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Association of Constellations of Parental Risk With Children's Subsequent Anxiety and Depression
Findings From a HUNT Survey and Health Registry Study

Ingunn Olea Lund, PhD; Svetlana Skurtveit, PhD; Marte Handal, PhD; Anne Bukten, PhD; Fartein Ask Torvik, PhD; Eivind Ystrøm, PhD; Jasmina Burdzovic Andreas, PhD

⊞ Supplemental content

IMPORTANCE The research focus on children of parents with alcohol use disorder has eclipsed the potentially wider-reaching detrimental effects of subclinical parental drinking, both alone and in combination with other parental risk factors.

OBJECTIVE To identify constellations of early parental risk characterized by variations in drinking, mental health, and education in both parents and examine their prospective associations with children's contact with the health care system for anxiety and/or depression (ie, diagnoses or treatment).

DESIGN, SETTING, AND PARTICIPANTS This prospective study was based on linked survey and health registries data. The sample included 8773 children from 6696 two-parent families in Norway who participated in the Nord-Trøndelag Health Study (HUNT) survey in 1995 to 1997 or 2006 to 2008, when the children were aged 13 to 19 years. Data were analyzed from January to September 2018.

EXPOSURES Five constellations of early parental risks, characterized by variations in drinking frequencies and amounts, mental health, and education for both parents, as identified through latent profile analysis.

MAIN OUTCOMES AND MEASURES Children's diagnoses or treatment of anxiety and/or depression from 2008 to 2016 were recorded in 3 health registries. The primary outcome was the total number of registries where participants presented (ranging from 0 to 3).

RESULTS Of the 8773 included children, 4404 (50.2%) were boys, and the mean (SD) age at the time of participation in the Nord-Trøndelag Health Study was 16.1 (1.8) years. Prevalence of anxiety and/or depression, as evidenced in at least 1 registry record, was 24.3% (2132 of 8773). Early parental risk profiles risks marked by (1) the lowest parental education (adjusted relative risk, 1.13; 95% CI, 1.01-1.25) and (2) elevated drinking in both parents and elevated mental health symptoms in fathers (adjusted relative risk, 1.52; 95% CI, 1.03-2.22) were associated with a significant increase in risk of anxiety and/or depression in children from those families compared with children from no-risk families.

CONCLUSIONS AND RELEVANCE Studies seeking to understand prospective associations of parental drinking with children's mental health need to consider additional risk factors in combination with one another as well as parental behaviors and characteristics below clinically defined levels. When accumulated at a family level, even seemingly innocuous characteristics contributed to meaningful increases in risk of anxiety and/or depression among children, potentially translating into poorer mental health outcomes for many young people.

Author Affiliations: The Norwegian Institute of Public Health, Oslo, Norway (Lund, Skurtveit, Handal, Ask Torvik, Ystrøm, Burdzovic Andreas); The Norwegian Center for Addiction Research, University of Oslo, Oslo, Norway (Skurtveit, Bukten); Department of Psychology, University of Oslo, Oslo, Norway (Ask Torvik, Ystrøm).

Corresponding Author: Ingunn Olea Lund, PhD, The Norwegian Institute of Public Health, PO Box 222, 0213 Oslo, Norway (ingunnolea @gmail.com).

W hile the research on children of parents with alcohol use disorder is extensive,[1-7] other types of parental drinking remain relatively understudied regarding their potential associations with child outcomes.[8,9] This focus on children of parents with alcohol use disorder has eclipsed the potentially wider-reaching detrimental effects from the more common subclinical parental drinking, as the number of children at risk may be substantial if even nonclinical levels of parental alcohol consumption are also harmful. Indeed, some studies suggest that even moderate parental alcohol consumption is detrimental to children[8,10] or that there are no safe levels of alcohol intake. Finally, as risks tend to co-occur, children from families characterized by multiple risk factors may be particularly vulnerable.[11-14] This is especially true if certain parental behaviors and characteristics (eg, nonclinical levels of drinking) are not understood as risks in the first place, leading to possible misclassification of children from such seemingly low-risk families.

