The association between marital history and cardiovascular disease

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Declaration

I, Tuba Mazhari confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Abstract

Background

Lower rates of mortality and morbidity from cardiovascular disease (CVD) have been found for married, relative to single, divorced and widowed persons. Relatively little work has investigated the association between marital history and CVD, and this is the first study to do so in British samples.

Methods

Data came from the National Survey for health and development (NSHD) at 60-64 years (N=2259) and 43 years (N=3239), and National Child Development Survey (NCDS) at 44-45 years (N=9080), of age.

To assess the effect of a previous marital loss on current CVD risk, regressions were employed to compare remarried persons with their counterparts in a first marriage on CVD prevalence, systolic blood pressure (SBP mmHg), diastolic blood pressure (DBP mmHg), body mass index (BMI kg/m^2) and waist circumference (cm). CVD prevalence and scores on risk factors for CVD for continually married persons was also compared with single, widowed and divorced persons. Confounding from SEP and behavioural problems pre-adulthood were explored. Random coefficient models were employed to assess whether differences in SBP, DBP and BMI between continually married and divorced persons change with divorce duration.

Results

CVD prevalence at 60-64 years was higher for widowed women. Divorced status was associated with lower blood pressure, among women of the NSHD, and SBP at 43 years was higher for single men of this cohort. BMI for members of the NSHD at 43 years and members of the NCDS who were previously married, was relatively lower than that of their continually married counterparts. Relative differences in BMI between married and divorced persons converge with divorce duration.

Discussion

CVD prevalence at 60-64 years was higher for widowed women but not men, compared with their continually married counterparts. Differences in BMI and systolic blood pressure by marital status appear to vary by, gender, cohort and divorce duration.

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Abbreviations

CVD=Cardiovascular disease

Risk factors for CVD = Blood pressure, BMI and waist circumference

BMI=Body Mass Index

SBP=Systolic blood pressure

DBP=Diastolic blood pressure

Marital loss=Divorce or widowhood

Marital dissolution=Divorce

NSHD=National Survey for Health and Development

NCDS=National Child Development Survey

SEP= Socioeconomic position

Single=Never Married

Cohabiting=Living with a partner, but not legally married.

IHD=Ischaemic heart disease

Contents

Abstract 3
Acknowledgments 4
Abbreviations 5

List of Tables 11

List of Figures 16

1 Chapter 1: Background 18

1.1 Introduction 18

1.1.1 The need for a life course approach in studies of marriage and health 18
1.1.2 Life course influences on marital status and CVD 21
1.1.3 The role of gender in the association between marital status and CVD. 24
1.1.4 Birth cohorts: National Survey for Health and Development and National Child Development Survey 25

2 Chapter 2: Literature review, aims and objectives 28

2.1 Literature review 28

2.1.1 A review of existing studies of marital status and CVD 28

2.2 Marital history 36

2.2.1 Previous marital loss and the association between marital status and CVD 36
2.2.2 Time since marital loss: A moderator of relative differences in risk of CVD by marital status. 39

2.3 Socioeconomic position and psychological distress as confounders of the association between marital status and CVD 44

2.3.1 SEP measures in adulthood and marital union 44

2.4 Contributions of the present study on the association between marital status, marital history (previous marital loss and time since divorce) and CVD. 52

2.5 Contributions of the present study to the confounding effects of SEP and psychological distress, on the relationship between marital status and CVD 55

2.6 Gender as a moderator of the relationship between marital history and CVD, and lifecourse influences on marital status. 57

2.7 Gender differences in the relationship between socioeconomic position and marital status – and their potential confounding effects on the relationship between marital status and CVD. 57

2.8 Objectives & hypotheses. 59

3 Chapter 3: Methods 64

3.1 Data 64

3.1.1 NSHD 64
3.1.2 NCDS 67
3.1.3 Outcome measures 69

3.2 Marital History 71

3.2.1 Operationalizing marital history for members of the NSHD 71
3.2.2 Operationalizing marital history for members of the NCDS 71

3.3 Confounders 72

3.3.1 Father's social class 72
3.3.2 Educational attainment 72
3.3.3 NSHD – behavioural problems in adolescence 73
3.3.4 NCDS – behavioural problems in childhood 73

3.4 Analytical sample, descriptive characteristics and statistical analyses employed for each of the objectives of the present study 74

3.4.1 Objective 1 74
3.4.2 Objective 2 82
3.4.3 Objective 3 88
3.4.4 Sources of attrition 89

4 Chapter 4: The association between marital history and CVD for members of the NSHD at 60-64 and 43 years, and for members of the NCDS at 44-45 years of age 92

4.1 Analytical sample and statistical analyses 94

4.2 Relative differences in CVD and risk factors for CVD, at 60-64, by marital history 95

4.2.1 Systolic blood pressure & marital history at for members of the NSHD (age 43) & NCDS (age 44-45). 98
4.2.2 Diastolic blood pressure at midlife for members of the NSHD (age 43) & NCDS (age 44-45). 98

4.2.3 Body Mass Index at midlife for members of the NSHD (age 43) & NCDS (age 44-45). 98
4.2.4 Waist circumference at midlife for members of the NSHD & NCDS 98

4.3 Discussion 103

4.3.1 Summary of main findings: Relative differences in CVD for single, divorced, widowed and remarried persons relative to their continually married counterparts among members of the NSHD at 60-64 years and 43 years and members of the NCDS at 44-35 years of age. 103
4.3.2 Inter-cohort differences in the association between marital history and CVD – for members of the NSHD at 43 years and members of the NCDS at 44-45 years of age 110

4.4 Strengths of the present study 112

4.5 Limitations of the present analyses. 113

5 Chapter 5 – The confounding effects of father's social class, educational attainment and behavioural problems on the association between marital history and CVD among members of the NSHD at 60-64 and 43 years, and members of the NCDS at 44-45 years of age. 116

5.1 Analytical sample and statistical methods 116

5.1.1 SEP and the likelihood of marriage among members of the NSHD at 60-64 years. 117
5.1.2 SEP, psychological distress and the likelihood of divorce and widowhood among members of the NSHD at 60-64 years. 120
5.1.3 The relationship between father's social class, educational attainment and marriage among members of the NSHD at 43 years, and members of the NCDS at 44-45 years of age 123
5.1.4 The relationship between father's social class, educational attainment and behaviour problems with marital loss (divorce and widowhood) among members of the NSHD at age 43, and members of the NCDS at 44-45 years of age. 123
5.1.5 Educational attainment and divorce 124

5.2 The role of father's social class, educational attainment and behavioural problems in the association between marital history and CVD among members of the NSHD at age 60-64. 128

5.2.1 The relationship between CVD prevalence and father's social class, educational attainment and conduct problems 128

5.3 The role of father's social class, educational attainment and behavioural problems in the association between marital history and CVD among members of the NSHD at 43 years and NCDS at 44-45 years. 142

5.3.1 The relationship between blood pressure (SBP & SBP) and father's social class, educational attainment and behavioural problems 142

5.3.2 The relationship between BMI and father's social class, educational attainment and behavioural problems 143

5.3.3 The relationship between waist circumference and father's social class, educational attainment and behavioural problems 143

5.4 Discussion 162

5.5 Summary of main findings in relation to marital history and CVD. 162

5.6 Strengths of the present study 167

5.7 Limitations of the present study 168

6 Chapter 6: The role of time since divorce, on relative differences in BMI and blood pressure, between married and divorced persons. 170

6.1 Analytical sample & statistical methods 170

6.2 BMI & blood pressure trajectories, by marital status 171

6.3 Discussion 177

6.3.1 Main results 177

6.4 Strenghts of the present study 180

6.5 Limitations of the present study 181

7 Chapter 7: Conclusions 183

7.1 Overview and contributions of the present study 183

7.2 Summary & explanation of main findings 185

7.2.1 The association between marital history and CVD. 185

7.2.2 The confounding effects of father's social class, educational attainment and behavioural problems on the association between marital history and CVD. 187

7.3 Limitations. 188

7.3.1 Limitations of measures employed 188

7.3.2 The impact of differential non-response on the present findings. 189
7.3.3 Problems with generalizability 193

7.4 Recommendations for future research 195

7.4.1 Recommendations for assessing the causal relationship between marital history and CVD, among members of the NSHD and NCDS. 195
7.4.2 Cohabitation 197
7.4.3 Inter-cohort differences in the association between marital history and CVD 198
7.4.4 Recommendations for future research: cultural differences in the in the association between marital history and CVD. 201
7.4.5 Same-sex couples 202
References 204

Appendices 217

List of Tables

Table 3.1 Response rate in the NSHD 66

Table 3.2 Response rate in the NCDS 68

Table 3.3 The distribution of marital history, CVD prevalence and risk factors for CVD at 60-64 years among members of the NSHD. 77

Table 3.4 Age at first marital transitions among men and women from the NSHD, by 60-64 years. 78

Table 3.5 The distribution of marital history, and risk factors for CVD at 43 years among members of the NSHD and 44-45 years among members of the NCDS. 80

Table 3.6 Marital history for members of the NSHD at 43 years and members of the NCDS at 44-45 years 81

Table 3.7 The distribution of marital history, CVD prevalence, risk factors for CVD, father's social class, educational attainment and conduct problems among members of the NSHD at 60-64 years of age. 85

Table 3.8 The distribution of marital history, CVD prevalence, risk factors for CVD, father's social class, educational attainment and behavioural problems among members of the NSHD at 43 years of age, and members of the NCDS at 44-45 years of age. 87

Table 3.9 The likelihood of not being in the analytical sample, for the present study, among members of the NSHD at 43 and 60-64 years of age by factors throughout the life course. 91

Table 4.1 Regression estimates (odd ratios) for CVD by marital history at 60-64 years among men and women from NSHD 96

Table 4.2 Regression estimates (coefficients) for CVD risk factors by marital history, at 60-64 years among members of the NSHD 97

Table 4.3 Regression estimates (coefficients) for SBP (mmHg) by marital history, stratified by birth cohort and gender cohort. 99

Table 4.4 Regression estimates (coefficients) for DBP (mmHg) by marital history and birth cohort. 100

Table 4.5 Regression estimates (coefficients) for BMI (kg/m^2) by marital history and birth cohort. 101

Table 4.6 Regression estimates (coefficients) for waist circumference (cm) by marital history and birth cohort. 102

Table 5.1 Regression estimates for the likelihood of marriage by socioeconomic status among members of the NSHD at 60-64 years. 119

Table 5.2 Regression estimates for the likelihood of divorce and widowhood by socioeconomic status and conduct problems among members of the NSHD, at age 60-64. 121

Table 5.4 Regression estimates for the likelihood of divorce by socioeconomic status and behavioural problems by gender and birth cohort 126

Table 5.5 Regression estimates for the likelihood of widowhood by socioeconomic status and behavioural problems by gender and birth cohort 127

Table 5.6 Regression estimates (odds ratios) to show the association between marital history and CVD prevalence at age 60-64 among NSHD men, adjusted for father's social class, educational attainment and adolescent conduct problems N=901 131

Table 5.7 Regression estimates (odds ratios) to show the association between marital history and CVD prevalence at age 60-64 among NSHD women, adjusted for father's social class, educational attainment and adolescent conduct problems N=967 132

Table 5.8 Regression estimates (coefficients) to show the association between marital history and SBP (mmHg) at age 60-64 among NSHD men , adjusted for father's social class, educational attainment and adolescent conduct problems N= 790 133

Table 5.9 Regression estimates (coefficients) to show the association between marital history and SBP (mmHg) at age 60-64 among NSHD women , adjusted for father's social class, educational attainment and behavioural problems N= 871 134

Table 5.10 Regression estimates (coefficients) to show the association between marital history and SBP (mmHg) at age 60-64 among NSHD men , adjusted for father's social class, educational attainment and adolescent conduct problems N= 790 135

Table 5.11 Regression estimates (coefficients) to show the association between marital history and DBP (mmHg) at age 60-64 among NSHD women , adjusted for father's social class, educational attainment and behavioural problems N=871 136

Table 5.12 Regression estimates (coefficients) to show the association between marital history and BMI (kg/m2) among NSHD men , adjusted for father's social class, educational attainment and behavioural problems at age 60-64 N=787 137

Table 5.13 Regression estimates (coefficients) to show the association between marital history and BMI (kg/m2) among NSHD men , adjusted for father's social class, educational attainment and behavioural problems at age 60-64 N=871 138

Table 5.14 Regression estimates (coefficients) to show the association between marital history and BMI (kg/m2) among NSHD men , adjusted for father's social class, educational attainment and behavioural problems at age 60-64 N=871 139

Table 5.15 Regression estimates (coefficients) to show the association between marital history and waist circumference (cm) among NSHD men , adjusted for father's social class, educational attainment and behavioural problems at age 60-64 N=788 140

Table 5.16 Regression estimates (coefficients) to show the association between marital history and waist circumference (cm) among NSHD men , adjusted for father's social class, educational attainment and behavioural problems at age 60-64 N=876 141

Table 5.17 Regression estimates (coefficients) to show the association between marital history and SBP (mmHg) at age 43 among NSHD men adjusted for father's social class, educational attainment and adolescent conduct problems N=1359 145

Table 5.18 Regression estimates (coefficients) to show the association between marital history and SBP (mmHg) at age 43 among NSHD women adjusted for father's social class, educational attainment and adolescent conduct problems N=1355 146

Table 5.19 Regression estimates (coefficients) to show the association between marital history and SBP (mmHg) among NCDS men adjusted for father's social class, educational attainment and adolescent conduct problems at age 43 N=3175 147

Table 5.20 Regression estimates (coefficients) to show the association between marital history and SBP (mmHg) among NCDS women adjusted for father's social class, educational attainment and adolescent conduct problems at age 44-45 N=3356 148

Table 5.21 Regression estimates (coefficients) to show the association between marital history and DBP (mmHg) among NSHD men adjusted for father's social class, educational attainment and adolescent conduct problems at age 43 N=1359 149

Table 5.22 Regression estimates (coefficients) to show the association between marital history and DBP (mmHg) at age 43 among NSHD women adjusted for father's social class, educational attainment and adolescent conduct problems N=1355 150

Table 5.23 Regression estimates (coefficients) to show the association between marital history and DBP (mmHg) among NCDS men adjusted for father's social class, educational attainment and adolescent conduct problems at age 44-45 N=3175 151

Table 5.24 Regression estimates (coefficients) to show the association between marital history and DBP (mmHg) among NCDS women adjusted for father's social class, educational attainment and adolescent conduct problems at age 44-45 N=3356..... 152

Table 5.25 Regression estimates (coefficients) to show the association between marital history and BMI among NSHD men adjusted for father's social class, educational attainment and adolescent conduct problems at age 43, N=1374 153

Table 5.26 Regression estimates (coefficients) to show the association between marital history and BMI (kg/m^2) among NSHD women adjusted for father's social class, educational attainment and adolescent conduct problems at age 43 N=1367 154

Table 5.27 Regression estimates (coefficients) to show the association between marital history and BMI (BMI (kg/m2)) among NCDS men adjusted for father's social class, educational attainment and adolescent conduct problems at age 44-45 N=3155..... 155

Table 5.28 Regression estimates (coefficients) to show the association between marital history and BMI kg/m^2 among NCDS women adjusted for father's social class, educational attainment and adolescent conduct problems at age 44-45 N=3358 156

Table 5.29 Regression estimates (coefficients) to show the association between marital history and waist circumference (cm) among NSHD men adjusted for father's social class, educational attainment and adolescent conduct problems at age 43 N=1368..... 157

Table 5.30 Regression estimates (coefficients) to show the association between marital history and waist circumference (cm) among NSHD women adjusted for father's social class, educational attainment and adolescent conduct problems at age 43 N=1373..... 158

Table 5.31 Regression estimates (coefficients) to show the association between marital history and waist circumference (cm) among NCDS men adjusted for father's social class, educational attainment and adolescent conduct problems at age 44-45 N=3184..... 159

Table 5.32 Regression estimates (coefficients) to show the association between marital history and waist circumference (cm) among NCDS women adjusted for father's social class, educational attainment and adolescent conduct problems at age 44-45 N=3388 .. 160

Table 6.1: The number of observations and mean BMI SBP, DBP at 43, 53 and 60-64 years for members of the NSHD..... 171

Table 6.2 Trajectories of change in SBP, DBP, and BMI between 43 & 60-64 years, by marital status 173

Table 7.1 Different types of missigness, on outcomes and marital history at age 60-64 among members of the NSHD, by factors throughout the life course. 191

List of Figures

Figure 1.1 – Life course pathways between marital status and cardiovascular disease. 24

Figure 1.2 – This figure shows the rate of divorce, by age group, per 1000 married persons. 26

Figure 2.1 Hypothesized pathways of the long term effects of widowhood or divorce 53

Figure 2.2 Time as a moderator of relative differences in BMI between married and divorced persons..... 53

Figure 1.1 – Life course pathways between marital status and cardiovascular disease. 56

Figure 2.3 - Analytical model, objective 1, among members of the NSHD at age 60-64 59

Figure 2.4 - Analytical model, objective 1, among members of the NSHD at age 43..... 60

Figure 2.5 - Analytical model, objective 1, among members of the NCDS at age 44-45 60

Figure 2.6 – Analytical model to assess the relationship of entry in to and out of marriage, with confounders. 61

Figure 2.7 - Conceptual model to show the potential confounders of the relationsihp between marital history and CVD 62

Figure 2.1 Hypothesized pathways of the long term effects of widowhood or divorce 92

Figure 2.3 - Analytical model, objective 1, among members of the NSHD at age 60-64 93

Figure 2.4 - Analytical model, objective 1, among members of the NSHD at age 43..... 93

Figure 2.5 - Analytical model, objective 1, among members of the NCDS at age 44-45 94

Figure 2.6 – Analytical model to assess the relationship of entry in to and out of marriage, with confounders. 116

Figure 2.7 - Conceptual model to show the potential confounders of the relationsihp between marital history and CVD 117

Figure 2.2 Time as a moderator of relative differences in BMI between married and divorced persons..... 170

Figure 6.2 – SBP trajectories for married and divorced men 174

Figure 6.3 – SBP trajectories for married and divorced women 174

Figure 6.4 – DBP trajectories for married and divorced men 175

Figure 6.5 – DBP trajectories for married and divorced women 175

Figure 6.6 - BMI trajectories for married and divorced men 176

Figure 6.7 – BMI trajectories for married and divorced women 176

1 Chapter 1: Background

1.1 Introduction

The health benefits of marriage are well documented. There is consistent evidence for lower rates of mortality and morbidity for those who are married, relative to their single (never married) and previously married (divorced or widowed) counterparts. [1,2,3,4] However, there are several gaps in the existing literature on marriage and health, which the present study aims to address. The remainder of this chapter highlights the gaps which this thesis aims to address. A more detailed account of the specific aims and objectives of this thesis, and the relevant literature is presented in chapter 2.

1.1.1 The need for a life course approach in studies of marriage and health

Firstly, the work on marriage and health has focussed largely on current marital status only, with little consideration of marital events over the life course. An increasing recognition of the life course approach to health and ageing emphasizes the importance of experiences throughout the life course in determining current health.

Specifically, the life course approach proposes that experiences throughout the life course may have long-term effects on health. Several principles of the life course approach to health suggest how events throughout the life course may affect future and present health. According to the principle of accumulation, the adverse effects of a transition into harmful circumstances will increase with the duration spent in those circumstances and the number of times the duration is experienced. [5] Another principle is that of a sensitive or critical period. That is, the effect of a transition on health will vary according to when in the life course it occurs, which can be indexed by age. According to the life course approach, age does not act simply as a marker of the stage at which one is across the chronological life course, but also as a marker of the resources and responsibilities associated with an individual, which may impinge upon the effect of adverse circumstances on health.[6] [5] The coping resources available to an individual may also vary with historical time. For example the effect of an injury, such as a car accident, may be less harmful for quality of life in recent compared with past decades, due to medical advances. It is further proposed that the impact of these transitions on health will vary according to the number of times it occurs, the duration spent in harmful circumstances and the stage of the life course at which it takes place.[5,7,8,9]

The principles of the life course theory are relevant to health differences in marital status, in several ways. With the exception of those who never marry, there can be considerable variation in marital biography between individuals. Currently married respondents may vary with regard to whether this is their first or subsequent marriage. Marital loss has been

associated with adverse outcomes on health, and these effects have been attributed to financial losses, the loss of social support and the uptake of health behaviours e.g. smoking that are detrimental to health. Therefore it is plausible to expect that health of those in a first marriage will be different to those in a second marriage, given that the latter have experienced the effects of divorce or widowhood. Divorced and widowed respondents may have experienced previous marital losses which according to the accumulation principle may result in worse health, relative to experiencing one marital loss only.

Among those who do not differ on both current marital status and number of marital transitions, differences may arise from age at marriage or age at separation or widowhood. Raising children single-handedly may contribute to greater strains of marital loss more so for younger relative to older persons, which in turn may result in a higher risk of poor health among those who are divorced or widowed at younger, relative to older ages. The socio-emotional selectivity theory, however, predicts that as individuals age they restrict their social networks to primary social networks.[10] Thus the existence of a spouse may become more important with older age, which may make the loss of a spouse more harmful for health.[11] Historical time may also moderate the meaning and implications of a marital dissolution. For example, in older cohorts, divorced status may be associated with higher levels of stigma, compared with more recent cohorts and this may have differential effects of marital loss on health.

The adverse effect of a marital loss on health may also vary in magnitude with time the onset of a divorce or widowhood. Divorce constitutes the process of separating as well as the state of *being* divorced. Marital conflict may be especially high in the months preceding the dissolution of marriage, which may have adverse consequences for health. For example, there is evidence to suggest that high marital conflict is associated with higher SBP, relative to those in low conflict marriages.[12] Leading up to the divorce, one spouse may also change residence. Widowhood may be preceded by a long period of care-giving. It is therefore plausible to expect that the increased psychological distress associated with divorce and widowhood[2] will be apparent immediately and early on in the divorce process. While the long term financial declines may continue to elevate levels of psychological stress or poor health among previously married persons it is possible that the additional feelings of shock and grief in the early stages of marital loss, may compound the adverse effects on health, of marital loss. Subsequently the health advantages of married persons compared with their divorced and widowed persons may vary in magnitude with time since divorce or widowhood.

Since one's current marital status may encompass varying exposure to divorce, widowhood and marriage, it is plausible to expect that the failure to take into account marital history may undermine the health benefits and adverse consequences of transitions in to and out of marriage, respectively.[13 9]

There is indeed evidence to suggest that aspects of marital history, in addition to marital status, are important predictors of both mortality and morbidity risk. Increasing marital duration is associated with reduced risk of mortality, and a decrease in the rate of age related chronic disease. [14,15,16] There is evidence for time since widowhood as a moderator of differences in by mortality between widowed and married persons. There is also evidence to suggest that time since widowhood and divorce moderate differences in in BMI, self-rated heath, chronic conditions and mobility-related limitations by marital status.[17] [11,18] Younger age at both marriage and divorce are associated with mortality, mortality, [14] obesity, [19] chronic conditions, mobility limitations[18] and self-rated health. [20] There is also evidence to suggest that the impact of age at marital loss on self-rated health differs between older and younger cohorts. [20] Having experienced a marital loss is associated with higher risk of mortality, [14,15,21] depressive symptoms, chronic illness, mobility limitations, higher risk of CVD[13,22] and poor self-rated health [18], compared with those in a first marriage, regardless of current marital status. Studies based on American and Finnish samples have found that differences in self-rated health and mortality by marital status have increased over historical time.[23] [21] There is also evidence for an association of poor marital quality with elevated blood pressure, [12] increased heart rate, [12] atherosclerosis, higher blood pressure and increased risk of depression.

Investigating the association between marital history and health from a life course perspective, has become increasingly important. There have been several changes to family formation in recent decades. Since the 1970s, there has been a decline in marriage rates from 400, 000 in 1972 (among a population of 56.1 million) to 250,000 (among a population of 63.7 million)[24] in 2012. [25] An increasing number of people are choosing to cohabit rather than, and prior to their first marriage. The number of people choosing to cohabit prior to a first marriage has increased from 31.7% between 1980-1984 to 80.1% between 2004-2007.[26] Marriages are becoming less stable. The rate of people divorcing increased from 1970 up until around 2003, after which there seems to be evidence for a decline.[25]

There is evidence for a delay in transitions in to and out of marriage. In 2012 the mean age at first marriage was 32.4 and 30.3 years among men and women, respectively. The corresponding figures in 1972 were 24.9 and 22.9 years.[27] In 1971, the mean age at divorce was below 40 for both men and women. By 2011, mean age at divorce rose to above 40 for both men and women.[25]

Each of these changes to marital trends has led to diversity in partnership histories, among members of different cohorts in the current marriageable population. This increasing diversity underscores the importance of investigating both marital status and marital history in relation to health.

The primary focus of the present study is to take a life course approach to the study of marriage and health. Specifically, the present study investigates the association between

marital history and cardiovascular disease (CVD). The present study focusses on the association between two aspects of marital history and CVD. These are whether one has experienced a previous marital loss, and time since marital loss. Existing studies of marital history and health have suggested that marital history, in addition to marital status, is an important predictor of differences in CVD.[13,22] These studies are described in 2.2. However, no studies have investigated the association between marital history and risk of CVD among British samples, and the present study is the first to do so.

CVD is an umbrella term for disease of the heart and circulation. These diseases include, but are not limited to, coronary heart disease, stroke and heart failure. Different types of CVD stem from the same cause: atherosclerosis. Atherosclerosis is the result of a build-up of atheroma (fatty materials) in arterial walls. The build-up of atherosclerosis can result in the narrowing of arteries which reduces the supply of oxygen-rich blood to the heart, resulting in angina. If the atheroma breaks away from the arteries, it may form a blood clot. A blood clot can block coronary arteries that supply oxygen-rich blood to both the heart and brain, which can result in a heart attack or stroke. [28]

The purpose of employing CVD in relation to marital status is two-fold. Firstly, CVD is a major concern for public health. Though the rates of deaths attributable to CVD are declining, it still remains the biggest killer for those aged under 75, in the United Kingdom.[29] In 2011, a quarter of deaths were attributable to heart and circulatory disease.[29] A total of 74, 000 and 42,000 deaths were attributable to coronary heart disease and stroke, respectively. [29] Furthermore, there are currently 2.3 million people in the UK living with CVD, which has significant costs for the United Kingdom. An estimated nine billion pounds was spent on the care of CVD patients, in 2009.[29]

In addition, much is known about the social, behavioural and biological pathways to CVD. There is compelling evidence for an inverse gradient of SEP, Education, income and occupational class, and the risk of cardiovascular disease. [30,31,32,33,34,35] The higher risk of unhealthy lifestyles (cigarette smoking and physical inactivity); biological risk factors (BMI, blood pressure), lower perceived control at work, and increased allostatic load among those from a less advantaged socioeconomic position have been found to mediate some, but not all, of this association.[30,32,35] Psychological distress too has been linked with the risk of cardiovascular disease. Increased platelet activation, allostatic load and the increased risk of cigarette smoking and low quality diets among those with higher levels of psychological distress appears to explain some of this relationship. Therefore focussing on CVD is useful for understanding the mechanism relating marriage to health.

1.1.2 Life course influences on marital status and CVD

It is plausible to expect that there will be a relationship between marital status and marital history, and the risk of cardiovascular disease. This is due to the fact that risk factors for

CVD, including, socioeconomic position (SEP), health behaviours and psychological distress, vary by marital status. Indeed there is evidence to suggest that economic well-being is higher, and both psychological distress and the risk of health behaviours that may have adverse effects on health (e.g. cigarette smoking), are lower among married relative to unmarried persons. [2,13,36,37,38,39,40,41,42,43]

The cause of differences in these factors by marital status have been attributed to both causation and social selection hypothesis, and has been a a matter of debate in the health-marriage literature. The causation hypothesis proposes that there are causal effects of marital transitions on health. The social selection hypothesis argues, however, that the association between marital status and health may reflect reverse causality, and confounding from factors that are related to both marital status and health.[44]

The resource model, is a commonly cited explanation for the health advantages for married, relative to unmarried persons. According to the resource model being in a marriage facilitates economic well-being, lower levels of psychological distress and a greater tendency toward healthier lifestyles. It is plausible to expect that marriage may facilitate each of these changes to ones lifestyles. Marriage as a social instituition encourages the view that spouses are responsible for and one to another. For example, spouses are legally obligated to provide for one another financially which, coupled with the economies of scale may contribute to higher economic well being among married persons. Furthermore it is known that married persons, in particular women, tend to monitor one another's health behaviours, which may explain their greater tendency toward healthier lifestyles. Furthermore, marriage provides a form of social support – which reduces the likelihood anxiety and depression, which in turn is associated with a lower likelihood of unhealthy behaviours. Furthermore, it is well-known that there are several consequences of marital loss including declines in financial well-being, the uptake of poor health behaviours in response to stress and increases in psychological well-being. Each of these lines of evidence support a causal relationship between transition in to and out of marriage and health.

Existing studies have found evidence to suggest that adjustment for economic resources, psychological distress and health behaviours attenuate the relationship between marital status and CVD. Studies have suggested that this attenuation reflects a mediating role of each of these factors.

While the evidence for a casual relationship between marital status and health is compelling, this does not necessary preclude any selection effects. There are several reasons to expect that marriage differentials in health may reflect confounding from factors which are independently related to both marital status and health.

Scholars have previously identified socio-economic position and psychological distress as antecedents of marital status. Indeed, there is evidence to suggest that favourable economic circumstances are associated with a higher probability of marriage and lower risk of divorce for men. Though there is evidence for an association of SEP with marital status for women, the direction of these differences is unclear. There is also some evidence for an association of psychological distress with the likelihood of marriage and divorce. While there is agreement that psychological distress and economic factors play an important role in predicting marital status, the exact nature of this association remains unclear. Much of the ambiguity is attributable to shortcomings in the study designs and limited availability of longitudinal data. Since both socioeconomic position and psychological distress are associated with CVD, it is possible that each of these factors confound the relationship between marital history and CVD. In spite of this, there is a dearth in the epidemiological literature on factors which select persons in to and out of marriage, and how these factors may result in spurious relationships between marital status and health. This dearth also contributes to a relatively limited understanding in how circumstances throughout the life course play a role in creating marriage differentials in health. A more extensive explanation of the potential role of socioeconomic position and psychological distress on the relationship between marital status and CVD is discussed in 2.3.

The present study explores the role of socioeconomic position and psychological distress as predictors of marital status, and CVD. The individual and simultaneous role of these factors of confounders of the relationship between marital status and CVD is also explored. The conceptual model, shown in Figure 1.1 below, shows how factors throughout the life course may contribute to differences in the risk of CVD by marital status. A more detailed conceptual model, detailing the specific pathways that are analysed in this thesis, is shown in chapters 3-6.

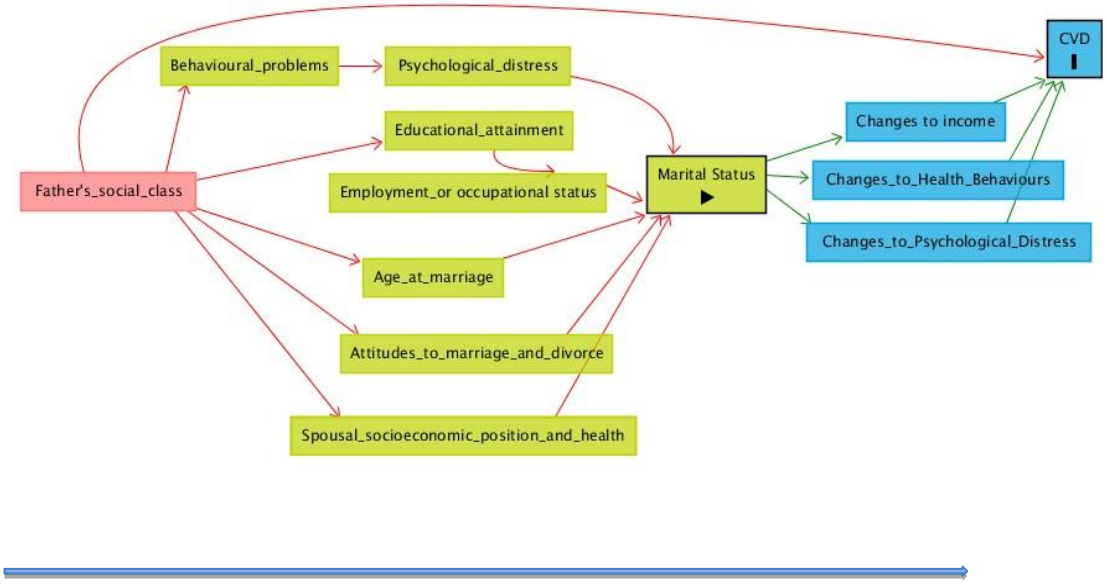

Figure 1.1 – Life course pathways between marital status and cardiovascular disease.

Marital status and CVD are the exposure and outcome in this model, respectively. Father's social class, and all other variables in the green boxes are denoted as on the causal pathway to marriage. The variables in the blue boxes represent causal relationships between marital status and CVD. The blue arrow indicates time.

1.1.3 The role of gender in the association between marital status and CVD.

There are several reasons to expect that the association between marital status and risk of CVD will be different for men and women. Women are more likely than men to develop close social networks outside of marriage, which may reduce the impact of stressors associated with marital loss, on mental health for women. [7;36] Women are more susceptible to the adverse effects of marital quality, on health. There is evidence to suggest that low marital quality is associated with higher SBP, particularly among women. [12] A transition out of a harmful marriage may therefore be less detrimental to women, than men. Indeed, there is evidence also to suggest that cardiovascular health is better for women who are unmarried, relative to those in low quality marriages.[45,46]

However, women are more likely than men to act as primary care-giver to their children, and this may increase the stressors associated with being divorced for women. Furthermore, there is evidence to suggest that the economic declines associated with marital loss are worse for men than women. [47] [48] All these factors combined, may result in a higher level of stress associated with being divorced or widowed on men than women.

Given that the costs associated with marital dissolution may vary by gender, it is also plausible to expect that the moderating effects of time since marital loss on the association between marital status and health, and the continuing effects of adverse effects post remarriage may differ by gender. Further, the additional stressors of being the custodial parent combined with step children from a remarriage may act as an additional source of stress for women, which may make the relative differences in CVD between remarried and married women larger than for men.

The present study takes into account the role of gender as a potential moderator of the association between marital status and CVD. The association between marital status and CVD are explored separately for men and women. The interaction between gender and marital status, on the risk of CVD is also explored.

1.1.4 Birth cohorts: National Survey for Health and Development and National Child Development Survey

This study employed data from two long-standing British cohorts. These are the National Survey For Health and Development (NSHD) and National Child Development Survey (NCDS). Members of the NSHD and NCDS have been followed up from their births in 1946 and 1958 to date, respectively. A rich repository of information, throughout the life course, is available for individuals from each of these birth cohorts. This makes the NSHD and NCDS particularly valuable for the over-arching aim of this study which is to assess the role of marital history, in addition to marital status, on CVD. Since both of these surveys collect information from birth onwards it is possible to obtain information on marital events at several points in the life course, which subsequently allows for the operationalization of marital history. .

It is acknowledged here that there may be some problems with generalizing the findings of the present study, to that of younger cohorts. This is because there have been several ongoing changes to rates of marriage and divorce, spanning the period in which members of the NSHD and NCDS were entering adulthood and now. Changes to marriage rates over historical time were discussed in section 1.1.2 To reiterate, marriage rates have fallen and divorce rates have risen considerably, since the 1970s. Therefore, marital patterns among members of both cohorts, particularly for those of the NSHD, are different from more recent trends. For example by age 31, 77% of men and 88% of women from the NSHD had married. For members of the NCDS these rates are lower at 45% and 50% for men and women, respectively. These rates are further lower for men and women born in 1970, with 38% of men and 48% of women report marrying by the same age.[49] By 25 years 5% of men and 11% women born in 1986 had married.[25]

The stability of marriage is also markedly different for recent cohorts, relative to members of the NSHS and NCDS. By the age of 31 less than 5% of men and women from the NSHD

had experienced a divorce compared with 12% of men and 18% of women from the NCDS. Very few men (5%) and women (8%) born in 1970 reported divorce by the age of 30, owing to the lower rates of marriage for this group. However it is clear that those born in 1970s were more likely to have experienced multiple cohabitations by the time of 30, relative to members of the NCDS and NSHD.[49] By 2012, the rates of divorce by age 30-34 was 21.9 and 19.2/1000 married persons, for men and women, respectively.[25] The figure below is taken from the office of national statistics. [25]

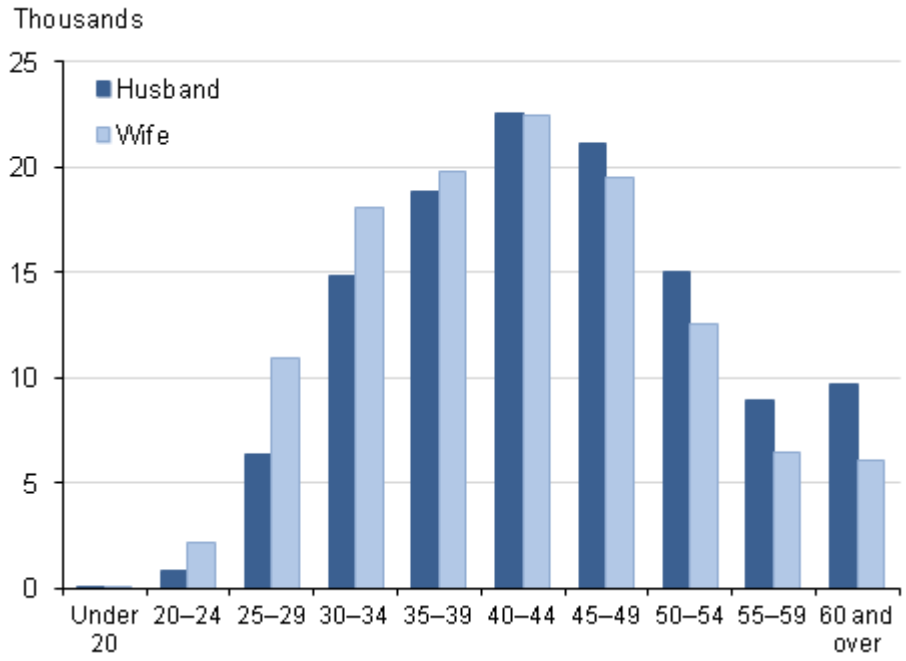

Figure 1.2 – This figure shows the rate of divorce, by age group, per 1000 married persons.

An increase in divorce rates, as discussed in 1.1.2, and delay of transition from single to married status also contribute to differences in marital behaviours for members of these cohorts, and their younger counterparts.

Changes in marital trends have been attributed to social developments that have taken place over the past century.[50,51] Since the rise of secularization – the declining influence of the institutional church and authority on individual behaviour – there has been a change to the way in which individuals interact with the wider society. Therefore the motivation behind individual decisions have shifted from conformity to authority, to a larger focus on individuals and fulfilment of personal goals of happiness and self-actualization.[50,51] [46]

The retreat from traditional values compound the decreasing necessity for marriage, in order to form an adult partnership. In the past, marriage was considered an essential precursor to adult transitions including sex, childbearing and cohabitation. The rising rates of cohabitation suggest that each of these transitions outside of marriage are becoming increasingly acceptable, reducing the necessity for marriage. [26] It has been further

suggested the decreasing urgency for marriage may explain the increase age at first marriage. [50,51]

Given that the meaning and potentially the significance of marriage has changed over the past few decades, a marital loss is likely to affect the health of younger and relatively older cohorts differently. Declines in marriage and an increase in cohabitation suggest that the perceived necessity for marriage to legitimise an adult partnership may not be as high for younger, relative to older cohorts. As a result, a marital loss or single status may prove to be more stressful for older relative to younger cohorts.

The possibility of inter-cohort differences in the association between marital status and health, may limit the extent to which results of the present study can be generalized to more recent cohorts of marriageable age. The fact that findings from the present study may not be entirely generalizable to younger cohorts, doesn't take away from the importance of studying the association between marital history and risk of CVD among these cohorts. Firstly, members of this cohort are at an age where the risk of CVD is higher than for younger age groups. Secondly, one of the challenges accompanying increasing life expectancy, is the higher prevalence of disease associated with older age. Thus this group remains an important focus for study.

It is acknowledged that there may be inter-cohort differences in the association of marital history and CVD, between members of the NCDS and NSHD. While not as stark as differences between members of the NSHD and more recent cohorts, variations in marital patterns are evident for members of the NSHD and NCDS. For example, 88% and just under 50% of women from the NSHD and NCDS had married by the age of 30,[49] respectively. For men, the corresponding figures were 45% and 70%. Furthermore while cohabitation was unreported among members of the NSHD, 35% of men and 33% of women from the NCDS, reported living with a partner to whom they were not married by the age of 30. Differences in the association marital status and CVD between each of these cohorts may provide some evidence for the importance of marital trends in the association of marriage with CVD.

2 Chapter 2: Literature review, aims and objectives

2.1 Literature review

2.1.1 A review of existing studies of marital status and CVD

This section reviews the literature on marital status and cardiovascular disease. CVD outcomes considered in this review include CVD incidence, CVD prevalence, mortality from CVD, and biological risk factors of CVD. Biological risk factors of CVD include blood pressure; hypertension; BMI; weight; cholesterol, triglyceride levels, and heart-rate variability.

These outcomes can be broadly grouped into two categories. The first of these categories includes outcomes which are not reliant on a doctor-diagnosis. These outcomes include blood pressure readings, cholesterol levels, BMI, coronary events, stroke incidence and CVD mortality. For the purposes of this discussion outcomes which are not reliant on doctor-diagnosis are referred to as objective outcomes. The second category includes a measure of doctor-diagnosed CVD. These outcomes include reports of doctor diagnosed CVD, CHD, stroke, heart disease and hypertension. For the purposes of this discussion, this latter set of measures is referred to as subjective outcomes.

In addition to variation in outcome, both longitudinal and cross-sectional studies differ in the way in which marital status is conceptualised. The first of these groups do not distinguish unmarried persons by their marital status. The latter distinguish unmarried persons by their marital status: single, divorced or widowed. As discussed above marital status has been conceptualised broadly in two ways: all unmarried persons are grouped together; and unmarried persons are distinguished by marital status. For ease of discussion, “unmarried” will refer to the combined groups of single, divorced and widowed for the remainder of the discussion. Differences found between particular groups of unmarried persons and their married counterparts, are defined explicitly. Though there are differences in the way in which marital status is conceptualised among both longitudinal and cross-sectional studies the majority of studies compare the risk of CVD, relative to married persons. Unless specified otherwise, risks of CVD will be discussed relative to married persons.

Longitudinal studies are further distinguished into two categories. The first category of studies assesses CVD incidence or mortality, in relation to marital status at baseline. The second category of studies, assess the effect of marital status change (transitions into and out of marriage) on change in outcome. Studies in the latter group have employed BMI or weight in kg/pounds as an outcome.

The course of this discussion in relation to the existing studies of marital status and CVD, will be as follows: Studies will be grouped in to whether they have employed objective or

subjective measures. A necessary distinction is made between these studies, the reasons for which are discussed in section 2.1.1.5. Within each of these groups, the discussion of studies will be discussed by study design. In the instance that a study has employed a prospective design but has also assessed differences at baseline, the latter results will be discussed within the cross-sectional section.

2.1.1.1 A summary of cross-sectional & case-control studies assessing the role of marital status and CVD, as measured by objectives outcomes

With the exception of one study that found that SBP was higher for married relative to unmarried persons[52], studies have generally been consistent in finding an advanatage for married persons. Being unmarried is associated with lower heart rate variability,[53] and lower HDL cholesterol(among men only)[54,55], lower ambulatory blood pressure dipping and higher mean blood pressure. [56] [57] [54] [55] There is also some evidence to suggest that divorced status among women, is associated with a higher risk of being overweight[58] and obese.[59] Among studies of single men only, there is evidence to suggest that single men are at higher risk of CVD, as measured by BMI,[55,60] triglyceride levels, HDL cholesterol, hypercholestrolaemia and hyperglycemia relative to their married counterparts.[55] Furthermore, unmarried persons are over represented among cases of incident stroke,[61] sudden cardiac arrest[62] and acute myocardial infarction.[63] There is evidence for a higher risk of mortality by CVD among single men and women, and widowed men.[64] There was some evidence for a protective effect of divorce on CVD mortality among women.[64]

With the exception of one study, [65] there is consistent evidence for higher blood pressure among single relative to married men. [55,57,60,66] Fewer studies have focussed on relative differences in blood pressure between previously married and married persons. Among these few studies, There is evidence for relative higher systolic blood pressure among widowed but not divorced men[60] and some evidence for lower blood pressure among divorced women, relative to their married counterparts.[60] Thus among the few studies that do exist, there is little evidence to suggest that blood pressure is relatively higher among those who are unmarried, which seems implausible. There are several studies which find that lowered marital quality and conflict are associated with higher blood pressure, all of which may precede marital loss.[12,56,67] Furthermore transition from married to divorced and widowed status is associated with psychological distress, which itself is associated with increased blood pressure.[68] It is possible that the failure to find higher systolic blood pressure among previously married persons is due to a higher use of blood-pressure lowering medication among previously married relative to married persons. A second possibility is that differences in blood pressure between married and previously married persons vary with time since divorce and widowhood, the reasons for which are described in section 2.2.2.2.

A consistent exception to the advantage for married persons is observed in studies of marital status and BMI. Studies repeatedly suggest that the risk of being obese or overweight, and BMI, is higher for single relative to married persons. [65; 58,59,69,70,71] There is some also evidence for a lower risk of being overweight or obese for divorced relative to married men. [59,70]

2.1.1.2 A summary of longitudinal studies assessing the role of marital status and CVD, as measured by objective outcomes

There is evidence for a higher risk of mortality by CVD/coronary events,[60,66,72,73,74];stroke incidence and coronary events among all groups of unmarried persons (single, divorced and widowed), relative to married persons.

Although the studies have generally been consistent in finding some evidence that married persons are at a lower risk of CVD than their unmarried counterparts, this relationship appears to vary by gender and marital status. For example, some studies have found that the risk of coronary event and mortality by CVD are higher for single, divorced and widowed men, but not women.[60,73] Other studies have found that the risk of stroke incidence is higher among single women, but not men.[75] Among studies of men only, there is evidence to suggest that the risk of mortality by CVD is higher among widowed men only,[76] divorced men only,[77] single men only,[66] and single and widowed but not divorced men.[78] Furthermore there is some evidence to suggest that while IHD mortality is higher for unmarried relative to married women, no differences in hospital admission are apparent.[72]

2.1.1.3 A summary of longitudinal studies of marital status change and changes in BMI

There is evidence to suggest that transition into widowhood was associated with weight loss for both men and women over a 4 year period,[79,80] relative to their counterparts who remained married. Futhermore there is evidence to suggest that transition into widowhood was associated with a weight loss, over a 5-7 year period and 11 year period[17] (marital status marital transitions, and body weight). Weight loss post-widowhood isn't always reflected in cross-sectional studies of marital status and BMI. Divorce too, is associated with weight loss. There is evidence for weight loss associated with transition into divorce for both men and women over a 4 year and 2 year period,[79,80 17,81] but not over a 10 year follow up, relative to their continually married counterparts. [82]

While there is evidence to suggest transition to widowhood and divorce is associated with weight loss, though this isn't always reflected in cross-sectional associations of marital status and BMI. For example, there is some evidence from cross-sectional studies to

suggest that the risk of obesity is higher among widowed and divorced, relative to married women.[71 58 59]

Longitudinal studies which find that the onset of divorce is associated with weight loss for divorced persons at shorter but not longer periods of observation, suggest that the effects of divorce on weight loss may vary with time since divorce. The discrepancy between longitudinal and cross-sectional studies which might encompass varying lengths of time since both divorce and widowhood, also support this assertion. The potential for time since marital loss to affect relative differences in health between married and previously married persons is explored more extensively in section 2.2.2.

2.1.1.4 A summary of studies assessing the role of marital status and CVD, as measured by self-reported diagnosis of CVD.

Relative to studies of marital status and cardiovascular mortality, fewer studies have focussed specifically on CVD incidence or prevalence in relation to marital status. Therefore both cross-sectional and longitudinal studies of marital status and CVD, which employ a self-reported diagnosis of CVD, are reviewed together in this section.

With the exception of one study which found that self-reported hypertension was higher among never married women, studies of self-reported CVD diagnosis have not found differences between married and never married persons. [13,83,84] There is some evidence for differences in self-reported CVD between previously married and married persons. Largely, these differences are observed for women. With the exception of one study which found that the risk of self-reported incident CHD was higher among women who divorced relative to those who stayed married,[85] the literature has been generally consistent in finding that previously married women are at a higher risk of CVD than their married counterparts. Relative to married women, the risk of stroke, hypertension, heart disease, CVD incidence and prevalence is higher among divorced and widowed women.[13,22,83] While there is some evidence for a higher risk of stroke and CVD prevalence[13,22] among divorced and widowed men, no association was found for self-reported incident CHD and CVD incidence between married and previously married men.[13,84]

2.1.1.5 The possible role of illness behaviour, in explaining some of the discrepanices between studies which employ objective and subjective measures of CVD

With some exceptions, studies employing objective measures of CVD e.g. risk factors or mortality have generally been consistent in finding that the risk of CVD is higher for single, divorced and widowed relative to married persons. [55,57,73,74,75,77] Studies that employ subjective measures of CVD however, have not always been consistent in finding a higher risk of CVD among those who are unmarried. In particular, many of these studies found that the single report comparable CVD prevalence and incidence relative to those who are married. [13,22,83,84]

Some authors have suggested that a failure to find differences CVD diagnosis between married and single persons, provide evidence for the crisis model which purports that health differences by marital status are attributable to the strains of marital loss, only.[11,13] However the fact that CVD mortality, risk factors for CVD including SBP, LDL cholesterol, psychological distress, low levels of economic well-being and cigarette smoking are all consistently higher among those who are single, [2,13,36,37,38,39,40,40,41,42,43,55,57,73,74,75,77] casts doubt on this interpretation. Furthermore discrepancies between studies which employ subjective and objective measures of CVD are also evident for previously married persons.

Inconsistencies in studies may be attributable to numerous factors including, but not limited to, differences in sample sizes, cohorts, as well as cultural differences between study samples employed. However, one key feature that distinguishes study findings is their use of subjective and objective measures of CVD. As a reminder, objective outcomes are not reliant on a doctor-diagnosis, while subjective measures are.

One possibility for the discrepancy in results among studies which employ subjective and objective mesures of CVD, is that the majority of longitudinal studies which employ objective measures focus on mortality,[66,72,73,74,76,78,86] whereas studies that employ subjective measures focus on incidence or prevalence.[13,22,83,84,87] It is possible therefore the role of marital status is a better predictor of CVD prognosis, rather than the development of CVD. Some studies support this suggestion in finding that while there is little evidence for differences in hospital admission between married and unmarried women, death from IHD is higher among unmarried women.[72]

While differences in the relationship of marital status with CVD prognosis and incidence may be a possible source of these inconsistencies, this is not entirely plausible. Firstly, as discussed in 1.1.3, there is evidence for differences in lifestyle risk factors, psychological

distress and economic well-being by marital status, [31,88,89,90,91,92] all of which can plausibly result in lower risk of CVD among married, relative to unmarried persons. [31,88,89,90,91,92] Furthermore there appears to be a reversal of gender differences between studies that employ objective, and self-reported outcomes. In the case of objective outcomes, there is more consistent evidence for a marital benefit among married men,[73] while the reverse is true for studies of self-reported outcomes. Given that women are more likely than men to provide a care-giving role in the spousal relationship,[93] it is implausible to suggest that marital benefits in studies which have employed CVD mortality as outcomes are reflective of differences in prognosis, only.

