**DEPARTMENT OF EPIDEMIOLOGY
AND PUBLIC HEALTH**

# The relationship between maternal employment in childhood and health-related outcomes in adolescence: findings from the BHPS

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I, Jitka Pikhartova 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.

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# Abstract

Objective: Maternal employment has been shown to influence a number of child and adolescent health, cognitive and behavioural outcomes. There are, however, only a limited number of UK studies using health measures as study outcomes. The aim of this thesis is to examine the influence of maternal employment during three periods of childhood on health outcomes among young adults aged 16–21 in the British Household Panel Survey (BHPS).

Methods: The BHPS is an annual nationally representative panel study which started in 1991, and data from 18 waves were available for this thesis. There were 3,940 individuals with at least one measurement of self-rated health and/or psychological distress and/or smoking in young adulthood (age 16–21) and maternal employment prior to age 16 years. Other variables, such as gender, maternal age, maternal education and marital status, household income, maternal self-rated health, maternal psychological distress and maternal smoking, were used as covariates. Multilevel logistic regression (using clustering of repeated measurements within individuals) was used for the analysis.

Results: 19% of young adults reported poor self-rated health, 23% reported psychological distress and 27% reported being current smoker. 56%, 76% and 79% had mothers who worked during the preschool (age 0–4 years), primary school (age 5–11) and secondary school (age 12–16) periods of their childhood. In general, the results suggest that maternal employment is protective for those from socially advantaged families, while it has no effect or increases the risk of poor self-rated health, psychological distress and smoking among those from less advantaged families.

Conclusions: The associations between maternal employment during childhood and young adults' health and smoking differ in different social groups. Maternal employment might have only a limited role in the health and health behaviours of young adults, and maternal education, household income and marital status seem to be stronger predictors of the study outcomes than maternal employment status.

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This thesis is dedicated to Hynek and Katka.

# Abbreviations

| | |
|---|---|
| BHPS | British Household Panel Survey |
| CES-D | Centre for Epidemiological Studies Depression Scale |
| CI | Confidence interval |
| EU | European Union |
| FACS | Families and Children Study |
| GEE | Generalised estimating equations |
| GHQ-12 | General Health Questionnaire, 12-item version |
| OFSTED | Office for Standards in Education, Children's Services and Skills |
| MCS | Millennium Cohort Study |
| MRC | Medical Research Council |
| NCS | National Childcare Strategy |
| NICHD | National Institute of Child Health and Human Development |
| OECD | Organisation for Economic Co-operation and Development |
| OR | Odds ratio |
| PAF | Population-attributable risk fraction |
| PSU | Primary sampling unit |
| Q | Quintile |
| SEP | Socio-economic position |
| SRH | Self-rated health |

# 1  Introduction

## 1.1  Changes in women's employment in recent decades

Mothers are exposed to conflicting messages about childcare. This is especially true of the role of maternal employment. Mothers who work may feel guilty about "abandoning" their children to formal or informal childcare. On the other hand, single mothers are told that employment is the key to social mobility and a better future for their children. The purpose of this report is to explore some of these issues, and to address some gaps in current evidence regarding the association between maternal employment in childhood and health among young adults.

The social environment in Britain, as in most societies in Europe and North America, has changed significantly in the last 30–50 years. At the start of 1971, in Britain the employment rate for women was 56%, compared with 70% in 2008. This increase in female employment rates has been accompanied in absolute terms by a similar-sized decrease in male employment rates, from 92% to 78% over the same period.[1] Employment rates have changed rapidly for mothers in particular. At the end of the 1970s, about 24% of mothers of dependent children were in paid work in the UK; this proportion had increased to 67% by 1996,[2] and to 69% by 2001.[3] In 2008, mothers who were married or cohabiting were more likely to be in employment (72%) than lone mothers (56%).[1]

The family structure has also changed in recent decades. The proportion of children born outside marriage has increased rapidly in the last 40 years as the proportion of cohabiting-couple families and lone-parent families has increased. For example, the proportion of children born outside marriage was 37 percentage points higher in 2007

than in 1965 (45% compared to 8%).[4] Additionally, the proportion of stepfamilies (couple families with stepchildren, or with step- and natural children to both parents) has increased. While in 1965 approximately 1% of children in the UK lived in stepfamilies, in 2001, according to the first available information from the Census, 10% of all families with dependent children were stepfamilies.[4] The proportion of lone-parent families increased from 7% in 1971 to 24% in 2001.[5]

These statistics document major social and demographic changes in the United Kingdom in recent decades. Changes in maternal employment rates and family structure have been accompanied by many other changes in family life. Modern technology has significantly reduced the amount of necessary housework and food preparation, women are more educated, life expectancy has increased from 72 years in 1970 to 80 years in 2008,[6] expectations for personal fulfilment have expanded, and traditional gender-role attitudes are less widely held.

Large demographic changes in the family structure and high rates of maternal employment mean that a large proportion of children live in dual-earning families[7] (or single-earning lone-parent families) and thus depend on some type of childcare. UK government policies over the last decade have also changed substantially, moving from policies which originated from conservative post-war family theories based on a working father and stay-at-home mother[8;9] towards feminist-influenced models based on equality for women, the encouragement of women's employment, and future-oriented social investment.[10] These policies include, for example, developing "family-friendly policies", free nursery and day care for preschool children, and tax credit provisions for families with children.[11;12] These policies are not only directed towards families, but also encourage employers to provide childcare support, for example through workplace nurseries or childcare vouchers.[12]

## 1.2 Maternal employment and children's development, well-being and health

Because of the previous influence of conservative family theories on public policy and the worry that working mothers were not good for their children's development, a number of studies have looked at the impact of maternal employment on a range of markers of well-being in children, such as cognitive outcomes, educational achievement, behavioural problems, overweight, self-rated health, overall well-being and child fatalities,[13-28] although not all of these outcomes have been studied to the same extent. The life-course epidemiological approach suggests that exposure to adverse social and environmental circumstances in early life may lead to poorer health outcomes in later life.[29] Studies taking a life-course approach may be particularly helpful in evaluating the effect of childhood conditions on health in adulthood, whether cumulative or as the result of a specific sensitive period.

The increase in the proportion of working mothers and the social changes of recent decades make research into the impact of maternal employment on children's development and well-being more important than ever before. While employment support helps to reduce poverty and enables parental self-sufficiency, it is vital to answer questions regarding how these strategies affect children's development and health. Another aspect of active maternal participation in the labour market is that maternal employment may force some children into suboptimal care settings or reduce parents' ability to monitor the behaviour of their children. Alternatively, maternal employment may also help to create positive maternal role models, to promote maternal self-esteem and to place children in stimulating childcare setting.

Despite the volume of literature examining the effects of maternal employment on certain characteristics of health and well-being in young children, relatively little is known about the effects of maternal employment on markers of subsequent health and well-being in young adults. Life-course theories suggest that the effects of maternal employment might be longer-lasting, over and above any short-term effects, and maternal employment might be important as a determinant of subsequent health-related outcomes not only in the earliest phase but also in the later stages of childhood. This project aims to look at the associations between maternal employment in several stages of childhood and the subsequent health and health behaviours of young adults in the UK to evaluate such potentially longer-lasting effects.

## 1.3  Structure of the thesis

Previous research on the topic of this PhD project has been relatively extensive, and will be reviewed in Chapter 2 of this report. The key concepts related to maternal employment will be defined, the existing literature investigating the association between maternal employment and the health and well-being of children will be summarised and critically evaluated, some methodological issues and the strengths and weaknesses of the published literature will be discussed, and the gaps in the existing literature will be identified. Chapter 3 states the aims of the study, its specific objectives and proposed hypotheses. Chapter 3 also describes the conceptual model, explaining how this PhD project will address some of the gaps identified in Chapter 2. Chapter 4 will describe the data, the study population and the variables (study outcomes, main exposure and all covariates) used to evaluate the model, along with the steps of the analysis, a description of the study power, and ethical issues relevant to the project. In Chapters 5, 6 and 7, results from the analyses conducted for this thesis will be presented. Chapter 5 focuses

on describing the sample and evaluating the crude, unadjusted effects of maternal employment on selected outcomes, namely on self-rated health, psychological distress and smoking of young adults. Chapter 6 deals with the role of maternal employment in different stages of childhood after taking other covariates, such as maternal education, household income, maternal marital status, maternal health and health behaviour, childcare arrangements and maternal job satisfaction, into account. Chapter 7 evaluates the combined role of maternal employment throughout childhood using life-course epidemiological methods. In Chapter 8, the results of the project will be discussed and compared with previous findings. Methodological issues and the strengths and limitations of the project will also be discussed in this chapter, along with potential research and policy recommendations. Finally, the conclusions will be drawn.

# 2 Background

This chapter summarises recent trends in maternal employment, critically appraises articles that investigate the association between maternal employment during childhood and various health outcomes among children and young adults, and assesses the role of family structure and socio-economic position in that association. The focus will be on studies that examine young adults aged 16–21, but studies on younger individuals will also be examined.

## 2.1 Social changes in Western societies in recent decades

Western societies have undergone extensive social and demographic changes during the last 30–50 years. Some of the changes relevant to this project, such as changes in employment, family structures and the distribution of family responsibilities between men and women, will be described in sections 2.1.1–2.1.3 of this chapter.

### 2.1.1 Women's paid employment

Over the last few decades, the role of women in most societies in Europe and North America and in the context of the family has changed dramatically. The educational attainment of women has improved and the proportion of economically active women is substantially higher than in the past. For example, in Britain at the start of 1970, the employment rate for women was 52%, compared with almost 70% in 2000, although it slightly decreased to 66% in 2010, according to ONS statistics (Figure 2.1).[30]

**Figure 2.1. UK employment rates for men and women of working age in 1971-2011**
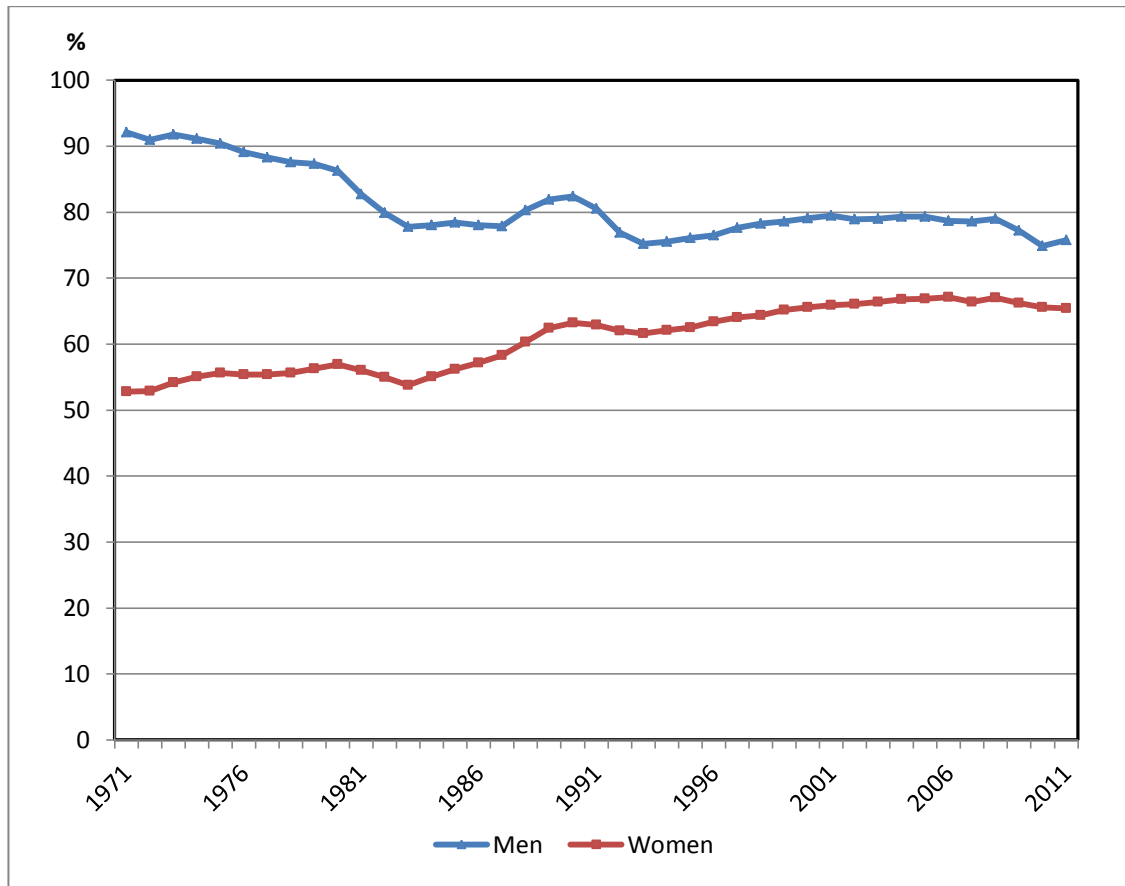


Source: ONS, 2011[30]

Employment rates among mothers have similarly changed. The proportion of British women in paid work 8–11 months after childbirth increased from 24% in 1979 to 67% in 1996.[2] Most recent ONS data from 2011 suggest that 67% of mothers with children were employed in first quarter of 2010.[31] More detailed figures from 2008 show that 57% of mothers whose youngest child is under five are in the labour force; the figures rise to 70% for those whose youngest child is aged 5–10, and 78% for those whose youngest child is aged 11–15, compared with approximately 72% for women without dependent children (Figure 2.2).[32]

**Figure 2.2. UK paid employment rates by gender and age of youngest child, 2008**
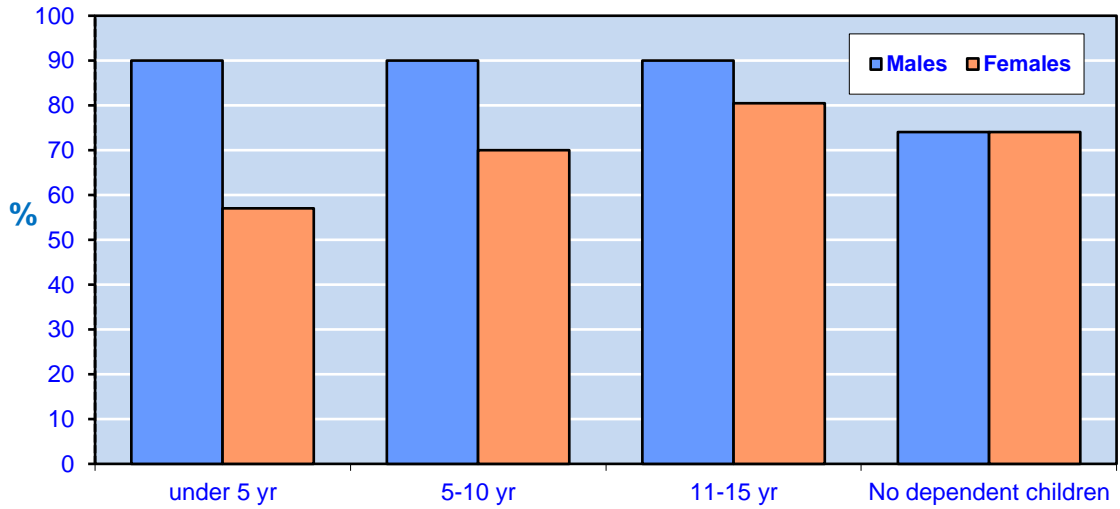


Source: Labour Force Survey 2008, ONS

However, despite the increase in the number of mothers in the labour force, mothers are more likely than fathers to give up their careers and work part-time if they have dependent children. For example, as Figure 2.3 shows, in data from the 2002 Labour Force Survey, more than 50% of women in paid employment with dependent children aged 0–18 years were working fewer than 30 hours per week, compared with approximately 32% of women without dependent children and 9% of men. In data from 2008, among parents with dependent children, 38% of mothers worked part-time, compared with 3% of fathers. By contrast, among parents without dependent children, only 22% of mothers and 7% of fathers were part-time workers.[32]

**Figure 2.3. Usual working hours, men and women with and without children, UK, 2002**
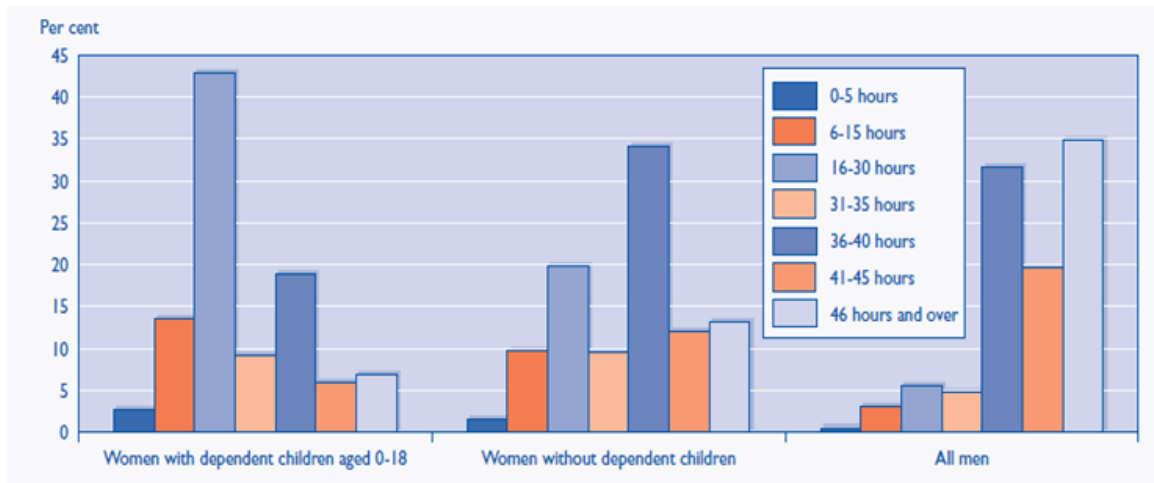


Source: Labour Force Survey 2002, ONS

Compared with women in other European countries, British women are more likely to work part-time.[33-35] Overall, nearly 50% of British women in paid employment work part-time,[34;36] while in other European countries a much higher proportion of women work full-time.[37;38] In 2002 the Netherlands was the only EU country with a higher proportion of part-time employed women than the UK.[34;38] Cross-country comparisons show large differences in the proportions of part-time employment. It is more widespread in the countries of northern Europe than in those of southern Europe. The highest proportion of part-time employed women is in the Netherlands (72.8% of all employed women), followed by the United Kingdom, Germany, Belgium and Austria, while the lowest prevalence of part-time female employment is in Greece, Portugal, Italy and Spain. These national differences are probably influenced by a number of factors, such as differences in the labour market, the organisation of childcare, the education systems, or the social-security and tax systems.

In addition to large differences between countries and societies, maternal employment is not uniform within the UK. First, it varies by marital status. Married or cohabiting

mothers are more likely to be in employment (72%) than lone mothers (56%).[1] This has not always been the case. For example, in the MRC 1946 Birth Cohort Study, lone mothers had stronger ties to the labour market than married mothers.[39] Women's employment and parental status also varies by socio-economic position. While highly educated women (86% of whom are employed, compared to 50% of those who have only a secondary-school or lower-level education: http://www.nationmaster.com/red/country/uk-united-kingdom/lab-labor&all=1,accessed October 2011) postpone motherhood, and are then able to purchase reliable formal childcare and return to work relatively soon after childbirth, lower-educated mothers with lower incomes tend to take longer breaks from paid employment and are forced to use informal sources of childcare, which limits the hours they can travel and work.[40-42] Results from the International Social Survey show that lower-educated mothers are more likely to leave employment after becoming mothers than those who are more skilled and more educated.[37] Women in more advantaged socio-economic positions are able to improve their socio-economic positions, to earn higher incomes and therefore to provide their children with higher-quality care. This leads to a growing socio-economic polarisation between these two groups of women.[42;43]

These changes in maternal employment rates have been accompanied by many other changes in family life.

## 2.1.2  Family structure

Parallel to the increased participation of women in the job market, there have been big changes in the structures of families. The types of family in which children grow up have changed over the past 30 years, with a decrease in the proportion of dependent children living in families with two parents and an increase in those living in families with single parent. Over the last 30 years the divorce rate in England and Wales has

increased substantially, from 6 per 1,000 of the married population in 1971 to 14 per 1,000 in 2003, although there is some evidence of a decrease in divorce rates since 2004 (Figure 2.4).[4;44;45;46] Most recent data show that the divorce rates were 10.5 and 11.1 per 1,000 in 2009 and 2010, respectively. [45]

**Figure 2.4. Divorce rates in England and Wales, 1971-2010**
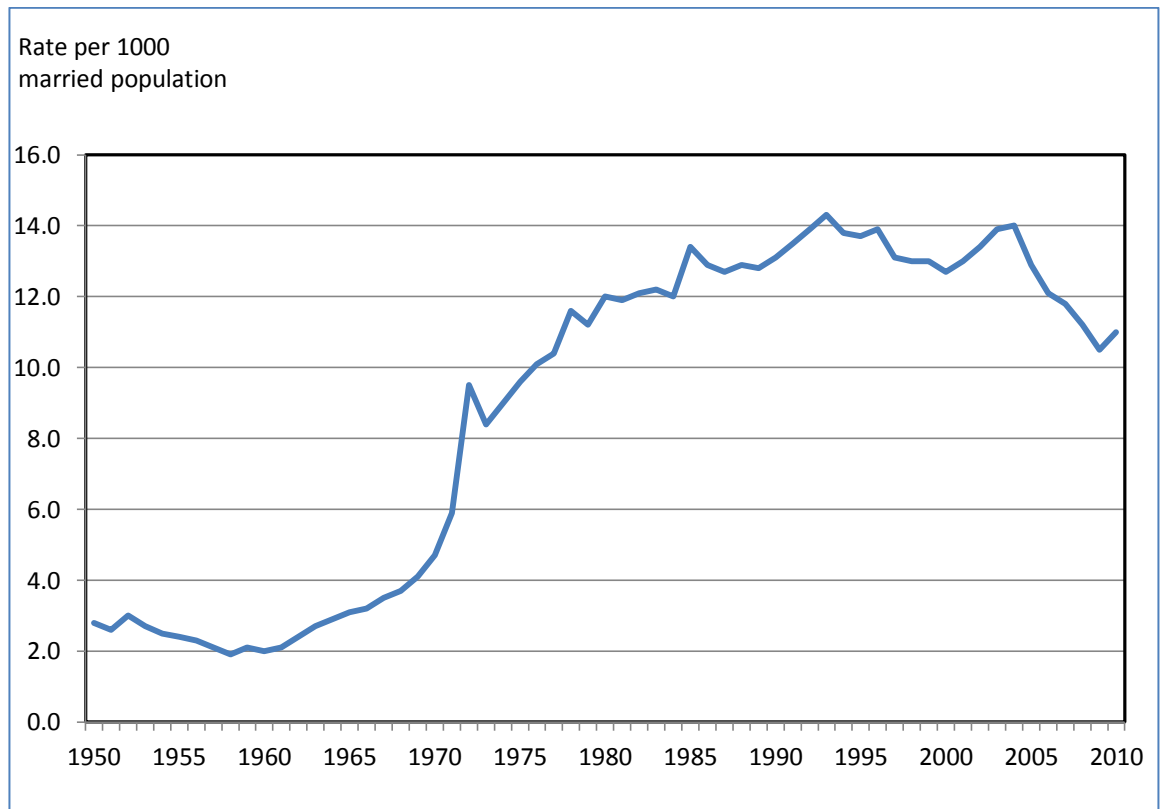


Source: Office for National Statistics[45]

The proportion of children born outside marriage has also increased steeply in the past 40 years, from approximately 8% in 1965 to almost 47% in 2010 (Figure 2.5).[47] This proportion further increased to 46.2% in 2009. In 2009, 380,000 children were born within marriage while 326,000 were born outside marriage.[46] The proportion of children living in stepfamilies has increased from approximately 1% in 1965 to 10% in 2005.[48] Similar trends can be seen among children who live in lone-mother families (from approximately 8% in 1971 to 21% in 2007 [4;49;50]). Although divorced mothers were the most frequent among lone mothers in the 1970s and 1980s, single mothers became more common than divorced lone mothers at the beginning of the 1990s. The proportion of

single lone mothers started to increase quite sharply after 1985, when the proportion of births outside marriage started to rise at a faster rate. Families with lone fathers accounted for 2% of all families with dependent children in spring 2000.[4;50;51] There was a corresponding decrease in the proportion of children living with both biological parents during the same period. Nevertheless, the traditional family with two parents is still the most frequent type of family with dependent children in the UK – 80% lived in such families in spring 2000.

**Figure 2.5. The proportion of children born outside marriage in England and Wales**



Source: Office for National Statistics
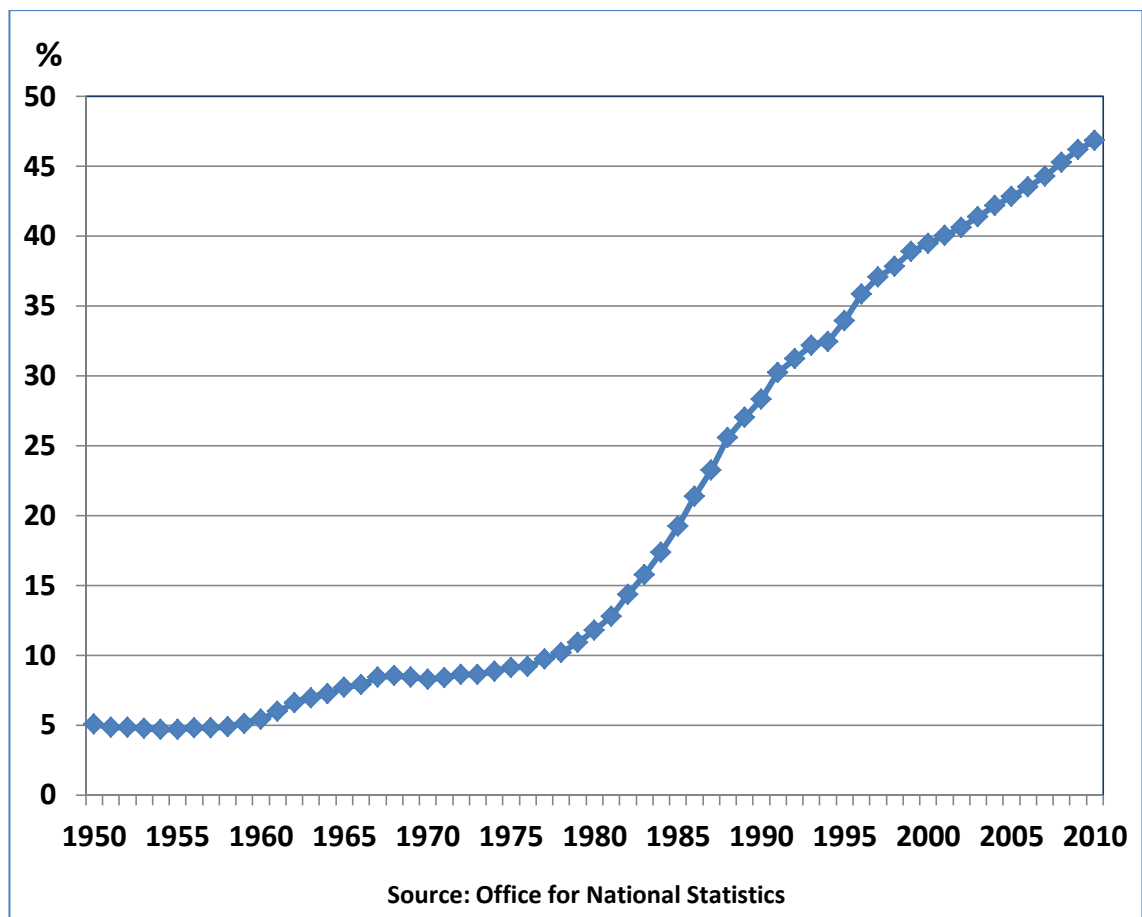
### 2.1.3 Childcare

The large demographic changes in family structures and the increased rates of maternal employment mean that a large proportion of children live in dual-earning families (or single-earning lone-parent families)[52] and depend on some type of childcare, formal or informal, other than parental childcare.

In 2006, approximately 40% of all families in the UK where the mother was in work relied on informal childcare. Grandparents were the most common source for both couples and lone parents (32% and 31% respectively), but other relatives or older siblings also provided childcare for both couples and lone parents. In addition, lone parents were more likely than couples to rely on ex-partners for childcare. The use of formal childcare decreased with the increasing age of children. In 2006 more than half (54%) of all children under five years whose mothers worked were looked after in some form of formal childcare. This fell to one third (33%) for children aged 5 to 10 years (primary-school age), and decreased further to around one in 20 (6%) when they reached secondary-education age. Around 6 in 10 (59%) children aged between 5 and 10 years with working mothers in the UK received some form of formal or informal childcare in 2006. The use of informal childcare decreased more slowly with age than the use of formal childcare, with around one half (51%) of children under 10, and around one quarter (26%) of children between the ages of 11 and 16, receiving this form of childcare (Table 2.1).[53]

As mentioned in Section 2.1.1 in relation to women's employment, childcare arrangements tend to differ by socio-economic status. Women with higher educational attainment or in highly paid jobs often postpone motherhood, and when they have children they are able to pay for formal childcare and to return to work soon after childbirth. Women with less education or in lower-paid jobs often take longer maternity

leave or even longer breaks from paid employment, and often use informal childcare resources; they often also reduce the hours they work.[42]

**Table 2.1. Informal childcare arrangements for children whose mothers were in employment, 2006, UK**

| Type of childcare arrangements | Lone parent | Couple |
|---|---|---|
| | % * | |
| Child's grandparents | 31% | 32% |
| Friends, neighbours, babysitters coming to the home | 11% | 7% |
| Child's brother or sister or other relative | 15% | 8% |
| Non-resident parent or ex-partner | 14% | 1% |
| *Total informal child care ** * | *46%* | *39%* |
| *Formal child care*** * | *28%* | *27%* |
| *None of these/ does not require minding* | *47%* | *39%* |

* percentages do not sum to 100% as respondents could give more than one answer
** first four options combined (sum of percentages is not equal to total informal care as respondents could give more than one answer)
*** nurseries, playgroups, registered childminders, after school clubs, breakfast clubs, holiday play schemes
**Source**: Social Trends 39, ONS 2009, page 124

Parental perceptions of the affordability of local childcare provision vary between lone parents and couples. In the Families and Children Study (FACS) in 2006,[54] nearly one third (31%) of lone parents in the UK described their local childcare provision as "not at all affordable", compared with more than one fifth (22%) of couples. A further 34% of lone parents found the provision "fairly affordable", compared with 45% of couples. Couples in which both partners worked 16 hours or more per week were more likely to consider local childcare to be "fairly affordable" than couples in which one partner worked between one and 15 hours per week – 48% compared with 42%. The age of the child may also affect parental perceptions of affordability: almost half (49%) of parents with a child aged under five believed that childcare was "fairly affordable", compared

with 32% of those with a child aged 11–15 and 30% of those with a child aged 16–18, despite childcare generally being more expensive for younger children (http://campaigns.dwp.gov.uk/asd/asd5/rports2007-2008/rrep486.pdf).

Changes in maternal employment and childcare arrangements have been accompanied by changes in government policies. Since the mid-1990s the UK government has introduced a number of labour market-oriented policies for families, including the National Childcare Strategy (http://www.lbcma.org.uk/NCS.asp), the minimum wage, the New Deal for Lone Parents, the new Working Families Tax Credit, and extended maternity and paternity leave. One of the most important programmes was Sure Start, introduced in 1998. The aim of this programme was to "give children the best possible start" through the improvement of childcare, early education and healthcare, and family support. The original aim was to support families until children started school at the age of four, but the programme was later extended to children aged 14. While there is some controversy about the effectiveness of the programme,[55;56] a recent report from the National Evaluation of Sure Start (NESS)[57] suggested that differences in results between the two phases of evaluation might have been due to the "increasing quality of service provision, greater attention to the hard to reach ... as well as the greater exposure to the programme of children and families".

Childcare is an important topic in the European context as a whole, not only in the UK. At the Barcelona summit of the European Council in 2002, EU member states agreed on harmonised childcare targets. It was agreed that by 2010 member states would provide childcare to at least 90% of children between the age of three and mandatory school age and at least 33% of children under three, "taking into account the demand for childcare facilities and in line with national patterns of provision".[58] The European Commission strongly supported the demand for the expansion of state childcare facilities, and the

Labour government undertook a moderate broadening of the services on offer.[59] Nevertheless, the UK still ranks among the EU members with very low state support for childcare.[60] Parental and informal childcare arrangements still play an important role in a large number of European countries (Figures 2.6 and 2.7). [61]

**Figure 2.6. Use of formal childcare arrangements in the EU (0-2 years old)**
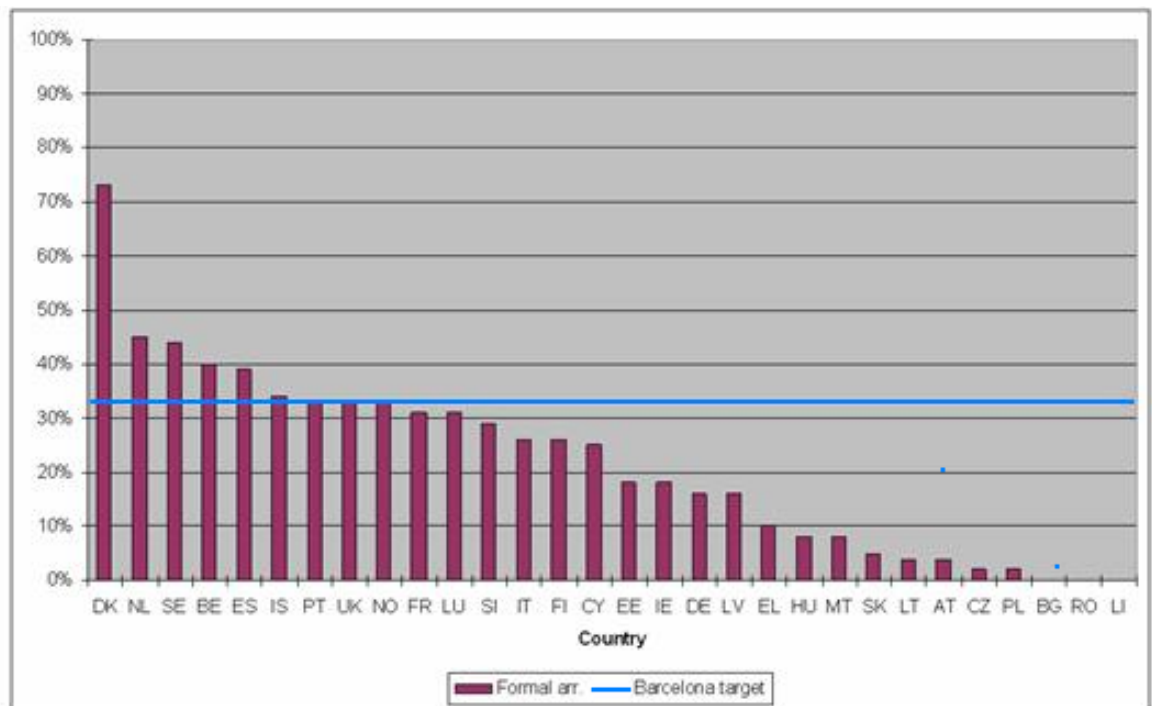


Source: Plantenga, 2008 [61]

**Figure 2.7. Use of formal childcare arrangements in the EU (3 years to mandatory school age)**

## 2.1.4 Gender differences in domestic responsibilities

Alongside women's increasing labour participation, the British government has changed its policies in the last few years in an attempt to offer more provision for families with children, such as child tax credit, free nurseries and day care for three-year-old children, or the provision of childcare vouchers.[11;12] Although such formal policies do help working mothers with childcare, they remain insufficient, as there is still an increasing demand for childcare related to the increase in maternal employment[62] described at the beginning of section 2.1. It has been reported that the increased demand has been at least partly met by men's greater participation in family duties and the more extensive sharing of domestic responsibilities between men and women.[60] According to the OECD database for 2002, the gendered division of housework in the UK was 2.11 (on the Gender Division of Labour Index scale, on which 1.00 means that women do all the housework and 5.00 that men do all the housework in a household:

http://www.nationmaster.com/red/country/uk-united-kingdom/lab-labor&all=1, accessed October 2011).

In the United States, women's participation in housework decreased by about 19% between 1965 and 1975, but men's participation did not increase.[63] More recently, Bianchi and colleagues have estimated that men's participation in housework almost doubled in the US between 1965 and 1995, from approximately 5 to 10 hours per week, and that men were responsible for almost a third of housework, compared to 15% in 1965.[64] The source and scale mentioned above show that the gendered division of housework is 2.26 in the USA, which means men in the USA do 7% more work in the household than men in UK (http://www.nationmaster.com/compare/United-Kingdom/United-States/Labor, accessed October 2011). Comparing data from two countries in northern Europe, Bernhardt and colleagues found that a long-established gender-egalitarian system (the so-called Scandinavian system) leads to more equal sharing of housework – surprisingly, more so in Sweden than in Norway, even though the same conditions prevail in both countries.[65]

In the UK, the proportion of housework undertaken by women fell from 77% in 1975 to 63% in 1997, and in families in which both the husband and the wife were fully employed this proportion fell from 68% in 1975 to 60% in 1997.[60] In addition to men's greater participation in family duties, modern technology and the employment of others who come into household have considerably reduced the amount of necessary housework and food preparation.[64;66;67]

Although there has been a reduction in women's share of the housework, and an increase in men's housework participation, the participation of men and women in housework and domestic activities is not yet uniform across society. Some authors have suggested that household social and demographic characteristics play an important role.

Kan[68] showed in the British Household Panel Survey that women from high-income households and younger women spent less time doing housework than other women, although such differences were not found for men. Kalenkoski and colleagues[69] reported in the United Kingdom 2000 Time Use Study that married and cohabiting parents were similar with respect to the time spent on childcare and work, and that single parents spent less time on work-related activities than other parents with co-resident children. McMunn showed preliminary evidence from the Millennium Cohort Study that parents were more likely to share childcare responsibilities than other forms of domestic labour.[70]

To summarise, women, whether married, cohabiting or single, spend less time today on housework activities compared to 30 or 40 years ago. While the time spent by women on housework activities continues to fall, it is still women more often than men who are the main caregivers for children, and who exit the labour market or change their workload if necessary.

## 2.1.5  Attachment theory and maternal employment

The previous sections of this chapter have summarised some demographic changes in Western societies, particularly those related to the role of women in the last 50 years. These changes in women's roles have occurred within the context of various sociological and psychological theories. Developmental psychology has focused extensively on the relationship between maternal employment and child development, with a particular focus on the child's early life and early development. Probably the most influential theory has been the attachment and maternal deprivation theory[8;9;71] developed shortly after World War Two by John Bowlby, a British psychoanalyst who believed that mental health and behavioural problems in later life might be related to a

lack of attachment in early childhood. Attachment was outlined by Bowlby as a social, emotional, physiological and cognitive phenomenon characterizing the relationship between caregiver (the mother in most situations) and child which operates to promote child development and the development of the child's personality. Bowlby highlighted the first 12 months of a child's life as a critical period for the possible development of later problems. The importance of relationships in the child's development was stressed by Bowlby and most of his colleagues. In addition to attachment theory, researchers also used other frameworks, such as psychoanalytic or family theories, but all of these frameworks described the importance for child development of close relationships between the child and its parents, particularly the mother, in giving the child a secure basis for its learning and development.[72-76] They suggested that attachment is of primary importance for social, emotional or cognitive development. Bowlby's theory was introduced at a time when responsibility for early childcare was largely a female role in Western society, but it was also a period when women were becoming more economically independent as a result of their increased labour market participation during World War Two. Attachment theory was not particularly gender-specific; however, it proved a useful instrument for some policymakers, particularly conservative ones, to promote the idea that the role of women was to take care of their families, rather than to be in formal paid employment. With changing patterns of maternal employment, childcare and family structure, psychological and social researchers focused on how these changes might influence child development.[77;78] Although the effect of these changes has long been discussed, recent evidence, discussed later in this chapter, suggests that the use of non-maternal childcare does not negatively influence attachment.[79;80]

In addition to psychological theory, there have been other, sociological or economical, theories developed in relation to maternal employment. For example, one theory focuses

on the home-work balance, describing how working and domestic roles can complement or conflict with each other.[81] It has been postulated that the characteristics of the parent's work might moderate the relationship between parental employment and child outcomes. It has been suggested that parents may better respond to their children if they have rewarding and interesting work while stressful or boring work may reduce their sensitivity or responsiveness at home. Another example of social theories related to the role of the mother and maternal employment in the child development is Parson's theory of social functionalism.[82] He evaluated changes in the functions of the family related to changes in society. Parsons says that the family has two main functions in contemporary society: the socialisation of children, and the "stabilization of the adult personalities of the population of the society".[83;84] Among other ideas, he argues that the roles of the husband and wife in the family are quite different: "in order to survive, the family needs an income from the husband's occupation, while it also depends on the wife's expressive and integrative activity". The wife's main role is to react to the needs of her children and husband, and to take care of the household. It has been argued that such a division of roles is important for "marital solidarity because it prevents potentially divisive competition between husband and wife".[85] This theory has been criticised, both at the time of its development and more recently. The main criticism is related to the conservative nature of its model of the family. It has been also pointed out the families described in the model mainly resemble middle-class families in North America shortly after World War Two, and that poor, migrant or even upper-class families differ substantially from this model. As the model was developed in the middle of the 20th century, it also does not take into account any of the substantial social changes that have occurred in approximately the last 30 years, such as the reductions in family size, the older age of marriage, the higher proportion of women in the labour force, or the high proportion of single-parent families.

Functionalist theories have been particularly criticised by feminist sociologists, who argue that females may be disadvantaged within the family in several ways. For example, parents socialise their daughters to show dependence, obedience or domesticity, while boys are encouraged to be dominant and competitive; women are encouraged to accept traditional gender roles that socially disadvantage them; and many important spending decisions are taken by men rather than women. While there are different varieties of feminism, such as Marxist feminism, socialist feminism, liberal feminism or black feminism, and each differs from the other, they all criticise family-oriented theories, of which functionalist theory is just one example, as being over-optimistic and inaccurate in terms of the role of females in the family and in society. They therefore try to adapt family-oriented theories in line with wider social changes.

Economic theories such as Becker's *Treatise on the Family* [86] focus on several key areas, such as parental time allocation within families or the impact of parental decisions about investments in children.[87] These theories suggest that maternal employment may increase family income and extend the resources available to the child, and that such increases can improve the child's health and development.[88]

In summary, it can be said that the attachment theory model cannot address the complexity of social experiences in current society, including complex relationships within the family and in childcare settings.[89] Existing theories suggest that the role of maternal employment might differ when the child is at different ages. This is because infants and preschool children are more dependent on their mothers and fathers than older children; because changes in the family's economic resources and home environment affect the role of maternal employment; and because the role of maternal employment may differ by the characteristics of the family or of the mother's work.

These theories also highlight the role of potential selection bias, as there are various influences affecting a mother's decision whether and when return to work.[87]

Social policies related to childcare are an important consideration for any theory that emphasises sensitivity and continuity in caregiving relationships.[90] As already mentioned in previous sections, government policies on families, especially mothers, have changed in recent decades, including in the UK. The British government has changed its policies in the last few years in an attempt to offer more provision for families with children, such as child tax credit, free nurseries and day care for three-year-old children, and the provision of childcare vouchers.[11;12] Family-friendly policies such as parental leave, job-sharing, subsidised childcare and home working have been introduced or become more common in many workplaces.

Because of the influence of attachment theory in some Western societies, including the UK, a number of studies have looked at the impact of maternal employment on child development and health. In the wake of large demographic changes in family structures and a steep increase in maternal employment, research into the effects of maternal employment on children's development and well-being, as well as on health-related outcomes and the health behaviours of children in later stages of life, is more important than ever before.

With the important development of life-course epidemiological research, which emphasises the impact of experiences in different periods of life on the health of individuals, research into the role of maternal employment and other social characteristics in childhood has started to focus on later periods beyond early childhood, both in terms of exposure during later childhood and in terms of later outcomes. The association between maternal employment and the health and development of children, both in early childhood and later, will be the focus of section 2.4. However, before

summarising the evidence about this relationship, I will briefly introduce the period of young adulthood, as well as life-course theory, which will play an important role in the assessment of the associations of interest in this project.


## 2.2  Young adult and adolescent health

In addition to women, and mothers in particular, young adults are the focus of this project. It is therefore important to describe and characterise these individuals. The age specification of the group called "young adults" differs in different publications and when used by different authors. It might be used for a group of individuals aged 18–24, 20–24, 20–30, or in other age ranges. It is therefore essential to specify which group it will refer to here. In this thesis, the term "young adults" will be used to refer to individuals aged 16–21. The 16–21 age group has been chosen because this is the age period which includes and extends beyond the end of compulsory education, when young people are able to make choices affecting their future life circumstances, including their health. The 16–21 age period is an important transitional period of physical and mental development, accompanied by greater independence, both formal and informal, as well as greater demands from friends, school and wider society. It is also the period of life when individuals gain certain legal rights, such as the rights to enter paid employment, vote and have legal sexual relationships, as well as rights related to various health behaviours, such as the right to buy and drink alcohol, or to buy and smoke cigarettes.

Youth is thought to be a relatively healthy stage of life, with low rates of serious physical illness; in particular, the early-youth period covered in this project is usually an illness-free period. However, it is thought that health indicators such as self-rated health

deteriorate during this period, and a relatively high proportion of young people report poor self-rated health and subjective health complaints.[91] It is also thought that health tracks into adulthood, and health measurements during youth might therefore be important indicators of future health and mortality.

## 2.2.1 Self-rated health

Self-rated health has been shown to be an important predictor of future mortality[92;93] and an even better predictor of mortality than clinically assessed health,[94] as well as being an easily obtainable measure of health. While an association between self-rated health and future mortality has often been shown in the middle-aged or older populations, such associations have only rarely been shown for young adults, mostly for technical reasons: as mortality is low among young adults, the follow-up period would need to be extremely long, or the sample size to be extremely large. However, a strong association between self-rated health at age 18–20 and future mortality was shown in a 27-year-long follow-up study of Swedish men.[95] Those who reported poor or very poor health at the baseline of the Swedish study had significantly increased mortality in the next 27 years compared to those reporting very good health. In another study in Norway it was shown that both men and women aged 20–44 at the time of the initial interview who had poor self-rated health had an increased risk of future mortality compared to those who reported very good health.[96]

Self-rated health is not related only to mortality. For example, it was shown that among those who had applied for a disability pension because of musculoskeletal complaints, there was a high level of poor self-rated health but little or no objectively verifiable disease.[97] Another study in Scandinavia reported that only approximately half of the reduction in function among persons who received a disability pension could be explained by objective health conditions, while those individuals also had high levels of

poor self-rated health;[98] it has been suggested that rehabilitation might focus, at least partly, on patients' own perceptions of their health. Because of the potential consequences of self-rated health in adult life, assessing this measure in young adulthood is relevant and important.

It has been reported that one's subjective perception of one's health is formed during this early period of adolescence, that it is influenced by demographic and social characteristics as well as one's own health-compromising behaviours,[99-101] and that young people define health in quite a broad way. For example, Breidablik et al. found an association between self-rated health and a large set of psychological, social, medical and structural factors among a representative sample of 16–20-year-old Norwegians.[102] The association between self-rated health and some of these factors (those that are focus of this thesis) will be further summarised in sections 2.3 and 2.4.

## 2.2.2 Psychological health

While there is an extensive body of evidence showing an association between self-rated health and a wide range of health outcomes in later life, this is not the only health indicator that is the focus of health-related studies with young adults and adolescents. Psychological health and well-being, among other factors, should be considered no less important than self-rated health. Mental illness, and depression in particular, is one of the leading causes of ill health and disability throughout the world.[103] Studies focusing on the aetiology of depression and other mental-health outcomes have long shown the potential importance of the early life. For example, it was demonstrated several decades ago that adverse emotional experiences in childhood and young adulthood might affect adult mental health.[104;105] More recently, in the 1970 British Birth Cohort, it has been

shown that those reporting psychological distress at age 16 were 5.5 times more likely to report psychological distress at age 30.[106] Thus emotional or psychological distress in early periods of life, including adolescence and young adulthood, is likely to play an important role in health later on. Psychological well-being is therefore included as one of the outcomes of interest in this project, as it might have long-lasting effects on health in later periods of life.

### 2.2.3 Smoking

Adolescence and young adulthood is also a period when people start to experiment with behaviours, such as alcohol consumption or smoking. From a public-health point of view, smoking might be the most dangerous health behaviour, as rates of smoking are relatively high in society, and smoking is a known risk factor for a wide range of diseases in middle and old age. Different cohort studies have been used to describe trajectories of smoking over long periods. Early evidence on nicotine dependence starting in adolescence comes from McNeill.[107] In a US-based study comparing smoking habits at the ages of 15–16 and 32–33, Juan et al. reported that about 24% of the sample had smoked both at age 16–17 and at 32–33, while only about a quarter of the approximately 13% of respondents classified as former smokers at age 32–33 had started to smoke at the age of 16–17, suggesting that a substantial majority of those who smoked at 16 would continue to smoke into adulthood.[108] Jefferis et al. showed that more than 55% of those who smoked at the age of 41 in the 1958 Birth Cohort Study had already smoked at the age of 16. Adolescent smoking was a strong predictor of adult smoking, and those who smoked more in adolescence were more likely to smoke in adulthood than those who smoked only occasionally in adolescence.[109] Smoking in adolescence or young adulthood was repeatedly associated with a higher risk of smoking and heavy smoking in adulthood.[110] For example, those who smoked at age 16

were 7.5 times more likely to smoke at age 30 in the 1970 British Birth Cohort study.[106] The evidence evaluating trajectories of alcohol consumption from adolescence to adult life is more limited. In the analysis of alcohol consumption trajectories in the 1958 Birth Cohort Study, it was reported that those who were heavier drinkers at 16 were more likely to be binge drinkers at 42 than those who had been non-drinkers or light drinkers.[111] Those who were binge drinkers at 23 were more likely to be binge drinkers at 41. The evidence from the 1958 Birth Cohort Study suggests, however, that patterns of alcohol consumption in different periods of life are not as stable as patterns of smoking. However, it has been reported that risk behaviours such as smoking, alcohol consumption or drug use co-occur among young people.[112] It has also been shown that those who smoke regularly in adolescence are more likely to drink and to have serious psychological distress.[106;113]

Relatively stable patterns and the co-occurrence of risk behaviours are two reasons for choosing to focus only on smoking as a marker of the health behaviour of young adults.

Additionally, like self-rated health and psychological well-being, smoking in adolescence and young adulthood might have a long-lasting effect over the life course. Thus it is important to evaluate the role of risk factors influencing smoking in young adulthood.

## 2.3  The life-course epidemiological approach

The life-course epidemiological approach suggests that long-term exposure to particular conditions, or exposure to particular conditions during specific periods of life, may lead to poorer health outcomes in later life.[114] It attempts to build theoretical models that propose possible pathways that may link such exposures across different time periods to

later outcomes, on the basis of the assumption of temporal ordering in those exposures and outcomes. While the term "life-course" might suggest studies focusing on all or most periods of human life, methodologically the focus is on evaluating the role of risk factors in one or more periods preceding the health outcomes in question.[115-117] Therefore studies taking a life-course epidemiological approach are likely to be particularly useful for identifying pathways that originate in childhood and shape health in adulthood or late adulthood, as well as for identifying relationships between childhood risk factors and health-related outcomes in young adulthood or even adolescence. Such studies will enable the identification of sensitive periods for particular risk factors, as well as the potential accumulation of effects across several periods.[118-120]

In general, there are three main hypotheses regarding the relationship between such risk factors and later health outcomes.[121] These are (1) that there is a critical or sensitive period of the risk factor; (2) that there is an accumulation of the risk across different periods of life; and (3) that there are pathways or trajectories of change between different categories of risk factor that are particularly important for later health outcomes. In the first hypothesis, it is assumed that there is a particularly sensitive period in the individual's life during which the risk factor of interest has the most significant effect on the health outcome in question in later life. A classic example of such a sensitive period is Barker's hypothesis that poor maternal social circumstances during pregnancy lead to poor child development and an increased risk of coronary heart disease in adulthood.[122] In another example of a sensitive period, based on data from the 1958 British Birth Cohort Study, Power et al suggest that childhood social conditions from birth to age seven have a strong influence on the risk of adult obesity.[123] Lower socioeconomic status around the ages two to three is reported as influential for the risk of respiratory disease.[124] Montgomery et al conclude that growth between the

ages of five and eight is associated with blood pressure levels in early old age.[125] As these examples suggest, studies focusing on a critical or a sensitive period commonly focus on early periods of life, usually during child development and changes in human systems that might have consequences for health in middle or old age.