Parental mental health problems[15-19] and low socioeconomic status[20,21] are also known risk factors for child mental health outcomes. Although prior research accounted for these factors when examining the associations of parental drinking with child outcomes,[22-26] we believe it is more informative to consider them together, as they may naturally co-occur within and across families.[13,14,27] With this in mind, we aimed to identify constellations of early parental risk characterized by variations in drinking frequencies and amounts, mental health, and education in both parents and examine whether such risk constellations are associated with children's subsequent contact with the health care system for anxiety and/or depression (ie, diagnoses or treatment).

Studies examining these questions typically rely on self-reports only, be it from the child alone or the child and just 1 parent.[28-32] This can introduce bias, especially if there are notable differences between the participating and nonparticipating parent. As both alcohol use and mental health problems are associated with study nonparticipation, the probability of biased estimates seems high.[33] We examined these questions in a sample of adolescents from 2-parent families where the child and both parents provided information on key exposures and where national health registries provided information on outcomes of interest with practically no missing data,[34] thereby improving on prior studies using only single informants or single data sources.[28-32] The extent to which children experience harm from parental drinking may be underestimated, as most research has examined the question in the context of parents with alcohol use disorder. To our knowledge, the possible harm from common subclinical parental drinking, alone or in combination with other parental risk factors, has not yet been examined and may result in the identification of a larger group of affected individuals.

Methods

Design and Sample

This prospective study was based on linked survey and health registry data. Our analytical sample consisted of 8773 chil-

Key Points

Question Are different constellations of early parental risk, characterized by drinking, mental health, and education, associated with children's subsequent diagnoses or treatment of anxiety and/or depression?

Findings In this study of linked HUNT survey data and health registry data including 8773 children from 6696 two-parent families, despite seemingly innocuous levels of some parental behaviors and characteristics, certain early risk constellations (such as low parental education as well as elevated drinking in both parents and elevated mental health symptoms in fathers) were associated with significant increases in the risk of subsequent anxiety and/or depression among children compared with children from no-risk families.

Meaning Studies examining the associations of parental risks with children's mental health should consider parental risk factors in combination with one another, even if they appear below clinically defined levels.

dren from Norway who participated in the adolescent survey of the Nord-Trøndelag Health Study (Young-HUNT)[35] when they were aged 13 to 19 years as well as 6696 two-parent families (either biological or step-families) who participated in the adult HUNT survey[36] in 1995 to 1997 and/or 2006 to 2008. Only children with data from parental HUNT surveys and their own Young-HUNT self-reports were included and then linked with data from 3 national health registries from 2008 to 2016. We used a 2-parent sample because we wanted to study associations between exposures and outcomes in a sample not affected by multiple additional risk factors (such as single-parent families). Thus, by design, we eliminated or minimized other sources of risk. The used data sources were linked at the individual level using personal identification numbers.[35,37] For an overview of study design and data sources, please see the **Figure** and Lund et al.[38]

All study participants provided written informed consent and written informed assent if younger than 16 years. The present study was approved by the Regional Committees for Medical and Health Research Ethics (No. 2014/867) and the Norwegian Data Protection Authority (No. 38949).

Measures and Data Sources

Young-HUNT and HUNT Surveys (1995-1997 and 2006-2008)

We obtained data on exposures of interest and other substantive covariates from the Young-HUNT and HUNT surveys completed by participants and their parents at the same time. The HUNT and Young-HUNT are sizeable general population studies carried out in Nord-Trøndelag county, Norway, covering a range of health-related topics. All adolescents in Nord-Trøndelag county aged 13 to 19 years were invited to participate in the Young-HUNT survey, and all adults 20 years and older were invited to participate in the HUNT survey. We used data from waves 1 and 3 from Young-HUNT and from waves 2 and 3 from HUNT in the same period (Figure). The response rates for these surveys ranged from 54.1% to 82.7%.[37] Additional information on response rates, handling of nonparticipation, and reasons for nonparticipation has been previously

