

Dysfunctional family functioning in high socioeconomic status families as a risk factor for the development of psychiatric disorders in adoptees: the Finnish Adoptive Family Study of Schizophrenia

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Abstract

Purpose Earlier findings indicate that socioeconomic status (SES) of family associates with family functioning. This study examined the impacts of family functioning and genetic risk for schizophrenia on psychiatric morbidity of adoptees in families of high SES (HSES) and low SES (LSES).

Methods The study population is a subgroup of the Finnish Adoptive Family Study of Schizophrenia. Of the adoptees, 152 had high genetic risk for schizophrenia spectrum disorders (HR) and 151 adoptees had low risk (LR). Of the adoptees, 185 (HR=94, LR=91) were raised in high-SES (HSES) families and 118 (HR=58, LR=60) in low-SES (LSES) families. The family SES was determined by the occupational status of the main provider of the family. The functioning of adoptive families was assessed based on Global Family Ratings (GFRs) and psychiatric disorders on DSM-III-R criteria.

Results In the HSES families, the psychiatric morbidity of the adoptees was emphasized by HR (OR = 4.28, CI 2.14–8.56) and dysfunctional family processes (OR = 6.44, CI 2.75–15.04). In the LSES families, the adoptees' psychiatric morbidity was almost significantly increased by HR (OR = 2.10, CI 0.99–4.45), but not by dysfunctional family processes (OR = 1.33, CI 0.53–3.34).

Conclusions This study showed that in HSES families, dysfunctional family processes and HR for schizophrenia increased the likelihoods for the development of psychiatric disorders in adoptees. The results can be utilized in identifying risk factors in the development of psychiatric disorders and focusing preventative strategies on risk groups with acknowledging the importance of family functioning.

Keywords:

Gene-environment interaction, Socioeconomic status, Family functioning, Adoption study, Psychiatric disorders, Schizophrenia

1. Introduction

The concept of socioeconomic status (SES) refers to a multifaceted and contextual social phenomenon that covers a wide variety of social aspects such as education, occupation and wealth [1]. Depending of the context, SES has been determined by societal rank-based measures, such as educational or occupational levels, or by economic factors, like personal or household income. Similarly, the concept of social class refers to occupational, educational and economical layers in societies that combine and separate individuals [4, 5]. The individuals and families of higher SES (HSES) or higher social classes are described as succeeding more in terms of education, occupation or wealth in their context compared to individuals of lower SES (LSES) [6, 7].

It has been proposed that the different aspects of SES cannot be utilized interchangeably [8-9]. Braveman and colleagues [8] have proposed that different conclusions can be made regarding to the measured aspects of SES and that unmeasured SES aspects may influence the findings. Likewise, Geyer and colleagues [9] have shown that education, social class and income do not oftentimes correlate in study populations. However, some studies have implied that the different SES factors are interrelated, and that occupation can be used as a rough estimate for the educational and income level [1, 3] although such practice has also been criticized [8].

The SES of a family is reported to associate with parenting, parental relationships and family functioning [1, 6]. Taraban and Shaw [10] have proposed that the association of SES and parenting is due to contextual factors, such as access to quality nutrition or housing moderated by SES. The individuals and families of HSES are universally assumed to have better access to material and social resources, for instance better access to healthcare and education [1]. Furthermore, Bornstein and Bradley [1] have suggested that HSES enhances circumstances to more adaptive individual and familial functioning. Conger and colleagues [11] have reported that LSES increases risk for disadvantageous social and material conditions which may impair marital relationships and parenting. Hoffman [3] has implied that because of their lower occupational background, the LSES parents are more likely to invoke authoritarian parenting and less likely to use conversational parenting methods compared to HSES parents.

Living in LSES circumstances is widely reported to increase the risk for unfavorable mental health outcomes for children [6, 12-15]. In different types of study populations schizophrenia and other psychiatric disorders are more often found to manifest among the offspring in LSES families with poor social and occupational conditions compared to offspring in HSES families [15-22]. The study of Wicks and colleagues [23] showed that children who were reared in socioeconomically deprived families were in higher risk for psychosis compared to children with advantaged SES background. Furthermore, the results of the study

[23] indicated a possible interaction effect of disadvantaged SES of family and genetic risk for psychosis in the development of psychosis.

