After the Divorce: Academic Achievement, Mental Health, and Health Complaints in Adolescence

Heterogeneous associations by parental education, family structure, and siblings.

Sondre Aasen Nilsen

Thesis for the degree of Philosophiae Doctor (PhD)
University of Bergen, Norway
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Abstract

Experiencing parental divorce or separation in childhood is associated with poorer academic achievement, and impairments in physical and mental health. Numerous studies suggest that children and youth who grow up with divorced parents get lower grades and test scores in school and have more symptoms of externalizing and internalizing problems compared to those raised in two-parent nondivorced families. Moreover, these problems are not confined to childhood but tend to persist into adulthood as well.

The overall aim of the current thesis was to expand the knowledge of how parental divorce relates to adolescents' academic achievement, mental health and health complaints, by examining heterogeneity in the outcomes of divorce by parental educational qualifications, family structure, and sibship-type (i.e., biological, half – and stepsiblings). To reach these aims, we utilized data from the large population-based youth@hordaland study of adolescents aged 16–19, that was merged with data from national registries.

In Paper I, the aim was to investigate whether the association between parental divorce and adolescents' grade point average (GPA) was related to parental educational qualifications. Overall, it was found that adolescents with divorced parents had a GPA that was 0.3 standard deviation units lower than adolescents with nondivorced parents. However, while a divorce was hardly related to GPA among adolescents with uneducated parents, divorce was linked to a lower GPA among adolescents with educated mothers, independent of paternal educational qualifications and household income measures.

In Paper II, the aim was to investigate the distribution of mental health problems across six different family structures following the steep increase in parents choosing joint physical custody in Norway. It was found that adolescents living in joint physical custody (JPC) displayed significantly lower levels of both externalizing and internalizing problems than their peers living in single parent and stepparent families. Moreover, levels of mental health problems among adolescents in JPC were quite

similar to and not statistically significantly different from those living in a two-parent nuclear family.

In Paper III, the aims were to investigate how family structures were related to health complaints among adolescents, while capturing the complexity of the modern family by including information about sibship-type (i.e., biological, half- and stepsiblings) in the household. Corroborating the findings from Paper II, it was found that adolescents in JPC reported lower levels of health complaints than their peers in other post-divorce family structures. Moreover, independent of family structure, sharing a household with biological siblings was associated with lower levels of health complaints, while living with stepsiblings was associated with higher levels, but only among girls.

Overall, the findings from this thesis suggest that adolescents with divorced parents get lower grades and report higher levels of mental health problems and health complaints than their peers in nuclear two-parent families. Furthermore, parental educational qualifications, adolescents' post-divorce family structure, and the presence of biological and stepsiblings in the household, may influence the associations between parental divorce and adolescents' post-divorce adjustment.

List of Publications

Paper I Nilsen, S.A, Breivik, K., Wold, B., Askeland, K.G., Sivertsen, B., Hysing, M., & Bøe, T. (2020). Divorce and adolescent academic achievement: Heterogeneity in the associations by parental education. PloS ONE, 15(3), e0229183. doi: 10.1371/journal.pone.0229183

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Contents

1. Introduction

1.1 Background for the thesis

One of the great changes to family life during the second half of the 20th century was the steep rise in divorce rates in industrialized western societies.[1] The crude divorce rate[a] more than doubled from 0.8 in 1965 to 1.9 in 2015 within the EU-28 countries.[2] In the U.S., the rates soared from 2.2 in 1960 to 5.2 in 1980 [3] before gradually declining to 3.2 in 2016.[b] A similar trend was observed in Norway, where the crude divorce rate rose from 0.7 in 1960 to 1.9 in 2016.[2] According to recent official statistics, approximately 20,000 Norwegian children below the age of 18 experienced that their parents either divorced or separated in 2018.[4] No official statistics exist with regards to children experiencing parental break-up from cohabitation. As more than 40 % of children in Norway are born to cohabiting parents,[5] the rate of children experiencing family dissolution during childhood is likely much higher.

Rising divorce rates and their impact on the lives of adults and children sparked a formidable interest among scientists from a range of different fields spanning from developmental and clinical psychology to sociology, demography, history, and economics, to name a few. As noted by Amato,[1] this poses a sobering challenge to any reviewer attempting to synthesize the knowledge on this topic.

At times, a divorce[c] may be in the best interest of parents and their children. Nevertheless, most academic attention has been devoted to the negative consequences a divorce might entail for children's well-being and later life chances. Most notably, a large body of scientific literature has documented that children and adolescents with

[a] The *crude divorce rate* is a measure of number of divorces per 1,000 persons.

[b] Figures for the U.S. 2016 retrieved from OECD Family Database; https://bit.ly/2l0WTtw

[c] Throughout this thesis, the term 'divorce' is generally used in a broad sense to refer to both relationships that were legal marriages (de jure marriage) as well as de facto marriages (cohabiting relationships). Legal marriages and cohabiting relationships are in most respects treated equivalently under Norwegian law.

divorced parents, on *average*, display higher levels of physical and mental health problems, and do less well in school compared to their peers living with nondivorced parents.[3,6–11] These adversities are not limited to childhood. Adults whose parents divorced during their childhood tend to have lower levels of psychological well-being, lower educational attainment, experience more relationship instability, and are more likely to themselves divorce, compared to those whose parents remained married.[12–16]

A couple of decades ago, some believed that the impact of divorce on children's adjustment would be less pronounced in the Scandinavian countries.[17] The generous welfare state and liberal attitudes towards divorce in these countries were assumed to act as a buffer against adversities of divorce on children's adjustment.[17] This assumption has not withstood the test of time; it is now well documented that divorce is associated with adverse outcomes among children also in the Scandinavian countries,[17–24] with effect sizes quite similar to those obtained in the U.S.[25,26]

A divorce does not affect families equally. While some families may welcome the cessation of a troubled marriage, a divorce might put other families in a situation of temporal or chronic disadvantage. Research on divorce and outcomes among children and youth have gradually tried to identify risk and resilience factors that may determine under which circumstances a divorce might lead to adverse outcomes.[3,27]

Research has shown a growing interest with regards to whether the link between divorce and academic outcomes among youth differ across socioeconomic strata. Despite some mixed findings, recent studies tend to support the *floor effects hypothesis*, whereby the educational consequences of divorce are relatively larger among youth with highly educated compared to lowly educated parents.[28–32] Previous studies have primarily been conducted on British, US, and German samples, often on cohorts from the 1970–1980s. It is unclear whether the previous somewhat mixed results stem from cross-national differences in demographics, political, or educational systems. There is a stated need for studies on more recent cohorts in other cultural contexts.[28,29]

High divorce rates, coupled with re-partnering and remarriages, have increased the complexity of modern families.[33] An important part of the restructuring of post-divorce family life involves the division of the time each parent spends with the child.[34] Whereas maternal custody used to be the norm, the last decades have put a greater emphasis on children spending equal time with both parents after a divorce.[35,36] As a result, the number of families choosing joint physical custody[d] have sharply risen in several western countries.[37] This custody arrangement has its opponents, and it has been frequently stated that the stresses of living in two homes may be a burden and hamper children's post-divorce adjustment.[38–40] Proponents of joint physical custody, on the other hand, tend to focus on the beneficial effects of increased access to both parents' resources.[41] A growing body of research supports this latter view, whereby children and adolescents in joint physical custody tend to be better adjusted than their peers living in single parent or stepparent families.[37,42–47]

Family structure has traditionally been defined according to the parental adult(s) present in the household while ignoring siblings.[48] As families have become more diverse, children are also more likely to grow up with half- and stepsiblings. Accounting for *sibship*-type (i.e., whether the household consists of biological, half- or stepsiblings) may be necessary, as youth's adjustment appear to not only be related to the adult(s) whom they share a home with, but also the presence of siblings.[49] Few studies have, however, considered both family structure and sibship-type when examining youth's post-divorce adjustment.

Perspectives launched to explain why divorce is associated with adjustment problems in children and adolescents have focused on the loss of a parent, parental adjustment, conflict between parents, life stress, economic hardship, and selection effects.[50] In trying to unify these perspectives, Amato [1] has proposed the divorce-stress-adjustment perspective. This perspective highlights that a divorce is not a single

[d] Also called shared (physical) custody. This is different from "joint legal custody", which implies that both parents have equal right to make legal decisions on matters impacting the child. Although many parents with joint legal custody also choose joint physical custody, parents with joint legal custody might also choose other custody arrangements (e.g., that the child lives primarily with the mother).

event, but a process that may begin long before and may end long after the legal divorce is finalized. How children adjust to this process, depends, according to this perspective, on explanatory/mediating mechanisms (e.g., parental conflict and parenting quality, changes in household income), and fixed/moderating factors that create variability in how these mechanisms are linked to child outcomes (e.g., parental education, family structure, personality factors, and resilience).

The present thesis is divided into four main parts. The first part will provide a brief overview of theoretical perspectives underpinning most contemporary divorce research. In the second part, the heterogeneity in the link between parental divorce and youths' educational outcomes will be explored. Recent studies suggest that parental education may be an important moderator of the association between parental divorce and youth's academic achievement, and most attention will be paid to this finding. The third part examines how growing up in different post-divorce family structures is related to youths' post-divorce adjustment. A particular focus will be devoted to joint physical custody, as this living arrangement has received a great deal of attention among both scientists, policymakers, and the general population in recent years. Finally, the fourth part builds on this research by reviewing an emerging field of studies focusing on how sibship-type (i.e., biological, half- and stepsiblings) relate to adolescents' post-divorce adjustment, and by examining how health complaints among adolescents might be a function of both family structure and sibship-types.

1.2 Theoretical perspectives

The theories aiming to explain the impact of divorce on adults and children span from attachment theory [51] and feminist theory,[52] to more contemporary perspectives that focus on the loss of a parent, adjustment of the custodial parent, stress, interparental conflict, economic deprivation, and selection.[6,50,53] These contemporary perspectives are considered complementary, rather than mutually exclusive.[50] This thesis leans mostly on the parental loss and parental adjustment perspectives, the economic deprivation perspective, and the divorce-stress-adjustment perspective. These perspectives will be given the most attention in the following. The degree to which divorce is causally related to child outcomes is further an ongoing debate within this research field. This will be covered in the final part about selection and methodological considerations.

The thesis is also rooted within a different branch of sociology investigating how adverse life events may disrupt the transmission of social capital between parents and their offspring. The theoretical foundation of this branch will be presented in more detail in section 1.3. The classical perspectives presented in the following might nevertheless be relevant as a background also for this part.

1.2.1 The parental loss perspective

This perspective builds on the notion that both parents are important resources for their children through providing emotional and practical support, guidance, and supervision, and by serving as role models whereby children learn cooperation and compromise.[50,53] Decreased quantity and quality of contact with the noncustodial parent are thus within this perspective seen as a key mechanism in explaining the risk of adjustment problems among children. The quality of parenting provided by the custodial parent may also decline following a divorce, due to time and energy constraints by the combination of labor force participation and sole parenting. Two key hypotheses drawn from this perspective are of special interest to the present thesis:[50,53] (1) The frequency of contact with the noncustodial parent or having joint custody is *positively* associated with children's post-divorce adjustment. (2) The

introduction of a stepparent may *improve* children's adjustment as the new parent may cover for the loss of parental resources when one of the parents moves out following a divorce.

1.2.2 The economic deprivation perspective

Economic hardship may be a consequence of divorce and single parenthood and has a well-documented association to adjustment problems among children and youth.[9,54,55] The economic deprivation perspective has thus become one of the main perspectives in understanding the potential negative consequences of divorce. This perspective leans on family investment and family stress models.[56–58] It posits that divorce-driven economic decline may affect children through less parental investment (e.g., investment in their education, leisure activities, and housing), and through increased parental stress which may affect children through less optimal parenting practices.[50,59]

Several studies have found that accounting for various measures of household income reduces differences in negative outcomes between children with and without divorced parents.[9,59,60] The relevance of this perspective, however, has been questioned in understanding the higher levels of adjustment problems among children with divorced parents in the Nordic countries, due to the elaborate welfare systems which reduce absolute levels of poverty among single mothers.[17] Supporting this notion, two studies from Sweden found that accounting for measures of disposable household income hardly changed the difference in adjustment between children in nuclear families versus children in single parent households.[61,62] Similarly, two Norwegian studies found weak attenuating effects of register-based household income or a composite measure of SES including register-based income, on the links between divorce and measures of anxiety and depression among adolescents.[18,19]

Nordic studies utilizing subjective measures of economic well-being [e] tend to find that such measures explain part of the differences between children from nondivorced

[e] Whereby respondents typically are asked to rate how they perceive their economic well-being compared to others, or asked to indicate their perceived subjective SES on a pictorial representation of a ladder where the top represents those who are best off (i.e., have most money, education, and the best jobs; see e.g., [63,64]).

versus single or stepparent households. While not measuring absolute levels of poverty, subjective measures are proposed to measure the cognitive average of several socioeconomic indicators.[64] They may perhaps capture the feeling of being relatively deprived in the sense of failing to meet some form of desirable standard of living.[65] The relative deprivation hypothesis proposes that inequality is experienced through several forms of social comparisons, whereby income is an especially salient feature.[66] Experiencing relative deprivation has been linked to mental health outcomes among children and youth.[67,68] Hence, it is viable that the notion of relative deprivation is more applicable than absolute deprivation in understanding how economic consequences of divorce influence the post-divorce adjustment among youth in Norway. In the present thesis, objective and subjective measures of familial socioeconomic status are part of the investigations of the links between divorce, family structure, and outcomes among adolescents.

1.2.3 Parental adjustment

The parental adjustment perspective highlights that divorce is a stressful experience, to which most adults will have some difficulties adjusting.[50] Stress may further impair parents' psychological well-being, resulting in less optimal parenting practices and less positive parent-child relationships. These processes are within this perspective believed to account for the negative consequences of divorce on children's adjustment. Moreover, this perspective lends more weight to the custodial parent's adjustment, as most childrearing responsibilities fall on this individual. Two key hypotheses have been derived from this perspective: (1) The well-being of children of divorce is positively related to the custodial parent's post-divorce adjustment. (2) The custodial parent's parenting skills and the quality of the child-parent relationship are predictive of children's post-divorce adjustment. Measures of parental adjustment and the quality of child-parent relationships have not been available in the present thesis. Keeping in mind that a divorce is a challenging process for most parents and that their adjustment may have implications for their children's well-being, is still valuable when interpreting the results of this thesis.

1.2.4 The interparental conflict perspective

This perspective holds that conflict between parents before, during, or after the divorce is a primary mechanism in explaining unfavorable outcomes of divorce. In general support of this perspective, several studies find that parental conflict is a robust predictor of children and youth socio-emotional functioning.[69–75] Parental conflict is believed to have direct negative effects on children through mechanisms such as children's modeling of negative parental behavior, and indirect effects through affecting the parent-child relationship.[76] According to Amato,[77] several models might explain how divorce and parental conflict relate to children's adjustment, as parental conflict and divorce might both have independent [f] and interactive effects on children's outcomes. Of note, a few studies suggest that children and youth may be better off when a divorce removes them from a conflict-ridden home.[77,78]

1.2.5 The divorce-stress-adjustment perspective

Most perspectives start with the notion that divorce is a stressful life change that both parents and their children are impacted by. Based on this observation, Amato has formulated the *divorce-stress-adjustment perspective* [1] as a unifying framework integrating elements from previous perspectives (see Figure 1). This model emphasizes that divorce is a process rather than a discrete point in time. An essential insight gained by this view is that the "divorce" can start long before the couple splits apart. As most people enter marriage hoping it will last, the realization that the marriage is not sustainable is likely painful. This can set into motion several processes (e.g., denial, grief, negotiations, conflicts) that can lead to observable negative consequences among adults and their children, even years prior to the formalization of the divorce.[1] For some, the formalization of the divorce may bring an end to such adversities. For others, new events and processes emerge that can make post-divorce life equally or more troubling.

[f] See also Amato[50] for an elaboration of this take on the *interparental conflict perspective.*

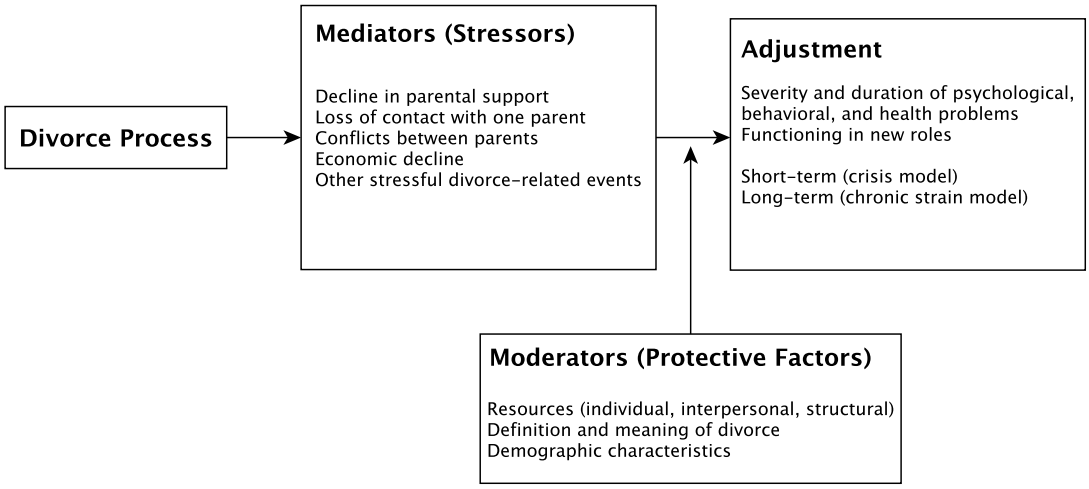

Figure 1. The divorce-stress-adjustment perspective. Adopted from Amato.[1]

Experiencing less effective parenting, decreased involvement of a parent, exposure to parental conflict, and stressors tied to decline in economic resources, moving of households, and introduction of a stepparent, are all potential risk factors that may impact children's adjustment. Some of these factors may be preceded by, be a consequence of, or be reciprocally influenced by each other. The previous perspectives mentioned above are thus generally viewed as complementary.

This perspective permits considerable heterogeneity in the outcomes of divorce as individual (e.g., resilience, temperament, genetics), social (e.g., social support), and structural roles and settings (e.g., education, employment, stigmatization) may act as moderators creating variability in how risk factors affect the individual. As a consequence, two apparent contrary models, the *crisis model* and the *chronic strain model,* are embedded within this perspective.[1] While the crisis perspective suggests that children's adjustment will be increasingly better with time as the child adjusts to the divorce, the chronic strain perspective suggests that children's adjustment will be more stable or gradually worsen.[50] Most studies tend to find that children's adjustment following divorce is rather stable but somewhat worse than that of their

peers with nondivorced parents,[9,79–81] or that children of divorce gradually display more psychological problems as time passes.[82,83] Nevertheless, this perspective is not incompatible with the notion that for some children, a divorce may improve their adjustment (e.g., by removing them from conflicts), or that their adjustment gradually improves as time passes after the divorce.[78,84–86]

1.2.6 Selection and methodological considerations

The selection perspective holds that observable differences between children with and without divorced parents are not due to marital disruption or mechanisms set into motion by the divorce process, but other confounding factors that co-vary with both parents' inclination to divorce and children's well-being. Such factors include personality dispositions, parental conflict, mental health issues, and genetic influences, that may both increase the chance of divorce and of negative child outcomes.[1,3]

Considerable attention has been devoted to the question of causation versus selection.[3,10–12,87] Overall, studies tend to find that accounting for selection factors reduces and sometimes removes differences between children of divorced versus nondivorced families.[3,11] A conventional technique has been to statistically control for some observed pre-divorce characteristics on a static outcome measure (e.g., child's post-divorce mental health), by using standard regression analytical approaches. However, as it is impossible to statistically control for all factors that may influence the relationship between divorce and children's outcomes, and static outcome measures fail to account for children's adjustment over time, such methods impede strict causal interpretations.

Longitudinal data with repeated measures of predictors and outcomes have been increasingly applied to the field of divorce and child outcomes.[3,10,11] Such data permit investigations of child outcomes in the years before, during, and after the formal divorce, and may come closer to an estimate of how children adapt during the divorce process. Moreover, longitudinal data may be used to account for mechanisms that select into divorce and negative child outcomes that are hard to measure, by utilizing

methods that permit control of unobserved selection mechanisms. Individual fixed effects (IFE) models, for example, is one method used to analyze longitudinal data where each individual serves as their own control to adjust for time-constant (i.e., fixed) unobserved factors.[11] In brief, findings from such studies tend to support the notion that divorce might partly be causally related to children's adjustment.[10,11]

Viewing divorce as a process that often initiates years before the legal divorce, means that even longitudinal studies finding child problems prior to parental divorce does not necessarily unequivocally support selection. Pre-divorce child problems may instead be an expression of the ongoing *process of separation*.[3] Härkönen et al. [11] therefore suggest that it is quite possible to decide which aspects of the divorce process that is of interest (e.g., the *whole* separation process or the *event* of the separation), and choose appropriate designs thereafter – bearing in mind the underlying theoretical model that the study draws upon.

As stated by Amato,[3] it is self-evident that divorce changes children's lives in many ways. Rather than asking *whether* divorce affects children, it is perhaps more important to investigate *how* and under *what* circumstances a divorce affects children, either positively or negatively. The present thesis has a particular focus on heterogeneity in the associated outcomes of divorce. Through the thesis, the potential moderating role of parental educational qualifications and family structure on the associations between divorce and adolescents' post-divorce adjustment will be explored.

1.3 Divorce, parental education and academic achievement among adolescents

1.3.1 Compensatory class or floor effect?

In recent years, there has been a growing interest in whether the link between divorce and youth academic achievement depends on parental educational levels. Two contrasting theoretical positions, the *compensatory class hypothesis* [88] and the *floor effects hypothesis*,[31,89] have been put forth, and both perspectives have received empirical support.

The compensatory class hypothesis [88] posits that divorce is less harmful to children from higher social classes[g] due to their greater access to financial and social resources that can buffer against adverse outcomes of divorce. This hypothesis is derived from similar concepts of *cumulative* [90] and *compensatory advantage*,[91] which have been applied to the study of social inequality to explain how life course trajectories of individuals from different socioeconomic backgrounds are differently affected by prior negative life events.[h] The underlying idea in these concepts is that current levels of a given resource (e.g., cognitive abilities, education, income, or health) directly affects its future state. However, an early disadvantage is more likely to be stable or grow larger over time in disadvantaged families, while similar disadvantages attenuate more over time among people from more advantaged families.[91]

According to the compensatory class hypothesis,[88] more highly educated parents can, for instance, pay for private lessons if their children's grades become worse after the divorce. Greater social support may further mean they have more access to extended family and friends that can compensate for the parent that moves out of the household. Moreover, more highly educated parents might be more able than less educated parents to plan to counteract adverse effects of divorce on their children's

[g] The terms *social class, social status,* and *socioeconomic background* are used, often interchangeably, in the literature. Most often these are measured by either maternal, paternal or both *parents' education*.

[h] Compensatory effects of having highly educated parents have been documented in other areas such as late birth month on school performance,[91] grade retention,[92] sibling differences,[93] prenatal exposure to radiation [94] and low birth weight.[95]

adjustment, which could lead to a more stable post-divorce environment for their children.[88]

A few studies have found that children with highly educated parents are less affected by divorce than children with less educated parents, in support of the compensatory class hypothesis.[88,96–99] For instance, Augustine [96] found that being unmarried or divorced was linked to lower-quality parenting among *less* educated mothers, which in turn was linked to negative consequences of the school achievement trajectories of their children. Among educated mothers, however, there were no such links to either parenting or school achievement.

The floor effects hypothesis, on the other hand, states that children from higher class families are relatively more affected by divorce than their peers from less educated families.[31,89] According to this perspective, children of highly educated parents may lose more of parental and economic resources invested in them following a divorce than children with less educated parents. For instance, as educated parents tend to provide parenting practices that facilitate academic achievement among their offspring to a relatively larger degree than less educated parents,[100–103] a divorce might reduce the amount of time educated parents have to engage in such activities. Meanwhile, less educated parents may have spent less time engaging in such activities before the divorce, thus rendering the effects of divorce on academic mentoring limited.[104] Moreover, although educated parents tend to have higher economic resources after a divorce, it is possible that the absolute losses in economic resources from pre- to post-divorce life are more significant for them than among less educated parents who have less economic resources to lose.[28,29] It has also been found that re-partnering and post-separation conflicts are more common among highly educated parents.[105,106] This might, in turn, affect the well-being of children with highly educated parents.

Several recent studies lend support to the floor effects hypothesis.[28,29,31,32,107] Martin[32] found a consistent pattern where divorce was more negatively associated with test scores, GPA, and later educational transitions among children of educated parents

than children of less educated parents. Another recent paper found that parental divorce was more detrimental among children whose parents had a low likelihood of divorce, compared to those with parents with a high likelihood of divorce.[i30] A low likelihood of divorce was, in turn, more common among highly educated parents. As noted by the authors, a divorce might come as more of a shock among relatively advantaged children in highly educated families, while perhaps being one of several adverse circumstances faced by families prone to divorce. The independent effects of divorce might thus be less severe in this latter group.

Institutional and societal factors that vary across countries and periods could underlie the somewhat mixed findings.[28,29,108,109] For instance, utilizing data from the 1970 British Cohort study, two studies found that the negative associations between divorce and adolescents' academic achievement among youth with highly educated parents were driven by the loss of access to fathers' financial resources.[28,29] However, as noted by the authors, few non-resident fathers paid child support during this period in Britain. Thus, other mechanisms might be more critical in other socio-political contexts. Indeed, a study from the U.S. found that maternal educational levels were relatively more important than paternal educational levels in explaining heterogeneous outcomes of divorce on youth academic achievement.[32] This was in turn partly explained through lower academic expectations and school-involvement among divorced, educated mothers, suggesting that *parental* rather than *financial* resources were driving the heterogeneous outcomes.