Figure. Study Design and Data Sources
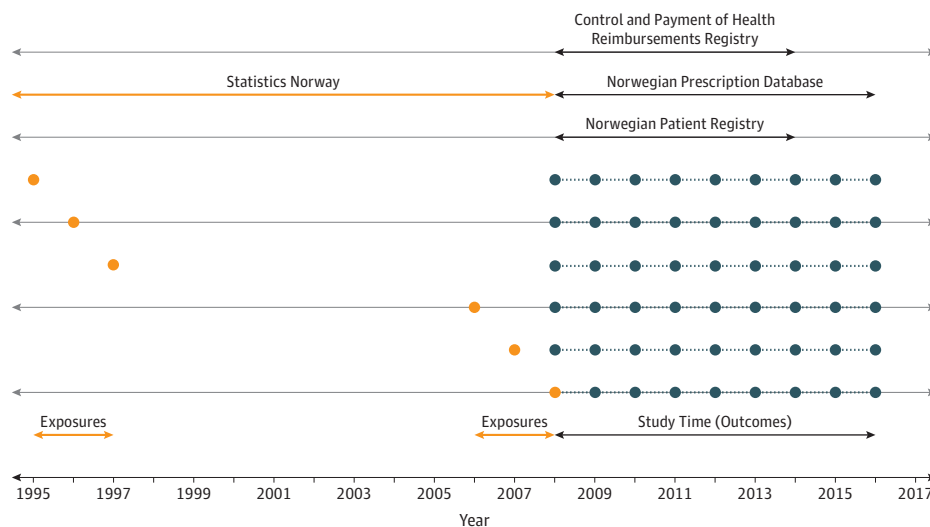
Exposure variables were collected at a single time for each child participant as part of the Nord-Trøndelag Health Study (HUNT); Young-HUNT and HUNT surveys were administered to children and parents, respectively, in 2 waves over 3-year periods (1995 to 1997 and 2006 to 2008). These data collection points for both HUNT waves are shown in orange. All children were aged 13 to 19 years at the time of participation in the Young-HUNT survey. Even though each individual child participated in the Young-HUNT survey only once, family participation might have been repeated within and/or across HUNT waves (ie, for families with multiple children within designated age ranges within and/or across data collection waves). This family-level clustering was accounted for in all regression analyses. Outcomes were collected prospectively through

3 national health registries in Norway—the Control and Payment of Health Reimbursements Registry, the primary care registry and the first point of contact with the health care system; the Norwegian Prescription Database, the prescription drug registry; and the Norwegian Patient Registry, the registry with information on treatment in specialist health services and the most severe point of contact with the health care system. Available years of registry data are shown on the right-hand side. Even though some registries were available prior to 2008, the study initiation was defined in 2008 because that was the first year when all 3 registries were available and the last year of exposure data collection. This approach ensured equal follow-up time for all participants and equal contribution of information from all 3 registries.

published.[35-37,39] Statistics Norway provided educational attainment information and family identifier numbers.

Primary Exposure (HUNT): Parental Drinking, Mental Health, and Education

Both parents reported drinking frequencies (as number of drinking days per month in HUNT wave 2 and as binned categories in HUNT wave 3, recoded into days per month using the midpoint method) and drinking quantities (as number of consumed glasses of beer, wine, or liquor during a typical 2-week period) in both HUNT surveys. Parents reported their current mental health on the 14-item Hospital Anxiety and Depression Scale.[40] We used years of completed parental education, obtained from Statistics Norway, as an indicator of family socioeconomic status.[13]

Covariates (Young-HUNT)

Adolescents reported their sex, birthday (used to compute relevant ages at study participation), and mental health symptoms during the past 14 days on the 5-item Hopkins Symptom Checklist 5.[41] The mental health variable was recoded to reflect the top 25% of the distribution and to prevent loss of information from nonresponders (n = 138), a potentially informative group.

