Complex Families and Health Complaints among Adolescents: A Population-based Cross-sectional Study

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Abstract

Aims: The structure of adolescents' families has become more complex over the last decades in several western countries. In parallel, health complaints among adolescents appear to have risen in the Nordic countries. This study aimed to examine the association between family structure and health complaints among Norwegian adolescents while capturing biological, half -and stepsiblings (sibship-type) in the families.

Methods: Data stem from the youth@hordaland study, an epidemiological study of adolescents aged 16-19 years (*N*=10,257, participation rate=53 %) conducted in 2012. This study is based on a subsample of 8,808 adolescents who lived with parent(s). The adolescents provided detailed information on sociodemographics, family structure, sibship-type, and common health complaints among youth (headache, dizziness, and abdominal, neck, back, and shoulder pain).

Results: Adolescents in nuclear families and joint physical custody (JPC) reported significantly lower levels of health complaints compared to peers in single- or stepparent families. Independent of family structure, biological siblings were associated with lower levels of health complaints, while stepsiblings were associated with higher levels of health complaints, but only among girls. These findings were robust to adjustments of sociodemographic variables.

Conclusions: Health complaints are frequent but unequally distributed across family structures. Adolescents in nuclear families and JPC report lower levels of health complaints compared to peers in single- or stepparent families. Considering siblings appear relevant, as biological- and stepsiblings were related to adolescents' symptoms independent of family structure. In combination, knowledge about family structure and sibship-type may aid the identification of adolescents at risk of experiencing health complaints.

Keywords: Family Structure; Family Complexity; Siblings; Joint Physical Custody; Shared Custody; Adolescent Health; HBSC; Adolescence; Health complaints; Psychosomatic symptoms

Introduction

Family structure in developed countries has become more complex in recent years. High divorce rates coupled with multipartner fertility have increased the prevalence of single parent and stepparent families, and a larger share of youth now grow up with half- and stepsiblings[1,2]. Furthermore, the frequency of joint physical custody (JPC), where children live with each parent at least 35% of the time after the divorce, has increased in several western industrialized countries the last two decades[3]. In Norway, the site of the present study, it is currently estimated that 30% of children and youth with separated parents live in JPC [4].

Parallel to the increased complexity of modern families, the prevalence of health complaints among older adolescents has risen in the Nordic countries, especially among girls[5,6]. In Norway, about 50% of girls and 20% of boys aged 16 - 19 years experience at least one weekly recurrent symptom, such as neck, shoulder, and back pain[7]. Health complaints tend to increase from early to late adolescence[8] and show high stability into adulthood[9,10]. Health complaints are related to school absence among youth[11], lower educational attainment among young adults[10], and may represent a significant public health issue emerging in adolescence.

Exposure to stressful life events put adolescents at risk of experiencing health complaints [7,12]. Divorce is considered a major life event for children. Numerous studies have shown that youth with divorced parents, on average, display higher levels of adjustment problems compared to peers with nondivorced parents[13]. A longitudinal study found that divorce also represents a risk factor for health complaints among Norwegian youth and young adults. A risk that was stable from the age of 13 until 30 years of age[14].

Several mechanisms might explain this increased risk. Poorer family finances and less contact with a parent is often a consequence of living with a single parent, while stepfamily formation poses the stress of adjusting to a new extended family[2,13]. Moreover, rising rates of JPC have fostered concerns that this family structure might harm youth due to the stress of having two homes; the need to adapt to different neighborhoods, parenting styles, or exposure to parental

conflict[15].

The risk of health complaints may, however, not be equal across different post-divorce family structures. A series of studies from Sweden found that adolescents in JPC displayed lower levels of health complaints than peers in single parent families, but were at equal or at a somewhat higher risk of health complaints compared to those in nuclear families[16–18]. Moreover, youth in stepparent families have been found to report higher levels of health complaints compared to their counterparts in nuclear families[19].

A potential limitation with the above-mentioned studies is the lack of information about siblings present in the household. As families have become more diverse, children and adolescents are also more likely to experience *family complexity*, a recently coined term to denote sharing a household with half- or stepsiblings[1]. Whereas biological siblings may promote a sense of continuity and shared experience during family reorganization[20], the introduction of half- and stepsiblings may make it harder to define belongingness to the family after the divorce[21]. Studies focusing on siblings tend to find small but rather consistent negative effects of living with half- or stepsiblings on outcomes such as depressive symptoms and physical well-being, although youth may also report such relationships as a resource following parental divorce[22].

