Socioeconomic Status and Mental Health in Children and Adolescents

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Dissertation for the degree philosophiae doctor (PhD)

at the University of Bergen

2013

Dissertation date: 16.12.2013

Scientific environment

The work presented in the current thesis was financed through a four year PhD-grant from the Regional Centre for Child and Youth Mental Health and Welfare, Uni Health, Uni Research. The PhD project was part of the "Bergen Child Study", a comprehensive study of children's mental health and development conducted in the city of Bergen, Norway. The management group for the Bergen Child Study has included Kjell Morten Stormark, Astri J. Lundervold, Einar Heiervang, Mari Hysing and Maj-Britt Posserud. The BCS was supported financially by the Norwegian Directorate for Health, the Research Council of Norway, Western Norway Regional Health Authority, the Meltzer foundation and the City of Bergen.

The doctoral education was carried out within the institutional framework of the Graduate School of Clinical and Developmental Psychology and the general doctorate program at the Faculty of Psychology, University of Bergen. The scientific work conducted in the thesis was primarily done at the Regional Centre for Child and Youth Mental Health and Child Welfare, Uni Health, Uni Research.

The dissertation is presented through the Regional Centre of Child and Youth Mental Health and Child Welfare, Uni Health, Uni Research, under supervision from Professor Børge Sivertsen at the Norwegian Institute of Public Health, Professor Astri J. Lundervold, and Dr. Mari Hysing at the Institute of Biological and Medical Psychology, Faculty of Psychology, University of Bergen.

Acknowledgements

First and foremost I would like to thank my main supervisor Professor Børge Sivertsen and my co-supervisors Professor Astri J. Lundervold and Dr. Mari Hysing for your invaluable support and guidance during my PhD-work. Thank you for your outstanding availability, willingness to support me and for your friendship! I am enthusiatically looking forward to continue collaborating with you in the future.

Mari – thank you for all your brilliant ideas and suggestions, for keeping me motivated and for all our formal and informal talks at work, on commutes from work, and over coffe with you and Børge in your home. You have been an incredible discussion partner and have always found time for me in your busy schedule. Thank your for being a such a wonderful colleague and for having made the last years so enjoyable. I am looking forwards to working with you in the future, and who knows, maybe one day I may even join you for a run to work!

Besides my eminent supervisors, I have also been fortunate to collaborate with several outstanding co-authors. To Professor Simon Øverland (paper I), Professor Kjell Morten Stormark (paper II), and Professor Einar Heiervang and Professor Robert Goodman (paper III): Thanks for all your valuable input and discussions during the preparations of the papers. Thanks also to Professor Jim Stevenson for valuable input to paper II.

A very special thanks also to Professor Kjell Morten Stormark, Head of Research at the Regional Centre of Child and Youth Mental Health and Welfare (RKBU). Thank you for inviting me to join the Regional Centre as a first year psychology student, and for supervising my masters thesis and many student papers. Thank your for believing in me, for supporting me, and for giving me the opportunity to pursue my research interests.

I would also like to thank RKBU for financing my PhD work, and the Meltzer fund

for giving me the opportunity to present my work at various seminars and conferences in Norway and abroad. RKBU has been my working environment during the completion of my PhD. Thanks to the Head of the Centre, Dr. Reidar Jakobsen for your availability and for always finding time for chats and discussions. I would also like to thank all my cheerful, helpful and skilled colleagues at RKBU, and especially Hilde Sakariassen for enthusiastic and extremely valuable contributions to my working environment. Thanks also to my wonderful colleages Dr. Siren Haugland and Dr. Kyrre Breivik who read and provided valuable comments and suggestions on the summary.

I would also like to thank Dr. Kyrre Breivik at RKBU, Associate Professor Torbjørn Torsheim at the Faculty of Psychology, University of Bergen, and Professor Leif Edvard Aarø at the Norwegian Institute of Public Health for opportunities to discuss statistical methodology with you.

Thanks also to my fellow PhD-students at RKBU, the Faculty of Psychology, University of Bergen, and the Norwegian Institute of Public Health for sharing the fun!

I would also like to thank my parents for introducing me to the joys of reading and for encouraging and supporting my curiosity. Thanks also to my sister Monica for all our interesting discussions throughout the work with the thesis. To all of you: Thank you for believing in me, for always supporting me, for always being interested in my work, and for providing much needed recreational facilities and opportunities!

Finally, I want to give my most heartfelt thanks to Solfrid Henden Sagen, my beautiful beloved wife and best friend. Thank you for standing by my side, and for all the patience and tolerance you have shown me during times of absentmindedness, and when I have had to work during evenings, weekends and holidays. Thank you for all our discussions, for your valuable inputs and for your attention to detail. I could never have accomplished this without your neverending support and faith in me!

Abstract

Socioeconomic disadvantage in childhood is related to both immediate and persisting impairments in mental health and well-being. Findings from epidemiological studies suggest that children who grow up in families with a lower socioeconomic status (SES) have more symptoms of mental health problems, compared to those raised in more affluent families.

The overall aim of the current thesis was to expand the knowledge of the socioeconomic distribution of childhood mental health problems by conducting detailed investigations of how indicators of socioeconomic status are associated with different domains of mental health problems. A second aim was to examine some of the potential mechanisms through which socioeconomic disadvantage may translate into mental health problems using a path analytical framework. In order to accomplish these aims, data from a large sample of 11-13 years old children who participated in the Bergen Child Study was utilized.

In Paper I, the aims were to investigate whether there are general inverse relationships between indicators of socioeconomic status and different domains of mental health problems, and to determine whether specific indicators of socioeconomic status were associated with particular dimensions of mental health. The findings confirmed an inverse relationship across all the symptom dimensions. Poor family economy consistently predicted the mental health problems investigated, while parental level of education predicted externalizing problems stronger than internalizing problems.

In Paper II, the aims were to investigate the association between familial socioeconomic status and children's sleep problems, and to assess the role of sleep problems as a potential mediator of the association between familial socioeconomic status and childhood mental health problems. It was found that sleep problems were significantly more common in socioeconomically disadvantaged children, and that having difficulties initiating and/or maintaining sleep partially mediated the association between poor family economy and mental health problems.

In paper III, the aims were to investigate associations between family economy, parental level of education, parental emotional well-being, and parenting practices. An additional goal was to assess whether associations between SES indicators and internalizing or externalizing child mental health problems were mediated through parental well-being and parenting practices. The findings were generally supportive of a model where parental emotional well-being and parenting practices mediated the associations between indicators of SES and mental health problems in children.

Overall, the findings from the three papers comprising this thesis suggest that mental health problems and sleep problems are distributed according to familial socioeconomic status, with more problems for those who are socioeconomically disadvantaged. Furthermore, sleep problems, as well as parental emotional well-being and parenting practices may influence the association between familial socioeconomic status and childhood mental health problems.

List of publications

Paper I Bøe, T., Øverland, S., Lundervold, A. J., & Hysing, M. (2012). Socioeconomic status and children's mental health: results from the Bergen Child Study. Soc Psychiatry Psychiatr Epidemiol, 47(10), 1557-1566. doi:10.1007/s00127-011-0462-9

Paper II Bøe, T., Hysing, M., Stormark, K. M., Lundervold, A. J., & Sivertsen, B. (2012). Sleep problems as a mediator of the association between parental education levels, perceived family economy and poor mental health in children. Journal of Psychosomatic Research, 73(6), 430-436. doi:10.1016/j.jpsychores.2012.09.008

Paper III Bøe, T., Sivertsen, B., Lundervold, A.J., Heiervang, E., Goodman, R. & Hysing M. (n.d.). Socioeconomic status and child mental health: The role of parental emotional well-being and parenting practices. *Submitted to Journal of Abnormal Child Psychology.*

Contents

1. Introduction

1.1 Background for the thesis

"In a democratic society, it should be obvious to try to influence the conditions that create social inequalities in health" St. Meld. 16 (2002-2003) [1, p 47.]

Mental health problems are common and many disorders have an early onset. Estimates show that the lifetime risk for developing a mental disorder is close to 50% and half of all cases debute before the age of 14 [2,3]. The prevalence rates for children and adolescents vary from approximately 7–15% depending on how diagnoses are assigned, and the age and origin of the sample studied [4-10]. Socioeconomic status, socioeconomic position or social class (collectively "SES") has emerged as one of the important correlates or risk factors of mental health problems in childhood and adolescence[11].

1.2 Social inequality in mental health during childhood and adolescence?

Many studies have found associations between behavioural and emotional problems[a] in children and the economic situation in the family. See Table 1 for a detailed overview of some of these studies.

Low income has been associated with increased odds for parent reported conduct-, hyperactivity-, and emotional problems, and all teacher- and self-reported disorders measured with the Child Behaviour Checklist[18] (CBCL)[19]. Likewise, Lempers et al.[20] found financial adversity measured with the Economic Hardship Questionnaire to be associated with depression and loneliness in ninth graders. In a more recent study,

[a] Economic adversity has also been associated with poorer achievement, language and cognitive outcomes in children[12,13]. Deep[14] and persistent[15] poverty experienced in early childhood[16] has been found to have especially detrimental effects[16,17].

Newacheck et al.[21] found poor adolescents to have more emotional and behavioural problems compared to middle- and higher-income peers as defined by income-to-needs ratio.

The influence of poor economy on child and adolescent mental health has also been found in longitudinal studies. Bolger et al.[22] defined economic hardship as receiving federally mandated free or reduced price school lunches, and found symptoms of internalizing and externalizing problems to be associated with enduring economic hardship in a longitudinal study of adolescents. In a three wave longitudinal study it was demonstrated that early childhood poverty predicted symptoms of depression and antisocial behaviour when children were older, whereas persistent poverty (being poor in all three waves) was related to symptoms of antisocial behaviour[23]. Strohschein [24] found low household income in the first wave to be associated with higher levels of depression and antisocial behaviour in a seven wave longitudinal study. Subsequent improvements in income were associated with reductions in symptoms of mental health problems.

Evidence for the role of economy in influencing the psychological functioning of children and adolescence have also been demonstrated in randomized- and natural experiments, and in within-family studies of economic mobility. In a series of experimental studies conducted during the 1970s[25], certain US families with income below a predetermined economic threshold were given extra payments in order to increase their income. It was found that youth in the families who received extra payments had better school related performance, classroom conduct, and achievement test scores compared to those in the control group. In a more recent investigation, Costello et al.[26] studied the effect of gains in family income on youth mental health by taking advantage of a natural experiment occurring when a casino was established in an American Indian reservation. Costello et al. observed the prevalence of psychiatric disorder before and after the opening of the casino, and provided evidence for decreases in externalizing problems among youth in those families who benefited financially from the casino opening and thus moved out of poverty. Finally, in a study using individual fixed effects, Dearing et al.[27] showed that children demonstrated

fewer externalizing problems during times when the family had relatively more money compared to times when income in their family was relatively low.

Studies have also found child and adolescent mental health problems to be associated with parental occupational status. Achenbach et al.[28] showed a tendency of lower SES parents (defined according to their occupation) to report more problems on the CBCL[18] in a study using both a US and a Dutch sample. Using three classes of occupational status to indicate SES, Bird et al. [29] demonstrated higher rates of psychiatric disorder among children with the lowest SES, compared to those with medium and higher SES. Sund et al.[30] found maternal unemployment to predict higher scores on depression as measured with the Moods and Feelings Questionnaire[31]. Likewise, Ashford et al.[32] documented that parental unemployment or having a primary level job when participants were aged 4-5, predicted internalizing problems when they were 11 years, adjusted for several potential confounders.

Parental education levels have also been associated with child and adolescent mental health problems. Kaltiala-Heino et al.[33] found lower parental education levels to be associated with symptoms of depression measured with the Beck Depression Inventory[34]. Von Rueden et al. [35] showed that children of parents with higher education reported better quality of life in terms of psychological well-being. In a longitudinal investigation, Schneiders et al.[36] demonstrated associations between higher parental education level when children were aged 10-12 and lower total symptoms scores and fewer externalizing problems when children were aged 12-14.

Studies have also demonstrated child and adolescent mental health problems to be associated with composite indicators of SES (i.e. various combinations of the indicators mentioned above). Costello[37] found lower SES defined according to the Hollingshead index[38] (combining parental education and occupation) to be associated with higher odds for child and parent reported oppositional disorder. In another study using the Hollingshead index to define SES, Dodge et al. [39] showed low SES to predict teacher- and peer rated externalizing problems in kindergarten and in grades 1-3, adjusted for a range of elements in the child's context. Amone-P'Olak et al.[40]

found low SES (measured by combining family income and parental education- and occupation levels) to predict internalizing and externalizing problems in a sample from the TRAILS study.

In addition to those presented in some detail above, there are many other studies where the association between SES and child and adolescent mental health problems have been investigated[41-52]. See Table 1 for further details about some of these studies.

Other studies did not find the same pattern of social inequalities in mental health among youth. Based on a review of the literature up until the mid-1990s, West[53] suggested that social health inequalities were less marked in adolescence compared to other stages of development. Although West identified studies that were in support of social health inequalities[19,29,37,51,52], he also found several studies with no evidence of social gradients. Recently, Myklestad et al.[54] provided evidence for bivariate associations between economic problems and psychological distress, but this association attenuated when adjusting for covariates. Some support for West's[53] hypothesis of relative equalisation during adolescence was also demonstrated in a recent study by Sonego et al.[55]: Whereas lower parental education levels were associated with parent reported mental health problems for those aged 4-11, this association did not appear for those aged 12-15 years old.

Table 1
Studies Where the Association Between Socioeconomic Status and Mental Health Problems in Childhood and/or Adolescence has been a Major Focus for the Investigation

First author (year)	Age range; sample size	SES measure	Outcome	Description of findings
Achenbach et al., (1987)	4-16, US: N = 1,300, Dutch: N = 2,033	Parental occupation	CBCL	Tendency of lower SES parents to report more problems, but small effects.
Costello, (1989)	7-11; N (stage 2) = 300	Hollingshead index of SES	DISC, DISC-P	Lower SES associated with higher odds for child and parent reported Oppositional disorder.
Bird, et al., (1989)	4-16; N (stage 2) = 386	Three categories of occupational study	DISC	Lowest SES associated with having any DSM-III diagnosis. No difference between lower and medium SES for ADD. No difference between medium and higher SES for ODD, SEP, DEP and Any diagnoses.
Lempers et al., (1989)	Ninth graders; N = 622	EhQ	BDI, LQ , DQ, DUQ	Significant direct effect of economic hardship on depression/loneliness, indirect effects through parental nurturance and inconsistent discipline. For delinquency/drug use, only indirect effect for boys.
Offord et al., (1989)	4-16; N = 3,294	Low income	Modified CBCL, SDI	Low income increased odds for parent reported conduct, hyperactivity, emotional (in agegroup 4-11 only) and somatization disorders. Low income increased odds for all teacher/self-reported disorders.
West et al., (1990)	15; N = 1009	Occupation of head of household	GHQ	No evidence for class gradients.

(table continues)

Table 1 *(continued)*

First author (year)	Age range/ sample size	SES measure	Outcome	Description of findings
Patterson et al., (1990)	Grades 2-4, N = 868	Teacher ratings of economic difficulty (free/reduced price lunch, subsidized housing)	CARS	Income level was associated with children's conduct problems.
Gore et al., (1992)	9th - 11th graders; N = 1,208	Family standard of living, parental education levels	CES-D	In total sample, standard of living associated with depression. Not parental education levels. For girls both standard of living and parental education level associated with depression. For boys, no association found.
Mcleod et al., (1993)	14-21; N = 1,733	Concurrent and persistent poverty	Scales measuring internalizing and externalizing problems	Current poverty were associated with externalizing symptoms. Persistent poverty associated with internalizing problems.
Lipman et al., (1994)	T1: 4-16. T2: 8-16; T1: N = 1,701, T2: N = 1,075	Income, low maternal education	Psychiatric disorder (one or more of conduct-, hyperactivity- or emotional disorder)	Prevalence of psychiatric disorder vaired by income level. Poor children had higher odds of psychiatric disorder. Not found for 12-16 year olds. Low maternal eduction not related to psychiatric disorder. Not found in longitudinal investigation.
Dodge et al., (1994)	Preschool, grades 1, 2, 3; N = 585	Paternal education and occuption (Hollingshead)	TRF, Peer nominated ratings for aggressive behaviors	SES predicted teacher- and peer rated externalizing problems in kindergarten and grades 1-3 adjusted for a range of elements in child's social context.

