotional score or life change score at age 53 years.

4.5.2.3 Health related life events at age 53 years.

For the health related life events, 20% had no event and 69% (95% CI: 67%, 70%) of cohort members had at least 1 health related life event. There was no particular pattern in the distribution of the cohort members by the health related life events score

(Table 4.7). There was no variable for health related emotional score or life change score at age 53 years.

4.5.2.4 Diagnosis of a medical condition at age 53 years.

From the data available, 431 (15%) cohort members were found to have been diagnosed with high blood pressure between age 44 and 53 years (Table 4.7). This was followed by angina (2%), diabetes (2%), stroke (<1%) and heart attack (<1%). A total of 484 (17%) of the cohort members were diagnosed with at least one of the medical conditions by age 53 years.

4.6 Social support variables.

4.6.1 Social support variables at age 43 years.

For the *perceived support* factor, 92% of the cohort members thought that they always had the support of family and friends during a crisis (Table 4.9). Four percent thought that they would get the help, and another 4% thought they would get the help only sometimes or no help at all. For the *social network* factor, the result showed that the majority of cohort members (64%) had an intermediate degree or level of relationship with their family and friends (score 3 or 4). A fifth (20%) scored the lowest score (0 - 2) and 16% had the highest score. For the *social participation* factor, it was found that 42% of the cohort members were not involved in any of the social activities, such as helping out at school, being a member of the church, trades union, or sports (score = 0). The proportions of cohort members with high (6 or more) and intermediate (1 - 5) score were similar. A similar proportion had an intermediate score (30%) and a high score (29%) of social participation factor. Each of the factors above were treated as an ordinal variable with descending effect.

4.6.2 Social support variables at age 53 years.

The distribution of the *perceived support* factor at age 53 years was similar to age 43 years. However, the proportion of cohort members who thought that they would always get support was smaller and, the proportion who thought that they would often or, only sometimes or never get help during a crisis was greater; at age 53 years than at age 43 years (Table 4.9). The degree of relationship with their family and friends that subjects experienced was found to be better at age 53 years than age 43 years. The greater proportion of cohort members (75%) scored a higher social network score (4 and 5) and smaller proportion (25%) had a lower score (3 or less). There was no variable for social participation at age 53 years. Each of the factors above were treated as an ordinal variable with descending effect.

Table 4.9: Distribution of the social support factors at age 43 and 53 years.

Social support factors	**Age 43 years n (%)**	**Age 53 years n (%)**
Perceived support (unit) **[N (%)]**	**3240 (99.3)**	**2985 (99.9)**
1 (Always)	2974 (91.8)	2605 (87.3)
2 (Often)	144 (4.4)	208 (7.0)
3 (Sometimes – none)	122 (3.8)	172 (5.8)
Social network (unit) **[N (%)]**	**3248 (99.6)**	**2987 (99.9)**
5	529 (16.3)	948 (31.7)
4	915 (28.2)	1303 (43.6)
3	1158 (35.7)	508 (17.0)
0-2	646 (19.9)	228 (7.6)
Social participation (unit) **[N (%)]**	**3254 (99.8)**	
6 or more	931 (28.6)	Not applicable
1-5	962 (29.6)	
0	1361 (41.8)	

4.7. Correlation between variables.

4.7.1 Correlation between the variables at age 43 years.

The results of the correlations analyses between the variables are presented in Table 4.10. Sex, social class, and education were correlated with each other. More men than the women had tertiary education and were from the social class I and II and, III manual. The members from the higher social class were more likely to have better levels of education than those from the lower social class, who were more likely to be less well educated. Women were more affected emotionally by life events than men. However, members who reported that they had better perceived support, better relationships with family and friends, and participated more in social activity, were less likely to have more life events. Diagnosis of medical condition was not related to any of the variables.

Table 4.10: Correlation between the variables age 43 years.

	Sex	Education	Social class	LES	EMS	LCS	HR LES	HREMS	HRLCS	DOMC	PSUP	SNET	SP
Sex	-												
Education	c	-											
SC	c	c	-										
LES	ns	ns	ns	-									
EMS	b	ns	ns	c	-								
LCS	ns	ns	ns	c	c	-							
HRLES	ns	ns	ns	c	c	c	-						
HREMS	c	ns	c	c	c	c	c	-					
HRLCS	b	ns	ns	c	c	c	c	c	-				
DOMC	ns	ns	ns	ns	ns	ns	ns	ns	ns	-			
PSUP	a	ns	b	c	c	ns	b	b	ns	ns*	-		
SNET	a	ns	a	a	ns	ns	b	b	b	ns	c	-	
SP	a	c	c	a	ns	ns	b	a	b	ns	ns	c	-

ns = not significant , a: p < 0.05, b: p = <0.01, c: p <0.001
**Fisher exact test.*
See abbreviation on page 22.

4.7.2 Correlation between the variables at age 53 years.

The results of the analysis are presented in Table 4.11. More women had reported a greater number of life events than men ($p<0.05$). Demographic factors were also found to be related to each other. Life events and health related life events were inversely associated with level of social network. There were more women who had a greater number of life events. Cohort members who were diagnosed with at least one medical condition were more likely to have higher social class background ($p<0.05$) and to be the least educated ($p<0.001$). There was an inverse relationship between having more social relationship with family and friends and, life events and health related life events.

Table 4.11: Correlation between the variables age 53 years.

	Sex	**Education**	**Social class**	**LES**	**HR LES**	**DOMC**	**PSUP**	**SNET**
Sex	-							
Education	c	-						
SC	c	c	-					
LES	a	ns	ns	-				
HRLES	ns	ns	ns	c	-			
DOMC	ns	a	c	ns	ns	-		
PSUP	b	b	b	ns	ns	ns	-	
SNET	c	ns	ns	b	c	ns	c	-

ns = not significant , a: p < 0.05, b: p = <0.01, c: p <0.001
See abbreviation on page 22.

4.8. The aggregated data.

The aggregated data are derived from the data that pooled both the data at age 43 and 53 years in a single dataset and includes similar variables that were available at both ages only. Therefore the description of the aggregated data is exactly the same as the description of the data at age 43 and 53 years combined.

4.9 Result of the analysis.

The results of the analysis of the association between change in health behaviour and life stress are presented in the next 4 chapters. In each chapter a short introduction that includes the specific objectives of the analysis of the relevant health behaviours are presented. This is followed by the descriptive results that examined the distribution or summary statistics of the outcome variables (objective 1). Then the results of the analysis of the association between a healthful change in health behaviours and life stress (in order: stressful life events, health related life events, and diagnosis of a medical condition) are presented. The results of the analysis at age 43 years are presented first, then the results at age 53 years, and followed by the results of the aggregated data. This is followed by the results of the analysis of the association between adverse change in health behaviours and life stress in a similar order. A summary of the results are presented at the end of each result chapters.

CHAPTER 5

Smoking behaviour.

5.1 Introduction.

This chapter presents the results of the analysis of the association between stressful life events, health related life events, and diagnosis of medical condition and; change in smoking behaviour. There are two outcomes measures for smoking change at each age 43 and 53 years: *stopping smoking and smoking relapse*. Stopping smoking is the change from the current smoker status to ex-smoker status and smoking relapse is the change from the ex-smoker status to current smoker status. The specific objectives of the analysis at age 43 and 53 years and, the aggregated data were;

1) To examine the distribution and odds of change in smoking behaviour by the social support and demographic factors,

2) To assess whether there is any evidence of a linear trend in the odds of change in smoking behaviour with the increase in the level of exposure of the different measures of the stressful life events and health related life events, and then to compare the odds of change in smoking behaviour in the cohort members, who were diagnosed with at least one medical condition compared to those who were not diagnosed with a medical condition, using logistic regression analysis in the analysis at age 43 and 53 years and logistic regression analysis with random effect for the aggregated data,

3) To assess the influence of social support factors in any association found in (2) above, by examining the statistical effect of the factors in the logistic regression model using the likelihood ratio test.

4) To obtain an estimate of the effect of the main independent variables that were adjusted for the factors found in (3) above using the stepwise forward selection method.

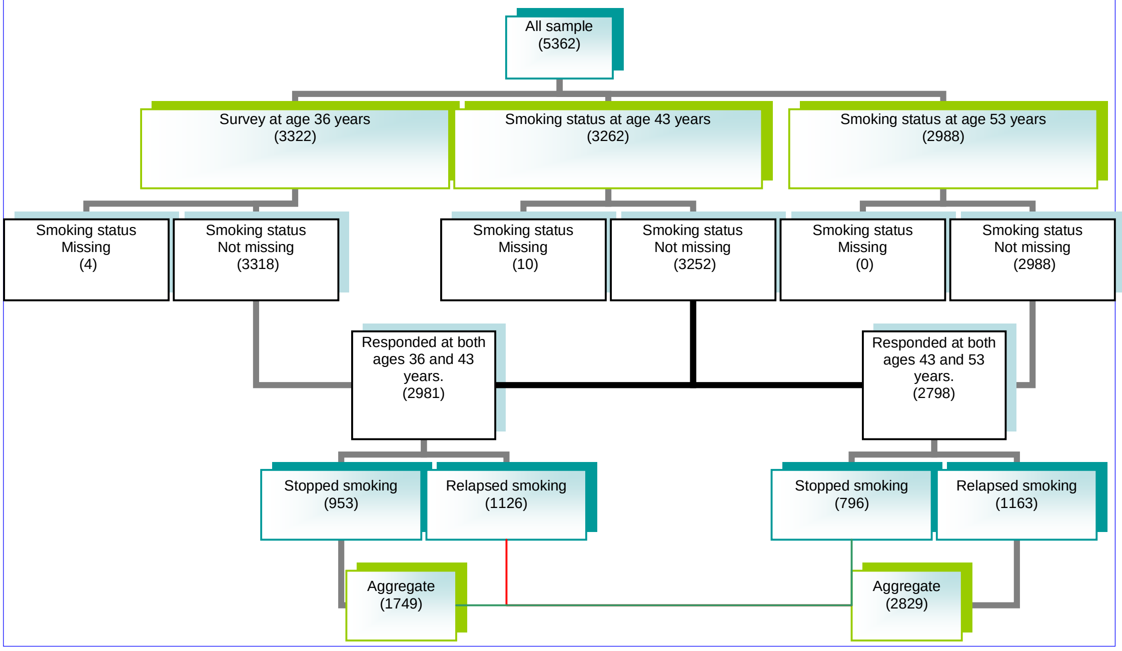
The preliminary analyses to assess whether sex modified the effect of the main independent variables found that the interaction variables between them did not significantly affect the results of the analyses; hence, all the analyses carried out in this chapter included both men and women.

5.2 Descriptive results: distributions by the demographic and social support factors.

5.2.1 The sample.

The data for the analysis were from the cohort members who participated in two consecutive surveys of the 3 waves at age 36, 43, and 53 years. The flowchart in Figure 5.1 shows how the samples for the analysis were derived. Smoking status was available for 2981 subjects who participated in the surveys at ages 36 and 43 years and, 2798 subjects who participated at ages 43 and 53 years. From this sample, there were 953 (31.9%) observations available for the analysis of stopping smoking at age 43 years and 796 (28.4%) at age 53 years. The sample for smoking relapse were 1126 (41.4%) and 1163 (41.6%) in that respective order. The analyses of the aggregated data combined the observations at ages 43 and 53 years. There were 1749 observations for stopping smoking and 2829 observations for smoking relapse.

Figure 5.1: The summary of the sample used in the analysis of change in smoking behaviour.



5.2.2 Missing data.

The number of subjects for whom information about smoking status was missing, for each of the 3 waves were small at 4 (0.1%) and 10 (0.3%) at age 36 and 43 years respectively, and none at age 53 years. There was no association found between the missing data in the sample at age 43 years and sex, social class, and education (Table 5.1). Similarly, there was no association between the missing data in the sample at age 53 years, sex and social class. However, there was significant association between missing data in the sample at age 53 years and education (p= 0.01) but the number of subjects with missing information was very small (n=6) and they were not among the cohort members who had changed their smoking behaviour.

Table 5.1: Number of subjects with missing information on smoking.

	Missing at both age 36 and 43 years			Missing at both age 43 and 53 years.		
	N	**n (%)**	**p***	**N**	**n (%)**	**p***
Sex (N)	(2990)			(2807)		
Men	1488	5 (0.3)	0.8	1366	5 (0.4)	0.7
Women	1502	4 (0.3)		1441	4 (0.3)	
Social class (N)	(2901)			(2721)		
I-II	1273	3 (0.2)		1195	1 (0.1)	
III-NM	683	3 (0.4)	0.6	620	3 (0.5)	0.4
III-M	523	1 (0.2)		485	1 (0.2)	
IV-V	422	0 (0)		421	1 (0.2)	
Education (N)	(2847)			(2661)		
A level/University	1000	1 (0.1)	0.1	958	0 (0)	0.01
O level/ Vocational	809	5 (0.6)		747	5 (0.7)	
No education	1038	1 (0.3)		956	1 (0.1)	

**Fisher exact test.*

5.2.3 Smoking behaviour at age 36, 43 and 53 years.

The data showed that the proportion of cohort members who were still smoking at the time of the interview had declined from 34% at age 36 to 23% at age 53 years (Table 5.2). Correspondingly, the proportion of the ex-smokers had increased and the proportion of members who never smoked remained similar over the same 17 years period. The smoking pattern in the NSHD was similar to the General Household Survey report for the UK (Rickards et. al., 2002) and concurred with the declining smoking trend with age at midlife (Stapleton, 1998). The reason given by the cohort members who had stopped smoking by age 36 years (n = 851) were related to the health (62%), cost of maintaining the habit (15%), not having pleasure from the habit (12%), and doctors’ instruction (4%).

Table 5.2: Smoking status at age 36, 43 and 53 years.

Smoking status	Age 36 years n=3318 n (%)	Age 43 years n = 3252 n (%)	Age 53 years n =2988 n (%)
Never smoked	975 (29.4)	956 (29.4)	883 (29.6)
Ex-smoker	1216 (36.7)	1322 (40.7)	1410 (47.2)
Current smoker	1127 (34.0)	974 (30.0)	695 (23.3)

5.2.4 Changes in smoking behaviour.

The proportions of the cohort members who stopped smoking at age 43 and 53 years were greater compared to those who relapsed at the same age; and the proportion who stopped at age 53 years was greater compared to age 43 years (Table 5.3). Among the current smokers at age 36 years, 23.5% had stopped smoking at age 43 years, and among the current smokers at age 43 years, 30.4% had stopped at the age of 53 years. Smoking relapse was greater at age 43 years than at age 53 years. When the observations at age 43 and 53 years were aggregated, it was found that 27% of the cohort members had stopped smoking and 9% had relapsed over the 17 years.

Smoking initiation in the cohort members who had never smoked was low at 1% at age 43 years and less than 1% at age 53 years. The proportion who reported to have had never smoked at age 36 years and then reported to have had stopped smoking in the surveys at ages 43 or 53 years were less than 2%. These cohort members could have had started to smoke briefly at some point after the survey at age 36 years but then had stopped at the latter surveys. Because the numbers of subjects in these categories were too small and they were not examined further.

Table 5.3: Number of subjects and types of smoking change.

Type of change	Age (years)	N	n (%)
Stopped smoking	43	953	224 (23.5)
	53	796	242 (30.4)
	Aggregate	1749	466 (26.6)
Relapsed smoking	43	1126	136 (12.1)
	53	1163	68 (5.9)
	Aggregate	2829	204 (8.9)

5.3 Change in smoking behaviour: stopping smoking.

5.3.1 Descriptive results: distributions by the demographic and social support factors.

5.3.1.1 Descriptive results of the data at age 43 years.

The results of the descriptive analysis are shown in Table 5.4. There were more men than women who had stopped smoking, but there was no association between stopping smoking and sex. More members from the higher social classes and the better educated subjects had stopped smoking compared to those who were from lower social classes and were less educated ($p<0.01$). There were significant declining trends in the proportion of members who had stopped smoking moving down the social class and education level ($p\leq 0.01$). For the social support factors, no association was found between stopping smoking and perceived support, social network, and social activity.

5.3.1.2 Descriptive results of the data at age 53 years.

The results at age 53 years were similar to age 43 years. Social class and education were found to be significantly associated with stopping smoking ($p<0.01$) with a significant declining trend ($p<0.001$). There was no association found between stopping smoking and, perceived support and social network.

5.3.1.3 Descriptive results of the aggregated data.

The results of the analysis of the aggregated data showed that there were significant associations between stopping smoking and, social class ($p<0.001$) and education (p<0.001), but not with sex (Table 5.4). The declining trend in the social class and educational level were also significant (p<0.01). There was an increasing pattern in the proportion of cohort members who stopped smoking with a decrease in the degree of social network but the association was not significant.

5.3.2 Descriptive results: numbers and odds ratios of stopping smoking by the stressful life events measures.

5.3.2.1 Results of the analysis at age 43 years.

For the *stressful life events*, the results showed no pattern in the odds ratios of stopping smoking at age 43 years with the increase in the life events score, emotional score, and life change score (Table 5.5). For the *health related life events*, the analysis also found no pattern in the odds ratios of stopping smoking with the increase in the health related life events score (Table 5.5). Similarly, there was no pattern found in health related, emotional and life change score. The proportion of cohort members who stopped smoking were greater in those cohort members who were *diagnosed with at least one medical condition* compared to those who were not diagnosed (Table 5.6).

Table 5.4: Number of subjects who stopped smoking by the demographic and social support factors.

	Age 43 years			Age 53 years			Aggregate		
Demographic factors	**n**	**n (%)**	**p**	**n**	**n (%)**	**p**	**n**	**n (%)**	**p**
Sex (N)	953			796			1749		
Men	481	122 (25.4)	0.2	400	130 (32.5)	0.2	881	252 (28.6)	0.1
Women	472	102 (21.6)		396	112 (28.3)		868	214 (24.7)	
Social class (N)	925			768			1693		
I-II	319	106 (33.2)		245	92 (37.6)		564	198 (35.1)	
III-NM	189	36 (19.1)	<0.001	157	51 (32.5)		346	87 (25.1)	<0.001
III-M	233	44 (18.9)		192	43 (22.4)	<0.01	425	87 (20.5)	
IV-V	184	35 (19.0)		174	51 (29.3)		358	86 (24.0)	
Education (N)	909			758			1667		
A-level/university	210	77 (36.7)		170	71 (41.8)		380	148 (39.0)	
Ordinary / vocational	234	45 (19.2)	<0.001	203	59 (29.1)	<0.001	437	104 (23.8)	<0.001
None	465	90 (19.4)		385	97 (25.2)		850	187 (22.0)	
Social support factors									
Perceived support (N)	951			793			1744		
Always	877	210 (24.0)	0.5	695	210 (30.2)	0.1	1572	420 (26.7)	0.1
Often	36	8 (22.2)		40	18 (45.0)		76	26 (34.2)	
None or sometimes	38	6 (15.8)		58	13 (22.4)		96	19 (19.8)	
Social network (unit) (N)	952			795			1747		
5	175	44 (25.1)	0.6	260	79 (30.4)		245	123 (28.3)	0.5
4	271	58 (21.4)		313	103 (32.9)	0.3	483	161 (27.6)	
3	353	78 (24.2)		160	47 (29.4)		584	125 (25.9)	
0-2	183	44 (24.0)		62	13 (21.0)		435	57 (23.7)	
Social activities (unit) (N)	889								
6 or more	317	9 (2.8)	0.4						
1-5	266	4 (1.5)							
0	306	5 (1.6)							

Table 5.5: Number and odds ratio of stopping smoking at age 43 years by the stressful life events and health related life events measures.

	Stressful life events			Health related life events		
	N	**n (%)**	**Odds ratio**	**N**	**n (%)**	**Odds ratio**
Life event score	952			951		
None	207	52 (25.1)	1	355	87 (24.5)	1
1	293	68 (23.2)	0.90 (0.59, 1.36)	364	87 (23.9)	0.97 (0.68, 1.36)
2*	225	54 (24.0)	0.94 (0.61, 1.46)	232	50 (21.6)	0.85 (0.57, 1.26)
3 or more	227	50 (22.0)	0.84 (0.54, 1.31)			
Emotional score	940			937		
None	207	52 (25.1)	1	347	84 (24.2)	1
1	151	34 (22.5)	0.87 (0.53, 1.42)	157	34 (21.7)	0.87 (0.55, 1.36)
2	195	51 (26.2)	1.06 (0.67, 1.65)	228	62 (27.2)	1.17 (0.80, 1.71)
3**	202	37 (18.3)	0.67 (0.42, 1.07)	205	39 (19.0)	0.74 (0.48, 1.13)
4 or more	185	47 (25.4)	1.02 (0.64 , 1.60)			
Life change scores	943			941		
0	207	52 (25.1)	1	350	87 (24.9)	1
1	437	111 (25.4)	1.01 (0.69, 1.49)	423	99 (23.4)	0.92 (0.66, 1.29)
2	129	23 (17.8)	0.65 (0.37, 1.12)	92	20 (21.7)	0.84 (0.48, 1.46)
3	170	38 (22.4)	0.86 (0.53, 1.38)	76	17 (22.4)	0.87 (0.48, 1.57)

**2 or more, **3 or more for health related life events measures.*

Table 5.6: Number of cohort members who had stopped smoking by age 43 years by diagnosis of a medical condition.

Diagnosed with medical condition (N=771)	N	n (%)
No	742	174 (23.5)
Yes	29	11 (37.9)

5.3.2.2 Results of the analysis at age 53 years.

There was no pattern found in the odds ratio of stopping smoking in relation to the life events score and health related life events score (Table 5.7). For the diagnosis of a medical condition, the analysis found that the proportion of current smokers at age 43 years who had stopped smoking at age 53 years and diagnosed with at least one medical condition were greater compared to those who were not diagnosed (Table 5.8).

5.3.2.3 Results of the analysis of the aggregated data.

There was no particular pattern found in the odds ratio of stopping smoking in the life events score and health related life events score (Table 5.9). More cohort members who were diagnosed with at least one medical condition had stopped smoking compared to those who were not diagnosed.

Table 5.7: Number and odds ratio of stopping smoking at age 53 years by the stressful life events and health related life events.

	Stressful life events			Health related life events		
	N	**n (%)**	**Odds**	**N**	**n (%)**	**Odds**
Life event score	796			796		
None	146	45 (30.8)	1	247	72 (29.2)	1
1	234	67 (28.6)	0.90 (0.57, 1.41)	291	84 (28.9)	0.99 (0.68, 1.43)
2*	161	56 (34.8)	1.20 (0.74, 1.93)	258	86 (33.3)	1.21 (0.83, 1.77)
3 or more	255	74 (29.0)	0.91 (0.59, 1.43)			

**2 or more for health related life events score.*

Table 5.8: Number of cohort members who stopped smoking at age 53 years by the diagnosis of a medical condition.

	Age 53 years (N=759)	
Diagnosed with medical condition	**N**	**N (%)**
No	617	175 (28.4)
Yes	142	54 (38.0)

Table 5.9: Number and odds ratio of stopping smoking by the life events score and health life events score and; number who had stopped smoking by the diagnosis of a medical condition, in the aggregated data.

	N	**n (%)**	**Odds**
Life event score	1748		
None	353	97 (27.5)	1
1	527	135 (25.6)	0.91 (0.67, 1.23)
2	386	110 (28.5)	1.05 (0.76, 1.45)
3 or more	482	124 (25.7)	0.91 (0.67, 1.25)
Health life event score	1747		
None	602	159 (26.4)	1
1	655	171 (26.1)	0.98 (0.77, 1.27)
2 or more	490	136 (27.8)	1.07 (0.67, 1.25)
Diagnosed with medical condition	2061		
No	1849	349 (25.7)	-
At least one medical condition	212	65 (38.0)	

5.3.3 Association between stopping smoking and life stress.

5.3.3.1 The results at age 43 years.

5.3.3.1.1 Association between stopping smoking and stressful life events.

The analysis of the effect of stressful life events found no statistically significant association between stopping smoking at age 43 years and the life events score, emotional score, and life change score (Table 5.10).

5.3.3.1.2 Association between stopping smoking and health related life events.

Likewise, the analysis of the effect of health related life events found no statistically significant association between stopping smoking at age 43 years and, the health related life events score, health related emotional score, and health related life change score (Table 5.10).

Table 5.10: Unadjusted odds ratios for the association between stopping smoking at age 43 years and, the stressful life events and health related life events.

	Stressful life events		Health related life events	
	N OR (95% CI)	p	N OR (95% CI)	p
Life events score	952 0.96 (0.83, 1.10)	0.5	951 0.92 (0.76, 1.12)	0.4
Emotional score	940 0.98 (0.88, 1.08)	0.6	945 0.94 (0.83, 1.07)	0.4
Life change score	943 0.91 (0.78, 1.06)	0.2	941 0.93 (0.76, 1.15)	0.5

5.3.3.1.3 Association between stopping smoking and diagnosis of a medical condition.

The analysis of the effect of the diagnosis of a medical condition found that the odds of stopping smoking at age 43 years were nearly twice as large in the cohort members who were diagnosed with at least one medical condition compared to those who were not so diagnosed; but the odds ratio for the association was not statistically significant (Table 5.11).

Table 5.11: Unadjusted odds ratios for the association between stopping smoking at age 43 years and diagnosis of a medical condition (n =771).

Diagnosed with medical condition	OR (95% CI)	p
No	1	
Yes	1.99 (0.92, 4.30)	0.08

5.3.3.2 The results at age 53 years.

5.3.3.2.1 Association between stressful life events, health related life events, and diagnosis of a medical condition and, stopping smoking.

The analysis at age 53 years found no association between stopping smoking and the life events score (Table 5.12). The health related life events score was also found not to be associated with stopping smoking at age 53 years (Table 5.12). There was a statistically significant association found between stopping smoking at age 53 years and the diagnosis of a medical condition (Table 5.12). The current smokers at age 43 years who were diagnosed with at least one medical condition between the age of 43 and 53 years had 55% higher odds of stopping at age 53 years compared to those who were not diagnosed (unadjusted OR= 1.55, 95%CI: 1.06, 2.27).

Table 5.12: Unadjusted odds ratios for the association between stopping smoking at age 53 years and, the stressful life events, health related life events, and the diagnosis of a medical condition.

	N	OR (95% CI)	p
Stressful life events			>0.9
Life events score	796	1.00 (0.87, 1.14)	
Health related life events			0.3
Health related life events score	796	1.11 (0.91, 1.34)	
Diagnosis of a medical condition	759		0.02
No		1	
Yes		1.55 (1.06, 2.27)	

5.3.3.2.2 Relationship between stopping smoking and the covariate factors.

The result of this analysis is presented in Table 5.13. It shows that there was a statistically significant interaction between perceived support factor and diagnosis of a medical condition (OR= 0.38, 95%CI: 0.15, 0.95) (LRTχ^2= 5.5, p= 0.02) (See Appendix 5.1 for the effect of interaction on diagnosis of medical condition). The social class (OR= 0.84, 95%CI: 0.73, 0.96) (LRT: χ^2= 7.6, p< 0.01) and education (OR= 0.70, 95%CI: 0.57, 0.84) (LRT: χ^2= 15.3, p$\leq$ 0.001) were also found to be significant factors in the association (Table 5.13). Other results were found to be not significant.

Table 5.13: Unadjusted odds ratios of the potential covariate factors and the results of the LRT for the influence on the association between diagnosis of a medical condition and stopping smoking.

Factors	N	OR (95% CI)	p	LRTχ^2(p)
Perceived support	793	0.93 (0.71, 1.24)	0.6	0.6 (0.4)
PS x MC	756	0.38 (0.15, 0.95)	0.04	5.5 (0.02)
Social network	795	0.91 (0.77, 1.07)	0.3	2.7 (0.1)
SN x MC	758	0.86 (0.56, 1.31)	0.5	0.5 (0.5)
Sex (Women)	796	0.82 (0.61, 1.11)	0.2	2.2 (0.1)
Social class	768	0.84 (0.73, 0.96)	0.01	7.6 (0.006)
Education	758	0.70 (0.57, 0.84)	<0.001	15.3 (<0.001)

PS: perceived support, SN: social network, MC: the diagnosis of a medical condition, x: interaction.

5.3.3.2.3 Influence of the covariate factors on the association between stopping smoking at age 53 years and diagnosis of a medical condition.

A stepwise forward selection method was employed to obtain an adjusted estimate of the effect of the diagnosis of a medical condition. In the final model, the effect of the diagnosis of a medical condition was adjusted for the perceived support, interaction of perceived support and medical condition, and education factors. The addition of the social class factor in the model did not improve the fit of the model above and was excluded. The Pearson Goodness of fit chi-squared test was used to check the fit of the model and it was found that there was no evidence that the model had a poor fit (Pearson χ^2= 12.6, p= 0.3). The effect of the diagnosis of medical condition was 2.02 (95%CI: 1.32, 3.08) after adjusting for the factors mentioned (Table 5.14).

Table 5.14: Adjusted odds ratios for the association between stopping smoking at age 53 years and diagnosis of a medical condition (n = 721)

Factors	OR (95% CI)	p
Diagnosis of a medical condition	2.02 (1.32, 3.08)	0.001
Perceived support	1.04 (0.75, 1.45)	0.8
PS x MC	0.38 (0.15, 0.99)	<0.05
Education	0.67 (0.55, 0.82)	<0.001

PS: perceived support, MC: the diagnosis of a medical condition, x: interaction.

5.3.3.3 Results for the aggregated data.

5.3.3.3.1 Association between stopping smoking and stressful life events, health related life events and diagnosis of a medical condition.

The analysis was carried out using logistic regression with random effect. The results of the analysis are shown in Table 5.15. The unadjusted odds ratios in the analysis for the association between stopping smoking and, life events score and health related life events score were not found to be significant. However, a significant association was found in the analysis of the diagnosis of a medical condition. The cohort members who were diagnosed with at least one medical condition had almost twice the odds of stopping smoking compared to those who were not so diagnosed (unadjusted OR = 1.98, 95%CI: 1.31, 2.99).

Table 5.15: Unadjusted odds ratios for the association between stopping smoking and, the stressful life events, health related life events, and the diagnosis of a medical condition in the aggregated data.

	N (s) OR (95% CI)	P
Stressful life events	1748 (1152)	0.8
Life events score	0.99 (0.89, 1.10)	
Health related life events	1747 (1152)	0.6
Health related life events score	1.04 (0.90, 1.19)	
Diagnosis of a medical condition	1530 (962)	0.001
At least one medical condition	1.98 (1.31, 2.99)	

N= number of observation, s = number of subjects.

5.3.3.3.2 Influence of the covariate factors on the association between stopping smoking and diagnosis of a medical condition in the aggregated data.

The analysis did not find any association between stopping smoking and the perceived support or social network (Table 5.16). But there were significant effects of perceived support and social network on the above association. There was an interaction between the perceived support and diagnosis of a medical condition (OR = 0.36, 95%CI: 0.13, 0.97) (LRT: χ^2 = 5.3, p= 0.02) and a moderating effect of the social network (OR= 0.89, 95%CI: 0.78, 1.02) (LRT: χ^2 = 7.2, p<0.01) (See Appendix 5.2 for the effect of interaction on diagnosis of medical condition). The effects of the social class (OR = 0.79, 95% CI: 0.71, 0.88) (LRT: χ^2 = 20.4, p<0.001) and education

(OR = 0.65, 95% CI: 0.55, 0.77) (LRT: χ^2 = 32.2, p<0.001) on the association above were also significant (Table 5.16).

The adjusted odds ratio estimate of the association between stopping smoking and the diagnosis of medical a condition in the aggregated data was obtained by fitting logistic regression model that included the interaction variable between perceived support and medical condition, social network score, social class and education. There was no evidence from the examination of the relative differences in the coefficients to suggest that the fitted model was inadequate. After adjusting for the factors mentioned, the estimated odds ratio of the effect of diagnosis of a medical condition had increased to 3.0 (95% CI: 1.80, 5.01) and although it remained significant, the confidence interval had widened (Table 5.17).

Table 5.16: Unadjusted odds ratios of the potential covariate factors and the results of the LRT for the influence on the association between diagnosis of a medical condition and stopping smoking.

Factors	N	S	OR (95% CI)	p	LRTχ^2(p)
Perceived support	1744	1149	0.90 (0.71, 1.15)	0.4	1.4 (0.2)
PS x MC	1526	960	0.36 (0.13, 0.97)	0.04	5.3 (0.02)
Social network	1747	1152	0.89 (0.78, 1.02)	0.1	7.2 (<0.01)
SN x MC	1528	962	0.95 (0.62, 1.45)	0.8	0.1 (0.9)
Sex (women)	1749	1152	0.81 (0.64, 1.02)	0.1	3.1 (0.08)
Social class	1693	1113	0.79 (0.71, 0.88)	<0.001	20.4 (<0.001)
Education	1667	1091	0.65 (0.55, 0.77)	<0.001	32.2 (<0.001)

PS: perceived support, SN: social network, MC: the diagnosis of a medical condition, x: interaction,. N: number of observation, s: number of subject.

Table 5.17: Adjusted odds ratios for the association between stopping smoking and diagnosis of a medical condition in the aggregated data (observation = 1425, subject: 891).

	OR (95% (95% CI: ,))	p
Diagnosis of a medical condition	3.00 (1.80, 5.01)	<0.001
Perceived support	0.95 (0.68, 1.33)	0.8
Interaction: PS x MC	0.34 (0.11, 0.99)	<0.05
Social network	0.84 (0.71, 0.997)	<0.05
Social class	0.87 (0.75, 1.00)	0.05
Education	0.66 (0.53, 0.82)	<0.001

PS: perceived support, MC: the diagnosis of a medical condition, x: interaction.

5.4 Change in smoking behaviour: smoking relapse.

5.4.1 Descriptive results: distributions by the demographic and social support factors.

5.4.1.1 Descriptive results of the data at age 43 years.

The results of the descriptive analysis are shown in Table 5.18. For the analysis at age 43 years, it was found that there was a significant association between smoking relapse and social class ($p<0.01$). Although it was less clear in the social classes I and II, the data suggested that there is an increasing pattern in the proportion of cohort members who had relapsed in the lower social classes. No significant result was found in education and social support factors.

5.4.1.2 Descriptive results of the data at age 53 years.

The results of the analysis were similar to age 43 years. Significant association was also found between smoking relapse and social class, but with a less clear increasing pattern in the proportion who had relapsed smoking with the decline in the social class status ($p<0.01$). No significant result found was found for sex, education, or social support factors.

5.4.1.3 Descriptive results of the aggregated data.

The results were similar to those at age 43 and 53 years. A significant association was found between smoking relapse and social class and, with a less clear increasing pattern as the social class declined ($p<0.01$) (Table 5.18). No other significant association was found.

Table 5.18: Number of subjects who relapsed by the demographic and social support factors.

	Age 43 years			Age 53 years			Aggregate		
	N	**n (%)**	**p**	**N**	**n (%)**	**p**	**N**	**n (%)**	**p**
Sex (N)	1126			1163			2289		
Men	611	83 (13.6)	0.1	606	37 (6.1)	0.7	1217	120 (9.9)	0.1
Women	515	53 (10.3)		557	31 (5.6)		1072	84 (7.8)	
Social class (N)	1104			1142			2246		
I-II	543	66 (12.2)		571	35 (6.1)		1114	101 (9.1)	
III-NM	245	16 (6.5)	<0.01	234	9 (3.9)	0.4	479	25 (5.2)	<0.01
III-M	181	29 (16.0)		184	12 (6.5)		365	41 (11.2)	
IV-V	135	24 (17.8)		153	12 (7.8)		288	36 (12.5)	
Education (N)	1079			1108			2187		
A-level/university	432	44 (10.2)		443	24 (5.4)		875	68 (7.8)	
Ordinary / vocational	315	41 (13.0)	0.3	306	13 (4.3)	0.2	621	54 (8.7)	0.2
None	332	44 (13.3)		359	27 (7.5)		691	71 (10.3)	
Social support									
Perceived support (N)	1123			1163			2286		
Always	1025	122 (11.9)	0.7	1000	57 (5.7)	0.9	2025	179 (8.8)	0.7
Often	55	6 (10.9)		105	7 (6.7)		160	13 (8.1)	
None or sometimes	43	7 (16.3)		58	4 (6.9)		101	11 (10.9)	
Social network (unit) (N)	1124			1163			2287		
5	171	27 (15.8)		351	28 (8.0)		522	55 (10.5)	
4	329	41 (12.5)	0.2	558	29 (5.2)	0.1	887	70 (7.9)	0.4
3	407	46 (11.3)		178	6 (3.4)		585	52 (8.9)	
0-2	217	20 (9.2)		76	5 (6.6)		293	25 (8.5)	
Social activities (unit) (N)	1126								
6 or more	386	40 (10.4)	0.3						
1-5	340	41 (12.1)							
0	400	55 (13.8)							

5.4.2 Descriptive results: number and odds ratios of smoking relapse by the life events measures.

5.4.2.1 Results of the analysis at age 43 years.

For the analysis of the stressful life events, it was found that the pattern of the odds ratios of smoking relapse was less clear in both the life events score and emotional score. With the exception of the cohort members who had no events, the odds ratios of smoking relapse increased as the scores increased (Table 5.19). The odds ratios of relapse in cohort members were also greater in those with greater life change score.