Outcomes: Registry Data

Contact with the health care system for anxiety and/or depression from 2008 to 2016 was detected through participants' rec-

ords in 3 primary health registries in Norway: (1) the Control and Payment of Health Reimbursements Registry for practitioners in primary health care provided information on the *International Classification of Primary Care* diagnosis code recorded at each contact with primary health care; (2) the Norwegian Prescription Database provided information on all dispensed prescriptions drugs to patients in ambulatory care in Norway[42]; and (3) the Norwegian Patient Registry provided information on admission to hospitals and other specialist health care and included *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision* diagnosis codes (**Table 1**) (Figure). The total number of registries where participating children presented during the defined study time (2008 to 2016) was our main outcome (from 0 to 3), where increasing numbers reflected both the severity of anxiety and/or depression and diagnostic or treatment process. As supplemental analyses, we also examined the total number of health records in each registry.

Statistical Analyses

We reported basic descriptive statistics for all study variables, including the relevant parameter estimates (ie, numbers and percentages or means and standard deviations). A latent profile (LP) analysis in Mplus[43] with a default MLR estimator for all available data was used to classify family risk profiles based on indicators of parental drinking (frequencies and quantities), mental health, and years of education at the time of each child's participation in the Young-HUNT

Table 1. Overview of Registry Entries Extracted to Identify Anxiety and Depression Problems

Control and Payment of Health Reimbursements Registry	
ICPC codes	
P01	Feeling anxious/nervous/tense
P03	Feeling depressed
P73	Affective psychosis
P74	Anxiety disorder/anxiety state
P76	Depressive disorder
P79	Phobia/compulsive disorder
Norwegian Prescription Database	
ATC codes	
N03AF01[a]	Carbamazepine
N03AX09[a]	Lamotrigine
N05AH03[a]	Olanzapine
N05AH04[a]	Quietapine
N05AN01	Lithium
N05AX12[a]	Aripiprazole
ATC codes starting with N05B	Anxiolytics
ATC codes starting with N06A	Antidepressives
Norwegian Patient Registry	
ICD-10 codes	
F30-F39	Mood (affective) disorders
F40-F48	Anxiety, dissociative, stress-related, somatoform, and other nonpsychotic mental disorders

Abbreviations: ATC, Anatomical Therapeutic Chemical; *ICD-10, International Statistical Classification of Diseases and Related Health Problems, Tenth Revision; ICPC, International Classification of Primary Care.*

[a] Only included if the reimbursement code suggested that the medication was given for mood-related or anxiety-related problems.

survey.[44-46] All variables were available separately for both parents and were used in their original format; to account for their interdependence, all within-parent indicators were allowed to covary.

A sequence of models (from 2-class to 6-class solutions) was fitted to identify an optimal baseline model.[44] Several starting values were used to avoid the issue of local maxima and to ensure all values converged to the same solutions. We used the Akaike information criterion, Bayesian information criterion, and adjusted Bayesian information criterion as the principal indices of best fit.[44] For an overview of fit indices of identified LPs, see the eTable in the Supplement. We imported class posterior probabilities and corresponding class memberships from the chosen model into Stata version 15 (StataCorp) and assigned each child to 1 LP (ie, 1 family risk profile) based on the maximum posterior probabilities. In other words, LPs describe substantive constellations of parental-level risks.

Poisson regression models with clustered robust errors to account for within-family nesting were used to examine hypothesized associations between the key exposures (ie, the LP analysis–derived risk profiles) and our count outcomes. All regression analyses were conducted in Stata. See the eAppendix in the Supplement for our definitions of *family* for the separate purposes of LP analysis and regression analyses.

Results

Sample Description

Children were on average aged 24 years at first registry assessment in 2008 and aged 16 years when they participated in the Young-HUNT (**Table 2**). Descriptive statistics for the parental characteristics suggest a relatively low-risk sample regarding years of education and self-reported drinking characteristics and mental health.

A total of 2132 of 8773 children (24.3%) presented in at least 1 registry with anxiety and/or depression, while 417 (4.8%) presented in all 3. Most patients had data in the Control and Payment of Health Reimbursements Registry (1510 [17.2%]) and the Norwegian Prescription Database (1405 [16.0%]), and fewer patients had data in the Norwegian Patient Registry (673 [7.7%]).

