


# Disruptive Mood Dysregulation Disorder in a Norwegian Clinical Child Population

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## Abstract

**Background:** Disruptive Mood Dysregulation Disorder was included in DSM-5 to accommodate new research addressing aspects of emotional dysregulation in children suffering from disruptive behavior problems. Despite growing interest in Disruptive Mood Dysregulation Disorder, few studies have looked at prevalence rates in European clinical populations. The primary objective of this study was to examine the prevalence and characteristics associated with Disruptive Mood Dysregulation Disorder in a Norwegian clinical sample.

**Methods:** The present study assessed children 6–12 years of age referred to a mental health clinic for evaluation and treatment ( $N = 218$ ,  $M_{age} = 9.6$ , 60.4% boys) and compared those who did and did not meet Disruptive Mood Dysregulation Disorder diagnostic criteria. Diagnoses were determined using K-SADS-PL 2013. Associated difficulties at home and in school were measured by Achenbach Systems of Empirically Based Assessment battery.

**Results:** In this clinical sample, 24% met the diagnostic criteria for Disruptive Mood Dysregulation Disorder. Children with Disruptive Mood Dysregulation Disorder were more likely than those without Disruptive Mood Dysregulation Disorder to be male (77% vs. 55%,  $p = .008$ ), be living in poverty, have multiple mental health diagnoses (79% vs. 53%,  $p = .001$ ), and have lower global functioning levels as measured by Children's Global Assessment Scale (range 0–100,  $M = 47$ ,  $SD = 8.5$  vs.  $M = 57$ ,  $SD = 11.4$ ,  $p < .001$ ). Finally, parents and teachers of children with Disruptive Mood Dysregulation Disorder reported lower overall competence and adaptive functioning, and higher total symptom load than children with other diagnoses.

**Conclusion:** Disruptive Mood Dysregulation Disorder is highly prevalent in a Norwegian clinical sample and displays a high symptom load. Our results are in accordance with similar studies.

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Consistent findings across the world may support Disruptive Mood Dysregulation Disorder as a valid diagnostic category.

### **Keywords**

Disruptive mood dysregulation disorder, emotional dysregulation, severe irritability, prevalence, comorbidity, demographics

In the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5), Disruptive Mood Dysregulation Disorder (DMDD) was introduced as a new diagnosis that included chronic irritability (daily for at least 1 year) and severe episodes of anger (3 or more times per week for at least 1 year) in children (APA, 2013). Research suggests that children with DMDD constitute approximately 26–30% of children in clinical samples, and that DMDD is associated with major impairments in almost all aspects of life; psychologically, socially, and functionally (Copeland et al., 2013; Leibenluft et al., 2021).

DMDD is considered an affective disorder, supported by longitudinal studies showing that chronic irritability in childhood can lead to internalizing (anxiety and depressive) disorders in adulthood, and by genetic and family studies (Roberson-Nay et al., 2015; Sorcher et al., 2022; Stringaris et al., 2009). Chronic irritability in children is therefore thought of as an early manifestation of depression (Vidal-Ribas & Stringaris, 2021).

A number of researchers have voiced concern about DMDD, mainly due to a lack of empirical evidence (Mayes et al., 2016). The evidence that led to its inclusion in the DSM-5 was based on Severe Mood Dysregulation (SMD), a category developed from the concern of severe misdiagnosis of bipolar disorders in children (Leibenluft et al., 2003), and then the diagnostic criteria were changed when DMDD was introduced. Furthermore, high comorbidity rates (63–92%, Copeland et al., 2013), overlapping symptoms with oppositional defiant disorder (ODD), and low test–retest reliability have raised concerns. In this respect, more research on DMDD and its characteristics is needed, and the present study's main objective is to address this need.

## **Prevalence and Comorbidity Levels Associated with DMDD**

Prevalence rates for DMDD have been estimated to be 0.8–3.3 in the general child population (Copeland et al., 2013), whereas, in clinical samples of children aged 6–12 years, it is estimated to range from 26–31% (e.g., Axelson et al., 2012; Freeman et al., 2016). Hence, DMDD is likely to be one of the most common disorders seen in youth treatment settings (Freeman et al., 2016).

Although differing across clinical samples, the comorbidity rates for children and youth with DMDD have been shown to be very high (Freeman et al., 2016). The most common disorders associated with DMDD are found in ODD (70–96%), Attention-Deficit/Hyperactivity Disorder (ADHD) (30–60%), anxiety disorders (26–71%), depressive disorders (12–35%), and conduct disorders (13–23%) (Copeland et al., 2013; 2014; Freeman et al., 2016; Mayes et al., 2016). Notably, diagnoses associated with DMDD vary widely across samples, likely due to few studies examining DMDD according to the strict DSM-5 criteria, in clinical settings, using validated instruments specifically developed for broad diagnostic evaluation of children including DMDD. Importantly, studies adhering to DSM criteria for DMDD whereby ODD is excluded are few, which might result in studies reporting artificially high comorbidity rates for this patient group.

## Demographic Characteristics and DMDD

Sex differences in DMDD seem to vary across studies, age groups, and likely cultures. For instance, 76% of children with DMDD in a Taiwanese community sample were boys (Lin, Tseng and Gau, 2020), and in a Canadian sample of children with DMDD, 61% were boys (Benarous et al., 2020). However, several studies in the US (Copeland et al., 2013; Mayes et al., 2016) and Turkey (Tüğen et al., 2019) report no sex differences in prevalence rates of DMDD.