For the analysis of the health related life events, no pattern in the odds ratios of smoking relapse was found in the health related life events score (Table 5.19). A less clear increasing pattern was found in the odds ratios of smoking relapse in the emotional score and life change score.

For the diagnosis of a medical condition, the proportion of ex-smokers at age 36 years who had relapsed at age 43 years were greater in those who were diagnosed with at least one medical condition between age 36 years and 43 years compared to those who were not diagnosed (Table 5.20).

5.4.2.2 Results of the analysis at age 53 years.

The analysis found no particular pattern in the odds ratios for the stressful life events score and health related life events score (Table 5.21). In contrast to the result at age 43 years, fewer cohort members who were diagnosed with at least one medical condition had relapsed compared to those who were not so diagnosed (Table 5.22).

Table 5.19: Number and odds ratios of smoking relapse at age 43 years by the stressful life events and health related life events.

	Stressful life events			Health related life events		
	(N), n	n (%)	Odds ratio	(N), n	n (%)	Odds ratio
Life event score	(1126)			(1126)		
None	287	32 (11.2)	1	436	52 (11.9)	1
1	333	31 (9.3)	0.82 (0.49, 1.38)	404	40 (9.9)	0.81 (0.52, 1.26)
2*	254	29 (11.4)	1.03 (0.60, 1.75)	286	44 (15.4)	1.34 (0.87, 2.07)
3 or more	252	44 (17.5)	1.69 (1.03, 2.75)			
Emotional score	(1112)			(1106)		
None	287	32 (11.2)	1	428	51 (11.9)	1
1	190	15 (7.9)	0.68 (0.36, 1.30)	203	15 (7.4)	0.59 (0.32, 1.08)
2	215	22 (10.2)	0.91 (0.51, 1.61)	225	28 (12.4)	1.05 (0.64, 1.72)
3**	218	28 (12.8)	1.17 (0.68, 2.02)	250	40 (16.0)	1.41 (0.90, 2.20)
4 or more	202	37 (18.3)	1.79 (1.07, 2.98)			
Life change scores	(1112)			(1107)		
0	287	32 (11.2)	1	427	50 (11.7)	1
1	495	53 (10.7)	0.96 (0.60, 1.52)	474	56 (11.8)	1.01 (0.67, 1.52)
2	168	23 (13.7)	1.26 (0.71, 2.24)	126	16 (12.7)	1.10 (0.60, 2.00)
3	162	25 (15.4)	1.45 (0.83, 2.55)	80	11 (13.8)	1.20 (0.60, 2.42)

**2 or more, **3 or more for health related life events measures*

Table 5.20: Number of ex-smokers who had relapsed by the age 43 years by the diagnosis of a medical condition (N = 971).

Diagnosed with medical condition	N	n (%)
No	948	114 (12.0)
Yes	23	4 (17.4)

Table 5.21: Number and odds ratios of smoking relapse at age 53 years by the stressful life events and health related life events.

	Stressful life events (N = 1163)			Health related life events (N = 1163)		
	N	n (%)	Odds ratio	N	n (%)	Odds ratio
Life event score						
None	226	10 (4.4)	1	353	20 (5.7)	1
1	321	16 (5.0)	1.13 (0.50, 2.54)	428	24 (5.6)	0.99 (0.54, 1.82)
2*	250	19 (7.6)	1.78 (0.81, 3.91)	382	24 (6.3)	1.12 (0.61, 2.06)
3 or more	366	23 (6.3)	1.45 (0.68, 3.10)			

**2 or more for health related life events.*

Table 5.22: Number of ex-smokers who had relapsed by the age 53 years by the diagnosis of a medical condition. (N = 1090).

Diagnosed with medical condition	N	n (%)
No	901	56 (6.2)
Yes	189	6 (3.2)

5.4.2.3 Results of the analysis of the aggregated data.

The analysis found that the odds ratios of smoking relapse in the life events score did not show a clear increasing pattern (Table 5.23). There was no pattern in the health related life events score. For the diagnosis of a medical condition, the result was consistent with that at age 53 years. The proportion of cohort members who were diagnosed with at least one medical condition and had relapsed smoking were smaller compared to subjects who were not so diagnosed.

Table 5.23: Number and odds ratio of smoking relapse by the life events score and health life events score and, number of cohort members who had relapsed smoking by the diagnosis of a medical condition; in the aggregated data.

	N	n (%)	Odds ratio
Stressful life events.			
Life event score (N=2289)			
None	513	42 (8.2)	1
1	654	47 (7.2)	0.87 (0.56, 1.34)
2	504	48 (9.5)	1.18 (0.77, 1.82)
3 or more	618	67 (10.8)	1.36 (0.91, 2.04)
Health related life events.			
Health life event score (N=2289)			
None	789	72 (9.1)	1
1	832	64 (7.7)	0.83 (0.58, 1.18)
2 or more	668	68 (10.2)	1.13 (0.80, 1.60)
Diagnosis of a medical condition (N= 2061)			
No	1849	170 (9.2)	-
Yes	212	10 (4.7)	

5.4.3 Association between smoking relapse and life stress.

5.4.3.1 The results at age 43 years.

5.4.3.1.1 Association between smoking relapse and stressful life events.

The analysis found two statistically significant associations for the stressful life events measures in the analysis of smoking relapse (Table 5.24). The odds ratios for the associations were 1.22 (95% CI: 1.03, 1.43) for the life events score and 1.18, (95% CI: 1.04, 1.33) for the emotional changes. There was no association found between smoking relapse at age 43 years and the life change score.

Table 5.24: Unadjusted odds ratios for the association between smoking relapse at age 43 years and stressful life events.

Stressful life events	N	Unadjusted OR (95% CI)	p
Life events score	1126	1.22 (1.03, 1.43)	0.02
Emotional score	1112	1.18 (1.04, 1.33)	0.01
Life change score	1107	1.16 (0.96, 1.38)	0.1

5.4.3.1.2 Association between smoking relapse and health related life events.

In the analysis of the health related life events no significant association was found between smoking relapse and the health related life events score, emotional score, and life change score (Table 5.25). Although the results consistently showed that the odds of relapse increased linearly with the increase in the level of exposure to the health related life event measures, they were however not statistically significant at the 5% significance level.

Table 5.25: Unadjusted odds ratios for the association between smoking relapse at age 43 years and health related life events.

Health related life events	N	Unadjusted OR (95% CI)	p
Life events score	1126	1.14 (0.91, 1.43)	0.2
Emotional score	1114	1.13 (0.97, 1.31)	0.1
Life change score	1116	1.06 (0.86, 1.29)	0.6

5.4.3.1.3 Association between smoking relapse and diagnosis of a medical condition.

The analysis showed that the odds of smoking relapse was greater in the cohort members who were diagnosed with at least one medical condition but, the odds ratio for the association was not significant (Table 5.26).

Table 5.26: Unadjusted odds ratios for the association between smoking relapse at age 43 years and diagnosis of a medical condition (n=971).

Diagnosis of a medical condition	Unadjusted OR (95% CI)	P
No	1	0.4
Yes	1.54 (0.51, 4.61)	

5.4.3.1.4 Association between smoking relapse at age 43 years and the covariate factors.

In the analysis of the association between smoking relapse and the social support factors, the only statistically significant association found was between the social network and life events score (Table 5.27). The lower the level of relationship with family and friends the lower the odds of relapse (OR= 0.83, 95%CI: 0.69, 1.00). The analysis found no relationship between smoking relapse and the demographic factors.

5.4.3.1.5 Influence of the covariate factors in the association between smoking relapse at age 43 years and *life events score*.

The results of the likelihood ratio test analysis of the influence of the potential factors on the association are presented in Table 5.28. The analysis showed no evidence of an influence of perceived support, social network, and social activity in the association. There was also no evidence for the moderating effects of sex, social class, and education. Hence, no adjusted estimate was obtained for the association. The data were found to have adequate fit to the model (Pearson χ^2 GOF = 3.6, p=0.2). The unadjusted OR of the association was 1.22, 95% CI: 1.03, 1.43 (Table 5.24).

Table 5.27: Unadjusted odds ratios of the potential covariate factors.

Factors	N	OR (95% CI)	p
Perceived support	1123	1.14 (0.77, 1.68)	0.5
PS x LES	1123	1.22 (1.04, 1.44)	0.6
PS x ES	1109	0.93 (0.72, 1.20)	0.6
Social network	1124	0.83 (0.69, 1.00)	<0.05
SN x LES	1124	1.12 (0.95, 1.33)	0.2
SN x ES	1110	1.10 (0.96, 1.26)	0.2
Social participation	1126	1.17 (0.95, 1.46)	0.1
SP x LES	1126	0.94 (0.77, 1.15)	0.6
SA x ES	1112	1.01 (0.93, 1.11)	0.8
Sex (Women)	1126	0.73 (0.51, 1.05)	0.1
Social class	1104	1.17 (0.996, 1.38)	0.1
Education	1079	0.86 (0.69, 1.07)	0.2

PS: perceived support, SN: social network, SP: social participation, LES: life events score, ES: emotional score, x: interaction.

Table 5.28: LRT for the influence of potential covariate factors on the association between smoking relapse at age 43 years and life events score.

Factors	N	LRT χ^2(p)
Perceived support	1123	0.3 (0.6)
PS x LES	1123	0.3 (0.6)
Social network	1124	3.7 (0.05)
SN x LES	1124	0.4 (0.6)
Social participation	1126	2.7 (0.10)
SP x LES	1126	1.8 (0.2)
Sex	1126	3.2 (0.07)
Social class	1104	2.9 (0.08)
Education	1079	1.7 (0.2)

PS: perceived support, SN: social network, SP: social participation, LES: life events score, ES: emotional score, x: interaction.

5.4.3.1.6 Influence of the covariate factors in the association between smoking relapse at age 43 years and *emotional score*.

The results for the analysis of the influence of the social support factors showed that the social network score had a significant effect on the association (LRT, χ^2= 4.4, p= 0.04) (Table 5.29). The perceived support and social activity were found not to have any effect in the association. There was also no effect of the demographic factors. The final estimate for the association had included only the social network factor in the logistic regression model (Pearson χ^2 GOF = 21.2, p = 0.3). There was no change in the adjusted odds ratio (OR= 1.18, 95%CI: 1.04, 1.34) compared to the unadjusted odds ratio (Table 5.30).

Table 5.29: LRT for the effects of potential covariate factors on the association between smoking relapse at age 43 years and the emotional score.

Factors	N	LRT χ^2(p)
Perceived support	1123	0.02 (0.9)
PS x ES	1123	0.3 (0.6)
Social network	1124	4.4 (0.04)
SN x ES	1124	2.0 (0.2)
Social activity	1112	2.1 (0.2)
SA x ES	1112	0.8 (0.4)
Sex	1126	3.7 (0.06)
Social class	1104	3.3 (0.07)
Education	1079	1.3 (0.3)

PS: perceived support, SN: social network, SA: social participation, ES: emotional score, x: interaction.

Table 5.30: Adjusted odds ratios for the association between smoking relapse at age 43 years and emotional score (N=1110).

Factors	OR (95% CI)	p
Emotional score	1.18 (1.04, 1.34)	<0.01
Social network	0.82 (0.68, 0.99)	0.04

5.4.3.2 Results at age 53 years.

5.4.3.2.1 Association between stressful life events, health related life events, and diagnosis of a medical condition and, smoking relapse.

The analysis at age 53 years found that there was no association between smoking relapse and the life event score (Table 5.31). There was also no association found in the analysis of the health related life events (Table 5.31). For the analysis of the diagnosis of a medical condition, it was found that the cohort members who were diagnosed had lower odds of relapse compared to age 43 years but the odds ratio was not significant (Table 5.31).

Table 5.31: Unadjusted odds ratios for the association between smoking relapse at age 53 years and diagnosis of a medical condition.

	N	OR (95% CI)	p
Stressful life events	1163		
Life events score		1.15 (0.92, 1.43)	0.2
Health related life events	1163		
Health related life events score		1.06 (0.78, 1.44)	0.7
Diagnosed with medical condition			
No	1090	1	0.1
Yes		0.49 (0.21, 1.17)	

No further analysis at age 53 years was performed because no significant result was found.

5.4.3.3 Results for the aggregated data.

5.4.3.3.1 Association between stressful life events, health related life events, and diagnosis of a medical condition and, smoking relapse in the aggregated data.

The result of the analysis of the aggregated data showed that smoking relapse was associated with the life events score (Table 5.32). It was found that one level increase in the life events score higher corresponded to 15% greater odds of relapsing in the ex-smoker (OR= 1.15, 95%CI: 1.00, 1.31). There was no significant association between relapse and health related life events (Table 5.32). The result of the analysis of the aggregated data showed that smoking relapse was associated with the diagnosis of a medical condition. Ex-smokers who were diagnosed with at least one medical condition had 52% lower odds of relapsing compared to those who were not diagnosed (OR= 0.48, 95%CI: 0.25, 0.94) (Table 5.32).

Table 5.32: Unadjusted odds ratios for the association between smoking relapse and life circumstances in the aggregated data.

	N	s	OR (95% CI)	p
Stressful life events	2289	1404	1.15 (1.00, 1.31)	0.04
Health related life events	2289	1404	1.06 (0.88, 1.28)	0.5
Medical condition	2061	1227	0.48 (0.25, 0.94)	0.03

N= number of observation, s = number of subjects.

Further analysis of the influence of social support factors were carried out for the effect of stressful life events and the diagnosis of a medical condition only.

5.4.3.3.2 Relationship between smoking relapse and the covariate factors.

Logistic regression analysis of the relationship of smoking relapse and the social support and demographic factors did not find any significant results (Table 5.33). The cohort members with lower social support had greater odds of relapsing but the odds ratio were not significant. The odds ratio for the sex, social class, and education were also not statistically significant.

Table 5.33: Odds ratios for the relationship of smoking relapse and, the social support and demographic factors in the aggregated data.

Factors	N	n	OR (95% CI)	p
Perceived support	2286	1402	1.07 (0.79, 1.45)	0.7
PS x LES	2286	1402	1.08 (0.82, 1.41)	0.6
Social network	2287	1402	0.94 (0.80, 1.10)	0.4
SN x LES	2287	1402	1.09 (0.95, 1.25)	0.2
Sex (Women)	2289	1404	0.77 (0.57, 1.04)	0.09
Social class	2246	1376	1.13 (0.99, 1.30)	0.06
Education	2187	1334	1.17 (0.98, 1.40)	0.09

PS: perceived support, SN: social network, LES: life events score, x: interaction.

5.4.3.3.3 Influence of the covariate factors on the association between smoking relapse and stressful life events in the aggregated data.

The results of the analysis, as shown in Table 5.34, showed no evidence of the effect of the perceived support and social network on the association. There was also no significant effect of sex, social class, and education. Hence, no analysis to obtain the adjusted estimate of the association was performed. The analysis of the relative difference in the parameter estimates for the unadjusted model of the association showed that there was no evidence of inadequate fit. The unadjusted estimate OR for the association between smoking relapse and life events score was 1.15 (95%CI: 1.00, 1.31) ($p<0.05$) (Table 5.32).

Table 5.34: LRT for the influence of potential covariate factors on the association between smoking relapse and the life events score in the aggregated data.

Factors	Number of observation	Number of subjects	LRTχ^2(p)
Perceived support	2286	1402	0.2 (0.7)
PS x LES	2286	1402	0.3 (0.6)
Social network	2287	1402	0.4 (0.5)
SN x LES	2287	1402	1.6 (0.2)
Sex (Women)	2289	1404	3.3 (0.07)
Social class	2246	1376	3.6 (0.06)
Education	2187	1334	2.9 (0.09)

PS: perceived support, SN: social network, LES: life events score, x: interaction.

5.4.3.3.4 Influence of the covariate factors on the association between smoking relapse and diagnosis of medical condition in the aggregated data.

The results of the likelihood ratio test for the effects of the social support factors are presented in Table 5.35. The perceived support and social network were found to have no statistically significant effect in the association. There was also no effect of the sex, social class, and education factors in the association. No analysis was performed to obtain the adjusted OR of the association. The unadjusted odds ratio of the association was 0.48 (95%CI: 0.25, 0.94) (Table 5.31).

Table 5.35: LRT for the influence of potential covariate factors on the association between smoking relapse and diagnosis of medical condition in the aggregated data.

Factors	Number of observation	Number of subjects	LRTχ^2(p)
Perceived support	2059	1226	0.3 (0.6)
PS x MC	2059	1226	0.4 (0.5)
Social network	2059	1225	0.6 (0.4)
SN x MC	2059	1225	0.5 (0.5)
Sex (Women)	2061	1227	2.4 (0.1)
Social class	2029	1207	2.7 (0.1)
Education	1975	1170	2.4 (0.1)

PS: perceived support, SN: social network, MC: the diagnosis of a medical condition, x: interaction.

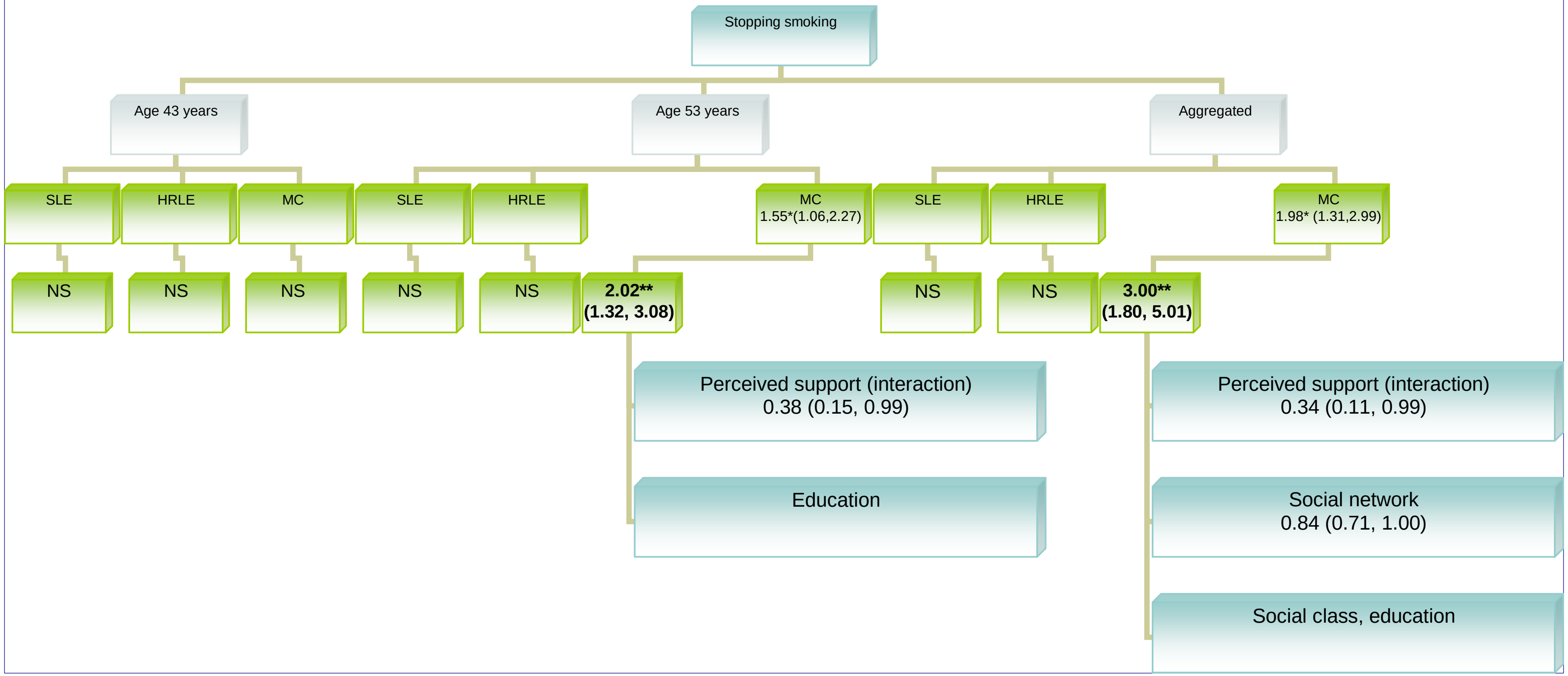
5.5 Summary of results.

The main objective of this chapter was to examine the association between smoking change and three kinds of life circumstances; the stressful life events, health related life events, and the diagnosis of a medical condition. Figures 5.2 and 5.3 summarised the findings from the analysis. The analysis of the NSHD data did not find significant association between stopping smoking and, stressful life events and health related life events. For the diagnosis of a medical condition, the analysis found a consistent and healthy effect on smoking change. The analysis showed that the odds of *stopping smoking* at age 53 years were more than twice as great in the cohort members who were current smokers at age 43 years and diagnosed with at least one medical condition between age 43 and 53 years compared to those who were not diagnosed (adjusted OR= 2.02, 95%CI: 1.32, 3.08). The result was consistent in the aggregated data, where it was found that the odds ratio for the association between stopping smoking and the diagnosis of a medical condition increased to 3.00 (95% CI: 1.80, 5.01) after adjusting for the effect of the social support and demographic factors compared to the unadjusted odds ratio (1.98, 95% CI: 1.31, 2.99). However, the confidence interval for the adjusted OR was wide, hence it should be interpreted with caution.

The analysis found that there was an association between the stressful life events and smoking relapse. Statistically significant odds ratios were found in the analysis at age 43 years (life events score and emotional score) and in the aggregated data (life events score). The odds of smoking relapse at age 43 years among the cohort members who were the current smokers at age 36 years increased by 22% for one level of increase in the life events score (OR= 1.22, 95%CI: 1.03, 1.43) and 18% for one level of increase in the emotional score (OR= 1.18, 95%CI: 1.04, 1.34). The aggregate effect of stressful life events (life events score) when both the data at age 43 and 53 years were combined was slightly smaller but still significant (OR= 1.15, 95%CI: 1.00, 1.31). The analysis did not find any evidence for the association between health related life events and smoking relapse. The analysis did find that the diagnosis of a medical condition has a protective effect of smoking relapse. The analysis of the aggregated data showed that the ex-smokers in the NSHD had less odds of relapse after they were diagnosed with a medical condition (unadjusted OR= 0.48, 95%CI: 0.25, 0.94).

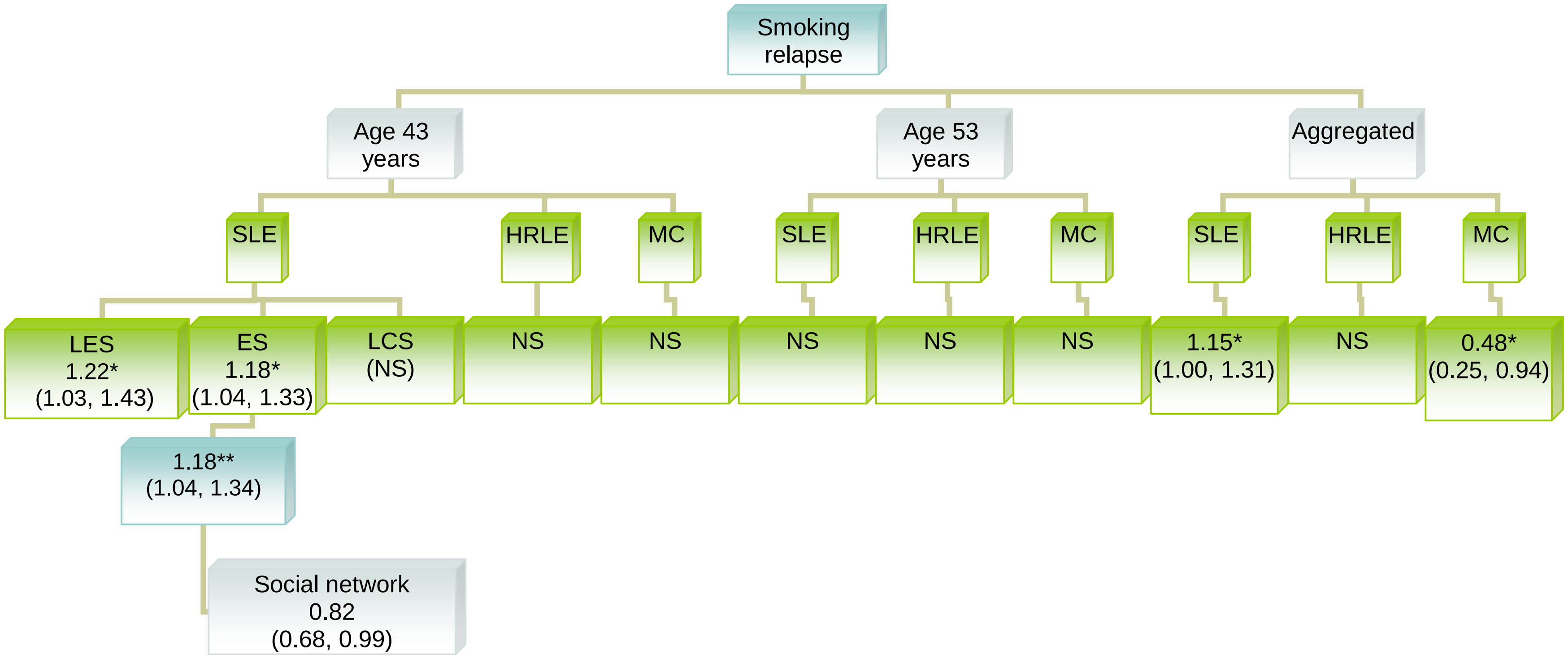
There were also a statistically significant influence of social support factors on smoking change. There were interactions between the perceived support and diagnosis of a medical condition in the analysis at age 53 years and the aggregated data. In the smokers who were diagnosed with at least one medical condition, there was 62% reduction in the odds of stopping smoking at age 53 years in those with one level of decrease in their perceived support (adjusted OR for the interaction = 0.38, 95%CI: 0.15, 0.99). A slightly greater effect of perceived support was found in the aggregated data (OR= 0.34, 95%CI: 0.11, 0.99). The social network factor was found to moderate the effect of the stressful life events at age 53 years and diagnosis of a medical condition in the aggregated data. In the association between smoking relapse and emotional score, the ex-smoker at age 36 years with a lower degree of relationship with the family and friends were found to be less likely to relapse at age 43 years (OR= 0.82, 95%CI: 0.68, 0.99). In the analysis of stopping smoking and the diagnosis of a medical condition, the odds of stopping was lesser in those with a lower degree of relationship with the family and friends (OR of the aggregated data = 0.84, 95%CI: 0.71, 1.00).

Figure 5.2: Summary of results of the analysis of the association between stopping smoking and life stress measures at age 43 and 53 years, and the aggregated data.



**unadjusted odds ratio and 95% CI, **adjusted odds ratio (95%CI).*
See abbreviation on page 22.

Figure 5.3: Summary of results of the analysis of the association between smoking relapse and life stress measures at age 43 and 53 years, and the aggregated data.



**unadjusted odds ratio and 95% CI, **adjusted odds ratio and (95%CI).*
See abbreviation on page 22.

CHAPTER 6

Alcohol behaviour.

6.1 Introduction.

This chapter presents the results of the analysis of the association between change in alcohol behaviour and stressful life events, health related life events, and the diagnosis of a medical condition. As explained earlier in section 3.4.3.2, there was neither an analysis at age 43 years nor of the aggregated data. The analysis was only carried out on the data at age 53 years and only the adverse changes in drinking behaviour. There were two outcome measures for these changes: an increased risk of being classified as having an alcohol problem at age 53 years, which was based on the change in the CAGE score, and increased alcohol consumption at age 53 years, which was the change in the amount of alcohol drunk in the past 7 days before the interview based on the cut-off of the sensible drinking recommendations of the Department of Health (1995). The details were described in Section 3.4.3.2. The specific objectives of the analyses in this chapter were;

1) To examine the distribution and odds of change in drinking behaviour,

2) To assess whether there is any evidence of a linear trend in the odds of change in drinking behaviour for the effects of stressful life events and health related life events and, to compare the odds of change in drinking behaviour in the cohort members who were diagnosed with at least one medical condition to those who were not diagnosed, using logistic regression analysis;

3) To assess whether the social support factors moderated or modified the association found in (2) above using the likelihood ratio test, and

4) To obtain an adjusted estimate of the association in (2) above using stepwise forward selection method.

Preliminary analysis was carried out and it was found that there was no interaction between the sex and the life events score, health related life events score, and the diagnosis of a medical condition. Hence, the following analysis has included both sexes.

6.2 Descriptive results.

6.2.1 The sample.

The sample for the analysis of increased risk of having an alcohol problem was derived from the cohort members who had participated in both the surveys at age 43 and 53 years and at each survey, responded to at least one of the 4 CAGE questions (n = 2556) (Figure 6.1). From this, there were 2342 (91.6%) observations available for the analysis of increased risk of being classified as having an alcohol problem.

The data for the analysis of change in alcohol consumption was derived from the information on the amount of alcoholic beverage consumed in the past 7 days before the interview at ages 43 and 53 years. From the 2807 cohort members who participated in both surveys at age 43 and 53 years, 2552 (90.9%) observations were available; of which 2345 (91.9%) observations were used in the analysis of increased alcohol consumption (Figure 6.2).

Figure 6.1: The sample for the analysis of an increased risk of being classified as having an alcohol problem at age 53 years.

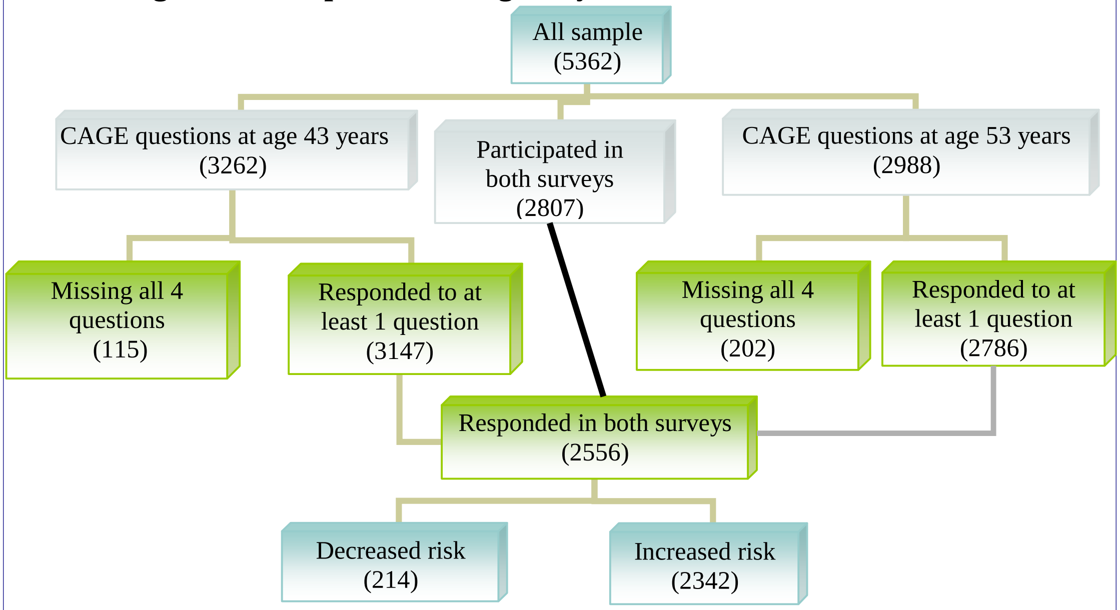
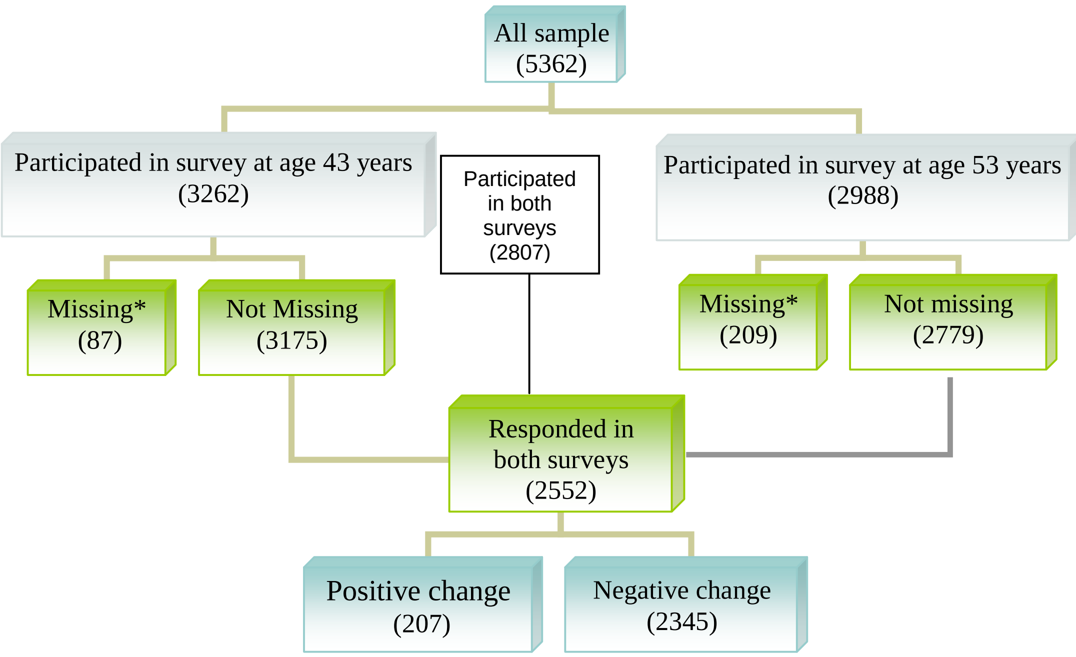


Figure 6.2: The sample for the analysis of increased alcohol consumption at age 53 years.



*missing all 3 categories of alcoholic beverages.

6.2.2 Missing data.

There were 115 (3.5%) and 202 (6.8%) cohort members who failed to respond to at least one of the CAGE questions at age 43 years and 53 years respectively. Among the cohort members who participated in both the surveys, 251 (8.9%) were excluded due to missing data at either one or both of the surveys. The analysis found that the missing data was significantly greater in; women than the men ($p<0.001$), the lower social classes than the higher social classes ($p<0.001$), and the less educated than the better educated ($p<0.001$) (Table 6.1). The increasing trend of the missing data as the social class and education level decreased was also significant ($p<0.01$).

For the analysis of the amount of alcohol consumed there were 87 (2.7%) and 209 (7.0%) cohort members who failed to respond to at least 1 of the 3 categories of alcoholic beverages consumed. There were 255 (9.1%) members who had missing information at either age 43 years, 53 years, or both. The missing data was found to be statistically significantly associated with sex, social class, and education. The missing data were greater in women than the men ($p<0.001$), the lower social classes than the higher social classes ($p<0.001$), and the less educated than the better educated ($p<0.001$). There was significant increasing trend found in the cohort members who had increased alcohol consumption as the social class and education level decreased ($p<0.01$).

Table 6.1: Number of missing data at age 53 years by the demographic factors.