It is argued here that subjective outcomes may underestimate the risk of CVD among unmarried persons. Self-reported doctor diagnosis of an event is dependent on a subjective assessment of ones symptoms since the onset of a disease, after which medical advice must be sought. The way in which symptoms are perceived, evaluated and acted upon has been termed illness behaviour. Illness behaviour can affect whether a diagnosis is made. For example while persistent coughing may signal the possibility of underlying disease for some, it may be "normalized" as a smokers cough for others.[94] In the latter case, an individual may not receive a diagnosis. Even in the instances that symptoms are recognised as serious, individuals may vary in the extent to which they seek medical advice. This may be due to but not limited to reasons including belief in the health care-system or the value one places on their own health, which can vary between sub-groups. Relative differences in disease prevalence between subpopulations may therefore reflect differences in illness behaviour rather than underlying disease. [94]

Of particular concern is whether illness behaviour varies by marital status which would render self-reported diagnosis of CVD as an unreliable measure. There is scope for marital status to affect one's illness behaviour at two stages between disease onset and potential diagnoses. The first is through variability in symptom reporting and the second is through variation in seeking medical advice. Specifically it is suggested that married persons are more likely to recognise their symptoms and also more likely to seek medical advice – and subsequently receive a medical diagnosis

There are several symptoms associated with the onset of CVD. Some of these symptoms are discussed to illustrate how differences in illness behaviour by marital status can affect the way in which these symptoms are interpreted. The symptoms of angina include a mild pain in the chest, resembling indigestion. They can also be more severe and feel like a tightness in the chest, which can spread to other areas of the body such as the arms, jaw, back, stomach or neck. The frequency of symptoms too may vary. Those with stable angina will experience these symptoms only after exercise. Those with unstable angina, however, may experience these symptoms with no obvious trigger. The main symptoms of heart failure include breathlessness, ankle-swelling, extreme tiredness, persistent cough, weight

loss, increased heart rate and a lack of appetite. Aortic disease, like angina, is often characterized by pain in the chest, abdomen or back. There is considerable scope for "normalization" of these symptoms to diseases of a less serious nature or to general feelings of stress, with no obvious diagnosis. For example, chest pains may be attributed to general tiredness, stress or even muscle pain rather than indicative of angina. The onset of pain preceded by exercise, as in stable- angina, may be attributed to low physical fitness. The perception of symptoms and the way in which they are presented to a doctor can be influenced by interpersonal interactions. Interpersonal interactions about symptoms can affect perceptions of how serious they are, what could cause them, and how they are presented to a doctor.[94]

It has been previously reported that married couples report monitoring the health status, and health behaviours of their spouses. [93] Given this is the case it is possible that couples are more likely to have an awareness of illness history and lifestyles.[93] A spouse is more likely, therefore, than a colleague to be aware of whether their spouse has risk factors for CVD such as high cholesterol levels and hypertension. Therefore, spouses may treat chest pains more seriously, and normalization of symptoms may be less likely among married persons. Spouses, through monitoring one another's health and also living with them, may also be more likely than an external social contact, to provide contextual information that would be useful in a diagnosis. An example of this would be a wife noticing that her husband only experiences the symptoms of angina, post work-out. A spouse will also know if the symptoms being experienced are typical of health or out of the ordinary, whereas a colleague will be less well-equipped to make this judgment.

Spouses not only monitor one another's health but they provide a form of social control. The social institution of marriage defines a role for married persons, in which they are responsible for and to one another. [3] For example, In England and Wales, married couples are under duty to provide for one another financially. In the event that this duty is not upheld, an individual can be ordered to do so via the courts. Furthermore married couples are entitled to money from a joint account even in the instance that one spouse does not contribute. [95] It is therefore conceivable, to expect that married couples are in an influential position over each other's healths behaviour. Indeed it has been reported that married couples are more likely to encourage behaviours that are conducive to good health, and discourage behaviours that aren't. It has also been suggested that those in a marriage are more likely to take steps to ensure they are in good health, due to feelings of obligations toward a spouse.[93] Therefore, it can be expected that married couples are more likely to seek medical attention than their unmarried counterparts. Previous research supports these assertions. There is evidence to suggest that married are more likely to visit the doctor for check-ups and go for screening, than single respondents with the same symptoms[3], There is evidence for a lower likelihood of delay in presenting with chest pains for acute myocardial infarction for married men, compared with their single, divorced and widowed counterparts.

[96] Disclosure of potential cancer symptoms met with support from partners and other social networks, was associated with reduced patient delay in women, though only partner support was associated with reduced patient delay in men.[97] Three studies have found no association between marital status and patient delay, in presenting with cancer symptoms[98,99,100]. A possible explanation is that two of these studies did not stratify by gender. It has been previously suggested that men may benefit more than women, from the healthier lifestyles associated with marriage. This is because women are more likely than men to monitor the behaviour of her spouse. [93] Therefore failing to stratify by gender may have obscured the higher likelihood of health care utilization commonly observed for married men.

In sum, the use of subjective measures of CVD may be problematic, and is one of several limitations of the existing literature on marital status and CVD. Differences in doctor-diagnosed CVD, by marital status may reflect both differences in risk of CVD and illness behaviour. The use of a subjective outcome may underestimate the prevalence of CVD among unmarried persons due to a lower likelihood of medical diagnosis.

2.1.1.6 The role of gender in the association between marital status and CVD

Among studies which have investigated the association between marital status and CVD, separately for men and women, there is some support for gender differences. For example there is evidence from studies to suggest that divorce, widowhood and single status is associate with a higher risk of CV mortality for men but not women. CVD diagnosis is more often higher among married women however. A possible explanation for this discrepancy is that since women are more likely than men to provide a care-giving role in the spousal relationship, the absence of a spouse may be particularly detrimental to the prognosis of CVD among unmarried men. Related to this argument is the fact that men who are unmarried men be less likely to visit the doctor in the absence of a spouse, reducing their likelihood of a CVD diagnosis. This may explain why CVD prevalence and incidence among unmarried women, relative to their married counterparts, is observed more consistently related to men. Another explanation is that the financial losses of divorce are larger for women that men, resulting in larger disparities in the risk of CVD for women relative to men.

2.2 Marital history

Section 1.1.1 discussed the several ways in which marital events throughout the life course may result in differences in health. These predictions are based on life course principles which suggest that differences in health arrive not only from differences in contemporaneous circumstances but differences in trajectories, prior to arriving in a given circumstance.[5] Consistent with the life course approach to health and ageing, the existing literature has been consistent in suggesting that in addition to marital status several aspects of the marital biography including age at marriage, marital duration, divorce duration, number of marital transitions and previous marital losses are important predictors of health. [11,14,15,16,17,18] The present study focusses on two aspects of marital history, each of which are discussed more extensively below.

2.2.1 Previous marital loss and the association between marital status and CVD

The first aspect of marital history that is investigated in relation to CVD is one's previous marital status. There are several reasons to expect that those in a remarriage will be in a worse health than those in a first marriage.

Firstly, the accumulation principle of the life course approach proposes that adverse events across the life course have long term effects on health. Therefore the long term effects of a marital loss may continue in to remarriage. Indeed it is clear from studies that the adverse effects following marital loss continue post remarriage. Those who are remarried are less wealthy, more depressed and anxious than their continually married counterparts.[43,45,101,102].Being remarried itself may involve stressors that are not common in a first marriage. An example of this is the stressors of having to adapt to step-children, or taking care of two families. Existing studies of marital history have found that having experienced a marital loss is associated with a higher risk of mortality , depressive symptoms, chronic illness, mobility limitations, CVD[13,22] and poor self-rated health [18], regardless of current marital status. A linear model below is shown in to illustrate how long term effects of divorce or widowhood may continue to affect ones risk of CVD even after remarriage.

Four studies have been conducted to investigate the risk of CVD in relation to marital history. One of these studies, in relation to marital history, assessed differences in the risk of mortality by ischaemic heart disease between men in a first and subsequent marriage. No differences were found. Since the focus of the present study, as outlined in section 2.1.1.3 is on measures of CVD prevalence and risk factors for CVD, the remaining three studies will be discussed more extensively. Three studies have been conducted to investigate differences in the risk of CVD between those in a first and subsequent marriage. All three of these studies were based on American samples. [13,22,103]

In the first of these studies information was obtained from members of the HRS at 51-61 years of age. The purpose of this study was to investigate the association between CVD prevalence and marital history. [22]

CVD was defined by respondent's reports of ever having been diagnosed with heart disease, stroke and heart attack. Marital history was defined as follows: Those that were currently married were distinguished by whether they had been previously divorced, previously widowed or had experienced multiple marital losses. Those respondents that reported being currently separated or divorced were distinguished by whether this was their first or subsequent divorce. Currently widowed persons were also distinguished in this way. Other marital history groups included those who were cohabiting (but not married) and single persons. Prevalence of heart disease, stroke and heart attack for each of these groups was compared with continually married persons.

The association of marital history with heart disease, stroke and heart attack was estimated in four models. The first of these models adjusted for age, gender, race and nativity. The second model adjusted for all the covariates in the first model plus SEP (education, household insurance coverage, household income and household wealth). Model 3 added to Model 2, measures of social integration (childlessness, parental survival status and church attendance). Model 4 added health behaviours (smoking status, BMI, alcohol consumption and exercise) to Model 3.

The results of Model 1 found that those who had experienced marital loss were at a higher risk of experiencing one or more of the outcomes employed, relative to those who were continually married. This is with the exception of first time widows/widowers or those who had remarried post one experience of widowhood. Cohabiting individuals were also at an increased risk of heart attack or stroke. Authors attributed this to the fact that the majority of cohabiters had experienced at least one marital loss. There were no differences in the risk of CVD between single and continually married persons.

A separate study was conducted to investigate relative differences in both CVD prevalence and incidence by marital history. This study too was based on members of the HRS. CVD prevalence was assessed at baseline, when respondents were 51-61 years old. CVD incidence 8 years later was assessed for those who reported not having been diagnosed with CVD at baseline. Information on CVD incidence and marital status were updated biannually over this period of time.[13]

A dichotomized variable was produced, indicating if respondents had ever been diagnosed with CVD. The presence of CVD was indicated by an affirmative response to ever having been diagnosed with one or more of the following conditions; heart attack, congestive heart failure, angina, coronary heart disease (CHD), other heart problems or stroke. Supplementary information on CVD diagnosis was obtained from respondent's death

certificates. The risk of both CVD prevalence and incidence were estimated for single, divorced, widowed and remarried persons, relative to their married counterparts.

The association between marital history and CVD incidence was estimated in five models. All models, including estimates of marital status and CVD, adjusted for age, race, nativity and parental survival status. Subsequent models adjusted sequentially for SES (education, household insurance coverage, household income, household wealth); mental distress (depressive symptoms, emotional problems); Health behaviours (smoking status, alcohol consumption, exercise and obesity) and comorbid conditions (high cholesterol, hypertension and diabetes).

Gender stratified estimates revealed that CVD prevalence was higher among men and women who had experienced a marital loss (divorced, widowed and remarried). There were no differences in CVD prevalence between continually married and single respondents. Relative differences in CVD prevalence between continually married and divorced persons were the largest.

Those respondents that did not report CVD at baseline were followed up over 8 years, until 2000. This information was employed to investigate an association between marital history and CVD incidence, adjusting for age, race, nativity and parental survival status.

CVD incidence was relatively higher among divorced, widowed and remarried women. Compared with their continually married counterparts, single and remarried men had lower CVD incidence. CVD incidence was comparable between divorced and married men. For women, there was evidence for attenuation after adjustment for mediators. Relative difference in risk of CVD between divorced and continually married women was no longer significant after adjustment for SEP. There was some evidence of a decrease in the magnitude of relative differences in risk of CVD between remarried and continually married women, and widowed and continually married women, after adjustment for mental distress. The association remained significant in both cases. There was little effect of adjusting for health behaviours and comorbid conditions.

The third study is based on data from the first wave of National Social Life, Health and Aging Project (NSHAP), which took place in 2005-2006.[103] All analyses was restricted to respondents aged 75 or below. Measures of blood pressure and heart rate were employed to create a CVD risk score. Respondents were given a score of 0,1 or 2, a higher score denoting a higher risk of CVD. SBP higher than or equal to 140 mmHg, diastolic blood pressure higher than or equal to 90 mmHg and resting heart rate higher than or equal to 90 beats per minute formed the criteria for high risk of CVD. Respondents that met none or 1 of these criteria were given a score of 0 and 1, respectively. Those with 2 or more of these criteria were given a score of two, and formed the highest risk group.

The risk of CVD was compared to those in a continuous marriage. Groups for comparison include those who remarried post 1 disruption, remarried post 2 disruptions, previously married (and had experienced one disruption) and previously married (and had experienced 2 disruptions). Relative to women in a continuous marriage, those women who were remarried post 2 disruptions and previously married post two disruptions were significantly less likely than continually married women, to have zero CVD risks. Remarried women who had experienced 2 disruptions were more likely to score a score of 2, on CVD risk factors. There was no evidence of an association between marital history and CVD for men.[103]

While these studies do capture the effect of previous marital loss on risk of CVD, they are limited in several ways. Firstly, two of these studies rely on a self-reported doctor diagnosis of a coronary event. As noted in section 2.1.1.5 relying solely on self-reported measures of CVD may be problematic when looking at health differences by marital status. A limitation of all of three of these studies is that they do not take into account the potential role for selection in to and out of marriage, on the association between marital history and CVD. Finally, all of these studies have been based on American respondents. No study has been conducted to investigate the association between marital history and risk of CVD among British samples.

2.2.2 Time since marital loss: A moderator of relative differences in risk of CVD by marital status.

There are several reasons to expect that time since marital loss, will moderate relative differences between married and previously married persons. These reasons can be grouped, broadly, in to two groups. The first of these, stem from inconsistencies in the literature which may be attributable to differences in the time since marital loss. These inconsistencies refer to studies of marital status and BMI– discussed in section 2.1.1.1 & 2.1.1.3. The second category of reasons stem from the secondary effects of marital loss, which include: economic declines, increases in cigarette smoking and psychological distress. It is proposed that psychological distress and economic declines may be pivotal mechanisms, in the role of time since marital loss as a moderator of marital status with BMI, and blood pressure. Each of these reasons is discussed in turn.

2.2.2.1 Inconsistencies in the literature: the possible role of time since marital loss.

It became clear in section 2.1.1.3 that, overall, transition to widowhood and divorce was associated with declines in weight. However there was some evidence to suggest that weight loss associated with divorce was short-lived, particularly among women.

To reiterate: transition from married to widowed status is associated with weight loss, which is apparent at 4 years, 5-7 years, and 11 years follow up. [17,79,80] However there is little evidence to suggest that weight loss associated with divorce is apparent for more than 4 years post-follow up. [17;79,80;82;130] Further support for the assertion that weight loss associated with divorce came from cross-sectional studies of marital status and BMI which tended to find that divorced women – who may have been divorced for a period exceeding 4 years - were at a higher risk of being overweight or obese, relative to their married counterparts (2.1.1.3 & 2.1.1.1). [58 59]

The existing literature on studies of marital status and BMI suggest that relative differences in weight or BMI between married and divorced persons may be more susceptible to the effects of time since divorce, than is the case for widowed persons. Therefore the focus of this discussion will be in assessing the role of time since divorce on relative differences in blood pressure and BMI between married and previously married persons. [104]

There is very little literature that focusses specifically on differences in blood pressure between previously married and married persons. The literature that does exist, however, reveals inconsistent findings. There is evidence for higher systolic blood pressure among widowed, but not divorced men relative to their married counterparts.[60] Furthermore, there is evidence for lower systolic blood pressure among divorced relative to divorced women.[60] It is proposed here that at least in relation to divorced persons, there may be a decrease in the magnitude of relative differences in blood pressure between married and previously married persons.

2.2.2.2 The moderating role of time since divorce, on relative differences in blood pressure between married and divorced persons

Both the lead up to divorce and its secondary stressors may result in higher levels of blood pressure for divorced relative to married persons. Marital conflict and low marital quality, both of which are likely precede divorce, are associated with higher levels of blood pressure.[12,45] Furthermore psychological distress – which arises as a result of divorce - has been linked with increases in blood pressure. The extent to which relative differences in SBP between married and divorced persons endure, may therefore be dependent on whether and if differences in psychological distress between married and divorced persons change with time since the onset of divorce.

There is some evidence to suggest that the risk of psychological distress associated with marital loss may vary with time since the onset of divorce. A handful of studies have suggested that higher levels of depression among divorced relative to married women, is evident for observation periods as long as 6 years, but this is not true for men. There is, however, evidence to suggest for a higher risk of psychological distress between married

and divorced men, 2 years post-divorce. [105,106,107,108] There is also evidence from one study to suggest that psychological distress associated with transition to divorced status is largest closest to the time of divorce and only evident for as long as 3 years, post-divorce, after which no differences between married and previously married persons is apparent,.[109] Several suggestions can be made from this literature. There may be some evidence for a reduction of magnitude in differences in psychological distress between married and divorced persons. While differences may attenuate, they appear to persist for as long as six years among women. Thus differences in SBP between married and divorced persons may reduce in magnitude and subsequently, converge over time. No studies have assessed the role of time since divorce on relative differences in blood pressure between married and divorced persons, and the present study is the first to do so.

2.2.2.3 The moderating role of time since divorce, on relative differences in BMI between married and divorced persons

It is conceivable to expect that higher levels of smoking among divorced or widowed persons may result in lower BMI for previously married relative to married persons.[110] Furthermore unpleasant arousal from psychological distress may increase the risk of cigarette smoking, [111] which in turn may result in weight loss. The extent to which these changes in health continue to affect weight are dependent therefore on how and whether relative differences in the secondary effects of divorce (economic well-being, mental health and psychological distress) remain constant with time since the onset of divorce or widowhood. It is proposed here that psychological distress and economic well-being may be influential in affecting how relative differences in BMI between married and previously married, change with time since the onset of divorce.

It is also important to consider the possibility that at later periods of the divorce process, financial decline may contribute to higher weight gain among divorced persons. Lower income has been associated with the consumption of energy dense foods e.g. refined grains, fats or added sugars. The higher availability of these foods at lower costs has been proposed as a reason for this association. Furthermore energy dense foods are less filling than healthier foods and may therefore result in over-consumption.[112] Consistent with this assertion there is evidence for a higher rate of weight gain among divorced, relative to married women [45]

Overall it is proposed here that divorce, due to higher rates of smoking and psychological stress, might initially be associated with loss, It is further proposed that at longer periods since divorce, the adverse effects of health may be more closely related with economic losses. Of relevance to this discussion, the rate of increase in age-related increase BMI may be faster for divorced relative to married persons once the initial levels of psychological distress have subsided, as a result of consuming cheap and unhealthy food.

The crux of this argument lies in the possibility that the salience of stressors associated with marital loss vary in salience, with time since marital loss. That is, while there may be enduring differences in the risk of psychological distress and economic declines associated with being divorced, differences in each of these factors between married and divorced persons may vary over time. There is some indirect evidence for this assertion from studies of time since widowhood, on relative differences in mortality between married and widowed persons. There is consistent evidence to suggest that the risk of mortality is higher among widowed persons – and that the magnitude of this effect is largest closest ot the time of the widowhood. This is true for all causes of death including suicide, accidental and violent causes of death, and heart disease. However, the drop in excess mortality associated with suicide is much larger than for causes such as heart disease.[113] In addition to psychological distress, both behavioural and material causes are well-known predictors of heart disease. The evidence to suggest that that the effect of divorce on weight loss is short-lived and some evidence to suggest that rate of weight gain is faster for divorced women, also suggests that the effect of divorce on weight might change over time – and in the case of BMI, it might change in direction. A conceptual model of the proposed pathways through which time since marital loss may moderate relative differences in BMI between divorced and married persons, is shown below.

Much of the literature on the moderating effects of time since marital loss on differences in health by marital status, have focussed on the differences in mortality between married and widowed persons. These studies have found that relatively higher mortality among widowed persons declines with time since the onset of widowhood. [113,114,115,116,117,118,119,120,121,122] Psychological distress post-divorce and self-rated health post-widowhood appear to be short-lived, with no evidence for differences with married persons 3 and 1 year post marital loss, respectively. One study has found a positive association of time since divorce with chronic disease,[13,18] while another has found no association.[13] Furthermore, another study has found that the risk of stroke is larger 1-2 years compared with 1 year or more than 2 years, post-divorce.[75] Very few studies have looked at this association in relation to BMI and none, in relation to blood pressure.

One study investigated relative differences in BMI between those who transitioned out of marriage and those who remained continually married. Differences in BMI trajectories were observed over a 15 year period at 4 points: 1986, 1989, 1994 and 2001. Divorce could occur between any of these time points. In 1989 BMI was lower for divorced persons who had divorced between 1989 and 1999. Post 1989, no differences in BMI were observed between married persons and those who divorced between 1986 and 1989. Those who experienced a divorce between 1989 and 1994 and 1994 and 2001 did not have lower BMI at follow-up.[17,81] The second study assessed intra-individual change in BMI between marriage and divorce at 1 year, 2 years and three years, post-divorce. Weight loss was associated with divorce. At 2 years post-divorce, difference in BMI between married and divorced women

were particularly large, and appeared to attenuate by the third years.[123] Both these studies suggest that the impact of divorce on weight loss is short-lived. These findings have been cited as support for the crisis model – which suggests that the adverse effects of marital loss on health are short term. However it is proposed here a converging of BMI differences between married and divorced persons may reflect a higher rate of BMI increase among divorced persons, due to reasons explored in section. This assertion is supported by an existing study which found a higher rate of age-related increases in BMI for divorced relative to married women.

2.2.2.4 The role of gender in the association between marital history and CVD.

Studies which have compared those who are remarried relative to those who are continually married have generally found that the risk of CVD is higher among those in a remarriage. The higher risk of CVD associated with a subsequent relative to first marriage, was larger and more consistently for women compared to women. This may be attributable to the fact that economic declines of a divorce is larger for women than men, or that the adverse psychological effects of marital loss appear to endure for longer periods of time for women than men. Indeed there is evidence to suggest that adjustment for both SEP and mental health reduced CVD disparities between continually married, and both divorced and remarried women. It is therefore plausible that the consequences of divorce or widowhood which continue in to remarriage, may be more consistently observed for women.

It is also plausible to expect that any change in blood pressure or BMI differences between divorced and married persons, may vary by gender. For women, elevated psychological distress post-divorce appears to last longer for women than men. Thus higher systolic blood pressure, in response to psychological distress may continue to be elevated post divorce, for a longer period of time for women, than men. A longer period of elevated psychological distress among women, may continue to result in weight loss for a longer period of time for women. However a longer period of weight loss due to psychological distress for women, may be counteracted by a larger economic losses which in turn may lead to a higher risk of eating foods which are unhealthy, and faster weight gain. Larger risk of weight gain among divorced women may also be compounded by the fact that women may have less time for food preparation due to child-rearing constraints. Futhermore, since women are more likely, than men, to take on a care-giving role, divorced men may be more likely to start smoking or less likely to quit smoking. Therefore weight loss associated with divorce may persist for longer periods of time post-divorce, for men.

2.3 Socioeconomic position and psychological distress as confounders of the association between marital status and CVD

2.3.1 SEP measures in adulthood and marital union

One theory of why economic circumstances may be influential in the likelihood of marriage has been proposed by Becker. Becker – in his specialization theory - proposes that a mutual dependence on resources attained from marriage provides an incentive to marry. [123] According to the theory of specialization, while men are dependent on women for household tasks, women are dependent on men for financial resources. Subsequently, this theory predicts that men in advantaged circumstances will be more likely to marry, while women in advantaged circumstances will be less likely to marry. This theory has been termed the "independence effect". It is also plausible that those who are more affluent may be perceived as more attractive. Accordingly, it is also possible that socio-economic position may be associated with a higher likelihood of marriage for both men and women.

Studies of socio-economic position and the likelihood of marriage, have generally found evidence for the independence effect. [124,125,126,127,128,129] [130] [131] However, limitations of the study designs and samples employed, cast doubt on the validity of these findings.

Much of the work on the socioeconomic antecedents of marriage has focussed on ecological studies – linking employment rates with marriage rates in a given area – and cross-sectional studies. Ecological studies have found that areas with higher levels of employment among men had higher rates of marriage. Areas with higher levels of employment among women had lower rates of marriage.[124,125,126,127] A major problem with employing ecological studies for this purpose, is that it can overlook factors that may be associated with both a given area and prevalence of marriage. For example some areas may have more conservative attitudes to both the role of women in society and marriage. Among such areas it is likely that unemployment among women among are lower, and marriage rates are higher.

The potential for reverse causality in cross-sectional studies of employment and marital status cannot be ruled out. Women who are married may be less likely to take on a working role due to household and child-bearing responsibilities, rather than the reverse. Longitudinal studies provide some support for this assertion. There is evidence from longitudinal studies find that there is either a positive,[130] or no association between socioeconomic circumstances and the likelihood of marriage among women. [131] Though there is some evidence to suggest that the effect of employment status on increasing the likelihood of marriage is larger for men, than women. [132]

Another problem with these studies is the reliance of samples in their twenties. It is known that educational participation is associated with delay of entry into marriage among both

men and women.[133] [134]This finding is particularly pronounced among women – owing possibility to greater difficulties in compatibility between the role of a wife and a student than between the role of a husband and a student. It has been suggested that domestic responsibility still lies primarily with the woman, which may make it harder for women to marry while studying, than men. [132] Delay of marriage among relatively more educated women who are also more likely to be employed, might result in misleading conclusions about the actual prevalence of marriage among young women.

Educational attainment, like employment status, is also influential in marriage rates. One obvious mechanism through which this may occur is higher levels of employment afforded by educational attainment.[135] Several studies have found that educational attainment is associated with a higher likelihood of marriage among both men and women.[136] [132] [137] Among studies that have looked at marital status by categories of educational attainment – differentiating women with and without degrees- findings have been mixed with evidence for a positive, negative and no association.[136,136] [133,134] Thus, the education-marriage relationship among women, appears to be more complicated. It is argued here that there are several points that may have been overlooked in assessing the relationship between educational attainment and marriage. For example, the majority of studies looked at years of education and didn't differentiate between higher education (A-levels) and a degree. The problem with using years of education without differentiating by educational attainment is best illustrated in a study by Sandra Eldrige.[138] The likelihood of marriage at 20, 22, 24 and 31 years among women of the national survey for health and development, was assessed against several socioeconomic factors including educational attainment, occupational class and mother's age at marriage. Educational attainment was defined as no qualifications, Sub 'o' level, 'o' level or equivalent, 'A' level or equivalent, Higher non degree or Degree or above. What became clear was that the likelihood of marrying at earlier ages was highest for women with relatively lower qualifications. Women who have attained A-level or equivalent or below, also have a smaller interquartile range of ages at marriage which suggests that relatively less educated women up until this points are not only more likely to enter marriage earlier, but at a faster rate. This pattern is not true for women who have attained a higher non-degree. Though these women marry later than their less educated counterparts, their rate of entry into marriage is faster. Thus is it likely that the delay of marriage among women with higher education is due to educational participation rather than a reduced preference for marriage – as indicated by their rapid entry into marriage. For women who have attained a degree, the interquartile of age at marriage is much larger. Heterogeneity in marriage ages for women with a degree suggests that educational – though may lead to more desirability of marriage due to higher rates of employment – in the marriage market, it is also allows freedom for alternatives to marriage.

Several studies have looked at the association of a continuous measure of years of educational attainment with the likelihood of marriage rather than differentiating by

categories of educational attainment.[132,133,137,137] Therefore it is possible that a higher likelihood of marriage among relatively educated women may reflect more rapid marriage after completion of women, up to a given level of educational attainment rather than a linear association.

It is plausible to expect that the association between marital status and educational attainment for women, will vary in magnitude by cohort. In speculating about why this may be, it is important to consider the influence of educational attainment on the desirability of an individual, as well as the resources it may provide.

Compared with more recent times, older cohorts of were less likely to participate in education and employment.[135] Thus traditional gender roles within a marriage, which refers to the role of man as breadwinner and woman as home-maker, were likely more strongly enforced for these cohorts. For older cohorts, a women's desirability in the marriage market may depend on her domestick skills. Higher levels of educational attainment may signal a desire for participation in employment – which may be considered incompatible with a home-making role, reducing the desirability of educated women. Furthemore a combination of societal norms and the resources provided by education, may work to reduce the likelihood of marriage among relatively educated women. It has been previously hypothesized that a departure from societal and institutional norms, is more likely among those with access to greater resources.[139,140] Since marriage rates are particularly high among members of the NSHD,[49] it is possible therefore that a preference not to marry would be more likely realised among educated, relative to less educated women. While gender roles within a marriage are not as stark as they once were, domestic chores still lie primarily with the woman. Again, this results in the possibility of a conflict between roles, and may result in a lower likelihood of marriage for relatively more educated women even among younger cohorts, but the magnitude of these differences is smaller. Consistent with this assertion is the finding that while the likelihood of marriage among highly educated women was lower among a serious of cohorts, differences lessened with time.[134]

2.3.1.1 Adult socioeconomic position and marital dissolution

Economic theories are also relevant to the likelihood of marital loss. The independence effect predicts that advantaged women are less likely to be dependent on men for financial resources. In turn, this may reduce the incentive to stay in a marriage, in the instance that marital quality is low, relative to less advantaged women. Oppenheimer argues that in extreme cases, specialization of tasks between spouses may increase the chances of divorce. She argues that depending on the husband to act as the breadwinner increases the risk of economic hardship, in the event that a man is no longer able to fulfil this role. In which case, extreme specialization might increase the risk of divorce. Second, given that the standards of living are continually increasing, two incomes can reduce the risk of economic

hardship, which itself is conceivably a risk factor for marital dissolution.[141] Furthermore it is conceivable that with the provision of income from a wife there is a higher likelihood of joint marital investments, which may act as barriers to divorce. [141]

There is evidence from one study to suggest that the risk of marital dissolution is lower among women who earn more and work in non-manual occupations, compared with their less advantaged counterparts. [142] With the exception of this study, studies have generally found evidence for the independence effect. Specifically, there is evidence for a positive association between socioeconomic circumstances and marital stability among men, and a negative association between socioeconomic circumstances and marital stability among women.[143] The risk of divorce for women is positively associated with higher absolute income [144,145] the proportion of married years she has spent working [146],and employment [147]. There is also evidence to suggest that women who spend more hours working[148,149] and earn more than their husbands are a higher risk of dissolution, [145,149,150] though there is some evidence to suggest that this effect is not linear. [151] Conversely there is evidence to suggest that the risk of divorce is lower when the husband plays the role of the breadwinner and earns more than his wife. [152]

While studies on socioeconomic circumstances and the likelihood of divorce are mainly based on longitudinal studies, the potential of reverse causality on this association cannot be ruled out. For example, women who are in low quality marriages may be more likely to work because in preparation for a divorce. There is some evidence for this assertion. There is evidence to suggest that the independence effect is evident only in the instance that marital quality is low. [70] Furthermore, there is evidence to suggest that the independence effect is restricted to women who have traditionalist views[153] regarding their financial contributions to the household and women from older cohorts[154] – who possibly also have more traditional views. Dissatisfaction with one's role in a marriage may become a source of conflict between spouses, and increase the risk of marital dissolution through lowered marital quality. These findings suggest that economic resources alone, do not predict an increased risk of marital dissolution among women.

Further, there is no consistent evidence for a positive association between women's educational attainment and risk of marital dissolution. There is evidence for positive[147], negative[144,155]and no association with marital dissolution.[146] The lack of a consistent positive association between educational attainment and marital loss also casts doubt on the possibility that potential for access to financial resources, which are plausibly provided by education, reduce the incentives to stay in a marriage. Rather, evidence for a positive association between educational attainment and marital stability finds support for Oppenheimer's theory, which suggests that a lower risk of economic strains reduces the risk of divorce.

2.3.1.2 Childhood socioeconomic position and marital status and dissolution

Much of the literature on the association between socio-economic position and marital status has focused on adult measures of socioeconomic status. There has been little investigation of how parental social class may contribute to marital status. There are both theoretical reasons and existing literature – albeit limited – to suggest that parental SEP may be influential in marital status. Furthermore, there is consistent evidence for an association of childhood social class with CVD. Therefore it is important to consider the role of parental social class on marital status, and its influence on the association between marital status and CVD.

2.3.1.3 Pathways between childhood SEP and CVD

Growing up in a disadvantaged background is characterised by poverty, lower levels of parental employment and educational attainment. Each of these factors is associated with adverse effects on childhood health including low birth weight, premature birth,[156] inadequate nutrition and shorter height in adulthood. Each of these adverse effects in adulthood can have long term effects on health. For example there is evidence to suggest that shorter adult height and low birth weight is associated with an increased risk of cardiovascular disease.[157]

A central pathway through which childhood SEP may affect disease risk is through SEP in adulthood. It is well-known that paternal social class shapes opportunities in several ways that can influence adulthood SEP, through opportunities for educational attainment and in turn employment. [135] Health deficits acquired in childhood as a result of disadvantaged circumstances, may reduce the likelihood of attaining education or seeking employment independently of parental characteristics.[158]

While there is evidence to suggest that the inverse gradient between SEP in childhood and obesity in adulthood is entirely mediated by education, [159]other studies have suggested that the effects of childhood SEP on CVD is independent of adult SEP, [34]suggesting other factors may be responsible for the long term effects of SEP in childhood on health.

A possible pathway through which this may occur is the development of health habits in childhood and adolescence, which are socially patterned. These health habits may continue into adulthood and affect disease risk thereon, independently of adult SEP. [157]

Theoretically there are several ways in which parental SEP may affect marital status. Firstly, socio-economic position may predict risk of divorce among parents, which through inter-generational transmission of divorce may increase the risk of divorce among their children.[160] Socio-economic position during childhood may also affect marital choices and attitudes toward marriage among offspring. [165]. There is evidence to suggest that children

from less advantaged homes are more likely to marry young,[138] which itself increases the risk of marital dissolution [18] and some evidence to suggest that parental social class affects the likelihood of marriage independently of adult SEP.

The finding that SEP in childhood affects both marital status and CVD independently of adult SEP suggests that the use of adult measures alone, may not reliably capture potential confounding from SEP.

2.3.1.4 Psychological distress & marital status

Intuitively, it is plausible to theorize that there may be an association between psychological distress and marital status. Previously, researchers have suggest that cheerful and happy people may make more attractive mates than anxious and depressive ones.[161] Stigma commonly related to mental health may result in a less positive view towards those with mental health, decreasing their likelihood of marriage. Feelings of low mood may also lessen the likelihood of engaging in social activities, where there is potential to meet a partner for marriage. Feelings of depression or anxiety may contribute to the exacerbation of negative feelings associated with marital disputes, which may increase the likelihood of separation. While there is an abundance of literature on relative differences in mental health between married and unmarried persons, relatively few studies have investigated how mental health itself may influence marital union and divorce.

These studies of psychological distress and marriage provide some evidence to suggest that those in better psychological health are more likely to marry. A prospective study of over 9000 single adults aged between 20-39 years was conducted to investigate the association between subjective well-being and the probability of marriage among single persons , over an observation period ranging from 22-47 months.[162] Subjective well-being was associated positively with a higher likelihood of marriage. This relationship remained after adjustment for whether one was in a cohabiting relationship, which may have increased both subjective well-being and the probability of marriage. Another study found that psychological distress at 23 years among single persons was lower among those who went on to marry at age 33, relative to those who remained single. This relationship remained after exclusion of respondents who had married at or prior to 25 years, to rule out the possibility that an impending marriage may have temporarily lowered the likelihood of psychological distress.[163]

One study however, failed to find any selection effects. [38] Cross-sectional associations between marital status and psychological distress were assessed, and adjusted for personality traits. It was argued that if there was a selection effect from mental health on marital status, it would be evident in an elimination of the association between marital status and psychological distress after adjustment for personality characteristics. The authors argue that personality traits are an effective proxy for mental health prior to marriage. They

base this argument on the finding that personality traits are usually stable throughout the life course. The personality traits included: mental ability (intelligence), neuroticism, extraversion, openness, agreeableness and conscientiousness. Each of these personality characteristics was associated with psychological distress. With the exception of neuroticism, all personality characteristics were associated with a lower likelihood of psychological distress. Neuroticism was associated with a higher risk of psychological distress. Overall, there was little evidence among women to suggest that personality traits were more favourable among married women. In fact there was evidence to suggest that unmarried women were more likely to be intelligent and were likely to score higher on openness. There was some evidence to suggest that single women scored lower on agreeableness, however. Among men, there was some evidence to suggest that marriage may be more likely among those with relatively less problematic personalities. Never-married men exhibited more neurotic and less extraverted traits than married men. Adjustment for personality traits provided little evidence for selection in the association between marital status and psychological distress. [38]

2.3.1.5 Psychological distress and marital dissolution

The literature has generally been consistent in suggesting that those who divorce experience higher levels of psychological distress while married, relative to those who remain married. [164] [165] [166] [167] [38]

Authors have argued however that higher levels of psychological distress preceding divorce, are not necessarily indicative of a selection effect and may reflect the process of separation prior to the onset of divorce instead. This argument is based on two lines of evidence.

The first is that while there is evidence for higher levels of psychological distress for those who later go onto divorce, there is no evidence for differences in more stable characteristics such as self-esteem and mastery. There is evidence for an association between depression and self-esteem. Lower levels of self-esteem and declines in self-esteem in adolescence have been found to predict depression in adulthood. Even in the instance of evidence for an association between personality characteristics and the probability of divorce, there is no evidence to suggest that this association explains higher levels of psychological distress for divorced relative to married persons. There is evidence for an association between depression and self-esteem. Lower levels of self-esteem and declines in self-esteem in adolescence have been found to predict depression in adulthood.

The second argument against a selection effect is that relative differences in psychological distress between those who go onto divorce and those who don't are largest closest to the time of the divorce. It is argued that if there was a stable selection effect – the association should not change with time. There is evidence from studies to suggest that higher levels of psychological divorce are limited to 2-3 years prior to divorce.[109,163] [no para break here]

One study, of 39000 respondents, assessed psychological distress at baseline between those who remained married and those who went onto divorce over a 2-4 year observation period. [168] Results suggest that the predictive effect of psychological distress at baseline is stronger, the shorter the duration between baseline and divorce. The association at longer periods were not trivial, however.

Since there was evidence that the predictive effect of psychological distress on divorce was larger when closest to the time of the event, authors concluded that these strains were reflective of the strains of separation.

An alternative argument is that the more modest effects of psychological distress at longer periods prior to divorce is reflective of a selection effect, and the stronger effects closer to the actual event are reflective of the additional stressors of marital strains and the process of separation. Evidence for a possible selection effect comes from a higher risk of divorce among those who experienced behavioural problems in adolescence, which are associated with psychological distress. [169]

The fact that psychological distress has been measured while respondents are married makes it difficult to reliably disentangle selection effects from strains of low marital quality. A more reliable measure would be the psychological distress prior to marriage. One study has attempted this, but measures of mental health were based on retrospective evaluations of psychological distress in childhood. Retrospective evaluations of psychological distress may be unreliable and a more robust test of selection effects of psychological distress on marital status would require prospective associations of psychological distress taken prior to marriage with subsequent marital status.[170]

2.3.1.6 Selection and widowhood.

Selection may also play a role in relative differences in the risk of CVD between married and widowed persons. Existing literature has found evidence for homogamy between spouses on a number of factors including educational attainment,[171] socioeconomic status[172], class background,[173] psychosocial afflictions[174,175] as well as height and weight,[176] all of which are linked are linked with CVD risk. , [88,89] [31,90,91,92]. If spouses are similar on characteristics that are related with mortality and health then this may explain why they are more likely to lose a spouse to death and develop CVD. The higher risk of CVD for widowed relative to married persons would therefore be spurious. Studies of the existing literature on marital status and risk of CVD have adjusted for characteristics such as psychological health and SEP in adulthood. However levels of psychological distress and SEP may not capture bias introduced by homogamy because it is well known that there are changes to each of these factors *following* widowhood. Little work has been done to adjust for characteristics prior to marriage.

2.4 Contributions of the present study on the association between marital status, marital history (previous marital loss and time since divorce) and CVD.

Some evidence is found for the association of marital status with CVD incidence, CVD prevalence, CV mortality and risk factors for CVD. Inconsistencies are evident among studies which have employed objective measures and studies which have employed subjective measures of CVD diagnosis. While the former of these studies consistently find evidence to suggest that unmarried persons are at higher risk, the latter do not always find this. There is some evidence to suggest that the higher risk of CVD, as measured by objective outcomes, of unmarried persons is observed more consistently for men, than women. The reverse is true for studies employing subjective outcomes. It has been proposed that the use of subjective measures in studies of marital status and CVD may be problematic. This is thought to be due to higher levels of health-seeking behaviour among married persons, which would facilitate a greater likelihood of receiving a diagnosis. This could underestimate the risks of CVD among unmarried, relative to married persons. Objective measures were therefore employed, in addition to the use of doctor diagnosed CVD, for the present study.

Three studies, based on American samples have assessed relative differences in the risk of CVD between those in a first and subsequent marriage. Existing studies have found that the risk of CVD is higher among those who have experienced a marital loss, relative to those in a first marriage. The present study adds to the existing literature by investigating relative differences in the risk of CVD between those who are in a first and subsequent marriage, among British samples. A linear model below is shown to summarize how the long term effects of divorce or widowhood may continue to affect ones risk of CVD even after remarriage, The blue arrow represents time. Each of these arguments are discussed more extensively in section 2.2.1.

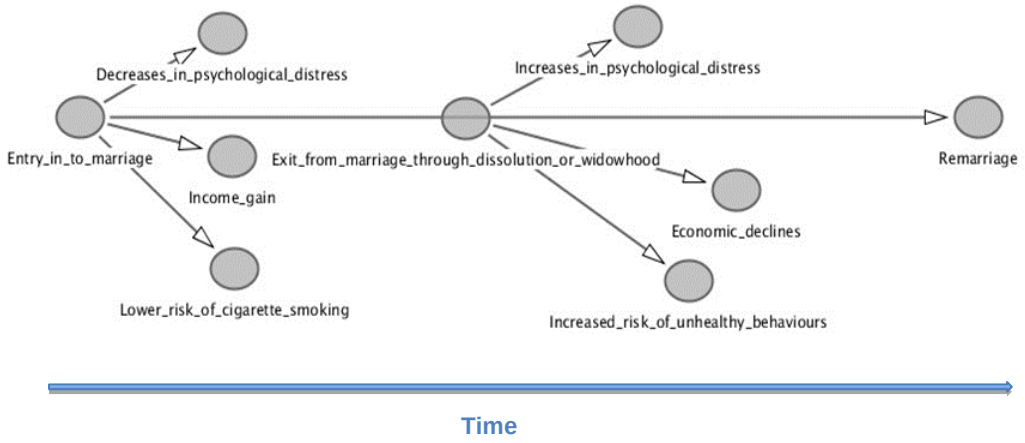

Figure 2.1 Hypothesized pathways of the long term effects of widowhood or divorce

Two studies, based on American samples, have investigated the role of time since marital loss on relative differences in BMI between married and previously married persons. These studies have found that the effects of divorce on weight loss are short-lived and do not extend beyond 4 years, after which divorced respondents no longer differ on BMI relative to their married counterparts. While there is evidence for declines in weight post-divorce and widowhood in longitudinal studies, this isn't reflected in cross-sectional studies. Inconsistencies in the relationship between marital status and risk factors for systolic blood pressure also suggest that there may be an effect of time, in moderating relative differences in BMI and systolic blood pressure between married and divorced persons. A possible role for time since marital loss in moderating relative differences in BMI and blood pressure between married and divorced persons is explored in section 2.2.2

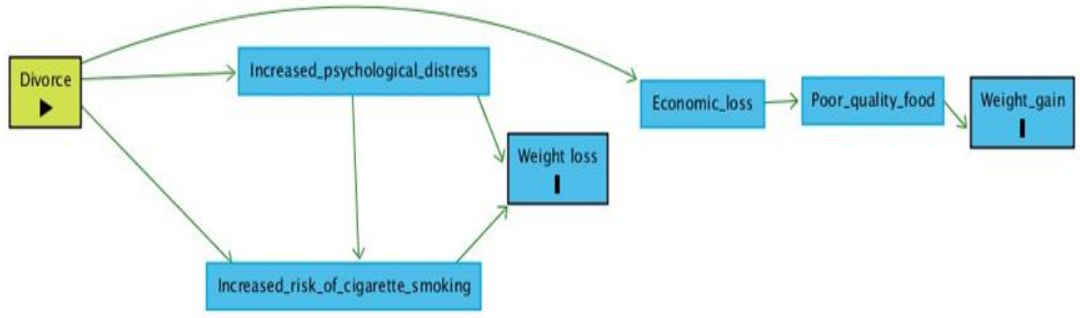

Figure 2.2 Time as a moderator of relative differences in BMI between married and divorced persons

Note: Divorce and weight gain (or loss) denote the exposures and outcomes, respectively. The straight arrows from divorce to increased psychological distress and in turn cigarette smoking, illustrate the early effects of divorce, which lead to weight loss. The bendy arrow connecting divorce with economic loss illustrate the later consquences of divorce, which result in weight gain. The blue arrow indicates time. The heightened psychological distress associated with divorce, is predicted to subside with time, which may result in decreasing differences in blood pressure between married and divorced persons.

No studies have been conducted to investigate if time since divorce affects relative differences in blood pressure between married and divorced persons, or in BMI among british samples. This is the first study to do so.

2.5 Contributions of the present study to the confounding effects of SEP and psychological distress, on the relationship between marital status and CVD

While SEP and psychological distress are related to both marital status and CVD, studies of marital status and CVD have failed to adjust for the potentially confounding effects of psychological distress and SEP in childhood. Rather, studies have focussed on the extent to which factors such as income, psychological distress and health behaviours explain differences in the risk of CVD by marital status/marital history and CVD. There is consistent evidence to suggest that these factors do explain a cardiovascular advantage among married persons. However, since measures are not taken prior to entry in to and out of marriage, it is not possible whether these factors reflect selection or mediation. This is because factors such as income or psychological distress can reflect both a cause and consequence of marriage.

The focus of the present study is to assesss the extent to which socioeconomic position and psychological distress confound the relationship between marital history and CVD. Therefore relationships between measures of SEP and psychological distress prior to marriage, with both marital status and CVD, were ascertained. The extent to which relationships of potential confounders with both exposure and outcome, resulted in spurious relationships between marital history and CVD were also assessed. Figure 1.1. below shows the way in which relationships between father's social class and markers of psychological problems in childhood – through their relationship with both marital status and CVD – may result in spurious associations between marital status and CVD (pink pathways denote biasing paths). This model also shows that while there may be some confounding effects of factors which select people in to marriage, it does not preclude the possibility of a causal association between marital status and CVD – as denoted by the green pathways. The blue arrow indicates time.

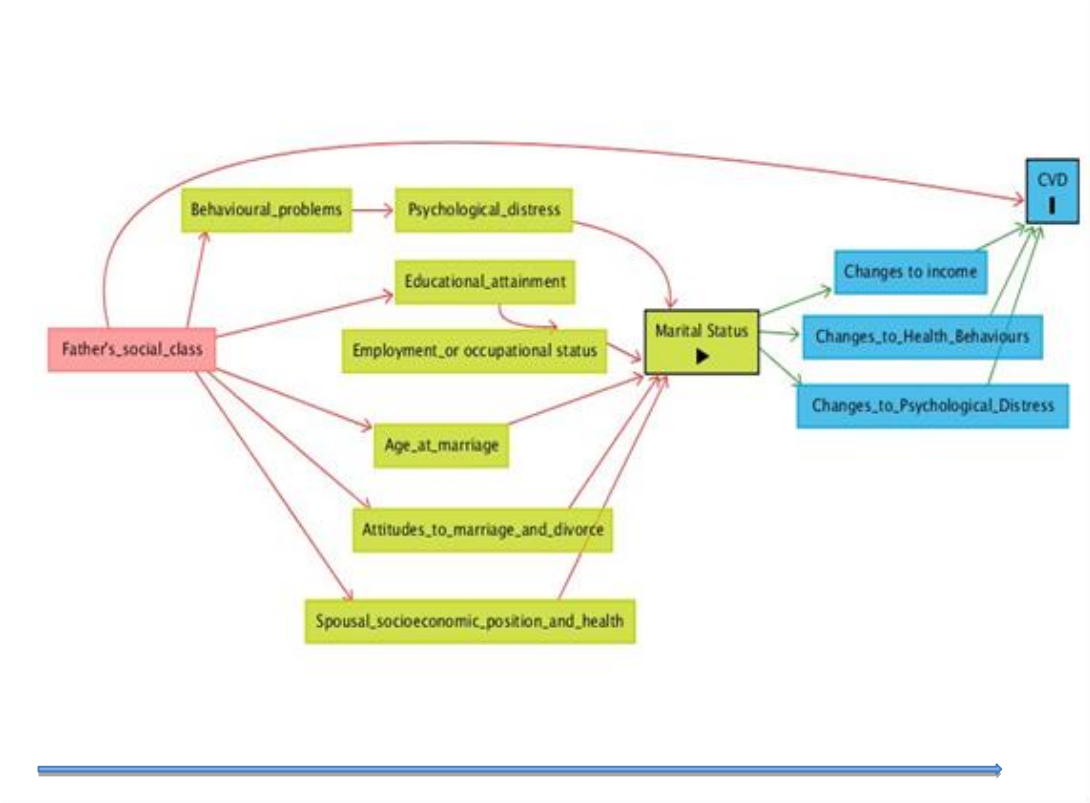

Figure 2.3 – Life course pathways between marital status and cardiovascular disease.

2.6 Gender as a moderator of the relationship between marital history and CVD, and lifecourse influences on marital status.

Throughout the course of this discussion, there has been evidence for the way in which marital status may influence and be influenced, by gender. To reiterate briefly, relative differences in CVD incidence between those who have and haven't experienced a divorce or widowhood is larger for women than men. Furthermore, there is some evidence to suggest that psychological distress and economic losses associated with divorce endure for longer periods and are larger for men, than women. These findings may shed some light on the extent to which the costs of divorce or widowhood may continue in to marriage, may vary by gender. The fact that men and women differ in the duration and magnitude of divorce consequences by gender, also has implications for the way in which they adapt to being divorced. Furthermore the fact that the duration and magnitude of divorce consequences may vary by gender, also means that adaptation to divorce over time will be different for men and women. Predictors of marital status also appear to vary by gender – affluence is consistently associated with a higher and lower likelihood of marriage for men, while the reverse is often observed for women. The role of gender as a moderator of marital history and CVD and life course infuences on marital status, is discussed more extensively in 2.2.2.4 and 2.6.

2.7 Gender differences in the relationship between socioeconomic position and marital status – and their potential confounding effects on the relationship between marital status and CVD.

From the literature thus far, it is apparent that the relationship between socieconomic position and marital status, varies by gender. For example, there is consistent evidence to suggest that the likelihood of marriage and divorce is higher and lower, respectively, among men with relatively higher levels of education, income. For women however, there is evidence for affluence and education to be linked both positively and negatively with marriage and divorce. It is proposed here that for women, the socioeconomic position-marriage relationship, may be contingent on their own, and societal views regarding the role of women in marriage – which may affect both willingness to marry among women, and their attractiveness in the marriage role. There is also some evidence to suggest that higher levels of income and employment is associated with higher levels of divorce for women, however. Some studies suggest that this finding is moderated by cohort, how satisfied a woman is her role in a marriage, and marital quality. Therefore while cohort and time have little influence on the SEP-marital status relationship for men, they appear to be influential in this relationship for women. Given that the association of SEP with marital status may vary by gender, there may be some differences in whether and how SEP confounds the relationship between marital status and CVD, for men and women. Since higher levels of

SEP is associated with a higher likelihood of marriage and lower risk of CVD, failing to account for the SEP-marital status and SEP-CVD relationship, may result in an overestimation of health benefits for marriage for men. In the instance that there may be a lower likelihood of marriage among educated women, for whom the risk of CVD may be lower, failing to account for the SEP-marital status and SEP-CVD relationship may underestimate health benefits of marriage for women.

2.8 Objectives & hypotheses.

Objective 1:

To compare CVD prevalence (CVD) at 60-64 for single, divorced, widowed and remarried persons with that of their continually married counterparts, for members of the NSHD. To compare blood pressure, BMI and waist circumference (risk factors) for single, divorced and widowed persons with that of their continually married counterparts. To compare whether any of these relationships vary by gender.

The association of marital history with risk factors for CVD was assessed for members of the NSHD at 60-64 years and 43 years, and members of the NCDS at 44-45 years. The analytical model, denoting the outcomes (in blue) and exposures (in green), for each of these samples are shown in Figures 2.3-2.5.