(table continues)

Table 1 *(continued)*

First author (year)	Age range/ sample size	SES measure	Outcome	Description of findings
Bolger et al., (1995)	T1: 8-10, T2: 10-12, T3: 12-14, T4: 14-16; N = 575	Receiving federally mandated free or reduced price school lunches	HSP, CARS	Children's symptoms of externalizing and internalizing problems associated with endurance of economic hardship.
McCleod et al., (1996)	T1: 4-5, T2 :6-7, T3: 8-9; N = 907	Income-to-needs ratio	Modified CBCL; depression and antisocial scores	Early poverty predicts symtoms of depression and antisocial behavior in childhood, persistent poverty is related to increases in symptoms of antisocial behavior, but not to symptoms of depression.
Goodman, E., (1999)	11.4-21.4; N = 15,483	Household income, parental education and occupation	CES-D	Number of parents having a manual occupation, household income and parental education levels associated with levels of depression.
Kaltiala-Heino et al., (2001)	14-16; N = 17,643	Parental education, parental unemployment	BDI	Parental unemployment and low parental education associated with depression.
Starfield et al., (2002)	6-11, N = 1,018	Parental education and occupation	CHIP-CE	Those with higher SES had fewer parent-reported psychosocial problems than those with lower SES.
Starfield et al., (2002)	11-17, N = 3,15	Parental education and occupation	CHIP-AE	No evidence for social gradients in self-reported psychosocial problems.
Costello, et al., (2003)	9-13; N = 1,420	Income-to-needs ratio	CAPA	Children living in poverty were more likely to have a psychiatric disorder. Increasing family income was associated with reduction in symptoms of conduct and oppositional defiant disorders.

(table continues)

Table 1 *(continued)*

First author (year)	Age range/ sample size	SES measure	Outcome	Description of findings
Sund, et al., (2003)	12-14; N = 2,465	Parental occupation	MFQ	In bivariate analysis, MFQ scores were lower for those in the upper class, for those with unemployed parents. In multivariate analysis maternal unemployment predicted higher scores on MFQ.
Newacheck et al., (2003)	10-18; N = 12,434	Income-to-needs ratio	Questions about emotional and behavioral problems	Poor adolescents had more emotional and behavioral problems compared to middle- and higher-income peers.
Schneiders et al. (2003)	T1 10-12, T2 12-14; N = 2,587	Parental education and education levels, ordinal scale treated dimensionally	CBCL, YSR	Higher occupation associated with fewer CBCL total and externalizing problems. Higher parental education associated with fewer YSR total and externalizing problems.
McLeod et al., (2004)	T1: 10-11, T2: 12-13, T3: 14-15; N (T1) = 560, N (T2) = 465, N (T3) = 424	Income-to-needs ratio	CBCL: Behavior problems, depression	Early povery was associated with more rapid increased in symtoms with age, controlled for subsequent poverty.
Emerson et al., (2005)	5-15; N = 10,438	Equivalised household income, family social class, parental education level	DAWBA	Increased odds of having any psychiatric disorder, and any emotional and any conduct disorder for those in the lower income quintile.

(table continues)

Table 1 *(continued)*

First author (year)	Age range/ sample size	SES measure	Outcome	Description of findings
Reijneveld et al., (2005)	4-16; N = 4,480	Parental education and employment	CBCL, diagnoses made by clinical health personell	Chisquare test demonstrated different distributions of problems across education level for CBCL-total and externalizing, and for employment level for CBCL-total and internalizing. Both associated with diagnoses made by clinical health personell.
Strohschein (2005)	4-14, N (T1) = 1,733, N (T2) = 2,557, N (T3) = 3,325, N (T4) = 3,947, N (T5) = 3,928, N (T6) = 3,653, N (T7) = 3,291	Household income	Modified CBCL	Low income at T1 is associated with higher levels of depression and antisocial behavior. Subsequent improvents in income was associated with reductions in child mental health problems.
Wadsworth et al., (2005)	8-17; N = 1,075	Family income, federal assistance, parental occupation. Made into composite.	CBCL, YSR	SES effects on various CBCL/YSR scales, mostly for the low-SES group.
von Rueden et al., (2006)	8-11; N = 754	Parental education, FAS	KIDSCREEN (measure of HRQoL)	Differences for all 10 HRQoL scale between groups with different levels of family wealth. Children of parents with higher education reported better quality of life in terms of psychological well-being, moods and emotions, and physical well-being.

(table continues)

Table 1 *(continued)*

First author (year)	Age range/ sample size	SES measure	Outcome	Description of findings
Lemstra et al., (2008)	10-15; N = 34,752	Income, parental employment status, education and occupation.	Dom, CES-D, DISC, CAPA, MFQ	The pooled prevalence of depressed mood or anxiety was 2.29 times higher in youth with low SES compared to youth with higher SES.
Ashford et al., (2008)	T1: 2-3, T2: 4-5, T3: 11; N = 358	Unemployment, or having a primary level job	CBCL, TRF	SES predicted internalizing problems at 11 years, adjusted for parental psychopathology, parenting stress, and internalizing problems at 4-5 years.
Mendelson et al., (2008)	15; N = 455	Household income, caretaker education	YSR	Household income and caretaker eduaction was not associated with internalizing symptoms when controlling for female gender.
Amone-P'Olak et al., (2009)	T1: 10-12, T2: 12-15; N (T1) = 2,230, N (T2) = 2,149	Family income, parental education and occupational levels	CBCL, YSR, TCP	Higher level of SEP was associated with lower prevalence of all mental health problems. Steeper for aggressive, delinquent behaviors, attention and total problems, than for anxiety/depressed, withdrawn/depressed and though problems.
Frigerio et al., (2009)	10-14; P1: N = 3418, P2: N = 631	Parent education level, income	P1: CBCL, P2: DAWBA	Low parental education and income increased odds of CBCL caseness; low paternal education level and income increased odds for any disorder.

(table continues)

Table 1 *(continued)*

First author (year)	Age range/ sample size	SES measure	Outcome	Description of findings
Carter et al. (2010)	M age 6.6; N = 441	Poverty, maternal education	DISC	Poverty associated with any disorder. Low maternal education more strongly related to internalizing than externalizing problems. Poverty associated with internalizing problems.
Perna et al., (2010)	Median age 5.9; N = 1,265	Household income, parental education and occupation.	SDQ	All SES indicators related to higher SDQ total problems score in bivariate analysis. In multivariate analysis, influence of household income diminished.
Van Oort et al., (2011)	4-16; US: N = 833, Dutch: N = 708	Parent occupation	ACQ, CBCL, YABCL	Low SES predicted high Withdrawn, Aggressive behavior, Thought problems and Attention problems scores.
Amone-P'Olak et al., (2011)	12-15; N = 2,149	Family income, parental education and occupational levels	CBCL, YSR, TCP	Family SEP predicted offspring internalizing and externalizing problems, independent of parental psychopathology.
Alatupa et al., (2012)	T1: 3-9, N = 782	Parental education and occupation, parental income	Scales measuring aggression, hyperactivity and social adjustment	Participants with lower occupational status had lower levels of social adjustment, higher levels of aggression. Lower income was associated with higher levels of aggression.
Vine et al., (2012)	11-13; N = 498	Household income	MASC	Negative association between household income and separation-/panic anxiety.

(table continues)

Table 1 *(continued)*

First author (year)	Age range/ sample size	SES measure	Outcome	Description of findings
Sonego et al., (2013)	4-15; N = 5,635	Parental education and occupation level, household income	SDQ	Parental education levels were associated with increased odds for mental health problems according to the total SDQ score. In multivariate analysis, ajusting for family income, occupation status, and other covariates such as family structure, migration status and parental health, parental education was found to increase odds for mental health problems for children (4-11 years). Family income and occupation status were marginally significant predictors. These associatons were not found in the older sample (12-15 years).

Note. SES = Socioeconomic status; SEP = Socioeconomic position; CBCL = Child Behavior Checklist; YSR = Youth Self Report, ACQ = Achenbach-Conners-Quay Behavior Checklist, YABCL = Young Adult Behavior Checklist, TCP = Teacher Checklist of Psychopathology, FAS = Family Affluence Scale, HRQoL = Health Realted Quality of Life, DAWBA = Develomet and Well-Being Assessment, CES-D = Center for Epidemiological Studies Depression Scale, MFQ = Moods and Feelings Questionnaire, CIDI = World Health Organization Composite International Diagnostic Interview, CAPA = Child and Adolescent Psyciatric Assessment, CARS = Classroom Adjustment Rating Scales, HSP = Harter Self Perception Scale, SDQ = Strengths and Difficulties Questionnaire, BDI = Beck Depression Inventory, EhQ = Economic hardship Questionnaire, LQ = Loneliness Questionnaire, DQ = Delinquency Questionnaire, DUQ = Drug Use Questionnaire, GHQ = General Health Questionnaire, Dom = Dominic questionnaire, DISC = Diagnostic Interview Schedule for Children, TCP = Teacher Checklist of Psychopathology, ACQ = Achenbach-Conners-Quay Behavior Checklist, YABCL = Young Adult Behavior Checklist, MASC = Multidimensional Anxiety Scale for Children, DISC-P = Diagnostic interview schedule for children - parent version, SDI = Survey Diagnostic Instrument, CHIP-CE = Child Health and Illness Profile - Child Edition, CHIP-AE = Child Health and Illness Profile - Adolescent Edition

1.2.1 Measuring socioeconomic status in childhood and adolescence

The socioeconomic status of children and adolescents[b] has most often been measured by reference to their parents' SES[68], see Table 1 for examples. Many previous investigations of the association between SES and mental health problems in children have relied on single indicators of socioeconomic status, such as measures of the economic situation in the family [19,21-24,26,47-49], or the occupational position or education level of parents[28-30,32,69].

Another common method is to collect several individual indicators of SES, and combine these into a global measure of SES[37,39-41,58]. One approach to creating composite scores is using the Hollingshead four-factor index (HI) of social status[38] or derivations from this[39,68,70]. The HI is a composite measure of education and occupation employed householders in a home, and is a commonly used measure of SES [69].

Whereas some studies have used the full range of SES and investigates social gradients in mental health[43], others use fewer levels or categories, such as "poor" versus "not poor"[65], depending on the aims of the study. See the column titled "SES measure" in Table 1 for examples of different methods that have been used to measure SES in the literature.

1.2.2 Measuring childhood mental health problems

There are different ways of defining mental health problems in childhood, see the column titled "Outcome" in Table 1 for examples. Several studies have focused on one particular condition (such as depression, delinquency or conduct problems) [20,30,33,47,48] or domains of related problems (such as anxiety disorders) [20,30,33,47,48], whereas other studies have used instruments that measure health globally, for example by examining health related quality of life [35,56].

[b]For a more general presentation of different approaches to measuring socioeconomic status, see for example [67].

Another approach used in the literature on SES and mental health, is diagnostic classification of psychiatric disorders obtained with clinical interviews [6,29,37,45]. Other studies rely on symptom scores from screening instruments such as the Strengths and Difficulties Questionnaire [71,72] or the ASEBA[18,73,74] instruments[19,23,24,26,28,32,39-42,49]. These studies report either specific symptoms, narrow-band conditions (e.g., conduct disorder or emotional problems), or broad-band syndromes (e.g., externalizing versus internalizing problems or mental health problems).

1.2.3 Studies using multiple SES indicators and mental health

One approach to disentangling the association between SES and childhood and adolescent mental health problems is to investigate in detail how different indicators of SES are associated with particular domains of mental health problems. In order to identify such studies, a search was conducted in the databases PubMed, PsychInfo and Web of Knowledge, using relevant search terms (see details in Table 2).

This search resulted in 142 studies from PubMed, 301 studies from PsychInfo and 620 studies from Web of Science, some of which were duplicates. A manual search was also conducted by means of citation tracking. From the studies that were identified, only a few fulfilled the criteria for inclusion in this review, namely to 1) include both income and education as indicators of SES and treat these as individual predictors in the analyses, and 2) to measure and report results for several domains of mental health problems simultaneously. Studies exclusively concerning pre-school children were excluded. Seven studies were identified; see Table 3.

Six of the identified studies defined child- and adolescent mental health problems according to diagnostic categories. In a three-wave longitudinal study, Velez et al.[75] found bivariate associations between low income and low parental educational level at the first wave and several psychiatric disorders measured in the second wave. In multivariate analysis, some of these associations attenuated, and it was demonstrated that low income predicted externalizing disorders whereas educational level was related to separation anxiety only. When analysing data from the second to the third wave, low income in the second wave predicted externalizing disorders and

separation anxiety in the third wave, whereas low maternal education (from wave two) predicted separation anxiety in wave three. In a study of 939 participants aged 15, Miech et al.[76] showed negative bivariate correlations between parental education and anxiety-, conduct- and attention-deficit disorder. Ford et al.[77] demonstrated that low maternal education increased the odds for anxiety, oppositional defiant disorder and conduct disorder in analyses adjusting for several family characteristics. When additional adjustments for child-, school- and neighbourhood characteristics were made, lower maternal education levels increased odds for anxiety and conduct disorder only. Roberts et al. [78] found low family income and parental education levels to be associated with increased odds for anxiety disorders without impairment. When impairment was taken into account, the associations diminished. Merikangas et al.[79] did not provide support for any associations between poverty and mental disorder, but did find that participants whose parents were not college graduates had increased risk for mood-, anxiety-, behavioural- and substance abuse disorders. McLaughlin et al.[80] demonstrated that low parent education increased odds for anxiety disorders in multivariate analysis, after adjustments for relative SES, age, gender and ethnicity were made. For further details, see Table 3.

Huisman et al.[81] used data from two samples in their study. In the ALSPAC sample mental health problems were defined according to the SDQ[71,72], whereas the CBCL[18] was used in the TRAILS sample. They found lower maternal education to be associated with externalizing problems only, whereas low household income was associated with both externalizing and internalizing problems, see details in Table 3.

In general, previous studies find that socioeconomic factors are associated with mental health problems in childhood and adolescence, but the associations depend on SES indicator and type and definition of such problems. Although there has been a strong emphasis on the influence of poverty or economic adversity in the previous literature [19,21-24,26,47-49], the importance of parental education level also emerge as an important correlate of mental health problems in the studies reviewed above.

Table 2

Details of the literature search.

Search terms used for studies of child and adolescent mental health problems.	child psychopathology OR adolescent psychopathology OR mental health OR mental disorders OR emotional disturbances OR behavior problems OR mental disorders OR peer relations OR emotional adjustment OR conduct disorder OR behavior disorders OR attention deficit disorder with hyperactivity OR anxiety disorders OR anxiety OR depression OR major depression
Search terms used for studies of socioeconomic status.	socioeconomic status OR family socioeconomic level OR income level OR lower class OR social class OR disadvantaged OR economic security OR income OR poverty AND Parent education OR parent educational background OR educational background OR family background OR parental characteristics

The two searches were then combined using the Boolean operator "AND" and limited to include studies of children and adolescents (ages 6-18) that had been published in peer reviewed journals during the last 36 years.

Table 3
Studies of how different indicators of SES are associated with particular domains of mental health problems

First author (year)	Age range; sample size	SES measure	Outcome	Description of findings
Velez et al., (1989)	T1: 1-10, T2: 9-18, T3: 11-20 ; T1 N = 976, T2 N = 776 , T3 N = 776	Low income, low maternal and paternal education	DISC, DISC-P	T1-T2: Adjusted for age and sex, low income increased odds for conduct- (CD), attention deficit- (ADD), oppositional defiant- (ODD), over-anxious disorder and separation anxiety (SEP). Low maternal education increased odds for CD, ADD, ODD, major depressive disorder and SEP. Paternal education related to ADD and SEP. In multivariate analysis, income predicted all externalizing disorders, education levels only related to SEP; T2-T3: In multivariate analysis income predictive externalizing disorders (CD, ADD, OPP) and SEP, maternal education predicted SEP.
Miech et al., (1999)	15; N = 939	Parental education and occupation, family income	DISC-C. Diagnostic categories and symptom scales.	Negative bivariate correlations between parental education level and anxiety, conduct disorder and attention deficit disorder.

