British Parents' Trajectories of Partnership and Fertility and Midlife Mental Health

ABSTRACT This study examines how complex family formation processes are associated with midlife mental health. Our study contributes to the literature in three ways. By focusing on the intersection of partnership and fertility dynamics, we identify family life trajectories, including multi-partner fertility. Using rich prospective birth cohort data and a life course framework, we examine how these trajectories relate to midlife mental health while controlling for observed parental background and childhood factors which select individuals into different family life trajectories. Last, we analyse how family background buffers or exacerbates mental health risks associated with complex family life trajectories. We find that individuals in trajectories involving multi-partner fertility or serial cohabitations report worse mental health than those in long-term marriages. These associations remain, but the strength of the associations is reduced once parental background and childhood circumstances are considered. Individuals from more advantaged family background with higher parental education appear less vulnerable to the mental health risks associated with complex trajectories, whereas those from disadvantaged origins face greater risks. These findings highlight that the vulnerability associated with complex family life trajectories reflects not only adult family experiences but also early-life selection and broader processes of social stratification.

KEYWORDS Partnership and fertility trajectories • socioeconomic buffering • sequence analysis • mental health • British Cohort Study

Introduction

Rising levels of cohabitation, partnership dissolution, nonmarital childbearing and childbearing across multiple partnerships are all features of the Second Demographic Transition (Lesthaeghe and Van De Kaa 1986; Van De Kaa 2004). As a result family trajectories have become de-standardised, with greater heterogeneity in the timing and sequencing of family events (Elzinga and Liefbroer 2007). A large literature has examined trajectories into adulthood, first partnership formation and dissolution (Buchmann and Kriesi 2011; Perelli-Harris and Lyons-Amos 2016; Widmer and Ritschard 2009). However, less attention has been paid to family trajectories that exist after partnership dissolution, and to complexities arising from partnership dissolution, stepfamily formation and multi-partner fertility (MPF) (Guzzo 2014; Kristensen and Lappegård 2025; Vidal and van Damme 2024). These developments raise important questions about the implications of complex family trajectories for inequalities in mental health – a critical dimension of health and wellbeing in later life (Dierker et al., 2025; Grundy et al., 2020; Marks and Lambert 1998).

Family complexity can introduce instability and stress into family life. Partnership-related stressors such as marital disruptions can undermine long-term health, increasing the risks of depressive symptoms and loneliness (Hughes and Waite 2009; Peters and Liefbroer 1997; Roberson et al., 2018). Fertility-related stressors, such as early motherhood and nonmarital childbearing are often associated with a heightened level of material and psychological strain (Grundy et al., 2020). Childbearing without adequate support may also disrupt key developmental pathways by introducing barriers to education and employment, which can potentially worsen mental wellbeing (Boden et al., 2008; Hank 2010). These events in turn are associated with a higher level of subsequent partnership dissolutions (Grundy et al., 2020). The combination of repeated partnership transitions and childbearing across unions,

such as MPF, can intensify these stressors by creating greater relational and parental uncertainty (Carlson and Furstenberg 2006; Lappegård and Thomson 2018).

The work reported here extends this work by focusing on the *intersection* between partnership and fertility, using sequence-based methods and cluster analysis (Booth and Amato 1991; Kalmijn 2017; Soons et al. 2009) to identify trajectories of marital and nonmarital childbearing, lone parenthood and MPF. Existing research on the health implications of family experiences tends to focus on a single event rather than the trajectory as a whole (Booth and Amato 1991; Kalmijn 2017; Wu and Hart 2002). Studies which examine family trajectories tend to include only partnership trajectories (e.g. Mäki et al. 2025), or include fertility status in a simplified way which does not identify the partnership context of childbearing (Arpino et al. 2023; Dierker et al. 2025; Hughes and Waite 2009). As far as we are aware, there is only one previous paper that applied sequence analysis (SA) to study MPF (Arnolfo and Hiekel 2024), but the latter does not look at any outcomes associated with these trajectories.

This paper also extends current findings by considering more closely the selection of individuals into family complexity on the basis of parental background, child physical and mental health as well as childhood and adolescent experiences. Family background continues to stratify the timing and type of partnership formation and dissolution (Mooyaart et al. 2022; Sironi et al. 2015). Experience of family complexity has been found to be greater among those from less resourced backgrounds (McLanahan 2004; Di Nallo 2025), with lower levels of education (Perelli-Harris et al. 2010), those who have experienced family complexity in their own childhood (Di Nallo and Oesch 2023; Stannard et al. 2022), as well as those who have a history of poor mental health (Idstad et al. 2015; Wade and Pevalin 2004). Thus, parental background, childhood, and adolescent factors may contribute to greater risk of poor mental health in adulthood directly, or indirectly via selection into more complex family life

trajectories (Ben-Shlomo and Kuh 2002). Our study provides new insight as to whether family trajectories relate to mental health but also advances knowledge of how early life events influence these variations.

Finally, this paper contributes to the literature by examining heterogeneities in these relationships, including whether parental background resources buffer or mitigate any negative consequences of complex family trajectories, and whether the relationships differ for women and men. Family resources, such as wealth, human capital and social capital can provide material and emotional support to individuals during negative transitions and life events (Pearlin et al. 2005). Individuals from more advantaged backgrounds may have better access to resources that buffer them against the stressors associated with early childbearing or repeated partnership transitions, while those from disadvantaged backgrounds may face compounded risks (Di Nallo and Oesch 2023; DiPrete and Eirich 2006).

The UK provides a useful context for our study since the timing and partnership context of childbearing is (Di Nallo 2025). In 2024 around half of all births took place outside of marriage, up from one third in 1994 (Office for National Statistics 2025). Among children born in the early 2000s (around the time that our study participants were forming their families), one in six firstborns were to women who were not in a co-residential partnership and around one in four were born to cohabiting parents (Centre for Longitudinal Studies 2017). Moreover, levels of partnership dissolution, re-partnering and MPF are significant in the UK – almost one in two children born in the early 2000s (Kiernan et al. 2024). The prevalence of MPF in the UK, around 12-14% of men and 15-18% of women, is comparable to Nordic countries, but higher than South European countries and the US (Stannard et al. 2024). Consistent with McLanahan (2004;607)'s "diverging destinies" thesis there are strong educational gradients in the timing of family formation (Berrington et al., 2015), experience of nonmarital childbearing (Di Nallo 2025; Perelli-Harris et al. 2010), partnership dissolution

(Di Nallo and Oesch 2023) and MPF fertility (Stannard et al. 2024). Past research has also found consistent intergenerational transmission of partnership dissolution (Di Nallo and Oesch 2023; Stannard et al. 2022). Relationships between family trajectories and midlife health must, therefore, be seen within a life course perspective and examined using prospective data which can capture these predisposing factors.

Theoretical Background

Life Course Model of Health

Guided by the life course model of health, we recognize that midlife health inequalities are rooted in biological and social processes that unfold across the life span (Cain 1964; Elder, Johnson, and Crosnoe 2003; Elder Jr. 1994). Parental characteristics and childhood experiences may all contribute to later health outcomes. Since these early life experiences are also likely to be associated with selection into family trajectories it is important to consider them as confounders. According to the accumulation-of-risk model, partnership and fertility experiences in adulthood may cumulatively influence wellbeing (Ben-Shlomo and Kuh 2002). Stressful life events such as repeated union dissolution or MPF may general cumulative strain, while protective resources such as stable long-term unions may accumulate benefits. Taken together, our framework (Figure 1) suggests that midlife health inequalities emerge from the accumulation of partnership and fertility experiences while considering early-life selection.

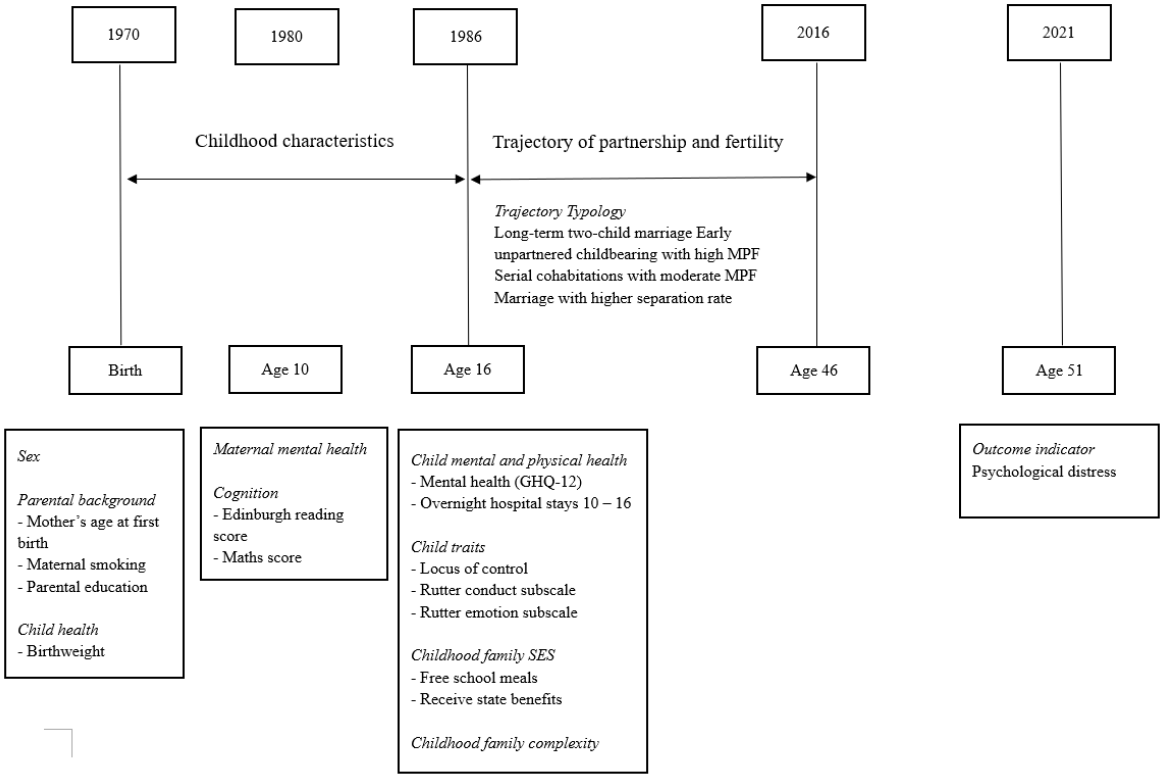

Fig. 1 Illustrative life course framework

Family Complexity And Midlife Mental Health

Marriage has long been associated with health benefits through mechanisms such as enhanced financial stability, emotional and instrumental support, social control of health behaviours and expanded kinship and friendship network (Barban 2013; Fleming, White, and Catalano 2010; Goldman 1993, 1993; Waite and Gallagher 2002; Waldron, Hughes, and Brooks 1996). Marriage remains a broadly recognised social institution that conveys legitimacy and social status, which embodies normative expectations and confers social and legal recognition (Kalmijn 2017; Perelli-Harris and Bernardi 2015). Deviation from these norms may decrease life satisfaction and wellbeing (Cohen and Wills 1985; Lamb et al. 2003). An alternative explanation for the health benefits of marriage focuses on selection - healthier individuals are more attractive on the marriage market and therefore more likely to marry (Goldman 1993; Lamb et al. 2003; Perelli-Harris and Styrc 2018; Waldron et al. 1996).