Only a few studies have expanded the traditional classification of family structure and included information about siblings in their analyses. These studies have linked the presence of half- and stepsiblings to higher levels of depression, aggression, and delinquent behavior among adolescents in single parent and stepparent families[23,24]. In general, residing with nonbiological siblings appear to be associated with worse outcomes independent of family structure[1,24]. The impact of family complexity may, however, be gender-dependent. Girls have been found to report worse relationships with stepsiblings than boys[22], and a recent study found higher levels of internalizing problems among girls but not among boys living with nonbiological siblings[25]. Few studies have, however, examined such gender-specific effects. Whether similar patterns exist with regards to health complaints among adolescents remains uncertain. There is a lack of studies

investigating health complaints among adolescents as a function of both family structure and sibship-type present in the household.

The Present Study

This study aimed to examine health complaints among adolescents across different family structures in Norway while capturing the presence of biological, half- and stepsiblings in the household. The Norwegian context provides an interesting site of exploring these issues due to the recent increase in families choosing JPC after the divorce[4]. Further, a sizable proportion of Norwegian children live only with half-siblings (8%), while 7% live with a blend of biological, half- and stepsiblings[26]. We expand the research literature in two ways: Firstly, by examining health complaints across five different family structures (nuclear families, JPC, single mother, single father, and stepparent families). Secondly, by investigating whether sibship-type was related to health complaints independent of family structure and if the effects of siblings varied with the adolescents' gender.

Methods

Procedure and Sample

This study employed data from the population-based youth@hordaland study (y@h). All adolescents born between 1993 and 1995 living in Hordaland, Western Norway, during spring 2012 (N=19,439) were invited to participate by the county council. One school hour was allocated for them to complete the Internet-based questionnaire at school. For respondents not attending school on the day of the study, catch-up days were arranged. Alternative solutions were made for students in hospitals or institutions. The adolescents themselves consented to participate in the study, as Norwegian law dictates that students 16 years and older decide matters of consent on health issues themselves. Parents/guardians received information about the study in advance. The study was approved by The Regional Committee for Medical and Health Research Ethics in

Western Norway.

10,257 adolescents (53% female, mean age 17.4 (SD=0.84)) completed the survey yielding a participation rate of 53% of the entire study. The present study is based on a subsample of adolescents who confirmed to live at home with parents during the study period (we removed 1,269 respondents who stated to live in own apartment, dorm or similar), and who did not live with adoptive or foster parents (we removed 156 stating to live with foster/adoptive parents), as this study sought to investigate adolescents sharing a household with one or both of their biological parents and potential stepparents. We removed an additional 24 due to unlikely answers with regards siblings (i.e., stating to have more than 12 biological, half – and stepsiblings or by stating to live with two biological parents and stepsiblings). The subsample utilized in the present study thus consisted of 8,808 adolescents (mean age=17.4, 53% girls).

Measures

Gender and age were collected through the adolescents' personal identity number in the Norwegian National Population Register.

Family structure. The adolescents were classified as living in either (1) nuclear/two-parent family (n=5,436, 52% girls), (2) joint physical custody (i.e., living equally with both parents after the divorce, 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). This categorization was based on adolescent reports concerning parental divorce and who they currently lived with. A detailed explanation of this categorization is presented in a previous publication[27]. We combined those living in a stepmother and a stepfather family into the category stepfamily, due to the few adolescents reporting to live in a stepmother family (i.e., living with their divorced single father and his new partner, n=86).

Sibship-type/family complexity. Through three binary items, the adolescents reported if they lived with biological, half- or stepsiblings.

Economic well-being (EWB). EWB was measured by the following question: "Compared to others, how would you rate your family's economic situation?" Response options were "Poorer than others", "Equal to others", and "Better than others".

Parental education. The adolescents rated their parents' highest level of education by the options "elementary school", "high school, vocational", "high school, general", "college/university, less than four years", "college/university, four years or more", and "don't know". The response options were collapsed into *basic* (elementary school level), *intermediate* (high-school levels), *higher* (college/university levels) and *unknown*.

Health complaints were measured using four items from the Health Behavior in School-Aged Children Symptoms Checklist[28]. The items measured symptoms of headache, abdominal pain, back pain, and dizziness. Neck and shoulder pain were also measured, representing symptoms common among adolescents and adults[28]. Each symptom was measured on a five-point rating scale, rising in severity 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, yielding a sum score ranging from 0 - 20. A previous study on the same base population as the current found this sum score to be unidimensional, supporting its continued use[7]. We also created a measure capturing those who reported that they experienced the respective symptom weekly (i.e., "more than once a week" or "about every day").

Statistical analyses

Data were analyzed using R version 3.5.1 for Mac. Family structure had the majority of missing values (12.8%), followed by sibship-type (5.3%) and health complaints (3.7%). The remaining variables had below 3% missingness. Overall, 15.4 % had missing values on one or more of the variables utilized in the present study.