	Increased risk of having a drinking problem			Increased alcohol consumption		
	Total	**n (%)**	**p**	**Total**	**n (%)**	**p**
Sex (N)	2807	251		2807	255	
Men	1366	91 (6.7)	<0.001	1366	96 (7.0)	<0.001
Women	1441	160 (11.1)		1441	159 (11.0)	
Social class (N)	2721	223		2721	225	
I-II	1195	66 (5.5)	<0.001	1195	68 (5.7)	<0.001
III-NM	620	61 (9.8)		620	60 (9.7)	
III-M	485	41 (8.5)		485	40 (8.3)	
IV-V	421	55 (13.1)		421	57 (13.5)	
Education (N)	2661	231		2661	233	
A level/University	958	51 (5.3)	<0.001	958	47 (4.9)	<0.001
O level/ Vocational	747	63 (8.3)		747	63 (8.4)	
No education	956	117 (12.2)		956	123 (12.9)	

6.2.3 Drinking behaviour at age 43 and 53 years.

The distribution of the cohort members by the CAGE score was presented in section 4.4.2. Based on the score, the cohort members were categorised into having low (score < 2) or high (score ≥ 2) risk of having an alcohol problem. The proportions of cohort members who were at high risk of having an alcohol problem were small - 265 (8.4%) at age 43 years and 218 (7.8%) at age 53 years. Because of the small number of observation at age 43 years, the analysis of change from a high to low risk of having an alcohol problem was not carried out. There were 2882 (91.6%) cohort members who were at low risk of having an alcohol problem at age 43 years and 2568 (92.2%) members at age 53 years (Table 6.2). All of the observations at age 43 years were used in the analysis of change in risk of having an alcohol problem.

The distribution of the cohort members by the amount of alcohol consumed was presented in section 4.4.2. For the analysis of change in the drinking behaviour, the cohort members were grouped into two categories based on the sensible drinking recommendations of the Department of Health (1995). Based on the maximum cut-off limit, the data showed that the majority of the cohort members drank alcohol within the recommended limit (7 days average: 4 units or less per day for the men and 3 units or less per day for the women) (2549 at age 43 years and 2240 at age 53 years) and a smaller number drank over the limit (7 days average: more than 4 units per day for the men and more than 3 units per day for the women) (626 at age 43 years and 539 at age 53 years) at both waves (Table 6.3). There was also no analysis for the change in drinking behaviour from over to within the recommended limit because of the small number of observation at age 43 years.

Table 6.2: Number of subjects with low and high risk of having a drinking problem.

Risk of having an alcohol problem	Age 43 years (n = 3147) n (%)	Age 53 years (n = 2786) n (%)
Low	2882 (91.6)	2568 (92.2)
High	265 (8.4)	218 (7.8)

Table 6.3: Number of subjects who drunk within and over the recommended limit.

Alcohol consumption	Age 43 years (n = 3175) n (%)	Age 53 years (n = 2779) n (%)
Drank within limit	2549 (80.3)	2240 (80.6)
Drank over than limit	626 (19.7)	539 (19.4)

6.2.4 Change in drinking behaviour.

The descriptive analysis found that there were 114 (4.9%) cohort members who had changed their drinking behaviour from being classified as low risk at age 43 years to high risk of having an alcohol problem at age 53 years (Table 6.4). In the analysis of change in alcohol consumption, 213 (10.4%) of the cohort members who drank within the recommendation limit at age 43 years had increased their drinking to over the recommended level at age 53 years (Table 6.4).

Table 6.4: Number of subjects and changes in drinking behaviour.

	N	n (%)
Change in the risk of having drinking problems.		
Increased risk of having an alcohol problem	2342	114 (4.9)
Change in alcohol consumption.		
Increased alcohol consumption	2046	213 (10.4)

6.3 Change in drinking behaviour: increased risk of having an alcohol problem.

6.3.1 Descriptive results: distributions by the demographic and social support factors.

The analysis found that there were significantly more men than women who had an increased risk of having an alcohol problem at age 53 years ($p<0.001$) (Table 6.5). There was no association found between increased risk of having an alcohol problem and social class and educational level. The data also showed that more of the cohort members with an increased risk were those who had lower perceived support and lower degree of relationship with the family and friends; but the relationship was not statistically significant.

6.3.2 Descriptive results – number and odds ratios of increased risk of having an alcohol problem.

The examination of the descriptive results showed that the odds ratio of increased risk of having an alcohol problem at age 53 years increased as the stressful life event experience increase (Table 6.6). There was a less clear increasing pattern in the odds ratio of the health related life events. For the diagnosis of a medical condition, the was slightly greater proportion of cohort members who were diagnosed with at least one medical condition between ages 43 and 53 years were compared to those who were not diagnosed.

Table 6.5: Numbers of subjects who had negative change in drinking habit at age 53 years by demographic and social support factors.

Demographic factors	Increased risk of having an alcohol problem N	n (%)	p
Sex (N)	2342		
Men	1134	74 (6.5)	<0.001
Women	1208	40 (3.3)	
Social class (N)	2289		
I-II	1026	57 (5.6)	
III-NM	534	23 (4.3)	0.5
III-M	395	21 (5.3)	
IV-V	334	13 (3.9)	
Education (N)	2232		
A-level/university	821	42 (5.1)	0.6
Ordinary / vocational	635	26 (4.1)	
None	776	39 (5.0)	
Perceived support (N)	2341		
Always	2050	95 (4.6)	0.2
Often	168	9 (5.4)	
None or sometimes	123	10 (8.1)	
Social network (N)	2341		
5	756	32 (4.2)	
4	1022	50 (4.9)	0.4
3	404	20 (5.0)	
0-2	159	12 (7.6)	

Table 6.6: Number and odds ratios of increased risk of having an alcohol problem by the stressful life events and health related life events scores and, number who had increased risk by the diagnosis of a medical condition.

	N	n (%)	Odds
Stressful life events.			
Life event score *(N)*	2342		
None	487	17 (3.5)	1
1	646	28 (4.3)	1.25 (0.68, 2.32)
2	483	24 (5.0)	1.45 (0.77, 2.73)
3 or more	726	45 (6.2)	1.83 (1.03, 3.23)
Health related life events.			
Life event score *(N)*	2342		
None	742	32 (4.3)	1
1	845	41 (4.9)	1.13 (0.70, 1.82)
2 or more	755	41 (5.4)	1.27 (0.79, 2.05)
Diagnosis of medical condition (N)	2222		
No	1862	85 (4.6)	-
Yes	360	25 (6.9)	

6.3.3 Association between increased risk of having an alcohol problem and life stress.

6.3.3.1 Association between increased risk of having an alcohol problem and stressful life events.

The logistic regression analysis found a statistically significant association between increased risks of having an alcohol problem at age 53 years and stressful life events. There was a 22% increase in the odds of the increased risk for each level of increase in the life events score (OR = 1.22, 95%CI: 1.03, 1.44) (Table 6.7).

6.3.3.2 Association between increased risk of having an alcohol problem and health related life events.

The analysis found no statistically significant association between health related life event score and increased risk of having an alcohol problem at age 53 years. Although the analysis showed that the odds increased with the increase in the health related life events score, the odds ratio was not statistically significant (Table 6.7).

6.3.3.3 Association between increased risk of having an alcohol problem and diagnosis of a medical condition.

The analysis found that the odds of an increased risk of having drinking problems were greater in the cohort members who were diagnosed with at least one medical condition compared to those who were not, but the odds ratio for the association was not significant (Table 6.7).

Table 6.7: Odds ratios of the association between increased risk of having an alcohol problem and stressful life events, health related life events, and diagnosis of a medical condition.

	N	Unadjusted OR (95% CI)	p
Stressful life events.			
Life events score	2342	1.22 (1.03, 1.44)	0.03
Health related life events			
Life events score	2342	1.14 (0.90, 1.45)	0.3
Diagnosis of medical condition			
No	2222	1	0.06
Yes		1.56 (0.98, 2.47)	

6.3.3.4 Relationships between an increase in the risk of having an alcohol problem and covariate factors.

The results of the logistic regression analysis for the association are presented in Table 6.8. There was no association found, from the analysis, between increased risk of having an alcohol problem at age 53 years and, the perceived support and social network factors. For the demographic factors, an association was found with sex. The data showed that the women in the NSHD study were 51% less likely to have an increased risk of having an alcohol problem than the men (OR = 0.49, 95%CI: 0.33, 0.73). Social class and education were found to be not associated with the increased risk.

Table 6.8: Unadjusted odds ratios of the potential covariate factors.

	N	Unadjusted OR (95% CI)	p
Perceived support	2341	1.31 (0.96, 1.81)	0.09
Social network	2341	1.17 (0.95, 1.44)	0.1
Sex (Women)	2342	0.49 (0.33, 0.73)	<0.001
Social class	2289	1.01 (0.85, 1.20)	0.9
Education	2232	0.99 (0.79, 1.24)	0.9

6.3.3.5 Influence of covariate factors on the association between an increase in the risk of having an alcohol problem at age 53 years and stressful life events.

The likelihood ratio test found no evidence for the influence of the perceived support and social relationship factors in the association (Table 6.9). Sex was found to be a significant factor in the association (LRTχ^2 = 14.3, p<0.001), but social class and education were not. The final logistic regression model to estimate the effect of life events score was adjusted for sex only. There was no evidence to show that the fit of the model was inadequate (Pearson goodness of fit χ^2 = 1.2, p > 0.9). The adjusted odds ratio for the effect of life events score after adjusting for sex had increased slightly (OR = 1.24, 95% CI: 1.05, 1.48) compared to the unadjusted odds ratio (Table 6.10).

Table 6.9: LRT for the effects of the potential covariate factors in the association between increased risk of having drinking problems and life events score.

Factors	N	**LRT χ^2(p)**
Perceived support	2341	2.1 (0.1)
PS x LES	2341	2.1 (0.3)
Social network	2341	2.8 (0.1)
SN x LES	2341	3.0 (0.2)
Sex (Women)	2342	14.3 (<0.001)
Social class	2289	0.03 (0.9)
Education	2232	0.01 (0.9)

PS: perceived support, LES: life events score, SN: social network, x: interaction.

Table 6.10: Adjusted OR of the association between increased risk of having a drinking problem and life events score.

	N	**Adjusted OR (95% CI)**	**p**
Life events score	2342	1.24 (1.05, 1.48)	0.01
Sex		0.48 (0.32, 0.71)	<0.001

6.4 Change in the drinking behaviour: an increase in alcohol consumption.

6.4.1 Descriptive results: distributions by the demographic and social support factors.

The results of the descriptive analysis are presented in Table 6.11. The analysis found a statistically significant association between increased alcohol consumption and sex, social class, and education. There were more men than the women, more cohort members from higher social classes than the lower social classes, and better educated members than the lesser educated who had increased alcohol consumption at age 53 years ($p < 0.001$). Significant declining trend in the proportion were also found in the social class and education ($p<0.01$). No association was found between increased alcohol consumption and, the perceived support and social network factors.

Table 6.11: Numbers of subjects who had an increase in alcohol consumption at age 53 years by demographic and social support factors.

Demographic factors	**Increased alcohol consumption**		
	N	**n (%)**	**p**
Sex (N)	(2046)		
Men	846	149 (17.6)	<0.001
Women	1200	64 (5.3)	
Social class (N)	(1994)		
I-II	878	133 (15.2)	
III-NM	493	30 (6.1)	<0.001
III-M	312	32 (10.3)	
IV-V	311	14 (4.5)	
Education (N)	(1950)		
A-level/university	706	107 (15.2)	<0.001
Ordinary / vocational	565	51 (9.0)	
None	679	49 (7.2)	
Perceived support (N)	(2045)		
Always	1785	192 (10.8)	0.2
Often	145	15 (10.3)	
None or sometimes	115	6 (5.2)	
Social network (N)	(2045)		
5	645	65 (10.1)	
4	926	107 (11.6)	0.4
3	334	28 (8.4)	
0-2	140	13 (9.3)	

6.4.2 Descriptive results: number and odds ratio of increased alcohol consumption by the stressful life events measures.

No particular pattern in the odds ratio of increased consumption at age 53 years was found in the analysis of the life events score and health related life events score (Table 6.12). The proportion of cohort members who had increased their consumption at age 53 years was found to be lesser in cohort members who were diagnosed with at least one medical condition compared to subjects who were not diagnosed.

Table 6.12: Number and odds ratios of increased alcohol consumption by the stressful life events and health related life events scores and, number who had increased consumption by the diagnosis of a medical condition.

	N	n (%)	Odds ratio
Stressful life events.			
Life event score *(N)*	(2046)		
None	416	39 (9.4)	1
1	570	51 (8.9)	0.95 (0.61, 1.47)
2	413	49 (11.9)	1.30 (0.83, 2.03)
3 or more	647	74 (11.4)	1.25 (0.83, 1.88)
Health related life events.			
Life event score *(N)*	(2046)		
None	646	64 (9.9)	1
1	736	74 (10.1)	1.02 (0.71, 1.45)
2 or more	664	75 (11.3)	1.16 (0.81, 1.65)
Diagnosis of medical condition (N)	(1944)		
No	1631	172 (12.6)	-
Yes	313	31 (9.9)	

6.4.3 Association between an increase in alcohol consumption and life stress.

6.4.3.1 Association between an increase in alcohol consumption and stressful life events.

The analysis found no statistically significant association between increased consumption at age 53 years and the life events score. The result showed that there was a consistent increase in the odds with an increase in the score but the odds ratio was not significant (Table 6.13).

6.4.3.2 Association between an increase in alcohol consumption and health related life events.

The analysis also found no association between increased alcohol consumption and the health related life events score (Table 6.13).

6.4.3.3 Association between an increase in alcohol consumption and diagnosis of medical condition.

There was no association found in the analysis of the diagnosis of a medical condition. The result of the analysis showed that the odds of increased alcohol consumption were less in the cohort members who were diagnosed with at least one medical condition compared to those who were not diagnosed (Table 6.13).

Table 6.13: Odds ratios of the association between an increase in alcohol consumption and life events score, health related life events, and diagnosis of a medical condition.

	N	Unadjusted OR (95% CI)	p
Stressful life events			
Life events score	2046	1.10 (0.97, 1.25)	0.1
Health related life events			
Life events score	2046	1.08 (0.90, 1.29)	0.4
Diagnosis of medical condition			
No	1944	1	0.7
Yes		0.93 (0.62, 1.40)	

No further analysis was performed for the association because there was no significant result.

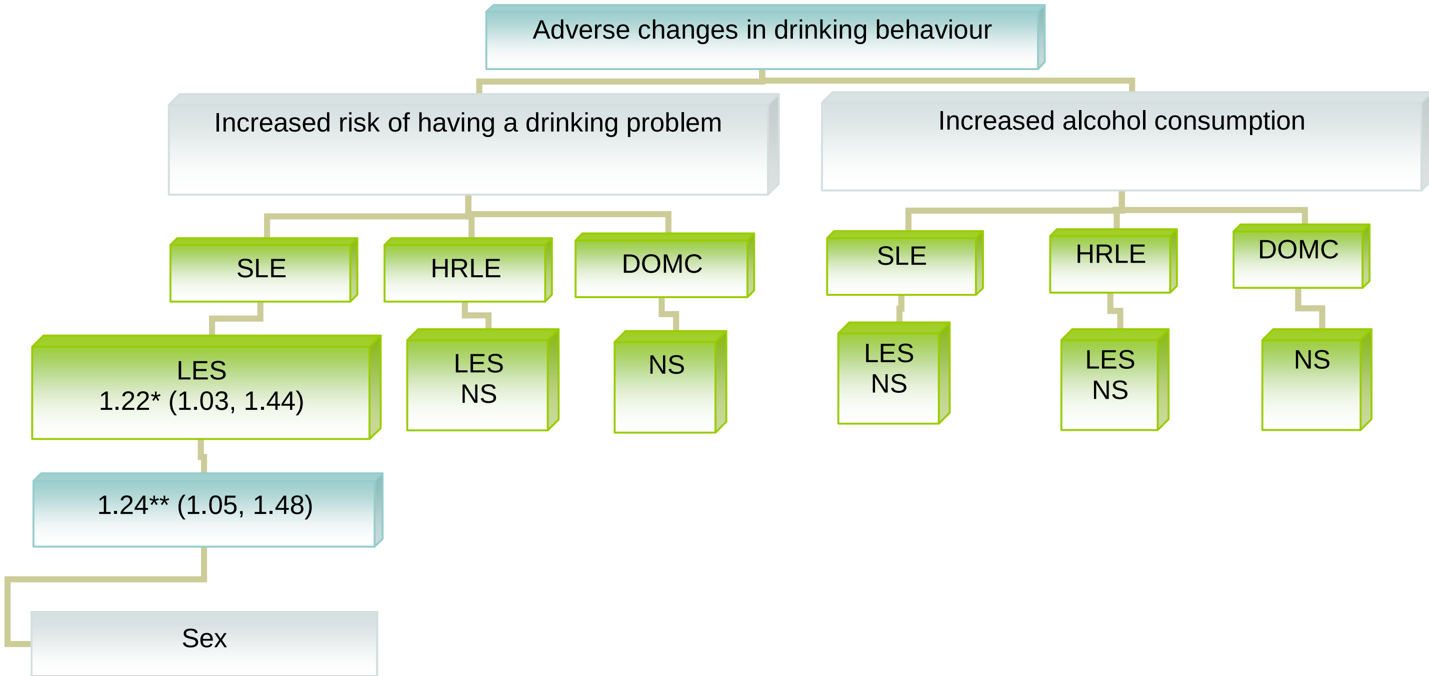
6.5 Summary of the main results.

This chapter has examined the association of change in drinking behaviour and stressful life events, health related life events, and the diagnosis of a medical condition. The association was assessed at age 53 years only and used 2 outcomes for drinking behaviour change.

Only one relationship was found for the effect of stressful life events. A statistically significant association was found between the life events score and increased risk of having an alcohol problem at age 53 years (Figure 6.3). Cohort members who were initially at low risk of having an alcohol problem at age 43 years and had more life events in the past year before the survey interview at age 53 years were 24% more likely to be classified as having an alcohol problem at age 53 years (adjusted OR = 1.24, 95%CI: 1.05, 1.48). The result also showed that sex had a positive confounding effect on the life events score. The women in the 1946 cohort had lower odds of increased alcohol consumption compared to the men.

The analysis did not find any effect of the health related life events on increased risk of having an alcohol problem and increased alcohol consumption at age 53 years. The diagnosis of a medical condition also did not have any effect on change in drinking behaviour. Although the odds ratios were not significant, their adverse effects on drinking behaviour were found to be consistent in many of the analysis. The analysis also found no evidence for the influence of the social support factors found in the association.

Figure 6.3: Summary of the results of the analysis of the association between change in alcohol drinking behaviour and stressful life events, health related life events, and diagnosis of a medical condition at age 53 years.



*unadjusted odds ratio and 95% CI, **adjusted odds ratio and 95%CI.
See abbreviation on page 22.

CHAPTER 7

Dietary behaviour.

7.1 Introduction.

This chapter presents the results of the analysis of the association between stressful life events, health related life events, and diagnosis of a medical condition and; change in diet behaviour. The *dietary behaviour score* was generated for each age group: 36, 43 and 53 years old from five components; the types of bread, the types of milk, the portions of fruit and vegetables, the percentage of energy from fat intake, and the frequency of eating breakfast. The details of how the score was generated were presented in section 3.4.3.3 and the descriptive results were described in section 4.4.3. The change in the diet behaviour was indicated by the *dietary change index* at age 43 and 53 years, which was the difference between the diet behaviour scores from two consecutive surveys at age 36 and 43 years and, age 43 and 53 years. The higher or lower dietary change index indicates improvement or deterioration respectively, in the diet behaviour as observed at the respective ages. The specific objectives of the analysis at age 43 and 53 years and, the analysis of the aggregated data in this chapter were;

1) To examine the mean of the dietary change index by the social support and demographic factors,

2) To assess whether there are any evidence of a linear trend in the means of the dietary change index with the increase in the level of exposure of the different measures of the stressful life events and health related life events and, to compare the means of the index in the cohort members who were diagnosed with at least one medical condition to those who were not diagnosed, using linear regression analysis for the analysis at age 43 and 53

years and, linear regression analysis with random effect was used to analyse the aggregated data,

3) To assess the influence of the social support factors on the association found in (2) above by examining the statistical effect of the four factors in the linear regression model using the likelihood ratio test.

4) To obtain the adjusted estimate of the association in (2) using the stepwise forward selection method.

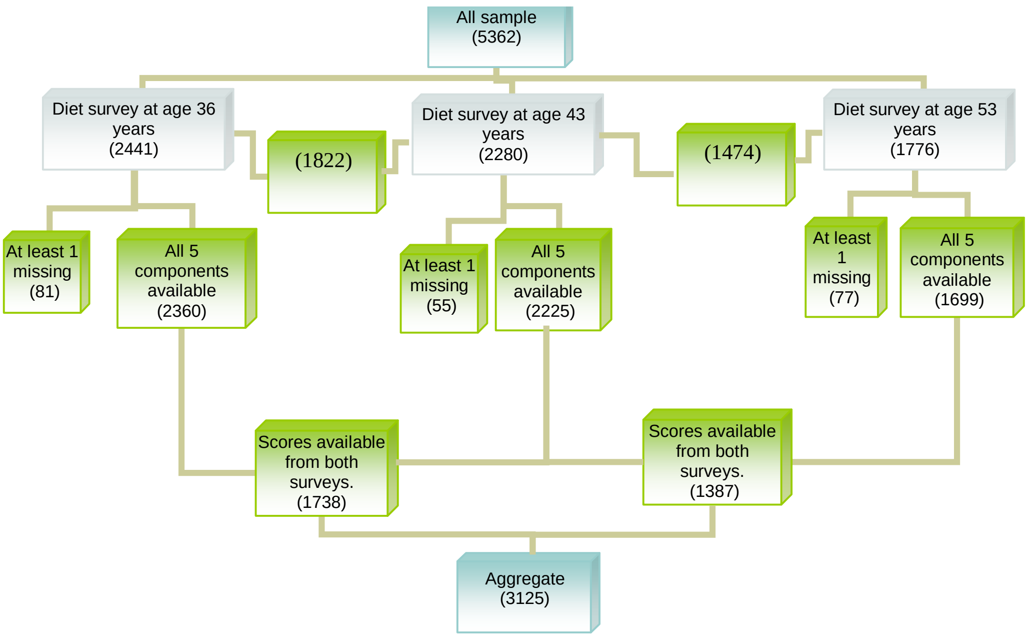
A preliminary analysis was carried out to assess whether the analyses should be done separately by sex. An interaction was found between sex and the diagnosis of a medical condition in the aggregated data (LRT χ^2: 5.0, 2DF, p= 0.02), hence the analysis was carried out separately in the men and women (See appendix 7.1). There was no interaction found in the other analyses, therefore the analysis at age 43 and 53 years, and the analysis of the effects of the stressful life events and health related life events on dietary behaviour change in the aggregated data included both sexes.

7.2 Descriptive results.

7.2.1 The sample.

The data showed that there were 2441 (73.5%), 2280 (69.9%), and 1772 (59.3%) of the cohort members who participated in the diet surveys from the total number of participation at age 36, 43 and 53 years respectively (Figure 7.1). The cohort members were included in the analysis if they had all the 5 diet components to generate the dietary behaviour score and participated in 2 consecutive surveys from the 3 waves. From the 1822 cohort members who participated in the dietary survey at both ages 36 and 43 years, 1738 (95.4%) were available for analysis at age 43 years and; from 1474 cohort members who participated in the dietary surveys at age 43 and 53 years, 1387, (94.1%) were available for analysis at age 53 years. There were a total of 3125 observations available for analysis in the aggregated data.

Figure 7.1: Summary of the sample used in the analysis of change in diet behaviour.



7.2.2 Missing data.

There were 81 (3.3%), 55 (2.4%), and 77 (4.3) cohort members at age 36, 43, and 53 years respectively, who had at least one of the dietary behaviour components (breakfast, milk, bread, fruit and vegetables, percentage of energy from fat) missing (Figure 7.1). A total of 84 (4.6%) from 1822 cohort members who participated in the surveys at age 36 and 43 years were excluded because they had either a missing diet behaviour score or the score was only available in one of the surveys. From this group, the missing data were mainly from the more educated members ($p<0.05$) with a significant declining trend with a decrease in education level ($p<0.05$). From 1474 cohort members who participated in the surveys at age 43 and 53 years, 87 (5.9%) were excluded because of missing dietary behaviour score or the score was only available in one of the surveys. There were more men than the women ($p<0.05$) and, more members with higher education than those with lower education ($p<0.05$) who were excluded from the analysis of the diet behaviour change at age 53 years (Table 7.1).

Table 7.1: Distribution of cohort members with missing diet behaviour score by the demographic factors.

	Missing dietary data age 43 years			Missing dietary data at age 53 years		
	N	**n (%)**	**p**		**n (%)**	**p**
Sex (N)	(1822)			(1474)		
Men	884	49 (5.5)	0.1	671	49 (7.3)	0.04
Women	938	35 (3.7)		803	38 (4.7)	
Social class (N)	(1764)			(1426)		
I-II	798	43 (5.4)		655	50 (7.7)	
III-NM	429	23 (5.4)	0.3	343	17 (5.0)	0.1
III-M	284	11 (3.9)		215	8 (3.7)	
IV-V	253	7 (2.8)		216	9 (4.2)	
Education (N)	(1749)			(1407)		
A level/University	689	42 (6.1)		583	42 (7.2)	
O level/ Vocational	498	23 (4.6)	0.03	412	27 (6.6)	0.01
No education	562	17 (3.0)		412	12 (2.9)	

7.2.3 Diet behaviour score.

The *diet behaviour score* (see section 7.1) is a measure of an individual's dietary behaviour, where a higher score indicates a healthier dietary behaviour. The summary of the scores at age 36, 43 and 53 years is presented in Table 7.2. The scores ranged from 5 to 19 units. There was an increasing pattern in the scores across the 3 waves found in the men, women and both sexes combined. The mean diet behaviour score increased from 11.2 unit (SD=2.00) at age 36 years to 14.2 unit (SD=2.40) at age 53 years. The increase in the scores in the consecutive waves observed at age 43 and 53 years were greater in women than in men. The mean diet behaviour score was significantly different between the men and women at each wave. At age 36 years, the mean score in the women was lower than the men although the difference in the mean score was very small (mean score difference = 0.22, $p < 0.01$). But, the score was significantly greater in the women than in men at age 43 (mean score difference = 0.28 unit, $p<0.01$) and age 53 years, (Mann-Whitney test, $p<0.001$). The pattern of the mean scores by social class and education was similar in all 3 waves. Cohort members from the higher social classes and those with better education had a greater score than lower social classes and those with lower education respectively ($p<0.001$).

Table 7.2: Summary of diet behaviour score at age 36, 43 and 53 years.

	Age 36 years	**Age 43 years**	**Age 53 years***
Men (n)	1154	1089	782
Mean (SD)/ unit	11.3 (1.89)	12.0 (2.28)	
Median (IQR)/ unit			14 (3.00)
Women (n)	1206	1136	917
Mean (SD)/ unit	11.1 (2.08)	12.2 (2.55)	
Median (IQR)/ unit			15 (3.50)
Total (N)	2360	2225	1699
Mean (SD)/ unit	11.2 (1.99)	12.1 (2.42)	14.2 (2.40)
Median (IQR)/ unit			14 (3.50)

**Positively skewed distribution.*

7.3 Change in the diet behaviour – dietary change index.

7.3.1 Descriptive results: summary statistics of the dietary change index by the demographic and social support factors.

7.3.1.1 Descriptive results of the data at age 43 years.

The dietary change index ranges from -7 to 11 units and was approximately normally distributed. Table 7.3 presents the summary statistics of the index. There was a small improvement in the dietary behaviour score at age 43 years as indicated by the dietary change index (mean change of the diet behaviour score) (mean index = 0.9 unit, SD = 2.41 unit). The index was greater in the women than in men (p<0.001), social class III non-manual compared to social class IV-V (p<0.01), and cohort members who had A-level education or higher compared to those without education by age 26 years (p<0.05). No association was found between perceived support, social network, and participation in social activity factors and the index.

Table 7.3: Summary of the dietary change index at age 43 years by the demographic and social support factors.

	N	**Mean (SD)/ unit**	**P**
All members	1738	0.93 (2.41)	
Sex (N = 1738**)**			
Men	835	0.7 (2.38)	<0.001
Women	903	1.2 (2.42)	
Social class (N = 1680)			
I-II	755	0.9 (2.31)	
III-NM	406	1.2 (2.43)	<0.01
III-M	273	0.8 (2.55)	
IV-V	246	0.6 (2.27)	
Education (N = 1667)			
A level/ University	647	1.1 (2.18)	0.02
O level/ Vocational	475	0.9 (2.50)	
None	545	0.7 (2.58)	
Perceived support (N = 1735)			
Always	1585	1.0 (2.38)	0.2
Often	87	0.6 (2.55)	
None or sometimes	63	0.7 (2.90)	
Social network (N = 1736)			
5	270	0.9 (2.38)	0.9
4	491	1.0 (2.42)	
3	621	0.9 (2.34)	
0-2	354	1.0 (2.56)	
Social participation (N = 1737)			
6 or more	549	1.1 (2.37)	0.1
1-5	518	1.0 (2.47)	
0	670	0.8 (2.40)	

7.3.1.2 Descriptive results of the data at age 53 years.

The dietary change index ranged from -5.5 to 11 units. The mean of the index at age 53 years (mean = 2.1 unit, SD = 2.47 unit) was greater compared to age 43 years (mean difference in the index = 1.02 unit, $p<0.001$) (Table 7.4). There was no difference in the mean of the index by the social class. A statistically significant relationship was found between the index and education ($p<0.05$), where those with the highest education had the least change in their diet behaviour compared to those with lesser education. However, it is plausible that the better educated cohort members were already practising better dietary behaviour at age 43 years (i.e. they had a larger diet behaviour score) than those who were less educated, and also because there was a maximum limit to the score, only a small increase was possible at age 53 years; hence the small dietary change index.

Table 7.4: Summary of the dietary change index at age 53 years by the demographic and social support factors.

	N	Mean (SD)/unit	p
Total	1387	2.1 (2.47)	
Sex (N= 1462)			0.01
Men	664	1.9 (2.37)	
Women	798	2.2 (2.54)	
Social class (N= 1415)			0.1
I-II	648	1.9 (2.38)	
III-NM	339	2.2 (2.47)	
III-M	214	2.0 (2.60)	
IV-V	214	2.3 (2.61)	
Education (N= 1397)			0.02
A level/ University	579	1.8 (2.31)	
O level/ Vocational	411	2.2 (2.56)	
None	407	2.2 (2.56)	
Perceived support (N= 1387)			
Always	1196	2.1 (2.45)	0.01
Often	118	1.5 (2.50)	
None or sometimes	73	2.2 (2.63)	
Social network score (N= 1387)			
5	413	2.1 (2.51)	0.1
4	599	2.2 (2.39)	
3	264	1.9 (2.58)	
0-2	111	1.6 (2.47)	

7.3.1.3 Descriptive results of the aggregated data.

The summary statistics of the aggregated data are described for the men and women separately, and both men and women combined. These are presented in Table 7.5. The mean of the dietary change index in the men (mean = 1.2 unit, SD =2.44 unit) was slightly, but statistically significantly smaller than that for women (mean = 1.7 unit, SD = 2.53 unit) (mean difference = -0.47 unit, $p<0.001$). No association was found between the index and social class or education, neither in the men nor women or, both sexes combined. As for the social support factors, no association was found in the perceived support, but there was a statistically significant relationship with the social network. In the men, the mean index was greater in the cohort members who scored 4 units compared to those who scored 3 units or less on the social network score ($p<0.05$). In the women, those who scored 5 and 4 on the social network score had a greater mean index than those with a score of 3 ($p<0.001$). In the data that combined both sexes, the mean index was greater in the cohort members who scored 4 or 5 than those with score 3 or 4 on the social network score ($p<0.001$).

Table 7.5: The mean of the dietary change index (unit) in the men, women, and both sexes combined by the demographic and social support factors in the aggregated data

	Men			Women			All		
	n	**mean (SD)**	**p**	**n**	**mean (SD)**	**p**	**n**	**mean (SD)**	p
Dietary change index	1457	1.18 (2.45)		1668	1.65 (2.53)		3125	1.43 (2.50)	<0.001
Social class (N)	(1437)			(1585)			(3022)		
I-II	785	1.17 (2.37)	0.8	572	1.62 (2.38)	0.5	1357	1.36 (2.39)	
III-NM	136	1.12 (2.49)		596	1.77 (2.49)		732	1.65 (2.50)	0.05
III-M	360	1.26 (2.60)		120	1.54 (2.75)		480	1.33 (2.64)	
IV-V	156	1.07 (2.34)		297	1.52 (2.67)		453	1.36 (2.57)	
Education (N)	(1396)			(1597)			(2993)		
None	674	1.24 (2.24)	0.5	514	1.67 (2.28)	0.5	1188	1.43 (2.27)	
O level/ Vocational	284	1.06 (2.65)		576	1.73 (2.58)		860	1.51 (2.62)	0.3
A level/ University	438	1.09 (2.61)		507	1.54 (2.71)		945	1.34 (2.67)	
Social support									
Perceived support (N)	(1457)			(1665)			(3122)		
Always	1260	1.17 (2.44)	0.3	1521	1.68 (2.49)	0.2	2781	1.45 (2.48)	0.1
Often	122	1.01 (2.39)		83	1..12 (2.80)		205	1.06 (2.56)	
None or sometimes	75	1.57 (2.80)		61	1.58 (2.95)		136	1.57 (2.86)	
Social network score (N)	(1457)			(1666)			(3123)		
5	299	1.27 (2.47)		384	1.90 (2.53)		683	1.62 (2.52)	
4	524	1.37 (1.40)	0.04	566	1.88 (2.52)	<0.001	1090	1.64 (2.48)	<0.001
3	407	1.01 (2.42)		478	1.32 (2.49)		885	1.18 (2.46)	
0-2	227	0.90 (2.57)		238	1.37 (2.52)		465	1.14 (2.55)	

7.3.2 Descriptive results: summary statistics of the dietary change index by the life stress measures.

7.3.2.1 Results of the analysis at age 43 years.

The summary statistics of the relationship between the dietary change index and stressful life events measures are presented in Tables 7.6. The means of the index on the life events score, emotional score, and life change score were close or equalled to 1 unit and no pattern was observed as the scores increased. For the health related life events, similar results were found. There was no pattern observed in the means of the dietary change index as the health related life events score, emotional score, and life change score increased (Table 7.7). A smaller sample (n = 1533, 52.6%) was available for the analysis of the diagnosis of a medical condition compared to the total number of cohort members available at age 43 years (n = 2915). There were only 39 (2.5%) cohort members (17 men and 22 women) who were diagnosed with at least one medical condition. The mean of the dietary change index was similar in subjects who were and were not diagnosed with at least one medical condition (Table 7.8).

Table 7.6: Summary of the dietary change index at age 43 years by stressful life events.

	n	Mean (SD)/ unit
Life event score (N = 1738)		
0	458	0.9 (2.34)
1	552	1.0 (2.47)
2	383	0.9 (2.34)
3 or more	345	0.9 (2.50)
Emotional score (N = 1720)		
0	458	0.9 (2.34)
1	322	1.0 (2.47)
2	316	0.9 (2.24)
3	335	1.0 (2.43)
4 or more	287	0.9 (2.60)
Life change score (N = 1722)		
0	458	0.9 (2.34)
1	785	1.0 (2.44)
2	234	0.9 (2.51)
3 or more	245	0.8 (2.35)

Table 7.7: Summary of the dietary change index at age 43 years by health related life event.

	n	Mean (SD)/ unit
Life event score (N = 1736)		
0	682	0.9 (2.37)
1	657	1.0 (2.47)
2	397	1.0 (2.38)
3 or more		
Emotional score (N = 1720)		
0	682	0.8 (2.37)
1	331	1.1 (2.38)
2	349	0.9 (2.44)
3 or more	358	0.9 (2.50)
Life change score(N = 1714)		
0	674	0.9 (2.36)
1	730	1.0 (2.46)
2	184	0.8 (2.32)
3 or more	126	1.0 (2.56)

Table 7.8: Summary of the dietary change index at age 43 years by diagnosis of medical condition.