(table continues)

Table 3 *(continued)*

First author (year)	Age range; sample size	SES measure	Outcome	Description of findings
Ford, et al., (2004)	5-15; N = 8,772	Weekly household income, parental education and occupation	DAWBA	In analysis adjusting for several family characteristics, lower maternal education level increased odds for anxiety, oppositional defiant disorder and conduct disorder. When also adjusted for several child-, school- and neighbourhood characteristics, lower maternal education level increased odds for anxiety disorder and conduct disorder only.
Roberts et al., (2007)	11-17; N = 4,175	Family income, parental education level	DISC-IV	Low family income and parental levels education associated with increased odds ratios for anxiety disorders without impairment. No association with anxiety disorders with impairment.
Merikangas, et al., (2010)	13-18; N = 10,123	Parental education levels, poverty index (based on family size and income-to-needs ratio)	CIDI	Parental poverty level was not associated with any of the classes of mental disorder. Adolsecents whose parents were not college graduates were at increased risk for all disorder classes (mood-, anxiety-, behavioural- and substance abuse disorder).

(table continues)

Table 3 *(continued)*

First author (year)	Age range; sample size	SES measure	Outcome	Description of findings
Huisman et al., (2010)	ALSPAC: 13, TRAILS: 12-15; ALSPAC N = 4,041, TRAILS N = 2,149	Mothers' highest education level, household income	ALSPAC: SDQ, TRAILS: CBCL	Lower maternal education associated with externalizing problems (SDQ: conduct problems), but not internalizing problems (SDQ: emotional problems); low household income associated with both externalizing and internalizing problems.
McLaughlin et al., (2012)	13-17; N = 6,483	Household income, parental education levels, subjective social status, relative deprivation, community-level income inequality	CIDI	In multivariate analysis, adjusting for relative SES indicators, age, gender and ethnicity, low parent education was found to increase odds of anxiety disorders.

Note. SES = Socioeconomic status, CBCL = Child Behavior Checklist, DAWBA = Development and Well-Being Assessment, CIDI = World Health Organization Composite International Diagnostic Interview, SDQ = Strengths and Difficulties Questionnaire, DISC = Diagnostic Interview Schedule for Children, DISC-P = Diagnostic interview schedule for children - parent version, DISC-C = Diagnostic interview schedule for children - child version

1.3 Socioeconomic status and childhood mental health problems

The majority of studies reviewed in the sections above have established an association between childhood and adolescent mental health problems and socioeconomic disadvantage. Questions still remain with regards to *how* these associations emerge. This section will introduce some of the theoretical frameworks about how SES may influence child and adolescent mental health, before presenting some of the variables or factors that contribute to this association.

1.3.1 Conceptual and theoretical frameworks

A main distinction between the conceptual frameworks that have been proposed to explain how socioeconomic circumstances influence health are explanations based on *social causation*, versus explanations that are based on *social drift/selection*. Whereas social causation suggests that the causal direction is from SES to health, social drift/selection suggests that the causal direction is from health problems to SES[82,83]. Social selection is unlikely to affect children directly, as they have not yet established their own SES, but may become more relevant as children grow older and start to establish their own socioeconomic status. However, social selection may affect children indirectly through their parents' SES and is therefore a useful perspective in understanding the process of socioeconomic influence on health. It has been demonstrated that the two perspectives are not mutually exclusive[84] and may in fact be disorder specific[76,85,86]. A third approach, the interactionist perspective[87], aims to integrate both the social causation and social selection perspectives on social influence on child mental health.

Social causation views of socioeconomic influence

Researchers have proposed several theories defined within the social causation perspective, both from the field of social epidemiology and from developmental psychology.

Social epidemiological theories

The following theoretical perspectives are commonly used to explain how social disadvantage can be associated with inequalities in health[88-92]: 1) Materialistic or neo-materialistic explanations, 2) health behaviours and lifestyle choices, 3) psychosocial explanations, 3) life course or pathway perspectives, 4) personal characteristics, and, 6) contextual explanations. See Table 4 for a brief description of these frameworks.

Table 4

An overview of theories from social epidemiology aiming to explain social inequalities in health[88-92]

Perspective	Short description
Fundamental/ materialistic and neo-materialistic perspectives	Initially related to poverty. Those with a low SES do not have resources to meet basic human needs, to avoid exposure to disease causing agents or to minimize the consequences of disease that has occurred. Neo-materialistic explanations see increased access to resources as providing better opportunities to improve own health.
Health behaviours and lifestyle choices	There are social inequalities in life style factors, and individuals with low SES are more likely to engage in health damaging behaviours and less likely to have a pattern of health promoting behaviours, compared to those with higher SES.
Psychosocial explanations	Related to the detrimental effect of psychological stress on health. People may also have unhealthy coping behaviours.
Life course perspective/ pathway model	Poor conditions early in life, both biologically, socially, culturally and materialistically, starts a trajectory where negative influences accumulate over time and contribute to poorer health.
Personal characteristics	Health is affected by cognitive ability and personal characteristics.
Contextual explanations	Concerned with both the individual and the ecological context surrounding the individual.

The majority of the theoretical perspectives from the field of social epidemiology have been developed to explain how socioeconomic disadvantage is related to poor (somatic) health in adults, but they may also provide a framework for understanding social inequalities in mental health in children. In social epidemiological theories, there has been less emphasis on the *relational* aspects of children and their parents/caregivers and the opportunity for this relationship to influence the mental health of children. This has been addressed in the frameworks developed within the developmental psychology tradition.

Developmental psychology theories

Within development psychology, there are two major theoretical perspectives on how socioeconomic status influences child mental health: The family process or family stress model[93,94], and the family investment model[95]. Both models have had a primary focus on the financial or economic aspects of socioeconomic disadvantage. Whereas the family process/stress model has a focus on how economic pressures adversely affects parental mental health and in turn have negative influences on parenting strategies, the family investment model focus on how parents make financial, social and human investments into the well-being of their children. Both models have been supported empirically[87,96].

Yoshikawa, Aber and Beardslee[97] recently presented a model adapted from Gershoff, Aber and Raver[98] that incorporates both the family investment model[95] and the family process/stress model[93,94]. Their model organise the mediating mechanisms into: 1) institutional, 2) relational, and 3) individual mechanisms, see Figure 1. Although these models and perspectives have been developed to primarily account for the negative effect of *poverty* on child mental health, it may be extended to other indicators of socioeconomic disadvantage, also called for in the literature[99].

The *institutional* mechanisms include factors such as neighbourhood characteristics and access to health care. The *relational* mechanisms include conflict between parents, or between parents and children, and parenting behaviours. The *individual* mechanisms include parent and child stress, and parental mental health. The model

also illustrates that there are reciprocal influences between these categories of mediating mechanisms, and that they all contribute to mental health problems in children.

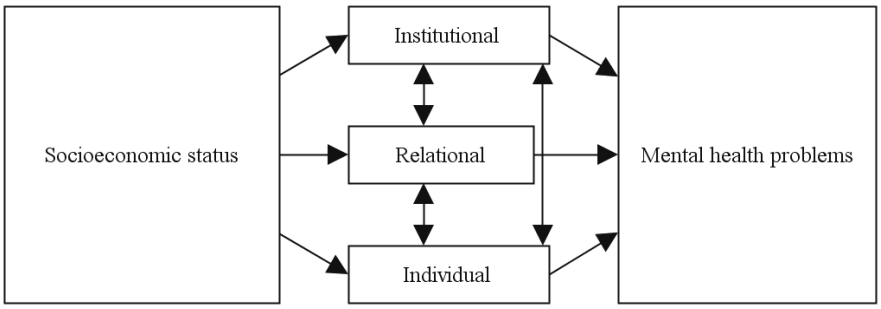

Figure 1. An adaptation of the conceptual framework suggested by Yoshikawa et al.[97]

Social selection view of socioeconomic influence

Explanations and theories that are based on the social selection view of socioeconomic influence represent the major alternative to the social causation perspective. Rather than health being influenced by SES, proponents of the selection perspective argue that individual characteristics influence SES, and that these characteristics in turn are being transmitted to the next generation[95,100,101], for example genetically[101]. There may, for instance, be some parental characteristics that may make the parents both obtain high SES *and* facilitate development of positive mental health in their children. Such parental characteristics may be particular skills, trustworthiness, conscientiousness, and good health[95].

There is also a distinction in the literature between *direct* and *indirect* selection. The former argues that childhood health problems are causally related to both SES and health in adulthood[102], whereas the latter argues that the child possesses certain characteristics (for example poor coping styles) that could contribute to both poor health and social disadvantage in adulthood[82].

An interactionist view of socioeconomic influence

Conger and Donnellan[87] have presented a perspective that merges the social causation and the social selection perspectives, in what they call an interactionist approach.

They suggest that individuals, during childhood and adolescence, possess particular characteristics that may cause them both to have a high SES as adults, and also become skilled at caring for their children and make sound investments into the child's environment when they themselves become parents. These individual characteristic *and* the positive environment in which the child grows up will benefit the emotional, behavioural, cognitive and physical well-being of their children. The interactionist model is illustrated in Figure 2.

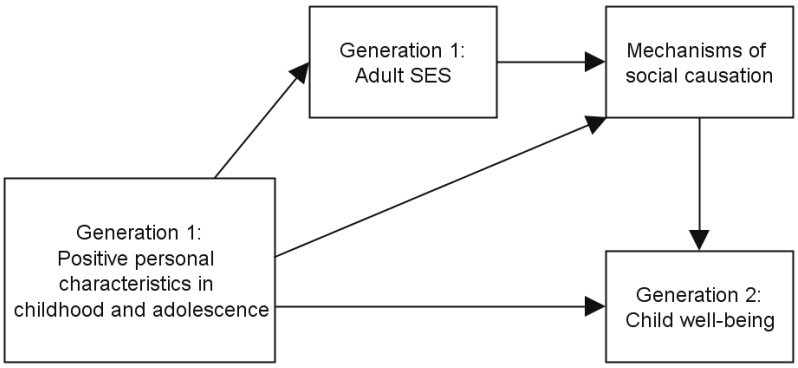

Figure 2. An illustration of the interactionist model, adapted from Conger and Donnellan[87]

The concept of relative deprivation

Relative deprivation is a concept that is commonly used to explain socioeconomic health inequalities, in particular in welfare states where *absolute* deprivation is rare[103]. However, the concept has been used in many ways and in several theoretical frameworks. Smith et al.[104] state that the concept originates from Stouffer et al. (1949) and was later refined by Merton (1957) and Pettigrew (1967) to describe a process where an individual compares him or herself to a reference group, perceives to be at disadvantage, and experiences this disadvantage to be unfair leading to particular internal states or behaviours (for the individual or a group). Internal states may be psychological stress, depression or physical health, whereas behaviours may be deviance-, achievement- or escape actions (for review, see[104]). According to this definition, the feelings of being unfairly disadvantaged may be related to poor health, both directly, and through the mechanisms described in the health behaviours/life

style- and the psychosocial perspectives. However, relative deprivation has also been invoked as a term to describe inequality between countries[105], and lack of capability to obtain material goods available in a society (e.g. a computer) [103], similar to the mechanisms described in the neo-materialistic perspective.

1.3.2 Factors that may influence the association between socioeconomic status and mental health problems

The relation between socioeconomic status and mental health are most likely multicausal and a range of factors may account for this relation. When assessing the relation between poverty and health, environmental-, family- and child-based mediators have been investigated[106,107]. Factors that may mediate this relationship are stressful life events[57,108,109], self-esteem[110], identity development[111], and approval of aggression[109].

Many other variables are associated with both socioeconomic disadvantage and child mental health, and could therefore contribute to the observed health inequalities. Socioeconomic disadvantage has been related to unhealthy behaviours in children and adolescents[112], for example being less physically active[113], having a poorer diet[114], overweight[115] and early sexual debut[116], which in turn have been associated with mental health problems in children and adolescents[117-120]. There has also been increasing attention to the influence of neighbourhood conditions on the association between SES and childhood mental health. Families who are socioeconomically disadvantaged may be forced to reside in deprived neighbourhoods, which may have a negative influence on the mental health of children in these families[48,121], possibly through increased reactivity to stress[122]. Differential access to and use of health services could also contribute to social inequalities in mental health among children, and it has been found that children who are socioeconomically disadvantaged have less frequent contact with health services [10,123-125], which could delay discovery and treatment of mental health problems. It has also been found that ethnic minorities in general experience more socioeconomic disadvantage and more symptoms of mental health problems[49], although there are gender differences in this pattern of association[126,127]. Socioeconomic disadvantage is also related to poorer health in

adults[128,129], and both somatic[130] and mental illness[131] in parents have been associated with child and adolescent mental health problems. Family structure factors, such as experiencing divorce and growing up in single parent households, are other variables that has been found to be related to both SES and child well-being[129,132].

Sleep problems, SES and childhood mental health problems

Sleep problems are common during childhood and adolescence [133-135], and socioeconomic disadvantage has been related to more awakenings during the night, snoring, restless sleeping, being fearful of going to sleep, and experiencing daytime drowsiness[136], having more nocturnal awakenings, more wake periods and lower sleep efficiency[137]. Conversely, high SES has been associated with lower levels of self-reported sleep problems and longer actigraphy measured sleep duration[138]. The hypothesis that sleep could act as a mediator of the association between SES and health was proposed in a paper by Van Cauter and Spiegel[139] based on findings that sleep deprivation had adverse effects on immune and endocrine function, and on the hypothalamo–pituitary–adrenal (HPA) system. HPA system hyperactivity (hyper-arousal) has been suggested as a causal factor for insomnia[140], and short sleep and low sleep efficiency is associated with higher cortisol awakening response and elevated cortisol levels during the day in children[141]. Van Cauter and Spiegel's[139] hypothesis was confirmed in a study by Moore et al[142] on 1,139 adults where it was found that the effect of low income on psychological health was mediated by sleep quality. The effect of low education levels was not found to influence sleep quality directly, but through its association with low income.

Family processes, SES and childhood mental health problems

Another potential pathway between SES and child- and adolescent mental health is the family environment[143] and parent-child interactions. Various styles of parenting may influence a child in a differentiated manner[144-146], although some children may be more or less susceptible to these influences[147,148]. Parenting that lacks warmth and involvement represent a serious risk to children's mental health[149,150] and harsh and erratic disciplinary practices are associated with both externalizing and internalizing symptoms in children and adolescents[151-156]. Many studies have found that

socioeconomic status influences parent's beliefs about their children, their style of parenting and their parenting practices, for reviews, see [157,158].

Several studies have investigated mediation by family processes, and the association between poverty and child and adolescent mental health problems may be mediated by harsh or inconsistent discipline and lack of warmth, either directly, or through parental mental health and marital conflict, as predicted by the family stress model. For reviews, see[87,106,107] and see also[159] for a recent study confirming these findings.

1.4 Avenues for further research

The associations between socioeconomic disadvantage and child- and adolescent mental health problems have been extensively researched, as evidenced by the literature referenced above. Previous studies have identified several areas where there are opportunities for gaining further knowledge.

One such area relates to the potential disorder or symptom specific associations between childhood mental health problems and different indicators of socioeconomic status. SES is a complex and multifactorial construct, and use of single indicators of SES may be problematic as the indicators are not interchangeable, and may not accurately represent overall SES[160,161]. A related issue is the use of composite SES measures, as the constituents of the composite may not be uniformly associated with children's mental health problems[35,162,163]. Income, education and occupational status may represent different aspects of social stratification and this information is potentially lost when they are grouped together[162]. The need for investigations of the influence of different indicators of SES on several domains of mental health has been recognised previously[59,163], but the review of the literature shows that such studies are still relatively scarce. Uncovering specific associations could provide hypotheses about differences in etiological mechanisms of particular mental health problems, and may inform researchers about selection of appropriate outcome-specific indicators of SES[161] for future investigations.