However, there are also opposite findings regarding the association of SES and psychiatric morbidity. A northern Finland 1966 Birth cohort study by Mäkikyrö and colleagues [24] showed that the incidence of early onset schizophrenia until 23 years was significantly higher in the children from upper social classes (1.14%) than among the children from lower social classes (0.47%). Similarly, Mulvany and colleagues [25] reported in their case control study of first onset schizophrenia patients, a slightly increased risk of schizophrenia among the offspring in the highest social classes compared to the offspring raised in lower social class families. The study of Hjern and colleagues reported [26] a higher risk for social maladjustment in adoptees in white-collar families compared to adoptees in blue-collar families. Some studies have also reported that the children of parents who had high educational levels were at greater risk for schizophrenia and other psychiatric disorders compared to children whose parents had a lower educational background [13, 27-28]. A study by Kristensen and colleagues [29] reported that high parental educational levels associated with a four-fold risk for schizophrenia among the offspring with low educational level compared to offspring with high educational level. Likewise, the study of Goldberg and colleagues [30] reported that being raised in HSES families increased slightly the risk for schizophrenia among the individuals with low cognitive functioning compared to individuals with high cognitive functioning.

Increasing evidence has shown that the genetic burden for schizophrenia increases the risk for all psychiatric disorders in addition schizophrenia in the offspring of a schizophrenic parent [31-35]. Although there is a significant genetic component in the etiology of schizophrenia, environmental factors contribute to the development of schizophrenia and other psychiatric disorders [36]. Previous findings from the Finnish Adoptive Family Study of Schizophrenia have demonstrated that adoptees with genetic liability for schizophrenia spectrum disorders are more vulnerable to disadvantageous environmental stressors, such as dysfunctional rearing, compared to adoptees with no such genetic risk status [35, 37-41]. On the other hand, healthy rearing is reported to be protective against psychiatric disorders and other internalizing symptoms [41-43].

Earlier studies have widely documented the impacts of socioeconomic status of childhood family as an environmental factor contributing to the psychiatric morbidity of offspring. However, the interaction of genetic risk for schizophrenia, family functioning and psychiatric morbidity of children have seldom been examined in relation to socioeconomic status of the childhood family. The adoptee study design enables the examination of associations of childhood SES, family functioning and genetic risk. This study examines the impacts of family functioning and genetic risk for schizophrenia on psychiatric morbidity of adoptees in HSES and LSES families.

2. Methods

2.1 Subjects

This study uses the nationwide data from the Finnish Adoptive Family Study of Schizophrenia. The study design, diagnostic procedures and selection criteria have been thoroughly reported elsewhere [34-35, 38, 44-45] and will be presented here briefly. The study population was based on the hospital records covering all women (n=19447) admitted to Finnish psychiatric hospitals during the time span of 1960–1979. Of these women, those who had been diagnosed at least once with schizophrenia or paranoid psychosis were identified. After that, these women were checked through the census and parish registers to find the mothers who had given a child or children (high-risk adoptees) for adoption. The adoptees who were adopted by relatives, adopted after the age of four or adopted abroad were not included in the study population. After identifying the index adoptees, their adoptive parents were included in the study with no diagnostic exclusion criteria applied [34-35].

The genetically high-risk adoptees (HR) and their adoptive families were demographically matched with control adoptees (LR) and their adoptive parents on criteria such as sex, age of adoptee, the age of the adoptees at the time of the placement and SES of the adoptive family. The control adoptees were given up for adoption by biological mothers, who were either diagnosed with a psychiatric disorder other than schizophrenia spectrum disorder or had no diagnosed psychiatric disorder [34-35].

Following the definitions of Kendler and colleagues [46], the diagnoses of index mothers, based on DSM-III-R criteria [47], were arranged into broad schizophrenia spectrum disorders as follows: schizophrenia, the odd-cluster personality disorders (schizotypal, schizoid and paranoid personality disorders plus avoidant personality disorder), non-schizophrenic non-affective psychoses (schizoaffective, schizophreniform, and delusional disorders and psychotic disorder not otherwise specified) affective psychoses (bipolar and depressive disorders with psychotic features) [35]. The adoptees were defined to have HR for schizophrenia spectrum disorders, if they were given up for adoption by a mother with a verified diagnosis of a schizophrenia spectrum disorder. The biological mothers of the LR adoptees had either non-spectrum diagnoses or no diagnosis of a psychiatric disorder [34, 44].