The second hypothesis, the accumulation of risk, assumes that exposures to risk factor across different periods of life accumulate and increase the risk of the health outcome in question in later life. For example, it has been suggested that the accumulation of social disadvantage is the main reason for socio-economic inequalities in mortality,[126;127] coronary heart disease[128] or the risk of respiratory disease.[129] Singh-Manoux et al evaluated the role of the accumulation of socioeconomic disadvantage across the life course in relation to the incidence of coronary heart disease, poor mental and physical functioning, and minor psychiatric disorders, and concluded that the health effects of such disadvantage do indeed accumulate over the life course.[130] Finally, the third hypothesis suggests that the trajectories of exposure to risk factors throughout life differentially influence later health outcomes. For example, it has been hypothesised that upward and downward social mobility differentially influence the risk of disease in the population.[131] Lynch et al. suggest that adult socio-economic conditions are more important than childhood conditions; however, they showed that one particular downward trajectory, combining high childhood socio-economic status with low adult socio-economic status, increased all-cause mortality among Finnish middle-aged men. These three main life-course models are graphically presented in Appendix 1. While these are the three main hypotheses regarding the relationship between risk factors in early life and health outcomes in later life, it is likely that many of the causal processes related to various health outcomes are a combination of some or all of these. Indeed, Hallqvist et al. in their analysis of Swedish data argue that with only a limited number of trajectories available, there is often only limited space for differentiating between the

three proposed life-course models, and interpretation of the results must often depend on a prior knowledge of underlying causal mechanisms.[118] Mishra et al. recently proposed a new, alternative methodology by which to distinguish between different life-course models,[132] although they admitted that such an approach requires data of sufficient power, a requirement that is frequently difficult to achieve in life-course longitudinal studies.

## 2.4 Maternal employment during childhood and children's later health and health behaviours

Maternal employment has been viewed negatively by some in terms of its effect on the development of children. In the 19th and early 20th centuries it was even viewed as one of the causes of increased childhood mortality.[133;134] This view has changed in the last half century, but the impact of maternal employment on the health and developmental outcomes of children has been the focus of further research. In one of the first published papers on this topic, in an early analysis of the 1946 British Birth Cohort, Douglas and Blomfield reported that hospital admissions were more frequent and hospital stays longer among the children of employed mothers, but they concluded that the possible reason for more and longer hospitalisations was that children could not be cared for at home because of maternal employment, rather than that these children had worse health.[135] The authors further concluded that there was no evidence showing that children whose mothers worked were disadvantaged in relation to any health-related outcome compared to children whose mothers did not work.

A relatively large number of studies have assessed the impact of maternal employment on a range of outcomes related to various aspects of well-being in children, such as

cognitive outcomes, measures of educational achievement, various behavioural problems, overweight, self-rated health, overall measures of well-being, and child fatalities, although not all of these outcomes have been studied to the same extent. [13-28;136;136-139] The results from these studies are rather mixed and, for example, a recent meta-analysis of 69 studies focusing on the role of maternal employment on children's later educational achievement and behavioural problems has suggested that the small effect size and the non-significant findings for the effects of maternal employment should limit the anxieties of working mothers.[136]

Although the results are not entirely consistent, most studies suggest that maternal employment during the initial stages of a child's life might have a negative effect on the child's development. Two main explanations are offered for such negative effects. First, it is hypothesised that maternal paid employment reduces the time mothers can spend with their children. Spending less time with a child can be negative if childcare arrangements that do not involve mothers are of worse quality than maternal childcare. Second, maternal employment may have negative effects on the quality of maternal care if mothers return from their work tired or exhausted.[17] However, it is also proposed that maternal employment might have positive effects if those mothers who stay at home are psychologically affected by being at home with reduced contact with their friends and work colleagues, thereby reducing the quality of the maternal time spent with their children.[138-140] It has been also hypothesised that maternal paid employment has positive effects on the family's financial resources, enabling the family to buy better childcare and better developmental inputs, such as family trips, books or toys.[141]

The life-course approach to epidemiological studies described in the previous section suggests that exposure to adverse social and environmental circumstances in early life may lead to poorer health-related outcomes in later life.[117] Therefore studies that take a

life-course approach might be particularly helpful for evaluating the effect, whether cumulative or as the result of a sensitive period, of childhood conditions on health in adulthood. Studies focusing on the impact of maternal employment in childhood on health and health behaviours in later periods of life, either in adolescence or in young adulthood, are less common than studies focusing on the role of maternal employment on developmental outcomes during childhood, and these studies will be summarised in the next two sections. While there is, to my knowledge, almost no literature relating maternal employment with health outcomes during young adulthood, the literature focusing on the role of maternal employment on health behaviours is somewhat more extensive. Papers in this area of research often concentrate on risk behaviours in adolescence. The potential advantages and disadvantages of maternal employment in the early part of adolescence (adolescence is defined by the WHO as the period between the ages of 10 and 20) in relation to the development of risk behaviours (smoking, drinking, substance use, engaging in early and unsafe sex and committing crimes) will be discussed in section 2.4.2. In more general terms, without focusing exclusively on maternal employment, it has been hypothesised in previous research that the early influence of the family has a lifelong impact on healthy behaviours (and other outcomes such as healthy relationships or success at school).[142] In addition to maternal employment, a good relationship with one's parents, a high degree of parental control and parental influence, and a stable family structure also reduce adolescents' likelihood of engaging in risk behaviours.[143-149] The results of studies focusing on maternal employment and risk behaviours are not entirely consistent, and will be the focus of the next two sections.

### 2.4.1 The association between paid maternal employment in childhood and health-related outcomes in adolescents and young adults

While the literature relating maternal employment (and related variables characterising the length and quality of care) to health behaviours (such as overweight, dietary habits or smoking) is relatively extensive, and is described in section 2.4.2, there are only a few studies evaluating the impact of maternal employment on well-being or other measures of health in adolescents and young adults.

In the late 1990s a study of Dutch and Slovak adolescents produced mixed results. Sleskova and colleagues[150] analysed the association between parental employment status and health among adolescents, measured by self-rated health, psychological well-being measured by 12-item version of the General Health Questionnaire (GHQ-12), long-term well-being, and the Rosenberg self-esteem scale. The results were heterogeneous for different health outcomes and between genders. While having an unemployed father had a negative effect on the self-rated health and long-term well-being of Slovak adolescents, having an unemployed mother or a mother who was a housewife had no effect (and there was a positive effect of mothers who were housewives on the psychological well-being of Dutch adolescents). Although this paper has some limitations, the most important being the cross-sectional design of the study, it is the only paper I have identified that focuses on maternal employment and the health status of adolescents and distinguishes between mothers who are short- or long-term unemployed and those who classify themselves as housewives. Other papers classify mothers as employed or unemployed without the clear distinction between the two categories suggested in this paper. Previous papers have suggested that parental unemployment has negative effects on the health of adolescents.[26;151] For example,

Sleskova et al.[26] reported that the long-term unemployment of parents has negative effects on the health of 14–22-year-old young adults and adolescents, but that short-term unemployment is not related to their health. Ermisch et al.[152] showed with British data that the unemployment of parents at some point in childhood (until the age of 15) increased the likelihood of psychological distress in young adulthood between the ages of 16 and 30 in the British Household Panel Survey. These authors also showed that the parental experience of unemployment in the later years of the respondents' childhoods had the most harmful effects on their psychological well-being.

## 2.4.2  The association between paid maternal employment in childhood and health behaviours in adolescents and young adults

The evidence for the role of maternal employment in young adults' health behaviours is also limited; however, it is more extensive than the literature related to health outcomes summarised in the previous section.

Overweight and obesity is probably the health behaviour indicator which has been most extensively studied. Studies from countries such as the United States, Canada, the United Kingdom, or Australia have argued that women's gradual reduction in domestically oriented work and their accompanying increase in labour market participation have been a vital factor in the rise of overweight and obesity in children and adolescents in these countries. [19;22;23;150;151;153;154]

For example, in an Australian study, part-time employment was not associated with the increased likelihood of a child being overweight, while full-time employment was associated with a significant increase in the overweight of children.[155] These results are

similar to those from the National Longitudinal Survey of Youth in the United States on adolescents and young adults aged 14–22, which reported that the increasing number of hours worked by mothers was strongly associated with children's increasing likelihood of being overweight. The association between maternal work (in terms of hours worked) and overweight was the strongest among those from higher socio-economic groups.[23] In the Canadian National Longitudinal Survey of Children and Youth an increase in maternal working hours by 10 hours a week was associated with a 2.4–4.0% increase in children's later overweight or obesity.[156] Several explanations are offered for these associations such as that mothers who work cannot monitor or control what their children eat and what are their physical activity levels. Anderson et al suggested several explanations for stronger observed gradient in higher socio-economic group such as difficulties to find caregivers with skills as good as those of mothers in this group, or difficulties to provide high quality food and active play by lower socioeconomic status mothers regardless of whether they work.[23]

The potential advantages and disadvantages of maternal employment in the early part of adolescence for the development of risk behaviours (smoking, drinking, and substance use, engaging in early and unsafe sex and committing crimes) are discussed in several papers. It is hypothesised that the early influence of the family has a lifelong impact on healthy behaviours (and other outcomes such as healthy relationships or success at school).[142;157-159] In addition to maternal employment, a good relationship with one's parents, a high degree of parental control and parental influence, and a stable family structure also reduce young adults' likelihood of engaging in risk behaviours.[143-149;160] The interplay of these other variables with maternal employment has been evaluated in several papers, and they will be summarised in section 2.5.

Three papers have focused on a range of health behaviours other than overweight or obesity, and have included smoking, alcohol and substance use. The results of these studies are not consistent, and are partially different from the results shown for overweight and obesity. Aughinbaugh and Gittleman[161] examined the impact of maternal employment during the first three years of life and during adolescence on children's later risk behaviours using data from the US National Longitudinal Survey of Youth. They focused on a set of six non-healthy behaviours: cigarette smoking, alcohol consumption, marijuana use, the use of other drugs, engaging in sex, and committing crimes. They found little evidence of a negative effect of maternal employment (employed mothers compared to mothers who were not employed) in the first three years on non-healthy risk behaviours in adolescence and young adulthood. They suggested several reasons for the lack of any association between maternal employment and these behaviours. They hypothesised that the first three years of life are not long enough to have a lasting influence on behaviours in the distant future, such as in adolescence or young adulthood. Additionally, using results from Sandberg and Hofferth [162] and reasoning presented by Bianchi,[163] they argued that the assumption that those who are employed have less time to spend with their children might not be empirically confirmed, and thus that such hypotheses might not be correct. The authors also proposed other explanations, such as that working mothers might be positive role models, or that granting adolescents more independence might be positive at that age, although these could not be tested in their data. Hillman and Sawilowski,[164] in a cross-sectional study preceding that by Aughinbaugh and Gittleman,[161] found that maternal employment status was not associated with alcohol, tobacco or drug use in adolescence. These findings should be treated with caution, however, because of the very small sample size, the cross-sectional character of the study, and the grouping together of participants with part-time and full-time employed mothers.

The impact of maternal employment on health or health behaviours cannot be assessed in isolation. The role of other covariates, such as maternal marital status and socio-economic factors, might also be important for the association between maternal employment and the health and behaviours of young adults, and the existing evidence, although limited, will be summarised in the next few sections.

## 2.5 Factors influencing the association between maternal employment and health-related outcomes and behaviours

The association between paid maternal employment during childhood and health and health behaviours in adolescence and young adulthood might be influenced by many different covariates, such as those associated with the socio-economic position of the family, family structure, type of childcare, maternal job satisfaction, maternal physical and mental health, and the mother's own health behaviours. The variables whose role is evaluated in the next few sections of this chapter are not only those that are important from a theoretical point of view, but are also those available in the data set used for this project and described later in the Methods section. Further covariates which may influence the association between maternal employment and children's later health and health behaviours, such as paternal job characteristics, paternal health and health behaviours, will not be used in my analysis (the reasons for this are discussed in section 8.2.5), and, therefore, the existing evidence related to them will not be summarised in this chapter. The potential role of such variables will be briefly summarised in the Discussion of this thesis (chapter 8).

## 2.5.1  The role of socio-economic position and maternal education

While the focus of this study is not primarily on the effect of familial or maternal socio-economic position (SEP) on children's health and health behaviours, the role of socio-economic position is important because it might have an impact on the association between maternal employment and children's health and health behaviours.

The health of individuals is strongly influenced by socio-economic circumstances at birth and during early childhood.[165-168] During childhood, the association between low socio-economic position and a range of negative health outcomes, such as a higher incidence of chronic and acute diseases, vision and hearing problems, or injuries, has been reported repeatedly.[169-172] These studies show that as socio-economic position decreases, all-cause mortality, overall morbidity rates and the prevalence and incidence of various health-related outcomes increase. A low socio-economic position may play a role in lower use of healthcare and in less health and safety knowledge, and can be related to a lower likelihood of avoiding unhealthy behaviours.[173-175] Children might end up living in less safe environments, they might have less access or less frequent access to healthcare, and they tend to have less information about healthy diets and other healthy lifestyle factors.[176-179]

While the existing evidence illustrating the importance of socioeconomic position for children's and adolescents' health is extensive and consistent, the role of socioeconomic position in the association between maternal employment and children's health needs further investigation. As with marital status and family structure, described in the next section, the socio-economic position of the family or maternal education have been used as potential confounding factors in the analysis of the impact of maternal employment on the health and health behaviours of children in adolescence,[150;161] but the exclusive impact of these variables has not been assessed. Virtually all studies mutually adjust for

number of covariates and do not report independent effects of each covariate on the association of interest. Variables characterising socio-economic position have been used alongside other covariates, and their role can be assessed only in conjunction with other covariates used for the adjustment of the effect of maternal employment.

A little more might be said about the role of SEP characteristics in relation to literature on the impact of maternal employment on children at younger ages and outcomes related to child development. The socio-economic position of the family could affect child development directly, or it could influence proximal variables like parenting beliefs and behaviours, and thus could affect child development and health indirectly.[180] Existing research mostly focuses on general, average effects, without considering whether the findings related to the role of maternal employment differ for different socio-economic positions, assuming that socio-economic position could play the role of effect-modifier. Only a few studies have attempted to address this issue. Anderson and colleagues[23] showed that the risk of overweight in young adults was positively associated with more time spent by their mothers at paid employment, although this effect was stronger and greater for those from households from higher socio-economic groups. These results from the National Longitudinal Survey of Youth in the United States on adolescents and young adults aged 14–22 reported that an increase in the number of hours worked by mothers was strongly associated with a greater likelihood that children would be overweight, and the association was the strongest among those from higher socio-economic groups.[23]

Similarly, in the UK Millennium Cohort Study, an increased number of working hours of mothers was related to a higher likelihood of children's overweight;[181] however, this association was only statistically significant for children from high-income households. Using data from the Child Development Supplement of the Panel Study of Income

Dynamics in the United States, Fertig and colleagues[182] assessed mechanisms that might influence the association between maternal employment and body mass index (BMI) in children, and suggested some limited differences in such mechanisms related to the mother's education. They proposed that while the average number of meals per day and the time spent reading, talking, listening to music and watching TV were factors in the connection between maternal employment and BMI that were common to all socio-economic groups, time spent at school was important for the children of less educated mothers, and time spent in childcare was important for the children of more educated mothers.

Several other recent studies[15;19;183;184] have provided evidence that children from higher socio-economic groups are particularly disadvantaged by maternal employment, although these studies focus only on a limited number of outcomes, including cognitive development, body weight and teenage childbearing, and the effect-modifying role of SEP was not evaluated for outcomes such as smoking or alcohol consumption. The results suggest that socio-economic position or maternal education may play the role of effect-modifiers in the association between maternal employment and the health and health behaviours of children and young adults, but the evidence so far is limited and no firm conclusions can be made.

## 2.5.2  The role of marital status

Maternal marital status or family structure in childhood might influence the association between maternal employment and children's health and health behaviours. The role of family structure, and particularly of parental separation or divorce, on further cognitive, psychological or health development, as well as on the well-being of children, has been studied in the past.[185-188] Family structure and parental separation are also related to

maternal employment. For example, in the United Kingdom, the employment rate of mothers living with partners was approximately 20% higher than for those living without partners in 2007 (OECD Family Database: www.oecd.org/social/family/database, accessed October 2011). These associations suggest that it is important to assess the role of maternal marital status and family structure in the association between maternal employment and the health and health behaviours of children.

Several studies have focused on explaining how parental cohabitation can affect the well-being of children, and how living in a single-parent family may have a negative impact on children's well-being, development and health status.[185-190] Other papers have shown that children face an increased risk of academic and behavioural deficits when raised in a single-parent family, or by cohabiting but unmarried parents.[191-194] Furthermore, several studies have shown that having parents whose marital status is other than married is related to significantly more emotional and behavioural problems among adolescents.[159;195-200] Heck and colleagues[201] looked at the association between family structure and children's healthcare, and they suggested that family structure and maternal education interact in their impact on the healthcare of children. When the mothers had a higher education, the family structure did not affect the number of visits to a doctor. Among those with low education, however, single mothers' children visited their general practitioners significantly more often than children from two-parent families. In their analysis of more than 10,000 adolescents in the National Longitudinal Study of Adolescent Health in the United States, Blum et al.[202] showed, among other results, that the likelihood of smoking was significantly higher among children and adolescents living in single-parent households compared to those in two-parents households. Otten et al.[203] in the Dutch study found that single-parent status alone (regardless of the smoking status of parents) increased the chances of adolescents' smoking. Moreover, single-parent smoking was a strong predictor of adolescent

smoking, suggesting an interaction between parents' smoking and marital status. Tyas et al.[204] concluded in their literature review that an intact two-parent family had a positive effect against smoking in adolescence.

While most of the studies described above focus on the effect of marital status, divorce or separation on a range of health and developmental outcomes in children, and Heck's study assessed the interaction between family structure and maternal education, very little has been written about the role of marital status or family structure in the association between maternal employment and the health or developmental outcomes of children. The majority of the studies focusing on the role of maternal employment that considered marital status or family structure in their analyses used these variables as potential confounding factors, and adjusted the effect of maternal employment for them. [150;161] Even when marital status was used as a covariate in these analyses, the justification for its use as a confounding variable was clearly described, and the specific roles of maternal marital status or family structure were not studied or reported in detail.

The previously mentioned meta-analysis of 69 studies focusing on early maternal employment and its association with school achievement and behavioural problems found differences in the association between maternal employment and study outcomes among families with single parents versus two-parent families (Lucas-Thompson et al., 2010).[136] The findings of this analysis suggested that mothers' employment was associated with reduced behavioural problems in single-parent samples, while it increased the likelihood of externalising behaviours, such as acting out during class, in samples with two-parent families. The focus of this meta-analysis, however, was on maternal employment in the first years of life and early childhood outcomes, and the samples included in the meta-analysis came primarily from the United States.

Probably the most relevant paper to assess the role of both family structure and parental employment during childhood uses data from the first nine waves of the British Household Panel Survey.[152] In this analysis, the role of living in a complete family at some point in childhood, and with parents who experienced unemployment at some point in childhood, was investigated in a sample of almost 1,800 young adults with a mean age of approximately 22. The results showed that those young adults who had experienced childhood in single-parent households or with jobless parents were more likely to smoke or report psychological distress, and that experience of a single-parent family has a bigger negative impact than experiences of parental joblessness. Additionally, when evaluating the most critical childhood periods, the authors concluded that experiencing a single-parent family in the early period childhood (age 0–5) and parental joblessness in a later period of childhood (age 11–15) increased the risk of smoking and psychological distress in young adulthood the most. However, the authors did not evaluate the interrelation between these two exposures in the form of a formal interaction, and they suggested that this would be an important further step for future research.

Kestila et al.[147] looked at the influence of parental smoking status, parental education and family structure on children's smoking habits during young adulthood at ages 18–29 in a Finnish population-based study. They found that living conditions in childhood strongly determine daily smoking. The influence is often mediated through current living conditions, which in turn are also influenced by childhood conditions. It was suggested that smoking behaviour is influenced by determinants that developed throughout the whole life-course. For example, the authors reported that experiences of regular parental unemployment and parental divorce increased the odds of smoking by 50% and 76% respectively. In this paper the authors did not test for interactions between parental employment and marital status. It is also difficult to estimate how

much of the association between parental employment and smoking in adulthood is explained by parental divorce, because eight variables labelled childhood adversities were added to the model at the same step of the analysis.

There is a lack of literature focusing on the interplay between parental marital status or family structure in childhood and parental employment status or the experience of unemployment in relation to young adults' outcomes. While some papers have identified that maternal or parental (un)employment might influence later outcomes, and other papers have identified that living in a single-parent family or a family with unmarried parents might increase the risk of certain outcomes in young adulthood, there is no evidence that combines these childhood events in terms of formal statistical interactions. Additionally, parental employment status and family structure may share some common risk factors with young adults' outcomes, such as risky parental health behaviours or parental medical conditions, and it is therefore important to focus on such variables as well. The existing evidence related to such variables is summarised in next section.

### 2.5.3 The role of maternal psychological well-being and health behaviour

Maternal mental health, psychological well-being and health behaviours might influence similar characteristics in children. The health and behavioural characteristics of mothers and their influence on the health and health behaviours of their children are not the main topic of this thesis, and are considered as potentially important confounding variables.

The mental health of parents and parental psychological well-being has been repeatedly shown to be an important predictor of children's psychological well-being and mental

health. Parental mental problems are well-documented risk factors for many types of child outcome.[205;206] For example, despite the methodological problems they identified in previous studies, Downey and Coyne concluded two decades ago in their review of existing evidence that high rates of various psychological problems were repeatedly reported by the children of depressed mothers or depressed parents, and that maternal depression was associated with various problems related to parenthood.[206]

Paulson and colleagues looked at the mechanisms that may connect parental depressive symptoms to the development of similar outcomes in children.[207] They hypothesised that parental depression affects family functionality. Low functionality could then be the major mechanism through which any low psychological well-being of parents will increase the risk of their children developing such outcomes.[207;208]

There are suggestions in the literature that parents or mothers who are economically disadvantaged, e.g. unemployed or on a low income, are more vulnerable and could transfer this vulnerability to their families. These studies suggest a potential interaction between social and economic measurements and parental psychological health in the developmental of psychological outcomes in children. For example, McLoyd and Wilson have pointed out that single mothers who are economically disadvantaged report anxiety, depression and psychological health problems more often than couple mothers, and that this might have a greater effect on psychological outcomes of their children.[209] On the other hand, there are many studies, focusing mainly on bipolar disorders in parents, that point out the higher risk that children will develop similar symptoms, regardless of sociodemographic circumstancies.[210-214] The associations described in the literature are mostly short-term effects focusing on outcomes in children. Little is known about the long-term role of maternal psychological well-being on child health and behaviour at later ages. The studies usually take into account a short period of

childhood, such as that between birth and admission to primary school, and their primary concern is the influence of maternal mental health on the child's mental health immediately or during a few years of follow-up. Most of the studies evaluate the relationship between maternal depressive symptoms and child psychological outcomes, and most use the CES-D scale.[211-214] Very little is known about how maternal employment can influence these associations.

Similarly to the intergenerational transmission of mental-health disorders and psychological problems, the association between mothers' and children's unhealthy behaviours has been described repeatedly. Several studies have shown that children of mothers with any type of substance dependence, such as alcoholism, nicotine use or other psychotropic substance use, have an increased risk of the same or a similar type of dependency,[203;215-217] although the Early Developmental Stages of Psychopathology project concluded that only the children of heavily smoking and nicotine dependent mothers had a higher risk of the same type of dependency than children of mothers who did not smoke regularly or at all, while those whose mothers smoked regularly but not heavily did not differ from the children of non-smoking or irregularly smoking mothers.[216] Ermisch et al.[152] in their analysis of BHPS data showed that having smoking parents increased the risk of smoking behaviours in young adults aged 16–29.

While some studies do not take socio-economic or demographic variables into account when assessing the associations between substance use by parents and later substance use by their children, others have evaluated the role of such variables although they did not find any effect modifying role of education, social class or completeness of family in the association between parental alcoholism and children's alcohol abuse and alcohol dependence,[217] parental and children's substance use disorders,[218] or parental substance use and children's tobacco use.[215]

While the role of parents in the development of unhealthy behaviours has been documented in a number of studies, other studies have shown that siblings and friends might also play an important role.[219-221] Although the relative importance of parental smoking might not be entirely understood, it seems that there is a consensus in the literature that parental smoking is an important risk factor influencing the smoking habits of children. This is therefore an important covariate to be taken into account in the analysis of data for this project.

To summarise the findings in this section, it has been shown that children whose mothers suffer from mental illness or report worse psychological well-being have an increased risk of developing similar symptoms later. As with psychological well-being, parental substance misuse, including smoking and heavy alcohol consumption, is associated with higher rates of similar behaviour in children. Thus it seems appropriate to use available data on maternal health and psychological well-being, as well as data on maternal smoking (representing substance misuse in this project), as potential confounding factors in the association between maternal employment and the health and health behaviours of children.

### 2.5.4  The role of type of childcare arrangement

Another potentially important influence that may have an impact on developmental and health outcomes in later life is the type of childcare arrangement. Childcare arrangements are related to parental employment and family structure, and the potential interaction between these factors may be important for evaluating the role of these variables in the development of the health and behavioural outcomes of adolescents and young adults. The aim of this section is to summarise the literature related to the association between maternal or parental childcare arrangements and the health, well-

being and health behaviours of children (primarily within the age range of interest to this project), and to the role that childcare arrangements play in the association between maternal employment and health-related outcomes.

Given the importance of the topic, research studies in both Europe and North America have tried to evaluate the role of childcare arrangements in different aspects of children's lives. Most of the studies mentioned below in this section have shown that it matters what form of care children receive, how much care they receive during infancy and early childhood, and whether the care they receive meets certain quality standards. For example, studies from the United States have shown that the quality of childcare, the quality of the home environment and the quality of parenting can explain negative associations between the mother's employment begun during the first year of a child's life and the child's cognitive development.[222-224] Higher-quality childcare was related in these studies to better cognitive, language, socio-emotional and peer-relationship outcomes. More hours in formal childcare predicted more behavioural problems and conflict, according to care providers. Similar results were shown in two other studies. More time spent in formal care was related to higher cognitive and language scores and more problems and antisocial behaviour in the United States[225] and the UK.[226] The UK study used data from the Effective Provision of Pre-School Education (EPPE) project, and showed that quality of care played an important role. Children who experienced higher-quality formal care showed less antisocial behaviour than those who experienced a lower quality of preschool care. Care by relatives such as grandparents in the US, according to the National Institute of Child Health and Human Development (NICHD) study,[225] was not associated with changes in cognitive development or social skills, while in the EPPE study, care by relatives was associated with improved social development, suggesting the potentially different roles of relatives in the social

development of children or the different type of families using grandparents and relatives for childcare in US and UK societies.

While most studies focusing on non-maternal care have mainly concentrated on the effects of group day care, the last two examples also highlight the importance of "non-maternal" individual care, which is frequently informal and provided by family members and friends. Recent demographic changes particularly highlight the growing importance of grandparents in contemporary childcare and family life in general. As life expectancy increases and fertility decreases, with women deciding to have less children and starting their families later, the profile of families is changing, resulting in a large number of so-called beanpole families – long thin groups of several small generations.[227]

The decreasing number of aunts, uncles, siblings and cousins increases an importance of grandparents in informal childcare.[228-230] The US study conducted by the National Institute of Child Health and Human Development found that non-parental care did not have any worsening effect on child outcomes, with the exception of situations where poor-quality care was combined with poor parenting.[231] Another study from Australia backed up these findings, suggesting that the quality of parental care is not weakened by the use of non-parental care.[232] It is therefore important to focus not only on the role of formal childcare in the association between maternal employment and children's and adolescents' outcomes, but to include the role of informal childcare provided by grandparents, other relatives or friends as well.

Several studies have also focused on the role of siblings in childcare. Several authors have mentioned in their studies the differences in sibling caregiving roles across cultures.[233-237] In many non-Western cultures, and in many ethnic minority groups in the countries of Western Europe and North America, siblings' caregiving is a significant

part of family life that enables parents to provide for the family economically.[234;238-240]

On the other hand, in Western societies, siblings' caregiving is more limited,[234] and if it occurs its role is usually to provide parents with leisure time.[238] It has been shown repeatedly that siblings' caregiving might not always be associated with healthy development and might have a negative impact. For example, some siblings may actively engage in deviant activities together, and encourage and support each other's involvement in such behaviours, being described as "partners in crime" and "co-conspirators".[241] Such forms of sibling support have been theorised as responsible for sibling similarity in deviance,[241] and as related to higher rates of adolescent drug use and sexual risk behaviour.[242;243] In addition, it has also been suggested that "babysitting" by older siblings plays a negative role for the older siblings, as they need to fulfil the role of childminder after coming home from school, instead of having time for schoolwork and relaxation.[244-247]

One specific type of childcare arrangement that should be mentioned at the end of this section is related to so-called latchkey children, which refers to a form of self-caring that was relatively common in the 1970s and 1980s. Such children were left routinely uncared for by fully working parents, without any supervision, either at home or on the street.[247] Some reports have suggested that such self-care arrangements ("self-care arrangement" means when middle-grade students spend more than three hours per day at home alone) might lead to behavioural problems, higher rates of depression and lower levels of self-esteem,[248;249] although the evidence related to the health consequences of self-caring and its effects on later development is limited. Some authors suggest that there might be an increased risk of physical or sexual abuse as well as problems in child-parental relationships or general education associated with such caring practices.[245-247]

In summary, most studies suggest that the quality of childcare is the most important component of childcare provision, although the quantity and type of childcare might play some, possibly more limited, role as well. Most literature focuses on childcare arrangements for preschool children, and substantially less has been written about childcare after starting school. While children spend a substantial part of the day at school, there is still a need for childcare before and after school time. In addition to the limited number of results focusing on older children, there is also a lack of surveys that treat childcare arrangements as a potential moderator of the association between maternal employment and children's health status. The British Household Panel Survey (BHPS) that will be used in this project does enable the assessment, albeit in a limited way, of the effects of childcare arrangements on the health-related outcomes and health behaviours of adolescents and young adults. While some specific features of childcare, such as self-care or grandparents' care, cannot be assessed through the BHPS, it will be possible to evaluate the effects of formal and informal non-maternal care arrangements at preschool and primary-school ages and its role in the association between maternal employment and study outcomes.

### 2.5.5  The role of maternal job satisfaction

While the type and quality of childcare arrangements may affect the association between maternal employment and the health, development and behaviours of children, certain characteristics of the work itself, such as job satisfaction, might play as important a role as arrangements outside work. Job satisfaction may be one such characteristic. Job satisfaction has been defined as "a pleasurable emotional state resulting from the appraisal of one's job"[250] or "an attitude towards one's job".[251] These definitions suggest that people form attitudes towards their jobs by taking into account

their own feelings, beliefs and behaviours as well as rewards of the job such as pay, autonomy, status and esteem, effort or work control.

Maternal job satisfaction has been proposed as an important characteristic which might play a role in good work-family balance.[252] It has been proposed that it might be important for the mother's work-family balance, and for the well-being of her children and other family members, whether she likes her job, and whether her employer offers her working conditions that allow her to be a good parent as well as a good employee. Research into work-family balance has increased dramatically over the past two decades. Work-family conflict has been associated with various negative health and behavioural outcomes.[253-259] Maternal job satisfaction might influence the relationship between the mother's employment status and the health and health behaviours of her child, as well as the overall situation in the family, the character of the family cohesion, and parental time spent with children. However, there are only a very small number of studies focusing on the role of mothers' job satisfaction in the association between their employment and the outcomes for their children. A Canadian survey looked at maternal job strain and how it influences children, and concluded that holding the role of mother and employee simultaneously can indirectly affect the behaviour of one's child's through one's feelings of personal strain and parenting behaviour.[260] Another Canadian survey looked at preschool age children, and found that mothers' job satisfaction had a positive effect on daughters' self-control and a negative one on behavioural problems; the mother's role conflict had a negative effect on sons' and daughters' self-control, and a positive one on sons' behavioural problems and daughters' immaturity. They concluded that the quality of the maternal employment experience influences nursery schoolchildren's behaviour.[261]

## 2.6 Summary of the literature review and gaps in previous research – what this thesis will add to current knowledge

To summarise the literature review, there have been a number of studies on the effects of maternal employment on various children's outcomes, such as different health behaviours, health and health-related outcomes, and measures of cognitive development. Most of the studies found a negative effect of maternal employment on these outcomes, but the results were not entirely consistent. Some more recent studies show smaller effects than earlier studies, and it has been speculated that improvements in childcare, and support for working parents and working mothers in particular, have improved children's prospects in terms of their health and development. The effect of maternal employment has been assessed in different periods of childhood, and the results suggest that maternal employment in the early years of children's lives has the most negative effect.

While the effect of maternal employment has not been formally assessed in the context of life-course epidemiology,[29] the results of these studies at least partly support the sensitive period life-course model, suggesting that an exposure during a specific sensitive period of development has long-lasting effects on health outcomes later in life. The accumulation of the effects of maternal employment throughout different periods of childhood, corresponding to the cumulative life-course model, has not been evaluated in studies of the association between maternal employment and children's health and health behaviours. What is missing in the literature is a life-course approach to understanding the role of maternal employment in children's and young adults' health and health behaviours, because most published studies do not follow children across different periods of childhood. As suggested by some studies, the preschool period up to the age of four might be a sensitive period with lifelong effects on health and health

behaviours. Additionally, the role of potential covariates, such as maternal education, family socio-economic position, family structure and maternal marital status, maternal mental health and maternal health behaviours, on the association between maternal employment and the health and health behaviours of children was discussed in some previous studies, and it has been shown that the evidence on the role of these additional variables is limited.

Several gaps in the literature have thus been identified, and these were considered when formulating the aims, objectives and hypotheses for this PhD project. In particular, (1) there are only a few British studies, (2) only a few studies use longitudinal data, (3) virtually no studies use several periods of childhood (which would enable at least a limited attempt to use a life-course epidemiological approach), and (4) there are limited analyses of the health of young adults. Most of the existing evidence comes from studies that use US data. Although UK-based analyses are more common than analyses of data from other European or non-American countries, more evidence is needed. The existing studies mostly focus on the role of maternal employment during the preschool years, and particularly during the first two years of life. While the existing literature suggest that it is an important period of childhood in terms of the mothers' caring for their children, it is difficult to empirically assess whether it is the most important period because there is very limited evidence evaluating the relative importance of later parts of childhood. Because these later years are evaluated only rarely, it is not possible to focus on life-course methodology and the evaluation of the potential accumulation of the effects of maternal employment on the health and health behaviours of children. Studies using data from later periods of childhood do not use data from additional periods, and usually focus on only one childhood period. Finally, when evaluating the role of other covariates, previous studies have usually focused on the role of these covariates as potential confounding factors, but do not consider the possibility of a

modification of the effect of maternal employment by these variables. Previously published studies reported interesting findings relating to the role of these variables, such as that the quality and form of childcare arrangements might influence children's future health behaviours and development, but there is a need for more a detailed investigation of the role of childcare arrangements and their influence on the association between maternal employment and the studied outcomes.

This project will therefore attempt to fill some of these gaps by looking at the impact of maternal employment during three periods of childhood – during preschool, primary school and secondary school – on health-related outcomes among young adults, namely self-rated health, psychological distress and smoking behaviour, and by exploring the roles played by the covariates listed above in the literature review, namely maternal education, household income, maternal marital status, child care arrangements, maternal job satisfaction, maternal mental health and maternal smoking behaviour, in this association in British longitudinal data using British Household Panel Survey (BHPS). There will be a particular focus on evaluating the role of the potentially sensitive period of 0–4 years of age, and the potentially detrimental effects of maternal employment at this age on health-related outcomes among young adults aged 16–21, as well as the role of the two periods covering primary-school age (5–11) and secondary-school age (12–16), and testing the potential accumulation of the effects during these three periods of childhood as well as identifying potential trajectories of maternal employment particularly affecting health-related outcomes in young adulthood.

# 3 Study aims, objectives and hypotheses

## 3.1 Study aims

The aim of this project is to assess the relationship between maternal employment at three periods of childhood (during preschool, primary school and secondary-school years) and the self-rated health, psychological well-being and smoking behaviour of young adults aged 16–21 in Britain, and to identify factors that may affect this relationship. These three outcomes have been selected because they have an impact on health in later stages of life.

## 3.2 Study objectives and hypotheses

In order to achieve the main aim of the project, more detailed study objectives and related hypotheses have been defined as follows:

O1.  To investigate the effect of maternal employment during childhood (at preschool, primary-school and secondary-school ages) on the self-rated health, psychological well-being and smoking behaviour of young adults.

H1.  *Young adults aged 16–21 whose mothers worked during their childhood have worse health and are more likely to smoke than those with non-working mothers. The crude (unadjusted) association might show an inverse relationship, but any such inverse relationship will be later explained in adjusted analysis by socio-economic and demographic variables such as education, household income and marital status.*

O2.  To assess whether there is a cumulative effect of maternal employment across childhood on markers of health and health behaviour in young adults.

*H2.  The larger the number of periods of childhood (from none to three) when the mother worked, the greater will be the negative effect on markers of health and health behaviour.*

O3.  To assess whether there are any differences in the effects of maternal employment during different periods of childhood on the self-rated health, psychological well-being and smoking behaviour of young adults.

*H3.  The younger the child at the time the mother worked, the greater will be the negative effect of maternal employment in childhood.*

O4.  To examine the role played by

   a.  maternal education,

   b.  household socio-economic position, represented by household income,

   c.  marital status,

   d.  maternal health-related characteristics, represented by maternal self-rated health, maternal psychological well-being and maternal smoking,

   e.  childcare arrangements, and

   f.  maternal job satisfaction,

in the association between maternal employment and the self-rated health, psychological well-being and smoking behaviour of young adults.

*H4. The negative effect of maternal employment is reduced if the mother is better educated.*

*H5. The negative effect of maternal employment is reduced in households with a higher income.*

*H6. The negative effect of maternal employment is greater in young adults whose mothers were not married during some period(s) of their childhood.*

*H7. The negative effect of maternal employment is greater if different childcare arrangements (such as formal or informal childcare, or the involvement of various individuals) are combined.*

*H8. The negative role of maternal employment is reduced if the mother is satisfied in her work.*

*H9. Maternal health, maternal psychological distress and maternal smoking play a confounding role in the association between maternal employment and the study outcomes.*

## 3.3  Conceptual model

The following conceptual model shows the hypothesised relationships between maternal employment in childhood and the health of young adults aged 16–21 (hereafter referred to as "young adults"; the period in question will be referred to as "young adulthood" in the rest of this thesis) with potential contextual factors. The proposed conceptual model (simplified so as not to include the three age periods of childhood) is shown in Figure 3.1. The empirical model, including the preschool period at ages 0–4 (hereafter simply referred to as the "preschool period"), the period at primary-school age 5-11 ("primary-school period") and the secondary-school period of childhood at ages 12–16 ("secondary-school period"), is presented in Figure 3.2.

The model includes maternal employment status as the key exposure. Maternal education, household socio-economic position and maternal marital status may affect the role of maternal employment in that they may act as potential effect-modifiers or confounders. While the main interest related to these three covariates is to test whether

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they act as effect-modifiers in line with the hypotheses listed above, thus enabling the project to fill one of the gaps highlighted in last section of the previous chapter, the literature summarised in section 2.5 used these variables as factors affecting the self-rated health, psychological well-being and smoking behaviour of young adults independent of maternal employment, as well as confounders reducing the effect of maternal employment on selected health-related outcomes in adjusted analyses. Thus the role of these variables should be evaluated in both conceptual ways.

The exposures (main exposure and covariates) will be available in the three stages of the children's lives approximately equivalent to the preschool, primary-school and secondary-school periods of childhood, and their role in these different stages will be tested. Additionally, the role of maternal employment will be tested according to the sensitive period and accumulation models[29] to identify the stages of children's lives in which maternal employment has the strongest impact on the self-rated health, psychological well-being and smoking behaviour of young adults. The role of other potential influences, such as childcare arrangements, maternal job satisfaction, maternal health and maternal smoking habits, may be important in terms of their impact on the association between the main exposure and the self-rated health, psychological well-being and smoking behaviour of young adults, and will also be tested (as shown in Figures 3.1 and 3.2). The role of these additional characteristics is clearer than that of maternal education, maternal marital status or household income, and they will be used either as effect-modifiers (childcare arrangements, maternal job satisfaction) or as confounding factors (maternal health and well-being, maternal smoking). The role of some other variables not tested in this project, such as that of father-related characteristics, will be discussed in section 8.2 of Chapter 8. As they are not assessed in this project, they are not included in the models shown in Figures 3.1 and 3.2.

**Figure 3.1. The conceptual model illustrating associations between maternal employment, study outcomes and other covariates**
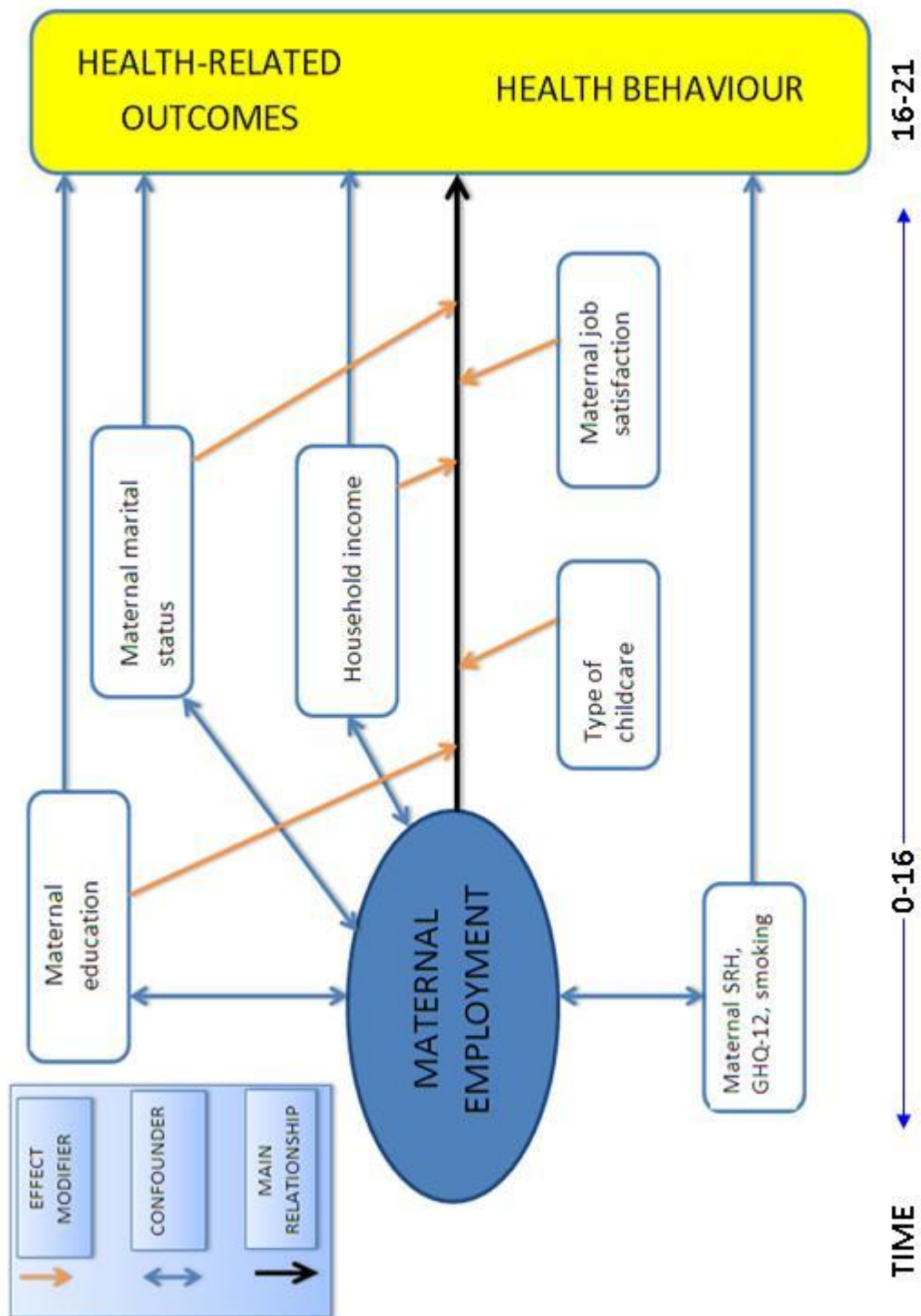
**Figure 3.2. Empirical model showing the associations between maternal employment, study outcomes and other covariates in four age periods of interest**
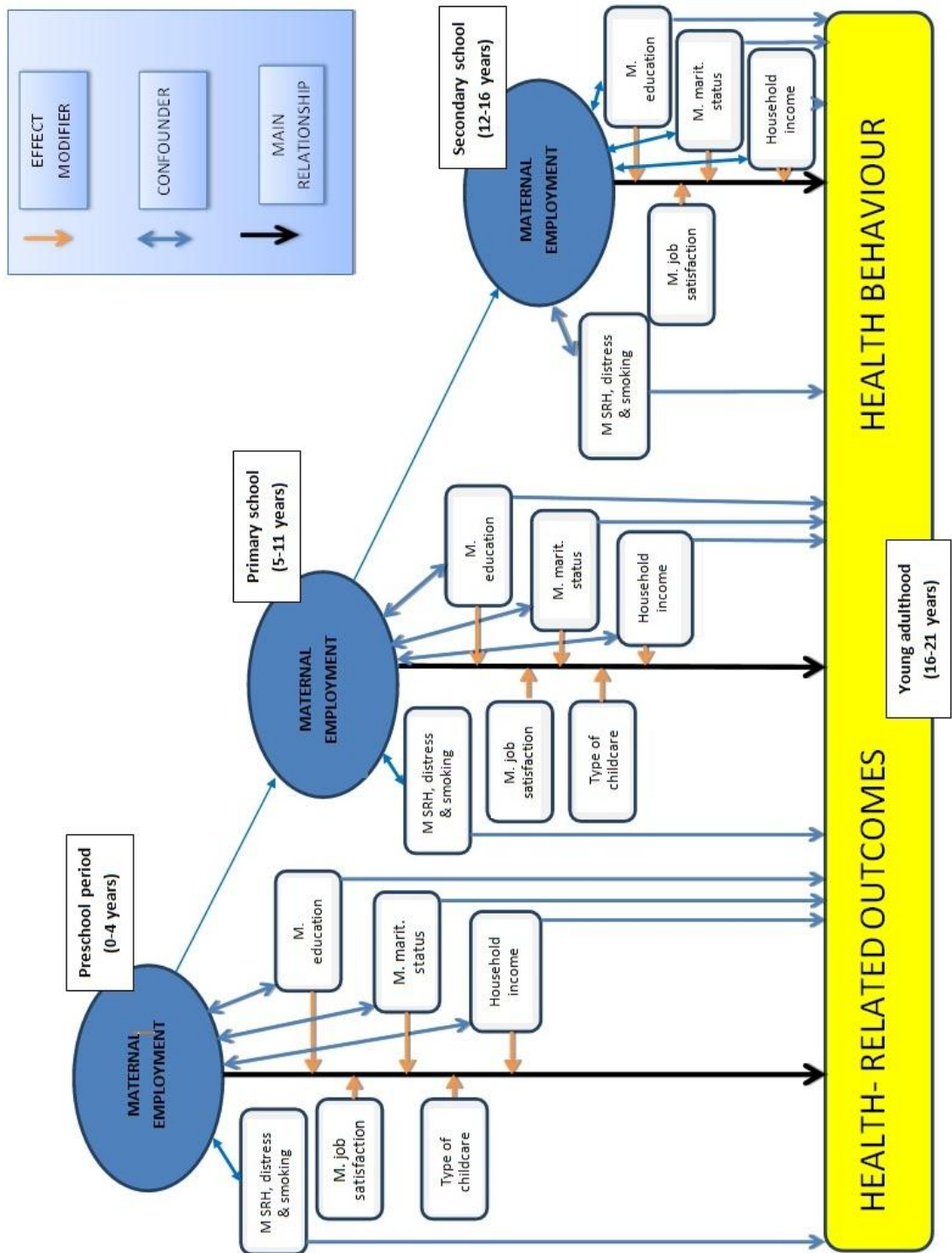
# 4  Methods

The aim of this chapter is to describe the methodology used in this project. First the data set used in this project, the British Household Panel Survey (BHPS), will be described. Its design and data collection will be described only briefly, as this project uses existing data for secondary analysis. Second, a construction of the data set extracted and linked together from different waves of the BHPS will be explained. In the third section, the variables used in the analysis, and the definitions and the construction of derived variables will be described, together with a justification of their choice. The fourth, most extensive part of this chapter will describe the analytical steps used in this project. Because this project uses already existing data, and the hypotheses of this project are not identical to the original aims of the BHPS, power calculations were performed to assess what power the project has to investigate its hypotheses. The power calculations will be summarised in part 5 of this chapter (section 4.5). Finally, ethical issues such as ethical approval and informed consent are covered in part 6 (section 4.6).

## 4.1  The British Household Panel Survey

For this project, data from the British Household Panel Survey (BHPS) will be used to achieve the aims and objectives set out in Chapter 3. This data set was chosen because it is well placed to examine the effect of maternal employment status and the other maternal and family exposures outlined in previous chapters on the health and well-being of young adults. A major advantage is that the data were collected repeatedly each year, and thus this data set offers more detailed information about maternal and family social circumstances during childhood than most other studies.

The BHPS is an annual nationally representative panel study including a sample of approximately 5,500 households. The study started in 1991 and contained approximately 10,000 interviewed individuals. The sample was selected using a stratified clustered design, and was chosen from the Postcode Address File. All residents at selected addresses in the first wave of the survey in 1991 became designated panel members.

A sample of 8,217 addresses was drawn using a two-stage clustered design and systematic sampling. 250 postcode sectors were randomly selected as the primary sampling units (PSUs) from all sectors included in the "Postcode Address File for Great Britain south of the Caledonian Canal". Between 21 and 36 addresses were then sampled from each selected PSU, with a total of 8,167 addresses selected for Wave 1 of the BHPS. Non-residential and institutional addresses were excluded from the sample. For addresses with more than three households, a maximum of three households were randomly selected for inclusion in the sample. Students returning to the parental home during vacations were excluded, while students selected at their term-time address were included if it was a non-institutional address (thus halls of residence were excluded). All resident household members were defined as eligible if they were aged 16 or over on 1 December 1991. For those who were eligible but could not be interviewed because of absence or illness, proxy interviews were attempted.[262]

Of the 8,167 addresses selected, 1,033 were not eligible (not occupied, non-residential or occupied by foreign citizens). There were also 357 multi-household addresses. Thus overall there were 7,491 households eligible for Wave 1 of the study. Of these, 5,143 households (69%) fully completed the interviews (including 281 proxy interviews). Another 395 households partially completed Wave 1 of the study, giving an overall

response rate of 74%. Of the 10,751 eligible individuals in these households, 10,264 interviews were completed (95%).

The same individuals were re-visited each successive year. If they split off from their original households to form new households, they were followed, and all adults in these new households were also interviewed. New members joining the sample households became also eligible for interview, and children were interviewed when they reached the age of 16. From 1994 onwards, children aged 11–15 also completed a short interview, including questions about their opinions, feelings or family integrity.[262] Additionally, the interviewers tried to interview all those individuals in responding households who had refused to participate or were unable to take part in Wave 1. Children born to original study members after the start of the BHPS were automatically included as eligible individuals when the age criterion was fulfilled. Again, proxy interviews were conducted with another household member if the eligible member was too ill or not available to be interviewed.

Between Waves 2 and 18, the wave-on-wave household response rate varied between 84% and 92%. The response rate of the original Wave 1 respondents varied between 88% (Wave 2) and 45% (Wave 18).

Additional samples of 1,500 households in Scotland and another 1,500 households in Wales were included to the BHPS sample in 1999. In 2001, a further sample of 2,000 households was added in Northern Ireland. This means that the sample size for the BHPS is now around 10,000 households across the whole United Kingdom. A full description of sampling procedures has been presented in detail by the BHPS coordinating group to the Institute for Social and Economic Research.[262] The data set is freely available through the UK Data Archives at the University of Essex for academic use, and I downloaded it for this thesis. First I downloaded data from Waves 1–17

during the first year of the project, and later I added the data from Wave 18 when it became available.