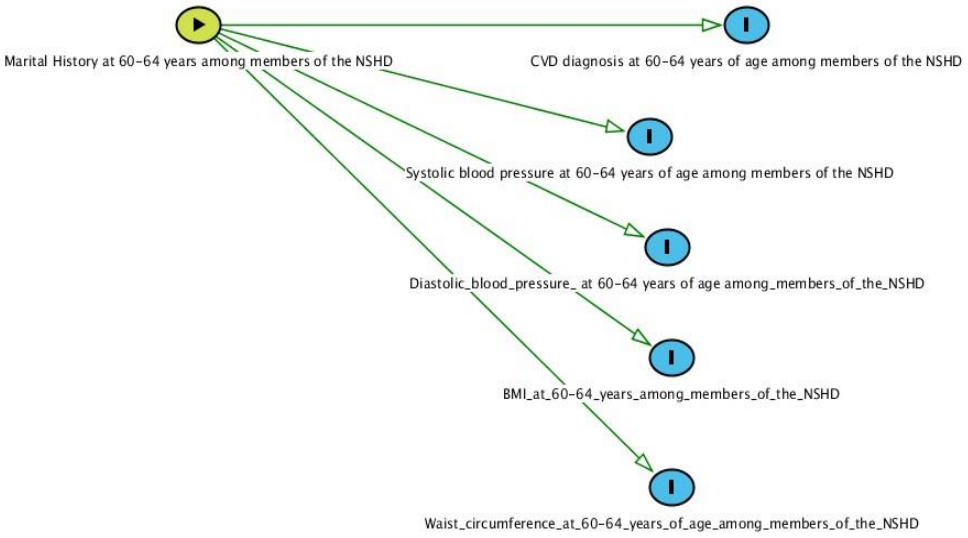

Figure 2.4 - Analytical model, objective 1, among members of the NSHD at age 60-64

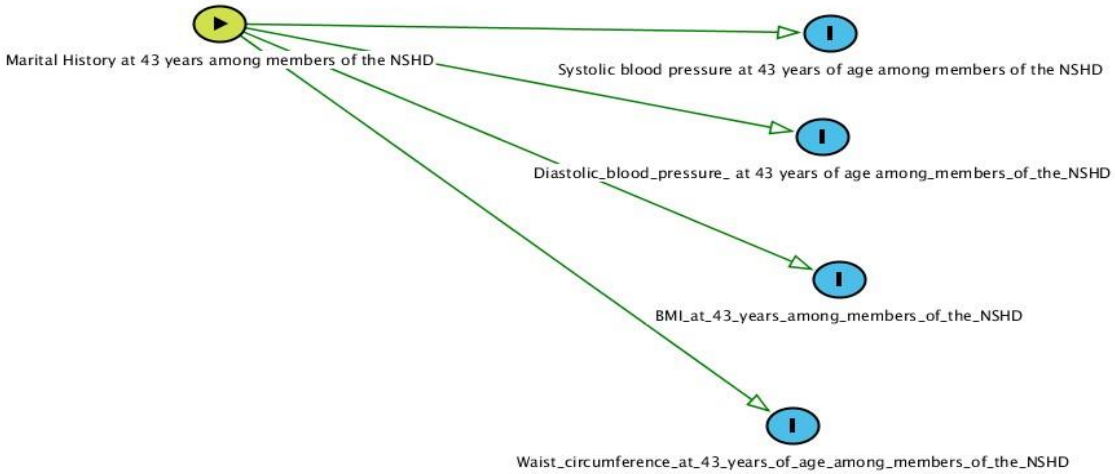

Figure 2.5 - Analytical model, objective 1, among members of the NSHD at age 43

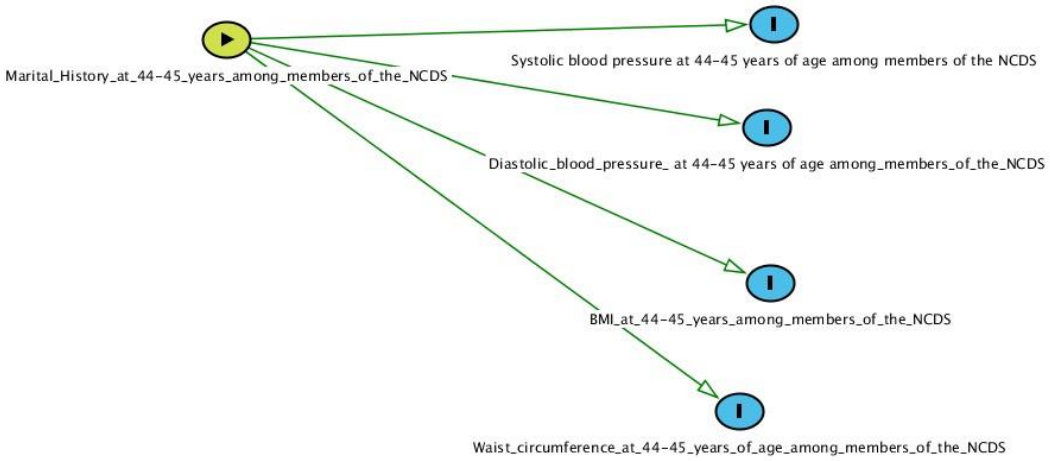

Figure 2.6 - Analytical model, objective 1, among members of the NCDS at age 44-45

Hypothesis:

CVD prevalence will be higher for those who are unmarried or remarried relative to those in a first marriage.

Those who are unmarried and remarried will score higher on blood pressure than those who are in a first marriage. Single respondents will have lower BMI than their continually married counterparts.

Objective 2: To investigate the role of the following predictors: childhood and early adulthood factors (father's social class, behavioural problems and educational attainment) on the likelihood of marriage, divorce and widowhood, and to investigate the effect of these factors on the association between marital history and CVD. To explore whether predictors of marital status; and their role on the association between marital history and CVD, varies by gender. This objective will be investigated among members of the NSHD at 60-64 years and 43 years, and members of the NCDS at 44-45 years of age.

Figure 2.7 shows the outcomes against which the confounders were regressed. The model shows that the pathway through which which behavioural problems and educational attainment may influence marial history, may stem from father's social class. Thus the present study, assessed whether the effects of father's social class, behavioural problems and educational attainment on the likelihood of marriage, divorce and widowhood, were independent from one another.

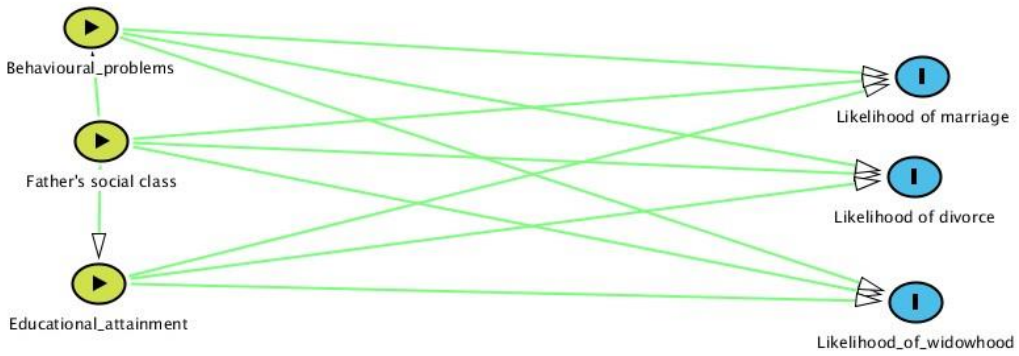

Figure 2.7 – Analytical model to assess the relationship of entry in to and out of marriage, with confounders.

Figure 2.8 shows the confounding effects of father's social class, behavioural problems and educational attainment on the relationship between marital history and each of the outcomes. Exposures are denoted in green, and outcomes in blue. The green lines between marital history and the outcomes denoted causal pathways. The pink lines between confounders, which are also shown in pink, denote a biasing pathway. This biasing pathway

represents the possibility of a spurious relationship between marital history and CVD, both of which may be related to all three confounders. The blue arrow indicates time.

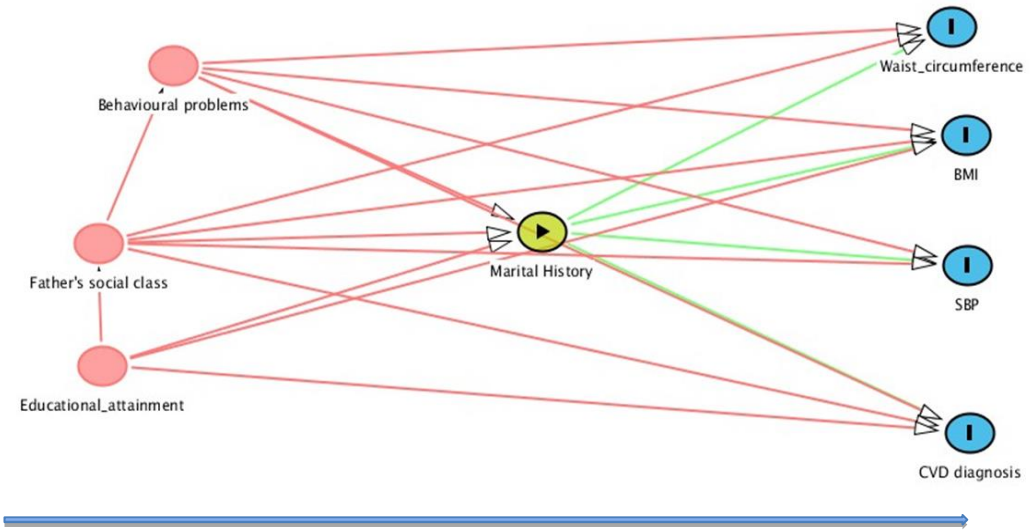

Figure 2.8 - Conceptual model to show the potential confounders of the relationsihp between marital history and CVD

Hypothesis 1: There will be a higher likelihood of marriage among men who come from non-manual backgrounds and are relatively more educated. There will be a lower likelihood of marriage among women who come from non-manual backgrounds and are relatively more educated.

Hypothesis 2: There will be a lower likelihood of marital loss (divorce and widowhood) among those who come from non-manual backgrounds and are relatively more educated. Conduct problems will be associated positively with marital loss.

Hypothesis 3: Adjusting for educational attainment and father's social class and conduct problems in childhood will attenuate but not eliminate the increased risk of CVD for those who have experienced a marital loss or remain single.

Objective 3: To investigate whether time since marital loss moderates relative differences in BMI and SBP between married and divorced persons, and whether this relationship varies by gender. This objective will be investigated among members of the NSHD.

Hypothesis 1: BMI for divorced persons will be lower relative to married persons at the early stages of divorce. Weight gain among divorced persons will be higher as time since divorce progresses, and relative differences in BMI between married and divorced persons will converge with time.

Hypothesis 2: Systolic and diastolic blood pressure will be higher for divorced, relative to married persons. The relative difference will be largest closest to the time of the divorce, after which differences will decrease.

The next chapter presents the methods and datasets explored to present each of these objectives.

3 Chapter 3: Methods

This chapter presents the data and methods employed to assess the objectives of the present study. This chapter covers 1) An overview of the design and scope of the MRC National Survey for Health and Development (NSHD) and the National Child Development Survey (NCDS). 2) A description of the exposures, outcomes and covariates employed 3) The analytical samples and statistical procedures employed for each objective.

3.1 Data

3.1.1 NSHD

The NSHD is the longest running British birth cohort study and has informed UK health care, social and educational policy for over 60 years. Both the research and policy focus of the NSHD has changed substantially since its onset. Originally the NSHD was set up as a maternity study, the purpose of which was to explore falling fertility rates in Britain and maternity service costs. In the early years, of the cohort members' lives, the focus was largely on the relationship of social class, with child and maternal health. During the cohort member's childhood years and early adulthood, the focus was on educational and occupational attainment. From 1989, when respondents were aged 36, onwards research has focused on health and ageing.

The initial sample for this cohort included all births that occurred one week in March in NSHD across England, Scotland and Wales (N=16,695). From this initial population, 13,687 mothers were interviewed for the maternity study. The follow up sample of cohort members, included 5362 singleton babies (2815 male, 2547 female) born to mothers successfully interviewed for the maternity survey. This sample was stratified by social class including all babies born to women who were married to agricultural and non-manual workers, and one in four babies born to women who were married to manual workers.[177] To limit costs, increase the likelihood of maintaining contact with pariticpants and to maintain a representative sample, multiple births and children born to unmarried women were excluded from the sample.

Respondents were followed up 11 times from birth up until 16 years of age. The main data collections in adulthood have been at 26, 36, 43, 53 and 60-64 years. From birth to age five, survey member's mothers provided information to health visitors. During the school years (5-15), information was obtained from health visitors, doctors, school nurses and teachers. After a series of postal data collections in early adulthood, the first adulthood home visit was conducted by interviews at age 26. Subsequent data collections at age 36, 43 and 53 were undertaken by research nurses. The most recent data collection, when respondents were aged between 60-64 years, consisted of postal questionnaires and subsequent invitations

(2 months-2 years later) to visit clinical research facilities (CRF) across the UK. At this 'visit' stage, respondents underwent clinical assessments.[178] Survey members were asked to provide written, informed consent. The Greater Manchester Local Research Ethics Committee and the Scotland A Research Ethics Committee, provided Ethic approval for the study.

3.1.1.1 Response rate and representativeness of the NSHD

A problem common to all longitudinal studies, is loss to follow up due to death, migration or refusal to participate. Though this has reduced the sample size of this cohort over time, response rates remain good. Table 3.1 shows respondents who had participated in the survey in adulthood as a proportion of the target sample, and the original sample N=5362. The target sample includes respondents respondents who were alive and resident in England, Scotland or Wales and had not permanently refused or been untraced since the previous stage of data collection.

Table 3.1 Response rate in the NSHD

Year	Age of cohort member	Sample successfully contacted	% of target sample	% of original sample
1946	8 weeks	5,362	(100)	(100)
1948	2	4,698	(94)	(87)
1950	4	4,700	(96)	(87)
1952	6	4,603	(95)	(86)
1953	7	4,480	(93)	(84)
1954	8	4,435	(92)	(83)
1955	9	4,181	(87)	(78)
1956	10	4,077	(85)	(76)
1957	11	4,281	(89)	(80)
1959	13	4,127	(86)	(77)
1961	15	4,247	(89)	(79)
1965	19	3,561	(75)	(66)
1966	20	3,899	(83)	(73)
1968	22	3,885	(84)	(72)
1969	23	3,026	(67)	(57)
1971	25	3,307	(74)	(62)
1972	26	3,750	(85)	(70)
1977	31	3,340	(78)	(62)
1982	36	3,322	(86)	(62)
1989	43	3,262	(87)	(60)
1999	53	3,035	(83)	(57)
2006-10	60-64	2,661	(84)	(50)

Target sample include respondents who were alive, resident in England, Scotland & Wales, and had not refused to participate or been untraced since the previous data collection.

As is evident from Table 3.1, there was a decrease in the number of participants over time. The proportion of the target sample, who participated in the study, was smallest in early adulthood between 19-31 years, after which it increased slightly. By the latest data collection over half the original cohort and 84% of the target sample, were in the study sample. The rate of attrition was contingent upon a series of factors in both childhood and adulthood. The likelihood of providing data by the final stage of data collection was relatively higher among women, those who were relatively more educated, from relative higher adult social class, had higher levels of cognition throughout the life course, and fewer health at problems at 53 years of age. By 60-64 years of age, differences in socio-demographic factors between the sample and national populations of the same age were not apparent, with the exception of a higher rate of owner-occupation and a lower rate of limiting illness for members of the cohort.[178]

3.1.2 NCDS

The National Child Development Study (NCDS) is the second oldest British Birth cohort. It was initially set up as the Perinatal Mortality Survey (PMS), to examine social and obstetric predictors of infant mortality and stillbirth. Over the years, the focus of the NCDS has expanded to include various aspects of survey member's lifestyles including health, education and familial circumstances.

The original cohort of respondents included babies born in Great Britain (England, Scotland and Wales), in a week in March in NCDS, and included over 17000 births.[179] Survey members were subsequently followed up eight times, at 7, 11, 16, 23, 33, 44-45 years, 46 and 50 years of age. During the first three waves of follow up (7, 11 and 16) years of age, immigrants born in the same week were recruited and formed the target samples (N=18558) for subsequent waves.

Up until 23 years, information on survey members was obtained from teachers, parents and medical staff. From 23 years onwards, information was obtained via home interviews. The biomedical survey conducted at 45 years consisted of both a home interview by a research nurse, blood and saliva samples, and self-completed questionnaires. Information obtained from the biomedical survey is employed for the present study. Ethical approval was obtained from the South East Multi-centre Research Ethics Committee.[179]

The eligible sample of respondents at each of the adulthood waves of data collection included all respondents who were part of the cohort at age 16 (including immigrants), and were resident in Britain. Table 3.2 Response rate in the NCDS below shows response rates at each of the stages of adulthood up until 45 years of age, as a proportion of the target sample (respondents who were contacted) and original sample. The target sample excludes respondents who hadn't participated since 16 years of age, did not have a valid address, were in the armed forces, had displayed threatening behaviour in the past and were not capable of giving informed consent. It is acknowledged that in adulthood, the target sample includes respondents who had participated at 16 years of age rather than those who had participated at any age, as was done for the NSHD. This should be considered when response rates are compared between Table 3.2 and Table 3.1.

Table 3.2 Response rate in the NCDS

Year	Age of cohort member	Sample successfully contacted	% of target sample	% of original sample
1958	Birth	17,416	(99)	(100)
1965	7	15,425	(92)	(89)
1969	11	15,337	(92)	(88)
1974	16	14,647	(87)	(84)
1978	20	14,331	(98)	(82)
1981	23	12,537	(76)	(72)
1991	33	11,407	(70)	(65)
2000	42	11,419	(70)	(66)
2003	45	9426	(59)	(54)

From 20 years onwards, the target sample included only those respondents who had participated at 16 years of age. Respondents who were in the armed forces, displayed threatening behavior, were not capable of giving consent and did not have a valid address were excluded from the target sample.

Respondents who were from manual backgrounds, lived in rented accommodation and whose mothers had left school early were less likely to participate at 45 years, relative to their counterparts. Within respondents from manual backgrounds, the risk of loss to follow up was particularly large among those who had spent time in care as children/there was no man of household present in childhood.

Respondents who showed behavioural problems and poor reading in childhood were also likely to be under-represented in the 45 year survey. Adult predictors of loss to follow up by 45 years include being a smoker, obese and being in a manual social class. Overall, these biases were modest and the 44-45 year survey remained representative of the original cohort. [179] There was no evidence of differences in participation rate, by marital status.

Loss to follow up is an inherent problem of longitudinal and survey data. In the event that loss to follow up is non-random, this can lead to biased conclusions about the association between two factors. In spite of the limitations potentially proposed from cohort studies, these two cohorts are well-suited for the objectives of the present study.

Firstly, cohort studies allow for assessing whether one is in a first or subsequent marriage, based on marital information collected prospectively throughout the life course. Secondly, in order to assess whether relative differences in health between married and previously married persons change with time since the onset of marital loss, repeat measures of health are required. The longitudinal nature of cohort studies allows for this. Finally, both these cohorts collect information from throughout the life course, which is essential for assessing the role of social selection on the association between marital history and cardiovascular disease.

3.1.3 Outcome measures

Two types of indicators were employed to assess CVD risk. One type is objective risk factors for CVD including blood pressure (systolic (SBP) and diastolic (DBP)) and anthropometric measures (Body mass index (BMI) and waist circumference). Each of these measures are positively related to the risk of cardiovascular disease.[104] These measures are available for members of both the NSHD and NCDS, and are referred to as CVD risk factors for the remainder of the document. The second type is self-reported diagnosis of CVD. The latter is available for members of the NCDS at 60-64 years and at 53 years. For the purpose of this study, this measure is employed at 60-64 years only. This outcome is referred to as doctor-diagnosed CVD for the remainder of the document.

3.1.3.1 Systolic and diastolic blood pressure

Among members of the NSHD, blood pressure was measured by trained personnel from 36 years onwards. At ages 36 and 43 years, blood pressure was measured using the Hawksley random zero sphygmomanometer. In the penultimate and final sweep to date, 53 and 60-64 years respectively, the validated Omron HEM-705 (Omron Corp., Tokyo, Japan) automated digital oscillometric sphygmomanometer was employed. All readings were taken using an appropriate cuff size for arm circumference. Two measures of blood pressure were taken, while respondents were seated, with an interval of 5 minutes in between. Where the second measure was available, it was employed as a measure of respondent's blood pressure. Otherwise, the first measure of blood pressure was employed. Measures of blood pressure from 43 years onwards were used for this thesis.

The Omron 907 was employed to measure blood pressure among members of the NCDS, at 44-45 years. Respondents were asked to remove outer garments, to expose their upper arm. Watches and bracelets were also removed. Nurses were advised to ensure long sleeves were not so tight, so as to restrict blood flow. Respondents' forearms were supported on a table/armrest, in preparation for administering the cuff. n the instance that the mid-point circumference of the respondents arm exceeded or measured 32cm, a large adult cuff was used. A normal adult size cuff was used otherwise. The cuff was placed about 2 to 3 finger-breadths from the crook of the arm. Respondents were asked not to move or speak during the measurement of blood pressure which was taken three times, one minute apart. Blood pressure was computed as an average of the second and third measures taken for the purpose of this study. Information on blood-pressure lowering medication was obtained for members of both cohorts. At age 43, members of the NSHD were asked if they had hypertension and whether they were on medication for this. At ages 53 and 60-64 for members of the NSHD, and at age 44-45 for members of the NCDS, respondents were asked to complete a list of the medications that they had been prescribed. These medications were matched to BNF codes. Corrections were made, to measures of systolic and diastolic blood pressure, for blood-pressure lowering medication. Among those who

reported on being on medication SBP and DBP were increased by 10 mmHg and 5 mmHg respectively.

3.1.3.2 BMI and waist circumference

Among members of the NSHD, height and weights were measured during childhood and at 26, 36, 43, 53 and 60-64 years. In this thesis BMI at ages 43 and 60-64 years was used. Heights and weights were also measured for members of the NCDS at 44-45 years, which is used for the purposes of the present study. Standardized protocols were used to assess heights and weights for all the measures of height and weight employed in the present study. BMI was calculated from the division of height (meters) by weight (kg/m^2). Both a continuous and categorical measure of BMI was used for the present analysis. BMI classifications were derived according to WHO cut off points. Respondents with BMI lower than 18.5 kg/m^2 were categorised as underweight. Respondents with BMI between 18.5 kg/m^2 and 24.99 kg/m^2 were categorised as normal weight. Those who exceeded a BMI of 25 kg/m^2 and 30 kg/m^2 were classified as over-weight and obese, respectively.

Waist circumference was measured at 36, 43 and 53 and 60-64 years among members of the NSHD, and at 44-45 years among members of the NCDS. Information on waist circumference was used at 43 and 60-64 years for members of the NSHD. For members of the NSHD, at 43 years of age, waist circumference was measured twice. An average of these two measures was employed. If in the instance, that a second measure was not available (N=186), then the first was used. Waist circumference measured at a point midway between the costal margin and the iliac crest and in line with the mid-axilla, was obtained by trained professionals for members of both cohorts. For the purposes of this study waist circumference is reported in centimetres.

3.1.3.3 CVD prevalence (NSHD)

Information on whether respondents had been diagnosed with a CVD related condition was collected at 53 years, and at 60-64 years. Respondents were asked if they had been diagnosed with any of the following heart conditions: angina, heart attack (myocardial infarction/coronary thrombosis), valvular disease, aortic stenosis, Heart trouble (valve disease, congenital heart, disease or irregular heart- beat, or ischaemic heart disease, and whether they had had any of the following procedures: angioplasty of coronary arteries, (balloon treatment for angina) or insertion of a stent and a coronary artery bypass graft (CABG). Respondents that reported a condition but didn't confirm that a doctor or specialist had diagnosed their condition were not included in the affirmative category. A binary variable was created to distinguish respondents who had reported a diagnosis of CVD at either 53, 60-64 or both, from those who didn't report being diagnosed at both times.

3.2 Marital History

3.2.1 Operationalizing marital history for members of the NSHD

At each sweep from 26 years onwards, respondents were asked to indicate their marital status. Respondents could report being single, married, divorced, separated or widowed. At each sweep respondents were also asked to report whether they were in a first or subsequent marriage; whether they had experienced any transitions in to marriage, death of a spouse or a divorce. In the instance that a marital transition had occurred between sweeps, respondents were asked to report the date at which this occurred. Data from each of these sweeps were used to create several measures of martial history. These include the number of marriages experienced to date, and the ages at first, second, third, fourth and fifth marriages, separation and widowhood if relevant.

Two measures of marital history were created, using NSHD data, for the present study. For objective 1 married and remarried respondents were distinguished, using the number of marriages to date and current marital status by whether they were in a first or subsequent marriage.

For objective 3, a second measure of marital history was employed. A variable was created to distinguish between three groups. The first group included those who were in a first marriage between 36 and 60-64 years of age.This group of respondents is referred to as the continually married group, in the remainder of the thesis. The second group were in a first marriage by 36 years of age and had experienced a divorce between 36-43 years. This second group was further stratified, to distinguish respondents who were continually divorced up until the end of the observation period (60-64 years) and those who remarried at any point after the first divorce. The latter of this group therefore included those who were remarried and those who were in a second or subsequent divorce, or first/subsequent widowhood. The former and latter of these groups is referred to as the divorced and remarried group, respectively.

3.2.2 Operationalizing marital history for members of the NCDS

As part of the self-completion questionnaire section part of the biomedical survey, respondents of the NCDS were asked to indicate their legal marital status as one of the following categories: First marriage, remarriage (second or subsequent), single (never married), legally separated, divorced, widowed or cohabiting. Respondents were asked not to report being married in the instance that they were cohabiting. All cohabiting respondents were excluded from analysis, to achieve consistency with the measure of marital status employed for members of the NSHD. The resulting groups were as follows: continually married, single, divorced, widowed or remarried.

3.3 Confounders

3.3.1 Father's social class

Father's social class was based on registrar general coding of Father's occupational class. Father's occupation class was obtained at 4 years for members of the NSHD. In the instance that data was not available at 4 years, information on father's occupation was obtained at 11 or 15 years.

The categories of occupational class for members of the NSHD were as follows: professional (1), intermediate (2), skilled (3) (Non-Manual), skilled (4) (Manual), partly skilled (5) and unskilled (6). For members of the NSHD father's occupational class was defined as was classified as Social class 1, 2, 3(non-manual), 3 (manual), 4 (manual) 4 (non-manual) and 5. For the purposes of this thesis a binary variable was created to distinguish those whose fathers were in non-manual occupations, from those whose fathers were in manual occupations for both cohorts.

3.3.2 Educational attainment

Members of the NSHD were asked about their highest educational qualification at 26 years of age. Levels of educational attainment were classified using the Burnham scale, ranging from no qualifications to doctorate degrees.

Categories of educational attainment included: None attempted (0), vocational course (proficiency only) (1), SUB GCE or sub Burnham C (2), GCE 'O' level or Burnham C (3), GCE 'A' Level or Burnham B (4), Burnham A2 (5), 1st Degree or graduate equivalent (6), Higher degree (Masters) (7), Higher degree (doctorate) (8). For the present analyses educational attainment groups 0, 1-3, 4-5 and 6-8 were recoded into no qualifications, lower secondary, advanced secondary, and degree level or above, respectively.

Among members of the NCDS, highest educational attainment was measured at 22 and 33 years. For the purpose of the present study, educational attainment at 33 years was employed. By 33 years respondents reported up to 36 qualifications, which were summarized in 5 levels of educational attainment: No qualifications, CSE levels 2-5 (CSE grade of 2-5 or technical or business qualifications including HGV and PSV); O-level (CSE grade 1, GCSE grades A-C, Scottish 'O' grades passes or grades A-C, Scottish Standard Grades 1-3, Royal Society of Arts Awards (RSA):Stage 2 or 3, City and Guilds and Regional qualifications: operative or Craft/Intermediary/Ordinary/Part I, Other City and Guilds, Insignia Award in Technology (CGIA), JIB/NJC or other Craft/Technician Certificate); A-level (GCE A level, Scottish Certificate of Sixth Year Studies 09 3, RSA: Advanced/Final/Part II or III , National General Certificate or diploma) and degree or higher (first degree, a post-graduate degree (MSc or PhD) or a post graduate diploma). These groups were further coded in to No

qualifications; Lower Secondary (CSE levels 2-5 and O-level); Higher Secondary (A-level), and degree level or above.

3.3.3 NSHD – behavioural problems in adolescence

Adolescent behavioural (conduct) problems were assessed by teachers at 13 & 15 years of age. Teachers were asked to rate children on the frequency with which they carried out each of seven behaviours, relative to other children. These seven items of behaviour were drawn from confirmatory factor analysis, on data obtained from forerunners of the Rutter behaviour rating scales. These are: disobedience, lying, lack of punctuality, restlessness, truancy, day dreaming in class and poor response to discipline. Teachers could respond with more frequently than, same rate as or less frequently than for other children in the class. Scores could range from 7-21 with higher scores representing higher levels of behavioural problems. For the purposes of this study, an average score of adolescent behavioural problems at 13 and 15 years, was used.

3.3.4 NCDS – behavioural problems in childhood

The British Social Adjustment Guide (BSAG) was employed as an indicator of behavioural problems in childhood, among members of the NCDS. BSAG scores were available at NCDS1 and 2, at which respondents were aged 7 and 11 respectively. BSAG scores at 7 years were used because information of a larger number of respondents were available at this age (N= 14,926), compared with at 11 years.

The BSAG is an indicator devised by Stott (1965) to assess possible behavioural problems, shown by children in a particular setting. Teachers were asked to underline items of behaviour written as ‘phrases’, best describing the behaviour of child in question. Each of the phrases was written under a particular heading relating to a scenario such as ‘response to greeting’. Each of the phrases was given a code and clustered into a number of syndromes, in accordance with the assumption that the behaviours that were clustered together were part of the same behavioural pattern/along the same continuum. This is yet to be verified and the validity of clustering certain behaviours together to form a syndrome is yet to be determined. Therefore it must be acknowledged that this is a fairly crude measure of behavioural maladjustment. The syndromes were as follows; Unforthcomingness, Withdrawal, Depression, Anxiety, Hostility towards adults, Writing off- of adults and adult standards, anxiety for acceptance by children, Hostility towards children, Restlessness, Inconsequential behaviour, Miscellaneous symptoms and Miscellaneous 'Nervous' symptoms. A continuous score ranging from 0-64 on each of these symptoms were derived for respondents.

For the purpose of this study the terms behavioural problems and conduct problems will be used interchangeably, for members of the NSHD. Behavioural problems will be used in reference to members of the NCDS.

3.4 Analytical sample, descriptive characteristics and statistical analyses employed for each of the objectives of the present study

This section presents the eligibility criteria for the analytical samples employed, per objective. The distribution of exposures, outcomes and covariates are presented. Statistical methods employed to investigate each of the objectives are also outlined. All analyses were conducted in STATA 13, and stratified by gender.

3.4.1 Objective 1

To compare CVD prevalence (CVD) at 60-64 for single, divorced, widowed and remarried persons with that of their continually married counterparts, for members of the NSHD. To compare blood pressure, BMI and waist circumference (risk factors) for single, divorced and widowed persons with that of their continually married counterparts. To compare whether any of these relationships vary by gender.

3.4.1.1 Analytical sample for members of the NSHD at 60-64 years, for objective 1

Eligible respondents included those with complete information on marital history and any outcome (a diagnosis of CVD, SBP, DBP, BMI or waist circumference). The available sample at age 60-64 was N=2661. Respondents were eligible for inclusion in the present study if information, for individuals, was available on: 1) Marital status at age 60-64 2) Number of marriages, if marriage, to distinguish remarried respondents from their continually married counterparts 3) Outcome measures (1 or more). As a result of this criteria, N=402 respondents were excluded, resulting in a final sample of N=2259, among whom 52.2% were women.

The distribution of marital history, CVD and risk factors for CVD (SBP, DBP, BMI and waist circumference) among members of the analytical sample for members NSHD at 60-64 years, is shown in Table 3.3 Additional information on marital history among members of the analytical sample is shown in Table 3.4 .

3.4.1.2 Analytical sample for members of the NSHD at 43 years, for objective 1

Eligible respondents included those with complete information on marital history at 43 years and any risk factor for CVD including SBP, DBP, BMI and waist circumference. N=1343

respondents with complete information on marital history were excluded, as a result of not having information on any of these risk factors. The largest proportion of respondents with information on marital history and no measures of risk factors was single. The risk of exclusion was lower for divorced, widowed and remarried women, relative to their continually married counterparts. The final sample included N=3239 respondents of whom 52.4% were women.

3.4.1.3 Analytical sample for members of the NCDS at 44-45 years, for objective 1

Eligible respondents, as for members of the NSHD at 43 years, included respondents with complete information on marital history and any risk factor for CVD including SBP, DBP, BMI and waist circumference. N=256 respondents with information on CVD but not martial history were excluded. N=30 respondents with information on marital history but no measures of CVD were excluded. Single women were more likely to be excluded, relative to their continually married counterparts.

The final sample included N=9080 respondents of whom 50.3% were women. Since inter-cohort differences of the association between marital history and risk factors for CVD is compared between members of the NSHD at 43 years and members of the NCDS at 44-45 years in chapter 4, the distribution of marital history and CVD are presented for both cohorts in Table 3.5. Additional information on marital history including number of marriages and the age of first transitions in to and out of marriage, for both cohorts, is presented in Table 3.6. While these measures are not employed for analysis, they provide useful information on marital history differences between members of the NSHD and NCDS, the potential impact of which is discussed in chapter 4, in relation to inter-cohort differences in the association of marital history and CVD. .

3.4.1.4 Descriptive characteristics of the analytic sample at 60-64 years, NSHD for assessment of objective 1

Over 95% of the analytical sample had married at least once (Table 3.3). The largest proportion of respondents was still in their first marriage at 65 years (60.3%) and the smallest had never married (4.9%). Trends in the data suggest that a higher proportion of women were widowed relative to men

The risk of CVD appears to be higher for men than women This finding is reflected in the higher mean systolic blood pressure and waist circumference for men. Furthermore the proportion of men diagnosed with CVD was higher than for women. All differences were significantly different from zero, $p<0.01$, Table 3.3.

As is evident from Table 3.4 **Age** at first marital transitions among men and women from the NSHD, by 60-64 years. a large proportion of respondents reported marrying prior to their mid- twenties. It is also evident that there is homogeneity in age at first marriage. Over 50% of respondents reported marrying between 20 and 24 years. Very few respondents married for the first time post 35 years of age. The likelihood of divorce and widowhood appears to be largest between 30-40 years and 45 years +, respectively.

Table 3.3 The distribution of marital history, CVD prevalence and risk factors for CVD at 60-64 years among members of the NSHD.

			Overall			Men			Women	Gender differences
			N=2259			N=1079			N=1180	
Marital History at age 60-64	%		N	%		n	%		N	
Continually married	60.3		1,362	62.5		674	58.3		688	ns
Single	4.9		110	5.8		62	4.1		48	ns
Widowed	6.1		137	3.2		34	8.7		103	P<0.001
Divorced	12.4		280	11.8		127	13.0		153	ns
Remarried	16.4		370	16.9		182	15.9		188	ns
			N=2,174			**N=1,050**			**N=1,124**	
CVD	%		N	%		n	%		N	
Yes	6.5		142	9.6		101	3.7		41	P<0.01
No	93.5		2,032	90.4		949	96.4		1,083	
Risk factors for CVD	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	
Systolic blood pressure (mmHg)	1921	139.1	19.19	911	142.5	18.79	1010	136.1	19.05	P<0.01
Diastolic blood pressure(mmHg)	1921	79.1	10.36	911	81.0	10.34	1010	77.5	10.11	P<0.01
BMI kg/m^2	1927	27.9	4.93	909	27.9	4.10	1018	28.0	5.58	ns
Waist (cm)	1926	96.3	12.89	910	100.8	11.02	1016	92.3	13.16	P<0.01
BMI Categories			**N=1927**			**N=909**			**N=1018**	
	%		N	%		n	%		N	
Underweight	0.57		11	0.33		3	8		0.79	ns
Normal	28.33		546	25.19		229	317		31.14	ns
Overweight	42.40		817	47.08		428	389		38.21	ns
Obese	28.70		553	27.39		249	304		29.9	ns

SD=standard deviation; BMI=Body mass index; BMI Categories: Underweight (BMI<18.5kg/m2); Normal Weight (BMI 18.5-24.99kg/m2); Overweight (BMI>=25kg/m^2); Obese BMI>=30kg/m^2 ns=non-significant

Table 3.4 Age at first marital transitions among men and women from the NSHD, by 60-64 years.

	Marriage (%)		Separation (%)		Widowhood (%)	
Age at first transition	**Men N=1,012**	**Women N= 1,125**	**Men N=294**	**Women N= 350**	**Men N=46**	**Women N= 117**
16-19	4.3	20.7	2.0	4.3		
20-24	60.0	60.9	4.1	10.6		2.6
25-29	24.9	13.0	15.3	19.4	2.2	5.1
30-34	7.9	3.3	19.4	16.0	2.2	5.1
35-39	1.9	1.2	15.3	17.4	8.7	2.6
40-44	1.1	0.4	16.3	13.4	13.0	6.0
45-49	0.5	0.1	12.2	9.4	10.9	13.7
50-54	0.2	0.1	9.5	6.0	17.4	13.7
55-59	0.1	0.2	4.8	2.9	32.6	33.3
60-65	0.2	0.1	1.0	0.6	13.0	18.0

Note: Information on age at first transition was missing for some respondents

3.4.1.5 Descriptive characteristics of the analytic sample at 43 years among members of the NSHD and 44-45 years among members of the NCDS for assessment of objective 1

Among both cohorts, the largest proportion of respondents was in a continuous marriage, Table 3.5. Furthermore by midlife the smallest proportion of respondents had widowed. There was also some evidence for within cohort differences in marital history, by gender. Among both cohorts the likelihood of remaining single was lower for women. The experience of divorce and widowhood was higher among women from both cohorts. By midlife, the largest proportion of respondents had experienced one marriage. A very small proportion of respondents from both cohorts had experienced more than 2 marriages, Table 3.6.

There is some evidence for inter-cohort differences in the distribution of marital history by mid-life. A larger proportion of men and women from the NSHD had never married by midlife. The likelihood of divorce was also higher for members of the NCDS birth cohort, Table 3.5. Statistically significant differences were observed among age in to and out of marriage between members of the NSHD and NCDS, which was higher among the latter, Table 3.6.

There was some evidence for both inter-cohort differences and intra-cohort gender differences, in risk factors. Women from both cohorts had lower mean blood pressure, BMI and waist circumference. Systolic blood pressure was higher for men from NCDS, relative to men from the NSHD. The reverse was true for women. BMI and waist circumference was higher for both men and women from the NCDS. All of these differences were statistically significant, $p<0.05$.

Table 3.5 The distribution of marital history, and risk factors for CVD at 43 years among members of the NSHD and 44-45 years among members of the NCDS.

	NSHD (43 years)					NCDS (44-45 years)				
	Men N=1621		Women N=1618		Gender difference	Men N=2510		Women N=4570		Gender differences
	N	%	N	%		N	%	N	%	
Marital History										
Continuously married	1,111	68.5	1,084	67.0		2,683	59.5	2,587	56.6	ns
Single	135	8.3	76	4.7	p<0.001	544	12.1	442	9.7	ns
Widowed	11	0.7	26	1.6	p=0.02	16	0.4	51	1.1	ns
Divorced	176	10.9	228	14.1	p-0.01	656	14.6	825	18.1	ns
Remarried	188	11.6	204	12.6		611	13.6	665	14.6	Ns
Risk factors for CVD	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**		**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	
SBP mmHg	1596	125.2	15.66	1590	121.6	16.53	P<0.001	4483	125.2	15.66	4512	120.0	15.68	P<0.001
DBP mmHg	1596	82.2	12.22	1590	77.4	12.7	P<0.001	4482	82.2	11.03	4512	75.7	11.0	P<0.001
BMI mmHg	1617	25.7	3.52	1608	25.2	4.8	P<0.001	4460	27.8	4.3	4508	26.9	(5.5	P<0.001
Waist (cm)	1609	91.9	9.9	1613	77.9	(11.2)	P<0.001	4500	98.5	11.3	4550	85.5	12.9	P<0.001
BMI	**Men N=1617**		**Women N=1608**			**Men N=4460**		**Women N=4508**		
	N	%	N	%		n	%	N	%	
Underweight	10	0.6	26	1.6		12	0.3	37	0.8	ns
Average	712	44.0	942	58.6		1,089	24.4	1,939	43.0	ns
Overweight	724	44.8	416	25.9		2,220	49. 8	1,485	32.9	ns
Obese	171	10.6	224	13.9		1,139	25.5	1,047	23.2	ns

SD=standard deviation; SBP=systolic blood pressure (mmHg);DBP=Diastolic blood pressure (mmHg); BMI=Body mass index (kg/m^2); Waist=Waist circumference (centimetres)
Gender differences reflect significant differences in the distribution of CVD, systolic blood pressure and waist between men and women, in the analytical sample. BMI Categories: Underweight (BMI<18.5kg/m^2); Normal Weight (BMI 18.5-24.99kg/m^2); Overweight (BMI>=25kg/m^2); Obese (BMI>=30kg/m^2) ns=not significant

Table 3.6 Marital history for members of the NSHD at 43 years and members of the NCDS at 44-45 years

	NSHD (43 years) N=3239					NCDS 44-45 years n=9080				
		Men N=1621		Women N=1681	Gender difference		Men N=4150		Women N=4570	Gender difference
Marital History	**%**	**N**	**%**	**N**		**%**	**n**	**%**	**n**	
Continuously married	68.5	1,111	67.0	1,084	ns	59.5	2,683	56.6	2,587	ns
Single	8.3	135	4.7	76	P<0.001	12.1	544	9.7	442	P=0.02
Widowed	0.7	11	1.6	26	P=0.01	0.4	16	1.1	51	P<0.001
Divorced	10.9	176	14.1	228	P=0.01	14.6	656	18.1	825	P<0.001
Remarried	11.6	188	12.6	204	ns	13.6	611	14.6	665	P=0.05
Number of marriages	**%**	**N**	**%**	**n**		**%**	**n**	**%**	**n**	
0	8.3	135	4.7	76	ns	13.8	592	10.9	480	
1	78.2	1268	80.8	1308	P<0.001	75.0	3224	75.5	3335	P=0.001
2	12.2	198	13.4	216	P<0.001	11.0	474	13.4	592	P<0.001
3	1.2	20	1.1	18	ns	0.21	9	0.2	8	ns
First transitions	**N**	**Mean (SD)**	**N**	**Mean (SD)**		**N**	**Mean (SD)**	**N**	**Mean (SD)**	
Age at marriage	1483	24.2 (4.14)	1537	22.0	P<0.001	3846	25.7 (5.41)	4062	23.3 (5.16)	P<0.001
Age at widowhood	19	37.1 (5.35)	40	34.0 (7.20)	ns	21	40.3 (3.74)	50	40.1 (5.27)	ns
Age at divorce	348	33.1 (6.02)	414	32.0 (6.62)	P=0.02	80	43.8 (1.22)	80	43.7 (0.97)	ns

Note: Information on age at first transition was missing for some respondents. ns=not significant.

3.4.1.6 Statistical analysis employed for objective 1

Logistic regressions were employed to assess the risk of CVD diagnosis for single, divorced and widowed respondents, compared with that of their continually married counterparts among members of the NSHD at 60-64 years. Relative risks were denoted by odds ratios. Linear regressions were employed to estimate relative differences (denoted by coefficients) in risk factors (SBP, DBP, BMI and waist) between continually married respondents and their counterparts at 60-64 and 43 years among members of the NSHD and 44-45 years, among members of the NCDS. In a pooled analysis with both cohorts, an interaction term for marital history and cohort was included to investigate the possibility of inter-cohort differences in the association between marital history and risk factors. Within cohort gender interactions with marital history, on risk factors for CVD were also explored. There were no evidence for differences in the association between marital status and BMI using categorical and continuous measures, and thus only continuous measures are presented in the results chapters.

3.4.2 Objective 2

To investigate the role of the following predictors: childhood and early adulthood factors (father's social class, behavioural problems and educational attainment) on the likelihood of marriage, divorce and widowhood, and to investigate the effect of these factors on the association between marital history and CVD. To explore whether predictors of marital status; and their role on the association between marital history and CVD, varies by gender. This objective will be investigated among members of the NSHD at 60-64 years and 43 years, and members of the NCDS at 44-45 years of age.

3.4.2.1 Analytical sample members of the NSHD at 60-64 years, for objective 2.

For objective 2, the sample for analysis was derived from the main sample N=2259 respondents described for objective 1. This sample was further reduced to all those with complete information on socioeconomic factors (father's social class and educational attainment) and conduct problems. The remaining sample included N=1940 respondents of whom 52.4% were female. There was little evidence for systematic differences in the likelihood of exclusion from sample 2, among members of the NSHD at 60-64 years. The distribution of marital history, CVD diagnosis, and risk factors for CVD and potential confounding factors among members of the analytical sample at 60-64 years is shown in Table 3.7.

3.4.2.2 Analytical sample members of the NSHD at 43 years and members of the NCDS at 44-45 years, for objective 2.

The sample included respondents from analyses pertaining to objective 1, and was further restricted to those with complete information on father's social class, educational attainment and behavioural problems. The resulting analytical sample was N=2753 and N=6599 for members of the NSHD and NCDS at 43 and 44-45 years, respectively. The distribution of marital history, risk factors for CVD and potential confounding factors among members of the analytical samples, is shown in Table 3.8.

Respondents from the original sample, who were not included in the analyses for objective 2, varied on several factors from those who were included for each of these samples. Among members of the NCDS those who were single and from a non-manual class were less likely to have information on all three potential confounders, and therefore less likely to be included in the sample for objective 2. Higher levels of education, and being previously married was associated with a lower likelihood of having information on all three confounders, and were therefore less likely to be in the sample for objective 2. The impact of non-random exclusion on results will be discussed in relation to results, Chapter 5.

3.4.2.3 The distribution of confounding factors, among the analytical sample at 60-64 and 43 years among members of the NSHD, and at 44-45 years for members of the NCDS

The distribution of marital history, CVD prevalence and risk factors for CVD for each of these samples is similar for samples employed in objective 1, see sections 3.4.1.4 and 3.4.1.5 . Therefore, the distributions of father's social class, educational attainment and behavioural problems only are discussed.

At 60-64 years, a larger proportion of respondents in the analytical sample were from a manual background. A larger proportion of respondents had not attained any qualifications or lower secondary level education only, relative to higher levels of education. The distribution of exposure and outcomes appear to vary by gender among members of this sample. Conduct problems were lower for women, than men (Table 3.7).

At 43 years the proportion of respondents with some qualifications was higher for men, among members of the NSHD. Among both cohorts, behaviour problems were lower among women relative to men. All of these differences were statistically significant, $p<0.05$. A smaller proportion of respondents from the NCDS were from manual backgrounds. A binary variable was created to distinguish those with no qualifications, from those who had attained some qualifications. When compared by cohort it became apparent that a larger proportion

of those from NCDS were likely to have gained some qualifications. This is reflected in the larger number of respondents from the NSHD with no qualifications, in Table 3.8.

Table 3.7 The distribution of marital history, CVD prevalence, risk factors for CVD, father's social class, educational attainment and conduct problems among members of the NSHD at 60-64 years of age.

			Overall			Men			Women	Gender differences
			N=1940			N=926			N=1014	
Marital History at age 60-64		**%**	**N**		**%**	**n**		**%**	**n**	**ns**
Continually married		60.6	1175		62.8	581		58.6	594	ns
Single		4.5	87		5.5	51		3.6	36	Ns
Widowed		6.1	118		3.1	29		8.8	89	P<0.001
Divorced		12.6	244		12.0	111		13.1	133	ns
Remarried		16.3	316		16.6	154		16.0	162	ns
			N=1868			**N=901**			**N=967**	
CVD		**%**	**N**		**%**	**n**		**%**	**n**	
Yes		6.6	124		9.8	88		3.7	36	P<0.01
No		93.4	1744		90.2	813		96.3	931	
Risk factors for CVD	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	
Systolic blood pressure (mmHg)	1661	139.5	19.22	790	142.9	18.91	871	136.4	18.99	P<0.01
Diastolic blood pressure(mmHg)	1661	79.2	10.24	790	80.9	10.24	871	77.7	9.99	P<0.01
BMI kg/m^2	1666	28.0	4.95	787	27.9	4.07	879	28.1	5.62	**ns**
BMI (categorical)			**N=1666**			**N=787**			**N=879**	**ns**
		%	**N**		**%**	**n**		**%**	**n**	**ns**
Underweight		0.5	9		0.3	2		0.8	7	
Normal		27.9	465		24.4	192		31.1	273	P=0.004
Overweight		42.5	708		47.9	377		37.7	331	**ns**
Obese		29.1	484		27.5	216		30.5	268	**ns**
	N	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	
Waist (cm)	1664	96.4	12.9	788	100.9	11.08	876	92.4	12.13	P<0.01
Father's social class			**N=1940**			**N=926**			**N=1014**	
		%	**n**		**%**	**n**		**%**	**n**	
Manual		55.4	1075		55.6	515		55.2	560	
Non-manual		44.6	865		44.4	411		44.8	454	ns
Educational attainment at 26 years			**N=1940**			**N=926**			**N=1014**	
		%	**n**		**%**	**n**		**%**	**n**	
No qualifications		32.7	635		33.4	309		32.2	326	
Lower Secondary		28.7	557		20.4	189		36.3	368	P<0.001
Advanced Secondary		27.3	529		29.2	270		25.5	259	ns
Degree level		11.3	219		17.1	158		6.0	61	P<0.001

	N	Mean	SD	N	Mean	SD	N	Mean	SD	
Conduct problems	1940	8.5	1.54	926	8.6	1.61	1014	8.4	1.47	P=0.003

SD=standard deviation; Gender differences reflect significant differences in the distribution of CVD, systolic blood pressure and waist between men and women, in the analytical sample

Table 3.8 The distribution of marital history, CVD prevalence, risk factors for CVD, father's social class, educational attainment and behavioural problems among members of the NSHD at 43 years of age, and members of the NCDS at 44-45 years of age.

	NSHD at 43 years							NCDS at 44-45 years						
	Men N=1376			Women N=1377			Gender differences	Men N= 3190			Women N=3401			Gender differences
Marital History	**%**		**n**	**%**		**N**		**%**		**n**	**%**		**n**	
Continually married	69.2		952	67.3		927		61.4		1959	58.0		1971	
Single	7.6		105	4.1		56	P<0.001	11.5		366	9.6		326	P<0.001
Widowed	0.6		8	1.7		24	P=0.02	0.4		14	1.2		42	P=0.02
Divorced	11.3		155	14.2		195	P=0.01	13.9		443	16.9		573	P<0.001
Remarried	11.3		156	12.7		175		12.8		408	14.4		489	P=0.05
Risk factors for CVD	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**		**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	
Systolic blood pressure (mmHg)	1359	125.0	15.62	1355	121.7	16.48	P<0.001	3175	132.5	14.84	3356	120.2	15.61	P<0.001
Diastolic blood pressure(mmHg)	1359	82.1	12.20	1355	77.4	12.50	P<0.001	3175	82.3	10.97	3356	75.8	11.00	P<0.001
BMI kg/m^2	1374	25.7	3.47	1367	25.1	4.76	P<0.001	3155	27.9	4.21	3358	26.9	5.43	P<0.001
Waist (cm)	1368	91.9	9.80	1373	77.8	11.22	P<0.001	3184	98.9	19.49	3388	85.5	12.84	P<0.001
BMI (categorical)			**N=1374**			**N=1367**				**N=3155**			**N=3358**	
	%		**N**	**%**		**n**		**%**		**n**	**%**		**N**	
Underweight	0.6		8	1.90		26		0.22		7	1.0		32	Ns
Normal	43.7		601	60.0		806		23.8		752	42.8		1436	Ns
Overweight	44.8		616	25.7		351	P<0.001	1595		1595	33.1		1111	P<0.001
Obese	10.8		149	13.5		184		801		801	23.2		779	Ns
Father's social class			**N=1376**			**N=1377**				**N=3190**			**N=3401**	
	%		**N**	**%**		**n**		**%**		**n**	**%**		**N**	
Manual	59.3		816	58.8		810		64.6		2059	65.3		2219	Ns
Non-manual	40.7		560	41.2		567		35.5		1131	34.8		1182	
Educational attainment at 26 years			**N=1376**			**N=1377**				**N=3190**			**N=3401**	
	%		**N**	**%**		**n**		**%**		**n**	**%**		**N**	
No qualifications	37.0		509	37.9		522		18.8		600	23.6		802	
Lower Secondary	21.5		296	35.1		483	P<0.001	30.1		959	38.9		1323	
Advanced Secondary	27.5		379	21.9		302	P=0.02	20.2		643	10.1		345	p<0.001
Degree level	14.0		192	5.1		79	P<0.001	31.0		988	27.4		931	p<0.001
	N	**Mean**	**SD**	**N**	**Mean**	**SD**		**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	
Behavioural problems	N=1374	8.8	1.75	N=1377	8.5	1.5	P<0.001	N=3190	8.9	8.7	N=3401	6.4	7.28	P<0.001

SD=standard deviation; Gender differences reflect significant differences in the distribution of CVD, systolic blood pressure, diastolic blood pressure, BMI, waist circumference and behavioural problems between men and women of both cohorts, in the analytical sample.