The final study population (n=382) of the Finnish Adoptive Family Study of Schizophrenia consisted of 190 adoptees at HR and 192 adoptees at LR for schizophrenia spectrum disorders [35, 38]. The adoptive families were evaluated with comprehensive research procedures by experienced psychiatrists. The research procedures included family observations along with interviews and tests individually and with different family combinations [44, 48].

The study sample of the current study consists of 303 adoptees (152 HR adoptees, 151 LR adoptees) and their adoptive families, for whom the SES information of the adoptive family was available for statistical analyses. SES and the family functioning of the adoptive family was measured at the time of initial assessment when the median age of the adoptees was 25 years (sd=10 years; IQR 18-34 years) of age. The mean age of adoptive parents in initial assessment was for mothers 60 years (sd=11 years, IQR 52-69 years) and for fathers 60 years (sd=10 years; IQR 52-67 years).

2.2 Measures

2.2.1. Psychiatric disorders of the adoptees

The adopted offspring's psychiatric disorders were based on DSM-III-R criteria [47] and classified in this study into two categories in the following way: adoptees diagnosed with a psychiatric disorder (n=140; HR=89, LR=51) and adoptees with no psychiatric diagnosis (n=163; HR=63, LR=100). The category of schizophrenia spectrum disorders included (n=40; HSES=25, LSES=15) diagnoses for schizophrenia, the odd-cluster personality disorders (schizotypal, schizoid and paranoid personality disorders plus avoidant personality disorder), non-schizophrenic non-affective psychoses (schizoaffective, schizophreniform, and delusional disorders and psychotic disorder not otherwise specified), and affective psychoses (bipolar and depressive disorders with psychotic features). The psychiatric disorders other than schizophrenia spectrum disorders disorder (n=100; HSES=58, LSES=42) included all the non-schizophrenia spectrum disorders [35].

The DSM-III-R diagnoses [47] of the adoptees were made, whenever possible, by personal interviews and from hospital records and other diagnostically significant sources available [35]. The psychiatric status of the adoptees was defined as the hierarchically most severe lifetime diagnosis and followed the definitions of Kendler et al. [46], Tienari et al. [35] and Wynne et al. [41]. The diagnostic status of the adoptees was reassessed at the register follow-up when the median age of the adoptees was 44 years [38].

2.2.2 Socioeconomic status of childhood family

Originally, the SES of the adoptive families was rated according to the four-level Finnish socioeconomic classification and determined by the main provider of the family [49]. The SES of the adoptive family was divided into four socioeconomic groups. The first group (SES I) (n=49) included adoptive families in which the head of the family was either academically educated, a free entrepreneur or worked in a

supervisory position. The second group (SES II) (n=136) covered adoptive families in which the head of the family worked either in a technical position, was a foreman or worked in an independent position as an entrepreneur or an office worker. The third group (SES III) (n=97) included adoptive families in which the head of the family was a subordinate office worker, a professional worker with at least two years of education or worked in an assistant position. The fourth group (SES IV) (n=21) consisted of families in which the head of the family worked as a helper or a cleaner or was employed in multiple minor positions. The retired and unemployed parents were classified according to their previous occupational positions.

In this study, the first two groups (SES I & SES II) (n=211) were compound together because of the overlapping similarities between them to create a category of high socioeconomic status (HSES) of an adoptive family. Likewise, the last two groups (SES III & SES IV) (n=134) were also combined, and they form the category of low socioeconomic status (LSES) of an adoptive family.

2.2.3. The assessment of family functioning

The functioning of adoptive families was assessed using Global Family Ratings (GFRs) [41, 45]. The GFRs are based on semi-structured individual, pair and family interviews and broad observations done by the researchers during the interview sessions. The researchers conducted the interviews blinded to genetic risk status of the adoptees. [41, 44-45, 48]. The GFRs reflect the functioning of adoptive families broadly from various viewpoints. These include: 1) Anxiety, 2) Boundaries, 3) Parental coalition, 4) Interaction and its quality, 5) Flexibility of homeostasis, 6) Transactional defenses, 7) Conflicts, 8) Empathy, 9) Power relations, 10) Reality testing, and 11) Basic trust. Based on the GFRs criteria, the families were classified into five categories on a scale from 1 = healthy to 5 = severely disturbed, chaotic [41, 45, 50].