## 4.2  Data for this project

This thesis is based on data from young adults aged 16–21 who have known mothers in the data set. Not all young adults in this age range have all the required data available. This thesis is concerned with the possible effects of maternal paid employment during three periods of childhood on the health and health behaviours (represented by self-rated health, psychological distress and smoking) of young adults aged 16–21. The three age-specific exposure periods of interest are 0–4, 5–11 and 12–16, coinciding with preschool, primary- and secondary-school ages (and hereafter simply referred to as the "preschool period", "primary school period" and "secondary school period"). The requirement to have data from several time periods and within specific age ranges has had serious consequences for the eligibility of BHPS participants for inclusion in this project.

There were 774 individuals at preschool age, 2,240 at primary school age, and 3,940 individuals at secondary school age with some existing data characterising their mother's employment of the 5,494 eligible young adults who were 16–21 years old at some point during the study (i.e. at any point between Wave 1 and Wave 18) (see Table 4.1 for a detailed example of the data available for the analysis of self-rated health; similar numbers would be available for an analysis using smoking behaviour or psychological well-being as study outcomes). 770 participants had the required information available for all of the important periods (preschool, primary school and secondary school ages, and young adulthood). While the objectives of the study would

be best answered using data from all four periods in one analysis, the sample size for such an analysis is relatively small. Four separate data sets were therefore constructed – three for the analysis of the effects of maternal paid employment in each childhood period separately, and one for the analysis of the effect of maternal paid employment in all three periods (focusing on accumulation, the identification of sensitive period(s), and the potential pathways of the effect of maternal employment in the three predefined periods). The analysis was thus first completed on three separate data sets, using data on maternal employment from each childhood period and health outcome information from young adulthood. Second, the data set including all available data from all three periods of childhood and from the young adulthood period was analysed in the final step of the analysis in order to focus on potential life-course models.

It is important to clarify why there is such a substantial reduction in the number of study participants used in the different analyses, and to show that this reduction is primarily due not to an absence of data, but to eligibility issues. While this reduction is presented for the example of self-rated health, the numbers would be very similar for the other two outcomes.

The number of eligible young adults with data available between the ages of 16 and 21 is reduced from 5,494 to the numbers shown in last column of Table 4.1 (774, 2,240 and 3,940 respectively) for several reasons. For example, the reduction from 5,494 eligible young adults to 3,940 individuals with data for the secondary school period and young adulthood can be described as follows: there were 660 study participants in Wave 1 aged 16–21 (of 807 individuals aged 16–21 and shown in Table 4.1) for whom there were data about self-rated health, but no data had been collected on maternal employment or other maternal and household circumstances when they were younger, because there was no data collection before Wave 1, and hence there were no data from

when these young adults were younger than 17. Similarly, in Wave 9, 330 16–21-year-old study participants were added to the study in the Welsh and Scottish samples (Wave 9 was when these two samples were added to the study), and in Wave 11 there were 279 16–21-year-old participants added in the newly added sample from Northern Ireland (see Figure 5.1 for the detailed age structure of the data set). These Welsh, Scottish and Northern Irish young adults do have self-rated health data at the relevant age, but they do not have data about childhood exposures to maternal employment, because they entered the study too late. Thus in total, 1,269 young adults were recruited to the study at the right age to have data about their self-rated health collected, but too late for data about childhood exposures.

**Table 4.1 Detailed description of available data**

| Wave | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | Total N across waves |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. of 'eligible' young adults (aged 16-21) | 807 | 805 | 807 | 814 | 798 | 812 | 917 | 888 | 1171 | 1244 | 1520 | 1326 | 1318 | 1295 | 1353 | 1344 | 1339 | 1295 | 5494 |
| No. of 'eligible' young adults with data on self-rated health | 807 | 804 | 807 | 814 | 797 | 812 | 917 | 888 | 1107* | 1243 | 1519 | 1326 | 1318 | 1295 | 1351 | 1344 | 1332 | 1295 | 5430 |
| No. of 'eligible' young adults with data on self-rated health AND mother's employment data when child was at preschool age | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 131 | 258 | 383 | 475 | 583 | 625 | 774 |
| No. of 'eligible' young adults with data on self-rated health AND mother's employment data when child was at primary school age | NA | NA | NA | NA | NA | 135 | 254 | 374 | 481 | 583 | 679 | 639 | 651 | 719 | 803 | 916 | 1027 | 1092 | 2240 |
| No. of 'eligible' young adults with data on self-rated health AND mother's employment data when child was at secondary school age | 144 | 287 | 404 | 525 | 636 | 785 | 798 | 800 | 863 | 956 | 1075 | 1031 | 1131 | 1201 | 1282 | 1313 | 1311 | 1277 | 3940 |

NA: Not Applicable

* Wave 9 did not include question on self-rated health

**Figure 4.1. Age of study individuals in different waves of BHPS**

| Wave | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 21 | | | | | | | | | | | | | | | | | |
| | 20 | 21 | | | | | | | | | | | | | | | | |
| | 19 | 20 | 21 | | | | | | | | | | | | | | | |
| | 18 | 19 | 20 | 21 | | | | | | | | | | | | | | |
| | 17 | 18 | 19 | 20 | 21 | | | | | | | | | | | | | |
| | 16 | 17 | 18 | 19 | 20 | 21 | | | | | | | | | | | | |
| | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | | | | | | | | | | |
| | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | | | | | | | | | |
| | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | | | | | | | | |
| | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | | | | | | | |
| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | | | | | | |
| Age | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | | | | | |
| | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | | | | |
| | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | | | |
| | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | | |
| | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | |
| | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | |
| | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |

Scottish and Welsh sample added

Northern Irish sample added

Preschool age (0-4 years)

Primary school age (5-11 years)

Secondary school age (12-16 years)

Young adulthood

## 4.3  Variables

This analysis uses variables from four different age periods: ages 0–4 (preschool age), 5–11 (primary-school age), 12–16 (secondary-school age) and 16–21 (young adulthood). Self-rated health over the previous 12 months, psychological well-being using the GHQ-12 questionnaire, and smoking between the ages of 16 and 21 will be used as the outcome variables. Paid maternal employment in three different periods of childhood (preschool, primary school and secondary school) will be used as the main

exposure of interest. A further set of characteristics describing the households and parents of the study individuals will be included and used in this analysis.

### 4.3.1 Self-rated health

Self-rated health over the previous 12 months was given using a 5-point Likert scale. The question was formulated as follows: "Please think back over the last 12 months about how your health has been. Compared to people of your own age, would you say that your health has on the whole been..." The five possible answers were: excellent, good, fair, poor, or very poor. The results were coded between 1 and 5, from excellent to very poor health. For most of the analyses, a dichotomous measure of poor self-rated health was used that combined the original categories of fair, poor and very poor health as "poor", and excellent and good health as "good". This is the same categorisation as in previously published research using a binary outcome for self-rated health from BHPS data.[263-265] Self-rated health is available for each wave of the study except Wave 9. In Wave 9, a question was asked about health in general rather than health in the previous 12 months, and this question has not been used in this analysis for both theoretical and empirical reasons: first, it has not previously been shown in the literature that these questions can be used interchangeably; and second, when the proportions of those classified as reporting poor health were compared in this study, the results in Wave 9 differed substantially from other waves. It was decided that only answers from Waves 1–8 and 10–18 would be used in this study. The abbreviation SRH is used for self-rated health in some tables and figures. Information from every age between 16-21 years is used (as described further in section 4.4.2).

### 4.3.2 Psychological well-being

The GHQ-12 instrument (the General Health Questionnaire) was used as an indicator of psychological well-being in the BHPS. It is an instrument originally developed for the screening of psychiatric illness and later used as an indicator of subjective well-being.[266;267] The GHQ-12 is comprised of 12 items, and was asked at each wave of the study (see Appendix 2 for the exact wording of the questions). Each question had four possible answers, which were scored on a scale of 0 to 3. The GHQ-12 score was constructed by adding together the scores for individual items to give a scale from 0 (the least distressed) to 36 (the most distressed). The overall sum was calculated if at least nine of the 12 questions were answered; if more than eight but fewer than 12 questions were answered, the score was rescaled to have values between 0 and 36. This was done by dividing the original sum by the number of valid answers and then multiplying the result by 12.

Previous studies have validated GHQ-12, and most studies use a dichotomised measure of psychological distress rather than the original continuous measure. Previous studies have most frequently used the threshold of 11 or 12 to dichotomise the scale.[266-268] For this analysis, those scoring above 12 were classified as being in psychological distress, and those scoring up to 12 were classified as being without psychological distress. GHQ-12 information from every age between 16-21 years is used (section 4.4.2).

Two other measures – the original continuous scale, and a dichotomised scale using the threshold 2/3 when all individual items are scored as a binary using 0-0-1-1 scoring[269] – will be discussed in Chapter 8 (section 8.2.6), and selected tables from the analysis using continuous scale will be reported in Appendix 9.

### 4.3.3 Smoking

Current smoking was assessed through the question "Do you smoke cigarettes?" and was recorded as a binary variable (yes/no responses) in each wave of the study except Wave 9. In Wave 9, the study participants were asked: "Do you smoke cigarettes at all nowadays?" with a yes/no response. This question from Wave 9 was not used in this analysis, because the prevalence of positive answers to this question was approximately 20% higher than to the question asked in the other waves before and after Wave 9. It is possible to speculate about the reasons for this prevalence of positive answers in Wave 9 (e.g. because it asks about smoking in general compared to cigarette smoking, or because it is part of a series of smoking-related questions in Wave 9 rather than a single question in every other wave, or because of the addition of "at all" to the question in Wave 9), but for reasons of consistency it has been decided to exclude smoking in Wave 9 from this analysis, and to use only answers from Waves 1–8 and 10–18. Smoking status from every age between 16 and 21 is used in analysis (as described in section 4.4.2).

### 4.3.4 Paid maternal employment

The main exposure in the project is maternal employment. Maternal employment data were collected at each wave of the study. Answers from individual waves enabled the creation of a binary variable characterising whether the mother was employed at least once during a specific childhood period (in relation to mothers who were not employed at all during the specific period). Three such variables were defined separately for each of the three periods of childhood.

### 4.3.5 Further covariates

*Maternal education*

Maternal education in each wave of the BHPS was coded into three categories based on the highest level of academic qualification attained. It was coded as higher education (a university degree or higher), secondary-school qualifications (A levels, O levels, Certificates of Secondary Education), and no formal qualification (marked as "no qualification" later in the text). As with maternal marital status and household income, the earliest available information during each childhood period (at preschool, primary-school and secondary-school ages) was treated as characteristic of maternal education in that period.

*Household income*

Household income was used as a measure of material circumstances in the study participant's household during different periods of childhood. Household income in the month before the interview was collected on a continuous scale. This was derived as net overall household income, based on a series of questions about different types of individual and household income, and created by the BHPS data management team. Household income in each wave was then grouped into wave-specific quintiles (quintiles were calculated for all the households in the wave, rather than only those used in this analysis with children in appropriate age ranges) and used as a categorical variable of relative material position. The use of all the households in the wave means that there is not the same (approximate) number of records in each quintile of household income in the study data set. The earliest available information for the specific childhood age period was then used for each of the three periods of childhood for each individual. For regression models, when examining interactions between maternal employment and household income, quintiles of household income were grouped to

form a binary variable: quintiles 1–3 (lower quintiles of income) formed the category "more financially disadvantaged", and quintiles 4 and 5 formed the category "more financially advantaged".

## *Maternal marital status*

For maternal marital status, respondents' mothers were classified at each wave as either (1) married, (2) cohabiting or (3) not living with a partner. The earliest available information during each childhood period (at preschool, primary school and secondary school ages) was treated as characteristic of maternal marital status. In regression analysis, individuals with cohabiting mothers or mothers not living with a partner were grouped together. There are at least two reasons for such a grouping. First, on the basis of some of the results from previous studies reported in Chapter 2, it was decided that being in a family with married parents may have a different impact on children's health and development than being in a household with a mother and father (or step-parent) who cohabit but are not married. Second, while it would have been useful to place those with cohabiting mothers and those whose mother lives without a partner in two distinct categories, there were not enough individuals in those two categories, particularly in data sets covering the two earlier periods of childhood; this did not allow any meaningful analysis of the role of maternal marital status in the association between maternal employment and the three study outcomes. A dichotomous variable with the categories "married" and "not married" was therefore used to characterise maternal marital status.

While it was decided that the earliest available information in each period would be used in the analysis as the value characterising the study participants' mothers or households in each period of childhood, other definitions could also have been used for

these social measures, such as the mean score in each period, the number or proportion of years in each period that the mothers were married, the households that were in the top two quintiles of income, or the mothers who were in the highest category of education. Each of these definitions would have had some advantages and disadvantages. There are at least two advantages for using the earliest available information. First, using early social and economic characteristics of participants' households seems to be a preferred option because it has been suggested in earlier papers, and is hypothesised in this project, that the influence of maternal employment or other social and economic variables might have the greatest importance at the earliest ages. This choice of exposure, and the use of binary or categorical exposure variables, also enables a relatively straightforward interpretation of the results. On the other hand, using mean scores over a specific childhood period would not have allowed such clear interpretation; for example, a score of 1.3 for marital status would not give a clear reference to any category of marital status. The number of years in a certain category of exposure would be influenced by the number of years in each childhood period for which data are available. There are individuals whose data are available for all years within a certain childhood period, while for some individuals only one or two records exist for the same period. The mean score or proportion of years in a certain category would not be directly affected by the number of records available for each individual in each period, but these two measures would be influenced indirectly by the number of records available if, for example, it was more likely that households would be in a higher quintile of income in later years, when parents were older and might be in better jobs. In such circumstances, individuals with records available only for the later years of a certain childhood period would be more likely to have a higher proportion of their income records in the top two quintiles of household income.

### *Maternal self-rated health, psychological well-being and smoking*

Mothers' self-rated health, psychological well-being and smoking came from the same data as the participants' self-rated health, psychological well-being and smoking, and as such they were defined in a similar way as that described for respondents' self-rated health, psychological well-being and smoking in sections 4.3.1, 4.3.2 and 4.3.3; they were linked to the appropriate records of their children through their exclusive personal identifiers. This was possible because each study participant had recorded the study IDs of their parents if their parents were also part of the BHPS.

Maternal smoking was calculated for each of the three childhood periods in the following way. If the mother reported having been a smoker at least once during a specific period of childhood, then maternal smoking at that childhood period was coded as "yes". If the mother reported having been a non-smoker in all waves during a specific childhood age period, then maternal smoking was coded as "no".

Maternal psychological well-being was defined using the GHQ-12 instrument in a similar way as for the definition of psychological well-being for study participants. Maternal psychological well-being at specific childhood periods was calculated as an average of maternal GHQ-12 scores in all waves within the period in question. Maternal psychological distress was then generated as a binary variable from the maternal GHQ-12 score by using 12 as the cut point, with those scoring more than 12 being classified as being in psychological distress.

Maternal self-rated health at a specific childhood period was calculated as the average of the self-rated health scores on a scale of 1 to 5 in all waves related to that period of childhood. Poor maternal self-rated health at a specific childhood period was generated

as a binary variable from maternal self-rated health, using 2.5 as the cut point. Mothers with average scores above 2.5 were classified as having poor self-rated health. This cut point is equivalent to the definition of respondents' poor self-rated health, with scores 1 and 2 classified as good health and scores 3, 4 and 5 as poor health.

### *Childcare arrangements*

Childcare arrangements were assessed using the following question: "Which of the following best describes the way you arrange for your children *aged 12 or under* to be looked after while you are at work?" The possible answers were:

- I work only while the children are at school

- They look after themselves until I get home

- I work from home

- My spouse/partner looks after them

- A nanny or mother looks after them at home

- They go to a workplace nursery

- They go to a day nursery

- They go to a childminder

- A relative looks after them

- A friend or neighbour looks after them

- Other

Each respondent could select up to three answers that best described their current arrangements, and this question was available at each wave of the BHPS. Thus it was possible to construct childhood arrangements at every time point of childhood (up to age 12) while the mother was taking part in the study. Therefore the childcare

arrangements were available for almost all the data records with available maternal employment information.

The answers were combined into three groups: informal childcare by the mother and/or her partner; informal childcare by other individuals; and formal childcare. The first four answers (I work only while the children are at school; the children look after themselves until I get home; I work from home; my spouse/partner looks after them) were combined into the category "childcare by mother/partner". The answers "they go to a workplace nursery", "they go to a day nursery" and "they go to a childminder" formed the formal childcare group. The remaining answers – "a nanny or mother looks after them at home", "a relative looks after them", "a friend or neighbour looks after them" and "other" – formed the group of other informal childcare.

The option "a nanny or mother looks after them" was not ideal, as it combines informal and formal options. After considering the definitions of nanny and childminder (nannies are defined as professional carers who look after children in the latter's homes, do not need to register with the government, and do not need to have any training or certification, while childminders are defined as professional carers who work in their own homes, must be registered, and are inspected by OFSTED: http://www.abritishnanny.co.uk/difference-between-nanny-and-childminder.html, accessed March 2011), I decided to include the "nanny/mother" option in the "other informal childcare" group.

Through the combination of a binary measure of the mother's employment (employed/not employed) with childcare arrangements, mothers were classified into five groups: those who are not working; those who are working and look after their children alone or with the help of their partners; those who also use formal childcare; those whose childcare is covered by a mother, partner or other individuals, such as other

family members or friends; and those whose childcare is covered using a combination of all kinds of help (on one's own, by a partner, by other individuals and with formal care). While it would have been ideal to use all the original answers as separate categories, this was not possible in this study because some of the answers were reported by very few individuals (as summarised in the relevant section of Results below). Even when the mothers are categorised in the ways described above, some groups do not frequently appear, and this might be a particular problem at ages 0–4, for which the sample size is relatively small. Similarly to maternal marital status or household income, the earliest available information during each period (preschool and primary school age) was treated as characteristic of childcare arrangements.

### *Maternal job satisfaction*

Maternal job satisfaction is based on answers to the question "All things considered, how satisfied or dissatisfied are you with your present job overall using the 1–7 scale?" with 1 meaning "not satisfied at all", 4 meaning "neither dissatisfied nor satisfied", and 7 meaning "completely satisfied". Valid measures of job satisfaction within each childhood period were used (i.e. those with answers 1–7; data points when the mother did not work or did not answer the job satisfaction question were ignored), and the mean score was calculated from valid answers.[270;271] As proposed by Bardasi and Francesconi[232], the cut point used in the analysis to create the binary variable was 4.0 (0–3.9, 4.0–7.0); those with values below four reporting lower job satisfaction and those with values of four or more reporting higher job satisfaction.

## 4.4 Data manipulation and statistical analysis

### 4.4.1 Data preparation and sample description

The BHPS data are organised into separate data sets for each wave of data collection. Before any data analysis could be started, several steps of data preparation and data manipulation were needed:

(1) Merging the data for study individuals from different waves by using personal identification codes to get as complete a data set for each person as possible.

(2) Merging maternal data with the study participants' data through parental identification codes to get all the available information about mothers at the time of the study participants' childhoods.

(3) Reducing the data set in order to satisfy the inclusion and exclusion criteria for this project, such as age restrictions and the availability of (at least some) maternal data.

The percentage of missing outcome data was generally relatively low. For the three study outcomes, among 5,250 eligible study participants in young adulthood, self-rated health was missing for 65 participants, GHQ-12 scores for 254 participants, and smoking for 203 participants. Most of the records excluded from the analysis were those from which the mother's data were missing because of the study design (as described above in section 4.2). Such data were missing completely at random, and they did not introduce any systematic bias into the analysis. Data were analysed using Stata software, versions 10.0 and 11.0 (Stata Corp., College Station, USA).

Statistical analysis was done in several steps. As described above in sections 4.3.1, 4.3.2 and 4.3.3, all three study outcomes were defined as binary variables. A descriptive analysis was conducted first by compiling frequency tables, to assess the distribution of

observations with each variable. Next, cross-tabulations between poor self-rated health, psychological distress or smoking, and maternal employment in different periods of childhood were done, as well as cross-tabulations between the three study outcomes and main covariates.

Regression modelling was used in the next step of the analysis. In line with the repeated measures structure of the data set (described in the next section), a multilevel logistic regression for binary outcomes was chosen.[272;273] Regression analysis was first done without additional explanatory variables, and this was followed by multivariable analysis taking other covariates into account. These further steps of the analysis will be described in more detail in section 4.4.3, after I have explained the hierarchical structure of the data with repeated measures.

## 4.4.2 Repeated outcome measures in young adulthood

This project is about the health and smoking behaviour of young adults aged 16–21. Because the BHPS is an annual household survey, it is possible to have between one and six reports on each study outcome at ages 16–21. While there might be various possible ways to use a single record for each individual – for example, by using the last available record at the oldest possible age within the 16–21 range, or using the average of all available responses for each respondent – it is more efficient to use all the available data for each person, and thus to use all existing records for each study outcome.

The construction of the data set with repeated data will be illustrated in relation to self-rated health. The same process was also used to create data for the analysis of psychological distress and smoking at ages 16–21. By combining self-rated health in

each wave of the BHPS with the age at each wave, new variables for self-rated health at the ages of 16, 17, 18, 19, 20 and 21 were created for each study participant. After completing this first step, this "wide" data set with six variables for each individual in a single record – the values of several of which were potentially missing, if data for a particular age did not exist for a given individual – was transformed into a "long" data set. This "long" data set had up to six records for each individual, with one variable for self-rated health and a second variable indicating the age at which the self-rated health was collected.

This newly created data set thus contained as many records for each individual as there were valid measures of outcomes at ages 16–21. There were between one and six records for each person. Using all individual records rather than only one improved the statistical power of the analysis (presented in chapter 4.5), and also enabled the use of all available information about the study outcomes rather than one summary characteristic (either the last or first record at ages 16–21, or some kind of summary measure such as the mean).

Repeated outcome measurements for a particular individual are likely to be correlated with each other. The classical methods, including logistic regression, assume the independence of observations. However, measurements of self-rated health in the same person are not independent, and they provide less variability than measurements from different individuals. If the lack of independence of observations in the data set in this project were not taken into account, the main problem in the analysis would be incorrect – artificially small – standard errors. In general, the estimates would be "too precise". This would lead to confidence intervals that were too narrow and p-values that were too small. It would be likely that the results would be falsely significant in situations that should not suggest statistically significant conclusions.

Table 4.2 shows the number of individuals with data available for self-rated health, psychological distress and smoking at ages 16–21 whose maternal employment is known at the three periods of their childhood. The analysis uses a data set with repeated measures of the three study outcomes between the ages of 16 and 21. Table 4.3 shows the number of available records in the newly created data set with repeated measures. The size of the data set is slightly different for each study outcome, and the maximal available data will be used for the analysis of each separate outcome. Table 4.4 shows how many records were available per individual for each study outcome in the analysis of different childhood periods with known maternal employment data. The relatively large difference in the numbers of those with five or six available records of study outcomes at ages 16–21 and those whose mother's employment status is available for ages 5–11 and 12–16 are because the self-rated health and smoking questions were differently worded in Wave 9 and were therefore excluded (while questions from the GHQ-12 instrument were asked identically in every wave). This methodological issue has already been explained in a previous section describing definitions of the study outcomes.

**Table 4.2. Number of individuals with data available for self-rated health, psychological distress and smoking at young adulthood and paid maternal employment at three periods of childhood**

| Mother's data available at age of child | Study outcomes at young adulthood | | |
| --- | --- | --- | --- |
| | Self-rated health | Psychological distress | Smoking |
| | N | N | N |
| Preschool age | 774 | 731 | 765 |
| Primary school age | 2240 | 2132 | 2197 |
| Secondary school age | 3940 | 3779 | 3859 |

**Table 4.3. Number of records of available data for self-rated health, psychological distress and smoking at young adulthood and paid maternal employment at three periods of childhood**

| Mother's data available at age of child | Study outcomes at young adulthood | | |
|---|---|---|---|
| | Self-rated health | Psychological distress | Smoking |
| | N | N | N |
| Preschool age | 2459 | 2269 | 2398 |
| Primary school age | 7876 | 7769 | 7608 |
| Secondary school age | 14968 | 14714 | 14417 |

**Table 4.4. Number of valid health outcome measurements for individuals with data on self-rated health and paid maternal employment at certain age of child**

| | Study outcomes at young adulthood | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Self-rated health | | | Psychological distress | | | Smoking | | |
| | Mother's employment at given age | | | | | | | | |
| | 0-4 | 5-11 | 12-16 | 0-4 | 5-11 | 12-16 | 0-4 | 5-11 | 12-16 |
| Number of valid study outcome measurements | | | | | | | | | |
| **1** | 138 | 369 | 555 | 132 | 357 | 536 | 139 | 367 | 558 |
| **2** | 182 | 400 | 621 | 185 | 385 | 601 | 181 | 409 | 633 |
| **3** | 133 | 316 | 470 | 128 | 298 | 479 | 140 | 328 | 485 |
| **4** | 132 | 317 | 515 | 119 | 260 | 489 | 126 | 307 | 510 |
| **5** | 104 | 537 | 973 | 95 | 284 | 561 | 101 | 505 | 940 |
| **6** | 85 | 301 | 806 | 72 | 548 | 1163 | 78 | 281 | 733 |

0-4 = preschool age; 5-11 = primary school age; 12-16 = secondary school age

### 4.4.3 Analysis of hierarchical data

The data in the "long" data set essentially have a hierarchical structure. In level one there are measurements, in level two individuals. It is essential to choose a statistical method that takes this correlation and hierarchical structure into account.

It is possible to use one of several methods for correlated data in a hierarchical structure:

(1) Robust standard errors

(2) Generalised estimating equations

(3) Random effect models (multilevel models)

Analysis using robust standard errors takes account of possible clustering when computing the standard errors, but it ignores clustering when estimating the odds ratios. Thus the point estimate (OR) will remain the same as in ordinary logistic regression assuming independent measurements. Another method is to use generalised estimating equations (GEE) with robust standard errors and an exchangeable correlation matrix. The third method, random effects models (or multilevel models) include the likelihood of variation between clusters, and therefore take account of intra-cluster correlations. The random effects model assumes that person effects are drawn from a probability distribution.

Random effects analysis will be used for the analysis of the repeated measures data set, the creation of which was described in the previous section. Multilevel regression analysis will be conducted in several steps, mirroring the conceptual model described in Chapter 3. The crude effects of maternal employment in three periods of childhood on the three study outcomes will first be estimated separately for each period, meaning that there will be three crude models for each study outcome. Next, the role of social and

demographic covariates in the association between maternal employment and the three study outcomes will be estimated in two steps, in line with the description in section 3.3. First, in line with the analysis of existing literature, the role of maternal education, maternal marital status and household income as potential confounding factors will be evaluated. Second, in line with the hypotheses of this project, these three covariates will be assessed as potential effect-modifiers. In addition to the role of maternal education, maternal marital status and household income, childcare arrangements and maternal job satisfaction will be tested as potential effect-modifiers, and maternal self-rated health, maternal psychological distress and maternal smoking will be tested as potential confounding factors. On the basis of the results of the previous step, the final models for each study outcome and the role of maternal employment in each period will be estimated using all of the important covariates identified in each period.

A Wald test [272] will be used at each step to compare pairs of models to identify covariates that are retained in the models for each period and each outcome. A Wald test is used to evaluate difference between nested models (comparing model with extra predictor parameter(s) against model with such parameter(s) removed). Finally, several life-course models will be assessed in the last part of the analysis, and this analytical step is described in more detail in section 4.4.5, after I have described the testing for the interactions hypothesised in the theoretical model for this analysis.

## 4.4.4 Testing interactions between maternal employment and relevant covariates from the conceptual model

As stated in sections 3.2 and 4.4.3, it has been hypothesised that some variables might modify the association between maternal employment and the study outcomes (maternal education, maternal marital status, household income, childcare arrangements and

maternal job satisfaction). A Wald test will be used to test for such interactions, comparing a model that includes an interaction term between maternal employment and each hypothesised effect-modifier with a model including only the main effects of maternal employment and any such hypothesised effect-modifier but excluding an interaction term. Such a test will allow the evaluation of whether the interaction between two variables is statistically significant, whether there is a large difference between stratum-specific estimates (although this may not be statistically significant, and may be due to a lack of power to identify interactions – see section 4.5 for a discussion of the statistical power of the study), or whether the data do not support the original hypotheses.

### 4.4.5 Trajectories

In final step of the analysis, the "life-course analysis" (in Chapter 7), different models using data from all of the three periods of childhood combined will be tested. These models will reflect different theoretical life-course models. The main focus will be on pathway (or "trajectory") models, accumulation models and "sensitive period" models.

A "trajectories" model (in the epidemiological sense) or a "saturated" model (in the statistical sense), including all possible pathways, will be applied first. All of the possible trajectories of maternal employment in the three periods are illustrated in table 4.5. It will be shown in Chapter 7 that some of the trajectories, such as "101" and "010", represent a very small number of records, and the estimates from regression modelling characterising these records are very imprecise. This issue will be further addressed and explained in Chapter 7. However, it is possible to mention at this stage that if such a situation gives such wide confidence intervals and such imprecise estimates that no meaningful interpretation is possible, some pathways will be combined (only those which allow logical combination, such as pathways suggesting mobility in same

direction, for example from an original "not employed" status to an "employed" status), and four pathways groups ("Never employed", "Moving into employment", "Moving out of employment", "Always employed") will be used in final pathway analysis.

**Table 4.5. Indicator of trajectory of paid maternal employment in childhood**

| Maternal employment at preschool age (1=employed; 0=not employed) | Maternal employment at primary school age (1=employed; 0=not employed) | Maternal employment at secondary school age (1=employed; 0=not employed) | **Trajectory of maternal employment during childhood*** |
|:---:|:---:|:---:|:---:|
| 0 | 0 | 0 | 000 |
| 0 | 0 | 1 | 001 |
| 0 | 1 | 0 | 010 |
| 0 | 1 | 1 | 011 |
| 1 | 0 | 0 | 100 |
| 1 | 0 | 1 | 101 |
| 1 | 1 | 0 | 110 |
| 1 | 1 | 1 | 111 |

*each row of the table represents one possible trajectory

Second, an accumulation model, counting the number of periods when the mother was employed, will be applied. This model will allow me to test whether there is any "dose-response" relationship between the number of periods the mother was employed during the participant's childhood and the three study outcomes. Such a model does not, however, enable the analysis to give different weight, and hence different significance, to different periods of childhood. Third, sensitive period models will be considered. These are generally the models that will have been applied in simplified version (including only one exposure period at a time) in the previous steps of the analysis. A different significance can be given to different periods through the application of a

model with independent variables for maternal employment in each of the three childhood periods. This model assumes that all three periods do not necessary have the same significance in the development of health and health behaviours, but it still allows the assumption of a certain effect of maternal employment across the different periods of childhood.

Finally, results using all of the above-described models will be compared and discussed in order to decide which of the models best describes the associations between maternal employment and self-rated health, psychological distress and smoking.

## *4.5  The power of the study*

This study is based on existing data. Although the size of the population samples for this project could not be influenced, it is possible, under the following assumptions, to calculate the power of the study.

For the power calculations, the following assumptions are used:

- A 95% confidence level

- An exposed: unexposed ratio of 1:1 (using maternal employment at preschool age as the exposure variable for this calculation), 3:1 (primary school age), 4:1 (secondary school age), respectively

- A 15% prevalence of disease in the unexposed group (poor self-rated health among those with non-working mothers)

Three different data sets were used in the analysis presented in this thesis:

(1) Individuals for whom there were data from the secondary-school age period 12–16 and health data at young adulthood (ages 16–21)

(2) Individuals with data from the primary-school age period 5–11 and health data at young adulthood

(3) Individuals with data from the preschool age period 0–4 and health data at young adulthood

Additionally, a data set comprising individuals with data from all four periods (preschool, primary school and secondary school ages and young adulthood) will be used in the final steps of the analysis (described in Chapter 7). The statistical power was calculated for these four different samples. All calculations are post-hoc calculations. The calculations take into account the fact that there are several records per individual, because of the repeated-measures nature of the data. Table 4.6 shows the statistical power of the study for all four data sets, for a range of odds ratios and a 95% confidence level, using the Statcalc module of the EpiInfo software that uses Fleiss formulas.[274] The calculation of effective sample size uses an assumption of an intra-class correlation of 0.70.

**Table 4.6. Power calculation for study sample in the analysis of self-rated health**

| Odds ratios | Study power | | | |
|---|---|---|---|---|
| | Secondary school period and young adulthood | Primary school period and young adulthood | Preschool period and young adulthood | All 4 periods |
| Records | N=14968 | N=7876 | N=2459 | N=2439 |
| Individuals | N=3940 | N=2240 | N=774 | N=770 |
| Mean number of records/individual | 3.8 | 3.5 | 3.2 | 3.2 |
| Effective sample size* | 5056 | 2864 | 968 | 960 |
| 1.50 | 99% | 90% | 75% | 75% |
| 1.75 | >99% | 99% | 90% | 90% |
| 2.00 | >99.9% | >99% | 98% | 98% |

*Effective sample size of a two-stage cluster sampling design, $n_{eff}$, is computed by following formula: $n_{eff}=n/[1+(n_{clus}-1)\rho]$. In this formula n is the total number of records in the study, $n_{clus}$ is the number of records per cluster (in this study it is number of records per individual); and $\rho$ is the intra-class correlation.[275]

Although there is some loss of power in multivariate analyses (adjusting for sex and other factors), all samples were sufficient to study relatively strong associations. For odds ratios larger than, say, 2.00, the statistical power was over 98% in all samples. It seems, however, that the power is not great enough (around 75%) to study weaker associations (for example, with odds ratios of less than 1.50) in a sample of individuals with data from the age 0–4 study period, because the sample is relatively small.

The power calculation described above relates to one of the study outcomes, self-rated health. Power calculations for psychological distress and smoking will give similar but slightly improved power estimates, because (1) the sample size for the other two

outcomes is very similar, and (2) the proportion of records with positive outcomes is higher (above 20%), and the power of the study improves for more common outcomes.

These power calculations estimate the power of the study to assess the main effect of exposure on the study outcomes. However, it is important to mention that the power to assess the interaction between the main exposure and other covariates will be more limited. In particular, data sets in the two younger periods will have only limited power to assess such interactions, and such interactions will appear significant only if there are large differences between stratum-specific estimates.

## *4.6  Ethical issues*

This study has adopted the Ethical Guidelines of the Social Research Association (www.the-sra.org.uk/ethical.htm). All participants gave informed consent. This project only uses data already collected by the main investigators of the BHPS study (as this is secondary data analysis) and provided by publicly available data archives, and as such it does not need special ethical approval.

# 5  Descriptive results

The results of this project will be reported in Chapters 5, 6 and 7. Chapter 5 will include a sample description and an unadjusted analysis of the association between maternal employment and the three study outcomes. Chapter 6 will focus on the role of other covariates in the association between maternal employment and the three study outcomes. Finally, Chapter 7 will include results of analyses that combine exposure data from all three periods of childhood and test different life-course models.

## 5.1  Study outcomes

The distribution of self-rated health, psychological distress and smoking in the study sample is presented in Table 5.1 (the units in this table are records, taking into account the repeated-measures nature of the data set).

**Table 5.1. Distribution of study outcomes in three datasets based on availability of mother's data**

| Mother's employment status known at childhood period | Study outcome at young adulthood | | | | | |
| | Self-rated health | | Psychological distress | | Smoking | |
| | N | Poor (%) | N | Distress (%) | N | Yes (%) |
|---|---|---|---|---|---|---|
| Preschool age | 2459 | 16.6% | 2269 | 24.8% | 2398 | 22.3% |
| Primary school age | 7876 | 18.7% | 7769 | 24.5% | 7608 | 24.4% |
| Secondary school age | 14968 | 19.1% | 14714 | 24.2% | 14417 | 25.7% |

While the prevalence of psychological distress is similar in all three data sets, the prevalence of poor self-rated health and smoking is slightly higher in data sets with available data on maternal paid employment status in later periods of childhood. The likely explanation of this effect is the reduction of reported poor self-rated health and smoking in the later years of the study.

The changes in outcome prevalence are illustrated in figures 5.1, 5.2 and 5.3, which show trends in poor self-rated health, psychological distress and smoking throughout the whole study period. Figure 5.1 shows trends in poor self-rated health; figure 5.2 shows trends in reported psychological distress within the study, and figure 5.3 shows trends in smoking prevalence. Wave 9 was not included in figures 5.1 and 5.3 because the difference in smoking and self-rated health definitions, described earlier in sections 4.3.1 and 4.3.3, resulted in substantial differences in the percentages of individuals who gave positive answers on smoking and poor self-rated health in Wave 9. In all three figures, the calendar years on the horizontal axis relate to the waves of the BHPS. For example, "1991" relates to Wave 1 of the study. This is not entirely precise, because Wave 1 started in autumn 1991 and ended in spring 1992. All other waves of the BHPS study also started in the autumn and finished in the spring of the following year. However, single-year labels were used to make the graphs easier to read.

The graph at the top of figure 5.1 shows the smoothed three-year average prevalence of poor self-rated health by age of respondents (for example, connecting those who were 16 years old in the different waves, or those who were 17 years old in the different waves), while the lines in the bottom graph of figure 5.1 connect the same individuals at different ages throughout the study (e.g. those who were 16 in Wave 1, 17 in Wave 2, 18 in Wave 3, 19 in Wave 4, 20 in Wave 5 and 21 in Wave 6). While the decreasing trend in the prevalence of poor self-rated health over time is not entirely clear, it can be seen that the proportion of those reporting poor self-rated health in young adulthood in later waves is a little lower than at earlier waves. The data set with existing maternal data for the preschool period has self-rated health data for respondents at the ages 16–21 only from the last six waves, because those respondents could not reach the age of 16 any earlier (for example, those who were four years old in Wave 1 were 16 in Wave 13)

when the prevalence of poor self-rated health was a little lower than in previous periods, while the data set with existing maternal data for the secondary-school period can have self-rated health data for respondents at ages 16–21 from all waves of the BHPS. This means that the prevalence of poor self-rated health in the data set with existing maternal data for the preschool period is slightly lower than in data sets with existing maternal data for the primary- and secondary-school periods.

Figure 5.2 shows the trends in reporting psychological distress. As figure 5.2 suggests, a similar change to that detected for poor self-rated health cannot be observed in the prevalence of psychological distress over the waves of the BHPS. Similarly to the previous figure, the graph at the top ("period effect") shows the smoothed three-year moving average prevalence of psychological distress by age, while the lines in the bottom graph ("cohort effect") connect the same individuals throughout the study (e.g. those who were 16 in Wave 1, 17 in Wave 2, 18 in Wave 3, 19 in Wave 4, 20 in Wave 5 and 21 in Wave 6). The trend for the prevalence of psychological distress over time is not as clear as for self-rated health. If anything, the graphs show a small increase in psychological distress over time, resulting in a slightly higher proportion of psychological distress among those with known maternal employment during the preschool period (because such respondents could reach the age of 16 or more only in the last six waves of the BHPS) compared to those with known maternal employment during the secondary-school period (because these respondents could reach the age of 16 in the early waves of the BHPS).

The graph at the top of figure 5.3 ("period effect") shows smoking prevalence by age among young adults, while the lines in the bottom graph ("cohort effect") connect the same individuals throughout the study. The decreasing trend in the prevalence of smoking over the study period is clearer than the trends in figures 5.1 and 5.2. If we use

a similar explanation as for self-rated health, this decrease seems to be responsible for the differential rates of smoking in the three data sets. Thus the data set of respondents who have existing maternal data from the preschool period can cover the smoking of young adults only in the last six waves, when smoking prevalence was on average lower than in previous waves, while the data set with existing maternal data during the secondary-school period can have the smoking data of young adults from all waves of the BHPS.

**Figure 5.1. Period and cohort effect in poor self-rated health**

## Period effect
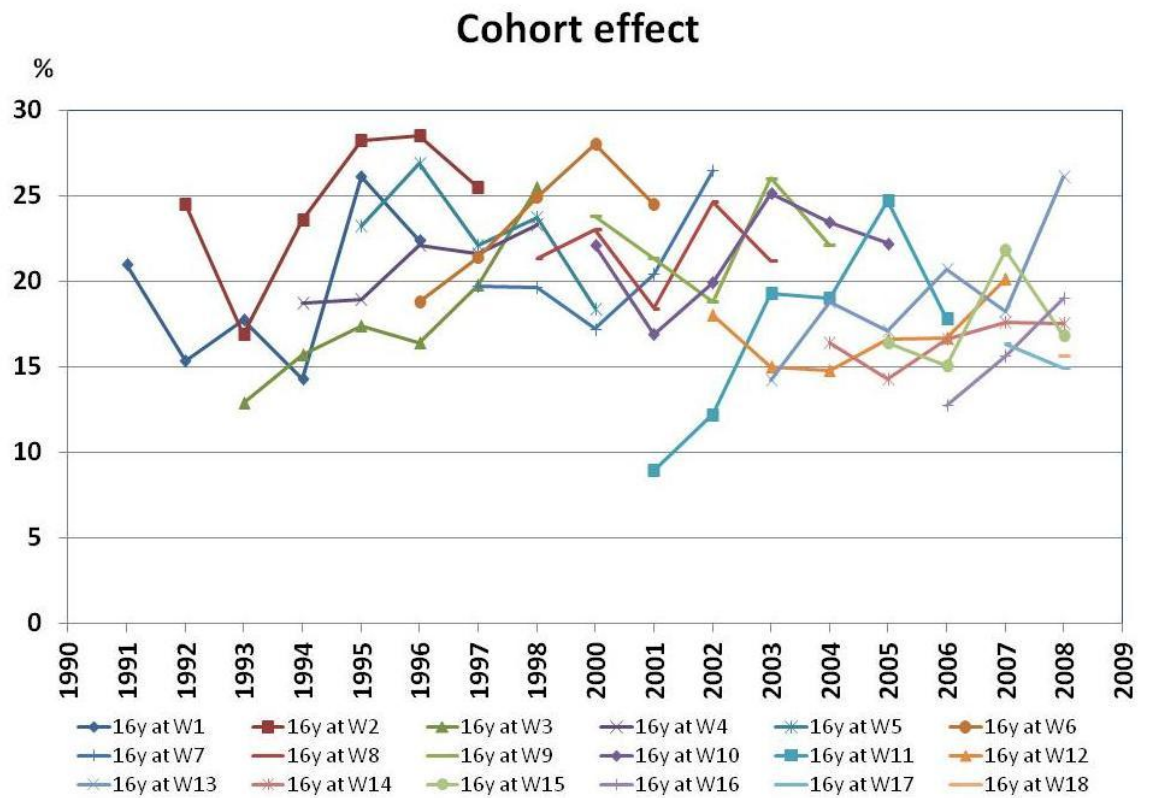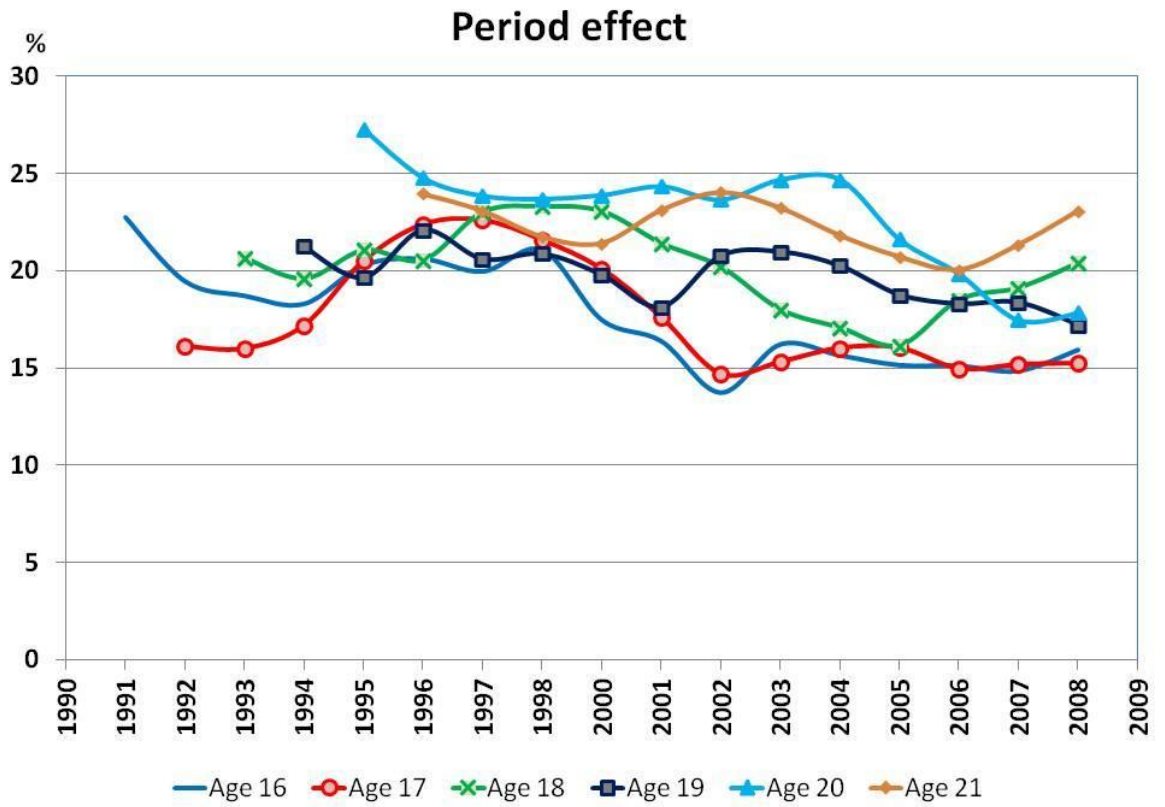


## Cohort effect

**Figure 5.2. Period and cohort effect in psychological distress**



Period effect

Legend: Age 16, Age 17, Age 18, Age 19, Age 20, Age 21



Cohort effect

Legend: 16y at W1, 16y at W2, 16y at W3, 16y at W4, 16y at W5, 16y at W6, 16y at W7, 16y at W8, 16y at W9, 16y at W10, 16y at W11, 16y at W12, 16y at W13, 16y at W14, 16y at W15, 16y at W16, 16y at W17, 16y at W18
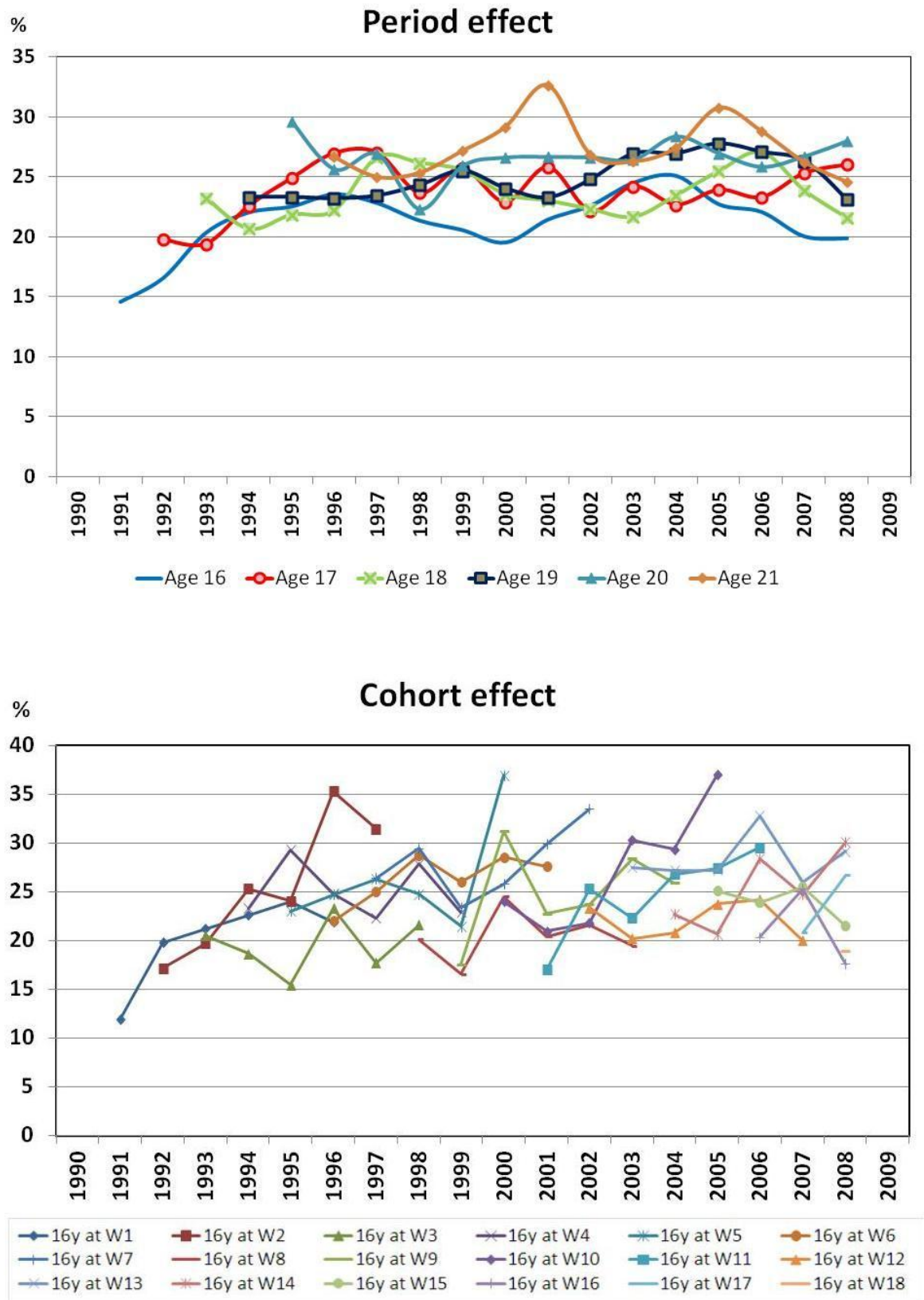
**Figure 5.3. Period and cohort effect in smoking**
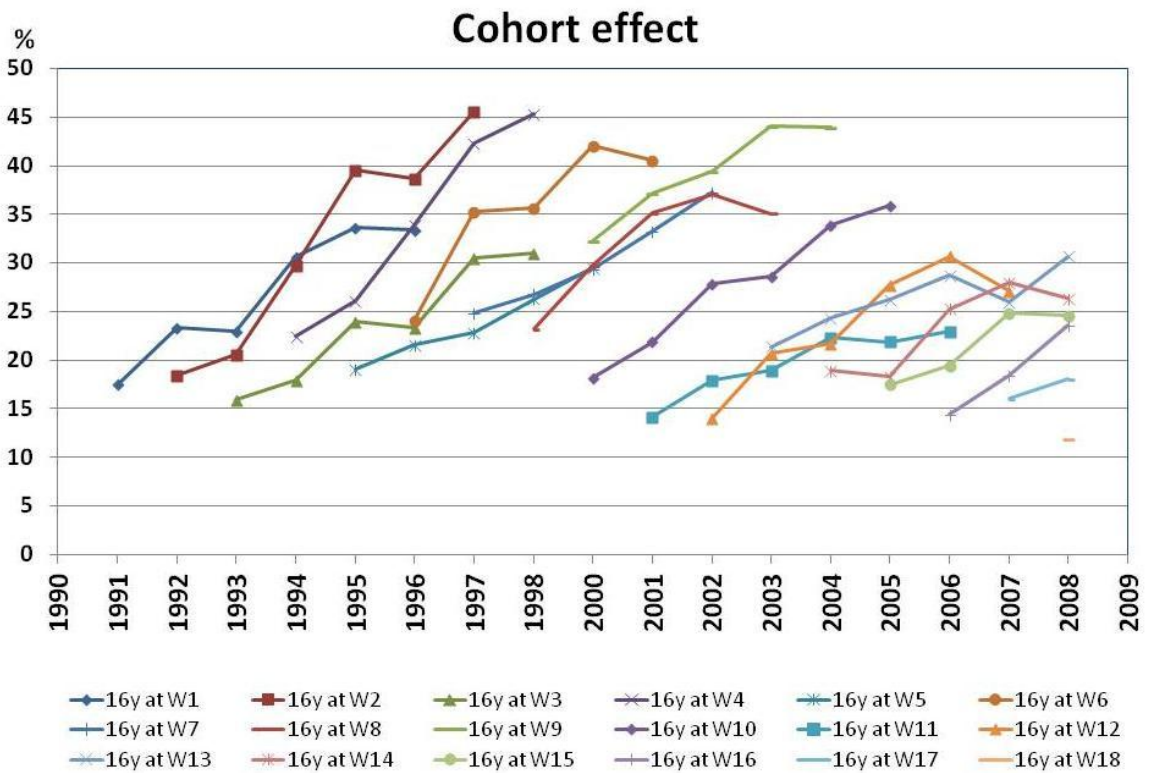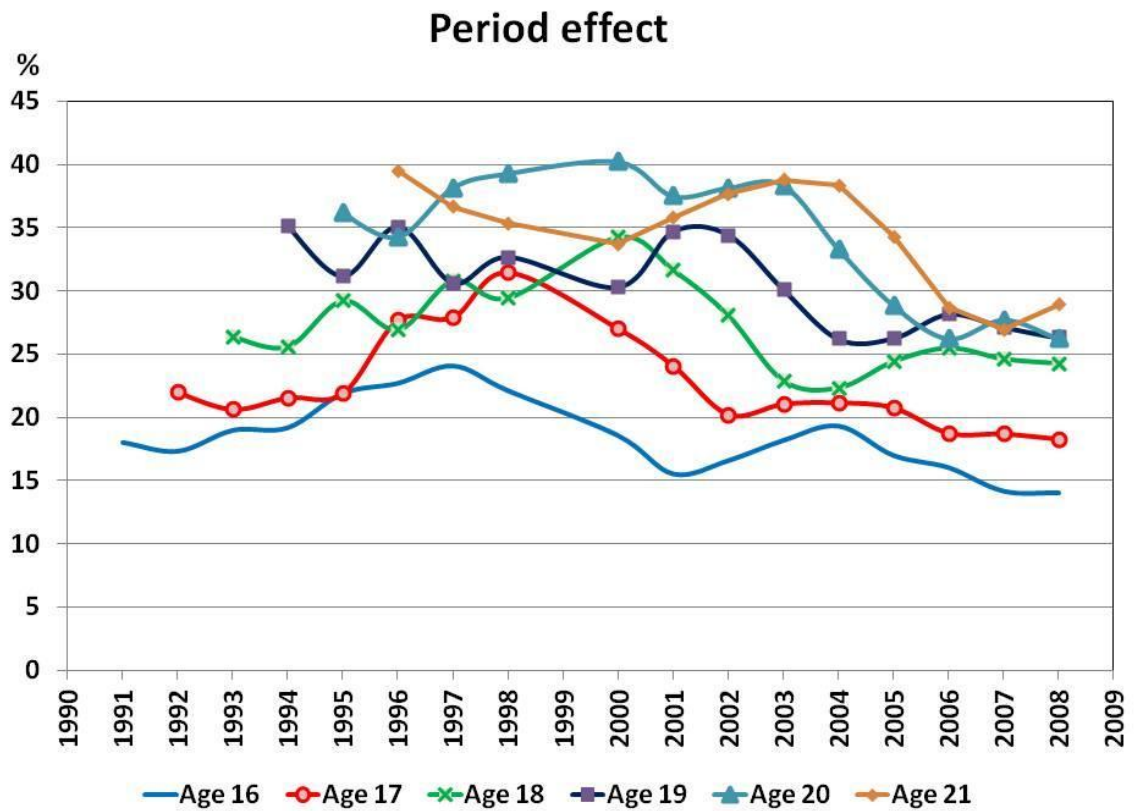
## 5.2 Maternal employment

The prevalence of paid maternal employment in the three periods of childhood is shown in tables 5.2 (individuals) and 5.3 (study records, which have been created by using repeated measurement described in 4.4.2). The prevalence of paid maternal employment increases in the later stages of childhood for the data sets related to all three study outcomes. While during the preschool period approximately half of mothers were employed at least, this percentage increases to 76% for the primary-school period, and to almost 80% for the secondary-school period.