Descriptive analyses were performed on data from adolescents who had no missing values on items utilized to categorize family structure (n = 7,683). Sociodemographics stratified by family structure were calculated (chi-square tests were used for categorical variables and a One-way analysis of variance (ANOVA) for continuous variables), and we estimated the proportions of adolescents experiencing weekly health complaints across family structure stratified by gender. A raincloud plot was created[29], showing key statistics (density distribution, raw data, and mean with 95 % confidence intervals) of the health complaints sum score across the family structures grouped by gender.

Ordinary Least Squares regression analyses were conducted to investigate the relationships between family structure, sibship-type, and health complaints. We found no gender by family structure interaction (i.e., the pattern of overall levels of health complaints were similar for boys and girls across family structure, cf. Figure 1). Preliminary investigations showed no statistically significant family structure by sibship-type interaction effects, suggesting that family structure and sibship-type have independent associations with adolescents' health complaints (results not shown). In the presented regression analyses, the sibship-type variables were therefore entered as covariates in the analyses.

The regression models were structured as follows; A baseline model estimating the relationship between family structure and overall levels of health complaints adjusted by gender and age; Model 1 added sibship-type captured by three dummy coded variables specifying the presence of biological, half- and stepsiblings. These estimates thus provided the predicted change in the health complaints sum score by sharing a household with a specific sibship-type (e.g.,

biological siblings) independent of other sibship-types present in the household (e.g., stepsiblings), adjusted by the variables entered in the baseline model; Model 2 added all variables included in model 1 and an interaction term to investigate if gender moderated the effects of living with biological, half- and stepsiblings, and parental education and EWB. The models were re-run while alternating the omitted family structure reference category, to check for other potential differences between the family structures.

In the regression analyses, missing values were handled by multiple imputation with the R-package "mice", which performs multivariate imputation by chained equations[30]. Multiple imputation is considered a state-of-the-art technique for handling missing data, and to perform better than more traditional methods (e.g., listwise deletion) unless the proportion of missing is very low and data is missing completely at random, which seldom is the case[31]. In the imputation model, all variables present in the fully adjusted regression model were entered: Family structure, age, gender, maternal education, paternal education, perceived economic well-being, sibship-type variables, and health complaints variables. The interaction terms between gender and sibship-type were accounted for in the imputation model by imputing the data in separate groups by gender, before combining the imputed datasets together (30 imputed datasets were created on each group). This imputation method has been recommended before conducting planned categorical interaction analyses when one of the variables in the interaction term is fully observed (in our data, "gender" was fully observed)[32]. The estimates and standard errors from the regression analyses were pooled into overall estimates according to Rubin's rules[33]. Of note, the results of the regression analyses presented in the following were robust whether missing values were handled by multiple imputation or by listwise deletion (results available on request).

Results

Sociodemographic characteristics by family structure

Most adolescents lived in a nuclear family (70%). Of adolescents with divorced parents, the

majority lived in a single mother(45%) followed by stepparent family(28%), while approximately 18% lived in JPC. Having parents with *higher* educational levels and perceiving their economic well-being to be *better than others* were more frequent in nuclear families and JPC than in single parent and stepparent families. Living with biological siblings was most frequent among youth in nuclear families, while sharing a household with half- or stepsiblings was most common in JPC and in stepfamilies (cf. Table 1 for details). About 12 % and 10 % of adolescents in stepfamilies and JPC reported to live with both half- and stepsiblings, respectively. The share of adolescents living with both biological and stepsiblings was highest in JPC(20 %; percentages not shown in table).

Insert Table 1 about here

Family structure, sibship-type and health complaints among adolescents

As shown in Table 2, adolescents in nuclear families and JPC generally reported lower levels of weekly – and overall levels of health complaints compared to those in single parent and stepparent families. This pattern was similar for girls and boys. An exception was that boys in a single father family reported the lowest levels of dizziness, while boys in stepfamilies reported the lowest levels of abdominal pain. The distributions and means of the health complaints sum score by family structure and gender are displayed in Figure 1.

Insert Table 2 and Figure 1 about here

The regression analyses confirmed that adolescents in JPC did not differ significantly compared to peers in nuclear families with regards to overall levels of health complaints (b = 0.021, 95% CI -0.436 to 0.479). Adolescents in single- or stepparent families scored significantly higher than their counterparts in nuclear families, also after adjustments of siblings and sociodemographics (cf. Table 3). Accounting for sibship-type somewhat attenuated the differences

between the family structures, especially among adolescents in stepfamilies (model 1). Living with biological siblings was associated with lower levels of health complaints independent of family structure (b = -0.302, 95% CI -0.506 to -0.097). The interaction between stepsiblings and gender was significant, indicating that independent of family structure and sociodemographic variables, living 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; cf. Figure 2).