The categorization of GFRs followed conceptually the hypothetical continuum of five-level Global Assessment of Relational Functioning (GARF), which was published in DMS-IV [51]. The criteria used in formulation of GFRs categories was based on contemporary family research literature [52]. The GFRs were grouped in the following way: 1) Families with functional processes, 2) Families with mildly dysfunctional processes, and 3) Families with dysfunctional processes [37]. The families with functional processes were represented by the GFRs categories 1 and 2, which were evaluated as healthy or mildly disturbed, for example in relation to anxiety; boundaries between the individual family members, generations, and between the family and the outside world; and interaction. Families with mildly dysfunctional processes were represented by GFRs category 3, which was estimated as moderately dysfunctional or neurotic in terms of interaction, relationships and interpersonal patterns and in which the conflicts were unresolved. Families with dysfunctional processes were represented by GFRs categories 4 and 5, which were evaluated as disturbed or severely disturbed and in which, for example, interpersonal patterns, conflict solving, and emotional

expression were deemed to be dysfunctional and maladaptive [41, 45]. The category groupings were formed based on the definitions of Tienari and colleagues [45].

2.2.4 Age at placement

The adoptees' age at the time of placement in the family was classified in three categories: 0–6 months, 7–18 months and over 19 months. In the HSES group the median age was 15 months and in the LSES group 11 months. The categorization was influenced by earlier research showing that adoption during the early months may reinforce secure attachment, whereas later adoption age may enhance attachment difficulties and worsen parent-child relationships [53-55].

2.2.5 Statistical analyses

Statistical significance of group differences in categorical variables were assessed with Pearson's Chi-Square test or Fisher's Exact Test. A logistic regression model was used to examine the association of genetic risk, the GFRs, gender and the age at placement with the psychiatric disorders of the adoptees separately for HSES and LSES families. Additional logistic regression analysis was conducted to examine the interaction of genetic risk for schizophrenia spectrum disorders and family functioning with adoptees' psychiatric morbidity. All tests were two-tailed and the limit for statistical significance was set at $p=0.05$. The statistical software used in analyses was IBM SPSS Statistic Version 26.

3. Results

Table 1 presents the bivariate associations between characteristics of the adoptees and SES of the adoptive families. In both SES groups, women and HR for schizophrenia spectrum disorders accounted for approximately half of the adoptees. In the HSES group of the adoptees, a significantly higher proportion of adoptees belonged to families showing functional processes compared to the LSES group of the adoptees. In the LSES group of adoptees, significantly more families were evaluated as families with dysfunctional processes compared to the HSES group of adoptees. In both SES groups, a nearly equal proportion of adoptees were diagnosed with a psychiatric disorder.

Table 1. The characteristics of the adoptees, by the socioeconomic status (SES) groups of the adoptive families.

	High SES (HSES) (n = 185)	Low SES (LSES) (n = 118)	P-VALUE
High genetic risk (HR) for schizophrenia spectrum disorders			0.778
Yes	94 (50.8%)	58 (49.2%)	
No	91 (49.2%)	60 (50.8%)	
Global Family Ratings (GFRs)			0.014
Families with functional processes	89 (48.1%)	37 (31.4%)	
Families with mildly dysfunctional processes	51 (27.6%)	40 (33.9%)	
Families with dysfunctional processes	45 (24.3%)	41 (34.7%)	
Gender			0.709
Female	101 (54.6%)	67 (56.8%)	
Male	84 (45.4%)	51 (43.2%)	
Age at placement			0.083
0–6 months	47 (25.4%)	37 (31.3%)	
7–18 months	63 (34.1%)	48 (40.7%)	
19+ months	75 (40.5%)	33 (28%)	
Diagnosed psychiatric disorder			0.558
Yes	83 (44.9%)	57 (48.3%)	
No	102 (55.1%)	61 (51.7%)	

SES = socioeconomic status. HSES = high socioeconomic status (SES I–II). LSES = low socioeconomic status (SES III–IV).

HR = high genetic risk for schizophrenia spectrum disorders.

Age at placement = adoptee’s age at the time of the placement into the adoptive family.

Global Family Ratings (GFRs): Families with functional processes (GFR categories 1–2), families with mildly dysfunctional processes (GFR category 3), families with dysfunctional processes (GFR categories 4–5).