**Table 5.2. Study individuals by paid maternal employment status in different periods of childhood**

| Mother's data available at age of child | Study outcome at young adulthood | | | | | |
|---|---|---|---|---|---|---|
| | Self-rated health | | Psychological distress | | Smoking | |
| | N | Mother employed[1] (%) | N | Mother employed[1] (%) | N | Mother employed[1] (%) |
| Preschool age | 774 | 55.7% | 731 | 55.1% | 765 | 55.8% |
| Primary school age | 2240 | 76.5% | 2132 | 76.4% | 2203 | 76.4% |
| Secondary school age | 3940 | 78.9% | 3779 | 79.0% | 3868 | 78.9% |

[1] Employed = employed at least once during specified childhood period

**Table 5.3. Study records by paid maternal employment in different periods of childhood**

| Mother's data available at age of child | Study outcome at young adulthood | | | | | |
|---|---|---|---|---|---|---|
| | Self-rated health | | Psychological distress | | Smoking | |
| | N | Mother employed[1] (%) | N | Mother employed[1] (%) | N | Mother employed[1] (%) |
| Preschool age | 2459 | 52.0% | 2269 | 51.5% | 2398 | 51.9% |
| Primary school age | 7876 | 76.7% | 7769 | 76.6% | 7608 | 76.6% |
| Secondary school age | 14968 | 79.6% | 14714 | 80.0% | 14417 | 79.7% |

[1] Employed = employed at least once during specified childhood period

The small difference between the maternal paid employment percentages in tables 5.2 and 5.3 (particularly during the preschool period) is due to the increasing likelihood of mothers' being in paid employment in the later parts of the study period. More study records (with study outcomes at ages 16–21) are available for those who were born in the early stages of the study, when maternal paid employment was less likely than in later study waves. For example, a study participant who was four years old in Wave 1 can have six records of study outcomes at ages 16–21 in Waves 13–18 (and will be represented six times in table 5.3), while a participant who was four years old later, for example in Wave 6, can have only one record of study outcomes in Wave 18. In Wave 1 it is more likely that mother was not in paid employment than in Wave 6. Both these participants will, however, be represented only once in table 5.2. Thus the percentage of maternal employment is slightly higher when one uses study individuals as a reporting unit in the summary table (table 5.2).

## 5.3 Covariates

Table 5.4 shows the distribution of further demographic and social variables (gender, maternal marital status, maternal education and household income) in the data sets related to the analysis of self-rated health in the three different periods of childhood. The frequency distribution of these variables is shown in data sets that use study records rather than in those that use study individuals, because these will be the data sets used in regression modelling later on (and these data sets will be used in all following tables unless specifically stated). There were slightly more females than males in all three data sets (around 51–53%). The distribution of study participants by maternal education showed only small differences. While the proportion of mothers with higher education was virtually the same in the study samples related to different age groups (13–14%), the proportion of mothers with no educational qualifications slightly differed, and was

highest in the sample of children with known maternal employment status at secondary-school age. There were about 20% of mothers with no qualification in the data set focusing on the preschool period, while there were more than 30% of such mothers in the data set assessing the secondary-school period. In terms of household income, there were more individuals from households in the bottom two quintiles in the first two periods, while in the third period of childhood the study participants were distributed approximately equally across all five groups. This is because household income quintiles were calculated for all households in each wave, rather than only for those with children used in the analysis (see the household income variable description in section 4.3 for more details). It is most likely that the employment positions (and related salaries) of parents improved as they grew older, and because more women were employed (and thus the household income increased). The distribution of study participants by maternal marital status differed more substantially, with more mothers living without a partner in the data sets related to later periods of childhood. Most of the mothers in all three data sets were married, but the proportion of married mothers decreased from approximately 80% in the preschool period to 75% in the secondary-school period. At the same time, the proportion of mothers living without partners increased from approximately 12% to 18%.

Tables related to the data sets used in the analysis of psychological distress and smoking are shown in Appendix 3. The distribution of demographic and socio-economic characteristics in these data sets is virtually identical to the distribution described for data sets used for the analysis of self-rated health, because there were only minimal differences in the sample sizes related to missing values in the three study outcomes.

**Table 5.4. Distribution of social and demographic characteristics in three periods of childhood in the sample used for analysis of self-rated health**

| | Age of child | | |
|---|---|---|---|
| | **Preschool age** | **Primary school age** | **Secondary school age** |
| *Gender* | | | |
| Men | 1165 (47.4%) | 3864 (49.1%) | 7195 (48.1%) |
| Women | 1294 (52.6%) | 4012 (50.9%) | 7773 (51.9%) |
| *Maternal education* | | | |
| No qualification | 496 (20.2%) | 2106 (26.7%) | 4737 (31.7%) |
| Secondary education | 1604 (65.2%) | 4641 (58.9%) | 7933 (53.0%) |
| Higher education | 325 (13.2%) | 1044 (13.3%) | 2109 (14.1%) |
| *Missing data* | *34 (1.4%)* | *85 (1.1%)* | *189 (1.3%)* |
| *Household income* | | | |
| 1Q (low) | 711 (28.9%) | 1924 (24.4%) | 3008 (20.1%) |
| 2Q | 670 (27.3%) | 1865 (23.7%) | 3103 (20.7%) |
| 3Q | 500 (20.3%) | 1704 (21.6%) | 3149 (21.0%) |
| 4Q | 349 (14.2%) | 1374 (17.5%) | 3080 (20.6%) |
| 5Q (high) | 229 (9.3%) | 1009 (12.8%) | 2596 (17.3%) |
| *Missing data* | - | - | *32 (0.2%)* |
| *Maternal marital status* | | | |
| Married | 1969 (80.1%) | 6181 (78.5%) | 11309 (75.5%) |
| Cohabiting | 194 (7.9%) | 522 (6.6%) | 937 (6.3%) |
| Not living with partner | 296 (12.0%) | 1173 (14.9%) | 2722 (18.2%) |

Between 22% (during the preschool period) and 25% (during the secondary-school period) of mothers reported poor self-rated health, and between almost 40% (during the preschool period) and 45% (during the secondary school period) reported psychological distress. The prevalence of smoking among mothers was relatively stable, as it varied

between 33% and 34% (table 5.5). The number of records shown in table 5.5 is related to the data sets used for the analysis of participants' self-rated health. Similarly to the previous descriptive table, these numbers change slightly for data sets used for the analysis of participants' psychological distress and smoking (not shown in the tables).

**Table 5.5. Descriptive statistics of mother's health and smoking in three periods of childhood**

| Period of childhood | Mother's health and smoking | | | | | |
|---|---|---|---|---|---|---|
| | Self-rated health | | Psychological distress | | Smoking | |
| | N | Poor (%) | N | Distress (%) | N | Yes (%) |
| Preschool age | 2459 | 22.3% | 2409 | 39.6% | 2459 | 33.4% |
| Primary school age | 7569 | 22.5% | 7794 | 41.4% | 7556 | 34.5% |
| Secondary school age | 14631 | 25.3% | 14777 | 44.8% | 14533 | 34.0% |

As already described in more detail in section 4.3.5, data about childcare arrangements were available for children up to the age of 12. The question related to childcare arrangements asked: "Which of the following best describes the way you arrange for your children aged 12 or under to be looked after while you are at work?" Hence the answers gave additional information only for those mothers who were in paid employment at some point of that specific period of participants' childhood. Table 5.6 shows the numerical and percentage distribution of the answers to the question about childcare arrangements given most frequently by the families of study participants with existing self-rated health data at ages 16–21. Each respondent in paid employment who answered the question about childcare arrangements could choose up to three possible answers, and this is why the overall percentage is greater than 100. In the first period of childhood, the most common answers were "my spouse or partner looks after them" and "a relative looks after them" (51.5% and 46.0%, respectively). During the primary-

school period, the most frequent response was that mothers worked only when the children were at school (65%), followed again by a spouse/partner or other relative taking care of the child (51.7% and 48.5%). In 12.5% of cases, the answer was that children looked after themselves until the mother got home from work. A very similar proportion of children were looked after by a childminder in both periods (17.8% at preschool age and 16.5% at primary-school age).

**Table 5.6. Frequency of different types of childcare arrangements of mothers in paid employment in two periods of childhood of those with available data on self-rated health at young adulthood**

|  | Preschool age (N=1279)[1] | | Primary school age (N=6043)[1] | |
| --- | --- | --- | --- | --- |
|  | N (%) | | N (%) | |
| I work only while children are at school | 260 | 20.3% | 3929 | 65.0% |
| They look after themselves until I get home | 6 | 0.5% | 756 | 12.5% |
| I work from home | 155 | 12.1% | 660 | 10.9% |
| My spouse/partner looks after them | 658 | 51.5% | 3123 | 51.7% |
| A nanny or mother's help looks after them at home | 70 | 5.5% | 370 | 6.1% |
| They go to a work-place nursery | 45 | 3.5% | 108 | 1.8% |
| They go to a day nursery | 219 | 17.1% | 300 | 5.0% |
| They go to a child minder | 227 | 17.8% | 994 | 16.5% |
| A relative looks after them | 588 | 46.0% | 2928 | 48.5% |
| A friend or neighbour looks after them | 198 | 15.5% | 1710 | 28.3% |
| Other | 81 | 6.3% | 838 | 13.9% |

[1] those with valid data on self-rated health at young adulthood and maternal employment at specified period of childhood

Because the number of individuals available for analysis is very similar for the other two outcomes, the frequency distribution of answers by those with valid data on maternal employment and psychological distress, and on maternal employment and smoking, is not shown in additional tables.

Individuals whose mothers were not employed were kept as a separate category. The childcare arrangements of employed mothers were then grouped into four categories (see section 4.3.5 and table 5.7). This grouping was chosen for two reasons. First, the grouping focused on whether the mother uses formal or informal arrangements. Those whose mothers were employed were divided into four groups: those whose childcare was entirely covered by the child's mother and her partner ("parental care"); those whose childcare was covered by their mother, partner or formal care arrangements (either a nursery or a formal childminder); those whose childcare was covered by their mother, partner or other individuals, such as other family members or friends (informal care arrangements; there is a detailed description of childcare arrangement variables in section 4.3.5); and those whose childcare was covered using a combination of all kinds of help (oneself, one's partner, other individuals and formal care). Second, it was not possible to keep all of the available answers separate, because of small number of responses in some categories made the use of all original responses as individual categories unusable for statistical analysis.

Table 5.7 shows that in both periods the most common childcare arrangement was care shared between the mother, her partner and some other individuals (39% and 50% of childcare arrangements among employed mothers during the preschool and primary-school periods respectively).

**Table 5.7. Child care arrangements (combined variables) of those with self-rated health data at young adulthood**

| | | Preschool period N=2459 | | | Primary school period N=7876 | | |
|---|---|---|---|---|---|---|---|
| Mother not employed | | 1180 | 48.0% | - | 1833 | 23.3% | - |
| Mother employed | Parental only (A) | 380 | 15.5% | 29.7%[1] | 1826 | 23.2% | 30.2%[1] |
| | Parental and/or formal care (B) | 162 | 6.6% | 12.7%[1] | 221 | 2.8% | 3.7%[1] |
| | Parental and/or informal care (C) | 500 | 20.3% | 39.1%[1] | 3016 | 38.3% | 49.9%[1] |
| | A, B and C | 237 | 9.6% | 18.5%[1] | 980 | 12.4% | 16.2%[1] |

[1] % of childcare arrangement among employed mothers

As described in more detail in section 4.3.5, the mother's job satisfaction is based on her answer to the question: "All things considered, how satisfied or dissatisfied are you with your present job overall using the 1–7 scale?" with 1 meaning "not satisfied at all", 4 meaning "neither dissatisfied or satisfied", and 7 meaning "completely satisfied". Valid measures of job satisfaction within each childhood period were used (data points when the mother did not work or did not answer the job satisfaction question were ignored), and a mean score was calculated from valid answers.

Among 1,279 records for working mothers with preschool-age children, maternal job satisfaction was not known for 99 of them (7.7%). During the primary-school period, maternal job satisfaction was not known for 457 of 6,391 records (7.2%), and during the secondary-school period it was not known for 851 of 12,594 records (6.8%). Table 5.8 shows the distribution of maternal job satisfaction scores in all three periods of childhood.

**Table 5.8. Maternal job satisfaction at 3 periods of childhood among those who answered the question**

|  | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
|  | N (%) | N (%) | N (%) |
| 1-2 | 19 (1.6%) | 76 (1.3%) | 137 (1.2%) |
| 2.1-3 | 14 (1.2%) | 106 (1.8%) | 206 (1.8%) |
| 3.1-4 | 60 (5.1%) | 283 (4.8%) | 697 (5.9%) |
| 4.1-5 | 162 (13.7%) | 916 (15.4%) | 1839 (15.7%) |
| 5.1-6 | 462 (39.2%) | 2557 (43.1%) | 5469 (46.6%) |
| 6.1-7 | 463 (39.2%) | 1996 (33.6%) | 3395 (28.9%) |
| TOTAL | 1180 | 5934 | 11743 |
| Mean (SD) | 5.91 (1.05) | 5.72 (1.02) | 5.63 (1.01) |

In all three periods of childhood, mean maternal job satisfaction scores were between 5.6 and 6, with more than 75% of job satisfaction scores above 5. There was only minimal change in the distribution and mean scores across the three periods.

The cut point used to create the binary variable was 4 (those scoring 0–4 were categorised as "not satisfied with their job", and those scoring 4.1–7.0 as "satisfied with their job"). Table 5.9 shows the distribution of the binary variable of maternal job satisfaction in all three periods of childhood.

**Table 5.9. Binary job satisfaction in 3 periods of childhood**

|  | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
|  | N (%) | N (%) | N (%) |
| 1-4 ("not satisfied") | 93 (7.9%) | 465 (7.8%) | 1040 (8.9%) |
| 4.1-7 ("satisfied") | 1087 (92.1%) | 5469 (92.2%) | 10703 (91.1%) |
| TOTAL | 1180 | 5934 | 11743 |

## 5.4 The crude effect of maternal employment on self-rated health, psychological well-being and smoking

This section shows the unadjusted differences in the three study outcomes for study participants whose mothers were employed and those whose mothers were not employed during the three periods of their childhood. The aim of this section is to present the results of testing Hypothesis 1 ("Young adults aged 16–21 whose mothers worked during their childhood have worse health and are more likely to smoke than those with non-working mothers").

The unadjusted associations between paid maternal employment status and self-rated health are presented in table 5.10. In each data set – unexpectedly, under Hypothesis 1 – those young adults whose mothers previously worked in paid employment during individual childhood periods were less likely to report poor self-rated health. The size of the crude effect of paid maternal employment on poor self-rated health did not differ substantially between the periods, but seemed to be smallest when children were at primary-school age (odds ratio 0.76). The odds of poor self-rated health among those whose mothers were employed when children were preschool age was approximately 35% lower than among those whose mothers were not employed during the preschool

period. The same was true for those whose mothers worked when they were secondary school age.

The unadjusted association between paid maternal employment and psychological distress is presented in table 5.11. There was no relationship between psychological distress and maternal employment in the preschool or secondary-school periods. A significant relationship between maternal employment at primary school period and psychological distress in young adulthood was seen. Those whose mothers were working while they were at primary-school age were 43% more likely to report psychological distress in young adulthood than those whose mother was not working during the primary-school period.

**Table 5.10. Crude (unadjusted) association between poor self-rated health at young adulthood and paid maternal employment status in three periods of childhood**

| | N total | Self-rated health | | |
| --- | --- | --- | --- | --- |
| | | Poor | OR (95% CI)[1] | P value |
| **Mother employed at preschool age of child** | | | | |
| No | 1180 | 19.2% | 1 | |
| Yes | 1279 | 14.1% | 0.65 (0.43-0.97) | 0.04 |
| **Mother employed at primary school age of child** | | | | |
| No | 1833 | 20.9% | 1 | |
| Yes | 6043 | 18.0% | 0.76 (0.58-1.00) | 0.05 |
| **Mother employed at secondary school age of child** | | | | |
| No | 3053 | 22.9% | 1 | |
| Yes | 11915 | 18.1% | 0.66 (0.54-0.81) | <0.001 |

[1] OR (95%CI) from multilevel logistic model

**Table 5.11. Crude (unadjusted) association between psychological distress at young adulthood and paid maternal employment in three periods of childhood**

| | N total | Psychological distress | | |
| --- | --- | --- | --- | --- |
| | | Distress | OR (95% CI) [1] | P value |
| **Mother employed at preschool age of child** | | | | |
| No | 1101 | 24.3% | 1 | |
| Yes | 1168 | 25.2% | 1.08 (0.76-1.54) | 0.67 |
| **Mother employed at primary school age of child** | | | | |
| No | 1815 | 21.0% | 1 | |
| Yes | 5954 | 25.6% | 1.43 (1.13-1.81) | 0.003 |
| **Mother employed at secondary school age of child** | | | | |
| No | 2949 | 23.7% | 1 | |
| Yes | 11765 | 24.3% | 1.07 (0.90-1.28) | 0.45 |

[1] OR (95%CI) from multilevel logistic model

**Table 5.12. Crude (unadjusted) association between smoking at young adulthood and paid maternal employment in three periods of childhood**

| | N total | Smoking | | |
| --- | --- | --- | --- | --- |
| | | Smokes | OR (95% CI) [1] | P value |
| **Mother employed at preschool age of child** | | | | |
| No | 1153 | 22.8% | 1 | |
| Yes | 1245 | 21.8% | 0.66 (0.29-1.49) | 0.32 |
| **Mother employed at primary school age of child** | | | | |
| No | 1781 | 25.6% | 1 | |
| Yes | 5827 | 24.1% | 0.78 (0.44-1.37) | 0.39 |
| **Mother employed at secondary school age of child** | | | | |
| No | 2934 | 30.0% | 1 | |
| Yes | 11483 | 24.7% | 0.39 (0.25-0.61) | <0.001 |

[1] OR (95%CI) from multilevel logistic model

Young adults whose mothers worked during each specific period of childhood were less likely to be smokers. The negative association between maternal employment in childhood and smoking in young adulthood could be seen in all three periods of childhood, but was not statistically significant in first two periods (table 5.12). The

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effect was the strongest for maternal employment during the secondary-school period, when the odds of smoking by those whose mothers were employed was reduced by 60% compared to those whose mothers were not employed ($p < 0.001$). It should be pointed that relatively small differences in the percentage of smokers in table 5.12 are slightly misleading because they do not take into account repeated nature of the data. Only odds ratios and confidence intervals from regression models account for the repeated nature of the data, and these results seem more extreme than the differences in percentages would suggest.

In summary, in unadjusted analysis the participants whose mothers were employed were less likely to report poor subjective health and being a smoker. These findings do not support the original hypothesis, but it is too early to draw any firm conclusions because no other variables have been accounted for. The direction of the association between maternal employment and psychological distress was in the opposite direction. Those whose mothers were employed during the primary-school period were more likely to report psychological distress, which is in line with the original hypothesis; maternal employment in the other two periods of childhood was not related to psychological distress. It is too early to speculate on these results and on reasons why results for psychological distress are in different direction to the other two outcomes as these may be genuine difference as well as a consequence of confounding by other covariates.

# 6 The role of individual covariates in the association between paid maternal employment and the study outcomes

In Chapter 6 the individual roles of a number of covariates will be investigated. This chapter is divided into five sections. Section 6.1 will focus on the role of available socio-economic and demographic variables (maternal education, household income and maternal marital status); section 6.2 will concentrate on the role of maternal health (both self-reported health and psychological distress) and maternal smoking habits; section 6.3 will focus on the role of childcare arrangements; and section 6.4 will focus on the role of job satisfaction. Section 6.5 will then present an analysis using all of the covariates identified as influential for the association between maternal employment and self-rated health, psychological distress and smoking, combined into a final model for each outcome in each period of childhood.

## *6.1 The role of maternal education, household income and maternal marital status*

This section investigates the role of three covariates: maternal education, maternal marital status and household income (their definition and construction having been defined in detail in section 4.3) – in the association between paid maternal employment and indicators of young adult health. In line with the conceptual model described in section 3.3, these variables are considered as potential confounders (section 6.1.1) as well as effect-modifiers (section 6.1.2). Considering them as effect-modifiers will allow me to test Hypotheses 4, 5 and 6, and using them as possible confounders will allow me

to compare my results with previously published findings. The aim of this chapter is to evaluate, at least partly, Objectives 1 and 4, and not only to present results related to Hypotheses 4, 5 and 6 but also to extend the evidence related to Hypothesis 1 by comparing the adjusted results from this chapter with the crude results from the previous chapter. Hypothesis 1 stated that the crude effects of maternal employment presented in Chapter 5 might be explained in adjusted analysis by socio-economic and demographic variables. It was hypothesised that, after considering variables such as education or maternal marital status, the self-rated health and psychological distress of those whose mother had worked during their childhood would be worse, and also that these participants would be more likely to smoke. Hypotheses 4, 5 and 6 in section 3.2 proposed that the negative effect of maternal employment would increase in young adults whose mothers had not been married during some period(s) of their childhood; the negative effect of maternal employment would be reduced if the mother had a higher socio-economic position and/or was better educated.

In addition to the three variables included in the conceptual model, the effect of maternal employment on study outcomes will be further adjusted for gender (and all later models will also be adjusted for gender), as gender has been found in the past to be related to all three study outcomes.[150;261] However, it should not be related to maternal employment, and thus should not be an important confounding factor.

### 6.1.1 Maternal education, marital status and household income as potential confounders

In this section, the potential confounding role of the three socio-economic and demographic variables is going to be assessed. Figure 6.1 shows the parts of the conceptual model being tested in this section.

**Figure 6.1. Relationships from conceptual model tested in section 6.1.1**
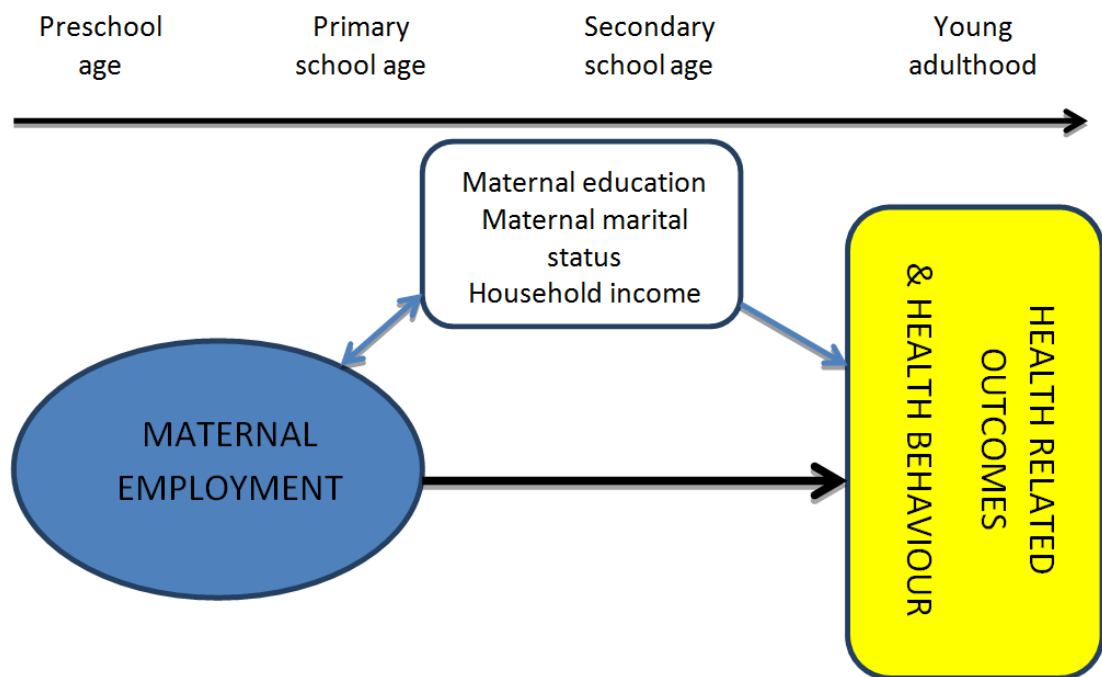


### 6.1.1.1 The crude effects of gender, maternal education, marital status and household income on the study outcomes

The effects of gender, maternal education, maternal marital status and household income on self-rated health, psychological distress and smoking were assessed before their potential role in the association between maternal employment and study outcomes was evaluated. Tables 6.1, 6.2 and 6.3 show the unadjusted associations between gender, maternal education, household income, maternal marital status and self-rated health, psychological distress and smoking.

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Poor self-rated health (table 6.1) was reported by more young women in all three data sets. Young adults whose mothers had a lower education had higher odds of poor self-rated health than those with more educated mothers. There was stepwise decrease in the odds of poor self-rated health associated with increasing maternal education (the p-value for the trend in odds ratios was 0.06 in the preschool period, and <0.01 in the later two periods of childhood). There was also a stepwise decrease in the odds of poor self-rated health related to increasing monthly household income (the p-value for the trend in odds ratios was <0.05 for all three data sets). Finally, poor self-rated health was reported more by young adults whose mothers had cohabited or lived without a partner compared to those whose mothers had been married. Young adults with unmarried mothers during the preschool period were 2.5 times more likely to report poor self-rated health. This increase in the odds of poor self-rated health was somewhat reduced at primary and secondary-school ages, but was still above 1.5.

**Table 6.1. The unadjusted association between social and demographic covariates in three periods of childhood and poor self-rated health of young adults**

| | Preschool period | | | Primary school period | | | Secondary school period | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | % poor | OR (95% CI) | N | % poor | OR (95% CI) | N | % poor | OR (95% CI) |
| *Gender* | | | | | | | | | |
| Men | 1165 | 14.1 | 1 (ref) | 3864 | 15.8 | 1 (ref) | 7195 | 16.5 | 1 (ref) |
| Women | 1294 | 18.9 | 1.63 (1.08-2.46) | 4012 | 21.5 | 1.72 (1.36-2.17) | 7773 | 21.4 | 1.57 (1.33-1.86) |
| *Maternal education* | | | | | | | | | |
| No qualification | 496 | 20.2 | 1 (ref) | 2106 | 22.1 | 1 (ref) | 4737 | 21.4 | 1 (ref) |
| Secondary education | 1604 | 15.6 | 0.60 (0.36-0.99) | 4641 | 17.5 | 0.64 (0.49-0.84) | 7933 | 18.5 | 0.76 (0.63-0.92) |
| Higher education | 325 | 15.1 | 0.54 (0.26-1.11) | 1044 | 17.4 | 0.57 (0.39-0.85) | 2109 | 16.5 | 0.59 (0.45-0.78) |
| *P for linear trend* | | | *0.06* | | | *0.001* | | | *<0.001* |
| *Household monthly income* | | | | | | | | | |
| 1st Q (low) | 711 | 19.8 | 1 (ref) | 1924 | 23.0 | 1 (ref) | 3008 | 22.7 | 1 (ref) |
| 2nd Q | 670 | 16.6 | 0.75 (0.44-1.27) | 1865 | 18.9 | 0.73 (0.53-1.02) | 3103 | 20.2 | 0.81 (0.63-1.04) |
| 3rd Q | 500 | 14.0 | 0.64 (0.35-1.14) | 1704 | 18.1 | 0.69 (0.49-0.96) | 3149 | 19.2 | 0.71 (0.55-0.91) |
| 4th Q | 349 | 13.2 | 0.45 (0.23-0.89) | 1374 | 16.0 | 0.53 (0.37-0.76) | 3080 | 16.5 | 0.54 (0.42-0.70) |
| 5th Q (high) | 229 | 17.5 | 0.62 (0.29-1.34) | 1009 | 14.7 | 0.44 (0.30-0.67) | 2596 | 16.4 | 0.54 (0.41-0.71) |
| *P for linear trend* | | | *0.03* | | | *<0.001* | | | *<0.001* |
| *Maternal marital status* | | | | | | | | | |
| Married | 1969 | 14.6 | 1 (ref) | 6181 | 17.3 | 1 (ref) | 11309 | 17.8 | 1 (ref) |
| Cohabiting | 194 | 24.2 | 2.51 (1.29-4.89) | 522 | 24.7 | 1.91 (1.24-2.94) | 937 | 22.6 | 1.58 (1.15-2.19) |
| Not living with partner | 296 | 25.0 | 2.75 (1.51-5.00) | 1173 | 23.4 | 1.76 (1.29-2.41) | 2722 | 23.1 | 1.67 (1.35-2.06) |

Psychological distress (table 6.2) was related to gender, as women were approximately three times more likely to report psychological distress than males in all three periods (ORs 3.31, 3.17 and 2.78 respectively). Psychological distress, somewhat surprisingly,[276] was more likely to be reported by those with mothers with higher education than by those with less educated mothers, but similarly to the effects of household income and maternal marital status reported below, the differences between social groups were not substantial. The only statistically significantly increase in the odds of psychological distress among those with mothers with higher education compared with those with mothers with no qualification was at ages 5–11 (OR 1.42). The differences in the likelihood of psychological distress among participants from households with different levels of income were small and not consistent across the three data sets. Young adults whose mothers had been married during their childhood were slightly less likely to report psychological distress, but the differences between those with married and those with unmarried mothers were not statistically significant in the first two periods of childhood. Those whose mothers had not been living with a partner or had been cohabiting during the secondary-school period were significantly more likely to report psychological distress in young adulthood than those whose mothers had been married.

**Table 6.2. The unadjusted association between social and demographic covariates in three periods of childhood and psychological distress of young adults**

| | Preschool period | | | Primary school period | | | Secondary school period | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | % distress | OR (95% CI) | N | % distress | OR (95% CI) | N | % distress | OR (95% CI) |
| **Gender** | | | | | | | | | |
| Men | 1050 | 17.0 | 1 (ref) | 3783 | 16.8 | 1 (ref) | 7024 | 17.1 | 1 (ref) |
| Women | 1219 | 31.5 | 3.31 (2.30-4.77) | 3986 | 31.9 | 3.17 (2.61-3.86) | 7690 | 30.7 | 2.78 (2.41-3.21) |
| **Maternal education** | | | | | | | | | |
| No qualification | 447 | 26.0 | 1 (ref) | 2108 | 24.7 | 1 (ref) | 4665 | 24.4 | 1 (ref) |
| Secondary education | 1486 | 23.3 | 0.81 (0.52-1.27) | 4546 | 23.6 | 0.92 (0.73-1.15) | 7825 | 23.9 | 0.96 (0.82-1.13) |
| Higher education | 302 | 30.1 | 1.33 (0.72-2.43) | 1026 | 28.8 | 1.42 (1.03-1.96) | 2060 | 25.3 | 1.12 (0.89-1.41) |
| *P for linear trend* | 0.51 | | | 0.11 | | | 0.52 | | |
| **Household monthly income** | | | | | | | | | |
| 1st Q (low) | 658 | 24.6 | 1 (ref) | 1894 | 26.4 | 1 (ref) | 2922 | 25.1 | 1 (ref) |
| 2nd Q | 635 | 25.7 | 1.17 (0.73-1.86) | 1841 | 24.8 | 0.92 (0.70-1.22) | 3066 | 24.0 | 0.90 (0.72-1.12) |
| 3rd Q | 446 | 19.3 | 0.77 (0.46-1.30) | 1664 | 24.8 | 0.95 (0.71-1.26) | 3098 | 24.3 | 0.94 (0.75-1.17) |
| 4th Q | 318 | 26.1 | 1.10 (0.63-1.93) | 1347 | 21.8 | 0.75 (0.55-1.03) | 3025 | 24.1 | 0.93 (0.74-1.16) |
| 5th Q (high) | 212 | 32.1 | 1.68 (0.89-3.16) | 1023 | 23.6 | 0.88 (0.63-1.23) | 2598 | 23.3 | 0.90 (0.71-1.14) |
| *P for linear trend* | 0.36 | | | 0.18 | | | 0.51 | | |
| **Maternal marital status** | | | | | | | | | |
| Married | 1820 | 24.1 | 1 (ref) | 6110 | 24.1 | 1 (ref) | 11152 | 23.2 | 1 (ref) |
| Cohabiting | 185 | 28.7 | 1.22 (0.66-2.24) | 522 | 25.5 | 1.13 (0.78-1.64) | 928 | 28.2 | 1.39 (1.05-1.85) |
| Not living with partner | 264 | 26.9 | 1.08 (0.62-1.90) | 1137 | 26.4 | 1.14 (0.86-1.49) | 2634 | 27.1 | 1.34 (1.11-1.61) |

Young adults whose mothers had a lower-level education, who were from families with a lower income, and whose mothers had been living without a partner were significantly more likely to be smokers (table 6.3). As the size of the odds ratios suggests, the relative differences in the odds of smoking between different social and demographic groups were very large. However, there were no gender differences in smoking, as both males and females were almost equally likely to be smokers.

**Table 6.3. The unadjusted association between social and demographic covariates in three periods of childhood and smoking of young adults**

| | Preschool period | | | Primary school period | | | Secondary school period | | |
|---|---|---|---|---|---|---|---|---|---|
| | N | % smoke | OR (95% CI) | N | % smoke | OR (95% CI) | N | % smoke | OR (95% CI) |
| *Gender* | | | | | | | | | |
| Men | 1119 | 22.6 | 1 (ref) | 3693 | 24.5 | 1 (ref) | 6870 | 25.9 | 1 (ref) |
| Women | 1279 | 22.0 | 0.85 (0.38-1.92) | 3915 | 24.3 | 0.90 (0.56-1.45) | 7547 | 25.6 | 0.86 (0.61-1.22) |
| *Maternal education* | | | | | | | | | |
| No qualification | 477 | 26.8 | 1 (ref) | 2028 | 32.5 | 1 (ref) | 4529 | 32.8 | 1 (ref) |
| Secondary education | 1571 | 23.2 | 0.57 (0.20-1.59) | 4493 | 23.3 | 0.22 (0.12-0.40) | 7680 | 24.5 | 0.25 (0.17-0.37) |
| Higher education | 316 | 13.0 | 0.10 (0.02-0.46) | 1006 | 13.6 | 0.04 (0.02-0.09) | 2027 | 15.3 | 0.05 (0.03-0.09) |
| *P for linear trend* | 0.004 | | | <0.001 | | | <0.001 | | |
| *Household monthly income* | | | | | | | | | |
| 1st Q (low) | 691 | 31.8 | 1 (ref) | 1866 | 31.4 | 1 (ref) | 2892 | 34.3 | 1 (ref) |
| 2nd Q | 658 | 21.3 | 0.13 (0.04-0.49) | 1799 | 26.1 | 0.41 (0.20-0.83) | 2996 | 27.5 | 0.42 (0.24-0.74) |
| 3rd Q | 458 | 16.9 | 0.07 (0.02-0.27) | 1635 | 20.8 | 0.17 (0.08-0.36) | 3016 | 25.0 | 0.20 (0.12-0.35) |
| 4th Q | 341 | 15.8 | 0.05 (0.01-0.24) | 1325 | 21.0 | 0.15 (0.07-0.33) | 2968 | 20.6 | 0.11 (0.06-0.19) |
| 5th Q (high) | 224 | 17.0 | 0.05 (0.01-0.30) | 983 | 18.6 | 0.13 (0.05-0.29) | 2515 | 20.9 | 0.10 (0.06-0.19) |
| *P for linear trend* | <0.001 | | | <0.001 | | | <0.001 | | |
| *Maternal marital status* | | | | | | | | | |
| Married | 1923 | 19.3 | 1 (ref) | 5968 | 21.7 | 1 (ref) | 10889 | 22.3 | 1 (ref) |
| Cohabiting | 193 | 21.8 | 1.25 (0.32-4.82) | 514 | 30.2 | 3.79 (1.47-9.75) | 912 | 35.5 | 9.16 (4.29-19.60) |
| Not living with partner | 282 | 42.6 | 25.89 (5.13-130.5) | 1126 | 36.2 | 9.43 (4.52-19.65) | 2616 | 36.5 | 9.46 (5.82-15.38) |

The magnitude of the association and the frequent statistical significance of the association between the social and demographic variables used in this section and the study outcomes suggest that these variables might play an important role in the relationship between maternal employment and the three study outcomes. This role will be investigated in the next subsections.

### 6.1.1.2 The effect of paid maternal employment on young adult health adjusted for maternal education, household income and maternal marital status

The adjusted odds ratios for study participants whose mothers were employed compared to those whose mothers were not employed during the three periods of their childhood are presented in tables 6.4, 6.5 and 6.6, taking gender, maternal education, monthly household income and maternal marital status into account as potential confounding factors. The results are shown as adjusted for each variable separately, and in the final stage as adjusted for all three social covariates together. In addition to assessing the role of these three variables, all results are adjusted for gender. The evaluation of the association between self-rated health, psychological distress, smoking and paid maternal employment in the adjusted analysis found little change in the relationships (or lack of relationship in some cases) shown in the crude, unadjusted analysis.

The unadjusted analysis found that young adults whose mothers had been employed during specific periods of their childhood were less likely to self-report poor health, and this association could still be seen in the adjusted analysis, although it was weaker (table 6.4). The odds ratios reduced from 0.65 to 0.70 for the preschool period, from 0.76 to 0.94 for the primary-school period, and from 0.66 to 0.80 for the secondary-school period. Only the association for the secondary-school period remained borderline statistically significant. The results presented in table 6.4 suggest that the roles of

maternal education, household income and maternal marital status might be stronger in the two later periods, as the crude effect of maternal employment reduced more substantially in these two periods. Furthermore, the analysis of all three time periods suggested that household income reduced the crude effects of maternal employment the most: the reduction in the last model (the bottom row) using all of the covariates at once was almost identical to the reduction in the model using household income alone (the third row of results from the top).

**Table 6.4. The association between paid maternal employment and poor self-rated health in adjusted analysis**

|  | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
|  | OR and 95% CI | | |
| **Unadjusted** | | | |
| Mother employed | 0.65 (0.43-0.97) | 0.76 (0.58-1.00) | 0.66 (0.54-0.81) |
| **Adjusted for gender and education** | | | |
| Mother employed | 0.65 (0.43-0.98) | 0.83 (0.63-1.09) | 0.71 (0.58-0.88) |
| **Adjusted for gender and household income** | | | |
| Mother employed | 0.68 (0.45-1.04) | 0.90 (0.68-1.20) | 0.78 (0.63-0.97) |
| **Adjusted for gender and marital status** | | | |
| Mother employed | 0.67 (0.44-1.00) | 0.82 (0.62-1.07) | 0.71 (0.58-0.87) |
| **Adjusted for gender and education, marital status and household income** | | | |
| Mother employed | 0.70 (0.46-1.07) | 0.94 (0.71-1.26) | 0.80 (0.64-0.99) |

Mother not employed is a reference category in all analyses

Unadjusted associations between psychological distress and paid maternal employment were assessed in Chapter 5. As shown there, only those whose mothers had been employed during the primary-school period reported a higher likelihood of psychological distress, while maternal employment in the other two periods of

childhood was not related to this outcome. The adjustment for gender, maternal marital status, maternal education and household income did not substantially change the association between paid maternal employment and psychological distress (table 6.5), although it seems that the adjustment made the associations slightly greater. While there is virtually no difference between the odds of psychological distress among those whose mothers had been employed and those whose mothers had not been employed during the preschool or secondary-school periods, the odds ratio comparing those whose mothers had been employed during the primary-school period with those whose mothers had not been employed is 1.56 in the fully adjusted model (compared to 1.43 in the unadjusted analysis), suggesting worse psychological well-being in young adulthood among those whose mothers had been employed during the primary-school period.

**Table 6.5. The association between paid maternal employment and psychological distress in adjusted analysis**

| | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
| | OR and 95% CI | | |
| **Unadjusted** | | | |
| Mother employed | 1.08 (0.76-1.54) | 1.43 (1.13-1.81) | 1.07 (0.90-1.28) |
| **Adjusted for gender and education** | | | |
| Mother employed | 0.99 (0.70-1.40) | 1.41 (1.12-1.79) | 1.10 (0.92-1.32) |
| **Adjusted for gender and household income** | | | |
| Mother employed | 0.99 (0.70-1.41) | 1.57 (1.24-2.00) | 1.15 (0.96-1.39) |
| **Adjusted for gender and marital status** | | | |
| Mother employed | 1.02 (0.72-1.44) | 1.46 (1.16-1.83) | 1.15 (0.97-1.37) |
| **Adjusted for gender and education, marital status and household income** | | | |
| Mother employed | 1.00 (0.70-1.43) | 1.56 (1.22-1.99) | 1.13 (0.94-1.36) |

Mother not employed is a reference category in all analyses

In contrast to the two previous study outcomes, the effect of paid maternal employment on smoking substantially changed after adjustment for socio-economic characteristics. While the reduced likelihood of smoking among those whose mothers had been employed during the secondary-school period almost disappeared (an odds ratio of 0.90 in the fully adjusted model, compared to 0.39 in the unadjusted model), the direction of the relationship between paid maternal employment in the earlier two periods and smoking in young adulthood reversed: the reduced likelihood of smoking amongst children of employed mothers was explained by their relatively advantaged socioeconomic circumstances. This increased risk in the adjusted relationship only reached statistical significance for those whose mothers had worked during the primary-school period. The adjustment for household income seemed to be particularly influential, but the other two variables – maternal education and maternal marital status – also played the role of important confounding factors. After full adjustment, young adults whose mothers had worked during the primary-school period were almost twice as likely to smoke as those whose mothers had not been in paid employment during that period of their childhood.

**Table 6.6. The association between paid maternal employment and smoking in adjusted analysis**

| | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
| | OR and 95% CI | | |
| **Unadjusted** | | | |
| Mother employed | 0.66 (0.29-1.49) | 0.78 (0.44-1.37) | 0.39 (0.25-0.61) |
| **Adjusted for gender and education** | | | |
| Mother employed | 0.71 (0.31-1.62) | 1.19 (0.66-2.15) | 0.59 (0.38-0.94) |
| **Adjusted for gender and household income** | | | |
| Mother employed | 1.26 (0.47-3.34) | 1.47 (0.80-2.71) | 0.73 (0.46-1.17) |
| **Adjusted for gender and marital status** | | | |
| Mother employed | 0.86 (0.38-1.93) | 1.02 (0.57-1.81) | 0.48 (0.31-0.75) |
| **Adjusted for gender and education, marital status and household income** | | | |
| Mother employed | 1.17 (0.50-2.73) | 1.91 (1.03-3.57) | 0.90 (0.56-1.46) |

Mother not employed is a reference category in all analyses

To sum up the analysis so far, these results were at least partially expected under Hypothesis 1 as stated in section 3.2 (Young adults aged 16–21 whose mothers worked during their childhood have worse health and are more likely to smoke than those with non-working mothers. The crude (unadjusted) association might show an inverse relationship, but any such inverse relationship will be later explained in adjusted analysis by socio-economic and demographic variables such as education, household income and marital status, although some results, mentioned in the next paragraph, are not consistent with this hypothesis. On the other hand, Hypothesis 3 ("The younger the child at the time the mother worked, the greater the negative effect of maternal employment in childhood") has not been supported by the results so far, because the findings do not seem to be the most extreme for the relationship between maternal employment in the preschool period and the three study outcomes.

The crude analysis suggested some weak evidence for a decrease in the odds of poor self-rated health and of being a smoker among those whose mothers had been employed. After adjustment for socio-economic and demographic variables in this section, the association with poor self-rated health partly decreased, but it still had the same direction. These findings do not support Hypothesis 1 of this project, and are in contrast to the majority of previous research. The relationship between paid maternal employment during the secondary-school period and poor self-rated health in young adulthood was statistically significant even in the fully adjusted model. The magnitude of the effect of maternal employment during the preschool period on poor self-rated health in young adulthood was greater, but was not significant (probably because of the smaller sample size). While the results for self-rated health do not entirely support Hypothesis 1, the adjusted results for smoking and psychological distress do so in part. The unadjusted relationship between maternal employment and smoking was almost entirely explained in fully adjusted analysis (for the secondary-school period) or even reversed (for the preschool and primary-school periods) when household income, maternal education and maternal marital status were adjusted for. Thus the findings for smoking no longer contradict the original hypothesis, but the evidence of association is not very strong. Household income seemed to be the most important variable affecting the relationship between paid maternal employment and these two outcomes. A relationship between psychological distress and maternal employment during the preschool and secondary-school periods was not found in the crude analysis, as the likelihood of psychological distress among those with working mothers and those with mothers who did not work was almost the same, and these differences did not substantially change in the adjusted models. However, psychological distress was significantly more likely among study participants whose mothers had worked during

the primary-school period than among those whose mothers had not worked in the fully adjusted model, again at least partially supporting Hypothesis 1. The results presented so far are not consistent in terms of the direction and size of the effect, and as such do not support Hypothesis 3 that proposes that maternal employment has the most negative effect during the early period of childhood. Maternal employment during the preschool period seems to be protective against poor self-rated health; there is no association between maternal employment and smoking (odds ratio 1.00), and only limited increases in psychological distress, with a much smaller magnitude of effect than for the primary-school period.

The analysis reported so far has at least partly tested Hypotheses 1 and 3. Further analysis will be needed to try to explain these inconclusive findings. While these results do not suggest a strong (or consistent) effect of maternal employment on the health outcomes of young adults, more complex relationships will be tested in the further steps of the analysis described in the next sections of this chapter and in Chapter 7.

In next section, the original hypotheses related to this project, namely hypotheses related to interactions between maternal employment and other socio-economic and demographic measures (Hypotheses 4, 5 and 6), will be evaluated.

### 6.1.2 Maternal education, marital status and household income as potential effect-modifiers

In this part of Chapter 6, the potential modifying roles of maternal education, household income and maternal marital status will be assessed according to Hypotheses 4, 5 and 6. Figure 6.2 illustrates the part of the conceptual model tested in section 6.1.2. Tables 6.7–6.15 show the associations between paid maternal employment and the three study outcomes stratified by the three socio-economic variables, and formal tests of the statistical interactions are also presented.

**Figure 6.2. Relationships from conceptual model tested in chapter 6.1.2**
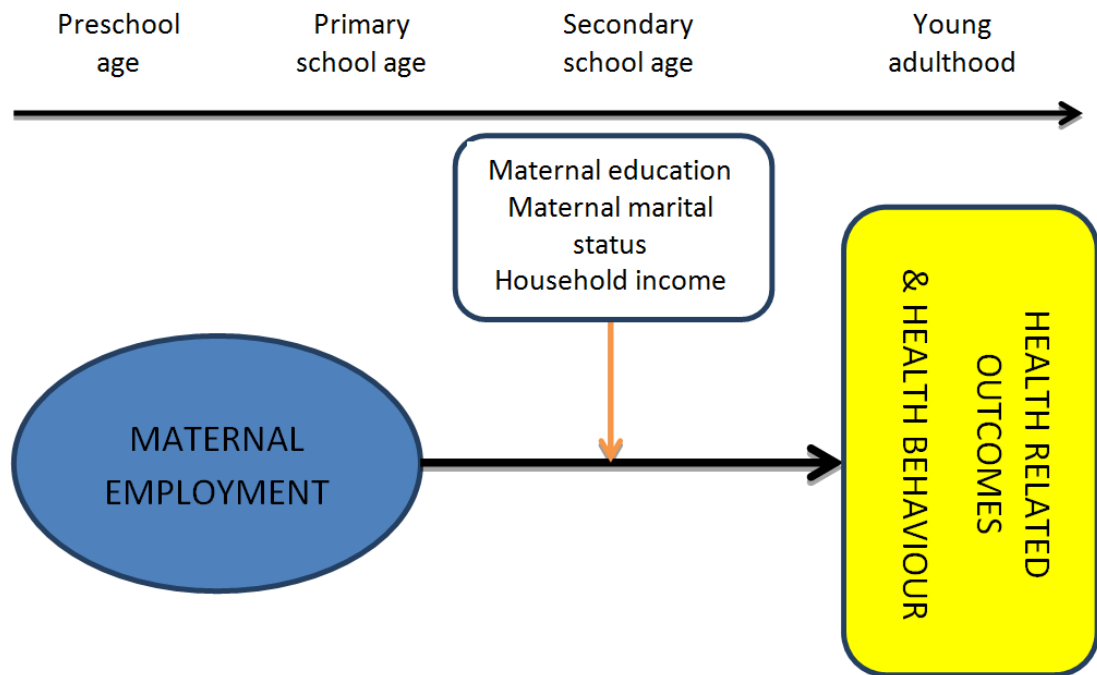


*Maternal education*

The effect of paid maternal employment on poor self-rated health did not differ between those whose mothers had no formal qualification and those whose mothers had a secondary education (table 6.7). It seems, however, that maternal employment in the first two periods of childhood had a more protective effect on those whose mothers had an above-secondary education. While the odds ratio for the effect of paid maternal employment among those with less educated mothers was 0.76 and 0.70 in those two periods, it was 0.39 during the preschool period among those with the most educated mothers. The difference in the effect of maternal employment during the primary-school period was even larger: the odds ratios were 0.96 and 0.87 for less educated mothers, compared to 0.30 for above-secondary educated mothers. The effect of maternal employment during the secondary-school period on poor self-rated health did not seem to be modified by maternal education when the stratum-specific odds ratios were similar (0.67, 0.74 and 0.74). The modification of the effect of maternal employment, however,

was not statistically significant even for the first two periods of childhood, probably due to the small sample size.