It has already been demonstrated that there are several mechanisms or mediators of the association between SES and child- and adolescent mental health problems[106,107]. Further knowledge about such mechanisms, in particular malleable ones, could provide leverage points amenable to intervention. One mechanism is sleep problems, which is common during childhood and adolescence[133-135] and is associated with socioeconomic disadvantage[136,137] and emotional and behavioural problems in youth[164]. Sleep quality have been found to mediate the association between low income and psychological health in adults[142], thus, it is of interest to examine a mediator effect of sleep problems in the relationship between socioeconomic disadvantage and mental health problems in children.

Whereas the family process perspective has been empirically well-supported[106], a potential limitation of the studies on the family process model has been the exclusive focus on the economic indicator of SES[99]. Education level is a component of socioeconomic status that is reliably associated with differences in parenting[157,165]. Maternal education is associated with increased knowledge about childrearing and child development, and supportive parenting[166-168]. Increased maternal parenting knowledge is in turn associated with fewer childhood behaviour problems[169,170]. One possible explanation is that increased maternal parental knowledge gained through higher education leads to more accurate expectations about children, which then are reflected in the mothers' parenting behaviours. Mothers with unrealistic expectations about their children are more likely to use severe discipline and to be abusive with their children compared to mothers with more accurate expectations [171]. This suggests an opportunity for extending the framework of the family economic stress model to also include parental education levels.

Furthermore, it has been argued that there may be an over-reliance on North American children and parents in studies of parenting [172]. Parenting practices are normative and highly culturally influenced, and theories developed from North American samples may not apply to other countries and cultures [173]. Whereas 94% of American parents report corporal punishment (spanking) before their children turn three or four years old [174], other countries prohibit the use of corporal punishment by

law [175]. Differences in legal and cultural practices would presumably exert large influences on parenting practices, which may affect the generalizability of prior findings. Cultures also differ in the extent they judge certain parenting practices as physically or emotionally abusive [176]. The use of particular parenting techniques is moderated by mother's perceptions of normativeness, and the extent to which children respond with aggression or anxiety to perceived negative events (such as corporal punishment and yelling) is moderated by children's perception of the normativeness of such techniques [172]. In fact, the association between use of harsh corporal punishment and children's aggression and anxiety symptoms is stronger in samples where such punishment is least normative [177]. Taken together, the findings on cultural differences in parenting practices suggest a need for more studies of the association between parenting and children's mental health using non-North American samples.

1.5 The research aims of the current thesis

In the current PhD-thesis, three papers have been written, and the overarching goal is to expand the knowledge about the mechanisms in the relationship between familial socioeconomic status and childhood mental health. All papers are based on data from the Bergen Child Study [10,178] and is using information about parental education and reported family economy as independent variables, and self- and/or multiple informant-reported mental health problems as dependent variables. Specifically, based on a sample of children and adolescents, we aimed to investigate the following research questions:

- Is there a general inverse relationship between SES and mental health problems across SES indicators (family economy and parental education levels) and across different mental health domains (conduct-, hyperactivity/inattention-, emotional- and peer problems)?
- Are children with low SES at higher risk of particular mental health problems?
- Are sleep problems more prevalent among those with low SES?

- Is the association between low SES and mental health problems confounded by family and demographic factors associated with socioeconomic status?
- Do sleep problems mediate the association between SES and mental health?
- Is SES associated with parental emotional well-being and parenting practices?
- Are the associations between SES indicators and internalizing or externalizing child mental health problems mediated by parental well-being and parenting practices?

2. Methods

2.1 The Bergen Child Study

The data used in the thesis originates from wave two of the Bergen Child Study, a population-based study that targets all children living in Bergen and attending grade 2-4 in 2002. Some of the major aims of the BCS were to establish prevalence data for mental health problems, to determine risk- and protective factors for development of such problems, and to investigate the use of health- and school services.

So far, the BCS has resulted in more than 30 international publications and several PhD-theses, and has contributed to shed light on various areas of mental health in childhood such as conduct problems, autism, mental health of children with chronic somatic illness, prevalence of and comorbidity between emotional problems and attention-deficit hyperactivity disorder, and associations between self-esteem, mental health and overweight [179-184]. Ongoing projects investigate social and intellectual functioning in children with chronic illness[185], and self-perception among children with emotional and behavioural disorders[186].

2.2 Sample and recruitment

The Bergen Child Study may be conceptualized as a series of cross-sectional studies, which also contains a longitudinal sample (see flowchart in Figure 3). It comprises four *waves* of data collection. Waves One and Two also included more than one *phase*. In the three first waves, the total number of participants that fitted the inclusion critera (i.e. born in 93-95 and attending schools in Bergen during the periods when data was gathered) were invited to participate. In the fourth and final wave, the scope of the study was extended to include all youth in upper secondary school in the country of Hordaland. Since the participants were now aged 16-18, the study was renamed into ung@hordaland (youth@hordaland). More information about the study can be found on the following website: http://www.unghordaland.no**.**

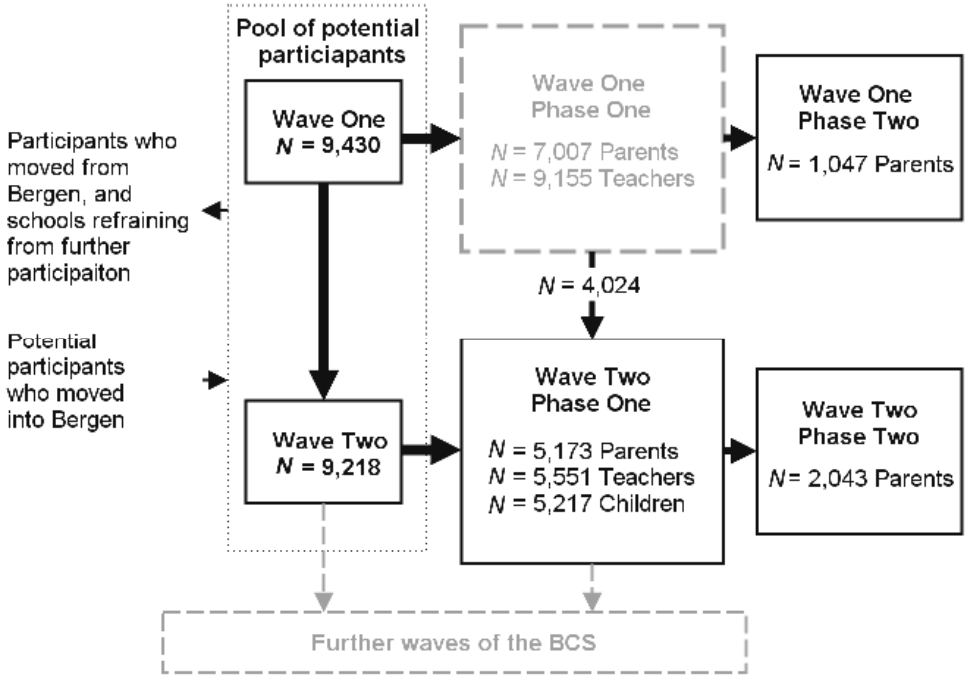

Figure 3. Recruitment into the different waves and phases of the Bergen Child Study. Grey dashed lines indicate data not used in the current thesis.

2.2.1 Wave One Phase One

Data from Wave One Phase One is not used in this thesis. Still, a description has been provided in order to facilitate an understanding of the structure of the Bergen Child Study, as well as recruitment and participant flow through the study.

Wave One Phase One of the Bergen Child Study was conducted in 2002, and consisted of a comprehensive questionnaire that was distributed to parents and teachers of 9,340 second to fourth graders in Bergen. Recruitment was done through the children's schools, and all the schools in Bergen agreed to send parents an invitation to participate in the survey.

As described in previos publications [10,178] the children were catagorized as *screen positive* or *screen negative* based on their scores on the instruments included in the questionnaire in Wave One Phase One. All children defined as screen positive, and a

random sample of screen negative children were invited to take part in Wave One Phase Two.

2.2.2 Wave One Phase Two

In Wave One Phase Two parents were interviewed according to the Development and Well-Being Assessment (DAWBA)[187]. The DAWBA gathers detailed information about symptoms and impairment that form the basis of assigning psychiatric diagnoses according to the 4th edition of the Diagnostic and Statisical Manual of Mental Disorders (DSM-IV)[188] and the International Classification of Diseases, 10th edition (ICD-10)[189]. In addition, the interview also included information about family-type, sociodemographic variables and service use. The DAWBA was administered by trained assistants and scored by experienced clinicians. A total of 2,393 parents were invited to take part in this interview, with 1,047 chosing to do so.

The information about *household income* that is used in the thesis originates from this phase.

2.2.3 Wave Two Phase One

Wave Two Phase One was conducted in 2006, and the children eligible for participation were now in fifth to seventh grade. Participants were recruited through schools. The target population was slightly smaller since some private schools refrained from participating in Wave Two Phase One. In this wave, information was gathered from the children themselves, their parents and their teachers. The questionnaire was simliar to the one used in Wave One Phase One, for details see[10,178], but was extended to also include questions about sleep habits and demographic information such as questions about parental education, family economy, family structure, and parental health.

The majority of data used in the papers comprising this thesis originates from Wave Two Phase One. This includes data on parental education, family economy and family structure, measures of mental health problems obtained using the SDQ[71,72] and sleep habits. Meausurements and assement is described in detail in section 2.4.

2.2.4 Wave Two Phase Two

Wave Two Phase Two consisted of detailed psychiatric assessment using the DAWBA[187], this time administered through a web-based system. All parents who participated in Wave Two Phase One were invited to take part in Wave Two Phase Two, with 2,043 parents choosing to do so (i.e. a full information sample). They were provided with a unique ID number and password which allowed them to log on to a website where they could provide detailed information about their child.

The data from this phase used in the thesis include information about parental emotional well-being, a survey of parenting practices, and two questions regarding the economic situation in the family. See section 2.4 for descriptions of these measures.

2.3 The socioeconomic context in Bergen in 2006

A study of socioeconomic disadvantage may be best understood in the larger context of the area wherein the study was conducted. The following section provides a brief description of the socioeconomic context in the city of Bergen during the time when the majority of the data used in the thesis was obtained.

2.3.1 Education levels in Bergen during the data collection

The highest resolution of the official statistics of education that are available for Bergen in 2006 are people "aged 16 and older" [190]. Parents who participated in the Bergen Child Study during 2006 were necessarily older than the lowest age segment in the educational statistics, but these still provide some insight into the general educational level at the time of the data collection.

Information was available for the level of highest education completed, proportions were: Elementary school 26.7% (25.1 % male), High school 40.5% (42.6% male), University and/or college degrees up to four years 23.8% (21.0% male), and University and/or college degrees more than four years 9% (11.3% male) [190].

Data with higher resolution give a more detailed perspective on the education levels in Bergen, and there appears to be large differences in education levels in different areas of the city. In the "Report of living conditions in Bergen" published in 2008 [191], the proportion of 30–39 years old with elementary school as their highest level of completed education varied from 3.8–34.3% (data from 2005) depending on residential area in Bergen.

2.3.2 Income levels in Bergen during the data collection

The median household income for couples with children aged 0–17 in Bergen in 2006 was 566,000NOK (€77,000), whereas it was 296,000NOK (€40,300) for single parents with children aged 0–17[190]. However, there are large inequalities within the city. District level data reveal substantial differences in mean income and mean taxable assets (see Figure 4), and data with even higher resolution[191], show that the median taxable income for people older than 17 varies between 181,200–320,600 NOK (€24,600–43,600) depending on where in Bergen one resides (data from 2006).

2.3.3 Poor children in Bergen during the data collection

There were 55,483 persons under the age of 18 living in Bergen in 2006. According to the OECD-scale[c], 5.3%[d] were living in families earning less than 50% of the median household income [190].

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[c] Equivalence scales: In the OECD scale, the first adult member of the household has a weighting of 1.0, with the next adult having a weighting of 0.7, children are weighted of 0.5 each. A household consisting of two adults and two children must have an income that is 2.7 times higher than the income of a single person, in order to have the same economic standard of living. The EU scale, which is a 'modification' of the OECD scale, puts more weight on large households achieving economies of scale when more people live together. According to the EU scale, the first adult member of the household have a weighting of 1.0, the next adult have a weighting of 0.5, and children are weighted of 0.3 each. In this scale a two-child family would need a total income equivalent to 2.1 times the income of a single person in order to have the same standard of living.

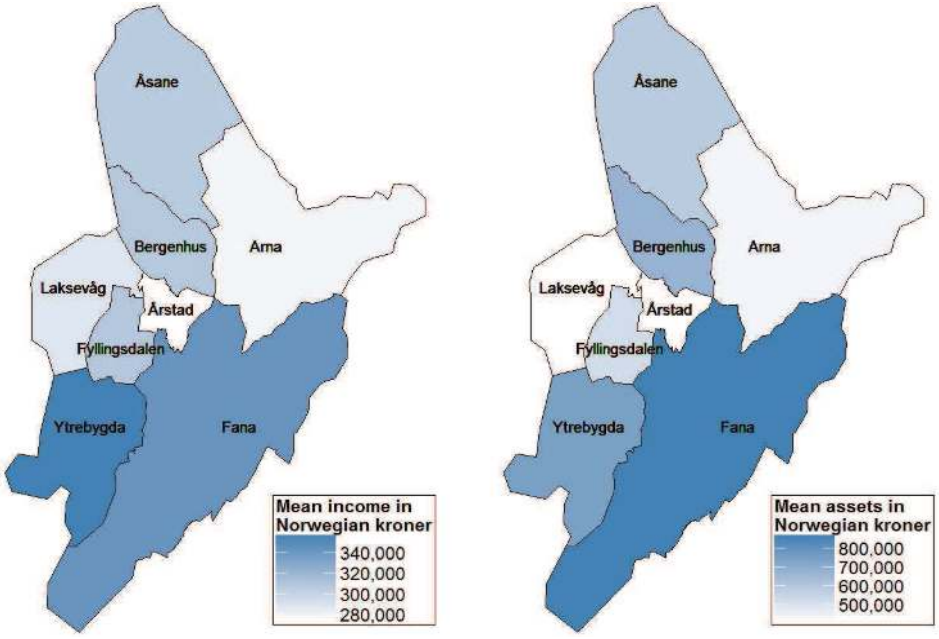

Figure 4. Mean income and mean taxable assets in the eight different districts in the city of Bergen in 2006. Data retrieved from Statistics Norway[190].

2.4 Measures and assessment

Several instruments and measures are included in the BCS, covering many aspects of mental health and functioning. Only the measures relevant to the thesis will be described in the following, but a comprehensive description of other instruments used in the BCS can be found in Heiervang et al.[10] and Stormark et al.[178].

Child mental health problems

Across all three papers, mental health problems were defined according to scores on the SDQ[71,72] obtained in Wave Two Phase One. The SDQ is a screening

[d] Equivalent proportion when using the EU-scale is 4.1%.

questionnaire for children aged 4–16 years, comprising 25 items describing positive and negative attributes of children.

The SDQ has been extensively validated in various countries [192-197]. A recent review of 48 studies (including a total sample of 131,223 participants) found the psychometric properties of the SDQ to be strong [198], but there is some controversy regarding the factor structure of the instrument and whtether the negatively worded items should be included or not [199-203].

In Wave Two, the SDQ was completed by children, parents and teachers, and was scored according to the SPSS syntax provided on the SDQ website (www.sdqinfo.com). Data from the SDQ can form the basis of several types of scores: Subscale scores, a total problems score, and externalizing and internalizing scores.