Table 2 presents the associations of psychiatric disorder status with the characteristics of the adoptees in HSES and LSES groups, separately. In the HSES group, the psychiatric disorder of the adoptees was statistically significantly associated with HR status of the adoptees and families with dysfunctional processes. Furthermore, in the HSES group, the adoptees were not diagnosed with a psychiatric disorder to a statistically significant degree in families with functional processes. In the LSES group, HR status showed a marginally significant association with adoptee psychiatric disorders.

Table 3 shows the results of logistic regression analysis, separately for HSES- and LSES-adoptive families. In the HSES group, the likelihood of a psychiatric disorder was increased in HR adoptees (OR 4.28, CI 2.14–8.56) and those exposed to adoptive families with dysfunctional processes (OR 6.44, CI 2.75–15.04). In the LSES group of the adoptive families, the likelihood for a psychiatric disorder was almost significantly associated with HR status of the adoptees (OR 2.10, CI 0.99–4.45).

Furthermore, an additional analysis was done to examine the interaction of genetic risk for schizophrenia spectrum disorders and family functioning with adoptees' psychiatric morbidity. The analysis revealed no significant (HSES, $p = 0.802$; LSES, $p = 0.601$) interaction between the variables and the likelihood for the development of any psychiatric disorder.

Table 2. The characteristics of the adoptees in relation to their psychiatric disorder status, by socioeconomic status (SES) groups of the adoptive families.

	High SES (n=185)			Low SES (n=118)		
	Adoptee's any psychiatric disorder		P-value	Adoptee's any psychiatric disorder		P-value
	YES (n=83)	NO (n=102)		YES (n=57)	NO (n=61)	
High genetic risk (HR) for schizophrenia			0.001			0.066
Yes	56 (67.5%)	38 (37.3%)		33 (57.9%)	25 (41%)	
No	27 (32.5%)	64 (62.7%)		24 (42.1%)	36 (59%)	
Global Family Ratings (GFRs)			<0.001			0.890
Families with functional processes	27 (32.5%)	62 (60.8%)		17 (29.8%)	20 (32.8%)	
Families with mildly dysfunctional processes	24 (28.9%)	27 (26.5%)		19 (33.3%)	21 (34.4%)	
Families with dysfunctional processes	32 (38.6%)	13 (12.7%)		21 (36.8%)	20 (32.8%)	
Gender			0.697			0.892
Female	44 (53%)	57 (55.9%)		32 (56.1%)	35 (57.4%)	
Male	39 (47%)	45 (44.1%)		25 (43.9%)	26 (42.6%)	
Age at placement			0.311			0.479
0–6 months	17 (20.5%)	30 (29.4%)		20 (35.1%)	17 (27.9%)	
7–18 months	32 (38.5%)	31 (30.4%)		20 (35.1%)	28 (45.9%)	
19+ months	34 (41%)	41 (40.2%)		17 (29.8%)	16 (26.2%)	

Adoptees' any psychiatric disorder includes all the diagnosed psychiatric disorders.

SES = socioeconomic status. High SES = high socioeconomic status (SES I–II). Low SES = low socioeconomic status (SES III–IV).

HR = high genetic risk for schizophrenia spectrum disorders.

Age at placement = adoptee's age at the time of the placement into the adoptive family.

Global Family Ratings (GFRs): Families with functional processes (GFR categories 1–2), families with mildly dysfunctional processes (GFR category 3), families with dysfunctional processes (GFR categories 4–5).

Table 3. The likelihood for psychiatric disorder of the adoptees, by the socioeconomic status (SES) groups of the adoptive families.

	High SES (n=185)		Low SES (n=118)	
	OR	95 % CI	OR	95 % CI
High genetic risk (HR) for schizophrenia, yes	4.28***	2.14–8.56	2.10	0.99–4.45
Global Family Ratings (GFRs)				
Families with functional processes	ref.		ref.	
Families with mildly dysfunctional processes	2.83**	1.29–6.21	1.17	0.46–2.95
Families with dysfunctional processes	6.44***	2.75–15.04	1.33	0.53–3.34
Gender of the adoptee, female	0.78	0.40–1.50	0.95	0.45–2.01
Age at placement				
0–6 months	ref.		ref.	
7–18 months	1.36	0.57–3.25	0.59	0.24–1.42
19+ months	1.04	0.45–2.43	0.92	0.35–2.39

^a Adoptees' any psychiatric disorder includes all the diagnosed psychiatric disorders.