Description of LPs

A 5-class model showed a good fit to the data and was selected as the final solution based on fit indices, cluster sample sizes, and conceptual relevance (ie, interpretability and meaning; eTable in the Supplement). **Table 3** summarizes the characteristics of the 5 identified parental LPs (LP1 to LP5). LP1, the largest class, was characterized by the lowest education for both parents and otherwise relatively low drinking and mental health symptoms. LP2 was characterized by less than 12 years of education and slightly elevated mental health symptoms scores for both parents as well as heavy episodic drinking for fathers. LP3, the second largest class, was selected as a reference group because of its low-risk characteristics, including highest education, low frequency and quantity of drinking, and lowest mental health symptoms scores for both parents. LP4 was characterized by occasional low-quantity drinking for both parents and otherwise relatively normative education and mental health. Finally, LP5, the smallest class, was marked by low-intake yet frequent drinking in mothers and fathers who consumed about the same number of alcohol units as mothers spread across fewer drinking occasions as well as slightly elevated paternal mental health symptom scores. For a graphic representation of the LP groups, see eFigure in the Supplement.

See **Table 4** for results from the Poisson regression models. As seen in the results for model 1, compared with children from low-risk LP3, children from LP1 (adjusted relative risk, 1.13; 95% CI, 1.01-1.25) and LP5 (adjusted relative risk, 1.52; 95% CI, 1.03-2.22) were at increased risk of anxiety and/or depression during adolescence and early adulthood. These results held after accounting for age, sex, and early internalizing symptoms in children, which were also all significantly associated with our key outcome.

Models 2, 3, and 4 show some variability across the different data sources. Results for Control and Payment of Health Reimbursements Registry, the first point of contact with the health care system, and the Norwegian Prescription Database were conceptually similar to the aggregated results. The results for the Norwegian Patient Registry (model 4), the registry with information on treatment in specialist health services and the most severe

Table 2. Sample Characteristics and Study Variables

Characteristic	Total No.	Mean (SD)	% (95% CI)
Male[a]	8773	NA	50.2 (49.2-51.3)
Age at Young-HUNT participation, y[a]	8773	16.05 (1.79)	NA
Age at study entry in 2008, y	8773	23.80 (5.68)	NA
Adolescent self-reported anxiety, SCL-5 score[a]	8773		
Bottom 75%	NA	NA	75.9 (74.9-76.8)
Top 25%	NA	NA	22.5 (21.7-23.4)
No valid report	NA	NA	1.6 (1.3-1.8)
Years of education[b]			
Maternal	7014	11.66 (1.88)	NA
Paternal	7024	11.56 (1.91)	NA
Drinking frequency (No. of times/mo)[c]			
Maternal	8403	2.55 (3.24)	NA
Paternal	8440	3.60 (3.77)	NA
Drinking quantity (No. of glasses of alcohol/2 wk)[c]			
Maternal	8424	2.85 (3.55)	NA
Paternal	8438	5.14 (5.52)	NA
Mental health, HADS score[c]			
Maternal	8085	7.41 (5.60)	NA
Paternal	7888	7.35 (5.41)	NA
Registry-based outcomes[d]			
CPHR (2008-2014)	8773	1.57 (6.36)	17.2 (16.4-18.0)
NorPD (2008-2016)	8773	1.96 (11.51)	16.0 (15.2-16.8)
NPR (2008-2014)	8773	2.13 (13.55)	7.7 (7.1-8.2)
Sum (No. of registries where participants presented at least once)	8773	0.41 (0.82)	NA
0 registries	NA	NA	75.7 (74.8-76.6)
Only 1 registry	NA	NA	12.4 (11.8-13.1)
Any 2 registries	NA	NA	7.1 (6.6-7.7)
All 3 registries	NA	NA	4.8 (4.3-5.2)

Abbreviations: CPHR, Control and Payment of Health Reimbursements Registry; HADS, 14-item Hospital Anxiety and Depression Scale; HUNT, Nord-Trøndelag Health Study; NA, not applicable; NorPD, Norwegian Prescription Database; NPR, Norwegian Patient Registry; SCL-5, 5-item Hopkins Symptom Checklist 5.