Subscale scores: The 25 items on the SDQ are allocated to five subscales with five items each: (1) emotional symptoms (2) conduct problems (3) hyperactivity-inattention problems (4) peer relationship problems, and (5) pro-social behaviour. Each subscale is scored on a three-point scale; *not true*, *somewhat true*, and *certainly true*, with each subscale scores ranging from 0 to 10. Subscales are created if there is a response on at least three out of five items, using mean substitution in case of missing data on items. Subscale scores were used in paper I.

Total problems score: The total problem score is based on the sum of 20 items, measuring symptoms of emotional, conduct, hyperactivity-inattention and peer relationship problems. The total problems scale has a range from 0 to 40. The total problems score was used in paper II.

Internalizing and externalizing problems: This score is created by combining the peer problems and emotional problems subscales into an internalizing problems scale, while the conduct problems and hyperactivity-inattention subscales were combined into an externalizing problem scale. This scoring was recently recommended by A.

Goodman et al.[204] for conducting analyses in low-risk epidemiological samples. The internalizing/externalizing score was used in paper III.

The SDQ also includes information about impact on everyday functioning. In this section of the SDQ, parents are asked if their child has problems with emotions, concentration and behaviour or with getting along with other people. If they confirm such problems, they are asked about duration, whether the problem upsets or distresses the child, and whether the problems interfere with the child's everyday life in four areas (home life, friendships, classroom learning, or leisure activities), as in the disability assessment domains of the multiaxial classification of child and adolescent psychiatric disorders [205]. Finally, the parents are asked whether the difficulties put a burden on the family as a whole. Similar questions are asked to the children in the self-report version of the SDQ, although the wording is altered to reflect that this is self-reported information. The teacher version of the impact supplement is also similar to the parent version, but uses a different wording (e.g., "this child" instead of "your child", and burden on the "class" rather than on the "family"), assessing to which extent the problems interfered with the child's peer relationships and classroom learning. The level of impact was scored according to the syntax available on the SDQ website, where the threshold for scores greater than two is classified as abnormal and a score of one as borderline. The ranges of scores were 0-6 for teacher reported impact, and 0-10 for parent- and self-reported impact.

Diagnostic probability rating: By combining information from multiple informants about symptomatology and impairment from mental health problems, it is possible to create a predicted diagnostic probability rating for psychiatric disorders. This probability rating was used in paper I. Although the rating has been used in several studies[206,207] there is no detailed explanation of the algorithm, besides references to the computer syntax available on the SDQ website (http://sdqinfo.com/c4.html). A comprehensive description is therefore provided in the following.

The algorithm makes diagnostic probability ratings the following way: For hyperactivity-/inattention disorder, ratings are based on a three-step procedure. First,

single-informant ratings are made in the following manner: A parent reported SDQ hyperactivity symptom score of seven and impact score of two (i.e. “quite a lot” of distress in two domains, or “a great deal” of distress in one), or a symptom score of nine and impact score of one gives a parent-”probable” rating. A symptom score of six and impact score of one gives a parent-”possible” rating. Symptom scores lower than six and impact scores of zero results in a parent-”unlikely” rating. Secondly, a teacher symptom score of seven and impact score of two gives a teacher-”probable” rating, a symptoms core of six and impact of one a teacher-”possible” rating, and symptom scores lower than six and impact score of zero produce a teacher-”unlikely” rating. In the third step, information from both teachers and parents are combined to make the final prediction. The prediction is set to “unlikely” if ratings are “unlikely” from any of the informants and “probable when both parent *and* teacher ratings are “probable”, or when parent rating is “probable” *and* teacher rating is “possible”. All other combinations of “probable” and “possible” ratings from the informants result in a “possible” rating for hyperactivity- /inattention disorder.

With regards to conduct disorder, a “possible” prediction is made if parent reported SDQ conduct symptom score is four or greater, or teacher reported symptom score is three or greater. Parent symptom scores of five or greater in combination with a parent reported impact score of two or more results in a “probable” rating. Teacher reported symptom scores of four or more in combination with impact scores of two or greater also results in a “probable” rating of conduct disorder.

For the prediction of emotional disorder, both a parent and teacher reported score on SDQ emotional symptoms of five or more and impact score of one or greater results in a “possible” rating. A “probable” rating is made if parent or teacher SDQ emotional symptom scores are six or greater and impact is two or more. That is unless a “probable” rating has been made for conduct- or hyperactivity- /inattention disorder. In that case, both teachers and parents must rate “probable” for emotional disorder, if not, the rating becomes “possible”. This last condition was made after observations of over diagnosing emotional disorders occurring comorbidly with either of the two other disorders [206].

The ratings for each disorder described above are then combined into an any disorder category. Any "possible" rating for particular disorders results in a "possible" rating for any disorder, and any "probable" ratings in a "probable" rating for any disorder. If all ratings are "unlikely", then any disorder is rated "unlikely".

The diagnostic probability algorithm has been found to work well in clinical samples [206]. In a community sample, Goodman, Ford, Simmons, Gatward, Meltzer [207] found the algorithm to detect around two-thirds of children with a psychiatric disorder, but performance of the algorithm varied by type of disorder and it was found to detect around 70-90 % of children with conduct, hyperactivity, depressive and some anxiety disorders, but for specific phobias, separation anxiety and eating disorders, detection rates dropped to 30-50 %. The algorithm generated approximately the same number of false positives as false negatives.

Sleep and sleep problems

The BCS included multiple indicators of sleep problems which was used in paper II. Parents reported whether their child had "difficulties initiating and/or maintaining sleep" (DIMS) with response options being *Not true*, *Somewhat true*, and *Certainly true*. In addition, both the children and their parents were asked when the child usually went to bed and when they usually got up in the morning on weekdays. From this, we created a "time in bed" (TIB) variable serving as a proxy measure for sleep duration. The parent reported TIB was used in the analyses to avoid issues with mono-informant bias with mental health problems self-reported by the children. As sleep duration changes with age, TIB was converted into a z-score for each age group (zTIB), similarly to previous publications from the BCS [164,208]. In order to aid interpretation, children were divided into three groups according to the standard deviations of their age- and gender adjusted sleep duration (< -2, -2 to <-1, -1 to +1).

Familial socioeconomic status

Across all three papers socioeconomic status was based on questions to parents about their family economy and about each parent's level of education obtained in Wave Two Phase Two.

Family economy was measured by asking the parents to rate their family economy as *very poor*, *poor*, *fair*, *good* or *very good*. Parental education levels were assessed by asking parents to report their highest level of completed education by choosing one of the following response options: *compulsory education* (< 11 years); *additional technical qualification* (2-3 additional years); *additional academic qualification* (2-3 additional years); *up to four years at college/university*; *four years or more at college/university*. Information about maternal education was provided by mothers (70.1%), fathers (10%), both (19.4%) or others (0.6%), whereas information about paternal education was provided by mothers (68.7%), fathers (10.8%), both (20%) or others (0.5%). Family economy and parental education were weakly correlated (paternal education $r = 0.256$, $p < 0.001$; maternal education $r = 0.214$, $p < 0.001$). A moderate correlation was found between paternal and maternal education ($r = 0.443$, $p < 0.001$).

Some additional data about socioeconomic status was obtained for those who had completed the DAWBA in Wave Two Phase One. This included information about annual (taxable) household income (with the following response options: *less than 100,000, 100,000 – 199,000, 200,000 – 399,000, 400,000 – 599,000, 600,000 – 799,000 and 800,000 or more*), and a moderately strong correlation was found between household income and reported family economy ($r = 0.586$, $p < 0.001$). The DAWBA in Wave Two Phase Two also included one question about ever experiencing a serious financial crisis (equal to losing three months of income; used in paper III) and one question about current experiences of economic difficulties (used in paper III). Amongst those who rated their family economy as poor or very poor, 51.4% had experienced a financial crisis, whereas 74.3% confirmed that they were currently experiencing economic difficulties.

In all papers the independent variables were family economy and parental education levels. In paper I and II, reports of poor and very poor were collapsed (into a category called poor) due to a small number of participants in the very poor category. Three categories of parental education were created: *Basic* (Compulsory education), *intermediate* (additional technical/academic qualification) and *high* (up to four years

at college/university and four years or more at college/university. In paper III, the SES variables were used dimensionally, no categories were created.

Parent health and family structure

Also included in the analyses in paper II was a a global self-assessment measure of parental health. This was obtained using a single item where the parents were asked to describe their own health using the response options *Very good*, *Good*, *Average*, *Poor* and *Very poor.* From this we created a dichotomous variable which distinguished between average/good/very good health and poor/very poor health.

Parents also reported "with whom the child currently lives" with the response options being *Mother, Father, Mother's new partner, Father's new partner* or *Others.* This information was used to distiguish between single parent or two-parent families.

Parenting practices

A measure of parenting practice was used in paper III. It was obtained using the Family Life Questionnaire (FaLQ) available in the Appendix 1 of Last, Miles, Wills, Brownhill, Ford [209]. The FaLQ was included as part of the Development and Well-Being Assessment (DAWBA[187]) and consists of four scales: Affirmation (consisting of four items related to the child-parent relationship), Discipline (consisting of four items related to punishment), Rules (consisting of two items measuring structure and organization within the family) and Special allowances (consisting of two items related to over- and under involvement from parents). Participants were asked to indicate how well the descriptions in the questionnaire apply to their child using four ordered response options (*not at all*, *a little*, *a medium amount,* and *a great deal*).

In paper III, three scales from the FaLQ were used: Affirmation, Rules and Discipline. The majority of respondents completing this instrument were "Mothers" (63.5%), other respondents were "Both parents" (14.9%), "Parent" (i.e. gender of parent was not specified, 10.1%), "Fathers" (10.4%) and others (e.g. grand-/foster-/step parents, 1.1%).

Last et al.[209] found the internal consistency and test-retest reliability of Affirmation and Rules to vary between moderate and very good, whereas the Discipline subscale showed poor internal consistency. In order to test the factor structure of the three subscales (Affirmation, Rules and Discipline) in the current sample, a confirmatory factor analysis with maximum likelihood estimation was run. Goodness of fit indices suggested a reasonably good fit for a three-factor solution (χ^2 [41] = 209.301, $p <$ .001, CFI = 0.939, RMSEA = 0.050, 90% confidence interval [CI] for RMSEA = 0.043-0.057). Although the χ^2-test was significant, other, less stringent, indices are usually relied upon when evaluating model fit in large samples[210].

Parental emotional well-being

The emotional well-being of the children's caretakers was measured using the self-report version of the Everyday Feelings Questionnaire (EFQ; accessible from http://www.youthinmind.info/EFQ) which is designed to be used in a non-clinical population. This was used in paper III. The EFQ consists of 10 items, measuring symptoms related to depression and anxiety, as well as items reflecting psychological well-being, such as optimism, self-esteem and coping. There are five response options (*none of the time*, *a little of the time*, *some of the time*, *most of the time*, and *all of the time*) reflecting the frequency of experiencing each feeling in the past four weeks. Well-being items are reverse scores, meaning that higher scores represent higher levels of distress and lower levels of well-being. The EFQ was administered as part of the DAWBA and completed by the same respondents as for the FaLQ described above.

Uher and Goodman[211] found the EFQ to be internally consistent with all items loading strongly on a single common factor, and item-response theory analysis showed that the ten items had excellent sensitivity and good information content. In order to test the factor structure of the EFQ in the current sample, a confirmatory factor analysis with maximum likelihood estimation was run. The model fit indices for a one-factor solution were acceptable (χ^2 [35] = 398.347, $p <$ .001, CFI = 0.927, RMSEA = 0.079, 90% CI for RMSEA = 0.072-0.086), again, relying on CFI and RMSEA indicators for evaluation of model fit.

2.5 Statistical analyses

2.5.1 Paper I: SES and child mental health

Statistical analyses were conducted using R version 2.10.1 for Windows [212]. The associations between social gradients and self-reported symptom scores were assessed using multiple linear regression analysis with family economy and parental education as predictors, and self-reported SDQ symptom scores as outcome measures. Preliminary analyses revealed that the residuals of the SDQ subscales violated normality. Violations of normality, however, may be less concerning in studies with large samples[213].

Logistic regression analyses were conducted to assess the association between SES and the diagnostic probability scores, which were created by combining self-, parent- and teacher reported symptom- and impact scores. The diagnostic probability ratings were dichotomized by combining the "possible" and "probable" ratings. As the "possible" rating may indicate a borderline clinical mental health disorder that should be monitored [206], the findings are relevant in a public health perspective. The dichotomized predicted probability score was entered as the dependent variable (with "unlikely" = 0 and "possible/probable" = 1) with parent reported family economy, paternal and maternal education levels entered as categorical predictors.

Both regression analyses were organized in a similar manner: in Model 1 each predictor was entered individually to assess its univariate association to the outcome measure; in Model 2 all predictors were entered in a single step to assess their multivariate associations to the outcome measure. Multicollinearity among the predictors was assessed by standard methods (variance inflation factor, tolerance and condition number[213]), none of which suggested any problems.

2.5.2 Mediation analysis

The conceptual characteristics of a mediator variable (and the distinction from a *moderator* variable) has been detailed in a much cited publication by Baron and Kenny[214], see illustration of mediation in Figure 5. In this publication, the authors

also provide stepwise details of tests for mediation using regression analysis, a procedure much used in mediator research[106,107]. In papers II and III, potential mediators of the association between socioeconomic disadvantage and child and adolescent mental health was assessed using path analysis in Mplus[215], a software package developed for structural equation modelling (SEM). In contrast with the traditional regression approach advocated by Baron and Kenny[214], path analysis allows for quantification of the intervening effect[216]. By using Mplus, we were also able to use bootstrapping to test the effect of the intervening variable(s). Simulation studies have demonstrated bootstrapping to be one of the more powerful and valid methods for testing indirect effects[217].

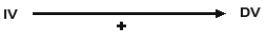

Figure 5a

Figure 5a illustrates a direct association between an independent variable (IV) and dependent variable (DV).

In the current thesis, the IV(s) are family economy and parental education, whereas the DV is mental health problems.

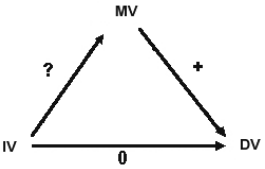

Figure 5b

Figure 5b illustrates how the direct association between the IV and the DV can be accounted for by a mediator variable (MV). The figure illustrates full mediation (i.e. the direct association between the IV and the DV is 0), but partial mediation may also occur, and would be evident by residual direct effects that are not fully accounted for by the MV.

In the current thesis, the IV(s) are family economy and parental education, whereas the DV is mental health problems. The MV could for example be sleep problems (as in paper II).

Figure 5. Illustration of direct versus mediated effects.

2.5.3 Paper II: SES, sleep and child mental health

Pearson χ^2-tests and ANOVAs were used to examine differences on demographics and sleep variables across SES indicators. Logistic regression analyses were conducted to assess the association between SES indicators and sleep problems. Firstly, we conducted crude analyses to evaluate the association between each SES indicator and sleep problems (step one), and adjusted analyses controlling for BMI (step two) and also for poor parental health and single parenting status (step three). Dichotomized DIMS (0 = "not true", 1 = "somewhat true/certainly true") and TIB (0 = zTIB +1 to −1 SD, 1 = zTIB ≤1 SD) were used as dependent variables in each of the logistic regression models. Independent variables were SES indicators (one indicator entered per model) with "high" education and a "very good" reports of family economy as reference, and in the adjusted analyses, parental health (0 = "average/good/very good", 1 = "poor/very poor"), single parenting status (0 = "cohabiting", 1 = "single parenting"), and BMI. Preliminary analyses showed that BMI was unrelated to sleep problems and it was therefore excluded in the final adjusted model, with the SES indicator in step one and poor parental health and single parenting status in step two. Missing values were handled by listwise deletion in the regression analyses. Multicollinearity among the predictors was assessed by standard methods (variance inflation factor, tolerance and condition number [213]), none of which suggested any problems. SPSS version 18[218] was used for analyses.