Methodological considerations regarding operationalizations of dependent and independent variables and the degree to which pre-divorce measures have been taken into account may also have contributed to this discrepancy in the literature.[28,29] For instance, it has been suggested that to account for the resources available in a family, measures of both maternal and paternal educational levels are needed.[96,98] Relying

[i] This study modeled the probability of divorce as a function of set of theoretically informed pre-divorce covariates (e.g., family factors; family size, and presence of fathers; socioeconomic factors; parental education, household income, and employment status; individual factors; cognitive abilities, depression, self-esteem, family values and attitudes, interpersonal factors. The study then assessed whether the effects of divorce (i.e., children's educational attainment) varied with the *propensity* for parental divorce.

solely on a measure of maternal educational qualifications might, for instance, not sufficiently capture the decline in resources experienced when a highly educated father moves out of the home.[28] Additionally, findings might depend on the chosen outcome. In general, results appear to be more mixed in studies investigating current test scores, subject grades, and GPA, than later educational attainment.[28]

Most research has been conducted on cohorts from the 1970s and 1980s on British, U.S., and German samples, and it is uncertain whether these findings generalize to other periods or contexts. There is a stated need for further research in other cultural contexts.[11,28,29]

1.3.2 The Norwegian context

Norway may serve as an interesting country to explore heterogeneous outcomes of divorce based on the following considerations: Free access to health care and access to sickness-, unemployment-, and family-related benefits are among the hallmarks of the Norwegian welfare state.[110] Levels of absolute economic deprivation and income inequality are low,[111,112] and the Norwegian population is highly educated; in 2019 more than one-third of the adult population had completed some form of university-level education.[113] Education is associated with divorce-risk in Norway, and a couple where both have low levels of education run a risk that is more than fourfold in magnitude compared to a couple with two highly educated individuals.[114] Additionally, mental distress, poor health, and negative health behaviors predict divorce risk also in Norway.[115,116]

Participation in the workforce is strongly encouraged, and subsidized public childcare and generous parental leave rights promote the combination of full-time employment and childcare among both parents.[117] Following a divorce, the custodial parent is supported through tax deductions, cash allowances, and child support, which is enforced by the authorities. Approximately 50 % of parents experience a drop in income following a divorce.[118] Nonetheless, the welfare state appears to equalize the cost of divorce between men and women as both genders, on average, experience a similar 20 % drop in household income.[119] This is in contrast with several other

countries where women generally suffer a greater cost of divorce than men.[120,121] A divorce has, however, been found to increase sickness absence among women with children in Norway, but less so for men.[122] This has been suggested to stem from a "double-burden" among divorced women due to high labor participation coupled with often greater child-rearing responsibilities.[123]

Previous studies have documented that the link between parental divorce and youth's academic achievement is present in Norway; divorce is found to predict school-problems,[18] lower GPA,[17,20,124] and lower probability of successfully transitioning from secondary school to completed higher secondary education.[125] However, no study has yet investigated potential heterogeneity in the associations between divorce and youth's academic achievement within the Norwegian context.

1.4 Adjustment in different post-divorce family structures

Heightened divorce rates, repartnering, and remarriages have greatly augmented the diversity and complexity of modern families, leading many children to grow up in single parent and stepparent households. In Norway, in 2018, about 55 % of children below the age of 18 whose parents were not living together lived in a single mother family, while 32 % lived in a stepparent family, if not considering joint physical custody [j] (see Figure 2).

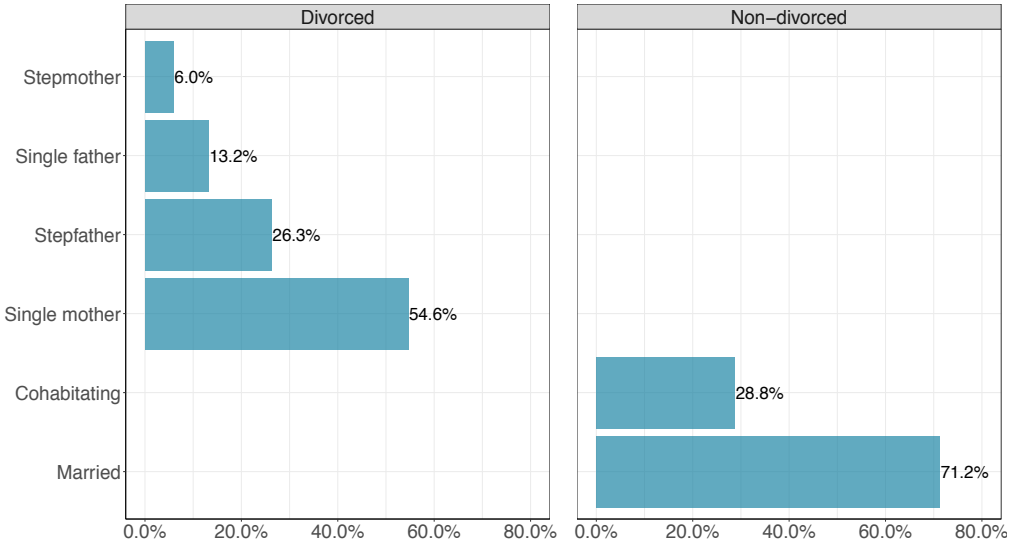

Figure 2. Percentages of children in different family structures in Norway 2018, stratified by whether their parents were divorced/separated or not. Data retrieved from Statistics Norway.[126]

1.4.1 Single parent and stepparent families

An extensive literature has documented that children in single parent and stepparent families are less well-adjusted than their peers living in nuclear families.[10,127] These problem domains extend to cognitive abilities (e.g., reading, verbal and math skills)

[j] Unfortunately, no official registry data on the prevalence of joint physical custody exists.

and academic outcomes,[128–132] higher rates of internalizing and externalizing problems,[129,131,133–136] and health and health-related behaviors.[137–141]

Recent studies have documented a similar pattern when utilizing diagnostic interviews to assess mental disorders. To date, children and youth in single parent and stepparent families have been found to be more likely to suffer from depressive disorders,[79,142] emotional disorders,[79,143,144] conduct disorders,[79,144–147] attention-deficit/hyperactivity disorder,[79,142–146,148] aggression disorders,[146–148] and more rare disorders such as bipolar disorder and schizophrenia,[142,149] relative to peers in two-parent nondivorced families.

Most studies comparing children's adjustment in single parent and stepparent families tend to find few differences on measures of physical and mental well-being and school performance.[6,150] This finding has been interpreted as a sign that potential benefits such as economic and parental resources provided by a stepparent might be offset by the stress of establishing a new family structure.[124] An exception to this pattern is that several studies have found that adolescents living with a single father are at heightened risk of externalizing problems such as antisocial behavior, and health-compromising behaviors, compared to those living in single mother- and in stepparent families.[137,151] Two main explanations have been proposed in understanding this finding. Firstly, single father families are relatively rare, suggesting that specific characteristics might select children into this family structure. Indeed, a Norwegian study found that living in a single father family was more likely when the mother had health or financial problems.[152] Hence, it is conceivable that circumstances increasing the probability of growing up with a single father, rather than living with a single father per se, increase the risk of externalizing problems among youth in this family structure. On the other hand, it has been reported that fathers display less parental monitoring and have a more uninvolved parenting style than mothers.[151] A Norwegian study found parental monitoring to be an important mediator of the association between living in a single father family and antisocial behavior, and substance use among adolescents.[153] In sum, these findings suggest that both selection and inherent qualities of single father families may play a part in the

elevated levels of externalizing problems observed among youth living in this family structure.

1.4.2 Joint physical custody

One noteworthy change to post-divorce family life in the last two decades has been the steep increase in parents choosing joint physical custody in several western industrialized countries. Joint physical custody (JPC) is often defined as a living arrangement where the child spends 35–50% of its time with each parent following a divorce.[43,46] In Norway, the frequency of JPC has more than tripled from 8 % in 2002 to about 25 % in 2012.[k] [117,152] Similarly, about 40 % of children and youths in Belgium [154] and Sweden [155] live in JPC, while the rate is about 20 % the Netherlands.[156] In the U.S., states such as Wisconsin have seen a formidable rise in JPC, and about 50 % of divorced parents now have this custody arrangement.[157] Although the prevalence of JPC is lower in countries such as Australia (16 %) [158] and the UK (12 %),[159] the rates are much higher than only a few decades ago also here.

In Norway, as elsewhere, JPC was typically practiced by a selected group of parents with higher socioeconomic status, who cooperated well and had low levels of interparental conflict.[152,160–163] The rise in JPC across several western societies suggests that a more heterogeneous group of families now practice this family form. Indeed, recent reports from Norway suggest that JPC is now a more common choice among most types of parents; both among the highly educated and less educated, and among parents where conflicts are high and low.[164]

Some have worried that JPC might be harmful due to the stress of having two homes. It has been argued that JPC might increase the risk of being exposed to potential stressors such as parental conflict, feeling torn between parents, the need to adapt to different parenting regimes, and long distance to school, friends and other leisure activities.[38–40,42,165] Furthermore, concern has been voiced that children's understanding of equal time-sharing might be linked to feelings of responsibility and

[k] The frequency of JPC is estimated based on interviews of 2,604 parents.

even guilt for their parents' well-being.[166] Another hotly debated topic relates to whether JPC is suitable for all age groups. Specifically, concern has been expressed that frequent overnight stays with parents living in two different homes might be detrimental for the attachment formation of young children.[1] [169–171]

The overall rise in JPC across Europe, Australia, and in the U.S. has led to a formidable research effort examining the correlates of JPC. There now exist several literature reviews [37,44–47] and two meta-analyses [42,43] summarizing research on how children and adolescents in JPC adjust compared to those in other family structures across a multitude of outcomes. In brief, findings suggest that children and youth in JPC display lower levels of stress, and health-related- and psychosomatic problems than those living in single parent or stepparent families.[155,172–176] Several studies have found that children and youth in JPC have fewer mental health problems compared to those in single parent and stepparent families.[61,62,124,177,178] Furthermore, children and youth in JPC tend to report higher life satisfaction and well-being,[179] higher self-esteem,[180] and report lower levels of risk behaviors than their peers in single parent families.[181,182]. It should be noted that some studies find that children and youth in JPC appear similar in their adjustment compared with those in single parent families, especially after adjustments of sociodemographic variables or measures of parental conflict [182–184].

Based on these findings, there now appears to be a growing consensus among researchers, practitioners, and law professionals that JPC may be favorable for many children.[39,41] Explanations regarding beneficial effects of JPC tend to highlight that this arrangement may increase the parental and economic resources available to the child, facilitate parent-child relationships and collaboration between parents, dampen potential custody disputes, and that JPC may offset negative consequences of weak

[1] Adolescence is the focus of this thesis, and JPC for young children will not be discussed further. The degree to which JPC hampers adjustment and attachment formation among young children is debated. Although few studies exist, many now argue that there is little theoretical or empirical evidence suggesting that JPC among infants and toddlers is detrimental for their attachment formation or later adjustment.[39,167] Parents also in general appear pleased with the arrangement, unless ongoing conflicts are present.[168]

parenting by one parent by strong parenting from the other parent, in times of stress.[41–43,124]

It is important to note that the differences between children and youth in JPC compared to other post-divorce family structures are generally small. A recent meta-analysis found that the better adjustment among youths in JPC compared to those in single parent families corresponded to an overall effect size of $d = .109$.[43]

Quite a few studies from Sweden have documented that children and adolescents in JPC show favorable outcomes compared to those in single- or stepparent families.[61,62,176,177,180,182,185–188] In Norway, comparatively fewer studies exist. An early study conducted in 2003 found that adolescents in JPC had lower scores of depression than their peers in single parent or stepparent families, and were quite similar to those living in a nuclear family.[189] Similarly, it was reported that children in JPC also got better grades in school compared to those in single parent and stepparent families.[190] Corroborating these findings, Breivik et al.[124] documented that across several outcome measures, youth in JPC were at no higher risk of displaying adjustment problems than their peers from nondivorced families, except in the area of academic achievement. However, this study was based on a sample from 1997 and included only 28 youth living in JPC. All previous Norwegian studies have been conducted on data from before the steep rise in families choosing JPC in Norway. As JPC now is a common choice among parents across different socioeconomic backgrounds,[164] there is a need for studies on larger and more recent samples to detail how youth in Norway adjust in this custody arrangement.

1.5 Family complexity, sibship-type and health complaints among adolescents

1.5.1 Siblings and sibship-type

High rates of divorce, cohabitation, and remarriage have not only increased the prevalence of single parent and stepparent families, but also led to greater complexity

in sibling compositions or sibship-types.[m] In Norway, about 80 % of all children and youth live with at least one sibling. Although the majority of these live with only full biological siblings (85 %), a significant 15 % grow up sharing a household with either half- or stepsiblings or a combination of biological-, half-, and stepsiblings,[191] quite similar to estimates reported from the U.S.[192]

Siblings have long been acknowledged as a vital part of family life, and to play a role in children's socio-cognitive development. For instance, through conflicts, siblings can practice perspective-taking, negotiation, and problem-solving.[193] Biological siblings may also play a part in the experience of family dissolution through providing support, and a sense of continuity and shared experience during divorce and family reorganization.[194] The introduction of half- and stepsiblings, on the other hand, have been suggested to reinforce the ambiguity that stepfamily formation might entail, making it difficult to define family roles and boundaries.[195–197] Traditional research on siblings has focused on the relationship between biological siblings in nuclear families.[198] According to a recent systematic review, the literature on half- and stepsiblings has nonetheless grown during the last five decades. While only one empirical study was identified published before 1980, and five studies during the 1980s–1990s, a total of 40 empirical studies were identified from 2000 to 2017.[49]

The most frequently investigated outcomes appear to relate to family dynamics, such as the relationship with parents, stepparents and other siblings.[49] Regarding relationship quality, for instance, research appear to agree that full biological siblings are closer than half- or stepsiblings.[199–203] However, genetic relatedness also seems to predict levels of conflict, whereby full biological siblings more often exhibit rivalry and aggression in their relationships than half- and stepsiblings.[204,205] Regarding gender, it has been found that females tend to have more frequent contact with half and stepsiblings.[203] Males, on the other hand, have been found to report their relationships with stepsiblings as more positive.[206]

[m] In this thesis, the term *sibship-type* will be utilized to denote the biological relatedness between siblings (i.e., full biological siblings, half-siblings, and stepsiblings).

Other studies suggest that children living with half- or stepsiblings are at higher risk for antisocial behavior,[207–210] have somewhat weaker academic achievement and test scores,[209,211–214] and display higher levels of depressive symptoms than peers that did not share a home with half- or stepsiblings.[209] Not all studies find significant associations between sibship-types and negative outcomes,[215–217] and one study found that adolescents living with half- or stepsiblings reported better adjustment after their parents' divorce than those only living with biological siblings.[218] In sum, most research on sibship-types nonetheless suggests small but rather consistent negative effects of having half- or stepsiblings on a variety of outcome measures.[49]

1.5.2 Family complexity

Family structure has traditionally been operationalized by children's relatedness to the adult(s) present in the household while ignoring sibling-relationships. The term *family complexity* has recently been coined in efforts to expand this approach by also considering the sibship-types present in the household.[48] Family complexity may be evident across all family structures and is not simply a measure of living in a stepfamily. For instance, a child typically categorized as living in a nuclear family (i.e., with his/her two biological parents) may also share a household with a half-sibling if one parent has a child from a previous relationship.

As the reviewed research above suggests, including information about sibship-type might be relevant, as siblings may be a source of both support and maladjustment. With some exceptions (i.e., [208,209,213,217,219]), few studies investigating siblings have explicitly combined information about family structure and sibship-type in their analyses. Hence, most studies have taken a "deficit approach" whereby families with half- or stepsiblings have been compared to those without,[49] while ignoring or only crudely specifying the structure of the family as defined by the parental adult(s) present in the household.

Of the studies incorporating family structure and sibship-type, findings to date suggest that although both sibship-type and family structure appear to be predictive of youth outcomes, they operate independently. For instance, adolescents sharing a

household with half- or stepsiblings have poorer academic achievement, and higher levels of school-related difficulties, depression, and delinquency behaviors;[209,213] findings that were evident across different family structures and robust to adjustments for other background characteristics. Similarly, children's aggressive behavior at school entry was in a recent study higher among those with half- and stepsiblings, independent of whether they resided with a single parent or in a stepparent family.[208]

The associated outcomes of living with non-biological siblings may, however, vary with gender. Living with half-siblings was found to be associated with having a lower GPA and lower probability of attending upper secondary school among adolescents across various stepfamily constellations in Sweden, a trend that was stronger among girls than boys.[211] This study was particularly informative as it contained the full population of 9th graders in Sweden, thus enabling the authors to conclude that there was, in fact, a gender difference. It should be noted that a study from the U.S. reached the opposite conclusion, suggesting that the GPAs of males were more negatively affected by half- or stepsiblings than the GPAs of females.[213] With regards to physical and health-related outcomes, a recent study found that girls living with half- or stepsiblings in single parent or stepparent families reported higher levels of internalizing problems than girls living without, while no such pattern was seen among boys.[219] Whether similar results exist with regards to health complaints remains uncertain. There is a lack of studies investigating health complaints among adolescents as a function of family structure and sibship-type, and whether this link is moderated by gender.

1.5.3 Health complaints in adolescence

Health complaints, such as neck, shoulder, and back pain, are common in adolescence. Although prevalence rates differ across studies and across countries, recent reports suggest that countries in the northern part of Europe, and especially in the Nordic countries, have seen a rise in self-reported health complaints among adolescents.[220–223] In Norway, a study found that the prevalence of health complaints[n]

[n] Defined as the presence of two or more symptoms at least once a week.

among 15-year-olds rose from 21.8 % to 32.5% from 1994 to 2010.[220] The rise in health complaints appears to be more evident among older adolescent girls,[224] who also in general tend to report higher levels of health complaints than boys.[225–228]

Health complaints have been linked to negative outcomes such as school absence and lower educational attainment among youth and young adults,[229,230] and to be a strong predictor of work absenteeism in adults.[231] Health complaints may thus have functional significance, and could represent a public health issue emerging in adolescence.

Levels of health complaints appear to be unequally distributed across different post-divorce family structures. Recent studies have found that children and youth in single parent or stepparent families display higher levels of health complaints than peers in nuclear families.[137,138,232,233] Moreover, several studies from Sweden found that children and adolescents in JPC displayed lower levels of health complaints than peers in single parent families; for instance, a large-scale study of sixth- and ninth-grade students in Sweden (N = 147839) found that children in JPC suffered less psychosomatic problems than those living mostly or only with one parent.[155] However, youth in JPC displayed somewhat higher levels than those in a nuclear family, similar to findings reported in three other studies conducted in Sweden.[173,174,234] Of note, another Swedish study found no difference between children in nuclear families and in JPC.[176]

To the best of my knowledge, no study has yet investigated health complaints across different family structures, while also considering the siblings present in the household. The increased complexity of the modern family in Norway, coupled with the parallel reported increase in self-reported health complaints among adolescents, highlights the need for further investigations into the distribution of health complaints among adolescents as a function of both family structure and sibship-types.

1.6 The research aims of the current thesis

The overall aim of the current thesis was to expand the knowledge of how parental divorce relates to adolescents' academic achievement, mental health and health complaints, by examining heterogeneity in the outcomes of divorce by parental educational qualifications, family structure, and sibship-type. Specifically, by utilizing data from the large population-based youth@hordaland that was linked with registry data on household income, parental education, and the adolescents' GPA, the following research questions and hypotheses were investigated:

Divorce, parental education, and adolescents' GPA

- To what extent is divorce associated with lower GPA among adolescents?
- Do parental educational qualifications moderate the association between parental divorce and adolescents' GPA?

The following hypotheses and expectations were derived: We hypothesized that adolescents with divorced parents on average had lower GPAs than their peers with nondivorced parents, in line with the well-documented link between divorce and lower academic achievement among children and adolescents. Due to the high divorce rate among the relatively few uneducated parents in Norway, suggesting that a divorce perhaps is one of many adverse events experienced in these often socioeconomically disadvantaged families, we expected that the negative association between divorce and adolescents' GPA would be stronger in highly educated families where a divorce might carry greater changes to the adolescents' lives. As previous studies have been conducted on older cohorts outside the Scandinavian welfare countries, we were more uncertain with regards to the relative contributions of maternal and paternal educational qualifications. However, as the Norwegian welfare state appears quite successful in equalizing the cost of divorce between men and women, we suspected that maternal educational levels might be relatively more important than paternal educational levels in understanding heterogeneous associations between divorce and adolescents' GPA in Norway, compared to previous studies conducted in other sociopolitical contexts.

Family structure and adolescents' mental health and health complaints

- To what extent is family structure related to adolescents' post-divorce mental health and health complaints?
- What is the link between family structure and sibship-type on adolescents' health complaints?

We hypothesized that adolescents in nuclear families and in joint physical custody would display lower levels of mental health problems and health complaints than peers in single parent or stepparent families. Moreover, we expected no statistically significant differences between adolescents in single parent and stepparent families. Lastly, we expected that levels of health complaints would vary with the sibship-type(s) present in the household, specifically that sharing a household with non-biological siblings would be linked to higher levels of health complaints among the adolescents. We were also interested in examining whether the link between sibship-type and health complaints were gender-dependent, as a few previous studies suggest that the associated outcomes of living with non-biological siblings might differ among boys and girls.

2. Methods

2.1 The youth@hordaland-survey

This thesis draws on data from the youth@hordaland-survey, a population-based study of adolescents conducted in the spring of 2012 in Hordaland County, Norway. The principal aims of the youth@hordaland were to assess mental health, family life, lifestyle factors and health service use among adolescents.

The youth@hordaland survey is the fourth and last *wave* of the Bergen Child Study (BCS). The BCS is perhaps best described as a series of cross-sectional studies with a longitudinal sample. The first *wave* of the BCS was conducted in 2002 and invited all parents of children born between 1993 and 1995 attending schools in the municipalities of Bergen and Sund to participate. The second and third *waves* were conducted in 2006 and 2009. These waves also included information from the children themselves. The fourth *wave* of the BCS expanded the scope of the study to include all youth in upper secondary school in the county of Hordaland. The participants were now aged 16–19, and the study was therefore renamed as youth@hordaland.

To date, over 30 peer-reviewed articles have been published on data from youth@hordaland, investigating topics such as socioeconomic influences on child and adolescent mental health [54,63,235] and health complaints,[228,229,236] alcohol and drug use,[237–239] sleep,[240–243] and school absence among adolescents.[229,244] Several articles investigating the psychometric properties of the instruments utilized in the survey have also been published.[228,236,245–247] For more information about the youth@hordaland, see the project webpage at https://www.norceresearch.no/en/projects/the-bergen-child-study.

2.1.1 Sample and recruitment

The youth@hordaland-survey was conducted by Uni Research Health (currently Norwegian Research Centre, NORCE) in collaboration with Hordaland County Council. All adolescents born between 1993 and 1995 residing in Hordaland County

were invited to participate (N = 19,440). Adolescents in secondary education were informed about the study by email, and one regular school hour was allocated to them to complete the questionnaire. A teacher was present during data collection to ensure confidentiality. Survey staff was available through phone to answer questions during the data collection period. Some schools arranged catch-up days. Efforts were also made for the participation of adolescents in hospitals or institutions. For those not at school, the questionnaire could be completed at their convenience during the study period. A reminder to complete the questionnaire was sent via e-mail, and text message to adolescents enrolled in school, and via post to those not attending school.

The survey was designed as a web-based questionnaire covering topics such as demographic background, socioeconomic status, family life, resilience, health service use, and mental health problems. The questionnaire took approximately 45 minutes to complete. The adolescents themselves consented to complete the entire or selected parts of the survey, including consenting to linkage with national Norwegian registries, as Norwegian regulations dictate that individuals aged 16 and older are required to consent themselves. A project web-page containing information about the project, about the option to consent to registry-linkage, and whom to contact in need of help were available to the adolescents. Their parents were informed about the study.

The study was approved by the Regional Committee for Medical and Health Research Ethics in Western Norway (REC approval number 2012/1467).

2.1.2 Representativeness and generalizability of the youth@hordaland

The term *representative sample* has been used to denote everything from general claims about data to specific sampling methods or estimations.[o] For ease of exposition, the term representative sample will here be used to denote a sample where a specified set of variables resembles the population such that certain specified

[o] For a detailed historical walkthrough of the terms *representativeness* and *representative sample*, see Kruskal and Mosteller.[248–250]

analyses (e.g., computation of means, standard deviations etc.) will yield results within acceptable limits set about the corresponding population values.[250]

A key threat to representativeness is nonresponse bias, a bias arising if respondents and non-responders differ on the dimensions or variables that are of interest to the researchers.[251] As attrition from survey studies has drastically increased in the last decades,[252] nonresponse bias is a common issue in survey research. In epidemiological research, response rates have plummeted from rates of 90 % in the 1950s to a point where few studies today achieve a response rate of 70 %, and response rates are commonly much lower.[253] Nonresponse is found to be related to sociodemographic variables; women participate more than men, and there is an overweight of respondents with higher socioeconomic status.[254–258]

In the youth@hordaland, 10,257 of the 19,440 invited adolescents consented to participate in the study, making the participation rate 53 %. No data are available from non-responders. Due to restrictions from the ethical committee REC, information about school affiliation was not collected as part of the youth@hordaland. Hence, we do not know with certainty the degree to which missing are primarily at the school-level or at the individual level among the adolescents in school at the time of the study. We do, however, consider that nonresponse among adolescents in school at the time of the study is more likely to stem from schools failing to organize for participating in the study, rather than individuals choosing not to participate in schools where this had been arranged for. In general, this would be considered less of a threat to the representativeness of the study, as missing at school level is usually less likely to create highly selected samples.[259]

Non-responders were in any case likely to have differed to some extent compared to those participating in the study. In the youth@hordaland 98% of participating adolescents attended upper secondary school, compared to 92% from official national statistics.[p] Moreover, a study on previous waves of the BCS found non-participation

[p] Figures retrieved from Statistics Norway table 06942: https://www.ssb.no/en/statbank/table/06942/

to be related to poorer mental health and lower SES.[260] This may also be the case in the youth@hordaland survey. Mental health problems and health complaints are of focal interest in Paper II and Paper III, respectively. Poorer financial circumstances and low levels of parental education are associated both with levels of mental health problems among children and increased risk of divorce among adults.[115,235,261] Nonresponse might therefore have had some impact on the results of this thesis. For instance, it is possible that the adolescents most negatively affected by their parents' divorce have had a lower likelihood of participating in the study than their less affected peers. This could potentially have led to an underestimation of the differences between adolescents with and without divorced parents, or between adolescents in different post-divorce family structures.