[a] Obtained from Young-HUNT child self-reports.

[b] Obtained from official Statistics Norway records.

[c] Obtained from HUNT parental self-reports.

[d] For registry-based outcomes, shown are both the proportions of participants with at least 1 registry record (%) and the average number of registry records (mean [SD]) for all 3 examined registries.

point of contact with the health care system, diverged somewhat from the aggregated results, possibly indicating the diagnostic or treatment selection processes.

Discussion

To our knowledge, this is the first study to examine the potential detrimental association of subclinical parental drinking alone or in combination with other parental risk factors with children's mental health. In our sample of 2-parent families, we first identified 5 different constellations of parental risks characterized by variations in drinking, mental health, and education in both parents. Second, even after accounting for known covariates, including elevated early internalizing symptoms in adolescents, children from families marked by certain risk constellations were more likely to receive a diagnosis of and/or treatment for anxiety and/or depression during adolescence and early adulthood. These findings suggest the utility of examining parental risk factors as they may naturally occur within and across families, as our person-centered approaches provided information above and beyond that obtained by traditional variable-centered approaches.[25,26,32]

The identified constellations of parental risks are best interpreted in conjunction with one another. The different constellations ranged from the overall low-risk group (LP3: lowest drinking and mental health symptoms as well as highest education for both parents) to groups with some parental risk factors (LP1: the lowest education for both parents) to groups with several risks (LP2: heavy episodic drinking in fathers and elevated mental health symptomatology in both parents; and LP5: particularly high maternal drinking frequency and elevated paternal mental health scores). In this sample, parental behaviors on their own seldom greatly exceeded traditionally defined clinical cutoffs. For example, even though LP5 appears to be the most severe group regarding parental drinking, these drinking patterns did not diverge substantially from the recommended daily alcohol intake guidelines. Similarly, the average mental health symptoms scores in LP2 and LP5 exceeded the conservative cutoffs for possible anxiety and/or depression disorder[40] but not dramatically so.

We still observed significant and meaningful associations between these relatively low-risk behaviors as they co-occurred in some constellations with subsequent anxiety and/or depression in children. For example, for each registry-specific contact with the health care system for anxiety and/or depression by a child

Table 3. Description of the Selected Latent Profile (LP) Analysis Solution and Corresponding Parental Risk Constellations[a]

Characteristic	Mean (SE)				
	LP1	LP2	LP3	LP4	LP5
Participants, No. (%)					
Family[b]	4857 (69.1)	194 (2.8)	1444 (20.5)	473 (6.7)	61 (0.9)
Children	5966 (68.0)	246 (2.8)	1884 (21.5)	598 (6.8)	79 (0.9)
Years of Education[c]					
Maternal	11.22 (0.03)[d]	11.22 (0.16)[d]	12.86 (0.05)	12.53 (0.10)	12.65 (0.29)
Paternal	10.60 (0.01)[d]	11.05 (0.14)[d]	14.61 (0.03)	12.35 (0.13)	12.60 (0.30)
Drinking Quantity (No. of Drinks/2 wk)[e,f]					
Maternal	2.08 (0.04)	7.84 (1.06)	2.50 (0.09)	8.17 (0.21)[d]	13.07 (1.07)[d]
Paternal	4.13 (0.09)	22.40 (1.56)[d]	4.56 (0.14)	9.56 (0.28)[d]	13.22 (1.36)[d]
Drinking Frequency (No. of Times/mo)[f]					
Maternal	1.61 (0.03)	3.82 (0.30)	2.16 (0.06)	9.57 (0.11)[d]	21.71 (0.25)[d]
Paternal	2.85 (0.05)	7.52 (0.57)[d]	3.65 (0.11)	8.12 (0.27)[d]	12.16 (1.01)[d]
Mental Health (HADS Score)[f,g]					
Maternal	7.65 (0.09)	8.19 (0.53)[d]	6.89 (0.14)	7.17 (0.32)	6.95 (0.75)
Paternal	7.59 (0.08)	8.87 (0.65)[d]	6.75 (0.15)	6.39 (0.24)	8.33 (0.89)[d]

Abbreviation: HADS, 14-item Hospital Anxiety and Depression Scale.