In order to assess the mediation effect of sleep problems on the relationship between SES and mental health problems, path analysis was conducted using Mplus [215]. There were 473 cases with missing on all values, resulting in 5,311 observations being included in the path analysis. The robust mean and variance-adjusted weighted least squares (WLSMV) procedure was used for estimation as this estimator is preferred when modelling categorical data [210]. Socioeconomic status indicators were entered as separate correlated predictors, non-dichotomized DIMS as a mediator variable and self-reported SDQ total problem score as the outcome variable. Model testing was conducted by first fitting a saturated model including all paths between SES indicators and DIMS and SDQ total problems, then proceeding by removing

nonsignificant paths and testing the reduced model. This resulted in a model where the paths from parental education to DIMS were excluded. Preliminary analysis revealed a weak negative correlation between the age-adjusted z-transformed continuous measure of TIB (zTIB) and SDQ total problems score ($r = -0.29$, $p < .05$), but zTIB was not associated with any of the SES indicators. Path analysis was therefore not run on zTIB.

2.5.4 Paper III: SES, parent characteristics and child mental health

Correlation analysis was used to measure associations between SES, parental emotional well-being, and parenting characteristics. Based on previous findings in the literature, we expected the direct effect of our SES indicators on externalizing and internalizing problems to be mediated by parental emotional well-being and/or parenting practices. The first step in model development therefore consisted of fitting a model where all the direct paths from the SES indicators to externalizing and internalizing problems were constrained to zero, whereas other paths were estimated freely. The next step involved inspecting the modification indices to see if this model could be improved by respecification. Jöreskog[219] suggested that model respecification should start by iteratively freeing constraints on the parameters where the largest modification index (MI) and expected parameter change (EPC) value is observed, before re-testing the model. This approach may also solve problems with high MI and EPC values in other parameters. This purely statistical approach must be accompanied by a theoretical rationale for why certain parameters are freed, in order to establish a model that gives meaning theoretically as well as fits the data statistically[210]. The same analytical approach was used for the analysis where comorbidity was taken into account. In this analysis, externalizing and internalizing problems were included simultaneously in the same model and allowed to correlate.

Model fit was evaluated according to the recommendations by Hu and Bentler[220]; standardized root mean square residual (SMR) values close to 0.08 or below, Comparative Fit index (CFI) close to 0.95 or greater, and root mean square error of approximation (RMSEA) close to, or below, 0.06 indicate good fit between the target

model and the observed data. If the upper limit of the 90% confidence interval (CI) of the RMSEA is below 0.08, this indicates additional support for the model[210]. X^2 is also reported, but other fit indices will be relied more heavily upon when evaluating model fit, as the X^2 has very stringent assumptions and is sensitive to inflation by sample size and thereby routinely rejects solutions with a large N [210].

Statistical analyses were conducted in version 12.1 of STATA (StataCorp, 2011). Confirmatory factor analyses and path analyses were carried out in Mplus version 6.1[215].

2.6 Ethics

Data in the Bergen Child Study was collected in accordance with standards required by the Regional Committee for Medical and Health Research Ethics in Western Norway. Permission to collect and store the data was given by the Data Inspectorate in Norway. All participation was voluntary, and all potential participants received written information about the project prior to deciding whether to take part in the study.

3. Results

This chapter provides a brief overview of the results presented in the three papers included in this thesis[221-223]. Please refer to each respective paper for further details. Papers I and II are based on the same Wave Two Phase One sample and will be described together.

3.1 Papers I and II

3.1.1 Demographics

Approximately one-third of the sample in Wave two Phase one described their economy as average and only a marginal (2.8%) proportion reported poor family economy. The majority (68.1%) described their economy as good or very good. Regarding parental education levels, the majority of our respondents reported education beyond high school, and only a small proportion reported elementary school as their highest level of education. In the Wave two Phase one sample, 47.8% were boys, with approximately equal numbers of children from each school grade sampled (34.7% 5th grade, 34.8% 6th grade, 30.5% 7th grade).

Younger children spent more time in bed than older children (5th graders: *M* =10 h, 2 min, *SD* = 29 min; 6th graders: *M* = 9 h, 44 min, *SD* = 31 min; 7th graders: *M* = 9 h, 26 min, *SD* = 33 min), and the average SDQ score for the sample as a whole was 6.41 (±4.87 *SD*). Across all three indicators, families with low SES were most likely to report poor parental health and single parent families, as well as higher levels of child emotional and behavioural problems.

3.1.2 SES indicators and symptoms of mental health problems

A monotonic pattern emerged illustrating that self-reported SDQ symptom scores within each domain of mental health problems were lower in families with better economy and higher parental education. In bivariate regression analysis, both family

economy and parental education predicted self-reported mental health problems across all four domains of mental health.

In multivariate regression analyses with all predictors entered simultaneously, poorer family economy persisted as a significant predictor of higher symptom scores across all domains of self-reported mental health. Lower parental education predicted higher symptom scores on conduct problems and hyperactivity/inattention, but only lower paternal education predicted higher symptom scores on emotional problems. SES status explained slightly more variance in hyperactivity/inattention- and conduct problems than in emotional- and peer problems.

3.1.3 SES indicators and probability rating for mental disorder

Univariate logistic regression models showed that both average and poor family economy was significantly associated with higher levels of conduct disorder and emotional disorder. Only poor family economy increased the odds for hyperactivity/inattention disorder. Both intermediate and basic parental education increased the odds for diagnostic probability across all the three domains (i.e. emotional problems, conduct disorder and hyperactivity/inattention disorder) of mental health problems. In multivariate analyses, average and poor family economy increased the odds of emotional disorder, but only poor family economy did so for conduct disorder and hyperactivity/inattention disorder. Paternal education categorized as intermediate and basic increased the odds for child conduct disorder, but only basic paternal education level increased the odds for emotional disorder and hyperactivity/ inattention disorder. With regards to maternal education, basic and intermediate increased the odds for hyperactivity/inattention disorder and basic level increased the odds for conduct disorder.

3.1.4 SES and sleep problems

Difficulties initiating and/or maintaining sleep were more common in families with a poor economy (27.7%) compared to families with reports of very good economy (9.8%). The proportion of children with short TIB was highest in children within the

lower categories of perceived family economy. Similar patterns were found for both maternal and paternal education.

3.1.5 SES, sleep, and the role of parental characteristics

To explore potential confounding effects of parent characteristics, we conducted a series of logistic regression analyses on the association between SES and sleep problems. Children from families with poor and average perceived family economy had significantly higher odds of reporting DIMS compared to children from families with very good economy (ORs = 3.5 and 1.7, respectively). The odds were reduced by 12-36% when adjusting for poor parental health and single parent families, but remained significant (ORs = 2.6 and 1.6, respectively). Children from families who reported poor economy also had increased odds of a short TIB, both in the crude analysis (OR = 1.9) and when adjusting for parental characteristics (OR = 2.2). No significant associations were found between DIMS and parental educational levels, but maternal education was significantly associated with short TIB in both the crude and adjusted analyses.

3.1.6 Sleep as a mediator between SES and mental health

To investigate the potential mediating role of sleep problems in the relationship between SES and mental health, a path analysis was conducted, including all the three SES indicators as exogenous variables, DIMS as a mediator and SDQ total problems score as the outcome variable. The reduced model fitted the data well, and explained 13.5% ($R^2 = 0.135$, $p < .001$) of the variation in SDQ total problems score, and 1.8% ($R^2 = 0.018$, $p = .002$) of the variance in DIMS. The significant total effect from perceived family economy to self-reported SDQ total problems score (−0.127, $SE = 0.014$, $p < .001$) was partially mediated by a significant specific indirect effect of sleep problems (−0.042, $SE = 0.007$, $p < .001$) thereby accounting for approximately one-third of the total effect.

3.2 Paper III

3.2.1 Sample characteristics

Compared to the sample only participating in Wave Two Phase One, the children in the full information sample (i.e. those who participated both in Wave Two Phase One and Wave Two Phase Two) had somewhat lower hyperactivity and conduct scores, but effect sizes were small. The remaining analyses were conducted on the full information sample of 2,043 respondents (50.7% female; 37.6% 5th graders, 36.2% 6th graders and 26.2% 7th graders).

3.2.2 SES and parent characteristics

The correlation between maternal and paternal education was moderate (r = .484) and correlations between family economy and parental education small (r maternal = .232, r paternal = .282). Perceived family economy was negatively correlated with parental EFQ scores, while associations with parenting practices (FaLQ) were mostly insignificant and/or trivial (rs from .002 to .064). Maternal education was significantly correlated with Discipline, but the correlations were insubstantial (rs from -.011 to .072).

3.2.3 Parent characteristics as a meditator between SES and mental health

A series of path analyses was conducted to test for the potential mediating effect of parental emotional health and parental practices on the relationship between SES and child mental health. The FaLQ scale Rules was neither correlated with any of the SES indicators, nor with internalizing or externalizing problems and was therefore not included in the path analyses.

Externalizing problems

The model where the direct paths from SES indicators to externalizing problems were constrained to zero fitted the data poorly, X^2 (3) = 51.60, p < .001, SRMR = 0.032, RMSEA = 0.089 (90% CI = 0.069-0.111), CFI = 0.886. Modification indices suggested that improvements could be made to the model by freeing the direct path

from paternal education levels to externalizing problems (MI = 46.433, EPC = -0.315, STDYX EPC= -0.151). Freeing this path and re-running the model resulted in a model with good fit to the data, X^2 (2) = 4.623, p = 0.0991, SRMR = 0.007, RMSEA = 0.025 (90% CI = 0.00-0.057), CFI = 0.994. No further improvements were suggested by the modification indices. The resulting path model can be seen in Figure 2 in Paper III (paths with significant coefficients shown).

The indirect paths from family economy to externalizing problems through parental emotional well-being and discipline (-.006, SE = .001, p < .001), and through parental emotional well-being and affirmation (-0.006, SE = 0.002, p < .001) were both significant, as was the indirect path from maternal education levels to externalizing problems through discipline (-0.017, SE = 0.007, p = 0.009). Overall, the model explained 11.5% of the variance in externalizing problems.

Internalizing problems

The model where all direct paths from the SES indicators to internalizing problems were constrained to zero yielded a poor fit to the data, X^2 (3) = 31.470, p < .001, SRMR = 0.025, RMSEA = 0.068 (90% CI = 0.048-0.091), CFI = 0.911. Modification indices suggested that the direct path from family economy to internalizing problems (MI = 21.221, EPC = -0.399, STDYX EPC = -0.106) should be added. Respecification by freeing this path resulted in a model with good fit X^2 (2) = 10.002, p = 0.0067, SRMR = 0.012, RMSEA = 0.044 (90% CI = 0.020-0.073), CFI = 0.975. No further improvements were suggested by the modification indices. The resulting path model can be seen in Figure 3 in Paper III (paths with significant coefficients shown).

The indirect path from family economy to internalizing problems through parental emotional well-being and discipline was significant (-0.002, SE = 0.001, p = 0.006). The indirect path from family economy to internalizing problems through parental emotional well-being and affirmation was borderline significant (-0.003, SE = 0.001, p = 0.056). Overall, the model explained 5.2% of the variance in internalizing problems.

Joint analysis of externalizing and internalizing problems

The model where the direct paths from SES indicators to internalizing/externalizing problems were constrained to zero fitted the data poorly, X^2 (6) = 72.679, $p < .001$, SRMR = 0.036, RMSEA = 0.074 (90% CI = 0.059-0.089), CFI = 0.930. Modification indices suggested that the direct path from paternal education to externalizing problems should be freed (MI = 40.450, EPC = -0.263, STDYX EPC = -0.126). Re-running the model after respecification improved model fit (X^2 [5] = 31.422, $p < .001$, SRMR = 0.024, RMSEA = 0.051 [90% CI = 0.035-0.069], CFI = 0.972), but modification indices suggested that further improvements could be obtained by freeing the direct path from family economy to internalizing problems (MI = 19.011, EPC = -0.342, STDYX EPC = -0.091). Re-running the model after freeing this path resulted in a model with good fit, X^2 (4) = 12.103, $p = 0.0166$, SRMR = 0.014, RMSEA = 0.032 (90% CI = 0.012-0.053), CFI = 0.992, and modification indices did not suggest further improvements to the model. The resulting path model can be seen in Figure 6 (paths with significant coefficients shown).

The indirect paths from family economy to externalizing problems through discipline (-.006, SE = 0.001, $p < .001$) and affirmation (-.006, SE = 0.002, $p < .001$) were significant, as was the indirect path from family economy to internalizing problems through discipline (-0.002, SE = 0.001, $p = 0.008$). The comorbidity model accounted for 11.2% of the variance in externalizing problems, and 5.2% of the variance in internalizing problems.

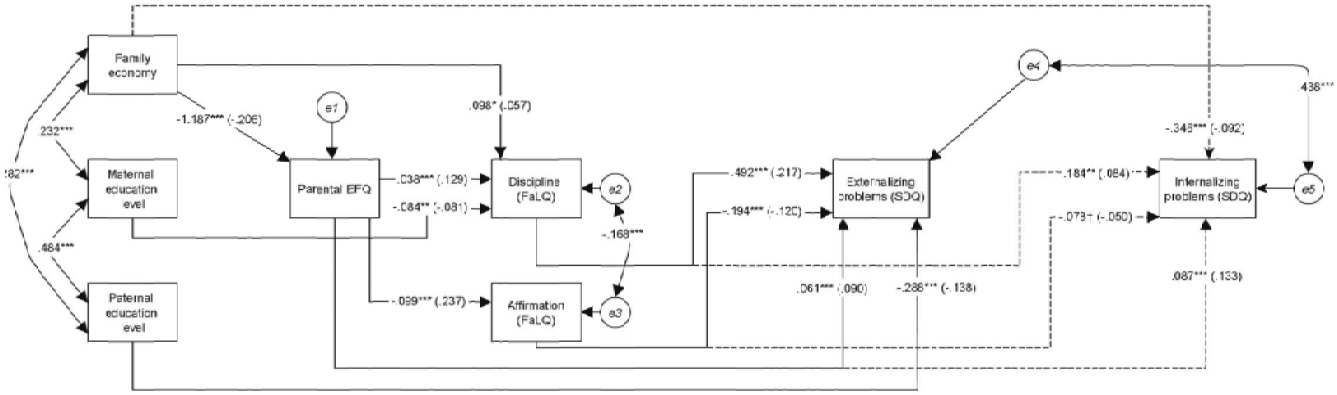

Figure 6. Model of paths among socioeconomic status indicators, parental emotional well-being, parenting practices and SDQ externalizing and internalizing problems.

Estimates outside brackets are unstandardized path coefficients, estimates in brackets are standardized (STDYX). Double headed arrows indicate correlations between the exogenous variables and between the error terms of the endogenous variables. Solid lines illustrate paths to externalizing problems and broken lines illustrate paths to internalizing problems. Goodness-of-fit indices: X^2 (4) = 12.103, p = 0.0166, SRMR = 0.014, RMSEA = 0.032 (90% CI = 0.012-0.053), CFI = 0.992.

†p = .053, *p < .05, **p < .01, ***p < .001.

4. Discussion

The results in this thesis showed that there is a general inverse relationship between SES and mental health problems across SES indicators and across different mental health domains, and that there are specific associations between certain indicators of SES and particular kinds of mental health problems. It was also found that sleep problems were more common among children and adolescents with a lower SES, also after adjusting for family and demographic factors known to be associated with socioeconomic disadvantage. Furthemore, difficulties initating and/or maintaining sleep was found to partially mediate the association between SES and poor mental health in childhood. Finally, it was found that lower SES was associated with poor parental emotional well-being and parenting practices, and that the associations between SES and internalizing and externalizing child mental health problems were partially mediated through parental well-being and parenting practices.