Diagnosis of a medical condition (N = 1533)	n	Mean (SD)/ unit
Yes	39	0.8 (2.57)
No	1494	0.9 (2.38)

7.3.2.2 Results of the analysis at age 53 years.

The means of the dietary change index in the life events score were similar and there was no pattern observed, as the score increased (Table 7.9). A similar result was found in the health related life events score (Table 7.9). From 1326 cohort members available for the analysis of diet behaviour change at age 53 years, there were 205 (15.5%) (men = 95, women = 110) who were diagnosed with at least one medical condition. The mean index was slightly greater in the cohort members who were diagnosed with at least one medical condition (mean = 2.3, SD = 2.53) compared to those who were not (mean = 2.0, SD = 2.44) (Table 7.9).

Table 7.9: Summary of the dietary change index at age 53 years by stressful life events, health related life events, and the diagnosis of a medical condition.

	N	Mean (SD)/ unit
Stressful life events		
Life event score (N = 1387)		
None	296	2.1 (2.55)
1	400	2.1 (2.40)
2	300	2.1 (2.51)
3 or more	391	1.9 (2.46)
Health related life events		
Health related life event score (N = 1387)		
None	454	2.1 (2.50)
1	506	2.1 (2.49)
2 or more	427	2.0 (2.43)
Diagnosis of medical condition (N = 1326)		
Yes	205	2.3 (2.53)
No	1121	2.0 (2.44)

7.3.2.3 Results of the aggregated data.

The summary statistics of the index by the stressful life events, health related life events, and diagnosis of a medical condition is shown in Table 7.10. In the men, the means of the index did not present any particular pattern in the life events score and health related life events score. The mean index of the men in the cohort who were diagnosed with at least one medical condition (mean = 2.22 unit, SD = 2.56 unit) was found to be greater than those who were not diagnosed (mean = 1.11 unit, SD = 2.40 unit).

In women, the means of the index showed a less clear declining pattern as the life events score increased and no pattern in the health related life events score. The women who were diagnosed with at least one medical condition also had a greater mean index (1.99 unit, SD = 2.63) compared to those who were not diagnosed (mean = 1.62 unit, SD = 2.49 unit).

The combined data of both sexes showed no pattern in the means of the index as the life events score increased, but a less clear increasing pattern was found as the health related life events score increased. The cohort members who were diagnosed with at least one medical condition had a greater mean index (2.09 unit, SD = 2.59 unit) compared to those who were not so diagnosed (mean = 1.38 unit, SD = 2.46 unit).

Table 7.10: Summary of dietary change index in men, women, and both sexes combined by the life stress measures in the aggregated data.

	Men		Women		All	
	(N), n	**Mean (SD)/ unit**	**(N), n**	**Mean (SD)/ unit**	**(N), n**	**Mean (SD)/ unit**
Stressful life events						
Life event score	(1457)		(1668)		(3125)	
None	364	1.07 (2.23)	390	1.63 (2.62)	754	1.36 (2.50)
1	454	1.23 (2.45)	498	1.72 (2.53)	952	1.48 (2.51)
2	339	1.16 (2.61)	344	1.65 (2.35)	683	1.41 (2.49)
3 or more	300	1.25 (2.43)	436	1.58 (2.57)	736	1.45 (2.52)
Health related life events						
Health related life events score	(1457)		(1666)		(3123)	
None	542	1.09 (2.41)	594	1.54 (2.54)	1136	1.33 (2.49)
1	554	1.23 (2.50)	609	1.71 (2.56)	1163	1.48 (2.54)
2 or more	361	1.22 (2.45)	463	1.70 (2.46)	824	1.49 (2.47)
Diagnosis of a medical condition						
	(1321)		1538)		(2859)	
Yes	112	2.22 (2.56)	132	1.99 (2.63)	244	2.09 (2.59)
No	1209	1.11 (2.40)	1406	1.62 (2.49)	2615	1.38 (2.46)

7.4 Association between the diet behaviour change and stressful life events, health related life events, and diagnosis of a medical condition.

7.4.1 Results of the analysis at age 43 years.

7.4.1.1 Association between stressful life events and change in dietary behaviour.

The results of the linear regression analysis are presented in Table 7.11. They show that the regression coefficients for the effects of the life events score, emotional score, and life change score were very small and not statistically significant.

7.4.1.2 Association between health related life events and change in dietary behaviour.

The result was similar in the analysis of the effects of health related life events. The regression coefficients of the health related life events score, health related emotional score, and health related life change score were small and not statistically significant (Table 7.12).

7.4.1.3 Association between diagnosis of a medical condition and change in dietary behaviour.

The analysis found that the regression coefficient for the association between the diagnosis of a medical condition and dietary change index was not statistically significant (Table 7.13).

Table 7.11: Linear regression coefficient of the association between stressful life events diet and change index at age 43 years.

	Regression coefficient	95%CI	p
Life events score (n=1738)	0.01	-0.098, 0.114	0.9
Emotional score (n=1720)	0.03	-0.068, 0.126	0.6
Life change score (n=1722)	-0.01	-0.131, 0.102	0.8

Table 7.12: Linear regression coefficient of the association between health related life events and dietary change index at age 43 years.

	Regression coefficient	95%CI	p
Life events score (n=1736)	0.07	-0.075, 0.219	0.3
Emotional score (n=1720)	0.03	-0.068, 0.126	0.6
Life change score (n=1714)	0.04	-0.089, 0.171	0.5

Table 7.13: Linear regression coefficient of the association between diagnosis of a medical condition and dietary change index at age 43 years.

Diagnosed with a medical condition (n=1533)	Regression coefficient	95%CI	p
Yes	-0.13	0.885, 0.631	0.7

There were no further analyses carried out at age 43 years because no significant association was found in these previous analyses.

7.4.2 Results of the analysis at age 53 years.

7.4.2.1 Association between stressful life events, health related life events, and diagnosis of a medical condition and, change in dietary behaviour.

The result of the analysis of diet behaviour change at age 53 years is presented in Table 7.14. The analysis found that there was an inverse relationship between stressful life events and dietary change index, but the regression coefficient for the association was small and not significant. Similarly, an insignificant result was found for the effect of health related life events. In the analysis of the diagnosis of a medical condition, a positive relationship was found, but the regression coefficient was marginally insignificant at 5% significance level. There were no further analyses carried out because no significant association was found.

Table 7.14: Linear regression coefficient of the association between life stress measures and dietary change index at age 53 years

	Regression coefficient	95%CI	p
Stressful life events			
Life events score (n=1387)	-0.08	(-0.199, 0.035)	0.2
Health related life events			
Life events score (n=1387)	-0.04	(-0.200, 0.127)	0.7
Diagnosed with a medical condition Yes (n=1326)	0.36	(-0.002, 0.729)	0.05

7.4.3 Results of the analysis of the aggregated data.

7.4.3.1 Association between stressful life events, health related life events, and diagnosis of a medical condition and, change in dietary behaviour.

The examination of the effect of stressful life events, health related life events, and diagnosis of a medical condition at age 43 and 53 years, and stressful life events and health related life events in the aggregated data, included both sexes. The analysis of the effect of diagnosis of a medical condition in the aggregated data was carried out separately for men and women. All the associations were analysed using multi level linear regression analysis with random effect using the maximum likelihood estimation method to obtain the adjusted estimate.

There was no linear association found between life events score and the dietary change index (Table 7.15). The result showed a positive relationship but regression coefficient was very small and not significant. Similarly, there was also no linear relationship found in the analysis of health related life events. In the analysis of the diagnosis of a medical condition, no association was found in women, but there was a significant association found in men. The men who were diagnosed with at least one medical condition had a larger change in dietary behaviour compared to those who were not diagnosed (regression coefficient = 1.11, 95% CI: 0.65, 1.58). Further analyses were carried out for the latter association.

Table 7.15: Unadjusted linear regression coefficient of the association between life stress measures and dietary change index in the men in the aggregated data.

Life stress	Number of observation	Number of subject	Unadjusted regression coefficient (95% CI)	p
Stressful life events				
Life events score	3125	1967	0.02 (-0.06, 0.10)	0.7
Health related life events				
Health related life events score	3123	1966	0.09 (-0.02, 0.20)	0.1
Diagnosis of a medical condition				
Men	1321	827	1.11 (0.65, 1.58)	<0.001
Women	1538	922	0.37 (-0.07, 0.82)	0.1

7.4.3.2 Relationship between dietary change index in men and, social support and demographic factors.

The analysis did not find any association between the perceived support and dietary change index, but a statistically significant relationship was found with the social network factor (Table 7.16). The cohort members who had a better relationship with family and friends had a greater change in dietary behaviour where one level of decrease in the social network score corresponded to 0.16 unit (95%CI: -0.29, -0.03 score unit) decrease in the mean index. No association was found between social class, education and the dietary change index.

Table 7.16: Regression coefficient of the association between the potential covariate factors and dietary change index of the men in the aggregated data.

Factors	Number of observation	Number of subject	Unadjusted regression coefficient (95% CI)	p
Perceived support	1457	946	0.10 (-0.15, 0.35)	0.4
Social network	1457	946	-0.16 (-0.29, -0.03)	0.02
Social class	1437	933	-0.001 (-0.112, 0.115)	>0.9
Education	1396	901	-0.08 (-0.22, 0.07)	0.3

7.4.3.3 Influence of social support factors on the association between diagnosis of a medical condition and dietary behaviour change in men.

The effects of the social support and demographic factors were examined using the likelihood ratio test. The results, as presented in Table 7.17, showed that there was no evidence for the effects of perceived support in the association. However, there was evidence for the moderating effects of the social network factor found in the association (LRT $\chi^2 = 4.4$, $p = 0.04$). The analysis did not find significant effects of social class and education in the association.

The adjusted estimate of the effect of the diagnosis of a medical condition was obtained using the stepwise forward elimination method at 5% probability. The final model for the association included only the social network factor. The mean dietary change index in men who were diagnosed with at least one medical condition was 2.54 units (95% CI: 1.71, 3.33) compared to 1.47 (95% CI: 1.10, 1.79) units in those who were not diagnosed (Table 7.18).

Table 7.17: LRT for the effects of potential covariate factors on the association between diagnosis of a medical condition and dietary change index of the men in the aggregated data.

Factors	Observation	N	LRT χ^2(p)
Perceived support	1321	827	1.0 (0.3)
PS x MC	1321	827	0.06 (0.8)
Social network	1321	827	4.4 (0.04)
SN x MC	1321	827	0.2 (0.7)
Social class	1303	815	0.1 (0.8)
Education	1271	792	0.3 (0.6)

PS: perceived support, SN: social network, MC: the diagnosis of a medical condition, x: interaction.

Table 7.18: Adjusted regression coefficients for the association between diagnosis of a medical condition and dietary change index of the men in the aggregated data.

	Observation	N	Regression coefficient (95% CI)	p
DOMC*			1.07 (0.62, 1.52)	<0.001
Social network	1397	857	-0.15 (-0.28, -0.02)	0.02
Constant			1.47 (1.14, 1.80)	<0.001

**Diagnosis of a medical condition.*

7.5 Summary of the main results.

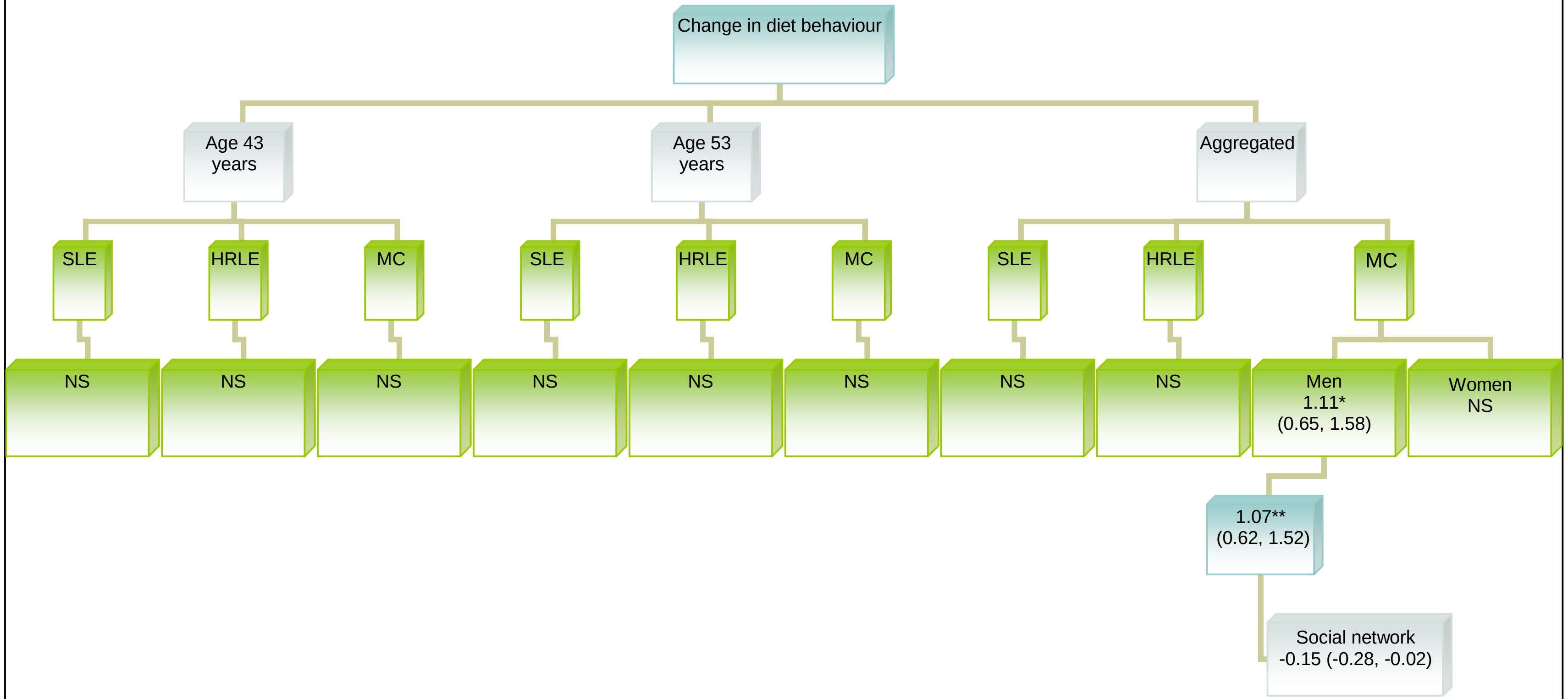
This chapter assessed whether there was any relationship between stressful life events, health related life events, and the diagnosis of a medical condition and dietary behaviour change. The examination of the dietary behaviour score showed that the men in the NSHD had better dietary behaviour (i.e. a greater dietary behaviour score) at age 36 years, but for women, their diet behaviour surpassed that of the men at age 43 and 53 years ($p<0.01$). They were also found to have improved their dietary behaviour (i.e. they had a greater dietary change index), which was more than the men ($p<0.01$). The cohort members who belonged to the higher social classes, and those who had a higher level of educational attainment at age 26 years, also had better dietary behaviour than those in lower social classes, and those with lower educational attainment, respectively ($p<0.001$). Improvement in dietary behaviour was found to be greater in the higher social classes and the better educated at age 43 years. But at age 53 years, greater improvement was found in the lower social classes and the less educated. However, this was because there was a limit to the range of the dietary behaviour score (5 to 19 unit) and the cohort members in the higher social classes and the better educated already had a higher score than those observed at age 43 years, hence, only a small change in the index was possible in this age group.

The analysis of the effect of stressful life events on change in dietary behaviour did not find evidence for an association either in the analysis at age 43 or 53 years, or in the analysis of the aggregated data (Figure 7.2). There was also no evidence for an association of health related life events and dietary behaviour change found in the analysis at age 43 and 53 years, or in the aggregated data (Figure 7.2).

The analysis of the effect of the diagnosis of a medical condition on dietary behaviour change at age 43 and 53 years did not show any significant association. The analysis of the association of the diagnosis of a medical condition and diet behaviour change in the aggregated data was carried out separately for the men and women. There was no evidence for an association found in the women, but there was a statistically significant association found in the men. The average change in the dietary behaviour (dietary change index) was 1.11 units higher in the men who were diagnosed with at least one medical condition (hypertension, angina, heart attack, stroke, or diabetes) between age 36 and 53 years compared to those who were not so diagnosed (unadjusted regression coefficient = 1.11, 95% CI: 0.65, 1.58). After adjusting for the negative confounding effect of the social network factor, the effect of the diagnosis of a medical condition decreased slightly to 1.07 (95% CI: 0.62, 1.52).

The analysis also found a significant influence of the relationship with family and friends on the association of the diagnosis of a medical condition and change in dietary behaviour. The greater the social network, the greater the improvement in dietary behaviour seen in the men in the NSHD (regression coefficient = -0.15, 95% CI: -0.28, -0.02).

Figure 7.2: Summary of the results of the analysis of the association between stressful life events, health related life events, and diagnosis of a medical condition and, change in diet behaviour at ages 43 and 53 years, and the aggregated data.



**unadjusted regression coefficient and 95% CI, **adjusted regression coefficient and 95%CI.*
See abbreviation on page 22.

CHAPTER 8

Physical activity behaviour.

8.1 Introduction.

This chapter presents the results of the analysis of the association between change in physical activities and stressful life events, health related life events, and the diagnosis of a medical condition. Participation in physical activity 4 times or more in a month was categorised as practising regular physical activity and participation in less than 4 times a month or none at all were categorised as not practising regular physical activity. This study examined two types of change in physical activity outcomes: an *increase in physical activity*, which was the change from practising physical activity less than 4 times a month in an earlier survey to 4 times or more a month in the following survey; and a *decrease in physical activity,* which was the change from practising physical activity 4 times or more a month in an earlier survey to less than 4 times a month in the following survey. The specific objectives in each type of change in physical activity of the analysis at age 43 and 53 years and, of the aggregated data were;

1) To examine the distribution and odds of change in physical activity by social support and demographic factors,

2) To assess whether there are any evidence of a linear trend in the odds of change in physical activity with the increase in the level of exposure to the different measures of stressful life events and health related life events and, to compare the odds of change in physical activity in the cohort members who were diagnosed with at least one medical condition to those who were not diagnosed; using logistic regression analysis at age 43 and 53 years and, logistic regression analysis with random effect in the aggregated data,

3) To assess the influence of the social support factors on the association found in (2) above, by examining the statistical effect of the factors in the logistic regression model using the likelihood ratio test.

4) To obtain an estimate effect of main independent variables that was adjusted for the factors found in (3) above using the stepwise forward selection method.

The preliminary analyses to assess whether sex modified the effect of the main independent variables found that the interaction variables were not significant; hence, the data for all the analysis had combined both sexes.

8.2 Descriptive results.

8.2.1 The sample.

There was a high response rate to the question on physical activity for each age group studied. The data showed that the physical activity information was available from 3309 (99.6%), 3262 (100%) and 2986 (99.9%) cohort members at ages 36, 43, and 53 years respectively (Figure 8.1). The cohort members were included in the analysis if they had physical activity information for 2 consecutive surveys, that is at both ages 36 and 43 years for the analysis at age 43 years (n = 2990) and at both ages 43 and 53 years for the analysis at age 53 years (n = 2805). The information from 2981 (99.7%) cohort members was available for analysis at age 43 years, of which 1835 observations were included in the analysis of increase in physical activity and 1146 observations were included in the analysis of a decrease in physical activity. For the analysis at age 53 years, there were 2085 observations available, where 1870 observations were included in the analysis of increase in physical activity, and 935 observations were included in the analysis of a decrease in physical activity.

8.2.2 Missing data.

The number of missing physical activity data in each survey was small. There were 13 (0.4%) at age 36 years, none at age 43 years, and 2 (0.1%) at age 53 years (Figure 8.1). From 2990 cohort members who participated in both surveys at age 36 and 43 years, 9 (0.3%) observations were excluded from the analysis at age 43 years, because the physical activity information was available in one of the surveys only. For the analysis at age 53 years, 2 (0.1%) (N = 2807) observations were excluded for the same reason. Examination of the missing data showed no significant pattern in the distribution of missing data by the sex, social class, or education (Table 8.1).

Table 8.1: Distribution of cohort members with missing physical activity data.

	Missing at both age 36 and 43 years			Missing at both age 43 and 53 years.		
	N	**n (%)**	**p**	**N**	**n (%)**	**p**
Sex (N)	(2990)			(2807)		
Men	1488	6 (0.4)	0.3	1366	2 (0.2)	0.2
Women	1502	3 (0.2)		1441	0 (0)	
Social class (N)	(2901)			(2721)		
I-II	1273	3 (0.2)		1195	2 (0.2)	
III-NM	683	1 (0.2)	1.0	620	0 (0)	0.8
III-M	523	1 (0.2)		485	0 (0)	
IV-V	422	0 (0)		421	0 (0)	
Education (N)	(2847)			(2661)		
A level/University	1000	1 (0.1)	0.6	958	0 (0)	0.5
O level/ Vocational	809	1 (0.1)		747	1 (0.1)	
No education	1038	3 (0.3)		956	1 (0.1)	

8.2.3 Physical activity status at age 36, 43 and 53 years.

The greater proportion for each age group of cohort members reported, in the month prior to the interview that they had not participated in physical activity or had participated in physical activity less than 4 times in the month, (i.e. they were not practising regular physical activity) (Table 8.2). The proportion of cohort members who practised regular physical activity (i.e. they had participated in physical activity 4 times or more in a month) had decreased from 37.9% to 33.0% between age 36 and 43 years; and had remained similar until age 53 years. Practising regular physical activity was more common in men than in women at age 36 and 43 years ($p<0.01$), but there were no differences between the sexes at age 53 years. In each wave, more cohort members who practised regular physical activity were from the higher social classes and the better educated and, more of those who were not practising regular physical activity were from the lower social classes and the lesser well educated ($p<0.001$).

Figure 8.1: Sample for the analysis of an increase, and a decrease in physical activity.

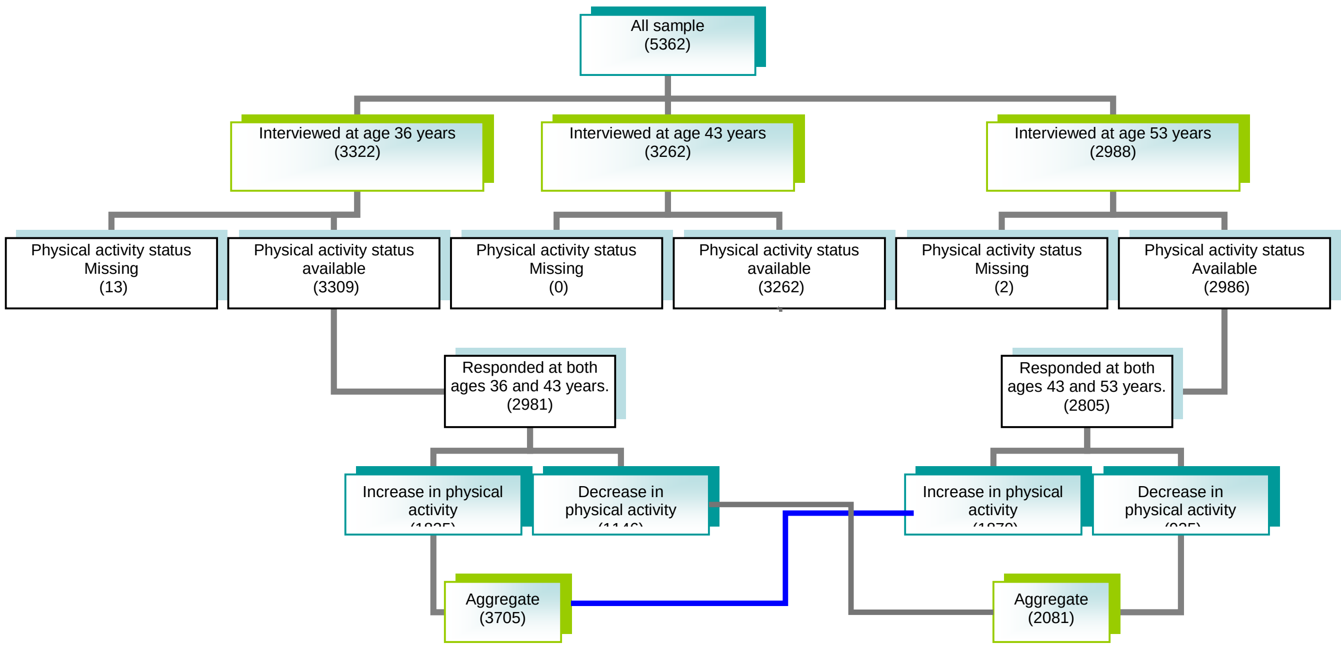


Table 8.2: Frequency of physical activity of the cohort members at age 36, 43, and 53 years.

	Age 36 years N = 3309 n (%)	Age 43 years N = 3262 n (%)	Age 53 years N = 2986 n (%)
None or less than 4 times a month	2056 (62.1)	2185 (67.0)	1995 (66.8)
More than 4 times a month	1253 (37.9)	1077 (33.0)	991 (33.2)

8.2.4 Change in physical activity.

There were more of the cohort members who had a decrease in physical activity compared to those who had an increase in physical activity at both age 43 and 53 years (Table 8.3). At age 43 years, 47.9% of the cohort members had decreased their physical activity and 20.9% had increased their physical activity. At age 53 years, 48.9% of the cohort members had increased and, 24.6% had decreased their physical activity. The aggregated data showed that there were 843 (22.8%) observations of increase in physical activity and 1006 (48.3%) observations of decrease in physical activity.

Table 8.3: Number of cohort members who had an increased or a decrease in physical activity at ages 43 and 53 years and, in the aggregated data.

		Age 43 years n (%)	Age 53 years n (%)	Aggregated data n (%)
Increase in	(N)	(1835)	(1870)	(3705)
physical activity		384 (20.9)	459 (24.6)	843 (22.8)
Decrease in	(N)	(1146)	(935)	(2081)
physical activity		549 (47.9)	457 (48.9)	1006 (48.3)

8.3 Change in physical activity: increase in physical activity.

8.3.1 Descriptive results: distributions by the demographic and social support factors.

8.3.1.1 Descriptive results of the data at age 43 years.

The results of the descriptive analysis are shown in Table 8.4. Similar proportions of men and women of the NSHD members had increased their physical activity at age 43 years. Statistically significant relationships were found with social class and education. A greater proportion of cohort members, who had an increase in physical activity, were from the higher social classes and the better educated ($p<0.001$), and these proportions declined in the lower social classes and less educated ($p <0.01$). For the social support factors, statistically significant relationships were found with the social network and social participation factors. An increase in physical activity was more common in cohort members who reportedly had a stronger relationship with family and friends ($p<0.001$), and those who were more active in social activities such as in churches, schools, and local government ($p<0.001$). A statistically significant declining trend was found with the social participation factors ($p<0.01$).

8.3.1.2 Descriptive results of the data at age 53 years.

There was no difference in the proportions of men and women who had an increase in physical activity (Table 8.4). More of the cohort members who had increased their physical activity were from the higher social classes and had better education ($p<0.001$). There was a significant declining trend in the proportions with a decrease in social class and education level ($p<0.001$). There was no relationship found between social support factors and an increase in physical activity.

8.3.1.3 Descriptive results of the aggregated data.

The results from the aggregated data were similar to those at age 43 and 53 years. There was no relationship between sex and an increase in physical activity, but a statistically significant relationship was found with social class and education. Greater proportions of the cohort members, who had an increase in physical activity, were from the higher social classes ($p<0.001$) and the better educated ($p<0.001$). There was a significant declining trend in the proportion as social class and education levels decreased ($p<0.01$). A statistically significant relationship was found with the social network factor. Cohort members who had increased their physical activity were more likely to have had a better relationship with family and friends ($p= 0.02$).

8.3.2 Descriptive results: numbers and odds ratios of increase in physical activity by the life stress measures.

8.3.2.1 Results of the analysis at age 43 years.

In the stressful life events measures, the odds ratios of an increase in physical activity was found to be greater in cohort members who experienced fewer life events and there was a declining pattern in the odds ratios with an increase in life events experience (Table 8.5). The odds ratios were also greater in the cohort members who scored lower in the emotional score, but the declining pattern in the odds ratio with an increase of the score was less clear. The odds ratios in the life change score was found not to show any particular pattern.

The results in the analysis of the health related life events were similar to those of stressful life events (Table 8.6). The odds ratios of an increase in physical activity were also greater in cohort members who had fewer health related life events and were less affected emotionally by the events. A declining pattern in the odds ratios was found in the health related life events score and emotional score but none was found in the life change score.

From 1553 cohort members whose data were available for analysis at age 43 years, only 5 (9.4%) whom were diagnosed with at least one medical condition between age 36 and 43 years had increased their physical activity. (Table 8.7)

Table 8.4: Number of cohort members who had an increase in physical activity by the demographic and social support factors.

	Age 43 years			Age 53 years			Aggregate		
	n	**n (%)**	**p**	**n**	**n (%)**	**p**	**n**	**n (%)**	**p**
Sex (N)	(1835)			(1870)			(3705)		
Men	850	186 (21.9)	0.4	861	205 (23.8)	0.5	1711	391 (22.9)	0.9
Women	985	198 (20.1)		1009	254 (25.2)		1994	452 (22.7)	
Social class (N)	(1776)			(1810)			(3586)		
I-II	693	193 (27.9)		693	212 (30.6)		1386	405 (29.2)	<0.001
III-NM	421	85 (20.2)	<0.001	429	114 (26.6)	<0.001	850	199 (23.4)	
III-M	345	56 (16.2)		358	64 (17.9)		703	120 (17.1)	
IV-V	317	40 (12.6)		330	63 (19.1)		647	103 (15.9)	
Education (N)	(1746)			(1769)			(3515)		
A-level/university	508	157 (30.9)		539	180 (33.4)		1047	337 (32.2)	<0.001
Ordinary / vocational	504	102 (20.2)	<0.001	504	116 (23.0)	<0.001	1008	218 (21.6)	
None	734	106 (14.4)		726	140 (19.3)		1460	246 (16.9)	
Social support factors	(1829)			(1869)			(3698)		
Perceived support (N)	1681	360 (21.4)		1632	404 (24.8)		3313	764 (23.1)	0.2
Always	80	15 (18.8)	0.1	117	30 (25.6)	0.5	197	45 (22.8)	
Often	68	8 (11.8)		120	24 (20.0)		188	32 (17.0)	
None or sometimes									
Social relationship score (N)	(1833)			(1870)			(3703)		
5	280	52 (18.6)		575	148 (25.7)		855	200 (22.8)	
4	490	119 (24.3)	0.02	826	208 (25.2)	0.5	1316	327 (24.9)	0.02
3	666	148 (22.2)		328	71 (21.7)		994	219 (22.0)	
0-2	397	65 (16.4)		141	32 (22.7)		538	97 (18.0)	
Social participation score (N)	(1832)								
6 or more	453	154 (34.0)	<0.001						
1-5	519	127 (24.5)							
0	860	103 (12.0)							

Table 8.5: Number and odds ratios of cohort members who had an increase in physical activity at age 43 years by the stressful life events measures.

	N	n (%)	Odds
Life event score (N = 1834)			
None	465	113 (24.3)	1
1	587	126 (21.5)	085 (0.64, 1.14)
2	395	76 (19.2)	0.74 (0.53, 1.03)
3 or more	387	69 (17.8)	0.68 (0.48, 0.95)
Emotional score (N = 1814)			
None	465	113 (24.3)	1
1	328	76 (23.2)	0.93 (0.67, 1.31)
2	351	69 (19.7)	0.76 (0.54, 1.07)
3	343	64 (18.7)	0.71 (0.51, 1.01)
4 or more	237	60 (18.4)	0.70 (0.49, 0.99)
Life change score (N = 1815)			
0	352	113 (24.3)	1
1	663	159 (19.3)	0.75 (0.57, 0.98)
2	194	53 (21.5)	0.85 (0.59, 1.23)
3 or more	224	57 (20.3)	0.79 (0.55, 1.14)

Table 8.6: Number and odds ratios of cohort members who had an increase in physical activity at age 43 years by the health related life events measures.

	N	n (%)	Odds
Life event score (N = 1832)			
None	728	170 (23.4)	1
1	700	139 (19.9)	0.81 (0.63, 1.05)
2 or more	404	74 (18.3)	0.74 (0.54, 0.999)
Emotional score (N = 1813)			
None	728	170 (23.4)	1
1	336	71 (21.1)	0.88 (0.64, 1.20)
2	369	71 (19.2)	0.78 (0.57, 1.07)
3 or more	380	69 (18.2)	0.73 (0.53, 0.995)
Life change (N = 1805)			
0	717	169 (23.6)	1
1	774	150 (19.4)	0.78 (0.61, 0.999)
2	184	39 (21.2)	0.87 (0.59, 1.29)
3 or more	130	22 (16.9)	0.66 (0.40, 1.08)

Table 8.7: Number of cohort members diagnosed with at least one medical condition who had an increase in physical activity at age 43 years.

Diagnosis of a medical condition (N =1553)	N	n (%)
No	1500	328 (21.9)
Yes	53	5 (9.4)

8.3.2.2 Results of the analysis at age 53 years.

There was no pattern in the odds ratios of an increase in physical activity at age 53 years found in relation to the life events score (Table 8.8). The odds ratios of an increase in physical activity was found to be greater in cohort members who scored lower in the health related life events score and there was a decreasing pattern in the odds ratio as the score increased. There were 66 (19.7%) cohort members who were diagnosed with at least one medical condition and had an increase in physical activity at age 53 years and, the proportion in this group were smaller than in those who were not so diagnosed and had increased their physical activity.

Table 8.8: Number and odds ratios of cohort members, by the stressful life events and health related life events and, number of cohort members diagnosed with at least one medical condition; who had increased physical activity at age 53 years.

	N	n (%)	Odds
Stressful life events.			
Life event score (N)	(1870)		
None	398	109 (27.4)	1
1	517	115 (22.2)	0.76 (0.56, 1.03)
2	392	93 (23.7)	0.82 (0.60, 1.14)
3 or more	563	142 (25.2)	0.89 (0.67, 1.20)
Health related life events.			
Life event score (N)	(1832)		
None	601	161 (26.8)	1
1	674	153 (22.7)	0.80 (0.62, 1.04)
2 or more	595	145 (24.4)	0.88 (0.68, 1.14)
Diagnosis of a medical condition (N)	(1762)		
No	1427	375 (26.3)	-
Yes	335	66 (19.7)	

8.3.2.3 Results of the analysis of the aggregated data.

There was no pattern found in the odds ratios of increased physical activity in the life events score and health related life events score in the aggregated data (Table 8.9).

The proportion of the cohort members who were diagnosed with at least one medical condition was smaller than those who were not diagnosed with a medical condition.

Table 8.9: Number and odds ratios of cohort members, by the stressful life events and health related life events and, number of cohort members diagnosed with at least one medical condition; who had an increase in physical activity in the aggregated data.

	N	n (%)	Odds
Life event score (N)	**3704**		
None	863	222 (25.7)	1
1	1104	241 (21.8)	0.81 (0.65, 0.99)
2	787	169 (21.5)	0.79 (0.63, 0.99)
3 or more	950	211 (22.2)	0.82 (0.66, 1.02)
Health life event score (N)	**3702**		
None	1329	331 (24.9)	1
1	1374	292 (21.3)	0.81 (0.68, 0.97)
2 or more	999	219 (21.9)	0.85 (0.70, 1.03)
Diagnosed with medical condition (N)	**3315**		
No	2927	703 (24.0)	-
Yes	388	71 (18.3)	

8.3.3 Association between an increase in physical activity and life stress.

8.3.3.1 Results of the analysis at age 43 years.

8.3.3.1.1 Association between an increase in physical activity and stressful life events.

The results of the analysis of the association of stressful life events with an increase in physical activity are presented in Table 8.10. A statistically significant association was found in the analysis of life events and emotional scores. The result showed that one level of increase in the life events score corresponded with 12% lower odds of an increase in physical activity (OR = 0.88, 95%CI: 0.79, 0.97), and one level of increase in emotional score corresponded with 10% lower odds of an increase in physical activity (OR = 0.90, 95%CI: 0.84, 0.98). No association was found in the analysis of life change score.