Even though some suggest that the protective effects of marriage are not static and may decline over time, indicating an adaption process (Kalmijn, 2017), overall empirical evidence suggests that long-term marriage is generally associated with lower risks of mental health issues such as depression and anxiety. Therefore, we expect that *family life trajectories characterised by long-term marriage are associated with a lower likelihood of poor mental health in midlife.*

Cohabitation has become a mainstream form of living together, either as a prelude to, or an alternative to marriage, and increasingly involves childbearing (Perelli-Harris and Bernardi 2015). In terms of wellbeing, cohabitation is comparable to marriage in several ways. Both can provide emotional support, companionship, and pooling of financial resources. Prior research suggests that depressed individuals are not differently selected into either marriage or cohabitation (Lamb et al. 2003; Marcussen 2005; Perelli-Harris and Styrc 2018). Consistent with this, differences in mental health between cohabitors and married individuals often disappears after controlling for childhood selection, socioeconomic status or union duration (Horwitz and White 1998; Perelli-Harris et al. 2018; Wu and Hart 2002).

Despite this, differences remain between cohabitation and marriage. Marriage continues to hold greater symbolic legitimacy (Berrington et al. 2015), is less likely to dissolve (Kuang et al. 2025) and continues to provide greater legal protection, at least in the UK (Thompson 2024). Cohabiting unions may exert weaker social control over health-related behaviours than marriage, as marriage is more strongly associated with normative regulation and spousal monitoring, although these differences may vary across social contexts (Horwitz and White 1998; Perelli-Harris et al. 2018). Even though cohabitation can also enhance mental wellbeing – especially when it involves children or shared investment – it may lack external validation and undermine wellbeing in certain contexts (Berrington et al. 2015). Evidence is more mixed in the American context, with some studies finding that even after controlling for

economic resources, social support and physical health, cohabitors report higher levels of depression than married individuals (Brown et al. 2005). However these differences appear to reflect the nonnormative positioning of cohabitation and the mental health gap is reduced to insignificance once structural support and self-esteem are controlled (Brown et al. 2005; Marcussen 2005). This may be further supported by cross-national evidence showing that in countries with a long history of cohabitation and more gender equal policies, the marriage gap in mental health no longer exists (Perelli-Harris et al. 2018). In the UK context, differences in mental health associated with cohabitation likely reflect greater partnership instability, as cohabitation is more common among individuals with prior separations and repeated partnership transitions (Perelli-Harris et al. 2018).

Although for some couples in conflictual circumstances breaking up can be a positive outcome (Amato 2000), partnership dissolution usually entails a range of stressors that may undermine mental health, such as sole parenting responsibility or loss of custody of children, loss of emotional support, conflict, economic costs, residential moves, reduced social networks, and stigma (Amato 2000; Avellar and Smock 2005; Booth and Amato 1991). Partnership transitions with young children introduces changes in family routines and rules, increasing uncertainty in parenting (Beck et al. 2010). Two theoretical perspectives are often used to explain how partnership dissolutions affect wellbeing. The crisis model argues that declines in mental health stem largely from the acute stress surrounding the separation itself and these effects diminish as individuals adapt over time (Amato 2000; Leopold and Kalmijn 2024). The chronic strain model suggests that partnership dissolutions can generate longer-lasting stressors, such as persistent economic hardship and extended periods of lone parenthood, which do not easily resolve over time and may lead to sustained declines in wellbeing, particularly among the more disadvantaged groups (Booth and Amato 1991; Tach and Eads 2015). Individuals who experienced at least one separation report more symptoms

of depression than the continuously married, with the remarried falling in between (Hughes and Waite 2009). Older adults with multiple dissolutions report greater loneliness than those with only one dissolution, and even those with any dissolution are lonelier than the stably partnered, regardless of current status (Peters and Liefbroer 1997). These findings suggest that the consequences of partnership dissolutions may extend well beyond the initial adjustment period, consistent with chronic strain processes (Dierker et al. 2025). Whether the dissolution of cohabiting unions is less stressful than marital dissolution remains unclear. Although the social and emotional barriers to separation – and the associated stigma – may be lower for cohabiting relationships (Berrington et al. 2015), the practical consequences of dissolution appear broadly similar. These include the loss of economic support (Tach and Eads 2015) and, in some cases, the need for geographic relocation, which can disrupt neighbourhood ties and diminish access to local social networks (Beck et al. 2010). The lack of legal protection for cohabitors in the UK (Women and Equalities Commission 2022), particularly at the point of partnership dissolution, may mean that these practical consequences are more severe. Taken together, we expect that *family life trajectories characterised by serial cohabitations and repeated cohabitation dissolutions are associated with a higher likelihood of poor mental health in midlife, compared with trajectories characterised by long-term marriage.*

Partnership dissolution often constitutes a turning point that redirects individuals toward more complex life-course trajectories, including re-partnering. A growing body of research suggests that re-partnering may confer mental health benefits (Leopold and Kalmijn 2024; Soons et al. 2009), as it can restore financial stability, provide emotional and social support, and reduce feelings of loneliness (Umberson and Montez 2010; Wright et al. 2020). Remarriage, in particular, may offset income losses following separation, a mechanism that is especially consequential for women who experience divorce with low earnings or limited

educational credentials (Dewilde and Uunk 2008). Consistent with these mechanisms, empirical evidence indicates that individuals who re-partner after divorce report lower levels of depressive symptoms than those who remain unpartnered (Strohschein et al. 2005), although some studies find that these mental-health gains fade, returning to pre-dissolution levels over time (Hughes and Waite 2009; Kalmijn 2017; Lin et al. 2019). Selection processes may also be relevant. Individuals with poorer mental health are less likely to re-partner (Pevalin and Ermisch 2004), and parents – particularly those living with their children – have reduced chances of forming new unions (Vanassche et al. 2015). Re-partnering can also introduce new strains. Stepfamilies may involve complex stepparent, stepsibling, and half-sibling dynamics that create uncertainty and strain within the family system (Raley and Sweeney 2020). Complex family structure may introduce additional stress because legal definitions of roles and obligations are often ambiguous and social norms governing relationships and behaviour are less established (Lappegård and Thomson 2018). Managing family ties across multiple households further generates challenges than when all family members reside in a single home (Furstenberg 2014). Partnership transitions occurring later in the family life course may introduce cumulative role strain, particularly for cohabiting parents. Because the roles, norms, and expectations surrounding unmarried parenthood are less institutionalised, cohabiting parents may face greater ambiguity in parental, partner, and coparenting roles.

Childbearing-related stressors such as early parenthood and unpartnered childbearing can hinder the accumulation of human and social capital, generate financial strain, and may lead to greater instability and more stressful interrelated life events, all of which are associated with poorer mental health (Boden et al. 2008; Carlson et al. 2004; Falci et al. 2010; Grundy et al. 2020; Hank 2010; Hofferth and Goldscheider 2010). When births occur outside of a co-residential partnership, risks may be compounded by limited financial and emotional support,

lower level of paternal involvement, and a higher chance of entering more complex family structures (Sigle-Rushton and McLanahan 2002; Tach et al. 2010). These patterns are also observed in trajectories involving MPF, which encompass early childbearing, nonmarital births and repeated union dissolution (Arnolfo and Hiekel 2024). Parents with children across several partnerships experience extended periods of childrearing due to the spacing of births across unions (Andersson 2021). When individuals have subsequent children with new partners household relationships are often renegotiated, introducing stressors related to the division of time and resources across children (Furstenberg 2014). This combination creates a trajectory with heightened cumulative exposure to stressors over the life course and have the potential for compounding disadvantages in midlife mental health. Taken together, we expect that *family life trajectories characterised by multi-partner fertility, which involves repeated partnership dissolutions, re-partnering, and early or unpartnered childbearing, are associated with a higher likelihood of poor mental health in midlife, compared with trajectories characterised by long-term marriage and childbearing within marriage.*

Socioeconomic Buffering and Differential Vulnerability to Family Trajectories

Individuals vary in their susceptibility to the stresses introduced by complex family life trajectories. Kessler (1979) argues that there is an association between social status and mental health that rises from differences in the impacts of comparable stressor events across groups with different socioeconomic statuses. Disadvantaged individuals may experience greater distress because they are more frequently exposed to stress-inducing environments. Another important element shaping heterogeneity in coping with stress is the extent to which individuals possess adequate resources to buffer stress. Coping resources and social support can limit the number, severity, and spread of stressors across life domains (Pearlin, 1989).