The finding of a robust monotonic pattern of decreasing symptoms across multiple domains for mental health problems with better family economy and higher levels of parental education – a social gradient – is in general supportive of other studies that have demonstrated that socioeconomic disadvantage is associated with mental health problems in children and adolescents[11]. Social gradients in health have previously been found for depression[43], health satisfaction[58] and emotional and behaviour problems[21]. Poorer family economy was independently and consistently related to all mental health problems, both as measured by symptom counts and probability of psychiatric disorder, whereas parental education levels showed a more differential pattern across the different types of mental health problems. Similar results have been obtained in another publication where mental health problems were measured with the SDQ[81]. Using the diagnostic probability ratings, poor family economy was found to increase odds of all categories of mental health problems (emotional-, conduct- and hyperactivity problems). Other researchers have found a similar pattern of association using clinically defined psychiatric diagnoses[75,76], some have only found associations

with anxiety disorders[78], and others have not found any associations between poor economy and mental disorder[79].

Parental education levels were in general more closely related to conduct- and hyperactivity problems than to emotional problems, this is in contrast to some other studies that have found stronger associations between parental education levels and internalizing types of problems (such as anxiety) [78,80], or both internalizing and externalizing types of problems [77,79]. Methodological differences between these studies and ours, such as differences in definition of poor economy [77] and controlling for variables such as subjective social status[80] and family characteristics[77] in the analyses may explain the differences in results. Also, although the diagnostic probability rating share some features with diagnoses, these are not analogous, and this may also contribute to the differences in results.

Social gradients[102,224,225] may be challenging for social epidemiological theories such as fundamental/materialistic perspectives that evoke mechanisms related to *absolute* deprivation and a lack of basic resources to explain social health inequalities[226,227]. Although such mechanisms still may account for some of the health differences that emerged in this thesis, few people in the current sample live under conditions that deprived, and the gradient pattern cannot be explained in terms of absolute deprivation. The results may be better understood in light of the neo-materialistic perspective, which explains social health inequalities in terms of *relative* rather than absolute materialistic deprivation. According to that perspective, each level of improved SES is seen as being associated with increased access to resources and opportunities to improve health such as being physically active and eating healthy which is both associated with better mental health[117,118,120]. The findings may also be explained with reference to direct negative psychological consequences of feeling unfairly socioeconomically disadvantaged[104]. Socioeconomic disadvantage has also been associated with less contact with health services[10,90,117,118], thus children from families with a low SES may be more likely to have untreated mental health problems for prolonged period of times. Delayed detection and treatment could be associated with a poorer prognosis for these children and adolescents. Although this was not

explicitly investigated in the current thesis, it could explain the pattern of results obtained.

Difficulties initiating and/or maintaining sleep (DIMS) was more frequent amongst children from families with a poorer economy, whereas short time in bed (TIB) was more common in children from families with a lower SES according to all indicators. The association between poorer family economy and DIMS was somewhat attenuated by family factors, but such factors had minor influence on the association between poorer family economy and lower maternal education levels and TIB. These results are generally supportive of earlier studies that have found lower SES to be associated with sleep problems[136,228]. In addition, our findings suggest that there may be differential associations between particular facets of SES and certain types of sleep problems, which may be one reason for the inconsistencies between findings in earlier studies.

It was also found that DIMS partially mediated the association between low SES and self-reported mental health problems in children. This result provides support for the hypothesis suggested by Van Cauter and Spiegel[139], and replicates previous findings obtained with adult participants[142]. Socioeconomic disadvantage may act on the HPA-axis[139] which has been suggested to be etiologically associated with insomnia [229]. This hypothesis fits well with the psychosocial explanations for social health inequalities, which state that lower SES increases the level of psychological stress in those who are socioeconomically disadvantaged, and that this may have direct consequences for their health. In these terms, children who are socioeconomically disadvantaged may experience higher levels of stress, which in turn is giving them sleep problems with adverse influences for their mental health. The pattern of results may also be explained in accordance with neo-materialistic explanations, as socioeconomically disadvantaged families may have poorer living conditions, which can be associated with factors such as crowding and noisy surroundings and therefore contribute to poor sleep in children and adolescents [230]. It could also be that children in families with poor economy make poorer lifestyle choices and do more health damaging behaviours as suggested by proponents of the health behaviours/life style

perspective. Sleep problems have for example been associated with poor nutrition[231] and lower levels of physical activity[232]. Sleep problems could also be associated with family characteristics such as lax enforcement of sleep routines and failure to provide an environment conducive to sleeping, which would be in accordance with some of the elements from the family process-[87,88] and family investment[95] models.

Family economy was associated with externalizing and internalizing problems through parental emotional well-being and more use of harsh discipline and less use of affirmative parenting practices. These findings align with findings from previous studies of the family stress model which suggest that economic strain adversely affects parental mental health and in turn have negative influences on parenting strategies[87,88]. Our findings also replicate those from a previous investigation of the consequences of economic recession in a Finnish sample[233,234], although the strengths of the associations in our study were somewhat weaker than those in the Finnish study. Other measures of family economy, but also a better economic situation in Norway with less disparity, might have contributed to these weaker associations.

Maternal education levels were associated with externalizing and internalizing problems through discipline. Although the influence of parental education levels has not been explicitly tested within the framework of the family process model previously, the results are in support of other previous studies that have demonstrated maternal education to be associated with both parenting practices[166-168], and childhood behaviour problems[169,170]. It has been shown that mothers with a lower SES use more direct control practices with their children[157], and parental education levels have been found to directly influence the use of harsh disciplinary practices with boys[235]. In general it has been demonstrated that lower SES parents are more concerned with conformity to societal norms, establishing their authority over children, and enforcing their authority with punitive practices[157]. Theoretically, poor parenting can be placed within the family process perspective, but it may also be conceptualised with reference to the ecological surroundings in which the child grows up in accordance with the contextual perspective on social inequalities. Also, parenting practices are strongly influenced by the parenting oneself has received[235],

and mothers' parenting practices are related to the education level of their own mothers' when they grew up[236]. This intergenerational transmission of parenting practices is in agreement with the social drift perspective [68, 69] and the interactionist model[87].

In the analyses that took comorbidity into account, a similar pattern of association emerged to that of the individual analyses of externalizing and internalizing problems. However, the indirect effect of maternal education through discipline on externalizing problems and of family economy through affirmation on internalizing problems attenuated, suggesting that their relative influence in the comorbidity model is weaker. Overall, this suggests that although externalizing and internalizing problems are related and may coexist, there are nevertheless differences in how each domain of mental health problems is associated with SES.

The relation between socioeconomic disadvantage and mental health problems in children and adolescents is most likely multicausal and many factors may contribute to this association. Unexplained variance and unmediated direct paths in the current analyses suggest that factors besides sleep problems, poor parental health, family structure, parental emotional well-being and parenting practices may contribute to the associations between socioeconomic disadvantage and child and adolescent mental health problems. Such factors may for example include unhealthy behaviours[112,118-120] (in accord with the health behaviours/life style perspective), neighbourhood characteristics and increased reactivity to stress[48,121,122] (in agreement with the psychosocial- and the contextual perspectives), and heritable characteristics[237,238] (in agreement with the social drift and personal characteristics perspectives). Although the current thesis only used cross-sectional data, one could also imagine the role of early mental health problems and sleep problems as the start or continuation of a trajectory of negative influences that over time accumulates to health problems in adulthood, as stated by the proponents of the life course perspective on social inequalities in health[239].

4.1 Methodological and ethical considerations

Strengths of the study

The main strengths of the study are the large sample size, the multiple indicators of socioeconomic status, and the use of a well-validated and versatile instrument to measure mental health problems.

The large sample size has allowed us to conduct detailed analyses of several indicators of socioeconomic status and multiple domains of mental health problems simultaneously. Few studies have used this approach [240], and these kinds of analyses have been called for in the literature[59].

The multiple indicators of socioeconomic status has allowed for detailed investigation of how each indicator is associated with particular facets of mental health problems, and comparisons of the indicators relative contribution to this association. Conducting indicator-level analysis has been recommended by several authors[68,70,162], who at the same time have suggested that use of aggregated measures of socioeconomic status is not ideal, as composite measures may conceal more specific associations.

The multiple uses of the data obtained from the Strengths and Difficulties Questionnaire has allowed us to investigate the influence of socioeconomic status on mental health at different resolutions; both as a global structure, at the level of particular clusters of symptoms or disorders, and as externalizing and internalizing problems. The use of multiple-informant reports about both symptoms of and impairment from mental health problems has been advocated in the literature for increasing accuracy and estimates of mental health problems [206,241], and the use of different informants for the exposure and outcome variables and the potential confounders has reduced the concern for mono-informant bias.

Additional strengths of the study is the inclusion of several other relevant instruments that measure parental mental health and parenting practices, as well as indicators of family structure and sleep problems, which has allowed us both to conduct detailed

analysis of potential mechanisms and to control for potential confounding factors of the association between socioeconomic status and child mental health.

Representativeness and external validity

There are particular issues of representativeness that is relevant to the sample used in the three papers. The first relates to the participants who took part in in Wave Two of the BCS. From the target population of approximately 9,200, 5,781 did participate. Although a low-response proportion does not necessarily produce biased results [242], it may have limited the external validity of our findings. A previous publication using data from Wave One Phase One[178] analysed the differences between the sample where parents consented to participate (responders), with the sample where parental consent was not obtained (nonresponders). The results showed that children for whom teachers reported moderate or high symptom scores were less likely to participate in the study (i.e. they were nonresponders). It is likely that nonresponse in the Wave Two Phase One sample has been influenced by the same mechanisms, although we were unable to assess this. Our own analyses showed that the sample from Wave Two Phase One had somewhat lower symptom scores on teacher and parent reported SDQ than the sample from Wave One Phase One, but the effect sizes were small to moderate.

A second issue pertaining to representativeness relates to those participating in phase two of the second wave of the BCS (compared and contrasted with those participating in only phase one of the second wave of the BCS) and is relevant for the third paper in my thesis. From the 5,781 who participated in Wave Two Phase One, 2,043 participated in Wave Two Phase Two. In a previous publication, it was found that not participating in Phase Two was predicted by four factors measured during Phase One: 1) lower maternal education, 2) being from a single-parent or reconstituted family, 3) having an immigrant parent from a low of middle income country, and 3) higher teacher reported SDQ scores [243]**.** Our own analyses revealed that a greater proportion of the participants in Wave Two Phase Two had higher education levels and a better family economy, and that the Wave Two Phase Two sample had significantly lower hyperactivity and conduct scores than the Wave Two Phase One sample, but the

effect sizes were small (i.e. Cohen's *d*s = 0.062–0.069). This is suggesting that the significant difference has largely to do with the relatively large *N*, and less to do with clinically meaningful differences between the two groups. Despite this, issues of missingness is important to account for, both in the analysis of the data, as well as in the interpretation and dissemination of the results obtained using this particular sample.

Measuring mental health problems

Mental health problems were measured with the SDQ in this thesis. Despite the many favorable features of this instrument, it is a challenge to find appropriate screening instruments for mental health problems in children. In general, a screen is a brief measure of psychopathology that is completed by parents, teachers, children or other respondents, where a score above or below a certain cutoff defines a person as a case (i.e. in need of treatment or referral) or a non-case, respectively. A challenge with relying on a symptom-screen only for identifying cases is that it may either under- or overestimate the number of respondents who are being defined as cases. In addition, current diagnostic manuals for mental health problems require significant distress or social impairment to be present in order for some [205] or all diagnoses to be made [188]. In evaluations of questionnaires that include assessment of impairment and distress, in addition to inquiring about symptomatology, it has been found that level of impairment is better than symptom scores at discriminating a clinical from a community sample, but that the best prediction of clinical status is obtained by a combination of symptoms and impairment which was used in some of the analyses in the current thesis[72].

Apart from the issues of over- and underreporting, another salient issue in childhood psychopathology is that of co-morbidity e.g., having multiple co-occurring disorders or pathologies[4,6]. With the very high co-morbidity rates found during childhood, it is uncertain to which extent the four domains of problems measured with the SDQ is adequately distinct and represents different types of problems. A pragmatic solution is to use the *total problems score* available from the SDQ, which is the sum of symptoms of emotional, conduct, hyperactivity-inattention and peer relationship

problems, and this is the score that we used in the second paper of the thesis. This score disregards co-morbidity as such, by providing a grand score of the level of problems that children have, irrespectively of which domain they are experiencing problems within. This score is also favorable with regards to another, analytical challenge, when screening for health problems in community samples, namely the issues of kurtosis and skewness. Many statistical tests depend on normality assumptions [244] and this is commonly violated when screening populations where the majority is healthy. In studies where we are investigating more general mechanisms that are thought to apply for several types of mental health problems, the total SDQ score may be useful.

The total SDQ score is useful in elucidating certain types of research questions, but is at the same time somewhat unsatisfactorily as it only provides an indication of global problems. Sometimes more refined categories of problems are needed, as they have higher utility both clinically and etiologically. One strategy we used was to create factors at a level that intermediates the total SDQ score and the subcategory-scores. This was achieved by creating two factors; one *externalizing* (consisting of scores of conduct- and hyperactivity-inattention problems) and one *internalizing* (consisting of symptoms of emotional- and peer relationship problems) as suggested by A. Goodman et al. [204]. This way of categorizing mental health problems has both historical traditions [75], and is clinically and etiologically meaningful [245], although comorbidity between these "super-factors" very often appears [246].

Measuring socioeconomic status

A limitation in the current study is that information about paternal education is largely provided by mothers, which could render it less accurate than had it been reported by the fathers themselves. One may argue that our measure of paternal education is largely a measure of mothers' recollection and/or appreciation of the education level of their child's fathers.

We assessed family economy with a single question: "How would you describe your family economy" with response options ranging from "Very good" to "Very poor".

There are several other commonly used measures of economic resources, each with strenghts and limitations, such as *household income* (the sum of income from all household member over a given limited time period), *wealth* (all the financial assets in a household at a given point in time), *hourly earnings* (sometimes calculated from yearly wage), and *poverty* (defined as a given discrepancy between a household's income and some threshold of income adjusted for family size and inflation) [70,90]. Whereas these are based on actual monetary income or assets, other measures are more focused on the psychological responses to economic strain, such as problems paying bills, making ends meet and recognition of financial difficulties [247]. Our measure does not fit perfectly well into either the "monetary income" or the "psychological response" concepts, but it is perhaps more strongly related to the latter. Having a perception of the family economy as being "poor" or "very poor" is probably more strongly related to experiences of not being able to make ends meet rather than to an arbitrary amount of money available in the household at a given time, although these two necessarily will be related.

Since our measure of economy is an uncommon one, several attempts to validate it have been made. The face validity of the question appears to be high, thus attempts have focused on construct- and criterion validity, that is, measuring it against other constructs that we assume are also related to SES. In the current thesis, we found family income and maternal and paternal education levels to be weakly correlated (rs = 0.214 and 0.256 respectively, both ps < .001), and one could conclude that family economy is a poor indicator of SES since it is only weakly related to the two other indicators measuring SES. An alternative explanation, however, may be that the association between income and education in Norway is less strong than what has been found in other countries [248].

An alternative strategy used for assessing the convergent validity of our measure of family economy was to compare it to an alternative measure of financial resources. For some of the participants (N = 642), the answer to the question about family economy could be correlated with a related question about household income asked in Wave one Phase One a few years earlier (see section 2.4). We found a moderately

strong significant positive correlation between these two questions ($r = 0.586$, $p < 0.001$). This indicates that the family economy question does measure something that is related to household income, but the correlation is far from perfect, and the numbers of participants available for such analysis were relatively few. For the Wave Two Phase Two sample, we also had information regarding the experience of economic difficulties or financial crisis (equivalent to loosing three months worth of income or more). Among the participants who rated their economy as "poor" or "very poor", 51.4% confirmed that they had experienced a financial crisis, whereas 74.3% confirmed that they were currently experiencing economic difficulties. Taken together, the convergent validity analyis suggests our measure is not equivalent to a measure of monetary income, although it seems to be relatively closely related to it.

We also evaluated the ecological validity of the family economy measure by comparing the pattern of responses in the current study with population statistics from register studies/government statistics. By comparing the frequency of people endorsing the response options "poor" and "very poor" with the number of people classified as "poor" in population statistics, one may determine to which extent these two distributions align. In the BCS, approximately 3% of the participants rated their economy as "poor" or "very poor", a figure that align reasonably well with the frequency of people characterized as poor in government statistics [249], despite the very different approaches through which poverty is defined.