3.4.2.4 Statistical Analysis employed for objective 2

For objective 2, logistic regressions were employed to regress the likelihood of marriage, divorce and widowhood on to socioeconomic factors (father's social class and educational attainment), and behavioural problems. A complete case analysis was conducted, including respondents with complete information on marital history, any outcome and all three predictors. A sensitivity analyses was conducted to assess whether the exclusion of respondents who did not have information on all three potential confounders, on relationships between each of the potential confounders with marital status and CVD, and on the relationship between marital history and CVD. No differences in estimates were found, and thus only the results of the complete case analysis are presented.

To explore the role of these factors on the association between marital history and risk of cardiovascular disease, regression estimates of marital history and cardiovascular disease was estimated in 5 models. The first model estimated bivariate associations of marital history, father's social class, educational attainment, behavioural problems and each of the outcomes of CVD (Outcome measures). Model 2, Model 3, Model 4 estimated the association of marital history with CVD after adjustment for father's social class, educational attainment and behavioural problems, respectively. The fifth model assessed the association between marital history and each of the outcomes, and simultaneously adjusted for father's social class, educational attainment and behavioural problems.

3.4.3 Objective 3

To investigate whether time since marital loss moderates relative differences in BMI and SBP between married and divorced persons, and whether this relationship varies by gender. This objective will be investigated among members of the NSHD.

The purpose of objective 3 was to investigate if relative differences in SBP, DBP and BMI trajectories between married and divorced persons changed with time since divorce. These trajectories were based on repeat measures of each of these outcomes at 3 points: 43, 53 and 60-64 years. Trajectories were compared between respondents who were continually married from 36 years onwards (up until 60-64 years), and those who had experienced a first divorce between 36-43 years.

Respondents who had divorced between 36-43 years were chosen for this analysis because observations on at least three occasions are required to estimate linear change. Prior sweeps of data could not be used as a measure of blood pressure (or BMI) closest to the time of divorce, was sought. This was so that the short term effects of divorce could be ascertained.

3.4.3.1 Analytical sample

The eligible sample included respondents for whom there was complete information on marital status and SBP/BMI at one point in time at least. All of these respondents were in their first marriage by 36 years of age. The sample included N=1480 respondents. Of these 1480 respondents, 230 had experienced divorce between 36-43 years. Among this group of respondents 126 (54.8%) experienced a remarriage, of whom 39.7% were women

3.4.3.2 Statistical analyses

The statistical analyses employed to investigate the effect of marital status SBP, DBP and BMI were identical. Therefore the methods employed will be described for BMI only. Since there were multiple measurements of BMI per individual, data were converted from wide to long format. This is so that multiple measures of BMI per individual were used as part of the analysis, to assess intra-individual change. Person-level trajectories of BMI were estimated using multi-level growth models, with measurement occasion nested within participant.

The basic growth model for all analyses included a fixed term for an intercept capturing initial BMI at 43 years. Time was denoted by annual increase in years. Thus relative differences in BMI trajectories by marital status, reflected differences in BMI change per year. Random terms for an intercept, capturing each participant's deviation from initial BMI and a linear term for time to capture each participant's deviation from the overall slope were included. Marital status and an interaction term between marital status and age were added to this model. This was to capture both initial differences in BMI between married and divorced respondents, as well as differences in the rate of change in BMI over time. Adjustments were made for subsequent marital transitions experienced by the divorced group. This is to reduce the potential effect of subsequent marital transitions on trajectories of BMI for the divorced group. For example an attenuation of the effects of divorce on BMI or SBP over time may be the effect of entering a new marriage rather than a declining effect of divorce. Similarly, a constant or increasing effect of divorce on BMI or SBP over time may reflect effects of a subsequent divorce. The results of this analysis are presented in Chapter 6.

3.4.4 Sources of attrition

As discussed in section 3.1 there is evidence to suggest that attrition varies by sociodemographic factors, and factors pertaining to health throughout the life course, among members of both the NSHD and NCDS.

Some additional work has been conducted, as part of this thesis, to investigate how factors relating to both marriage, the risk of cardiovascular disease, and potential mediating factors of this relationship e.g. health behaviours and psychological distress contributes to differences in non-response and subsequently, inclusion from the analytical samples used

for the present study. This work was conducted among members of the NSHD. Responents who were and were not part of the sample at 60-64 and 43 years of age, were compared on a range of factors, to those who were in the sample. The results of these analyses, are presented in Table 3.9.

It is evident that attrition varies by a range of factors which are relevant to both marital status and CVD. Disadvantage in both childhood and adulthood, as evidenced by father's social class, lifetime SEP and educational attainment, is associated with a higher likelihood of attrition. Attrition at age 60-64 is higher among those who are at a higher risk of CVD. Being diagnosed with CVD at 53 years, is associated with double the likelihood of attrition at 60-64 years;the likelihood of attrition is also higher among predominant and life-long smokers relative to those who have never smoked. Those with higher mean levels of blood pressure, BMI and waist circumference are also associated with a higher risk of attrition, though estimates are very small in magnitude. Similiarly – though estimates are small -higher levels of psychological distress and a tendency toward problematic alcohol consumption are associated with a higher likelihood of attrition.

Loss to follow up is an inherent problem of longitudinal and survey data. In the event that loss to follow up is non-random, this can lead to biased conclusions about the association between two factors. For example, there is evidence to suggest that the risk of attrition by age 60-64 was greater among those who had been diagnosed with CVD at 53 years, had never married or had experienced a divorce. If loss to follow up was more common among those who experienced a marital loss/remained unmarried and were at a higher risk of CVD, then the analytical sample would include only the healthiest of those who were unmarried, previously married or remarried. Thus differences in CVD prevalence between unmarried and remarried persons, and that of their continually married persons wouldn't be apparent. The potential impact of non-random loss to follow up on the results of the present study, are discussed in Chapter 7.

Table 3.9 The likelihood of not being in the analytical sample, for the present study, among members of the NSHD at 43 and 60-64 years of age by factors throughout the life course.

		Age 60-64	Age 43
Sources of attrition	N	OR	OR
Sociodemographic factors			
Women	2547	1	1
Men	2815	1.39***	1.29***
Non-manual father's social class	1899	1	1
Manual father's social class	2774	1.44***	1.19***
Degree level or above at age 26	411	1	1
No qualifications at age 26	1765	2.33***	1.50***
Lower secondary qualifications at age 26	1216	1.52***	
Life time SEP Social class 1			
Life time SEP Social class 4	952	1.98***	
Life time SEP Social class 5	345	1.76***	
Life time SEP Social class 6	129	1.58**	
Marital status			
Married at age 36	2790	1	
Single at age 36	266	1.58***	
Divorced at age 36	253	1.63***	
Married at age 43	3498	1	
Single at age 43	611	4.02***	5.38***
Divorced at age 43			0.21***
Married at age 53	2328	1	
Single at age 53	183	2.29***	
Widowed at age 53		1.58*	
Divorced at age 53		1.73***	
Health/well being			
Conduct problems in adolescence	4201	1.18***	1.09***
Psychological distress at 43 years	3160	1.03***	
Psychological distress at 53 years	1954	1.07***	
Psychological distress at age 60-64	2185	1.02***	
SBP at age 43		1.01***	
DBP at age 43		1.01**	
BMI at age 43		1.03***	
Waist circumference at age 43		1.02***	
Waist circumference at age 53		1.01***	
Not diagnosed with CVD			
Diagnosis of CVD at 53 years			
Problematic alcohol consumption age 43	201	1.64***	
Problematic alcohol consumption age 53	1380	1.50***	
Smoking History			
Non-smoker	950		
Predominantly smoker	715	1.67	
Life-long smoker	621	2.95	

*p=0.05;**p<0.05;p<=0.001 - only significant results are shown.

4 Chapter 4: The association between marital history and CVD for members of the NSHD at 60-64 and 43 years, and for members of the NCDS at 44-45 years of age

This chapter explores objective 1 of the present study, among members of the NSHD at 60-64 years and at 43 years, and members of the NCDS at 44-45 years. It was hypothesized that the risk of CVD would be lowest among those who were continually married. The hypothesized pathways through which the risk of CVD may be higher for unmarried and remarried persons is shown in Figure 2.1. Each of these pathways were not explored, however. The exposures and outcomes explored in the present study are shown in Figure 2.4-Figure 2.6.

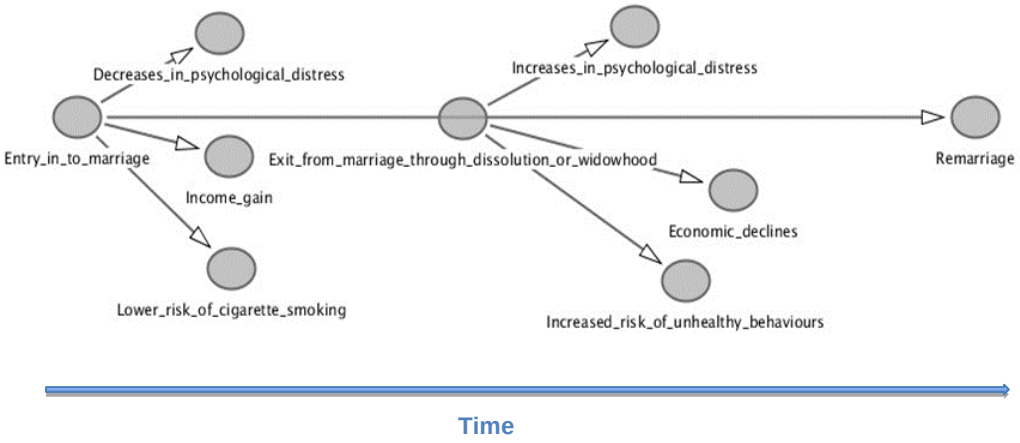

Figure 4.1 Hypothesized pathways of the long term effects of widowhood or divorce

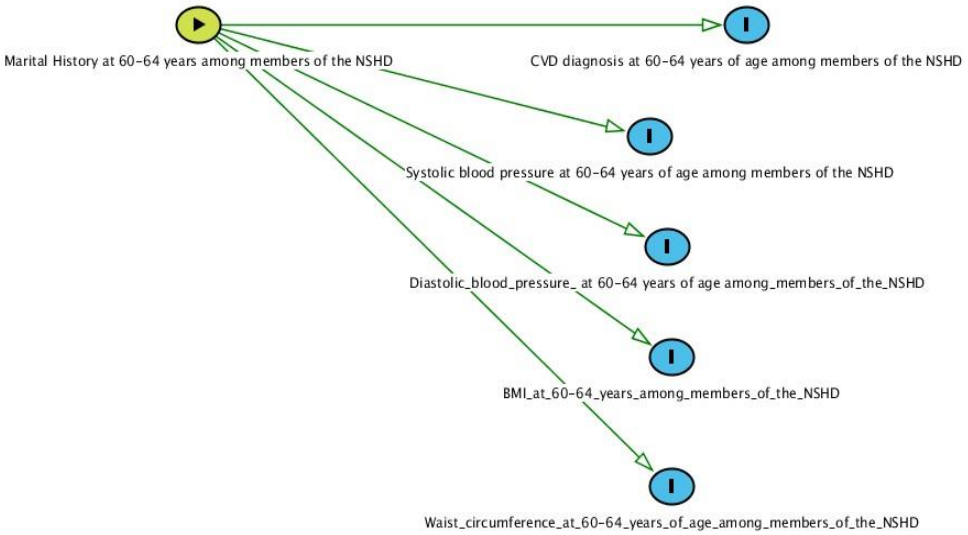

Figure 4.2 - Analytical model, objective 1, among members of the NSHD at age 60-64

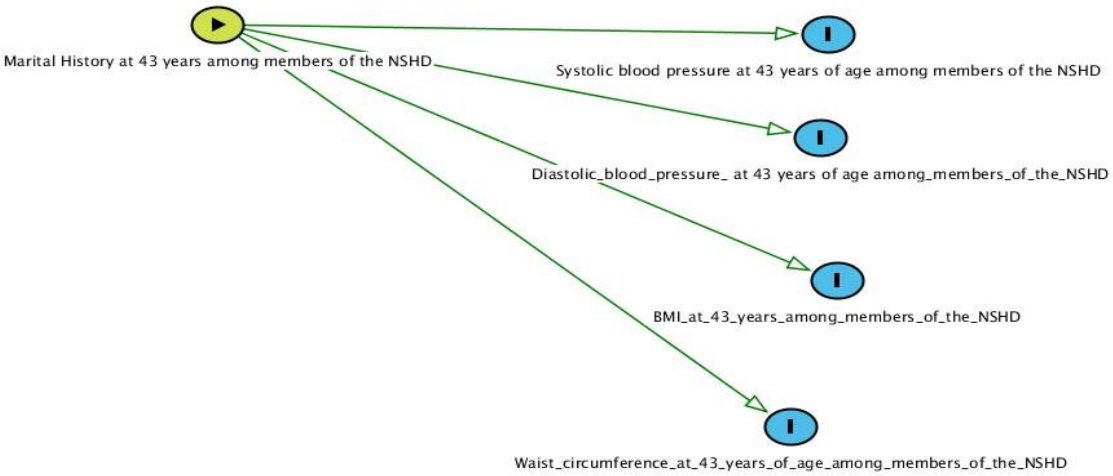

Figure 4.3 - Analytical model, objective 1, among members of the NSHD at age 43

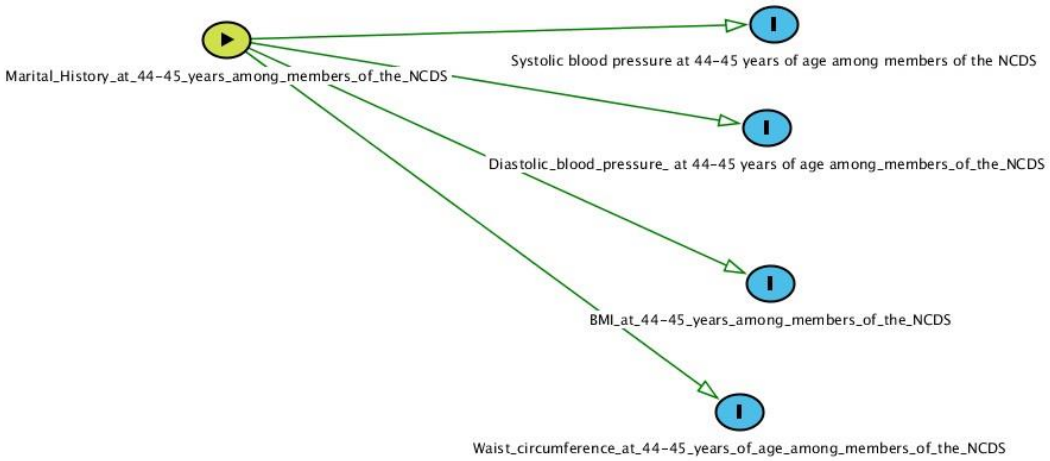

Figure 4.4 - Analytical model, objective 1, among members of the NCDS at age 44-45

4.1 Analytical sample and statistical analyses

Five outcomes including doctor-diagnosed CVD, SBP, DBP, BMI and waist were employed to assess the risk of CVD N=2259 respondents of whom 52.2% are women, at 60-64 years of members of the NSHD. Logistic regressions were conducted to investigate differences in CVD prevalence between continually married persons and their single, divorced, widowed and remarried counterparts. Results are presented in Table 4.1. Linear regressions were conducted to investigate differences in SBP, BMI and waist circumference by these groups, the results of which are presented in Table 4.2.

The association between marital history and risk of CVD was assessed at 43 years for members of the NSHD (N=3239) and 44-45 years for members of the NCDS (N=9080). Linear regressions were conducted to investigate relative differences on CVD risk factors (DBP, SBP, BMI and waist circumference) by cohort. In a pooled analysis with both cohorts, an interaction term for marital history and cohort type was included to investigate the possibility of inter-cohort differences in the association between marital history and risk

factors. Since no interactions between marital history and cohort were found, cohort stratified analysis are presented in this chapter. The association of marital history with SBP, DBP, BMI and waist circumference with marital history among members of both cohorts is shown in Table 4.3-Table 4.6. The results of pooled analyses can be seen in Appendix 1, of Appendices.

4.2 Relative differences in CVD and risk factors for CVD, at 60-64, by marital history

The risk of being diagnosed with CVD by 60-64 years for those who are single, divorced, widowed and remarried, is shown relative to that of their continually married counterparts. The proportion of respondents who have been diagnosed with CVD is shown by marital history. On the basis of these proportions, odds ratios are employed to denote the risk of being diagnosed with CVD, for single, divorced, remarried and widowed persons relative to their continually married counterparts.

Results in Table 4.1 show that the likelihood of being diagnosed with CVD was over three times higher 3.45 (1.44, 8.22) for widowed compared to continually married women. Trends in the data suggest that the likelihood of being diagnosed with CVD was relatively higher for unmarried and remarried women. This was especially true for single relative to continually married women OR= 2.61 (0.74, 9.27). Differences were only significantly different between continually married and widowed women, however.

Table 4.2 shows the mean of each of the risk factors at age 60-64, by marital history. On the basis of mean differences in risk factors by marital history, coefficients are employed to denote relative differences in mean systolic blood pressure, diastolic blood pressure BMI and waist circumference between continually married persons and their counterparts

With the exception of differences in blood pressure (both systolic and diastolic) between divorced and continually married persons, there is no consistent relationship between marital history and blood pressure Table 4.2. Both systolic and diastolic blood pressure is relatively lower among divorced persons. For married men, men systolic and diastolic blood pressure was 142.6 mmHg and 81.1 mmHg, respectively. The corresponding figures for divorced men were 141.5 mmHg and 80.5 mmHg respectively. Married women had a mean SBP and DBP of 136.7 mmHg and 77.5 mmHg, respectively. The corresponding figures for divorced women are 131.2 mmHg and 74.9 mmHg respectively. Differences are significant for continually married compared with divorced women only, however.

The relationship between marital history and BMI shows no significant trends for either men or women. Relative to continually married men and women there is evidence for both higher and relative BMI among other marital groups. Relative to continually married men and

women there is evidence for lower BMI among those who are single. The same is true for remarried men. BMI among divorced and widowed men and women and remarried women, is higher than for their continually married counterparts. Relative differences in BMI are small however, and do not attain statistical significance.

Trends in the data suggest that waist circumference is relatively higher for all but remarried men compared to their continually married counterparts, though all differences are small, (Table 4.2).

Table 4.1 Regression estimates (odd ratios) for CVD by marital history at 60-64 years among men and women from NSHD

	Men N=1050			Women N=1124		
Marital History	**CVD prevalence**	**OR**	**95% CI**	**CVD prevalence**	**OR**	**(95% CI)**
Continually married +	9.7	1		2.6		
Widowed	11.8	1.24	(0.42, 3.62)	8.4	3.45	(1.44, 8.22)
Divorced	8.9	0.90	(0.46, 1.77)	4.7	1.86	(0.76, 4.57)
Remarried	12.0	1.27	(0.75, 2.14)	3.3	1.28	(0.50, 3.31)

+=reference group *=p=0.05 **=p<0.05 **=p<=0.01; CVD prevalence = self-reported doctor diagnosed by 60-64 years. Single men were omitted from analysis, due to very small numbers of men among this group being diagnosed with CVD. OR=1, odds ratio to denote the reference category.

Table 4.2 Regression estimates (coefficients) for CVD risk factors by marital history, at 60-64 years among members of the NSHD

	SBP (mmHg) N= 911			DBP (mmHg) N= 911			BMI (kg/m$^{2)}$ N=909			Waist (cm) N=910		
	Mean	**Coefficient**	**(95% CI)**	**Mean**	**Coefficient**	**(95% CI)**	**Mean**	**Coefficient**	**(95% CI)**	**Mean**	**Coefficient**	**(95% CI)**
Men												
Marital History												
Continually married+	142.6			81.1			27.9			100.8		
Single	142.7	0.05	(-5.80, 5.89)	82.5	1.45	(-1.76, 4.66)	27.8	-0.10	(-1.38, 1.19)	101.6	0.78	(-2.72, 4.27)
Widowed	143.3	0.72	(-6.69, 8.13)	78.4	-2.70	(-6.77, 1.37)	28.3	0.47	(-1.15, 2.08)	102.3	1.53	(-2.80, 5.87)
Divorced	141.5	-1.08	(-5.10, 2.94)	80.5	-0.54	(-2.76, 1.66)	28.5	0.63	(-0.24, 1.51)	102.1	1.37	(-0.99, 3.73)
Remarried	142.6	-0.04	(-3.33, 3.25)	80.9	-0.19	(-2.00, 1.62)	27.6	-0.25	(-0.97, 0.47)	99.4	-1.33	(-3.25, 0.59)
Women	**SBP (mmHg)** N= 1010			**DBP (mmHg) N= 1010**			**BMI (kg/m$^{2)}$ N= 1018**			**Waist (cm) N= 1016**		
Marital History												
Continually married+	136.7			77.5			27.8			91.7		
Single	136.3	-0.46	(-7.22, 6.30)	77.6	0.14	(-3.45, 3.72)	27.1	-0.73	(-2.72, 1.25)	92.3	0.54	(-4.15, 5.22)
Widowed	137.8	1.06	(-3.18, 5.29)	78.5	1.08	(-1.16, 3.33)	28.6	0.74	(-0.51, 1.98)	93.7	1.91	(-1.01, 4.84)
Divorced	131.2	-5.54	(-9.25, -0.84)***	78.8	-2.52	(-4.48, -0.56)***	28.2	0.37	(-0.72, 1.45)	93.6	1.90	(-0.67, 4.47)
Remarried	136.3	-0.48	(-3.75, 2.79)	76.6	1.38	(-0.35, 3.11)	28.1	0.30	(-0.66, 1.26)	93.1	1.18	(-1.08, 3.43)

+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 SBP=Systolic blood pressure mmHg (10mmHg added if respondents reported being on blood pressure lowering medication) DBP=diastolic blood pressure mmHg (5mmHg added if respondents reported being on blood pressure lowering medication) BMI=Body mass index kg/^{2} Waist=Waist circumference, measured in centimetres .

4.2.1 Systolic blood pressure & marital history at for members of the NSHD (age 43) & NCDS (age 44-45).

Being unmarried (single, divorced or widowed) was associated with higher SBP among men from the NSHD. Differences attain significance between single and continually married men only 3.02 (0.17, 5.87). SBP was lower among all men from the NCDS birth cohort, relative to their continually married counterparts, though not significantly. Trends in the data suggest that divorced women from both cohorts have lower SBP than their continually married counterparts, Table 4.3. Though differences attain statistical significance between continually married and divorced women from the NSHD only, 2.35 (-4.72, 0.03).

4.2.2 Diastolic blood pressure at midlife for members of the NSHD (age 43) & NCDS (age 44-45).

Being unmarried was associated with higher DBP for all unmarried men from NSHD, though these differences were not significant. There was no consistent relationship between DBP and marital history among men from the NCDS. Trends in the data suggest that divorced status is associated with lower BMI among both cohorts, for women - Table 4.4..

4.2.3 Body Mass Index at midlife for members of the NSHD (age 43) & NCDS (age 44-45).

Overall, with some exceptions, there is evidence to suggest that BMI is lower for all groups relative to those who are in a continuous marriage. This is true for both cohorts. Relative to being in a continuous marriage, divorced status among men and widowed status among women, is associated with significantly lower BMI among members of the NSHD – Table 4.5. Single and widowed status among men from the NCDS, is associated with significantly lower BMI (Table 6.3).

4.2.4 Waist circumference at midlife for members of the NSHD & NCDS

Trends in the data suggest that the experience of a marital loss is associated with lower waist circumference for members of the NCDS, Table 4.6. This is reflected in the lower waist circumference for previously married and remarried persons. The results suggest that mean waist circumference is lower for unmarried men from the NCDS, though differences are only significant between divorced and continually married men -1.63 (-3.13, -0.13).

Interaction terms for marital history and cohort on risk factors, didn't attain statistical significance. Interaction terms between marital history and gender on risk factors, within each cohort did not attain statistical significance.

Table 4.3 Regression estimates (coefficients) for SBP (mmHg) by marital history, stratified by birth cohort and gender.

	NSHD at 43 years				NCDS at 44-45 years		
	Mean	**Coefficient**	**95% CI**		**Mean**	**Coefficient**	**95% CI**
Men N=1596				**Men N=4483**			
Marital History				**Marital History**			
Continually married (+)	125.0			**Continually married (+)**	132.2		
Single	128.1	3.02	(0.17, 5.87)	**Single**	133.4	1.21	(-0.19, 2.60)
Widowed	125.8	1.08	(-8.22, 10.38)	**Widowed**	128.9	-3.30	(-10.94, 4.33)
Divorced	127.2	2.27	(-0.25, 4.78)	**Divorced**	132.1	-0.10	(-1.39, 1.18)
Remarried	124.7	-0.18	(-2.60, 2.25)	**Remarried**	132.0	-0.13	(-1.46, 1.19)
	Mean	**Coefficient**	**95% CI**		**Mean**	**Coefficient**	**95% CI**
Women N=1590				**Women N=4512**			
Continually married(+)	122.0			**Continually married(+)**	119.9		
Single	124.1	2.15	(-1.75, 6.05)	**Single**	120.8	0.86	(-0.74, 2.46)
Widowed	120.2	-1.96	(-8.39, 4.48)	**Widowed**	121.7	1.77	(-2.71, 6.24)
Divorced	120.0	-2.35	(-4.72, 0.03)*	**Divorced**	119.4	-0.52	(-1.76, 0.71)
Remarried	122.1	0.27	(-2.23, 2.77)	**Remarried**	120.2	0.29	(-1.06, 1.63)

+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 SBP=Systolic blood pressure mmHg (10mmHg added if respondents reported being on blood pressure lowering medication)

Table 4.4 Regression estimates (coefficients) for DBP (mmHg) by marital history, stratified by birth cohort and gender.

	NSHD at 43 years				NCDS at 44-45 years		
	Mean	**Coefficient**	**95% CI**		**Mean**	**Coefficient**	**95% CI**
Men N=1596				**Men N=4482**			
Marital History				**Marital History**			
Continually married(+)	82.2			**Continually married(+)**	82.0		
Single	83.2	1.07	(-1.16, 3.29)	**Single**	83.0		(-0.01, 2.04)
Widowed	84.9	2.68	(-4.58, 9.94)	**Widowed**	80.3	-1.65	(-7.25, 3.95)
Divorced	83.0	0.94	(-1.02, 2.90)	**Divorced**	82.3		(-0.58, 1.31)
Remarried	90.1	-1.29	(-3.18, 0.60)	**Remarried**	82.5		(-0.44, 1.51)
	Mean	**Coefficient**	**95% CI**		**Mean**	**Coefficient**	**95% CI**
Women N=1590				**Women N=4512**			
Marital History				**Marital History**			
Continually married(+)	77.4			**Continually married(+)**	75.6		
Single	78.1	0.69	(-2.30, 3.69)	**Single**	75.8	0.20	(-0.92, 1.32)
Widowed	79.4	1.92	(-3.02, 6.88)	**Widowed**	77.1	1.47	(-1.66, 4.60)
Divorced	76.9	-0.58	(-2.40, 1.25)	**Divorced**	75.4	-0.23	(-1.09, 0.64)
Remarried	77.5	0.07	(-1.85, 1.99)	**Remarried**	76.2	0.54	(-0.40, 1.49)

+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 DBP=diastolic blood pressure mmHg (5mmHg added if respondents reported being on blood pressure lowering medication

Table 4.5 Regression estimates (coefficients) for BMI (kg/m^2) by marital history, stratified by birth cohort and gender.

	NSHD at 43 years				NCDS at 44-45 years		
	Mean	Coefficient	95% CI		Mean	Coefficient	95% CI
Men N=1617				**Men N=4460**			
Marital History				**Marital History**			
Continually married(+)	25.8			**Continually married(+)**	27.9		
Single	25.6	-0.26	(-0.89, 0.37)	**Single**	27.4	-0.50	(-0.89, -0.10)**
Widowed	24.9	-0.96	(-3.05, 1.13)	**Widowed**	26.6	-1.35	(-3.45,0.75)
Divorced	25.2	-0.61	(-1.17, -0.05)*	**Divorced**	27.4	-0.56	(-0.93,-0.20)**
Remarried	25.8	-0.01	(-0.55, 0.54)	**Remarried**	28.2	0.26	(-0.12,0.64)
	Mean	**Coefficient**	**95% CI**		**Mean**	**Coefficient**	**95% CI**
Women N=1608				**Women N=4508**			
Marital History				**Marital History**			
Continually married(+)	25.3			**Continually married(+)**	27.0		
Single	25.7	0.37	(-0.74, 1.48)	**Single**	26.6	-0.39	(-0.95,0.18)
Widowed	23.3	-2.01	(-3.91, -0.12)*	**Widowed**	27.3	0.32	(-1.21, 1.85)
Divorced	24.7	-0.63	(-1.32, 0.05)	**Divorced**	26.8	-0.22	(-0.66,0.22)
Remarried	25.2	-0.07	(-0.78, 0.65)	**Remarried**	26.9	-0.11	(-0.58, 0.36)

+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 BMI=Body mass index

Table 4.6 Regression estimates (coefficients) for waist circumference (cm) by marital history, stratified by birth cohort and gender.

	NSHD at 43 years				NCDS at 44-45 years		
	Mean	Coefficient	95% CI		Mean	Coefficient	95% CI
Men N=1609				**Men N=4501**			
Marital History				**Marital History**			
Continually married(+)	92.1			**Continually married(+)**	98.7		
Single	92.3	0.23	(-1.54, 2.00)	**Single**	98.3	-0.41	(-1.45, 0.63)
Widowed	90.9	-1.23	(-7.09, 4.63)	**Widowed**	97.2	-1.54	(-0.1,7.08)
Divorced	91.0	-1.12	(-2.69, 0.45)	**Divorced**	97.1	-1.63**	(-3.13, -0.13)
Remarried	91.4	-0.81	(-2.34, 0.71)	**Remarried**	99.1	0.43	(-1.11, 1.97)
	Mean	**Coefficient**	**95% CI**		**Mean**	**Coefficient**	**95% CI**
Women N=1613				**Women N=4550**			
Marital History				**Marital History**			
Continually married(+)	78.0			**Continually married(+)**	85.6		
Single	79.8		(-0.85, 4.38)	**Single**	85.2	-0.47	(-1.78,.83)
Widowed	75.9	-2.15	(-6.53, 2.22)	**Widowed**	86.0	0.34	(-3.28, 3.95)
Divorced	77.4	-0.66	(-2.26, 0.95)	**Divorced**	85.6	0.01	(-1.01, 1.02)
Remarried	77.7	-0.34	(-2.03, 1.34)	**Remarried**	85.1	-0.55	(-1.65, 0.56)

+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 Waist=Waist circumference, in centimetres

4.3 Discussion

The first objective of the present study was to investigate differences in the risk of CVD between continually married persons with that of their single, widowed, divorced and remarried counterparts. CVD prevalence was compared by marital history at 60-64 years, for members of the NSHD, only. Differences in all other outcomes (blood pressure, BMI and waist circumference) by marital history were assessed at 60-64 years and 43 years for respondents of the NSHD and at 44-45 years for members of the NCDS. Interactions between cohort type and marital history on relative differences in CVD at 43 years for members of the NSHD, and 44-45 years for members of the NCDS were explored. Within cohorts at all ages, an interaction of marital history with gender was explored. Throughout the course of this discussion, references will be made to members of the NSHD at both 43 and 60-64 years. In some instances, the terms mid-adulthood and older adulthood will be used interchangeably with NSHD at age 43 and NSHD at 60-64 years, respectively.

4.3.1 Summary of main findings: Relative differences in CVD for single, divorced, widowed and remarried persons relative to their continually married counterparts among members of the NSHD at 60-64 years and 43 years and members of the NCDS at 44-35 years of age.

As expected, there was a trend toward a higher likelihood of CVD diagnosis among unmarried women, relative to their continually married counterparts. Differences were only significant between widowed and continually married women. There was no evidence for an association of CVD diagnosis and marital history, among men.

There was no support for the hypothesis that blood pressure would be higher for unmarried and remarried, relative to continually persons at 60-64 years among members of the NSHD, or members of the NCDS. There was some evidence to suggest that being unmarried may be associated with higher blood pressure among men of the NSHD, at 43 years. Trends suggested that systolic and diastolic blood pressure was higher among all men, relative to their continually married counterparts. Differences in systolic blood pressure were only significant between single and continually married men.

Unexpectedly, divorced women from the NSHD had significantly lower SBP and DBP at 60-64 and lower SBP at 43, relative to their continually married counterparts. Trends in the data suggest that SBP is lower among divorced women from the NCDS too, though not significantly. The same is true for DBP and divorced status among women of the NSHD and NCDS at 43 and 44-45 years, respectively.

There was little evidence to support the hypothesis that BMI would be lower among single, relative to continually married persons, at 60-64 years among members of the NSHD.

Trends in the data did suggest relatively lower BMI among single persons, though differences did not attain statistical significance. There was some support of this hypothesis among men from the NCDS, for whom BMI was significantly lower for single, relative to continually married men. Trends in the data suggested that BMI among previously married persons was relatively higher at older age for members of the NSHD. The reverse appears to be true for members of the NSHD at 43 years, as well as for members of the NCDS at 44-45 years. BMI for divorced men and widowed women from the NSHD at 43 years was significantly lower than that of their continually married counterparts. Widowed relative to married status was associated with significantly lower BMI among men from the NCDS.

There was no evidence to support the hypothesis for lower waist circumference of single relative to married persons in either cohort, in both mid-adulthood and older-adulthood. With the exception of remarried men, trends in the data suggested that waist circumference at 60-64 years was relatively higher for all marital groups, though not significantly. Trends in the data also suggested that the experience of marital loss might be associated with lower waist circumference for men from the NCDS, as reflected in lower waist circumference among widowed, divorced and remarried men. Differences between continually married and divorced men only, attained significance.

Differences in the risk of CVD for members of the NSHD in mid-adulthood and members of the NCDS by marital history did not attain statistical significance. Gender differences in the association of marital history and CVD within cohorts, did not attain statistical significance.

4.3.1.1 Differences in CVD prevalence between widowed and continually married persons at 60-64 years among members of the NSHD: Comparison with previous findings & explanations

Relative to continually married women, the risk of a CVD diagnosis was three times higher for widowed women. This finding is in line with previous studies.[13,22] Previous studies have found that those who have experienced widowhood are at a higher risk of stroke,[180] incident coronary heart disease[60] CVD prevalence [13,22] and CVD incidence[13], relative to married persons. There is also evidence to suggest that the risk of mortality by CVD is relatively higher among those who are widowed.[73,74]

That there is a causal association between the onset of widowhood and risk of CVD is plausible in light of the secondary effects of widowhood. Financial declines, relapse among former smokers and a decline in psychological well-being are well documented effects of transition to widowhood, and risk factors for CVD. However, it is also important to consider the possibility of a spurious association, resulting from unmeasured confounders. For example, it is plausible that homogeneity between spouses may explain a higher risk of CVD among widowed women. Homogeneity between spouses on several factors including SEP,

[171] [172] [173] and psychological distress[54;155] have been documented. Each of these factors has been linked with both mortality and cardiovascular disease. It is therefore possible, that women who were at a higher risk of CVD due to psychosocial distress or coming from less advantaged backgrounds were also more likely to marry men who are prone to early death. Furthermore it is possible that a shared environment may contribute to similar health behaviours between spouses, which may increase the risk of mortality and CVD, resulting in a spurious association between widowhood and CVD among widowed women.

This is unlikely however, as has been shown by previous studies. Existing studies have attempted to assess the influence of homogamy and a shared environment on risk of mortality among widowed, relative to married persons. After adjustment for health status, morale, education, alcohol, smoking status, SEP of the household, region of residence, size of household, housing tenure and family disposable income, which captures both homogamy and the possible effects of a shared environment, the risk of mortality among widowed persons was still higher, than for their married counterparts. Therefore it is unlikely that the present results reflecting confounding from homogamy or shared environment between spouses.[118];[116]

There was no evidence to suggest that the risk of CVD diagnosis was higher among widowed relative to continually married men. The existing literature on relative differences in the risk of CVD has been inconsistent. Among widowed men, there is evidence for higher risk of stroke incidence, CVD prevalence and CVD mortality, relative to that of their married counterparts.[13,22,73,74,75] However, self-reported incident CHD and incidence CVD was comparable with that of married men.[13,84]

There are several potential reasons for why there was no evidence for a difference in the risk of CVD between widowed and continually married men. The present study employed a self-reported measure of CVD diagnosis. The use of self-reported outcome may underestimate relative differences in health between married and unmarried persons. This is because married persons are more likely to seek medical advice and in turn receive a medical diagnosis than their unmarried counterparts. An extensive discussion of the potential for measures of health which are reliant on a doctor-diagnosis, to bias associations between marriage and health is outlined in section 2.1.1.5. It is plausible that this bias may be particularly pertinent among men since women are more likely to take on the care-giving role in a spousal relationship.[93]

Secondly, it is also possible that there may be differences between men and women in the experience of widowhood. Firstly, financial decline post widowhood for women is greater than for men, which may pose greater risks for CVD among widowed women than men.[48]

Thirdly, there is evidence to suggest that the longer term effects of marital loss are larger for women, than men. [181] It is therefore possible that among men the commonly adverse effects

of marital loss on health, dissipate with time. Support for this assertion comes from a previous study which finds that while CVD prevalence was higher among widowed men and women, CVD incidence after an 8 year follow up was only higher among widowed women.[130]

A fourth explanation is that the present study did not distinguish widowed persons by the number of marriages they had previously experienced. There is evidence from one study to suggest that widowhood was associated with a higher risk of CVD prevalence only in the instance that they had experienced a marital loss prior to becoming widowed. [22] Whether there is a moderating effect of the number of marriages on relative differences in health between married and widowed persons for members of this cohort, and whether this moderating effect varies by gender remains to be explored.

4.3.1.2 Differences in CVD prevalence between, single, divorced, remarried and continually married persons at 60-64 years among members of the NSHD: Comparison with previous findings and explanations

There was no evidence for differences in the risk of CVD diagnosis between single, divorced and remarried persons with that of their continually married counterparts.

The existing literature on differences in risk of CVD between single and married persons yields inconsistent findings. There is evidence for higher blood pressure,[55,57] BMI,[55,60] triglyceride levels, HDL cholesterol, hypercholestrolaemia and hyperglycemia for single, relative to married men. [55] Furthermore single persons are at a higher risk of CVD mortality[73,74,77] coronary events[60] and stroke incidence[75], relative to their married counterparts. However, studies of self-reported CVD diagnosis have not found a higher risk among single persons. [13,13,83,84] A plausible explanation, therefore, is that the use of a self-reported diagnosis of CVD led to an underestimation of CVD diagnosis among single, relative to continually married persons.

There was no evidence for difference in the risk of CVD between divorced and continually married persons, in the present study. The existing literature provides evidence for a higher risk of CVD mortality, coronary events and a diagnosis of CVD among divorced relative to married persons.[60,73,74,75,77] One possible explanation for discrepancies between studies which found that divorced persons were at a higher risk of CVD mortality[73,77] and stroke incidence[75] and the present study is the use of self-reported diagnosis CVD in the latter. Indeed a previous study which found a higher risk of CVD diagnosis among divorced persons, supplemented their outcome with death by reported cases of CVD death. The inclusion of these cases may have allowed for a more objective measure and accurate CVD diagnosis among divorced persons.[13] Even among this study there was no evidence for differences in incidence of CVD between divorced and married men, only prevalence.

Further, one study failed to find differences in self-reported CHD incidence between married and divorced persons.[84]

However previous studies which have relied on a doctor diagnosis of CVD have found a higher risk of CVD diagnosis for divorced persons. [13,13,83,84] which was not replicated in the present study. Existing studies which found a higher risk of CVD diagnosis among divorced persons, were based on American samples. It is possible that differences in health care systems in the UK and the US may pose a higher risk of CVD among previously married persons in the US. As discussed in section 2.1.1.5, it is likely that married persons are more likely to seek health care, recognise their symptoms and seek advice. [96 97 93] Given this is the case, married persons may be more likely to avoid heart attacks/or stroke in the instance that they become aware of high blood pressure/being overweight and seek early or preventative treatment. In the UK, the NHS provides access to free health care for all. In the US, access to health care can be attained through health care insurance, outside of which access to medical consultations may be highly expensive. There is evidence from the existing studies on American samples to suggest that health care insurance coverage differs by marital status. Continually married women were more likely to have health insurance coverage than their divorced, remarried and widowed counterparts. Widowed women were least likely to have health insurance. Continually married men were more likely to have health insurance than their single, divorced, widowed and remarried counterparts. Therefore, there may be some compounding, from the US health care system, in inequalities of health-seeking behaviour, by marital status which poses unmarried persons in the US at a greater risk of CVD.

Since American divorcees are less likely than their continually married counterparts to have health insurance coverage,[13,22] they may be at a particularly high risk of being unaware of high blood pressure or other risk factors that are modifiable – and subsequently less likely to avoid a heart attack or stroke, placing them at even greater risk of CVD than their counterparts in the UK. Therefore, there may be some compounding, from the US health care system, in inequalities of health-seeking behaviour, by marital status.

There was no evidence for differences in the risk of CVD diagnosis between remarried and continually married persons. Only two studies have previously investigated this association. [13,22] These studies found that CVD prevalence is higher among remarried relative to continually married persons, and that CVD incidence is higher for remarried relative to continually married women. These studies were also based on American samples and found that health insurance coverage was lower for remarried relative to continually married persons. It is possible that differences in access to health-care between US and UK samples detailed above, may contribute to risk of CVD among Americans who have experienced a marital loss relative to their UK counterparts. Therefore while the use of self-reported measures may underestimate differences in the risk of CVD between married and previously

or remarried persons in UK samples, this bias may be smaller among US samples – for whom a marital loss may be associated with an even higher risk of acute CVD events.

4.3.1.3 Differences in blood pressure between single, widowed, divorced, remarried and continually married persons at 60-64 years and 43 among members of the NSHD and 44-45 years among members of the NCDS: Comparison with previous findings and explanations

The finding that single status is associated with higher SBP among single men from the NSHD is consistent with existing literature. [55,57,60,66] Possible explanations include higher levels of stress associated with being single relative to being married, which is associated with higher SBP.[182] These sources of stress could include relatively lower levels of wealth and absence of social support from marriage.

There was some evidence to suggest that blood pressure is lower for divorced, relative to married women. The finding that divorced status is associated with lower blood pressure for women from the NSHD is consistent with two other studies.[60] One possible explanation – proposed in section 2.1.1.3 – was that since other studies failed to correct for blood pressure lowering medication, which might be more common among divorced persons. However, this study corrected for blood pressure lowering medication and thus other explanations are considered.

Another possible explanation is low marital quality among married women of the NSHD. There is evidence for marital quality as a moderator of the impact on marital status on systolic blood pressure. That is, being married is associated with lower SBP compared with being single, divorced or widowed only in the instance that marital quality is high. Otherwise, the unmarried are at an advantage. A series of lab based experiments assessing the impact of negative marital interactions were associated with elevated blood pressure, particularly for women. There is also evidence that the recall of marital conflict elevated blood pressure, more so for women in poor quality marriages compared with women in high quality marriages. As discussed in section 0 a large proportion of respondents in this sample had married at least once. There is also homogeneity in the ages at marriage of respondents which suggests that there are strong societal norms governing marriages for members of the 0). It is possible therefore that respondents from this cohort may be unwilling to leave a marriage, even in the instance that marital quality is low. Thus the costs of staying in a low quality marriage may not necessarily be outweighed by the costs of divorce.

4.3.1.4 Differences in BMI between single, widowed, divorced, remarried and continually married persons at 60-64 years and 43 among members of the NSHD and 44-45 years among members of the NCDS:

Comparison with previous findings and explanations

There was some evidence from trends in the data, to suggest that BMI at 60-64 years was lower for single, relative to continually married persons. Furthermore BMI for single men from the NCDS was significantly lower, relative to their continually married counterparts. This is in line with previous studies which have been consistent in finding that BMI the risk of obesity is lower for single, relative to married persons. Furthermore this finding is plausible in light of differences in health and dietary behaviours, and social support by marital status. The presence of a partner is associated with more frequent and regular eating intervals – and it has also been reported that people eat more in the presence of others.[183,184] Further, married persons are less likely to smoke than their unmarried counterparts, which also makes it plausible that they will be heavier than their unmarried counterparts. [110,185]

In mid-life BMI for divorced men and widowed women of the NSHD was significantly lower than that of their continually married counterparts. The same was true for widowed men of the NCDS. The finding that previously married persons have lower BMI than their continually married counterparts is consistent with existing studies, which have found that BMI and the risk of being overweight or obese is lower for divorced and widowed persons relative to their continually married counterparts. Furthermore studies have found that transition from married to widowed or divorced status is associated with declines in weight. [17;79,80;82;130] This finding is plausible also in light of the secondary stressors of both divorce and widowhood. There is evidence for increases in psychological distress and a likelihood of relapse among former smokers post-transition out of marriage, section 1.1.3. Both psychological distress and smoking can result in weight loss, and therefore provide plausible pathways between a marital loss (divorce or widowhood) and weight loss. [111]

4.3.1.5 The potential role of bias, from attrition, on results in relation to marital history and CVD

With the exception of a higher risk of CVD diagnosis among widowed relative to continually married women, and higher SBP at 43 years among single relative to continually married men, there was little evidence for a higher risk of CVD among unmarried relative to married persons.

Bias due to attrition may also explain why differences in CVD prevalence were not apparent for continually married respondents and other marital groups. There was evidence to suggest that the risk of attrition by age 60-64 was greater among those who had been diagnosed with CVD at 53 years, had never married or had experienced a marital loss, as discussed in section 3.4.4.

If loss to follow up was more common among those who experienced a marital loss/remained unmarried and were at a higher risk of CVD, then the analytical sample would

include only the healthiest of those who were unmarried, previously married or remarried. Thus differences in CVD prevalence between unmarried and remarried persons, and that of their continually married persons wouldn't be apparent. The potential impact of selection bias on the present result, is discussed more extensively in Chapter 7.

4.3.2 Inter-cohort differences in the association between marital history and CVD – for members of the NSHD at 43 years and members of the NCDS at 44-45 years of age

Though inter-cohort differences in the association between marital status and risk factors for CVD didn't attain statistical significance, some differences are noteworthy.

While there was evidence for higher SBP among single men from the NSHD, this wasn't apparent for men from the NCDS. Further, while trends in the data suggest that SBP is lower for divorced women in both cohorts, this difference was larger and significant for women of the NSHD. It is possible that inter-cohort differences in marital status and CVD reflect differences in attitudes toward marriage and divorce. Data on attitudes toward marriage and divorce are not available for members of the NSHD, but differences in the distribution of marital status by cohort suggest that the perceived necessity of marriage may be greater for members of the NSHD, relative to members of the NCDS.

Among both cohorts, the largest proportion of respondents was in a continuous marriage, Table 3.6, section 3.4.1. However, by midlife, larger proportions of NCDS members had never married and were divorced, relative to members of the NSHD. Furthermore transitions in to and out of marriage were experienced later for members of the NCDS and the age of transitions in to marriage were more volatile among this group, relative to members of the NSHD who married within a very narrow age-range.

This is reflective of changes in trends to rates of marriage since the 1970s, which include a decrease in marriage rates and increase in divorce and cohabitation. The possible causes for changes to marital trends were discussed in section 1.1.4, and are summarized here, briefly. It has been purported that the declining influence of the church on individual life decisions, have lessened the likelihood that marriages will form in adherence to societal norms. Furthermore, a growing acceptance for cohabitation, sex and child-bearing outside of marriage, have reduced the urgency for marriage

Therefore remaining single – not married – may be a stressful situation for members of the NCDS than members of the NSHD, as adult partnerships formed through other partnerships e.g. cohabitation are now more acceptable. This may explain why SBP was higher among single men of the NSHD only relative to continually married men for whom marriage was deemed a greater necessity.

Further the stronger societal norms governing marriage and stigmatising against divorce might lessen the likelihood of divorce among members of the NSHD relative to members of the NCDS, in the instance that marital quality is low. This may explain why lower blood pressure among divorced relatively married women was more pronounced among NSHD members (-2.34) than NCDS members (-0.52). Since marital quality between members of each of these cohorts has not been compared, these suggestions are speculative only. There has been no investigation of marital quality for members of each of these cohorts and therefore these conclusions are speculative, only.

4.3.2.1 Differences in the association between marital history and risk factors for CVD at 43 and 60-64 years for members of the NSHD

There is some evidence, from the present findings, to suggest that relative differences in SBP and BMI between continually married persons and their counterparts differ by age at which this relationship is observed.

At older age there was no evidence to suggest that systolic blood pressure differed between single and continually married persons. However there was evidence for a relationship in mid-adulthood. SBP for single men was significantly higher than that of their continually married counterparts.

At older age there was no evidence to suggest that systolic blood pressure differed between single and continually married persons. However there was evidence for a relationship in mid-adulthood. SBP for single men was significantly higher than that of their continually married counterparts.

Trends in the data suggested that being widowed or divorced was associated with higher BMI relative to being in a continuous marriage, at older age. However at 43 years, there is evidence for lower BMI among divorced men and widowed women, relative to their continually married counterparts.

Since these analyses were based on different analytical samples, it is possible that this discrepancy is an outcome of bias in one sample. However it is possible that these differences are due to age of the sample employed. Some evidence for this assertion comes from the fact that BMI at 44-45 years for members of the NCDS also appears to be lower for previously married, relative to continually married persons. Therefore the impact of divorce or widowhood on BMI may vary by individual age.

Secondary effects of marital loss include: declines in economic well-being, increased psychological distress and relapse among former smokers. The response to a marital loss might vary depending on age however. Since the risk of smoking decreases with older age, it is possible that the higher risk of relapse among previously married ex-smokers may be

smaller at older, relative to younger ages. Therefore the finding that BMI was lower for previously married in middle-adulthood, but not at older age might – in part - reflect differences in smoking behaviour. The presence of children may contribute to differences in the experience of widowhood and divorce, by age. The stress of marital loss is plausibly exacerbated by single parenting. Further among remarried respondents, step children may be a source of stress. When respondents are at older age however, they are more likely to have adult children and thus single parenting doesn't remain an issue. Additionally, adult children may act as a form of social support for their parents. The larger pool of lone individuals at older ages – through an increased likelihood of widowhood – may increase social support available to older individuals who are no longer married relative to their younger counterparts. The additional stressors of children and absence of social support therefore might increase psychological distress for younger divorced and widowed persons, relative to their older counterparts, Psychological distress can increase the risk of maladaptive coping behaviours e.g. cigarette smoking which may in turn increase in a larger risk of weight loss among those who are divorced or widowed at younger, relative to older ages.

In addition to the moderating effects of age on marital status and CVD, another explanation is also plausible for intra-cohort age variation. Since the NSHD is a cohort study a lot of the respondents that reported being widowed or divorced in mid-adulthood would also have been divorced or widowed at older age. For differences in BMI to no longer be apparent at 60-64 years, suggest that the effect of divorce or widowhood is moderated by time since the onset of marital loss. The existing literature has indeed found that the effects of divorce on weight loss are short-lived, and that relative differences in BMI between married and previously married persons vary by the length of observation period. [17,81]This explanation is considered more extensively in Chapter 6– which explores differences in BMI and blood pressure between married and divorced persons, and the extent to which this relationship varies with time since the onset of divorce.