The models were re-run using each of the other family structures as a reference group. These analyses revealed that adolescents in JPC reported statistically significantly lower levels of health complaints than those in single parent and stepparent families. No statistically significant differences between single parent and stepparent families were detected. The estimated effect sizes of the differences between nuclear families and single parent and stepparent families were in the range of 0.19 (single mother) to 0.25 (stepfamily) in the baseline model, and 0.09 (single mother) to 0.16 (single father) in the fully adjusted model.

Insert Table 3 and Figure 2
about here

Discussion

In this population-based study of Norwegian youth, adolescents living in nuclear families and JPC reported lower levels of health complaints compared to peers in single parent and stepparent families. The adolescents' perception of their family's economic well-being and their parents' educational qualifications attenuated, but did not fully explain, the differences between the family structures. Living with biological siblings was associated with lower levels of health complaints independent of family structure, while the presence of stepsiblings was associated with higher levels of health complaints among girls.

Adolescents in nuclear families and JPC reported lower levels of health complaints compared to those in single parent and stepparent families in accordance with previous studies[16–

19]. Furthermore, adolescents in JPC did not differ statistically significantly from those living in a nuclear family. This is comparable to a finding reported in a recent Swedish study[18]. The two groups were quite similar with regards to specific symptoms, the frequency of weekly health complaints, and overall levels of health complaints.

The frequency of parents choosing JPC has sharply risen in many western countries, including Norway[3,4]. Concerns have been raised that JPC might be harmful due to the stress of having two homes[15]. Stress is associated with health complaints[34], and unfortunately, measures of stress were not available in the current study. Nevertheless, our results align with previous studies finding that youth in JPC also display lower levels of stress and stress-related illness[35], and mental health problems[36] compared to those living with a single parent. This might suggest that the potential stressors of alternating between two homes are outweighed by the positive effects of close contact with both parents[17]. Indeed, previous studies have reported that children in JPC report more positive relationships with their parents than those in a single parent family, especially with their father[37].

It is important to acknowledge that unmeasured factors that may have selected adolescents into JPC, such as good health, high levels of cooperation, and low levels of interparental conflict, could explain part of our results. Children who adjust well to the post-divorce process may also be more likely to be selected into JPC, which might be especially important when investigating older adolescents[27]. The present study contributes to the field by showing that adolescents in JPC display lower levels of health complaints compared to single parent and stepparent families also when accounting for sibship-types present in the household. There is, however, a great need for future studies utilizing longitudinal designs to come closer to establish possible causal relationships between JPC and outcomes among adolescents.

There were no statistically significant differences in health complaints between adolescents living in single-parent and stepparent families. Similar findings have been reported for adolescents' mental health[27]. Although adolescents in stepfamilies may benefit from increased economic and

parental resources[2], stressors associated with establishing a new family structure might counteract such benefits. This could explain the few reported differences between single parent and stepparent families[38]. Living with nonbiological siblings might be one such stressor. Indeed, the current study found that accounting for sibship-type reduced the predicted level of health complaints by approximately 25% among adolescents living in a stepfamily.

Sharing a household with biological siblings was associated with lower levels of health complaints independent of family structure. This result aligns with previous studies finding small but beneficial effects of living with biological siblings on adolescent adjustment[22]. Biological siblings can support a sense of continuity and shared experience during family reorganization[20]. Thus, biological siblings could perhaps buffer against some of the stressors associated with post-divorce family life. Future studies are needed to verify this finding and detail potential mechanisms linking biological siblings with levels of health complaints among adolescents.

Living with stepsiblings was associated with higher levels of health complaints among girls. This is in line with a previous study that found a similar gender-specific effect of residing with stepsiblings on internalizing problems[25]. Girls tend to have more contact with nonbiological siblings and to strive for positive relationships with siblings to a greater extent than boys, which may perhaps account for this finding[22,39]. Coupled with the role and boundary ambiguity that stepfamily formation often entails[24], it is possible that efforts to maintain a close relationship with stepsiblings become an additional stressor for girls, which in turn manifests itself through elevated levels of health complaints. Stepsiblings present in a household may also be a proxy of family instability and resources available to the child[1]. The novelty of this finding highlights the need for continued research before reaching firm conclusions.

Strengths and limitations

The main strength of the current study was the detailed information about family structure and siblings that made it possible to capture greater complexity in modern families than previous

studies examining health complaints among adolescents. Another strength was the inclusion of parental education and economic well-being as covariates in the analyses. Furthermore, we relied on a measure of health complaints that has been validated on the current sample.