A previous study from the youth@hordaland found that the GPA in this sample was identical to the national GPA in 2012 in this age cohort, and only slightly lower than the GPA in Hordaland county (by 0.04 points).[244] Moreover, as described in detail in section 2.1, the distribution of adolescents in various family structures in the youth@hordaland was relatively similar to official regional statistics. In sum, these findings would be somewhat surprising if the youth@hordaland consisted of a highly selected group of adolescents based on sociodemographic background, academic achievement, and mental health status. Nonetheless, based on the above considerations, caution should be applied when generalizing the findings from the present thesis to the population level.

2.2 Registry data

Two central registries were utilized in this thesis to complement the data from the youth@hordaland survey. The Norwegian National Income Registry provided information on family income (Paper I).[q] The adolescents' GPAs and their parents'

[q] See https://bit.ly/2JlUY01 for the official web site for the Norwegian National Income Registry.

educational qualifications were obtained from the National Education Database in Norway (NUBD) (Paper I).[r]

2.2.1 The Norwegian National Income Registry

The Norwegian National Income Registry is owned by Statistics Norway (SSB). The family income data utilized in Paper I is based on tax return data from the Norwegian Tax Administration. This is the same information utilized by the Norwegian government to estimate taxation, and can, therefore, most likely be considered reliable and of high quality. See [262] for more information about the Norwegian National Registry.

2.2.2 National Education Database in Norway

The National Education Database in Norway (NUBD) collects all individual-based educational statistics from SSB, from primary school through Ph.D.-level, in one database. The main aim of the database is to collect and store data that makes it possible to examine educational trends across time periods in Norway; it contains information from 1970.[263]

2.3 Measures from the youth@hordaland-survey

The youth@hordaland-survey comprises a variety of instruments assessing dimensions of mental health and lifestyle factors among adolescents. Only measures utilized in the current thesis will be described.

2.3.1 Parental divorce/separation and family structure

Parental divorce (Paper I)

The youth@hordaland contained detailed self-reported information about parental divorce and the family structure the adolescents resided in. Parental divorce was defined according to answers on two items assessing if (a) their biological parents lived together ("yes," "no") and (b) if their biological parents were divorced or separated ("yes," "no"). Adolescents confirming that their parents (a) did not live

[r] See https://bit.ly/2Hkb2vy for the official web site for the National Education Database in Norway.

together and (b) that their parents were divorced or separated were defined as having divorced/separated parents. Adolescents stating that their biological parents still lived together were categorized as having nondivorced parents.

We had no means of distinguishing between adolescents whose parents were formally married compared to cohabiting or had formally divorced compared to those who were separated (either because not being divorced in the first place, or as a step towards formalizing a divorce). This limitation is, however, not unique to the present thesis (see e.g.[7,17,50]). For ease of exposition, the term *divorce* is in the present thesis generally used in a broad sense to include families that spilt up from cohabitation and from legal marriages. Potential limitations of this approach are discussed in section 4.4.2.

Family structure (Papers II- III)

Family structure was defined according to the adolescents' answers to five items regarding their parent's union status and their current living situation. The adolescents were asked whether (a) their biological parents lived together ("yes," "no"), (b) if their biological parents were divorced or separated ("yes," "no"), (c) who they completely or partially lived with most of the time ("both parents," "biological mother," or "biological father"), (d) where they presently lived ("parents or guardians," "foster parents," "residential care," "bedsit/dorm/collective apartment," "own apartment," or "other"), and (d) who they presently lived with (including biological parents, stepparents, foster parents, and adoptive parents).

The adolescents were classified into six different family structures: nondivorced, two-parent family (i.e., nuclear family), joint physical custody (JPC), single mother family, stepfather family, single father family, and stepmother family. The nuclear family group consisted of adolescents who reported that (a) their biological parents lived together, and (b) they presently lived with their parents (i.e., did not live with foster parents, in residential care, bedsit/dorm/collective apartment, or the similar.). The JPC group consisted of adolescents who reported that (a) their biological parents did not live together, (b) their parents were divorced or separated, (c) they lived

wholly or partially most of the time with both their parents, and (d) they presently lived with their parents (i.e., did not live with foster parents, in residential care, bedsit/dorm/collective apartment, etc.). The inclusion criteria for the single-mother group were (a) the respondent's biological parents were divorced or separated, (b) they entirely or partially lived with their biological mother most of the time, (c) they presently lived with their parents (i.e., did not live with foster parents, in residential care, bedsit/dorm/collective apartment, etc.), and (d) did not live with their mother's new partner. The same logic was used for the single father group. Lastly, the adolescents were classified in the stepfather or stepmother group if they affirmed the criteria for the single-mother or single-father group and specified that they also lived with their mother's or father's new partner (see Figure 2 for a detailed flowchart of this categorization).

Compared to official statistics from Statistics Norway (SSB) of families from Hordaland county in 2012,[s] the proportion of adolescents categorized as living in a nuclear family in youth@hordaland (68.6 %) was quite similar to official county level statistics (70.7%). If considering those with divorced or separated parents, the corresponding proportions of adolescents in single mother families (youth@hordaland = 44.7 %, SSB = 52.2 %), single father families (youth@hordaland = 9.4 %, SSB = 11.2 %), and stepparent families (youth@hordaland = 27.9 %, SSB = 36.6 %) were lower in the youth@hordaland survey. However, no official statistics regarding the proportion of children and adolescents in JPC exists. Adolescents in JPC are therefore categorized in either single parent or stepparent families in official registries, and the lower proportion of adolescents in single parent and stepparent families in the youth@hordaland compared to the SSB is therefore expected. Moreover, it should be added that official figures represent all families with children below 18 of age, and no age-specific estimates exists. The figures are therefore not directly comparable, but they indicate that the youth@hordaland at least fairly well has captured the distribution of

[s] Figures retrieved from Statistics Norway Table 06239: https://www.ssb.no/en/statbank/table/06239

adolescents in different family structures within the limits of what could be expected from official county level registry data.

It has been estimated that 25–30 % of children and adolescents with divorced or separated parents lived in JPC in 2012 (based on data from telephone interviews of a national representative sample [152,264]). In the youth@hordaland, the corresponding proportion of adolescents in JPC was 17.6 %. As older adolescents may for various reasons choose to live more with one parent than the other (e.g., be closer to friends, leisure activities, school), it could make sense that the rate of adolescents aged 16–19 in JPC is lower than average estimates of all children and adolescents.

In Paper III, we combined the stepfather and stepmother group into the category "stepfamily". This was done as both the findings from Paper II and previous studies [6,50] suggest few differences in outcomes among youth in stepmother versus stepfather families. The relatively few adolescents who would be classified as living in a stepmother family would further limit the possibility to draw meaningful inferences when incorporating information about sibship-type into the regression equation.

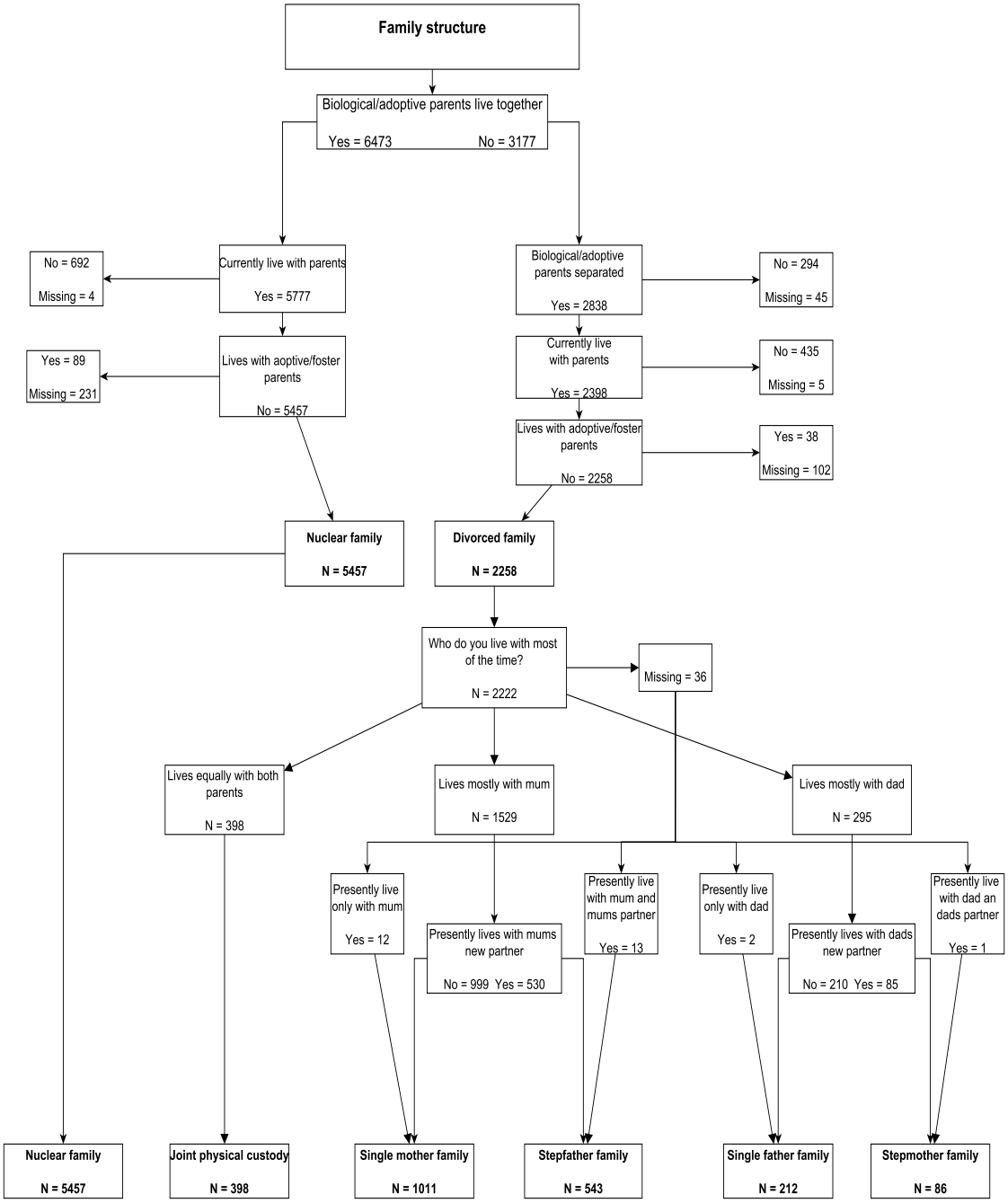

Figure 2. Flowchart of the selection of adolescents into different family structures in Paper II based on available measures from the youth@hordaland.

2.3.2 Sociodemographic measures

Economic well-being (EWB) (Papers II - III)

EWB was measured by a single item asking the participants to report how they would rate their family's economic situation compared to most others. Response options were: "poorer than others", "equal to others", and "better than others". Similar questions have been used by others to determine adolescents' perceived socioeconomic status.[235,265] In general, studies of subjective ratings of SES tend to find that they predict health outcomes at least as well as objective indicators,[64,265,266] and have been suggested to represent a cognitive average over multiple socioeconomic indicators.[266]

2.3.3 Mental health measures

The Strengths and Difficulties Questionnaire (SDQ; Paper II)

General mental health problems were defined according to the adolescents' scores on the SDQ.[267,268] The SDQ is a commonly used mental health instrument for youth: by 11 November 2017, 4699 publications across 100 countries have in some form utilized the SDQ as a measure of mental health problems among children and adolescents.[269]

The SDQ is a screening instrument initially developed for children aged 4–17 years. It comprises 25 items describing positive (e.g., "I try to be nice to other people…") and negative (e.g., "I am often unhappy, depressed or tearful") attributes of children and youth. The items are allocated to five subscales measuring (1) emotional symptoms, (2) conduct problems, (3) hyperactivity-inattention problems, (4) peer problems and (5) prosocial behaviors. The items are rated on a 3-point Likert scale ("not true," "somewhat true" and "certainly true") giving a subscale score ranging from 0–10. Multiple informants can complete the SDQ, including parents, teachers and self-report.

In Paper II, we utilized the Total problems score as a measure of overall levels of mental health problems. This score is based on the sum of 20 items of the subscales emotional symptoms, conduct problems, hyperactivity-inattention problems and peer

problems, yielding a range from 0 to 40. We also calculated internalizing and externalizing problems scores. These are created by combining the peer problems and emotional symptoms subscales (into internalizing problems) and by combining the conduct problems and hyperactivity-inattention subscales (into externalizing problems). This use of the SDQ has been recommended for conducting analyses in low-risk epidemiological samples such as the current one.[270]

The SDQ has been validated in several countries including Norway [271–276] and has been found to have adequate reliability and validity also among adolescents.[246,277] Nevertheless, some controversies regarding the internal factor structure of the instrument remain, and also whether the SDQ is measurement-invariant across gender (see, e.g., [246]).

2.3.4 Health complaints

Health complaints were measured with four items from the Health Behavior in School-Aged Children Symptoms Checklist, measuring symptoms of headache, abdominal pain, back pain, and dizziness.[278] Additionally, an item measuring neck and shoulder pain was included, reflecting a commonly reported symptom among adolescents and adults.[226,227,278–280] The symptoms were measured on a five-point rating scale where the adolescents were asked to report the frequency of each health complaint during the last six months ranging from “seldom or never”, “about every month”, “about every week”, to “more than once a week”, and “about every day”. An overall measure of health complaints was created by adding the scores of the five items together, resulting in a sum score with a range from 0–20. This sum score has been found to be unidimensional by a previous study on the youth@hordaland sample, supporting its continued use.[228]

2.4 Measures from registries

Age and Gender (Papers I - III)

Gender and birth date were derived from the adolescents' personal identity number in the Norwegian national population registry. Exact age was calculated by date of participation in the youth@hordaland and birth date.

Register based Measures of Income (Paper I)

Equivalized disposable income (EDI) in the household occupied by the adolescents, and mother's and father's net income were obtained from the Norwegian Tax Administration for the years 2004–2011 by using each participant's personal identification number. All three income measures represent the sum of all wages and salaries, income from self-employment, property income and transfers received, minus total assessed taxes and negative transfers. As the EDI is tied to all adults in the household, it also captures the income of other adults (e.g., new partners) residing in the household. The EDI is further adjusted by an equivalence scale. In this thesis, the OECD-modified scale was used. This scale gives the first adult in a household a weight of 1, while subsequent adults are given a weight of 0.5, while children < 14 years of age are given a weight of 0.3 each.[281] The weights facilitate comparisons between households of different size and composition (i.e., acknowledges that the economic resources and needs of a nuclear two-parent family with two children are different to those of a single parent raising two children alone). In Paper III, both EDI and mother's and father's income for the year 2011 were utilized.

Parental Educational Qualifications (Paper I)

The educational qualifications of both parents when the adolescents were 16 years of age were obtained from NUBD. The data received from NUBD was coded according to the Norwegian Classification of Education ("Norsk standard for utdanningsgruppering"; NUS2000), in the form of a six-digit number. The 1st digit represents the overall educational level (e.g., Bachelor's level or equivalent), the 2nd digit specifies the broad field of education (e.g., social sciences and law), the 2nd–3rd digits in combination define the narrow field of education, the 2nd–4th the detailed

field of education, whilst all digits (1st–6th) details the exact individual educational program (for a full description of the NUS2000 codes, see Barrabés & Østli [282]).

Parents' overall level of education was the primary interest in the present thesis. Therefore, the 1st digit of the NUS2000 code was extracted. The NUS2000 codes were then translated into the International Standard Classification of Education (ISCED) 2011. The ISCED 2011 was adopted by the UNESCO General Conference in November 2011, with the aims of facilitating the compilation and comparison of education statistics both within and across nations.[283] The coding scheme delivered by Barrabés & Østli [282] on behalf of Statistics Norway, was utilized to translate the NUS 2000 code to the ISCED 2011 code. See Table 1 of the correspondence between ISCED 2011 and NUS 2000 levels.

Table 1

The correspondence between ISCED 2011 and NUS 2000

Level	**ISCED 2011**	**NUS 2000**
Early childhood education, age 0 to 2 years	ISCED 01	0
Early childhood education age 3 to 5 years	ISCED 02	0
Primary education	ISCED 1	1
Lower secondary education	ISCED 2	2
Upper secondary education	ISCED 3	3 & 4
Post-secondary non-tertiary education, (Post-secondary vocational education 0,5-1,5 years)	ISCED 4	5
Short-cycle tertiary education (Post-secondary vocational education, 2 years)	ISCED 5	5
Bachelor's or equivalent level	ISCED 6	6
Master's or equivalent level	ISCED 7	7
Doctor or equivalent level (Ph.D.)	ISCED 8	8

Note: Table content adopted from Barrabés & Østli.[282] The NUS 2000 also contains a "level 9", which indicates that the educational level of the person is unknown.

In the present thesis, the ISCED 2011 levels were used to create three measures of parental education levels in the families:

1. A dominance measure indicating the highest education in the family defined as the highest educational level by either the mother or the father. The levels of the categorical variable were:

- Both parents have no qualifications higher than ISCED 2
- One or both parents have qualifications equivalent to ISCED 3–5
- One or both parents have an education equivalent to ISCED 6
- One or both parents have an education equivalent to ISCED 7–8

2. A measure capturing the highest completion of either the mother or the father:

- Both parents have no qualifications higher than ISCED 2
- Only the mother has some qualifications (above ISCED 2)
- Only the father has some qualifications (above ISCED 2)
- Both parents have some qualifications (above ISCED 2).

3. Two separate variables for maternal and paternal educational qualifications

- Maternal/paternal educational qualifications ISCED 0–2
- Maternal/paternal educational qualifications ISCED 3–5
- Maternal/paternal educational qualifications ISCED 6
- Maternal/paternal educational qualifications ISCED 7–8

This first categorization aimed at capturing the scope of educational levels in Norway, within a manageable set of categories with a sufficient number of cases. The ISCED 0–2 levels were collapsed as few adults in Norway have less than lower secondary education ("*Ungdomsskole")* as the highest educational level.[113] Furthermore, as the NUS 2000 coding scheme does not differentiate between ISCED 4 and ISCED 5, these levels were collapsed together with ISCED 3 to create a level containing families where the highest educational qualifications were ISCED 3–5.

The second categorization was adopted from two recent publications by Bernardi et al. [28,29] and was used to investigate potential differential associations between parental divorce and adolescents' GPA based on whether either the mother or the father had the highest level of education in the family.

The third categorization was created to further investigate the relative contribution of maternal and paternal educational qualifications, and thus also functioned as a sensitivity check of the two above categorizations that combined maternal and paternal educational qualifications into single variables.

Grade point average (GPA; Paper I)

The adolescents' GPA for the school-year of 2011 – 2012 was obtained from NUBD. Each subject is graded on a scale from 1 (failure) to 6 (excellent) in Norway, and the GPA was calculated by taking the sum of all grades received in this school-year divided by the total number of subjects.

2.5 Samples utilized for the individual articles

In Paper I, adolescents from youth@hordaland consenting to register linkage (N = 9,166) formed the base sample. Of the 9,166, incomplete responses were fairly low. The majority pertained to the divorce status variable (8.8 %), followed by father's net income (4.6 %) and parental education (3.7 %), whereas the remaining variables utilized in the current study had below 3 % missingness. Due to the relatively low proportion of missing, and the challenges posed by using multiple imputation for handling missing values with planned categorical interaction analyses,[284] missing values were handled by listwise deletion in the regression analyses.

In Paper II and Paper III, we drew on the entire youth@hordaland sample (N = 10,257). Of these, an initial 1,269 respondents were removed due to reporting "not living at home with parents" at the time of data collection (i.e., living in own apartment, dorm or similar). In Paper II, an additional 1,281 respondents were removed from the analyses due to missingness on variables utilized to operationalize family structure or due to living with foster or adoptive parents, rendering a total

sample of 7,707 adolescents (see Figure 2 for details). The age (M = 17.40, SD = 0.84) and gender (53.5% female) distribution in this subsample were quite similar compared to the age (M = 17.42, SD = 0.84) and gender (52.7% female) distribution in the entire youth@hordaland sample.

In Paper III, in addition to the initial 1,269 removed respondents (i.e., "not living at home"), and the 156 that were removed due to living with foster or adoptive parents, 24 respondents were removed due to unlikely answers with regards to number of siblings (i.e., stating to have > 12 biological, half- and/or stepsiblings) or by stating to live in a nuclear family (i.e., with two biological parents) with stepsiblings present in the household; rendering a sample of 8,808 adolescents. Adolescents who had missing values on items used to categorize family structure were in this paper *not* removed from the main analyses, as multiple imputation was used to handle missing values. The descriptive analyses, on the other hand, consisted of adolescents with valid responses on items utilized to categorize family structure (7,707 – as in Paper I) minus the 24 identified adolescents who provided unlikely answers with regards to siblings. As in Paper I, the gender (53.5 % female) and age distribution (M = 17.4, SD = 0.83) were very similar to that of the entire youth@hordaland.

2.6 Statistical analyses

2.6.1 Paper I: Divorce and academic achievement

Chi-square test (for categorical variables) and Welch Two Sample *t*-tests (for continuous variables) were used to examine differences on sociodemographic variables between adolescents with and without divorced parents. The Welch's *t*-test performs better than the classic Student's *t*-test when sample sizes and variances are unequal between groups, and is approximately equal to the Student's *t*-test when the sample sizes and variances are equal.[285] The Welch's *t*-test has therefore been recommended as a default choice, and it removes the need to test the equal variance assumption.[285]

A series of OLS regression analyses were conducted to investigate the associations between parental divorce status and the adolescents' GPA. Furthermore, as we were interested in investigating whether parental education moderated this association, interaction terms between the divorce status variable and the parental education variables were added to the models.

We ran three series of analyses: The first investigated the combined highest educational level in the family as a moderator between parental divorce and the adolescents' GPA. The second investigated the relative importance of mother's versus father's educational qualifications as a moderator (i.e., whether both parents had ISCED 0–2, only the mother had above ISCED 2, only the father had above ISCED 2, or both parents had educational qualifications above ISCED 2). In the third analysis, the two variables capturing maternal and paternal educational levels separately were entered simultaneously in order to test the sensitivity of the above models, and to further detail the relative contribution of maternal and paternal educational qualifications within a broader range of educational levels.

All analyses were similarly organized: A baseline model estimating the associations between parental divorce and GPA, adjusted by gender and age. Gender and age were added to the baseline model as both a priori assumptions and preliminary analysis suggested that girls had higher GPA than boys and that GPA tends to weaken with

age within this age group (16–19). Model 1 included parental educational qualifications (either as combined variables or separate variables); Model 2 added the interaction term between parental education and parental divorce to estimate potential heterogeneity in the associations between parental divorce and the adolescents' GPA based on parental education; and Model 3 further added controls for equivalized disposable income in the household occupied by the adolescents and mother's and father's net income.

Due to the ordinal nature of the parental educational variables, a dummy coding system was applied by creating *k-1* dummy coded variables of the original parental educational variables, as detailed in Cohen et al.[286] The ISCED 0–2 educational level was initially chosen as a reference group. Differences between the other educational levels were then tested by alternating the reference category in the regression analyses.

Conditioning on income and paternal and maternal educational qualifications simultaneously in a regression model may introduce overcontrol bias. In the first two sets of regression analyses, we largely avoided this problem by creating single measures of the highest educational qualifications in the family by combining maternal and paternal educational levels [287]. Moreover, we added income measures in the last model, as we were not interested in the main effects of income per se. In the last set of regressions, robustness checks were made by also running analyses whereby maternal and paternal education variables were entered in separate models.

One could speculate that the timing of divorce could covary with parental educational levels and adolescents' GPA. For instance, if highly educated parents divorced later on, estimates of potential heterogeneity of divorce by parental education on the adolescents' GPA could reflect differences in timing of the event of divorce. Subgroup analyses were therefore performed in order to assess whether timing of divorce differed across parental educational qualifications, and whether timing of divorce was related to adolescents' GPA.

Age and all income measures were centered on their respective means in the regression analyses to ease the interpretation of the regression coefficients, and the income measures were reduced by a factor of 100,000. The regression coefficients of the income measures, therefore, indicated the predicted change in the adolescents' GPA by an increase of 100,000 NOK above the mean. To estimate effect sizes for the categorical predictors (represented by dummy variables), the GPA score was z-transformed by setting the grand mean to zero and the standard deviation equal to one. When regressing a z-transformed outcome-measure on a set of dummy coded variables, the resulting "unstandardized beta coefficient" is transformed into a standardized unit that corresponds roughly to Cohen's *d.*[288]

Statistical analyses were conducted using R version 3.5.2 for Mac.[289] Figures were created with help from the packages "ggplot2" [290] and sjPlot[291] and the manuscript was prepared using the APA article (6th edition) template in the "papaja"-package.[292]

2.6.2 Paper II: Family structure and adolescent mental health

Sociodemographic characteristics across the family structures were calculated. Chi-square tests were used to examine potential differences across the family structures with regards to gender and economic well-being (EWB).

The associations between family structure and self-reported symptom scores were investigated using Ordinary Least Squares (OLS) regression analyses with family structure as the primary independent variable, and the SDQ-total, SDQ-externalizing, and SDQ-internalizing scales as dependent measures. Preliminary analyses found no interaction effects between family structure and gender on any of the outcome measures (i.e., the pattern of adjustment across the family structures was similar for boys and girls). The analyses were therefore collapsed over gender.

The first regression models (Model 1) assessed the bivariate relationships between family structure and the SDQ-scales. The second models (Model 2), were adjusted by gender and EWB.

"Nuclear family" was initially chosen as a reference group, as we were interested in examining whether the other post-divorce family structures reported statistically significantly higher levels of mental health problems compared to those living with their two biological nondivorced parents. The models were then re-run with alternating reference categories, to detail potential differences between the other family structures.