4.4 Strengths of the present study

This is the first study to investigate the association between marital history and CVD, among British cohorts. Secondly, some of the limitations of the existing studies on marital history and CVD are addressed in the present study. Two of the existing studies on marital history and CVD focussed solely on doctor-diagnosed measures of CVD. Self-reported measures may underestimate relative differences in health between married and unmarried persons, due to a higher tendency for married persons to seek health care and in turn receive a diagnosis. Therefore the use of doctor-diagnosed CVD is acknowledged as a limitation of the present study. However, the inclusion of risk factors for CVD, including blood pressure, BMI and waist circumference, allowed for an investigation of the association between marital

history and CVD with the use of measures which aren't reliant on a doctor-diagnosis. Further, the present study corrected for anti-hypertensive medication use, which has not been done in previous studies of marital status and blood pressure.

4.5 Limitations of the present analyses.

Data constraints made it difficult to assess the relationship of marital history with CVD, longitudinally. Specifically it was not possible to assess CVD incidence and changes in risk factors for CVD in relation to marital status changes. Therefore it is not possible to definitively decipher the direction of the relationships observed in the present study. The remainder of this discussion presents some of the data limitations, which lead to the use of a cross-sectional designs and assessess the possibility of reverse causation between CVD, risk factors for CVD and marital history.

To date, measures of CVD prevalence in NSHD have been assessed at 53 and 60-64 years only. Cases of CVD incidence between these two time points are few in number, and therefore it was not possible to compare CVD incidence by marital transitions between 53 and 60-64 years. Since differences in CVD prevalence, rather than CVD incidence, were compared between continually married and widowed persons, it is possible that the higher risk of CVD among widowed women reflects reverse causality. However there are no possible pathways through which being diagnosed could result in an increased risk of widowhood. It is of course possible that the higher risk of CVD may be spurious, and apparent as a result of unmeasured confounders. For example homogeneity on risk factors for CVD and mortality such as psychological distress and SEP, may contribute to a higher risk of becoming both widowed and developing CVD. Furthermore a shared environment between spouses – through similar lifestyles – may place both spouses at a greater risk of both mortality and CVD. However this is unlikely, as previous studies have found that widowhood is associated with a higher risk of mortality even after adjustment for shared lifestyles and homogamy between spouses.[116,118] Furthermore there is evidence for a higher risk of mortality from CVD, incident CHD, incident CVD, coronary events and stroke incidence for those who are widowed at baseline, relative to their married counterparts.[13,60,74,75] Therefore it is likely that higher CVD prevalence reflects a causal relationship between widowhood and the higher risk of CVD.

Risk factors were measured at several points in adulthood for members of the NSHD. To summarize briefly, blood pressure was measured from 36 years onwards and BMI at 20, 26, 36, 43, 53 and 60-64 years. However, the small number of marital transitions between data-waves made it difficult to assess changes in risk factors between widowed and married persons. Transitions from married to divorced status in relation to changes in BMI are explored in chapter 6, and therefore difficulties in assessing BMI changes in relation to widowhood only, are outlined. To assess changes in BMI for those who transitioned from

married to widowed status relative to those who didn't, measures of marital status would have to be ascertained at both marriage and widowed status. Measures of marital status were available at 26, 36, 43, 53 and 60-64 years of age. Therefore one solution would have been to assess changes in marital status between 26 and 36, 36 and 43, 43 and 53, and 53 and 60-64 years of age. However, stratifying respondents who had widowed between these time points would have resulted in very small numbers. Another possible solution was to compare changes in BMI between 26 and 60-64 years for those who were married at 26 and widowed by 60-64 relative to those who remained continually married over this period. While this approach would have increased the sample size, it potentially introduces other problems. There is consistent evidence to suggest that the risks of mortality is highest, closest to time of the onset of widowhood, thought to be owing largely to levels of grief which are highest at this point.[113,114,115,116,117,118,119,120,121,122] Therefore pooling together those who had experienced marital loss closest to the time of BMI at follow up (at 60-64) and those who had experienced widowhood at younger ages may have diluted the effects of widowhood, on weight loss.

Looking at cross-sectional relationships of BMI and marital history does not make it possible to rule out the possibility of reverse causation. However, it is unlikely that lower BMI would increase the likelihood of divorce and widowhood. An existing study has explored the role of selection from BMI in to divorced status, and found little support for selection from weight in to divorced status.[81] Furthermore longitudinal studies have been consistent in suggesting that transition from married to unmarried status is associated with a higher risk of weight loss, which adds to the credibility of the present findings in suggest that there is a causal relationship between the onset of marital loss and declines in BMI.

It was not possible to test mediating between widowhood and the risk of cardiovascular disease among members of the NSHD. Possible pathways between widowhood and increased risk of CVD among widowed women include: higher levels of psychological distress, economic declines and poor health behaviours. It was not possible to test mediating pathways between widowhood and the risk of cardiovascular disease, among members of the NSHD.

In order to test for mediation it would have been essential to demonstrate that a change from married to widowed status, for example, is associated with a an increase in psychological health, increase in cigarette smoking or problematic alcohol consumption and a decline in income. In adulthood, data collection took places at 26, 36, 43, 53 and 60-64 years. As an example, a change in psychological distress between two stages in adulthood would therefore have to be observed concurrently with changes in marital status between 26-36, 36-43, 43-53 and 53-60-64. Stratifying widowed respondents in this way would have resulted in very small numbers.

Though mediation could not be tested, it is likely that the present findings reflect causal associations between marital history and CVD. There is an abundance of relationship to suggest that the transition from married to widowhood and divorce is associated with an increase in psychological distress, a higher likelihood of cigarette smoking and financial declines, [8;49;49;50;52;56;57;73;80;13] all of which increase the risk of CVD and provide plausible pathways to weight loss. [31,88,89,90,91,92] Existing studies have found evidence to suggest that SEP, psychological distress and unhealthy lifestyles explain – to some extent – the higher risk of CVD incidence and CVD mortality among those who have experienced a marital loss and the risk of weight loss post-divorce.[13,17,74] Each of these studies also supports a causal interpretation of the present findings.

5 Chapter 5 – The confounding effects of father's social class, educational attainment and behavioural problems on the association between marital history and CVD among members of the NSHD at 60-64 and 43 years, and members of the NCDS at 44-45 years of age.

This chapter explores objective 2, the purpose of which is to assess the confounding effects of father's social class, educational attainment and behavioural problems on the association between marital history and CVD among members of the NSHD at 60-64 and 43 years, and members of the NCDS at 44-45 years.

5.1 Analytical sample and statistical methods

The sample was drawn from respondents with complete information on marital history and CVD, employed for analysis in objective 1. To briefly reiterate, this was N=2259 respondents for members of the NSHD at 60-64 years, N=3239 among members of the NSHD at 43 years and N=9080 among members of the NCDS at 44-45 years of age. Each of the three samples was then restricted to those with complete information on father's social class, educational attainment and behavioural problems. The resulting sample N=1927, N=2753 and N=6599 among members of the NSHD at 60-64 years, NSHD at 43 years and NCDS at 44-45 years, respectively.

Logistics regressions were employed to regress the likelihood of marriage, divorce and widowhood on to socioeconomic factors (father's social class and educational attainment) and behavioural problems Each of these measures has been described in chapter 3. The analytical model for this part of the analyses is depicted in Figure 2.7.

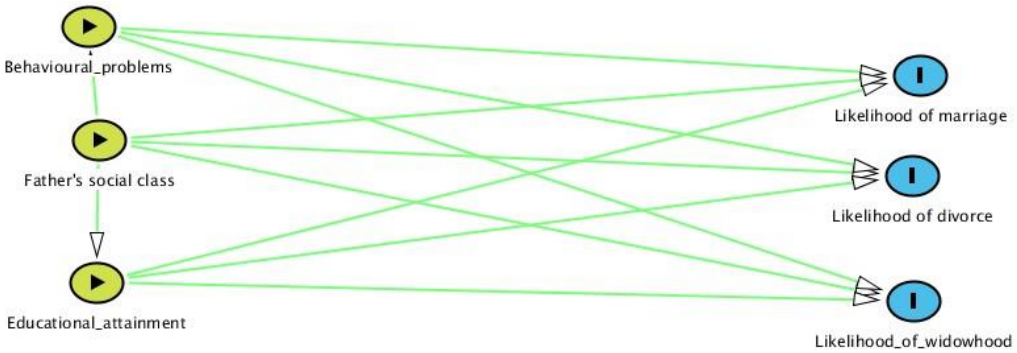

Figure 5.1 – Analytical model to assess the relationship of entry in to and out of marriage, with confounders.

The association of confounders with CVD and each of the risk factors (SBP, DBP, BMI and waist circumference) was investigated. Further to this, the regression estimates of marital history and risk factors were estimated in 5 models. The first model assessed bivariate associations of marital history, father's social class, educational attainment and behavioural problems with CVD diagnosis and risk factors for CVD. The second, third and fourth adjusted for father's social class, educational attainment and conduct problems respectively. The fifth model simultaneously adjusted for father's social class, educational attainment and conduct problems. The analytical model to show how confounding factors may result in spurious associations between marital history and CVD, is depicted in

Figure 2.8.

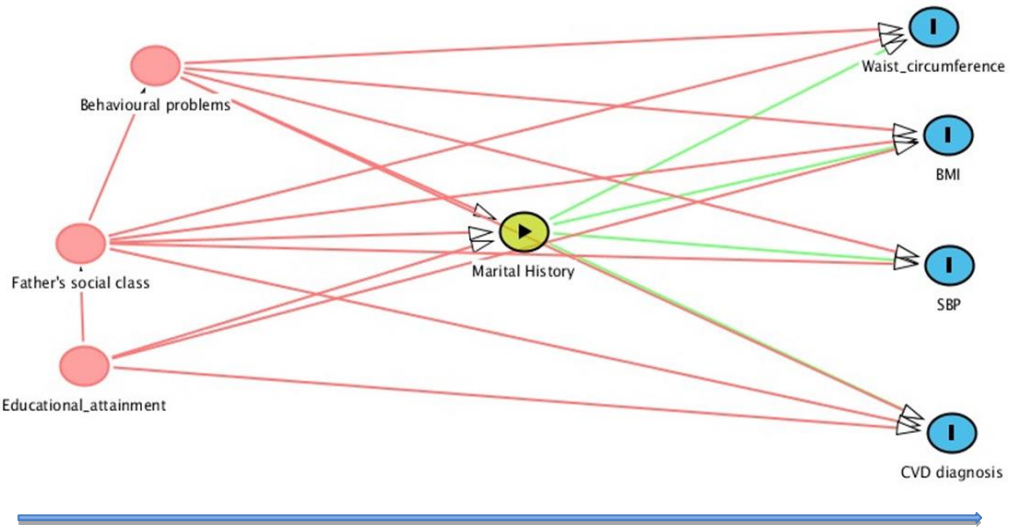

Figure 5.2 - Conceptual model to show the potential confounders of the relationsihp between marital history and CVD

5.1.1 SEP and the likelihood of marriage among members of the NSHD at 60-64 years.

Gender stratified estimates of association between father's social class and educational attainment with the likelihood of marriage is shown in Table 5.1. The proportion of those who were married by age 60-64 is shown by each category of father's social class and educational attainment. Odds ratios reflect the likelihood of marriage for those from a non-manual class, compared with a manual class. The likelihood of marriage among those with lower secondary education, advanced secondary education and a degree or above is compared with the likelihood of marriage among those with no qualifications.

There is no evidence to suggest that father's social class is associated with the likelihood of marriage for men. Father's social class was associated with marriage among women OR=0.50 (95% CI: 0.25, 0.10). This translates to a 50% lower likelihood of marriage among women from a non-manual background. There was no significant difference in the likelihood of marriage by educational attainment, for men. Trends in the data suggest however, that the likelihood of marriage among who had attain attained advanced secondary education

(94.8%) and a degree or above (95.6%) was higher for men with no qualifications (94.2%), Table 5.1. The likelihood of marriage was lower for women who had attained advanced secondary education (95.4%) compared with women who had no qualifications (97.2%), though not significantly. Having attained a degree or higher was associated with a lower likelihood of marriage by 74%, OR=0.26 (95% CI: 0.09, 0.76), among women. There was evidence for a significant interaction between sex and educational attainment on the likelihood of marriage, OR: 0.20 (95% CI: 0.05, 0.79) suggesting that higher levels of education was associated with a larger risk of not marrying among women, while the reverse was true for men.

Table 5.1 Regression estimates for the likelihood of marriage by socioeconomic status among members of the NSHD at 60-64 years.

	Men N=926			Women N=1014		
	% ever married	OR	(95% CI)	% ever married	OR	(95% CI)
Father's social class						
Manual +	94.6	1		97.5	1	
Non-manual	94.4	0.97	(0.55, 1.71)	95.2	0.50	(0.25, 0.10)*
Educational attainment						
No qualifications +	94.2	1		97.2	1	
Lower Secondary	93.7	0.91	(0.43, 1.94)	97.6	1.13	(0.44, 2.89)
Advanced Secondary	94.8	1.13	(0.55, 2.32)	95.4	0.58	(0.24, 1.41)
Degree level	95.6	1.33	(0.55, 3.27)	90.2	0.26	(0.09, 0.76)***

+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 Educational attainment was measured at 26 years. Father's social class was measured at age 4.

OR=1, odds ratio to denote the reference category.

5.1.2 SEP, psychological distress and the likelihood of divorce and widowhood among members of the NSHD at 60-64 years.

The association between father's social class, educational attainment and conduct problems with the likelihood of getting divorced and widowed is shown in Table 5.2. The proportion of those who were divorced and widowed by age 60-64 is shown by father's social class and educational attainment. Odds ratios are employed to denote the relative risks of divorce and widowhood. Relative risks reflect the likelihood of divorce and widowhood for those from a non-manual class, compared with a manual class. The risk of divorce and widowhood among those with lower secondary education, advanced secondary education and a degree or above is compared with the likelihood of divorce and widowhood among those with no qualifications. The risk of divorce and widowhood is shown per a 0.5 unit increase in conduct problems.

While trends in the data suggest that divorce was lower among those from a non-manual class, differences didn't attain significance, Table 5.2. Father's social class was significantly associated with widowhood among both men and women. Coming from a non-manual background was associated with a lower likelihood of widowhood by 21% OR=0.79 (95% CI: 0.54, 1.16) and 41% OR=0.59 (95% CI: 0.37, 0.94), among men and women respectively.

A protective effect of education on divorce was evident for men. As is evident the proportion of divorced men is lower among men with some educational qualification, relative to those with none Differences in the risk of divorce were only significant between men with no qualifications and those with advanced secondary education, for whom the risk of divorce was 42% lower odds ratio =0.58 (95% CI 0.35, 0.98). There is no evidence for an association between educational attainment and the risk of divorce among women.

The results in Table 5.2 also suggest that relatively higher levels of education are associated with a lower likelihood of widowhood among men, but only at the trend level. The results also suggest the same is true for women. The relative risk of widowhood is significantly lower only among women who have attained advanced secondary education for whom the risk is 65% lower OR=0.35 (95% CI 0.18, 0.67).

An increase in conduct problems of 0.5 units was associated with a 21% increase in the risk of divorce OR=1.21 (95% CI: .08, 1.36) among men. Trends in the data suggest a positive association between conduct problems and divorce for women, also. The results suggest that the risk of widowhood is positively associated with conduct problems for both men and women. The association is significant for women only, among whom an increase in conduct problems of 0.5 is associated with a 27% higher risk of widowhood OR=1.27 (95% CI: 1.11, 1.46).

Table 5.2 Regression estimates for the likelihood of divorce and widowhood by socioeconomic status and conduct problems among members of the NSHD, at age 60-64.

	Men				Women			
	N=692		N= 610		N=727		N=683	
	% divorced	OR (95% CI)	% widowed	OR (95% CI)	% divorced	OR (95% CI)	% widowed	OR (95% CI)
Men								
Father's social class								
Manual+	17.3	1	6.4	1	19.9	1	15.6	1
Non-Manual	14.4	0.81 (0.53, 1.22)	2.6	0.39 (0.16,0.93)**	16.4	0.79 (0.54, 1.16)	9.8	0.59 (0.37, 0.94)**
Educational attainment at 26 years								
No qualifications+	20.5	1	7.4	1	20.4	1	17.8	1
Lower Secondary	14.3	0.65 (0.36, 1.15)	4.0	0.52 (0.18, 1.48)	18.5	0.89 (0.56, 1.40)	14.1	0.76 (0.46, 1.26)
Advanced Secondary	13.0	0.58 (0.35, 0.98)**	4.3	0.56 (0.23,1.36)	15.1	0.70 (0.42, 1.15)	7.0	0.35 (0.18, 0.67)***
Degree level	15.2	0.70 (0.39, 1.25)	1.9	0.24 (0.05, 1.06)	21.3	1.06 (0.49, 2.29)	9.8	0.50 (0.17, 1.49)
Conduct Problems (per 0.5 unit increase)		1.21 (1.08, 1.36)***		1.14 (0.93, 1.40)		1.11 (0.98, 1.25)		1.27 (1.11, 1.46)**

+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 Conduct problems measured at 13 & 15 years – an average of measures of both time points is employed. Educational attainment was measured at 26 years. Father's social class was measured at age 4. OR=1, odds ratio to denote the reference category.

Table 5.3 regression estimates for the likelihood of marriage by socioeconomic position, by gender and birth cohort

	NSHD (43 years)						NCDS (44-45 years)					
	Men N=1376			Women N=1377			Men N=3190			Women N=3401		
	% ever married	OR	95% CI	% ever married	OR	95% CI	% ever married	OR	95% CI	% ever married	OR	95% CI
Father's social class												
Manual +	91.9			97.2			88.5			91.2		
Non-manual	93.0	1.18	(0.78, 1.77)	94.2	0.47	(0.27,0.81)***	88.6	1.01	(0.80, 1.27)	88.9	0.77	(0.61, 0.98)
Educational attainment												
No qualifications +	90.6			96.7			83.8			90.5		
Lower secondary	92.6	1.30	(0.77, 2.20)	97.1	1.13	(0.55, 2.31)	89.4	1.62	(1.20, 2.18)	92.7	1.34	(0.98, 1.83)
Advanced secondary	93.9	1.61	(0.96, 2.70)	94.4	0.56	(0.28, 1.12)	89.7	1.69	(1.21, 2.36)	89.6	0.90	(0.59, 1.37)
Degree level or above	93.8	1.56	(0.81, 3.01)	88.6	0.26	(0.11, 0.63)***	89.8	1.69	(1.26, 2.28)	87.3	0.72	(0.53, 0.98)

+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 Educational attainment was attained at ages 26 and 33 for members of the NSHD and NCDS, respectively. The corresponding ages for father's social class was 4 and 7 years, respectively.

5.1.3 The relationship between father's social class, educational attainment and marriage among members of the NSHD at 43 years, and members of the NCDS at 44-45 years of age

The association between father's social class, educational attainment and behavioural problems with the likelihood of getting married is shown in Table 5.3. The proportion of NSHD members who were married by 43 years and the proportion of NCDS members who were married by 44-45 years, is shown is shown by each category of father's social class and educational attainment. Odds ratios are employed to denote the relative risks of marriage. Relative risks reflect the likelihood of marriage for those from a non-manual class, compared with a manual class. The risk of marriage among those with lower secondary education, Advanced secondary education and a degree or above is compared with the likelihood of marriage among those with no qualifications. The risk of marriage is shown per a score increase in behaviour problems of 0.5 for members of the NSHD, and an increase in score of 1 for members of the NCDS. Results are shown separately for each cohort, by gender.

5.1.3.1 Father's social class and marriage

For men from both cohorts there was little evidence for a relationship between father's social class and the likelihood of marriage. Coming from a non-manual background was associated with a lower likelihood of marriage for women from the NSHD and women from the NCDS by 43% and 23% respectively. Though the relative difference in the likelihood of marriage by father's social class is larger among NCDS women, interaction terms between marital history and gender do not attain statistical significance.

5.1.3.2 Educational attainment and marriage

Trends in the data suggest that the likelihood of marriage is associated positively with educational attainment for men from both cohorts. Relative to men with no qualifications, the proportion of men who marry is higher among those with secondary education, advanced secondary education and a degree or above.

The proportion of women marrying is lower for those who have attained secondary education or a degree among both cohorts. However differences in the likelihood of marriage are only significant between women from the NSHD with no qualifications, relative to those who have attained a degree or above. The likelihood of marriage among women with a degree or above is 74% lower 0.26 (0.11, 0.63).

5.1.4 The relationship between father's social class, educational attainment and behaviour problems with marital loss (divorce and widowhood)

among members of the NSHD at age 43, and members of the NCDS at 44-45 years of age.

The association between father's social class, educational attainment and conduct problems with the likelihood of getting divorced and widowed, is shown in Table 5.4 and Table 5.5, respectively. The proportion of those who were divorced and widowed by midlife is shown by each category of father's social class and educational attainment. Odds ratios are employed to denote the relative risks of divorce and widowhood. Relative risks reflect the likelihood of divorce and widowhood for those from a non-manual class, compared with a manual class. The risk of divorce and widowhood among those with lower secondary education, advanced secondary education and a degree or above is compared with the likelihood of divorce and widowhood among those with no qualifications.

The risk of divorce is shown per a score increase in behaviour problems of 0.5 for members of the NSHD, and an increase in score of 1 for members of the NCDS. Results are shown separately for each cohort, by gender.

5.1.4.1 Father's social class and divorce

There was no evidence for a relationship between father's social class and divorce among members of the NSHD, Table 5.4. An association was apparent for both men and women from NCDS. The risk of divorce was lower by 28% and 18% for men and women who came from a non-manual background. However differences were only marginally significant among women p=0.05. There was evidence for a significant interaction between father's social class and cohort type on the risk of divorce among men, OR=0.87 (95% CI: 0.60, 1.26).

5.1.5 Educational attainment and divorce

There was no evidence for an association between educational attainment and divorce for members of the NSHD, Table 5.4. Among members of the NCDS there was an inverse association between educational attainment and the risk of divorce, such that the risk of divorce was lowest among those who had attained a degree or above. The protective effects of a degree were similar between men and women. There was a significant interaction between educational attainment and cohort type on the risk of divorce, among women. Specifically there was an interaction between having a degree or above and cohort type on the risk of divorce, OR=0.41 (95% CI 0.19, 0.87) among women.

5.1.5.1 Behaviour problems and divorce

With the exception of women from the NCDS, there was evidence for a positive association between conduct problems and the likelihood of divorce, Table 5.4. Though there was a

significant association between behaviour problems and the risk of divorce among men from the NCDS, the effects are small in magnitude OR=1.02 (95% CI 1.01, 1.03)

5.1.5.2 SEP & and widowhood

Trends in the data suggest that among men and women from both cohorts, the risk of widowhood is lower among those from a non-manual background. The difference is only significant among women from the NCDS for whom the risk of widowhood associated with coming from a non-manual class was 53% lower OR= 0.47 (0.23, 0.10). There was no evidence for an association between educational attainment and widowhood. Trends in the data suggest an inverse association for members of the NCDS, Table 5.5.

5.1.5.3 Behaviour problems and widowhood

The trends in the data suggest that higher behavioural problems, is associated with a higher risk of widowhood for both men and women from the NSHD. This association is only significant for women, for whom the risk of widowhood is associated with a 33% increase/ 0.5 increase in behaviour problems, Table 5.5. There was no consistent relationship between behaviour problems and widowhood among members of the NCDS.

Table 5.4 Regression estimates for the likelihood of divorce by socioeconomic status and behavioural problems by gender and birth cohort

	NSHD (43 years)						NCDS (44-45 years)					
	Men N=1107			Women N=1122			Men N=2402			Women N=2544		
	% ever divorced	OR	95% CI	% ever divorced	OR	95% CI	% ever divorced	OR	95% CI	% ever divorced	OR	95% CI
Father's social class	13.2	1		17.7	1		20.2	1	1	23.7	1	
Manual+	15.2	1.2	(0.84, 1.66)	16.9	0.95	(0.69, 1.30)	15.4	0.72	(0.58, 0.90)***	20.4	0.82	(0.67,1.00)***
Non-manual												
Educational attainment	15.4	1		17.3	1		24.9	1	1	27.4	1	
No qualifications+	13.9	0.88	(0.56,1.40)	18.5	1.08	(0.76, 1.56)	19.7	0.74	(0.55, 0.98)**	26.4	0.95	(0.76, 1.20)
Lower secondary	14.0	0.89	(0.58, 1.36)	15.5	0.88	(0.58, 1.33)	18.7	0.69	(0.51, 0.95)**	19.0	0.62	(0.44, 0.89)***
Advanced secondary	10.9	0.67	(0.38, 1.18)	18.6	1.09	(0.54, 2.20)	13.5	0.47	(0.35, 0.64)***	14.4	0.45	(0.34, 0.59)***
Degree level or above												
Behaviour problems		1.18	(1.08, 1.29)***		1.21	(1.10, 1.33)***		1.02	(1.01, 1.03)***		1.01	(0.10, 1.03)

+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 01 Educational attainment was attained at ages 26 and 33 for members of the NSHD and NCDS, respectively. The corresponding ages for father's social class was 4 and 7 years, respectively. For members of the NSHD, behavioural problems is measured at 13 & 15 years – an average of measures of both time points is employed, odds ratios are estimated per increase in behavioural problems of 0.5. OR=1, odds ratio to denote the reference category.

Behavioural problems is measured at age 7 for members of the NCDS, odds ratios are given per increase in behavioural problems of 1. OR=1 is the odds ratio for the reference group.

Table 5.5 Regression estimates for the likelihood of widowhood by socioeconomic status and behavioural problems by gender and birth cohort

	NSHD (43 years)						NCDS (44-45 years)					
	Men N=813			Women N=951			Men N=1973			Women N=2013		
	% ever widowed	OR	95% CI	% ever widowed	OR	95% CI	% ever widowed	OR	95% CI	% ever widowed	OR	95% CI
Father's social class												
Manual+	0.88	1		2.49	1		0.81	1		2.57	1	
Non-manual	0.76	0.86	(0.20, 3.60)	2.58	1.04	(0.46, 2.36)	0.54	0.66	(0.21, 2.11)	1.23	0.47	(0.23, 0.10)***
Educational attainment												
No qualifications+												
Lower secondary	1.20	1		2.75	1		0.94	1		2.80	1	
Advanced secondary	0.49	0.40	(0.04, 3.61)	2.22	0.80	(0.31, 2.13)	0.69	0.73	(0.16, 3.27)	2.27	0.81	(0.38, 1.71)
Degree level or above	1.09	0.91	(0.20, 4.10)	2.24	0.81	(0.27, 2.40)	0.74	0.78	(0.16, 3.90)	0.89	0.31	(0.07, 1.41)
	0.00			4.00	1.47	(0.31, 6.91)	0.60	0.64	(0.14, 2.87)	1.80	0.64	(0.28, 1.46)
Behaviour problems		1.18	(0.83, 1.66)		1.33	(1.07, 1.65)***		0.99	(0.92, 1.06)		1.00	(0.96, 1.05)

+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 01 Educational attainment was attained at ages 26 and 33 for members of the NSHD and NCDS, respectively. The corresponding ages for father's social class was 4 and 7 years, respectively. For members of the NSHD, behavioural problems is measured at 13 & 15 years – an average of measures of both time points is employed, odds ratios are estimated per increase in behavioural problems of 0.5. Behavioural problems is measured at age 7 for members of the NCDS, odds ratios are given per increase in behavioural problems of 1. OR=1, odds ratio to denote the reference category.

5.2 The role of father's social class, educational attainment and behavioural problems in the association between marital history and CVD among members of the NSHD at age 60-64.

5.2.1 The relationship between CVD prevalence and father's social class, educational attainment and conduct problems

Differences in CVD prevalence by each of the possible confounders are discussed in relation to Model 1. Men from a non-manual social class were 38 less likely to be diagnosed with CVD, relative to their counterparts from a manual social class 0R=0.62 (95%CI: 0.30, 0.98). Having attained advanced secondary education or a degree level or above, was associated with a lower likelihood of CVD by 67% 0.33 (0.18, 0.61) and 59% 0.44 (0.20, 0.82), respectively. Having attained secondary education was also associated with a lower risk of CVD, though differences didn't attain significance (Table 5.6). A 0.5 increase in conduct problems was associated with a 21% increase in the likelihood of CVD diagnosis OR=1.21 (95% CI: 1.09, 1.34). Trends in the data suggest that both father's social class and educational attainment are associated with CVD among women (Table 5.6) As is evident lower proportions of those from non-manual classes and higher education was associated with a lower risk of CVD, though these differences do not attain statistical significance. A 0.5 increase in conduct problems was associated with a 28% increase in the likelihood of CVD diagnosis 1.28 (1.07, 1.53).

5.2.1.1 The relationship between blood pressure and father's social class, educational attainment and conduct problems

Father's social class and educational attainment were not associated significantly with systolic or diastolic blood pressure among men or women (Table 5.8-Table 5.11.). Trends in the data are consistent in showing, however, that both systolic blood pressure and diastolic blood pressure is lower among those from non-manual backgrounds, and those who are relatively more educated. Conduct problems were associated positively with both systolic and diastolic blood pressure for women (Table 5.9 and Table 5.11). Trends in the data suggest a positive relationship between conduct problems and blood pressure for men, though differences do not attain significance (Table 5.8 and Table 5.10). All differences refer to Model 1.

5.2.1.2 The relationship between BMI and father's social class, educational attainment and conduct problems

Coming from a non-manual background was associated with lower BMI among men and women, by 1.32kgm/m2 (-1.88, 0.75) and 1.99kg.m2 (-2.73, -1.25) respectively (Model 1 of

Table 5.12 and Table 5.13). Being relatively more educated was associated with lower BMI for both men and women. Higher levels of educational attainment are associated with lower BMI. For both men and women differences in BMI were largest between those with a degree and those with no qualifications. Conduct problems was associated with higher BMI for both men and women.

5.2.1.3 The relationship between waist circumference and father's social class, educational attainment and conduct problems

Coming from a non-manual background was associated with a significantly lower waist circumference among both men and women, by 3.04 cm and -4.24 respectively (Model 1 of Table 5.14 and Table 5.15). An inverse association was observed. Relative to those with no qualifications, having attained a qualification was associated with lower waist circumference. This relative difference was largest for men and women who had attained a degree or above. An increase in conduct problems was associated with higher waist circumference for both men and women.

5.2.1.4 Father's social class, educational attainment and conduct problems as confounders of the association between marital history and CVD.

The impact of adjustment for each of the potential confounders factors, on the association between marital history and CVD, is discussed where statistically significant or substantial (sizeable) differences were found. At age 60-64 for members of the NSHD, there was little difference to the association between marital history and CVD in the sample obtained for objective 2 (complete covariate data) and the sample for objective 1, 0. To summarize briefly, there was a higher risk of CVD diagnosis for widowed relative to married women, Table 5.7. Although not significant, there was some evidence for sizeable differences in the risk of CVD between all groups of unmarried women, and their continually married counterparts, among whom the risks were lower, Table 5.7. Both systolic and diastolic blood pressure was lower for divorced relative to continually married women, Table 5.9 and Table 5.11.

As is evident, there is some attenuation of relative differences in CVD between widowed and continually married women in Models 2, 3 & 4. Some of the variation in CVD between married and continually married women can be attributed to socioeconomic factors and conduct problems. The higher risk of CVD among widowed women is attenuated most in Model 4, on adjustment for conduct problems. The same appears to be true for single and divorced women. Overall, however the attenuation from adjustment for each of these factors, on the higher risk of CVD for widowed women, is small. Models 2, 3 and 4 of Table 5.9 show relative differences in SBP between divorced and continually married women, after adjustment for each of the proposed confounders. As is evident, relative differences in SBP

are larger in each of these models, relative to the unadjusted estimates of Model 1. This suggests that there is some negative confounding from each of these factors. This is plausible given that there is a trend toward a higher likelihood of divorce for women from manual backgrounds, lower educational attainment and higher conduct problems – each of which is related to higher mean SBP. There is some suggestion of negative confounding from father's social class and conduct problems on relative differences in DBP between married and continually married women, also (Table 5.11). Overall, however, estimates in Models 2, 3 and 4 do not vary largely from Model 1.

Table 5.6 Regression estimates (odds ratios) to show the association between marital history and CVD prevalence at age 60-64 among NSHD men, adjusted for father's social class, educational attainment and adolescent conduct problems N=901

		Model 1		Model 2		Model 3		Model 4		Model 5	
	CVD Prevalence	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Marital History											
Continually married +	9.9	1		1		**1**		**1**		**1**	
Widowed	13.8	1.46	(0.49, 4.34)	1.32	(0.44, 3.96)	1.26	(0.42, 3.80)	1.39	(0.47, 4.15)	1.23	(0.41, 3.71)
Divorced	7.3	0.72	(0.33, 1.56)	0.70	(0.32, 1.52)	0.65	(0.30, 1.42)	0.66	(0.30, 1.43)	0.62	(0.29, 1.37)
Remarried	12.8	1.34	(0.77, 2.34)	1.38	(0.79, 2.40)	1.26	(0.72, 2.21)	1.31	(0.75, 2.28)	1.27	(0.72, 2.24)
Father's social class											
Manual+	11.6	1		1						1	
Non-Manual	7.5	0.62	(0.38, 0.98)**	0.61	(0.38, 0.97)**					0.81	(0.49, 1.35)
Educational attainment											
No qualifications+	14.8	1				1				1	
Lower Secondary	10.3	0.67	(0.37, 1.17)			0.66	(0.37, 1.17)			0.73	(0.40, 1.31)
Advanced Secondary	5.4	0.33	(0.18, 0.61)***			0.32	(0.17, 0.61)***			0.36	(0.19, 0.70)***
Degree level	6.5	0.40	(0.20, 0.82)***			0.40	(0.19, 0.82)***			0.51	(0.23, 1.13)
Behavioural problems		1.21	(1.09, 1.34)**					1.16	(1.02, 1.31)	1.09	(0.95, 1.24)

Model 1 assessed bivariate associations between marital history and CVD, father's social class and CVD, educational attainment and CVD and behavioural problems and CVD. .All subsequent models estimated the association between marital history and CVD. Model 2 controlled for father's social class; Model 3 adjusted for educational attainment; Model 4 adjusted for behavioural problems; Model 5 simultaneously adjusted for father's social class, educational attainment and behavioural problems in adolescence. +=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 CVD prevalence = self-reported doctor diagnosed by 60-64 years. Behavioural problems is measured at 13 & 15 years – an average of measures of both time points is employed, odds ratios are estimated per increase in behavioural problems of 0.5. Educational attainment at 26 years; father's social class at 4 years; behavioural problems is measured at 13 & 15 years – an average of measures of both time points is employed, odds ratios are estimated per increase in behavioural problems of 0.5. OR=1, odds ratio to denote the reference category.

Table 5.7 Regression estimates (odds ratios) to show the association between marital history and CVD prevalence at age 60-64 among NSHD women, adjusted for father's social class, educational attainment and adolescent conduct problems N=967

	CVD prevalence	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
		Model 1		Model 2		Model 3		Model 4		Model 5	
Marital History											
Continually married +	2.7	1		1		**1**		**1**		**1**	
Single	2.9	1.11	(0.14, 8.69)	1.19	(0.15, 9.30)	1.27	(0.16, 10.0)	1.07	(0.14, 8.42)	1.21	(0.15, 9.58)
Widowed	9.6	3.92	(1.61, 55)***	3.72	(1.52, 9.10)***	3.58	(1.46, 0.80)***	3.48	(1.41, 8.56)***	3.28	(1.33, 8.11)
Divorced	5.4	2.11	(0.84, 5.28)	2.06	(0.82, 5.18)	2.10	(0.83, 5.27)	1.98	(0.79, 5.00)	1.95	(0.77, 4.95)
Remarried	3.2	1.22	(0.44, 3.42)	1.22	(0.44, 3.41)	1.11	(0.40, 3.12)	1.11	(0.40, 3.13)	1.04	(0.37, 2.94)
Father's social class											
Manual+	4.5	1		1						1	
Non-Manual	2.8	0.60	(0.30, 1.22)	0.66	(0.32, 1.34)					0.85	(0.40 1.83)
Educational attainment											
No qualifications+	4.8	1				1				1	
Lower Secondary	4.2	0.88	(0.42, 1.83)			0.91	(0.44, 1.91)			1.07	(0.49 2.31)
Advanced Secondary	2.5	0.50	(0.19, 1.32)			0.57	(0.21, 1.50)			0.70	(0.25, 2.00)
Degree level	0										
Behavioural problems		1.28	(1.07, 1.53)***					1.25	(1.04, 1.50)**	1.22	(1.01 1.47)**

Model 1 assessed bivariate associations between marital history and CVD, father's social class and CVD, educational attainment and CVD and behavioural problems and CVD. .All subsequent models estimated the association between marital history and CVD. Model 2 controlled for father's social class; Model 3 adjusted for educational attainment; Model 4 adjusted for behavioural problems; Model 5 simultaneously adjusted for father's social class, educational attainment and behavioural problems in adolescence. +=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 CVD prevalence = self-reported doctor diagnosed by 60-64 years. Behavioural problems is measured at 13 & 15 years – an average of measures of both time points is employed, odds ratios are estimated per increase in behavioural problems of 0.5. Educational attainment at 26 years; father's social class at 4 years; behavioural problems is measured at 13 & 15 years – an average of measures of both time points is employed, odds ratios are estimated per increase in behavioural problems of 0.5. OR=1, odds ratio to denote the reference category.

Table 5.8 Regression estimates (coefficients) to show the association between marital history and SBP (mmHg) at age 60-64 among NSHD men , adjusted for father's social class, educational attainment and adolescent conduct problems N= 790

		Model 1		Model 2		Model 3		Model 4		Model 5	
	Mean SBP	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Marital History											
Continually married +	142.9										
Single	143.3	0.36	(-6.05, 6.77)	0.42	(-5.99, 6.82)	0.39	(-6.01,6.80)	0.37	(-6.04, 6.79)	0.48	(-5.93, 6.88)
Widowed	145.3	2.38	(-5.72, 0.48)	1.92	(-6.18, 0.02)	2.07	(-6.03, 0.18)	2.27	(-5.82, 0.37)	1.90	(-6.21, 0.01)
Divorced	141.2		(-6.01, 2.57)	-1.83	(-6.12, 2.47)	-1.81	(-6.11, 2.49)	-2.05	(-6.37, 2.27)	-1.96	(6.28, 2.36)
Remarried	143.5	0.62	(-2.96, 4.20)	0.72	(-2.85, 4.30)	0.52	(-3.06, 4.09)	0.53	(-3.05, 4.41)	0.60	(-2.98, 4.18)
Father's social class											
Manual+	144.1										
Non-Manual	141.5	-2.60	(-5.25, 0.05)	-2.62	(-5.28, 0.05)					-1.91	(-4.83, 1.00)
Educational attainment											
No qualifications+	143.3					0.99	(-2.76, 0.75)			1.57	(-2.27, 5.40)
Lower Secondary	144.3	1.01	(-2.73, 4.76)			0.28	(-3.10, 0.66)			1.15	(-2.43, 4.72)
Advanced Secondary	143.6	0.33	(-3.03, 3.69)			-3.85	(-7.75, 0.05)			-2.28	(-6.69, 2.13)
Degree level	139.4	-3.84	(-7.72, 0.04)								
Behavioural problems		0.50	(-0.33, 1.34)					0.54	(-0.29, 1.39)	-1.91	(-4.83, 1.00)

Model 1 assessed bivariate associations between marital history and SBP, father's social class and SBP, educational attainment and SBP and conduct problems and SBP. All subsequent models estimated the association between marital history and SBP. Model 2 controlled for father's social class; Model 3 adjusted for educational attainment; Model 4 adjusted for behaviour problems; Model 5 simultaneously adjusted for father's social class, educational attainment and behaviour problems.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 SBP=systolic blood pressure mmHg. Educational attainment at 26 years; father's social class at 4 years; behavioural problems is measured at 13 & 15 years – an average of measures of both time points is employed, coefficients are estimated per increase in behavioural problems of 0.5.

Table 5.9 Regression estimates (coefficients) to show the association between marital history and SBP (mmHg) at age 60-64 among NSHD women , adjusted for father's social class, educational attainment and behavioural problems N= 871

		Model 1		Model 2		Model 3		Model 4		Model 5	
	Mean SBP	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Marital History											
Continually married	137.1										
Single	138.4	1.36	(-6.40, 9.12)	1.63	(-6.12, 9.39)	1.79	(-5.97, 9.55)	1.79	(-5.97, 9.55)	1.83	(-5.92 , 9.59)
Widowed	139.0	1.98	(-2.51, 6.47)	1.74	(-2.75, 0.22)	1.56	(-2.96, 6.07)	1.56	(-2.96 6.07)	1.15	(-3.39 , 5.68)
Divorced	131.5	-5.55	(-9.50, -	-5.69	(-9.64, -	-5.56	(-9.50, -	-5.56	(-9.50 -1.62)***	-5.79	(-9.73, -
Remarried	136.0	-1.01	(-4.53, 2.51)	-1.10	(-4.61, 2.42)	-1.44	(-4.98, 2.11)	-1.44	(-4.98, 2.11)	-1.64	(-5.21, 1.92)
Father's social class											
Manual+	137.6										
Non-Manual	135.1	-2.46	(-4.99, 0.07)	-2.55	(-5.08, -0.02)*					-1.70	(-4.46, 1.06)
Educational											
No qualifications+	138.0										
Lower Secondary	136.5	1.54	(-4.65, 1.56)			-1.57	(-4.67, 1.53)			-0.74	(-3.95, 2.46)
Advanced Secondary	135.7	-2.34	(-5.69, 1.01)			-2.39	(-5.76, 0.99)			-1.02	(-4.70, 2.66)
Degree level	131.7	-6.36	(-11.92, -			-6.31	(-11.89, -0.73)**			-4.50	(-10.40, 1.40)
Behavioural problems		0.87	(-0.01, 1.76)*					0.91	(0.02, 1.80)*	0.70	(-0.21, 1.62)

Model 1 assessed bivariate associations between marital history and SBP, father's social class and SBP, educational attainment and SBP and conduct problems and SBP. All subsequent models estimated the association between marital history and SBP. Model 2 controlled for father's social class; Model 3 adjusted for educational attainment; Model 4 adjusted for behaviour problems; Model 5 simultaneously adjusted for father's social class, educational attainment and behaviour problems.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 SBP=systolic blood pressure mmHg. Educational attainment at 26 years; father's social class at 4 years; behavioural problems is measured at 13 & 15 years – an average of measures of both time points is employed, coefficients are estimated per increase in behavioural problems of 0.5.

Table 5.10 Regression estimates (coefficients) to show the association between marital history and SBP (mmHg) at age 60-64 among NSHD men , adjusted for father's social class, educational attainment and adolescent conduct problems N= 790

		Model 1		Model 2		Model 3		Model 4		Model 5	
	Mean SBP	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Marital History											
Continually married +	81.1										
Single	82.3	1.28	(-2.19, 4.75)	1.31	(-2.16, 4.78)	1.27	-2.20, 4.75	1.28	(-2.19, 4.76)	1.32	(-2.15, 4.79)
Widowed	78.8	-2.28	(-6.67, 2.10)	-2.54	(-6.92, 1.85)	-2.42	-6.82, 1.97	-2.33	(-6.72, 2.05)	-2.53	(-6.93, 1.87)
Divorced	80.3	-0.71	(-3.04, 1.61)	-0.77	(-3.09, 1.55)	-0.79	-3.12, 1.55	-0.86	(-3.20, 1.48)	-0.85	(3.19, 1.50)
Remarried	80.9	-0.12	(-2.06, 1.82)	-0.06	(-2.00, 1.87)	-0.18	-2.12, 1.76	-0.16	(-2.10, 1.78)	-0.12	(-2.06, 1.82)
Father's social class											
Manual+	81.6										
Non-Manual	80.2	-1.37	(-2.80, 0.07)	-1.43	(-2.88, 0.01)					-1.20	(-2.78, 0.38)
Educational attainment											
No qualifications	81.2										
Lower Secondary	81.6	0.44	(-1.60, 2.47)			0.35	(-1.69, 2.39)			0.68	(-1.40, 2.76)
Advanced Secondary	80.9	-0.28	(-2.11, 1.54)			-0.37	(-2.20, 1.47)			0.12	(-1.82, 2.06)
Degree level	79.8	-1.37	(-3.48, 0.74)			-1.48	(-3.60, 0.64)			-0.58	(-2.98, 1.81)
Behavioural problems		0.22	(-0.24, 0.67)					0.24	(-0.21, 0.70)	0.14	(-0.35, 0.62)

Model 1 assessed bivariate associations between marital history and DBP, father's social class and DBP, educational attainment and SBP and conduct problems and DBP. All subsequent models estimated the association between marital history and DBP. Model 2 controlled for father's social class; Model 3 adjusted for educational attainment; Model 4 adjusted for behaviour problems; Model 5 simultaneously adjusted for father's social class, educational attainment and behaviour problems.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 DBP=Diastolic blood pressure (mmHg). Educational attainment at 26 years; father's social class at 4 years; behavioural problems is measured at 13 & 15 years – an average of measures of both time points is employed, coefficients are estimated per increase in behavioural problems of 0.5.

Table 5.11 Regression estimates (coefficients) to show the association between marital history and DBP (mmHg) at age 60-64 among NSHD women , adjusted for father's social class, educational attainment and behavioural problems N=871

		Model 1		Model 2		Model 3		Model 4		Model 5	
	Mean DBP	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Marital History											
Continually married +	77.6										
Single	78.0	0.37	(-3.70, 4.45)	0.49	(-3.59, 4.56)	0.52	(-3.57, 4.60)	0.38	(-3.70, 4.45)	0.55	(-3.54, 4.63)
Widowed	79.1	1.54	(-0.82, 3.90)	1.44	(-0.92, 3.80)	1.45	(-0.93, 3.83)	1.33	(-1.04, 3.71)	1.29	(-1.10, 3.68)
Divorced	75.1	-2.46	(-4.54, -0.39)**	-2.51	(-4.60, -0.45)**	-2.44	(-4.52, -0.37)**	-2.54	(-4.61, 0.46)**	-2.54	(-4.62, -0.46)**
Remarried	79.2	1.65	(-0.20, 3.50)	1.62	(-0.23, 3.46)	1.51	(-0.36, 3.38)	1.51	(-0.36, 3.37)	1.44	(-0.44, 3.31)
Father's social class											
Manual+	78.2										
Non-Manual	77.1	-1.04	(-2.37, 0.30)	-1.03	(-2.37, 0.30)					-0.89	(-2.34, 0.57)
Educational attainment											
No qualifications	77.6										
Lower Secondary	78.0	-0.03	(-1.67, 1.60)			-0.07	(-1.70, 1.57)			0.31	(-1.38, 2.00)
Advanced Secondary	79.1	-0.56	(-2.33, 1.20)			-0.36	(-2.13, 1.42)			0.28	(-1.66, 2.22)
Degree level	79.2	-2.48	(-5.42, 0.45)			-2.14	(-5.08, 0.80)			-1.30	(-4.40, 1.81)
Behavioural problems	0.32	(-0.15, 0.78)								0.27	(-0.21, 0.76)

Model 1 assessed bivariate associations between marital history and DBP, father's social class and DBP, educational attainment and SBP and conduct problems and DBP. All subsequent models estimated the association between marital history and DBP. Model 2 controlled for father's social class; Model 3 adjusted for educational attainment; Model 4 adjusted for behaviour problems; Model 5 simultaneously adjusted for father's social class, educational attainment and behaviour problems.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 DBP=Diastolic blood pressure (mmHg). Educational attainment at 26 years; father's social class at 4 years; behavioural problems is measured at 13 & 15 years – an average of measures of both time points is employed, coefficients are estimated per increase in behavioural problems of 0.5.

Table 5.12 Regression estimates (coefficients) to show the association between marital history and BMI (kg/m2) among NSHD men , adjusted for father's social class, educational attainment and behavioural problems at age 60-64 N=787

		Model 1		Model 2		Model 3		Model 4		Model 5	
	Mean BMI	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Marital History											
Continually married +	27.8										
Single	28.0	0.17	(-1.23, 1.57)	0.22	(-1.16, 1.60)	0.14	(-1.23, 1.52)	0.18	(-1.22, 1.57)	0.19	(-1.19, 1.56)
Widowed	28.7	0.89	(-0.86, 2.63)	0.66	(-1.07, 2.34)	0.57	(-1.15, 2.30)	0.84	(-0.90, 2.57)	0.50	(-1.22, 2.22)
Divorced	28.4	0.61	(-0.31, 1.53)	0.56	(-0.35, 1.47)	0.44	(-0.47, 1.36)	0.46	(-0.46, 1.39)	0.40	(-0.51, 1.32)
Remarried	27.9	0.10	(-0.67, 0.87)	0.15	(-0.61, 0.92)	0.02	(-0.74, 0.79)	0.05	(-0.71, 0.82)	0.07	(-0.69, 0.83)
Father's social class											
Manual+	28.5										
Non-Manual	27.2	-1.32	(-1.88, -0.75)***	-1.30	(-1.87, -0.73)***					-0.86	(-1.48, -0.24)***
Educational											
No qualifications	28.8					-0.90	(-1.70, -0.09)**			-0.66	(-1.47, 0.16)
Lower Secondary	27.9	-0.93	(-1.72, -0.13)**			-1.15	(-1.87, -0.42)***			-0.79	(-1.55, -0.03)**
Advanced Secondary	27.7	-1.18	(-1.90, -0.47)***			-1.97	(-2.80, -1.14)***			-1.32	(-2.26, -0.38)***
Degree level	26.8	-2.01	(-2.83, -1.18)***								
Behavioural problems		0.26	(0.08, 0.44)***					0.24	(0.06, 0.43)***	0.10	(-0.09, 0.29)

Model 1 assessed bivariate associations between marital history and BMI, father's social class and BMI, educational attainment and BMI and behavioural problems and DBP. All subsequent models estimated the association between marital history and BMI. Model 2 controlled for father's social class; Model 3 adjusted for educational attainment; Model 4 adjusted for behaviour problems; Model 5 simultaneously adjusted for father's social class, educational attainment and behaviour problems.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 BMI=Body mass index (kg/m^2). Educational attainment at 26 years; father's social class at 4 years; behavioural problems is measured at 13 & 15 years – an average of measures of both time points is employed, coefficients are estimated per increase in behavioural problems of 0.5.

Table 5.13 Regression estimates (coefficients) to show the association between marital history and BMI (kg/m2) among NSHD men , adjusted for father's social class, educational attainment and behavioural problems at age 60-64 N=871

		Model 1		Model 2		Model 3		Model 4		Model 5	
	Mean BMI	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Marital History											
Continually married +	27.9										
Single	27.9	-0.01	(-2.32, 2.30)	0.21	(-2.07, 2.48)	0.17	(-2.12, 2.47)	-0.00	(-2.31, 2.30)	0.26	(-2.02, 2.53)
Widowed	28.6	0.69	(-0.64, 2.02)	0.50	(-0.81, 1.81)	0.37	(-0.96, 1.70)	0.52	(-0.82, 1.85)	0.27	(-1.06, 1.59)
Divorced	28.0	0.05	(-1.12, 1.22)	-0.08	(-1.23, 1.08)	-0.02	(-1.18, 1.15)	-0.01	(-1.19, 1.16)	-0.13	(-1.28, 1.03)
Remarried	28.2	0.27	(-0.78, 1.31)	0.21	(-0.82, 1.24)	0.03	(-1.01, 1.08)	0.14	(-0.91, 1.19)	0.03	(-1.01, 1.08)
Father's social class											
Manual+	29.0										
Non-Manual	27.0	-1.99	(-2.73, -1.25)***	-1.98	(-2.72, -1.24)***					-1.61	(-2.42, -
Educational attainment											
No qualifications	29.1										
Lower Secondary	28.1	-1.05	(-1.96, -0.14)**			-1.04	(-1.95, -0.13)**			-0.58	(-1.51, 0.36)
Advanced Secondary	27.1	-1.98	(-2.96, -0.10)***			-1.95	(-2.94, -0.96)***			-1.07	(-2.15, -0.00)*
Degree level	27.0	-2.10	(-3.73, -0.46)***			-2.08	(-3.73, -0.43)***			-0.92	(-2.65, 0.81)
Behavioural problems		0.30	(0.04, 0.55)**					0.28	(0.02, 0.54)**	.15	(-0.11, 0.42)

Model 1 assessed bivariate associations between marital history and BMI, father's social class and BMI, educational attainment and BMI and behavioural problems and DBP. All subsequent models estimated the association between marital history and BMI. Model 2 controlled for father's social class; Model 3 adjusted for educational attainment; Model 4 adjusted for behaviour problems; Model 5 simultaneously adjusted for father's social class, educational attainment and behaviour problems.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 BMI=Body mass index (kg/m^2). Educational attainment at 26 years; father's social class at 4 years; behavioural problems is measured at 13 & 15 years – an average of measures of both time points is employed, coefficients are estimated per increase in behavioural problems of 0.5.