8.3.3.1.2 Association between an increase in physical activity and health related life events.

The analysis of health related life events also found significant relationships in the life events score and emotional score (Table 8.11). An one level of increase in the health related life events score (OR = 0.85, 95 % CI: 0.73, 0.99) and emotional score (OR = 0.90, 95% CI: 0.81, 0.99) was associated with lower odds of an increase in physical activity. No association was found in the analysis of life change score.

8.3.3.1.3 Association between an increase in physical activity and diagnosis of a medical condition.

The analysis found a significant association between an increase in physical activity and the diagnosis of a medical condition. The cohort members who were diagnosed with at least one medical condition between age 36 and 43 years were 63% less likely to increase their physical activity at age 43 years (OR = 0.37, 95%CI: 0.15, 0.94) (Table 8.12).

Table 8.10: Odds ratios for the association between an increase in physical activity at age 43 years and stressful life events.

Stressful life events	N	Unadjusted OR (95% CI)	p
Life events score	1814	0.88 (0.79, 0.97)	0.01[1]
Emotional score	1814	0.90 (0.84, 0.98)	0.01[2]
Life change score	1815	0.94 (0.84, 1.05)	0.3

Table 8.11: Odds ratios for the association between an increase in physical activity at age 43 years and health related life events.

Health related life events	N	Unadjusted OR (95% CI)	p
Life events score	1832	0.85 (0.73, 0.99)	0.03[3]
Emotional score	1813	0.90 (0.81, 0.99)	0.03[4]
Life change score	1805	0.88 (0.77, 1.01)	0.06

Table 8.12: Odds ratios for the association between an increase in physical activity at age 43 years and diagnosis of a medical condition.

Diagnosis of a medical condition	N	Unadjusted OR (95% CI)	p
No	1553	1	0.04[5]
Yes		0.37 (0.15, 0.94)	

The following are the results of further analyses to assess the influence of the social support and demographic factors on the significant associations numbered (in superscript [1-5]) in Tables 8.10-12.

8.3.3.1.4 Relationships between increase in physical activity at age 43 years and the covariate factors.

The relationships above were assessed using the logistic regression analysis. The odds ratios of the association between increase in physical activity and, perceived support and social network factors were found not to be significant, but the odds ratio of social participation was significant (Table 8.13). One level lower of the social participation factor was associated with 48% lower odds of increase in physical activity (OR = 0.52, 95%CI: 0.45, 0.59). It was also found that the cohort members in the lower social classes had 28% lower odds of an increase in physical activity (OR = 0.72, 95%CI: 0.64, 0.80) and that the cohort members with lower levels of education were 39% less likely to increase their physical activity (OR = 0.61, 95%CI: 0.53, 0.71).

Table 8.13: Odds ratios for the association between social support and demographic factors and an increase in physical activity at age 43 years.

Factors	N	Unadjusted OR (95% CI)	p
Perceived support	1829	0.74 (0.54, 1.01)	0.1
Social network	1833	0.93 (0.83, 1.04)	0.2
Social participation	1832	0.52 (0.45, 0.59)	<0.001
Sex (Women)	1835	0.90 (0.72, 1.13)	0.4
Social class	1776	0.72 (0.64, 0.80)	<0.001
Education	1746	0.61 (0.53, 0.71)	<0.001

Logistic regression model included the outcome variable and the listed factors.

8.3.3.1.5 Influence of the covariate factors on the association between an increase in physical activity at age 43 years and life events score.

The likelihood ratio test did not find any evidence that the perceived support and social network factors had significant influence in the association but, there was evidence for the influence of the social participation (LRT: $\chi^2 = 91.7$, $p<0.001$) (Table 8.14). The analysis also found that there were significant influences of the social class (LRT: $\chi^2 = 39.3$, $p<0.001$) and education (LRT: $\chi^2 = 48.0$, $p<0.001$) in the association.

The final model used to obtain the estimate effect of the life events score had included the social participation score, social class, and education level. There was no evidence that the fit of the model was inadequate (Pearsonχ^2: 131.2, p = 0.5). The size of the adjusted odds ratio was reduced slightly (adjusted OR = 0.84, 95%CI: 0.75, 0.94) compared to the unadjusted odds ratio (OR = 0.88, 95%CI: 0.79, 0.97) (Table 8.15).

Table 8.14: LRT for the influence of social support and demographic factors on the association between an increase in physical activity at age 43 years and health related life events score.

Factors	N	LRTχ^2(p)
Perceived support	1829	3.5 (0.1)
PS x LES	1829	2.3 (0.1)
Social network	1832	1.6 (0.2)
SN x LES	1832	1.5 (0.2)
Social participation	1831	91.7 (<0.001)
SP x LES	1831	0.1 (0.8)
Sex	1834	1.0 (0.3)
Social class	1776	39.3 (<0.001)
Education	1745	48.0 (<0.001)

PS: perceived support, SN: social network, SP: social participation, LES: life events score, x: interaction.

Table 8.15: Adjusted odds ratios for the association between an increase in physical activity at age 43 years and life events score.

Stressful life events	N	Adjusted OR (95% CI)	p
Life events score	1689	0.84 (0.75, 0.94)	0.002
Social participation		0.56 (0.48, 0.65)	<0.001
Social class		0.83 (0.73, 0.95)	0.006
Education		0.80 (0.68, 0.96)	0.01

8.3.3.1.6 Influence of the covariate factors on the association between an increase in physical activity at age 43 years and emotional score.

There was no evidence from the analysis of the effects of perceived support and social network factors, but there was a significant influence of social participation factor on the association (LRTχ^2 = 91.7, p<0.001) (Table 8.16). Social class (LRTχ^2 = 39.2, p<0.001) and education (LRTχ^2 = 47.6, p<0.001) were also found to significantly influence the association.

The model to obtain the adjusted odds ratio of the effect of the emotional score included social participation, social class, and education factors. There was no evidence that the fit of the data was inadequate (Pearsonχ^2: 142.7, p = 0.9). The effects of the emotional score increased slightly to 0.88 (95%CI: 0.81, 0.96) after adjusting for the covariates compared to the unadjusted odds ratio (OR = 0.90, 95%CI: 0.84, 0.98) (Table 8.17).

Table 8.16: LRT for the influence of social support and demographic factors on the association between an increase in physical activity at age 43 years and emotional score.

Factors	N	LRT χ^2(p)
Perceived support	1809	3.0 (0.1)
PS x ES	1809	2.3 (0.1)
Social network	1812	1.6 (0.2)
SN x ES	1812	1.6 (0.2)
Social participation	1811	91.7 (<0.001)
SP x ES	1811	0.4 (0.6)
Sex (women)	1814	0.9 (0.4)
Social class	1756	39.2 (<0.001)
Education	1726	47.6 (<0.001)

PS: perceived support, SN: social network, SP: social participation, ES: emotional score, x: interaction.

Table 8.17: Adjusted odds ratios for the association between an increase in physical activity at age 43 years and emotional score.

	N	Adjusted OR (95% CI)	p
Emotional score	1670	0.88 (0.81, 0.96)	0.003
Social participation		0.56 (0.48, 0.65)	<0.001
Social class		0.83 (0.73, 0.95)	0.006
Education		0.81 (0.68, 0.96)	0.01

8.3.3.1.7 Influence of the covariate factors on the association between an increase in physical activity at age 43 years and health related life events score.

The results of the analysis are shown in Table 8.18. The effect of perceived support (OR = 0.75, 95%CI: 0.55, 1.02) in the association was found to be marginally significant (LRTχ^2 = 3.7, p= 0.05). There was also an interaction found between perceived support and health related life events score (OR = 1.61, 95%CI: 1.08, 2.40) (LRTχ^2 = 1.7, p= 0.02). The result also showed that there was a significant influence of social participation factor in the association (LRTχ^2 = 92.4, p<0.001). Social class and education factors were also found to significantly influence the association (LRTs, $p < 0.001$).

The model used to obtain the estimated effect of health related life events was adjusted for the perceived support, interaction of perceived support and health related life events score, social participation, social class, and education factors. The goodness of fit test did not find that the fit of the data in the model was inadequate (Pearsonχ^2 = 156.3, p= 0.9). The size of the adjusted odds ratios for the effects of health related life events score (OR =0.77, 95% CI: 0.65, 0.91) was found to be smaller than the unadjusted odds ratio (OR = 0.85, 95%CI: 0.73, 0.99) (Table 8.19).

Table 8.18: LRT for the influence of social support and demographic factors on the association between an increase in physical activity at age 43 years and health related life events score.

Factors	N	LRTχ^2(p)
Perceived support	1827	3.7 (0.05)
PS x HLES	1827	5.8 (0.02)
Social network	1830	1.7 (0.2)
SN x HLES	1830	0.1 (0.7)
Social participation	1829	92.4 (<0.001)
SP x HLES	1829	0.3 (0.6)
Sex	1832	1.0 (0.3)
Social class	1774	38.3 (<0.001)
Education	1743	48.1 (<0.001)

PS: perceived support, SN: social network, SP: social participation, HLES: health related life events score, x: interaction.

Table 8.19: Adjusted odds ratios for the association between an increase in physical activity at age 43 years and health related life events score.

	N	Adjusted OR (95% CI)	p
Health related life events score	1683	0.77 (0.65, 0.91)	0.002
Perceived support		0.45 (0.24, 0.85)	0.01
PS x HLES		1.75 (1.14, 2.69)	0.01
Social participation		0.56 (0.48, 0.65)	<0.001
Social class		0.84 (0.73, 0.96)	0.01
Education		0.79 (0.67, 0.94)	<0.01

PS: perceived support, HLES: health related life events score, x: interaction.

8.3.3.1.8 Influence of the covariate factors on the association between an increased in physical activity at age 43 years and health related emotional score.

The analysis found two social support factors that significantly influenced the association. These were, an interaction between perceived support and health related life events scores (OR = 1.33, 95%CI: 1.02, 1.74) (LRTχ^2 = 4.6, p= 0.03), and the social participation factor (LRTχ^2 = 18.1, p<0.001) (Table 8.20). Social class and education were also found to be statistically significant factors in the association (LRTs, p< 0.001).

The effect of the emotional score was adjusted for the perceived support, interaction of perceived support and emotional score, social participation, social class, and education factors. The goodness of fit test carried out for the model showed no evidence of inadequate fit of the data in the model (Pearson χ^2: 181.6, p= 0.9). The effect of emotional score was greater after adjusting for the covariates (OR = 0.85, 95% CI: 0.76, 0.95) compared to unadjusted odds ratio (OR = 0.90, 95% CI: 0.81, 0.99) (Table 8.21).

Table 8.20: LRT for the influence of social support and demographic factors on the association between an increase in physical activity at age 43 years and health related emotional score.

Factors	N	LRT χ^2(p)
Perceived support	1808	3.2 (0.1)
PS x HES	1808	4.6 (0.03)
Social network	1811	1.5 (0.2)
SN x HES	1811	0.9 (0.3)
Social participation	1810	18.1 (<0.001)
SP x HES	1810	0.6 (0.5)
Sex	1813	0.6 (0.4)
Social class	1755	37.4 (<0.001)
Education	1725	46.6 (<0.001)

PS: perceived support, SN: social network, SP: social participation, HES: health related emotional score, x: interaction.

Table 8.21: Adjusted odds ratios for the association between an increase in physical activity at age 43 years and emotional score.

Stressful life events	N	Adjusted OR (95% CI)	P
Health related emotional score	1665	0.85 (0.76, 0.95)	0.003
Perceived support		0.49 (0.27, 0.90)	0.02
PS x HES		1.41 (1.06, 1.88)	0.02
Social participation		0.56 (0.48, 0.65)	<0.001
Social class		0.84 (0.74, 0.96)	0.01
Education		0.80 (0.67, 0.95)	0.01

PS: perceived support, HES: health related emotional score, x: interaction.

8.3.3.1.9 Influence of the covariate factors on the association between an increase in physical activity at age 43 years and diagnosis of medical condition.

The LRT of the effect of social support factors showed that perceived support and social network did not have a significant effect in the association (Table 8.22). The interaction of perceived support and the diagnosis of a medical condition was not analysed, because there was no observation in the 'often' and 'none/sometimes' categories of the perceived support factor in the cohort members who were diagnosed with at least one medical condition and who had an increase in physical activity. The interaction between diagnosis of a medical condition and social network was found to be marginally significant (LRTχ^2 = 3.8, p= 0.05) and there was a significant effect of social participation in the association (LRTχ^2 = 81.8, p<0.001). Social class and education were also found to be important factors in the association (LRTs, p< 0.001).

Table 8.22: LRT for the influence of social support and demographic factors on the association between an increased physical activity at age 43 years and diagnosis of a medical condition.

Factors	N	LRTχ^2(p)
Perceived support	1549	2.22 (0.1)
PS x MC	1549	-
Social network	1551	1.4 (0.2)
SN x MC	1551	3.8 (0.05)
Social participation	1550	81.8 (<0.001)
SP x MC	1550	2.3 (0.1)
Sex	1553	1.0 (0.2)
Social class	1515	35.9 (<0.001)
Education	1486	38.4 (<0.001)

PS: perceived support, SN: social network, SP: social participation, MC: diagnosis of a medical condition, x: interaction.

The adjusted odds ratio of the effect of diagnosis of a medical condition was obtained by fitting a logistic model that included the social participation, social class, and education factors (Table 8.23). The goodness of fit test did not find that the fit of the model was inadequate (Pearson χ^2= 40.6, p = 0.8). The effect of diagnosis of a medical condition increased after adjusting for the covariates mentioned (OR = 0.12, 95% CI: 0.02, 0.91) compared to the unadjusted odds ratio (OR = 0.37, 95%CI: 0.15, 0.94).

Table 8.23: Adjusted odds ratios for the association between an increase in physical activity at age 43 years and diagnosis of a medical condition.

	N	Adjusted OR (95% CI)	p
Diagnosis of a medical condition	1441	0.12 (0.02, 0.91)	0.04
Social participation		0.57 (0.48, 0.67)	<0.001
Social class		0.81 (0.70, 0.94)	0.005
Education		0.83 (0.69, 0.99)	0.04

8.3.3.2 Results of the analysis at age 53 years.

8.3.3.2.1 Association between stressful life events, health related life events, and diagnosis of a medical condition and, an increase in physical activity.

The analysis found no association between an increase in physical activity and, stressful life events and health related life events measures (Table 8.24). The unadjusted odds ratios for the effects of the life events score and health related life events score were less than unity and not statistically significant. In the analysis of the diagnosis of a medical condition, it was found that the cohort members who were diagnosed with at least one medical condition between age 43 and 53 years had 31% less odds to increase physical activity at age 53 years compared to those who were not so diagnosed (OR = 0.69 (95%CI: 0.51, 0.93).

Table 8.24: Odds ratios for the association between an increase in physical activity and stressful life events.

	Unadjusted OR (95% CI)	p
Stressful life events		
Life events score (N = 1870)	0.98 (0.90, 1.08)	0.7
Health related life events		
Health related life events score (N = 1870)	0.94 (0.82, 1.07)	0.3
Diagnosed with a medical condition (N = 1762)		
No	1	0.01
Yes	0.69 (0.51, 0.93)	

The following results examined the effect of the covariates in the association between an increase in physical activity at age 53 years and diagnosis of a medical condition.

8.3.3.2.2 Relationships between an increase in physical activity at age 53 years and the covariate factors.

The logistic regression analysis did not find any association between an increase in physical activity, and perceived support and social participation (Table 8.25). The analysis found that the cohort members in lower social classes had 22% less odds of increase in physical activity (OR = 0.78, 95%CI: 0.71, 0.86) and those with one education level lower had 31% less odds of increase in physical activity (OR = 0.69, 95%CI: 0.61, 0.78).

Table 8.25: Unadjusted odds ratios for the association between social support and demographic factors and an increase in physical activity at age 53 years.

Factors	N	Unadjusted OR (95% CI)	p
Perceived support	1869	0.90 (0.74, 1.11)	0.3
Social network	1870	0.92 (0.82, 1.04)	0.2
Sex (Women)	1870	1.08 (0.87, 1.33)	0.5
Social class	1810	0.78 (0.71, 0.86)	<0.001
Education	1769	0.69 (0.61, 0.78)	<0.001

8.3.3.2.3 Influence of the covariate factors on the association between increase in physical activity at age 53 years and diagnosis of a medical condition.

The likelihood ratio test carried out to asses the statistical influence did not find any significant effect of the perceived support and social network factors or their interaction factors with the diagnosis of a medical condition (Table 8.26). For the demographic factors, social class and education factor were found to have statistically significant effects in the association (LRTs, p< 0.001)

The odds ratio of the effect of diagnosis of medical condition in the final model was adjusted for the social class and education factors only. The goodness of fit test of the model did not find any evidence of inadequate fit (Pearsonχ^2= 12.3, p = 0.9). The adjusted estimate of the effect of diagnosis of medical condition (OR = 0.70, 95%CI: 0.51, 0.95) was similar to the unadjusted odds ratio (OR = 0.69, 95%CI: 0.51, 0.93) after accounting for the effects of social class and education (Table 8.27).

Table 8.26: LRT for the influence of the social support and demographic factors on the association between increased physical activity at age 53 years and emotional score.

Factors	N	LRTχ^2(p)
Perceived support	1761	0.4 (0.5)
PS x MC	1761	2.4 (0.1)
Social network	1762	1.8 (0.2)
SN x MC	1762	0.2 (0.7)
Sex	1762	0.6 (0.5)
Social class	1710	23.4 (<0.001)
Education	1665	28.0 (<0.001)

PS: perceived support, SN: social network, MC: diagnosis of a medical condition, x: interaction.

Table 8.27: Adjusted OR for the association between an increase in physical activity at age 53 years and diagnosis of a medical condition.

	N	Adjusted OR (95% CI)	p
Diagnosis of a medical condition	1622	0.70 (0.51, 0.95)	0.02
Social class		0.86 (0.77, 0.97)	0.01
Education		0.77 (0.67, 0.90)	<0.01

8.3.3.3 Results of the analysis of the aggregated data.

8.3.3.3.1 Association between stressful life events, health related life events, and diagnosis of a medical condition and, an increase in physical activity.

The analysis of the association between an increase in physical activity and, life events score and the health related life events score, did not find any association, but a significant association was found in the analysis of diagnosis of a medical condition (Table 8.28). The result showed that the cohort members who were diagnosed with at least one medical condition had 28% lower odds of an increase in physical activity compared to those who were not so diagnosed (OR = 0.72, 95%CI: 0.53, 0.99).

Table 8.28: Unadjusted odds ratios for the association between an increase in physical activity and stressful life events, health related life events, and diagnosis of a medical condition in the aggregated data.

	N	S	Unadjusted OR (95% CI)	p
Stressful life events				
Life events score	3704	2449	0.94 (0.87, 1.02)	0.1
Health related life events				
Health related life events score	3702	2448	0.91 (0.81, 1.01)	0.1
Diagnosis of a medical condition				
No	3315	2143	1	0.04
Yes			0.72 (0.53, 0.99)	

N: number of observation, s: number of subjects.

The following are the results of the analysis of the influence of the covariates on the association between an increase in physical activity and diagnosis of a medical condition in the aggregated data.

8.3.3.3.2 Relationships between an increase in physical activity and the covariates.

The results of the analysis are presented Table 8.29. There was no relationship found between an increase in physical activity and the perceived support factor, but a significant relationship was found in the social network factor. The result showed that cohort members with a lower degree of relationship with family and friends were 14% less likely to increase their physical activity (OR = 0.86, 95%CI: 0.78, 0.96). The cohort members in the lower social classes and less educated were also less likely to increase their physical activity (social class: OR = 0.74, 95%CI: 0.67, 0.80; education: OR = 0.61, 95%CI: 0.54, 0.70).

Table 8.29: Unadjusted odds ratios for the association between an increase in physical activity and life circumstances in the aggregated data.

	N	S	Unadjusted OR (95% CI)	p
Perceived support	3698	2446	0.87 (0.72, 1.06)	0.2
Social network	3703	2449	0.86 (0.78, 0.96)	0.005
Sex	3705	2449	0.99 (0.82, 1.20)	0.9
Social class	3586	2364	0.74 (0.67, 0.80)	<0.001
Education	3515	2314	0.61 (0.54, 0.70)	<0.001

N: number of observation, s: number of subjects.

8.3.3.3.3 Influence of the covariate factors on the association between an increase in physical activity and diagnosis of medical condition in the aggregated data.

The likelihood ratio test found that the perceived support factor had no significant effect on the association but there was significant moderating effect of social network on diagnosis of a medical condition (LRTχ^2 = 8.8, p= 0.003) (Table 8.30). Education was found to be a significant factor in the association (LRTχ^2 = 54.2, p<0.001). The Wald test was used to assess the effect of social class because the likelihood ratio test did not produce a valid p-value. The result showed that social class had a significant effect on the association (p<0.001).

The final model to obtain the estimate effect of the diagnosis of a medical condition was adjusted for social network, social class, and education. The result showed that the odds ratio of the effect the diagnosis of a medical condition had changed very little. The adjusted odds ratio of diagnosis of a medical condition was 0.72 (95%CI:

0.52, 0.99), which was similar to the unadjusted estimate. The relative differences in the estimates was smaller than 0.01%, suggesting a reasonable fit of the data.

Table 8.30: LRT for the influence of social support and demographic factors on the association between an increase in physical activity and diagnosis of a medical condition in the aggregated data.

Factors	Number of observation	number of subjects	LRT χ^2(p)
Perceived support	3310	2141	0.5 (0.5)
PS x MC	3310	2141	0.1 (0.8)
Social network	3313	2142	8.8 (0.003)
SN x MC	3313	2142	3.6 (0.2)
Sex	3315	2143	0.0 (>0.9)
Social class	3225	2080	53.4 (<0.001)*
Education	3151	2033	54.2 (<0.001)

**Wald test.*

Table 8.31: Adjusted odds ratios for the association between an increase in physical activity and diagnosis of a medical condition in the aggregated data.

N = 3071 s = 1978	Adjusted OR (95% CI)	p
MC	0.72 (0.52, 0.99)	0.04
Social network	0.87 (0.78, 0.96)	0.01
Social class	0.83 (0.75, 0.92)	<0.001
Education	0.71 (0.62, 0.82)	<0.001

N: number of observation.
s: number of subject.

8.4 Change in physical activity – a decrease in physical activity.

8.4.1 Descriptive results – the distribution by social support and demographic factors.

8.4.1.1 Descriptive results of the analysis at age 43 years.

The descriptive results are presented in Table 8.32. There were more women than men who had a decrease in physical activity at age 43 years ($p<0.05$). The decrease in physical activity was statistically significantly related to social class and education. There were more cohort members from the lower social classes and the less educated who had decreased their physical activity than those in the higher social classes ($p<0.01$) and the more educated respectively ($p<0.01$). There were also significant declining trends found as the social class and education level decreased ($p<0.01$). The decrease in physical activity was inversely related to the social network ($p<0.01$) and social participation ($p<0.001$) factors. Greater proportions of cohort members who had decreased their physical activity had lower social network and social participation scores, and there were significant declining trends in the proportions as the scores increases ($p <0.01$).

8.4.1.2 Descriptive results of the analysis at age 53 years.

There was no relationship between sex and decrease in physical activity at age 53 years but significant relationships were found for social class and education (Table 8.32). A greater proportion of cohort members who had decreased their physical activity were from the lower social class ($p<0.05$) and the less educated ($p<0.001$). There were also significant increasing trend in the proportion as the social class and education level decreased ($p<0.01$). A decrease in physical activity was less common in the cohort members with greater degree of relationship with family and friends ($p<0.05$) and the proportion increased as the social network score decreased ($p<0.01$).

8.4.1.3 Descriptive results of the analysis of the aggregated data.

The aggregated data showed similar results to that at age 53 years. There was no relationship between sex and decrease in physical activity (Table 8.32). There were more cohort members from the lower social classes ($p<0.001$) and the less educated ($p<0.001$) who had decreased their physical activity. The result also showed significant increasing trend with the decrease in the social class and education level ($p<0.01$). There were fewer cohort members with better relationship with family and friends who had decreased their physical activity ($p<0.001$) and, there was significant increasing trend in the proportion with the decrease in the social network score ($p<0.01$).

Table 8.32: Numbers of cohort members who had a decrease in physical activity by the demographic and social support factors.

	Age 43 years			Age 53 years			Aggregate		
Demographic	**N**	**n (%)**	**p**	**n**	**n (%)**	**p**	**N**	**n (%)**	**p**
Sex (N)	(1146)			(935)			(2081)		
Men	632	286 (45.3)	<0.05	503	251 (49.9)	0.5	1135	537 (47.3)	0.3
Women	514	263 (51.2)		432	206 (47.7)		946	469 (49.6)	
Social class (N)	(1120)			(909)			(2029)		
I-II	577	236 (40.9)	<0.001	500	221 (44.0)	0.03	1077	457 (42.4)	<0.001
III-NM	261	142 (54.4)		191	95 (49.7)		452	237 (52.4)	
III-M	177	94 (53.1)		127	71 (55.9)		304	165 (54.3)	
IV-V	105	65 (61.9)		91	52 (57.1)		196	117 (59.7)	
Education (N)	(1096)			(890)			(1896)		
A-level/university	491	212 (43.2)	<0.01	419	117 (42.2)	<0.001	530	303 (57.2)	<0.001
Ordinary / vocational	304	152 (50.0)		242	118 (48.8)		546	270 (49.5)	
None	301	163 (54.2)		229	140 (61.1)		910	389 (42.8)	
Social support factors									
Perceived support (N)	(1141)			(934)			(2075)		
Always	1052	503 (47.8)	0.7	815	397 (48.7)	0.9	1867	900 (48.2)	0.7
Often	49	21 (42.9)		81	39 (48.2)		130	60 (46.2)	
None or sometimes	40	21 (52.5)		38	20 (52.6)		78	41 (52.6)	
Social relationship (N)	(1142)			(935)			(2077)		
5	215	89 (41.4)	<0.01	319	133 (41.7)	0.01	534	222 (41.6)	<0.001
4	358	159 (44.4)		403	207 (51.4)		761	366 (48.1)	
3	394	197 (50.0)		143	80 (55.9)		537	277 (51.6)	
0-2	175	101 (57.7)		70	37 (52.9)		245	138 (56.3)	
Social participation (N)	(1145)								
6 or more	418	144 (34.5)	<0.001						
1-5	351	168 (47.9)							
0	376	236 (62.8)							

8.4.2 Descriptive results: numbers and odds ratios of a decrease in physical activity by the life stress measures.

8.4.2.1 Results of the analysis at age 43 years.

The odds ratios of decrease in physical activity by the stressful life events measures are shown in Table 8.33. There was no pattern found in the odds ratios of the life events score, emotional score, or life change score. There was also no pattern found in the odds ratios of the health related life events score and emotional score and, a less clear declining pattern in the life change score (Table 8.34). There were 39.1% (n = 9) cohort members who where diagnosed with at least one medical condition between age 36 and 43 years had decreased their physical activity at age 43 years compared to 47.9% in those who were not so diagnosed (Table 8.35).

Table 8.33: Number and odds ratios of cohort members who had a decrease in physical activity at age 43 years by the stressful life events measures.

	N	n (%)	Odds
Life event score (N = 1144)			
0	273	138 (50.6)	1
1	349	168 (48.1)	0.91 (0.66, 1.25)
2	246	119 (48.4)	0.92 (0.65, 1.29)
3 or more	276	122 (44.2)	0.77 (0.55, 1.08)
Emotional score (N = 1132)			
0	273	138 (50.6)	1
1	192	89 (46.4)	0.85 (0.58, 1.22)
2	214	103 (48.1)	0.91 (0.63, 1.30)
3	254	118 (46.5)	0.85 (0.60, 1.20)
4 or more	199	92 (46.2)	0.84 (0.58, 1.21)
Life changes score (N = 1135)			
0	273	138 (50.6)	1
1	503	231 (45.9)	0.83 (0.62, 1.12)
2	167	77 (46.1)	0.84 (0.57, 1.23)
3 or more	192	96 (50.0)	0.98 (0.68, 1.42)

Table 8.34: Number and odds ratios of cohort members who had a decrease in physical activity at age 43 years by the health related life events measures.

	N	n (%)	Odds
Life event score (N = 1143)			
0	412	200 (48.5)	1
1	430	212 (49.3)	1.03 (0.79, 1.35)
2 or more	301	134 (44.5)	0.85 (0.63, 1.15)
Emotional score (N = 1138)			
0	412	200 (48.5)	1
1	208	97 (46.6)	0.92 (0.66, 1.29)
2	264	126 (47.7)	0.97 (0.71, 1.32)
3 or more	254	119 (46.9)	0.93 (0.68, 1.28)
Life change score (N = 1132)			
0	406	197 (48.5)	1
1	493	237 (48.1)	0.98 (0.76, 1.28)
2	137	60 (43.8)	0.83 (0.56, 1.22)
3 or more	96	45 (46.9)	0.94 (0.60, 1.46)

Table 8.35: Number of cohort members diagnosed with at least one medical condition who had a decrease in physical activity at age 43 years (N =979).

Diagnosed with a medical condition	N	n (%)
No	956	458 (47.9)
Yes	23	9 (39.1)

8.4.2.2 Results of the analysis at age 53 years.

There was a less clear declining pattern found in the odds ratios of decreased physical activity as the life events score increased (Table 8.36). No pattern was found in the odds ratios of a decrease in physical activity in the health related life events score. There were slightly smaller proportion of cohort members who were diagnosed with at least one medical condition between age 43 and 53 years had decreased their physical activity at age 53 years (45.5%) compared to those who were not so diagnosed (49.7%) (Table 8.36).

Table 8.36: Number and odds ratios of cohort members, by the stressful life events and health related life events and, number of cohort members diagnosed with at least one medical condition, who had a decrease in physical activity at age 53 years.

	N*	n (%)	Odds
Stressful life events			
Life event score (N)	(935)		
None	178	80 (44.9)	1
1	250	130 (52.0)	1.33 (0.90, 1.95)
2	203	102 (50.3)	1.24 (0.83, 1.85)
3 or more	304	145 (47.7)	1.12 (0.77, 1.62)
Health related life event			
Health related life events score (N)	(935)		
None	286	136 (47.6)	1
1	338	173 (51.2)	1.16 (0.84, 1.58)
2 or more	311	148 (47.6)	1.00 (0.73, 1.38)
Diagnosis of a medical condition (N)	(895)		
No	774	385 (49.7)	-
Yes	121	55 (45.5)	

**number of subjects.*

8.4.2.3 Results of the analysis of the aggregated data.

The aggregated data also showed no clear pattern in the odds ratios of a decrease in physical activity in the life events score and health related life events score (Table 8.37). There were smaller proportion of cohort members who were diagnosed with at least one medical condition and had decreased their physical activity (44.4%) compared to those who were not so diagnosed (48.7%).

Table 8.37: Number and odds ratios of cohort members, by the stressful life events and health related life events and, number of cohort members diagnosed with at least one medical condition, who had a decrease in physical activity in the aggregated data.

	N*	n (%)	Odds
Life event score (N)	(2079)		
None	451	218 (48.3)	1
1	599	298 (49.8)	1.06 (0.83, 1.35)
2	449	221 (49.2)	1.04 (0.80, 1.35)
3 or more	580	267 (46.0)	0.91 (0.71, 1.17)
Health life event score (N)	(2078)		
None	698	336 (48.1)	1
1	768	385 (50.1)	1.08 (0.88, 1.33)
2 or more	612	282 (46.1)	0.92 (0.74, 1,14)
Diagnosed with medical condition (N)	(1874)		
No	1730	843 (48.7)	-
Yes	144	64 (44.4)	

**number of subjects.*

8.4.3 Association between a decrease in physical activity and life stress.

8.4.3.1 Results of the analysis at age 43 years.

8.4.3.1.1 Association between a decrease in physical activity and stressful life events.

The analysis did not find any association between a decrease in physical activity and, life events score, emotional score, and life change score (Table 8.38).

8.4.3.1.2 Association between a decrease in physical activity and health related life events.

There was also no association found between a decrease in physical activity and health related life events score, emotional score, and life change score (Table 8.39).

8.4.3.1.3 Association between a decrease in physical activity and diagnosis of medical condition.

For the diagnosis of medical condition, the analysis found that the odds ratio in cohort members who were diagnosed with at least one medical condition was lower compared to those who were not diagnosed but it was not significant at 5% significant level (Table 8.40).

Table 8.38: Odds ratios for the association between a decrease in physical activity at age 43 years and stressful life events measures.

	N	Unadjusted OR (95% CI)	p
Life events score	1144	0.93 (0.83, 1.03)	0.2
Emotional score	1132	0.96 (0.89, 1.04)	0.4
Life change score	1135	0.99 (0.88, 1.12)	0.9

Table 8.39: Odds ratios for the association between a decrease in physical activity at age 43 years and health related life events measures.

	N	Unadjusted OR (95% CI)	p
Life events score	1143	0.93 (0.80, 1.08)	0.3
Emotional score	1138	0.98 (0.89, 1.08)	0.7
Life change score	1132	0.96 (0.84, 1.09)	0.5

Table 8.40: Odds ratios for the association between a decrease in physical activity and diagnosis of a medical condition.

Diagnosis of a medical condition	N	Unadjusted OR (95% CI)	p
No	979	1	0.4
Yes		0.70 (0.30, 1.63)	

8.4.3.2 Results of the analysis at age 53 years.

8.4.3.2.1 Association between stressful life events, health related life events, and diagnosis of a medical condition and, a decrease in physical activity.

The analysis of decrease in physical activity at age 53 years and, life events score and health related life events score did not find any significant association (Table 8.27). For the diagnosis of a medical condition, the analysis found that the odds ratio was lower in cohort members who were diagnosed with at least one medical condition but it was not significant (Table 8.41).

Table 8.41: Results for the association between a decrease in physical activity and, stressful life events and health related life events.

	N	Unadjusted OR (95% CI)	p
Stressful life events			
Life events score	935	1.01 (0.90, 1.13)	0.9
Health related life events			
Health related life events score	935	1.00 (0.85, 1.17)	>0.9
Diagnosis of a medical condition			
No	895	1	0.4
Yes		0.84 (0.57, 1.24)	

8.4.3.3 Results of the analysis of the aggregated data.

8.4.3.3.1 Association between stressful life events, health related life events, and diagnosis of a medical condition and, a decrease in physical activity.

The analysis of the aggregated data did not find any association between a decrease in physical activity and life events score, health related life events score, and the diagnosis of a medical condition.

Table 8.42: Odds ratios for the association between a decrease in physical activity and the diagnosis of a medical condition in the aggregated data.

	N	S	Unadjusted OR (95%CI)	p
Stressful life events				
Life events score	2079	1557	0.97 (0.89, 1.05)	0.4
Health related life events				
Health related life events score	2078	1556	0.97 (0.86, 1.09)	0.6
Diagnosis of a medical condition				
No	1874	1377	1	0.4
Yes			0.86 (0.59, 1.26)	

8.5 Summary of the results.

This chapter assessed whether an increase or a decrease in physical activity was related to stressful life events, health related life events, and diagnosis of a medical condition. Examination of the NSHD data at age 43 and 53 years and, the aggregated data found that increased physical activity was more likely in the higher social classes and the better educated. Increased physical activity was also more likely in the cohort members who had a better relationship with their family, friends (age 43 years and in the aggregated data), and in those who participated more in social activities (age 43 years). In contrast, a decrease in physical activity was more likely in the lower social classes and less educated (age 43 and 53 years and, in the aggregated data) and, in those who had poorer relationships with family and friends (age 43 and 53 years and, in the aggregated data) and were less involved in social activities (age 43 years).

In respect of the effect of stressful life events, the analysis found that there was an inverse association between stressful life events and an increase in physical activity at age 43 years. (Figure 8.2). Cohort members who had more life events (unadjusted OR = 0.88, 95%CI: 0.79, 0.97) or were more affected emotionally (unadjusted OR = 0.90, 95%CI: 0.84, 0.98) by the life events were less likely to increase their physical activity. The effects of the life events score (adjusted OR = 0.84, 95%CI: 0.75, 0.94) and emotional score increased slightly (adjusted OR = 0.88, 95%CI: 0.81, 0.96) and remained significant after adjusting for the covariates. There was, however, no significant finding in the analysis at age 53 years and the analysis of the aggregated data.