The ordinal EWB variable was also dummy coded, using the "equal to others" level as the reference group. The SDQ-scales were z-transformed whereby the grand mean was set to zero and the standard deviation equal to one to estimate effect sizes.[288]

Visual inspections of normal predicted probability plots indicated that the residuals of the SDQ-scales were approximately normally distributed in all regression analyses. Multicollinearity among the predictors was assessed by inspecting the variance inflation factor in all regression models, none of which suggested any problems.[286] Statistical analyses were conducted using SPSS version 24 for Windows.[293]

2.6.3 Paper III: Complex families and health complaints among adolescents

Sociodemographics stratified by family structure were calculated. The overall levels of health complaints and the proportions of adolescents experiencing weekly symptoms across family structure grouped by gender were estimated. To visually display the overall levels of health complaints among boys and girls across family structure, a raincloud plot was created, showing the density distribution, raw jittered data points, and the mean with 95 % confidence intervals.[294]

OLS regression analyses were utilized to estimate the relationships between family structure, sibship-type, and health complaints. Preliminary analyses indicated no statistically significant family structure by sibship-type interaction effects, suggesting that the impact of sibship-type on health complaints among adolescents did not appear to depend on the specific family structure in which the adolescents resided. Moreover, as the frequency of half- and stepsiblings were low in some of the family structures, the main chosen analytic strategy was to investigate the impact of sibship-

type on the adolescents' health complaints sum score independent of family structure (i.e., sibship-types were entered as categorical covariates in the regression analyses).

The regression models were structured as follows; A baseline model assessing the association between family structure and overall levels of health complaints adjusted by gender and age; Model 1 included sibship-type as captured by three dummy variables (i.e., Biological siblings: 0 = No, 1 = Yes etc.); Model 2 added interaction terms between the sibship-type dummies and gender, to investigate whether gender moderated the estimates of living with biological, half- and stepsiblings, and also included parental education, and economic well-being.

Missing values were handled by multiple imputation with the R-package "mice" which performs multivariate imputation by chained equations.[295] Multiple imputation performs better than more traditional methods for dealing with missing data (e.g., listwise deletion, mean replacement), unless the proportion of missing is very low and values are missing completely at random, an assumption that seldom holds.[296–299] All variables present in the final regression model were entered in the imputation model, as any relationship in the analysis model should be a part of the imputation model.[284] To account for the planned interaction analyses between gender and sibship-type in the imputation procedure, the data was split by gender, and 30 imputed datasets were created on each group before combining the datasets together. This method has been recommended when multiple imputation is used to handle missing values before conducting planned categorical interaction analyses, when one of the variables in the interaction term is fully observed (i.e., contains no missing values; in our data, "gender" was fully observed).[284] The estimates and standard errors were pooled into overall estimates following Rubin's rules.[300] Of note, the results from the regression analyses were robust independent of whether missing values were imputed or handled by list-wise deletion.

All analyses were conducted using R version 3.5.2 for Mac.[289] Figures were created with the package "ggplot2".[290]

3. Results

This chapter provides an overview of the results presented in the three papers included in the thesis [301–303]. Papers II and III are based on the entire sample of adolescents from the youth@hordaland-study, and the sociodemographic statistics of these papers will, therefore, be described together.

3.1 Paper I

The sample consisted of 9,166 adolescents who consented to register linkage. The age (*M* = 17.4, *SD* = 0.8) and gender (54 % female) distribution were very similar to the age (*M* = 17.4, *SD* = 0.8) and gender (53 % female) distribution in the total youth@hordaland sample.

3.1.1 Sociodemographics by divorce status

There were fewer boys in the divorced sample (43.6 %) compared to the nondivorced sample (47.2 %). The majority of adolescents with divorced parents reported that they currently lived with their mother (68.4 %). The average number of years since parental divorce was 10.6 (*SD* = 5.2). Divorced parents had overall lower educational qualifications; approximately twice as many divorced parents did not have higher than ISCED 2 qualifications (6.6 %) compared to nondivorced parents (3.8 %), and having qualifications equivalent to Bachelor's level (ISCED 6) or Master's or Ph.D.-levels (ISCED 7–8) was more frequent among nondivorced parents compared to divorced parents.

The households occupied by an adolescent with divorced parents had an equivalized disposable income that was about 70,000 NOK lower compared to nondivorced households. While nondivorced fathers had higher net earnings than their divorced counterparts, divorced mothers had higher net earnings than non-divorced mothers.

3.1.2 The link between parental divorce and adolescents' GPA

Adolescents with divorced parents had on average about 0.3 points lower GPA than their peers with nondivorced parents. This difference corresponded to a Cohen's *d* of 0.34.

The first tested regression models investigated the highest educational qualification obtained in the family (as measured by the highest education obtained by either the mother or the father) as a moderator of the association between parental divorce and GPA. The results revealed that the negative associations between parental divorce and GPA were relatively larger among adolescents where at least one parent had education equivalent to ISCED 3–5 (b = -0.202, $p < 0.05$) or education equivalent to ISCED 6 (b = -0.245, $p < 0.05$), compared to adolescents where both parents had no higher educational qualifications than ISCED 2 (reference group). Although the same trend was observed among adolescents with highly educated parents (Master's or Ph.D. degree), the negative association between divorce and GPA was not statistically significantly different compared to those whose parents had low educational qualifications (b = -0.169, p = 0.12). Adjusting the analyses by the equivalized disposable income in the household occupied by the adolescents, and mother's and father's net income hardly changed these estimates.

The second set of regression models utilized the other measure of parental education, separating between families where either no parent had over ISCED 2 (reference group), only the mother had above ISCED, only the father had above ISCED 2, and families where both parents had above ISCED 2. The results showed that in families where only the mother had above ISCED 2 qualifications (b = -0.225, $p < 0.05$) and in families where both parents had above ISCED 2 qualifications (b = -0.246, $p < 0.05$), the negative association between parental divorce and GPA was relatively larger compared to families where both parents had no higher than ISCED 2 qualifications. A weaker relationship was observed among adolescents where only the father had above ISCED 2 qualification, and in this group the relationship between divorce and GPA was not statistically significantly different compared to adolescents where both parents had below ISCED 2 qualifications (b = -0.111, p =

0.32). In keeping with the previous analyses, adding income variables to the regression equation only very slightly altered these estimates.

Finally, entering maternal and paternal educational qualifications as separate variables simultaneously in the analyses further confirmed that the heterogeneity in the outcomes of divorce was primarily driven by maternal educational qualifications; the negative associations between divorce and GPA were relatively larger when maternal educational levels were at secondary school levels (ISCED 3–5; b = -0.120, $p < 0.05$), at Bachelor's levels (ISCED 6; b = -0.175, $p < 0.05$) and at Master's or Ph.D.-levels (ISCED 7–8; b = -0.209, $p < 0.05$) compared to basic-level education (ISCED 0-2), independent of paternal education and income measures. No significant interaction effects between divorce and paternal educational levels on the adolescents' GPA were found.

Robustness and sensitivity checks

Alternating the reference categories of the educational variables confirmed that all significant differences were between the ISCED 0-2 educational level and the other educational levels. Robustness checks suggested limited threat by overcontrol bias; entering maternal and paternal educational qualifications in separate models (i.e., unadjusted by each other) revealed the same general pattern, whereby heterogeneity in the associations was present by maternal but not paternal educational qualifications.

Additional checks revealed that adolescents with educated parents, on average, reported that their parents had somewhat more recently divorced than less educated parents. Subgroup analyses showed a slightly positive curvilinear, but very weak, association between years since the divorce and the adolescents' GPA. Although being statistically significant, the estimate of the quadratic slope of the year since divorce variable on the adolescents' GPA was very weak (b = -0.0007, $p < 0.001$). Practically speaking, this trend nonetheless suggested considerable stability in the negative association between divorce and adolescents' GPA. Additional checks showed that the association between the parental education variables and the GPA

among adolescents with divorced parents hardly changed when adjusted by year since divorce (when modeled as a linear and curvilinear relationship [i.e., the squaring the year since divorce variable]). Hence, the heterogeneity in the links between divorce and GPA by parental education reported in this thesis does not appear to be explained by differential timing of divorce across different parental educational levels.

3.2 Paper II & Paper III

3.2.1 Sociodemographics

In Paper II, the adolescents were classified into six different family structures: a nuclear, nondivorced, two-parent family (n = 5,457, 52% girls), joint physical custody (i.e., living equally with both parents after the divorce, n = 398, 49% girls), single mother (n = 1,011, 58% girls), stepfather (n = 543, 63% girls), single father (n = 212, 44% girls), and stepmother families (n = 86, 59% girls). The age distributions were quite similar across the family structures (mean age: 17.3 – 17.5 years).

There were statistically significantly differences between the family structures on gender, $\chi 2(5, 7707) = 39.02$, $p < .001$; and perceived economic well-being, $\chi 2(10, 7596) = 492.91$, $p < .001$. The majority in all family structures rated their economic well-being as equal to others. Adolescents living with a single mother were, however, about six times more likely to rate their economic well-being as poorer than others (a total of 20.5 %), and about half as likely to report it to be better than others (16.0 %) compared to adolescents living in a nuclear family (poorer than others = 3.2 %; better than others 28.8 %). Of the post-divorce family structures, adolescents living in JPC were the ones most similar to those living in a nuclear family regarding their perceived economic well-being.

In Paper III, the adolescents were classified as living in either (1) nuclear/two-parent family (n = 5,436, 52 % girls), (2) joint physical custody (n = 397, 49 % girls), (3) single mother family (n = 1,009, 58% girls), (4) single father family (n = 212, 44 % girls), and (5) stepfamily (i.e., living with a divorced single parent and his or her new partner, n = 629, 62% girls).

As the paper III sample consisted of approximately the same sample as in Paper II, the pattern of ratings of economic well-being across the family structures was nearly identical. Both paternal and maternal educational levels were quite similar and the highest in nuclear families and in JPC, while adolescents in single parent and stepparent families had less educated parents. Living with biological siblings was most common in nuclear families (72.4 %), and least common in single father families (28.8 %). About 50 % and 25 % of all adolescents in a stepfamily reported living with half-siblings or stepsiblings, respectively. While nearly 25 % of adolescents in JPC lived with half- or stepsiblings, the frequency of adolescents in single parent families living with half- or stepsiblings was generally much lower (10.4 % and 2.3 % in single mother families; 5.7% and 3.3 % in single father families).

3.2.2 Family structure and adolescent mental health

In the crude regression models, adolescents in single-parent and stepparent families scored statistically significantly higher than adolescents living in a nuclear family across the SDQ scales. One exception was that those living in a stepmother family did not significantly differ ($b = 0.67$, $p = .064$) on the SDQ internalizing scale compared to those in a nuclear family. Adolescents living in a stepfather family had the highest SDQ total score, with a predicted 1.87 points higher score than those living in a nuclear family ($b = 1.87$, $p < .001$). Expressed in standardized deviation units, this difference corresponded an effect size of 0.36.

Adolescents in JPC scored somewhat lower but not statistically significantly different to those in a nuclear family across all SDQ-scales (SDQ total: $b = - 0.27$, $p = .310$; SDQ internalizing: $b = - 0.14$, $p = .408$; SDQ externalizing: $b = - 0.13$, $p = .404$).

Adjusting for gender and economic well-being (Model 2) attenuated the differences between those in a nuclear family compared to those in single parent and stepparent families. The reduction was most prominent for adolescents living in a single-mother family across all three scales. Nevertheless, the differences remained significant across all three scales, except for adolescents living in a stepmother family, who also

in Model 2 did not score significantly higher on the SDQ internalizing scale. The range of the estimated effect sizes for the single-parent and stepparent families was higher for the SDQ externalizing scale (0.22–0.32) than for the SDQ internalizing scale (0.11–0.17). For both scales, those living in a single mother family had the lowest observed effect size, whereas for those living in a single father or a stepfather family effect sizes were higher.

To check for other differences between the family structures, the reference category of the family structure dummy variables was alternated. These analyses confirmed that adolescents in JPC had statistically significantly lower scores on the SDQ-scales than those in single-parent and stepparent families. A noteworthy difference was that the stepmother group was statistically significantly different compared to those living in joint physical custody in the unadjusted model on the SDQ internalizing scale (which they were not when compared to the nuclear family group). No statistically significant differences were found between single parent and stepparent families.

3.2.3 Family structure, sibship-type, and health complaints.

At the descriptive level, adolescents in single parent and stepparent families reported higher levels of weekly- and overall levels of health complaints compared to adolescents in nuclear families and in JPC. These findings applied to girls as well as boys, although girls reported higher levels of health complaints than boys. When considering specific symptoms, two exceptions from this general pattern emerged; boys in single father families were least likely to report experiencing weekly symptoms of dizziness, and boys in stepfamilies were least likely to report weekly experiences of abdominal pain. Among both genders, adolescents in nuclear families and in JPC were quite similar across all health complaints measures.

In the crude regression models predicting overall levels of health complaints, adolescents in JPC did not statistically significantly differ compared to peers in nuclear families (b = 0.021, *95% CI* -0.436 to 0.479). Adolescents in single parent and stepparent families, on the other hand, were predicted to have an overall score on the health complaints sum score that was 0.19 standard deviation units (*SD*s) higher

for youth living in a single mother family (*b* = 0.891, *95% CI* = 0.591 to 1.191), 0.22 SD's among youth in a single father family (*b* = 1.044, *95% CI* = 0.450 to 1.637), and 0.25 SD's higher among youths in a stepfamily (*b* = 1.185, *95% CI* = 0.814 to 1.555), compared to adolescents in a nuclear family. Accounting for sibship-type (Model 1) somewhat attenuated these associations, especially among adolescents in a stepfamily. Model 1 further revealed that independent of family structure, living with biological siblings was associated with lower levels of health complaints among the adolescents (*b* = -0.302, *95% CI* = -0.506 to -0.097), while halfsiblings and stepsiblings were not statistically significantly related to overall levels of health complaints among the adolescents. Adjusting the analyses by parental education and economic well-being (Model 2), further attenuated the associations, especially in the single mother group. The added interaction term between stepsiblings and gender was also statistically significant, suggesting that independent of family structure and sociodemographic variables, sharing a household with stepsiblings was associated with higher levels of health complaints among girls but not among boys (*b* = -1.410, 95% *CI* = -2.470 to -0.349).

4. Discussion

4.1 Summary of findings

The results in the present thesis suggest considerable heterogeneity in the outcomes of divorce by paternal educational qualifications, family structure, and siblings. The negative association between divorce and the adolescents' GPA was relatively larger among adolescents with educated mothers, compared to adolescents with less educated mothers, independent of paternal educational levels and household income measures. The increased risk of mental health problems and health complaints was confined to adolescents in single parent and stepparent families, while adolescents in joint physical custody (JPC) did not report any higher levels of mental health problems or health complaints relative to peers in a nondivorced two-parent family. Furthermore, independent of family structure, residing with biological siblings was associated with lower levels of health complaints, while sharing a household with stepsiblings was associated with higher levels of health complaints but only among girls.

4.2 Interpretation of findings

4.2.1 Heterogeneity in the associations between divorce and adolescents' academic achievement

Adolescents with divorced parents had on average a 0.3-point lower GPA compared to peers with nondivorced parents, a difference that was moderately reduced after adjustments of parental educational qualifications (to 0.24 points). This finding aligns with several previous studies.[7,10,304] Focusing on the average effects of divorce might, however, conceal important variability in how a divorce is related to outcomes among youth. Indeed, it was found that the negative association between divorce and the adolescents' GPA was stronger in families with educated parents compared to families with less educated parents. Moreover, this heterogeneity was driven by maternal educational levels, whereby a divorce was more negatively associated with the adolescents' GPA in families with educated mothers (i.e., above ISCED 2)

compared to families with less educated mothers (ISCED 0–2), after accounting for paternal education and income measures. No heterogeneity was, however, observed with regards to paternal educational levels.

Previous studies investigating heterogeneous outcomes of divorce on adolescents' academic achievement have yielded mixed findings, possibly due to differences in methodology and or differences across context and time periods.[28,29] The results of this thesis nonetheless lend support to a growing number of studies in favor of the floor effects hypothesis, whereby youth in educated or highly educated families are at higher risk of lower academic achievement following a parental divorce relative to peers with less educated parents.[28–32] Two related findings form the foundation of this conclusion. Firstly, a divorce was not statistically significantly related to the GPA among adolescents with two less educated parents (ISCED 0–2). Secondly, the negative association between divorce and GPA was relatively larger among adolescents with highly educated compared to lowly educated mothers. In the following, factors that might contribute to how this pattern may arise within the Norwegian context will be discussed.

Due to the general high level of education among Norwegian citizens, families where both parents have educational qualifications below ISCED 3 are relatively rare. Social gradients in health and education are still present in Norway, and it is established that socioeconomically disadvantaged families have more frequent experiences of negative life events and family stresses (e.g., related to unemployment and housing), including higher divorce rates than more affluent families.[114,305] Among children growing up with two less educated parents, a divorce might therefore be one of many potential stressful life events experienced during childhood. As noted by Brand,[30] the independent effects of a divorce might thus be less severe among these children, perhaps as they have come to expect instability in their lives. Among children with educated or highly educated parents, a divorce might, on the other hand, come of more as a shock to otherwise privileged youth. Moreover, as the floor effects hypothesis implies, the expected school performance among adolescents with lowly

educated parents is on average weak to begin with, leaving less room for their grades to deteriorate following a parental divorce.

The results suggest that maternal educational levels contribute to the observed heterogeneity in the link between divorce and adolescents' GPA in Norway. A study conducted on a U.S. sample reached a similar conclusion, whereby a divorce was more strongly associated with lower academic achievement among adolescents with a highly educated mother.[32] This finding was partly explained by children of educated divorced mothers not receiving similar levels of positive parenting practices as peers with educated married parents. Such mechanisms were not explored in the present study. However, one could speculate that similar mechanisms might also underlie our findings. As the Norwegian population is generally highly educated, and the Norwegian welfare state strongly encourages work participation among both men and women (i.e., the "dual-earner family" [t]), it is possible that educated divorced mothers in Norway experience a "double burden" due to the strain of high work load combined with child rearing responsibilities.[123] Due to the time and effort required to deliver parenting practices that foster academic skills in children, perhaps educated divorced mothers struggle to continue to deliver such parenting practices to the same extent after the divorce. Mothers with lower education levels, on the other hand, may not have spent as much time fostering such skills to begin with.

Adjustments to measures of household income did not alter these findings. This contrasts findings obtained by two studies conducted on a cohort born in 1970 in Britain, whereby the educational penalty associated with a divorce primarily was driven by the loss of fathers' financial resources.[28,29] As the authors noted, fathers often failed to pay child support during this time period in Britain and levels of single mother poverty were high. Given that child support is enforced by the public authorities in Norway, and that the Norwegian welfare state is found to be rather successful in equalizing the cost of divorce between men and women,[118,119] it could be sensible to find that fathers' financial resources are less important in understanding

[t] See Kitterød & Week [117] for a detailed overview.

the heterogeneous outcomes. This does not mean that income does not affect children's post-divorce adjustment, and indeed, single mothers are also in Norway among the least well off in society. Rather, this finding could perhaps hint at other mechanisms than income *per se* in understanding the observed heterogeneity in the outcomes of divorce found in the present study.

It is important to note that besides parental educational levels, which are usually established before a divorce, the present study lacked other historical information that could increase parents' risk of divorce and affect their children's academic achievement. The findings of the present thesis are thus largely descriptive. Proposed mechanisms such as changes in parenting among highly educated mothers have not been examined, and unmeasured selection mechanisms or confounding variables might give rise to the pattern observed in this study (e.g., physical or mental health problems among parents, parental conflict etc.).

Compared to several previous studies examining cohorts from the 1970s and 1980s, the current study investigated a relatively recent cohort born 1993–1995 and assessed in 2012. Due to differences in both school systems and welfare policies, it is important to note that the generalizability of these results might be limited to a Norwegian context.

4.2.2 Adjustment in single parent and stepparent families

Adolescents who lived in single mother, single father, stepfather or stepmother families were in general at a similar increased risk of displaying general mental health problems, externalizing and internalizing problems, and higher levels of health complaints compared to peers living in a nuclear two-parent family. The estimated effect sizes of the differences between single parent and stepparent families compared to nuclear families were in the range of 0.28–0.34 for externalizing problems, 0.17–0.26 for internalizing problems, and 0.19–0.25 for health complaints, in the crude models.

The findings of relatively small negative effects of living in single mother and stepparent households on adolescents' mental health and levels of health complaints

are in general keeping with previous studies.[1,10] Moreover, the findings corroborate earlier studies suggesting that experiencing parental divorce is more strongly related to externalizing problems compared to internalizing problems.[1,124]

Accounting for perceived economic well-being attenuated the differences in mental health problems, especially among adolescents living with a single mother compared to those in a nuclear family. Similarly, accounting for both perceived economic well-being and parental educational qualifications, led to a similar reduction in levels of health complaints among adolescents in a single mother family compared to nuclear family. The attenuating effects of perceived economic well-being suggest that the subjective experience of having poorer family finances than others may play a part in understanding the higher levels of mental health problems and health complaints among youth in single mother families. Similar attenuating effects of measures of family finances are frequent within this research field.[17,155,179,306–309]

Adolescents in single parent and stepparent families were at similar risk of both externalizing and internalizing problems, and overall levels of health complaints. Adolescents in stepparent families have been proposed to benefit from financial and parental resources gained by the introduction of a stepparent to the household.[50,127] Several stressors associated with stepfamily formation, such as adjustment to a new parental figure and the potential addition of half- and stepsiblings, might however equal out potential parental and economic benefits of having a stepparent, which could explain the few reported differences between single parent and stepparent families. Indeed, with regard to health complaints, accounting for sibship-types reduced the predicted higher levels of health complaints among youth in a stepparent family by about 25 % compared to those in a nuclear family (to be discussed further). Moreover, it has been highlighted that stepfathers are less likely to invest as much into their stepchildren as fathers in nuclear families, and stepfathers with children from previous unions usually still invest some in their biological children.[310] This may further limit the resources gained for children and adolescents by the introduction of a stepparent to the family. As such, our findings are at odds with one of the tenets of the parental loss perspective stating that the introduction of a

stepparent may alleviate the potential negative outcomes of single motherhood on children's adjustment.[50]

Adolescents living with a single father did not statistically significantly deviate from those in single mother and stepparent families with regard to externalizing problems. Previous Norwegian [20,25] and international studies [151] tend to report that adolescents in single father families have an additional risk of externalizing problems such as antisocial behavior, conduct problems and drug use. Such findings have often been explained through parenting practices (e.g., fathers monitor their children less), or through selection mechanisms (i.e., sickness or financial problems among the mothers might select youth to father custody).[151] It is uncertain whether the findings of this thesis reflect some positive changes in single father families such as increased parental monitoring, changes in selection mechanisms; or perhaps stem from methodological differences compared to previous studies (e.g., in measurements or age groups investigated). Future studies are needed in order to validate this finding before any conclusions regarding a possible decline in externalizing problems among adolescents in single father households can be reached.

4.2.3 Mental health and health complaints in joint physical custody

Adolescents living in joint physical custody (JPC) displayed lower levels of general mental health problems, internalizing and externalizing problems, and health complaints compared to peers in single parent and stepparent families. The results obtained in this thesis are thus in general agreement with several studies finding more favorable adjustment among youth in JPC compared to adolescents in single parent and stepparent families the last two decades.[37,42,43,46,47] Moreover, these findings were relatively robust to adjustments to sociodemographic characteristics, suggesting that higher levels of perceived economic well-being or parental educational levels among youth in JPC do not sufficiently explain these findings. Additionally, adolescents in JPC were quite similar to and not statistically significantly different to those in a nuclear family across all outcome measures. Similar results have been obtained from a few previous studies,[42] including a previous Norwegian study.[25] However, other studies have found that adolescents in JPC take an intermediate position, whereby

they report somewhat higher levels of adjustment problems than those in nuclear families, but lower levels than those in single parent and stepparent families.[61,155,173] It is not clear whether these differences reflect actual variation in how individuals in JPC adjust across nations or time periods, or whether they reflect differences in measures or analyses. Further cross-national studies are in this respect needed and would have the potential to elucidate context-specific mechanisms that might have implications for children's adjustment in JPC.

Several explanations have been advanced in understanding how JPC might be linked to better post-divorce adjustment among youth. For example, JPC have been proposed as beneficial by enabling the child to maintain a relationship with his or her two parents,[43] through facilitating child-parent relationships and improving cooperation between parents,[124] and by reducing potential economic stress for the child following the divorce.[42] Close contact with both parents may also enable potential negative effects of weak parenting by one parent to be offset by strong parenting from the other parent.[41] As adults' abilities to deliver good parenting may vary over time, JPC may thus enable parents' to "cover" for each other in periods where stress or other life events may temporarily reduce the parenting abilities of one parent. Additionally, many argue that even in the presence of conflict, keeping contact with both parents through JPC is beneficial.[47,311] Existing studies on potential explanatory mechanisms are somewhat scarce. A few studies have, however, suggested that fathers in joint physical custody are more involved with their children, and are more likely to have an authoritative rather than uninvolved parenting style,[312,313] which could contribute to more positive outcomes of JPC.

It is important to consider that the lower levels of adjustment problems found in joint physical custody compared to single parent and stepparent families might stem from selection effects. Traditionally, parents choosing JPC have been characterized by having higher socioeconomic status, displaying lower interparental conflicts and generally cooperating well following a divorce. As such, a common critique of positive outcomes associated with JPC has been that it is factors that select into JPC rather than inherent qualities of JPC that underlie these findings. Indeed, several

studies, including results from the present thesis, suggest that accounting for some of the commonly held selection factors (i.e., parental education and income measures) reduces differences in adjustment between adolescents in JPC compared to other post-divorce family structures.[42,47,61,155,173] A recent review concluded that JPC is generally linked to better outcomes even when accounting for factors such as income or parental conflict.[47] Specifically, of 36 studies including measures of parental conflict, JPC was associated with better outcomes on all measures in 18 studies, and equal to better in 11 studies, and only worse on one outcome measured in 4 studies. The same review found a similar pattern with regards to studies accounting for income measures. However, these studies were cross-sectional, thus measures of conflict and income were in general measured after the divorce. Hence, these findings do not by themselves exclude the possibility of selection by income and/or parental conflict, as these measures are also likely to be affected by the divorce process.