Individuals with greater socioeconomic resources are better equipped to contain stressors arising from family transitions and prevent them from proliferating into broader, chronic strains (Pearlin et al. 2005). Recent empirical support for this resource-substitution effect comes from Mäki et al. (2025) who find, using data from multiple pooled European countries, that the association between divorce and subjective health was weaker for those with greater resources. It is important to note that we capture socioeconomic standing by cohort members' parental education, which reflects a core dimension of ascribed inequality rather than personal achievement (Mooyaart et al. 2022). Taken together, we expect that *the negative associations between complex family life trajectories and midlife mental health are weaker among individuals from more advantaged family backgrounds, as indicated by higher parental education.*

Sex Differences

Men and women navigate diverse family life trajectories differently. The impact of divorce and separation differs for men and women (Amato 2000; McLanahan 2004). Women often face greater financial strain, and children more often reside with their mother following parental breakup (McLanahan 2009). Therefore, lone motherhood is far more prevalent than lone fatherhood. The gender inequality in childcaring responsibilities following a partnership dissolution also implies that women spend longer time in lone parenthood. In this regard, the chronic strain model is especially applicable to more vulnerable women, who are more likely to remain in poverty after divorce and separation for longer periods of time (Leopold and Kalmijn 2024). For women, re-partnering often signals new dynamics, which might bring support as well as stress (Ivanova, 2025). Re-partnering can mitigate financial strain after separation, especially for women and mothers (Hogendoorn et al. 2020), though older women and mothers are less likely to form second unions compared to men (Gałęzewska et al. 2017). Mothers face grater challenges in re-partnering due to low bargaining power and limited

resources because they are often the primary caregiver (Di Nallo 2019; Koops et al. 2021). Forming new unions can also bring further instability and emotional strain, particularly as women typically bear greater responsibility for maintaining kin relations and emotional labour (Dean et al. 2022). Men's involvement with children, by contrast, often depends on co-residence and their relationship with the child's mother (Ivanova 2025; Kalmijn et al. 2019). Therefore, we expect that *the associations between family life trajectories and midlife mental health differ by sex, with trajectories involving childbearing across diverse partnership contexts being more strongly associated with poor mental health among women than among men.*

Methods

Data And Sample

We use data from the birth, age 16 and age 51 sweeps of the British Cohort Study 1970 (BCS70), together with derived partnership and fertility histories between age 16 and 46 (Hancock and Peters 2021; Sedovic et al. 2024). Variables from the age 10 sweep are also used, but only for imputation purposes. Of the original 17,194 cohort members included in the birth sweep, 9767 are dropped due to them not participating at age 51, and 211 due to incomplete information on partnership and fertility histories, yielding 7216 cases. Since our focus is on the families with children, childless individuals (N=1358) and those with non-response on the mental health outcome at age 51 (N=673) are also excluded leaving a final sample of 5185 individuals. Attrition from the survey is more likely for individuals from poorer socioeconomic backgrounds and those with greater relationship churns (Mostafa and Wiggins 2014) meaning that our estimates of complex family trajectories are likely to be conservative. The main analyses use the non-response weight provided in the age 51 sweep.

Multiple imputation is used for item missingness which is most apparent at the age 16 sweep when a teachers strike in 1986 impeded survey data collection. The strike was not confined to specific regions and the distribution of students across school sectors was broadly representative, therefore the missingness is likely to have occurred at random (Gerova, 2006). We employ multiple imputation by chained equations, including variables from the substantive model and a set of auxiliary variables, capturing health (e.g., overnight hospital stays due to long-term illness), behavioural (e.g., locus of control and Rutter scores), and socioeconomic characteristics (e.g., receiving free meals at school and state benefits) measured at age 10. Fifty imputed datasets are created and used in all analyses.

Mental Health at Age 51

Mental health is measured by combining measures of depression and anxiety. Depression is captured with the two-item Patient Health Questionnaire Depression Scale (PHQ-2), which asks whether the cohort member had "little interest or pleasure in doing things in the last 2 weeks", and are "feeling down, depressed or hopeless in the last weeks" (Kroenke et al., 2003). Scores range from 0 to 6 and the PHQ-2 has been shown to perform comparably to the full PHQ-9 (Giuliani et al., 2021; Kroenke et al., 2003). We apply a cutoff of 2[1] to construct a binary indicator (1 = 2 or higher, 0 = 1 or none). Anxiety is measured using the 2-item Generalised Anxiety Disorder (GAD-2), which asks "whether nervous, anxious or on edge over the last 2 weeks" and "whether not able to stop or control worrying in the last 2 weeks" (Kroenke et al. 2007). The GAD-2 provides a level of sensitivity and specificity similar to the full GAD-7 (Plummer et al. 2016). A cutoff of 3 is applied to construct a binary indicator (1 = 3 or higher, 0 = 1 or none) (Kroenke et al., 2007). Those who score 1 on either depression or anxiety are coded as "high" on mental health symptoms, while those who score 0 on both measures are coded as "low" on mental health symptoms.[2]

Main Independent Variable: Family Trajectories

Sequence Analysis

For each of the 360 months between age 16 and 46 we identify whether cohort members are in one of four partnership states – "never partnered (NP)", "cohabiting (COH)", "married (MAR)", and "separated (SEP)", and seven childbearing states ("without children", "one child", "two or more children with one partner", "two children with two different partners", "two or more children with one partner, and one child with a previous partner", "children

[1] Kroenke et al. (2003) originally argued for a cut-off of 3 in their validation study, while Giuliani et al., (2021) more recently argued for a cut off of 2 to achieve a balance of sensitivity and specificity.
[2] 83% of the those who were identified as being at risk of depression, also identified as being at risk of anxiety thus underlining our decision to model the outcomes jointly.

with one partner, and two or more children with a previous partner", and "children with three or more partners"). Four of the seven childbearing states involves MPF which we identify by comparing each child's birth month and year with the start and end date of each partnership. Following Stannard et al. (2024), births during a coresidential partnership are attributed to that partner; births occurring within six months before a union forms are assigned to that partner, reflecting transitions into cohabitation or marriage following a birth; births within nine months after a union dissolution are attributed to the previous partner, since conception would have taken place during the union. All remaining births are deemed to have taken place outside of a coresidential partnership, with each such birth attributed to a distinct partner, yielding an estimate prevalence of MPF of 17% among men and 18% among women. Around 13% of both men and women have children with two partners, while 4% of men and 5% of women have children with three partners.

We combine the partnership and childbearing states into an extended alphabet of 28 distinct states (Table 1). It is important to note that though we are able to capture biological birth and, in most cases, which partnership the birth belongs to, we are not able to capture whether the cohort members reside with the children and are the responsible carer for the children.

Table 1. Extended alphabet combining partnership and fertility states

	Never Partnered (NP)	Cohabiting (COH)	Married (MAR)	Separated (SEP)
Without children (nc)	1	8	15	22
One child (1c1p)	2	9	16	23
Two or more children with one partner (2+c1p)	3*	10	17	24
Two children with two different partners (1cnp+1c1pp)	4	11	18	25
Two or more children with one partner, and one child with a previous partner (2+cnp+1c1pp)	5 *	12	19	26
Children with one partner, and two or more children with a previous partner (acnp+2+c1pp)	6*	13	20	27
Children with three or more partners (ac3+p)	7	14	21	28

Notes: The configurations of 3*, 5*, and 6*do not have representations in the study sample due to the

assumption that consecutive births outside of a partnership are to a different biological parent.

A dissimilarity index is computed to measure the distances between the sequences with Optimal Matching (OM) (Abbott and Tsay 2000) and theory-based costs (*indel* = 1; substitution = 2). This specification emphasises sequencing of events over timing (Raab and Struffolino 2023). We employ cluster analysis to extract trajectory typology by grouping similar sequences together. The clustering method begins by applying Ward's linkage, which minimises the within-cluster variance (Ward 1963). The solution is refined using Partitioning Around Medoids (PAM) to improve representativeness by selecting medoids and reassigning sequences. Cluster solutions are evaluated using several cluster quality indices (CQIs) that capture within-cluster homogeneity and between-cluster separation (Studer 2013) (See Appendix Table 1).

Logistic Regression of Mental Health at Age 51

With the typology identified, we then estimate logistic regression models to assess the association between the partnership-fertility trajectories and mental health risks. For ease of interpretation, we present average marginal effects (AMEs), which represent the average change in predicted probability of being at higher risk of poor mental health associated with a one-unit change in the covariate. AME are presented as probability differences, enabling direct comparison between types of family life trajectories.

Moderation Effects of Parental Family Resources And Sex

To test whether family resources buffer the potential negative associations between complex family life trajectories and midlife mental health, and whether the associations between family life trajectories and midlife mental health differ for women and men, we conduct additional analyses that include interaction terms. Family resources are operationalised using

parental education, while gender differences are examined using the reported sex of cohort members. As a sensitivity analysis, we replace parental education with parental occupational class – the findings are similar, though statistical significance is reduced (Appendix Figure A2). The measure of parental education is taken from the birth sweep. We take the highest age at completion of education between the two parents and construct a three-level measure. Those who leave school at or before age 15 are considered as having "low" education, while those who leave school at or before age 18 are considered as having secondary/post-secondary education, or "medium" education. Those who leave school after age 18 are considered as having "high" education. Sex is recoded to "female" and "male".

Control Variables

Control variables were included on the basis that they had been found in other research to be associated with both family trajectories and health. Where repeated measurements across childhood are available, we chose those closest to the exposure i.e. measurements at age 16. When this was not achievable, for example cognitive tests due to large missingness in age 16, we used the age-10 measurements instead. At birth, we include parental background variables such as mother's age at first birth, maternal smoking during pregnancy and parental education at birth, as well as child health indicator birthweight. The age-10 indicators include maternal mental health, measured by the Malaise Inventory (Rutter et al. 1970) with a cut-off at the 80th percentile, and childhood traits such as cognition, proxied by reading and maths scores.

The age-16 indicators include mental health measures at age 16 and overnight stays at hospital due to a long-term illness between ages 10 to 16. The former is assessed using self-reported General Health Questionnaire 12-item (GHQ-12) (Goldberg 1978). We adopt a binary scoring system (0-0-1-1) and the resulting scale ranges from 0 to 12, with higher score indicating higher level of psychological impairment (Comotti et al. 2024). We apply a cutoff

score of 3 (Goldberg et al. 1997) to convert the indicator into a binary variable, with "low" indicating a lower level or absence of psychological distress, and "high" indicating a higher level of psychological distress. Other childhood trait measurements include locus of control (LOC) (Gammage 1975), which measures whether children perceive outcomes as internally or externally determined, and the Rutter behavioural and emotional scales (Rutter 1967), which capture childhood externalising behavioural problems and internalising emotional problems. We use two subscales derived from the original 19 Rutter scale items. We follow the established subscales from prior studies (Crusco 2013; Rutter 1967) to use items 3,4,14,18,19 to form the behavioural subscale and items 6,9,16 to form the emotional subscale. The resulted scores are cut off at the 80th percentile and categorised according to severity of behavioural issues as "low" and "high". We also measure childhood family socio-economic status at age 16, using information on whether the family is in receipt of free school meals and state benefits. Experience of family complexity in childhood is measured by whether cohort members have lived with two biological parents up to age 16, have not lived with two biological parents and are without stepparents, or have not lived with two biological parents but experienced living with one or more stepparents prior to age 16.