SES = socioeconomic status. High SES = high socioeconomic status (SES I–II). Low SES = low socioeconomic status (SES III–IV).

HR = high genetic risk for schizophrenia spectrum disorders.

Age at placement = adoptee's age at the time of the placement into the adoptive family.

Global Family Ratings (GFRs): Families with functional processes (GFR categories 1–2), families with mildly dysfunctional processes (GFR category 3), families with dysfunctional processes (GFR categories 4–5).

*p < 0.05, **p < 0.01, ***p < 0.001

4. Discussion

This study examined the impacts of family functioning and genetic risk for schizophrenia on psychiatric morbidity of adoptees who were brought up in families of high SES (HSES) and low SES (LSES). In our study, there were approximately equal proportions of adoptees diagnosed with a psychiatric disorder both in the HSES and LSES groups. However, only in the HSES group was the family functioning associated with the psychiatric morbidity of the adoptees. The main finding of our study is that, regardless of the genetic liability for schizophrenia spectrum disorders, psychiatric morbidity was emphasized among the adoptees raised in HSES families with dysfunctional processes, compared to corresponding LSES families. Although HSES is commonly reported to enhance the functioning of families and psychosocial wellbeing of individuals, some studies have reported HSES as a risk factor for the development of schizophrenia and other psychiatric disorders. For example, the results of the birth cohort study by Mäkikyrö and colleagues [24], and a case control study by Mulvany and colleagues [25] showed a higher occurrence of schizophrenia among the children from upper social classes. In addition, some studies have reported increased likelihoods for psychiatric disorders among the offspring of parents with high educational levels [13, 27-28]. Our study brings a deeper perspective to the association of family SES with psychiatric morbidity of children, as our analysis includes the impacts of genetic and family environmental factors.

Furthermore, in addition to dysfunctional family processes, the high genetic risk for schizophrenia spectrum disorders (HR) was a significant risk factor for psychiatric disorders among the adoptees in HSES families. Earlier findings from the Finnish Adoptive Family Study of Schizophrenia [35, 38-41] and other HR studies [56] have shown that HR adoptees are more vulnerable to adverse environmental stressors. In LSES families also, the genetic risk for schizophrenia spectrum disorders increased the psychiatric morbidity of the adoptees, although not as notably as among the adoptees in HSES families. Furthermore, an additional analysis revealed that interaction between genetic liability for schizophrenia spectrum disorders and family functioning did not associate with the psychiatric morbidity of the adoptees in LSES families.

A plausible explanation for our main finding is that, when family processes in HSES families are rated as dysfunctional, parental expectations and demands on high educational or intellectual success from their offspring may manifest as more distressing than in corresponding LSES families. In our study, the Global Family Ratings (GFRs) scale was used to evaluate the level of functioning in adoptive families. The GFRs include many dimensions, such as level of conflicts, empathy and intrafamily interaction, which may designate the levels of parental support within the families. Previous research has shown that in conflict-ridden family systems, children may not learn adaptive ways to handle stress [57-58]. Overall, familial SES, whether assessed via education, occupation, or income, relates to nearly every aspect of offspring psychological development [5, 59], parental values, childrearing goals and rearing patterns [3], and parental aspirations for their children [60].

Particularly for the HR adoptees, harsh parental expectations in HSES families with dysfunctional processes can be notably stressful and harmful in terms of psychiatric morbidity, possibly because the adoptees' cognitive abilities may not equate to those of the adoptive parents [30]. The dissonance between an adoptee's own capabilities and parental expectations may be emphasized for HR adoptees in HSES families with dysfunctional processes. Therefore, in HSES families with dysfunctional processes, the HR adoptees may face constant and long-term experiences of social defeat, which is proposed to increase the risk for the development of schizophrenia [61].

Moreover, in our results the psychiatric disorders of the adoptees were less prevailing in the HSES families with functional processes as they were in HSES families with dysfunctional processes. This follows partly the earlier studies of the Finnish Adoptive Family Study of Schizophrenia [40-41] that have denoted the protective nature of functional rearing against psychiatric disorders among adoptees. Therefore, it is reasonable to assume that functional family processes may have protective effect against psychiatric morbidity of offspring in HSES families. It can be possible that in HSES families with functional processes, the rearing environment for adoptees is distinctively beneficial in terms of psychosocial well-being, because of both advantaged socioeconomic and familial factors.