The study also has some limitations. The participation rate of the study was 53%. Unfortunately, attrition from survey research is on the rise[40]. Previous research on former waves of the Bergen Child Study (in which the youth@hordaland is nested within) identified psychological problems as a predictor for non-participation[41]. This could apply to the youth@hordaland study as well, thus impacting the representativeness of the sample. The main aim of the present study was to examine associations. Measures of associations are less vulnerable to selective non-response than prevalence rates[42]. Inclusion of a more representative sample would add more precision to the estimates, but would probably not substantively change the main results.

A second limitation was not considering processes such as parental conflict, relationships with parents and with siblings, or accounting for levels of health complaints among parents or other family members. Combined with the cross-sectional design, such and other unmeasured factors may have both selected adolescents into different family structures and impacted their levels of health complaints, thus causality cannot be inferred from the present study. Thirdly, although the effects of sibship-type were not dependent on family structure in the current study, the relatively low frequency of halfsiblings and stepsiblings in some of the family structures limits the current study's ability to draw firm conclusions regarding possible interaction effects. Lastly, a limitation was not to investigate the potential influence of the national origin of the adolescents' parents, which might covary with family structure, sibship-type, and levels of health complaints among adolescents.

Conclusions and clinical implications

Adolescents in single parent and stepparent families reported higher levels of health complaints compared to peers in nuclear families and JPC. Our results contribute to the rising

number of studies finding less physical and mental health problems among youth in JPC compared to other post-divorce family structures. This study further highlights the importance of considering siblings, as health complaints among the adolescents were not only dependent on the parental adult(s) whom they shared a home with but also the presence of biological- and stepsiblings. Combined, information about family structure and sibship may help identify adolescents at risk of experiencing health complaints.

Acknowledgments: This project has been made possible by the Norwegian ExtraFoundation for Health and Rehabilitation (Grant number 2017/FO149543). The Regional Centre for Child and Youth Mental Health and Child Welfare, Norwegian Research Centre, Bergen, Norway, is responsible for the youth@hordaland-survey. We thank the participants for their time and effort.

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Table 1. *Sociodemographic characteristics by family structure from the youth@hordaland 2012 study (n = 7,683).*

	Nuclear family	JPC	Single mother	Single father	Stepfamily	*p*-value
N	5436	397	1009	212	629	
Age, *M* (*SD*)	17.41 (0.84)	17.28 (0.81)	17.46 (0.84)	17.50 (0.86)	17.36 (0.82)	0.001
Gender = Boy, *n* (%)	2586 (47.6)	202 (50.9)	427 (42.3)	118 (55.7)	238 (37.8)	<0.001
Maternal education, *n* (%)						<0.001
Basic	353 (6.5)	15 (3.8)	89 (8.9)	25 (12.0)	71 (11.4)	
Intermediate	1660 (30.7)	123 (31.1)	314 (31.3)	63 (30.3)	218 (34.9)	
High	2178 (40.3)	154 (39.0)	353 (35.2)	59 (28.4)	179 (28.6)	
Unknown	1219 (22.5)	103 (26.1)	246 (24.6)	61 (29.3)	157 (25.1)	
Paternal education, *n* (%)						<0.001
Basic	348 (6.4)	27 (6.9)	94 (9.4)	18 (8.6)	77 (12.4)	
Intermediate	1879 (34.8)	139 (35.3)	304 (30.4)	85 (40.7)	227 (36.4)	
High	1995 (36.9)	130 (33.0)	264 (26.4)	57 (27.3)	125 (20.1)	
Unknown	1183 (21.9)	98 (24.9)	338 (33.8)	49 (23.4)	194 (31.1)	
EWB, *n* (%)						<0.001
Worse than others	171 (3.2)	23 (5.9)	204 (20.6)	25 (11.8)	57 (9.2)	
Equal to others	3643 (68.0)	272 (69.2)	629 (63.4)	146 (69.2)	440 (70.9)	
Better than others	1541 (28.8)	98 (24.9)	159 (16.0)	40 (19.0)	124 (20.0)	
Sibship type, *n* (%)						
Biological siblings	3933 (72.4)	226 (56.9)	392 (38.9)	61 (28.8)	257 (40.9)	<0.001
Halfsiblings	64 (1.2)	93 (23.4)	105 (10.4)	12 (5.7)	297 (47.2)	<0.001
Stepsiblings	0 (0.0)	98 (24.7)	23 (2.3)	7 (3.3)	158 (25.1)	<0.001

Note: EWB: Economic Well-being. *p*-values derived from chi-square tests on categorical variables and a One-way analysis of variance (ANOVA) for continuous variables

Table 2. *Health complaints (proportions of weekly symptoms, mean number of weekly symptoms, and mean overall score) by family structure and gender, the youth@hordaland 2012 study (n = 7,683).*