The associations between the control variables and the outcome are shown in Appendix Table 1, and with the family trajectories in Appendix Table 2. In brief, less advantaged socioeconomic backgrounds, poor health in childhood/adolescence, and emotional and behavioural problems in childhood are associated with the experience of less stable family trajectories in adulthood, and also with poorer health at midlife. This demonstrates the importance of taking a life course approach to understanding health in later life.

Results

Typologies of Family Trajectory

The CQIs (Appendix Table A3) indicate that a four-cluster solution (Table 2) provides the best balance of fit and substantive interpretability. The largest group is "Long-term two-child marriage" (43.7%), while the smallest is "Marriage with higher separation rates" (16.1%). The remaining two trajectories, "Early unpartnered childbearing with high MPF" (20.0%) and "Serial cohabitations with moderate MPF" (20.2%), are of similar size.

Table 2 Family life trajectory typology and sample distribution

Typology Label	Short Label	N	Weighted %
Long-term two-child marriage	Long-Term 2C Mar	2627	43.7%
Early unpartnered childbearing with high MPF	Early Childbearing MPF	653	20.0%
Serial cohabitations with moderate MPF	Serial Cohabitations MPF	975	20.2%
Marriage with higher separation rates	Mar High Separation	930	16.1%
	Total	5185	100%

Notes: Unweighted frequencies are presented. Percentages are weighted using age 51 non-response weights.

A visual summary of the identified trajectory types is presented in Figure 2. Given the complexity of the states, we first provide a legend showing all 28 possible states, organised into four colour-coded series according to partnership status. Within each partnership category, states are further differentiated by the seven fertility states. Each row in the figure corresponds to one trajectory type and includes two plots – a *State Distribution Plot*, which depicts the distribution of states at each time point on a yearly granularity, and a *Relative Frequency Sequence Plot*, constructed using 100 medoid sequences, selected to represent the most central trajectories within each type and sorted by the first state transition (e.g., unpartnered and/or childless) (Gabadinho et al. 2011).

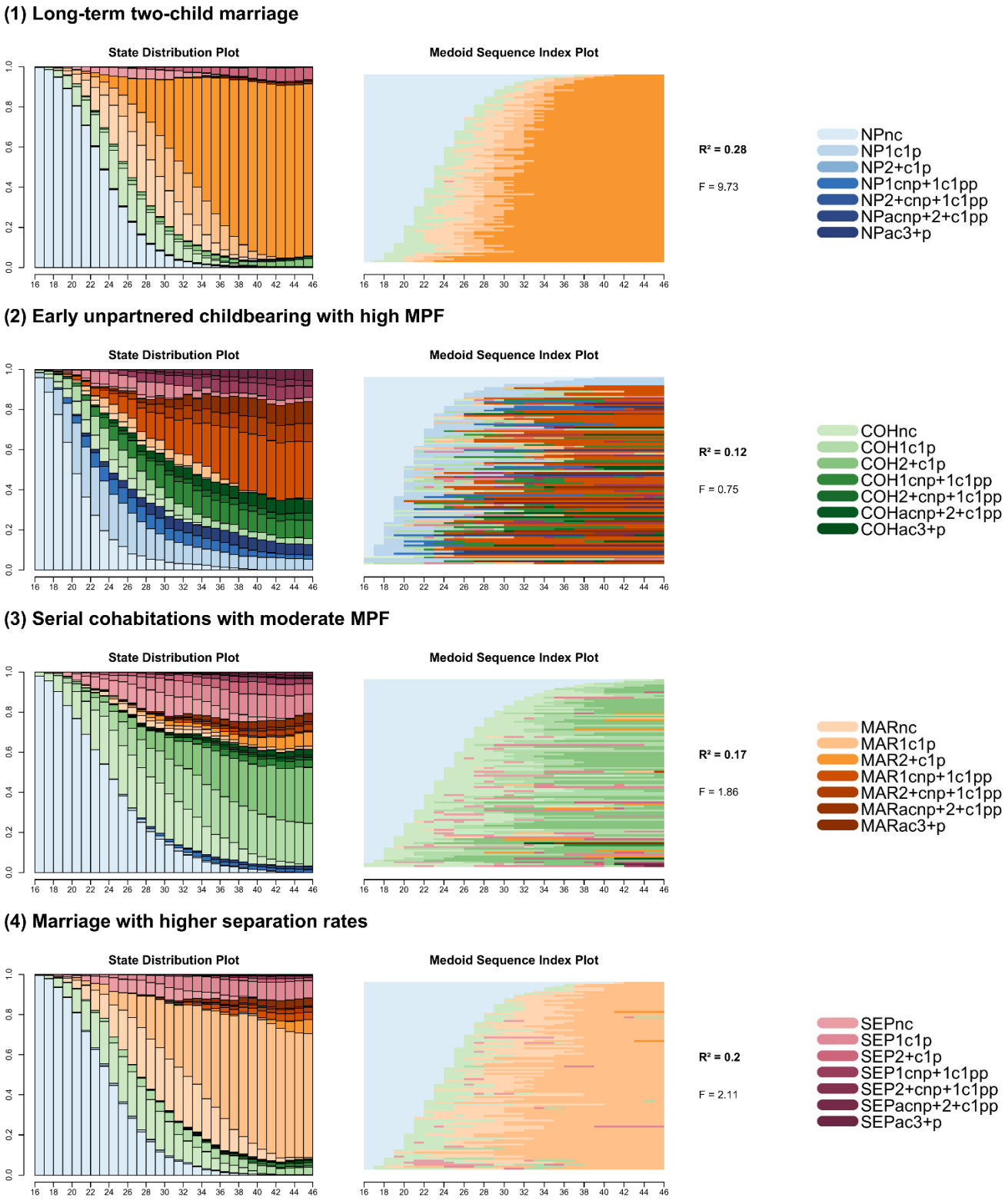

Fig. 2 The legend displays contains the colour series for each state using short labels. In each of the following rows, the plot on the left-hand side presents the State Distribution Plot based on the distribution of states at each time point on a yearly granularity. The plot on the right presents the Relative Frequency Sequence Plot using 100 medoid sequences for each cluster, sorted by the first state transition out of unpartnered and/or childless.

To complement these visualisations, we present key trajectory indicators by family life trajectory type and sex (Table 3). The largest trajectory type – *Long-term two-child marriage* – reflects a more traditional family pattern, with early partnerships and marriage followed by childbearing within marriage. Members of this type have a relatively low rates of dissolution (30.6% for women and 28.6% for men) and re-partnering (23.9% and 24.6%). Only a small portion of individuals experienced lone parenthood for a short period of time (2.1 and 1.3 years). This might be partially due to the fact that the data set does not capture "living apart together" relationships. In the event of a marriage or cohabitation following a birth, the data set still codes the birth as being outside of any coresidential relationships. Fertility is high, with an average of 2.6 children for women and 2.5 for men and relatively early childbearing (28.1 and 29.8 years of age). The proportion of members experiencing MPF is the lowest (7.9% and 6.2%) among all four types.

Table 3 Description of key trajectory indicators by typology and sex

Short Label	1. Long-Term Two-Child Marriage		2. Early Unpartnered Childbearing With High MPF		3. Serial Cohabitations With Moderate MPF		4. Marriage With Higher Separation Rates	
Indicators	Female	Male	Female	Male	Female	Male	Female	Male
% Ever cohabited	74.0%	81.0%	72.9%	76.0%	97.6%	92.9%	85.7%	87.5%
% Ever married	96.3%	97.9%	49.7%	51.2%	37.4%	32.7%	100.0%	100.0%
Mean no. of partners	1.3	1.3	1.3	1.3	1.9	1.6	1.6	1.5
Mean age at first partnership (if any)	23.4	25.2	26.4	29	23.5	26.7	24.2	26.1
Mean age at first marriage (if any)	26.8	28.6	30	33	32.4	34.6	28.9	30.9
Mean duration of first marriage (if any)	18.2	16.7	12.6	11.3	6.1	6.1	14.1	13.6
% Ever experience partnership dissolution	30.6%	28.6%	52.3%	43.6%	67.9%	54.2%	58.9%	46.1%
% Ever experience cohabitation dissolution	12.8%	15.3%	36.4%	34.4%	58.6%	46.2%	27.9%	23.6%
% Ever experience marriage dissolution	21.2%	17.9%	25.4%	16.5%	22.4%	17.9%	42.3%	30.5%
% Ever re-partnered	23.9%	24.6%	37.8%	32.1%	58.1%	47.2%	46.9%	39.3%
Mean no. of children	2.6	2.5	2.8	2.7	2.4	2.4	1.4	1.5
Mean age at 1st birth	28.1	29.8	21.3	24	29	31.3	31.5	32.2
% Children out of marriage	22.5%	20.9%	96.0%	96.1%	95.5%	96.9%	23.5%	31.0%
% Children out of partnerships	5.6%	2.7%	88.8%	90.9%	27.2%	27.2%	8.5%	11.2%
% Ever lone parent	21.7%	16.7%	95.2%	96.3%	59.2%	51.7%	38.0%	30.8%
Years spent as lone parent	2.1	1.3	13.4	10.9	5.4	3.9	3	1.8
% Have experienced MPF	7.9%	6.2%	83.3%	72.0%	24.3%	27.1%	9.4%	11.8%

Notes: The lone parenthood statistics should be understood with caution. We were able to capture biological children, but we cannot determine whether cohort members live with their children or whether they are the main responsible carer for the children. Percentages and means are weighted using the age 51 non-response weight.