In Norway, JPC is now a more common choice among most types of parents.[117] If having highly educated parents with low levels of conflict by and large explained the better outcomes among youth in JPC in earlier studies, one could speculate that as JPC becomes more frequent in a given population, the positive outcomes associated with JPC would get diluted. Interestingly, the present thesis finds quite similar differences between JPC and other post-divorce family structures as an early study conducted in Norway based on data collected in 1997,[25] before the marked increase in parents choosing JPC in Norway. Hence, there appear to be few indications that the positive outcomes associated with JPC have waned with time in Norway, although a comparison between two studies must be regarded as tentative at best.

The above argument does, however, not eliminate the possibility that other unobservable characteristics explain the better adjustment found among youth in JPC. As post-divorce family structures are not static entities, it is conceivable that the divorce-process, at least partly, self-selects children and youth into post-divorce family structures based on how they adjust to the divorce process. This might be particularly salient when investigating older adolescents. For instance, one could speculate that children and young adolescents not coping well in JPC would get

selected out of this custody arrangement, as parents or the child itself would "opt out," leading to a change in living arrangement. In the present thesis, this could hypothetically mean that adolescents classified as living in JPC stem from the pool of adolescents and parents who successfully adjusted to this type of custody arrangement. A recent Norwegian study found considerable stability across residential arrangements, and 80 % of mothers and 86 % of fathers with JPC reported no change in their living arrangement following separation.[u] This still implies that 10-14 % experienced a change from JPC to primarily sole mother/father custody. Moreover, a Norwegian survey found that the most frequently reported reason to change from joint- to sole mother/father custody was that the child wanted to.[314] As such, some self-selection out of JPC due to differential adjustment among children likely exists. As the majority report JPC to be a stable post-divorce living arrangement, self-selection nonetheless appear unlikely as a sole explanation of the better outcomes associated with JPC.

Overall, the present thesis contributes to the growing number of studies finding better adjustment among youth in JPC compared to other post-divorce family structures. Nonetheless, there is a great need for future studies utilizing longitudinal designs tracking children in the years before and after the divorce in order to further detail the mechanisms that underlie this finding.

4.2.4 Sibship-type and health complaints

Independent of family structure, living with biological siblings was associated with *lower* levels of health complaints among both boys and girls, while sharing household with stepsiblings was associated with *higher* levels of health complaints but only for girls. Overall, these findings support a growing number of studies suggesting that sharing a household with nonbiological siblings is associated with negative outcomes among youth,[49] and that family structure and sibship-type appear to be independently associated with youth outcomes.[48,208,209,213] Previous studies have focused on outcomes such as academic achievement, depression and delinquent behaviors,[208,209]

[u] Mean years since separation was 6.5 years; *SD* = 4.0, range 0–18 years.

while this thesis, to the best of my knowledge, is the first to report results from a study investigating health complaints among adolescents as a function of both family structure and sibship-type.

Living with biological siblings was associated with lower levels of health complaints. This is in general keeping with previous studies finding small but beneficial effects of living with biological siblings on adolescents' adjustment.[49] It has been suggested that biological siblings may support each other, and provide a sense of continuity and shared experience through the dissolution and subsequent reorganization of the family.[194] As such, having biological siblings might further act as a buffer against some of the stressors of divorce. Although this might be the case, the results of the present study suggest that sharing a household with biological sibling(s) might have more of a general buffering effect, as living with biological siblings was associated with reduced levels of health complaints independent of family structure (i.e., also among those in a nuclear family).

Sharing a household with stepsiblings was associated with higher levels of health complaints among girls. Few studies have investigated whether the associated outcomes of living with stepsiblings are gender dependent. However, this finding aligns with a previous study from the U.S., finding that sharing a household with stepsiblings was associated with higher levels of internalizing problems among girls.[219] Previous studies have reported that girls have more frequent contact with and invest more in their relationships with nonbiological siblings than boys.[49,315] One could speculate that due to the role and boundary ambiguity that stepfamily formation might entail,[208] efforts to maintain close relationships with stepsiblings becomes an additional stressor among girls, possibly increasing their risk of health complaints.

It is also possible that it is not the presence of stepsiblings per se, but other accompanying factors such as reduced parental and financial resources available, or increased family instability that explains these findings. It is, however, not clear why such factors should affect girls and boys differently. As few previous studies have investigated such gender effects, there is a need for more research before any firm

conclusions can be made. Nonetheless, the findings of the present study support the notion that incorporating information about sibship-types may be an important addition to traditional family structure research.[48]

4.3 Final theoretical considerations

Multiple perspectives are likely needed in order to understand the heterogeneity in the outcomes of divorce. In light of the classical perspectives,[50,53] the results of this thesis could be interpreted to lend some support to the parental loss perspective. This perspective holds that the quantity and quality of contact with the noncustodial parent are key mechanisms in explaining the negative associations between parental divorce and children's outcomes.[50,53] In the thesis, adolescents in single parent and stepparent families reported higher levels of mental health problems and health complaints compared to their peers in joint physical custody and nuclear families, suggesting that the *quantity* of contact with both parents in general appears to be associated with positive outcomes among adolescents. It must be stressed that we have neither had information regarding quantity nor quality of contact between the noncustodial parents and their adolescent offspring in single parent and stepparent families, thus limiting our ability to nuance this perspective. Furthermore, there are instances where frequent contact with the noncustodial parent should be avoided or limited (e.g., presence of high levels of interparental conflict, or poor parenting skills, or mental health problems [50]). Thus, this perspective might benefit from a more detailed specification of the conditions required for contact with the noncustodial parent to benefit the child. The notion that a stepparent buffers against negative outcomes of divorce did not receive any support in the present thesis, in general keeping with previous studies.[50] As such, the parental loss perspective appears insufficient in capturing the complexity that stepfamily formation entails, including the addition of half- and stepsiblings to the family.

As stated by the parental adjustment perspective, the custodial parents' adjustment is further likely important, as the child spends most of its time with this parent. We did not have information that enabled us to examine this perspective directly. However,

following the finding of a more negative association between divorce and GPA among adolescents with an educated mother, one could speculate that the parental adjustment perspective could benefit from an additional focus on the custodial parents' educational background. Indeed, the floor effects hypothesis [29] and the compensatory class hypothesis [88] have some similarities with both the parental loss and the parental adjustment perspectives. They highlight how a divorce might differentially impact youths' educational outcomes by parental educational levels, by altering the custodial or the noncustodial parents' abilities to transfer their resources to their children. Nonetheless, additional research is needed in order to elucidate possible mechanisms driving heterogeneous outcomes by parental education. Moreover, it is not quite clear whether parental educational levels theoretically should moderate the associated outcomes of divorce among those in joint physical custody differently compared to those in single parent or stepparent families, an issue not explored in the research literature. Most research has further focused on heterogeneous outcomes by parental education on measures of academic achievement, while less is known regarding measures of physical and mental health. Hence, future research is needed, and may provide an empirical basis for further theory development.

The present thesis lends some support to the economic deprivation perspective, stating that the observed negative association between divorce and children's adjustment partly stems from economic hardship and what follows from that. This perspective has traditionally focused on consequences of experiencing absolute levels of deprivation in single mother families.[50] The low levels of absolute poverty in Norway might suggest that individuals growing up in a single mother family are rather at risk of experiencing relative deprivation.[17,25] Relative deprivation has commonly been associated with poorer mental health.[316] Hence, it could be important to consider whether negative associated outcomes of residing in single mother families mainly operate through mechanisms of relative deprivation in countries known for their low levels of absolute poverty and generous welfare benefits. Simultaneously, it should be acknowledged that single parents in Norway

also may experience economic hardship in the sense of struggling to make ends meet.[17] For future research, it might therefore be advisable to consider both absolute and relative aspects of economic deprivation when investigating adjustment in different post-divorce family structures.

Bridging the perspectives, the divorce-stress-adjustment perspective [1,3] could serve as a basis for further empirical investigations as it allows for multiple pathways through which the divorce process may impact children's adjustment both before, during, and after the event of divorce. Moreover, it places the phenomenon within a greater sociodemographic framework, highlighting how sociopolitical and demographic context may influence who divorces and the consequences a divorce has on the lives of adults and children, both positively and negatively.

4.4 Methodological considerations

4.4.1 Strengths of the study

The main strengths of the study are the relatively large sample size, high-quality registry data on the adolescents' GPA, parental educational qualifications, and income measures, the use of well-validated instruments to measure mental health problems and health complaints, and the detailed measure of family structure and sibship-types.

A key strength of the study is the objective register-based measures of household income, parental education and the adolescents' GPA. The income data used in this thesis is utilized by the Norwegian Government to estimate taxation and can generally be considered to be of high quality. Whereas previous studies often calculate GPA by a subset of grades, test-scores or exams, sometimes self-reported, the measure of GPA in the present study was calculated from all grades obtained during a whole school year. This GPA measure forms the primary basis for admission into higher education in Norway and may thus be considered highly reliable.

The large sample size combined with the detailed data on family background is another considerable strength in the present thesis. This allowed us to investigate a

broader range of family structures than many previous studies. Moreover, several studies investigating siblings have not been able to differentiate between half- and stepsiblings.[49] As the findings of the present thesis suggest, neglecting to differentiate between various sibling bonds could be problematic, as it may obfuscate unique outcomes associated with each specific sibship-type.

The SDQ as a measure of both overall levels of mental health, and symptoms of externalizing and internalizing problems, is further a strength given its status as a well-validated and recommended screening instrument in general populations,[268,270] and as psychometric investigations have confirmed its utility also in the current sample.[246] Similarly, the measure of health complaints utilized in this thesis has previously been found to have adequate psychometric properties in the current sample,[228] and is based on well-founded symptoms commonly reported among adolescents.[225,278]

4.4.2 Limitations

Cross-sectional data and selection effects

The main limitation of the present thesis is the reliance on cross-sectional data, which prevents firm conclusion about causality and the direction of effects. As discussed, unobserved variables that may have selected youth into experiencing parental divorce, into subsequent post-divorce family structures, and which may affect their school performance and health, may be important in understanding the mechanisms driving the findings of this thesis. Longitudinal studies utilizing various sophisticated methods tend to suggest that divorce has at least some causal influence on children's outcomes,[3,10,11] although it should be noted that longitudinal data are only able to approximate causal processes. In any case, the general lack of historical data in the present thesis highlights the need to be cautious about causal inferences.

As highlighted by the divorce-stress-adjustment-perspective,[1] the finding that higher levels of adjustment problems among children may be evident also in the years before the formalization of the divorce, does not necessarily prove selection or that a divorce does not affect children's adjustment. It may instead be an expression of the ongoing

process of separation. Indeed, as a divorce is perhaps best viewed as a process rather than a fixed point in time, it is quite possible to decide and study specific aspects of the divorce process that are of interest. Moreover, as noted by several – the perhaps most important research questions pertain to *how* and under *what* circumstances a divorce affects children.[1,3,11] In this respect, this thesis, with its focus on heterogeneous outcomes of divorce due to family structure and parental educational qualifications, may perhaps be said to contribute mostly to the latter.

Representativeness

As discussed in section 2.1.2, the participation rate in the youth@hordaland survey was 53 %, and the sample was further slightly reduced in the individual papers due to either missingness on key variables, or due to lack of consent to register linkage (Paper I). The samples may therefore not be fully representative of the population they were drawn from. Moreover, one could speculate that adolescents most negatively affected by their parents' divorce perhaps had a lower likelihood of participating in the study than their less affected peers. This could, for instance, have led to an underestimation of the differences between adolescents with and without divorced parents.

Attrition from survey research is unfortunately an increasingly common problem in epidemiological research,[252] and nonresponse might also pose potential problems with regards to the representativity of the data utilized in the present thesis. Limited information about characteristics of non-responders highlights that statements about generalizability of the findings from this thesis should be made with some caution. The main findings of the present thesis nonetheless align well with previous research within this field of study. Moreover, the GPA in the youth@hordaland was very similar to both regional and national averages,[244] and the distribution of adolescents in different family structures corresponds fairly well to what could be expected based on available official regional statistics (although these estimates are not directly comparable, as previously discussed). In sum, it would be somewhat surprising if the youth@hordaland comprised of a highly selected and unrepresentative sample.

Measuring divorce, family structure and sibship-type

We did not have information specifying whether the parents were legally married or not, which is a limitation of the thesis. It is conceivable that cohabiting and married couples differ systematically on variables which might have implications for their children's adjustment. International studies have found that married couples rate their relationship quality and life satisfaction as better than do cohabiting couples.[317–319] Furthermore, cohabitants' well-being has been reported to be negatively related to the presence of children, more so than among married couples.[318–320] Whether such findings are applicable in Norway remains unclear. Unmarried cohabitation has a long history in Norway and is more widespread here than in many other countries. Over 90 percent of first partnerships are cohabitations,[321] and it is estimated that nearly two thirds of first births are born to cohabiting couples.[322] Furthermore, cohabiting couples generally have the same rights and obligations as married couples, but do, however, not have the same level of economic security as marriage (e.g., in case of dissolution or if one partner dies).

A study on a representative Norwegian sample found that the well-being of cohabitants was quite similar to those who were married, even when accounting for number of dependent children.[323] For instance, the risk of depression and anxiety was not found to differ between the groups. Cohabitants who separated or who never married, were, however, more likely to report alcohol problems. Similarly, another Norwegian study found that formerly married cohabitants reported equal levels of well-being as married couples, whereas never-married cohabitants evaluated their relationships and well-being as somewhat poorer.[324] The same study found that the presence of children was not related to lower well-being among cohabitants.

In sum, cohabiting unions appear more similar to their legally married counterparts in Norway than in many other countries. Some differences between cohabiting and married couples that might have implications for their children's adjustment, are nonetheless likely lost by the measure of parental divorce utilized in this thesis. More studies on the potential similarities and differences in adjustment among youths

experiencing parental divorce compared to parental break-up from cohabitation is in any case an interesting venue for future research.

Although a strength of the present study was the detailed categorization of both family structure and sibship-type, these were static measures taken at one point in time. Duration and frequency of changes between households with different family members have therefore not been captured in the present thesis. As family instability has been proposed as an additional factor impacting youth adjustment,[325,326] this is a limitation. Recent findings from Norway do, however, suggest that family structures or residential arrangements show considerable temporal stability, also among youth in joint physical custody.[117] Static measures appear therefore to at least be relatively good proxies. A clear drawback is nonetheless the loss of ability to capture those who experience multiple transitions during childhood – and who perhaps also are especially vulnerable to adverse outcomes.

We did not find evidence that the associated outcomes of various sibship-types depended on the family structure. However, a very large sample size would likely be needed in order to reliably investigate possible interaction effects between family structure and sibship-types (and gender). Thus, future large-scale studies are needed in order to corroborate this finding.

The categorization of family structure and sibship-types is based on the adolescents' self-report about other members in the household. However, family members may construct their own realities with regards to their own family (i.e., perceptions of kinship) that do not necessarily correspond to the scientists' view.[327] For instance, misclassifications could be common with regards to sibling ties, as children may be reluctant to label a half-sibling or step-sibling with whom they have shared their childhood as anything other than a full sibling.[49] This could further introduce some bias in the results of this thesis. Moreover, we did not have sufficient information to investigate whether the sibling structure (i.e., having younger or older siblings), the gender of siblings, or number of siblings were related to mental health problems or health complaints among the adolescents.

Compared to previous research, the measures utilized to capture family structure and sibship-types should nonetheless be considered a strength. Many previous studies have not distinguished between single mother or single father families, nor between stepmother or stepfather families. Moreover, many studies investigating sibship-types have combined half- and stepsiblings together into the same category [49].

Measuring mental health problems and health complaints

Another potential limitation of the thesis is the reliance on self-reported measures of mental health problems and health complaints among the adolescents using relatively brief measures. Although adolescents may provide accurate information regarding their own mental and physical health,[328] additional measures from other informants (i.e., parents and teachers) and clinical evaluations could perhaps have provided more nuance to the mental health measures.

4.5 Implications and directions for future research

The findings of this thesis suggest that focusing on average outcomes of divorce should be discouraged, as multiple patterns may underlie how families adopt to the divorce process which may be hidden using average estimates. Hence, this thesis contributes to the research field by exploring heterogeneous outcomes of divorce on adolescents' academic achievement by parental educational qualifications, by exploring a broad range of different post-divorce family structures including joint physical custody, and by investigating even greater family complexity by incorporating sibship-types into the analyses.

A novel finding was the discovery of a heterogeneous pattern whereby the negative association between divorce and the adolescents' GPA was relatively stronger in families with educated mothers compared to families with less educated mothers, independent of fathers' educational qualifications. Another novelty was the finding that independent of family structure, living with biological and stepsiblings was related to levels of health complaints among adolescents. Specifically, while the presence of biological siblings was associated with lower levels of health complaints,

living with stepsiblings was associated with higher levels of health complaints – but only among girls. In order to assess the validity of these findings, future replications are needed.

In general, the review of the literature indicates that a better understanding of *how* the divorce process may affect children's outcomes (both positive and negative) is still needed. Although several studies have accounted for theoretically relevant variables such as family finances, interparental conflict, and parenting styles, few studies have had available longitudinal datasets that make it possible to further understand how these factors interplay, and combined with moderating factors (e.g., family structure/siblings, parental education, individual factors; resilience etc.) in a given societal context (e.g., welfare policies, divorce rates) create variability in how children and youth adjust to the divorce process. As such, combining theoretical and methodological approaches from psychology, sociology, demography and genetics may benefit future research [3].

Specifically, drawing on the results of the present thesis, there is still a great need for future studies investigating the potential mechanisms behind (1) why the outcomes of divorce on adolescents' GPA appear to differ across socioeconomic strata, (2) the commonly reported better adjustment among children and youth in joint physical custody compared to other post-divorce family structures, and (3) the influences of sibling-relationships and wider family.

4.6 Ethical considerations

Studying associated outcomes of divorce and non-traditional family forms is a topic of both public and academic importance, due to the commonality of experiencing these events during childhood. However, it also raises ethical challenges. Firstly, although research – including findings from the present thesis – tends to find that children and youth with divorced parents on average are less well-adjusted than peers with nondivorced parents, many nevertheless manage to get through the divorce process without long-lasting negative consequences for their well-being. Hence, it is

important to convey findings from divorce research in ways that neither oversimplifies nor stigmatizes families who experience divorce. Moreover, the present thesis sought to elucidate heterogeneous associations of divorce by parental educational qualifications, family structure, and sibling ties. It is thus important that the findings from the present thesis are disseminated without contributing to stigmatization and social exclusion of potentially vulnerable groups (e.g., single parent families, less educated families, families with stepparents and/or stepsiblings). In order to inform the present Ph.D. project, close collaborations were made with a user panel consisting of adolescents of similar age as those participating in the youth@hordaland study. In meetings with this group, I have gained first-hand information of adolescents' experiences with parental divorce and alternate living arrangements, and a special focus has been devoted to how the results of the present thesis can be disseminated in ways that are accessible, meaningful and respectful to children, youth, and parents experiencing divorce.

Secondly, it should be evident that the present thesis provides no basis to conclude that children with divorced parents would have been better off had their parents *not* divorced. Counterfactual statements within this research field are generally challenging, as numerous factors interplay in predicting both parents' inclination to divorce on their children's adjustment. Moreover, remaining married might also cause harm to children if it keeps them in a dysfunctional home.

4.7 Conclusions

In this thesis, data from youth@hordaland study linked to official national registry data, was used to expand the knowledge of circumstances where divorce is associated with adolescents' academic achievement, mental health problems, and health complaints. The results suggested heterogeneous outcomes of divorce on adolescents' academic achievement, whereby a divorce was more strongly and negatively related to adolescents' GPA in families with educated or highly educated mothers compared to families with less educated mothers. This finding highlights the need to consider how the outcomes of divorce may differ across socioeconomic strata.

Another key finding was that post-divorce family structure was associated with adolescents' mental health and levels of health complaints. Adolescents in joint physical custody reported lower levels of mental health problems and health complaints than peers in single parent or stepparent families. These findings were relatively robust to adjustments of socioeconomic factors. Lastly, the results from the current thesis suggest that sharing a household with biological siblings is associated with lower levels of health complaints, while living with stepsiblings is associated with higher levels of health complaints among girls. Capturing greater complexity in modern families by incorporating measures of siblings in the household may be important to advance our understanding of how families affect children's and adolescents' adjustment.

Divorce is a common phenomenon in western societies. Future studies should aim to continue to monitor developments in divorce rates and how families are organized, in order to further expand our understanding of factors that contribute to the relationships between divorce, family complexity, socioeconomic background, and physical, mental, and school-related outcomes among children and adolescents. There is still a need for longitudinal designs that may monitor families over time, in order to understand the processes and potential malleable factors that precede and follows from a divorce, in order to gain further knowledge that can be used to identify, and aid, parents and children that may be at heightened risk of negative outcomes.

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RESEARCH ARTICLE

Divorce and adolescent academic achievement: Heterogeneity in the associations by parental education

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Abstract

Background

The link between parental divorce and adolescents' academic achievement may depend on parental educational levels. However, findings have been inconsistent regarding whether the negative associations between parental divorce and adolescents' academic outcomes are greater or smaller in highly educated families. The present study aimed to investigate the possible heterogeneity in the associations between divorce and adolescents' academic achievement by parental educational levels, within the context of the elaborate Norwegian welfare state.

Methods

The population-based cross-sectional youth@hordaland study of adolescents aged 16–19 years conducted in Norway in 2012, provided information about parental divorce and was linked to national administrative registries ($N = 9,166$) to obtain high-quality, objective data on the adolescents' grade point average (GPA), and their parents' educational qualifications and income.

Results

The negative association between parental divorce and GPA was stronger among adolescents with educated or highly educated parents compared to adolescents with less educated parents. This heterogeneity was driven by maternal educational qualifications, whereby divorce was more strongly and negatively associated with GPA among adolescents with educated mothers compared to those with less educated mothers, independent of paternal educational levels and income measures.

data outside of Norway. In this specific case, ethics approval is also contingent on storing the research data on secure storage facilities located in our research institution. Data are from the Norwegian youth@hordaland study whose authors may be contacted at bib@uni.no.

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Conclusions

Among adolescents whose parents have low educational qualifications, parental divorce is not associated with their academic achievement. Educated divorced mothers appear less likely to transfer their educational advantages onto their children than nondivorced equally educated mothers, perhaps due to a "double-burden" regarding work pressure and child-rearing responsibilities. There is a need for future studies to detail the mechanisms underlying this finding.

Introduction

Children and adolescents with divorced or separated parents are less well-adjusted on *average* across a spectrum of outcomes, including physical and mental health, and do less well in school compared to those who grow up with nondivorced parents [1–3]. Adolescents whose parents divorce have been found to experience a decline in overall grade point average (GPA) of one quarter to one-third of a letter grade and to fail more classes than those continuously living with both parents [4]. In general, recent studies suggest that the association between divorce and youths' academic success is partly causal [5,6]. This link between divorce and poorer academic achievement is important, as successful schooling may have a long-term impact on later educational attainment, occupational and economic stability [7], and future physical and mental health [8–10].

To advance research on divorce and youth adjustment, we need to move beyond focusing on averages and try to elucidate for whom and under which circumstances divorce might be associated with adverse outcomes [1]. It is well established that parents' educational attainment is a strong predictor of their children's academic achievement [11,12]. Educated parents monitor their children's academic progress more closely, have more realistic expectations of their academic abilities, and apply more optimal parenting strategies than less educated peers; all factors linked to positive school outcomes among youth [11,13–15]. Further, educated parents may be better able than less educated parents to cope with a divorce due to having greater financial resources and otherwise being more robust against the often-stressful situation that divorce entails [16]. Thus, at face value, it could be reasonable to assume that highly educated parents, on average, buffer their children more against possible negative consequences of divorce on their academic achievement.

Interestingly, two contrasting theoretical perspectives have been proposed in explaining how a divorce might differently impact children's academic achievement by parental educational levels, and both have received empirical support. Building on the above argument, the *compensatory class* hypothesis posits that adverse life events (such as parental divorce or separation) are less harmful to children from higher class (i.e., highly educated) families [17]. Greater financial, social, and parental resources among educated parents might enable them to plan ahead and counteract possible adverse post-separation effects on their children [17,18]. In support of this perspective, a few studies have found that highly educated parents buffer their children against negative consequences of divorce on measures such as math and reading skills, GPA, and later educational attainment [17,19,20].

The *floor effects* hypothesis, on the other hand, states that children in less educated families have limited access to financial, social, and parental resources to begin with. Thus, they have less to lose from a divorce than peers from more affluent families, who may experience a more

substantial reduction in financial and parental resources invested in them [16,18,21]. Several recent studies support this perspective, whereby the educational disadvantages associated with divorce are relatively larger among children with highly educated parents [16,21–24]. For example, Martin [23] found a larger negative association of divorce among children with highly educated compared to children with less educated parents across current math test scores, GPA, and later educational transitions (e.g., high school completion).

Recent efforts have been made in trying to reconcile these contradictory findings (see [21,22]). Firstly, they may stem from differences in measurements and analyses across studies. Importantly, including both parents' educational qualifications in the analyses appears necessary to capture the parental and economic resources available to the child when one of the parents moves out of the home. Relying solely on maternal educational levels, for instance, may not capture the loss in resources experienced when an educated father moves out, and have been found to remove heterogeneity in the outcomes of divorce on adolescents' educational attainment [22]. Moreover, the results might depend on the educational outcome; while findings regarding later educational attainment tend to favor the floor effects hypothesis [16,21–24], studies investigating current school performance (e.g., subject grades, GPA, test scores) have yielded more inconsistent results [17,20,21,23].

The diverging results may also stem from societal factors that vary across countries and time periods, possibly impacting the mechanisms driving heterogeneous outcomes. The economic cost of divorce has traditionally been higher for women than men in several western countries [25,26]. Thus, children with an educated father may lose relatively more financial resources following divorce (as the father often moves out) than peers with a less educated father. Supporting this notion, two studies utilizing data from the 1970 British Cohort Study found that the relatively larger educational consequences of divorce among children with highly educated parents primarily was driven by the lost access to the fathers' resources [21,22]. However, as noted by the authors, only a minority of nonresident fathers paid child support during this period in Britain. Thus, the role of fathers' resources might be less important in other contexts. Indeed, a study on a somewhat more recent US sample found that maternal education was relatively more important than paternal education, whereby highly educated divorced *mothers* were less likely to transfer their educational advantages onto their children [23]. This finding was partly explained through highly educated divorced mothers' relatively lower academic expectations, involvement in school, and leisure activities, compared to nondivorced peers. As put by the author [23]; "*High status single mothers are accomplished, but frequently time constrained*".