Table 5.14 Regression estimates (coefficients) to show the association between marital history and BMI (kg/m2) among NSHD men , adjusted for father's social class, educational attainment and behavioural problems at age 60-64 N=871

		Model 1		Model 2		Model 3		Model 4		Model 5	
	Mean BMI	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Marital History											
Continually married +	27.9										
Single	27.9	-0.01	(-2.32, 2.30)	0.21	(-2.07, 2.48)	0.17	(-2.12, 2.47)	-0.00	(-2.31, 2.30)	0.26	(-2.02, 2.53)
Widowed	28.6	0.69	(-0.64, 2.02)	0.50	(-0.81, 1.81)	0.37	(-0.96, 1.70)	0.52	(-0.82, 1.85)	0.27	(-1.06, 1.59)
Divorced	28.0	0.05	(-1.12, 1.22)	-0.08	(-1.23, 1.08)	-0.02	(-1.18, 1.15)	-0.01	(-1.19, 1.16)	-0.13	(-1.28, 1.03)
Remarried	28.2	0.27	(-0.78, 1.31)	0.21	(-0.82, 1.24)	0.03	(-1.01, 1.08)	0.14	(-0.91, 1.19)	0.03	(-1.01, 1.08)
Father's social class											
Manual+	29.0										
Non-Manual	27.0	-1.99	(-2.73, -	-1.98	(-2.72, -					-1.61	(-2.42, -0.80)***
Educational attainment											
No qualifications	29.1										
Lower Secondary	28.1	-1.05	(-1.96, -0.14)**			-1.04	(-1.95, -0.13)**			-0.58	(-1.51, 0.36)
Advanced Secondary	27.1	-1.98	(-2.96, -0.10)***			-1.95	(-2.94, -0.96)***			-1.07	(-2.15, -0.00)*
Degree level	27.0	-2.10	(-3.73, -0.46)***			-2.08	(-3.73, -0.43)***			-0.92	(-2.65, 0.81)
Behavioural problems		0.30	(0.04, 0.55)**					0.28	(0.02, 0.54)**	0.15	(-0.11, 0.42)

Model 1 assessed bivariate associations between marital history and BMI, father's social class and BMI, educational attainment and BMI and behavioural problems and DBP. All subsequent models estimated the association between marital history and BMI. Model 2 controlled for father's social class; Model 3 adjusted for educational attainment; Model 4 adjusted for behaviour problems; Model 5 simultaneously adjusted for father's social class, educational attainment and behaviour problems.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 BMI=Body mass index (kg/m^2). Educational attainment at 26 years; father's social class at 4 years; behavioural problems is measured at 13 & 15 years – an average of measures of both time points is employed, coefficients are estimated per increase in behavioural problems of 0.5.

Table 5.15 Regression estimates (coefficients) to show the association between marital history and waist circumference (cm) among NSHD men , adjusted for father's social class, educational attainment and behavioural problems at age 60-64 N=788

		Model 1		Model 2		Model 3		Model 4		Model 5	
	Mean waist	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Marital History											
Continually	100.7										
Single	102.6	1.87	(-1.98, 5.73)	2.02	(-1.81, 5.85)	1.75	(-2.05, 5.55)	2.01	(-1.83, 5.85)	1.91	(-1.89, 5.70)
Widowed	103.0	2.28	(-2.46, 7.02)	1.75	(-2.96, 6.46)	1.43	(-3.25, 6.11)	2.14	(-2.58, 6.86)	1.29	(-3.39, 5.97)
Divorced	102.0	1.27	(-1.26, 3.80)	1.16	(-1.35, 3.66)	0.77	(-1.72, 3.27)	0.86	(-1.67, 3.39)	0.66	(-1.85, 3.16)
Remarried	100.1	-0.65	(-2.74, 1.45)	-0.53	(-2.61, 1.55)	-0.89	(-2.95,1.18)	-0.76	(-2.85, 1.33)	-0.82	(-2.89, 1.25)
Father's social											
Manual+	102.3									-1.59	(-3.27, 0.10)
Non-Manual	99.2	-3.04	(-4.58, -1.49)***	-2.99	(-4.54, -1.44)***						
Educational											
No qualifications	103.4										
Lower Secondary	101.4	-1.99	(-4.16, 0.18)			-1.91	(-4.19, 0.27)			-1.42	(-3.64, 0.80)
Advanced Secondary	99.6	-3.84	(-6.78, -1.89)***			-3.77	(-5.73, -1.81)***			-3.03	(-5.10, -0.96)***
Degree level	97.9	-5.52	(-7.77, -3.28)***			-5.47	(-7.72, -3.21)***			-4.15	(-6.70, -.60)***
Behavioural problems		0.71	(0.21, 1.20)***					0.70	(0.20 , 1.19)***	.28	(-0.24, 0.80)

Model 1 assessed bivariate associations between marital history and BMI, father's social class and BMI, educational attainment and BMI and behavioural problems and DBP. All subsequent models estimated the association between marital history and BMI. Model 2 controlled for father's social class; Model 3 adjusted for educational attainment; Model 4 adjusted for behaviour problems; Model 5 simultaneously adjusted for father's social class, educational attainment and behaviour problems.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 BMI=Body mass index (kg/m^2). Educational attainment at 26 years; father's social class at 4 years; behavioural problems is measured at 13 & 15 years – an average of measures of both time points is employed, coefficients are estimated per increase in behavioural problems of 0.5.

Table 5.16 Regression estimates (coefficients) to show the association between marital history and waist circumference (cm) among NSHD men , adjusted for father's social class, educational attainment and behavioural problems at age 60-64 N=876

		Model 1		Model 2		Model 3		Model 4		Model 5	
	Mean waist	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Marital History											
Continually	91.9										
Single	94.3	2.43	(-2.94, 7.80)	2.90	(-2.42, 8.22)	2.92	(-2.42, 8.27)	2.45	(-2.91, 7.82)	3.09	(-2.22, 8.40)
Widowed	93.6	1.68	(-1.40, 4.77)	1.27	(-1.79, 4.33)	0.93	(-2.17, 4.02)	1.19	(-1.91, 4.30)	0.62	(-2.47, 3.71)
Divorced	93.0	1.10	(-1.64, 3.84)	0.85	(-1.86, 3.57)	0.95	(-1.78, 3.68)	0.92	(-1.82, 3.66)	0.71	(-2.00, 3.42)
Remarried	92.9	1.03	(-1.41, 3.47)	0.91	(-1.50, 3.32)	0.41	(-2.03, 2.85)	0.69	(-1.76,3.13)	0.34	(-2.09, 2.78)
Father's social											
Manual+	94.3										
Non-Manual	90.1	-4.24	(-5.97, -2.52)***	-4.22	(-5.95, -2.49)***					-3.25	(-5.13, -1.36)***
Educational											
No qualifications	94.5										
Lower Secondary	92.8	-1.72	(-3.84, 0.41)			-1.69	(-3.82, 0.44)			-0.63	(-2.82, 1.56)
Advanced	90.2	-4.37	(-6.67, -2.08)***			-4.31	(-6.64, -1.99)***			-2.38	(-4.90, 0.14)
Degree level	89.1	-5.40	(-9.22, -1.58)***			-5.45	(-9.29, -1.60)***			-2.89	(-6.93, 1.15)
Behavioural		0.83	(0.23, 1.43)***					0.79	(0.18, 1.40)***	0.51	(-0.11, 1.13)

Model 1 assessed bivariate associations between marital history and BMI, father's social class and BMI, educational attainment and BMI and behavioural problems and DBP. All subsequent models estimated the association between marital history and BMI. Model 2 controlled for father's social class; Model 3 adjusted for educational attainment; Model 4 adjusted for behaviour problems; Model 5 simultaneously adjusted for father's social class, educational attainment and behaviour problems.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 BMI=Body mass index (kg/m^2). Educational attainment at 26 years; father's social class at 4 years; behavioural problems is measured at 13 & 15 years – an average of measures of both time points is employed, coefficients are estimated per increase in behavioural problems of 0.5.

5.3 The role of father's social class, educational attainment and behavioural problems in the association between marital history and CVD among members of the NSHD at 43 years and NCDS at 44-45 years.

5.3.1 The relationship between blood pressure (SBP & SBP) and father's social class, educational attainment and behavioural problems

Coming from a non-manual background is associated with significantly lower systolic blood pressure for men and women from both cohorts (Table 5.17 - Table 5.23). The results suggest that diastolic blood pressure is lower for those who come from non-manual relative to a manual social class. This relationship is not significant for members of the NCDS and men of the NSHD.

Trends in the data suggest that relatively higher levels of educational attainment are associated with lower SBP and DBP for men and women from both cohorts, though differences do not always attain statistical significance. As is evident from Table 5.17 - Table 5.23 both SBP and DBP is lower for men and women, from both cohorts, who have attained some form of qualification, relative to those with no qualifications.

Among men from the NSHD, relative differences in blood pressures are largest between those who have attained a degree or above, followed by those who have attained lower secondary education. The difference in mean blood pressure between men who attained advanced secondary education and those with no qualifications was small, and not significant (Table 5.17 and Table 5.21).

Among women from the NSHD there appears to be an inverse association between SBP and educational attainment. Relative to those with no qualifications, SBP mean is lower among those with some form of qualification. This differences is largest between those who have attained a degree or above, and smallest for those who have attained secondary qualifications only. The association between SBP and educational attainment among women from the NSHD does not attain statistical significance, however (Table 5.18). Relative to women with no qualifications, DBP is significantly lower for all women who had attained some qualifications. The relative difference in DBP among women with some and no qualifications was largest for women with a degree or above (Table 5.22).

Among men from the NCDS having attained a degree or above was associated with a significantly lower mean blood pressure. Having attained secondary level education or above was also associated with lower SBP, though differences didn't attain statistical

significance. Relative to women with no qualifications, women from the NCDS who had attained some qualification had lower blood pressure. Differences were significant for those who had attained a degree or above, and advanced secondary qualifications. There was no association between behaviour problems and either systolic or diastolic blood pressure for either cohort. Effect sizes were small and almost negligible.

5.3.2 The relationship between BMI and father's social class, educational attainment and behavioural problems

BMI is relatively lower for all men and women who came from non-manual, relative to manual backgrounds. Relative to having no qualifications, those who had attained some qualifications had lower BMI. This difference was consistently largest among those who had attained a degree or above. An increase in one unit of behavioural problems was associated with an increase in BMI among men and women from both cohorts, Table 5.25 - Table 5.28.

5.3.3 The relationship between waist circumference and father's social class, educational attainment and behavioural problems

Waist circumference is relatively lower for all men and women who came from non-manual, relative to manual backgrounds, Table 5.30-Table 5.33 Relative to having no qualifications, those who had attained some qualifications had lower BMI. This difference was consistently largest among those who had attained a degree or above. The results suggest an inverse association between educational attainment and waist circumference for both men and women from the NCDS, Table 5.32 and men from the NSHD Table 5.29. A higher score on behaviour problems was associated with higher waist circumference for men and women from both cohorts.

Prior to discussing the confounding effects of father's social class, educational attainment and behavioural problems for members of the NSHD at 43 and members of the NCDS at 44-45, the association between marital history and risk factors for CVD are outlined. There is evidence for higher SBP among single relative to continually married, for both cohorts Table 5.17 & Table 5.19 BMI at 43 years for members of the NSHD was lower for widowed and divorced women, relative to their continually married counterparts.

Adjustment for each of these factors has some, albeit very small effect, on relative differences in risk factors for CVD, by marital history. There is some suggestion that relative to father's social class and behavioural problems, educational attainment explains a greater proportion of the variance in SBP between married and single men of the NSHD, Table 5.17. This is evident from the greater difference in estimates of SBP for singe relative to married men between Model 1, which estimates a bivariate association between marital history and SBP, and Model 3, which adjusts for educational attainment. Therefore selection from higher levels of education in to marriage, outlined in section 5.1.3, , which is also related to lower

levels of SBP might explain some but not all of the higher SBP among single men. The same explanation is also relevant to higher SBP among single relative to continually married men of the NCDS, for whom attenuation of differences in SBP between single and married persons is largest in Model 3, which adjusts for educational attainment (Table 5.19). Relative differences between BMI for continually married and women and continually married and divorced women of the NSHD, are virtually unaffected after adjustment for possible confounders, Table 5.25.

Table 5.17 Regression estimates (coefficients) to show the association between marital history and SBP (mmHg) at age 43 among NSHD men adjusted for father's social class, educational attainment and adolescent conduct problems N=1359

		Model 1		Model 2		Model 3		Model 4		Model 5	
	Mean SBP	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Marital History											
Continually married +	124.5										
Single	128.0	3.51	(0.34, 6.67)**	3.41	(0.26, 6.56)**	3.25	(0.10, 6.40)**	3.50	(0.34, 6.67)**	3.22	(0.07, 6.37)*
Widowed	130.8	6.29	(-4.57, 17.16)	6.20	(-4.63, 17.02)	5.37	(-5.45, 16.19)	6.34	(-4.53, 17.21)	5.61	(-5.19, 16.41)
Divorced	126.9	2.38	(-0.30, 5.07)	2.51	(-0.16, 5.18)	2.20	(-0.47, 4.87)	2.43	(-0.27, 5.13)	2.53	(-0.15, 5.21)
Remarried	124.0	-0.49	(-3.14, 2.15)	-0.64	(-3.27, 2.00)	-0.79	(-3.43, 1.85)	-0.45	(-3.11, 2.20)	-0.66	(-3.30, 1.98)
Father's social class											
Manual+	126.2										
Non-Manual	123.3	-2.59	(-3.66, -1.51)***	-2.96	(-4.64, 1.27)***					-2.20	(-4.06, -0.35)***
Educational attainment											
No qualifications	126.6										
Lower Secondary	123.8	-2.79	(-5.03, -0.55)**			-2.70	(-4.94, -0.46)**			-2.40	(-4.69, -0.12)**
Advanced	125.7	-0.95	(-3.04, 1.13)			-0.87	(-2.95, 1.22)			-0.52	(-2.74, 1.70)
Degree level	121.6	-5.04	(-7.64, -0.44)***			-4.90	(-7.50, -0.29)***			-4.13	(-7.05, -.20)***
Behavioural (conduct) problems		-0.01	(-0.07, 0.05)					-0.08	(-0.56, 0.40)	-0.37	(-0.87, 0.13)

Model 1 assessed bivariate associations between marital history and SBP, father's social class and SBP, educational attainment and SBP and conduct problems and SBP. All subsequent models estimated the association between marital history and SBP. Model 2 controlled for father's social class; Model 3 adjusted for educational attainment; Model 4 adjusted for behaviour problems; Model 5 simultaneously adjusted for father's social class, educational attainment and behaviour problems.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 SBP=systolic blood pressure mmHg. Educational attainment at 26 years; father's social class at 4 years; behavioural problems is measured at 13 & 15 years – an average of measures of both time points is employed, coefficients are estimated per increase in behavioural problems of 0.5.

Table 5.18 Regression estimates (coefficients) to show the association between marital history and SBP (mmHg) at age 43 among NSHD women adjusted for father's social class, educational attainment and adolescent conduct problems N=1355

		Model 1		Model 2		Model 3		Model 4		Model 5	
	Mean SBP	**Coefficient**	**(95% CI)**	**Coefficient**	**(95% CI)**	**Coefficient**	**(95% CI)**	**Coefficient**	**(95% CI)**	**Coefficient**	**(95% CI)**
Marital History	122.1										
Continually married +	122.2	0.08	(-4.44, 4.61)	0.51	(-4.01, 5.04)	0.38	(-4.17, 4.93)	0.11	(-4.42, 4.65)	0.68	(-3.87, 5.23)
Single	121.3	-0.79	(-7.48, 5.89)	-0.77	(-7.44, 5.90)	-0.82	(-7.50, 5.87)	-0.71	(-7.42, 5.99)	-0.60	(-7.29, 6.09)
Widowed	119.2	-2.90	(-5.45, -0.35)**	-2.93	(-5.47, -0.39)**	-2.92	(-5.47, -0.37)**	-2.85	(-5.41, -0.28)**	-2.82	(-5.39, -0.26)
Divorced	122.6	0.47	(-2.22, 3.15)	0.43	(-2.25, 3.12)	0.27	(-2.43, 2.98)	0.52	(-2.18, 3.23)	0.48	(-2.25, 3.20)
Remarried											
Father's social class	122.8										
Manual+	120.3	-2.54	(-4.32, -0.76)***	-2.57	(-4.36, -0.79)***					-2.27	(-4.26, 1.68)**
Non-Manual											
Educational attainment	122.7									-0.47	(-2.62, 1.68)
No qualifications	121.7	-0.93	(-2.98, 1.13)			-0.93	(-2.99, 1.13)			-1.20	(-3.81, 1.40)
Lower Secondary	120.5	-2.14	(-4.50, 0.22)			-2.16	(-4.53, 0.21)			-0.96	(-5.36, 3.43)
Advanced Secondary	120.5	-2.18	(-6.30, 1.94)			-2.14	(-6.28, 2.01)				
Degree level											
		-0.15	(-0.72, 0.42)					-0.10	(-0.68, 0.47)	-0.25	(-0.84, 0.34)
Behavioural (conduct) problems											

Model 1 assessed bivariate associations between marital history and SBP, father's social class and SBP, educational attainment and SBP and conduct problems and SBP. All subsequent models estimated the association between marital history and SBP. Model 2 controlled for father's social class; Model 3 adjusted for educational attainment; Model 4 adjusted for behaviour problems; Model 5 simultaneously adjusted for father's social class, educational attainment and behaviour problems.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 SBP=systolic blood pressure mmHg. Educational attainment at 26 years; father's social class at 4 years; behavioural problems is measured at 13 & 15 years – an average of measures of both time points is employed, coefficients are estimated per increase in behavioural problems of 0.5.

Table 5.19 Regression estimates (coefficients) to show the association between marital history and SBP (mmHg) among NCDS men adjusted for father's social class, educational attainment and adolescent conduct problems at age 43 N=3175

		Model 1		Model 2				Model 4		Model 5	
	Mean SBP	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Marital History											
Continually married +	132.3										
Single	134.2	1.84	(0.18, 3.51)**	1.78	(0.12, 3.43)**	1.65	(-0.02, 3.31)**	1.90	(0.22, 3.57)**	1.79	(0.12, 3.45)**
Widowed	129.1	-3.26	(-11.06, 4.55)	-3.50	(-11.27, 4.28)	-3.39	(-11.16, 4.38)	-3.27	(-11.07, 4.53)	-3.60	(-11.35, 4.15)
Divorced	132.4	0.06	(-1.47, 1.59)	-0.14	(-1.66, 1.39)	-0.27	(-1.80, 1.27)	0.08	(-1.45, 1.62)	-0.30	(-1.83, 1.23)
Remarried	131.9	-0.49	(-2.08, 1.09)	-0.69	(-2.28, 0.89)	-0.66	(-2.24, 0.92)	-0.48	(-2.07, 1.11)	-0.74	(-2.32, 0.84)
Father's social class											
Manual+	133.4										
Non-Manual	130.8	-2.59	(-3.66, -1.51)***	-2.61	(-3.69, -1.54)***					-2.01	(-3.13, -0.88)***
Educational attainment											
No qualifications	133.5										
Lower Secondary	134.0	0.50	(-1.01, 2.02)			0.58	(-0.93, 2.10)			0.61	(-0.93, 2.14)
Advanced Secondary	132.4	-1.13	(-2.78, 0.52)			-1.06	(-2.71, 0.60)			-0.91	(-2.60, 0.78)
Degree level	130.5	-3.03	(-4.53, -1.52)***			-2.96	(-4.48, -1.45) ***			-2.56	(-4.18, -0.94)***
Behavioural problems	-.01	(-0.08, 0.05)						-0.02	(-0.08, 0.04)	-0.06	(-0.12, 0.00)

Model 1 assessed bivariate associations between marital history and SBP, father's social class and SBP, educational attainment and SBP and behavioural problems and SBP. All subsequent models estimated the association between marital history and SBP. Model 2 controlled for father's social class; Model 3 adjusted for educational attainment; Model 4 adjusted for behaviour problems; Model 5 simultaneously adjusted for father's social class, educational attainment and behaviour problems.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 SBP=systolic blood pressure mmHg. Educational attainment at 33 years; father's social class at 7 years; behavioural problems is measured at 7 years –coefficients are estimated per increase in behavioural problems of 1.

Table 5.20 Regression estimates (coefficients) to show the association between marital history and SBP (mmHg) among NCDS women adjusted for father's social class, educational attainment and adolescent conduct problems at age 44-45 N=3356

		Model 1		Model 2				Model 4		Model 5	
	Mean SBP	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Marital History											
Continually married +	120.3										
Single	120.6	0.28	(-1.57, 2.13)	0.36	(-1.49, 2.20)	0.30	(-1.55, 2.15)	0.27	(-1.58, 2.12)	0.35	(-1.50, 2.19)
Widowed	121.4	1.09	(-3.87, 6.04)	0.77	(-4.17, 5.72)	0.88	(-4.07, 5.83)	1.10	(-3.86, 6.05)	0.68	(-4.26, 5.62)
Divorced	120.3	-0.02	(-1.48, 1.44)	-0.12	(-1.58, 1.34)	-0.22	(-1.69, 1.25)	-0.04	(-1.50, 1.42)	-0.23	(-1.70, 1.24)
Remarried		-0.62	(-2.18, 0.94)	-0.82	(-2.38, 0.74)	-0.84	(-2.40, 0.73)	-0.64	(-2.20, 0.92)	-0.93	(-2.49, 0.63)
	121.02										
Father's social class	118.76	-2.26	(-3.37, -1.16)***								
Manual+				-2.31	(-3.42, -1.19)***					-2.02	(-3.18, -0.85)***
Non-Manual											
Educational attainment											
No qualifications	121.30										
Lower Secondary	120.40	-0.91	(-2.28, 0.47)			-0.90	(-2.28, 0.47)			-0.59	(-2.00, 0.81)
Advanced Secondary	118.90	-2.40	(-4.38, -0.42)**			-2.47	(-4.45, -0.48)			-1.80	(-3.85, 0.25)
Degree level	119.57	-1.73	(-3.21, -0.25)**			-1.81	(-3.30, -0.32)			-2.02	(-3.18, -0.85)
Behavioural (conduct) problems		0.04	(-0.03, 0.12)					0.05	(-0.03, 0.12)	0.01	(-0.06, 0.09)

Model 1 assessed bivariate associations between marital history and SBP, father's social class and SBP, educational attainment and SBP and behavioural problems and SBP. All subsequent models estimated the association between marital history and SBP. Model 2 controlled for father's social class; Model 3 adjusted for educational attainment; Model 4 adjusted for behaviour problems; Model 5 simultaneously adjusted for father's social class, educational attainment and behaviour problems.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 SBP=systolic blood pressure mmHg. Educational attainment at 33 years; father's social class at 7 years; behavioural problems is measured at 7 years –coefficients are estimated per increase in behavioural problems of 1.

Table 5.21 Regression estimates (coefficients) to show the association between marital history and DBP (mmHg) among NSHD men adjusted for father's social class, educational attainment and adolescent conduct problems at age 43 N=1359

		Model 1		Model 2		Model 3		Model 4		Model 5	
	Mean DBP	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Marital History											
Continually married +	82.1										
Single	831	0.97	(-1.50, 3.44)	089	(-1.57, 3.35)	0.87	(-1.61, 3.34)	0.97	(-1.51, 3.44)	0.85	(-1.61, 3.31)
Widowed	88.3	6.18	(-2.31, 14.68)	6.09	(-2.35, 14.55)	5.64	(-2.84, 14.12)	6.24	(-2.26,	5.85	(-2.60, 14.31)
Divorced	82.9	0.78	(-1.32, 2.88)	0.89	(-1.20, 2.98)	0.68	(-1.41, 2.77)	0.84	(-1.27, 2.94)	0.97	(-1.13, 3.06)
Remarried	80.4	-1.66	(-3.72, 0.41)	-1.78	(-3.84, 0.28	-1.81	(-3.87, 0.26)	-1.61	(-3.68, 0.47)	-1.71	(-3.78, 0.35)
Father's social class											
Manual+	83.1										
Non-Manual	80.6	-2.48	(-3.80, -1. 16) ***	-2.52	(-3.84, -1.21)***					-2.35	(-3.81, -0.90) ***
Educational attainment											
No qualifications	82.6									-0.55	(-2.34, 1.24)
Lower Secondary	81.7	-0.95	(-2.71, 0.80)			-0.93	(-2.69, 0.82)			0.65	(-1.09, 2.39)
Advanced Secondary	82.8	0.18	(-1.45, 1.81)			0.15	(-1.49, 1.78)			-1.85	(-4.13, 0.44)
Degree level	79.8	-2.85	(-4.89, -0.82)***			-2.87	(-4.91, -0.83)***				
Behavioural problems		-0.11	(-0.48, 0.26)					-0.10	(-0.48, 0.27)	-0.27	(-0.66, 0.12)

Model 1 assessed bivariate associations between marital history and DBP, father's social class and DBP, educational attainment and DBP and conduct problems and DBP. All subsequent models estimated the association between marital history and DBP. Model 2 controlled for father's social class; Model 3 controlled for educational attainment; Model 4 controlled for behaviour problems; Model 5 simultaneously controlled for father's social class, educational attainment and behavioural problems in adolescence.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 Educational attainment at 26 years; father's social class at 4 years; behavioural problems is measured at 13 & 15 years – an average of measures of both time points is employed, coefficients are estimated per increase in behavioural problems of 0.5.

Table 5.22 Regression estimates (coefficients) to show the association between marital history and DBP (mmHg) at age 43 among NSHD women adjusted for father's social class, educational attainment and adolescent conduct problems N=1355

		Model 1		Model 2		Model 3		Model 4		Model 5	
	Mean DBP	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Marital History											
Continually married +	77.6										
Single	76.1	-1.42	(-4.86, 2.01)	-1.25	(-4. 96, 2. 91)	-1.19	(-4.64, 2.26)	-1.36	(-4.80, 2.08)	-1.00	(-4.46, 2.46)
Widowed	80.7	3.11	(-1.96, 8.19)	3.12	(-194., 8.20)	3.12	(-1.96, 8.19)	3.28	(-1.80, 8.37)	3.37	(-1.72, 8. 45)
Divorced	76.8	-0.73	(-2.67, 1.21)	-0.74	(-2.68, 1.19)	-0.75	(-2.69, 1.18)	-0.62	(-2.57, 1.32)	-0.61	(-2.55, 1.34)
Remarried	77.4	-0.19	(-2.23, 1.85)	-0.20	(-2.39, 1.84)	-0.35	(-2.41, 1.70)	-0.06	(-2.12, 1.99)	-0.17	(-2.24, 1.90)
Father's social											
Manual+	77.9										
Non-Manual	76.8	-1.05	(-2.41, 0.30)	-1.03	(-2.39, 0.33)					-0.71	(-2.22, 0.80)
Educational attainment											
No qualifications	77.9										
Lower Secondary	77.6	-0.34	(-1.90, 1.22)			-0.32	(-188, 1.25)			-0.31	(-1.94, 1.32)
Advanced	76.6	-1.36	(-3.15, 0.43)			-1.34	(-3.14, 0.45)			-1.23	(-3.21, 0.75)
Degree level	76.3	-1.57	(-4.70, 1.55)			-1.53	(-4.68, 1.61)			-1.47	(-4.81, 1.87)
Behavioural problems		-0.22	(-0.66, 0.21)					-0.22	(-0.66, 0.21)	-0.32	(-0.77, 0.13)

Model 1 assessed bivariate associations between marital history and DBP, father's social class and DBP, educational attainment and DBP and conduct problems and DBP. All subsequent models estimated the association between marital history and DBP. Model 2 controlled for father's social class; Model 3 controlled for educational attainment; Model 4 controlled for behaviour problems; Model 5 simultaneously controlled for father's social class, educational attainment and behavioural problems in adolescence.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 Educational attainment at 26 years; father's social class at 4 years; behavioural problems is measured at 13 & 15 years – an average of measures of both time points is employed, coefficients are estimated per increase in behavioural problems of 0.5.

Table 5.23 Regression estimates (coefficients) to show the association between marital history and DBP (mmHg) among NCDS men adjusted for father's social class, educational attainment and adolescent conduct problems at age 44-45 N=3175

		Model 1		Model 2		Model 3		Model 4		Model 5	
	Mean DBP	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Marital History											
Continually married +	82.0										
Single	83.6	1.51	(0.28, 2.74)	1.47	0.24, 2.70**	1.40	(0.17, 2.63)**	1.58	(0.34, 2.81)	1.51	0.28, 2.74
Widowed	80.9	-1.23	(--6.99, 4.54)	-1.37	-7.13, 4.34	-1.29	(-7.05, 4.46)	-1.24	(-7.01, 4.52)	-1.44	-7.19, 4.31
Divorced	82.4	0.35	-0.78, 1.48	0.23	-0.90, 1.36	0.19	(-0.95, 1.32)	0.38	-0.76, 1.51	0.17	-0.96, 1.31
Remarried	82.4	0.33	-0.84, 1.51	0.21	-0.96, 1.38	0.24	(-0.93, 1.42)	0.35	(-0.82, 1.53)	0.19	-0.98, 1.36
Father's social											
Manual+	82.9										
Non-Manual	81.3	-1.60	(-2.39, -0.80) ***	-1.58	(-2.38, -0.79) ***					-1.32	(-2.16, 0.35) ***
Educational attainment											
No qualifications	83.0										
Lower Secondary	83.1	0.08	(-1.05, 1.20)			0.15	(-0.97, 1.28)			0.14	(-0.10, 1.28)
Advanced	82.0	-1.05	(-2.27, 0.17)			-0.96	(-2.19, 0.26)			-0.90	(-2.16, 0.35)
Degree level	81.4	-1.58	(-2.70, -0.47)*			-1.49	(-2.61, -0.37)			-1.27	(-2.47, -0.07)**
Conduct problems/0.05		-0.02	-0.06, 0.03					-0.02	-0.07, 0.02	-0.04	-0.09, 0.001

Model 1 assessed bivariate associations between marital history and DBP, father's social class and DBP, educational attainment and DBP and conduct problems and DBP. All subsequent models estimated the association between marital history and DBP. Model 2 controlled for father's social class; Model 3 controlled for educational attainment; Model 4 controlled for behaviour problems; Model 5 simultaneously controlled for father's social class, educational attainment and conduct problems in adolescence.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 Educational attainment at 33 years; father's social class at 7 years; behavioural problems is measured at 7 years –coefficients are estimated per increase in behavioural problems of 1.

Table 5.24 Regression estimates (coefficients) to show the association between marital history and DBP (mmHg) among NCDS women adjusted for father's social class, educational attainment and adolescent conduct problems at age 44-45 N=3356

		Model 1		Model 2		Model 3		Model 4		Model 5	
	Mean DBP	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Marital History											
Continually married +	75.7										
Single	75.7	-0.07	(-1.37, 1.23)	-0.01	(-1.31, 1.29)	-0.05	-1.35, 1.25	-0.08	-1.38, 1.23	-0.01	-1.31, 1.29
Widowed	77.6	1.92	(-1.57, 5.40)	1.66	(-1.82, 5.14)	1.77	-1.71, 5.26	1.92	-1.57, 5.41	1.60	-1.88, 5.08
Divorced	75.9	0.15	(-0.88, 1.18)	0.07	(-0.96, 1.09)	-0.01	-1.05, 1.02	0.14	-0.89, 1.17	-0.02	-1.05, 1.02
Remarried	75.6	-0.08	(-1.18, 1.01)	-0.24	-0.96, 1.09	-0.25	-1.35, 0.86	-0.09	-1.19, 1.00	-0.32	-1.42, 0.78
Father's social class											
Manual+	76.4										
Non-Manual	74.5	-1.86	(-2.64, -1.08) ***	-1.86	(-2.64, -1.08) ***					-1.64	(-2.46, -0.82) ***
Educational attainment	76.7	-0.81	(-1.78, -0.16)			-0.81	-1.78, 0.16)			-0.60	(-1.59, 0.40)
No qualifications	75.8	-1.59	(-2.98, -0.19)**			-1.59	-2.99, -0.19)			-1.10	(-2.54, 0.34)
Lower Secondary	75.1	-1.55	(-2.59, -0.51)			-1.56	-2.61, -0.51)			-0.94	(-2.06, 0.18)
Advanced Degree level	75.1										
Conduct problems/0.05		0.03	(-0.02, 0.08)					0.03	-0.02, 0.08	.0002	(-0.05, 0.05)

Model 1 assessed bivariate associations between marital history and DBP, father's social class and DBP, educational attainment and DBP and conduct problems and DBP. All subsequent models estimated the association between marital history and DBP. Model 2 controlled for father's social class; Model 3 controlled for educational attainment; Model 4 controlled for behaviour problems; Model 5 simultaneously controlled for father's social class, educational attainment and conduct problems in adolescence.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 Educational attainment at 33 years; father's social class at 7 years; behavioural problems is measured at 7 years –coefficients are estimated per increase in behavioural problems of 1

Table 5.25 Regression estimates (coefficients) to show the association between marital history and BMI among NSHD men adjusted for father's social class, educational attainment and adolescent conduct problems at age 43, N=1374

		Model 1		Model 2		Model 3		Model 4		Model 5	
	Mean BMI	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Marital History											
Continually married +	25.8										
Single	25.7	-0.05	(-0.75, 0.65)	-0.09	(-0.78, 0.61)	-0.17	(-0.86, 0.53)	-0.04	(-0.74, 0.65)	-0.13	(-0.82, 0.56)
Widowed	24.9	-0.86	(-3.28, 1.55)	-0.90	(-3.29, 0.50)	-1.04	(-3.44, 1.36)	-1.00	(-3.40, 1.40)	-1.08	(-3.46, 1.31)
Divorced	25.4	-0.42	(-1.01, 0.17)	-0.39	(-0.97, 0.30)	-0.48	(-1.06, 0.11)	-0.56	(-1.15, 0.03)	-0.52	(-1.11, 0.06)
Remarried	25.9	0.14	(-0.45, 0.73)	0.09	(-0.49, 0.68)	0.03	(-0.55, 0.62)	0.02	(-0.58, 0.60)	-0.04	(-0.62, 0.55)
Father's social											
Manual+	26.1										
Non-Manual	25.2	-0.93	(-1.30, -0.56)***	-0.92	-1.29, -0.55***						
Educational attainment											
No qualifications	26.3										
Lower Secondary	25.7	-0.57	(-1.06, -0.07)**			-0.58	(-1.07, -0.08)**			-0.35	(-0.85, 0.15)
Advanced	25.4	-0.85	(-1.31, -0.39)***			-0.86	(-1.32, -0.40)***			-0.47	(-0.96, 0.01)
Degree level	25.0	-1.31	(-1.88, -0.73)***			-1.33	(-1.90, -0.75) ***			-0.68	(-1.32, -0.04) **
Behavioural problems		0.25	(0.14, 0.35)***					0.26	0.15, 0.36***	0.18	(0.07, 0.29)***

Model 1 assessed bivariate associations between marital history and BMI, father's social class and BMI, educational attainment and BMI and conduct problems and BMI. All subsequent models estimated the association between marital history and BMI. Model 2 controlled for father's social class; Model 3 controlled for educational attainment; Model 4 controlled for behaviour problems; Model 5 simultaneously controlled for father's social class, educational attainment and conduct problems in adolescence.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 Educational attainment at 26 years; father's social class at 4 years; behavioural problems is measured at 13 & 15 years – an average of measures of both time points is employed, coefficients are estimated per increase in behavioural problems of 0.5.

Table 5.26 Regression estimates (coefficients) to show the association between marital history and BMI (kg/m^2) among NSHD women adjusted for father's social class, educational attainment and adolescent conduct problems at age 43 N=1367

		Model 1		Model 2		Model 3		Model 4		Model 5	
	Mean BMI	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Marital History											
Continually married +	25.3										
Single	25.9	0.63	(-0.65, 1.91)	0.96	(-0.31, 2.22)	0.84	(-0.43, 2.11)	0.60	(-0.68, 1.88)	0.98	(-0.28, 2.25)
Widowed	23.1	-2.17	(-4.14, -0.21)**	-2.20	(-4.13, -0.26)**	-2.18	(-4.12, -0.24)**	-2.28	(-4.25, -0.31)**	-2.21	(-4.14, -0.28)
Divorced	24.2	-1.05	(-1.79, -0.32) ***	-1.08	(-1.80, -0.35) ***	-1.07	(-1.80, -0.35) ***	-1.12	(-1.86, 0.49) ***	-1.09	(-1.81, -0.36) ***
Remarried	25.1	-0.21	(-0.97, 0.56)	-0.23	(-0.98, 0.53)	-0.34	(-1.11, 0.42)	-0.28	-1.05, 0.49	-0.30	(-1.06, 0.46)
Father's social class											
Manual+	25.8										
Non-Manual	24.1	-1.73	(-2.24, -1.22) ***	-1.77	(-2.28, -1.27) ***					-1.30	(-1.86, -0.74) ***
Educational attainment											
No qualifications	26.1										
Lower Secondary	24.9	-1.22	(-1.80, -0.63) ***			-1.20	(-1.78, -0.62) ***			-0.86	(-1.46, -0.25) ***
Advanced Secondary	24.0	-2.08	(2.75, -1.41) ***			-2.13	(-2.80, -1.46) ***			-1.47	(-2.20, -0.74) ***
Degree level	24.4	-1.70	(-2.87, -0.53) ***			-1.77	(-2.94, -0.59) ***			-0.91	(-2.15, 0.33) ***
Behavioural (conduct)		0.09	(-0.07, 0.26)					0.13	(-0.03, 0.30)	0.00	(-0.16, 0.17)

Model 1 assessed bivariate associations between marital history and BMI, father's social class and BMI, educational attainment and BMI and conduct problems and BMI. All subsequent models estimated the association between marital history and BMI. Model 2 controlled for father's social class; Model 3 controlled for educational attainment; Model 4 controlled for behaviour problems; Model 5 simultaneously controlled for father 's social class, educational attainment and behavioural problems in adolescence.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 Educational attainment at 26 years; father's social class at 4 years; behavioural problems is measured at 13 & 15 years – an average of measures of both time points is employed, coefficients are estimated per increase in behavioural problems of 0.5.

Table 5.27 Regression estimates (coefficients) to show the association between marital history and BMI (BMI (kg/m2)) among NCDS men adjusted for father's social class, educational attainment and adolescent conduct problems at age 44-45 N=3155

		Model 1		Model 2		Model 3		Model 4		Model 5	
	Mean BMI	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Marital History											
Continually married +	27.9										
Single	27.6	-0.25	(-0.72, 0.23)	-0.27	(-0.74, 0.20)	-0.34	(-0.81, 0.13)	-0.33	(-0.81, 0.14)	-0.38	(-0.85, 0.10)
Widowed	26.1	-1.79	(-4.00, 0.42)	-1.87	(-4.07, 0.33)	-1.86	(-4.05, 0.34)	-1.77	(-3.98, 0.44)	-1.89	(-4.08, 0.31)
Divorced	27.6	-0.32	(-0.76, 0.11)	-0.39	(-0.82, 0.05)	-0.45	(-0.89, -0.12) **	-0.36	(-0.80, 0.08)	-0.49	(-0.92, -0.05) **
Remarried	28.3	0.37	(-0.08, 0.83)	0.31	(-0.14, 0.76)	0.32	(0.13,0.77)	0.35	(-0.10, 0.80)	0.27	(-0.17, 0.73)
Father's social											
Manual+	28.2										
Non-Manual	27.3	-0.89	(-1.20, -0.58)***	-0.89	(-1.20, -0.59) ***					-0.64	(-0.96, -0.32) ***
Educational attainment											
No qualifications	28.4										
Lower Secondary	28.1	-0.30	(-0.73, 0.13)			-0.33	(-0.76, 0.10)			-0.19	(-0.62, 0.25)
Advanced Secondary	28.0	-0.44	(-0.91, 0.03)			-0.46	(-0.94, -0.88) **			-0.25	(-0.73, 0.23)
Degree level	27.2	-1.25	(-1.68, -0.83) ***			-1.31	(-1.73, -0.88)***			-0.95	(-1.41, -0.50) ***
Behavioural problems		0.03	(0.01, 0.05) ***					0.03	(0.01, 0.05) ***	0.02	(-0.00, 0.03)

Model 1 assessed bivariate associations between marital history and BMI, father's social class and BMI, educational attainment and BMI and conduct problems and BMI. All subsequent models estimated the association between marital history and BMI. Model 2 controlled for father's social class; Model 3 controlled for educational attainment; Model 4 controlled for behaviour problems; Model 5 simultaneously controlled for father's social class, educational attainment and conduct problems in adolescence.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 Educational attainment at 26 years; father's social class at 4 years; behavioural problems is measured at 13 & 15 years – an average of measures of both time points is employed, coefficients are estimated per increase in behavioural problems of 0.5.

Table 5.28 Regression estimates (coefficients) to show the association between marital history and BMI kg/m^2 among NCDS women adjusted for father's social class, educational attainment and adolescent conduct problems at age 44-45 N=3358

		Model 1		Model 2		Model 3		Model 4		Model 5	
	Mean BMI	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Marital History											
Continually married +	27.0										
Single	26.6	-0.36	(-1.01, 0.28)	-0.31	(-0.95, 0.33)	-0.33	(-0.97, 0.31)	-0.38	(-1.02, 0.26)	-0.31	(-0.94, 0.33)
Widowed	27.7	0.76	(-0.90, 2.42)	0.53	(-1.12, 2.18)	0.60	(-1.05, 2.25)	0.75	(-0.91, 2.41)	0.47	(-1.17, 2.12)
Divorced	26.8	-0.17	(-0.68, 0.34)	-0.24	(-0.74, 0.27)	-0.35	(-0.86, 0.15)	-0.20	(-0.71, 0.31)	-0.36	(-0.87, 0.14)
Remarried	27.0	0.06	(-0.48, 0.60)	-0.06	(-0.60, 0.47)	-0.13	(-0.67, 0.41)	0.03	(-0.51, 0.57)	-0.18	(-0.71, 0.36)
Father's social											
Manual+	27.4										
Non-Manual	25.9	-1.51	(-1.90, -1.13)***	-1.51	-1.89, -1.12***						
Educational attainment											
No qualifications	27.9										
Lower Secondary	27.0	- 0.89	(-1.36, -0.41)***			-0.89	(-1.37, -0.42)***			-0.61	(-1.09, -0.12)***
Advanced	26.2	-1.70	(-2.38, -1.01)***			-1.72	(-2.40, -1.03)***			-1.17	(-1.88, -0.47)***
Degree level	26.1	-1.79	(-2.31, -1.28)***			-1.82	(-2.34, -1.30)***			-1.19	(-1.74, -0.64)***
Behavioural problems		0.06	(0.04, 0.09)***					0.06	(0.04, 0.09)***	0.04	(0.13, 0.06)***

Model 1 assessed bivariate associations between marital history and BMI, father's social class and BMI, educational attainment and BMI and conduct problems and BMI. All subsequent models estimated the association between marital history and BMI. Model 2 controlled for father's social class; Model 3 controlled for educational attainment; Model 4 controlled for behaviour problems; Model 5 simultaneously controlled for father's social class, educational attainment and conduct problems in adolescence.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 Educational attainment at 33 years; father's social class at 7 years; behavioural problems is measured at 7 years –coefficients are estimated per increase in behavioural problems of 1

Table 5.29 Regression estimates (coefficients) to show the association between marital history and waist circumference (cm) among NSHD men adjusted for father's social class, educational attainment and adolescent conduct problems at age 43 N=1368

		Model 1		Model 2		Model 3		Model 4		Model 5	
	Mean waist	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Marital History											
Continually	91.9										
Single	92.8	0.90	(-1.08, 2.88)	0.83	(-1.14, 2.81)	0.58	(-1.39, 2.54)	0.93	(-1.03, 2.90)	0.67	(-1.30, 2.63)
Widowed	91.6	-0.34	(-7.17, 6.49)	-0.40	(-7.21, 6.41)	-0.85	(-7.63, 5.93)	-0.69	(-7.48, 6.09)	-0.97	(-7.73, 5.79)
Divorced	91.3	-0.61	(-2.28, 1.07)	-0.53	(-2.20, 1.14)	-0.76	(-2.42, 0.90)	-0.97	(-2.64, 0.70)	-0.94	(-2.60, 0.73)
Remarried	91.5	-0.47	(-2.13, 1.20)	-0.55	(-2.21, 1.10)	-0.77	(-2.43, 0.88)	-0.79	(-2.44, 0.87)	-0.94	(-2.60, 0.71)
Father's social											
Manual+	92.6										
Non-Manual	90.8	-1.75	(-2.80, -0.69)***	-1.74	(-2.79, -0.68)***					-0.64	(-1.79, 0.52)
Educational											
No qualifications	93.4										
Lower Secondary	91.8	-1.65	(-3.05, -0.25)**			-1.66	(-3.06, -0.26)**			-1.28	(-2.71, 0.14)
Advanced Secondary	90.9	-2.51	(-3.81, -1.21) ***			-2.52	(-3.82, -1.22) ***			-1.83	(-3.22, -0.45) ***
Degree level	89.7	-3.77	(-5.38, -2.14)			-3.81	(-5.44, -2.18)			-0.64	(-1.79, 0.52)
Behavioural		0.64	(0.35, 0.94)			0.67	(0.38, 0.97)			0.27	(0.15, 0.78)

Model 1 assessed bivariate associations between marital history and waist circumference, father's social class and waist circumference, educational attainment and waist circumference and conduct problems and waist circumference. All subsequent models estimated the association between marital history and CVD. Model 2 controlled for father's social class; Model 3 controlled for educational attainment; Model 4 controlled for behaviour problems; Model 5 simultaneously controlled for father's social class, educational attainment and conduct problems in adolescence.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 Educational attainment at 26 years; father's social class at 4 years; behavioural problems is measured at 13 & 15 years – an average of measures of both time points is employed, coefficients are estimated per increase in behavioural problems of 0.5.

Table 5.30 Regression estimates (coefficients) to show the association between marital history and waist circumference (cm) among NSHD women adjusted for father's social class, educational attainment and adolescent conduct problems at age 43 N=1373

		Model 1		Model 2		Model 3		Model 4		Model 5	
	Mean waist	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Marital History											
Continually married +	78.0			2.25	(-0.74, 5.23)	1.99	(-1.01, 4.99)	1.33	(-1.69, 4.35)	2.25	(-0.73, 5.24)
Single	79.5	1.47	-1.56, 4.50	-2.57	(-7.04, 1.90)	-2.70	(-7.19, 1.79)	-3.01	(-7.56, 1.54)	-2.84	(-7.30, 1.63)
Widowed	75.4	-2.61	-7.16, 1.94	-1.60	(-3.30, 0.10)	-1.58	(-3.30, 0.13)	-1.80	(-3.54, -	-1.72	(-3.43, -0.01)***
Divorced	76.5	-1.55	-3.28, 0.19	-0.60	(-2.39, 1.19)	-0.84	(-2.65, 0.98)	-0.81	(-2.64, 1.02)	-0.87	(-2.68, 0.94)
Remarried	77.5	-0.52	-2.34, 1.31								
Father's social class											
Manual+	79.5										
Non-Manual	75.3	-4.19	(-5.38,-3.01)***	-4.28	(-5.47, -					-3.23	(-4.55, -1.92)***
Educational attainment											
No qualifications											
Lower Secondary						-2.87	(-4.25, -1.50)***			-1.89	(-3.31, -0.47)***
Advanced Secondary						-4.66	(-6.24, -3.08)***			-2.87	(-4.59, -1.15)***
Degree level						-4.74	(-7.53, -1.96)***			-2.37	(-5.30, 0.55)
Behavioural (conduct) problems	0.45	(0.07, 0.84)**					0.52	(0.13, 0.91)***	0.23	(-0.16, 0.62)	

Model 1 assessed bivariate associations between marital history and waist circumference, father's social class and waist circumference, educational attainment and waist circumference and conduct problems and waist circumference. All subsequent models estimated the association between marital history and CVD. Model 2 controlled for father's social class; Model 3 controlled for educational attainment; Model 4 controlled for behaviour problems; Model 5 simultaneously controlled for father's social class, educational attainment and conduct problems in adolescence.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 Educational attainment at 26 years; father's social class at 4 years; behavioural problems is measured at 13 & 15 years – an average of measures of both time points is employed, coefficients are estimated per increase in behavioural problems of 0.5.