The results of the analysis of the effect of the health related life events were similar to that of the stressful life events. There was an inverse association between the health related life events score and an increase in physical activity (unadjusted OR = 0.85, 95%CI: 0.73, 0.99) and the effect of the life events had increased after adjusting for the covariates (adjusted OR = 0.77, 95%CI: 0.65, 0.91) (Figure 8.2). Similarly, the effect of the health related emotional score had also increased after adjusting for the covariates (unadjusted OR = 0.90, 95%CI: 0.81, 0.99; adjusted OR = 0.85, 95%CI: 0.76, 0.95).

The measures in health related life events at age 43 years (life events score and emotional score) were the subsets of the measures in stressful life events at age 43 years. It is possible that the associations found in stressful life events, in part or as a whole, can be attributed to the effects of the health related life events. To examine this further, analysis was carried out by assessing the effect of the non-health related life events, which was the difference (in the original scores) between stressful life events measures and health related life events measures. The method for this analysis is described in Appendix 8.1. The result showed that there was no effect of non-health related life events in both life events score (n = 1832, unadjusted OR = 0.92, 95%CI: 0.80, 1.06; p = 0.2) and emotional score (n = 1813, OR = 0.93, 95%CI: 0.85, 1.00; p = 0.07). Thus, it is more likely that the associations found in the analysis of stressful life events were attributed to the health related life events.

The results of the effect of the diagnosis of a medical condition were the most consistent. The inverse association between diagnosis of a medical condition and increase in physical activity were found in the analysis at age 43 years (unadjusted OR = 0.37, 95%CI: 0.15, 0.94), 53 years (unadjusted OR = 0.69, 95%CI: 0.51, 0.93) and the analysis of the aggregated data (unadjusted OR = 0.72, 95%CI: 0.53, 0.99). The effect of the diagnosis of a medical condition increased by 40% greater after adjusting for the covariates (OR = 0.12, 95%CI: 0.02, 0.91) in the analysis at age 43 years, but there was little change in the odds ratios after adjusting for the covariates in the analysis at age 53 years (OR = 0.70, 95%CI: 0.51, 0.95), and in the analysis of the aggregated data (OR = 0.74, 95%CI: 0.56, 0.99). Although the odds ratios remained significant in these associations, the confidence intervals were very wide.

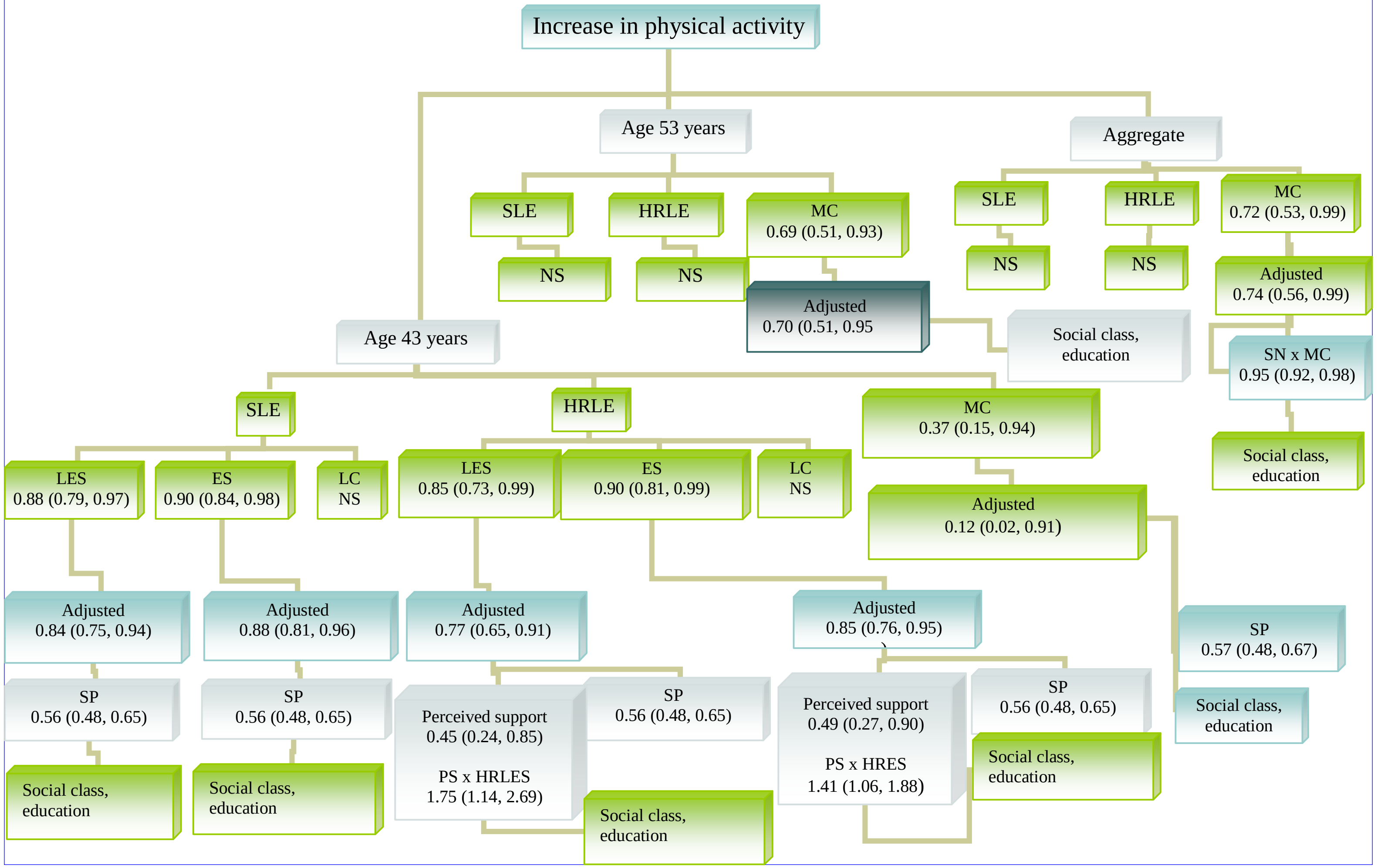
Social support factors were found to have a very strong influence on many of the associations above and were positively associated with an increase in physical activity. The effect of the perceived support factor was found in the analysis of health related life events. The adjusted odds ratio of 0.45 (95% CI: 0.24, 0.85) in the analysis of health related life events score was equivalent to 2.2 times greater odds of an increase in physical activity in the cohort members who reported they had a greater level of support during crises. Similarly, the adjusted odds ratio of 0.49 (95% CI: 0.27, 0.90) in the analysis of health related emotional score was equivalent to two times more likely to increase physical activity in those with greater level of support. There were also interactions between perceived support and, health related life events score (OR = 1.75, 95%CI: 1.14, 2.69) and health related emotional score (OR = 1.41, 95%CI: 1.06, 1.88). Greater perceived support increased the likelihood of increase in physical activity in those with a similar exposure to the health related life events measures.

Social network was found to be a significant factor in the association between diagnosis of a medical condition and an increase in physical activity in the aggregated data. Cohort members with poorer relationship with family and friends were found to be less likely to increase their physical activity than those who have better relationship (OR = 0.87, 95%CI: 0.78, 0.96).

The influence of participation in social activities was found in the analysis of stressful life events (life events score and emotional score: OR = 0.56, 95% CI: 0.48, 0.65), health related life events (health related life events score, health related emotional score: OR = 0.56, 95% CI: 0.48, 0.65), and the diagnosis of a medical condition (OR = 0.57, 95% CI: 0.48, 0.67) at age 43 years. The odds ratios were similar and it showed that the cohort members who were less involved in social activity were less likely to increase their physical activity.

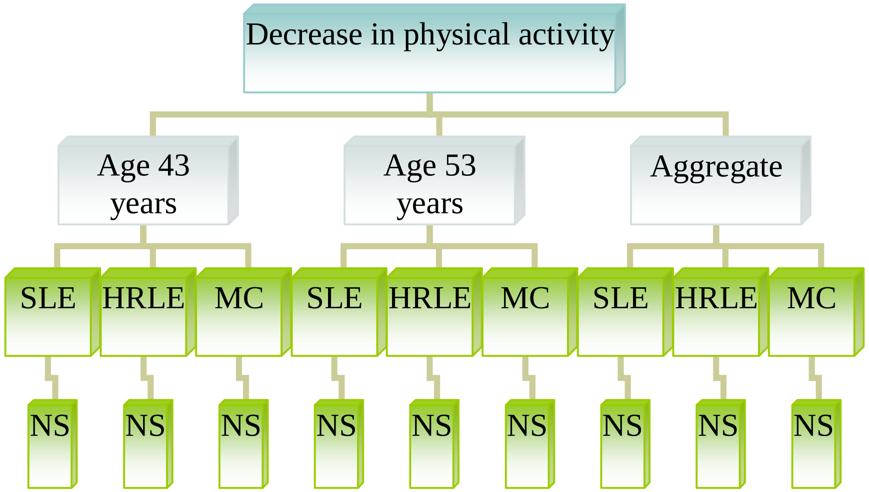
The analysis also showed that there were a positive association between an increase in physical activity and social class and education. The effects were consistent and were found in the analysis of stressful life events, health related life events and the diagnosis of a medical condition.

Figure 8.2: Summary of the results of the analysis of the association between an increase in physical activity and the life stress measures at age 43 and 53 years, and the aggregated data (OR (95% CI)).



**unadjusted odds ratio and 95% CI, **adjusted odds ratio and 95%CI. See abbreviation on page 22.*

Figure 8.3: Summary of the results of the association between a decrease in physical activity and the life stress measures at age 43 and 53 years, and the aggregated data (OR (95% CI)).



See abbreviation on page 22.

CHAPTER 9

Discussion.

9.1 Introduction.

Health related behaviours are a major concern in public health because of their role in the aetiology of chronic diseases. Health behaviours in the general population are dynamic. Although the overall trend in the population is towards healthier behaviours, there are still some sections of the population that have not changed and some that have adopted less healthy behaviours. Research has tended to focus on measuring need; assessing the prevalence of disease and to a lesser extent, evaluating interventions (Gochman, 1997a). The concern of this thesis has been on the influence of psychosocial factors on change in health behaviours in the general population with a specific focus on life stress that originates from life events. It aimed to assess the relationship between stressful life events and change in health behaviours using data from a national cohort study of the UK population. It was hypothesised that people in the general population are inclined to make adverse changes in health behaviours in the event of greater life stress and that people are inclined to make healthful change in health behaviours following the experience of health related life events.

9.2 Key findings and comparison with other studies.

9.2.1 Stressful life events and change in health behaviours.

9.2.1.1 Stressful life events and change in smoking behaviour.

This study found that ex-smokers in the NSHD cohort, who had experienced more stressful life events or whose feelings were more affected by the life events, were more likely to relapse back to smoking. The findings from this study were consistent with previous studies on the effect of life stress on smoking behaviour, but the latter were limited to the effect of specific life events. One study has reported that financial problems were associated with a three times greater likelihood of smoking relapse (unadjusted OR= 3.6, 95%CI: 1.66, 7.73) (McKee et. al., 2003). Another study reported that smoking relapse was more than twice as likely to occur in people who had lost their job (OR= 2.4, 95%CI: 1.16, 5.12) (Falba et. al., 2005). However, the confidence interval for the odds ratios in these studies were wide compared to the results from this present study (Table 9.1). Another study (Gottlieb and Green, 1984) also reported an association between the life events score and smoking initiation, but the study compared ex-smokers to current smokers, hence, is not directly comparable to this study. The results from this study were also consistent with the report of the General Household Survey of the UK, where the majority of the participants who had relapsed (34% in year 2000 and 38% in 2003), claimed that life stress was the main reason for them to start smoking again (Lader and Meltzer, 2002; Lader and Goddard, 2005). Based on the reports mentioned above, it is thought quite likely that the ex-smokers among the NSHD cohort members, who had relapsed, had used cigarette smoking to relieve stress (Shuval, 1981; DiClemente and Prochaska, 1985).

9.2.1.2 Stressful life events and change in alcohol drinking.

In respect of alcohol drinking, it was found that greater life stress from life events was positively associated with an increased risk of having a drink problem at age 53 years. However, the result must be treated with caution because there was a significant number of missing observations in the CAGE questions that resulted in the data used in the analysis to be different from the NSHD sample who participated in both surveys at age 43 and 53 years. Nevertheless, the findings were consistent with the results of previous studies.

Stressful life events, such as non-health related life events, health events, interpersonal, or financial/work events, were found to be associated with increased drinking problems, especially in late middle age to older people (Brennan et. al., 1999; Moos et. al., 2004, 2006; Bobak et. al., 2005). This study did not find any association between stressful life events and an increase in alcohol consumption over the recommended limit of 4 units per day for men and 3 units per day for women despite the evidence for this association from earlier studies (Romelsjö et. al., 1991; Pereira and Sloan, 2001; Glass et. al., 1995; Brennan et. al., 1999). However, the actual increase in consumption was small (Romelsjö et. al., 1991). An analysis of the NSHD data at age 53 years showed a small but significant increase in alcohol consumption for every unit increase in stressful life events (regression coefficient = 0.3 unit, 95%CI: 0.05, 0.59, $p = 0.02$). The small change in the consumption found in the NSHD data and an earlier study (Romelsjö et. al., 1991) supports the claim that the amount drank was insufficient to show the adverse effect of alcohol in a population (Bobak et.al., 2004). Instead, the CAGE score could have captured some aspects of drinking pattern through the questions about the drinking habits. A plausible explanation for the effect of life events on having a drink problem was similar to that on smoking relapse: alcohol was used to relieve stress. The way people respond to life stress depends on the coping method, and people who use a method that avoids thinking about the stressful experience (cognitive avoidance) or use negative feelings or behavioural expression to reduce tension (emotional discharge) are more likely to develop a drinking problem at a later age (Moos et. al., 2006).

9.2.1.3 Stressful life events and change in dietary behaviour.

This study found no evidence that life stresses have any effect on change in dietary behaviour. This result is not unexpected because the foods that people consume during stress are usually sweet foods (desserts, chocolate, ice-cream), snacks (biscuits, cake, crisps), and fast foods (burgers, pizzas and ethnic foods such as Chinese take-aways) (Oliver and Wardle, 1999; Kandiah et. al., 2006). Fat intake increased and meal type foods (e.g. fruit and vegetables, meat) decreased during stress (McCann et. al., 1990; Wardle et. al., 2000). Although the comfort foods mentioned are high in fat, but because fat consumption was only one of five components in the diet behaviour score, the fat component was less likely to make much impact on the overall dietary change index. The change in the fat and fruit and vegetables consumption could have been too small to affect the overall diet behaviour score; hence the insignificant result.

9.2.1.4 Stressful life events and change in physical activity behaviour.

A significant association was also found between stressful life events and an increase in physical activity. Cohort members who had experienced more stressful life events or whose feelings were more affected by the life events were less likely to make healthful change in their physical activity behaviour. An earlier study did not find that life stress from being widowed in the past year had a significant effect on change in physical activity (Wilcox et. al., 2003). In a report, Oman and King (2000) claimed that the study by Gottlieb and Green (1984) had shown an association between life events and an increase in physical activity in men. However, the latter study was a cross sectional study that did not assess change in physical activity, although the authors did claim that physical activity might be a coping mechanism used to buffer the effect of life events. How the stressful life events affect change in physical activity was not clear. To take up or maintain a continuous practise of physical activity requires the right attitude and knowledge about the benefit that can be gained (Riddle 1980). A deviation from the ideal, for example because of life stress which may take precedence at that time, may make physical activity a lower priority. For instance, people who loose their job would probably rather spend more time looking for a new job than enjoying leisure activity; or people who have been a victim of an assault or robbery may have fear going out to exercise often. Another plausible reason for not taking up physical activity could be that people are too busy or too tired after having to take care of other members of the family who have taken ill (or cannot care for themselves adequately) and consequently they have less time for personal leisure activities. It could also be a result of being ill and/or less capable physically of taking up regular and vigorous physical activity. Since physical activity can be helpful in buffering the effect of stress it is important to ensure that people understand the benefit and importance of maintaining regular physical activity and that fitness can be a healthier alternative for coping with stress compared to smoking, drinking or eating comfort foods.

9.2.1.5 Influence of social support factors on the effect of stressful life events.

Two of the social support factors assessed in this study were found to influence the effect of stressful life events: the social network and participation in social activity. *Social network* was found to moderate the association between stressful life events and smoking relapse, but the impact on the estimated odds ratio was small (difference between adjusted and unadjusted OR< 0.01). The result of this study contrasted with the findings from another study that showed that a more diverse social network was related to less drinking and smoking (Cohen and Lemay, 2007). In contrast, this study has shown that the NSHD cohort members with smaller social networks were less likely to relapse. It was possible that the ex-smokers in the NSHD with diverse social relationships were pressured to smoke while being in a smoking social environment where cigarette smoking was used to facilitate interaction with the people around them (Jarvis, 1997; Mohr et. al., 2001; Kawachi and Berkman, 2001; Cohen and Lemay, 2007). The NSHD data showed that the cohort members who were less active in social participation were less likely to increase their physical activity (Table 9.1). This is discussed in the next section because it seems to have a similar influence on the effect of health related life events.

9.2.2 Health related life events and change in health behaviours.

9.2.2.1 Health related life events and change in smoking, alcohol drinking, and dietary behaviour.

The NSHD data provided no evidence for an effect of life stress from health related life events on either healthful or harmful change in smoking, alcohol drinking, and dietary behaviour.

The results concerning smoking from this study contrasted with earlier reports that health events were positively associated with stopping smoking and inversely associated with smoking relapse (McKee et. al., 2003). Several other studies that found an association between diagnosis of a medical condition and change in smoking behaviour are commented on in later sections in the discussion of the results for the effect of the diagnosis of a medical condition.

The results on alcohol consumption in this study also contrasted with a study that reported associations between health events and the death of someone close, and reduced drinking (Schutte et. al., 2006). A decrease in alcohol consumption, because of health reasons could have been due to hospitalisation, which limits access to alcohol or that the subject was advised, by health professionals, to cut down alcohol consumption (Pereira and Sloan, 2001). It is also possible that some people used alcohol to reduce the anxiety of having someone they care for being critically ill. The consumption then decreases after the death of the loved one. No previous association has been reported between health related life events and change in dietary behaviour or adverse changes in smoking and alcohol consumption.

Table 9.1: Summary of the significant findings.

Life stress	Type of change	Estimate of effect	Significant covariates in adjusted model
Stressful life events	Smoking relapse	Age 43 years -LES: (OR= 1.2, 95%CI: 1.03, 1.43)* -ES: (OR= 1.2, 95%CI: 1.04, 1.34) Aggregated data (OR= 1.15, 95%CI: 1.00, 1.31)*	 - SN (OR= 0.82, 95%CI: 0.68, 0.99) -
	Increased risk of having a drinking problem.	Age 53 years (OR= 1.2, 95%CI: 1.05, 1.48)	Sex
	Increase in physical activity	Age 43 years -LES (OR= 0.8, 95%CI: 0.75, 0.94) -ES (OR= 0.9, 95%CI: 0.81, 0.96)	 PSA (OR= 0.56, 95%CI: 0.48, 0.65), SC, Education SP (OR= 0.56, 95%CI: 0.48, 0.65), SC, Education
Health related life events	Increase in physical activity	Age 43 years -LES (OR= 0.8, 95%CI: 0.65, 0.91) -ES (OR= 0.9, 95%CI: 0.76, 0.95)	 PS (OR= 0.45, 95%CI: 0.24, 0.85), x-PS (OR= 1.75, 95%CI: 1.14, 2.69), SP (OR= 0.56, 95%CI: 0.48, 0.65), SC, Education PS (OR= 0.49, 95%CI: 0.27, 0.90), x-PS (OR= 1.41, 95%CI: 1.06, 2.88), SP (OR= 0.56, 95%CI: 0.48, 0.65), SC, Education
The diagnosis of a medical condition	Stop smoking	Age 53 years, (OR= 2.0, %CI: 1.32, 3.08) Aggregated data (OR= 3.0, 95%CI: 1.80, 5.01)	x PS (OR= 0.38, 95%CI: 0.15, 0.99), Education x PS (OR= 0.34, 95%CI: 0.11, 0.99), SN (OR= 0.84, 95%CI: 0.71, 1.00), SC, Education
	Smoking relapse	Aggregated data (OR= 0.5, 95%CI: 0.25, 0.94)*	-
	Improved diet behaviour	Aggregated data, in men (RC= 1.1, 95%CI: 0.62, 1.52)	SN (OR= -0.15, 95%CI: -0.28, -0.02)
	Increase in physical activity	Age 43 years (OR= 0.1, 95%CI: 0.02, 0.91) Age 53 years (OR= 0.7, 95%CI: 0.51, 0.95) Aggregated data (OR= 0.7, 95%CI: 0.52, 0.99)	SP (OR= 0.57, 95%CI: 0.48, 0.67), SC, Education SC, Education SN (OR= 0.87, 95%CI: 78, 0.96), SC, Education

Adjusted OR unless marked, LES: Life events score, ES: Emotional score, SC: Social class, PS: Perceived support, SN: Social network, SP: Social participation.*

9.2.2.2 Health related life events and change in physical activity.

This investigation of the effect of health related life events found a significant association only with change in physical activity. The results of the analysis at age 43 years showed, for example, that cohort members who experienced more health related life events, or whose feelings were more affected by the events, were less likely to make a healthful change in their physical activity behaviour. The results from this study for the association could be unique because there has been no previous report on such a relationship. However, the finding is difficult to explain. A logical explanation would seem to be the same as that presented for the effect of stressful life events as discussed earlier. Health problems, for example, could have prevented the cohort members from taking up physical activity or, they could have had less time for physical leisure activities because of their commitment to other family members who had taken ill.

Because both stressful life events and health related life events were observed to have similar effects, this study explored further what could have been the most likely explanation. The result presented in Section 8.5 showed that there was no significant effect of non-health related life events. And, because the life events items in the latter was a subset of the former, a more likely explanation was that the effect of stressful life events was actually an artefact of the effect of health related life events. However, the health condition of the cohort members was unlikely to be the main contributor to the significant association, because the number of cohort members who had health problems was small. There were only 3% of the cohort members reported to have an illness, disabled, or hospitalised and 5% who were injured by an accident in the past year before the interview at age 43 years. However, a greater proportion had had family and friends who had had accidents, serious illnesses, or been injured (26%); or had died (35%). Hence, it was most likely that life stress from these events had taken priority in their life at the time, and prevented the cohort members from spending more time on physical leisure activities. If this was the case, then the results of this study contrasted with the report that found no association between death of a spouse and change in physical activity (Wilcox et. al., 2003).

9.2.2.3 Influence of social support factors on the effect of health related life events on physical activity.

Two of the social support factors were found to influence the effect of health related life events: perceived support and participation in social activity. The NSHD data showed that the perceived support factor significantly moderated the effect of health related life events score and emotional score. Lower perceived support was found to be associated with lower odds of increased physical activity at age 43 years. Interactions were also found between these scores and the perceived family and friends support received by the subjects. It also seemed to have greatly influenced the effect of health related life events measures (life events score and emotional score). The interaction showed that for every unit increase in the level of health related life events measures and perceived support, the odds of an increase in physical activity was greater than if there was no interaction. The influence of social participation was similar to that of perceived support. It was found that the cohort members who participated in fewer social activities were less likely to improve their physical activity at age 43 years. Both the influence of social support factors agreed with an earlier report that people with lower social support were more likely to be sedentary

(Eyler et. al., 1999). Support from friends and peers could be in various forms such as information about local community facilities and programs, encouragement and appraisal, or interaction during the activities (Gilette, 1988; Israel and Schurman, 1990).

9.2.3 Diagnosis of a medical condition.

9.2.3.1 Diagnosis of a medical condition and change in smoking behaviour.

As expected, this study found increased odds of stopping smoking in cohort members who were diagnosed with a medical condition between age 44 and 53 years, and in stopping smoking at age 53 years. The result was consistent with earlier reports. The diagnosis of stroke, myocardial infarction or cancer was found to be positively associated with stopping smoking among older subjects in a community study (Salive et. al., 1992). Another study reported that hypertension and diagnosis of heart disease was associated with greater odds of stopping smoking in a less affluent middle aged community sample (Hyman et. al., 1996). Another study found that subjects with 2 or more medical conditions, such as hypertension, myocardial infarction, angina, heart failure, other coronary diseases, stroke or other vascular disease, were less likely to have continued to smoke (John et. al., 2006).

The effect of the diagnosis of a medical condition on smoking relapse was consistent with that for stopping smoking. This study found that a diagnosis of a medical condition was protective of, or appeared to prevent, smoking relapse. An earlier study did not find any association between the diagnosis of stroke, myocardial infarction, or cancer and smoking relapse as there was a low rate of relapse among the sample in their study (Salive et. al., 1992).

However, the strength of the evidence from this study was lower compared to the former two studies mentioned above because of the wide confidence interval (Table 9.1). It therefore requires caution in interpretation. Nevertheless, findings from this study support the earlier studies. The medical events, in this situation, could have operated as a cue that triggered a change process, which resulted in stopping smoking and motivated the maintenance of abstinence. However, it was not clear whether the NSHD cohort members, who were diagnosed with the medical condition, had received any advice to stop smoking, although this is likely with the more serious health problems.

9.2.3.2 Diagnosis of a medical condition and change in alcohol behaviour.

There was no evidence from the NSHD data that diagnosis of a medical condition had increased the risk of having an alcohol problem or increased the cohort members' consumption above the recommended limit. This result is not unexpected because having a medical condition was associated with a reduced alcohol consumption, as discussed earlier in the effect of health related life events.

9.2.3.3 Diagnosis of a medical condition and change in diet behaviour.

The diet behaviour among the cohort members improved over 17 years between age 36 and 53 years. Even though a greater change in diet behaviour was found in women, the aggregated data showed that it was the men, who had been diagnosed with at least one medical condition, who had significantly improved their diet behaviour. However, the magnitude of change as indicated by the dietary change index was small. The index was recently developed and its application had not been reported before. As far as the review of this study is concerned, other similar indices, such as the Diet Quality Index (Patterson et. al., 1994) and Healthy Eating Index (McCullough et. al., 2000), had not been used in a similar context to this study; hence comparisons of the results from this present study was not possible. Nevertheless, several intervention studies have reported an improvement in the diet based on changes in nutrient content. There had been reports, for example, from clinical trials that people had decreased their fat intake and increased their fruit and vegetables consumption following the diagnosis of a medical condition such as cancer or hypertension (Carlsson et. al. 1997; Maunsell et. al., 2002; Cakir and Pinar, 2006). Although these results showed that people do change their diet following a medical event, the studies have been limited to clinical samples, unlike this study, which compared, changes in a representative sample of the whole UK population. The explanation for the changes was similar to that discussed for the change in smoking behaviour.

The use of a composite measure in the study on diet behaviour is relatively new and has its advantage and disadvantage. It was not clear whether, by examining food components or nutrients, much would be revealed about the consumption pattern or attitude towards healthy eating. It has been claimed that a change in nutrients was the result of a change in food choices (Norris et. al., 1997), but the same nutrient can be found in many types of food. Since daily requirements for key nutrients are usually small and available in most food, it is questionable whether minor changes and variations in daily intake of these nutrients will have a major impact on health. Further, it is questionable whether people shop for their food based on the nutrient content. The index of dietary pattern, used in this study, was based on a composite of breakfast eating behaviour, choices of types of milk, bread, amount of fruit and vegetables, and the percentage of energy from fat consumption. Each of these components consisted of a range of healthy and less healthy options and each was given a score based on the healthiness that was predetermined by the current theoretical nutritional knowledge (Waijers et. al., 2007). Therefore, the index directly reflects more general dietary behaviour, which can be indirectly linked to attitudes toward healthy eating. It also included dietary behaviour in respect of different types of foods. Hence it gives an overall account of the wide range of foods that people consume. However, the index (diet behaviour score) does not discriminate between the components and assumes that each is equally important, because of the way they are scored. Hence, it has less practical use for such purposes as clinical intervention, although it may be useful in describing variation in the dietary pattern of the population.

9.2.3.4 The diagnosis of a medical condition and increase in physical activity.

The present study also found that cohort members in the NSHD who had been diagnosed with at least one medical condition between age 44 and 53 years, were less likely to increase their physical activity at age 53 years (Table 9.1). Similar results were found in the analysis using the aggregated data. Limited research has been carried out on this relationship (Bryne et. al., 2005), despite evidence that physical activity is beneficial to health (Myers et. al., 2003; Batty and Lee, 2004). Nevertheless, the findings from this study were clear to the extent that coronary heart disease patients, who were more emotional about their condition, practiced physical activity less frequently (Bryne et. al., 2005). A possible explanation for this finding was that the medical condition itself had reduced the subjects' physical ability to carry out vigorous activity. It could also be that the cohort members who had the medical condition were those who had a sedentary life even before they were diagnosed and the change in their health status had not affected their lifestyle.

9.2.3.5 Influence of social support factors on the effect of diagnosis of a medical condition.

The influence of social support factors on the effect of diagnosis of a medical condition was found to be consistent in the analysis in this study. The results showed that a better social support was associated with health protective behaviour change (Table 9.1). There were interactions between *perceived support* and a diagnosis of a medical condition in the analysis of the data at age 53 years and the aggregated data. In the analysis at age 53 years, cohort members with at least one medical condition, who perceived that they had less support from family, friends, and neighbours during crises, were less likely to stop smoking than those who perceived that they had better support. In the analysis of the aggregated data it was shown that cohort members who had a better *social network* were more likely to stop smoking. A similar effect of the social network factor was found in the analysis of change in diet of the aggregated data. It was found that the men in the NSHD with a poorer social network had consumed a less healthy diet at age 53 years compared to at age 43 years. Social network was also found to have small but significant influence on the effect of diagnosis of a medical condition on physical activity change; cohort members diagnosed with poorer relationship with family and friends were less likely to increase their physical activity. In the analysis of change in physical activity at age 43 years, it was found that a lower level of *social participation* was associated with lower odds of increase in physical activity. The role of social support factors in this study in helping people to adjust to stress from chronic diseases was consistent with earlier reports (Welin et. al., 1985; Greenwood et. al., 1995; Lindsay et. al., 2001). The social contacts that included family, friends, and peers, could have provided emotional support, physical help with daily activities, and information, which encouraged subjects to make changes in their health behaviours (Stanfeld, 2006).

9.3. Strengths and limitations of study.

9.3.1 Strengths of the study.

A key strength of this study is the data used for the analyses. Compared to earlier studies that used community samples, this study used data from a sample that was nationally representative, hence the findings can be generalised to the UK population. Despite certain limitations of the NSHD sample, the data are still nationally representative of the UK population (Wadsworth et. al., 1992; Wadsworth et. al., 2003a; Wadsworths et. al., 2005). Another strength was the high quality of the data used for the analyses. Trained staff carried out the data collection in the survey and this ensured a good response rate. In the last 3 surveys, the response rates have been high where the averages of successful contact with cohort members were more than 80%. The interview method has increased the completeness of the questionnaire and ensured a clearer understanding about the questions compared to a self-completed questionnaire. For the self-completed sections in the questionnaire, the cohort members had been briefed thoroughly to ensure that they had a complete understanding of how to fill in the forms. The risk of bias from memory lapse for the questions on stressful life events was minimised as the subjects were asked to recall the events that occurred in the past 12 months, which has been shown to have good reliability (Paykel, 1987; Kessler and Wethington, 1991). For the medical conditions, although the information was self-reported, the condition itself was diagnosed by health professionals and confirmed by medical records. There was also reduced bias in recalling health behaviours, because they were based on current health behaviour at the time of the survey. This also limited the bias through leading questions, because no link between the variables of interest of this study was suggested during the survey interview. Another advantage of using the NSHD data was that it enabled the examination of multiple health behaviours compared to a single behaviour found in many earlier studies. The data also contained information about social support factors and the samples demographics. Therefore this study was able to investigate the effect of life stress, account for the buffering effect of support from family and friends, and potential confounding by sex, social class, and education. Further advantages were that this study was able to examine how people in the general population responded to life stress from different sources using the same data. In particular, it examined and found that responses to life stress, which originated from health events, were different to those resulting from more general stressful life events.

This study was different to other studies as regards the effect of life stress, in that it used birth cohort data, hence the entire sample had the same age. One advantage of this is that the sample was exposed to similar environmental factors and experienced similar changes to the overall UK population (Bynner et. al., 2003). They also had a similar level of maturity and perceptions about life and the environment were also more uniform, compared to samples with a wide age range. The effects of life stress were assessed at two different ages and also using repeated measure analysis. This latter attribute strengthened or enhanced many of the associations found. The use of cumulative measures of life stress for the relationship between life stress and smoking change in this study was also unique. Previous studies had examined the effect of specific life events. This study also assessed the relationship between life stress, diet and physical activity; topics which have received very limited research attention previously.

9.3.2 Limitations of the study.

There were several limitations of this study. The NSHD data used were a snapshot of repeated measures over time, which does not capture the dynamic and fluid nature of behaviour change. It also provided limited evidence for the causal effect of life stress. Because there was no direct question about the motives or reasons for the change in health behaviours asked in the survey, the motives for change were not clear. The information about the sequence of occurrence of the stressful events and change in health behaviours were also not available. The long gaps between the selected age groups - 7 years for those at age 43 years and 10 years for analysis at age 53 years - meant that the change could have had occurred at any time between the two surveys.

Since the effects of life stress was stronger in the first year and gets weaker over time (Brennan et. al., (1999), it seems unlikely that life events can result in a prolonged change. However, it remains plausible that the life events could have led to the changes. It has been reported, for example, that frequent alcohol consumption did not predict more life events, but that more life events predicted more frequent drinking (Brennan et. al., 1999). Cohort members, who were diagnosed with a medical condition by the health professionals, could have had some form of counselling concerning healthy lifestyle and the impact on their medical condition which led to the lifestyle change (McAvoy et. al., 1999; Department of Health, 2000; Aalto et. al., 2002; Lader and Goddard, 2004). Such interventions, and the consequent understanding of the risks associated with continuing unhealthy lifestyles, could have increased the motivation of the cohort members (Wilkes and Evans, 1999; Perkins-Porras et. al., 2006). Further, it was reported that the majority of the UK population in the ONS Omnibus survey gave up regular smoking for health reason, and about 16% wanted to stop because of a medical condition (Freeth, 1998).

There could also be another explanation for change in health behaviours that was not captured in this study. A healthy trend in health behaviours was already taking place in the UK population over the period of this study. The cohort members could have been influenced to improve their health behaviours by health promotion and policy changes that were introduced to tackle these health behaviours (WHO, 2005). With smoking behaviour, for example, during the period the data were collected there were changes in legislation, such as the restriction of smoking in certain public places and advertising, health warnings on cigarette packs, and news reports on the hazards of smoking and secondary smoking (The Stationary Office, 1998). There could also have been other reasons such as concern about children's' health with regards to secondary or passive smoking, cost and affordability, loss of pleasure from the habit, and family pressure (Lader and Meltzer, 2002). In respect of alcohol drinking, health awareness could have been increased through the introduction of safe drinking recommendations (Department of Health and Social Security, 1981; Department of Health, 1995). Few people, however, understand the meaning of the unit measures and drinking limits that have been introduced (Smith et. al., 1989), which raised the question of whether such interventions have been successful. Regarding dietary behaviour, various health messages had been recommended, such as increasing fibre, and fruit and vegetables consumption; and decreasing fat, salt, and sugar intake (Department of Health, 1991, 1992, 1994). However, it is arguable whether there were real changes in the diet in the general population; for example, there was no effective improvement in fried food and vegetable consumption; and there was also a social class gradient in change in vegetable consumption (Parson et. al., 2005).

There were also limitations related to the measurement of the variables. The scores for stressful life events and health related life events were limited by certain events that had contrasting effects. This has been discussed earlier in relation to intra-category variability in the literature review (Veenstra et. al., 2006; Dohrenwend, 2006). The criteria for the diagnosis of a medical condition were not specific and did not show, which medical condition had more effect on change in health behaviours. The analysis of change in alcohol drinking used the data that were significantly different from the original sample, thus this limits the validity and inferences from the results, although they support earlier reports. Change in physical activity was based on a crude measure of frequency of activity in the past month before the interview. Criteria for the successful maintenance of healthy activity, such as continuous monitoring activity over 6 months were not considered (Pate et. al., 1995) – neither were intensity or duration of activity, which are beneficial and directly linked to coronary heart disease and other chronic diseases (Hillsdon et. al., 2001).