Furthermore, the age at adoption was higher in the HSES group. Although, this did not associate with the psychiatric morbidity of the adoptees, earlier studies have proposed that earlier adoptions can be beneficial to children [62]. It may be possible that in some cases the adoptees in HSES families were taken care by their biological mothers a longer time than the adoptees in LSES families and some of HSES adoptees may have had an earlier placement in a foster home. There were however no significant differences between the SES-groups on the age at adoption.

It is also possible that the parents in HSES families may be more likely to refer their children for psychiatric help compared to LSES parents. Previous research has shown that HSES parents may be more aware of psychiatric disorders and consider more often psychiatric care as a possible treatment for mental disorders compared to LSES parents [63]. The study of von dem Knesebeck and colleagues [63] furthermore showed that LSES parents may be more likely than HSES parents to consider relaxation and sports as valid methods for treatment of psychiatric disorders. Therefore, the psychiatric morbidity of adoptees can possibly remain unnoticed in LSES families, whereas in HSES families the adoptees may end up to the path of accumulating psychiatric disorders.

Of notable interest is that in our results the family functioning of LSES adoptive families did not, *per se*, associate with psychiatric morbidity of the adoptees. This finding can be explained from various viewpoints. Firstly, in LSES adoptive families with dysfunctional processes, compared to HSES families with dysfunctional processes, the deficient parental support may not be as detrimental because of lower levels of parental expectations. Davis-Kean [64] showed that socioeconomically advantaged parents had higher

educational expectations for their children compared to less-educated and less-affluent parents. Secondly, functional family processes evidently protect adoptees from some generally recognized adverse effects of LSES. This phenomenon is described, for example, in the study by Pirkola and colleagues [65], in which parental unemployment did not associate with psychiatric morbidity of the offspring, possibly because unemployed parents may have more time for supportive parenting compared to their employed counterparts. Thirdly, as Bøe and colleagues [66], and Solantaus and colleagues [67] have reasoned, welfare state services and benefits can alleviate the adverse effects and stressfulness of disadvantaged economic circumstances, such as poor nutrition, inadequate housing and limited health care [16]. In Finland, the public health care services are nationwide and available for everyone comprehensively and impartially. It has been shown that in Finland the people of LSES more often lean on public health care services [68] and therefore the availability and quality of public health care directly affects those who are underprivileged.

It is suggested that SES generally moderates material and social conditions which affect parenting [10]. In our study the results of bivariate analyses (Table 2) showed that functional processes were emphasized in HSES families, whereas dysfunctional processes were more prevalent in LSES families. This is in line with a study by Bornstein and Bradley [1] reporting that HSES enhances circumstances to more adaptive individual and familial functioning. On the other hand, Conger and colleagues [11] have shown that LSES deteriorates marital relationships and parenting, which may be a result of economic hardship [67].

The adoption study design enabled us to examine both genetic and environmental contribution to psychiatric morbidity of the adoptees. The adoptees were adopted by families of different SES backgrounds, and thus, the HR adoptees were represented both in families of HSES and LSES. Therefore, we were able to analyze, in different SES contexts, the impact of genetic risk for schizophrenia spectrum disorders on the development of any psychiatric disorder. Our results expand the perception that increased levels of psychiatric disorders among the individuals of LSES are to be explained primarily by genetic factors. Gallagher and colleagues [16] have interpreted that because individuals with genetic risk for psychiatric disorders are often overrepresented in LSES stratum, therefore the increased occurrence of psychiatric disorders in the LSES context is mainly due to genetic factors. Our results instead showed an unequivocal impact of dysfunctional family functioning in HSES families on adoptees' psychiatric morbidity. Also, in the HSES families the functional processes seemed to protect adoptees from psychiatric morbidity. Furthermore, our results add some new perspectives to the theory of social causation in which the higher occurrence of psychiatric disorders in the LSES context is explained with the interpretation that disadvantageous socioeconomic milieus enhance the risk for psychiatric disorders [58, 69]. This demonstrates the sound design of this adoptee study and shows the necessity for more research concerning the role of both genetic and environmental factors in the development of psychiatric disorders.