	Nuclear family	JPC	Single mother	Single father	Stepfamily	*p*-value
Girls						
n	2850	195	582	94	391	
Weekly symptoms of, %:						
Headache	25.4	24.7	30.7	29.8	32.0	0.009
Abdominal pain	16.0	18.6	19.7	20.2	21.1	0.037
Back pain	19.1	20.0	24.6	27.7	28.4	<0.001
Dizziness	14.1	12.3	16.8	22.3	19.7	0.005
Pain in neck/shoulders	26.2	23.1	31.6	34.0	34.3	0.001
Number of weekly health complaints, *M* (*SD*)	1.01 (1.40)	0.98 (1.44)	1.23 (1.56)	1.34 (1.66)	1.35 (1.60)	<0.001
Sum health complaints, *M* (SD)	6.08 (4.79)	6.04 (4.80)	6.97 (5.14)	7.38 (5.18)	7.43 (5.08)	<0.001
Boys						
n	2586	202	427	118	238	
Weekly symptoms of, %						
Headache	7.4	8.0	11.6	11.1	11.0	0.018
Abdominal pain	6.2	8.5	7.5	12.8	5.9	0.042
Back pain	9.6	8.5	15.3	15.5	12.8	0.001
Dizziness	5.0	5.5	6.8	2.6	8.1	0.098
Pain in neck/shoulders	9.5	9.5	12.1	12.0	15.7	0.026
Number of weekly symptoms, *M* (*SD*)	0.38 (0.92)	0.40 (0.96)	0.54 (1.06)	0.53 (1.05)	0.53 (1.04)	0.002
Sum health complaints, *M* (SD)	2.97 (3.65)	3.00 (3.56)	3.82 (3.99)	3.82 (4.03)	3.86 (4.09)	<0.001

Note: *p*-values derived from chi-square tests on categorical variables and a One-way analysis of variance (ANOVA) for continuous variables.
M (*SD*) = Mean (Standard deviation). JPC = Joint Physical Custody

Table 3. *Ordinary Least Squares regression analyses of relationships between family structure, sibship-type and the health complaints sum score, the youth@hordaland 2012 study (n = 8,808; pooled estimates from 30 imputed datasets shown).*

	Baseline model			Model 1			Model 2		
Predictors	b (S.E)	95% CI	Eff.size	b (S.E)	95% CI	Eff.size	b (S.E)	95% CI	Eff.size
Nuclear family (Ref.)									
JPC	0.021 (0.233)	[-0.436, 0.479]	0.005	-0.182 (0.247)	[-0.668, 0.304]	-0.039	-0.215 (0.247)	[-0.700, 0.271]	-0.046
Single mother	**0.891 (0.153)**	**[0.591, 1.191]**	**0.190**	**0.761 (0.159)**	**[0.448, 1.074]**	**0.163**	**0.431 (0.163)**	**[0.111, 0.751]**	**0.092**
Single father	**1.044 (0.303)**	**[0.450, 1.637]**	**0.223**	**0.891 (0.306)**	**[0.290, 1.491]**	**0.190**	**0.748 (0.306)**	**[0.148, 1.348]**	**0.160**
Stepfamily	**1.185 (0.189)**	**[0.814, 1.555]**	**0.253**	**0.883 (0.235)**	**[0.421, 1.346]**	**0.189**	**0.679 (0.235)**	**[0.217, 1.142]**	**0.145**
Gender (Ref. Girl)	**-3.116 (0.096)**	**[-3.304, -2.928]**	**-0.666**	**-3.137 (0.096)**	**[-3.326, -2.948]**	**-0.670**	**-3.108 (0.166)**	**[-3.435, -2.782]**	**-0.664**
Biological siblings (Ref. No)				**-0.302 (0.105)**	**[-0.506, -0.097]**	**-0.064**	**-0.317 (0.145)**	**[-0.601, -0.032]**	**-0.068**
Halfsiblings (Ref. No)				0.206 (0.215)	[-0.215, 0.627]	0.044	0.204 (0.262)	[-0.310, 0.717]	0.044
Stepsiblings (Ref. No)				0.453 (0.291)	[-0.118, 1.023]	0.097	**1.106 (0.367)**	**[0.387, 1.826]**	**0.236**
Gender * Biological siblings							0.060 (0.202)	[-0.336, 0.456]	0.013
Gender * Halfsiblings							-0.005 (0.389)	[-0.768, 0.758]	0.001
Gender * Stepsiblings							**-1.410 (0.541)**	**[-2.470, -0.349]**	**-0.301**