By contrast, the second trajectory – *Early unpartnered childbearing with high MPF* – highlights the experience of early childbearing (21.3 years of age for women and 24.0 for men), which are mostly unpartnered (88.8% and 90.9%) and nonmarital (96.0% and 96.1%), and high fertility (2.8 and 2.7). Cohort members who follow this trajectory spend long periods as lone parents (13.4 and 10.9 years) and instability is high, with 52.3% of women

and 43.6% of men experiencing dissolutions. The majority also experience MPF (83.3% and 72.0%). This group represents the most complex family trajectory that feature partnership transitions and high prevalence of MPF.

The trajectory of *Serial cohabitations with moderate MPF* is defined by tendency to cohabit instead of getting married, a higher likelihood to experience union dissolution, and nonmarital childbearing. Only about one-third ever marry (37.4% of women and 32.7% of men), and those who do enter marriage at later ages (32.4 and 34.6 years). Dissolution is common (67.9% and 54.2%), and fertility is moderate, with an average of 2.4 children for both women and men, which most occur within a coresidential partnership. A moderate proportion of individuals of this type experiences MPF (24.3% and 27.1%).

Finally, the fourth type – *Marriage with higher separation rate* – is a group that features universal marriage and slightly delayed childbearing, with average first birth in the early 30s and low fertility. Although most children are born within a coresidential partnership, individuals in this group experience moderate instability, with dissolution affecting 58.9% of women and 46.1% of men. MPF is somewhat more common than those in the long-term marriage group (9.4% for women and 11.8% for men), but lower than the other two groups.

Individuals who experienced MPF are overwhelmingly concentrated in the *Early unpartnered childbearing with high MPF* trajectory, underscoring the extent to which this type captures the most complex and unstable family lives. Individuals in this trajectory experience repeated partnership transitions combined with early and predominantly unpartnered childbearing, possibly resulting in extended periods of parenting outside of coresidential unions and limited partner support. The strong clustering of MPF within a single trajectory highlights the value of the four-type solution in distinguishing qualitatively different types of family complexity. Having established the distinctiveness of the four

trajectories in terms of the partnership-fertility nexus, we next turn to their associations with mental health at midlife.

Bivariate Associations Between Family Life Trajectories and Mental Health Risks at 51

Individuals in the *Long-term two-child marriage* trajectory report the lowest level of mental health symptoms at age 51 (21.0%), whereas those in the *Early unpartnered childbearing with high MPF* trajectory report the highest level (41.4%) (Figure 3). The *Serial cohabitations with moderate MPF* and the *Marriage with higher separation rates* types fall in between (29.8% and 23.0%), though the former reports slightly higher levels of mental health symptoms than the latter.

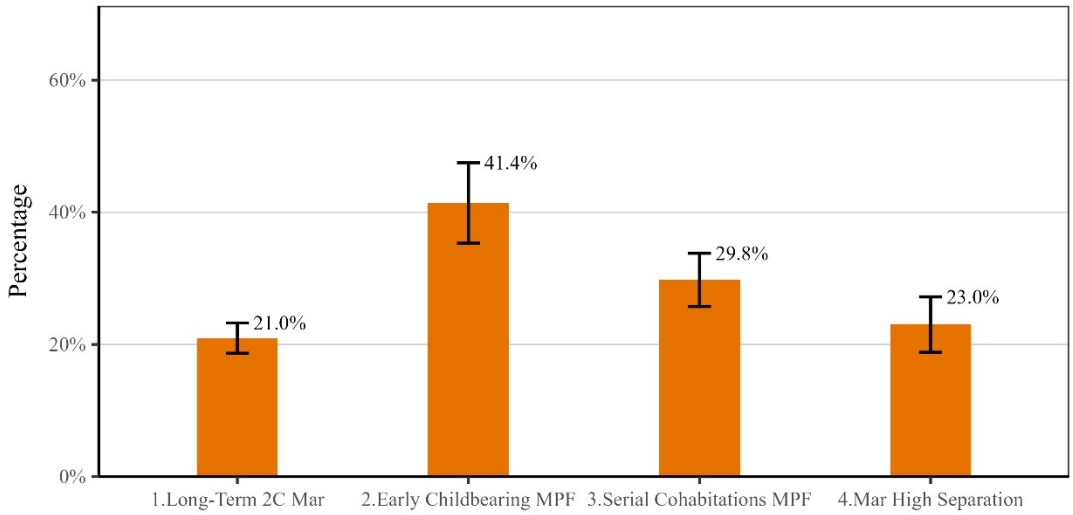

Fig. 3 Bars show the pooled weighted percentage of cohort members scoring high (vs. low) on mental health symptoms at age 51. Error bars indicate 95% confidence intervals.

Multivariable Regression Results of Association Between Family Life Trajectories And Mental Health Risks at Age 51

We estimate the average marginal effects (AMEs) of family life trajectory typologies on mental health risks at age 51 in reference to the first type (*Long-term two-child marriage*) on unadjusted Model 1, which are bivariate specification that includes only the trajectory types as the predictors, and on adjusted Model 2, which include the full set of covariates. To account for multiple imputation, AMEs were extracted from each imputed dataset and then averaged to produce pooled estimates. Figure 4 illustrates the results for both Model 1 and Model 2 and presents how the point estimates change after adding the controls in Model 2 (see Table A4 for the full results).

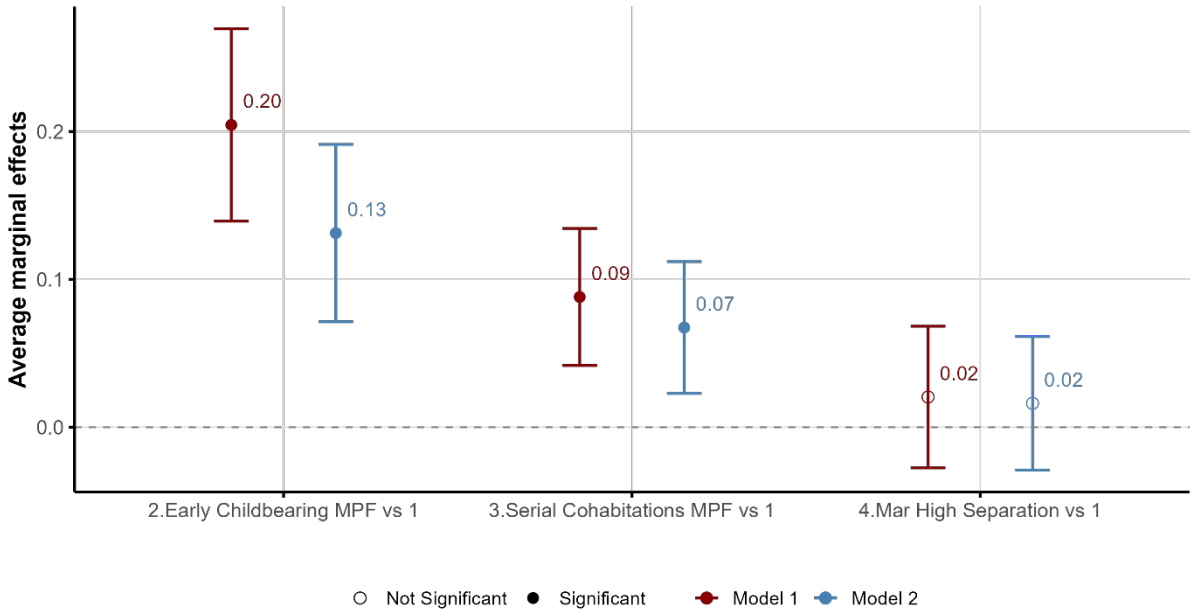

Fig. 4 Model comparisons for average marginal effects (AMEs) of family life trajectory typology on the probability of scoring high (vs. low) on mental health symptoms at age 51. Model 1 includes trajectory typology only, whereas Model 2 adjusts for all covariates. Estimates and 95% confidence intervals are pooled across multiple imputations and are based on weighted analyses.

In the unadjusted Model 1, the results indicate significant differences in the reporting of mental health. Individuals in the *Early unpartnered childbearing with high MPF* trajectory show the largest positive risk differences relative to the first trajectory type, 0.205 ($p<.001$) higher. This indicates that individuals in the second trajectory type are 20.5% more likely to report having higher levels of mental health symptoms than those who follow the first type of trajectory. There are also elevated risks for those in the *Unstable cohabitation* trajectory, though with smaller magnitudes (0.088; $p<.001$). They are 8.8% more likely to report mental health symptoms than those in the first type. There are no statistical differences between the *One-child marriage with higher separation* and the *Long-term two-child marriage* types.

When we include covariates collected before age 16 in Model 2, the estimated associations between family trajectories and midlife mental health reduce but remain significant. This attenuation indicates that a meaningful share of the observed differences across trajectories reflects early-life circumstances that shape both selection into various family life pathways and vulnerability to higher risk of poor mental health in later life. These results suggest that early-life factors partially account for the association between family trajectories and midlife mental health, suggesting that individuals are, at least to some extent, selected into various family life trajectories based on childhood advantages/disadvantages, which are also independently associated with midlife mental health inequalities. However, important differences persist even after adjusting for early-life factors. In Model 2, the *Early unpartnered childbearing with high MPF* trajectory remains the group that shows the highest probabilities of reporting mental health symptoms. Even though the gap with the *Long-term two-child marriage* trajectory narrows, the residual difference is still substantial and statistically significant (0.131; $p<.001$). Similarly, individuals of the *Serial cohabitations with moderate MPF* trajectory remain being 6.7% ($p<0.01$) more likely than those of the first type to report mental health symptoms. These findings show that beyond the early-life selection,

family life trajectories themselves remain meaningfully associated with midlife mental health.

Also shown in Table A4, men are 6.7% (p<.001) less likely to report mental health symptoms. Childhood physical health as well as mental health are strong predictors on midlife mental health. Those who score high on mental health at age 16 are 7.6% (p<.05) more likely to report more mental health symptoms in midlife.

Does Parental Education Buffer The Association Between Family Trajectories And Midlife Mental Health?

On the basis of the full model, we further include an interaction term between family life trajectories and parental education. The main findings are shown in Figure 5. First differences, which show within-type education effects, and second differences which show the difference-in-differences of the interaction effects are shown in Appendix Table A4.