Lastly, we attempted to validate our measure of family economy by relating it to other empirically related constructs. We found that the symptoms of health problems were lower in those participants with a good economy compared to those who were worse off, which replicates previous findings from other studies that have used household income. A second external related construct is that of being a single-parent which comprise a great share of those being characterized as poor in Norway [250]. Having a large proportion of single parents amongst those who describe their family economy as poor could be interpreted as indicating validity of the family economy measure. In the current study, more than 60% of those who reported their family economy to be poor or very poor were single parents, compared to only 4% single

parents amongst those with a very good economy. This pattern of results suggests that single parenting and poor family economy in the current study is associated in a way similarly to the association between single parenting and economic disadvantage that is found in government statistics.

Use of mediation analysis in cross-sectional studies

Mediation analysis on cross-sectional data was used in two of the papers comprising the current thesis. Mediation is used relatively often in psychological research, but the application of mediation analysis to cross-sectional data is debated. In 2007, MacKinnon et al[251] identified 291 studies when they searched PsychInfo for articles having "mediation" in the title and also citing Baron and Kenny's (1986) article on mediation methods. They identified a mix of studies, using both longitudinal and cross-sectional designs. In another review of the mediation literature in psychology, Maxwell and Cole[252] found that 53% of the 72 studies that were published in a selection of psychology journals in 2005 applied mediation analysis to cross-sectional data, other studies had obtained longitudinal data, but used measures in the analysis that had been obtained concurrently.

Although using mediation analysis on cross-sectional data is a common practice in psychology, concerns have been rasied that evidence of full or partial mediation from studies using such data may not always be informative with regards to longitudinal cauasal processes[252-254]. In a much cited study, Maxwell and Cole[252] found that estimates of longitudinal paramterers were biased in cross-sectional approaches, even under what they described as ideal conditions of full mediation. Later, they demonstrated biased estimates also under conditions of partial mediation[253]. Although this is an empirical question, Maxwell and Cole's findings suggest that different estimates could have been obtained in this thesis had longitudinal data been used. However, longitudinal designs are not a solution in themselves, and the results from such studies may be biased by use of suboptimal measurement times, incorrect specification of the causal ordering among variables, and omission of important variables and paths between variables[251,252,254,255]. Although recent methodological developments and new tools may offer better opportunities for making causal

inferences[256], statistical sophistication must also be accompanied by good design. Still, *appropriate* longitudinal designs may enable researchers to investigate how mediational processes develop over time[253].

When based on well-founded theoretical foundations for the causal direction, as well as prior findings from experimental and non-experimental studies, cross-sectional mediation has a potential to reveal causal mechanisms[251,257], and when used exploratory[258], results from cross-sectional mediation research may generate hypotheses that could be assessed in appropriately designed longitudinal investigations. In general, causality is central to epidemiologists and psychologists who aim to gain an understanding about how to improve peoples lives[259]. Endogeneity[260], instability in variables over time, unclear temporal ordering and reciprocity between variables[255], and the numerous observed and unobserved potential confounders (and colliders[261]) make causal inference in psychology a challenging task. Still, the results in the current thesis would have been more informative with regards to causal relationships had we for example been able to adjust for reciprocity between prior mental health problems, sleep problems, parenting practices and/or parental emotional well-being. Longitudinal data would also provide opportunities to investigate how the duration of socioeconomic deprivation affects the association with mental health problems, as earlier studies have found persistent poverty to be more likely to result in internalizing problems, whereas transient poverty is more closely related to externalizing problem[23].

Ethical considerations

Studying social inequalities in child and adolescent mental health is a topic of great importance, but also raises ethical challenges. Information about the association between socioeconomic circumstances and mental health problems should ideally motivate and provide politicians and health workers with opportunities to provide better health care. However, the results from the present studies could also elicit negative attitudes towards those who are socioeconomically disadvantaged and those children and adolescents who suffer from mental health problems. These are potentially vulnerable groups, and it is therefore of great importance that the results

are disseminated in a way that underscores the associations between socioeconomic circumstances and child and adolescent mental health, without contributing to stigmatisation and social exclusion.

Another central ethical consideration is related to protecting participants from potential harm. All questions that were included had been thoroughly discussed with the ethical committee before inclusion, and those questions that were believed to be offencive were omitted from the questionnaire. It is also concerning that participants may report mental health problems in an attempt to get in touch with health service providers. All participants were therefore provided with information about how to contact the researchers and thereby get help contacting school and health services if they felt a need for assistance following the completion of the questionnaire.

4.2 Implications

There are several opportunities for intervention that follow from the findings in the current thesis. The following section will discuss policy and clinical implications, as well as implications and directions for future research.

4.2.1 Policy implications

The findings from the current thesis suggest that socioeconomic disadvantage, both indicated by poorer family economy and lower educational levels, are associated with mental health problems in children, both directly, and through the mechanisms discussed above. Policy-level interventions should therefore both aim at reducing social inequality and to alleviate the negative consequences of being socioeconomically disadvantaged. In the following, national and local policy initiatives will be described, but see Gershoff, Aber and Raver[98], for a review of relevant programs and policies that have been implemented elsewhere (U.S.).

In Norway, the Ministry of Health and Care Services have developed a national strategy for equalizing social health differences[262]. This document details the following four priority areas[262, p 7.]: 1) Reduce social inequalities that contribute to

health inequalities, 2) reduce social inequalities in health behaviours and use of health services, 3) targeted efforts for social inclusion and, 4) develop further knowledge about and measures to reduce social health inequalities[e].

Among the strategies that aim to *reduce social inequalities that contribute to health* are interventions to secure equal distribution of income (through tax policies), equal access to high quality day-care centres and schools to children from different socioeconomic backgrounds, and interventions that aim to secure inclusion and protection of adults in the workforce.

The strategies that aim to *reduce social inequalities in health behaviours and use of health services* are for example interventions to reduce social differences in smoking, diet and physical activity. The government also details efforts to increase our understanding of whether access to and treatment in the health care system is related to socioeconomic background.

The third priority area deals with preventing particular groups from being excluded from the workforce, and the educational and health care system. Certain people and groups may be at a higher risk of social exclusion, and there may be a need for interventions that target these groups in particular, in order to secure their inclusion and equal participation at work, in schools and in the health services.

The fourth and final priority area details efforts to develop tools to monitor and evaluate efforts to reduce social health inequalities, to raise awareness about social health inequalities and mechanisms for these among decision makers, continue work to increase our knowledge about determinants of social health inequalities, and to evaluate the interventions that already have been put in place to reduce social health inequalities.

[e] Available in Norwegian only

Three areas of the national strategy are of particular relevance to children: 1) prevention, detection and treatment of mental health problems through the school-health service in cooperation with other health services, 2) increased capacity and ability to provide treatment of mental health problems in specialist- as well as in first line health services, and 3) the role of child welfare services in supporting other service providers of disadvantaged children[262].

In addition to these national strategies, local government is also legally required to monitor health and factors that influence health of those who reside in the municipality[263,264]. One result of this monitoring resulted in the "Report of living conditions in Bergen"[191], in which it was found high rates of socioeconomically disadvantaged in particular geographical areas of Bergen (as described in section 2.3). There are now ongoing efforts to intervene in these areas, in order to improve the physical infrastructure and the social and recreational opportunities for those who reside there[265]. The local government is also collaborating with health services and research institutions, and the Bergen Child Study, that provided data for the current thesis, was carried out in collaboration with the local government in Bergen.

The findings from the current thesis highlight the important associations between socioeconomic disadvantage and mental health problems in childhood and are supportive of strategies that aim to reduce social inequality. However, Norway is already among the most equal countries in the world[74] and it is questionable whether it is realistic to remove social inequality completely. It is therefore important to ensure that policy- and decision makers become aware of empirical work that has identified intermediate mechanisms, and that the findings from these investigations are disseminated to child and adolescent service providers in order to aid them in their work with preventing and treating mental health problems. While working to reduce social inequality, one can thereby alleviate the potential detrimental consequences of existing inequality.

4.2.2 Clinical implications

Mechanisms that were found to mediate the association between child mental health problems and socioeconomic disadvantage were difficulties initiating and/or maintaining sleep, and parental mental health and parenting practices. Clinical interventions could be directed both at mediating mechanisms and mental health problems. The strategy for intervention will necessarily depend on how the clinician comes into contact with the socioeconomically disadvantaged child and the family that seek treatment. In many cases, the child who has developed mental health problems and for whom the parents are seeking treatment will be the "client", and in some cases, clinicians may come in contact with families through parents who are seeking treatment for own problems. It is also important to appreciate that many of these children may not be in contact with doctors or psychologists, and information about effective treatment or intervention should also be disseminated to others that come in contact with socioeconomically disadvantaged children and their families. There is evidence to suggest that the negative influence of family adversity and economic disadvantage is evident from an early age[50,266], suggesting that also well-baby clinics may play an important role in this work.

Whereas childhood mental health problem should be treated according to established practices, see for example[267], the focus in this section will be on the mediating mechanisms that have been uncovered in the current thesis, and treatment should be extended to include these topics when working with socioeconomically disadvantaged children and families.

There are several methods that have been developed to treat sleep initiation and maintenance problems in children, for review, see[268]. Treatments are commonly based on principles of cognitive-behavioural theory, and include components aimed at 1) modifying parent cognitions vis-à-vis their child's sleep behaviour, and 2) changing parent behaviours towards the child's sleep behaviours[268]. Although some treatments have been developed for younger children, many of the same principles also apply to treatments of children in the age group studied in this thesis[269,270].

Treatment of older children may also include components aimed more directly at the children, such as teaching them self-control and relaxation techniques as well as positive imagery and self-statements[271]. The findings in this thesis suggest that by targeting child sleep problems in socioeconomically disadvantaged families, one may not only alleviate the immediate negative consequences of poor sleep, but also thereby contribute to prevent or reduce development of mental health problems in this group of children.

Poor family economy influenced parenting practices indirectly through parental mental health, whereas maternal education influenced parenting practices directly. This suggests that both parental mental health problems as well as parenting practices may be targeted by intervention when working with parents and children who are socioeconomically disadvantaged. Several promising evidence based parenting programs have become available, for review see [272], and a recent meta-analytical review suggests that the largest positive gains may be obtained by utilizing programs that teach parenting consistency, increases positive parent-child interactions and emotional communication skills, and focus on adaptive control strategies [273]. For parents who suffer from mental health problems, the focus on parenting practices must obviously also be accompanied by management of these problems, and treatment must be guided by their nature and severity. Current recommendations for treating common mental disorders (such as anxiety and depression) include psychoeducation, individual or group-based psychological interventions (such as cognitive behavioural therapy or interpersonal therapy) or drug-based treatments, depending on the severity and duration of these problems[274].

One potential barrier to clinical intervention may be limited access to information about the socioeconomic circumstances of the patients or clients. In a survey of 1,153 Norwegian medical doctors[275] less than 20% reported that their clinical management was influenced by knowledge of limited education or poor economy. Among those who *did* take socioeconomic circumstances into account, the most common response

was to give advice or spend more time during the consultation[f]. Ethical guidelines for Nordic psychologists state that they should be sensitive to, and respect, socioeconomic differences[276], and guidelines for medical doctors state that treatment should be independent of socioeconomic (and other) circumstances[277], or in the words of the Danish poet and philosopher Johan Ludvig Heiberg[278] – that King Solomon and Jørgen the Hatter should receive equal treatment independent of their wealth and power. These guidelines were probably intended to prevent the "King Solomons" of the world from receiving treatment at the expense of those less powerful and wealthy, but the question of whether socioeconomic circumstances should influence clinical management is a topic of debate[279-281]. However, given the current knowledge of the social distribution of disease and risk-factors, it seems highly relevant to include enquires about socioeconomic circumstances as a part of the anamnesis or case history, and to make use of this information clinically. A report recently published by the Institute of Health Inequality at University College London[282] provides concrete suggestions of how health personnel can work to tackle health inequalities, and provides many examples of how this may be done[g]. The report is supported by nineteen statements by organisations representing different health professions, detailing the role and providing practical guidance on how each profession can take action on the social determinants of health.

4.2.3 Implications and directions for future research

Our findings, together with findings from other studies, demonstrate that there are differential associations between different indicators of socioeconomic status and particular domains of mental health problems. These findings suggest that the use of

[f] A summary of the article in English is available online at http://tidsskriftet.no/article/1976523

[g] The report and supporting documents are available from http://www.instituteofhealthequity.org/projects/working-for-health-equity-the-role-of-health-professionals (accessed March 30th, 2013).

aggregated socioeconomic status variables should be limited, in line with general recommendations for conducting SES research[68,70].

There is also evidence for some symptom- or disorder specific associations from the findings presented in the current thesis, and from previous studies[78,80]. Researchers should therefore carefully consider their choice and use of SES indicators[160,161], and how they measure and analyse their association with child and adolescent mental health problems. In some studies, it also appears that information that would allow investigations of disorder specific associations have been available, but it has not been reported[44,46,60]. There could be opportunities for secondary analyses of data from these studies to investigate this in more detail.

One of the novel findings in the current thesis was the role of sleep problems as a mediator of the association between poor economy and mental health problems in children. Another novelty was the extension of the family process model to include parental education levels. In order to assess the validity of the findings obtained in these papers, future replications in other studies are needed.

In general, the review of the literature suggests that there may be an opportunity for closer collaboration between scholars from different research traditions. Studies of the association between socioeconomic status and mental health have been studied within three research traditions that may be broadly characterised as psychiatric epidemiology, social epidemiology, and developmental psychology, with implications for how socioeconomic status is conceptualized, how child mental health problems are defined and measured, and how data is analysed and presented. Investigations conducted within each of these research traditions have made large contributions to our understanding of how socioeconomic disadvantage is related to mental health problems in children and adolescents. However, there is still a need for further knowledge about the mechanisms behind symptom- and disorder specific associations with indicators of socioeconomic status. Future studies could fill this gap of knowledge by pulling together the strengths from each of these research traditions and investigate the processes or mechanisms (*from the tradition of developmental*

psychology) of how different indicators of socioeconomic status (*from the social epidemiology tradition*) are associated with different domains of child mental health problems defined according to validated and detailed instruments (*from the tradition of psychiatric epidemiology*).

The influence of socioeconomic circumstances on health will also be investigated further using data from the BCS study. In the fourth wave (youth@hordaland) completed when the participants were in high school, socioeconomic status was measured by multiple indicators reported by parents and adolescents. Adolescents have reported parental education and occupation levels, and family economy. Parental occupation has been categorized into job-type and competence level according to the International Standard Classification of Occupations (ISCO-08) [283,284]. In the youth@hordaland study we have also, among other variables, gathered extensive information about mental health problems, subjective health complaints, sleep problems and physical activity, as well as administrative data on academic grades and school attendance obtained from the school registry administered by Hordaland County Council. In addition, participants have self-reported school absence and the reasons for such absence. Most of the participants in youth@hordaland have also consented to linkage to registry data, allowing us to gather information about future educational attainment and dropout from school. Using these data, we will be able to investigate the associations between socioeconomic disadvantage and mental health problems in late adolescence, and by using longitudinal data, we are able to investigate how the interplay between low socioeconomic status and mental health problems earlier in childhood influence mental health and educational achievement in high school.

4.3 Conlusions

In this thesis, data from Wave Two of the Bergen Child Study was used to expand the knowledge of how socioeconomic status is associated with mental health problems in childhood and adolescence. The results show that poor family economy and low parental education are associated with mental health problems and with sleep

problems in children and adolescents. Furthermore, the findings from the current thesis suggest that problems of sleep initiation/maintenance, parental emotional well-being, and parenting practices may be potential mechanisms through which low SES is translated into mental health problems. Social inequalities in health are ubiquitous and working to reduce them is a matter of social justice. Future studies should aim to further expand our understanding of malleable factors that contribute to the relation between socioeconomic disadvantage and mental health problems in children and adolescents.

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