Note: Pooled estimates from 30 imputed datasets shown. *Baseline model:* Family structure, gender, and age predicting health complaints (results for age not shown). *Model 1:* Baseline model + sibship-type. *Model 2*: Model 1 + interactions between sibship-type and gender, and sociodemographic variables (parental education and economic well-being not shown). Ref. = reference group, b = unstandardized regression coefficient, S.E = standard error, 95% CI = 95% confidence intervals of b, Eff.size = Effect size calculated by z-transforming the outcome measure. JPC = Joint physical custody. Estimates in **bold** are statistically significant at $p < 0.05$. *Baseline model* adjusted $R^2 = 0.122$, *Model 1* adjusted $R^2 = 0.123$, *Model 2* adjusted $R^2 = 0.132$

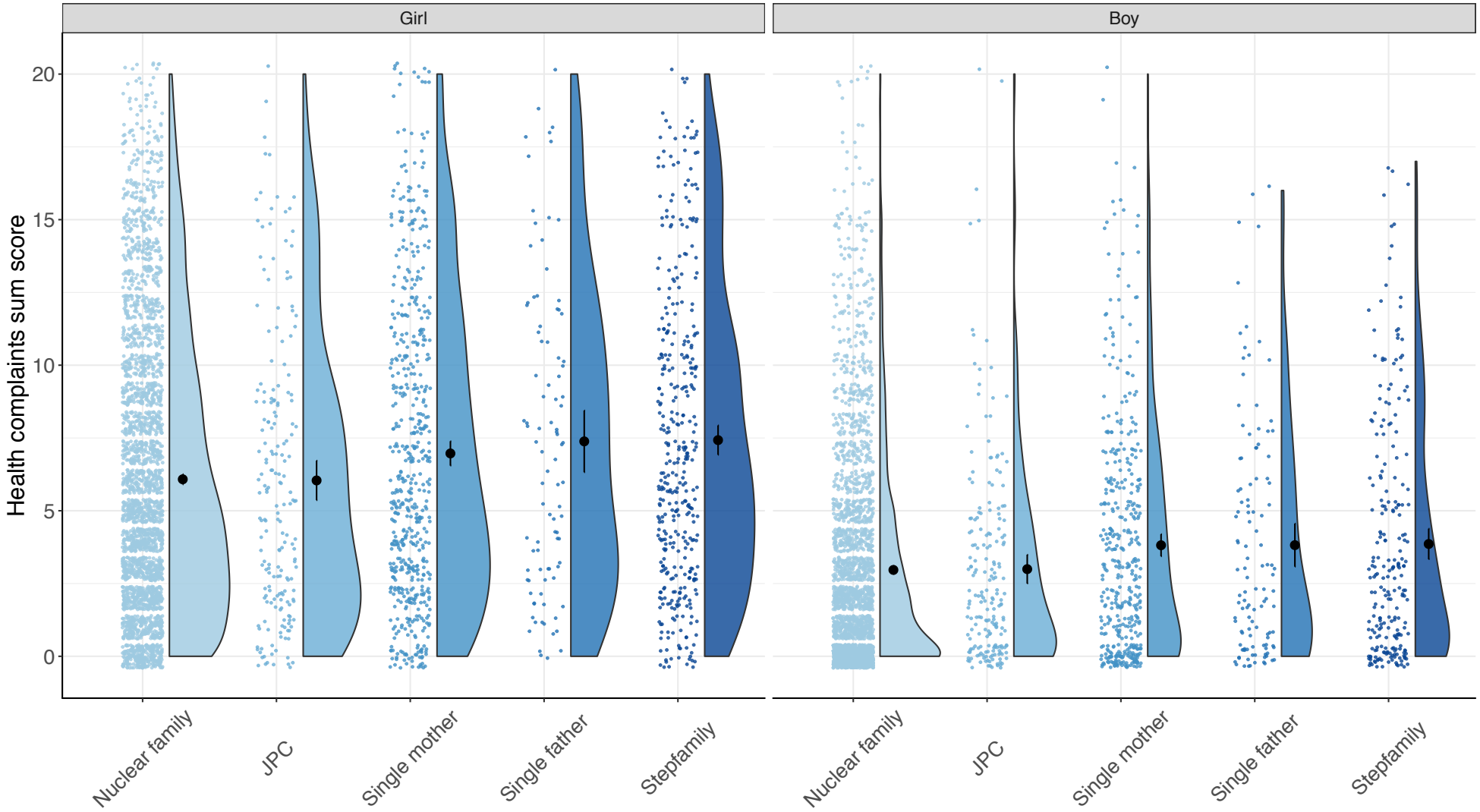
Figure legends

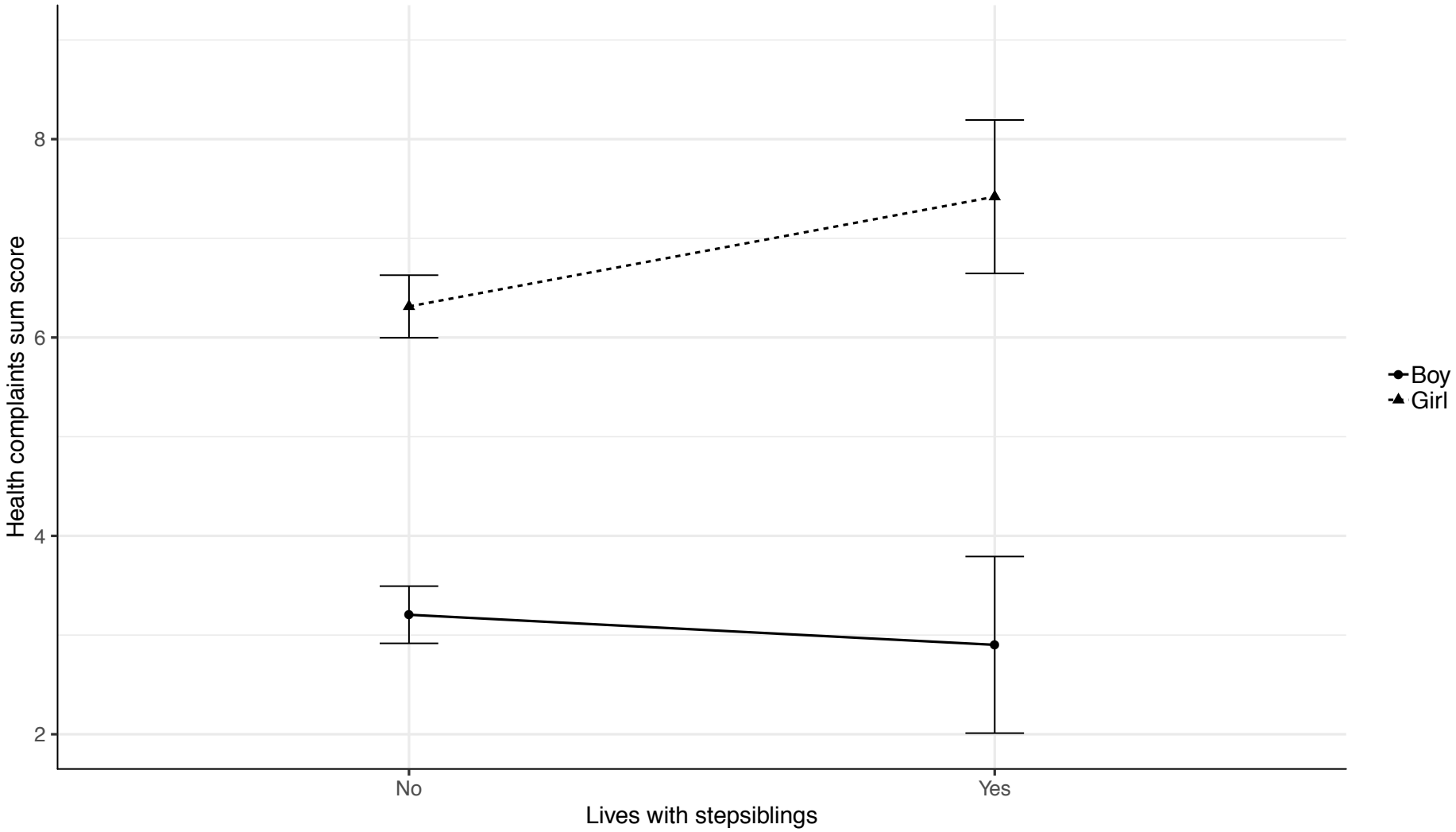
Caption Figure 1. Raincloud plot of the health complaints sum scores across the family structures grouped by gender.

Note. Raincloud plot showing the distribution (probability density function of observations), the raw jittered data points, and the mean with 95% confidence intervals (point with error bars) of the health complaints sum scores across the family structures grouped by gender.

Figure 2 . The interaction between gender and living with stepsiblings on the health complaints sum score.

Note. The figure illustrates the predicted health complaints sum scores among boys and girls by whether they lived with stepsiblings or not. Pooled estimates from 30 imputed datasets shown from the fully adjusted regression model. Error bars represents 95 % confidence intervals.


Girl
Boy
Health complaints sum score
20
15
10
5
0
Nuclear family
JPC
Single mother
Single father
Stepfamily
Nuclear family
JPC
Single mother
Single father
Stepfamily


Health complaints sum score
8
6
4
2
No
Yes
Lives with stepsiblings
Boy
Girl