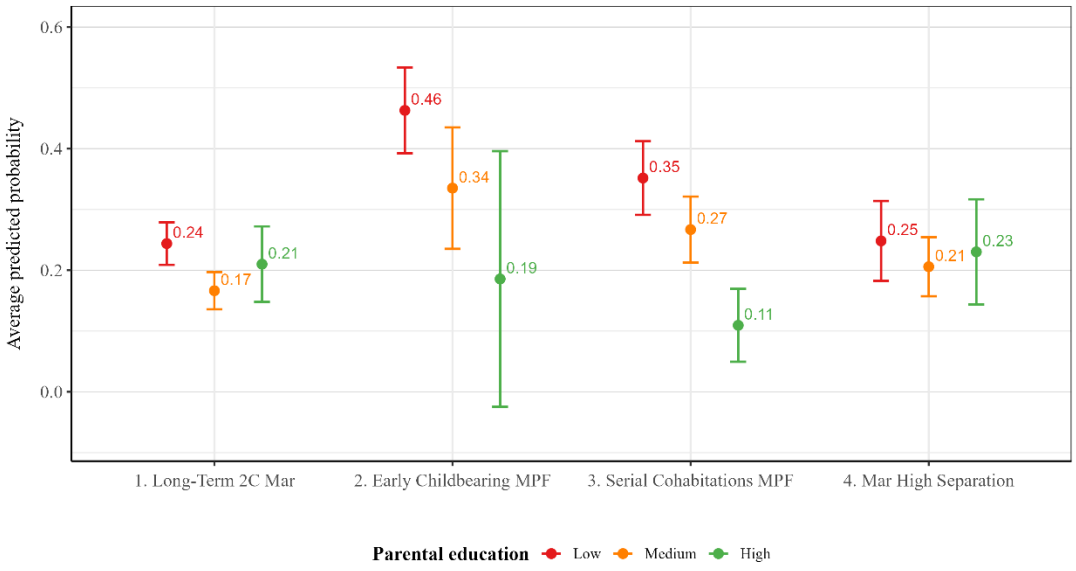

Fig. 5 Average predicted probabilities of scoring high (vs. low) on mental health symptoms at age 51 by family life trajectory typology and parental education. Estimates and 95% confidence intervals are pooled across multiple imputations and are based on weighted analyses.

In our sample, individuals with low-educated parents are disproportionally concentrated in the *Early unpartnered childbearing with high MPF* trajectory, while those with high-educated parents are more spread out in other trajectories. These findings echo Barban (2013), who shows that groups featuring cohabiting and lone mothers seem to be inferior in terms of family resources.

Among individuals with the *Long-term two-child marriage* trajectory, their parental education does not seem to play a role in the likelihood to report mental health symptoms. However, for individuals who follow the *Early unpartnered childbearing with high MPF* trajectory, education plays a more salient role. Individuals from low parental education background have a 27.7% ($p<.05$) higher likelihood in reporting mental health symptoms than those from high-education homes. This implies a stronger gradient of parental education among individuals who follow this trajectory. The results show that there are negative and statistically significant ($p<.05$) second differences, which indicates that the educational gradient is significantly steeper for individuals of the *Early unpartnered childbearing with high MPF* trajectory. In other words, high parental educational background is meaningfully more protective of individuals who follow this trajectory than those who follow the *Long-term two-child marriage* trajectory. There appears to be a compounded risk of poor mental health among individuals from lower-educated households who are observed to follow more unstable family life trajectories. Medium-education homes are similarly protective as the high-education homes.

We repeated the analysis to compare individuals of the *Long-term two-child marriage* trajectory and of the *Serial cohabitations with moderate MPF* trajectory. Similar to those of the Cluster 2 trajectory, moving from low-education homes to high-education homes increase the likelihood of reporting mental health symptoms increase by 24.2% ($p<.001$). Similar patterns are also observed for medium-education versus high-education homes. The

significant second differences indicate that the education gradient in poor mental health is steeper for Cluster 3 than for Cluster 1. These findings suggest that complex family life trajectory amplifies social inequalities in mental health, further reinforcing "diverging destinies" (McLanahan 2004).

Are There Sex Differences in The Relationship Between Family Trajectories And Midlife Mental Health?

Figure A1 display presents the interaction results between family life trajectories and sex visually, while Table A6 displays the results using first and second differences, and all analyses are based on pooled and weighted estimates. Across the four trajectory types, women are more likely to score high on mental health symptoms at age 51 than men. The second differences show that the gaps do not differ significantly across trajectory types. That is to say, it is not evident that mental health risks associated with complex family trajectories are disproportionately larger for women compared with men. This is contrary to our expectation that the stressors associated with complex family life trajectories would be greater for women.

Sensitivity Analyses

We perform the following sensitivity analyses. Firstly, using the same data on trajectories of partnership and fertility, we perform multichannel sequence analysis (MCSA) instead of using an extended alphabet, treating partnership formation and fertility trajectories as parallel dimensions. The results available on request. They show similar patterns as the extended alphabet, but the MCSA did not highlight to the same extent trajectories dominated by MPF. Secondly, in addition to using parental education at birth to proxy an individual's family resources, we alternatively use parental social class at birth and find similar patterns

(Appendix Figure A2). We note that the findings are in a similar direction, but the differences according to parental class are somewhat smaller than for parental education.

Discussion

This study contributed to the literature by examining heterogeneities in the association between complex family life trajectories, focusing on the partnership context of childbearing, and midlife mental health. Using rich prospective data and a life course framework we accounted for early-life course selection into diverse family trajectories and poor mental health in adulthood. The analyses provided new insight as to differential vulnerabilities to complex family life trajectories. Our findings suggested that the negative associations between complex family life trajectories and midlife mental health are more pronounced among individuals with lower resources, highlighting patterns of cumulative disadvantage in health across the life course.

The sequence and cluster analysis identified four family life trajectories with distinct characteristics. Around half of the sample followed a relatively traditional path of cohabitation before marriage, entry into long-term marriages, and childbearing within marriage. The remaining trajectories reflected varying forms of family complexity, including early and unpartnered childbearing combined with repeated partnership transitions and MPF, serial cohabitations with repeated partnership separations and re-partnering, and a largely traditional pathway, but with greater instability.

The availability of rich data for respondents from birth demonstrated how those with more disadvantaged backgrounds, i.e. according to SES, or health in childhood/adolescence are selected into more unstable family life trajectories. This was consistent with prior research. Individuals exposed to greater adversity in childhood might be more likely to encounter stressors in adulthood, and that the accumulation of stress over the life course may strain adult relationships, reducing the capacity to form and sustain close social ties (Miller et al. 2011; Shonkoff et al. 2009). Analyses of the implications of complex family trajectories

should therefore account for these early-life characteristics. When these characteristics were controlled, differences in mental health symptoms were attenuated, although meaningful associations between these trajectories and midlife mental health persisted. This indicated that while individuals may have been selected into complex family trajectories and poorer midlife mental health, the accumulation of stressors across these trajectories generated compounded risks and unequal exposure to mental health risks.

We found that cohort members with the most traditional trajectories were least likely to report poor mental health in midlife, while those in trajectories characterised by higher instability and multiple stressors displayed elevated risks. The risk of poor mental health was greater for those who experienced the *Early unpartnered childbearing with high MPF* trajectories. This is consistent with our expectations concerning the multiple and repeated stressors, both in terms of partnerships and childbearing in complex contexts of partnerships, such as early and unpartnered childbearing and long periods of lone parenthood (Arnolfo and Hiekel 2024; Stannard et al. 2024). These characteristics signalled that repeated exposure to stressors associated with this trajectory may have accumulated over time and undermined mental health in the long term (Andersson 2021; Grundy et al. 2020). At the meantime, trajectories involving MPF are highly complex and likely involve stressors that extend beyond what we have captured in the observed family life events, including derivative factors such as navigating relationships with former and current partners, sharing childcare responsibilities across households, moving houses, and complex dynamics involving stepchildren and stepsiblings. Further studies are therefore needed to disentangle these dynamics to better understand how family complexity is linked to mental health.

Individuals from the third trajectory, *Serial cohabitations with moderate MPF*, were also at heightened risk of mental health symptoms. This pattern was not necessarily inconsistent with prior findings that cohabitation could be similarly beneficial for individual wellbeing as

marriage. Cohabiting couples in long-term and committed unions may be similarly healthy as married couples, but individuals of this trajectory in our sample also experienced heightened instability through repeated partnership dissolutions. The cumulative stress associated with repeated partnership transitions was therefore likely to have been the primary mechanism underlying the added risks of poor mental health, consistent with previous research (Perelli-Harris et al. 2018).

Importantly, these risks were not homogenous across individuals with varying socioeconomic standings. Our interaction analysis demonstrated that family resources played a key role in shaping vulnerability to complex family life trajectories. Individuals with better-educated parents were more cushioned against the negative associations between complex trajectories and mental health, supporting the notion of socioeconomic buffering and aligning with prior research (Mäki et al. 2025; Mooyaart et al. 2022). These findings were consistent with our theoretical expectations that stressors arising from complex family life events may have proliferated by spreading from one domain of life to another, with their consequences depending on the coping resources and social support available (Pearlin 1989). Families with greater resources may have been more capable to buffer stress by utilising economic resources, access to childcare, stronger kin networks, housing stability, and greater flexibility in work arrangements. By contrast, individuals from disadvantaged backgrounds faced greater exposure to stress proliferation. Taken together, these findings suggested that inequalities in midlife health were reproduced through socioeconomic stratification in two ways: individuals from families of low socioeconomic standings were more likely to enter trajectories with more instability and churning and were prone to poorer mental health, and they were also more adversely affected by complex family life trajectories due to fewer resources to mitigate the emotional and financial strains they generated.

We did not find any differences in the relationships reported above by sex. This was surprising given that following a partnership dissolution, children in Britain tend to co-reside with their mother. Hence women would in theory be faced with greater day to day practical stressors in managing complex family dynamics. Perhaps for men, poor mental health also arises due to stressors involved in negotiating with former partners including in relation to access and care of joint children or meeting the financial obligations (Grundy et al. 2020; Turney and Carlson 2011).