9.4. Conclusion.

This study provides evidence from the general UK population for the effect of life stress on change in health behaviours. The results have been consistent with the hypothesis of this study and support many earlier reports. Taking into account the limitations discussed above, it can be concluded from this study that:

- Stressful life events are a potential cue for change in health behaviours.
- Life stress that originated from stressful life events can be detrimental to health because it can induce health damaging behaviour change, such as smoking relapse or increase the risk of having an alcohol problem in certain people.
- The effect of life stress after being diagnosed with a chronic medical condition, is different to that of other stressful life events. In contrast to the latter, it motivates health protective behaviour change such as stopping smoking and improvement in the diet.
- The influences of social support factors were small but important. Perceived support and social participation had a protective influence on the effect of life stress. A supportive social network has two contrasting influences on the

effect of life stress where it can function as a hazard in certain people, or it can bring benefits to others with life stress.

9.5 Recommendations.

There are several potential areas for further research about this subject. Research that is closer to the context of this study could be carried out to investigate the effect of life stress resulting from specific life events, such as work related events and stressful relationships on health behaviours using similar data. Studies could also investigate why people, who have been diagnosed with a chronic medical condition, do not improve their physical activity. Further research should avoid using a simple count based method to measure health events, especially medical events, when studying the effect of life stress on health behaviours. Because the data contain information about the four health behaviours they can be used to assess the clustering of health behaviours. They could also therefore show any pattern of clustering in change in health behaviours. It would also be possible to carry out more complex analyses using structural equation modelling to assess in more detail if there is a mediating role of social support factors in the relationship between life stress and change in health behaviours.

In a broader context, there are plenty of opportunities for epidemiological research in change in health behaviours. There are other potential determinants of change in health behaviours within the general population. Life stress from stressful life events and medical events are examples of psychosocial factors that can influence health behaviours. Other sources of life stress such as daily hassles, or types of stress such as chronic and acute stressors, can influence health behaviours in different ways.

The data presented in this study shows that cigarette smoking and alcohol drinking behaviour were used to buffer the effect of life stress in certain people. It is possible that these people turned to these behaviours because they know little about other methods that can be used to reduce stress. Since the incidence of life events is high (>75% in the NSHD data) it poses a great threat to the health of the population if the general public continue to regard such behavioural response to stress as the norm. Hence, it is recommended that people be supported by demonstrating how to deal with stress from a young age (Blackie et. al., 1998). People can benefit from this knowledge during unexpected eventualities across the life course. It is also recommended that people, who underwent an intervention programme for behaviour change such as for smoking and drinking problems, should be taught about alternative methods to deal with stress. People who are trying to stop smoking should also be advised to avoid being around people who smoke. Alternatively, people who are close to an individual who is quitting smoking should also be counselled to stop smoking, or at least to support the individual by not smoking when the individual concerned is around. Health professionals should also be trained to identify people who are exposed to life stressors and also, about the potential use of giving health behaviours advice to people with life stress to deter them from taking inappropriate actions.

REFERENCES.

Aalto,M., Pekuri,P., & Seppa,K. (2002). Primary health care professionals' activity in intervening in patients' alcohol drinking: a patient perspective. *Drug and Alcohol Dependency*, 66(1), 39-43.

Abbey,A., Smith,M.J., & Scott,R.O. (1993). The relationship between reasons for drinking alcohol and alcohol consumption: an interactional approach. *Addictive Behavior*, 18(6), 659-70.

Adlkofer,F., & Thurau,K. (1991). The effects of nicoteine on biological systems. Advances in Pharmacological Sciences (pp.473-578). Basel: Birkhauser Verlag.

Ajzen,I., & Fishbein,M. (1980). Understanding attitudes and predicting social behavior. Englewood Cliffs, NJ: Prentice Hall.

Ajzen,I. (1985). From intentions to actions: a theory of planned behaviour. In J. Kuhl, & J. Beckman (Eds.), Action control: From Cognition to Behaviour. Heidelberg: Springer.

Ajzen,I. (1991). The Theory of Planned Behaviour. *Organisational Behaviour and Human Decision Process*, 50, 179-211.

Ajzen,I. (2002). Perceived Behavioural Control, self efficacy, locus of control and the theory of planned behavior. *Journal of Applied Social Psychology*, 2, 1-20.

Alcohol Concern (2003). Factsheet 8: Health and Impact of alcohol. http://www.alcoholconcern.org.uk/files/20030819_153746_health%20effects.pdf

Altman,D., Machin,D., Bryant,T., & Gardner,S. (2000). Statistics with Confidence. London: BMJ.

Andersson,L., & Stanich,J. (1996). Life events and their impact on health attitudes and health behavior. *Archives of Gerontology and Geriatrics*, 23(2), 163-177.

Atkins,E., Cherry,N., Douglas,J.W.B., Kiernan,K.E., & Wadsworth,M.E.J. (1981). The 1946 British birth cohort: an account of the origins, progress and results of the National Survey of Health and Development. In S.A. Mednick, & A.E. Baert (Eds.), Prospective Longitudinal Research: An Empirical Basis for the Primary Prevention of Psychosocial Disorders. Oxford: Oxford University Press.

Auerbach,S.M., Laskin,D.M., Frantsve,L.M., & Orr,T. (2001). Depression, pain, exposure to stressful life events, and long-term outcomes in temporomandibular disorder patients. *Journal of Oral and Maxillofacial Surgery*, 59(6), 628-633.

Austoker,J., Sanders,D., & Fowler,G. (1994). Smoking and cancer: smoking cessation. *British Medical Journal*, 308, 1478-1482.

Bandura,A. (1977). Self -Efficacy: Toward a Unifying Theory of Behavioral Change. *Psychological Review*, 84, 191-215.

Bandura,A. (1986). Social learning theory. Englewood Cliffs, NJ: Prentice Hall.

Bartley,M. (2004). Health Inequality. In Introduction to Theories, Concepts and Methods. Oxford: Blackwell Publishing Inc.

Batty,G.D., & Lee,I.M. (2004). Physical activity and coronary heart disease. *British Medical Journal*, 328, 1089-1090.

Bergen,A.W., & Caporaso,N. (1999). Cigarette smoking. *Journal of National Cancer Institute*, 91(16), 1365-1375.

Bhargava,A. (2003). A longitudinal analysis of the risk factors for diabetes and coronary heart disease in the Framingham Offspring Study. *BMC Population Health Metrics*, 1(3).

Billings,A.G., & Moos,R.H. (1984). Coping, Stress, and Social Resources Among Adults With Unpolar Depression. *Journal of Personality and Social Psychology*, 46(4), 877-891.

Birley,J.L., & Brown,G.W. (1970). Crises and life changes preceding the onset or relapse of acute schizophrenia: clinical aspects. *British Journal of Psychiatry*, 116(532), 327-333.

Blackie,C., Gregg,R., & Freeth,D. (1998). Promoting health in young people. *Nursing Standard*, 12 (36), 39-44.

Blaxter,M. (1990). Health and lifestyle. London. Routledge.

Bobak, M., Pikhart, H., Kubinova, R., Malyutina, S., Pajak, A., Sebakova, S., Topor-Madry, R., Nikitin, Y., Caan, W., Marmot, M. (2005). The association between psychosocial characteristics at work and problem drinking: a European urban populations. *Occupational and Environmental Medicine*, 62, 546-550.

Bobak, M., Room, R., Pikhart, H., Kubinova, R., Malyutina, S., Kurilovitch, S., Topor, R., Nikitin, Y., Marmot, M. (2004) Contribution of drinking patterns to differences in rates of alcohol related problems between three urban population. *Journal of Epidemiology and Community Health*, 58, 238-242.

Booker,C.L., Gallaher,P., Unger,J.B., Ritt-Olson,A., & Johnson,C.A. (2004). Stressful life events, smoking behavior, and intentions to smoke among and multiethnic sample of sixth graders. *Ethnicity and Health*, 9(4), 369-397.

Braddon,F.E.M., Wadsworth,M.E.J., Davies,J.M.C., & Cripps,H.A. (1988). Social and regional differences in food and alcohol consumption and their measurement in a national birth cohort. *Journal of Epidemiology and Community Health*, 42(4), 341-349.

Brennan,P.L., Schutte,K.K., & Moos,R.H. (1999). Reciprocal relations between stressors and drinking behavior: a three-wave panel study of late middle-aged and older women and men. *Addiction*, 94(5), 737-749.

Breslau,N. (2002). Post-traumatic stress disorder. *New England Journal of Medicine*, 346(19), 1495-1498.

Bridgwood,A., Lilly,R., Thomas,M., Bacon,J., Sykes,W., & Morris,S. (2000). Office for National Statistics. Living in Britain: results from the 1998 General Household Survey. London: The Stationary Office.

Britton, A. and M. Marmot (2004). Different measures of alcohol consumption and risk of coronary heart disease and all-cause mortality: 11-year follow-up of the Whitehall II Cohort Study. *Addiction*, 99(1): 109-116.

Brown,G.W., & Birley,J.L.T. (1968). Crises and life changes and the onset of schizophrenia. *Journal of Health and Social Behavior*, 9, 203-214.

Brown,G.W., & Harris,T. (1978). The Social Origins of Depression: A Study of Psychiatric Disorder in Women. London: Tavistock.

Brown,G.W., & Harris,T.O. (1989). Life Events and Illness. London: Unwin Hyman.

Brown,G.W. (1989). Life Events and Measurement. In G.W. Brown, & T.O. Harris (Eds.), Life Events and Illness (pp.3-42). London: Unwin Hyman.

Brown,J.D. (1991). Staying Fit and Staying Well: Physical Fitness as a Moderator of life stress. *Journal of Personality and Social Psychology*, 60(4), 555-561.

Brugha,T.S. (2003). The effects of life events and social relationships on the course of major depression. *Current Psychiatry Reports*, 5(6), 431-438.

Brunner,E., & Marmot,M. (2006). Social organisation, stress, and health. In M. Marmot, & R.G. Wilkinson (Eds.), Social Determinants of Health (pp.6-30). Oxford: University Press.

Buchsbaum D.G., Buchanan R.G., Centor R.M., Schnoll S.H., & Lawton M.J. (1991). Screening for alcohol abuse using CAGE scores and likelihood ratios. Annals of Internal Medicine, 15(10), 774-777.

Bynner,J., & Parson,T.J. (2003). Social Participation, values and crime. In E. Ferri, J. Bynner, & M. Wadsworth (Eds.), Changing Britain, Changing Lives. Three Generation at the Turn of the Century. (p.261). London: Institute of Education.

Byrne,M., Walsh,J., & Murphy,A.W. (2005). Secondary prevention of coronary heart disease: Patient beliefs and health-related behaviour. *Journal of Psychosomatic Research*, 58(5), 403-415.

Cakir,H., & Pinar,R. (2006). Randomized Controlled Trial on Lifestyle Modification in Hypertensive Patients. *Western Journal of Nursing Research*, 28(2), 190-209.

Cannon,W. (1929). Bodily Changes in Pain, Hunger, Fear and Rage. New York: Appleton.

Carlsson,R., Lindberg,G., Westin,L., & Israelsson,B. (1997). Influence of coronary nursing management follow up on lifestyle after acute myocardial infarction. *Heart*, 77, 256-259.

Centre for Longitudinal Studies. (2008). http://www.cls.ioe.ac.uk/ .

Cerkoney,K.A.B., & Hart,L.K. (1980). The relationhsip between the health belief model and compliance of person with diabetes mellitus. *Diabetes Care*, 3, 594-598.

Chandola,T., Head,J., & Bartley,M. (2004). Socio-demographic predictors of quitting smoking: how important are household factors? *Addiction*, 99(6), 770-777.

Cohen,S., & Lemay,E.P. (2007). Why would social network be linked to be linked to affect and social practices. *Health Psychology*, 26, (2), 410-417.

Commission of the European Communities (2005). Green Paper. Promoting healthy diets and physical activity: a European dimension for the prevention of overweight, obesity and chronic diseases. Brussells, COM(2005)637.

Conner,M., & Norman,P. (1998). Predicting Health Behaviour. Buckingham and Philadelphia: Open University Press.

Cooper,M.L., Russell,M., Skinner,J.B., Frone,M.R., & Mudar,P. (1992). Stress and alcohol use: moderating effects of gender, coping and alcohol expectancies. *Journal of Abnormal Psychology*, 101(1), 139-152.

Critchley,J.A., & Capewell,S. (2003). Mortality Risk Reduction Associated With Smoking Cessation in Patients With Coronary Heart Disease. A Systematic Review. *JAMA*, 260(1), 86-97.

Croucher,R., Marcenes,W.S., Torres,M.C., Hughes,F., & Sheiham,A. (1997). The relationship between life-events and periodontitis. A case-control study. *Journal of Clinical Periodontology*, 24(1), 39-43.

Dallman,M.F., La Fleur,S., & Pecoraro,N.C. (2004). Minireview: glucocorticoids – food intake, abdominal obesity, and wealthy nations in 2004. *Endocrinology*, 145, 2633-2638.

Dallman,M.F., Pecoraro,N.C., & la Fleur,S.E. (2005). Chronic stress and comfort foods: self-medication and abdominal obesity. *Brain, Behaviour and.Immunity*, 19(4), 275-280.

Dawson, D. A., B. F. Grant, et al. (2005). The association between stress and drinking: Modifying effects of gender and vulnerability. *Alcohol and Alcoholism*, 40(5), 453-460.

Day,R. (1984). Afterword, Recent Directions in Life Events Research from a Public Health Prospective. In B.S. Dohrenwend, & B.P. Dohrenwend (Eds.), Stressful Life Events & Their Contexts. (p.284). New Brunswick: Rutger University Press.

DEFRA (2001). National Food Survey 2000. The Stationary Office, London.

Department of Education and Science (1972). Burnham Further Education Committee Grading Courses. London: HMSO.

Department of Health and Social Security (1980). Inequalities in Health: Report of a Research Working Group. London: DHSS.

Department of Health and Social Security (1981). Prevention and Health. Drinking Sensibly. A discussion document prepared by the Health Departments of Great Britain and Northern Ireland. London: HMSO.

Department of Health (1991). Dietary reference values for food energy and nutrients for the United Kingdom. Report of the Panel on Dietary Reference Values of the Committee on Medical Aspects of Food Policy. London: The Stationary Office.

Department of Health (1992). The Health of the Nation: A Strategy for Health in England. London: The Stationary Office.

Department of Health (1994). Department of Health (1994): Nutritional aspects of cardiovascular disease. Report of the cardiovascular review group of the Committee on Medical Aspects of Food Policy. London: The Stationary Office.

Department of Health (1995). Sensible Drinking. The report of an Inter-Departmental Working Group.

Department of Health (1998). Independent Inquiry into Inequalities in Health Report. London: HMSO.

Department of Health (2000). Chapter Seven: Cardiac rehabilitation: Department of Health.

DiClemente,C.C., & Prochaska,J.O. (1985). Processes and Stages of Change: Coping and Competence in Smoking Behavior Change. In S.W.T.A. Shiffman (Ed.), Coping and Substance Abuse (pp.319-342). New York: Academic Press.

Dohrenwend,B.P., & Dohrenwend,B.S. (1969). Social status and psychological disorder: A causal inquiry. New York: Wiley.

Dohrenwend,B.P., Link,B.G., Kern,R., Shrout,P.E., & Markowitz,J. (1990). Measuring life events: The problem of variability within event categories. *Stress Medicine*, 6, 179-187.

Dohrenwend,B.P. (2006). Inventorying stressful life events as risk factors for psychopathology: Toward resolution of the problem of intracategory variability. *Psychology Bulletin*, 132(3), 477-495.

Dohrenwend,B.S. (1973). Social Status and Stressful Life Events. *Journal of Personality and Social Psychology*, 28(2), 225-235.

Dohrenwend,B.S., & Dohrenwend,B.S. (1974). Stressful life events: Their nature and effects. New York: Wiley.

Dohrenwend,B.S., & Dohrenwend,B.P. (1984a). Stressful life events and their contexts. New Brunswick, NJ: Rutgers University Press.

Dohrenwend,B.S., & Dohrenwend,B.P. (1984b). Life Stress and Illness: Formulation of the Issues. In B.S. Dohrenwend, & B.P. Dohrenwend (Eds.), Stressful Life Events and Their Contexts New Brunswick, NJ: Rutgers University Press.

Doll,R., & Hill,A.B. (1954). The mortality of doctors in relation to their smoking habits: a preliminary report. *British Medical Journal*, ii, 1451-1455.

Erens,B., & Primatesta,P. (1999). Cardiovasuclar Disease. London: The Stationary Office.

Eyler,A.a., Brownson,R.C., Donatelle,R.J., King,A.C., Brown,G.W., & Sallis,J.F. (1999). Physical activity social support and middle-and older-aged minority women: results from a US survey. *Social Science and Medicine*, 49, 781-789.

Falba,T., Teng,H.-M., Sindelar,J.L., & Gallo,W.T. (2005). The effect of involuntary job loss on smoking intensity and relapse. *Addiction*, 100(9), 1330-1339.

Finney,J.W., Moos,R.H., & Brennan,P.L. (1991). The Drinking Problems Index: a measure to assess alcohol-related problems among older adults. *Journal of Substance Abuse*, *3*(4), 395-404.

Food Standards Agency (2005). Eat Well. Your guide to healthy eating. http://www.food.gov.uk/multimedia/pdfs/eatwell0708.pdf.

Fouquereau,E., Fernandez,A., Mullet,E., & Sorum,P.C. (2003). Stress and the urge to drink. *Addictive Behavior*, 28(4), 669-685.

Fox,K., & Rickards,L. (2004). Office for National Statistics. Sports and Leisure. General Household Survey 2002. London: The Stationary Office.

Freeman,L.M., & Gil,K.M. (2004). Daily stress, coping, and dietary restraint in binge eating. *International Journal of Eating Disorder*, 6(2), 204-212.

Freeth,D., & Nicol,M. (1998). Learning clinical skills: an interprofessional approach. *Nurse Education Today*, 18(6), 455-461.

Garceau,A.J. (1964). The Natural History of Cirrhossis. II. The influence of alcohol and prior hepatitis on pathology and prognosis. *New England Journal of Medicine*, 271, 1173-1179.

Giles,M., McClenahan,C., Cairns,E., & Mallet,J. (2004). An application of the Thoery of Planned Behaviour to blood donation: the importance of self efficacy. *Health Education Research*, 19(4), 380-391.

Gilette,P. (1988). Self reported factors influencing exercise adherence in overweight women. *Nursing Research*, 37, 25-29.

Glanz,K., Rimer,B.K., & Lewis,F.M. (1996). Health Behavior and Health Education. Theory, Research and Practice. San Francisco: Jossey-Bass.

Glanz,K., Rimer,B.K., & Lewis,F.M. (2002). Health Behavior and Health Education. Theory, Research and Practice. San Francisco: Jossey-Bass.

Glanz,K., & Maddock,J. (2007). Behavior, Health Related. http://www.enotes.com/public-health-encyclopedia/behavior-health-related

Glaser,R. (2005). Stress-associated immune dysregulation and its importance for human health: a personal history of psychoneuroimmunology. *Brain, Behaviour and Immunity*, 19, 3-11.

Glass,T.A., Prigerson,H., Kasl,S.V., & Mendes de Leon,C.F. (1995). The effects of negative life events on alcohol consumption among older men and women. *Journal of Gerodontology,* 50, S205-S216.

Gochman,D.S. (1997a). Handbook of Health Behavior Research I. Personal and Social Determinants. New York and London: Plenum Press.

Gochman,D.S. (1997b). Handbook of Health Behavior Research IV. Relevance for Professionals and Issues for the Future. New York and London: Plenum Press.

Goldberg,E.L., & Comstock,G.W. (1980). Epidemiology of life events: frequency in general populations. *American Journal of Epidemiology*, 111(6), 736-752.

Golding,J., Pembrey,M., Jones,R., & the ALSPAC Study Team (2001). ALSPAC-The Avon Longitudinal Study of Parents and Children I. Study Methodology. *Paediatric and Perinatal Epidemiology,* 15, 74-87.

Gottlieb,N.H., & Green,L.W. (1984). Life events, social network, life-style, and health: an analysis of the 1979 National Survey of Personal Helath Practices and Consequences. *Health Education Quarterly*, 11(1), 91-105.

Greenwood,D.C., Muir,K.R., Packham,C.J., & Madeley,R.J. (1995). Stress, social support, and stopping smoking after myocardial infarction in England. *Journal of Epidemiology and Community Health*, 49(6), 583-587.

Gregory,J.R., Foster,K., Tyler,H., & Wiseman,M. (1990). The Dietary and Nutritional Survey of British Adults. London: HMSO.

Harnack,L., Nicodemus,K., Jacobs,D.R.Jr., & Folsom,A.R. (2002). An evaluation of the Dietary Guidelines for Americans in relation to cancer occurrence. *American Journal of Clinical Nutrition*, 76, 889-896.

Harris,R., Skyler,J.S., Linn,M.W., & et.al. (1982). The relationship between the health belief model and compliance as a basis for intervention in diabetes mellitus. Psychological aspects of diabetes in children and adolescents, pediatrics adolescent endocrinology. (pp.123-132). Basel: Karger.

Harrison,J.A., Mullen,P.D., & Green,L.W. (1992). A meta-analysis of studies of the health belief model with adults. *Health Education Research*, 7 107-16.

Henderson,L., Gregory,J., Irving,K., & Swan,G. (2003). The National Diet and Nutrition Survey: adults aged 19 to 64 years. Energy, protein, carbohydrate, fat and alcohol intake. Volume 2. London: TSO.

Hillsdon,M., Cavill,N., Nanchahal,K., Diamond,A., & White,I.R. (2001). National level promotion of physical activity: results for England's ACTIVE for LIFE campaign. *Journal of Epidemiology and Community Health*, 55, 755-761.

Hochbaum,G.M. (1958). Public Participation in Medical Screening Programs: A Socio-Psychological Study. Public Health Service Publication No 572. Washington D.C.: United States Government Printing Office.

Hoenig,J.M., & Heisey,D.M. (2001). The Abuse of Power: The Pervasive Fallacy of Power Calculations for Data Analysis. *The American Statistician*, 55(1), 19-24.

Holmes,T.H. (1989). "It Was In This Setting...". In T.H. Holmes, & E.M. David (Eds.), Life Change, Life Events, and Illness. Selected Papers (pp.3-25). New York: Praeger.

Hyman,D.J., Simon-Morton,D.G., dunn,J.K., & Ho,K. (1996). Smoking, Smoking Cessation, and Understanding of the Role of Multiple Cardiac Risk Factors among the Urban Poor, Preventive Medicine, 25, 653-659.

Institute of Medicine (2001). Health and Behaviour. The Interplay of Biological, Behavioural and Societal Influences. Washington DC: National Academy Press.

Israel,B., & Schurman,S. (2008). Social support, control, and the stress process. Health Behavior and Health Education: Theory and Research Practice. In K. Glanz, F.M. Lewis, & B.K. Rimer (Eds.), (pp.187-215). San Francisco: Jossey-Bass Publishers.

James,W.P.T., Nelson,M., Ralph,A., & Leather,S. (1997). The contribution of nutrition to inequalities in health. *British Medical Journal*, 314, 1545-9.

Janz,N.K., & Becker,M.H. (1984). The Health Belief Model: A Decade Later. *Health Education Quarterly*, 11, 1-47.

Janz,N.K., Champion,V.L., & Strecher,V.J. (2002). The Health Belief Model. In K. Glanz, B.K. Rimer, & F.M. Lewis (Eds.), Health Behavior and Health Education. Theory, Research and Practice (pp.45-66). San Francisco: Jossey-Bass.

Jarvis,M. (1984). Gender and smoking: do women really find it harder to give up. *British Journal of Addiction*, 57, 57-61.

Jarvis,M.J. (1997). Pattern and predictors of unaided smoking cessation in the general population. *The Tobacco Epidemic*, 28, 151-64.

Jarvis,M.J. (2003). Monitoring cigarette smoking prevalence in Britain in a timely fashion. Addiction, 98, 1569-1574.

Jarvis,M.J., & Wardle,J. (2006). Social patterning of individual health behaviours: the case of cigarettes smoking. In M. Marmot, & R.G. Wilkinson (Eds.), Social Determinants of Health (pp.224-237). Oxford: Oxford University Press.

Jenkins,C.D., Hurst,M.W., & Rose,R.M. (1979). Life changes. Do people really remember? *Archives of General Psychiatry*, 36, 379.

Jennison,K.M. (1992). The impact of stressful life events and social support on drinking among older adults: a general population survey. *Journal of Epidemiology and Community Health*, 35(2), 99-123.

John,U., Meyer,C., Hanke,M., Volzke,H., & Schumann,A. (2006). Relation between awareness of circulatory disorders and smoking in a general population health examination. *BMC Public Health*, 6(48).

Jose, B. S., Van Oers, H. A. M., et al. (2000). Stressors and alcohol consumption. *Alcohol and Alcoholism,* 5(3): 307-312.

Kandiah,J., Yake,M., Jones,J., & Meyer,M. (2006). Stress influences appetite and comfort food preferences in college women. *Nutrition Research*, 25(3), 118-123.

Kant,A.K. (1996). Indexes of overall diet quality: a review. *Journal of American Diet Association*, 96, 785-791.

Kant,A.K. (2004). Kant AK (2004) Dietary patterns and health outcomes. J Am Diet Assoc 104, 615–635. *Journal of American Diet Association*, 104, 615-635.

Kasl,S.V., & Cobb,S. (1966). Health behaviour, illness behaviour, and sick role behaviour: II. Sick role behaviour. *Archives of Environmental Health, 12,* 531-41.

Kasl,S.V. (1984). Stress and health. *Annual Review of Public Health,* 5, 319-341.

Kawachi,I., & Berkman,L.S. (2001). Social Ties and Mental Health. Journal *of Urban Health,* 78(3), 458-467.

Kemm,J. (2003). An analysis by birth cohort of alcohol consumption by adults in Great Britain 1978-1998. *Alcohol and Alcoholism*, 38(2), 142-147.

Kessler,R.C., & Wethington,E. (1991). The reliability of life event reports in a community survey. *Psychological Medicine*, 21(3), 723-738.

King,A.C., Bernardy,N.C., & Hauner,K. (2003). Stressful events, personality, and mood disturbance: gender differences in alcoholics and problem drinkers. *Addictive Behaviors*, 28(1), 171-187.

Kobayashi,K., & Kazuma,K. (2005). Changes in alcohol consumption and related factors in diabetic Japanese men. *Japan Journal of Nursing Science,* 2, 95-105.

Krause,N. (1991). Stress, religiosity, and abstinence from alcohol. *Psychology and Aging*, 6(1), 134-144.

Kuh,D., & Wadsworth,M.E.J. (1993). Physical health status at 36 years in a British National birth cohort. *Social Science & Medicine*, 37(7), 905-16.

Lader,D., & Meltzer,H. (2002). Office for National Statistics. Smoking Related Behaviour and Attitudes, 2001. General Household Survey. London: Office for National Statistics.

Lader,D., & Meltzer,H. (2003). Smoking Related Behaviour and Attitudes, 2002. General Household Survey. London: Office for National Statistics.

Lader,D., & Goddard,E. (2005). Smoking-related Behaviour and Attitudes, 2004. London: Office for National Statistics.

Lampe,A., Sollner,W., Krismer,M., Rumpold,G., Kantner-Rumplmair,W., Ogon,M., & Rathner,G. (1998). The impact of stressful life events on exacerbation of chronic low-back pain. *Journal of Psychosomatic Research*, 44(5), 555-563.

Larson,E.B., Olsen,E., Cole,W., & et.al. (1979). The relationship of health belief and postcard reminder to influenza vaccination. *Journal of Family Practice*, 8, 1207-1211.

Larson,E.B., Bergman,J., Heidrich,F., & et.al. (1982). Do postcard reminders improve influenza vaccination compliance? *Medical Care*, 20, 639-648.

Liem,R., & Liem,J.H. (1984). Relations Among Social Class, Life Events and Mental Illness: A Comment on Findings and Methods. In B.S. Dohrenwend, & B.P. Dohrenwend (Eds.), Stressful Life Events and Their Contexts New Brunswick, NJ: Rutgers University Press.

Lin,N., Dean,A., & Ensel,W.M. (1986). Social Support, Life events and Depression. London: Academic Press.

Lindsay,G.M., Smith,L.N., Hanlon,P., & Wheatley,D.J. (2001). The influence of general health status and social support on symptomatic outcome following coronary artery bypass grafting. *Heart*, 85, 80-86.

Livingstone,M.B.E., Robson,P.J., Wallace,J.M.W., & McKinley,M.C. (2003). How active are we? Levels of routine physical activity in children and adults. *Proceedings of the Nutrition Society*, 62, 681-701.

Locker,D. (1989). An introduction to behavioural science & dentistry. London: Routledge.

Locker,D. (2005). An introduction to behavioural science & dentistry. In D.Locker (Ed.) Psychological factors and dental disease (p59). London: Routledge.

Macintyre,S. (1986). The patterning of health by social position in contemporary Britain: directions for sociological research. *Social Science and Medicine*, 23(4), 393-415.

Marcus,B.H., Dubbert,P.M., Forsyth,L.H., McKenzie,T.L., Stone,E.J., Dunn,A.L., & Blain,S.N. (2000). Physical Activity Behaviour Change: Issues in Adoption and Maintenance. *Health Psychology*, 19(1 (Suppl)), 32-41.

Marmot,M.G., Kogevinas,H., & Elston,M.A. (1987). Social/Economic Status and Disease.

Martikainen,P., Bartley,M., & Lahelma,E. (2002). Psychosocial determinants of health in social epidemiology. *International Journal of Epidemiology*, 31, 1091-1093.

Martikainen,P., Brunner,E., & Marmot,M. (2003). Socioeconomic differences in dietary patterns among middle-aged men and women. *Social Science and Medicine*, 56(7), 1397-1410.

Matarazzo,J.D. (1984). Behavioral Health. a 1990 challenge for the health sciences professions. In J.D. Matarazzo, N.E. Miller, S.M. Weiss, J.A. Herd, & S.M. Weiss

(Eds.), Behavioral Health: A Handbook of Health Enhancement and Disease Prevention (pp.3-40). New York: Wiley.

Maunsell,E., Drolet,M., Brisson,J., Robert,J., & Deschenes,L. (2002). Dietary Change After Breast Cancer: Extent, Predictors, and Relation With Psychological Distress. *Journal of Clinical Oncology*, 20(4), 1017-1025.

McAvoy,B.R., Kaner,E.F.S., Lock,C.A., Heather,N., & Gilvarry,E. (2008). *Our Healthier Nation*: are general practitioners willing and able to deliver? A survey of attitudes to and involvement in health promotion and lifestyle counselling. *British Journal of Clinical Practice,* 49, 187-190.

McCann,B.S., Warnick,G.R., & Knopp,R.H. (1990). Changes in plasma, lipids, and dietary intake accompanying shifts in perceived work-load and stress. *Psychosomatic Medicine,* 52, 97-108.

McClenahan, C., M. Shevlin, et al. (2007). "Testicular self-examination: a test of the health belief model and the theory of planned behaviour." *Health Education Research,* 22(2), 272-284.

McCrae,R.R., & Costa,P.T.Jr. (1986). Personality, coping, and coping effectiveness in an adult sample. *Journal of Personality, 54*(2), 385-405.

McCullough,M.L., Feskanich,D., Rimm,E.B., Giovannucci,E.L., Ascherio,A., Variyam,J.N., Spiegelman,D., Stampfer,M.J., & Willet,W.C. (2000). Adherence to the Dietary Guidelines for Americans and risk of major chronic disease in men. *American Journal of Clinical Nutrition*, 72, 1223-1231.

McDonald,B.W., Pugh,W.M., Gunderson,E.K., & Rahe,R.H. (1972). Reliability of life change cluster scores. *The British Journal of Social and Clinical Psychology,* 11(4), 407-409.

McKee,S.A., Maciejewski,P.K., Falba,T., & Mazure,C.M. (2003). Sex differences in the effects of stressful life events on changes in smoking status. *Addiction*, 98(6), 847-855.

McNaughton,S.A., Ball,K., Crawford,D., & Mishra,G.D. (2008). An Index of Diet and Eating Patterns Is a Valid Measure of Diet Quality in an Australian Population. *The Journal of Nutrition*, 138, 86-93.

McNeill,A.D., Jarvis,M.J., Stapleton,J.A., Russel,M.A.H., Eiser,J.R., Gammage,P., & Gray,E.M. (1988). Prospective study of facotrs predicting uptake of smoking in adolescents. *Journal of Epidemiology and Community Health*, 43, 72-8.

Meyer,A. (1951). The life chart and the obligation of specifying positive data in psychological diagnosis. In E. Winters (Ed.), The Collected Papers of A. Meyer Baltimore, USA.: The John Hopkins Press.

Meyerhoff,D.J., Bode,C., Nixon,S.J., de Bruin,E.A., Bode,C., & Seitz,H.K. (2005). Health Risks of Chronic Moderate and Heavy Alcohol Consumption: How Much Is Too Much? *Alcoholism: Clinical and Experimental Research,* 29(7), 1334-1340.

Mishra,G.D., McNaughton,S.A., Bramwell,G.D., & Wadsworth,M.E.J. (2006). Longitudinal changes in dietary patterns during adult life. *British Journal of Nutrition,* 96, 735-744.

Mohr,C.D., Armeli,S., Tennen,H., Carney,M.A., Affleck,G., & Hromi,A. (2001). Daily interpersonal experiences, context, and alcohol consumption: Crying in your beer and toasting good times? *Journal of Personality and Social Psychology*, 80, 489-500.

Moos,R.H., Schutte,K., Brennan,P., & Moos,B.S. (2004). Ten-year patterns of alcohol consumption and drinking problems among older women and men. *Addiction*, 99(7), 829-838.

Moos,R.H., Brennan,P.L., Schutte,K.K., & Moos,B.S. (2006). Older adults' coping with negative life events: common processes of managing health, interpersonal, and financial/work stressors. *International Journal of Aging and Human Development*, 62(1), 39-59.

Morris,J.K., Cook,D.G., & Shaper,A.G. (1992). Non-employment and changes in smoking, drinking, and body weight. *British Medical Journal*, *304*(6826), 536-541.

Morris,J.N., Marr,J.W., & Clayton,D.G. (1977). Diet and heart. *British Medical Journal*, 2, 1307-1314.

Morris,J.N. (1994). Exercise in the prevention of coronary heart disease: today's best buy in public health. *Medicine and Science in Sports and Exercise*, 26, 807-14.

Morrisey,E.R. (1980). The Role of Life Changes in the Development of Alcohol-Related Problems: An Investigation of Gender Differences. Seattle: University of Washington.

Mueller,D.P., Edwards,D.W., & Yarvis,R.M. (1977). Stressful life events and psychiatric symptomatology: change or undesirability? *Journal of Health and Social Behavior*, 18(3), 307-317.

Myers,J., Atwood,J.E., & Froelicher,V. (2003). Active Lifestyle and Diabetes. *Circulation*, 107(19), 2392-2394.

National Statistics (2005). Smoking-related behaviour and attitudes. http://www.statistics.gov.my .

Newby,P.K., & Tucker,K.L. (2004). Empirically Derived Eating Patterns Using Factor or Cluster Analysis: A Review. *Nutrition Reviews*, 62(5), 177-203.

Newton, J. T. and E. J. Bower (2005). The social determinants of oral health: new approaches to conceptualizing and researching complex causal networks. *Community Dentistry and Oral Epidemiology*, 33(1), 25-34.

Norris,J., Harnack,L., Carmichael,S., Pouane,T., Wakimoto,P., & Block,G. (1997). US trends in nutrient intake: the 1987 and 1992 National Health Interview Surveys. *American Journal of Public Health*, 87, 740-746.