**Table 6.7. The effect of paid maternal employment on poor self-rated health stratified by levels of education**

|  | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
|  | OR (95% CI) | | |
| **Mothers with no qualification** | | | |
| Mother employed | 0.76 (0.32-1.82) | 0.96 (0.62-1.49) | 0.67 (0.50-0.89) |
| **Mothers with secondary education** | | | |
| Mother employed | 0.70 (0.43-1.13) | 0.87 (0.60-1.28) | 0.74 (0.55-1.01) |
| **Mothers with higher education** | | | |
| Mother employed | 0.39 (0.09-1.75) | 0.30 (0.11-0.80) | 0.74 (0.32-1.70) |
| *P for effect modification* | *0.68* | *0.19* | *0.90* |

Those with mothers not in paid employment as reference category

As with the analysis of poor self-rated health, the effect of paid maternal employment during the preschool period on psychological distress does not substantially differ between participants with mothers with no qualification and those with mothers with a secondary education (table 6.8). The only exception is in the primary-school period: among those whose mothers had no qualification, maternal employment during this period increased the odds of psychological distress in young adulthood by 1.92, while the increase in the odds of psychological distress associated with maternal employment was only 1.26 among those whose mothers had a secondary education. Although not statistically significant, having a mother in paid employment had protective effect in terms of psychological distress among those whose mothers had above-secondary education: the odds of psychological distress were 0.53, 0.74 and 0.81 times lower among those with employed mothers compared to those whose mothers were not employed. The modification of the effect of maternal employment was statistically

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significant only for the primary-school period, but the results suggest that maternal employment in each of the three periods of childhood might play a different role among those with higher and lower education.

**Table 6.8. The effect of paid maternal employment on psychological distress stratified by levels of education**

| | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
| | OR (95% CI) | | |
| **Mothers with no qualification** | | | |
| Mother employed | 1.20 (0.62-2.30) | 1.92 (1.33-2.76) | 1.10 (0.85-1.43) |
| **Mothers with secondary education** | | | |
| Mother employed | 1.10 (0.69-1.75) | 1.26 (0.91-1.75) | 1.14 (0.88-1.48) |
| **Mothers with higher education** | | | |
| Mother employed | 0.53 (0.22-1.26) | 0.74 (0.34-1.58) | 0.81 (0.41-1.60) |
| *P for effect modification* | *0.26* | *0.04* | *0.82* |

Those with mothers not in paid employment as reference category

The effect of paid maternal employment on smoking differs between those with mothers with a below-secondary education, those with mothers with a secondary education, and those with mothers with an above-secondary education. It seems that maternal employment in the first two periods of their childhood might be a protective factor against smoking among young adults whose mothers have a secondary or above-secondary education (table 6.9), although none of these effects was statistically significant. While the odds ratio for the effect of paid maternal employment among those with less educated mothers was 1.36 for the preschool period and 2.08 for the primary-school period, it was 0.56 and 0.92 among those whose mothers had a secondary education, and 0.68 and 0.78 among those whose mothers had an above-secondary education. The effect of maternal employment during the secondary-school

period on smoking seems to be reversed, with stratum-specific odds ratios of 0.39 for those with mothers with below-secondary education, 0.74 for those with mothers with a secondary education, and 1.46 for those with mothers with above-secondary education. The modification by maternal education of the effect of maternal employment on the odds of smoking, however, was not statistically significant for any age period.

**Table 6.9. The effect of paid maternal employment on smoking stratified by levels of education**

|  | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
|  | OR (95% CI) | | |
| **Mothers with no qualification** | | | |
| Mother employed | 1.36 (0.20-9.35) | 2.08 (0.74-5.86) | 0.39 (0.19-0.84) |
| **Mothers with secondary education** | | | |
| Mother employed | 0.56 (0.20-1.57) | 0.92 (0.42-2.02) | 0.74 (0.40-1.39) |
| **Mothers with higher education** | | | |
| Mother employed | 0.68 (0.10-4.79) | 0.78 (0.13-4.65) | 1.46 (0.30-7.17) |
| *P for effect modification* | *0.89* | *0.51* | *0.46* |

Those with mothers not in paid employment as reference category

The role of household income in the association between paid maternal employment and the health in young adulthood was quite similar to that of maternal education. The results show that the effect of having a mother in paid employment is the most protective, at least for self-rated health and psychological well-being, for those in the most financially advantaged group (the fourth and fifth quintiles of household income). The effects of paid maternal employment on poor self-rated health in young adulthood by different levels of income are shown in table 6.10. While the odds ratios for the effect of paid maternal employment among those in the most financially disadvantaged or average households (the first, second or third household income quintiles) in all three periods, and among those in the most advantaged households (the fourth or fifth quintiles) in the second and third periods, was either close to 1 or slightly protective, the effect of paid maternal employment in the earliest period of childhood among those in financially advantaged households was substantially more protective (OR 0.27), and the effect modification in the first period was borderline significant.

**Table 6.10. The effect of paid maternal employment on poor self-rated health stratified by household income**

|  | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
|  | OR (95% CI) | | |
| **1Q+2Q household income (low income)** | | | |
| Mother employed | 0.86 (0.51-1.44) | 0.92 (0.65-1.30) | 0.70 (0.54-0.90) |
| **3Q** | | | |
| Mother employed | 1.10 (0.37-3.25) | 0.71 (0.33-1.53) | 1.11 (0.63-1.98) |
| **4Q+5Q (high income)** | | | |
| Mother employed | 0.27 (0.11-0.66) | 0.77 (0.42-1.39) | 0.73 (0.46-1.17) |
| *P for effect modification* | *0.05* | *0.76* | *0.30* |

Those with mothers not in paid employment as reference category

The income-stratified results for the association between psychological distress and maternal employment during the preschool period were similar to those for the association between poor self-rated health and maternal employment (table 6.11). In this first period of childhood, the effect of paid maternal employment on psychological distress was the most protective for those in the most financially advantaged group (odds ratio 0.48). In the latter two periods, the protective effect of maternal employment among those from the most advantaged group was less strong than in the first period, but was still more protective than among those in less advantaged groups (and the effect modification was statistically significant during the preschool and primary-school periods). In general, young adults whose mothers were employed during any of the three periods of their childhood are the most likely to report psychological distress if they come from the most financially disadvantaged households, and are the least likely to report psychological distress if they come from the most advantaged households.

**Table 6.11. The effect of paid maternal employment on psychological distress stratified by household income**

|  | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
|  | OR (95% CI) | | |
| **1Q+2Q household income (low income)** | | | |
| Mother employed | 1.30 (0.83-2.04) | 1.90 (1.41-2.56) | 1.28 (1.00-1.63) |
| **3Q** | | | |
| Mother employed | 1.21 (0.48-3.06) | 1.13 (0.60-2.15) | 1.02 (0.64-1.62) |
| **4Q+5Q (high income)** | | | |
| Mother employed | 0.48 (0.24-0.97) | 0.89 (0.54-1.46) | 0.91 (0.63-1.32) |
| *P for effect modification* | *0.05* | *0.03* | *0.31* |

Those with mothers not in paid employment as reference category

Finally, stratum-specific results suggest that household income does not play a modifying role in the association between paid maternal employment in childhood and smoking among young adults (table 6.12). While the association between maternal employment during the preschool period and smoking was inconsistent across household income strata (with very wide confidence intervals), maternal employment during primary school period was associated with increased odds of smoking in young adulthood in all three household income strata (although not significantly). Maternal employment during secondary school period was associated with a reduced the risk of smoking in young adulthood in all three household income groups. However, the 95% confidence intervals were wide and included 1.00 in all groups combining different age periods and different household income groups, and the modification of the effect of maternal employment was not statistically significant.

**Table 6.12. The effect of paid maternal employment on smoking stratified by household income**

|  | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
|  | OR (95% CI) | | |
| **1Q+2Q household income (low income)** | | | |
| Mother employed | 1.42 (0.48-4.19) | 1.22 (0.58-2.55) | 0.78 (0.41-1.45) |
| **3Q** | | | |
| Mother employed | 0.20 (0.01-6.74) | 1.67 (0.33-8.48) | 0.51 (0.17-1.49) |
| **4Q+5Q (high income)** | | | |
| Mother employed | 0.98 (0.21-4.55) | 1.18 (0.32-4.33) | 0.67 (0.27-1.69) |
| *P for effect modification* | *0.43* | *0.96* | *0.30* |

Those with mothers not in paid employment as reference category

*Maternal marital status*

The role of marital status in the association between paid maternal employment and young adult health seems to differ by study outcome. In line with the explanation in section 4.3.5, the results related to maternal marital status are presented for those with married and unmarried mothers, combining mothers who cohabited with their partners and mothers who lived without a partner into one group.

The effect of paid maternal employment on poor self-rated health did not differ between those with married and those with unmarried mothers (table 6.13). The small protective effect of maternal employment seemed to be very similar for the first two periods of childhood, while it slightly differed for the third period (0.80 and 0.54). The modification of the effect of maternal employment was not statistically significant for the first two childhood periods, and nearly reached significance for the third period of childhood (p = 0.06).

**Table 6.13. The effect of paid maternal employment on poor self-rated health stratified by maternal marital status**

|  | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
|  | OR (95% CI) | | |
| **Mothers married** | | | |
| Mother employed | 0.71 (0.44-1.16) | 0.82 (0.60-1.14) | 0.80 (0.63-1.03) |
| **Mothers not married** | | | |
| Mother employed | 0.64 (0.31-1.34) | 0.82 (0.49-1.35) | 0.54 (0.38-0.76) |
| *P for effect modification* | *0.79* | *0.99* | *0.06* |

Those with mothers not in paid employment as reference category

Maternal marital status seems to have a modifying effect (although not a statistically significant one) on the association between paid maternal employment when children are preschool aged and psychological distress in young adulthood, while no difference in the effect of maternal employment could be seen for the primary-school and

secondary-school ages. As shown in table 6.14, among those whose mothers were married, the odds of psychological distress of those whose mothers had been employed during the preschool period was slightly higher than among those whose mothers had not been employed, while for those whose mothers had not been married, maternal employment slightly lowered the odds of psychological distress. None of the interactions was statistically significant, supporting the conclusion that marital status does not modify the effect of maternal employment on psychological distress.

**Table 6.14. The effect of paid maternal employment on psychological distress stratified by maternal marital status**

|  | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
|  | OR (95% CI) | | |
| **Mothers married** | | | |
| Mother employed | 1.11 (0.76-1.61) | 1.43 (1.09-1.86) | 1.22 (0.99-1.51) |
| **Mothers not married** | | | |
| Mother employed | 0.69 (0.28-1.73) | 1.55 (0.97-2.48) | 1.03 (0.75-1.40) |
| *P for effect modification* | 0.36 | 0.82 | 0.33 |

Those with mothers not in paid employment as reference category

For smoking, the role of marital status seems to be rather different. Table 6.15 shows that the effect of paid maternal employment on smoking in young adulthood differed substantially between those with married mothers and those with unmarried mothers. It seems that maternal employment had a more protective effect among those with unmarried mothers. The odds ratios for the effect of paid maternal employment among those with unmarried mothers were 0.15, 0.27 and 0.12 for the three childhood periods, while the same odds ratios were 1.21, 1.80 and 0.86 among those with married mothers. The effect modification was statistically significant for all three periods. Combining information from this table with information from table 6.3 (smoking being substantially more likely among young adults whose mothers had lived without a

partner during their childhood), it is possible to say that children whose mothers were neither married nor employed were especially likely to be a  smoker in young adulthood. For example, the results show that young adults whose mothers were neither employed nor married during their secondary-school period were 38.7 times more likely to be smokers than those whose mothers were married but not employed.

**Table 6.15. The effect of paid maternal employment on smoking stratified by marital status**

|  | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
|  | OR (95% CI) | | |
| **Mothers married** | | | |
| Mother employed | 1.21 (0.46-3.21) | 1.80 (0.90-3.59) | 0.86 (0.52-1.44) |
| **Mothers not married** | | | |
| Mother employed | 0.15 (0.02-0.88) | 0.27 (0.09-0.79) | 0.12 (0.04-0.35) |
| *P for effect modification* | *0.04* | *0.004* | *0.001* |

Those with mothers not in paid employment as reference category

In summary, the results in this section suggest possible effect modifications of the association between maternal employment and self-rated health and psychological well-being by maternal education and household income, particularly in the early period of childhood, showing a relatively strong protective effect of maternal employment in the most advantaged social group as characterised either by highly educated mothers or by living in the households with the highest two income quintiles. In addition, marital status seems to modify the effect of maternal employment on smoking in young adulthood, suggesting the highest risk of smoking among young adults with unmarried and non-employed mothers. These findings will need to be confirmed in later stages of the analysis, when further explanatory variables identified in later sections of this chapter as important covariates will be included in the model (section 6.5 and Chapter

7), but it is possible to draw the preliminary conclusion that the results at least partly support Hypotheses 4, 5 and 6 about the differential impact of maternal employment on the three study outcomes in different social groups.

## 6.2 The role of maternal self-rated health, maternal psychological distress and maternal smoking habits

Maternal health and maternal health behaviours might be important factors influencing one's own health and health behaviours. Section 6.2 will focus on the role of maternal self-rated health, maternal psychological distress and maternal smoking in the association between paid maternal employment and self-rated health, psychological distress and smoking in young adults. In line with the conceptual model, these variables may confound the associations of interest, and so mothers' self-rated health, psychological distress and smoking will be considered as potential confounding factors (figure 6.3).

**Figure 6.3. The role of maternal self-rated health, psychological distress and smoking habits in the conceptual model**
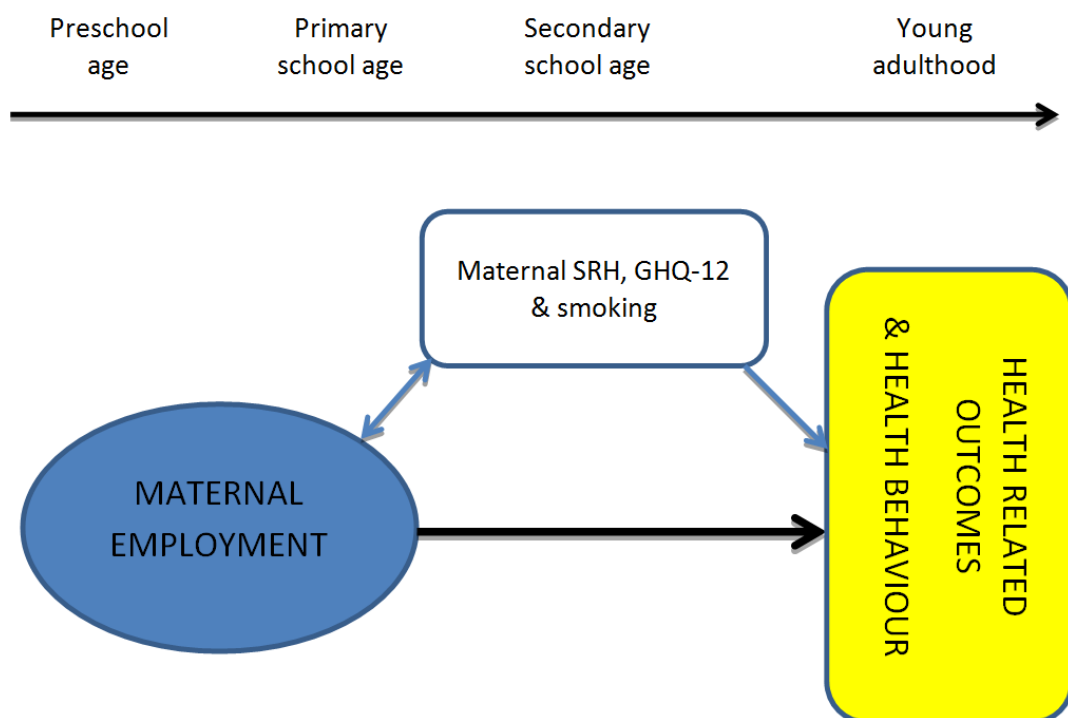
### 6.2.1 The crude effects of maternal self-rated health, maternal psychological distress and maternal smoking on the study outcomes

Before an evaluation was made of the role of maternal health and smoking in the association between maternal employment and young adult health, the independent effect of the maternal factors on the three indicators of young adult health was tested, and is shown in tables 6.16, 6.17 and 6.18. In line with previous literature (briefly summarised in section 2.3), there was a strong relationship between mothers' self-rated health, psychological distress and smoking and the young adult health. With few exceptions (mainly for the preschool period and possibly related to the small sample size), most of these associations were statistically significant, and all the relationships went in the same direction. Individuals whose mothers reported poor self-rated health or psychological distress or were smokers were more likely to report poor self-rated health or psychological distress or to be smokers themselves. The extreme magnitude of the relationship between maternal smoking and the participants' own smoking was probably the most interesting aspect of this particular analysis, with odds ratios between 27 and 52 for different periods of childhood, suggesting that individuals' smoking habits are strongly influenced by maternal (or possibly parental) smoking habits.

**Table 6.16. The unadjusted association between maternal self-rated health, maternal psychological distress and maternal smoking in three periods of childhood and poor self-rated health of young adults**

| | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
| | OR and 95% CI | | |
| **Maternal self-rated health** | | | |
| Good | 1 (ref) | 1 (ref) | 1 (ref) |
| Poor | 1.67 (1.03-2.71) | 2.22 (1.70-2.90) | 2.28 (1.90-2.75) |
| **Maternal psychological distress** | | | |
| No | 1 (ref) | 1 (ref) | 1 (ref) |
| Yes | 3.21 (2.12-4.88) | 1.66 (1.31-2.10) | 1.66 (1.40-1.96) |
| **Maternal smoking** | | | |
| No | 1 (ref) | 1 (ref) | 1 (ref) |
| Yes | 2.41 (1.58-3.66) | 1.62 (1.27-2.07) | 1.88 (1.58-2.24) |

**Table 6.17. The unadjusted association between maternal self-rated health, maternal psychological distress and maternal smoking in three periods of childhood and psychological distress of young adults**

| | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
| | OR and 95% CI | | |
| **Maternal self-rated health** | | | |
| Good | 1 (ref) | 1 (ref) | 1 (ref) |
| Poor | 1.21 (0.79-1.84) | 1.27 (1.00-1.60) | 1.45 (1.23-1.71) |
| **Maternal psychological distress** | | | |
| No | 1 (ref) | 1 (ref) | 1 (ref) |
| Yes | 1.59 (1.11-2.28) | 1.43 (1.17-1.74) | 1.54 (1.33-1.78) |
| **Maternal smoking** | | | |
| No | 1 (ref) | 1 (ref) | 1 (ref) |
| Yes | 1.11 (0.77-1.62) | 1.05 (0.86-1.30) | 1.20 (1.03-1.40) |

**Table 6.18. The unadjusted association between maternal self-rated health, maternal psychological distress and maternal smoking in three periods of childhood and smoking of young adults**

| | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
| | OR and 95% CI | | |
| **Maternal self-rated health** | | | |
| Good | 1 (ref) | 1 (ref) | 1 (ref) |
| Poor | 1.72 (0.63-4.68) | 4.96 (2.70-9.10) | 3.45 (2.30-5.20) |
| **Maternal psychological distress** | | | |
| No | 1 (ref) | 1 (ref) | 1 (ref) |
| Yes | 2.50 (1.07-5.85) | 4.22 (2.57-6.93) | 3.09 (2.17-4.39) |
| **Maternal smoking** | | | |
| No | 1 (ref) | 1 (ref) | 1 (ref) |
| Yes | 52.1 (21.6-125.5) | 27.5 (16.0-47.3) | 34.7 (23.0-52.4) |

## 6.2.2 The effect of paid maternal employment on the study outcomes adjusted by maternal self-rated health, maternal psychological distress and maternal smoking

The association between maternal employment, health and smoking was moderately influenced by maternal self-rated health, psychological distress and smoking (table 6.19). The protective effect of maternal employment on self-rated health was reduced for all three periods of childhood, especially when maternal psychological distress was included in the model. Approximately half of the difference in the odds of poor self-rated health among those with employed mothers and those with mothers who were not employed was explained by the three variables characterising maternal health and behaviours. The increase in the odds of psychological distress associated with mothers' employment became bigger when adjusted for mothers' health and smoking. The protective effect of mothers' employment on the odds of smoking was reduced when

adjusted for mothers' health and smoking, and even reversed during the second period of childhood (crude OR 0.78 to adjusted OR 1.28), suggesting that these variables might have an important role as confounding variables.

**Table 6.19. The effect of maternal self-rated health, psychological distress and smoking on the association between maternal employment and three study outcomes**

| | Maternal employment (yes vs. no) | | |
| --- | --- | --- | --- |
| | Poor self-rated health | Psychological distress | Smoking |
| | OR and 95% CI) | | |
| **At preschool age** | | | |
| Unadjusted | 0.65 (0.43-0.97) | 1.08 (0.76-1.54) | 0.66 (0.29-1.49) |
| Adjusted for maternal smoking | 0.67 (0.45-0.99) | 1.08 (0.76-1.54) | 0.75 (0.34-1.65) |
| Adjusted for maternal psychological distress | 0.72 (0.48-1.08) | 1.12 (0.78-1.60) | 0.61 (0.27-1.42) |
| Adjusted for maternal self-rated health | 0.66 (0.44-1.00) | 1.09 (0.77-1.56) | 0.68 (0.30-1.55) |
| Adjusted for all 3 variables | 0.75 (0.50-1.12) | 1.12 (0.79-1.60) | 0.71 (0.32-1.62) |
| **At primary school age** | | | |
| Unadjusted | 0.76 (0.58-1.00) | 1.43 (1.13-1.81) | 0.78 (0.44-1.37) |
| Adjusted for maternal smoking | 0.77 (0.58-1.01) | 1.52 (1.19-1.93) | 0.86 (0.48-1.54) |
| Adjusted for maternal psychological distress | 0.83 (0.63-1.10) | 1.54 (1.21-1.96) | 0.98 (0.55-1.77) |
| Adjusted for maternal self-rated health | 0.84 (0.64-1.11) | 1.55 (1.22-1.97) | 0.95 (0.53-1.73) |
| Adjusted for all 3 variables | 0.91 (0.69-1.20) | 1.65 (1.29-2.10) | 1.28 (0.69-2.38) |
| **At secondary school age** | | | |
| Unadjusted | 0.66 (0.54-0.81) | 1.07 (0.90-1.28) | 0.39 (0.25-0.61) |
| Adjusted for maternal smoking | 0.71 (0.58-0.87) | 1.07 (0.89-1.28) | 0.52 (0.33-0.81) |
| Adjusted for maternal psychological distress | 0.75 (0.61-0.92) | 1.18 (0.98-1.41) | 0.45 (0.29-0.71) |
| Adjusted for maternal self-rated health | 0.83 (0.67-1.02) | 1.16 (0.96-1.40) | 0.61 (0.38-0.95) |
| Adjusted for all 3 variables | 0.86 (0.70-1.06) | 1.22 (1.01-1.48) | 0.66 (0.42-1.05) |

## 6.3 The role of childcare arrangements

In addition to the three main covariates used in section 6.1, the role of maternal employment during childhood on self-rated health, psychological distress and smoking in young adulthood may be affected by several other variables, namely childcare arrangements, maternal job satisfaction (described in section 6.4), maternal health and maternal smoking habits (described in section 6.2). First, in line with Hypothesis 8 proposing that the association between maternal employment in childhood and the health and smoking behaviour of young adults is modified by the type of childcare arrangement, section 6.3 will focus on the role of childcare arrangements in the association between paid maternal employment and the three study outcomes.

As data on childcare arrangements were only available for children up to the age of 12, this section concentrates on the first two periods of childhood. The conceptual model considers childcare arrangements a potential effect-modifier on the association between paid maternal employment and the study outcomes, and as possibly changing the effects of maternal employment among those who make different childcare arrangements while they are employed. The associations from the conceptual model tested in this part of Chapter 6 are shown graphically in figure 6.4.

**Figure 6.4. The role of child care arrangements on the association between maternal paid employment and study outcomes**
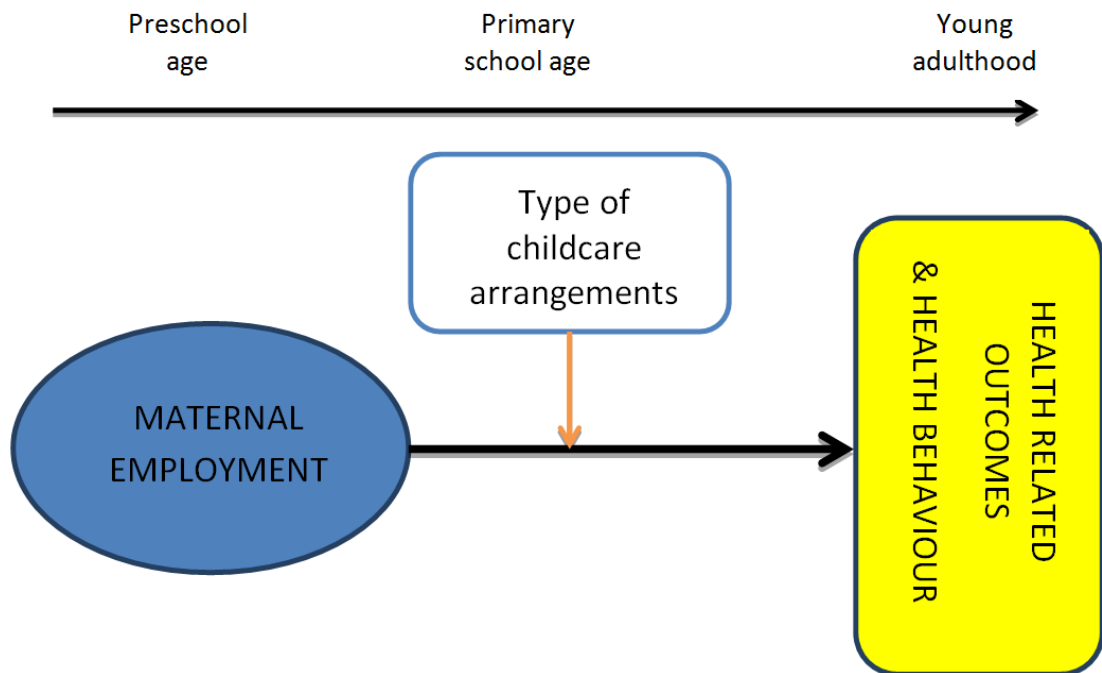


The analysis was done in two steps: first by comparing the four categories of childcare among employed mothers against those who were not employed, and second by assessing the relative differences between the four categories of childcare amongst employed mothers in the analysis of data excluding all mothers who were not employed.

In relation to the association between childcare arrangements and the study outcomes, the results from the unadjusted analysis suggested that the children of working mothers were less likely to report poor self-rated health (table 6.20). Those whose mothers had used a combination of different types of childcare arrangement during the preschool period (parental care, i.e. by the mother and her partner; other informal care, i.e. by other individuals; and formal care) were the least likely to report poor health later. The differences in the odds of poor self-rated health by type of childcare arrangement during the primary-school period were minimal.

**Table 6.20. The association between poor self-rated health and child care arrangements during preschool and primary school years**

| Child care arrangement | | | Preschool age | | Primary school age | |
|---|---|---|---|---|---|---|
| | | | N | OR (95% CI) | N | OR (95% CI) |
| All mothers | unadjusted | M not employed | 1180 | 1 | 1833 | 1 |
| | | M employed AND Parental only (A) | 380 | 0.84 (0.46-1.53) | 1826 | 0.75 (0.53-1.05) |
| | | Parental and/or formal care (B) | 162 | 0.63 (0.27-1.46) | 221 | 0.93 (0.45-1.93) |
| | | Parental and/or informal care (C) | 500 | 0.65 (0.38-1.11) | 3016 | 0.78 (0.58-1.05) |
| | | A, B and C | 237 | 0.43 (0.21-0.89) | 980 | 0.72 (0.48-1.08) |
| | adjusted | M not employed | 1180 | 1 | 1833 | 1 |
| | | M employed AND Parental only (A) | 380 | 1.01 (0.55-1.85) | 1826 | 0.93 (0.65-1.32) |
| | | Parental and/or formal care (B) | 162 | 0.67 (0.29-1.59) | 221 | 1.34 (0.64-2.82) |
| | | Parental and/or informal care (C) | 500 | 0.74 (0.43-1.26) | 3016 | 0.91 (0.67-1.24) |
| | | A, B and C | 237 | 0.50 (0.24-1.06) | 980 | 0.89 (0.59-1.36) |
| Employed mothers | unadjusted | Parental only (A) | 380 | 1 | 1826 | 1 |
| | | Parental and/or formal care (B) | 162 | 0.77 (0.32-1.85) | 221 | 1.25 (0.61-2.54) |
| | | Parental and/or informal care (C) | 500 | 0.79 (0.42-1.50) | 3016 | 1.04 (0.77-1.40) |
| | | A, B and C | 237 | 0.52 (0.23-1.16) | 980 | 0.97 (0.65-1.44) |
| | adjusted | Parental only (A) | 380 | 1 | 1826 | 1 |
| | | Parental and/or formal care (B) | 162 | 0.77 (0.31-1.90) | 221 | 1.50 (0.74-3.06) |
| | | Parental and/or informal care (C) | 500 | 0.74 (0.39-1.42) | 3016 | 0.99 (0.73-1.33) |
| | | A, B and C | 237 | 0.56 (0.25-1.27) | 980 | 0.99 (0.66-1.49) |

Adjusted = Adjusted for sex, maternal education, maternal marital status, household income

The direction of the association between childcare arrangements during the preschool period and psychological distress was similar to the association between childcare arrangements and self-rated health (although did not reach statistical significance): psychological distress was least likely among those whose mothers had used combined childcare arrangements, and the odds were the highest among those whose mothers had

used only the help of their partners (left side of table 6.21). This association was not substantially affected by further adjustments for socio-economic factors. In relation to childcare arrangements during the primary-school period, there were virtually no differences in the likelihood of psychological distress by type of childcare arrangement: the ORs comparing childcare arrangements among employed mothers were all between 0.90 and 1.00 (right side of table 6.21).

**Table 6.21. The association between psychological distress and child care arrangements during preschool and primary school years**

| Child care arrangement | | | Preschool age | | Primary school age | |
|---|---|---|---|---|---|---|
| | | | N | OR (95% CI) | N | OR (95% CI) |
| All mothers | unadjusted | M not employed | 1101 | 1 | 1816 | 1 |
| | | M employed AND Parental only (A) | 359 | 1.43 (0.86-2.39) | 1844 | 1.53 (1.14-2.03) |
| | | Parental and/or formal care (B) | 152 | 1.15 (0.57-2.30) | 210 | 1.43 (0.76-2.65) |
| | | Parental and/or informal care (C) | 449 | 0.99 (0.62-1.58) | 2968 | 1.35 (1.04-1.75) |
| | | A, B and C | 208 | 0.79 (0.43-1.48) | 931 | 1.45 (1.03-2.05) |
| | adjusted | M not employed | 1101 | 1 | 1816 | 1 |
| | | M employed AND Parental only (A) | 359 | 1.51 (0.90-2.52) | 1844 | 1.61 (1.20-2.16) |
| | | Parental and/or formal care (B) | 152 | 1.03 (0.51-2.09) | 210 | 1.55 (0.82-2.92) |
| | | Parental and/or informal care (C) | 449 | 1.00 (0.63-1.60) | 2968 | 1.42 (1.09-1.86) |
| | | A, B and C | 208 | 0.79 (0.42-1.48) | 931 | 1.51 (1.05-2.16) |
| Employed mothers | unadjusted | Parental only (A) | 359 | 1 | 1844 | 1 |
| | | Parental and/or formal care (B) | 152 | 0.80 (0.36-1.78) | 210 | 0.90 (0.48-1.68) |
| | | Parental and/or informal care (C) | 449 | 0.68 (0.37-1.26) | 2968 | 0.92 (0.71-1.18) |
| | | A, B and C | 208 | 0.54 (0.26-1.15) | 931 | 0.95 (0.68-1.34) |
| | adjusted | Parental only (A) | 359 | 1 | 1844 | 1 |
| | | Parental and/or formal care (B) | 152 | 0.79 (0.35-1.81) | 210 | 0.99 (0.53-1.85) |
| | | Parental and/or informal care (C) | 449 | 0.68 (0.37-1.25) | 2968 | 0.92 (0.71-1.19) |
| | | A, B and C | 208 | 0.58 (0.27-1.23) | 931 | 0.98 (0.69-1.38) |

Adjusted = Adjusted for sex, maternal education, maternal marital status, household income

For smoking the relationship is less clear, and the confidence intervals are very wide. In relation to childcare arrangements during the preschool period, smoking is least common among those whose mothers used all three modes of childcare (table 6.22, left side). The results were reversed for the primary-school period (table 6.22, right side). Those with combined childcare arrangements during that period of childhood were later the most likely to smoke after adjusting for maternal education, maternal marital status and household income. Compared to those whose care arrangements included only mothers or their partners, individuals whose mothers used all types of childcare arrangements during the primary-school period were almost 2.5 times more likely to smoke in young adulthood. However, it must be repeated that the confidence intervals in the assessment of the impact of childcare on smoking are extremely wide.

**Table 6.22. The association between smoking and child care arrangements during preschool and primary school years**

| Child care arrangement | | | Preschool age | | Primary school age | |
|---|---|---|---|---|---|---|
| | | | N | OR (95% CI) | N | OR (95% CI) |
| All mothers | unadjusted | M not employed | 1153 | 1 | 1781 | 1 |
| | | M employed AND Parental only (A) | 377 | 0.46 (0.14-1.59) | 1772 | 0.56 (0.28-1.13) |
| | | Parental and/or formal care (B) | 153 | 1.03 (0.22-4.85) | 204 | 0.46 (0.10-2.18) |
| | | Parental and/or informal care (C) | 483 | 1.33 (0.46-3.83) | 2903 | 0.93 (0.50-1.73) |
| | | A, B and C | 232 | 0.20 (0.05-0.83) | 948 | 0.92 (0.40-2.11) |
| | adjusted | M not employed | 1153 | 1 | 1781 | 1 |
| | | M employed AND Parental only (A) | 377 | 0.64 (0.17-2.38) | 1772 | 1.29 (0.62-2.68) |
| | | Parental and/or formal care (B) | 153 | 1.77 (0.33-9.51) | 204 | 1.98 (0.40-9.81) |
| | | Parental and/or informal care (C) | 483 | 1.69 (0.55-5.21) | 2903 | 1.91 (0.98-3.72) |
| | | A, B and C | 232 | 0.35 (0.08-1.54) | 948 | 2.71 (1.11-6.62) |
| Employed mothers | unadjusted | Parental only (A) | 377 | 1 | 1772 | 1 |
| | | Parental and/or formal care (B) | 153 | 2.30 (0.37-14.28) | 204 | 0.82 (0.18-3.73) |
| | | Parental and/or informal care (C) | 483 | 2.93 (0.72-11.94) | 2903 | 1.66 (0.90-3.06) |
| | | A, B and C | 232 | 0.43 (0.08-2.31) | 948 | 1.65 (0.74-3.71) |
| | adjusted | Parental only (A) | 377 | 1 | 1772 | 1 |
| | | Parental and/or formal care (B) | 153 | 3.14 (0.51-19.43) | 204 | 1.71 (0.35-8.29) |
| | | Parental and/or informal care (C) | 483 | 2.73 (0.70-10.66) | 2903 | 1.67 (0.87-3.21) |
| | | A, B and C | 232 | 0.70 (0.13-3.68) | 948 | 2.45 (1.02-5.87) |

Adjusted = Adjusted for sex, maternal education, maternal marital status, household income

To summarise the findings in section 6.3, it is possible to conclude that the results for childcare arrangements during the preschool period are relatively consistent for all three study outcomes, suggesting that combined childcare arrangements are the most protective, even after adjustment for maternal education, marital status and household

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income. The differences in the odds of poor self-rated health, psychological distress and smoking in young adulthood between those who experienced different childcare arrangements during the primary-school period are small, with one exception: having only one's mother and her partner sharing childcare responsibilities seems to be more protective against smoking than any other form of childcare arrangement.

These results, particularly for the preschool period, do not support the previous findings summarised in section 2.5.4., which proposed that mixed care arrangements might be the most negatively associated with health and developmental outcomes. In other words, the results from section 6.3 do not substantially support Hypothesis 8, which states that childcare arrangements will act as an effect-modifier between maternal employment and the three study outcomes.

## 6.4  The role of maternal job satisfaction

In addition to childcare arrangements, job satisfaction is another factor that might influence the association between maternal employment during childhood and health outcomes and smoking in young adulthood. Section 6.4 will assess the role of maternal job satisfaction in the association between paid maternal employment and self-rated health, psychological distress and smoking in young adults. In line with the conceptual model and Hypothesis 9 (The negative role of maternal employment is reduced if the mother is satisfied in her work), maternal job satisfaction was considered as a potential effect-modifier of the association between paid maternal employment and the study outcomes, and this section will test this hypothesis. The association from the conceptual model tested in this chapter is shown graphically in figure 6.5.

**Figure 6.5. The role of maternal job satisfaction in the conceptual model**
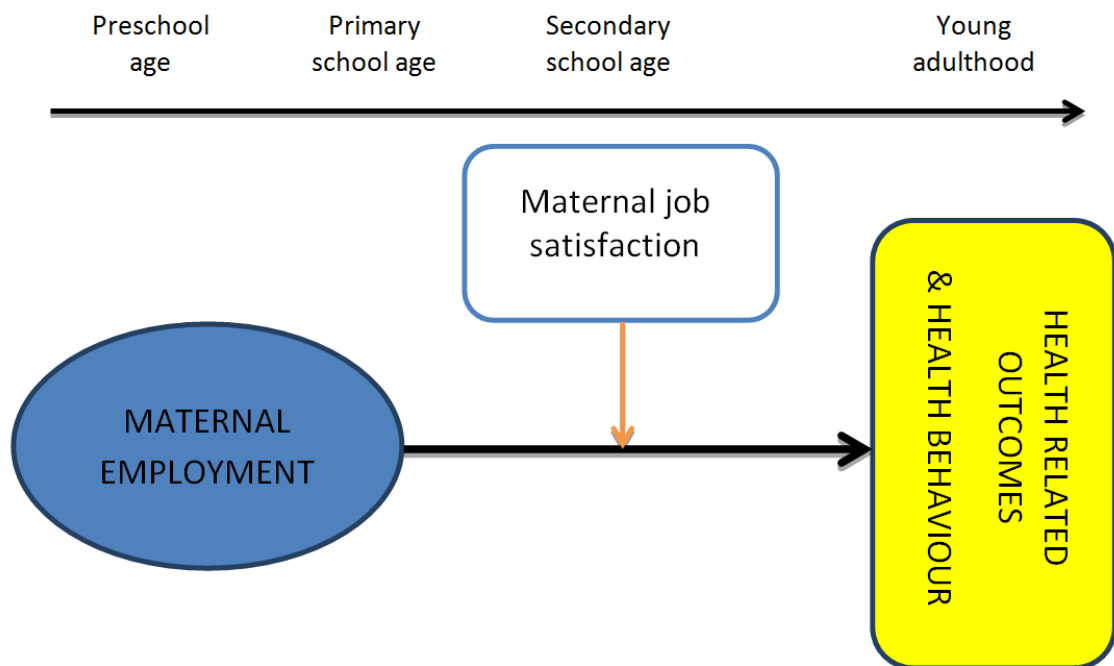


Tables 6.23 and 6.24 show the effects of maternal employment combined with job satisfaction on poor self-rated health, tables 6.25 and 6.26 on psychological distress, and tables 6.27 and 6.28 on smoking. The first table in each pair shows the results from an analysis using all eligible individuals, while the second table in each pair shows the results using only mothers who were employed during a given period of childhood.

For self-rated health, there is no evidence of a differential effect of maternal employment between those whose mothers were satisfied at work and those whose mothers were not. Both groups of respondents reported lower odds of poor self-rated health than those whose mothers were not employed (table 6.23), and the difference between the two groups was very small and not significant (table 6.24).

**Table 6.23. The effect of maternal employment and job satisfaction on poor self-rated health**

| Mother employed | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
| | OR and 95%CI | | |
| **Unadjusted** | | | |
| No | 1 (ref) | 1 (ref) | 1 (ref) |
| Yes and satisfied | 0.65 (0.42-0.99) | 0.77 (0.59-1.02) | 0.68 (0.55-0.83) |
| Yes but not satisfied | 0.68 (0.23-2.02) | 0.68 (0.39-1.19) | 0.77 (0.53-1.11) |
| **Adjusted for gender, maternal education, maternal marital status and household income** | | | |
| No | 1 (ref) | 1 (ref) | 1 (ref) |
| Yes and satisfied | 0.72 (0.47-1.11) | 0.93 (0.70-1.24) | 0.81 (0.65-1.01) |
| Yes but not satisfied | 0.70 (0.23-2.11) | 0.78 (0.45-1.37) | 0.90 (0.62-1.31) |

**Table 6.24. The effect of job satisfaction on poor self-rated health among those whose mothers were employed**

| Mother satisfied | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
| | OR and 95%CI | | |
| **Unadjusted** | | | |
| Satisfied | 1 (ref) | 1 (ref) | 1 (ref) |
| Not satisfied | 1.04 (0.37-2.88) | 0.88 (0.53-1.48) | 1.13 (0.81-1.59) |
| **Adjusted for gender, maternal education, maternal marital status and household income** | | | |
| Satisfied | 1 (ref) | 1 (ref) | 1 (ref) |
| Not satisfied | 1.04 (0.37-2.93) | 0.83 (0.50-1.38) | 1.12 (0.80-1.56) |

The role of job satisfaction in the association between maternal employment and psychological distress is more complicated than that for self-rated health (tables 6.25 and 6.26). While those whose mothers had reported positive job satisfaction during the

preschool period were more likely to report psychological distress than those whose mothers had reported dissatisfaction at work, this relationship was reversed when maternal job satisfaction during the secondary-school period was taken into account (table 6.26). Those whose mothers had reported low job satisfaction during this period were significantly more likely to report psychological distress. This change in the effect of maternal job satisfaction during different periods of childhood on psychological distress is difficult to explain, although the differences between those whose mothers were satisfied and those whose mothers were not are not significant for the first two periods, and the direction of difference for the latest period is what we would expect.

**Table 6.25. The effect of maternal employment and job satisfaction on psychological distress**

| Mother employed | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
| | OR and 95%CI | | |
| **Unadjusted** | | | |
| No | 1 (ref) | 1 (ref) | 1 (ref) |
| Yes and satisfied | 1.08 (0.75-1.56) | 1.46 (1.15-1.86) | 1.02 (0.85-1.23) |
| Yes but not satisfied | 0.70 (0.27-1.85) | 1.16 (0.73-1.87) | 1.71 (1.25-2.34) |
| **Adjusted for gender, maternal education, maternal marital status and household income** | | | |
| No | 1 (ref) | 1 (ref) | 1 (ref) |
| Yes and satisfied | 1.02 (0.71-1.46) | 1.52 (1.20-1.94) | 1.07 (0.89-1.29) |
| Yes but not satisfied | 0.59 (0.23-1.54) | 1.31 (0.83-2.08) | 1.85 (1.36-2.52) |

**Table 6.26. The effect of job satisfaction on psychological distress among those whose mothers were employed**

| Mother satisfied | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
| | OR and 95%CI | | |
| **Unadjusted** | | | |
| Satisfied | 1 (ref) | 1 (ref) | 1 (ref) |
| Not satisfied | 0.64 (0.24-1.75) | 0.80 (0.52-1.24) | 1.67 (1.26-2.21) |
| **Adjusted for gender, maternal education, maternal marital status and household income** | | | |
| Satisfied | 1 (ref) | 1 (ref) | 1 (ref) |
| Not satisfied | 0.65 (0.24-1.72) | 0.84 (0.55-1.29) | 1.73 (1.32-2.28) |

For smoking, the results suggest that participants whose mothers had not been satisfied in their work during the primary- and secondary-school periods were more likely to smoke than those whose mothers had been satisfied in their work (tables 6.27 and 6.28), but the difference in the odds of smoking was not statistically significant in the comparison of all those whose mothers worked (table 6.28).

**Table 6.27. The effect of maternal employment and job satisfaction on smoking (OR and 95% CI)**

| Mother employed | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
| | OR and 95%CI | | |
| **Unadjusted** | | | |
| No | 1 (ref) | 1 (ref) | 1 (ref) |
| Yes and satisfied | 0.54 (0.24-1.26) | 0.72 (0.40-1.27) | 0.38 (0.24-0.59) |
| Yes but not satisfied | 0.33 (0.04-2.95) | 2.22 (0.70-7.02) | 0.72 (0.33-1.58) |
| **Adjusted for gender, maternal education, maternal marital status and household income** | | | |
| No | 1 (ref) | 1 (ref) | 1 (ref) |
| Yes and satisfied | 0.78 (0.33-1.86) | 1.64 (0.88-3.06) | 0.84 (0.52-1.37) |
| Yes but not satisfied | 0.60 (0.06-5.77) | 3.71 (1.14-12.08) | 1.26 (0.55-2.88) |

**Table 6.28. The effect of job satisfaction on smoking among those whose mothers were employed**

| Mother satisfied | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
| | OR and 95%CI | | |
| **Unadjusted** | | | |
| Satisfied | 1 (ref) | 1 (ref) | 1 (ref) |
| Not satisfied | 0.61 (0.07-5.18) | 3.04 (1.06-8.67) | 1.92 (0.95-3.85) |
| **Adjusted for gender, maternal education, maternal marital status and household income** | | | |
| Satisfied | 1 (ref) | 1 (ref) | 1 (ref) |
| Not satisfied | 0.92 (0.11-7.72) | 2.28 (0.74-7.01) | 1.56 (0.77-3.15) |

In summary, the results presented in this section suggest that job satisfaction did not substantially modify the effect of maternal employment on health in young adulthood. In line with the Hypothesis 9, those whose mothers had not been satisfied in their work were more likely to report psychological distress and to smoke. However, these associations could be seen only in relation to some periods of childhood (secondary-school age for psychological distress, and primary- and secondary-school ages for smoking), the results are not consistent and, with the exception of the association between psychological distress and maternal job satisfaction during the secondary-school period, they lack statistical significance. Additionally, in relation to self-rated health, maternal job satisfaction did not play an important role during any period of childhood. It is possible to say that maternal employment was protective regardless of whether mothers were satisfied with their jobs.

## *6.5   The combined role of all identified covariates*

Sections 6.1–6.4 focused on the individual roles of different risk factors in the association between maternal employment and the three study outcomes. The objective of this section is to combine the roles of maternal psychological distress, maternal self-rated health and maternal smoking in the association between maternal employment and the study outcomes with the roles of maternal education, marital status, household income, childcare arrangements and maternal job satisfaction during each period of childhood. This analysis will show whether maternal employment has any independent effect on the study outcomes when all the additional variables are taken into account.

### 6.5.1  Self-rated health

The development of the final model for the selected study outcome and maternal employment in the selected childhood period is described in detail below for self-rated health and maternal employment during the preschool period, while the findings for the remaining combinations of outcomes with maternal employment in different childhood periods will be described more briefly later.

For self-rated health, tables 6.29, 6.30 and 6.31 show the changes in the effect of maternal employment during the different stages of childhood on poor self-rated health in young adulthood. The role of maternal employment during the preschool period is summarised in table 6.29. As shown earlier in Chapter 5, in unadjusted analysis the study participants whose mothers were employed during the preschool period were significantly less likely to report poor health in young adulthood (OR 0.65). Indeed, the association became slightly stronger when adjusted for participants' gender (model A, OR 0.62). When further adjusted for maternal education, marital status and household income (model B), the effect was reduced to OR = 0.70 (as reported earlier in section

6.1.1). However, as reported in section 6.1.2, it seems that the protective effect of maternal employment can be detected primarily among those with mothers with higher education, or those in households with the highest income. As the interaction between household income and maternal employment was borderline significant (as shown in table 6.10; $p = 0.05$), the role of maternal employment was adjusted for gender, maternal education and marital status, using household income as an effect-modifier in the next step of the analysis (model C). On the basis of the results shown in table 6.10, and as described earlier in section 4.3, the first, second and third quintiles of household income were grouped together to produce a dichotomous variable of financial disadvantage, and the role of maternal employment was reported separately for those in financially advantaged (the fourth and fifth quintiles) and disadvantaged (the first, second and third quintiles) households. The results from model C confirmed that maternal employment was protective for those in households with higher incomes, while among those from households with lower incomes there was virtually no difference in the odds of poor self-rated health between those whose mothers were employed and those whose mothers were not. When further adjusted for maternal self-rated health, maternal psychological distress and maternal smoking (model D), the effect of maternal employment did not substantially change, and maternal employment remained protective for those from financially advantaged households ($OR = 0.26$).

In the next step, childcare arrangements were taken into account (model E). In section 6.3 it was shown that childcare arrangements modify the effect of maternal employment, and childcare arrangements were therefore entered as an effect-modifier into the regression model. In line with previous models, the role of maternal employment and childcare arrangements is small (or non-existent) among those from financially disadvantaged households, while there is a strong association between maternal employment combined with childcare arrangements and self-rated health

among those from financially advantaged households. In these households, those whose mothers were not employed during the preschool period are significantly more likely to report poor health. Additionally, the protective effect of maternal employment is stronger among those whose mothers used all forms of childcare arrangement (parental care combined with both other informal care and formal care) compared to those whose mothers used only parental care.

As a final step, job satisfaction was added to the regression model. The results from this model are virtually identical with those from model E, and are not presented in table 6.29. Job satisfaction does not significantly change the effect of maternal employment on self-rated health, and can be dropped from the final model.

Thus Model E can be considered the final model for the evaluation of the association between maternal employment during the preschool period and self-rated health in young adulthood. There is some evidence of effect modification in the association between maternal employment and self-rated health by household income and childcare arrangements, although this evidence cannot be regarded as conclusive in light of the relatively small number of records in this data set. The results suggest that while maternal employment during the preschool period has no effect on poor self-rated health in young adulthood among those who lived in more financially disadvantaged households, maternal employment has a statistically significant protective effect on self-rated health among those from more financially advantaged households.

**Table 6.29. The role of maternal employment at preschool age on poor self-rated health in different stages of the analysis (OR and 95% CI)**

| | |
|---|---|
| Unadjusted | 0.65 (0.43-0.97) [1] |
| Adjusted for gender **(A)** | 0.62 (0.41-0.93) [1] |
| A + maternal education, maternal marital status and household income **(B)** | 0.70 (0.46-1.07) [1] |
| A + maternal education, maternal marital status **(C)** | |
|   Financially disadvantaged households | 0.95 (0.60-1.50) [1] |
|   Financially advantaged households | 0.25 (0.10-0.61) [1] |
|   *P-value for interaction (maternal employment x household income)* | *0.01* |
| C + maternal self-rated health, psychological distress and smoking **(D)** | |
|   Financially disadvantaged households | 1.04 (0.66-1.64) [1] |
|   Financially advantaged households | 0.26 (0.11-0.63) [1] |
|   *P-value for interaction (maternal employment x household income)* | *0.006* |
| D + childcare arrangements **(E)** | |
| <u>Financially disadvantaged households</u> | |
|   M not employed | 1 |
|   M employed AND parental care | 1.32 (0.69-2.50) |
|   M employed AND parental care AND/OR formal care | 0.99 (0.34-2.87) |
|   M employed AND parental care AND/OR others | 0.95 (0.53-1.71) |
|   M employed AND parental care AND/OR formal care AND/OR others | 0.88 (0.37-2.09) |
| <u>Financially advantaged households</u> | |
|   M not employed | 1 |
|   M employed AND parental care | 0.53 (0.14-2.03) |
|   M employed AND parental care AND/OR formal care | 0.20 (0.04-0.90) |
|   M employed AND parental care AND/OR others | 0.29 (0.09-0.91) |
|   M employed AND parental care AND/OR formal care AND/OR others | 0.15 (0.04-0.57) |
|   *P-value for interaction (maternal employment x household income)* | *0.10* |

[1] employed mothers compared to not employed mothers

The role of maternal employment during the primary-school period is summarised in table 6.30. As shown earlier, in unadjusted analysis the study participants whose mothers were employed during the primary-school period were borderline significantly less likely to report poor health in young adulthood (OR 0.76). The association did not change when adjusted for participants' gender, but the protective effect of maternal employment was reduced to OR = 0.94 when adjusted for socio-economic factors (model B). The results in section 6.1.2 suggested that the protective effect of maternal employment could be detected primarily among those in more advantaged social positions, and in particular among those whose mothers had higher education (model C). When further adjusted for maternal self-rated health, maternal psychological distress

and maternal smoking (model D), the effect of maternal employment did not substantially change.