The study was not without limitations. Similar to other longitudinal studies, the use of weights may not have fully accounted for attrition, therefore producing results on a sample in which socioeconomically disadvantaged individuals were disproportionately lost to follow-up. Second, our measures of fertility were restricted to biological children and did not capture stepchildren, or any other caregiving roles cohort members may have assumed. Third, information on relationship quality was unavailable, which may have biased the findings, as prior research showed that high-conflict marriages could be as detrimental as divorce (Roberson et al. 2018). Finally, due to research design, the study was unable to account for unmeasured confounding from adult life-course experiences between ages 16 and 46, such as employment or health-related events involving family members, which may have shaped both family trajectories and mental health outcomes. These limitations highlighted the need for future research to incorporate richer measures of family relationships and adult life-course dynamics.

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Appendices

Appendix 1: Descriptive statistics tabulating control variables against the mental health outcome, as well as family trajectories

Table A1 presents the distributions of parental and childhood characteristics according to whether cohort members report high vs. low on mental health symptoms.

Table A1 Covariate distribution (mean/percentage) against mental health levels with row-wise percentage

Variables And Values	Mental Health Symptoms		Unweighted N
	Low	High	
Sex (%)			
Female	68.6	31.4	2824
Male	77.5	22.5	2361
Mother's age at first birth (%)			
<=19	67.1	32.9	1193
20-24	74.1	25.9	2636
25+	77.1	22.9	1356
Maternal smoking behaviour (%)			
Nonsmokers	75.5	24.5	2938
Smokers	69.9	30.1	2247
Highest education qualification between parents at birth (%)			
Low	67.8	32.2	2509
Medium	78.1	21.9	1995
High	80.8	19.2	681
Birthweight (%)			
Normal	73	27	4922
Low (<2500 grams)	70.9	29.1	263
Mother's Malaise score at age 10 (%)			
Low	75.1	24.9	4265
High	63.6	36.4	920
Edinburgh reading score at age 10 (z-score; mean/sd)	-0.10 (0.97)	-0.33 (1.05)	5185
Maths score at age 10 (z-score; mean/sd)	0.01 (0.99)	-0.28 (1.08)	5185
GHQ-12 at age 16 (%)			
Low	76.1	23.9	3707
High	64.8	35.2	1478
Overnight hospital stays ages 10 to 16 (%)			
No overnight hospital stays since age 10	73.6	26.4	4020
Due to other reasons	74.4	25.6	853
Due to long-term illness since age 10	59.6	40.4	312
Locus of control at age 16 (mean/sd)	10.66 (2.75)	9.69 (2.95)	5185
Rutter Conduct Subscale at age 16 (%)			
Low	76	24	4212
High	62.4	37.6	973
Rutter Emotional Subscale at age 16 (%)			
Low	74.7	25.3	4645
High	58.5	41.5	540
Benefits at age 16 (%)			
Do not receive free school meals or state benefits	75.5	24.5	3835
Receive either free school meals or state	68.9	31.1	995

benefits			
Receive both free school meals and state benefits	61.9	38.1	355
Childhood family circumstances (%)			
Lived with two biological parents up to age 16	74.8	25.2	4034
Did not live with two biological parents and lived with one or more stepparents prior to age 16	66.4	33.6	709
Did not live with two biological parents and did not live with any stepparent prior to age 16	69	31	442

Notes: The digits shown are row-wise weighted percentage and unweighted frequency (N). For z-scores and numeric variables, means and standard deviations (in bracket) are shown.

Table A2 presents the distributions of parental and childhood characteristics according to the trajectory typology membership of the cohort members.

Table A2 Covariate distribution (mean/percentage) of family life trajectories according to parental and childhood characteristics

Variables And Values	1. Long-Term Two-Child Marriage	2. Early Unpartnered Childbearing With High MPF	3. Serial Cohabitations With Moderate MPF	4. Marriage With Higher Separation Rates	Unweighted N
Sex (%)					
Female	44.1	22.3	18.4	15.2	2824
Male	43.2	17.4	22.3	17.1	2361
Mother's age at first birth (%)					
<=19	35.4	31.3	20.7	12.6	1193
20-24	45	18.2	20	16.7	2636
25+	51	9.8	20.2	19	1356
Maternal smoking behaviour (%)					
Nonsmokers	48	14.9	19.6	17.5	2938
Smokers	38.8	25.6	21	14.6	2247
Highest education qualification between parents at birth (%)					
Low	39	25.2	20.7	15.1	2509
Medium	47.1	15.3	20.2	17.4	1995
High	55.8	9.2	18.3	16.7	681
Birthweight (%)					
Normal	44.2	19.1	20.5	16.1	4922
Low (<2500 grams)	34.4	34	15.9	15.7	263
Mother's Malaise score at age 10 (%)					
Low	45.2	18.3	20.3	16.2	4265
High	37.5	26.9	20.1	15.5	920
Edinburgh reading score at age 10 (z-score; mean/sd)	-0.01 (0.96)	-0.54 (1.03)	-0.18 (0.98)	-0.08 (0.95)	5185

Maths score at age 10 (z-score; mean/sd)	0.10 (0.99)	-0.48 (1.07)	-0.08 (0.98)	0.02 (0.97)	5185
GHQ-12 at age 16 (%)					
Low	44.2	19.6	20.2	16	3707
High	42.4	20.9	20.3	16.4	1478
Overnight hospital stays ages 10 to 16 (%)					
No overnight hospital stays since age 10	45	19.8	18.9	16.3	4020
Due to other reasons	42.4	18.3	24	15.3	853
Due to long-term illness since age 10	31	27.1	26.4	15.5	312
Locus of control at age 16 (mean/sd)	10.57 (2.82)	9.63 (2.88)	10.54 (2.84)	10.70 (2.71)	5185
Rutter Conduct Subscale at age 16 (%)					
Low	46.6	17.2	19.8	16.3	4212
High	33.9	29.3	21.6	15.3	973
Rutter Emotional Subscale at age 16 (%)					
Low	44.1	19.6	20	16.3	4645
High	40.6	22.9	22.3	14.1	540
Benefits at age 16 (%)					
Do not receive free school meals or state benefits	47	16.8	19.7	16.5	3835
Receive either free school meals or state benefits	38.4	24.2	20.2	17.1	995
Receive both free school meals and state benefits	30.5	34.7	24.7	10.1	355
Childhood family circumstances (%)					
Lived with two biological parents up to age 16	47.9	16.7	18.9	16.4	4034
Did not live with two biological parents and lived with one or more stepparents prior to age 16	33.5	28.9	20.7	16.8	709
Did not live with two biological parents and did not live with any stepparent prior to age 16	29.6	29.3	28.6	12.5	442

Notes: The digits shown are row-wise weighted percentage and unweighted frequency (N). For z-scores and numeric variables, means and standard deviations (in bracket) are shown.

Appendix 2: Cluster quality indices

Table A3 displays the cluster quality indicators derived from which we are able to select the optimal cluster solutions.

Table A3 Cluster quality indices for Ward's linkage clustering and partitioning around medoids (PAM) with initiation for partition based on Ward's linkage clustering

	a) CQIs for Ward's linkage clustering						b) CQIs for PAM with initiation for partition based on Ward's linkage clustering					
	PBC	HG	HGSD	ASW	CH	R2	PBC	HG	HGSD	ASW	CH	R2
Two clusters	0.37	0.39	0.39	0.24	0.24	863.72	0.43	0.46	0.46	0.24	0.24	721.19
Three clusters	0.49	0.53	0.53	0.23	0.23	611.88	0.52	0.57	0.56	0.25	0.25	558.25
Four clusters	0.61	0.70	0.70	0.25	0.25	497.02	0.66	0.77	0.77	0.28	0.28	524.26
Five clusters	0.42	0.53	0.53	0.11	0.11	443.55	0.47	0.61	0.60	0.17	0.17	466.32
Six clusters	0.39	0.51	0.51	0.12	0.12	398.14	0.50	0.67	0.66	0.18	0.18	422.17
Seven clusters	0.41	0.56	0.56	0.13	0.13	366.67	0.53	0.72	0.72	0.20	0.20	392.73
Eight clusters	0.44	0.63	0.63	0.14	0.14	341.98	0.51	0.72	0.72	0.19	0.19	369.89
Nine clusters	0.45	0.64	0.64	0.14	0.14	322.05	0.51	0.74	0.74	0.18	0.19	351.80
Ten clusters	0.47	0.69	0.69	0.15	0.15	303.21	0.53	0.76	0.76	0.21	0.21	326.35

Notes: This table presents CQIs for both the Ward's linkage solution and the PAM solution, which is based on the solution from Ward's linkage. The average silhouette width (ASW) assesses the coherence of case assignments to each cluster based on the dissimilarity of each sequence to the centre of the cluster it is assigned to (accounting for homogeneity) and the dissimilarity to the centre of the closest other cluster (accounting for separation) (Kaufman and Rousseeuw 1990). ASW ranges from -1 to 1. Values close to 1 indicate that the case is more consistent with its own cluster than with any alternative cluster of the selected partition. The point biserial correlation (PBC) (Hennig and Liao 2013) and Hubert's gamma (HG) (Hubert and Arabie 1985) are correlation-based measures. They refer to the ability of the partition to reproduce the original dissimilarity matrix. PBC calculates the Pearson correlation to compare the dissimilarity matrices, and HG uses parametric correlations based on order of magnitude. The Calinski-Harabasz (CH) (Calinski and Harabasz 1974) index uses on a pseudo-F statistic of the analysis of variance based on the dissimilarities. Pseudo R2 indicates the hare of discrepancy explained by a give partition (Studer et al. 2011). As presented in the table, ASW, PBC, as well as HG are highest for four-cluster solutions, pointing 4-cluster solution as the best solution (Studer 2013).

Appendix 3: Full model results

Table A4 displays the logistic regression results for trajectory typology and midlife mental health, reported as average marginal effects (AMEs) on predicted probabilities. The first trajectory type *Long-term two-child marriage* is the reference group.