OCPS (1984). Office of Population Censuses and Surveys. Social Survey Division. General Household Survey 1982. London: HMSO.

Office of National Statistics (2008). General household survey. http://www.statistics.gov.uk/ssd/surveys/general_household_survey.asp.

Oliver,G., & Wardle,J. (1999). Perceived effects of stress on food choice. *Physiology and Behavior*, 66(3), 511-515.

Oman,R.F., & King,A.C. (2000). The Effect of Life Events and Exercise Program Format on the Adoption and Maintenance of Exercise Behavior. *Health Psychology,* 19*(6),* 605-612.

Osler,M., Heitmann,B.L., Gerdes,L.U., Jorgensen,L.M., & Schroll,M. (2001). Dietary patterns and mortality in Danish men and women: a prospective observational study. *British Journal of Nutrition*, 85, 219-225.

Parson,T.J., Manor,O., & Power,C. (2005). Changes in diet and physical activity in the 1990s in a large British sample (1958 birth cohort). *European Journal of Clinical Nutrition*, 59 49-56.

Pate,R.R., Pratt,M., Blair,S.N., Haskell,W.L., Macera,C.A., Bouchard,C., Buchner,D., Ettinger,W., Health,G.W., King,A.C., Kriaka,A., Leon,A.S., Marcus,B.H., Morris,J., Paffenbarger,R.S., Patrick,K., Pollock,M.L., Rippe,J.M., Sallis,J., & Wilmore,J.H. (1995). Physical activity and public health: A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *JAMA: The Journal of the American Medical Association*, 273, 402-407.

Patterson,R.E., Haines,P.S., & Popkin,B.M. (1994). Health Lifestyle Patterns of U.S. Adults. *Preventive Medicine*, 23(4), 453-460.

Paykel,E.S., Prusoff,B.A., & Uhlenhuth,E.H. (1971). Scaling of Life Events. *Archives of General Psychiatry*, 25, 340-347.

Paykel,E.S. (1983). Methodological Aspects of Life Events Research. *Journal of Psychosomatic Research*, 27(5), 341-352.

Paykel,E.S. (1987). Methodology of life events research. *Advances in Psychosomatic Medicine*, 17, 13-29.

Paykel,E.S. (2003). Life events: effects and genesis. *Psychological Medicine*, 33, 1145-1148.

Perkins-Porras,L., Whitehead,D.L., & Steptoe,A. (2006). Patients' beliefs about the causes of heart disease: relationships with risk factors, sex and socio-economic status. *European Journal of Cardiovascular Prevention and Rehabilitation*, 13(5), 724-730.

Perreira,K.M., & Sloan,F.A. (2001). Life events and alcohol consumption among mature adults: a longitudinal analysis. *Journal of Studies on Alcohol*, 62(4), 501-508.

Phillips,A.C., Carrol,D., Ring,C., & et.al. (2005). Life events and acute cardiovascular reactions to mental stress: a cohort study. *Psychosomatic Medicine*, 67, 384-392.

Phillips,A.C., Der,G., & Carrol,D. (2007). Stressful life-events exposure is associated with 17-year mortality, but it is health-related events that prove predictive. *British Journal of Health Psychology,* [Epub ahead of print].

Price,G.M., Paul,A.A., Key,F.B., Harter,A.C., Cole,T.J., Day,K.C., & Wadsworth,M.E.J. (1995). Price GM, Paul AA, Key FB, Harter AC, Cole TJ, Day KC &Wadsworth MEJ (1995) Measurement of diet in a large national survey: comparison of computerised and manual coding in household measures. *Journal of Human Nutrition and Diet,* 8, 417–428.

Prochaska,J.O., & DiClemente,C.C. (1983). Stages and Processes of Self-Change of Smoking: Toward and integrative Model of change. *Journal of Consulting and Clinical Psychology*, 51(3), 390-95.

Prochaska,J.O., & DiClemente,C.C. (1984). Self change processes, self efficacy and decisional balance across five stages of smoking cessation. *Progress in Clinical and Biological Research*, 156, 131-140.

Rahe,R.H. (1974). The pathway between subjects' recent life changes and their near-future illness reports. In B.P. Dohrenwend, & B.S. Dohrenwend (Eds.), *Stressful life events: Their nature and effects.* New York: Wiley.

Rahe,R.H. (1975). Update to life change research*.* Unpublished manuscript.

Richards,M., Hardy,R., & Wadsworth,M.E.J. (2002). Long-term effects of breast-feeding in a national birth cohort: educational attainment and midlife cognitive function. *Public Health Nutrition,* 5(5), 631-635.

Richards,M., Shipley,B., Fuhrer,R., & Wadsworth,M.E.J. (2004). Cognitive ability in childhood and cognitive decline in mid-life: longitudinal birth cohort study. *British Medical Journal,* doi:10.1136.bmj.37972.513819.EE, (published 3 February 2004).

Richards,M., Hardy,R., & Wadsworth,M.E.J. (2003). Does active leisure protect cognition? Evidence from a national birth cohort. *Social Science & Medicine,* 56(4), 785-792.

Rickards,L., Fox,K., Roberts,C., Fletcher,L., & Goddard,E. (2004). Office for National Statistics. Living in Britain: Results from the 2002 General Household Survey. London: The Stationary Office.

Riddle,P.K. (1980). Attitudes, beliefs, intention, and behaviours of men and women towards regular jogging. *Research Quarterly for Exercise and Sports*, 51*,* 663-74.

Riemsma,R.P., Pattenden,J., Bridle,C., Sowden,A.J., Mather,L., Watt,I.S., & Walker,A. (2003). Systematic review of the effectiveness of stage based interventions to promote smoking cessation. *British Medical Journal*, 326(7400), 1175-1177.

Rigotti,N.A., Munafo,M.R., Murphy,M.F.G., & Stead,L.F. (2002). Interventions for smoking cessation in hospitalised patients (Review). The Cochrane Database of Systematic Reviews, 4, CD001837.

Roerecke,M., Haydon,E., & Giesbrecht,N. (2007). Alcohol and Chronic Disease: An Ontario Perspective. Toronto: Alcohol Policy Network.

Romelsjo,A., Lazarus,N.B., Kaplan,G.A., & Cohen,R.D. (1991). The relationship between stressful life situations and changes in alcohol consumption in a general population sample. *British Journal of Addiction*, 86(2), 157-169.

Rosenstock,I.M. (1974). Historical origins of the health belief model. *Health Education Monograph*, 2, 1-8.

Salive,M.E., Cornoni-Huntley,J., LaCroix,A.Z., Ostfeld,A.M., Wallace,R.B., & Hennekens,C.H. (1992). Predictors of smoking cessation and relapse in older adults. *American Journal of Public Health*, 82(9), 1268-1271.

Sandberg,S., Jarvenpaa,S., Penttinen,A., Paton,J.Y., & McCann,D.C. (2004). Asthma exacerbations in children immediately following stressful life events: a Cox's hierarchical regression. *Thorax*, 59(12), 1046-1051.

Schutte,K.K., Moos,R.H., & Brennan,P.L. (2006). Predictors of Untreated Remission From Late-Life Drinking Problems. *Journal of Studies on Alcohol*, 67, 354-362.

Schwarzer,R., & Fuchs,R. (1998). Self Efficacy abd Health Behaviours. In M. Conner, & P. Norman (Eds.), Predicting Health Behaviour (pp.163-196). Buckingham: Open University Press.

Seymore,J.D., Calle,E.E., Flagg,E.W., Coates,R.J., Ford,E.S., & Thun,M.J. (2003). Diet Quality Index as a predictor of short-term mortality in the American Cancer Society Cancer Prevention Study II Nutrition Cohort. *American Journal of Epidemiology*, 157, 980-988.

Shaper, A. G. and S. G. Wannamethee (2000). Alcohol intake and mortality in middle aged men with diagnosed coronary heart disease. *Heart*, 83(4), 394-399.

Sheeran,P., Trafimov,D., Finlay,K.A., & Norman,P. (2002). Evidence that the type of person affects the strength of the perceived behavioural control–intention relationship. British Journal of Social Psychology, 21, 253-270.

Sheiham,A., & Watt,R.G. (2000). The Common Risk Factor Approach: A rational basis for promoting oral health. *Community Dental and Oral Epidemiology*, *28*, 399-406.

Shumaker,S.A., Schron,E.B., Ockene,J.K., & McBee,W.L. (1998). The Handbook of Health Behavior Change. New York: Springer Publishing Company.

Shuval,J.T. (1981). The contribution of psychological and social phenomena to an understanding of the aetiology of disease and illness. *Social Science and Medicine*, 15(3 Pt 2), 337-342.

Simon,S.D. (2006). Statistical evidence in medical trials: what do the data really tell us? Oxford: Oxford University Press.

Smith,A.H., & Bates,M.N. (1992). Confidence Limit Analyses Should Replace Power Calculations in the Interpretation of Epidemiologic Studies. *Epidemiology*, 3(5), 449-452.

Smith,W.C.S., Tunstall-Pedoe,H., Crombie,I.K., & Travendale,R. (1989). Concomitants of excess coronary deaths - major risk factor and lifestyle findings from 10,359 men and women in the Scottish Heart Health Study. *Scottish Medical Journal*, 34, 550-5.

Smyth,M., & Browne,F. (1992). Office of Population Censuses and Surveys. Social Survey Division. General Household Survey 1990. In E. Goddard (Ed.), London: HMSO.

Stanfeld,S.A. (2006). Social support and social cohesion. In M. Marmot, & R.G. Wilkinson (Eds.), Social Determinants of Health (pp.148-171). Oxford: Oxford University Press.

Stapleton,J. (1998). Cigarette smoking prevalence, cessation and relapse. *Statistical Methods in Medical Research*, 7, 187-203.

Steele,G.P., Henderson,S., & Duncan-Jones,P. (1980). The reliability of reporting adverse experiences. *Psychological Medicine*, 10(2), 301-306.

Stephen, A.M., Sieber, G.M., (1994). Trends in individual fat consumption in the UK 1900-1985. *British Journal of Nutrition*, 71, 775-788.

Steptoe,A., Wardle,J., Lipsey,Z., Mills,R., Oliver,G., Jarvis,M., & Kirschbaum,C. (1998). A longitudinal study of work load and variations in psychological well-being, cortisol, smoking, and alcohol consumption. *Annals of Behavioral Medicine*, 20(2), 84-91.

Stone,A.A., & Neale,J.M. (1984). New Measure of Daily Coping: Development and Preliminary Results. *Journal of Personality and Social Psychology*, 46(4), 892-906.

Strecher,V.J., & Rosenstock,I.M. (1997). The Health Belief Model. In S.A. Glantz, B.A. Lewis, & B.K. Rimer (Eds.), Heath Behaviour and Health Education. Theory, Research and Practice (pp.41-59). San Francisco: Jossey-Bass Publishers.

Strong,K., Mathers,C., Leeder,S., & Beaglehole,R. (2005). Preventing chronic diseases: how many lives can we save? *Lancet*, 366(9496), 1578-1582.

Subramanian,S.V., Belli,P., & Kawachi,I. (2002). The Macroeconomic Determinants of Health. *Annual Review of Public Health*, 23(1), 287-302.

Tausig,M. (1986). Measuring Life Events. In N. Lin, A. Dean, & W.M. Ensel (Eds.), Social Support, Life Events, and Depression (pp.71-96). London: Academic Press.

The Stationary Office. (1998). Smoking Kills - A White Paper on Tobacco: The Stationary Office.

Thurlow,H.J. (1971). Illness in relation to life situation and sick-role tendency. *Journal of Psychosomatic Research*, 15(1), 73-88.

Todd,S., Woodward,M., Bolton-Smith,C., & Tunstall-Pedoe,H. (1995). An investigation of the relationship between antioxidant vitamin intake and coronary heart disease in men and women using discriminant analysis. *Journal of Clinical Epidemiology*, 48, 297-305.

Tosevski,D.L., & Milovancevic,M.P. (2006). Stressful life events and physical health. *Current Opinion in Psychiatry*, 19(2), 184-189.

Trichopoulou,A., Kouris-Blazos,A., Wahlqvist,M.L., Gnardellis,C., Lagiou,P., Polychronopoulos,E., Vassilakou,T., Lipworth,L., & Trichopoulos,D. (1995). Diet and overall survival in elderly people. *British Medical Journal*, 311, 1457-1460.

Van Os,J., & Jones,P.B. (1999). Early risk factors and adult person-environment relationships in affective disorder. *Psychological Medicine,* 29, 1055–1067.

Veenstra,M.Y., Lemmens ,P.H., Friesema ,I.H., Garretsen,H.F., Knottnerus,J.A., & Zwietering,P.J. (2006). A Literature overview of the relationship between life-events and alcohol use in the general population. *Alcohol and Alcoholism*, 41(4), 455-463.

Wadsworth,M., Ferri,E., & Bynner,J. (2003). Changing Britain. In E. Ferri, J. Bynner, & M. Wadsworth (Eds.), Changing Britain, Changing Lives. Three Generations At The Turn of The Century. (pp.1-28). London: Institute of Education.

Wadsworth,M.E., Mann,S.L., Rodgers,B., Kuh,D.J., Hilder,W.S., & Yusuf,E.J. (1992). Loss and representativeness in a 43 year follow up of a national birth cohort. *Journal of Epidemiology and Community Health*, 46, 300-304.

Wadsworth,M.E., Butterworth,S.L., Hardy,R., Kuh,D., Richards,M., Langenberg,C., Hilder,W.S., & Conner,M. (2003). The life course prospective design: an example of benefits and problem associated with study longevity. *Social Science and Medicine*, *57*, 2193-2205.

Wadsworth,M.E.J. (1987). Follow-up of the first British National birth cohort: findings from the MRC National Survey of Health and Development. *Paediatric and Perinatal Epidemiology*, 1, 95-117.

Wadsworth,M.E.J. (1991). The Imprint of Time: Childhood, History and Adult Life. Oxford: Oxford University Press.

Wadsworth,M., Kuh,D., Richards,M., & Hardy,R. (2005). Cohort Profile: The 1946 National Birth Cohort (MRC National Survey of Health and Development). *International Journal of Epidemiology*, 35(1), 49-54.

Waijers,P.M., Feskens,E.J., & Ocke,M.C. (2007). A critical review of predefined diet quality scores. *British Journal of Nutrition*, 97(2), 219-231.

Walker,A., Maher,J., Coulthard,M., Goddard,E., & Thomas,M. (2001). Office for National Statistics. Living in Britain. General Household Survey 2000. London: The Stationary Office.

Wannamethee,G., & Shaper,A.G. (1992). Blood lipids: the relationship with alcohol intake, smoking, and body weight. *Journal of Epidemiology and Community Health*, 46(3), 197-202.

Wardle,J., Steptoe,A., Oliver,G., & Lipsey,Z. (2000). Stress, dietary restraint and food intake. *Journal of Psychosomatic Research*, 48, 195-202.

Wardle,J., & Steptoe,A. (2003). Socioeconomic differences in attitudes and beliefs about healthy lifestyles. *Journal of Epidemiology and Community Health*, 57, 440-443.

Weinstein,S.J., Vogt,T.M., & Gerrior,S.A. (2004). Healthy Eating Index scores are associated with blood nutrient concentrations in the third National Health And Nutrition Examination Survey. *Journal of American Diet Association*, 104, 576-584.

Welin,L., Tibblin,G., Svardsudd,K., Tibblin,B., nder-Peciva,S., Larsson,B., & Wilhelmsen,L. (1985). Prospective study of social influences on mortality. The study of men born in 1913 and 1923. *Lancet*, 1(8434), 915-918.

Welte,J.W., & Mirand,A.L. (1995). Drinking, problem drinking and life stressors in the elderly general population. *Journal of Studies on Alcohol*, 56, 67-73.

Welte,J.W. (1998). Stress and elderly drinking. In A.M. Hegedus, & R.A. Zucker (Eds.), Alcohol Problems and Aging (pp.229-246). Bethesda: NIH Publication.

Werner,P. (2003). Factors influencing intentions to seek a cognitive status examination: a study based on the Health Belief Model. *International Journal of Geriatric Psychiatry*. 18, 787-794.

West,R. (2006). Theory of addiction. Oxford: Blackwell.

Wethington,E., & Kessler,R.C. (1986). Perceived Support, Received Support, and Adjustment to Stressful Life Events. *Journal of Health and social Behavior*, 27(1), 78-89.

Wethington,E. (2000). Expecting Stress: Americans and the Midlife Crisis. *Motivation and Emotion*, 24(2), 85-103.

WHO (2003). Diet, Nutrition and The Prevention Of Chronic Diseases. Report of a Joint WHO/FAO Expert Consultation. Geneva: World Health Organization.

WHO (2005). Preventing chronic diseases: a vital investment: WHO Global Report. Geneva: World Health Organization.

Wilcox,S., Evenson,K.R., Aragaki,A., Wassertheil-Smoller,S., Mouton,C.P., & Loevinger,B.L. (2003). The effects of widowhood on physical and mental health, health behaviors, and health outcomes: The Women's Health Initiative. *Health Psychology*, *22*(5), 513-522.

Wiles,S.J., Nettleton,P.A., Black,A.E., & Paul,A.A. (1980). The nutrient composition of some cooked dishes eaten in Britain: a supplementary food composition table. *Journal of Human Nutrition*, 34(3), 189-223.

Wilkes,S., & Evans,A. (1999). A cross-sectional study comparing the motivation for smoking cessation in apparently healthy patients who smoke to those who smoke and have ischaemic heart disease, hypertension or diabetes. *Family Practice*, *16*(6), 608-610.

Willett,W. (1988). Nutritional Epidemiology. New York: Oxford University Press.

Wilson,P.W.F. (1994). Established risk factors and coronary artery disease: the Framingham Study. *American Journal of Hypertension*, 7, 7s-12s.

Ziegler,R.G., Mayne,S.T., & Swanson,C.A. (1996). Nutrition and Lung cancer. *Cancer Causes and Control*, 7, 157-77.

Appendix 2.1

Examples of the ranges of life events in the literatures and the categories used to group some of the events.

Authors	**Categories**	**Examples of events**
Brown, 1989 (The LEDS grouping	Changes in role of subject. Changes in role of someone close. Changes in health of subject. Changes in health of someone close. Change in residence or social contact. Anticipation of change in life. Fulfilment or disappointment of something of value. Other significant events.	Becoming a parent, unemployed. Husband becoming housemaker due to redundancy. Develop an illness. Expecting to be made redundant.
Mattlin et. al., (1990)	Illness Practical Interpersonal Death Network illness Network other	Illness, injuries, chronic health conditions of self. Job losses, legal problem, burglaries, accidents and financial difficulties. Marital problems and problems with family members and friends. Death of loved ones. Health conditions of people social circle. Problems experienced by people in social circle.
Billings and Moos (1984) Number of event stressors	Negative life events Personal illness Children illness Spouse symptoms Negative home environment Family strains Work stressors	Loss of income, legal problems, death of friends. Diagnosed with medical conditions. Health problem in children. Headaches, indigestions, insomnia, trembling hands Lack of comfort, cleanliness in homes. Family disagreement such as on money, relatives, child discipline, house chores.
Dohrenwend (1973)	Events, • Controlled by the respondent • Possibly controlled by the respondent, • Probably influenced by the respondent. • Probably not controlled by the respondent – friends or relative other than spouse	 Events shared with another person, e.g. residential change, divorce Job promotion, fired. Death, physical illness, marriage, job change of

Billings and Moos (1981)	Illness Death Economic Children Other interpersonal Other non-interpersonal	
McCrae, 1984	Threat Loss Challenge	Illness in the family Deaths Marriage
Paykel (1976)	Social loss	Death of family members or someone close, divorce, children getting married or family members leaving homes
McKee et. al., (2003)	Interpersonal loss Personal financial problem Move to new residence Life threatening illness or injury	Death of friends or relative, divorce.
Gottlieb and Green (1984)	Negative life events (5 years)	Death of spouse or child, serious illness, injury or surgical operations of self, spouse or child, inaccessible medical treatment for self or family, separation or divorce, other marital difficulties, problems with a steady date or fiancé, financial difficulties.
Tausig (1986) Frequency of life events for previous 6 months Based on Holmes and Rahes' SRE (1967) and Rahe's RLCQ (1975)	School	Started school Graduated from school Failed school Ceased attending school Changed schools Problems in school
	Home	Moved within same town Moved to a different town Moved to same type of neighbourhood Moved to a better neighbourhood Moved to a worse neighbourhood Built a new house Remodelled house Change living conditions
	Love and marriage	Began serious relationship Cease steady dating Engaged Broke engagement Married Child married with approval Child married without approval Divorced Marital separation Separated from spouse (tour, business, vacation) Began extramarital affair Increased arguments with spouse Increased relations with spouse Trouble with in-laws

		Marital reconciliation
	Family	Birth of first child
		Birth of other child
		Adoption of first child
		Adoption of other child
		New person moved into household
		Child left home- married
		Child left home – college
		Child let home – other reason
		Family member entered armed forces
		Other family member left home
		Change in number of get-togethers
		Birth of grandchild
	Health	Serious physical illness
		Serious injury or accident
		Death of child
		Death of brother or sister
		Death of parent
		Death of other close family member
		Death of close friend
		Death of spouse
		Divorce of parents
		Remarriage of parents
		Change in health of family member
		Wanted pregnancy
		Unwanted pregnancy
		Menopause
		Miscarriage
		Stillbirth
		Frequent minor illness
		Major dental work
		Mental illness
		Death of pet
		Abortion
		Sexual difficulties
	Personal change	Change in personal habit
		Change in amount/type of recreation
		Change in church activities
		Change in sleeping habits
		Change in social activities
		Change in religious belief
		Change in political belief
	Work and finance	Spouse started/ended work
		Started to work first time
		Started to work other than first time
		Change to same type of job
		Change to different type of work
		More responsibilities at work
		Fewer responsibilities at work
		Promotion
		Demotion
		Transfer
		Laid off (temporarily)
		Expanded business
		Business failing

		Trouble with boss
		Troubles with co-workers
		Troubles with persons under your supervision
		Other work troubles
		Change in work hours or conditions
		Out of work over a month
		Out of work less than a month
		Fired
		Reorganisation at work
		Retirement
		Significant success at work
		Home study to improve you in your work
		Major improvement in financial status
		Financial status a lot worse than usual
		Foreclosure of mortgage or loan
		Outstanding personal achievement
		Credit rating difficulties
		Moderate purchase
	Legal	Major purchase or mortgage
		In court
		In jail
		Arrested
		Law suit or legal action
		Loss of drivers license
		Minor violation of law
	Other	Loss, robbery, or damage of personal property
		Serious argument with neighbour, friend, relative
		Improve relations with neighbour, friend, relative
		Separation from significant person N.E.C.
		Vacation
		Accident
		Major decision regarding the future
		Community crisis (fire, crime, etc)

Appendix 3.1

The CAGE questions from Self-Completion Booklet 1999.

1. In the last year, have you felt you ought to cut down on your drinking?
DO NOT INCLUDE DIETING.
    Yes
    No

2. In the last year, have people ever annoyed you by criticising your drinking?
    Yes
    No

3. In the last year, have you ever felt bad or guilty about your drinking?
    Yes
    No

4. In the last year, have you ever had a drink first thing in the morning to steady your nerves or to get rid of a hangover?
    Yes
    No

Appendix 3.2

The questions pertaining the amount of alcohol consumed from the survey questionnaire.

In the last seven days have you had any of the following drinks?
DO NOT COUNT NON-ALCOHOL DRINKS

a. Spirits or liqueurs (e.g. whisky, gin, brandy, vodka)
Yes / No
How many **measures?**

b. Wine, sherry, martini or port
Yes / No
How many **glasses**?

c. Beer, lager, cider or stout
Yes / No H
How many ½ **pints**?

Appendix 3.3

The checklist of physical activity at 36 years.

Badminton
Basketball
Bowls
Cricket
Dancing
Exercises (e.g. press ups, sit ups, in gym or at home)
Football (including refereeing)
Golf
Hill or mountain climbing
Jogging
Movement to music
Riding
Rowing
Running or athletics
Sailing
Scuba diving
Squash or rackets
Swimming
Table tennis
Tennis
Volleyball
Water skiing
Weight training
Yoga

(Source: Richards et. al., 2003b)

The question on physical activity at age 43 years.

- ❖ In the last 4 weeks, that is since (LFF day and date), have you taken any part in any sports or vigorous leisure activities or done any exercises in your spare time, not including getting to and from work? *If asked: Include things like badminton, swimming, yoga, press-ups, dancing, mountain climbing or jogging and brisk walks for 30 minutes or more.*
    - Yes
    - No
- ❖ On how many occasions in the last 4 weeks did you do these activities? *Enter a numeric value between 1 and 100.*

The question on physical activity at age 53 years.

- Do you regularly tak part in any sports or vigorous leisure activities or do any exercises? (Things like badminton, swimming, yoga, press-ups, dancing, football, mountain climbing or jogging?)

    - Yes
    - No

- How often do you do this?

Appendix 3.4

Questions on stressful life events from the NSHD survey at age 43 and 53 years.

Thinking back over the last year have you experienced any of these things?

a. Have you developed or found out you have a serious illness or handicap?
b. Have you had an accident or received an injury which has affected you for a month or more?
c. Have you been assaulted or robbed (or a victim of attempted robbery)?
d. Have you lost your job or thought you would soon lose your job?
e. Have you had any other crises or serious disappointments in your work or career in general?
f. Have you moved house in the last year? Did you move away from the area where most of your friends lived?
g. During the last year has your spouse/partner had a serious accident or illness, or received a serious injury, or been assaulted?
h. Has you spouse/partner lost his/her job or thought he/she would soon loose his/her job?
i. Has your spouse/partner had any other crises or serious disappointments in his/her work?
j. Have you had any serious disagreements with your spouse/partner or felt betrayed or disappointed by him/her?
k. In the last year have you had any serious difficulties with any of your children, because of their health or behaviour or for other reason?
l. Has a friend or relative or someone you know well had a serious accident or illness or received a serious injury?
m. Has a friend or relative or someone you know well died during the last year?

The response to each questions:

- Yes
- No

In the survey at age 43 years, each positive response from above will be followed by the 2 questions below:

1. As a result of this have you had to change your way of life?
    - No, not at all
    - Yes, somewhat
    - Yes, a great deal

2. When this happened or when you found out about it were you
    - Fairly calm about it
    - Shocked but able to cope
    - Rather overwhelmed

Appendix 3.5

Questions on selected medical conditions in the NSHD survey at age 53 years.

1. Question on angina.

a. Now I am going to ask you some question about you general health. Have you ever been told by a doctor that you have had angina?

Yes / No

b. How old were you when you first had this problem?

c. Have you consulted a doctor or other health professional about your angina in the last 12 months?

Yes, a doctor

Yes, another health professional

No

2. Question on heart attack.

a. Have you ever suffered from a heart attack?

Yes / No

b. Who diagnosed these heart attack(s). Was it….read out….Nurse: For more than one heart attack code all that apply. Enter at most 2 values.

A GP,

A specialist

Or was no medical diagnosis made?

c. How old were you when you had your first heart attack? Enter number in years. If less than one, enter 0. Enter a numeric value between 0 and 53.

Age :

3. Question on high blood pressure.

a. Have you had any kind of blood pressure problems in the last ten years that is since you were 43 years old?

Yes / No

b. What blood pressure problems have you had?

Hypertension/high blood pressure

Low blood pressure

Other kind of blood pressure

c. Has a doctor said you had this problem?

Yes / No

d. How old were you then?

Age:

4. Question on stroke.

a. And in the last ten years (that is since you were 43 years old, have had a stroke?

Yes / No

b. Has a doctor said you have this problem?

Yes / No

c. How old were you then?

Age:

5. Question on diabetes.

a. And in the last ten years (that is since you were 43 years old,) have you had diabetes?

Yes / No

b. What kind of diabetes have you had. Was it….read out…. Nurse: code all that apply.

Insulin-dependent

Non-insulin dependent or

High blood pressure or

Some other kind of diabetes?

Appendix 3.6

Questions on social support in the NSHD survey that was used in this study.

1. Question on perceived support.

- ❖ Do you think that you have friends, neighbours or relatives who would help you out if a problem or crisis came up?
  a. No one to help 1
  b. Would sometimes get help 2
  c. Would often get help or 3
  d. Would always get help 4

2. Questions relating to social network.

- ❖ How many friends or relatives would you say you had that you met and talked to socially on a regular basis?
  a. None
  b. 1-2
  c. 3-5
  d. 6-10
  e. 11-15
  f. More than 15

- ❖ How many friends or relatives would you say you had that you could visit at any time, without waiting for an invitation, or who could visit you anytime, without waiting for an invitation?
  a. None
  b. 1-2
  c. 3-5
  d. 6-10
  e. 11-15
  f. More than 15

- ❖ On average, how often would you say you met friends or relatives socially?
  a. Never
  b. 1-2 times a month

c. 3-5 times a month
d. 6-10 times a month
e. 11-15 times a month
f. More than 15 times

3. Questions relating to participation in social activity.

- In you spare time, do you help to run or are you currently involved in any o the following activities?
  - Church activities
  - Playgroup, nurseries or school
  - Local Government
  - Trade Unions
  - Voluntary services
  - Sports Clubs
  - Evening classes/ adult education
  - Other organizations (specify______________)

Response to the question:

- Do you?
  - Not belong to
  - Belong to
  - Help to run

- How often do you take part?
  - Less than once a month
  - Monthly
  - Weekly

Appendix 4.1

Number of life events in men and women at ages 43 and 53 years.

Table 1: Number of items of life events in men and women at age 43 years.

Life events	**N**	**Men n (%)**	**Women n (%)**	**Total (%)**
Have serious illness or handicap	3246	39 (2.4)	50 (3.1)	89 (2.7)
Affected by accident or injury for a month or more	3245	93 (5.7)	80 (4.9)	173 (5.3)
Had been assaulted or robbed or attempted robbery	3242	54 (3.3)	42 (2.6)	96 (3.0)
Had job lost or anticipating it	2968	151 (9.2)	107 (6.6)	258 (8.7)*
Had work or career crises / disappointment	3208	167 (10.2)	72 (4.4)	239 (7.5)*
Had moved house	3247	140 (8.6)	125 (7.7)	265 (8.2)
Moved away from friends	236	50 (3.1)	39 (2.4)	89 (37.7)
Spouse or partner had accident, illness, injury or been assaulted	2805	104 (6.4)	104 (6.4)	208 (7.4)
Spouse or partner had lost job anticipating it	2798	72 (4.4)	148 (9.1)	220 (7.9)*
Spouse or partner had work or career crises / disappointment	0	0 (0)	0	-
Have disagreement with spouse or partner	2811	101 (6.2)	134 (8.2)	235 (8.4)*
Have difficulty or concerned with children's health, behaviour or other reasons	2795	226 (13.8)	303 (18.6)	529 (18.9)*
Someone close had serious accident, illness or injury	3244	409 (25.0)	531 (32.6)	827 (25.5)
Someone close had died	3246	602 (36.8)	418 (25.7)	1133 (34.9)*
Had disagreement with someone close	3245	153 (9.4)	180 (11.1)	333 (10.3)
Loss contact with someone close	3243	122 (7.5)	139 (8.5)	261 (8.1)
Have other disappointment or upset	3213	96 (5.9)	122 (7.5)	218 (6.8)

**p<0.05 for differences between the sexes.*

Table 2: Number of items of life events in men and women at age 53 years.

Life events	N	Men n (%)	Women n (%)	Total (%)
Have serious illness or handicap	2986	83 (5.7)	100 (6.6)	183 (6.1)
Affected by accident or injury for a month or more	2986	109 (7.4)	117 (7.7)	226 (7.6)
Had been assaulted or robbed or attempted robbery	2987	59 (4.0)	59 (3.9)	118 (4.0)
Had job lost or anticipating it	2986	199 (13.6)	119 (7.8)	318 (10.7)*
Had work or career crises / disappointment	2985	161 (11.0)	127 (8.4)	288 (9.7)*
Had moved house	2988	94 (6.4)	90 (5.9)	184 (6.2)
Moved away from friends	184	24 (1.6)	26 (1.7)	50 (27.2)
Spouse or partner had accident, illness, injury or been assaulted	2473	134 (10.8)	135 (11.0)	269 (10.9)
Spouse or partner had lost job anticipating it	2474	78 (6.3)	149 (12.1)	227 (9.2)*
Spouse or partner had work or career crises / disappointment	2473	84 (6.7)	118 (9.6)	202 (8.2)*
Have disagreement with spouse or partner	2473	68 (5.5)	100 (8.1)	168 (6.8)*
Have difficulty or concerned with children's health, behaviour or other reasons	2606	182 (14.5)	294 (21.8)	476 (18.3)*
Someone close had serious accident, illness or injury	2972	603 (41.2)	601 (40.2)	1001 (33.7)
Someone close had died	2980	485 (33.2)	516 (34.1)	1213 (40.7)
Had disagreement with someone close	2979	121 (8.3)	163 (10.8)	284 (9.5)*
Loss contact with someone close	2979	93 (6.4)	116 (7.7)	209 (7.0)
Have other disappointment or upset	2987	173 (11.8)	239 (15.7)	412 (13.8)*

**p<0.05 for differences between the sexes.*

Appendix 5.1

Table 1. Odds ratios of stopping smoking for diagnosis of medical condition in all subjects and stratified by perceived support.

	N	OR (95% CI)	p
All subjects	759	1.55 (1.06, 2.27)	0.02
Stratified by perceived support			
Always	664	1.79 (1.19, 2.68)	0.005
Often	38	1.31 (0.27, 6.24)	0.7
None/sometimes	43	0.00 (-)*	0.06
Test for heterogeneity		LRTχ^2 = 5.9, 2 DF, p= 0.05	

*There was no cases of stopping smoking among the cohort members diagnosed with at least one medical condition.

Appendix 5.2

Table 1. Odds ratios of stopping smoking for diagnosis of medical condition in all subjects and stratified by perceived support.

	N	OR (95% CI)	p
All subjects	1530	1.77 (1.27, 2.48)	<0.001
Stratified by perceived support			
Always	1381	1.97 (1.39, 2.80)	<0.001
Often	69	2.21 (0.49, 10.02)	0.3
None/sometimes	73	0.00 (-)*	0.07
Test for heterogeneity		LRTχ^2 = 5.9, 2DF p= 0.05	

*There was no cases of stopping smoking among the cohort members diagnosed with at least one medical condition.

Appendix 7.1

Table 1. Linear regression coefficient of dietary change index by diagnosis of a medical condition in the aggregated data in all subjects and in men and women separately.

	N	Regression coefficient (95% CI)	p
All subjects	2859	0.71 (0.39, 1.04)	<0.001
Stratified by sex			
Men	1321	1.11 (0.65, 1.58)	<0.001
Women	1538	0.37 (-0.07, 0.82)	0.1
p for interaction			0.025

Appendix 8.1.

Methods for analysis of non-health related life events at age 43 years.

Non-health related life events score at age 43 years.

The non-health related life events in this study included all the life events items which were not part of the health related life events as listed in the table below. The variable non-health related life events score was derived by, using the original scores (uncategorised score), subtracting the health related life events score from the life events score (of the stressful life events) at age 43 years. The score ranged from 0 to 5 units and was ordinally categorised into 0, 1, 2, and 3 by combining those with 3 or more events in one category.

The non-health related life events items at age 43 years.

1. Had been assaulted or robbed or attempted robbery.
2. Had job lost or anticipating it.
3. Had work or career crises / disappointment .
4. Had moved house.
5. *Moved away from friends.*
6. Spouse or partner had lost job anticipating it.
7. Have disagreement with spouse or partner.
8. Had disagreement with someone close.
9. Loss contact with someone close.
10. Have other disappointment or upset.

There was no observation for spouse's work crises, hence was excluded from the category.

Non-health related emotional score at age 43 years.

The life events items included in this category was similar to that described above. The non-health related emotional score was derived in similar manner; that is, by using the original scores (uncategorised score), subtracting the health related emotional score from the emotional score (of the stressful life events). The score ranged from 0 to 16 units. It was then categorised into 0, 1, 2, 3, and 4 by combining those with 4 or more events in one category.

Method.

The analysis of the association between increase in physical activity and non-health related life events score and non-health related emotional score was carried out using the logistic regression analysis.