Table 5.31 Regression estimates (coefficients) to show the association between marital history and waist circumference (cm) among NCDS men adjusted for father's social class, educational attainment and adolescent conduct problems at age 44-45 N=3184

		Model 1		Model 2		Model 3		Model 4		Model 5	
	Mean waist	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Marital History											
Continually married +	98.7										
Single	100.8	2.09	(-0.09, 4.27)	2.04	(-0.14, 4.21)	1.88	(-0.30, 4.07)	1.86	(-0.33, 4.05)	1.77	(-0.42, 3.96)
Widowed	96.1	-2.64	(-12.88, 7.61)	-2.85	(-13.08, 7.38)	-2.79	(-13.03, 7.44)	-2.58	(-12.82, 7.66)	-2.87	(-13.10, 7.36)
Divorced	97.6	-1.13	(-3.14, 0.89)	-1.29	(-3.31, 0.72)	-1.41	(-3.43, 0.61)	-1.23	(-3.25, 0.78)	-1.52	(-3.54, 0.50)
Remarried	99.7	0.97	(-1.11, 3.05)	0.79	(-1.28, 2.87)	0.86	(-1.22, 2.94)	0.89	(-1.19, 2.97)	0.72	(-1.36, 2.80)
Father's social class											
Manual+	99.7										
Non-Manual	97.4	-2.30	(-3.71, -0.89)***	-2.31	(-3.73, -					-1.80	(-3.28, -0.32)**
Educational											
No qualifications	100.3										
Lower Secondary	99.2	-1.08	(-3.07, 0.91)			-1.03	(-3.02, 0.97)			-0.60	(-2.63, 1.42)
Advanced Secondary	99.6	-0.64	(-2.81, 1.53)			-0.57	(-2.74, 1.61)			0.08	(-2.15, 2.30)
Degree level	97.3	-2.97	(-4.95, -0.99)***			-2.96	(-4.95, -0.97)***			-1.92	(-4.05, 0.21)
Conduct problems/0.05		0.09	(0.01, 0.16)					0.08	(0.00, 0.16)	0.05	(-0.03,0.13)

Model 1 assessed bivariate associations between marital history and waist circumference, father's social class and waist circumference, educational attainment and waist circumference and conduct problems and waist circumference. All subsequent models estimated the association between marital history and CVD. Model 2 controlled for father's social class; Model 3 controlled for educational attainment; Model 4 controlled for behaviour problems; Model 5 simultaneously controlled for father's social class, educational attainment and conduct problems in adolescence.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 Educational attainment at 33 years; father's social class at 7 years; behavioural problems is measured at 7 years –coefficients are estimated per increase in behavioural problems of 1

Table 5.32 Regression estimates (coefficients) to show the association between marital history and waist circumference (cm) among NCDS women adjusted for father's social class, educational attainment and adolescent conduct problems at age 44-45 N=3388

		Model 1		Model 2		Model 3		Model 4		Model 5	
	Mean	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Marital History											
Continually married +	85.5										
Single	85.3	-0.26	(-1.77,1.26)	-0.15	(-1.65, 1.35)	-0.19	(-1.69, 1.31)	-0.30	(-1.81, 1.20)	-0.18	(-1.67, 1.32)
Widowed	86.6	1.06	(-2.92, 5.03)	0.60	(-3.35, 4.55)	0.71	(-3.23, 4.65)	1.12	(-2.83, 5.08)	0.53	(-3.39, 4.46)
Divorced	85.9	0.33	(-0.87, 1.52)	0.18	(-1.01, 1.37)	-0.12	(-1.32, 1.07)	0.23	(-0.96, 1.43)	-0.14	(-1.33, 1.05)
Remarried	85.1	-0.43	(-1.70, 0.84)	-0.70	(-1.97, 0.57)	-0.90	(-2.17, 0.37)	-0.51	(-1.78, 0.76)	-0.99	(-2.26, 0.27)
Father's social class											
Manual+	86.6										
Non-Manual	83.5	-3.12	(-4.02, -2.22)***	-3.14	(-4.04, -2.23)***					-2.23	(-3.17, -1.28)***
Educational											
No qualifications											
Lower Secondary						-2.35	(-3.47, -1.23)			-1.64	(-2.78, -0.50)
Advanced Secondary						-4.57	(-6.19, -2.96)			-3.29	(-4.95, -1.64)
Degree level						-4.37	(-5.59, -3.15)			-2.92	(-4.21, -1.63)
Behavioural problems		0.18	(0.12, 0.24)***					0.18	(0.12, 0.24	0.12	(0.06, 0.18)

Model 1 assessed bivariate associations between marital history and waist circumference, father's social class and waist circumference, educational attainment and waist circumference and behaviouralproblems and waist circumference. All subsequent models estimated the association between marital history and CVD. Model 2 controlled for father's social class; Model 3 controlled for educational attainment; Model 4 controlled for behaviour problems; Model 5 simultaneously controlled for father's social class, educational attainment and conduct problems in adolescence.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 Educational attainment at 33 years; father's social class at 7 years; behavioural problems is measured at 7 years –coefficients are estimated per increase in behavioural problems of 1

Table 5.33 Regression estimates (coefficients) to show the association between marital history and waist circumference (cm) among NCDS women adjusted for father's social class, educational attainment and adolescent conduct problems at age 44-45 N=3388

		Model 1		Model 2		Model 3		Model 4		Model 5	
	Mean	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)	Coefficient	(95% CI)
Marital History											
Continually married +	85.5										
Single	85.3	-0.26	(-1.77,1.26)	-0.15	(-1.65, 1.35)	-0.19	(-1.69, 1.31)	-0.30	(-1.81, 1.20)	-0.18	(-1.67, 1.32)
Widowed	86.6	1.06	(-2.92, 5.03)	0.60	(-3.35, 4.55)	0.71	(-3.23, 4.65)	1.12	(-2.83, 5.08)	0.53	(-3.39, 4.46)
Divorced	85.9	0.33	(-0.87, 1.52)	0.18	(-1.01, 1.37)	-0.12	(-1.32, 1.07)	0.23	(-0.96, 1.43)	-0.14	(-1.33, 1.05)
Remarried	85.1	-0.43	(-1.70, 0.84)	-0.70	(-1.97, 0.57)	-0.90	(-2.17, 0.37)	-0.51	(-1.78, 0.76)	-0.99	(-2.26, 0.27)
Father's social class											
Manual+	86.6										
Non-Manual	83.5	-3.12	(-4.02, -2.22)***	-3.14	(-4.04, -2.23)***					-2.23	(-3.17, -1.28)***
Educational											
No qualifications											
Lower Secondary						-2.35	(-3.47, -1.23)			-1.64	(-2.78, -0.50)
Advanced Secondary						-4.57	(-6.19, -2.96)			-3.29	(-4.95, -1.64)
Degree level						-4.37	(-5.59, -3.15)			-2.92	(-4.21, -1.63)
Behavioural problems		0.18	(0.12, 0.24)***					0.18	(0.12, 0.24	0.12	(0.06, 0.18)

Model 1 assessed bivariate associations between marital history and waist circumference, father's social class and waist circumference, educational attainment and waist circumference and behaviouralproblems and waist circumference. All subsequent models estimated the association between marital history and CVD. Model 2 controlled for father's social class; Model 3 controlled for educational attainment; Model 4 controlled for behaviour problems; Model 5 simultaneously controlled for father's social class, educational attainment and conduct problems in adolescence.+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 Educational attainment at 33 years; father's social class at 7 years; behavioural problems is measured at 7 years –coefficients are estimated per increase in behavioural problems of 1

5.4 Discussion

The present study assessed the confounding effects of father's social class, educational attainment and adolescent behavioural problems on the association between marital history and CVD. The association of each of these potential confounders with the likelihood of marriage, divorce and widowhood and CVD was explored.

5.5 Summary of main findings in relation to marital history and CVD.

In this chapter, the association between marital history and CVD was estimated among samples with complete information on marital history, CVD, father's social class, educational attainment and adolescent behavioural problems. At age 60-64 for members of the NSHD, the association between marital history and CVD in the complete covariate data is the same as for chapter 4: There was a higher risk of CVD diagnosis for widowed relative to married women, and SBP was lower for divorced relative to married women. No other differences in CVD prevalence, SBP, DBP, BMI or waist circumference between continually married and other marital groups were apparent.

There is however some evidence to suggest that the relationship between marital history and CVD in mid-adulthood for members of both the NSHD at 43 years and members of the NCDS at 44-45 years, is different after limiting samples to those with complete covariate data. It is possible that that exclusion of samples was not random.

In chapter 4 – which included subjects both with and without information on covariate data - there was no evidence for higher SBP among single relative to continually married men, of the NCDS. However in estimates of the sample with complete data on all covariates, SBP was higher for single men from the NCDS relative to their continually married counterparts. Single men or those from non-manual social classes were less likely to have complete data on all covariates. Among men from the NCDS, those who are from non-manual classes have lower SBP than their counterparts from manual classes. It is possible that restricting the sample to those with complete data on all covariates, resulted in a loss of men from single men from non-manual classes. The effect of this may have been a disproportionate of single men with high SBP in the sample. While divorced men from the NSHD had significantly lower BMI at age 43, this association was not significant in estimates of sample with complete covariate data. It is possible that the higher risk of exclusion from the sample with complete covariate data among men who were divorced or relatively more educated, may explain this discrepancy. Relatively higher education was associated with lower BMI. If the divorced men who were excluded were also more likely to be excluded from the sample with complete covariate data, then this might lead to an over-estimation of men who are relatively

less educated and possibly also have less BMI. This in turn, may have resulted in a null association. Prior to limiting the sample with complete information on covariate data, there was no evidence for differences in BMI between continually married and widowed men of the NSHD, at 43 years. After limiting the sample to those with complete covariate data however, there was evidence for lower BMI among widowed relative to continually married men. It is difficult to make any inferences about bias for widowed men in this sample, as numbers were very small.

Explanations in relation to significant findings and possible reasons for null findings in relation to the association between marital history and CVD for all three samples are outlined in chapter 4, and are therefore not repeated here.

For men from both cohorts, there was little evidence for a relationship between father's social class and the likelihood of marriage. Coming from a non-manual background was associated with a lower likelihood of marriage for women from the NSHD at both 60-64 and 43 years, and women from the NCDS. As expected there is evidence to suggest that the likelihood of marriage is higher among more educated men, while the reverse is true for women. Trends in the data suggest that the likelihood of marriage is associated with a higher likelihood of marriage, albeit not significantly. Educational attainment is linked negatively with educational attainment for women from both cohorts, though this difference is only significant between women from the NSHD.

There was some evidence to suggest that the risk of divorce was lower among men with relatively higher levels of education by 60-64 years among members of the NSHD, though this was not apparent by 43 years of age. No such findings were apparent for women. Educational attainment was associated with a lower risk of divorce among both men and women from the NCDS. There was a significant interaction between educational attainment and cohort type, on the likelihood of divorce among women. Behavioural problems in adolescence were associated with a higher risk of divorce among both cohorts. This is with the exception of women from the NCDS, for whom no association was evident.

Coming from a non-manual background, being relatively more educated and experiencing lower levels of conduct problems was associated with a lower risk of widowhood by 60-64 years among members of the NSHD. There was some evidence for a significant association between behavioural problems and widowhood among women by age 43.

Overall, there was evidence to suggest that coming from a manual background, having attained lower levels of education and experiencing behavioural problems is childhood was associated with a higher risk of cardiovascular disease for both cohorts, at both ages. There was little influence of these factors on the association between marital history and CVD.

5.5.1.1 SEP and marital union - Comparison with previous findings and explanations

The finding that educational attainment is associated with a higher likelihood of marriage among men is consistent with previous studies. [136] [132] [137] This finding is also plausible in light of the consistently higher rates of marriage among employed relative to unemployed men, [124,125,126,127,128,129] [130] [131] given that higher levels of educational attainment begets employment. [135]

The association of father's social class and educational attainment with marriage for women were not independent of each other. Therefore the focus of this discussion is on plausible pathways between educational attainment and marriage, among women. The finding that relatively more educated women are at a lower risk of marriage is inconsistent with the majority of literature. Previous findings have suggested that though educational participation delays marriage, the rate of marriage is higher among those who are relatively more educated.[136] [132] [137]

However, these studies have focussed mainly on a continuous measure – years of education – in relation to marriage. [132,133,137,137] The problem with relying on findings that employ this measure is that it is not possible to investigate how different levels of education affect marriage behaviour among women. The association of education and marriage among women is not linear. A study of women among the NSHD, found that women who had attained A-levels, but not a degree, married later but at a faster rate than women with no qualifications. [138] Therefore it is possible that the eventual rates of marriage would be higher for women with A-levels only, by "catching up." However, women with a degree or above married both later and at a lower rate than their less educated counterparts. Studies which employed a continuous measure of education, could not have captured this difference.

A lower likelihood of marriage among women with higher levels of education is plausible, via two mechanisms. This includes an ability to reject marriage among more educated women, and a lower desirability of educated women in the marriage market.

Employment and educational attainment among women has increased considerably over recent decades, since members of this cohort were entering adulthood. [135] This suggests a greater reinforcement of traditional gender roles within a spousal relationship, for members of these cohorts, particularly the NSHD, compared with more recent cohorts. Therefore the opportunity to contribute to a spousal relationship in traditional cohorts may be greater for women who are more willing to contribute to the domestic role in a marriage. Higher levels of educational attainment among women may signal a lesser to desire to fulfil such a role, reducing their desirability among traditional cohorts.

5.5.1.2 SEP and divorce: Comparison with previous findings and explanations

There was some evidence to suggest that the risk of divorce was lower among men with relatively higher levels of education. This is plausible in light of the employment opportunities afforded by education. Previous studies have been consistent in showing that being employed is associated with a lower risk of divorce for men.

5.5.1.3 Conduct problems and divorce: Comparison with previous findings and explanations

Behavioural problems were associated with an increased risk of divorce. Existing studies have also found that higher levels of psychological distress are evident for those who go on to divorce, relative to those who remain married.

This may occur as a result of mental health problems in adulthood. It has been previously demonstrated that the experience of conduct problems in adolescence was associated with a higher risk of mental health problems at 40 years of age for members of this cohort.[169] There are several ways in which mental health problems in adulthood may potentially increase the risk of divorce. Higher levels of anxiety and lower mood may reduce the quality of marriage, and in turn increase the risk of divorce.

5.5.1.4 SEP and conduct problems, and widowhood: Comparison with previous findings and explanations

It is clear that disadvantaged circumstances are associated with an increased likelihood of widowhood. Generally, the evidence suggests that coming from a non-manual background, being relatively more educated and not having experienced conduct problems in adolescence was associated with a lower likelihood of widowhood. A possible explanation here is that that those from disadvantaged circumstances and those who are at a higher likelihood of mental health problems marry those in similar circumstances, which may increase the risk of spousal death. [171 172 173 54;155,

5.5.1.5 Inter-cohort differences in the association between SEP and marital status: explanations

There was some evidence for differences in the association between father's social class and educational attainment with the likelihood of marriage and divorce, by cohort type.

The lower rates of education among relatively educated women are particularly pronounced among members of the NSHD relative to NCDS. It is likely that is due to differences in the rates of marriage, between members of the NSHD and NCDS which were discussed in section 4.3.2. To summarize briefly, there was evidence to suggest that the rates of

remaining single, divorce and age of transition in to marriage were higher for members of the NCDS, relative to members of the NSHD. Goode's hypothesis suggests that in the instance that an event is rare, those who are well-equipped with resources will be more likely to deviate from social norms relative to their less advantaged counterparts.[139] Since remaining single was less common among members of the NSHD than for members of the NCDS, it is possible that resources were more important in deciding not to marry for women from the NSHD. Another potential explanation for these findings is a higher desirability for marriage to educated women, among men of the NCDS. Traditionally, women played the role of the home-maker. It is possible that this view of women may have made educated women less desirable, if educational attainment signalled a lesser desire to fulfil a domesticated role. It is known that both employment and educational attainment among women have increased considerably, over recent decades. This change is reflected in the current study, which finds that educational attainment is higher among women from the NCDS relative to women from the NSHD.

Therefore women are becoming more and more likely to contribute to the household income as a result of which shared responsibility of children has increased. It is possible that men's attitudes toward what they search for in a wife have also started to move in a direction that favours educated women in a marriage market.

Furthermore there evidence for a significant interaction between educational attainment and cohort on the risk of divorce among women. Among women of the NCDS higher levels of education was associated with a lower risk of divorce, though no association was apparent for women of the NCDS. There is some evidence to suggest that the risk of divorce among employed women is higher relative to unemployed women, only in the instance that they disagree with the idea of women contributing to the household income. An increasing acceptance for women as contributors to the house-hold income over time may explain why educational attainment – which is linked with a higher likelihood of employment –was associated with a lower likelihood of divorce among women of the NCDS but not women of the NSHD, whose views about the role of women in marriages may be more conservative.

Though coming from a non-manual background and being relatively more educated was associated with a lower likelihood of divorce among men of both cohorts, this finding was stronger for members of the NCDS. It is thought that this may reflect the greater importance of education in securing employment – which reduces the risk of divorce - for members of the NCDS, relative to members of the NSHD. Though for both cohorts, employment is more likely among the more educated this relationship is stronger for members of the NCDS cohort.[135] Furthermore, gaps in educational attainment between those from manual and non-manual backgrounds are larger for members of the NCDS[135] which may explain the greater potency of father's social class in predicting divorce for members of the NCDS.

5.6 Strengths of the present study

The strengths and limitations of this PhD thesis in assessing the association between marital history and CVD among members of the NSHD at 43 and 60-64 years, and members of the NCDS at 44-45 years have been outlined in sections 4.4 and 4.5, and are not repeated here.

The remainder of this discussion will evaluate the strengths in the approach taken to investigating the role of father's social class, educational attainment and adolescent behavioural problems as confounders of the relationship between marital history and CVD.

The present study addressed limitations of the existing literature on socioeconomic status and psychological distress and marital status. Improvements were made on the study designs employed, and the measures employed. Existing studies on socioeconomic position and marital union focus largely on ecological studies and cross-sectional studies. [124,125,126,127,128,129 130 131]

Reverse causality and omitted variable bias are inherent problems of cross-sectional and ecological studies. Since information on socioeconomic position is collected throughout the life course for members of the NSHD, the present study was able to assess the association of SEP with marriage, prospectively. Furthermore the present study employs educational attainment in adulthood as a measure of SEP. The use of educational attainment rather than employment status – which has been used by several studies which have looked at the association between SEP and marital dissolution – is an important addition to the existing literature on SEP and marital status. This is because studies of employment and marital dissolution, even when prospective, may be confounded by marital quality. The literature on SEP and dissolution has been detailed in section 2.3.1.1, but warrants reiteration here. Studies of SEP and marital dissolution have found that employed women are more likely to divorce than their unemployed counterparts. [147] [148,149] However there is evidence to suggest that this association is dependent on marital quality. Specifically, employment is associated with a higher risk of marital dissolution in the instance that marital quality is low. [70] Furthermore, it is also possible that low marital quality may propel women to work, in preparation for a divorce. The use of educational attainment avoids problems of confounding in this way, and therefore provides a more accurate assessment of the association between SEP and divorce among women.

The majority of studies on psychological distress and divorce have taken measures of psychological distress while respondents are married. .[109,163] [168] This has made it difficult to conclude whether higher psychological distress for those who go onto those who divorce relative to those who stay married, is due to pre-existing differences in psychological distress or the strains of separation. The use of a cohort study provided an opportunity to assess the role of psychological distress *prior* to marriage on divorce, which allows for ruling out of the

possibility that higher levels of psychological distress preceding divorce are attributable to the strains of marital loss and may in fact reflect selection.

The existing literature on socioeconomic position and psychological distress with marriage has been consistent in showing that these factors are influential in determining both marital status and union. [124,125,126,127,128,129] [130] [131] [136,136] [133,134] [109,163] [168] Among men there is consistent evidence to suggest that an advantaged SEP is associated with a higher likelihood of marriage, and a lower likelihood of divorce. Furthermore, there is evidence to suggest that divorce is preceded by higher levels of psychological distress. Given that advantaged SEP and lower levels of psychological distress is associated with a reduced risk of CVD, it is entirely plausible to suggest that relationships between marital status and CVD are spurious. [88,89] In spite of this, there has been little work on adjusting for SEP and psychological distress in childhood or adolescence, as confounders of the association between marital status/marital history and CVD. Rather, existing studies have made adjustments for SEP and psychological distress in adulthood. [13,13,22,75] The problem with employing adult measures is that both SEP and psychological distress in addition to predicting marital status, are likely to change by marital status. [8;49;49;50;52;56;57;73;80;13] Therefore adjustment for each of these factors in adulthood doesn't reliably capture confounding. The use of a cohort study for the present analysis has provided an opportunity to estimate SEP and a measure of psychological distress prior to marriage and in turn has been better able to control for coufounding relative to existing studies.

5.7 Limitations of the present study

The present study allowed for an adjustment of variables throughout the life course, which may be important confounders of the relationship between marital history and cardiovascular disease. However, omitting to adjust for some variables may have resulted in misleading conclusions about the association between marital history, and the association of adolescent behavioural problems with the risk of divorce.

It is possible that omitted variables in the present study may have resulted in negative confounding, which could possibly explain why there was little evidence for an association between marital history and CVD in the present study. One possible explanation is the presence of children. There is evidence for an association of number of children with CVD, and of parental status with marital status. The way in which this relationship could have affected the present results, is explored.

Possible differences in the risk of CVD and the presence of children have focussed largely on studies of parity and CHD mortality among women.[186,187,188] Studies of parental status and CHD among men is relatively rare, but as for women there is some evidence for a J-shaped function which finds that the risk of CHD prevalence (or mortality by CHD) is higher

for those who have no children or one children, relative to those with two children. Once the number of children exceeds 2, the risk of CHD appears to be higher for both men and women. .[189]

It is unlikely that any relationship between parental status and CVD could have affected estimates of CVD prevalence for single, relative to continually married person. Among members of both cohorts the majority of those who reported having children were more likely to be in a marriage, than single.[190] Negative confounding could have occurred in the possibility that being a parent relative to not being a parent at all, was associated with a higher risk of CVD. However since this isn't the case, any impact of a J-shaped relationship between number of children and CVD on estimates of CVD for single relative to married persons is unlikely. Furthermore, there is only modest evidence for a relationship between number of children and marital stability and it is therefore unlikely that omitting to adjust for number of children or parental status could have affected estimates of CVD for divorced, relative to continually married persons. [191]

While the use of psychological distress prior to marriage was a strength of the present study – section 5.7 there may be some limitations in drawing a causal association between adolescent behavioural problems and the risk of divorce. It is possible that the link of adolescent behavioural problems and divorce is spurious, reflecting disadvantaged circumstances in childhood or adolescence, which may increase the likelihood of both adolescent behavioural problems as well as the risk of divorce. One possible factor that might lead to this spurious association is parental separation. Divorce among parents has been linked to higher levels of mental health problems as well as a higher likelihood of divorce among individuals. [160] [192] Since the present study doesn't adjust for parental separation, this possibility cannot be ruled out.

6 Chapter 6: The role of time since divorce, on relative differences in BMI and blood pressure, between married and divorced persons.

This chapter assesses objective 3 of the present study, which is to assess another aspect of marital history – the role of time since marital loss – in relation to risk factors of CVD. It was hypothesized that relative differences in both BMI and blood pressure between married and divorced persons would decrease since the onset of divorce.

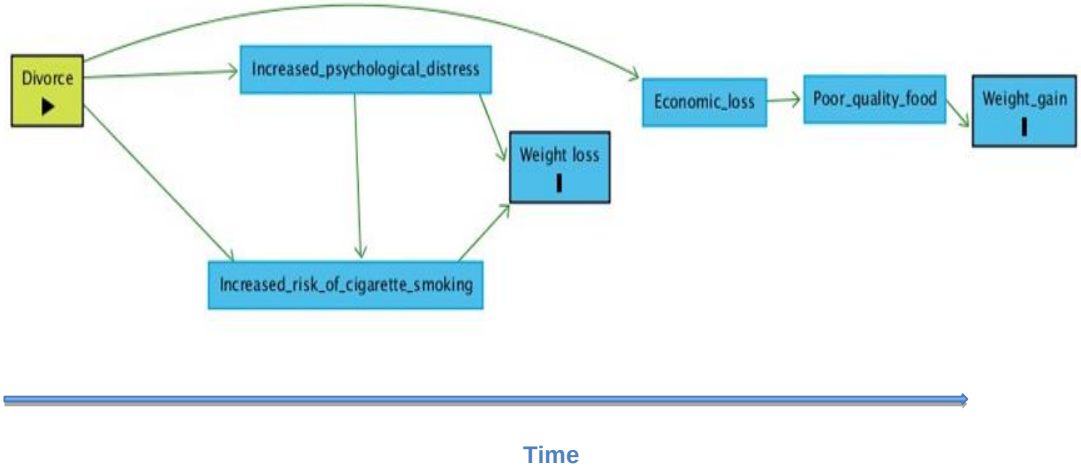

Figure 6.1 Time as a moderator of relative differences in BMI between married and divorced persons

Note: Divorce and weight gain (or loss) denote the exposures and outcomes, respectively. The straight arrows from divorce to increased psychological distress and in turn cigarette smoking, illustrate the early effects of divorce, which lead to weight loss. The bendy arrow connecting divorce with economic loss illustrate the later consquences of divorce, which result in weight gain. The blue arrow indicates time. The heightened psychological distress associated with divorce, is predicted to subside with time, which may result in decreasing differences in blood pressure between married and divorced persons.

6.1 Analytical sample & statistical methods

Random coefficient models were employed to assess trajectories of SBP, DBP and BMI between 43 and 60-64 years, by marital status. Groups of trajectories were assessed for those who were in their first and only marriage between 36 and 60-64 years, and compared with those who were in a first and continuous divorce between 36 and 60-64 years and those who experienced their first divorce between 36-43 years and remarried thereon. The focus of the present analyses is to compare relative differences in blood pressure and BMI

between those who are in a continuous marriage, with those in a continuous divorce. The purpose of including those who were remarried, in the analyses, is to adjust for the effect of subsequent marriages, or marital losses (divorce or widowhood) on trajectories.

The sample included N=1480 respondents. Of these 1480 respondents, 230 had experienced divorce between 36-43 years. Among this group of respondents, 126 (54.8%) experienced a remarriage of whom 39.7% were women.

Blood pressure readings and BMI were available at three points in time: 43, 53, and 60-64 years. Mean BMI, SBP, and DBP at each age are shown in Table 6.1. As is evident, there is evidence for an increase in BMI and SBP over time. A yearly increase in age was associated with an increase in BMI of 0.14 kg/m^2 and an increase in SBP of 0.86 mmHg. The direction of change in DBP with age appears to be different, with evidence for a decrease in DBP among both men and women. As for SBP, DBP and BMI is larger at all ages for both men and women.

Table 6.1: The number of observations and mean BMI SBP, DBP at 43, 53 and 60-64 years for members of the NSHD

	SBP (mmHg)				DBP (mmHg)				BMI kg/m^2			
	Men		Women						Men		Women	
Age	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
43	701	124.1	716	121.4	701	81.6	710	77.3	701	25.6	710	24.7
53	707	140.9	720	133.9	706	88.7	714	82.9	706	27.5	714	27.0
60-64	600	142.9	631	136.6	600	83.0	631	78.8	598	28.0	630	27.8

6.2 BMI & blood pressure trajectories, by marital status

Relative differences in SBP, DBP and BMI trajectories by marital status are shown in Table 6.2. Relative differences in trajectories are shown by two coefficients. These are the intercept and slope coefficients. The intercept coefficient represents BMI (or blood pressure) at 43 years, which is the first measure post-divorce. The slope coefficient represents the annual increase in BMI (or blood pressure). The annual increase in BMI (or blood pressure) for divorced persons, is shown relative to those in a continuous marriage.

At 43 years SBP for married men and women was 126.6 mmHg and 123.2 mmHg, respectively. The corresponding rate of increase in SBP between 43 and 60-64 years was 0.98 mmHg/year and 0.79 mmHg, respectively, Table 6.2. Trends in the data suggest that systolic blood pressure was lower for divorced men and women, and that divorced men experienced a greater increase in SBP over time than married men. Differences didn't attain significance, however.

Mean DBP for married men and women was 83.8 mmHg and 78.8 mmHg, respectively. The first measure of DBP post-divorce, at 43 years, appears to be lower for men and higher for women, albeit not significantly. DBP increased for married men and women by 0.07 mmHg/year and 0.04 mmHg/year, respectively. Relative to their continually married counterparts, the rate of age-related increase in DBP appears to be higher and lower, respectively, for divorced men and women.

Mean BMI at 43 years was 25.9 kg/m^2 and 25.1 kg/m^2 for married men and women, respectively. The first measure of BMI post-divorce, at 43 years, appears to be lower for divorced relative to continually married persons, though differences are only significant for women for whom BMI was 1.43 kg/m2 lower. The rate at which BMI increased between 43 and 60-64 years was 0.12 kg/m2 and 0.16 kg/m2 for married men and women respectively. There was evidence to suggest that the annual increase in BMI was higher for divorced compared with continually married men, by 0.04 kg/m^2 per year, and divorced compared with continually married women by 0.09 kg/m^2 per year.

Figure 6.6 & Figure 6.7, show the convergence of BMI between married and divorced men and women. Trajectories of SBP and DBP, by marital status, are shown for men and women in Figures Figure 6.2-Figure 6.5.

Table 6.2 Trajectories of change in SBP, DBP, and BMI between 43 & 60-64 years, by marital status

	Men N=730		Women N=750	
			Systolic blood pressure (SBP) mmHg	
	Intercept Coefficient (SE)	Linear Slope Coefficient (SE)	Intercept Coefficient (SE)	Linear Slope Coefficient (SE)
Continually Married	126.6	0.98 (0.04)**	123.2	0.79 (0.04)
Divorced between 36-43 years	-1.02 (2.65)	0.04 (0.22)	1.03 (2.36)	-0.08 (0.16)
Remarriage post-divorce	0.67 (3.17)	0.04 (0.25)	-4.35 (3.40)	0.12 (0.22)
			Diastolic blood pressure (DBP) mmHg	
Continually Married	83.8	0.07 (0.03)***	78.8	0.04 (0.03)
Divorced between 36-43 years	-0.24 (1.92)	0.18 (0.14)	1.83 (1.61)	-0.15 (.10)
Remarriage post-divorce	0.42 (2.29)	0.002 (0.17)	-3.72 (2.32)	0.30 (0.15)
			Body mass index (BMI) kg/m2	
Continually Married	25.9	0.12 (0.01)	25.1	0.16 (0.01)
Divorced between 36-43 years	-0.33 (0.54)	0.04	-1.43 (0.57)**	0.09 (0.03)**
Remarriage post-divorce	0.13 (0.65)	0.01 (0.03)	0.51 (0.81)	-0.06 (0.04)

*=p<=0.05, **=p<=0.01

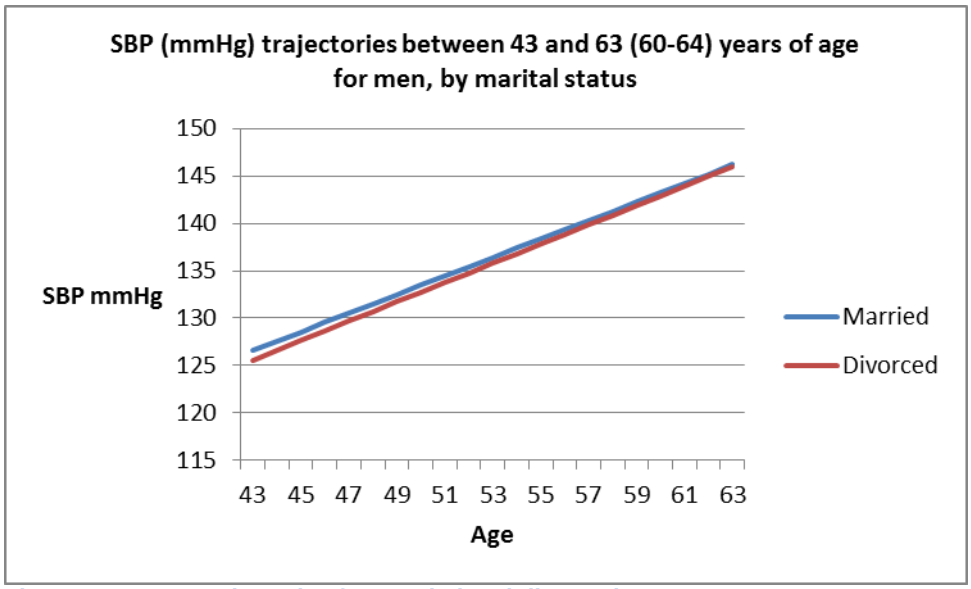

Figure 6.2 – SBP trajectories for married and divorced men

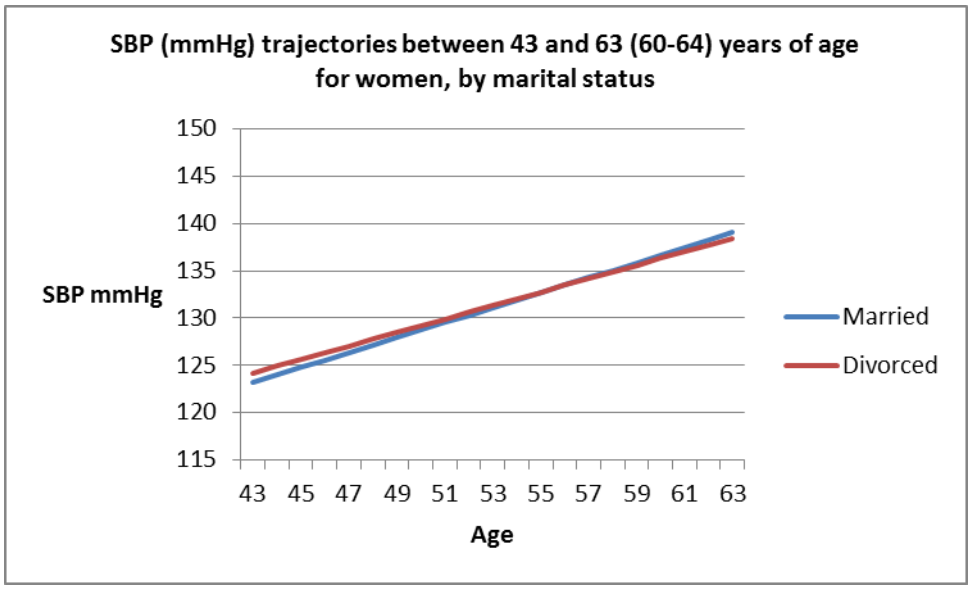

Figure 6.3 – SBP trajectories for married and divorced women

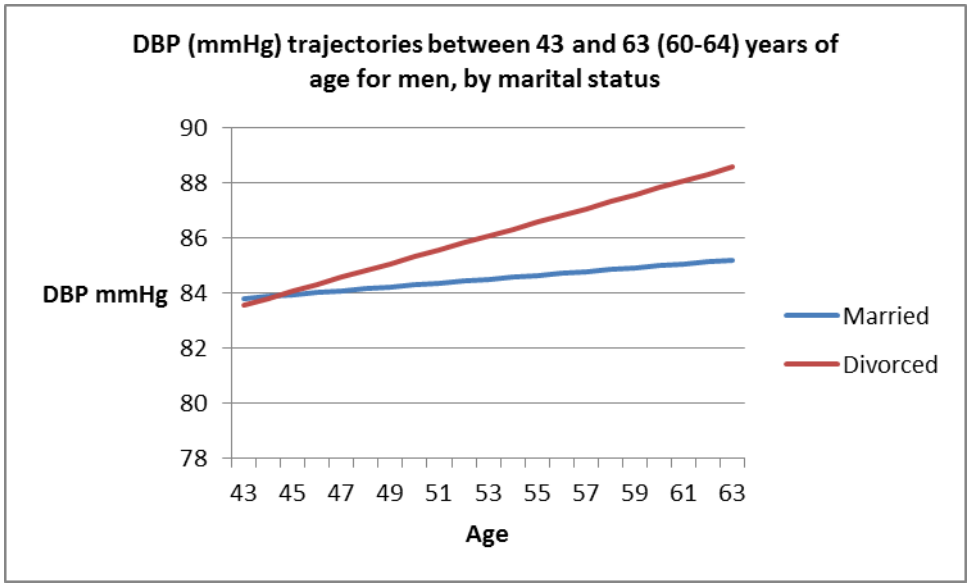

Figure 6.4 – DBP trajectories for married and divorced men

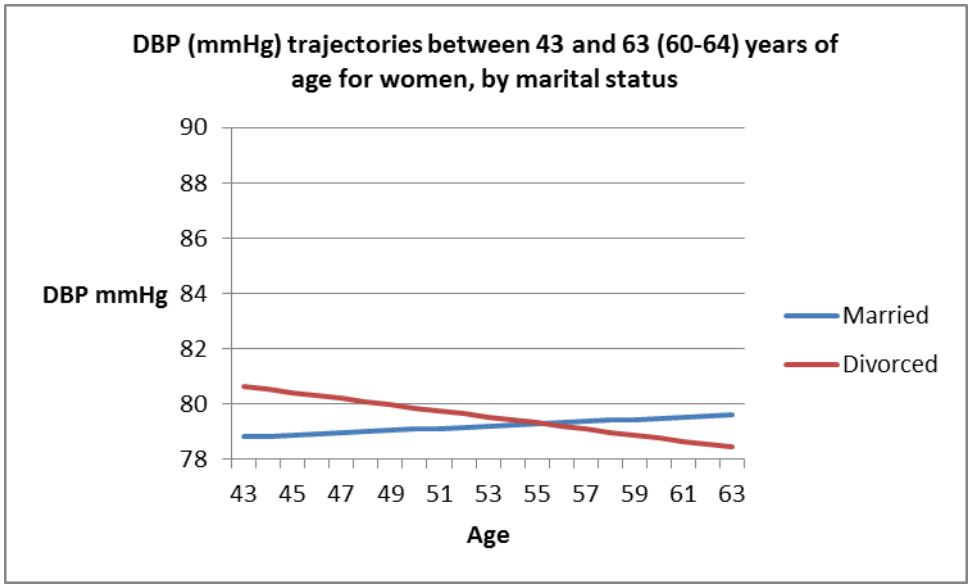

Figure 6.5 – DBP trajectories for married and divorced women

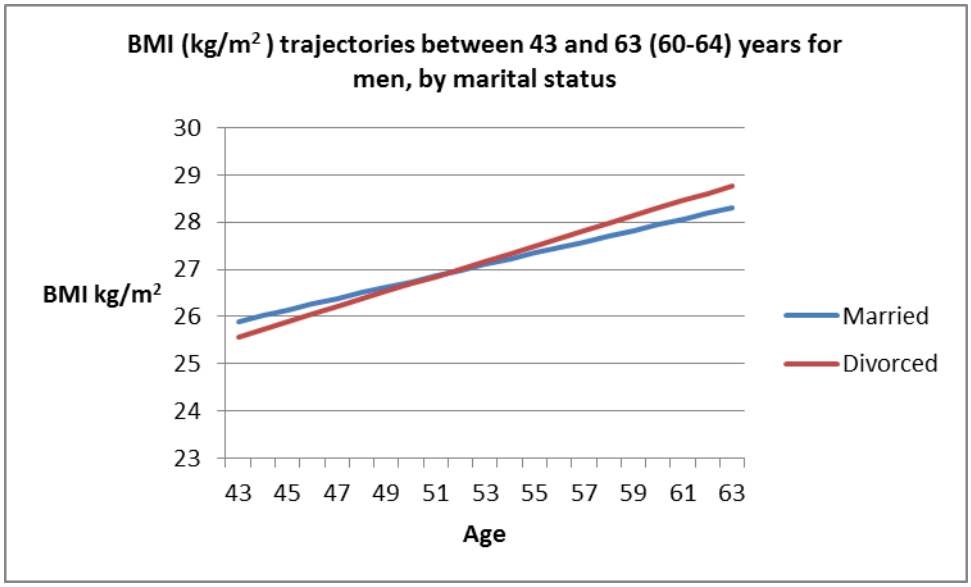

Figure 6.6 - BMI trajectories for married and divorced men

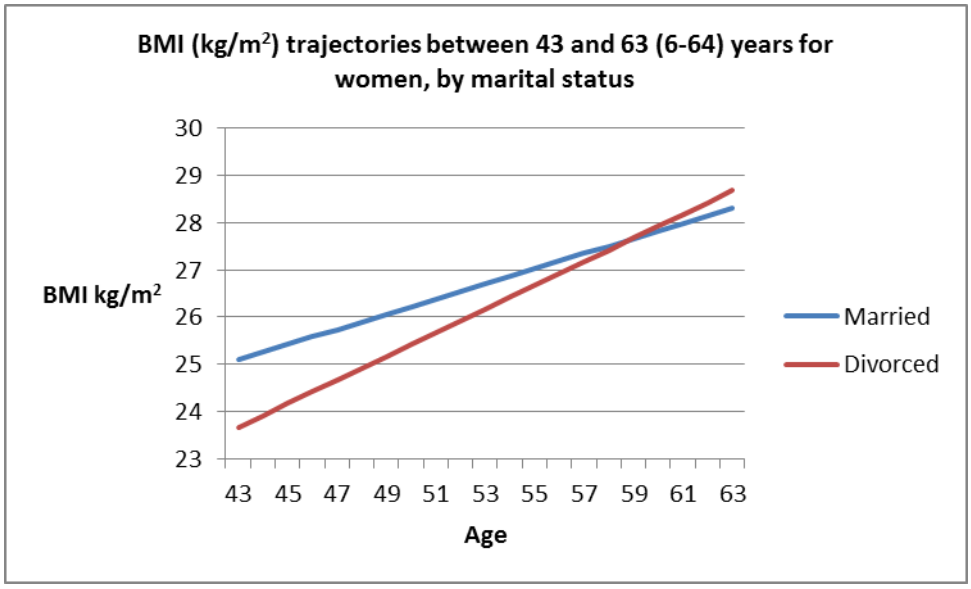

Figure 6.7 – BMI trajectories for married and divorced women

6.3 Discussion

This chapter explored differences in trajectories of SBP and BMI over a 20 year period (43, 53 and 63 years) among respondents who had experienced divorce between 36-43 years, with respondents who remained continually married over the entire observation period. It was hypothesized that differences in BMI and blood pressure between divorced and continually married persons would converge over time.

6.3.1 Main results

There was no evidence to suggest that trajectories of systolic blood pressure differed significantly between those who were continually married from midlife onwards, compared with those who experienced divorce in midlife. Though there was evidence for a higher rate of age-related increase in DBP among divorced men, this finding was eliminated on adjustment for remarriage of the divorced group. This suggests that there may be differences in trajectories between those who experience multiple marital losses and their continually married counterparts, but there was little evidence for differences between continually married and continually divorced persons.

6.3.1.1 Explanations for blood pressure and BMI trajectories differences between married and divorced persons.

There are two possible reasons for why differences in blood pressure between married and previously married persons at 43 years, were not apparent, and differences in BMI were. Laboratory studies of mental stress and blood pressure testing reveal that systolic blood pressure is a highly modifiable risk factor. Weight loss is plausibly not as modifiable – and therefore less sensitive to concurrent circumstances. For this reason adaptation to psychological distress among divorced persons might be more clearly reflected in blood pressure, relative to BMI.

The time span between the onset of the first divorce and the first point at which blood pressure was measured (43 years) is potentially 7 years. If the effects of divorce on systolic blood pressure decrease with time, it is possible that they have attenuated with time and are no longer apparent. Specifically, it is possible that prior to age 43, differences in SBP between married and divorced persons have already converged. To assess the possibility that differences in blood pressure might be apparent at shorter intervals between measurement of SBP and time of divorce, 8 new variables of marital status were created. 8 variables were created to distinguish those who divorced at 36,.37,38, 39, 40, 41, 42 and 43 years. In each case, the referent category was the continually married. Trajectories of SBP

were compared between married and divorced persons who had divorced at 36 years at 37 years, and so forth. There was little evidence for differences in SBP, regardless of the age group at which they divorced. It is unlikely therefore that the decision to compare SBP trajectories at 43 years for those who experienced marital loss between 36-43 years with their continually married counterparts, affected the present results.

Another possible reason might be that the weight loss associated with divorce is followed by decreases in blood pressure.[193] A third possible explanation is the association of marital quality with blood pressure. As discussed in chapter 4 of the present study, low marital quality is associated with higher blood pressure.[12] Failing to adjust for marital quality therefore may have resulted in an obscuring of health benefits of marriage relative to being divorced.

Consistent with what was expected, the results suggest that BMI at 43 years, which was the first measure post-divorce, was lower among divorced, relative to married persons. Also consistent with expectations, was the finding that the rate of age-related increase in BMI between 43 and 60-64 years was faster for divorced, relative to continually married persons. This pattern of differences in intiial BMI post-divorce and the rate of age related increase in BMI between married and divorced persons, resulted in a convergence of BMI trajectories between divorced and continually married persons.

An explanation for these results, are discussed in two parts: First, the biological plausibility of lower BMI for divorced relative to married persons is considered. It is plausible that initial BMI post-marital loss will be lower among those who experience a divorce, relative to their continually married counterparts. Several studies have found that undergoing a marital loss is associated with declines in weight. [17;79,80;82;130]

Furthermore, this result is plausible in light of the secondary effects of divorce. Divorce is associated with financial declines, which can constitute a stressful experience and in turn result in weight loss. There is evidence for a higher relapse among former smokers who experience a divorce relative to their continually married counterparts. Smoking is associated with weight loss, and may therefore provide a plausible pathway between the onset of divorce and weight loss. [111]

In understanding how divorce might be associated with later weight gain, the possibility that the salience of stressors associated with marital loss may vary with time since divorce. There is indeed some evidence to suggest that psychological distress associated with marital loss might vary with time since the onset of divorce. Specifically there is some evidence to suggest that psychological distress associated with divorce is closest to the onset of divorce. Therefore psychological distress associated with divorce might explain the largest variation in excess morbidity among divorced persons, in the earlier stages of divorce. [105,106,107,108; 109]

Some indirect evidence for this comes from studies of widowhood and mortality. Though excess mortality among widowed persons is largest in magnitude closest to the onset of divorce, the drop in magnitude over time is largest for deaths such as suicide – which may be linked with higher levels of psychological distress. The decline in excess mortality from deaths that may be caused by behavioural, economical and psychological causes e.g. was smaller. [113] This might suggest that the salience of the economic and behavioural changes in response to divorce, may become more salient in their effect on health, at the later stages of divorce.

It is proposed here that financial declines associated with divorce might explain their higher rate of weight gain, among divorced relative to married persons. Financial declines may result in diets that are more affordable. More affordable foods tend to be higher in energy density and lower in satiety, both of which may result in a higher rate of weight gain. Financial declines may also be apparent at early stages of divorce but the effect on weight gain might only become apparent, once the initially high levels of psychological distress have subsided. A higher rate of weight gain for divorced compared with married women, has been found in a previous study.

Existing studies have been conducted to investigate whether differences in BMI between divorced and married persons change with time since the onset of divorce. Both studies demonstrated that the effect of divorce on weight loss is temporary. While relatively lower BMI was apparent for divorced persons within 2-3 years since the onset of divorce, this finding was not apparent at later stages. Previously, the short-term effects of divorce on weight-loss have been cited as support for the crisis model. The crisis model purports that differences in health between married and previously married persons is attributable to the transient strains of marital loss. The present study suggests that the effects of divorce on weight endure over time, and change in direction. [17; 130]

The present results have been interpreted to suggest that the effects of divorce on weight loss are short-term. This interpretation was based on findings from the present study, which found that though BMI at 43 years was lower among divorced persons, the rate of weight gain was higher relative to married persons. Furthermore, lower BMI at 60-64 years for members of this cohort was not apparent, chapter 4. In fact the evidence suggested that BMI at 60-64 years was relatively higher for divorced persons, albeit not significantly.

Since it is plausible that a longer period of time since divorce has passed at 60-64 years relative to 43 years, it was suggested that the effect of divorce on weight loss are short-term. However, these findings could also reflect differences in the effects on health at 43 and 60-64 years.

In an attempt to disentangle the effects the effect of age from time since marital loss, a sensitivity analyses was conducted. A multi-level model was employed to assess whether

there was an interaction between marital status and age, on BMI among men. Results suggested that at 43 years BMI was lower among divorced men but that there was an interaction between marital status and age, which suggested that rate of change in BMI over time, was higher for divorced men. To assess whether this interaction was due to differences in age or by time since divorce, a second model adjusted for time since divorce. Time since divorce was computed on the basis of the age at first separation, where relevant. Respondents who had not divorced were given a score of zero for each of these variables. In some instances, information on age at first separation and widowhood were not available for those who had experienced these transitions. For these respondents a score of time since marital loss was imputed, using the median number of years of time since divorce by 43 and 63 years, based on existing information. The median number of years that respondents were divorced for at 43 and 63 years was 9 and 25.5 years, respectively. A second method of imputation was also used to derive time since divorce among those for whom information was not available. This method used the maximum number of years that respondents could potentially be divorced for. The maximum number of years respondents could be divorced for at 43 and 60-64 years was 26 and 46 years, respectively.

Results suggested that BMI at 43 years was lower for divorced, relative to continually married men. The significant interaction between age and divorced status on BMI suggests that age related increase in BMI is larger for divorced, relative to continually married persons. Adjustment for time since marital loss – regardless of the method of imputation employed – eliminated lower BMI among divorced, relative to continually married men. Thus the results suggested that while BMI for divorced men may be lower at 43 years, this effect is only temporary. The faster rate of BMI for divorced relative to continually married subsequently results in a converging BMI between divorced and continually married men. In sum, the results suggest that weight loss associated with divorce is temporary rather than an effect of age.

6.4 Strenghts of the present study

This is the first study to investigate the role of time since divorce on relative differences in blood pressure between married and divorced persons. Therefore this study is an important contribution to the existing literature on marital history and SBP. While there are several studies which investigate the effect of transition from married to divorced status on changes in BMI, few have looked at how this relationship may change with time since divorce and the present study is the first to do so in a British cohort. These findings suggest that while BMI post-divorce is lower than for continually married persons the faster rate of age-related

among divorced persons, causes BMI trajectories between divorced and continually married persons to converge. Furthermore this study suggests that findings which have found that weight loss is associated with divorce is more pronounced at younger relative to older ages might reflect the importance of time since divorce, rather than an interaction of age and marital status on BMI. The finding that differences in BMI between married and previously married persons change with time since the onset of divorce emphasizes the importance of looking at marital history rather than marital status only, the latter of which may result in misleading conclusions about the relationship between marital status and weight.

6.5 Limitations of the present study

A decision was taken to assess differences in blood pressure and BMI trajectories between continually married persons, and those who had experienced a divorce between 36 and 43 years. Since the purpose of this objective was to assess how marital differences in BMI and blood pressure post-divorce may change with time since the onset of divorce, it was important to obtain differences, between continually married and divorced persons, as close as possible to time since the onset of divorce. Therefore some control of the time span between onset of divorce and initial measure of BMI and blood pressure was required, and the period of time which preserved the maximum sample size was between 36-43 years of age.

While the present choice of sample is suited to this objective it may introduce some problems. Data constraints made it difficult to demonstrate a causal relationship between transition to divorce from married status, and BMI. Since respondents could have been divorced at any point between 36 and 43 years, it was not possible to gauge a measure of BMI while married, for respondents who later went on to divorce. Even among respondents who did not go on to divorce until after 36 years their measures of BMI might have been affected by the stressors of the process of separation, prior to divorce. For this reason, it was not possible to demonstrate a temporal relationship between transition from married divorced status and changes in BMI. It was also not possible, for this reason, to assess whether the higher rate of BMI increase among divorced persons was attributable to changes in diet as a result of financial declines. Thefore data constraints have made it difficult to demonstrate a causal relationship between transition to divorce from married status, and BMI.

However existing studies which assess changes in BMI and weight in relation to transition from married to divorced status have been consistent in demonstrating that divorce is associated with weight loss. Furthermore there is evidence to suggest that psychological distress, BMI and unhealthy lifestyles mediate the short term effects of divorce on weight loss. Studies have been consistent in demonstrating that divorce is associated with financial declines, which, in turn has been shown to affect diet quality in ways that can increase the

risk of weight gain. Therefore while the inability to demonstrate causal associations between transitions to BMI and divorced status are accepted as limitations of the present study, the existing literature lends support to a causal interpretation of the present findings.

Several references have been made, throughout this thesis, to potential problems of generalizability of findings from members of the NSHD, to younger cohorts. The stronger societal norms governing marriage and possibly preventing divorce for members of the NSHD relative to younger cohorts, may suggest that psychological distress for the latter may not be as high in the event of a divorce. Therefore weight loss post-divorce might be less pronounced for younger cohorts. Furthermore since women are becoming increasingly more economically independent the financial effects of divorce may not be as severe in younger cohorts, relative to members of the NSHD. As a result changes to diet as a result of low-income for divorced persons, may not be as large among younger cohorts, relative to women of the NSHD. Further problems in generalizability relate to ethnicity. There is some evidence to suggest that the rate of weight gain for African men who are continually divorced is larger than for their white counterparts, suggesting that trajectories of weight gain for divorced respondents among white cohort members of the NSHD, may not be generalizable to ethnic minority groups.

7 Chapter 7: Conclusions

7.1 Overview and contributions of the present study

This study took a life course approach to the association of marital status and cardiovascular disease, and was the first to do so among British cohorts. The use of birth cohorts, the National Survey for Health and Development and National Child Development Survey, allowed for an opportunity to investigate the influence of marital events throughout the life course on the risk of CVD. The use of cohort data also allowed for exploring the roles of factors throughout the life course – in predicting the marital trajectory – and assessing their roles in the association between marital history and cardiovascular disease.

Two aspects of marital history were considered in this study. The first aspect to be explored among members of both the NSHD at NCDS was the effect of a previous marital loss. Specifically, whether being remarried was associated with a higher risk of CVD relative to being continually married, given that the former had experienced a marital loss (divorce or widowhood) was explored. There was no evidence to suggest for differences in the risk of CVD between remarried and continually married persons, for members of either cohort. The second aspect of marital history that was considered in relation to CVD was time since divorce. The present study found evidence to suggest that relative differences in BMI between married and previously married persons changed with time since the onset of divorce. In finding that differences in risk factors for CVD between married and divorced persons are moderated by time since divorce, the present study has demonstrated the importance of incorporating measures of the marital biography, in addition to marital status, in studies of marriage and health. This study has found that divorce is associated with weight loss initially, but that the rate of weight gain is faster for divorced relative to married persons.

In addition to emphasizing the importance of marital biography the present study has also emphasized the importance, in studies of marriage and health, of historical time. The use of two cohorts, born 12 years apart, revealed some cohort differences in the association between marital history and CVD and of the association between SEP and marital status, These findings suggest that the role of marital status in CVD depends not only on factors particular to a given individual, but macro-level factors such as marital trends, rates of educational attainment among women, and the changing relationships of father's social class, educational attainment and employment, all of which vary by historical time. In demonstrating the importance of macro-level factors and marital biography, the present study emphasizes the importance of a life course approach to assessing marital status differences in CVD, which recognises that the effect of individual experiences on health vary

by both life stage and historical time, both of which might affect the meaning of an experience and available resources in coping with a given experience.

Furthermore the present study is an improvement on existing studies of marital history and CVD, due to the measures employed to assess the risk of CVD. Both the NSHD and NCDS collected objective measures of health, e.g. blood pressure and BMI. The existing studies on marital history and CVD have focussed on self-reported measures of doctor-diagnosed CVD which may results in misleading conclusions about the association between marital history and CVD, due to a higher prevalence of health seeking behaviour and doctor-diagnosis among married persons. The present study also improved upon existing studies of marital status and blood pressure, by correcting for antihypertensive medication use.