[a] Because some families had multiple children (within and across Nord-Trøndelag Health Study waves), the number of children is greater than the number of families for each LP. Our LP analysis used all indicator variables in their original format to aid interpretability of group membership and enable identification of subclinical risk levels, if any. These LP groups captured various constellations of parental-level risk factors of substantive interest.

[b] Family refers to 7029 temporally unique families used for clustering exposures (eAppendix in the Supplement).

[c] Obtained from the official Statistics Norway records.

[d] Elevated levels of individual risk factors for this LP.

[e] Number of drinks was defined as the number of glasses of beer, wine, or liquor reported in Nord-Trøndelag Health Study surveys.

[f] Obtained from Nord-Trøndelag Health Study.

[g] An HADS score of 8 was indicative of possible anxiety and/or depression.

Table 4. Latent Profiles (LPs) of Early Parental Risk and Children's Subsequent Contacts With Health Care System for Anxiety and/or Depression[a]

Variable	aRR (95% CI)			
		Supplemental Models		
	Model 1	Model 2: CPHR	Model 3: NorPD	Model 4: NPR
Male	0.64 (0.58-0.69)	0.52 (0.43-0.62)	0.70 (0.52-0.96)	0.40 (0.29-0.54)
Age at Young-HUNT participation	0.96 (0.93-0.98)	0.90 (0.86-0.96)	0.90 (0.81-0.97)	0.92 (0.85-1.01)
Age at study entry in 2008	1.03 (1.02-1.04)	1.08 (1.06-1.10)	1.09 (1.06-1.13)	1.04 (1.01-1.06)
Adolescent self-reported anxiety (SCL-5 score)				
Bottom 75%	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
Top 25%	1.79 (1.64-1.95)	2.07 (1.74-2.45)	2.11 (1.53-2.78)	2.34 (1.80-3.00)
No complete report	1.81 (1.36-2.41)	2.14 (1.15-4.00)	1.72 (0.90-3.50)	2.34 (1.05-5.27)
Latent profiles of early parental risk				
LP1	1.13 (1.01-1.25)	1.13 (0.90-1.42)	1.22 (0.93-1.60)	0.82 (0.60-1.11)
LP2	1.25 (0.97-1.62)	1.34 (0.82-2.20)	1.35 (1.69-2.64)	0.64 (0.36-1.15)
LP3	1 [Reference]	1 [Reference]	1 [Reference]	1 [Reference]
LP4	0.95 (0.77-1.16)	1.02 (0.69-1.54)	1.80 (0.74-4.36)	1.05 (0.58-1.91)
LP5	1.52 (1.03-2.22)	1.55 (0.74-3.25)	2.77 (0.48-6.38)	0.63 (0.24-1.68)

Abbreviations: aRR, adjusted relative risk; CPHR, Control and Payment of Health Reimbursements Registry; HUNT, Nord-Trøndelag Health Study; NorPD, Norwegian Prescription Database; NPR, Norwegian Patient Registry; SCL-5, 5-item Hopkins Symptom Checklist 5.

[a] Shown are adjusted relative risk estimates and 95% CIs from Poisson regression models. Model 1 estimates the number of registries where participants presented at least once (ranging from 0 to 3), and models 2, 3, and 4 estimate the number of registry records for each participant in each individual health registry.

from LP3, a child from LP1 averaged 1.13 contacts, a child from LP2 averaged 1.25, and a child from LP5 averaged 1.52 (Table 4). In other words, where a child from LP3 had records in 2 national registries for anxiety and depression, a child from LP5 had records in all 3 registries. Similarly, for each visit to the general practitioner for anxiety and/or depression by a child from LP3, a child from LP5 averaged 1.55 visits; for each prescription dispensed for anxiety and/or depression to a child from LP3, there were almost 3 dispensed prescription drugs to a child from LP5 (models 2 and 4 in Table 4). Even though these estimates may appear small statistically speaking, they may nevertheless have meaningful real-life implications[47] and affect sizeable proportions of young people. This may especially be the case, as we examined only diagnosed and/or treated cases of anxiety and/or depression in children, which likely underestimated the prevalence of these problems.