Another potential source of diverging results may stem from the commonality of divorce across different educational strata across countries. A recent study found that parental divorce was more detrimental to the educational attainment among children whose parents had a low likelihood of divorce, compared to those with parents with a high likelihood of divorce [24]. A divorce might thus come as more of a shock among families unprepared for disruption, in turn negatively impacting the children from a perhaps otherwise privileged background. Among children with parents at a high risk of divorce, a divorce might rather be one of many adverse events faced during childhood.

Previous studies have primarily been conducted on British, US and German samples on cohorts from the 1970–1980s, and it is uncertain whether previous findings generalize to other contexts. In keeping with the stated need for studies on more recent samples and in other cultural contexts [21,22], this study sought to investigate the potential heterogeneity in the associations between parental divorce and adolescents' academic achievement within the elaborate Norwegian welfare state.

The Norwegian context

The Norwegian welfare state is amongst the biggest spenders on welfare in the world [27]. It provides an elaborate social safety net through free access to the health care system and access to sickness, unemployment, and family-related benefits. Levels of absolute deprivation and income inequality in Norway is low [28,29], and the population is highly educated; 38.2% of all women and 30.1% of all men had completed some form of university-level education in 2019 [30]. Like in the other Nordic welfare states, the "dual-earner family" is strongly encouraged; public childcare and schools are highly subsidized, and generous parental leave rights (also for the father) have facilitated the combination of full-time employment and childcare among both mothers and fathers (see [31]). Perhaps, as a result, fathers' housework and childcare time are generally high among most groups of fathers, although women still do more than their male partners [32].

The crude divorce rate in Norway has nevertheless more than doubled since the 1970s, and there were approximately two divorces per 1000 persons in 2016 [33]. The risk of divorce is higher for the less educated, whereby a couple where both have low levels of education run a risk that is more than four-fold in magnitude compared to couples where both have higher educational qualifications [34]. After a divorce, custodians are supported by tax deductions, law-regulated cash allowances, and child support, which is enforced by the public authorities. It is estimated that 50% of parents experience a drop in household income following a divorce in Norway [35]. Nevertheless, the Norwegian welfare state appears fairly successful in equalizing gender differences in the cost of divorce, whereby men and women experience an approximately equal 20% decline in disposable income [36]. This contrasts findings from many other countries where women often lose substantially more than men [25,26]. However, a divorce increases the sickness absence among women with children in Norway but less so for men [37]. This is in general keeping with the "double-burden" hypothesis [38], suggesting that high labor participation, coupled with high child-rearing responsibilities, could be an extra burden for divorced, educated women in Norway. Indeed, although the rates of families who share custody have risen in Norway in the last decades, approximately 65% still live in mother custody following divorce [39].

The link between parental divorce and academic achievement is well documented in Norway; divorce has been associated with having more problems in school [40], lower GPA [41,42], and lower probability of completing higher secondary education [43]. The rates of students not completing high-school are higher in Norway than in many other comparable countries [44]. Not receiving a high-school diploma is associated with a higher risk of later receiving medical and non-medical social insurance benefits [45], and thus represents a significant public health concern. Increased knowledge of the links between parental divorce, parental education, and adolescents' school performance, could thus provide insights that can be utilized in efforts aimed at facilitating high-school completion among adolescents.

The present study

The main aims of the present study were twofold: Firstly, to investigate the association between parental divorce and adolescents' GPA. Secondly, to examine whether parental educational qualifications moderated this association. To aid these aims, we draw on high-quality register-based measures of adolescents' GPA, parental educational qualifications, and household income, that were merged with a population-based study.

The present study contributes to this field by studying heterogeneous associations of divorce in a society that combines generous social benefits; a highly educated population; high levels of labor-force participation among women; gender equity in the cost of divorce; and

high divorce rates and gender differences in sickness absence and health outcomes among divorced individuals.

The high divorce rate among the relatively few uneducated parents in Norway suggests that a divorce perhaps is one of many adverse events experienced in these selected and often socio-economically disadvantaged families. This led us to expect that the negative association between divorce and adolescents' GPA would be stronger in more highly educated families where a divorce might carry greater changes to children's lives. However, as the Norwegian welfare state appears successful in equalizing the cost of divorce between men and women, we suspected that loss of fathers' financial resources following divorce might be less important in understanding potential heterogeneous outcomes in Norway compared to previous studies conducted in other sociopolitical contexts.

Materials and methods

Procedure

We used data from the youth@hordaland study, a population-based survey of adolescents aged 16–19, conducted in the spring of 2012 in Hordaland County, Norway. The youth@hordaland study aimed to assess mental health, family life, lifestyle, school performance, and health service use in adolescents. The adolescents received information about the study per e-mail, and one regular school hour was allocated to complete the questionnaire. Those not attending school on the day of the study could complete the questionnaire at their convenience, and some schools arranged catch-up days. A teacher organized the data collection and protected confidentiality. The adolescents themselves indicated if they consented to complete the entire survey or selected parts of it, as Norwegian regulations dictate that individuals aged 16 years and older are required to consent themselves. Their parents were informed about the study, and the study was approved by the Regional Committee for Medical and Health Research Ethics in Western Norway.

Sample

All adolescents born between 1993 and 1995 and residing in Hordaland at the time of the survey were invited (N = 19,439) to participate, and 10,257 agreed, yielding a participation rate of 53% for the entire study. The present paper is based on a subsample of 9,166 adolescents (47% of the invited population) who consented to register linkage. This subsample was nearly identical to the total sample with regards to age and gender distribution, and self-reported sociodemographics (S1 Table).

Measurements from registers

Age and gender. Date of birth and gender were obtained through the adolescents' identity number in the Norwegian National Registry. Exact age was calculated from the date of participation in the youth@hordaland study and the birthdate of participants.

GPA. The adolescents' GPA for each year in upper secondary education were obtained from the National education database in Norway (NUBD) that is owned and administered by Statistics Norway. NUBD contains educational statistics from elementary school through PhD-level. In Norway, each subject is graded on a scale ranging from 1 (failure) to 6 (excellent), and the GPA is thus calculated by taking the sum of all grades received in a given school year divided by the total number of subjects. The grades used in the current study stem from the school-year of 2011–2012. Thus, the grades correspond to the school year that the adolescents were in at the time of the youth@hordaland study. A previous publication found that the

mean GPA in the current sample was quite similar to both regional and national statistics, indicating representativeness of the sample [46].

Parental education. The highest completed educational level of both parents when the adolescents were 16 years old were also obtained from NUBD. The International Standard Classification of Education (ISCED) 2011 coding-scheme was utilized to create three main measures of parental educational levels: 1: A combined measure of parents' educational level indicating the highest completed education in the family by either the mother or the father. The categories were (1) both parents have no qualifications higher than lower secondary education (ISCED 0–2), (2) at least one parent has qualifications equivalent to ISCED 3–5 (upper secondary education, post-secondary non-tertiary education, short-cycle tertiary education), at least one parent has education on Bachelor's level or equivalent (ISCED 6), and at least one parent has attained a Master's or Doctoral level of education (ISCED 7–8). This variable aimed at capturing the range of parental educational levels within a manageable and meaningful set of categories.

2: A combined measure of parents' educational level used to investigate the relative importance of maternal and paternal educational levels. The categories were (1) both parents have no qualifications (ISCED 0–2), (2) only the mother has some qualifications (above ISCED 2), (3) only the father has some qualifications (above ISCED 2), and both have some qualifications (above ISCED 2). This operationalization or similar has been utilized by previous studies [21,22], and we report the results of this categorization in order to facilitate comparison with the pre-existing literature.

3: We also created separate variables for maternal and paternal educational levels to investigate how sensitive the estimates were based on the choice creating combined measures of parents' education, and to further detail the relative contribution of maternal and paternal educational qualifications within a broader range of educational levels (i.e., ISCED 0–2, ISCED 3–5, ISCED 6, ISCED 7–8).

Measures of family finances. The Norwegian national income registry provided information on family finances. The Norwegian Government utilizes this data to estimate taxation, and it can be considered to be of high quality. We utilized three measures of income as covariates in the analysis: Mother's and father's net income (i.e., the sum of wages and salaries, income from self-employment, property income and transfers received minus total assessed taxes and negative transfers), and the equivalized disposable income (EDI) in the household occupied by the adolescents. EDI is a measure of income in a household that is adjusted by an equivalence scale. EDI has been documented in prior publications from the youth@hordaland study [47,48]. The current study utilizes the OECD modified scale, which gives the first adult in the household a weight of 1, subsequent adults are given a weight of 0.5, and each child below 14 years of age is given a weight of 0.3 [49]. The equivalence scale thus enables comparison between households of different sizes and compositions. All income measures stem from the year 2011.

Measures from the youth@hordaland study

Parental divorce or separation. We coded experience of divorce or separation according to the adolescents' answers to the following questions: "Do your biological parents live together?" and "Have your biological parents divorced or separated?". Adolescents stating that their biological parents did not live together and that their biological parents had divorced or separated were categorized as having divorced parents, while those stating that their biological parents still lived together were defined as living in a nondivorced two-parent (i.e., nuclear) family. These items allowed us to separate between adolescents whose parents split apart, from

adolescents whose parents never lived together, were separated due to death, illness or other reasons (which were removed from the analyses), and resulted in a dummy coded variable (0 = nondivorced/nuclear family, 1 = divorced family). The adolescents also reported year of parental divorce or separation allowing us to calculate a variable of years since the event of dissolution.

We had no means of determining whether the parents were legally married. Official statistics report that 73.5% of children and youth below the age of 18 in a two-parent household in Hordaland county in 2012 lived with married parents (the rest with cohabiting parents) [50]. Thus, the nondivorced group in the present study most likely contained a group of adolescents with parents that had cohabitated since their birth. As some cohabiting unions eventually marry, we find it likely that the proportion of cohabiting unions in the present sample was somewhat lower than regional estimates also including younger children. Similarly, the divorced group likely contained a group of adolescents whose parents split up from cohabitation. Unfortunately, no official statistics regarding dissolution from cohabiting unions in Norway exists. Our inability to exactly detail the adolescents' family structure is not unique to the present study but has been rather common within this research field [2]. For ease of exposition, while keeping the aforementioned statistics in mind, we use the term *divorce* to refer to the dissolution of either cohabitating or marital unions.

Statistical analyses

Ordinary Least Squares (OLS) regression analyses were conducted to investigate the associations between parental divorce, parental education, and the adolescents' GPA. In the first OLS models, we used the highest completed education in the family as a measure of parental education. The regression models were structured as follows: A baseline model estimating the associations between parental divorce and adolescents' GPA, adjusted by gender and age; Model 1 included the measure of parents' highest completed education; Model 2 added the interaction term between education and parental divorce to investigate the possible heterogeneity in the effects of divorce on the adolescents' GPA; and Model 3 further included the equivalized disposable income in the household currently occupied by the adolescent, mother's net income, and father's net income. These income measures would thus shed light on the possible attenuating effects of both maternal and paternal income levels on the associations between divorce, parental educational levels, and their interactions.

Age and all income measures were centered on their respective means in the regression analyses to ease the interpretation of the regression coefficients. The income measures were divided by a factor of 100,000. Thus, the regression coefficients of the income measures indicate the predicted change in the adolescents' GPA by an increase of 100,000 NOK above the mean.

To replicate the categorization of parental education used by several prior studies [21–23], the above models were re-run utilizing the second measure of parental education, separating families where either none, only the mother, only the father, or both parents had educational qualifications greater than ISCED 2.

Lastly, to test the sensitivity of the above models and to investigate further possible differential associations of maternal and paternal educational levels, the analyses were re-run with maternal and paternal education entered as separate predictors, while retaining the full range of educational levels.

In all regression models, the reference categories for the parental educational variables were set at the lowest parental educational level (i.e., ISCED 0–2). Checks were made for other

differences between the educational levels in the association between divorce and the adolescents' GPA by alternating the reference categories.

Incomplete responses were fairly low in the current sample, where the majority of missing values pertained to the divorce status variable (8.8%), followed by father's net income (4.6%) and parental education (3.7%), whereas the remaining variables utilized in the current study had below 3% missingness. Due to the relatively low proportion of incomplete responses, missing values were handled by listwise deletion in the regression analysis.

Robustness and sensitivity analyses. Conditioning on measures of income and paternal and maternal education simultaneously may introduce overcontrol bias [51]. In the two first set of regression analyses, we try to avoid this problem by creating single measures combining information on parental education from both parents, and by entering income variables in the last set of models (as we were not interested in the main effects of income per se). In the last set of regressions, we have made robustness checks by entering maternal and paternal education in separate models.

The timing of divorce could potentially covary with parental educational levels and the adolescents' GPA (e.g., if highly educated parents divorced later on, the estimates of divorce by parental education on the adolescents' GPA could be influenced by the proximity to the event of dissolution). Moreover, association between timing of divorce and the adolescents' GPA may depend on parental educational qualifications (i.e., that more time spent with highly educated divorced parents differ from time spent with lowly educated divorced parents). We investigate these issues by comparing years since divorce across parental educational levels, and by graphically plotting potential linear and non-linear relationships between timing of divorce and GPA by parental educational qualifications. Generalized additive models (GAMs) were used to investigate potential non-linear relationships. In brief, GAMs may be considered as a semi-parametric extension of the generalized linear model, with the strength of the ability to detect non-linear structures in data that otherwise might be missed [52].

Lastly, we performed checks utilizing the income measures as alternative indicators of the family's socioeconomic resources. The income measures were divided into quartiles (i.e., into four equal parts representing the lowest 25% to the highest 25%), and the adolescents' GPA was regressed on the interaction term between parental divorce and the income quartiles (similarly to the procedure described above).

All statistical analyses were conducted using R version 3.5.2 for Mac [53]. Figures were created with the packages "ggplot2" [54], "sjPlot" [55], and "ggstatsplot" [56]. The GAMs were plotted with aid from the "mgcv" package [57] within the "geom_smooth" function of the ggplot2 package. For brevity, statistical parameters are included in figures displaying pairwise comparisons. In Table 1, the effect sizes for categorical variables were calculated from the Mahalanobis distance method and compared between groups [58].

Results

Characteristics of the sample

There were fewer boys in the divorced sample (43.6%) compared to the nondivorced sample (47.2%). Parents who divorced had lower education; almost twice as many divorced parents did not have higher than ISCED 2 qualifications (6.6%) compared to nondivorced parents (3.8%), and having qualifications equivalent to Bachelor's level (ISCED 6) or Master's or PhD-levels (ISCED 7–8) were more frequent among nondivorced parents compared to divorced parents. Divorced households had lower equivalized disposable income compared to nondivorced households. While nondivorced fathers had higher net earnings than their divorced

Table 1. Sociodemographic statistics of the sample (n = 8360).

	Nondivorced families (n = 5809)	Divorced families (n = 2551)	Eff.size
	n (%)	n (%)	
Age [mean (sd)]	17.41 (0.84)	17.42 (0.83)	0.016
Male	2744 (47.2)	1113 (43.6)	0.072
Years since divorce [mean (sd)]	-	10.58 (5.20)	
Highest completed education in the family			0.267**
ISCED 0–2	217 (3.8)	158 (6.6)	
ISCED 3–5	2273 (39.9)	1168 (48.8)	
ISCED 6	2192 (38.4)	794 (33.2)	
ISCED 7–8	1019 (17.9)	271 (11.3)	
Parental education above/below ISCED 0–2			0.284**
No parent > ISCED 2	217 (3.8)	158 (6.6)	
Only father > ISCED 2	610 (10.7)	320 (13.4)	
Only mother > ISCED 2	495 (8.7)	367 (15.3)	
Both parents > ISCED 2	4379 (76.8)	1546 (64.7)	
Maternal education			0.213**
ISCED 0–2	848 (14.7)	512 (20.5)	
ISCED 3–5	2138 (37.2)	1027 (41.0)	
ISCED 6	2281 (39.7)	816 (32.6)	
ISCED 7–8	484 (8.4)	148 (5.9)	
Paternal education			0.338**
ISCED 0–2	722 (12.6)	531 (22.0)	
ISCED 3–5	2463 (43.0)	1150 (47.6)	
ISCED 6	1755 (30.6)	537 (22.2)	
ISCED 7–8	792 (13.8)	198 (8.2)	
Household income measures, in 100, 000 NOK [mean (sd)]			
Equivalized disposable income	3.71 (2.42)	3.02 (1.70)	0.330**
Net income mother	3.18 (2.05)	3.59 (2.39)	0.186**
Net income father	4.89 (4.47)	4.19 (2.77)	0.187**
Grade point average [mean (sd)]	4.07 (0.86)	3.76 (0.94)	0.339**

Eff. Size = effect size, as represented by the standardized mean difference. For categorical variables, the effect sizes were calculated from the Mahalanobis distance method. NOK = Norwegian krone.

** $p < 0.01$; p-values derived from chi square tests for categorical variables, and Welch two-sample t test for continuous variables.

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counterparts, divorced mothers had higher net earnings than nondivorced mothers (see Table 1 for details).

Regression results

Highest education in the family. The first tested OLS models utilizing the highest completed education in the family as a measure of parental education are displayed in Table 2. The baseline model indicated that adolescents with divorced parents on average had 0.30 points lower GPA score (Cohen's d = 0.34) compared to their peers with nondivorced parents. Statistically controlling for the highest completed parental educational level (Model 1), reduced the strength of the association between parental divorce and GPA by 0.06 GPA points (20%), indicating that the association between parental divorce and GPA were relatively robust to adjustments for parental educational levels. Independent of parental divorce, higher education in the

Table 2. Regression estimates of GPA by parental divorce and the highest parental education in the family (n = 7,739).

	Baseline model	Model 1	Model 2	Model 3
	b (S.E)	*b* (S.E)	*b* (S.E)	*b* (S.E)
Parental divorce (ref. nondivorced)	-0.300 (0.022) **	-0.240 (0.021) **	-0.037 (0.092)	-0.048 (0.092)
Gender (ref. girl)	-0.207 (0.020) **	-0.217 (0.019) **	-0.217 (0.019) **	-0.218 (0.019) **
Age	-0.087 (0.012) **	-0.088 (0.011) **	-0.088 (0.011) **	-0.089 (0.011) **
Highest education in the family (ref. both ISCED 0–2)				
ISCED 3–5	-	0.376 (0.048) **	0.458 (0.062) **	0.448 (0.062) **
ISCED 6	-	0.654 (0.048) **	0.748 (0.062) **	0.728 (0.062) **
ISCED 7–8	-	0.921 (0.051) **	0.998 (0.065) **	0.964 (0.065) **
Highest education x Parental divorce				
ISCED 3–5 x Parental divorce	-	-	-0.202 (0.097) *	-0.201 (0.097) *
ISCED 6 x Parental divorce	-	-	-0.245 (0.099) *	-0.246 (0.099) *
ISCED 7–8 x Parental divorce	-	-	-0.169 (0.109)	-0.172 (0.109)
Income measures				
Household EDI	-	-	-	-0.011 (0.009)
Net income father	-	-	-	0.010 (0.009) *
Net income mother	-	-	-	0.017 (0.009) **
Constant	4.181 (0.015) **	3.618 (0.047) **	3.535 (0.060) **	3.556 (0.060) **
Adjusted R^2	0.042	0.108	0.108	0.110

b = unstandardized regression coefficient, S.E = standard error, ref. = reference group.

Age and income variables are centered on their respective means. All income measures are presented in 100,000 NOK.

EDI = Equivalized disposable income.

* $p < 0.05$

** $p < 0.01$

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family was associated with a higher GPA. The interactions between divorce and parental education were further added in model 2, while income measures were added in model 3. Taken together, the results from these models showed that the associations between having divorced parents and the adolescents' GPA were significantly stronger among adolescents where the highest parental education was at secondary school levels (ISCED 3–5) or Bachelor's levels (ISCED 6), compared to those with parents that did not have higher than basic-level education (ISCED 0–2). Although the same trend was observed among adolescents with at least one parent with a Master's or PhD-level education (ISCED 7–8), the interaction term was not significant. Including the income measures (Model 3) hardly changed these estimates. The interactions are visually depicted in Fig 1A.

Maternal and paternal education. The OLS models with the parental education measure differentiating between families where either mother, father, or both had above ISCED 2 qualifications are displayed in Table 3. The main findings from these models were that the associated reduction in GPA by having divorced parents was significantly larger if only the mother or both parents had above ISCED 2 qualifications, compared to if no parent had above ISCED 2 qualifications. If only the father had above ISCED 2 qualifications, however, no significant interaction with parental divorce was observed (see Fig 1B).

To check whether the estimates from the above models were sensitive to the choice of combining the maternal and paternal educational levels into overall measures parental education, the analyses were re-run by entering paternal and maternal education as two separate and independent variables. These models revealed that the heterogeneity in the associations between divorce and GPA by parental education were driven by maternal educational levels;

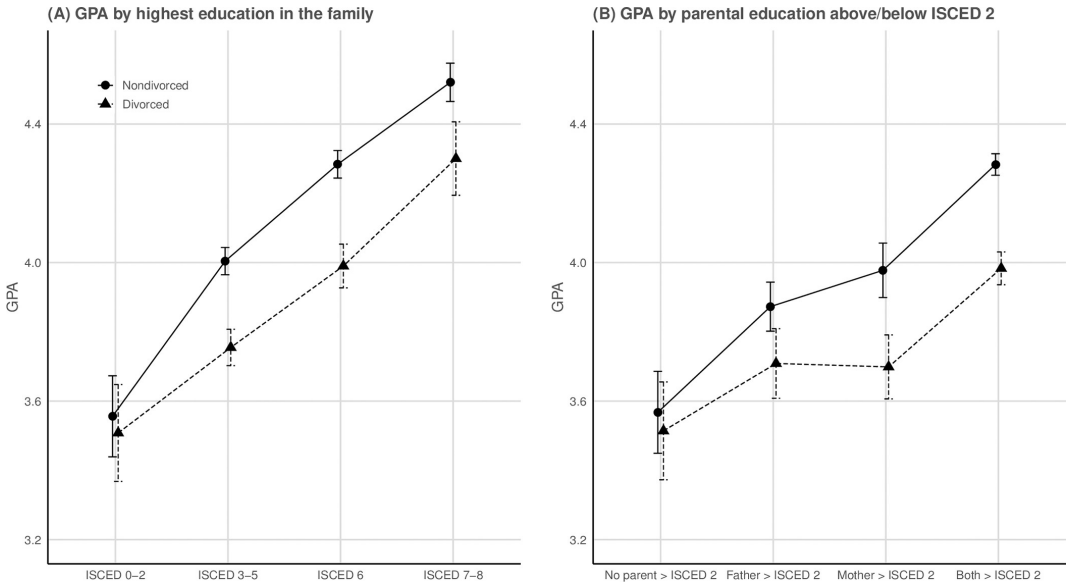

Fig 1. Predicted values of GPA by parental divorce and highest education in the family (n = 7,739). The predicted values of GPA by (**A**) the highest educational qualifications obtained in the family, and (**B**) by the highest maternal and paternal education above/below ISCED 2 from the fully adjusted regression models (cf. Tables 2 and 3), stratified by divorce status. Error bars represent 95% confidence intervals of *b*. **A**: ISCED 0–2 = up to lower secondary education, ISCED 3–5 = upper secondary education, post-secondary non-tertiary education, short-cycle tertiary education, ISCED 6 = Bachelor's level, ISCED 7–8 = Master's or Doctoral level. **B**: No parent > ISCED 2 = No parent with higher than lower secondary education, Father > ISCED 2 = Only father has above lower secondary education, Mother > ISCED 2 = Only mother has above lower secondary education, Both > ISCED 2 = Both parents have above lower secondary education.

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the estimated reduction in GPA by having divorced parents was statistically significantly higher when maternal educational levels were at secondary school levels (ISCED 3–5; b = -0.120, $p < 0.05$), at Bachelor's levels (ISCED 6; b = -0.175, $p < 0.05$) and at Master's or PhD-level (ISCED 7–8; b = -0.209, $p < 0.05$) compared to basic-level education (ISCED 0–2), after adjustments for paternal education and income measures. There were, however, no significant interaction effects between paternal educational levels and divorce on the adolescents' GPA while holding the effects of maternal education and income constant (see Table 4; Fig 2A and 2B).

Alternating the reference categories of the parental education variables in the regression analyses did not reveal any further statistically significant differences in the links between divorce and GPA by parental educational qualifications (i.e., the main differences were between the ISCED 0–2 levels and the other ISCED levels).

Robustness checks. Entering maternal and paternal educational levels in separate models, in order to check for overcontrol bias, yielded approximately identical estimates. The only exception was that the difference in the relationship between divorce and GPA was slightly smaller and not statistically significantly different (at $p < 0.05$) between the highest maternal educational levels (ISCED 7–8) compared to the lowest maternal educational levels (ISCED 0–2) in the interaction analyses (b = -0.163, p = 0.096).

Adolescents with highly educated parents experienced, on average, that their parents divorced somewhat later (see Fig 3A and 3B). The mean difference in years since divorce

Table 3. Regression estimates of GPA by parental divorce and maternal and paternal education above/below ISCED 2 (n = 7,739).

	Baseline model	Model 1	Model 2	Model 3
	b (S.E)	*b* (S.E)	*b* (S.E)	*b* (S.E)
Parental divorce (ref. nondivorced)	-0.300 (0.022) **	-0.254 (0.021) **	-0.037 (0.093)	-0.054 (0.093)
Gender (ref. girl)	-0.207 (0.020) **	-0.213 (0.019) **	-0.213 (0.019) **	-0.215 (0.019) **
Age	-0.087 (0.012) **	-0.085 (0.012) **	-0.085 (0.012) **	-0.087 (0.012) **
Parental education (ref. both ISCED 0–2)				
Only father > ISCED 2	-	0.263 (0.054) **	0.318 (0.069) **	0.305 (0.069) **
Only mother > ISCED 2	-	0.335 (0.055) **	0.432 (0.071) **	0.410 (0.071) **
Both parents > ISCED 2	-	0.654 (0.047) **	0.751 (0.061) **	0.715 (0.061) **
Parental education x Parental divorce				
Only father > ISCED 2 x Parental divorce	-	-	-0.111 (0.112)	-0.111 (0.111)
Only mother > ISCED 2 x Parental divorce	-	-	-0.236 (0.111) *	-0.225 (0.111)*
Both parents > ISCED 2 x Parental divorce	-	-	-0.248 (0.097) *	-0.246 (0.096) *
Income measures				
Household EDI	-	-	-	-0.014 (0.009)
Net income father	-	-	-	0.015 (0.004) **
Net income mother	-	-	-	0.027 (0.006) **
Constant	4.181 (0.015) **	3.622 (0.048) **	3.533 (0.060) **	3.567 (0.060) **
Adjusted R^2	0.042	0.086	0.087	0.092

b = unstandardized regression coefficient, S.E = standard error, ref. = reference group.