Unlike during the preschool period, the likelihood of poor self-rated health is not significantly affected by forms of childcare arrangement (model E). Model E is not significantly better than model D (p-value 0.60 for the Wald test comparing models D and E). Thus it is possible to omit childcare arrangements from the final model. As a final step, job satisfaction was added to the regression model. Job satisfaction does not significantly change the effect of maternal employment on self-rated health (not shown in the table), and can also be omitted from the final model.

Model D can thus be considered the final model for the evaluation of the association between maternal employment during the primary-school period and self-rated health. There is evidence of effect modification in the association between maternal employment and self-rated health by maternal education. The results suggest that while maternal employment during the primary-school period has no effect on poor self-rated health in young adulthood among those whose mothers had a secondary or lower-level education, maternal employment has a statistically significant protective effect on self-rated health among those whose mothers had higher education.

While education was chosen as an effect-modifier for this model, it should be pointed out that it could be replaced by household income with very similar results, suggesting that the role of maternal employment is protective for those in socially advantaged groups. As maternal education has been shown purely statistically in previous sections to be a stronger effect-modifier for this childhood period, it has been used as an effect-modifier in this chapter.

**Table 6.30. The role of maternal employment at primary school age on poor self-rated health in different stages of the analysis (OR and 95% CI)**

| | |
|---|---|
| Unadjusted | 0.76 (0.58-1.00) [1] |
| Adjusted for gender **(A)** | 0.76 (0.58-1.00) [1] |
| A + maternal education, maternal marital status and household income **(B)** | 0.94 (0.71-1.26) [1] |
| A + household income, maternal marital status **(C)** | |
|   Mother with secondary education or less | 0.95 (0.71-1.27) [1] |
|   Mother with higher education | 0.34 (0.14-0.84) [1] |
|   *P-value for interaction(maternal employment x maternal education)* | *0.03* |
| C + maternal self-rated health, psychological distress and smoking **(D)** | |
|   Mother with secondary education or less | 1.07 (0.79-1.44) [1] |
|   Mother with higher education | 0.35 (0.14-0.88) [1] |
|   *P-value for interaction(maternal employment x maternal education)* | *0.02* |
| D + childcare arrangements **(E)** | |
| Mother with secondary education or less | |
|   M not employed | 1 |
|   M employed AND parental care | 1.16 (0.80-1.69) |
|   M employed AND parental care AND/OR formal care | 1.53 (0.66-3.54) |
|   M employed AND parental care AND/OR others | 1.06 (0.76-1.47) |
|   M employed AND parental care AND/OR formal care AND/OR others | 0.84 (0.53-1.34) |
| Mother with higher education | |
|   M not employed | 1 |
|   M employed AND parental care | 0.26 (0.08-0.79) |
|   M employed AND parental care AND/OR formal care | 0.40 (0.08-2.01) |
|   M employed AND parental care AND/OR others | 0.32 (0.12-0.89) |
|   M employed AND parental care AND/OR formal care AND/OR others | 0.49 (0.16-1.45) |
|   *P-value for interaction(maternal employment x maternal education)* | *0.08* |

[1] employed mothers compared to not employed mothers

The role of maternal employment during the secondary-school period is summarised in table 6.31. As shown earlier in unadjusted analysis, study participants whose mothers were employed during the secondary-school period were significantly less likely to report poor health in young adulthood (OR 0.66). When further adjusted for maternal education, marital status and household income (model B), the protective effect of maternal employment was somewhat reduced to OR = 0.79, but remained statistically significant. The results in section 6.1.2 showed that the effect of maternal employment on self-rated health is not modified by maternal education and household income for

this childhood period, but it might be modified by maternal marital status, with a protective effect of maternal employment being detected primarily among participants with unmarried mothers (model C). This effect modification was substantially reduced when further adjusted for maternal self-rated health, maternal psychological distress and maternal smoking (model D), and was therefore subsequently removed from the regression model (model E). As with the previous periods of childhood, job satisfaction did not significantly change the effect of maternal employment on self-rated health (not shown in the table), and model E can therefore be considered the final model for the evaluation of the association between maternal employment during the secondary-school period and self-rated health in young adulthood. This model suggests that maternal employment during the secondary-school period does not influence self-rated health in young adulthood (OR 0.97).

**Table 6.31. The role of maternal employment at secondary school age on poor self-rated health in different stages of the analysis (OR and 95% CI)**

| | |
|---|---|
| Unadjusted | 0.66 (0.54-0.81) [1] |
| Adjusted for gender **(A)** | 0.67 (0.55-0.82) [1] |
| A + maternal education, maternal marital status and household income **(B)** | 0.79 (0.64-0.98) [1] |
| A + maternal education, household income **(C)** | |
|   Mother married | 0.91 (0.70-1.18) [1] |
|   Mother unmarried | 0.61 (0.43-0.86) [1] |
|   *P-value for interaction (maternal employment x marital status)* | *0.06* |
| C + maternal self-rated health, psychological distress and smoking **(D)** | |
|   Mother married | 1.08 (0.82-1.41) [1] |
|   Mother unmarried | 0.81 (0.56-1.15) [1] |
|   *P-value for interaction (maternal employment x marital status)* | *0.19* |
| B+ maternal self-rated health, psychological distress and smoking **(E)** | 0.97 (0.78-1.21) [1] |

[1] employed mothers compared to not employed mothers

## 6.5.2 Psychological distress

For psychological distress, tables 6.32, 6.33 and 6.34 show the changes in the effect of maternal employment during different stages of childhood on psychological distress in young adulthood. The role of maternal employment during the preschool period is summarised in table 6.32. Unadjusted analysis found that study participants whose mothers were employed during the preschool period were slightly more likely to report psychological distress in young adulthood (OR 1.08). After adjustment for participants' gender (model A) or maternal education, marital status and household income (model B, OR 1.00), there was virtually no difference in the odds of psychological distress between those whose mothers were employed and those whose mothers were not employed during the preschool period. However, as reported in section 6.1.2, it seems that the effect of maternal employment differs according to the level of household income (model C). The results suggested that maternal employment was protective for those in financially advantaged households (OR 0.45), while there were slightly increased odds of psychological distress associated with maternal employment among those in financially disadvantaged households (OR 1.25). The difference in the effect of maternal employment by financial advantage was statistically significant (p-value for interaction 0.02). Further adjustments for maternal self-rated health, maternal psychological distress and maternal smoking (model D) even somewhat strengthened this interaction (p = 0.01). In the next steps, childcare arrangements and maternal job satisfaction were taken into account (not shown in the table), but models including these variables were not statistically different from model D (as expressed by the Wald test), and were therefore dropped from the final model.

Thus model D can be considered the final model for the evaluation of the association between maternal employment during the preschool period and psychological distress in

young adulthood. There is evidence of effect modification in the association between maternal employment and self-rated health by household income. The results suggest that while there is no statistical evidence that maternal employment during the preschool period has an effect on psychological distress in young adulthood among those who lived in more financially disadvantaged households, maternal employment has a statistically significant protective effect on psychological distress among those living in more advantaged households.

**Table 6.32. The role of maternal employment at preschool age on psychological distress in different stages of the analysis (OR and 95% CI)**

| | |
|---|---|
| Unadjusted | 1.08 (0.76-1.54) [1] |
| Adjusted for gender **(A)** | 1.01 (0.72-1.43) [1] |
| A + maternal education, maternal marital status and household income **(B)** | 1.00 (0.70-1.43) [1] |
| A + maternal education, maternal marital status **(C)** | |
|   Financially disadvantaged households | 1.25 (0.84-1.87) [1] |
|   Financially advantaged households | 0.45 (0.22-0.93) [1] |
|   *P-value for interaction (maternal employment x household income)* | *0.02* |
| C + maternal self-rated health, psychological distress and smoking **(D)** | |
|   Financially disadvantaged households | 1.29 (0.86-1.93) [1] |
|   Financially advantaged households | 0.43 (0.22-0.83) [1] |
|   *P-value for interaction (maternal employment x household income)* | *0.01* |

[1] employed mothers compared to not employed mothers

The impact of maternal employment during the primary-school period on psychological distress in young adulthood is summarised in table 6.33. Unadjusted results showing that those whose mothers were employed during the primary-school period were statistically significantly more likely to report psychological distress in young adulthood (OR 1.43, 95% CI 1.13–1.81) changed only very little after adjustment for participants' gender (model A) or maternal education, marital status and household income (model B). Earlier analysis (reported in section 6.1.2) suggested again that household income was a potential effect-modifier, and it was used as such in the next step of the analysis

(model C). The interaction between household income and maternal employment adjusted for gender, maternal education and marital status was statistically significant (p = 0.02). The results again suggested that maternal employment was protective for those in more financially advantaged households (OR 0.87), while there were increased odds of psychological distress associated with maternal employment among those in households with lower incomes (OR 1.68). When further adjusted for maternal self-rated health, maternal psychological distress and maternal smoking (model D), the effect of maternal employment became more extreme, and the difference between those from households with lower incomes and those from households with higher incomes became larger (OR 1.98 in households with lower incomes and 0.83 in household with higher incomes; p for interaction 0.003).

As with the earlier period of childhood, when childcare arrangements and maternal job satisfaction were taken into account (not shown in the table), models including these variables were not statistically different from model D (as expressed by the Wald test), and therefore these two variables were dropped from the final model. Thus model D can again be considered the final model for the evaluation of the association between maternal employment during the primary-school period and psychological distress in young adulthood. There is some statistical evidence of effect modification in the association between maternal employment and psychological distress by household income. The results suggest that while there is a negative effect of maternal employment during primary school period on psychological distress in young adulthood among those from households with lower incomes, maternal employment has a statistically significant protective effect on psychological distress among those from higher-income households.

**Table 6.33. The role of maternal employment at primary school age on psychological distress in different stages of the analysis (OR and 95% CI)**

| | |
|---|---|
| Unadjusted | 1.43 (1.13-1.81) [1] |
| Adjusted for gender (**A**) | 1.44 (1.14-1.80) [1] |
| A + maternal education, maternal marital status and household income (**B**) | 1.50 (1.18-1.90) [1] |
| A + maternal education, maternal marital status (**C**) | |
|   Financially disadvantaged households | 1.68 (1.29-2.19) [1] |
|   Financially advantaged households | 0.87 (0.53-1.44) [1] |
|   *P-value for interaction (maternal employment x household income)* | *0.02* |
| C + maternal self-rated health, psychological distress and smoking (**D**) | |
|   Financially disadvantaged households | 1.98 (1.51-2.60) [1] |
|   Financially advantaged households | 0.83 (0.50-1.38) [1] |
|   *P-value for interaction (maternal employment x household income)* | *0.003* |

[1] employed mothers compared to not employed mothers

The role of maternal employment during the secondary-school period on psychological distress in young adulthood is summarised in table 6.34. In unadjusted analysis the study participants whose mothers were employed during the secondary-school period were 1.07 times more likely to report psychological distress in young adulthood (OR 1.07) than those with unemployed mothers. After adjustment for participants' gender, and for maternal education, marital status and household income, the effect of maternal employment on psychological distress became a little stronger compared to the crude effect, but remained small and non-significant (models A and B). Although the interactions between maternal employment and the three social characteristics were not significant in relation to the secondary-school period when unadjusted for other variables (as reported in section 6.1.2), household income was used in the next step (model C) as a potential effect-modifier. One reason for this inclusion was that the effect of maternal employment took different directions among those living in more or less financially advantaged households (OR 1.22 for those with employed mothers compared to those with not-employed mothers in lower-income households, and 0.87 in higher-income households). The difference in the effect of maternal employment by the level of household income became larger (and borderline statistically significant, p for

interaction 0.04) when further adjusted for maternal health and maternal smoking (model D). Job satisfaction plays a more significant role in the association between maternal employment during the secondary-school period and psychological distress than for previous periods. As expected (on the basis of results presented in tables 6.25 and 6.26), in both groups (households with lower and higher incomes) psychological distress was more likely among those whose mothers were not satisfied at work compared to those whose mothers were satisfied at work. The relative difference in the odds of psychological distress was smaller among those living in more advantaged households. The odds of psychological distress were particularly high among those from less advantaged households whose mothers were employed but not satisfied at work (model E).

In summary, household income modifies the association between maternal employment and psychological distress in ways that are similar to the role it plays in the previous two periods of childhood. In addition, job satisfaction is an important variable affecting this association.

**Table 6.34. The role of maternal employment at secondary school age on psychological distress in different stages of the analysis (OR and 95% CI)**

| | |
|---|---|
| Unadjusted | 1.07 (0.90-1.28) [1] |
| Adjusted for gender (**A**) | 1.12 (0.94-1.33) [1] |
| A + maternal education, maternal marital status and household income (**B**) | 1.13 (0.94-1.36) [1] |
| A + maternal education, maternal marital status (**C**) | |
|   Financially disadvantaged households | 1.22 (0.99-1.49) [1] |
|   Financially advantaged households | 0.87 (0.59-1.30) [1] |
|   *P-value for interaction (maternal employment x household income)* | *0.14* |
| C + maternal self-rated health, psychological distress and smoking (**D**) | |
|   Financially disadvantaged households | 1.38 (1.12-1.70) [1] |
|   Financially advantaged households | 0.86 (0.57-1.29) [1] |
|   *P-value for interaction (maternal employment x household income)* | *0.04* |
| D + stratification by work satisfaction (**E**) | |
|   <u>Financially disadvantaged households</u> | |
|    M not employed | 1 |
|    M employed and satisfied | 1.29 (1.04-1.60) |
|    M employed and not satisfied | 1.98 (1.35-2.91) |
|   <u>Financially advantaged households</u> | |
|    M not employed | 1 |
|    M employed and satisfied | 0.83 (0.55-1.26) |
|    M employed and not satisfied | 1.40 (0.80-2.45) |
|   *P-value for interaction (maternal employment x household income)* | *0.06* |

[1] employed mothers compared to not employed mothers

## 6.5.3 Smoking

Tables 6.35, 6.36 and 6.37 show the changes in the effect of maternal employment in different stages of childhood on smoking habits in young adulthood. The role of maternal employment during the preschool period is summarised in table 6.35. As shown earlier in Chapter 5, in unadjusted and sex-adjusted analyses the study participants whose mothers were employed during the preschool period were less likely to smoke in young adulthood, although not significantly so (OR 0.66 and 0.67 respectively). Adjustment for maternal education, marital status and household income further reduced the differences in the odds of smoking by maternal employment (model B). However, as reported in section 6.1.2, it seems that the effect of maternal

employment might differ by maternal marital status. Because the interaction between maternal marital status and maternal employment was on the borderline of statistical significance (p for interaction 0.06), maternal marital status was used as an effect-modifier (model C). Among those whose mothers were married, maternal employment did slightly increase the odds of smoking in young adulthood, while the association was the opposite among those whose mothers were not married. When further adjusted for maternal self-rated health, maternal distress and maternal smoking, however, the effects of maternal employment on smoking in young adulthood were less extreme (OR 1.05 among those with married mothers, and 0.32 among those whose mothers were not married), and there was less evidence for a potential interaction between maternal marital status and maternal employment (p = 0.26 for interaction). On the basis of this statistical evidence, this interaction was omitted from the model, and the differences in the odds of smoking by maternal employment adjusted for gender, socio-economic variables and maternal health and smoking were estimated in model E, suggesting no difference in the odds of smoking between those whose mothers were employed and those whose mothers were not.

In relation to childcare arrangements during the preschool period, smoking is least common among those whose mothers used all three modes of childcare (not shown in the table). Those with combined childcare arrangements during this period of childhood were the most likely to smoke later. However, there is no clear pattern in the results (similarly to the unadjusted results shown in section 6.3), and the confidence intervals are extremely wide. The model using childcare arrangements is not statistically different from model D, and therefore childcare arrangements were not further used in the analysis.

While the effect of the mothers' job satisfaction seemed to differ between those with married and unmarried mothers, there was no significant interaction between maternal marital status and maternal job satisfaction, and there was no statistically significant difference between model D and this model.

Although model E should be selected as the final model on the basis of statistical evidence, the stratum-specific results differ substantially between those whose mothers were married and those whose mothers were not married, and the non-significance of the interaction is most likely due to the low number of unmarried mothers in the data. Model D can therefore be considered the final model for the association between maternal employment during the preschool period and smoking in young adulthood.

**Table 6.35. The role of maternal employment at preschool age on smoking in different stages of the analysis (OR and 95% CI)**

| | |
|---|---|
| Unadjusted | 0.66 (0.29-1.49) [1] |
| Adjusted for gender (A) | 0.67 (0.29-1.50) [1] |
| A + maternal education, maternal marital status and household income (B) | 0.85 (0.34-2.15) [1] |
| A + maternal education, household income (C) | |
|   Married mothers | 1.34 (0.52-3.47) [1] |
|   Unmarried mothers | 0.15 (0.02-1.22) [1] |
|   *P-value for interaction (maternal employment x marital status)* | *0.06* |
| C + maternal self-rated health, psychological distress and smoking (D) | |
|   Married mothers | 1.05 (0.52-2.63) [1] |
|   Unmarried mothers | 0.32 (0.05-2.15) [1] |
|   *P-value for interaction (maternal employment x marital status)* | *0.26* |
| B + maternal self-rated health, psychological distress and smoking (E) | 0.82 (0.36-1.87) [1] |

[1] employed mothers compared to not employed mothers

The role of maternal employment during the primary-school period on smoking habits in young adulthood is summarised in table 6.36. In unadjusted analysis the study participants whose mothers were employed during the primary-school period were less

likely to smoke in young adulthood, but this effect was not statistically significant (OR 0.78, 95% CI 0.44–1.37). When adjusted for maternal education, maternal marital status and household income, however, the direction of the association changed, and those whose mothers were employed became more likely to smoke (OR 1.57, model B). As with the preschool period, maternal marital status was identified as a potential effect-modifier (p for interaction 0.003). While maternal employment increased the odds of smoking among those with married mothers (OR 2.89), it decreased the odds of smoking among those with unmarried mothers (OR 0.36). However, these odds ratios show only relative differences between the groups of participants with married and unmarried mothers. When all the participants were combined and the relative differences evaluated for the whole sample, it was estimated that those whose mothers were not employed and not married were 26.9 times more likely to smoke than those whose mothers were not employed but were married (95% CI 8.07–89.8). This figure shows how different a role employment might play in different social or demographic groups, and these roles will be discussed in the Discussion chapter. Further adjustment for maternal health and maternal smoking changed the estimated odds ratios somewhat, but the direction, the magnitude of the effect and the statistical interaction with marital status remained virtually the same (model D).

The model including childcare arrangements was not statistically better than the model without them (Wald p = 0.33), and it was therefore excluded from further analysis (not shown in the table). When maternal job satisfaction was added to model D (in model E), there was a relatively large difference in the effect of maternal employment among those whose mothers were satisfied with their work and those whose mothers were not, but the change between models D and E was not statistically significant (Wald p = 0.59), probably because of the small size of the group of mothers who were not satisfied with their work. Job satisfaction was therefore excluded from the final model.

Thus model D can be considered the final model for the evaluation of the association between maternal employment during the primary-school period and smoking in young adulthood. There is statistical evidence of effect modification in the association between maternal employment and smoking by the marital status of mothers. The results suggest that while maternal employment during the primary-school period might have a negative effect on smoking in young adulthood among those from households with married mothers, maternal employment might be protective in terms of smoking among those with unmarried mothers. However, the confidence intervals for these estimates are wide, and any conclusions must be drawn with this in mind.

**Table 6.36. The role of maternal employment at primary school age on smoking in different stages of the analysis (OR and 95% CI)**

| | |
|---|---|
| Unadjusted | 0.78 (0.44-1.37) [1] |
| Adjusted for gender **(A)** | 0.78 (0.44-1.37) [1] |
| A + maternal education, maternal marital status and household income **(B)** | 1.57 (0.86-2.85) [1] |
| A + maternal education, household income **(C)** | |
|   Married mothers | 2.89 (1.44-5.82) [1] |
|   Unmarried mothers | 0.36 (0.11-1.23) [1] |
|   *P-value for interaction (maternal employment x marital status)* | *0.003* |
| C + maternal self-rated health, psychological distress and smoking **(D)** | |
|   Married mothers | 3.15 (1.51-6.56) [1] |
|   Unmarried mothers | 0.59 (0.18-1.94) [1] |
|   *P-value for interaction (maternal employment x marital status)* | *0.02* |
| D + work satisfaction **(E)** | |
|   <u>Married mothers</u> | |
|    M not employed | 1 |
|    M employed and satisfied | 2.77 (1.32-5.84) |
|    M employed and not satisfied | 7.21 (1.87-27.9) |
|   <u>Unmarried mothers</u> | |
|    M not employed | 1 |
|    M employed and satisfied | 0.60 (0.18-2.01) |
|    M employed and not satisfied | 0.44 (0.04-4.71) |
|   *P-value for interaction (maternal employment x marital status)* | *0.16* |

[1] employed mothers compared to not employed mothers

The impact of maternal employment during the secondary-school period on smoking habits in young adulthood is summarised in table 6.37. In the unadjusted analysis the study participants whose mothers were employed during the secondary-school period were significantly less likely to smoke in young adulthood (OR 0.39). As with the primary-school period, maternal education, marital status and household income played an important role in the association between maternal employment and smoking in young adulthood. After adjustment for these three variables, the OR reduced to 0.81 (model B). Maternal marital status, however, was again found to be an important effect-modifier in the association between maternal marital status and smoking. Among those whose mothers were married during this period of childhood, the odds of smoking associated with employed mothers were 1.49 times greater compared to those with not-employed mothers. On the other hand, the odds ratio of smoking for those with employed mothers compared to those with not-employed mothers was 0.22 among those whose mothers were not married. As with the primary-school period, the interaction between maternal employment and maternal marital status was statistically significant ($p < 0.001$). A comparison of individuals in the four combined categories of maternal employment and maternal marital status found that those whose mothers were neither employed nor married were 34.1 times more likely to smoke (95% confidence interval 13.1–88.6) than those whose mothers were not employed but were married. When adjusted for maternal health and maternal smoking, the effect of maternal employment was somewhat reduced among those with unmarried mothers, but remained unchanged among those with married mothers.

When maternal job satisfaction was added to model D, there was virtually no difference in the effect of maternal employment among those whose mothers were satisfied with

their work and those whose mothers were not, and the change between model D and the model with job satisfaction was not statistically significant (Wald p = 0.89). Job satisfaction was therefore excluded from the final model (not shown in the table). Thus model D can be considered the final model for the evaluation of the association between maternal employment during the secondary-school period and smoking in young adulthood. There is statistically significant evidence of effect modification in the association between maternal employment and smoking by the marital status of mothers. The results suggest that while maternal employment during the secondary-school period has a negative effect on smoking in young adulthood among those from households with married mothers, maternal employment has a statistically significant protective effect on smoking among those with unmarried mothers.

**Table 6.37. The role of maternal employment at secondary school age on smoking in different stages of the analysis (OR and 95% CI)**

| | |
|---|---|
| Unadjusted | 0.39 (0.25-0.61) [1] |
| Adjusted for gender **(A)** | 0.39 (0.25-0.60) [1] |
| A + maternal education, maternal marital status and household income **(B)** | 0.81 (0.51-1.29) [1] |
| A + maternal education, household income **(C)**<br> Married mothers<br> Unmarried mothers<br> *P-value for interaction (maternal employment x marital status)* | <br>1.49 (0.87-2.55) [1]<br>0.22 (0.09-0.55) [1]<br>*<0.001* |
| C + maternal self-rated health, psychological distress and smoking **(D)**<br> Married mothers<br> Unmarried mothers<br> *P-value for interaction (maternal employment x marital status)* | <br>1.49 (0.86-2.58) [1]<br>0.49 (0.21-1.15) [1]<br>*0.03* |

[1] employed mothers compared to not employed mothers

To summarise section 6.5, there seems to be a suggestion of effect modification in the association between maternal employment and self-rated health and psychological well-being by maternal education and household income, particularly in the early period of childhood, showing a protective effect of maternal employment in more advantaged social groups (those with highly educated mothers or from households with higher

incomes). In addition, marital status seems to modify the effect of maternal employment on smoking in young adulthood, suggesting a higher risk of smoking among participants with unmarried and not-employed mothers. A summary of the independent variables used in the final models influencing the association between maternal employment in all three periods of childhood and the three study outcomes, together with the direction of the associations, is presented in table 6.38. In case of smoking, the table shows direction of the effect of maternal employment among those with married and unmarried mothers although it cannot capture the above mentioned greatest risk of smoking above those with unmarried and not employed mothers. The analyses in section 6.5 have focused on single periods of childhood, not taking into account the independent variables from the other two periods. Life-course models combining all three periods of childhood will be considered in the next chapter.

**Table 6.38. Summary of the associations found between maternal employment and variables used in the final models in each period of childhood for three study outcomes**

| Maternal employment | Self-rated health | Psychological distress | Smoking |
|---|---|---|---|
| **Preschool period (0-4)** | *Maternal education and marital status, maternal self-rated health, psychological distress and smoking*<br><br>Higher household income ↓<br><br>Lower household income- No association | *Maternal education and marital status, maternal self-rated health, psychological distress and smoking*<br><br>Higher household income ↓<br><br>Lower household income ↑ | *Maternal education, household income, maternal self-rated health, psychological distress and smoking*<br><br>Married mothers - No association<br>Unmarried mothers ↓ |
| **Primary school period (5-11)** | *Household income, maternal marital status, maternal self-rated health, psychological distress and smoking*<br><br>Higher maternal education ↓<br><br>Lower maternal education- No association[#] | *Maternal education and marital status, maternal self-rated health, psychological distress and smoking*<br><br>Higher household income ↓<br><br>Lower household income ↑ | *Maternal education, household income, maternal self-rated health, psychological distress and smoking*<br><br>Married mothers ↑<br><br>Unmarried mothers ↓ |
| **Secondary school period (12-16)** | *Maternal education and marital status, household income, maternal self-rated health, psychological distress and smoking*<br><br>No association | *Maternal education and marital status, maternal self-rated health, psychological distress and smoking*<br><br>Higher household income, satisfied at work ↓<br>Higher household income, not satisfied at work ↑<br>Lower household income, satisfied at work ↑<br>Lower household income, not satisfied at work ↑ | *Maternal education, household income, maternal self-rated health, psychological distress and smoking*<br><br>Married mothers ↑<br><br>Unmarried mothers ↓ |

↑ increase in the odds of outcome associated with mother being employed
↓ decrease in the odds of outcome associated with mother being employed
[#] for self-rated health and exposure at primary school age, similar association found when stratified by household income but the interaction with maternal education more statistically significant

# 7 Life-course models for the combined role of maternal employment during three childhood periods

The objective of this chapter is to assess the combined effects of maternal employment during all three periods of childhood on the three study outcomes. Various life-course models (trajectory, accumulation and sensitive-period models as described in section 4.4.5 and figure 4.5) will be applied to the data, and the models that best describe the association between maternal employment and each study outcome will be chosen. The findings from this chapter will be related to Hypotheses 1, 2 and 3 (main effect of maternal employment and the combination of the effect across the childhood periods), and will extend the evidence related to Hypotheses 4, 5 and 6 (effect modification hypotheses). While Hypotheses 1, 4, 5 and 6 have already been dealt with in previous chapter, Hypotheses 2 (the larger the number of periods of childhood when mother worked, the greater will be the negative effect on markers of health and health behaviour) and 3 (the younger the child at the time mother worked, the greater will be the negative effect of maternal employment in childhood) are a new additional focus of the analysis.

## 7.1  The analytical sample for combined analysis

This analysis can be done only on a restricted sample, using the records in which maternal employment data are available for all three periods. Data for all three periods of exposure and a period relevant to the outcomes (ages 0–4, 5–11, 12–16 and 16–21) are available in 2,439 (self-rated health), 2,251 (psychological distress) and 2,378 (smoking) records. This means that these analyses will be shown for data sets similar (in terms of sample size) to the samples used for the analysis of the effects of maternal

employment during the preschool period in previous chapters. However, the sample size is substantially smaller in relation to the effects of maternal employment during the age periods 5–11 and 12–16. This means that results for these two periods may somewhat change when compared to previous chapters, and will lose precision (having wider confidence intervals).

## 7.2 The life-course models

The models focusing on sensitive periods and accumulation will be compared to the "trajectories" model (described below), and the model that best describes the role of maternal employment in childhood for the given study outcome will be identified.

### 7.2.1 The trajectories model

The trajectories model used for comparison with the accumulation and sensitive-period models would ideally include all eight possible trajectories of maternal employment throughout childhood (table 7.1), taking into account whether mothers were or were not employed in each period. The numbers of individuals for each possible trajectory are also shown in table 7.1. It is clear from this table that the largest proportion of records falls into the "Always employed" (marked as EEE) path (approximately half for each outcome), in which study participants' mothers were employed during each period of the participants' childhood. The second most common path is that mothers were not employed during the first period, but were employed during both of the later periods of the participants' childhood (NEE). The third most common trajectory is that mothers were not employed during any period of the participants' childhood (NNN). The problem for the analysis using all eight trajectories is that some trajectories (particularly those marked ENE, ENN and NEN) are very rare, with a small number of records. The low number of records for these trajectories results either in very imprecise estimates

with wide confidence intervals, or in an inability to make effect estimates for such trajectories at all. Such problems will be discussed later in this chapter as they appear.

**Table 7.1. Possible trajectories of maternal employment and the number of records in each trajectory for 3 study outcomes**

| Employed/not employed (employment trajectory) | | | Label | Self-rated health | Psychological distress | Smoking |
|---|---|---|---|---|---|---|
| Preschool age | Primary school age | Secondary school age | | Number of records (% cases) | | |
| Not employed | Not employed | Not employed | NNN | 289 (25.6) | 260 (27.3) | 282 (20.9) |
| Not employed | Not employed | Employed | NNE | 176 (22.2) | 171 (20.5) | 176 (27.8) |
| Not employed | Employed | Not employed | NEN | 35 (11.4) | 35 (42.9) | 35 (11.4) |
| Not employed | Employed | Employed | NEE | 660 (16.7) | 617 (23.7) | 640 (23.6) |
| Employed | Not employed | Not employed | ENN | 17 (17.7) | 16 (12.5) | 16 (31.3) |
| Employed | Not employed | Employed | ENE | 30 (26.7) | 26 (19.2) | 29 (27.6) |
| Employed | Employed | Not employed | EEN | 51 (17.7) | 49 (30.6) | 51 (11.8) |
| Employed | Employed | Employed | EEE | 1181 (13.6) | 1077 (25.3) | 1149 (21.9) |

Because of the very low numbers of records, some trajectories were combined. The trajectories "Never employed" (NNN) and "Always employed" (EEE) were kept separate for two reasons: (1) these are particularly important trajectories, characterising mothers who were employed during all periods of participants' childhoods and those who were never employed throughout participants' childhoods, and (2) both of these trajectories have a relatively large number of records, and as such should not cause statistical problems. The trajectories marked as NNE and NEE were grouped together, as they characterised individuals whose mothers moved from not being employed to employment. Similarly, the trajectories ENN and EEN characterised individuals with mothers in the opposite situation, moving from employment to not being employed. The remaining two trajectories, ENE and NEN, were difficult to combine with other

trajectories. As they characterised a very limited number of individuals, they could not remain separate categories. It was therefore decided to combine them with trajectories that (1) have some change of status between employment and not being employed, and (2) have the same status during the early stages of childhood. Thus trajectory ENE was combined with ENN and EEN, while NEN was combined with NNE and NEE. The numbers of individuals in these newly created groups of trajectories are shown in table 7.2. It is clear from this table that the group "Moving out of employment" (ENN+EEN+ENE) is still relatively small, and the analysis may still result in very imprecise estimates with wide confidence intervals, but such problems will be discussed later in the chapter as they appear.

**Table 7.2. Combined trajectories of maternal employment and the number of records in each group of trajectories for 3 study outcomes**

| Trajectories | Self-rated health | Psychological distress | Smoking |
|---|---|---|---|
| | Number of records (% cases) | | |
| **Never employed (NNN)** | 289 (25.6) | 260 (27.3) | 282 (20.9) |
| **Moving into employment (NNE+NEE+NEN)** | 871 (17.6) | 823 (23.8) | 851 (24.0) |
| **Moving out of employment (ENN+EEN+ENE)** | 98 (20.4) | 91 (24.2) | 96 (19.8) |
| **Always employed (EEE)** | 1181 (13.6) | 1077 (25.3) | 1149 (21.9) |

The problem of sample size in some trajectories or groups of trajectories becomes even greater in stratified analysis. The results in Chapter 6 suggest that effect-modifiers play a potentially significant role in the association between maternal employment and the three study outcomes, and they will also be considered in the analyses presented in Chapter 7. The problems of limited sample size in stratified analysis are illustrated in tables 7.3 (the numbers of records in the analysis of self-rated health stratified by household income), 7.4 (the analysis of psychological distress stratified by household income) and 7.5 (the analysis of smoking stratified by maternal marital status).

**Table 7.3. The number of records in each group of trajectories for the analysis of self-rated health stratified by household income**

| Trajectories | Household income | |
| --- | --- | --- |
| | Financially advantaged households | Financially disadvantaged households |
| | Number of records (% poor) | |
| Never employed | 45 (15.6) | 244 (27.5) |
| Moving into employment | 156 (26.9) | 715 (15.5) |
| Moving out of employment | 22 (13.6) | 76 (22.4) |
| Always employed | 350 (9.7) | 831 (15.3) |

**Table 7.4. The number of records in each group of trajectories for the analysis of psychological distress stratified by household income**

| Trajectories | Household income | |
| --- | --- | --- |
| | Financially advantaged households | Financially disadvantaged households |
| | Number of records (% distressed) | |
| Never employed | 42 (45.2) | 218 (23.9) |
| Moving into employment | 150 (32.0) | 673 (22.0) |
| Moving out of employment | 21 (14.3) | 70 (27.1) |
| Always employed | 314 (25.8) | 763 (25.0) |

Tables 7.3 and 7.4 show that the main problem relates to the small number of records in the group of individuals from more advantaged households in terms of household income whose mothers did not work during any of the three childhood periods. There are only between 40 and 50 such records respectively in the two data sets. While there are even fewer such mothers in the "Moving out of employment" (ENN+EEN+ENE) group, this is not such a problem because this group does not act as a reference category in the regression analysis. With "Never employed" (NNN) being a reference group, it is

likely that confidence intervals in most analyses will be wide. This is also the reason why, in addition to "classical" results in tables with "Never employed" mothers as a reference category, results with "Always-employed" mothers (EEE) as a reference category will be also presented in the text.

**Table 7.5. The number of individuals in each group of trajectories for the analysis of smoking stratified by maternal marital status**

| Trajectories | Maternal marital status | |
| :---: | :---: | :---: |
| | **Married** | **Unmarried** |
| | **Number of individuals (% smoke)** | |
| Never employed | 193 (12.4) | 89 (39.3) |
| Moving into employment | 672 (19.6) | 179 (40.2) |
| Moving out of employment | 69 (20.3) | 27 (18.5) |
| Always employed | 969 (20.9) | 180 (27.8) |

The analysis of smoking stratified by marital status has similar a problem with sample size as that of the other two outcomes stratified by household income. In this case there are a limited number of individuals with unmarried mothers who were not employed during any period of the participants' childhoods, again making estimates of the effects rather imprecise. However, there are 89 records in the "Never employed (NNN) category in this situation, which is better than the two previous cases, where there were fewer than 50 records. Nevertheless, it is clear from the numbers of individuals presented in tables 7.3–7.5 that the stratified analysis of the trajectories of maternal employment will suffer from a lack of power.

## 7.2.2 Other life-course models

After the application of the trajectory model, other two models will be applied that focus on the accumulation of the effects of maternal employment (using a simple count

of periods when mothers were employed) or estimate the effect of maternal employment in particular periods mutually adjusted by maternal employment in the other two periods (helping identify periods particularly sensitive for the role of maternal employment), and the appropriateness of those models for particular outcomes will be discussed.

As the reference category in the analysis of accumulation is the same as that in the trajectory analysis (NNN, "Never employed", the trajectory with no periods of maternal employment), there might be the same problems with the precision of the results in the analysis of accumulation as in the trajectories analysis. Again, this issue will be more problematic in terms of stratification by household income because of the small number of records in categories with no periods and one period of maternal employment among those from more advantaged households.

### 7.2.3 The covariates

The results from section 6.5 will be taken into account, and covariates identified as important in section 6.5 will be used in the analysis in this chapter. In particular, the variables summarised in table 6.38 will be considered for adjustment or effect-modification in the models specified in the previous paragraphs. However, this table and the previous analysis will serve only as guidance, because the data set (particularly for the primary and secondary school periods) is smaller than those used in previous chapters, and only relatively large effects can be identified in this smaller data set.

For clarity, Chapter 7 will be divided into three sections: the first will focus on the models for self-rated health, the second on the models for psychological distress, and the third on the models for smoking. In each section a final model will be proposed and discussed. These three outcome-specific sections will be followed by a general

summary of the role of maternal employment during the age period 0–16 on the three study outcomes among young adults aged 16–21.

## 7.3 Models for self-rated health

First the analysis focuses on the role of maternal employment in self-rated health. The results from section 6.5 helped to identify the covariates considered for combined analysis. Section 6.5 showed that household income (particularly in the preschool period) and maternal education (particularly in the primary school period) might play the role of effect-modifiers. These roles will be tested in the analysis in this section. Furthermore, maternal marital status, maternal self-rated health and maternal distress, and maternal smoking will be used as confounders of the association. It was illustrated in table 6.31 that there is probably no association between maternal employment during the secondary-school period and self-rated health. This lack of association will also be assessed in different life-course models. If this lack of association is correct, "no association" models with no maternal employment during the secondary school period should be as good (in terms of model fit) as models including maternal employment during this period.

The first model evaluated in this section is the trajectory model, using the four trajectories or groups of trajectories defined in the previous section. Because the results in section 6.5 suggest statistically significant effect modification by maternal education or household income, the results from the trajectory analysis in table 7.6 (left column) are also shown separately for those in financially advantaged and financially disadvantaged households (table 7.6, middle and right columns). The analysis in table 7.6 is stratified by household income during the first period. On the basis of the results shown in unstratified analysis (upper part of table 7.6), it could be said that at least some

employment is in general protective. In stratified analysis the same could be said for those from financially disadvantaged households. Among those from more financially advantaged households, those whose mothers worked during the first period were less likely to report poor self-rated health (the last two rows in the middle column of table 7.6).

In adjusted analysis (lower part of table 7.6) the protective effect of maternal employment was somewhat reduced, but the overall reduction (left column) was almost entirely due to the reduction of the effect among those in financially disadvantaged households (right column). In stratified analysis the differences between those from financially advantaged and financially disadvantaged households showed more clearly than in the unadjusted analysis. There was statistically significant evidence for effect modification by social disadvantage ($p = 0.02$ in both unadjusted and adjusted analyses).

**Table 7.6. Unadjusted and fully adjusted association between maternal employment and self-rated health in trajectory model – unstratified and stratified by household income at preschool age**

| Trajectory | All | Financially advantaged households[1] | Financially disadvantaged households[2] |
|---|---|---|---|
| | OR (95% CI) | | |
| Unadjusted | | | |
| Never employed | 1 (ref) | 1 (ref) | 1 (ref) |
| Moving into employment | 0.55 (0.29-1.05) | 2.46 (0.44-13.7) | 0.42 (0.21-0.84) |
| Moving out of employment | 0.63 (0.21-1.88) | 0.50 (0.03-7.55) | 0.74 (0.22-2.46) |
| Always employed | 0.39 (0.21-0.73) | 0.53 (0.10-2.73) | 0.43 (0.22-0.84) |
| *P for interaction* | - | *0.02* | |
| Fully adjusted | | | |
| Never employed | 1 (ref) | 1 (ref) | 1 (ref) |
| Moving into employment | 0.92 (0.46-1.82) | 2.31 (0.45-11.97) | 0.74 (0.35-1.55) |
| Moving out of employment | 0.79 (0.27-2.31) | 0.45 (0.03-6.38) | 0.90 (0.28-2.92) |
| Always employed | 0.69 (0.35-1.35) | 0.49 (0.10-2.41) | 0.79 (0.38-1.64) |
| *P for interaction* | - | *0.02* | |

[1]    Financially advantaged households in Period 1
[2]    Financially disadvantaged households in Period 1

Because of the small number of records in the "Never employed" trajectory, the results could also be estimated using those whose mothers were employed in all periods as a reference category. Using the same groups of trajectories as in table 7.6 the results are presented in Appendix 4. The results for those in financially advantaged households suggest that maternal employment during the first period in particular plays an important protective role against poor self-rated health (the odds ratios in "Moving out of employment" and "Always employed" categories are less than 0.50). In general, wide confidence intervals do not allow identifying any trajectory of maternal employment that would significantly affect self-rated health of young adults. The role of maternal employment will be investigated further in additional life-course models.

As already mentioned, the interactions between maternal employment and household income, and between maternal employment and maternal education, may both play a role in the association between maternal employment and self-rated health. Stratum-specific analyses in this section were all stratified by household income. When similar analysis was conducted using maternal education during the primary-school period as an effect-modifier (as suggested in table 6.38), the results were similar to those presented in the tables in section 7.1. The results for those with less and more educated mothers were a little more extreme (as shown in Appendix 5), but the interaction was no longer significant (p for interaction 0.33). This is primarily because of the very low number of highly educated mothers in certain trajectories, particularly in those with no employment throughout the whole childhood or with changing employment status. The number of not-working mothers with high-level education is smaller than that of not-working mothers in households with higher incomes, and therefore the results are less precise. Therefore household income was a preferable variable for the stratification of the findings at this stage of the analysis.

A cumulative life-course model was evaluated next. In this model the number of periods of their childhood when the mother was in paid employment has been counted for each individual, and this count variable has been assessed for any association with self-rated health. The frequency distribution of this count variable is shown in table 7.7. As already mentioned at the beginning of Chapter 7, the sample size, and particularly the number of those whose mothers did not work or worked during only one period of the participant's childhood, is small for those from more advantaged households. The results are shown only in adjusted analysis (the unadjusted results are presented in Appendix 6). The results in table 7.8 show the association between the number of periods of childhood when the mother worked and self-rated health in the whole sample

and in specific strata related to household income. The same variables were used for the adjustment as were used in the previous trajectory analysis.

The results combining all participants suggested a small and non-significant reduction in the likelihood of poor self-rated health associated with an increasing number of periods in which the mothers were employed. The results for the two social groups differed when the previously identified effect modification by household income was taken into account. Among those from lower-income households, an increasing number of childhood periods when the mother was employed decreased the odds of poor self-rated health; however, this decrease was small, and did not show any statistically significant trend (p for trend in odds ratios 0.51). The results suggested that at least some period of childhood when the mother was employed might have been beneficial in terms of self-rated health, but there was no evidence that an increase in the number of such periods increased the benefits. At first glance, the relationship between maternal employment and self-rated health did not look very clear among those from more advantaged households (in the middle column of table 7.8). It seemed that those whose mothers were employed during one or two periods had increased odds of poor self-rated health, while those whose mothers were employed in all three periods had reduced odds of poor self-rated health. In a more detailed assessment of this relationship it became clear that it was mainly due to the very small number of respondents in more advantaged households whose mothers had not been employed during any period of the respondent's childhood (there were only 45 such records). A large majority of mothers in such households (>90%) had been employed at least once and more than 80% of mothers were employed in at least two periods. When trends in the ORs were tested for, the result was statistically significant. This is mainly due to trend in ORs within three categories of mothers who were employed in one, two or all three periods of childhood, showing very small influence of the group of individuals with no maternal employment

because of its small size. An increasing number of childhood periods when the mother was employed was statistically significantly associated with a reduction in the odds of poor self-rated health (p=0.04). Using the last category (those whose mothers were employed in all three periods) as a reference category, the odds ratios were 3.52 for those whose mothers were employed in two periods, 5.48 for those whose mothers were employed in one only period, and 2.0 for those whose mothers were not employed in any period. The data also suggest possible differential effects of maternal employment by levels of household disadvantage although this effect modification is not statistically significant (p for interaction 0.11 in the fully adjusted model).

**Table 7.7. The number of records in accumulation model for the analysis of self-rated health – overall and stratified by household income**

| Mother employed in number of childhood periods | All | Financially advantaged households[1] | Financially disadvantaged households[2] |
|---|---|---|---|
| | Number of records (% poor) | | |
| 0 | 289 (25.6) | 45 (15.6) | 244 (27.5) |
| 1 | 228 (20.2) | 37 (27.0) | 191 (18.9) |
| 2 | 741 (17.1) | 141 (24.8) | 600 (15.3) |
| 3 | 1181 (13.6) | 350 (9.7) | 831 (15.3) |

[1]  Financially advantaged households at preschool age
[2]  Financially disadvantaged households at preschool age

**Table 7.8. The fully-adjusted association between self-rated health and maternal employment in accumulation model – unstratified and stratified by household income at preschool age**

| Mother employed in number of childhood periods | All | Financially advantaged households[1] | Financially disadvantaged households[2] |
|:---:|:---:|:---:|:---:|
| | OR (95% CI) | | |
| 0 | 1 (ref) | 1 (ref) | 1 (ref) |
| 1 | 1.13 (0.48-2.67) | 2.74 (0.32-23.3) | 0.95 (0.38-2.41) |
| 2 | 0.83 (0.42-1.67) | 1.76 (0.33-9.25) | 0.69 (0.32-1.46) |
| 3 | 0.68 (0.35-1.33) | 0.49 (0.10-2.41) | 0.78 (0.38-1.62) |
| *P for trend* | *0.13* | *0.04* | *0.51* |
| *P for interaction* | - | *0.11* | |

[1]  Financially advantaged households at preschool age
[2]  Financially disadvantaged households at preschool age

In the final step, evaluating sensitive period hypothesis, the differential effects of maternal employment in different childhood periods were tested. In this analysis maternal employment in the three periods was mutually adjusted. As in the previous step, results are shown only for the fully adjusted analysis (unadjusted results are shown in Appendix 6). When the whole sample was used without considering any effect modification by household income or maternal education, the association between maternal employment and self-rated health was not particularly clear. After mutual adjustment the odds ratios for employment compared to not-employment during the preschool and primary school periods suggested non-significant reduction of the odds of poor self-rated health, while for the secondary-school period it suggested an increase in the odds of poor self-rated health (table 7.9, left column). These results, in line with all previous findings, did not suggest a strong relationship between maternal employment and self-rated health. However, again in line with previous steps of the analysis, the

interpretation of the findings changed when they were stratified by social characteristics.

The results stratified by household income are shown in the middle and right columns of table 7.9. In this analysis maternal employment in the three periods was again mutually adjusted. In addition to this mutual adjustment, the interaction with household income could be added to the model. The advantage of this model compared to the two previous models used in this chapter (the trajectory model and the accumulation model) is that household income in each period of childhood could be used for an appropriate measure of maternal employment. Although no evidence of interaction between social disadvantage and maternal employment during the secondary-school period was reported in section 6.5, for consistency of reporting it was decided to introduce this interaction into this model, meaning that interactions were tested for all three childhood periods. While there is strong evidence for a significant interaction between maternal employment and household income in the first period of childhood, there is no statistical evidence of any such interaction in the second and third periods of childhood. While the effect of maternal employment during the primary school period seems very similar by level of social disadvantage, the effect is the opposite in the secondary-school period (maternal employment increasing the risk of poor self-rated health among those from lower-income households, and reducing the risk of poor self-rated health among those from higher-income households).

In line with results for the trajectory model when household income is replaced by maternal education, the stratum-specific odds ratios are similar to those presented here, but the confidence intervals are wider and less precise, mostly because only a very few mothers with above-secondary education were not employed in different periods of participants' childhoods. Thus it seems that the variable of household income is a better

choice of effect-modifier in this analysis, mainly because of the nature of the available data.

**Table 7.9. Mutually adjusted model of maternal employment and self-rated health – unstratified and stratified by household income**

| | All | Financially advantaged households[1] | Financially disadvantaged households[2] |
|---|---|---|---|
| | OR and 95% CI | | |
| Employed at preschool period | 0.83 (0.53-1.29) | 0.32 (0.13-0.81) | 1.15 (0.70-1.88) |
| *P for interaction* | - | 0.01 | |
| Employed at primary school period | 0.56 (0.31-1.11) | 0.48 (0.15-1.53) | 0.67 (0.33-1.36) |
| *P for interaction* | - | 0.60 | |
| Employed at secondary school period | 1.44 (0.72-2.88) | 0.87 (0.27-2.77) | 1.66 (0.76-3.62) |
| *P for interaction* | - | 0.32 | |

[1] Financially advantaged households in three childhood periods (relevant income used for each period)
[2] Financially disadvantaged households in three childhood periods

Summarising the results by different levels of material disadvantage, it is possible to say that there is very limited evidence for an association between maternal employment and poor self-rated health in less advantaged households. The direction of the association changes between periods, and is not statistically significant for any period.

However, the data provide some evidence for a protective effect of maternal employment against poor self-rated health in young adulthood among those from more materially advantaged households. The effect of maternal employment (1) is protective in all three periods, (2) is statistically significantly protective in the early period of childhood, and (3) shows the largest magnitude of effect in the first period and reduces with the increasing age of the child.

These data provide evidence of a differential association between maternal employment and self-rated health in less and more advantaged social groups. There is particularly

strong statistical evidence for such a differential effect in preschool period (p for interaction 0.01). However, the results must be treated with caution, as the sample size is small and the confidence intervals are wide.

In terms of the hypotheses stated in Chapter 3, it is possible to say that Hypotheses 1 and 3 were not supported by this analysis in terms of self-rated health. There is no numerical evidence in the fully adjusted data of a negative effect of maternal employment during childhood on self-rated health in young adulthood. It is possible to say that Hypothesis 4 and to a certain extent Hypothesis 5, which state that the negative effects of maternal employment are reduced in households with higher incomes and among those with mothers with higher levels of education, were partially supported by the data. Household income (and maternal education) modifies the role of maternal employment. While no consistent effect has been identified among those in more socially disadvantaged households, a protective effect of maternal employment across the whole of childhood has been identified among those in more advantaged households. The simpler cumulative model showed that the greater the number of periods of employment, the smaller the likelihood of poor self-rated health. The model using the three variables of maternal employment mutually adjusted showed that maternal employment was protective in these socially advantaged households in all periods, although significantly protective only in the earliest period, and that the effect became weaker as the child became older. These results suggest that preschool period might be particularly sensitive for this social group. The results do not support Hypothesis 6 (on the modifying role of maternal marital status) for self-rated health; nor was such a role identified for childcare arrangements (Hypothesis 8) or maternal job satisfaction (Hypothesis 9). In line with Hypothesis 7, it has been shown that maternal health and smoking behaviours have important confounding roles, as the effects of

maternal employment changed when these variables were introduced into the statistical models.

It is important to further discuss the reasons for these results and the differential effects of maternal employment. These will be discussed briefly in section 7.6 and in more detail in Chapter 8 when compared to other existing evidence.

## 7.4  Models for psychological distress

Section 7.4 will focus on the role of maternal employment in psychological distress. The results from section 6.5 again helped to identify the variables to be used in this combined life-course analysis. Section 6.5 identified that household income might play the role of effect-modifier in all three periods of childhood. This role will be tested in this analysis. Furthermore, maternal marital status, maternal education, maternal self-rated health and psychological distress, and maternal smoking were identified as confounding variables in Chapter 6, and will be used in the adjusted models of the analysis in this section. The role of job satisfaction during secondary school period was also previously identified as potentially important. However, the effect of this variable disappears when variables from all three periods of childhood are included in the same model (not shown in the tables in this section), and this variable will not be used in the models presented here.

For psychological distress, the unadjusted results from the trajectories analysis are first shown for the whole sample and then stratified for those in households with lower and higher incomes during the preschool period. This is followed by the results from the adjusted analysis. The results for the whole sample are again followed by stratum-specific results (table 7.10).

In the crude and adjusted analyses of the pooled sample, there was no difference between the different trajectories of maternal employment in terms of their effect on psychological distress. The effect of maternal employment on psychological distress differed substantially between those living in households with lower incomes and those living in households with higher incomes in the analyses focusing on single periods of childhood, as reported in section 6.5. Thus the models presented in left column of table 7.10 might not be appropriate for trajectories analysis. Indeed, in the model focusing on unadjusted stratified analysis, the interaction between the trajectories of maternal employment and household income during the preschool period was borderline significant ($p = 0.06$). When adjusted for sex, maternal education, maternal marital status, maternal self-rated health, maternal psychological distress and maternal smoking, the interaction between household income and trajectories of maternal employment became statistically significant ($p = 0.02$ in table 7.10 at the bottom). While the trajectories that included periods of employment were associated with increased odds of psychological distress in financially disadvantaged households, maternal employment was generally protective among those from households with higher incomes. In addition, trajectories with two or three periods of maternal employment showed lower odds ratios than those with only one period of employment, suggesting a potential accumulation of effect.