Table A4 Logistic regression results for trajectory typology and midlife mental health

Indicators	Model 1	Model 2
Trajectory Typology		
Long-term two-child marriage (reference)		
Early unpartnered childbearing with high MPF	0.205*** (0.033)	0.131*** (0.031)
Serial Cohabitations with moderate MPF	0.088*** (0.024)	0.067** (0.023)
Marriage with higher separation rate	0.020 (0.024)	0.016 (0.023)
Sex		
Female (reference)		
Male		-0.067*** (0.019)
Mother's age at first birth		
<=19 (reference)		
20-24		-0.017 (0.023)
25+		-0.006 (0.027)

Birthweight		
Normal (reference)		
Low		-0.027 (0.038)
Maternal smoking behaviour		
Nonsmokers		-0.009 (0.018)
Continued smoking (reference)		
Highest education qualification between parents at birth		
Low		0.065* (0.030)
Medium		0.01 (0.029)
High		
Mother's Malaise score at age 10		
Low (reference)		
High		0.031 (0.027)
Edinburgh reading score at age 10		-0.005 (0.014)
Maths score at age 10		-0.010 (0.014)
Overnight hospital stays ages 10 to 16		
No overnight hospital stays (reference)		
Due to other reasons		0.019 (0.030)
Due to long-term illness since age 10		0.098† (0.052)
GHQ-12 at age 16		
Low (reference)		
High		0.076* (0.030)
Locus of control at age 16		-0.007 (0.006)
Rutter Conduct Subscale at age 16		
Low (reference)		
High		0.048 (0.034)
Rutter Emotional Subscale at age 16 (%)		
Low (reference)		
High		0.090* (0.039)
Benefits at age 16 (%)		
Do not receive free school meals or state benefits		-0.014 (0.049)
Receive either		-0.008 (0.051)
Receive both (reference)		
Childhood family circumstances (%)		
Lived with two biological parents (reference)		
Did not live with two biological parents and lived with one or more stepparents		0.003 (0.033)
Did not live with two biological parents and did not live with any stepparent		0.021 (0.040)
Number of observations	5185	5185

Notes: Average marginal effects of changes in predicted probability of reporting high (vs. low) on mental health symptoms are shown presented with the standard errors shown in parentheses.
*p<.05; **p<.01; ***p<.001.

Appendix 4: Interaction results of parental education using first and second differences.

Table A5 present the interaction effects between family life trajectories and parental education. The results are displayed using first and second differences.

Table A5 Probability of scoring high (vs. low) on mental health symptoms – results from testing the interaction effect between family trajectory typology and parental education levels.

Interaction Terms	Pr (High)	First Differences	Second Differences
Cluster 1 x low	0.244*** (0.018)	0.034 (0.036)	-0.243* (0.119)
Cluster 1 x high	0.210*** (0.032)		
Cluster 2 x low	0.463*** (0.036)	0.277* (0.113)	
Cluster 2 x high	0.186 (0.107)		
Cluster 1 x medium	0.166*** (0.016)	-0.044 (0.035)	-0.193 (0.124)
Cluster 1 x high	0.210*** (0.032)		
Cluster 2 x medium	0.335*** (0.051)	0.149 (0.119)	
Cluster 2 x high	0.186 (0.107)		
Cluster 1 x low	0.244*** (0.018)	0.034 (0.036)	-0.208*** (0.057)
Cluster 1 x high	0.210*** (0.032)		
Cluster 3 x low	0.352*** (0.031)	0.242*** (0.043)	
Cluster 3 x high	0.109*** (0.031)		
Cluster 1 x medium	0.166*** (0.016)	-0.044 (0.035)	-0.201*** (0.054)
Cluster 1 x high	0.210*** (0.032)		
Cluster 3 x medium	0.267*** (0.028)	0.157*** (0.041)	
Cluster 3 x high	0.109*** (0.031)		
Cluster 1 x low	0.244*** (0.018)	0.034 (0.036)	0.016 (0.066)
Cluster 1 x high	0.210*** (0.032)		
Cluster 4 x low	0.248*** (0.034)	0.018 (0.055)	
Cluster 4 x high	0.230*** (0.044)		
Cluster 1 x medium	0.166*** (0.016)	-0.044 (0.035)	-0.019 (0.062)
Cluster 1 x high	0.210*** (0.032)		
Cluster 4 x medium	0.206*** (0.025)	-0.024 (0.051)	
Cluster 4 x high	0.230*** (0.044)		

Notes: Cluster 1 represents the *Long-term two-child marriage* trajectory, Cluster 2 represents the E*arly lone parent with high MPF* trajectory, Cluster 3 represents the *Serial cohabitations with moderate MPF* trajectory and Cluster 4 represents the *Marriage with high separation rates* trajectory. Predicted probabilities are averaged predicted probabilities based on the MI-pooled logistic regression model and weighted data. Standard errors in parentheses. *p<.05; **p<.01; ***p<.001.

Appendix 5: Interaction results of sex

Figure A1 presents the interaction effects between family life trajectories and reported sex of cohort members.

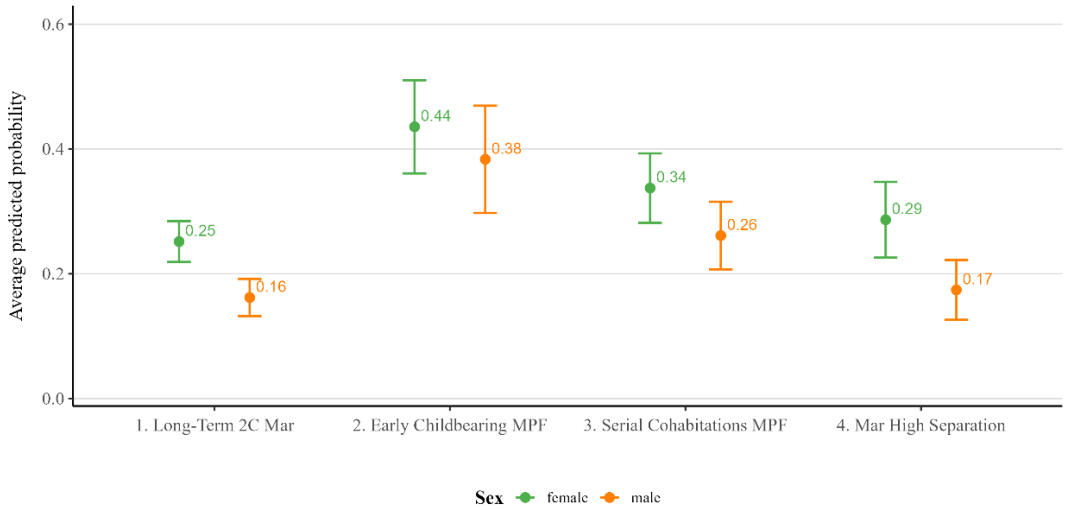

Fig. A1 Average predicted probabilities of scoring high on mental health symptoms at age 51 by family life trajectory typology and sex. Estimates and 95% confidence intervals are pooled across multiple imputations and are based on weighted analyses.

Table A6 present the interaction effects between family life trajectories and reported sex of cohort members. The results are displayed using first and second differences.

Table A6 Probability of scoring high (vs. low) on mental health symptoms – results from testing the interaction effect between family trajectory typology and reported sex of cohort members.

Interaction Terms	Pr (High)	First Differences	Second Differences
Cluster 1 x female	0.221*** (0.011)	0.090*** (0.023)	-0.037 (0.062)
Cluster 1 x male	0.145*** (0.010)		
Cluster 2 x female	0.348*** (0.023)	0.052 (0.058)	
Cluster 2 x male	0.274*** (0.028)		
Cluster 1 x female	0.252*** (0.017)	0.090*** (0.023)	-0.013 (0.046)
Cluster 1 x male	0.162*** (0.015)		
Cluster 3 x female	0.337*** (0.028)	0.076 (0.040)	
Cluster 3 x male	0.261*** (0.028)		
Cluster 1 x female	0.252*** (0.017)	0.090*** (0.023)	0.023 (0.045)
Cluster 1 x male	0.162*** (0.015)		
Cluster 4 x female	0.287*** (0.031)	0.112** (0.039)	
Cluster 4 x male	0.174*** (0.024)		

Notes: Cluster 1 represents the *Long-term two-child marriage* trajectory, Cluster 2 represents the E*arly lone parent with high MPF* trajectory, Cluster 3 represents the *Serial cohabitations with moderate MPF* trajectory and Cluster 4 represents the *Marriage with high separation rates* trajectory. Predicted probabilities are averaged predicted probabilities based on the MI-pooled logistic regression model and weighted data. Standard errors in parentheses. *p<.05; **p<.01; ***p<.001.

Appendix 6: Interaction with parental class as part of the sensitivity analysis

Figure A2 presents the interaction effects between family life trajectories and parental social class.

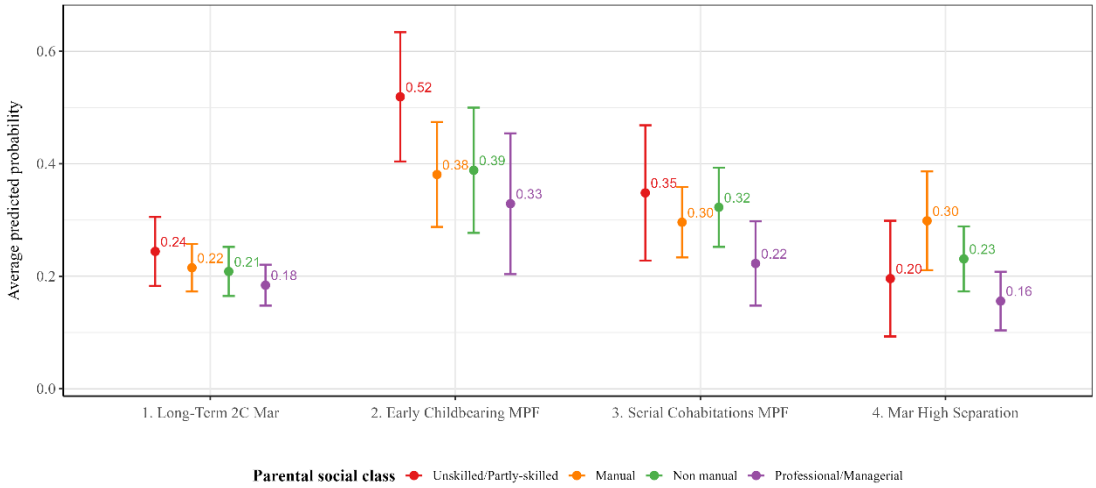

Fig. A2 Average predicted probabilities of scoring high on mental health symptoms at age 51 by family life trajectory typology and parental social class. Estimates and 95% confidence intervals are pooled across multiple imputations and are based on weighted analyses.