A further strength of this study is that it was able to adjust for potentially confounding factors of the association between marital history and CVD. Antecedents of marital union and dissolution include SEP and psychological distress. While existing studies of marital status and CVD have adjusted for SEP and psychological distress, these measures have been obtained in adulthood post-marriage and post-divorce. Adjustment for factors post-marriage is inappropriate as both psychological distress and SEP are on the causal pathway between marital status and CVD. The use of cohort data allowed for access to information on SEP and psychological distress throughout the life course and therefore prior to both marriage and divorce.

Though not the focal point of this study, the use of a cohort study has improved upon the existing literature on antecedents of marital status and union. Existing studies of SEP and marital union have focussed largely on cross-sectional and ecological studies, which make it difficult to rule out the possibility of reverse causality and omitted variable bias on the association of SEP and marital union (a detsiled explanation of these studies and their limitations is given in section 2.3). In assessing prospective associations of father's social class and educational attainment with marital status, the present study minimizes the possibility of reverse causation. Furthermore studies which investigate the role of SEP on the risk of divorce among women, have used employment status as an indicator of SEP. Women, in preparation for divorce, may be more likely to seek employment which might lead to misleading conclusions – through reverse causation -of the association between employment status and the risk of divorce. The use of educational attainment rather than employment status in assessing divorce risk, potentially avoids this problems. The majority of studies on psychological distress and marital dissolution have focussed largely on measures of psychological distress while respondents are married. This made it difficult to tell whether the higher risks of divorce among those who were more depressed at baseline was due to the strains of marital separation, or pre-existing differences in mental health. The use of this behavioural problems in childhood, in the present study, assesses mental health

prior to marital status, is therefore an important contribution to existing studies of divorce predictors.

7.2 Summary & explanation of main findings

Results of the present study are presented in chapters 4-6. Explanations for each of the main findings are presented in relation to the association between marital history and CVD, as measured by previous marital loss and time since marital loss, and the role of father's social class, educational attainment and behavioural problems in the association between marital history and cardiovascular disease.

7.2.1 The association between marital history and CVD.

The risk of CVD diagnosis at 60-64 years for single, widowed, divorced and remarried persons was compared with their continually married counterparts, among members of the NSHD. Risk factors for CVD including SBP, DBP, BMI and waist circumference for single, widowed, divorced and remarried persons relative to their continually married counterparts were observed at 43 and 60-64 years among members of the NSHD, and at 44-45 years for members of the NCDS. There was some evidence for differences in the association between marital history and CVD for members of the NSHD at 43 and members of the NCDS at 44-45 years of age. Some difference in the association between marital history and CVD at 60-64 years and 43 years for members of the NSHD, were also apparent.

There was evidence for a higher risk of CVD diagnosis among widowed relative to continually married women (chapter 4). This finding is consistent with existing literature which has suggested found evidence for a higher risk of CVD incidence, stroke and CVD mortality among widowed women. [13,22 60 180]Further, this finding is also plausible in light of the economic declines, higher risk of smoking relapse and increased psychological distress associated with widowhood, all of which are associated with an increased risk of CVD. There was no evidence for a difference in CVD diagnosis between widowed and continually married men. It is possible that the greater financial declines associated with widowhood for women than men, pose greater risks for widowed women.[194].

There was no evidence for differences in CVD diagnosis between all other marital groups and continually married persons. This is an unexpected finding in light of the well-documented economic advantages, lower levels of psychological distress and lower rates of cigarette smoking among married persons. [8;49;50;52;56;57;73;80;13] Furthermore, there is evidence to suggest that CVD mortality and incidence is higher for unmarried persons.

It is possible that the reason for no differences in self-reported CVD diagnosis between continually married and single, divorced and widowed persons is attributable to differences in illness behaviour between these two groups. Theories of illness behaviour and existing

studies would suggest that married persons are more likely than their unmarried counterparts, to both recognise their symptoms and receive a medical diagnosis, which would result in an underestimation of CVD diagnosis among unmarried persons. [94] Existing studies which have found an association between marital history and CVD, based on self-reports of doctor diagnosis are based on American samples. It was proposed that lower health insurance coverage among unmarried and remarried relative to continually married persons in American samples may mean that unmarried American persons are even less likely than their counterparts in the UK to seek preventative care and early treatment. This in turn result in an increased likelihood of acute events e.g. stroke and heart attack for unmarried Americans relative to their UK counterparts, which may reduce their likelihood of under-reporting CVD.

In all three samples (NSHD at 60-64 and 43 years; NCDS at 44 years) there was evidence for lower mean blood pressure among divorced, relative to continually married women. Relative differences were larger for women from the NSHD only. It was suggested that married women of the NSHD might be unwilling to divorce in the instance of low marital quality, given strong societal norms governing the importance of marriage for members of this cohort. Higher systolic blood pressure associated with low marital quality may off-set any benefits of marriage or costs associated with divorce, and result in higher SBP for married, relative to divorced women. Evidence to suggest that blood pressure is lower for divorced relative to married women in low quality marriage provides some support for this assertion. SBP at 43 years for members of the NCDS, was higher for single, relative to continually married men of the NSHD, though this finding wasn't true for men of the NCDS. Research has been consistent in finding that SBP is higher for single, relative to married men.. [55,57,60,66] Possible explanations for inter-cohort differences include greater levels of stress and loneliness associated with single status for men of the NSHD among whom marriage may have been considered a greater necessity, relative to members of the NCDS.

At mid-adulthood for both cohorts, there was some evidence to suggest that being previously married is associated with a lower BMI, relative to being continually married. This finding is plausible in light of existing literature which finds that marital loss is followed by weight loss, and in light of the secondary stressors of divorce including psychological distress and cigarette smoking.

Lower BMI wasn't apparent for divorced persons at 60-64 years, for members of the NSHD. This finding is possibly explained by the findings of chapter 6 which suggest that the risk of divorce on weight loss is short-lived after which the rate of age-related increases in BMI become faster, resulting in a convergence of BMI between married and divorced persons. It was suggested that the higher rate of weight gain among divorced relative to married persons might be explained by changes to diet as a result of low-income.

7.2.2 The confounding effects of father's social class, educational attainment and behavioural problems on the association between marital history and CVD.

Coming from a non-manual background, higher educational attainment and lower levels of behavioural problems were associated with lower risk of CVD, as measured by CVD diagnosis and risk factors for CVD for members of both cohorts. Among both cohorts, higher levels of educational attainment were associated with a greater likelihood of marriage among men while the reverse was true for women. Coming from a non-manual background was also associated with a lower likelihood of marriage among women. Adolescent behavioural problems were associated with a higher likelihood of divorce. Plausible explanations for each of these relationships and their consistency with the existing literature have been explained in chapter 5. Among members of the NSHD at 60-64 higher levels of educational attainment, coming from a non-manual background and lower levels of behaviour problems were associated with a lower risk of widowhood.

There was little evidence for an influential role of father's social class, educational attainment and behavioural problems in the association between marital history and CVD.

The present findings do however point to some interesting cohort differences in the association of father's social class and educational attainment with marital status. There was some evidence for inter-cohort differences in the association between father's social class and the likelihood of marriage, divorce and widowhood, thought to be attributable to changes rates of marriage and increase in educational attainment and labour force participation among women, and an increase in the inequality of educational attainment among those from manual and non-manual classes.

Though educational attainment was associated with a lower likelihood of marriage among women from both cohorts, this effect was larger among women from the NSHD. Furthermore while educational attainment was associated with a lower likelihood of divorce for women of the NCDS, no association was evident for women of the NSHD. These differences are possibly explained by a decrease in the potency of education in increasing the likelihood of single status among women, as it is becoming increasingly common. Other possible explanations include increasing acceptance of education and employment among women, which might contribute to their higher desirability in the marriage market. The inverse relationship of educational attainment and divorce attained significance for men from the NCDS only The greater need for educational attainment for members of the NCDS in gaining employment relative to members of the NSHD, may explain why there was a stronger relationship between educational attainment and divorce among men from the NCDS. [135]

7.3 Limitations.

7.3.1 Limitations of measures employed

While the present study is an improvement on studies which have looked at isolated measures of marital status only, data constraints did not allow for an assessment of other aspects of the marital biography that may be important predictors of CVD. The association of age at marriage, marital duration and age at separation of marriage were not included in the current measure of marital history. Among members of the NSHD, there was very little variation in age at marriage which did not allow for stratifying by age at first marriage. The duration of marriages which ended in divorce or widowhood could have been estimated from subtracting the age at marriage from the age at separation. However this may have introduced confounding from age at separation or widowhood as well as widowhood and divorce duration, both of which have been shown to affect health.

A particularly important omission in the measure of marital history employed for the present study, may be failing to distinguish previously married persons by number of marriages and remarried persons by second and subsequent marriages. An existing study has found some evidence to suggest that that the higher risk of CVD among widowed relative to continually married persons, is only evident, in the instance that widowed persons had experienced more than one marital loss. It was also found that those who had remarried post-widowhood were only at a higher risk of CVD, in the instance that they had experienced more than one marital loss. It was possible to distinguish those who had experienced a marital loss (divorce or widowhood) by the number of marriages they had experienced. However, doing so would have resulted in very small numbers of respondents per category and subsequently low statistical power. This is also true for the stratification of respondents in a second from subsequent marriage. At 60-64 years for members of the NSHD, information on the number of marriages for widowed persons was available for N=129 of N=137 persons. Of these 129 people N=106, N=22 and N=1 persons reported having been married once, twice, and thrice respectively. Among divorced persons N=280, information on number of marriages was available for N=250 persons. The number of people who had married once, twice, thrice and four times was N=193, N=46, N=9 and N=2, respectively. Among those who were remarried N=320, N=3, n=4, n=2 had experienced two, three, four and five marriages, respectively. At 43 years, the number of divorced (N=3) and widowed (N=7) and remarried respondents (N=3) respondents marrying more than twice was even smaller. A great majority of previously married and remarried persons of the NCDS had married once and twice, respectively. By 44-45 years only N=11 divorced respondents of the NCDS were married twice, and N=4 respondents reported marrying thrice. Among remarried persons, only N=13 persons reported being a third marriage For this reason, it was also not possible to distinguish respondents in a second marriage, from respondents in subsequent marriages. The present study did not assess differences in the risk of CVD among cohabiting and

continually married persons. Among members of the NSHD, the main focus was on legal marital status. Thus, there was lttle reliable information on whether or not unmarried persons were living alone, or cohabiting. As a result, it is possible that respondents who were single, divorced or widowed included a combination of persons who were and were not cohabiting. Cohabitation is similar to marriage in many respects. It is an intimate adult relationship where adults reside with one another. Thus some of the benefits of marriage, such as social support and the economies of scale may extend to that of cohabiting persons. Omitting to create a separate category for cohabiting persons can potentially lead to an underestimation of the differences in risk of CVD between unmarried and married persons. However, it is unlikely that this impact would have been large among members of the NSHD, given that rates of cohabitation were very low. Excluding cohabiting persons among members of the NCDS, for whom the rates of cohabitation were sufficiently large, limited the scope of the present study in important ways. Cohabitation, is on the rise and forms an increasingly larger proportion of adult relationships in recent decades. Therefore assessing the risk of CVD among cohabiting persons is an important area for research and an important omission of the present study.

7.3.2 The impact of differential non-response on the present findings.

The present study did not assess the impact of differential attrition, by sociodemographic and health-related factors, on the present results. Therefore the possibility that the results reflect selection bias rather than true associations between marital history and cardiovascular disease, cannot be ruled out. Selection bias is a possibility when the likelihood of drop out is dependent on a factor which affects both the exposure and the outcome. For example, if those who were missing were at a higher risk of CVD and divorced, the present results would reflect an underestimation of CVD risk among divorced persons. If, however, those who were missing were at a higher risk of CVD and were all continually married the analytical sample would include only the healthiest of continually married persons – which would lead to an over-estimation of the risk of CVD for all other groups, relative to continually married persons. The likelihood of attrition may also be dependent on social class, which is related to both CVD and marital status. Therefore, the risk of CVD, the likelihood of divorce and general disadvantage may be clustered among those from manual social class. Thus, a higher risk of drop-out among those from manual classes, may also lead to biased results.

Although it is possible to assess whether the risk of attrition varied by a given factor, educational attainment for example, it is not possible to assess whether the subset of respondents who were not part of the analytical sample differed on any other characteristics from those who were. However, it is possible to speculate about the ways in which the present results could have been biased, by assessing which factors predict missingness on

the outcomes, marital history, and existing relationships between factors which predict missingness and both exposure and outcome.

The potential impact of selection bias on the present study, is considered with respect to analyses which assessed the relationship between marital history and the risk of CVD, among members of the NSHD at 60-64 years of age. Indicator variables were created to differentiate those who were missing and not missing on each of the outcomes employed and Marital History, at 60-64 years of age. The likelihood of missingness was assessed by a range of factors including including father's social class, educational attainment, income, health behaviours, psychological distress, conduct problems and measures of blood pressure, BMI, waist circumference and a diagnosis of CVD, at previous sweeps. The relationship of these measures were then tested with marital history and each of the outcomes. Missingness patterns are denoted in Table 7.1, below. The results of analyses from which this table was formed are shown in Appendix 2, 3 and 4 of the Appendices.

Table 7.1 Different types of missingness, on outcomes and marital history at age 60-64 among members of the NSHD, by factors throughout the life course.

Group	Missingness Pattern	Variables
A	Related to missingness on Marital History and one or more outcomes, and predicts both marital history and one or more of the outcomes.	Father's social class Educational attainment Conduct problems in adolescence, sex, Marital status at age 36, 43 and 53
B	Related to missingness on Marital History but not on outcomes. Predicts Marital History but does not predict outcomes.	Financial difficulties
C	Related to missingness on Marital History and predicts Marital History. Not related to outcomes.	Diastolic blood pressure at 53 years of age
D	Related to missingness on one or more outcomes but not related to Marital History or missingess on Marital History	Psychological distress at 60-64 Lifetime SEP
E	Related to Marital History, one or more outcomes and missingness on outcomes. Not related to missingess on Marital History	Cigarette smoking
F	Related to missingness on Marital History, missingess on outcomes, outcomes but not Marital History	CVD diagnosis at 53 years
G	Related to Marital History only	SBP and DBP at 60-64 years
H	Related to BMI only	Problematic alcohol consumption
I	Related to outcomes only	SBP at age 43 DBP at age 43 BMI at age 43 Waist at age 43 DBP at age 53 BMI at age 53 Waist at age 53

Some of the factors were only associated with either the exposure, or the outcome - Table 7.1. For example, experiencing income difficulties at age 60-64 was associated with a higher risk of missingness on Marital History, and it also predicted marital history. Financial difficulties were experienced more so for divorced men and women, and widowed women, relative to their continually married counterparts. However, there was no evidence for an association of financial difficulties with any outcomes. Therefore while it is possible there may be some under-estimation among divorced and widowed women who are also suffering from financial difficulties, it is not associated with the risk of CVD and is therefore unlikely to affect the present results. Similarly factors which are related to outcomes and not Marital History, are unlikely to bias the present results.

In the instance that factors which are relatd to missingness on outcomes, exposures and are also predictive of both exposures and outcomes the possibility of selection bias on results is more likely. Factors which fall in to this category are shown in Row A. The possible ways in which these factors may have affected the results are discussed below.

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relative to their continually married counterparts. However, there was no evidence for an association of financial difficulties with any outcomes. Therefore while it is possible there may be some under-estimation among divorced and widowed women who are also suffering from financial difficulties, it is not associated with the risk of CVD and is therefore unlikely to affect the present results. Similarly factors which are related to outcomes and not marital history, are unlikely to bias the present results.

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Those who are from manual classes are more likely to be associated with missingness on CVD. Since coming from a manual background is associated with a higher risk of CVD diagnosis, there is a possibility that there is an under-representation among those who are diagnosed with CVD in the analytical sample. Some evidence from this comes from data which finds that the risk of drop out on CVD diagnosis and Marital History at 60-64 is higher for those who have been diagnosed with CVD at 53 years of age. Though it is not possible to ascertain whether and how, the subset of missing participants from manual social class, who are potentially at a higher risk of CVD, vary from the analytical sample on marital status, some plausible conclusions can be drawn from existing data patterns. Firstly, it is consistently observed that those that the risk of drop out is higher among those who are single at 36, 45 and 53 years of age. Existing analyses, in the present study, showed that the likelihood of marriage was relatively lower among men from manual backgrounds. Therefore it is possible that the men who are from manual backgrounds are both single and at a higher risk of being diagnosed with CVD. There were very small numbers of single men who had been diagnosed with CVD, by 60-64 years, and thus it was not possible to conclusively estimate their risk of CVD diagnosis relative to their continually married counterparts. Given the existing data patterns, however, it is not possible to rule out the possibility that relative differences in CVD diagnosis between single and continually married men do exist, among members of the NSHD. The impact of attrition in this case, is likely to be different for women. Women, unlike men, were more likely to marry if they came from manual backgrounds. Therefore it is possible that women who were lost to follow-up were more likely to be married and also, potentially, at a higher risk of CVD. Therefore if there is a loss of unhealthy married persons, there may be some over-estimation of the health benefits of married relative to unmarried women e.g. the higher risk of CVD among widowed men, and the sizeably, albeit not significant, higher risk of CVD among single women.

Among women, there was some evidence to suggest that coming from a manual social class was in fact associated with a higher likelihood of being divorced relative to continually

married. Therefore this may have resulted in an under-estimation of the risks of CVD diagnosis associated with divorced for women.

The small numbers of widowed persons prior to 64 years of age, make it difficult to arise at any conclusions about whether widowhood is associated with a higher risk of drop-out, by age 60-64. However existing data patterns – which find that the risk of drop out is higher among those from manual classes, which is associated with a higher likelihood of widowhood among men, suggests that there may be a higher risk of drop out among widowed men. This may explain why no significant differences were found between continually married and widowed men.

There was also some evidence to suggest that manual social class was associated with higher mean SBP, DBP, BMI and waist circumference. Among men, this may have led to an under-estimation of relative differences in each of these risk factors between unmarried and continually married persons. A higher risk of drop out among women who are from manual backgrounds – who may also have higher systolic blood pressure and more likely to be divorced – would have resulted in an underestimation of SBP among divorced women in the present sample. This may explain why SBP was found to be lower among divorced women, in the present study. Given the existing relationships, it is also possible that women from manual social classes are married – in which case – relative differences in SBP between continually married and divorced women have been under-estimated.

Higher scores of conduct problems in adolescence were associated with a higher risk of drop out on all outcomes and Marital History. Given that conduct problems is associated with a higher risk of CVD, and divorce among men it is possible that the risk of CVD was under-estimated among divorced men. Conduct problems is associated with a higher risk being divorced, widowed and remarried for women – which may contribute to an underestimation of CVD diagnosis among these groups of women.

CVD diagnosis and risk factors for CVD at all sweeps prior to age 60-64 were higher for men than for women. Men were also more likely to drop out. Therefore it's possible that men who had been diagnosed with CVD, were more likely under-represented in the current sample. Whether there is a systematic differences on CVD and marital status among men who were and weren't in the sample, cannot be concluded from the existing data.

As discussed above, there are several ways in which the results of the present study may have been biased by differential loss to follow-up. Although there is no way of testing each of these potential scenarios, the possibility of biased results cannot be ruled out.

7.3.3 Problems with generalizability

The analytic samples for the present study focussed on the association between marital history and CVD for members of the NSHD and NCDS. The choice of sample may limit the

generalizability of the present findings to cohorts of marriageable age today. This is because there have been several changes to rates of marriage and divorce, spanning the period in which members of the NSHD and NCDS were entering adulthood, and now. Changes to marriage rates over historical time were discussed in section 1.1.2 and section 1.1.4. To reiterate, marriage rates have fallen and divorce and cohabitation rates have risen considerably, since the 1970s. Age of first marriage has also increased. The potency of SEP as predictors of marriage and divorce may also change with time, which would also limit the extent to which present findings can be generalized to younger cohorts. There was some evidence for this assertion, from larger differences in marriage by education among women of the NSHD, relative to NCDS, which was attributed to both changes in marital trends and educational participation among women. The age of respondents in the present samples may also limit the generalizability of results, to younger adults. It is possible that the relationship of marital status and CVD, and indeed marital history and CVD may vary according to the age of the individual some of the reasons for which were outlined in section 4.3.2.1. To reiterate, these include the additional burdens of minor children and the higher likelihood of relapse of smoking for younger, relative to older adults. This may results in relatively larger differences in CVD between previously married and married persons who are younger.

Recent changes to legislation means that marriages now also take place between members of the same sex. Since only opposite-sex marriages were considered in the present study, this may pose problems of generalizability. Results of the present study cannot be generalised ethnic minorities. The NSHD is an all-white cohort, and while immigrants were selected in to the NCDS respondents, they were not stratified by ethnicity or race. Though the white ethnic group remains the majority group in England and Wales, it has decreased over the past two decades. Between 1991 and 2011, the proportion of white people accounting for the population has decreased from 94.1% to 86%.[195] There has been an increase over time in the proportion of Asian, Black, multiple ethnic and other groups, in England and Wales, which further limits the extent to which the present results apply to the general population.

Therefore while there was little evidence in this study to suggest that married persons had a cardiovascular advantage, the same may not be true of younger cohorts, those in same-sex marriages or ethnic minorities. The ways in which changes to marital trends and educational participation may moderate the association between marital history and CVD are discussed more extensively in section 7.4.3, where recommendations for future research are made.

7.4 Recommendations for future research

7.4.1 Recommendations for assessing the causal relationship between marital history and CVD, among members of the NSHD and NCDS.

The higher risk of CVD among widowed women relative to continually married women could not be demonstrated causally, in the present study. This is because CVD incidence could not be assessed in relation to a transition from married to widowed status due to small cases of incidence between 53 and 60-64 years, at which ages measures of doctor-diagnosed CVD were obtained. There is, however, scope to assess this relationship when data on CVD incidence between 60-64 years and later sweeps, become available. The number of widowhoods between 53 and 60-64 years is larger than for earlier sweeps and it can be expected that new cases of CVD will be sufficiently larger between 60-64 years and future sweeps. It is also conceivable to expect that the number of widowhoods between 60-64 and future sweeps will be sufficiently larger than for earlier sweeps. Therefore it may be feasible for CVD to be assessed between 60-64 years and future sweeps. Due to the small number of transitions to widowhood between NSHD sweeps, it was also not possible to test whether proposed mediators of widowhood and CVD, including higher levels of psychological distress, relapse among former smokers and economic declines, explain the higher risk of CVD diagnosis for widowed relative to continually married women. Given that a larger number of respondents widowed between 53 and 60-64 years and potentially between 60-64 and later sweeps, future data may allow for an assessment of proposed mediators between widowhood and CVD at marriage and post-widowhood. Changes in these mediators could then be assessed in relation to CVD incidence at later sweeps.

There was some evidence to suggest that BMI, at 43 years, for divorced men of the NSHD was lower relative to their continually married counterparts. Furthermore there was evidence to suggest that BMI at 43 years post-divorce was lower for those who divorced between 36-43 years and their continually married counterparts. The reasons for this choice of sample are outlined in section. While this method was well-suited for assessing changes in BMI trajectories in BMI with time since divorce, it poses problems in ascertaining a measure of BMI prior to, and post-divorce since respondents could have divorced at both 36 and 43 years as well as in between these time points. Potential explanations for initial weight loss post-divorce include cigarette smoking and psychological distress and could not be assessed in the present study. Testing for changes in diet, as a result of financial declines, as an explanation for higher rate of weight gain among divorced relative to continually married persons was also beyond the scope of this study.

Earlier sweeps of the NSHD might be useful in assessing, more definitively changes in BMI from married, to divorced status. A sufficient number of respondents were married by 26 years of age and divorced prior to 36 years of age, and can therefore be used to assess marital transitions and BMI changes among members of the NSHD. Measures of smoking

status and psychological distress are available from 26 years onwards, and can therefore be tested as potential explanations for weight loss post-divorce. However it will not be feasible to assess changes to financial declines and changes to diet between 26 and 36 years, as these measures become available from 36 years onwards only. The small number of respondents transitioning to widowhood between NSHD sweeps also made it difficult to assess differences in blood pressure and BMI trajectories between widowed and continually married persons. Future sweeps with larger transitions to widowhood may allow for an assessment of this relationship.

The possibility that lower blood pressure among divorced relative to married women of the NSHD was attributable to low marital quality among married women could not be assessed in the present study. Since marital quality was not assessed for members of the NSHD, this possibility could not be explored. There is however information on marital quality for members of both the NCDS and members of the 1970s birth cohort. Future research could focus on whether, if any, differences are apparent between divorced women and married women, and whether this relationship varies by marital quality. . There was no significant difference in blood pressure between married and divorced women from the NCDS, and so this was not considered necessary to explore among women of this cohort. However both the NCDS and the 1970 birth cohort have obtained information relating to marital quality.

There was some evidence to suggest behavioural problems in adolescence, was associated with a higher likelihood of divorce. Plausible causal pathways between mental health problems and the likelihood of divorce include: lowered marital quality. However it is acknowledged here that omitting to adjust for potential confounding problems e.g. parental separation which may be linked with both higher behavioural problems in childhood and divorce may have led to a spurious association between behavioural problems and divorce. Information on parental separation is available for members of the NSHD and therefore future research should make this adjustment.

Several reference were made, throughout this thesis, to the potential for differences in illness behaviour by marital status, may result in an under-diagnosis of CVD among those who are unmarried. It was suggested that this may explain why CVD diagnosis in the present study among previously married and single persons, was not higher than that of their continually married counterparts (chapter 4). However these assumptions were not tested in the present study, as no measures of attitudes toward health care, number of GP visits, response and reaction to symptoms were available at 60-64 years for members of the NSHD, at which age a measure of CVD was obtained. There is some availability of measures relating to receptivity to health promotion and use of health-services between 36-53 years for members of the NSHD.

Future research could focus on whether receptivity to health promotion and use of health-services differ by marital status, and whether these result in under-diagnosis of CVD among

unmarried persons at 53 years. One way of doing this would to be to assess whether the relationship between CVD diagnosis and risk factors for CVD e.g. BMI and hypertension vary by marital status.

7.4.2 Cohabitation

Assessing relative differences in the risk of CVD between married and cohabiting persons will allow for a greater understanding of how marriage, and social relationships in general, contribute to health and well-being.

There are several differences in the resources available to married and unmarried persons, such as social support, health-monitoring by one's spouse and higher levels of income – from economies of scale. However, such differences are not as stark between married and cohabiting persons, given that cohabitating persons too reside with their partners. Therefore they share factors such as economies of scales and the social support of a partner with whom they reside. In spoute of this, there is little evidence to suggest that the health benefits of marriage extend to cohabiting persons.[196,197,198,199] Furthermore the relatively higher economic well-being and lower levels of alcohol consumption among married relative to unmarried persons does not always extend to that of cohabiting persons. [196] That such differences exist, begs the questions of why they arise. Answering this question is important because it can help to elucidate whether marriage, as a social institution, provides unique benefits for health that cannot be provided by cohabitation.

It is possible that there are structural differences in marriage and cohabitation, which might affect the way in which involvement in a social tie and the social support afforded by marriage, may be particularly beneficial to health. Marriage is recognised as a legally binding contract. In England and Wales, married couples are under a legal obligation to provide for one another financially. [95] These rules do not apply to cohabiting couples or other adult relationships. While cohabitation is on the rise, marriage still remains the norm and is recognised universally as a binding relationship. Therefore, a relationship bound by marriage is culturally and socially defined in a way that cohabiting relationships aren't.[200] Subsequently, the social institution of marriage defines a role for married persons, in which they are responsible for and to one another. [3] It is therefore conceivable to expect that married couples are in a more influential position over each other's behaviour, relative to couples who are not bound together by the social institution of marriage. The greater structural meaning given to marriage also contributes to higher levels of commitment among married relative to cohabiting couples, and the greater perceived costs of leaving a married relative to cohabiting relationship. [196,200] Thus there is a greater incentive to behave in ways that facilitate the maintenance of a marital, relative to cohabiting relationship. The less structured nature of other adult partnerships can also reduce the sense of responsibility individuals feel toward one another, which in turn[201] can reduce the quality of emotional support afforded by these relationships, relative to marriage. Future research should focus

on differences in the risk of CVD between married and cohabiting persons, and how factors such as commitment, responsibility and feelings obligations toward one's partner explain these differences, if any.

7.4.3 Inter-cohort differences in the association between marital history and CVD

The association between marital history and cardiovascular disease, may vary by cohort. It is proposed here that the causal pathways through which marriage is thought to affect health may contribute to changes in marital status differences in CVD, over historical time.

Since the 1970s, there has been a decrease in marriage rates, and an increase in cohabitation, divorce and the age of entry in to marriage. Decline in marriage rates and increasing rates of divorce, have been attributed to a decline in the societal norms governing marriage and a decreasing necessity for marriage, given greater acceptance for adult partnerships outside of marriage. Greater acceptance for adult partnerships and child-bearing outside of marriage reduces the urgency for marriage and may explain why marriages are being delayed. Furthermore it has been proposed that a shift in attitude from conforming to societal norms to fulfilling goals of self-actualization and happiness might have transformed the view of marriage as a necessity or obligation, to a relationship which is fulfilled to attain personal goals of happiness.

Changes in societal and individual views on the importance of marriage may moderate the health benefits of marriage and adverse effects on health, of divorce. The declining importance of marriage and a greater acceptance for relationships outside of marriage may lessen relative differences in psychological distress between married and single persons. This in turn might reduce the risk of CVD for single relative to married persons, in younger cohorts. Availability of social support from adult partnerships outside of marriage may be greater for younger relative to older cohorts. Social support can reduce the risk of CVD through several pathways including lowered psychological distress, healthier lifestyles, and physiological functioning, all can reduce the risk of CVD among younger cohorts. Lower levels of stigma associated with divorce may to contribute to a declining cardiovascular advantage of married relative to previously married persons. Alternatively, it is also possible that psychological distress associated with divorce might be particularly high among younger cohorts, due to unmet expectations of personal goals of happiness.

Existing studies have indeed found that the relationship between marital status and health between the 1970s and recent decades, changes with historical time. These studies have been based on American and Finnish samples.[21,23] However since the changes to marital trends are similar to those observed in the UK, it is possible that changes in health differentials by marital status may be observed among UK samples, also. Among US samples, the likelihood of reporting good-health increase over time for married and never

married women, and decreased for previously married women. This resulted in a convergence of self-reported health between married and never married persons, and an increase in relative differences in self-reported health between married and previously married persons. There was also evidence for increasing inequality in mortality rates by marital status among Finnish samples, owing largely to a decrease in rate of mortality for married relative to unmarried persons. [21,23]

The present study found little evidence for father's social class, educational attainment and psychological distress as explanatory factors in the association between marital history and CVD, among members of the NSHD and NCDS. However, there is evidence to suggest that the relationship of each of these factors with the likelihood of marriage, divorce and widowhood differs between members of the NSHD and members of the. These differences were attributed to a decrease in marital status, and increases in educational attainment and employment status among women. Furthermore, the increasing potency of both father's social class and educational attainment in predicting divorce among members of the NCDS was attributed to the greater importance of father's social class in predicting educational attainment, which has become more important for securing employment. Each of these differences between members of the NCDS and NSHD reflect changes in current decades, and therefore the current findings may not necessarily be generalizable to even younger cohorts.

Differences in selection from SEP in to marital status by cohort might suggest that while there is little evidence for confounding among these cohorts, the contribution of SEP to marital differences in CVD might be different for younger cohorts. Current decades have witnessed an increase in educational attainment, particularly among women. The proportion of women attaining the highest possible educational qualification increased from 10% for members of the NSHD to 25% and 32% for members of the NCDS and 1970s birth cohort, respectively. The corresponding figures reflected a less steep increase at 21%, 26% and 31% respectively. Furthermore there is a dramatic drop in the number of women from leaving school at the first opportunity from 60% to members of the NCDS to 45% of women born in 1970. For men, this dropped from 60, to 55. This has been matched by higher rates of employment among women from 54% for women of the NSHD to 70 and 76% for women of the NCDS and 1970s births cohort, respectively. The proportion of women who solely look after the home and family has decreased from 46% for women of the NSHD, to 20% and 21% for women of the NCDS and 1970s birth cohort, respectively. [135] The increase in employment among women has been matched by an increasing number of men sharing responsibility for child-care, though larger proportions of women still remain the main carer.

According to Goode's hypothesis, those with greater resources are more likely to engage in behaviours that do not conform to societal norms, in the instance that the event is rare. [139,140] However since marriage rates have fallen, the occurrence of non-marriage is not as rare as

it was for members of the NSHD.[202] Marriage does remain the norm however. Therefore while educational attainment may continue to be associated with a lower likelihood of marriage among relatively educated women, the magnitude of differences may be smaller than for members of the NSHD and the NCDS. However it is important to acknowledge that while education and employment among women has increased and while they may be likely to contribute to the household income than in earlier times, they still bear the majority of household responsibilities. The possibility of many conflicting roles may reduce the incentive of marriage for highly educated women. Given that educational attainment is associated with CVD, widening or converging differences in marriage rates by educational attainment may contribute to a change in the association between marital history and CVD, over time.

The association of employment with the likelihood of marriage among men has been observed more consistently than for women, and was observed for both cohorts in the present study. Furthermore, there is evidence for an increase in the protective effects of education on divorce, for men of the NCDS. Given that educational attainment – which is becoming increasingly dependent on father's social class – has become increasingly important for securing employment, younger cohorts may find that differences in SEP between married and unmarried men increase over time. Given that lower levels of education and coming from a manual background is associated with a higher risk of CVD, the risk of CVD between married and unmarried men may increase with time.

Future research would benefit from comparing the association between marital history and CVD and the effect of SEP on marital status, among several cohorts of different ages. Three British birth cohorts reflecting continual changes to marital trends since the 1970s can be employed for this purpose. These include: the NSHD, the NCDS and the 1970s birth cohort. As discussed above, these cohorts reflect changes to educational participation for women. Furthermore, they also reflect changes to maritsal trends: By age 31, a large majority of both men (77%) and women (88%) from the NSHD. The corresponding figures for men and women from the NCDS were lower at 45% and 50% and even lower for members of the 1970s birth cohort, at 38% and 48% respectively. Though cohabitation was virtually unreported among members of the NSHD, a third of NCDS members and a quarter of those born in 1970 were cohabiting by the age of 30. A comparison of all three cohorts shows a continual increase in the age at which respondents enter adult partnerships. By the age of 20, 40% of NSHD members reported entering marriage. The same proportion of NCDS members reported entering any sort of partnership by this age. For those born in 1970, the proportion of those entering any sort of partnership was much smaller, at 25%. In addition to differences in entry into marriage and cohabitation, there is a marked difference between cohorts in the stability of relationships. By the age of 31 less than 5% of men and women from the NSHD had experienced a divorce compared with 12% of men and 18% of women from the NCDS. Very few men (5%) and women (8%) born in 1970 reported divorce by the age of 30, owing to the lower rates of marriage for this group. However it is clear that

those born in 1970s were more likely to have experienced multiple cohabitations by the time of 30, relative to members of the NCDS and NSHD.[49] Attitudes toward marriage, divorce and women's roles in family life is assessed for both the NCDS and 1970s birth cohort, and can therefore be used to test their contribution to inter-cohort differences, if any, in marital history and CVD.

7.4.4 Recommendations for future research: cultural differences in the in the association between marital history and CVD.

There are several reasons to expect that the relationship between marital history and CVD may vary by ethnicity. These differences may arise from differences in cultural norms surrounding the importance of marriage as an adult relationship and acceptability of adult relationships outside of marriage, as well as differences in the stressors associated with transitions out of marriage.

While there has been a shift from attitudes to marriage as an adherence to social norms, to marriage as a form of self-actualization and happiness, it is conceivable to expect that this change has not affected all ethnic groups, equally. Arranged marriages for example, remain a common form of meeting spouses in south Asian and Arab cultures and in this case marriage may possibly reflect conformity to societal norms. Ethnic groups may vary in the importance to which they attach to marriage, in preceding adult transitions. More conservative cultures may be less accepting of child-bearing and cohabitation outside of marriage. Therefore among more conservative cultures, being unmarried may pose a higher risk of loneliness and reduced social support. Furthermore there may be family pressures to remain in an arranged marriage even in the instance of low marital quality. The association of low marital quality with higher blood pressure may undermine health benefits of marriage, for those in arranged marriages. In turn, the relative disparity in health between married and unmarried persons for whom a marriage has been arranged may be smaller than for those marriages that have been formed solely on the basis of love.

The impact of divorce or widowhood on CVD may also vary by ethnicity, through differences in the stigma associated with divorced status and the strengths of family networks. Within cultures where divorce is relatively rare, stigma may be more prevalent. This in turn, may compound stress, and in turn the risk of CVD associated with divorce. Family support and networks which are more extensive in some cultures than others, may mitigate the effects of being divorced/widowed in for members of a given culture, through financial support for example.

Selection from SEP might also be a stronger predictor of marriage among cultures in which the tradition of dowry is adhered to. The dowry – which is commonly household furniture, money or jewellery – provided by a prospective bride's parents to her in-laws, is plausibly harder to attain for those from low-income families. Therefore while there was evidence for a

lower likelihood by father's social class among members of the NSHD, the reverse might be true among cultures which adhere to the dowry tradition. Among these cultures the risk of CVD – as a result of income – might be larger among unmarried women, independently of causal mechanisms between marital status and CVD. Furthermore the expectation of dowry in terms of the amount of money, jewellery or house-hold furniture may be lower for men of manual social classes than their counterparts from non-manual social classes. This, in turn, may result in greater homogamy on factors such as SEP among these cultures. While the role of homogamy does not appear to explain the higher risk of mortality and possibly CVD among widowed relative to married persons among western samples, it may play a larger role in other cultures.

An increase in the proportion of ethnic minorities which make up the British population today, calls for an investigation of marital history and CVD among these groups. The longitudinal study, Understanding Society – The UK Household Longitudinal Study, over-samples for ethnic minorities and obtains information relevant to their specific experiences, which may be useful for this purpose.

7.4.5 Same-sex couples

It is conceivable to expect that there may be some differences in the relationship between marriage and health between same-sex, and opposite-sex couples. Up until very recently, cohabitation was the only way in which same-sex couples could show their commitment for one another, in the way that heterosexual couples do via marriage. The sharing of financial resources may therefore be more common among cohabiting couples in same-sex relationships, relative to those of opposite-sex. Furthermore since 2005, the marriage allowance has been applicable also to those in a civil-partnership. It is possible therefore, that those in civil partnerships and those who are in same-sex cohabiting relationships are more similar than cohabiting and married couples of opposite sex. Therefore differences in CVD by those who report being married and single – and are cohabiting – may be smaller for same-sex than opposite sex couples. It is also important to acknowledge that while marriage among heterosexual couples is celebrated worldwide, high levels of stigma surround marriage among same sex couples.[203] Whether this additional stress offsets the benefits in relative to cardiovascular health of marriage, among same-sex couples, remains to be seen. [203]

It is possible that factors that select respondents in to marriage may also vary between same-sex and opposite-sex couples. While legalized, there are still high levels of stigma associated with same-sex marriage and it is still relatively rarer than opposite-sex marriages. As discussed in sections, Goode's hypothesis proposes that in the instance that an event is rare, those with access to more resources might be more likely to overcome social

barriers.[139] Therefore the higher likelihood of marriage observed among more educated men might be even greater for same-sex relative to opposite couples. By this reasoning, there may be a reversal in the association of educational attainment with marriage, such that relatively more educated women may be more likely to enter same-sex marriages relative to their less educated counterparts. Given that higher levels of education are associated with a lower risk of CVD, the differences in risk of CVD among same-sex couples may be larger than for counterparts in opposite-sex marriages.

Future studies which obtain information on same-sex marriages for a sufficient number of people would prove an invaluable source in assessing these potentially important differences.

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Appendices

Appendix 1 A pooled analysis of the association between CVD risk factors and marital history for members of the NSHD, at 43 years of age, and members of the NCDS at 44-45 years of age.

	SBP (mmHg) N= 6079			DBP (mmHg) N= 6078			BMI (kg/m$^{2)}$ N=6077			Waist (cm) N=6110		
	Mean	**Coefficient**	**(95% CI)**	**Mean**	**Coefficient**	**(95% CI)**	**Mean**	**Coefficient**	**(95% CI)**	**Mean**	**Coefficient**	**(95% CI)**
Men												
Marital History												
Continually married+	130.1			81.8			27.3			96.8		
Single	132.3	**2.28**	1.00, 3.56	82.8	**0.97**	0.05, 1.88	27.1	**-0.25**	-0.59, 0.10	98.5	**1.67**	**0.35, 2.99**
Widowed	127.6	**-2.44**	-8.42, 3.54	82.2	**0.41**	-3.87, 4.68	25.9	-1.43	-3.02, 0.15	94.6	-2.18	-8.29, 3.93
Divorced	131.1	1.01	-0.15, 2.18	82.3	0.46	-0.38, 1.29	26.9	-0.41	-0.72, -0.09	95.8	-0.10	-2.21, 0.22
Remarried	132.0	0..27	-0.92, 1.45	82.0	0.14	-0.71,0.99	27.6	0.32	-0.01, 0.64	97.3	0.51	-0.73, 1.74
Women	**SBP (mmHg)** N= 6102			**DBP (mmHg) N= 6102**			**BMI (kg/m$^{2)}$ N= 6116**			**Waist (cm) N= 6163**		
Marital History												
Continually married+	120.4			76.0			26.5			83.4		
Single	121.2	0.77	-0.70, 2.25	76.0	**0.05**	-0.99, 1.09	26.5	-0.02	-0.52, 0.48	84.4	0.98	-0.21, 2.17
Widowed	121.0	0.57	-3.10, 4.23	77.8	1.87	-0.70, 4.44	26.0	-0.50	-1.73, 0.72	82.5	-0.87	-3.81, 2.07
Divorced	119.4	-1.06	-2.16, 0.03	75.5	-0.44	-1.20, 0.33	26.3	-0.17	-0.55, 0.20	83.9	0.46	-0.43, 1.35
Remarried	120.6	0.17	-1.02, 1.36	76.3	0.30	-0.53, 1.13	27.8	0.004	-0.40, 0.40	83.4	-0.03	-0.98, 0.93

+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 SBP=Systolic blood pressure mmHg (10mmHg added if respondents reported being on blood pressure lowering medication) DBP=diastolic blood pressure mmHg (5mmHg added if respondents reported being on blood pressure lowering medication) BMI=Body mass index kg/^{2} Waist=Waist circumference, measured in centimetres .

Appendix 2 – The likelihood of missingness on exposure and outcome by factors throughout the life course

	N	CVD	SBP/DBP	BMI	Waist	MH	N	CVD	SBP/DBP	BMI	Waist	MH
		OR of the likelihood of missingness						OR of the likelihood of missingness				
Sources of attrition												
Gender												
Men	2815			1								
Women	2547	0..75***	0.74**	0.72***	0.73***	0.72***						
Father's social class	2452						2221					
Non-manual social class				1						1		
Manual social class		1.34***	1.35***	1.36***	1.37***	1.33***		1.54***	1.60***	1.56***	1.56***	
Educational attainment at 26 years	2308						2124					
Degree or above												
No qualifications		2.30***	2.24***	2.37***	2.39***	2.34***		2.14***		2.55***	2.66***	
Lower secondary qualifications		1.38**		1.74***	1.77***	1.90***						
Advanced secondary education		1.91***	1.73***			1.35**			2.58***			
Lifetime SEP	1802											
Life time SEP Social class 4		2.38***	2.17***	2.14***	2.21***	2.27***			1.97***	1.90***	1.94***	
Life time SEP Social class 5		1.72**	2.12**	2.18***	2.23***	1.81**		1.89***	1.89**	1.93**		
Life time SEP Social class 6		2.56**	2.29**	2.24**	2.29**					1.60***		
Financial difficulties	1060	0.82***	0.67***	0.68***	0.67***		1160	0.80**	0.67**			
Marital status at 36 years of age	1656						1666					
Married												
Single		2.12***	2.13***	2.16***	2.22***	1.82***			1.88**	2.02***	2.00***	
Marital status at 43 years of age	2381						2201					
Married												
Single		4.94***	5.00***	5.06***	5.16***	4.47***		3.31***	3.67***	3.75***	3.72***	
Divorced												
Married status at 53 years of age	1468						1520					
Married												
Single		2.26***	2.70***	2.78***	2.93***	2.43***		1.80***	2.54***	2.45***	2.55***	1.87***
Widowed												1.84***
Divorced												2.24***
SBP at age 43	1596	1.02***				1.01**						

DBP at age 43	1596	1.02***	1.02***	1.02***		1.02***						
Waist circumference at age 43								1.02***	1.02**			
BMI at age 53										1.11**		
Waist circumference at age 53			1.02**	1.01**	1.02**			1.01**	1.02***	1.02***	1.02***	1.01***
Not diagnosed with CVD												
Diagnosed with CVD			1.66**	1.64**	1.64**	1.90**		1.01**	1.02***	1.02***	1.02***	1.01***
SBP at age 60-64	1065	0.99**										
DBP at age 60-64	1065	0.98**	0.98**									
Waist circumference at age 60-64							1156		1.05**			
Conduct problems	2190	1.16***	1.14***	1.14***	1.15***	1.18***	2011	1.18***	1.17***	1.16***	1.16***	1.15***
Psychological distress at age 43	1588	1.02***	1.02***	1.02***	1.02***	1.02***	1572	1.02***	1.01**	1.01**	1.01**	1.02***
Psychological distress at age 60-64	1048	1.02*										
Problematic alcohol consumption at age 43												
Problematic alcohol consumption at age 60-64												
Smoking History												
Non-smoker												
Predominantly non-smoker												
Predominantly smoker												
Life-long smoker												

+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 SBP=Systolic blood pressure mmHg (10mmHg added if respondents reported being on blood pressure lowering medication) DBP=diastolic blood pressure mmHg (5mmHg added if respondents reported being on blood pressure lowering medication) BMI=Body mass index kg/^{2} Waist=Waist circumference, measured in centimetres . OR=1, odds ratio to denote the reference category.

Appendix 3 - Regression estimates to show relationship of outcomes, with factors throughout the life course.

	CVD		SBP		DBP		BMI		Waist circumference	
	N	OR	N	*Mean*	N	*Mean*	N	*Mean*	N	*Mean*
Sociodemographic factors										
Men	114	1	1065	142.5	1065	81.1			1061	100.9
Women	120	0.35	1151	-6.64***	1151	-3.69***			1156	-8.44***
Father's social class										
Non-manual father's social class	448	1	455	140.9	455	80.1				
Manual father's social class	606	1.76**	562	3.03**	562	1.77**		1.33***		3.05***
Educational attainment At age 26										
Degree level or above at age	183		171	139.5	171	79.9	171		172	98.0
No qualifications at age 26	369	3.04***	331	3.69**	331		327	1.98***	328	5.24***
Lower secondary education	214		206	4.85**	206	2.27**	206	1.04**	205	3.34**
Advanced secondary education	309		300		300		327	0.81**	299	3.55**
Lifetime SEP Social class 1	151									
Life time SEP Social class 4	259	3.83**								
Life time SEP Social class 5	88	4.17**								
Life time SEP Social class 6										
Financial difficulties			1031	1.11**	1031		1026	-0.33***	1027	-1.05***
Marital status										
Married at age 43			890	142.0	890					
Single at age 43										
Divorced at age 43			94	3.96*	94					
Married at age 53			823	142.6	823		821	27.7	824	100.3
Single at age 53										

Widowed at age 53										
Divorced at age 53							111	1.05**	109	2.22*
Married at age 60-64										
Single at age 60-64										
Widowed at age 60-64										
Divorced at age 60-64										
Age at first marriage	106	0.88***	1006	-0.25*	1006		1003	-0.09**	1004	-0.22**
Age at first separation	296	0.94					281	0.07**	280	0.20**
Health/well being										
Conduct problems in	101	1.17**								
Psychological distress at 43	104	1.04***								
Psychological distress at 53							681	0.21**	681	0.54**
Psychological distress at age	921	1.05***					1036	0.04**	1036	0.18***
SBP at age 43	104	1.02**	986	0.44***	986	0.17***			982	0.05**
DBP at age 43			986	0.37***	982	0.05***	982	0.13***		
BMI at age 43	105	1.11***	998	1.18***	998	0.54***				
Waist circumference at age 43		1.04***	991	0.40***	991	0.19***	987	0.29***	987	0.84***
DBP at age 53			990	0.62***	990	0.37***	987	0.08***	987	0.22***
BMI at age 53	103	1.01***	991	1.21***	991	0.63***	989	0.91***	988	2.16***
Waist circumference at age 53	103	1.04***	993	0.39***	993	0.21***	990	0.30***	990	0.85***
CVD diagnosis										
Not diagnosed with CVD							936	27.8	936	100.5
Diagnosis of CVD at 53 years							55	1.13*	55	3.33**
Problematic alcohol consumption age 43							115	1.77**		
Problematic alcohol consumption age 53							952	1.18**	952	2.75**
Smoking History										
Non-smoker	291	N=291					264	91.5	265	99.0
Predominantly non-smoker	381	2.66**								
Predominantly smoker	239	4.22***					216	1.34***		4.23***
Life-long smoker	148	5.94***								3.65**

*=p=0.05 **=p<0.05 ***=p<=0.01 SBP=Systolic blood pressure mmHg (10mmHg added if respondents reported being on blood pressure lowering medication) DBP=diastolic blood pressure mmHg (5mmHg added if respondents reported being on blood pressure lowering medication) BMI=Body mass index kg/^{2} Waist=Waist circumference, measured in centimetres .+=reference group *=p=0.05 **=p<0.05 ***=p<=0.01 BMI=Body mass index kg/^{2} Waist circumference, measured in centimetres . OR=1, odds ratio to denote the reference .

Appendix 4 – Relative risks (RR) to show the likelihood of being single, widowed, divorced and remarried relative to continually married, at 60-64 years of age.

	Continually Married	Single	Widowed	Divorced	Remarried					
Gender	N=1373	N=112	N=139	N=372						
Men	1		1							
Women			2.92***							
			Men					Women		
	Continually Married	Single	Widowed	Divorced	Remarried	Continually Married	Single	Widowed	Divorced	Remarried
Father's social class	N=631	N=54	N=32	N=119	N=166	N=621	N=40	N=89	N=141	N=174
Non-Manual (+)	1					1				
Manual			1.10***				0.42***		1.58***	
Educational attainment at 26 years [a]	N=639	N=205	N=34	N=123	N=174	N=660	N=42	N=99	N=147	N=179
Advanced secondary education	1							0.41**		0.53**
No qualifications	1		4.5**					1		
Lower secondary qualifications compared with	1									
Financial difficulties	N=581	N=41	N=28	N=103	N=163	N=608	N=33	N=91	N=121	N=164
RR/1 unit increase			0.71**	0.68***			0.69**		0.63***	
Conduct problems in adolescence	N=613			N=115						
RR/1 unit increase				1.19***				1.28***	1.13*	1.21***
Psychological distress at 43	N=647			N=113	167	N=649			N=140	
RR/1 unit increase				1.04***	1.02**	10.2			1.04***	
Psychological distress at 53	480	36		N=68						
RR/1 unit increase		1.20**		1.19**						
DBP at 53 years mmHg						676		N=96		
RR/1 unit increase in mmHg								1.02**		
SBP at age 60-64 mmHg						N=601			122	
RR/1 unit increase in mmHg									0.98**	
DBP at age 60-64						601			122	
RR/1 unit increase									0.97**	
Problematic alcohol consumption at age 53	662				102	164				
RR/1 unit increase					1.98**	1.78**				
Smoking history										
Life-long non smoker										
Predominantly non-smoker		0.50*						1.82**		
Predominantly smoker								2.59**	2.20**	2.29***

Life-longsmoker	3.14**	3.09***	1.99**	3.40***	4.23***	1.96**

*=p=0.05 **=p<0.05 ***=p<=0.01 SBP=Systolic blood pressure mmHg (10mmHg added if respondents reported being on blood pressure lowering medication) DBP=diastolic blood pressure mmHg (5mmHg added if respondents reported being on blood pressure lowering medication) BMI=Body mass index $kg/^2$ Waist=Waist circumference, measured in centimetres . OR=1, odds ratio to denote the reference category.