**Table 7.10. Unadjusted and fully adjusted association between maternal employment and psychological distress in trajectory model – unstratified and stratified by household income at preschool age**

| | All | Financially advantaged households[1] | Financially disadvantaged households[2] |
|---|---|---|---|
| Trajectory | OR (95% CI) | | |
| Unadjusted | | | |
| Never employed | 1 (ref) | 1 (ref) | 1 (ref) |
| Moving into employment | 0.83 (0.46-1.51) | 0.44 (0.10-1.83) | 0.93 (0.48-1.80) |
| Moving out of employment | 0.75 (0.27-2.07) | 0.10 (0.01-1.01) | 1.21 (0.39-3.75) |
| Always employed | 0.93 (0.52-1.66) | 0.26 (0.07-0.99) | 1.22 (0.64-2.34) |
| *P for interaction* | - | *0.06* | |
| Fully adjusted | | | |
| Never employed | 1 (ref) | 1 (ref) | 1 (ref) |
| Moving into employment | 1.11 (0.59-2.09) | 0.43 (0.11-1.68) | 1.45 (0.70-2.98) |
| Moving out of employment | 0.75 (0.27-2.05) | 0.09 (0.01-0.84) | 1.33 (0.43-4.13) |
| Always employed | 1.11 (0.60-2.06) | 0.24 (0.07-0.88) | 1.77 (0.87-3.61) |
| *P for interaction* | - | *0.02* | |

[1]    Financially advantaged households in Period 1
[2]    Financially disadvantaged households in Period 1

In the accumulation model, the number of periods of their childhood when the mother was in paid employment was again counted for each data record (table 7.11), and this count variable was assessed for any association with psychological distress. First the analysis was done for the whole sample (table 7.12, left column) and, consistently with the trajectories model, no association was identified between the number of periods when the mother was employed and psychological distress. Stratum-specific results, however, confirmed differences in the effects of maternal employment on psychological distress among those from less and more financially disadvantaged households. While among those from lower-income households an increasing number of childhood periods when the mother was employed increased the odds of psychological distress (p for trend

in odds ratios 0.08), the relationship took the opposite direction among those from higher-income households. An increasing number of childhood periods when the mother was employed was associated with a large reduction in the odds of psychological distress. Those whose mothers were employed in all three periods were four times less likely to be psychologically distressed in young adulthood than those whose mothers were not employed in any childhood period (p for trend 0.02). There is statistical evidence for the differential effect of maternal employment by household income (p for interaction 0.02).

**Table 7.11. The number of records in accumulation model for the analysis of psychological distress – overall and stratified by household income**

| Mother employed in number of childhood periods | All | Financially advantaged households[1] | Financially disadvantaged households[2] |
|---|---|---|---|
| | Number of records (% distressed) | | |
| 0 | 260 (27.3) | 42 (45.2) | 218 (23.9) |
| 1 | 222 (23.4) | 34 (44.1) | 188 (19.7) |
| 2 | 692 (24.0) | 137 (26.3) | 555 (23.4) |
| 3 | 1077 (25.3) | 314 (25.8) | 763 (25.0) |

[1] Financially advantaged households in Period 1
[2] Financially disadvantaged households in Period 1

**Table 7.12. The fully-adjusted association between psychological distress and maternal employment in accumulation model – unstratified and stratified by household income at preschool age**

| Mother employed in number of childhood periods | All | Financially advantaged households[1] | Financially disadvantaged households[2] |
|:---:|:---:|:---:|:---:|
| | OR (95% CI) | | |
| 0 | 1 (ref) | 1 (ref) | 1 (ref) |
| 1 | 1.00 (0.45-2.22) | 0.75 (0.12-4.61) | 1.12 (0.46-2.76) |
| 2 | 1.07 (0.56-2.03) | 0.30 (0.07-1.18) | 1.52 (0.73-3.16) |
| 3 | 1.10 (0.59-2.04) | 0.24 (0.07-0.88) | 1.75 (0.86-3.56) |
| P for trend | *0.70* | 0.02 | 0.08 |
| P for interaction | - | 0.02 | |

[1] Financially advantaged households in Period 1
[2] Financially disadvantaged households in Period 1

In the final step of the analysis, evaluating sensitive period hypothesis, the differential effects of maternal employment in different periods of childhood were tested and fully adjusted results are shown in table 7.13 (unadjusted results are shown in Appendix 7). In this analysis, the effect of maternal employment in the three periods was mutually adjusted. Similar to self-rated health, when the whole sample was used without accounting for any effect modification by household income, the association between maternal employment and psychological distress was weak and the pattern of the association was not very clear (table 7.13, left column). Again, similar to previous steps of the analysis, the interpretation of the findings changed when they were stratified by household income. While there is evidence for a borderline significant interaction between maternal employment and household income during the preschool period, and for a statistically significant interaction during the primary school period (p = 0.02), there is no evidence of any such interaction in the third period of childhood. Among participants from less advantaged households, the increase in the odds of psychological distress is small in relation to maternal employment in the first period of childhood,

while having a mother in paid employment in the second period of childhood significantly increases the likelihood of psychological distress (OR 2.34). Maternal employment in the third period, on the other hand, reduces the odds of psychological distress somewhat, although this reduction is not statistically significant.

While the picture is not entirely clear and consistent among those in less advantaged households, the protective role of maternal employment among those in more advantaged households seems relatively clear. In line with the accumulation model presented in the previous step of the analysis, maternal employment seems to be protective in every period of childhood. Although the reduction in the odds of psychological distress is not statistically significant in any period of childhood, this might be partly due to the relatively small number of individuals in this stratum of the data, because the effects are relatively large in terms of odds ratios.

**Table 7.13. Mutually adjusted model of maternal employment and psychological distress stratified by household income**

| | All | Financially advantaged households[1] | Financially disadvantaged households[2] |
|---|---|---|---|
| | OR and 95% CI | | |
| Employed at preschool period | 0.91 (0.62-1.33) | 0.52 (0.24-1.12) | 1.13 (0.74-1.74) |
| *P for interaction* | - | 0.08 | |
| Employed at primary school period | 1.61 (0.90-2.89) | 0.63 (0.23-1.74) | 2.34 (1.21-4.55) |
| *P for interaction* | - | 0.02 | |
| Employed at secondary school period | 0.74 (0.40-1.37) | 0.72 (0.27-1.96) | 0.67 (0.33-1.36) |
| *P for interaction* | - | 0.90 | |

[1]   Financially advantaged households in three childhood periods (relevant income used for each period)
[2]   Financially disadvantaged households in three childhood periods

These data from the BHPS study give some statistical evidence of a differential association between maternal employment and psychological distress in less and more advantaged social groups.

The findings in this section support the hypotheses of this project in similar way to those summarised in section 7.3 for self-rated health. It is again possible to say that Hypotheses 1, 2 and 3 were not confirmed in such a way that the results could be generalised for the whole population. There is no evidence in the fully adjusted data of a universally negative effect of maternal employment in childhood on psychological distress in young adulthood. It is possible to conclude that Hypothesis 5, which states that the negative effect of maternal employment is reduced in households with higher incomes, was supported by the data. Not only was the negative effect reduced, but the effect of maternal employment was protective among those from higher-income households, and household income was confirmed as a statistically significant effect-modifier for the role of maternal employment in psychological distress. The role of maternal education as an effect-modifier was not as strong as in the case of self-rated health (not shown in the tables). While it cannot be said that maternal education is not an effect-modifier, there is not enough evidence in these data to reject a null hypothesis of no interaction between maternal employment and maternal education. Hypotheses 6, 8 and 9 (on the modifying roles of maternal marital status, childcare arrangements and maternal job satisfaction) have not been supported in these data for psychological distress. However, Hypothesis 7, which states that maternal self-rated health, maternal psychological distress and maternal smoking have important confounding roles, has been confirmed, as the effects of maternal employment changed when these variables were introduced into the statistical models. Maternal psychological distress played the most important confounding role among these three variables.

The results in this section related to psychological distress give even clearer evidence for the differential relationship between maternal employment and this study outcome. Some potential explanations for these findings will be suggested in section 7.6 at the end of this chapter.

## 7.5  Models for smoking

The analysis of the effect of maternal employment on smoking in young adulthood will now be presented, using maternal education, household income, maternal self-rated health and psychological distress, and maternal smoking as potential confounders of the association. Maternal marital status was identified in section 6.5 as a potential effect-modifier in the effect of maternal employment in all three periods of childhood on the risk of smoking, and will be used in this role in this section.

The analysis in this section will follow the structure of previous sections. The unadjusted results for the whole sample are shown in table 7.14. As expected, no clear pattern was found for the association between maternal employment and smoking when the whole sample was used in the crude analysis.

Including maternal marital status in the model as an effect-modifier has an impact on the results. The pattern of the results is reversed between those whose mothers were married during the preschool period and those whose mothers were not married. In line with the findings related to single periods of childhood in Chapter 6, those whose mothers' employment trajectories included periods of employment were more likely to smoke in young adulthood if their mothers were married, while the odds of smoking were reduced for those whose mothers were not married and were employed at some point during their childhood. Although the magnitude of the effect seems numerically extreme, it must be pointed out that the confidence intervals are extremely wide, and the interaction between different employment trajectories and maternal marital status is not statistically significant. This statistical artefact is related to the facts that (1) there are a limited number of records in various trajectories for unmarried mothers (as shown in table 7.15), and (2) smoking is most common among those with unmarried and not employed mothers (as reported in Chapter 6).

The unadjusted results are followed by the results from the fully adjusted analysis. These results generally follow the same patterns as the unadjusted results. The confidence intervals became even wider in the adjusted analysis, although it may be said that the odds ratios among those with unmarried mothers became less extreme (at least in two groups of trajectories).

The results in table 7.14 suggest that in general maternal employment might increase the risk of smoking among those whose mothers were married, although the confidence intervals for the odds ratios are extremely wide. There is the opposite pattern in the association between maternal employment and smoking among those whose mothers were not married.

**Table 7.14. Unadjusted and fully adjusted association between maternal employment and smoking in trajectory model – unstratified and stratified by maternal marital status at preschool age**

| Trajectory | All | Married | Unmarried |
|---|---|---|---|
| | OR (95% CI) | | |
| Unadjusted | | | |
| Never employed | 1 (ref) | 1 (ref) | 1 (ref) |
| Moving into employment | 1.47 (0.37-5.77) | 4.68 (0.84-26.15) | 0.32 (0.02-6.52) |
| Moving out of employment | 0.31 (0.03-3.27) | 1.29 (0.07-23.15) | 0.02 (0.00-1.50) |
| Always employed | 0.88 (0.24-3.27) | 4.03 (0.77-21.21) | 0.07 (0.00-1.23) |
| *P for interaction* | - | 0.17 | |
| Fully adjusted | | | |
| Never employed | 1 (ref) | 1 (ref) | 1 (ref) |
| Moving into employment | 2.97 (0.67-13.22) | 6.74 (1.08-41.97) | 0.78 (0.05-13.22) |
| Moving out of employment | 0.36 (0.03-4.71) | 0.99 (0.05-21.68) | 0.07 (0.00-6.87) |
| Always employed | 2.15 (0.50-9.26) | 5.35 (0.90-31.86) | 0.34 (0.02-5.62) |
| *P for interaction* | - | 0.50 | |

The results of the accumulation model are presented next. The number of periods of childhood when the mother was in paid employment has been again counted, and the frequency distribution of this count variable is shown in table 7.15. From the results of the pooled analysis it could be suggested that having a mother who was employed in one or more periods of one's childhood increases one's risk of smoking in young adulthood (table 7.16, left column). However, in light of the stratum-specific results by maternal marital status shown in remaining two columns of table 7.16, it seems that such a message is relevant only for those whose mothers were married. While maternal employment increased the odds of smoking for individuals whose mothers were married, there was no clear stepwise increase in the odds related to the number of periods of childhood when the mothers were employed. The highest increase in the odds of smoking was among those whose mothers were employed in only one period. For those whose mothers were not married, however, it seems that maternal employment reduced the odds of smoking if mothers were employed during at least two periods of the participant's childhood. If those whose mothers were employed in all three periods are taken as a reference category, then the odds ratios in the unmarried mothers' group is 1.1 for those whose mothers were employed during two periods of the respondent's childhood, but 4.6 for those whose mothers were employed only once, and 3.0 for those whose mothers were not employed at all. As with the results from the trajectories models, the confidence intervals were very wide, and none of the results was statistically significant. Although the results for those with married and unmarried mothers seem to be very different, the interaction between maternal marital status and maternal employment was not statistically significant. These results again confirmed the very limited statistical power of the life-course analysis of this outcome.

**Table 7.15. The number of records in accumulation model for the analysis of smoking stratified by maternal marital status**

| Mother employed in number of childhood periods | All | Maternal marital status | |
|---|---|---|---|
| | | Married | Unmarried |
| | Number of records (% smoke) | | |
| 0 | 282 (20.9) | 193 (12.4) | 89 (39.3) |
| 1 | 227 (25.6) | 165 (20.0) | 62 (40.3) |
| 2 | 720 (22.9) | 576 (19.6) | 144 (36.1) |
| 3 | 1149 (21.9) | 969 (20.9) | 180 (27.8) |

**Table 7.16. The fully adjusted association between smoking and maternal employment in accumulation model – unstratified and stratified by maternal marital status at preschool age**

| Mother employed in number of childhood periods | All | Married | Unmarried |
|---|---|---|---|
| | OR (95% CI) | | |
| 0 | 1 (ref) | 1 (ref) | 1 (ref) |
| 1 | 4.17 (0.64-27.16) | 8.27 (0.86-79.5) | 1.51 (0.04-56.2) |
| 2 | 1.87 (0.41-8.47) | 4.65 (0.73-29.6) | 0.36 (0.02-6.40) |
| 3 | 2.00 (0.46-8.60) | 4.93 (0.83-29.4) | 0.33 (0.02-5.42) |
| P for trend | *0.72* | 0.27 | 0.31 |
| P for interaction | - | 0.47 | |

In the final step, the differential effects of maternal employment in different periods of childhood were tested when the effect of maternal employment in the three periods of childhood was mutually adjusted using variables for all three childhood periods in the same model (table 7.17). While there was some limited evidence for a potential interaction between maternal employment and maternal marital status in the second period of childhood, there was no statistical evidence of any such interaction in the first

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or third periods of childhood. In all three periods the effect of maternal employment was quite different between those whose mothers were married and those whose mothers were unmarried (maternal employment was less protective during the preschool period among those with married mothers compared to those with unmarried mothers, and was more harmful during the primary- and secondary-school periods, with much larger odds ratios, among those with married mothers compared to those with unmarried mothers), but these differences were not statistically significant. Thus the interaction terms were retained in the model, although they were not statistically significant.

These data partly suggest a differential effect of maternal employment on smoking by maternal marital status, but the evidence is not very strong. It is important to say that the marital status component of the interaction is more important than employment, and that smoking is more common among those with unmarried mothers than among those with married mothers, regardless of mothers' employment status.

The results from table 7.17 also suggest that this is the preferable model for smoking from a statistical point of view. The confidence intervals in this model, although still large, are narrower than those in the accumulation and trajectories models. The data suggest a protective effect of maternal employment in the first period of childhood and a harmful effect of maternal employment in the third period of childhood for the smoking behaviour of study participants; however, the findings are not precise enough to lead to any firm conclusions. In terms of the study hypotheses, it is possible to suggest that the results for smoking at least partly support Hypothesis 6, which proposes that marital status modifies the effect of maternal smoking on the smoking of young adults. The data also support Hypothesis 7, which suggests that maternal health and health behaviours play the role of confounding factors. Maternal smoking plays quite a substantial role in

this respect. However, the results do not support the other hypotheses. There was no evidence for any effect modification by household income (Hypothesis 5), maternal education (Hypothesis 4), childcare arrangements (Hypothesis 8) or maternal job satisfaction (Hypothesis 9). The results do not support Hypothesis 1, which stated that maternal employment would increase the risk of the outcome. Also, these results contradict Hypothesis 3, which expected that the harmful effect of maternal employment would be greatest in the earliest period of childhood. The results shown in table 7.17 suggest the opposite for smoking behaviour: maternal employment seems to increase the odds of smoking the most in the last period of childhood.

**Table 7.17. Mutually adjusted model of maternal employment and smoking**

|  | **All** | **Married[1]** | **Unmarried[2]** |
|---|---|---|---|
|  | OR and 95% CI | | |
| Employed at preschool period | 0.70 (0.29-1.71) | 0.76 (0.28-2.05) | 0.38 (0.05-2.84) |
| *P for interaction* | - | 0.55 | |
| Employed at primary school period | 0.78 (0.21-2.95) | 1.46 (0.29-7.39) | 0.22 (0.02-2.19) |
| *P for interaction* | - | 0.17 | |
| Employed at secondary school period | 3.34 (0.76-14.66) | 3.86 (0.62-24.0) | 1.79 (0.12-27.9) |
| *P for interaction* | - | 0.68 | |

[1]  Married mothers in three childhood periods (relevant maternal marital status used for each period)
[2]  Unmarried mothers in three childhood periods

The results in this section related to smoking give some further evidence of a differential relationship between maternal employment and this outcome when those who lived with married mothers during childhood are compared with those who lived with unmarried mothers. While there are differences in the effect, particularly during the primary-school period, it should be said that the effect of maternal employment had the

same directions in the early and late periods of childhood: it was protective in the early years and harmful in the late years. There may be various reasons for such findings; one of these might be that having a mother at work during the secondary-school period means more unsupervised time, possibly spent with friends who might encourage one to start smoking. These results contradict various findings from previous literature, and will be discussed further in Chapter 8.

## 7.6 Summary of the findings and their relation to the original hypotheses

To summarise overall, it is possible to say that the findings in this chapter (as well as the previous findings from Chapter 6) partly support the hypotheses listed in Chapter 3, and in particular the "modification" Hypotheses 4, 5 and 6. It has been shown that household income (Hypothesis 5) and maternal education (Hypothesis 4) play an important effect modification role in the association between maternal employment and self-rated health and psychological distress, while maternal marital status (Hypothesis 6) plays such a role in the association between maternal employment and smoking. However, it is important to mention that the evidence for these effect modifications is not particularly strong, and is either borderline significant or statistically significant to a 5% significance level in only a few cases. This is most likely due to the relatively small sample size, particularly in those analyses using the preschool period and in the life-course analysis in this chapter.

Hypothesis 2 related to the length of exposure is also at least partly supported by the results: the magnitude of the effect is largest in cases where the mothers were employed in all three periods. A particularly strong dose-response relationship was identified for the psychological distress outcome, with a clear increase in the odds of distress related

to an increasing number of maternal employment periods among those from lower-income households, and a clear reduction in the odds of distress related to an increasing number of maternal employment periods among those from higher-income households.

Hypotheses 8 and 9, which were related to the role of childcare and job satisfaction in the association between maternal employment and the study outcomes, were not supported by the results from the adjusted analyses, which showed no strong role for these variables in the associations of interest, and showed that maternal employment and socio-economic measures (maternal education and household income) in particular are stronger determinants of study outcomes.

The plausibility of these findings can be discussed briefly here. One possible explanation of the results for self-rated health and psychological distress might be related to the choice and availability of jobs for mothers from less and more socially advantaged groups and with higher and lower levels of education. Mothers from less disadvantaged groups might choose to work not so much for economic reasons but more out of choice, may spend more financial resources on different forms of care, and may choose to work part-time or with more standard working hours. Mothers from less privileged families may have less choice of jobs, may work because of the family's economic needs, may work longer hours or do shift work, and will not be able to spend financial resources on other forms of care. All of these reasons might contribute to the differential time and resources available to spend on the children, and potentially to the children's differential health and development. Mothers' personal satisfaction and happiness could influence the psychological well-being of their children in both the short and long term (captured here as psychological distress in young adulthood). It is important to underline that these are all hypotheses that are difficult to test in the data set used for this analysis, as the variables are either not available for such an analysis or

would reduce the sample to such a small size that it would not be sufficiently powerful

to make any estimates. This topic will be discussed further in Chapter 8.

# 8 Discussion

The aim of this chapter is first to present a brief overall summary of the results of this thesis. The strengths and limitations of this study will be discussed in the next section. This will be followed by a comparison of the findings from this project with the results of other relevant studies, and possible explanations for the similarities and differences between the results of this project and other results will also be considered. Finally, the potential implications for further research, policy and health promotion activities will be discussed.

## 8.1 Summary of the results and comparison with the existing evidence

This project used longitudinal data from the BHPS to show how self-rated health, psychological distress and smoking behaviour in young adults is influenced by maternal employment during childhood taking into account other social, psychological and behavioural risk factors. The descriptive analyses showed that almost 20% of study participants reported poor health, and approximately a quarter of participants reported psychological distress and smoked at some point in young adulthood. These estimates differed a little depending on the data set used, but the differences were small.

The unadjusted findings suggested in particular that the odds of poor self-rated health and of being a smoker were reduced if respondents' mothers had been employed during the respondents' childhood, while there was no evidence for an association between maternal employment and psychological distress.

Potential confounding factors and effect-modifiers in the associations of interest were household income, maternal education, maternal marital status, maternal health (in

terms of maternal self-rated health and maternal psychological distress), maternal smoking, childcare arrangements and maternal job satisfaction. Household income and maternal education modified the association between maternal employment and two health outcomes, self-rated health and psychological distress, while maternal marital status modified the association between maternal employment and smoking behaviour in young adulthood. Maternal health characteristics and maternal smoking were identified as confounding factors in these associations. Childcare arrangements and mothers' job satisfaction were less influential in the association between maternal employment and the three study outcomes. There was possibly some effect-modifying role played by childcare arrangements in the association between maternal employment and self-rated health, and by maternal job satisfaction in the association between maternal employment and psychological distress.

When adjusted for confounding factors and stratified for effect-modifying variables, the findings for the association between maternal employment and the three study outcomes can be summarised as follows:

### *Self-rated health*

The results showed that in the first two periods of childhood, the preschool and primary-school years, having an employed mother was a statistically significantly protective factor against poor self-rated health in socially advantaged groups of the population (whether defined as households in the top two quintiles of household income or as families with mothers with higher education) contrary to the idea that maternal employment should have negative effect on young adult health. No such association was identified between maternal employment and self-rated health in less advantaged households for these two periods, and similarly no statistically significant association

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was identified in the third period of childhood, the secondary-school period, for individuals in either advantaged or disadvantaged households.

The final analysis combining data from all three periods in different life-course models confirmed the findings from earlier steps of the analysis, suggesting that the interaction between maternal employment and the social position of participants' families influenced the findings of the study. The life-course analysis focusing on three different life-course models suggests that the sensitive-period model might be the most appropriate for the association between maternal employment and self-rated health among those from more socially advantaged households. The data show that the most important role of employment is in the first period of childhood for those from such households. The life-course analysis also confirmed that the association between maternal employment and self-rated health is limited, of very small magnitude and not statistically significant, for those from less socially advantaged households. None of the three life-course models identified any important associations between maternal employment and self-rated health in this group of young adults from less socially advantaged households.

### *Psychological distress*

Similar conclusions can be drawn about the findings for psychological distress in young adulthood. The main difference is related to the results for those from less advantaged households. While it can again be said that maternal employment was protective for those from more advantaged households, a negative effect of maternal employment was identified for those living in less advantaged households. The data suggest that maternal employment plays the most protective role for those from advantaged households during the preschool period, and there seems to be a stepwise reduction in the odds of psychological distress associated with the number of periods when the mothers were

employed. For those from less advantaged households, the most harmful period in terms of maternal employment seems to be the primary-school years, and there is the suggestion of a stepwise increase in the odds of psychological distress associated with the number of periods when the mothers were employed. The statistically significant interaction for the accumulation of the effect of maternal employment indicates an opposite role for maternal employment in psychological distress in different social groups in this sample.

### *Smoking*

While maternal education and household income do not play such an important role in the association between maternal employment and smoking in young adulthood, maternal marital status has been identified as a potential effect-modifier in this association. Being employed seems to be particularly protective among the children of unmarried mothers in this association. However, the results must be regarded in light of the fact that maternal marital status itself is an important risk factor for smoking, showing a significant increase in the odds of smoking among those whose mothers were not married. The results from this analysis suggest that the odds of smoking among those whose mothers worked do not substantially differ between those with married and unmarried mothers, while there is a more than 20-fold difference in the odds of smoking by marital status among those whose mothers did not work during any period of childhood, identifying those whose mothers were both unmarried and not employed as particularly exposed to the risk of smoking in young adulthood.

The findings from this thesis are important for the evaluation of the role of maternal employment on health later in the life because the literature on the association between maternal employment and health and health behaviours in adolescence and young adulthood is limited. Additionally, most of the existing evidence relates to the

association between experiences of unemployment and various health-related outcomes in adolescence.

In their earlier analysis of the BHPS data using the first nine waves of the study, Ermisch et al. identified a negative role of unemployment in the development of smoking habits and psychological distress.[152] They identified the 11–15 age period as the most sensitive period for these two outcomes. In their analysis of Slovak adolescents of a similar age to those analysed in this study (ages 14–22), Sleskova et al.[26] concluded that long-term parental unemployment was negatively associated with self-rated health and long-term well-being. In another analysis of Slovak and Dutch adolescents,[150] the same authors found no such association among Dutch adolescents. However, they found that Dutch male adolescents whose mothers were unemployed had worse psychological well-being and long-term well-being than those whose mothers were employed. For Dutch females the association was the same with long-term well-being, while there was no association found between maternal unemployment and psychological well-being. The difference between these three published analyses and the analysis presented in this project is the stratification of the results by characteristics of social circumstances. It can only be speculated how this stratification may affect the comparison of the results. Ermisch et al. in their analysis identified a "non-intact family" (which is somewhat similar to the category of "unmarried mothers" in this project) as another important variable influencing psychological distress and especially smoking behaviour.[152] Their results thus closely agree with this project's findings related to smoking. In this project those whose mothers were neither married nor employed in any period of childhood or were employed in only one period were more likely to be smokers in young adulthood. While Ermisch et al. did not consider the interaction between the two social exposures, their results indirectly suggest the possibility of such an interplay between maternal employment and family structure.[152] When proposing extensions of their work in their

conclusion they also explicitly mention that it would be important to evaluate the interaction between parental marital status and parental employment.

The results related to smoking, which show a negative impact of maternal employment in the last period of childhood, indirectly support the literature summarised in section 2.5.4 on the role of siblings in childcare. Several papers mention that siblings' caregiving might not always be associated with healthy development and healthy behaviours, and might have a negative impact.[241-243] In addition to siblings, friends might also play a particularly negative role. In this study, smoking behaviour in particular might have been influenced by siblings and friends. Having an employed mother in the last period of one's childhood increases one's likelihood of spending unsupervised time with friends and siblings who may act as role models and increase one's likelihood of smoking. This is particularly likely among those living with mothers who are not married. In this social group, maternal employment in the first two periods reduced the likelihood of smoking in young adulthood, while the effect of maternal employment in the last period of childhood was completely reversed.

In terms of maternal employment and smoking, evidence also comes from a study conducted by Aughinbaugh and Gittleman,[161] who did not find any relationship between maternal employment in the first three years of childhood and smoking in adolescence. The results from this thesis do not contradict these previously published results, at least in terms of statistical significance. However, the data and analyses shown in this thesis are more detailed, both because they have more extensive exposure data on maternal employment covering the 0–16 age period, and also because they can focus on subgroup analysis (testing marital status or SES interactions). Some of the interactions, particularly those between maternal employment and marital status, suggest that the effect of maternal employment on smoking behaviour is not uniform, and that maternal

employment might possibly play different roles in different phases of childhood. While it generally seems that maternal employment increases the likelihood of smoking among 16–21-year-olds with married mothers, and decreases the likelihood of smoking among those with unmarried mothers in preschool and primary school period (although it seems the association is in the same direction at secondary school age as among those with married mothers), it should be mentioned at the same time that the impact of marital status or socio-economic position on the likelihood of smoking is much stronger. The data also suggest that the impact of maternal employment, marital status and socio-economic circumstances on the likelihood of smoking in later periods of childhood is more important than the role of these variables at younger ages. This may also be an important factor in a comparison of these results with the results by Aughinbaugh and Gittleman.

The statistical evidence for the effect modifications was not particularly strong in most of the analyses, even in the case of psychological distress, most likely because of the relatively small sample size and the limited power of the analysis. The issues of the power of the analysis and the sample size will be discussed later in section 8.2, which focuses on the methodological issues of the project. The results suggest that the magnitude of the effect of maternal employment is the greatest when the mothers were employed in all three periods. Such a dose-response relationship (and the interaction with household social position expressed by household income) seems to be the clearest for psychological distress, with a clearly increasing likelihood of distress related to an increasing number of maternal employment periods among those from lower-income households, and a clear reduction in the odds of distress related to an increasing number of maternal employment periods among those from higher-income households.

In contrast to the findings for smoking, maternal marital status was not identified as playing an important role in the association between maternal employment and self-rated health or psychological distress. Thus none of the markers of socio-demographic position was a universally applicable effect-modifier, and the analysis of each specific marker of health required a consideration of different social and demographic influences.

The results of this study to some extent agree with the findings of other studies showing that social position during childhood might be associated with various health and health behaviour outcomes in adulthood. For example, it has previously been shown that children from families in socially disadvantaged groups are more likely to smoke as adults.[277-281] Jefferis et al.[282] looked at cumulative socio-economic positions throughout childhood and adulthood and their association with smoking behaviour, and found that those who repeatedly fell into the socially disadvantaged group were the most likely to smoke throughout adulthood. While these findings have been repeated in this study, showing that participants from families with less educated mothers, unmarried mothers or lower incomes were more likely to smoke or report psychological distress or poor health, this study has also shown that these factors influence the association between maternal employment and the study outcomes. This finding is new, and adds information to the evidence base on this topic. The findings of this study suggest that there may be different reasons for being in paid employment among those in more and less socially advantaged households. It is possible, for example, that mothers in more socially advantaged households are employed because that was their choice and they wanted to use their education and skills, while the reasons for employment among those from less advantaged households might primarily be the economic needs of the family. Additionally, it is possible that mothers in more socially advantaged household have different working patterns that than those in less advantaged households. For example,

they may choose to work part-time or with more standard working hours while mothers from less advantaged families may work longer hours, do shift work or even combine two jobs to secure financial resources for the family. These different reasons for employment and possibly different working patterns may explain the generally positive effect of maternal employment in socially advantaged groups and its generally not so positive effect in less advantaged groups. Unfortunately there is a lack of previous literature showing similar analyses, and thus it is difficult to find supporting or conflicting evidence for these findings.

Somewhat surprisingly, on the other hand, childcare arrangements and job satisfaction were not found to influence the association between maternal employment and the three markers of health of young adults, and these findings thus did not support Hypotheses 7 and 8.

Maternal health conditions and maternal smoking behaviour acted as important confounding factors in the analysis. They were strongly associated with the outcomes of the study participants, and confounded the associations between maternal employment and all three study outcomes.

On the basis of the overall pattern of results, it is not possible to conclude that those whose mothers were employed during various stages of their childhoods had worse health or more psychological distress or smoked more. While these (or the opposite) conclusions can be drawn for certain social groups and certain periods of childhood (as described above), they cannot be drawn universally for the whole population. While the results provide evidence that the of role maternal employment in self-rated health or psychological distress is the most important for the first (preschool) period of childhood, it has been shown that the role of maternal employment in smoking seems to be most important in the last (secondary-school) period.

One major objective of this study was to assess different life-course models and test which models might be particularly useful for the outcomes used in this study. While these models were tested and general support for accumulation models with some limited support for preschool period being particularly sensitive for self-rated health and psychological distress and secondary school period for smoking was found, it is again rather difficult to compare the findings from this study with previous findings, as most of the existing literature has focused on maternal employment in the earliest years of life, and often on outcomes in the early years of life. The most complete attempt at an analysis similar to that presented here is by Ermisch et al.[152] Unfortunately it is rather inappropriate to use that paper for detailed comparison with the findings of this project, as both projects use data from the BHPS, and thus the two analyses are not entirely independent. While it is possible to say that this analysis is an extension of that presented by Ermisch and colleagues, who used data from the first nine waves of the BHPS, and that the results of this analysis mostly confirm the previous finding that different periods of childhood are important for various outcomes related to child health and development, an independent source of data would be needed for any further confirmation of the findings of this project.

## 8.2 Methodological issues

The findings of this project should be interpreted cautiously within the context of its methodological strengths and limitations – the study design, sample, measures used, bias and generalisability. These issues will now be discussed.

## 8.2.1 Representativeness of the sample

The BHPS is a nationally representative study consisting of a random sample of households. As mentioned in the Methods, the household response rate in Wave 1 was relatively high at around 69%, and the wave-on-wave household response rate remained high throughout the whole study, varying between 84% and 92%. However, it should be said that overall, compared with the initial sample, the response rate in Wave 18 was only about 45%. The BHPS data set includes weights to make the data representative in terms of demographic variables, using the 1991 population census to derive weights to account for non-response in Wave 1. These weights were further modified in subsequent waves to account for the differential attrition of the sample. However, these weights were not used in the present analysis. There are several reasons for not using these weights. First, from a methodological point of view, using weights in multilevel modelling would be difficult. Multilevel commands in Stata do not allow the use of sample weights, and literature on this topic is also limited, although Carle[283] in his experimental work concluded that the differences observed between results from analyses including sample weights and those using unweighted samples were minimal and did not differentially influence the research conclusions. He used data from National Survey of Children with special Health Care Needs from the United States and compared results from analysis using two different sets of sample weights and unweighted sampling, and he used multilevel analysis both with continuous and categorical outcomes. While the results of two weighted analysis were virtually identical and little differed from unweighted results, the differences in the results was small and beta coefficients in his analyses differed by one or two hundredths. Second, BHPS weights are based on demographic variables included in the population census. It is only possible to speculate whether and how responders differ from non-responders in terms of their health, health behaviours or risk factor profiles. Thirdly, the weights were

created for the whole BHPS sample while this thesis uses only subsample of the study, and it is not entirely clear whether the existing weights would be representative for sample used in this analysis. Furthermore, the aim of this project was not to make nationally representative estimates of the rates of poor health or smoking behaviour. The focus was on relative comparisons between different exposure groups. For example, if responders were healthier, more likely to have employed and more educated mothers, then our national estimates of the rates of good health, high education or employment could be overestimated. However, the associations between health and the markers of socio-demographic position may be unbiased.

To consider possible bias in estimates of the prevalence of the three study outcomes, it is possible to look back at figures 5.1, 5.2 and 5.3 in section 5.1. Figures 5.1 and 5.3 showed a decreasing prevalence of smoking and, in some limited way, of poor self-rated health in the later waves of the BHPS, which coincided with decreasing overall response rates in the study. Thus it is possible that rates of smoking and poor self-rated health were underestimated in later waves of the study. However, the reduction is small, particularly in rates of poor self-rated health, and there is no association between rates of psychological distress and response rates. This suggests that this bias, if it exists, is not large.

Another, more important question is whether non-response to the BHPS study could have an impact on the observed associations between maternal employment and self-rated health, psychological distress and smoking in young adults. This would influence the generalizability of the findings of this study to the whole population. No data to evaluate this issue are available, as no data for non-responders could be used. While the findings of this project are plausible, they should be seen as hypothesis-generating, and should be confirmed in further research in different studies. Such confirmation from

independent samples, either from the UK population or from a different country with a similar social structure and a similar role for women in society, would help to determine whether the findings of this project show a causal association or are due to a selection bias related to non-response in this study.

In addition to missing data from non-participants, missing values in individual variables might influence the representativeness of the analysed sample and the validity of the results. While the response rate might be an issue in this project, the proportion of missing values in the key variables (maternal employment and the three study outcomes) used in this project was low, and should not substantially influence the validity of the results.

## 8.2.2 Design limitations

A common problem in the use of longitudinal data, such as from the BHPS, is that of missing data.[284] In this project, as already suggested in previous section, missing data might not play such an important role. This will be illustrated through the example of self-rated health. Study participants were identified on the basis of study outcomes: they had to be in the study during their young adulthood. Because study participants could enter the study at the age of 16, the main problem was getting data about the study exposures before the age of 16. Individuals were mostly excluded from the analysis because there were no exposure data from childhood available, and less than 10% of individuals had to be excluded because of missing data; therefore it is possible to say that missing data were unlikely to substantially influence the findings of this study. The limited number of missing data was also the reason for not using data imputation, as this would not have substantially improved the analytical power of the study.

One potential problem related to sample selection is that students living in the halls of residence were excluded from the study. While there would be number of individuals aged 18 and more who were excluded for this reason from data collection in some years, it should not be major problem as most adolescents aged 16 and 17 live at home, and there would be at least one or two records for such individuals in the project sample. As repeated measures of outcome are correlated, and the proportion of study participants with one or two measures of outcome is small (and mostly due to being aged 16 in last two waves of BHPS) it is likely that this issue does not substantially influence findings of this project.

One particular problem related to the design of this project was sample size. While the overall BHPS study had a large sample size and a large power to detect statistically significant associations of interest, in this project the sample size and power might be an issue. The focus on a particular subgroup of the population (those aged 16–21) substantially reduced the sample size, and the study might lack the power to detect associations of interest. This is the case especially in relation to the association between the study outcomes and maternal employment during the early period of childhood, when the sample size is the smallest. The problem of power increases when the potential effect-modifying roles of maternal education, household income and maternal marital status are evaluated and the stratum-specific odds ratios of the effect of maternal employment are estimated. Therefore the results of some analyses should be interpreted cautiously in light of the wide confidence intervals.

Gender differences in transitions from childhood to adolescence and adulthood, in health, risk behaviours or psychological distress have been shown to be related to family and educational factors.[285;286] The results presented in this thesis show that social

disadvantage and marital status modified the relationship between maternal employment in childhood and health and smoking behaviour. Gender might be another effect modifier affecting the role of maternal employment on health outcomes and health behaviours. Limited sample size of the dataset used in this project did not allow including assessment of gender and maternal employment interaction in addition to interactions between social disadvantage/marital status and maternal employment. Additionally, it is possible that the effect modifying role of social disadvantage/marital status in the association between maternal employment and health and smoking behaviour shown in this thesis might be different among young men and women (so-called triple interaction). Such complex interaction between several variables could be investigated only in much larger dataset than the one used in this project.

Some of the results presented in this project are relatively novel (some of the interactions presented here have not been widely considered in previous literature) but need further confirmation in other data sets with a larger sample size. Some of these analyses might possibly be repeated in the UK birth cohorts, for example, although these birth cohorts will not have such regular measures of exposures provided in the BHPS study. The disadvantage of the three existing birth cohorts that have existing data covering the whole period of interest to this study (the 1946, 1958 and 1970 cohorts) is that they cover different calendar periods than this study, and therefore the findings, if different from those of this project, might be the result of period changes in society and in the effect of maternal employment during last 60–70 years. Period changes might be at least partly tested in the BHPS too, and this will be discussed later in this chapter.

Another design limitation is related to the decision to use three periods of childhood as the periods of exposure. While the literature summarised in Chapter 2 focused mostly on early childhood (such as the first one or two years of life), this was not possible in

this study because of the very small sample size. For example, for a study of the influence of maternal employment at age <1 on the three study outcomes in young adulthood, study participants would have had to be 0–1 years old in Waves 1 or 2 so as to be at least 16 years old during the study period (they would be 16 in either Wave 17 or Wave 18). The sample size for such an analysis would thus be only around 300. Several regression models were applied for such exposures, but the results presented here should be considered with extreme caution, as the confidence intervals are extremely wide. In the analysis of the association between maternal employment at age 0–1 years and psychological distress in young adulthood, the role of maternal employment again differed by the level of household income. This time maternal employment was protective in both strata of the studied sample. Among those from the less advantaged group, the odds ratio associated with mothers being employed was 0.65 in the fully adjusted model (while it was 1.29 for the 0–4 age period, as shown earlier in the Results). The magnitude of the protective effect of maternal employment was even larger for those from the more advantaged group, with an odds ratio of 0.11 (compared to 0.43 for the 0–4 age period).

These findings were similar to those related to smoking. While the odds ratios associated with mothers being employed during the preschool period were 1.05 for those with married mothers and 0.32 for those with unmarried mothers, the odds ratios comparing those with employed mothers at age 0–1 against those with unemployed mothers were 0.65 and 0.17 respectively. The role of maternal employment seemed to be protective in both social groups, although there was no statistical evidence for such an effect because of the small sample. Unfortunately the results could not be estimated for poor self-rated health, because the multilevel model using exposure data from the first year only did not converge.

The data presented in the above two paragraphs suggest that maternal employment in the first year may indeed be more influential on future health outcomes than in the whole preschool period. Unfortunately the BHPS study does not allow any more detailed or precise analysis.

One further possibility for the assessment of the sensitivity of the results in relation to the period of exposure is also to look at exposure to maternal employment during the 0–2 age period. The sample size increased to approximately 600 records in this analysis. Maternal employment was again protective against psychological distress among those from more advantaged households, with an odds ratio of 0.34, compared with 1.03 among those from the less advantaged group. The magnitude of the protective effect of maternal employment among those from more advantaged households thus reduces from an odds ratio of 0.11 for maternal employment during the 0–1 age period to 0.34 for the 0–2 age period and 0.43 for the 0–4 age period. Similarly, for those from less advantaged households the effect of maternal employment changes from 0.65 for the 0–1 age period to 1.03 for the 0–2 age period and 1.29 for the 0–4 age period.

Again, all three British birth cohort studies would allow the more precise analysis required to confirm or disprove the results from the BHPS, although they would cover an entirely different period of exposure. Mothers' employment would refer to the years 1946–7, 1958–9 or 1970–1, while the BHPS exposures date from 1991–2, when maternal employment was more common.

### 8.2.3  Random error

Odds ratios can differ from unity merely by chance. Statistical tests are used to assess this possibility. Throughout the analysis, emphasis has been placed on the 95% confidence intervals of the odds ratios of poor self-rated health, psychological distress

and smoking behaviour. Formal tests of statistical significance were performed where appropriate. As a large number of statistical tests were conducted, there is still a possibility that some "significant" findings might in fact have occurred by chance (with the use of 95% confidence levels, it can still be expected that 5% of tests will appear to be significant by chance).

However, there are several reasons why this might not be the case in this study. First, the results were at least partially consistent in all three study periods, and they were consistent in different steps of the analysis. Second, the project hypotheses were created before the statistical analysis was begun, and thus were not driven by the analytical results. Finally, the results seem largely plausible, and this plausibility will be discussed in section 8.3.

However, it has been mentioned in previous parts of the discussion, and in several places in Chapters 6 and 7, that many confidence intervals are wide and include 1.00. Such results must be treated with caution and considered only as either generating new hypotheses or adding information to already existing evidence.

### 8.2.4 Misclassification

Appropriate design and selection of individuals and careful analysis can improve this project's ability to assess the evidence of the effects of maternal employment on self-rated health, psychological distress and smoking in young adulthood. However, there are other important limitations to epidemiological studies, and misclassification is one of them. Self-reports of health status, smoking behaviour and social status may be subject to such misclassification.

## _Non-differential misclassification_

Non-differential misclassification is independent of the outcome or exposure status: the misclassification of the variable in question is assumed to be incorrect for the same proportion of individuals in the compared groups.

If the misclassification of the outcome is random (i.e. independent of the classification of the explanatory variables), the effect of such misclassification will be a dilution of the association and a reduction in the power of the study (in cases where a real association exists). In this study, the classification of study outcomes (both health and smoking behaviour) is based on subjective self-reporting. Clearly there is substantial room for misclassification, although Patrick et al.[287] have shown that self-reported smoking measures, at least, are generally reliable. Such misclassification, if random, will underestimate the strength of the associations between independent and dependent variables (ORs in the case of this project).

Non-differential misclassification of explanatory variables cannot be excluded either. Such a misclassification would result in an underestimation of the size of the effect of explanatory variables (a bias towards unity). There are no strong reasons for a significant misclassification of maternal education or other demographic factors that tend to be stable over time and can easily be checked (such as marital status). There is a possibility of an underestimation of some economic variables, because of people's tendency to hide their own wealth. This might lead to an overestimation of the effects of such variables (in this project, household income in particular). Similarly, it is possible to hypothesise that a similar effect might be seen for maternal employment if a certain proportion of mothers, for example, were employed illegally (not paying taxes) and wanted to hide such employment. This hypothetical situation seems extremely unlikely in the case of the BHPS. A slightly different situation may occur with maternal health

and smoking behaviour. For these variables, it is more likely that misclassification might have occurred, and such misclassification would again result in an underestimation of the role of these variables in the explanation of the association between the main exposure and the study outcomes.

Of the three study outcomes, self-reported smoking status seems to be the least affected by misclassification. Although it has been reported that self-reported smoking may somewhat underestimate the real prevalence of smoking in certain subgroups of the population,[288] it has been shown that such misclassification is relatively small when compared to objective biochemical measures such as cotinine levels in hair samples.[289] It was estimated in the US Cardia study of young adults aged 18–30[289] that self-reported smoking may underestimate smoking habits by approximately 4%.

The misclassification of self-reported measures of health might be more serious than the magnitude of underestimation of smoking habits. It is likely, however, that this will be a less serious problem for psychological distress. Although it is possible that different definitions of psychological distress generated from the GHQ-12 instrument may be more or less sensitive, this instrument is constructed from 12 questions which have been previously validated and used in a number of studies. Additionally, a 12-item instrument should not be as sensitive to the misclassification of one or two items as a single-item measure. While section 8.2.6 will deal with the selection of an appropriate definition of psychological distress based on the GHQ-12 questionnaire, it seems less likely that GHQ-12 is prone to responders' misclassification than a single-item measure of self-rated health would be.

## *Differential misclassification of self-reported health*

There is probably a greater possibility that self-reported health will be misclassified. It has been stated that this measure combines the characteristics of objective health status and the subjective expectations that individuals might have for themselves.[290] It has been repeatedly shown that such expectations might depend on the cultural, demographic and social characteristics of these individuals.[291-293] Some authors state that respondents look at people from similar social groups and compare themselves with those people when evaluating their own health status. Ross and Van Willigen reported that those from the least disadvantaged groups have the greatest expectations about their own health.[294] It is thus likely that a higher prevalence of poor health might be reported by this social group than by other social groups that do not have such expectations. As social characteristics play an important role in this thesis, both as the main exposure and as the main covariates, and because the prevalence of poor health is higher among people from more disadvantaged groups, it is possible that the findings of this thesis might have been influenced by this type of misclassification, and that the magnitude of social differences in self-rated health might have been underestimated. Nevertheless, the key analyses are reported as stratum-specific according to household income, maternal education or maternal marital status, and as such the role of different misclassification of the outcomes by social conditions should be reduced. However, it is important to keep in mind that the strata are very crude (in some cases binary), and the danger of misclassification cannot be entirely dismissed.

## *Differential misclassification of exposure*

Differential misclassification of exposure is a type of misclassification that depends on study outcome status – the proportion of individuals giving incorrect information about

exposure will be different between those reporting positive and negative study outcomes. It is possible that people with worse health will report some variables differently than healthy people. Such differential misclassification can be a serious problem in any epidemiological study, as it is impossible to quantify the size of any such misclassification; but in general it should be a minor problem in a prospective cohort study in which people answered questions about exposure period characteristics before answering questions about the study outcomes. In addition, the data were collected from mothers (exposures) and young adults (outcomes), and this further diminishes the possibility of such a misclassification.

There is another possibility of exposure misclassification, and that is related to aspects of the definition of the maternal employment variables, such as when the maternal employment data were collected (for example, this could be when the respondent's child was aged one or four during the preschool period, and these would be treated equally) or whether there was movement into or out of employment during different periods of childhood. There is more on this issue in section 8.2.7, which focuses on the definition of the exposure variables.

## 8.2.5 Confounding and residual confounding

A consideration of the social measures used in the analysis is vital to the interpretation of these results. This research project used maternal employment as the main exposure, and used maternal education, maternal marital status and household income at three stages of childhood as further social covariates. Gilman et al.[278] have argued that socio-economic position is a multidimensional concept; perhaps therefore a wider range of indicators would have been more appropriate to fully capture an impression of childhood social circumstances, perhaps including variables related to the size of the

family, the number of siblings, occupational position, and especially variables related to the father's social position.

One reason why the father's data were not directly used (with the limited exception of maternal marital status, which indirectly indicated a missing father figure in some households, and of household income, which indirectly included any father's income) is the incompleteness of such data in the BHPS. The study size was partially limited (mainly in the early childhood period), and a further reduction through the inclusion of fathers' characteristics would have limited the explanatory power of the analysis even further. Some previous studies using the NCDS data, for example, suggest that the father's social class, as indicated by the Registrar General Social Class scale (RGSC), is a significant predictor of adult health and well-being.[295;296] However, for example, although Power and Matthews[295] used the father's social class, they did not use any of the mother's social characteristics from the same period, and thus it is not possible to assess whether the father's characteristics bring any additional information to the analysis.

Ermisch et al.[152] noted that including employment data for fathers in the sample for their BHPS analysis would have reduced the sample by approximately 30%. A similar proportion would be lost in this analysis. Approximately 30% of records would have to be dropped because the fathers either were not living with the families, were not present at home at the time of the interview, or had missing data for other reasons. This would be a substantial reduction of an already relatively small sample, particularly for the preschool period. Ermisch et al.[152] also reported that the covariances between employment data for mothers and fathers were small, and that the results from analysis using maternal information and analysis using information from both parents were very

similar. They suggested that the bias resulting from excluding the fathers' employment information might be small.

The use of maternal marital status and household income takes the father's social and economic circumstances into account at least indirectly, while allowing the retention of the original sample size.

At the same time, it is worth mentioning that it would be interesting to evaluate the role of the father's employment status in the later outcomes of their children. It was shown in the Background chapter that male employment rates were high, much higher than female employment rates, and men's reasons for not being employed might be different. For men the main reasons would be formal unemployment or illness, while women's reasons would also include family responsibilities or childcare. Thus the impact of a not-employed father might be more substantial than that of a not-employed mother.

This smaller proportion of fathers who were not employed would be another problem in the statistical analysis, in addition to the increased number of missing data. Because of the small number of "exposed" individuals, the power of the analysis related to the estimation of the role of fathers' (non-)employment would be very limited in the BHPS data, particularly in estimates of the role of employment in the early years of childhood.

The role of some of the variables used in the present analysis is not entirely clear. Some authors (for example, Cooksey, Joshi and Veropoulou[297]), for example, do not include household income in their analyses of the relationship between maternal employment and child outcomes, as they argue that it might mediate the association of interest because income from the mother's employment contributes to the family income. For the same reason of a "mediating effect", Cooksey et al.[297] did not include childcare

arrangements during the period of employment in their analysis. While it is possible that such variables do mediate the association of interest, the hypotheses in this thesis were different. It was hypothesised that such variables would modify the association between maternal employment and self-rated health, psychological distress and smoking rather than confound or mediate it, and for this reason the inclusion of these variables seemed valid. The effect modifications proposed in the hypotheses 4-8 suggest that the role of maternal employment differs in subgroups of the population while a mediating effect proposed in previous literature[297] would suggest uniform effect of maternal employment in the whole population. Indeed, the results justified inclusion of these markers of socio-demographic position in the analysis, and household income has been identified as a potentially important effect-modifier in the BHPS data.

The role of siblings could be further evaluated if the size of households or the number of siblings were included in the analysis. The role of siblings was summarised in the Background, and it was shown that they may play at least some role in health behaviours. The size of the family may also have an impact on likelihood of maternal employment as mothers in bigger families are less likely to be employed. These variables might be considered in further analyses of the BHPS or other British data sets, especially as the role of maternal employment and maternal marital status in the smoking behaviour of young adults in this study seems to be the greatest during the last period of childhood, when the role of siblings might be particularly important.

Another exposure that has not been used in the analysis in this thesis is maternal age. This variable was originally used as one of the covariates along with the child's gender, but it was dropped from reported analysis, as it did not play any role in the association between maternal employment and the three study outcomes reported here. Another variable that has not been used in this analysis is ethnicity. Ethnicity could play some

role in the associations reported here, but this study did not have any statistical power to look at the role of this variable. The BHPS did not include any "ethnic boost" samples, and the proportion of individuals from ethnic minorities was very small and would not allow any meaningful analysis. There might be further variables that would be important for the assessment of the role of maternal employment in the development of health outcomes and health behaviours at the ages of interest for this project, but such variables were not identified during the literature review.