About 25% of children from our sample received a diagnosis and/or treatment with prescription drugs for anxiety

and/or depression; these mental health outcomes were associated with early exposure to parental risk constellations. Our results are consistent with a cumulative risk model (ie, the more risk factors, the greater child vulnerability[13,14,16]) but only to a certain degree.[48] For example, our results for LP4 suggest that 1 risk (ie, somewhat elevated drinking in both parents) might have been offset by other positive characteristics, such as optimal mental health or higher education, while our results for LP1 suggest that some risks (ie, extremely low educational attainment for both parents) might carry unique weight when it comes to children's mental health.

Our combined survey and health registries study addresses methodological limitations of prior literature. First, cross-sectional studies offer only basic information about concurrent associations between parental drinking and child outcomes,[49] and nonlongitudinal studies often rely on retrospective and long-term recalls, likely introducing known biases. Second, studies where exposures are based solely on health registry data are likely to omit nonclinical-level yet potentially essential risk factors, as they capture only officially registered diagnoses, such as parental alcohol use disorder.[34,50] Third, longitudinal cohort studies provide the best observational study design to assess associations over time but are often plagued by attrition.[51] Our combination of survey self-reports at the family level and prospective registry data is unique, and it successfully addresses the above-identified issues. In short, this report extended the current literature on parental-level risks and children's mental health by using numerous sources of data, multiple informants, nonclinically defined behaviors and characteristics, and advanced analytical approaches to examine these prospective associations.

Limitations

The results should be interpreted with some limitations in mind. Our sample included not only 2-parent families but also those where both children, maternal, and paternal figures participated in the HUNT survey. While this sampling approach limits generalizability to other populations, it is possible that additional family types would have introduced other challenges and precluded focused examination of the 3 risk factors—parental drinking, mental health, and education—we were specifically interested in. In addition, without information from both parents, we would have encountered the same single data source limitations and information biases as in previous studies.[32,33] This study used linked extant data sources; thus, we are unable to produce exclusion rates. However, with our focus on identification of associations between the complex constellations of early risk factors and subsequent outcomes in children, representative samples and generalizability to other populations is neither necessary nor necessarily desired.[52,53] Family-based, quasiexperimental designs are better suited to explore potential familial confounding and examine what the true causes of the outcomes are.[54] However, there may be an association of parental mental health problems with child mental health problems—both measures were included in our analyses—and the findings suggest that parental risk constellations contributed to anxiety and depression problems in adolescence and adulthood above and beyond early mental health risk in children. Further, consideration of additional risk factors (eg, parental drug use) could have informed our classification procedures and resulted in different risk constellations. In addition, the precision of self-reports may be hampered by underreporting, inaccurate recall, and selective reporting,[25,55,56] and in this respect, our measures of parental drinking and mental health are reflective of the validity of the original HUNT survey. Finally, even though registry-based outcomes are not affected by various self-reporting biases, they only capture individuals who are diagnosed and/or receive treatment for their anxiety and depression.[57,58] In other words, it is possible that the true anxiety and depression rates were underestimated.

Conclusions

Studies seeking to understand prospective associations between parental drinking and children's mental health need to consider additional risk factors in combination with one another as well as parental behaviors and characteristics below clinically defined levels. While some risk factors carry unique weight, others may be offset by positive parental characteristics. In many cases, the level of each individual risk was not that high on its own, but when accumulated at a family level, even seemingly innocuous characteristics contributed to meaningful increases in risk of anxiety and/or depression among children, potentially translating into poorer mental health outcomes for many young people.

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