The family HR studies have principally focused on the development of the same disorder in offspring that the parents were diagnosed with. However, accumulating evidence from family HR studies has

documented that the offspring of a parent with schizophrenia are in increased risk, not only for schizophrenia, but also for any psychiatric disorder [32-33, 70]. Likewise, our results showed that the genetic vulnerability for schizophrenia spectrum disorders increased the likelihood for the development of any psychiatric disorder in the adoptees, especially when raised in HSES families with dysfunctional processes.

4.1 Strengths and limitations of the study

The major strength of the current study is the adoptee study design which enabled the examination of genetic and various environmental factors separately. Reliable diagnostics and diversified methodological procedures, accomplished by trained researchers, are also to be considered as substantial strengths of this study. Furthermore, the functioning of families was assessed with a detailed measure (GFRs), that evaluates adoptive families based on factors such as interaction between family members, level of conflicts, power relations and parental coalitions [41].

This study also has some limitations. To start with, we analyzed the overall psychiatric morbidity of the adoptees. The analysis of different psychiatric disorder groups was not feasible due to relatively small number of cases stratified by SES. Moreover, the SES groups used in this study were categorized according to the four-level Finnish socioeconomic classification, which is based solely on the occupational status of the main provider of the family. Although the classification has been widely used, it is, as anticipated, unobservant for different factors of SES, such as parental education, income, wealth, neighborhood SES, or occupational status of the second breadwinner of the family. We acknowledge the limitations concerning our SES variable and we cannot therefore estimate how the unmeasured SES factors may have affected our results. Furthermore, using the dichotomized occupational status (HSES/LSES) as the SES variable may not be sensitive enough to reflect the heterogeneity of the SES groups.

Furthermore, we cannot be completely certain of how permanent the SES of each family was throughout the years, as the SES circumstances were recorded at only one stage. Therefore, we cannot estimate how much our results are affected for circumstances, such as loss of job or income. However, Gottfried and colleagues [59] have demonstrated that the occupational status of fathers remains relatively consistent during the years, especially among the fathers of advanced ages. We can assume that also the adoptive parents from our study were at an advanced age and therefore their SES would have remained quite stable during the childhood and adolescence of the adoptees. Worthy of recognition is also that the Finnish society has traditionally been ethnically homogenous, consisting mainly by white people with a relatively small number of ethnic minorities among the population. Therefore, it is unlikely that ethnic differences could have affected our results about the SES variable. Furthermore, due to small number of cases, we were not able to examine the impacts of potential explaining factors, such as early parental death or early parental divorce on our results.

Moreover, the assessed family functioning is cross sectional and we cannot estimate how unchangeable it stayed through the years. Finally, as the number of families with functional processes in the HSES group and families with dysfunctional processes in the LSES group were elevated; this may have an impact on our results. Yet, it is to be considered that this reflects a commonly found phenomenon that improved socioeconomic factors enhance the functioning of families. All these limitations lead to the possibility for alternative findings (Type I error) and also the chance of not observing all the attainable findings remains (Type II error).

Conclusion/Summary

In this study, we were able to focus on family functioning and genetic vulnerability to schizophrenia spectrum disorders with an objective to clarify the associations of environmental and genetic factors in the development of psychiatric disorders of the adoptees in families of high and low socioeconomic status. The main finding of this study showed that psychiatric morbidity of the adoptees was emphasized in HSES families with dysfunctional family processes. Our findings furthermore demonstrated that genetic risk for schizophrenia spectrum disorders increased the risk for psychiatric disorders in adoptees, both in HSES and LSES families. Earlier findings from the Finnish Adoptive Family Study of Schizophrenia have reported that adoptees with high genetic risk for schizophrenia spectrum disorders are more vulnerable to adverse environmental stressors, which our results also confirm, especially concerning the HSES families. Furthermore, functional family processes seemed to protect adoptees from psychiatric morbidity in the HSES group. Based on our findings, the dysfunctional family processes were elevated in the LSES families. HR adoption family study design is an effective method to study gene-environment interactions. This is particularly important in identifying risk factors, finding ways treat psychiatric disorders and focusing preventative strategies on risk groups.

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*deceased

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Data availability Not available.

Code availability Not available.

Ethics approval The Finnish Adoptive Family Study was approved by the Ethics Committee of Oulu University Hospital on 2 May 1988. The study design was reviewed and reapproved on 15 October 1991 by the Ethics Committee of Oulu University Hospital. The study design was evaluated to have followed the ethical practices of the time.

Conflict of interest The authors declare that they have no conflict of interest.

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