Age and income variables are centered on their respective means. All income measures are presented in 100,000 NOK.

EDI = Equivalized disposable income.

* $p < 0.05$

** $p < 0.01$

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among highly educated (i.e., ISCED 7–8) vs. lowly educated (i.e., ISCED 0–2) mothers was about 2.2 years, while the comparable figure among fathers was 2.8 years. Plotting the adolescents' GPA as a function of years since divorce across the parental educational qualifications (see Fig 4) revealed a slight negative linear association between years since divorce and GPA across most of both maternal and paternal educational levels. The negative association between time since divorce and GPA was strongest among lowly educated mothers. As lowly educated mothers on average had most years since divorce, this finding highlights that time since divorce could not explain the heterogeneity in the associations between divorce and the adolescents' GPA by maternal educational qualifications. Indeed, the plot suggests that holding years since divorce constant across maternal educational qualifications would slightly strengthen the difference in the negative association between divorce and GPA among adolescents with highly- compared to lowly educated mothers.

The plotted GAM curves show some variability around the linear functions for some of the parental educational levels. Overall, these trends do not give any strong indications that GPA is highly influenced by the timing of divorce in the present study.

Lastly, using equivalized disposable income (EDI) as an alternative indicator of socioeconomic resources, we found a similar but weaker pattern whereby the negative association between divorce and GPA was relatively stronger among adolescents in the second income quartile (Q_2; b = - 0.16, $p < 0.01$) and in the fourth quartile (Q_4; b = -0.15, p = 0.02) compared to those in the first quartile (Q_1). The difference between Q_1 and Q_3 was not statistically significant (see S1 Fig with further test statistics). Adjusting the analyses for parental educational qualifications attenuated and removed the significant difference between Q_1 and Q_4. No

Table 4. Regression estimates of GPA by maternal and paternal education (n = 7,739).

	Baseline model	Model 1	Model 2	Model 3
	b (S.E)	*b* (S.E)	*b* (S.E)	*b* (S.E)
Parental divorce (ref. nondivorced)	-0.300 (0.022) **	-0.222 (0.021) **	-0.099 (0.064)	-0.104 (0.064)
Gender (ref. Girl)	-0.207 (0.020) **	-0.216 (0.019) **	-0.215 (0.019) **	-0.216 (0.019) **
Age	-0.087 (0.012) **	-0.087 (0.011) **	-0.087 (0.011) **	-0.087 (0.011) **
Maternal education (ref. ISCED 0–2)				
ISCED 3–5	-	0.242 (0.028) **	0.283 (0.035) **	0.279 (0.035) **
ISCED 6	-	0.401 (0.030) **	0.457 (0.036) **	0.447 (0.036) **
ISCED 7–8	-	0.541 (0.045) **	0.605 (0.053) **	0.584 (0.054) **
Paternal education (ref. ISCED 0–2)				
ISCED 3–5	-	0.187 (0.029) **	0.197 (0.036) **	0.196 (0.037)
ISCED 6	-	0.323 (0.032) **	0.319 (0.039) **	0.313 (0.039)
ISCED 7–8	-	0.512 (0.040) **	0.492 (0.047) **	0.483 (0.048)
Maternal education x Parental divorce				
ISCED 3–5 x Parental divorce	-	-	-0.120 (0.060) *	-0.119 (0.060) *
ISCED 6 x Parental divorce	-	-	-0.176 (0.064) **	-0.175 (0.064) **
ISCED 7–8 x Parental divorce	-	-	-0.212 (0.105) *	-0.209 (0.105) *
Paternal education x Parental divorce				
ISCED 3–5 x Parental divorce	-	-	-0.027 (0.059)	-0.029 (0.059)
ISCED 6 x Parental divorce	-	-	0.023 (0.068)	0.016 (0.068)
ISCED 7–8 x Parental divorce	-	-	0.096 (0.092)	0.091 (0.092)
Income measures				
Household EDI	-	-	-	-0.006 (0.009)
Net income father	-	-	-	0.006 (0.004)
Net income mother	-	-	-	0.011 (0.006) *
Constant	4.181 (0.015) **	3.636 (0.033) **	3.593 (0.040) **	3.605 (0.040) **
Adjusted R^2	0.042	0.119	0.120	0.120

b = unstandardized regression coefficient, S.E = standard error, ref. = reference group.

Age and income variables are centered on their respective means. All income measures are presented in 100,000 NOK.

EDI = Equivalized disposable income.

* $p < 0.05$

** $p < 0.01$

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heterogeneity in the associations between divorce and GPA by mother's or father's net income were found (results not shown).

Of note, it is highly likely that the potential heterogeneity by measures of household income in the links between divorce and academic outcomes is sensitive to how income is operationalized. As parental education was the main focus of interest in the present study, we did not examine this any further in the present paper (e.g., other ways of dividing income into categories).

Discussion

The purpose of this study was to investigate the possible existence of heterogeneity in the association between divorce and adolescents' academic achievement within the context of an elaborate welfare state such as Norway. As expected, adolescents with divorced parents had on average lower GPA compared to their peers with nondivorced parents. This difference was robust and only moderately reduced (from 0.30 to 0.24 points, about 20%) after adjustments

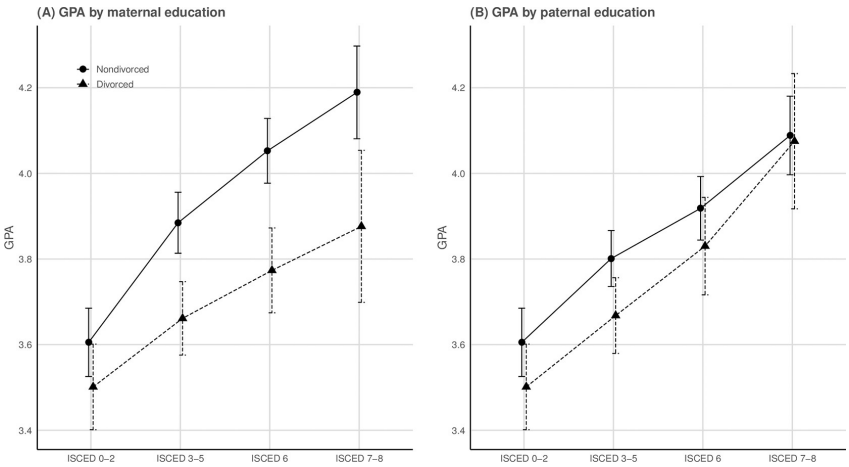

Fig 2. Predicted values of GPA by maternal and paternal educational qualifications (n = 7,739). The predicted values of GPA by (**A**) maternal educational qualifications, and (**B**) paternal educational qualifications from the fully adjusted regression models, stratified by divorce status (cf. Table 4). Error bars represent 95% confidence intervals of *b*. ISCED 0–2 = up to lower secondary education, ISCED 3–5 = upper secondary education, post-secondary non-tertiary education, short-cycle tertiary education, ISCED 6 = Bachelor's level, ISCED 7–8 = Master's or Doctoral level.

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for parental education. This finding fits well with previous studies [2,4,6], and suggest that divorce is associated with poorer school performance also among Norwegian adolescents.

The negative association between divorce and GPA was relatively stronger among adolescents where at least one of the parents had educational qualifications equivalent to upper secondary education or a bachelor's degree, compared to families without any educational qualifications. Further analyses revealed that this heterogeneity was primarily driven by maternal educational levels, whereby having divorced parents was more strongly and negatively associated with the GPA among adolescents with educated mothers (i.e., above ISCED 2) than among adolescents with less educated mothers (i.e., ISCED 0–2), after holding the effects of paternal education and income constant.

Overall, our findings thus lend support to the *floor effects* hypothesis [21], suggesting that the negative associations between divorce and adolescents' academic achievement are relatively stronger among adolescents with educated parents, compared to those with less educated parents. Similar floor effects have been reported in terms of youths' later educational attainment [16,21,22]. Our results also align with the study by Martin [23], which found that the link between divorce and subject grades was relatively stronger among adolescents with educated mothers compared to less educated parents. Other studies have, however, reported either no heterogeneity in GPA according to parental education [21], or a compensatory advantage of having educated parents on current school performance [17,20].

The heterogeneity in the associations between parental divorce and adolescents' GPA observed in the present study stem from two related findings: Firstly, a divorce was hardly related to the GPA among adolescents with two uneducated parents. Secondly, among adolescents with educated or highly educated mothers, a relatively larger negative association between divorce and the adolescents' GPA was observed. We offer the following interpretation of how this pattern may come about within the Norwegian context:

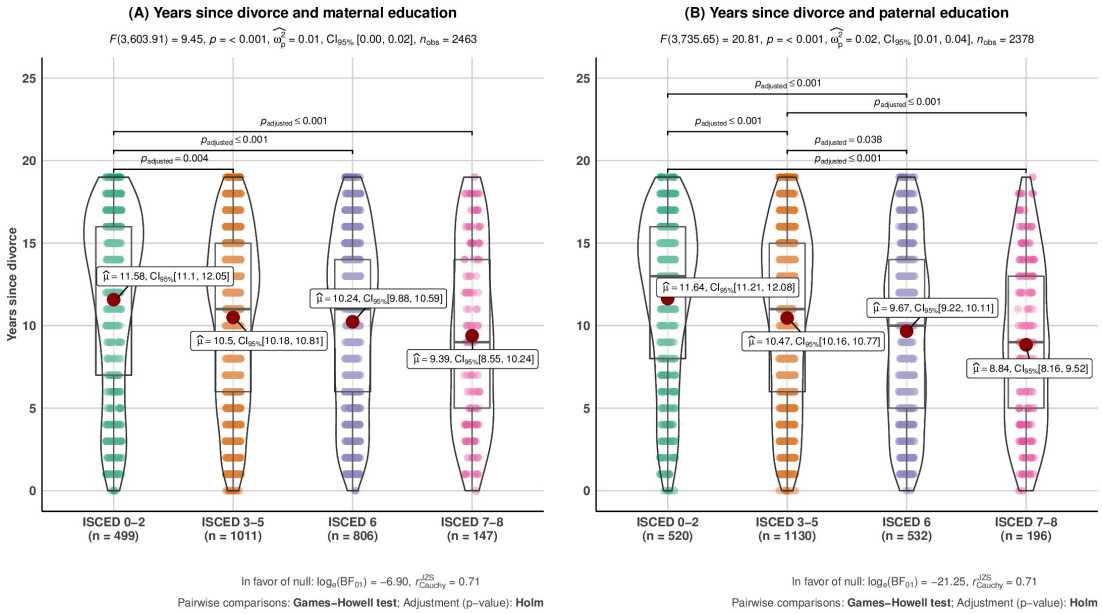

Fig 3. Years since divorce across maternal (n = 2,463) and paternal (n = 2,378) educational qualifications. Pairwise comparisons of years since divorce across maternal (**A**) and paternal (**B**) educational qualifications. The plots comprise a mix of a violin plot (displaying the shape of the variable distribution) and a box plot (where the box is split by the median and bounded by the first and third quartiles of the distribution) along with the jittered raw datapoints. The red dot signifies mean values, also reported in text as $\hat{\mu}$ with accompanying 95% confidence intervals ($CI_{95\%}$). Only significant pairwise comparisons are shown with accompanying p-values.

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The Norwegian population is highly educated, and families where both parents have low levels of educational qualifications are relatively rare. Social gradients in health and education are nevertheless well established also in Norway [59,60], and socioeconomically disadvantaged families have more frequent experiences of negative life events and family stresses (e.g., stress related to unemployment, work, and housing) including higher rates of marital dissolution than more affluent families [34,61]. The on average higher levels of family instability experienced by children in uneducated families might suggest that these children have come to expect adverse events in their lives. A divorce might thus be but one of several potential adversities experienced during childhood, rendering the independent effect of divorce less severe [24]. Moreover, the expected school performance among adolescents with parents with low levels of education are, on average, already weak to begin with. Thus, there is less room for their grades deteriorating further as a consequence of divorce. It is also conceivable that the elaborate welfare systems in Norway effectively buffer against further financial strain following divorce among less educated families, perhaps partly because there is less potential for their economic situation to worsen any further. Thus, although less educated families are more likely to experience stress related to poor family finances, a divorce might not exacerbate their financial situation.

We found that the negative association between divorce GPA was relatively larger among adolescents with educated compared to less educated mothers. Martin [23] reported a similar finding in the U.S., which in turn was partly explained by children of educated divorced/single

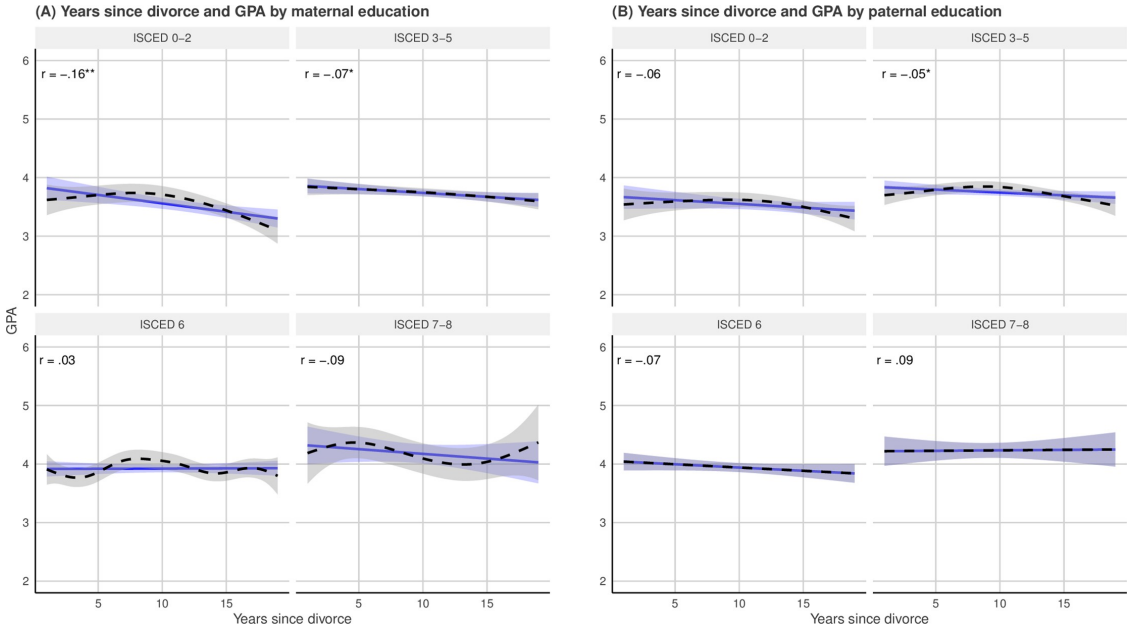

Fig 4. Associations between years since divorce and GPA by maternal (n = 2,463) and paternal (n = 2,378) educational qualifications. This figure shows the associations between years since divorce and the adolescents' GPA by maternal (**A**) and paternal (**B**) educational qualifications. The blue lines represent the linear association, while the smoothed dotted black lines stem from GAMs The shaded area represents the 95% confidence intervals. Pearson's product-moment correlations of the linear associations are displayed in the top left quadrants with asterisks denoting statistically significant associations (* < 0.05, ** < 0.01).

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mothers not receiving similar levels of positive parenting practices as peers with educated married parents. Such mechanisms were not explored in the current study. Thus, we can only speculate to whether they also apply to the Norwegian context. However, this explanation may fit the notion of a "double burden" experienced by educated, divorced single mothers in Norway, due to the strain of high workload combined with child-rearing responsibilities [37,38]. As it takes time and effort to engage in parenting practices that foster academic skills in children, educated divorced mothers are perhaps less able to continue providing such parenting practices to the same extent after the divorce relative to their equally educated married counterparts. Less educated mothers may, however, not have spent as much time fostering such skills to begin with.

Moreover, as the divorce might come as more of a shock among both parents and children in educated families [24], school-promoting activities might be more offset as the family tries to adjust to post-divorce family life.

Adjusting the analyses by measures of parental income hardly changed the estimated interactions between divorce and parental educational levels on the adolescents' GPA. This contrasts the findings of Bernardi and Boertien [21,22], which found that the link between divorce and adolescents' educational attainment among youth with highly educated parents was driven by the loss of access to father's financial resources following divorce. These studies were, however, conducted on a cohort born in 1970 in Britain, a context with higher levels of single mother poverty and where divorced fathers often failed to pay child support, as noted by the

authors [22]. The Norwegian welfare state, on the other hand, appears to be rather successful in equalizing the cost of divorce among men and women [35,36]. Hence, the departure of an educated father after a divorce may arguably be less economically detrimental to divorced mothers in Norway. Moreover, income is likely more important when considering later educational attainment than current school performance in countries where admission to higher education is costly. It is important to stress that our findings do not suggest that income is irrelevant to children's post-divorce adjustment, and indeed, single mothers are also in Norway among the least well of in society. Instead, the results of this study suggest that other mechanisms might be more important in explaining the observed heterogeneity in the associations between divorce and GPA by parental educational qualifications.

Our findings were robust to adjustments of age, gender, and current income measures. Adolescents with highly educated parents experienced, on average, that their parents had divorced somewhat more recently. Time since divorce was overall weakly and negatively associated with the adolescents' GPA, with some small observable variations across parental educational qualifications. These variations could, however, not explain the heterogeneity found in the present study. Overall, this is generally in keeping with studies that find that youth post-divorce adjustment is quite stable or gradually slightly worsen as time passes since the divorce [62,63].

Some previous studies have adjusted their analyses by different pre-divorce characteristics such as the child's behavioral problems, cognitive abilities, and material resources [21], the child's psychological well-being, academic ability, mothers' distress, and their family's pre-divorce economic resources [20], or utilized family fixed effects models [17]. Unfortunately, besides parental education, which is usually established before a divorce, other pre-divorce measures were not available in the current study. It is plausible that the differential inclusion of pre-divorce characteristics may account for parts of the diverging results. Other differences between the studies, such as the operationalization of dependent variables, differences in age groups, and cross-national differences, are also likely of importance. Compared to previous studies examining cohorts from the 1970s - 1980s [20,21,23], the current study is nonetheless unique by being based on a relatively recent cohort (born 1993–1995, and assessed in 2012). Due to the elaborate social welfare systems in Norway, where the school system is highly subsidized, higher education is common, and gender equity is high [44,64], direct comparisons with studies utilizing older samples from other countries should be made with care.

The following limitations of the current study should further be acknowledged. Firstly, due to the cross-sectional structure of our study, we have had no means of investigating potential changes from pre- to post-divorce family life. Proposed explanations such as changes in parenting among highly educated parents following divorce have, therefore, not been examined. Hence, this study is largely descriptive. Similarly, we did not have data to control for further differences between divorced and nondivorced families, which may induce selection effects [1]. For example, historical information that could both increase parents' inclination to divorce, and possibly affect the adolescents' GPA differently according to parental educational levels (e.g., mental health problems or levels of parental conflict) could be of importance and might explain the larger educational penalty observed in families with highly educated parents [22,65]. Of note, studies that have statistically adjusted their analysis by pre-divorce characteristics often find that it weakens the associations between divorce and educational outcomes [43]. The present study might thus overestimate the link between divorce and GPA. Nonetheless, divorce is generally understood as a process that gradually unfolds, rather than being a discrete point in time [1]. Adjustments of pre-divorce characteristics are thus not without problems either, as it may remove some of the effects that are intrinsically linked to the divorce

process. Adjustments of pre-divorce characteristics should, therefore, be made with care [1,66].

The present study focused on the distinction between divorced and nondivorced families, whereas an investigation of other family structures or arrangements (e.g., single father families, stepfamilies, joint physical custody) were outside the scope of this study. Adolescents' mental health and school engagement are found to vary across family structures [67–69]. It would be interesting for future studies to conduct a more detailed investigation of whether heterogeneous outcomes of divorce by parental education also depend on the post-divorce family structure. The findings of the present study might also depend on the adolescents' gender, an issue that warrants further investigations.

Lastly, the participation rate in the youth@hordaland study was 53%, and the sample in the current study was further reduced to 47% of the total invited population. Previous investigations have found that the GPA in this sample were quite similar to and not statistically significantly different from both the regional and national averages [46]. Nevertheless, non-response is known to be related to lower socioeconomic status, and an earlier study on the former waves of the Bergen Child Study (which the youth@hordaland is nested within) found more psychological problems among those not participating [70]. This could limit the generalizability of the findings.

Despite these limitations, some strengths of the current study deserve mentioning. We utilized high-quality register-based information about the adolescents' GPA, parental educational levels, and household income, which was merged with a large population-based study. Whereas previous studies have calculated the GPA by a subset of either subject grades, test scores, or exams, sometimes self-reported, the measure of GPA utilized in the current study is calculated from all graded subjects during a whole school year. As the measure of GPA used in the present study forms the primary basis for admittance into higher education in Norway, it may be considered highly reliable.

Conclusion

To conclude, the present study found that the association between parental divorce and adolescents' GPA is robust also within a Norwegian context. However, divorce was hardly associated with GPA among adolescents whose parents have low educational qualifications. In contrast, among adolescents from families with educated or highly educated mothers, parental divorce was associated with a lower GPA. These findings were robust to adjustments of measures of household income. Future studies are needed to investigate potential mechanisms (such as reduced parental monitoring or school-involvement), which might drive this finding.

The generalizability of these findings might be limited to a Norwegian context, as differences in both school systems and policies across nations may play an essential part in how parental divorce and parental education might affect adolescents' academic performance. Due to diverging results among existing studies examining this phenomenon, there is a need for future studies that can shed further light on the complex interactions between divorce, parental education, and outcomes among youths.

Supporting information

S1 Fig. Regression coefficient plot of estimates of GPA by parental divorce and equivalized disposable income (n = 7,739).
(PDF)

S1 Table. Comparison of the entire youth@hordaland with adolescents with register-based information.
(PDF)

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	Carlsten, Carl Thomas, Dr. philos.	God lesing – God læring. En aksjonsrettet studie av undervisning i fagtekstlesing.
	Dundas, Ingrid, Dr. psychol.	Functional and dysfunctional closeness. Family interaction and children's adjustment.
	Engen, Liv, Dr. philos.	Kartlegging av leseferdighet på småskoletrinnet og vurdering av faktorer som kan være av betydning for optimal leseutvikling.
2000 V	Hovland, Ole Johan, Dr. philos.	Transforming a self-preserving "alarm" reaction into a self-defeating emotional response: Toward an integrative approach to anxiety as a human phenomenon.
	Lillejord, Sølvi, Dr. philos.	Handlingsrasjonalitet og spesialundervisning. En analyse av aktørperspektiver.
	Sandell, Ove, Dr. philos.	Den varme kunnskapen.
	Oftedal, Marit Petersen, Dr. philos.	Diagnostisering av ordavkodingsvansker: En prosessanalytisk tilnærmingsmåte.
H	Sandbak, Tone, Dr. psychol.	Alcohol consumption and preference in the rat: The significance of individual differences and relationships to stress pathology
	Eid, Jarle, Dr. psychol.	Early predictors of PTSD symptom reporting; The significance of contextual and individual factors.
2001 V	Skinstad, Anne Helene, Dr. philos.	Substance dependence and borderline personality disorders.
	Binder, Per-Einar, Dr. psychol.	Individet og den meningsbærende andre. En teoretisk undersøkelse av de mellommenneskelige forutsetningene for psykisk liv og utvikling med utgangspunkt i Donald Winnicotts teori.
	Roald, Ingvild K., Dr. philos.	Building of concepts. A study of Physics concepts of Norwegian deaf students.
H	Fekadu, Zelalem W., Dr. philos.	Predicting contraceptive use and intention among a sample of adolescent girls. An application of the theory of planned behaviour in Ethiopian context.
	Melesse, Fantu, Dr. philos.	The more intelligent and sensitive child (MISC) mediational intervention in an Ethiopian context: An evaluation study.
	Råheim, Målfrid, Dr. philos.	Kvinners kroppserfaring og livssammenheng. En fenomenologisk – hermeneutisk studie av friske kvinner og kvinner med kroniske muskelsmerter.
	Engelsen, Birthe Kari, Dr. psychol.	Measurement of the eating problem construct.
	Lau, Bjørn, Dr. philos.	Weight and eating concerns in adolescence.
2002 V	Ihlebæk, Camilla, Dr. philos.	Epidemiological studies of subjective health complaints.