### 8.2.6  The choice of three outcomes

Three relatively diverse outcomes were included in this project. While the inclusion of self-rated health, psychological distress and smoking in adolescence and young adulthood contributes to comprehensively addressing the research question, it is important to consider their very distinct nature. While self-rated health does correlate well with physical function it also serves as an overall perception of health, covering all its different aspects. The use of GHQ-12 brings out an important dimension of health for this age group and psychological well-being may have increased importance in the absence of serious physical health problems, as is usually the case for young adults. And smoking is important in its own right, as in addition to being a key behaviour for this age group (with evidence suggesting that it may be a getaway for clustering of more health-compromising behaviours), is a major behavioural determinant of future health. All three outcomes might have a long-lasting effect over the life course.

### 8.2.7 The use of different variables generated from the GHQ-12 instrument

With regards to the GHQ-12, a binary measure using a cut point of 12 on a scale of 0–36 was used for the classification of psychological distress, and all the results are presented in terms of odds ratios of psychological distress. Other constructs could be made using the GHQ-12 questionnaire, such as the original continuous scale, or a dichotomous measure of psychological distress with a cut between the scores of 2 and 3 when individual items are scored as a binary (using 0-0-1-1 scoring).[269] While the second option was not tested in this project, selected tables using the continuous scale of the GHQ-12 are reported in Appendix 9. These results show virtually the same direction of effect as the use of the binary measure of psychological distress, as well as showing a similar role for all of the covariates of interest in the association between maternal employment and psychological well-being. This similarity of results confirms that the choice of the particular measure of psychological well-being generated from the GHQ-12 instrument might not be important.

### 8.2.8 The use of different definitions of maternal employment, maternal education, maternal marital status and household income in each period of childhood

As with psychological well-being and the GHQ-12 instrument, various different definitions of maternal employment, maternal education, maternal marital status and household income could have been used in this project. Some other possibilities for the definition of these variables were mentioned in section 4.3, and various definitions of maternal education in particular were mentioned, with their advantages and disadvantages.

The definition of maternal employment focused on the distinction between those whose mothers did not work at all during a particular childhood period and those whose mothers worked at least once. This definition did not distinguish between those who worked for just a short time and those who worked continuously. This definition also does not take into account whether the employment was full-time or part-time. Part-time employment is common among women in the UK (as already mentioned in section 2.1.1) and this may be an important issue in the relationship between maternal employment and health and health behaviours but the power of current analysis would be further reduced and it would be virtually impossible to obtain meaningful results. Other definitions would be needed to assess in more detail the accumulation of the effect of maternal employment, for example. An accumulation of the effect of maternal employment is suggested by the results of this project, particularly for psychological distress and also for the other two outcomes in some more limited way. This could be further assessed, for example by creating scores that count the years of maternal employment or the proportion of years of maternal employment to account for the uneven number of records for each study participant in various childhood periods and across the study overall. Another possibility would be to focus on the return to work, using variables characterising the age at which the mother first returned to work after the birth of the child. In yet another possibility, the stability of maternal employment (no changes in maternal employment during the age period of interest) might be important, and such a variable could also be created.

Similarly, there are various possibilities for definitions of maternal education, household income or maternal marital status in each childhood period, and these other definitions would all help to answer different questions related to the role of maternal employment and other social characteristics in the development of the three study outcomes. For example, household income was divided into two large groups (lower three quintiles

and higher two quintiles of income). It might be possible to create more extreme group of financial disadvantage, such as bottom 10% of households with the lowest income, but such definition would reduce analytical power of the study, and it would be difficult to identify any statistically significant differences in the likelihood of poor health, psychological distress or smoking between two social groups. Similarly, as already mentioned in section 4.3.5, it would be better to keep those with cohabiting mothers and those whose mother lives without a partner in two different categories but the groups of individuals in these two groups were small, and would not allow meaningful analyses of the role of maternal marital status in the association between maternal employment and poor self-rated health, psychological distress and smoking. However, it is not possible to test all above mentioned options in one project and the choices had to be made for the definition of variables of this project. Some of these additional definitions may be tested in the future in further analyses of BHPS data.

### 8.2.9 The relevance of the statistical techniques used in the analysis

A binary variable was created for each outcome to allow the use of the same statistical methods for all three outcomes, and to enable similar interpretations of the findings and the comparability of the results. Odds ratios with binary outcomes were reported in all steps of the analysis.

To improve the statistical power of the analysis in data with a limited sample size, a repeated-measures data set was created with up to six records for each study participant. To account for such repeated measures, a multilevel logistic regression was used to cluster records for specific individuals. This method still makes it possible to report odds ratios and 95% confidence intervals, and at the same time accounts for the intra-class correlations which would be accounted for using classical regression methods.

### 8.2.10 Two-level vs. three-level multilevel model

Some respondents have their siblings in the dataset. It is likely that records from siblings who have same mother are not entirely independent. It is therefore possible to consider three-level logistic model with records grouped within individuals and within families. The results reported in this thesis are however based on two-level model for several reasons. Firstly, the proportion of families with one child in the dataset is between 60-70%. It is the highest in the datasets used for the analysis of preschool period and for the life-course analysis because there are only few families in the data with records available for their children in early periods of childhood. The proportion of families with one child in the data is the lowest in the dataset for the analysis of secondary school period but there are still more than half of families with only one child in the data. Secondly, as mother's employment status often changed across the study period, only those siblings who either had mothers with constant employment status across the childhood or who were twins (and there is very low number of these in the dataset) have the same exposure data in their records. Thirdly, when analysis was performed in two- and three-level models, the results were virtually identical, and the odds ratios from two analyses were either same or differed by 0.01. Finally, some models with three-level structure had difficulties to converge, and as consequence some results would need to be reported from two-level models if three-level model was selected as theoretically preferred model. For consistency reasons and because the difference between results was minimal, two-level model was selected for all data analyses.

### 8.2.11 Methodological strengths of the project

There are several more methodological points that need to be mentioned in this part of the Discussion. In addition to the various limitations discussed earlier, there are also

several particular strengths. The major strength of this project is its use of one of the UK's large prospective panel studies with a large number of repeated contacts with the study participants. Because it is a prospective panel study and uses data about current events, it eliminates the likelihood of recall bias. This is a longitudinal study and therefore it allows for the temporal ordering of variables (from childhood to young adulthood) and the use of more appropriate life-course models, which better allow describing the way in which the exposures of interest influence study outcomes.

Another advantage of the study is that it is based on a random sample of the population, and thus is widely representative. It includes individuals from all social groups, both men and women, and from all parts of the UK, making the study results more generalisable.

Finally, this study is ideally placed in time in order to test the role of maternal employment on health and smoking of young adults in recent decades. Many previous studies used data from earlier periods, and thus it was not clear how some of the findings relate to current conditions while this study uses as recent data as possible (and the data from the most recent wave were added to the analysis as recently as in the middle of the project).

### 8.2.12 Period effect

In order to assess changes over time in the association between maternal employment and the three study outcomes, the analysis was conducted separately for those who reported their study outcomes in the first 10 waves and those who did so in the last eight waves of the BHPS. This period-specific analysis could not be done for the evaluation of maternal employment during the preschool period, because maternal employment

status during that period was only known in cases where the health outcomes were reported in the last eight waves of the study. The analysis was performed for the primary school period, but as with the preschool period, most of the outcomes were reported in later waves of the study, and such period comparisons lack sufficient power and should be considered indicative only. The only period of childhood for which more informative analysis could be done was the secondary school period, for which there were enough records in both periods.

While the results from period-specific analysis suggest no changes in the association between maternal employment and self-rated health or psychological distress, there seems to be quite a large period change for the association between maternal employment and smoking. While in earlier waves it seems that there is a relatively small difference in the effect of maternal employment on smoking among those with married and unmarried mothers, there is a very large difference in this effect in later waves. In Waves 11–18 there is a negative effect of maternal employment among those with married mothers, and a very protective effect among those with unmarried mothers (see Appendix 10 for the numeric results).

## 8.3 The project's contribution to society, and policy recommendations

The findings of this thesis highlight several areas for further research, policy development, and the direction and targeting of future health promotion activities, with the aim of reducing the health and health-behaviour inequalities that children might experience during their lives as a consequence of maternal employment (or non-

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employment). This thesis highlights the potentially differential needs of families in different groups of society; some of these needs, and possible policies to address them, will be discussed in section 8.3.2. First, the opportunities for future research are summarised in section 8.3.1.

## 8.3.1 Implications for further research

This project has examined the effect of maternal employment on three different outcomes – self-rated health, psychological distress and smoking behaviour – in early adulthood. The modifying effects of maternal education and household income (in the analysis of self-rated health and psychological distress) and maternal marital status (in the analysis of smoking behaviour) have been analysed. Other potential influences not considered in this thesis include the fathers' or even the grandparents' characteristics, and these could be included in further analysis. Parental role could be investigated in more detail to assess whether it is the mother's or the father's involvement that is more important, and to investigate the role of the father's occupation in the development of health outcomes and smoking behaviour.

Childhood was rather roughly divided into three periods approximately equivalent to the three different periods of schooling (the preschool, primary-school and secondary-school periods). This was done primarily because of limitations to the sample size. As previous literature suggested, the preschool period should be studied in more detail, possibly looking at each year of age separately. The sensitivity analysis briefly outlined in the Discussion showed rather surprising findings, suggesting a protective effect of maternal employment in the very early phase of childhood, although these results were not very precise in terms of very wide confidence intervals. Because the majority of

previous literature focused on the short-term effects of maternal employment on outcomes in childhood, it would be important to test the associations proposed by this project in further studies – possibly in British cohort studies, although these studies cover earlier periods of the 20$^{th}$ century than the BHPS study, and the role of maternal employment during those periods might have been different from that experienced at the end of the 20$^{th}$ century.

In relation to smoking behaviour, future analysis might try to investigate the role of employment in the age of smoking initiation, and might use a qualitative approach to assess people's reasons for starting to smoke. Siblings and friends may play a particularly important role in the development of smoking habits, and variables characterising these individuals might also be considered as a further extension in future work. In addition to smoking, future analysis may also investigate the role of employment on other health behaviours, particularly on alcohol and drug consumption. The role of siblings and friends may be as important in the development of these habits as it may be for smoking behaviour.

This study largely ignored the role of psychosocial factors and cognitive development in the health and health behaviours of young adults, as there was a lack of such variables in these data sets (particularly because individuals started to participate in the study at the age of 16, and were not interviewed at earlier ages). However, if there were other data that included such variables, it would be interesting to investigate the role of those variables in the association between maternal employment and the health and health behaviours of young adults. Again, this might be possible in British birth cohort studies, with a wide range of instruments available for the analysis.

In line with the main hypotheses, this analysis focused on the potential impact of the maternal employment. However, own current exposures might be as important as maternal employment in childhood. The ages at which health outcomes were investigated cover a period of emerging adulthood with various challenges for identity formation. It is also period when individuals develop intimate relationships and occupational choices. Thus, this age can be seen as a period when differences in social and human capital accumulated in childhood such as own education and family relationships emerge as the individual moves into adult roles. It has been shown recently that these transitions into adulthood might be quite heterogeneous, and they are related to broader social, political and economic influences as well as personal and family influences.[298-300] The nature of such transitions from adolescence into adulthood might be important for current health, and would be worth a further investigation as well as possible gender differences in such transitions.

As mentioned in section 8.2.2, this study adjusted for gender rather than investigated potential effect modifying role of this variable in the association between maternal employment in childhood and health and smoking behaviour in young adulthood. Future studies with larger sample size may focus on such gender interactions and on the potentially differential modifying role of social disadvantage and maternal marital status among men and women.

A problem with some cohort studies (particularly birth cohort studies) is their generalisability, as cohort members grow up within the context of specific social and cultural trends, in this case particularly with regards to smoking behaviours. The design of this project to some extent dealt with this issue, as participants aged 16–21 came from the whole period covered by the BHPS study (almost 20 years), although those

used in the analysis of maternal employment during the 0–4 age period came only from one five-year period (they were born either in the first two waves of the BHPS or shortly before the start of the study). A disadvantage related to this point is that the study lacks sufficient power to detect period changes in the associations of interest. While the testing of period changes was attempted, they would need to be greater in order to be clearly detected, if indeed they exist. It would therefore be interesting to assess whether the effects of maternal employment, maternal education, household income and maternal marital status on smoking behaviour, self-rated health and psychological distress have changed during the last 20 years, or whether the identified associations have remained similar or the same across the whole study period.  It might be interesting to conduct a similar analysis to that conducted in this project using newly collected data, possibly from the Millennium Cohort Study, and to assess the impact of intervention programmes such as Sure Start, which targets and supports parents in the most disadvantaged areas.

## 8.3.2  Implications of findings

The findings of this thesis suggest that while maternal employment is likely to be beneficial for children from more socially advantaged families in terms of future health and psychological well-being it is not so beneficial for children from less socially advantaged families. The differential effect of maternal employment in different socioeconomic groups should be considered in recommending public health and policy strategies and interventions.

Much research and government policy focuses on single mothers and the unemployed. As this thesis suggests, much more attention needs to be paid to low-income families (those with working mothers in socially disadvantaged families). As the results suggest,

these are the families with children at higher risk of poor future health and psychological distress. As already suggested in earlier sections, one possible explanation for differential results might be related to the choice of jobs for mothers from less and more socially advantaged groups. It is possible that mothers from more advantaged groups choose to work out of choice and have more resources to spend on various forms of child care. These mothers have also more choice to work part-time and have special working arrangements. On the other hand, mothers from less advantaged families have limited choice of jobs and are more likely to work because of economic needs of family. They are also likely to do shift work and to have less flexible working arrangements. Such mothers are also less likely to have resources for other forms of child care.

It seems likely that the financial strategies of socially disadvantaged families will be similar to those of unemployed families (and this has been reported previously in qualitative research[301]), while they also need to find solutions for childcare problems during working hours. Unfortunately, the current economic climate does not help to improve the lives of these families. First, global financial and economic problems increase the pressure, with massive public-sector job cuts and the reduction or even abandonment of plans for more family-friendly working and childcare policies. Second, in response to the economic situation, the British government has prepared extensive welfare reform, including substantial childcare tax credit reform and the introduction of the new Universal Credit (http://www.direct.gov.uk/en/Nl1/Newsroom/DG_191344, accessed on 5 May 2012). While it has been acknowledged that the new system will help many low-income families, the charity Save the Children recently estimated that this welfare reform will have a negative impact on poorer working women and their families, and that the reform will push approximately 250,000 children into poverty.[302] They argue that under the new Universal Credit benefit system, which will replace a

number of specific social benefits, single working mothers and many second earners in such families will lose up to £2,000 per year. This will either push families into deeper poverty or require the affected adults – most of whom will be women, particularly mothers – to work longer hours and hence be apart from their children for longer. As the results of this thesis suggest, such a move may have negative consequences for the future health and well-being of the children, and will therefore have long-term negative financial consequences for the whole economy, as more resources will be spent on healthcare.

The topic of maternal employment is also high on the current political agenda in the United States. There are currently two new laws being proposed in the US Congress, addressing whether single mothers of children under the age of three should be able to receive welfare without taking a job, and recognising that parents who stay home to raise small children are doing important work. If approved, these two laws will allow mothers to stay at home, be entitled to welfare, and raise their children. This would also provide an argument for similar legislation to be proposed in the UK.

The results of this project show that maternal employment is beneficial for those in more socially advantaged families. It is important not only to discover the reasons for this finding (as was attempted in earlier sections of this thesis), but also to suggest how to improve the social circumstances of those in more disadvantaged families. New legislation and new government policies targeting such families are one possible solution. Another, longer-term solution is to focus on improving the education and qualifications of future parents. This might be done by focusing on the improvement of academic performance in schools and universities, as well as by offering vocational training and the lifelong improvement of skills from prospective employers and further-education colleges. Better qualifications might widen the possibilities of getting more

highly skilled and better-paid jobs, which in turn might offer more family-friendly options for childcare and the raising of children.

In terms of health promotion, smoking seems to be potentially the most amenable target of the three study outcomes used in this project. It has repeatedly been argued that smoking is one of the most important targets for reducing health inequalities[303] and improving the health of society. In order to reduce the proportion of smokers among young adults, it is important to better understand the social and psychological processes underlying smoking behaviours. It is argued that in order for smoking cessation programmes to be effective, the root causes of disadvantage must be tackled so as to target policies towards young children, and this implies a life-course approach to health inequalities.[304;305] The findings of this project support the recommendations of the Acheson report,[305] which demonstrates the importance of maternal characteristics and the social environment during childhood for smoking in young adulthood. One potential intervention would be an improvement of education facilities to ensure that future mothers are well educated. Support for working and socially disadvantaged parents (such as better flexibility of working hours, as well as good welfare services) might also reduce childhood disadvantage, and consequently improve children's future health and reduce the risk of unhealthy behaviours. Thus policies might be targeted towards supporting families who live in disadvantage in order to improve their educational outcomes, which might later translate into a reduction in the gradient of health and health behaviours.

## 8.4  Conclusions

This project has estimated the relationship between several outcomes in early adulthood (self-rated health, psychological distress and smoking behaviour) and maternal employment, a socio-demographic characteristic which is relevant for policy. This variable has been a focus of sociological and political debates for the last 65 years, and has been particularly relevant to policy initiatives in last 15 years, such as the Sure Start programme and the promotion of formal childcare for working mothers. This study has used British Household Panel Survey data collected from 1991 to date, and has been able to estimate results for the whole sample, as well as producing stratum-specific results for specific subpopulations. The main finding is that the results of this study differ for different groups according to their level of social and economic advantage. While in general maternal employment is protective for those in socially advantaged groups, it is not so protective for those in more disadvantaged groups. It is possible to say that the findings of this project do not support the main hypothesis from previous literature that maternal employment in early childhood is universally harmful for outcomes later in life. The only example of a negative impact of maternal employment was on the risk of smoking in young adults whose mothers had worked during their secondary-school years. On the other hand, the results of this study do support hypotheses regarding the effect-modifying roles of maternal education, household income and maternal marital status; these hypotheses were not so strongly based on previous literature, and were original to this project. In particular, opposing effects of maternal employment on psychological distress were found according to the level of household income. For those from households with higher incomes, maternal employment in all three periods of childhood was protective and reduced the risk of later psychological distress, but the effect was the opposite for those from households with lower incomes. Although the findings of this project are interesting and novel,

further research is needed using both these data and other studies in order to further understand the effect of maternal employment on health in young adulthood.

# Appendices

## *Appendix 1: Life-course epidemiological models*

A life course approach in epidemiology investigates the long term effects of risk factors such as physical or social hazards on risk of chronic disease and other health-related outcomes during different periods of life (and across generations). It studies the biological, behavioural and psychosocial pathways that operate across the life course and influence the development of chronic diseases.[114;306]

There are several basic theoretical models:

1. Critical/sensitive period model
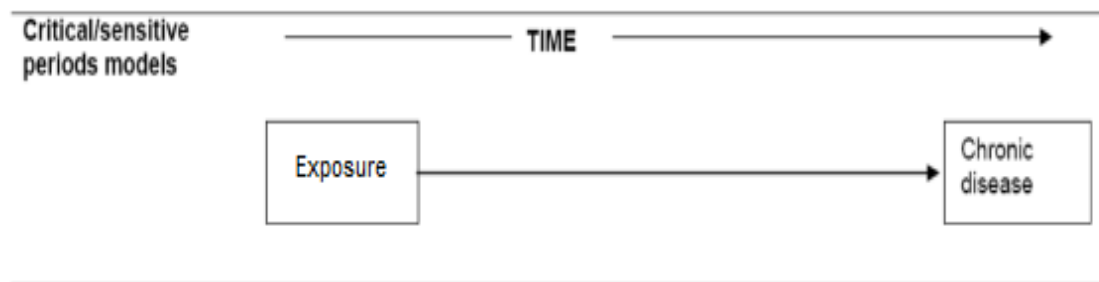


Critical period model and sensitive period model are relative similar suggesting that one time period is particularly important for the exposure to affect the health outcome.

*Critical period* – a time period only during which an exposure has an effect.

*Sensitive period* - a time period during which an exposure has a greater effect than outside this period

2. Accumulation of risk
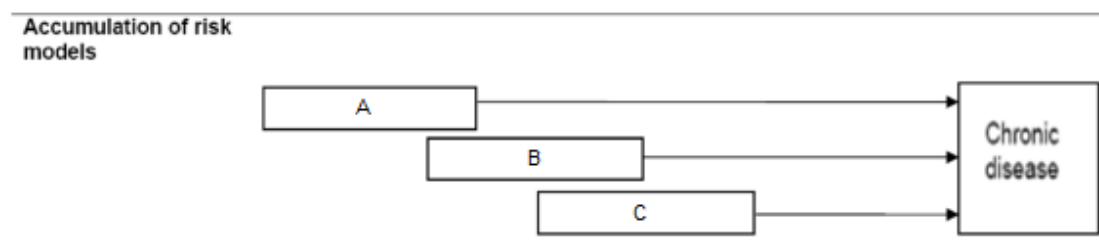
The accumulation of risk life course model suggests that "life course exposures gradually accumulate through episodes of illness and injury, adverse environmental conditions and health damaging behaviours".[29]

3. Chain of risk models (trajectories models)

Chains of risk model:

Additive models

| A | → | B | → | C | → | Chronic disease |

Trigger models

| A | → | B | → | C | → | Chronic disease |
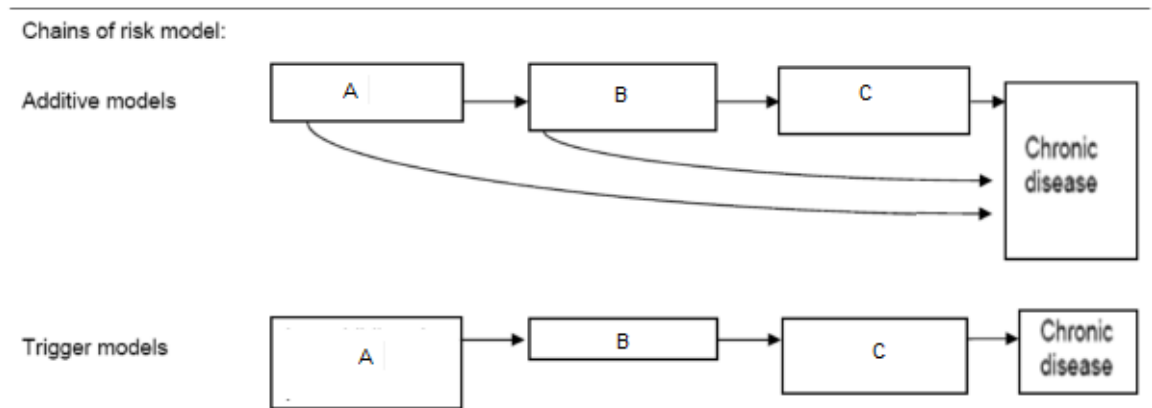
The chain of risk, or in other words "trajectories" models suggest that the impact of some risk factor in earlier period of life lie less in the immediate effect of this factor on health outcome than in the fact that it sets into motion a chain reaction in which one event leads to another, and finally the certain trajectory of events has greater impact on health outcome than other trajectories.

All the figures in this appendix adapted from Kuh et al (2003)[29]

## *Appendix 2: GHQ-12 questionnaire*

The GENERAL HEALTH QUESTIONNAIRE part of the BHPS questionnaire:

Here are some questions regarding the way you have been feeling over the last few weeks. For each question please tick the box next to the answer that best describes the way you have felt.
Have you recently....

a)  been able to concentrate on whatever you're doing?
> Better than usual
> Same as usual
> Less than usual
> Much less than usual

b)  lost much sleep over worry?
> Not at all
> No more than usual
> Rather more than usual
> Much more than usual

c)  felt that you were playing a useful part in things?
> More than usual
> Same as usual
> Less so than usual
> Much less than usual

d)  felt capable of making decisions about things?
> More so than usual
> Same as usual
> Less so than usual
> Much less capable

e)  felt constantly under strain ?
> Not at all
> No more than usual
> Rather more than usual
> Much more than usual

f)  felt you couldn't overcome your difficulties ?
> Not at all
> No more than usual
> Rather more than usual
> Much more than usual

g)  been able to enjoy your normal day-to-day activities ?
> More so than usual
> Same as usual
> Less so than usual

Much less than usual

h) been able to face up to problems ?
> More so than usual
> Same as usual
> Less so than usual
> Much less able

i) been feeling unhappy or depressed ?
> Not at all
> No more than usual
> Rather more than usual
> Much more than usual

j) been losing confidence in yourself ?
> Not at all
> No more than usual
> Rather more than usual
> Much more than usual

k) been thinking of yourself as a worthless person ?
> Not at all
> No more than usual
> Rather more than usual
> Much more than usual

l) been feeling reasonably happy, all things considered ?
> More so than usual
> Same as usual
> Less so than usual
> Much less than usual"

## Appendix 3: Distribution of demographic characteristics in datasets for the analysis of psychological distress and smoking

**Table A.1. Distribution of social and demographic characteristics in three periods of childhood in the sample used for analysis of psychological distress**

| | Age of child | | |
|---|---|---|---|
| | **Preschool age** | **Primary school age** | **Secondary school age** |
| *Gender* | | | |
| Men | 1050 (46.3%) | 3783 (48.7%) | 7024 (47.7%) |
| Women | 1219 (53.7%) | 3986 (51.3%) | 7690 (52.3%) |
| *Marital status of mother* | | | |
| Married | 1820 (80.2%) | 6110 (78.7%) | 11152 (75.8%) |
| Cohabiting | 185 (8.2%) | 522 (6.7%) | 928 (6.3%) |
| Not living with partner | 264 (11.6%) | 1137 (14.6%) | 2634 (17.9%) |
| *Maternal education* | | | |
| No qualification | 447 (19.7%) | 2108 (27.1%) | 4665 (31.7%) |
| Secondary school | 1486 (65.5%) | 4549 (58.6%) | 7825 (53.2%) |
| Higher education | 302 (13.3%) | 1026 (13.2%) | 2060 (14.0%) |
| *Missing data* | *34 (1.5%)* | *86 (1.1%)* | *164 (1.1%)* |
| *Household income* | | | |
| 1Q (low) | 658 (29.0%) | 1894 (24.4%) | 2922 (19.9%) |
| 2Q | 635 (28.0%) | 1841 (23.7%) | 3066 (20.8%) |
| 3Q | 446 (19.7%) | 1664 (21.4%) | 3098 (21.1%) |
| 4Q | 318 (14.0%) | 1347 (17.3%) | 3025 (20.6%) |
| 5Q (high) | 212 (9.3%) | 1023 (13.2%) | 2598 (17.7%) |
| *Missing data* | - | - | *5 (0.03%)* |

**Table A.2. Distribution of social and demographic characteristics in three periods of childhood in the sample used for analysis of smoking**

| | Age of child | | |
|---|---|---|---|
| | **Preschool age** | **Primary school age** | **Secondary school age** |
| *Gender* | | | |
| Men | 1119 (46.7%) | 3693 (48.5%) | 6870 (47.7%) |
| Women | 1279 (53.3%) | 3915 (51.5%) | 7547 (52.3%) |
| *Marital status of mother* | | | |
| Married | 1923 (80.2%) | 5968 (78.4%) | 10889 (75.5%) |
| Cohabiting | 193 (8.1%) | 514 (6.8%) | 912 (6.3%) |
| Not living with partner | 282 (11.7%) | 1126 (14.8%) | 2616 (18.2%) |
| *Maternal education* | | | |
| No qualification | 477 (19.9%) | 2028 (26.7%) | 4529 (31.4%) |
| Secondary school | 1571 (65.5%) | 4493 (59.1%) | 7680 (53.3%) |
| Higher education | 316 (13.2%) | 1006 (13.2%) | 2027 (14.1%) |
| *Missing data* | *34 (1.4%)* | *81 (1.1%)* | *181 (1.3%)* |
| *Household income* | | | |
| 1Q (low) | 691 (28.8%) | 1866 (24.5%) | 2892 (20.1%) |
| 2Q | 658 (27.4%) | 1799 (23.7%) | 2996 (20.8%) |
| 3Q | 484 (20.2%) | 1635 (21.5%) | 3016 (20.9%) |
| 4Q | 341 (14.2%) | 1325 (17.4%) | 2968 (20.6%) |
| 5Q (high) | 224 (9.3%) | 983 (12.9%) | 2515 (17.4%) |
| *Missing data* | - | - | *30 (0.2%)* |

## Appendix 4: Trajectory model for self-rated health using "Always employed" as reference category

**Table A.3. Fully adjusted association between maternal employment and self-rated health in trajectory model – unstratified and stratified by household income at preschool age**

| | All | Financially advantaged households[1] | Financially disadvantaged households[2] |
|---|---|---|---|
| | N=2439 | N=573 | N=1866 |
| **Trajectory** | **OR (95% CI)** | | |
| **Never employed** | 1.45 (0.74-2.84) | 2.03 (0.42-9.92) | 1.27 (0.61-2.63) |
| **Moving into employment** | 1.34 (0.86-2.08) | 4.69 (1.86-11.87) | 0.93 (0.57-1.53) |
| **Moving out of employment** | 1.14 (0.43-3.01) | 0.92 (0.10-8.79) | 1.14 (0.39-3.31) |
| **Always employed** | 1 (ref) | 1 (ref) | 1 (ref) |
| *P for interaction* | - | *0.02* | |

[1]  Financially advantaged households in preschool period
[2]  Financially disadvantaged households in preschool period

# *Appendix 5: The association between maternal employment and self-rated health in life-course models stratified by maternal education at primary school age*

**Table A.4. Unadjusted and fully adjusted association between maternal employment and self-rated health in trajectory model – unstratified and stratified by maternal education at preschool age**

| Trajectory | All | More educated mothers[1] | Less educated mothers[2] |
|---|---|---|---|
| | **OR (95% CI)** | | |
| **Unadjusted** | | | |
| **Never employed** | 1 (ref) | 1 (ref) | 1 (ref) |
| **Moving into employment** | 0.55 (0.29-1.05) | 0.20 (0.02-1.72) | 0.59 (0.29-1.18) |
| **Moving out of employment** | 0.63 (0.21-1.88) | 0.00 (NA) | 0.73 (0.23-2.31) |
| **Always employed** | 0.39 (0.21-0.73) | 0.14 (0.02-1.02) | 0.41 (0.21-0.80) |
| *P for interaction* | - | *0.46* | |
| **Fully adjusted** | | | |
| **Never employed** | 1 (ref) | 1 (ref) | 1 (ref) |
| **Moving into employment** | 0.92 (0.46-1.82) | 0.41 (0.05-3.37) | 0.93 (0.46-1.88) |
| **Moving out of employment** | 0.79 (0.27-2.31) | 0.00 (NA) | 0.95 (0.31-2.90) |
| **Always employed** | 0.69 (0.35-1.35) | 0.21 (0.03-1.50) | 0.73 (0.36-1.48) |
| *P for interaction* | - | *0.33* | |

[1]   Mothers with education higher than secondary in preschool period
[2]   Mothers with secondary education or below in preschool period

## Appendix 6: The unadjusted association between self-rated health and maternal employment in accumulation and sensitive period models

**Table A.5. The unadjusted association between self-rated health and maternal employment in accumulation model – unstratified and stratified by household income at preschool age**

| Mother employed in number of childhood periods | All | Financially advantaged households[1] | Financially disadvantaged households[2] |
|---|---|---|---|
| | OR (95% CI) | | |
| **0** | 1 (ref) | 1 (ref) | 1 (ref) |
| **1** | 0.71 (0.30-1.65) | 2.62 (0.30-22.61) | 0.57 (0.23-1.43) |
| **2** | 0.52 (0.27-1.01) | 1.89 (0.35-10.07) | 0.41 (0.20-0.84) |
| **3** | 0.39 (0.21-0.73) | 0.53 (0.11-2.63) | 0.43 (0.22-0.84) |
| *P for trend* | *0.002* | *0.02* | *0.05* |
| *P for interaction* | - | *0.08* | |

[1]  Financially advantaged households at preschool age
[2]  Financially disadvantaged households at preschool age

**Table A.6. Mutually adjusted (but not adjusted by any other variables) model of maternal employment and self-rated health – unstratified and stratified by household income**

| | All | Financially advantaged households[1] | Financially disadvantaged households[2] |
|---|---|---|---|
| | OR and 95% CI | | |
| **Employed at preschool period** | 0.80 (0.51-1.26) | 0.34 (0.13-0.88) | 1.15 (0.69-1.90) |
| *P for interaction* | - | *0.02* | |
| **Employed at primary school period** | 0.53 (0.28-1.02) | 0.55 (0.16-1.83) | 0.57 (0.28-1.17) |
| *P for interaction* | - | *0.96* | |
| **Employed at secondary school period** | 0.96 (0.49-1.88) | 0.76 (0.24-2.34) | 1.05 (0.49-2.26) |
| *P for interaction* | - | *0.61* | |

[1]  Financially advantaged households at specific childhood period (relevant income used for each period)
[2]  Financially disadvantaged households at specific childhood period

# *Appendix 7: The unadjusted association between psychological distress and maternal employment in accumulation and sensitive period models*

**Table A.7. The unadjusted association between psychological distress and maternal employment in accumulation model – unstratified and stratified by household income at preschool age**

| Mother employed in number of childhood periods | All | Financially advantaged households[1] | Financially disadvantaged households[2] |
|---|---|---|---|
| | OR (95% CI) | | |
| **0** | 1 (ref) | 1 (ref) | 1 (ref) |
| **1** | 0.80 (0.36-1.74) | 0.85 (0.13-5.49) | 0.79 (0.33-1.87) |
| **2** | 0.83 (0.45-1.53) | 0.30 (0.07-1.26) | 1.01 (0.51-1.98) |
| **3** | 0.93 (0.52-1.66) | 0.26 (0.07-0.99) | 1.22 (0.64-2.33) |
| *P for trend* | *0.95* | *0.03* | *0.30* |
| *P for interaction* | - | *0.07* | |

[1]   Financially advantaged households at preschool age
[2]   Financially disadvantaged households at preschool age

**Table A.8. Mutually adjusted (but not adjusted by any other variables) model of maternal employment and psychological distress – unstratified and stratified by household income**

| | All | Financially advantaged households[1] | Financially disadvantaged households[2] |
|---|---|---|---|
| | OR and 95% CI | | |
| **Employed at preschool period** | 1.02 (0.69-1.50) | 0.56 (0.25-1.25) | 1.24 (0.80-1.93) |
| *P for interaction* | - | *0.08* | |
| **Employed at primary school period** | 1.57 (0.87-2.84) | 0.73 (0.26-2.06) | 2.04 (1.05-3.98) |
| *P for interaction* | - | *0.08* | |
| **Employed at secondary school period** | 0.58 (0.32-1.06) | 0.47 (0.18-1.25) | 1.06 (0.38-2.92) |
| *P for interaction* | - | *0.76* | |

[1]   Financially advantaged households at specific childhood period (relevant income used for each period)
[2]   Financially disadvantaged households at specific childhood period

## *Appendix 8: The unadjusted association between smoking and maternal employment in accumulation and sensitive period models*

**Table A.9. The unadjusted association between smoking and maternal employment in accumulation model – unstratified and stratified by maternal marital status at preschool age**

| Mother employed in number of childhood periods | All | Married[1] | Unmarried[2] |
|---|---|---|---|
| | OR (95% CI) | | |
| **0** | 1 (ref) | 1 (ref) | 1 (ref) |
| **1** | 2.51 (0.40-15.63) | 5.82 (0.67-50.81) | 0.94 (0.01-60.47) |
| **2** | 1.00 (0.25-4.04) | 3.77 (0.66-21.71) | 0.12 (0.01-2.39) |
| **3** | 0.88 (0.24-3.28) | 4.03 (0.77-21.25) | 0.07 (0.01-1.21) |
| *P for trend* | *0.48* | *0.25* | *0.04* |
| *P for interaction* | *-* | *0.15* | |

[1] Mothers married at preschool age
[2] Mothers unmarried at preschool age

**Table A.10. Mutually adjusted (but not adjusted by any other variables) model of maternal employment and smoking – unstratified and stratified by maternal marital status**

| | All | Married[1] | Unmarried[2] |
|---|---|---|---|
| | OR and 95% CI | | |
| **Employed at preschool period** | 0.63 (0.25-1.58) | 0.89 (0.33-2.40) | 0.20 (0.02-1.63) |
| *P for interaction* | *-* | *0.20* | |
| **Employed at primary school period** | 0.46 (0.12-1.81) | 1.44 (0.30-6.95) | 0.10 (0.01-1.39) |
| *P for interaction* | *-* | *0.08* | |
| **Employed at secondary school period** | 2.86 (0.70-11.70) | 2.43 (0.46-12.99) | 2.01 (0.19-21.29) |
| *P for interaction* | *-* | *0.89* | |

[1] Mothers married at specific childhood period
[2] Mothers unmarried at specific childhood period

## *Appendix 9: Results for psychological well-being using continuous scale of GHQ-12*

The sample size of datasets used for the analysis of psychological well-being expressed by continuous measure of GHQ-12 as well as mean GHQ-12 scores in the datasets related to maternal employment in different childhood periods are reported in Table A.11.

**Table A.11. Distribution of psychological well-being scores in three datasets based on availability of mother's data**

| Mother's employment status known at age of child | Psychological well-being at young adulthood | |
|---|---|---|
| | N | Mean (SD) |
| **Preschool period** | 2269 | 9.9 (5.6) |
| **Primary school period** | 7769 | 10.0 (5.6) |
| **Secondary school period** | 14714 | 10.0 (5.4) |

The unadjusted association between paid maternal employment status and score of psychological well-being is presented in Table A.12. The differences in psychological well-being scores by maternal employment status are, contrary to hypothesis 1, small, and at preschool and secondary school ages virtually not existent. Some differences in these scores can be seen only at primary school age. Psychological well-being score of those whose mothers were working was on average 0.43 points higher compared to those whose mothers were not working at primary school age.

**Table A.12. Crude (unadjusted) association between psychological well-being at young adulthood years and paid maternal employment in three periods of childhood**

| | N total | Mean (SD) | Diff (95% CI) [1] | P value |
|---|---|---|---|---|
| | | **Psychological well-being** | | |
| **Mother employed at preschool age of child** | | | | |
| No | 1101 | 9.99 (5.86) | 0 | |
| Yes | 1168 | 9.88 (5.36) | -0.06 (-0.69,0.58) | 0.86 |
| **Mother employed at primary school age of child** | | | | |
| No | 1815 | 9.64 (5.44) | 0 | |
| Yes | 5954 | 10.12 (5.59) | 0.43 (0.00,0.85) | 0.05 |
| **Mother employed at secondary school age of child** | | | | |
| No | 2949 | 9.94 (5.61) | 0 | |
| Yes | 11765 | 10.03 (5.32) | 0.10 (-0.21,0.42) | 0.53 |

[1] Diff (95%CI) from random effect multilevel linear model

The adjustment for gender, maternal marital status, maternal education and household monthly income did not substantially change the association between paid maternal employment and psychological well-being although it seems that the adjustment made the differences in psychological well-being score between those with employed and not employed mothers slightly greater (Table A.13). While there was virtually no difference between psychological well-being of those whose mothers were employed and those whose mothers were not employed at preschool and secondary school ages; psychological well-being of those whose mothers were employed at primary school age was on average 0.56 (95% CI 0.13,0.99) points higher than psychological well-being of those whose mothers were not employed in fully adjusted model (compared to 0.43 difference in unadjusted analysis) suggesting worse psychological well-being at young adulthood of those whose mothers were employed at primary school age.

**Table A.13. The association between paid maternal employment and psychological well-being in adjusted analysis**

| | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
| | Psychological well-being (difference and 95% CI) | | |
| **Unadjusted** | | | |
| Mother employed | -0.06 (-0.69,0.58) | 0.43 (0.00,0.85) | 0.10 (-0.21,0.42) |
| **Adjusted for gender and education** | | | |
| Mother employed | -0.23 (-0.84,0.39) | 0.38 (-0.03,0.79) | 0.13 (-0.18,0.45) |
| **Adjusted for gender and marital status** | | | |
| Mother employed | -0.18 (-0.80,0.43) | 0.43 (0.03,0.84) | 0.22 (-0.09,0.53) |
| **Adjusted for gender and household income** | | | |
| Mother employed | -0.25 (-0.88,0.37) | 0.58 (0.15,1.00) | 0.20 (-0.13,0.52) |
| **Adjusted for gender and education, marital status and household income** | | | |
| Mother employed | -0.24 (-0.87,0.39) | 0.56 (0.13,0.99) | 0.16 (-0.17,0.48) |

Mother not employed is a reference category in all analyses

Stratification of the analysis by maternal education, maternal marital status and household income suggested that effect of maternal employment might differ among those from socially advantaged and socially disadvantaged households. The effect of paid maternal employment at preschool age on psychological well-being did not substantially differ between participants with mothers with no qualification and mothers with secondary education. As shown in the Table A.14, the effect of maternal employment among those whose mothers had no qualification and those whose mothers had secondary education was minimal (differences in psychological well-being scores of -0.07 and 0.18 between employed and not employed mothers). Having mother in paid employment, however, had protective effect in terms of psychological well-being among those with mothers with higher education: psychological well-being was 1.48 points lower among those with employed mothers compared to those whose mothers

were not employed. The modification of the effect of maternal employment was not statistically significant at preschool age. The difference in the effect of maternal employment by levels of maternal education was even larger at primary school period: coefficients 1.08 and 0.25 for mothers with no qualification and mothers with secondary education compared to -1.30 for mothers with higher education. The modification of the effect of maternal employment was statistically significant for primary school age with p-value for effect modification of 0.01. The effect of maternal employment on psychological well-being at secondary school age did not substantially differ by the levels of maternal education (coefficients 0.24, 0.01 and -0.33, p-value 0.63) although the trend in the effect was similar to age primary school period.

**Table A.14. The effect of paid maternal employment on psychological well-being stratified by levels of education (coefficient and 95% CI)**

|  | Preschool period | Primary school age | Secondary school age |
|---|---|---|---|
| **Mothers with no qualification** | | | |
| Mother employed | -0.07 (-1.58,1.44) | 1.08 (0.33,1.84) | 0.24 (-0.26,0.73) |
| **Mothers with secondary education** | | | |
| Mother employed | 0.18 (-0.59,0.96) | 0.25 (-0.32,0.82) | 0.01 (-0.47,0.48) |
| **Mothers with higher education** | | | |
| Mother employed | -1.48 (-3.19,0.22) | -1.30 (-2.79,0.20) | -0.33 (-1.54,0.89) |
| *P for effect modification* | *0.27* | *0.01* | *0.63* |

Those with mothers not in paid employment as reference category

As shown in the table A.15, among those whose mothers were married, psychological well-being of those whose mothers were employed was slightly higher than those whose mothers were not employed while among those whose mothers were not married this was the case only at primary school age. Being employed at preschool and secondary school periods slightly lowered psychological well-being among those whose mothers

were not married. Neither any of the stratum specific effects nor any interaction was statistically significant supporting a conclusion that marital status did not modify the effect of maternal employment on psychological well-being.

**Table A.15. The effect of paid maternal employment on psychological well-being stratified by marital status (coefficient and 95% CI)**

|  | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
| **Mothers married** | | | |
| Mother employed | 0.04 (-0.66,0.74) | 0.43 (-0.06,0.92) | 0.33 (-0.04,0.70) |
| **Mothers not married** | | | |
| Mother employed | -0.41 (-1.90,1.08) | 0.44 (-0.41,1.29) | -0.25 (-0.86,0.35) |
| *P for effect modification* | *0.58* | *0.97* | *0.10* |

Those with mothers not in paid employment as reference category

When using household income as potential effect modifier, the effect of paid maternal employment on psychological well-being was the most protective for those in the most advantaged income group (4th/5th quintile; table A.16) in the first period of childhood (reduction of GHQ-12 score by 1.31 points). In later two periods the protective effect of maternal employment among those from the most advantaged group was less strong than in first period but was still more protective than among those in less advantaged groups (and the effect modification was statistically significant in primary school period). The role of household income was very similar to the role played by maternal education suggesting that the maternal employment has different effect on psychological well-being among those from more and less socially advantaged group particularly in first two periods of childhood.

**Table A.16. The effect of paid maternal employment on psychological well-being stratified by household income**

| | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
| | Coefficient (95% CI) | | |
| **1Q+2Q household income** | | | |
| Mother employed | 0.41 (-0.45,1.27) | 0.94 (0.37,1.50) | 0.27 (-0.17,0.71) |
| **3Q** | | | |
| Mother employed | -0.17 (-1.71,1.37) | 0.01 (-1.12,1.15) | -0.09 (-0.91,0.74) |
| **4Q+5Q** | | | |
| Mother employed | -1.31 (-2.56,-0.07) | -0.46 (-1.36,0.45) | -0.24 (-0.93,0.45) |
| *P for effect modification* | *0.11* | *0.03* | *0.42* |

Those with mothers not in paid employment as reference category

The psychological well-being scores were the lowest (they reported to be less distressed) among those whose mothers used combined child care arrangements at preschool age, and the score was the highest among those whose mothers used only help of their partners (Table A.17). This association was not substantially affected by further adjustment for socioeconomic factors.

**Table A.17. The association between psychological well-being and child care arrangements at preschool age**

| | | Child care arrangement at preschool age | Psychological well-being | |
|---|---|---|---|---|
| | | | N | Coef (95% CI) |
| All mothers | unadjusted | Mother not employed | 1101 | 0 |
| | | Mother employed AND parental care (A) | 359 | 0.62(-0.32,1.56) |
| | | A and/or formal care (B) | 152 | -0.05(-1.30,1.19) |
| | | A and/or other individuals (C) | 449 | -0.33(-1.16,1.19) |
| | | A, B and C | 208 | -0.46(-1.53,0.60) |
| | adjusted | Mother not employed | 1101 | 0 |
| | | Mother employed AND parental care (A) | 359 | 0.69(-0.27,1.64) |
| | | A and/or formal care (B) | 152 | -0.23(-1.51,1.04) |
| | | A and/or other individuals (C) | 449 | -0.31(-1.15,0.53) |
| | | A, B and C | 208 | -0.53(-1.63,0.57) |
| Employed mothers | unadjusted | Mother employed AND parental care (A) | 359 | 0 |
| | | A and/or formal care (B) | 152 | -0.67(-2.01,0.67) |
| | | A and/or other individuals (C) | 449 | -0.94(-1.96,0.07) |
| | | A, B and C | 208 | -1.08(-2.28,0.12) |
| | adjusted | Mother employed AND parental care (A) | 359 | 0 |
| | | A and/or formal care (B) | 152 | -0.73(-2.11,0.65) |
| | | A and/or other individuals (C) | 449 | -0.99(-2.02,0.04) |
| | | A, B and C | 208 | -1.05(-2.28,0.18) |

In relation to the child care arrangements at primary school age, psychological well-being score was the lowest among those whose mothers were not working (Table A.18). Among those who were working, psychological well-being was again the lowest among those who used all three modes of child care.

**Table A.18. The association between psychological well-being and child care arrangements at primary school age**

| | | Child care arrangement at primary school age | Psychological well-being | |
|---|---|---|---|---|
| | | | N | Coef (95% CI) |
| All mothers | unadjusted | Mother not employed | 1816 | 0 |
| | | Mother employed AND parental care (A) | 1844 | 0.62(0.10,1.14) |
| | | A and/or formal care (B) | 210 | 0.79(-0.34,1.93) |
| | | A and/or other individuals (C) | 2968 | 0.29(-0.17,0.76) |
| | | A, B and C | 931 | 0.33(-0.29,0.96) |
| | adjusted | Mother not employed | 1816 | 0 |
| | | Mother employed AND parental care (A) | 1844 | 0.69(0.16,1.23) |
| | | A and/or formal care (B) | 210 | 0.91(-0.25,2.06) |
| | | A and/or other individuals (C) | 2968 | 0.39(-0.09,0.87) |
| | | A, B and C | 931 | 0.42(-0.24,1.07) |
| Employed mothers | unadjusted | Mother employed AND parental care (A) | 1844 | 0 |
| | | A and/or formal care (B) | 210 | 0.18(-0.97,1.34) |
| | | A and/or other individuals (C) | 2968 | -0.26(-0.74,0.22) |
| | | A, B and C | 931 | -0.28(-0.92,0.36) |
| | adjusted | Mother employed AND parental care (A) | 1844 | 0 |
| | | A and/or formal care (B) | 210 | 0.36(-0.81,1.52) |
| | | A and/or other individuals (C) | 2968 | -0.22(-0.70,0.26) |
| | | A, B and C | 931 | -0.19(-0.84,0.46) |

**Adjusted = Adjusted for sex, maternal education, maternal marital status, household income**

The role of job satisfaction in the association between maternal employment and psychological well-being is more complicated. While those whose mothers reported positive job satisfaction at preschool period had higher psychological well-being scores than those whose mothers were not satisfied in their jobs (by more than 1 unit in fully

adjusted model), this relationship reversed when taking into account maternal job satisfaction at secondary school age showing that those whose mothers reported positive job satisfaction had lower psychological well-being scores (Table A.19).

**Table A.19. The effect of job satisfaction on psychological well-being among those whose mothers were employed**

| Mother satisfied | Preschool period | Primary school period | Secondary school period |
|---|---|---|---|
| | Coefficient (95% CI) | | |
| **Unadjusted** | | | |
| Satisfied | 0 (ref) | 0 (ref) | 0 (ref) |
| Not satisfied | -0.98 (-2.55,0.58) | -0.04 (-0.84,0.77) | 0.99 (0.47,1.51) |
| **Adjusted for gender, maternal education, maternal marital status and household income** | | | |
| Satisfied | 0 (ref) | 0 (ref) | 0 (ref) |
| Not satisfied | -1.04 (-2.56,0.48) | 0.08 (-0.69,0.85) | 1.06 (0.56,1.57) |

Maternal self-rated health, psychological well-being and maternal smoking acted in the association between maternal employment and psychological well-being in young adults as confounding factors. Table A.20 shows how the difference in psychological well-being between those whose mothers were not in paid employment (reference category) and those whose mothers were employed changed when adjusted for maternal health and smoking behaviour. While particularly maternal psychological well-being influenced the association of interest, other two variables also played an important role.

**Table A.20. The effect of maternal self-rated health, maternal psychological well-being and maternal smoking on the association between maternal employment and psychological well-being at young adulthood**

| | Psychological well-being at young adulthood |
|---|---|
| | Coef (95% CI) |
| **At preschool age** | |
| *Unadjusted* | -0.06 (-0.69,0.58) |
| Adjusted for maternal smoking | -0.05 (-0.68,0.59) |
| Adjusted for maternal psychological well-being | 0.05 (-0.59,0.69) |
| Adjusted for maternal self-rated health | -0.04 (-0.68,0.59) |
| Adjusted for all 3 variables | 0.05 (-0.59,0.69) |
| **At primary school age** | |
| *Unadjusted* | 0.43 (0.00,0.85) |
| Adjusted for maternal smoking | 0.55 (0.12,0.97) |
| Adjusted for maternal psychological well-being | 0.68 (0.25,1.11) |
| Adjusted for maternal self-rated health | 0.57 (0.14,1.00) |
| Adjusted for all 3 variables | 0.77 (0.33,1.21) |
| **At secondary school age** | |
| *Unadjusted* | 0.10 (-0.21,0.42) |
| Adjusted for maternal smoking | 0.14 (-0.19,0.46) |
| Adjusted for maternal psychological well-being | 0.42 (0.10,0.75) |
| Adjusted for maternal self-rated health | 0.28 (-0.05,0.61) |
| Adjusted for all 3 variables | 0.48 (0.15,0.82) |

Those with mothers not in paid employment as reference category

The results shown for continuous measure of psychological well-being show same trends and similar effects as the results shown for binary measure of psychological distress presented in Chapters 5,6 and 7.

## Appendix 10: The association between maternal employment at secondary school age and smoking in two different study periods

**Table A.21. Fully adjusted model of maternal employment at secondary school age and smoking stratified by maternal marital status in two periods of the study**

|  | N | Married[1] | Unmarried[2] |
|---|---|---|---|
| Waves 1-10 | 5038 | 0.65 (0.30-1.38) | 0.91 (0.27-3.05) |
| Waves 11-18 | 8888 | 2.49 (1.15-5.36) | 0.37 (0.10-1.36) |

[1] Mothers married at secondary school period
[2] Mothers unmarried at secondary school period

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