	Rosén, Gunnar O. R., Dr. philos.	The phantom limb experience. Models for understanding and treatment of pain with hypnosis.
	Høines, Marit Johnsen, Dr. philos.	Fleksible språkrom. Matematikklæring som tekstutvikling.
	Anthun, Roald Andor, Dr. philos.	School psychology service quality. Consumer appraisal, quality dimensions, and collaborative improvement potential
	Pallesen, Ståle, Dr. psychol.	Insomnia in the elderly. Epidemiology, psychological characteristics and treatment.
	Midthassel, Unni Vere, Dr. philos.	Teacher involvement in school development activity. A study of teachers in Norwegian compulsory schools
	Kallestad, Jan Helge, Dr. philos.	Teachers, schools and implementation of the Olweus Bullying Prevention Program.
H	Ofte, Sonja Helgesen, Dr. psychol.	Right-left discrimination in adults and children.
	Netland, Marit, Dr. psychol.	Exposure to political violence. The need to estimate our estimations.
	Diseth, Åge, Dr. psychol.	Approaches to learning: Validity and prediction of academic performance.
	Bjuland, Raymond, Dr. philos.	Problem solving in geometry. Reasoning processes of student teachers working in small groups: A dialogical approach.
2003 V	Arefjord, Kjersti, Dr. psychol.	After the myocardial infarction – the wives' view. Short- and long-term adjustment in wives of myocardial infarction patients.
	Ingjaldsson, Jón Þorvaldur, Dr. psychol.	Unconscious Processes and Vagal Activity in Alcohol Dependency.
	Holden, Børge, Dr. philos.	Følger av atferdsanalytiske forklaringer for atferdsanalysens tilnærming til utforming av behandling.
	Holsen, Ingrid, Dr. philos.	Depressed mood from adolescence to 'emerging adulthood'. Course and longitudinal influences of body image and parent-adolescent relationship.
	Hammar, Åsa Karin, Dr. psychol.	Major depression and cognitive dysfunction- An experimental study of the cognitive effort hypothesis.
	Sprugevica, Ieva, Dr. philos.	The impact of enabling skills on early reading acquisition.
	Gabrielsen, Egil, Dr. philos.	LESE FOR LIVET. Lesekompetansen i den norske voksenbefolkningen sett i lys av visjonen om en enhetsskole.
H	Hansen, Anita Lill, Dr. psychol.	The influence of heart rate variability in the regulation of attentional and memory processes.
	Dyregrov, Kari, Dr. philos.	The loss of child by suicide, SIDS, and accidents: Consequences, needs and provisions of help.
2004 V	Torsheim, Torbjørn, Dr. psychol.	Student role strain and subjective health complaints: Individual, contextual, and longitudinal perspectives.

	Haugland, Bente Storm Mowatt Dr. psychol.	Parental alcohol abuse. Family functioning and child adjustment.
	Milde, Anne Marita, Dr. psychol.	Ulcerative colitis and the role of stress. Animal studies of psychobiological factors in relationship to experimentally induced colitis.
	Stornes, Tor, Dr. philos.	Socio-moral behaviour in sport. An investigation of perceptions of sportspersonship in handball related to important factors of socio-moral influence.
	Mæhle, Magne, Dr. philos.	Re-inventing the child in family therapy: An investigation of the relevance and applicability of theory and research in child development for family therapy involving children.
	Kobbeltvedt, Therese, Dr. psychol.	Risk and feelings: A field approach.
2004 H	Thomsen, Tormod, Dr. psychol.	Localization of attention in the brain.
	Løberg, Else-Marie, Dr. psychol.	Functional laterality and attention modulation in schizophrenia: Effects of clinical variables.
	Kyrkjebø, Jane Mikkelsen, Dr. philos.	Learning to improve: Integrating continuous quality improvement learning into nursing education.
	Laumann, Karin, Dr. psychol.	Restorative and stress-reducing effects of natural environments: Experiencal, behavioural and cardiovascular indices.
	Holgersen, Helge, PhD	Mellom oss - Essay i relasjonell psykoanalyse.
2005 V	Hetland, Hilde, Dr. psychol.	Leading to the extraordinary? Antecedents and outcomes of transformational leadership.
	Iversen, Anette Christine, Dr. philos.	Social differences in health behaviour: the motivational role of perceived control and coping.
2005 H	Mathisen, Gro Ellen, PhD	Climates for creativity and innovation: Definitions, measurement, predictors and consequences.
	Sævi, Tone, Dr. philos.	Seeing disability pedagogically – The lived experience of disability in the pedagogical encounter.
	Wiium, Nora, PhD	Intrapersonal factors, family and school norms: combined and interactive influence on adolescent smoking behaviour.
	Kanagaratnam, Pushpa, PhD	Subjective and objective correlates of Posttraumatic Stress in immigrants/refugees exposed to political violence.
	Larsen, Torill M. B. , PhD	Evaluating principals` and teachers` implementation of Second Step. A case study of four Norwegian primary schools.
	Bancila, Delia, PhD	Psychosocial stress and distress among Romanian adolescents and adults.
2006 V	Hillestad, Torgeir Martin, Dr. philos.	Normalitet og avvik. Forutsetninger for et objektivt psykopatologisk avviksbegrep. En psykologisk, sosial, erkjennelsesteoretisk og teorihistorisk framstilling.

	Nordanger, Dag Øystein, Dr. psychol.	Psychosocial discourses and responses to political violence in post-war Tigray, Ethiopia.
	Rimol, Lars Morten, PhD	Behavioral and fMRI studies of auditory laterality and speech sound processing.
	Krumsvik, Rune Johan, Dr. philos.	ICT in the school. ICT-initiated school development in lower secondary school.
	Norman, Elisabeth, Dr. psychol.	Gut feelings and unconscious thought: An exploration of fringe consiousness in implicit cognition.
	Israel, K Pravin, Dr. psychol.	Parent involvement in the mental health care of children and adolescents. Emperical studies from clinical care setting.
	Glasø, Lars, PhD	Affects and emotional regulation in leader-subordinate relationships.
	Knutsen, Ketil, Dr. philos.	HISTORIER UNGDOM LEVER – En studie av hvordan ungdommer bruker historie for å gjøre livet meningsfullt.
	Matthiesen, Stig Berge, PhD	Bullying at work. Antecedents and outcomes.
2006 H	Gramstad, Arne, PhD	Neuropsychological assessment of cognitive and emotional functioning in patients with epilepsy.
	Bendixen, Mons, PhD	Antisocial behaviour in early adolescence: Methodological and substantive issues.
	Mrumbi, Khalifa Maulid, PhD	Parental illness and loss to HIV/AIDS as experienced by AIDS orphans aged between 12-17 years from Temeke District, Dar es Salaam, Tanzania: A study of the children's psychosocial health and coping responses.
	Hetland, Jørn, Dr. psychol.	The nature of subjective health complaints in adolescence: Dimensionality, stability, and psychosocial predictors
	Kakoko, Deodatus Conatus Vitalis, PhD	Voluntary HIV counselling and testing service uptake among primary school teachers in Mwanza, Tanzania: assessment of socio-demographic, psychosocial and socio-cognitive aspects
	Mykletun, Arnstein, Dr. psychol.	Mortality and work-related disability as long-term consequences of anxiety and depression: Historical cohort designs based on the HUNT-2 study
	Sivertsen, Børge, PhD	Insomnia in older adults. Consequences, assessment and treatment.
2007 V	Singhammer, John, Dr. philos.	Social conditions from before birth to early adulthood – the influence on health and health behaviour
	Janvin, Carmen Ani Cristea, PhD	Cognitive impairment in patients with Parkinson's disease: profiles and implications for prognosis
	Braarud, Hanne Cecilie, Dr.psychol.	Infant regulation of distress: A longitudinal study of transactions between mothers and infants
	Tveito, Torill Helene, PhD	Sick Leave and Subjective Health Complaints

	Magnussen, Liv Heide, PhD	Returning disability pensioners with back pain to work
	Thuen, Elin Marie, Dr.philos.	Learning environment, students' coping styles and emotional and behavioural problems. A study of Norwegian secondary school students.
	Solberg, Ole Asbjørn, PhD	Peacekeeping warriors – A longitudinal study of Norwegian peacekeepers in Kosovo
2007 H	Søreide, Gunn Elisabeth, Dr.philos.	Narrative construction of teacher identity
	Svensen, Erling, PhD	WORK & HEALTH. Cognitive Activation Theory of Stress applied in an organisational setting.
	Øverland, Simon Nygaard, PhD	Mental health and impairment in disability benefits. Studies applying linkages between health surveys and administrative registries.
	Eichele, Tom, PhD	Electrophysiological and Hemodynamic Correlates of Expectancy in Target Processing
	Børhaug, Kjetil, Dr.philos.	Oppseding til demokrati. Ein studie av politisk oppseding i norsk skule.
	Eikeland, Thorleif, Dr.philos.	Om å vokse opp på barnehjem og på sykehus. En undersøkelse av barnehjemsbarns opplevelser på barnehjem sammenholdt med sanatoriebarns beskrivelse av langvarige sykehusopphold – og et forsøk på forklaring.
	Wadel, Carl Cato, Dr.philos.	Medarbeidersamhandling og medarbeiderledelse i en lagbasert organisasjon
	Vinje, Hege Forbech, PhD	Thriving despite adversity: Job engagement and self-care among community nurses
	Noort, Maurits van den, PhD	Working memory capacity and foreign language acquisition
2008 V	Breivik, Kyrre, Dr.psychol.	The Adjustment of Children and Adolescents in Different Post-Divorce Family Structures. A Norwegian Study of Risks and Mechanisms.
	Johnsen, Grethe E., PhD	Memory impairment in patients with posttraumatic stress disorder
	Sætrevik, Bjørn, PhD	Cognitive Control in Auditory Processing
	Carvalhosa, Susana Fonseca, PhD	Prevention of bullying in schools: an ecological model
2008 H	Brønnick, Kolbjørn Selvåg	Attentional dysfunction in dementia associated with Parkinson's disease.
	Posserud, Maj-Britt Rocio	Epidemiology of autism spectrum disorders
	Haug, Ellen	Multilevel correlates of physical activity in the school setting
	Skjerve, Arvid	Assessing mild dementia – a study of brief cognitive tests.

	Kjønniksen, Lise	The association between adolescent experiences in physical activity and leisure time physical activity in adulthood: a ten year longitudinal study
	Gundersen, Hilde	The effects of alcohol and expectancy on brain function
	Omvik, Siri	Insomnia – a night and day problem
2009 V	Molde, Helge	Pathological gambling: prevalence, mechanisms and treatment outcome.
	Foss, Else	Den omsorgsfulle væremåte. En studie av voksnes væremåte i forhold til barn i barnehagen.
	Westrheim, Kariane	Education in a Political Context: A study of Konwledge Processes and Learning Sites in the PKK.
	Wehling, Eike	Cognitive and olfactory changes in aging
	Wangberg, Silje C.	Internet based interventions to support health behaviours: The role of self-efficacy.
	Nielsen, Morten B.	Methodological issues in research on workplace bullying. Operationalisations, measurements and samples.
	Sandu, Anca Larisa	MRI measures of brain volume and cortical complexity in clinical groups and during development.
	Guribye, Eugene	Refugees and mental health interventions
	Sørensen, Lin	Emotional problems in inattentive children – effects on cognitive control functions.
	Tjomsland, Hege E.	Health promotion with teachers. Evaluation of the Norwegian Network of Health Promoting Schools: Quantitative and qualitative analyses of predisposing, reinforcing and enabling conditions related to teacher participation and program sustainability.
	Helleve, Ingrid	Productive interactions in ICT supported communities of learners
2009 H	Skorpen, Aina Øye, Christine	Dagliglivet i en psykiatrisk institusjon: En analyse av miljøterapeutiske praksiser
	Andreassen, Cecilie Schou	WORKAHOLISM – Antecedents and Outcomes
	Stang, Ingun	Being in the same boat: An empowerment intervention in breast cancer self-help groups
	Sequeira, Sarah Dorothee Dos Santos	The effects of background noise on asymmetrical speech perception
	Kleiven, Jo, dr.philos.	The Lillehammer scales: Measuring common motives for vacation and leisure behavior
	Jónsdóttir, Guðrún	Dubito ergo sum? Ni jenter møter naturfaglig kunnskap.
	Hove, Oddbjørn	Mental health disorders in adults with intellectual disabilities - Methods of assessment and prevalence of mental health disorders and problem behaviour
	Wageningen, Heidi Karin van	The role of glutamate on brain function

	Bjørkvik, Jofrid	God nok? Selvaktelse og interpersonlig fungering hos pasienter innen psykisk helsevern: Forholdet til diagnoser, symptomer og behandlingsutbytte
	Andersson, Martin	A study of attention control in children and elderly using a forced-attention dichotic listening paradigm
	Almås, Aslaug Grov	Teachers in the Digital Network Society: Visions and Realities. A study of teachers' experiences with the use of ICT in teaching and learning.
	Ulvik, Marit	Lærerutdanning som danning? Tre stemmer i diskusjonen
2010 V	Skår, Randi	Læringsprosesser i sykepleieres profesjonsutøvelse. En studie av sykepleieres læringserfaringer.
	Roald, Knut	Kvalitetsvurdering som organisasjonslæring mellom skole og skoleeigar
	Lunde, Linn-Heidi	Chronic pain in older adults. Consequences, assessment and treatment.
	Danielsen, Anne Grete	Perceived psychosocial support, students' self-reported academic initiative and perceived life satisfaction
	Hysing, Mari	Mental health in children with chronic illness
	Olsen, Olav Kjellevold	Are good leaders moral leaders? The relationship between effective military operational leadership and morals
	Riese, Hanne	Friendship and learning. Entrepreneurship education through mini-enterprises.
	Holthe, Asle	Evaluating the implementation of the Norwegian guidelines for healthy school meals: A case study involving three secondary schools
H	Hauge, Lars Johan	Environmental antecedents of workplace bullying: A multi-design approach
	Bjørkelo, Brita	Whistleblowing at work: Antecedents and consequences
	Reme, Silje Endresen	Common Complaints – Common Cure? Psychiatric comorbidity and predictors of treatment outcome in low back pain and irritable bowel syndrome
	Helland, Wenche Andersen	Communication difficulties in children identified with psychiatric problems
	Beneventi, Harald	Neuronal correlates of working memory in dyslexia
	Thygesen, Elin	Subjective health and coping in care-dependent old persons living at home
	Aanes, Mette Marthinussen	Poor social relationships as a threat to belongingness needs. Interpersonal stress and subjective health complaints: Mediating and moderating factors.
	Anker, Morten Gustav	Client directed outcome informed couple therapy

	Bull, Torill	Combining employment and child care: The subjective well-being of single women in Scandinavia and in Southern Europe
	Viig, Nina Grieg	Tilrettelegging for læreres deltakelse i helsefremmende arbeid. En kvalitativ og kvantitativ analyse av sammenhengen mellom organisatoriske forhold og læreres deltakelse i utvikling og implementering av Europeisk Nettverk av Helsefremmende Skoler i Norge
	Wolff, Katharina	To know or not to know? Attitudes towards receiving genetic information among patients and the general public.
	Ogden, Terje, dr.philos.	Familiebasert behandling av alvorlige atferdsproblemer blant barn og ungdom. Evaluering og implementering av evidensbaserte behandlingsprogrammer i Norge.
	Solberg, Mona Elin	Self-reported bullying and victimisation at school: Prevalence, overlap and psychosocial adjustment.
2011 V	Bye, Hege Høivik	Self-presentation in job interviews. Individual and cultural differences in applicant self-presentation during job interviews and hiring managers' evaluation
	Notelaers, Guy	Workplace bullying. A risk control perspective.
	Moltu, Christian	Being a therapist in difficult therapeutic impasses. A hermeneutic phenomenological analysis of skilled psychotherapists' experiences, needs, and strategies in difficult therapies ending well.
	Myrseth, Helga	Pathological Gambling - Treatment and Personality Factors
	Schanche, Elisabeth	From self-criticism to self-compassion. An empirical investigation of hypothesized change prosesses in the Affect Phobia Treatment Model of short-term dynamic psychotherapy for patients with Cluster C personality disorders.
	Våpenstad, Eystein Victor, dr.philos.	Det tempererte nærvær. En teoretisk undersøkelse av psykoterapautens subjektivitet i psykoanalyse og psykoanalytisk psykoterapi.
	Haukebø, Kristin	Cognitive, behavioral and neural correlates of dental and intra-oral injection phobia. Results from one treatment and one fMRI study of randomized, controlled design.
	Harris, Anette	Adaptation and health in extreme and isolated environments. From 78°N to 75°S.
	Bjørknes, Ragnhild	Parent Management Training-Oregon Model: intervention effects on maternal practice and child behavior in ethnic minority families
	Mamen, Asgeir	Aspects of using physical training in patients with substance dependence and additional mental distress
	Espevik, Roar	Expert teams: Do shared mental models of team members make a difference
	Haara, Frode Olav	Unveiling teachers' reasons for choosing practical activities in mathematics teaching

2011 H	Hauge, Hans Abraham	How can employee empowerment be made conducive to both employee health and organisation performance? An empirical investigation of a tailor-made approach to organisation learning in a municipal public service organisation.
	Melkevik, Ole Rogstad	Screen-based sedentary behaviours: pastimes for the poor, inactive and overweight? A cross-national survey of children and adolescents in 39 countries.
	Vøllestad, Jon	Mindfulness-based treatment for anxiety disorders. A quantitative review of the evidence, results from a randomized controlled trial, and a qualitative exploration of patient experiences.
	Tolo, Astrid	Hvordan blir lærerkompetanse konstruert? En kvalitativ studie av PPU-studenters kunnskapsutvikling.
	Saus, Evelyn-Rose	Training effectiveness: Situation awareness training in simulators
	Nordgreen, Tine	Internet-based self-help for social anxiety disorder and panic disorder. Factors associated with effect and use of self-help.
	Munkvold, Linda Helen	Oppositional Defiant Disorder: Informant discrepancies, gender differences, co-occuring mental health problems and neurocognitive function.
	Christiansen, Øivin	Når barn plasseres utenfor hjemmet: beslutninger, forløp og relasjoner. Under barnevernets (ved)tak.
	Brunborg, Geir Scott	Conditionability and Reinforcement Sensitivity in Gambling Behaviour
	Hystad, Sigurd William	Measuring Psychological Resiliency: Validation of an Adapted Norwegian Hardiness Scale
2012 V	Roness, Dag	Hvorfor bli lærer? Motivasjon for utdanning og utøving.
	Fjermestad, Krister Westlye	The therapeutic alliance in cognitive behavioural therapy for youth anxiety disorders
	Jenssen, Eirik Sørnes	Tilpasset opplæring i norsk skole: politikeres, skolelederes og læreres handlingsvalg
	Saksvik-Lehouillier, Ingvild	Shift work tolerance and adaptation to shift work among offshore workers and nurses
	Johansen, Venke Frederike	Når det intime blir offentlig. Om kvinners åpenhet om brystkreft og om markedsføring av brystkreftsaken.
	Herheim, Rune	Pupils collaborating in pairs at a computer in mathematics learning: investigating verbal communication patterns and qualities
	Vie, Tina Løkke	Cognitive appraisal, emotions and subjective health complaints among victims of workplace bullying: A stress-theoretical approach
	Jones, Lise Øen	Effects of reading skills, spelling skills and accompanying efficacy beliefs on participation in education. A study in Norwegian prisons.

2012 H	Danielsen, Yngvild Sørebø	Childhood obesity – characteristics and treatment. Psychological perspectives.
	Horverak, Jøri Gytre	Sense or sensibility in hiring processes. Interviewee and interviewer characteristics as antecedents of immigrant applicants' employment probabilities. An experimental approach.
	Jøsendal, Ola	Development and evaluation of BE smokeFREE, a school-based smoking prevention program
	Osnes, Berge	Temporal and Posterior Frontal Involvement in Auditory Speech Perception
	Drageset, Sigrunn	Psychological distress, coping and social support in the diagnostic and preoperative phase of breast cancer
	Aasland, Merethe Schanke	Destructive leadership: Conceptualization, measurement, prevalence and outcomes
	Bakibinga, Pauline	The experience of job engagement and self-care among Ugandan nurses and midwives
	Skogen, Jens Christoffer	Foetal and early origins of old age health. Linkage between birth records and the old age cohort of the Hordaland Health Study (HUSK)
	Leversen, Ingrid	Adolescents' leisure activity participation and their life satisfaction: The role of demographic characteristics and psychological processes
	Hanss, Daniel	Explaining sustainable consumption: Findings from cross-sectional and intervention approaches
	Rød, Per Arne	Barn i klem mellom foreldrekonflikter og samfunnsmessig beskyttelse
2013 V	Mentzoni, Rune Aune	Structural Characteristics in Gambling
	Knudsen, Ann Kristin	Long-term sickness absence and disability pension award as consequences of common mental disorders. Epidemiological studies using a population-based health survey and official ill health benefit registries.
	Strand, Mari	Emotional information processing in recurrent MDD
	Veseth, Marius	Recovery in bipolar disorder. A reflexive-collaborative exploration of the lived experiences of healing and growth when battling a severe mental illness
	Mæland, Silje	Sick leave for patients with severe subjective health complaints. Challenges in general practice.
	Mjaaland, Thera	At the frontiers of change? Women and girls' pursuit of education in north-western Tigray, Ethiopia
	Odéen, Magnus	Coping at work. The role of knowledge and coping expectancies in health and sick leave.
	Hynninen, Kia Minna Johanna	Anxiety, depression and sleep disturbance in chronic obstructive pulmonary disease (COPD). Associations, prevalence and effect of psychological treatment.

	Flo, Elisabeth	Sleep and health in shift working nurses
	Aasen, Elin Margrethe	From paternalism to patient participation? The older patients undergoing hemodialysis, their next of kin and the nurses: a discursive perspective on perception of patient participation in dialysis units
	Ekornås, Belinda	Emotional and Behavioural Problems in Children: Self-perception, peer relationships, and motor abilities
	Corbin, J. Hope	North-South Partnerships for Health: Key Factors for Partnership Success from the Perspective of the KIWAKKUKI
	Birkeland, Marianne Skogbrott	Development of global self-esteem: The transition from adolescence to adulthood
2013 H	Gianella-Malca, Camila	Challenges in Implementing the Colombian Constitutional Court's Health-Care System Ruling of 2008
	Hovland, Anders	Panic disorder – Treatment outcomes and psychophysiological concomitants
	Mortensen, Øystein	The transition to parenthood – Couple relationships put to the test
	Årdal, Guro	Major Depressive Disorder – a Ten Year Follow-up Study. Inhibition, Information Processing and Health Related Quality of Life
	Johansen, Rino Bandlitz	The impact of military identity on performance in the Norwegian armed forces
	Bøe, Tormod	Socioeconomic Status and Mental Health in Children and Adolescents
2014 V	Nordmo, Ivar	Gjennom nåløyet – studenters læringserfaringer i psykologutdanningen
	Dovran, Anders	Childhood Trauma and Mental Health Problems in Adult Life
	Hegelstad, Wenche ten Velden	Early Detection and Intervention in Psychosis: A Long-Term Perspective
	Urheim, Ragnar	Forståelse av pasientaggresjon og forklaringer på nedgang i voldsrate ved Regional sikkerhetsavdeling, Sandviken sykehus
	Kinn, Liv Grethe	Round-Trips to Work. Qualitative studies of how persons with severe mental illness experience work integration.
	Rød, Anne Marie Kinn	Consequences of social defeat stress for behaviour and sleep. Short-term and long-term assessments in rats.
	Nygård, Merethe	Schizophrenia – Cognitive Function, Brain Abnormalities, and Cannabis Use
	Tjora, Tore	Smoking from adolescence through adulthood: the role of family, friends, depression and socioeconomic status. Predictors of smoking from age 13 to 30 in the "The Norwegian Longitudinal Health Behaviour Study" (NLHB)
	Vangsnes, Vigdis	The Dramaturgy and Didactics of Computer Gaming. A Study of a Medium in the Educational Context of Kindergartens.

	Nordahl, Kristin Berg	Early Father-Child Interaction in a Father-Friendly Context: Gender Differences, Child Outcomes, and Protective Factors related to Fathers' Parenting Behaviors with One-year-olds
2014 H	Sandvik, Asle Makoto	Psychopathy – the heterogenety of the construct
	Skotheim, Siv	Maternal emotional distress and early mother-infant interaction: Psychological, social and nutritional contributions
	Halleland, Helene Barone	Executive Functioning in adult Attention Deficit Hyperactivity Disorder (ADHD). From basic mechanisms to functional outcome.
	Halvorsen, Kirsti Vindal	Partnerskap i lærerutdanning, sett fra et økologisk perspektiv
	Solbue, Vibeke	Dialogen som visker ut kategorier. En studie av hvilke erfaringer innvandrerungdommer og norskfødte med innvandrerforeldre har med videregående skole. Hva forteller ungdommenes erfaringer om videregående skoles håndtering av etniske ulikheter?
	Kvalevaag, Anne Lise	Fathers' mental health and child development. The predictive value of fathers' psychological distress during pregnancy for the social, emotional and behavioural development of their children
	Sandal, Ann Karin	Ungdom og utdanningsval. Om elevar sine opplevingar av val og overgangsprosessar.
	Haug, Thomas	Predictors and moderators of treatment outcome from high- and low-intensity cognitive behavioral therapy for anxiety disorders. Association between patient and process factors, and the outcome from guided self-help, stepped care, and face-to-face cognitive behavioral therapy.
	Sjølie, Hege	Experiences of Members of a Crisis Resolution Home Treatment Team. Personal history, professional role and emotional support in a CRHT team.
	Falkenberg, Liv Eggset	Neuronal underpinnings of healthy and dysfunctional cognitive control
	Mrdalj, Jelena	The early life condition. Importance for sleep, circadian rhythmicity, behaviour and response to later life challenges
	Hesjedal, Elisabeth	Tverrprofesjonelt samarbeid mellom skule og barnevern: Kva kan støtte utsette barn og unge?
2015 V	Hauken, May Aasebø	«*The cancer treatment was only half the work!»* A Mixed-Method Study of Rehabilitation among Young Adult Cancer Survivors
	Ryland, Hilde Katrin	Social functioning and mental health in children: the influence of chronic illness and intellectual function
	Rønsen, Anne Kristin	Vurdering som profesjonskompetanse. Refleksjonsbasert utvikling av læreres kompetanse i formativ vurdering

	Hoff, Helge Andreas	Thinking about Symptoms of Psychopathy in Norway: Content Validation of the Comprehensive Assessment of Psychopathic Personality (CAPP) Model in a Norwegian Setting
	Schmid, Marit Therese	Executive Functioning in recurrent- and first episode Major Depressive Disorder. Longitudinal studies
	Sand, Liv	Body Image Distortion and Eating Disturbances in Children and Adolescents
	Matanda, Dennis Juma	Child physical growth and care practices in Kenya: Evidence from Demographic and Health Surveys
	Amugsi, Dickson Abanimi	Child care practices, resources for care, and nutritional outcomes in Ghana: Findings from Demographic and Health Surveys
	Jakobsen, Hilde	The good beating: Social norms supporting men's partner violence in Tanzania
	Sagoe, Dominic	Nonmedical anabolic-androgenic steroid use: Prevalence, attitudes, and social perception
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