Research is indicating that lower global family functioning (parental income level, education levels, employment, and parental mental health concerns) is more likely with DMDD than with other comparable diagnoses (e.g., ADHD) (Uran & Kilic, 2020). When applying a broader definition of the core DMDD symptoms (irritability and temper outbursts) as externalizing behavior difficulties, several studies show a higher prevalence for family risk factors and lower socio-economic status (SES) (e.g., Forsman & Långström, 2012; Jusksch et al., 2011). Further knowledge about socio-demographic risk factors and DMDD might broaden our understanding of mechanisms affecting the symptoms as well as inform treatment planning.

## Functional Levels and Symptom Load Associated with DMDD

Children with DMDD exhibit significantly lower levels of psychosocial functioning as measured by the Children's Global Assessment Scale (CGAS) than children with other common psychiatric diagnoses (e.g., Benarous et al., 2020; Copeland et al., 2013; Dougherty et al., 2017; Jusksch et al., 2011). Functional levels may be explained, in part, by total symptom load consisting of both externalizing behavioral- and internalizing emotional symptoms. Mental disorders among children are often described as consisting of either externalizing or internalizing symptoms (Weisz et al., 2020), however, DMDD presumably consists of both internalizing and externalizing symptoms, where temper outbursts are externalizing symptoms, and persistent irritability are considered an indicator of mood symptoms (internalizing). Accordingly, one would expect to find high levels of both internalizing and externalizing symptoms in children with DMDD, but findings so far are equivocal (Benarous et al., 2020; Freeman et al., 2016). Children with DMDD do display more severe externalizing symptoms, as reported by parents and teachers, compared to children with other diagnoses (Freeman et al., 2016), but there are inconsistencies regarding internalizing symptoms and DMDD (e.g., Axelson et al., 2012; Freeman et al., 2016).

Based on inconsistencies in prior research, DMDD is a debated diagnosis. Moreover, there are few studies on clinical correlates and phenomenology of DMDD across the world and cultures to resolve this debate. To our knowledge, there has been no research on the prevalence of DMDD in Nordic countries. In the present study, we therefore aim to address the research gaps described above, using comprehensive diagnostic evaluations to determine the prevalence of diagnoses using a validated tool for DMDD. The main objective of the present study is to identify the prevalence of and characteristics of DMDD in a Norwegian clinical sample of children.

We expect to find the prevalence of DMDD to be approximately 26–31% based on previous findings (cf. Freeman et al., 2016), and DMDD-related comorbidity to be in line with findings from previous research (30–60%) having a comorbid diagnosis (cf. Copeland et al., 2013). Secondly, we expect significant differences between DMDD and a clinical non-DMDD group on socio-demographical characteristics (cf. Uran & Kilic, 2020). Thirdly, we expect to find lower global functional levels and higher dimensional total symptom loads for children with DMDD compared to a clinical non-DMDD group as reported by parents and teachers. Lastly, we expect to find elevated

clinical levels of both externalizing and internalizing symptom loads as a function of DMDD, as well as compared to the most prevalent child mental health diagnoses.

## Methods

This study is approved by the Regional Committees for Medical and Health Research Ethics (2017/135) and is part of a registered study protocol (NCT05049356).

### Participants

The sample consisted of 218 children (60.4% boys) ranging from 6 to 12.9 years of age ( $M = 9.6$ ,  $SD = 1.8$ ). Study inclusion criteria were: 1) children seeking transdiagnostic evaluation and treatment in outpatient clinics for children with moderate to severe mental health problems. The Norwegian mental health system consists of a primary and a specialized, secondary mental health service. The primary level consists of general practitioners serving mild to moderate mental health problems (e.g., general doctors, school psychologist), while secondary health services (in- and outpatient clinics) serve children with moderate to severe mental health problems, who are referred to the clinics by general practitioners. 2) 6–12 years of age, 3) caregiver providing written consent, and 4) both caregiver and youth conversant in Norwegian. Exclusion criteria were: 1)  $IQ < 70$  (based on information at the point of referral), 2) referred to the clinic with symptoms of psychosis, and 3) undetermined living conditions for the child. In total 319 were invited to participate, and 101 of these were subsequently excluded (76 declined, 18 did not meet inclusion criteria and seven dropped out).

### Procedure

Children aged 6–12 referred and accepted for evaluation at three different out-patient mental health clinics for children 0–18 years of age in Oslo, Norway, were invited to participate (sites: Oslo University Hospital: 1) BUP North and 2) BUP South, and Lovisenberg Diaconal Hospital: 3) Nic Waals Institute). All children referred to sites one and two were invited to participate, and every second child at site 3, in the period from August 2019 to August 2021. Participants and their parents completed a broad clinical assessment conducted as part of each site's standard clinical procedure.

### Measurements

*Schedule for Affective Disorders and Schizophrenia for School Aged Children (K-SADS-PL 2016*, (Kaufmann et al., 1997). Clinical psychologists and master-level psychology students administered the 2016 Norwegian version of the K-SADS-PL with parents. Nine percent of the interviews were independently scored by two different clinicians, demonstrating substantial agreement between the interviewers' diagnostic evaluations overall, with  $\kappa = .80$  (95% CI .71 to .89). Interrater reliability for DMDD was  $\kappa = .90$  (95% CI .70 to 1.0), ADHD had  $\kappa = .78$  (95% CI .50 to 1.0), ODD;  $\kappa = .78$  (95% CI .50 to 1.0), depressive disorders had  $\kappa = .77$  (95% CI .35 to 1.1) and anxiety disorders had  $\kappa = .57$  (95% CI .13 to 1.0).

*Child Global Assessment Scale (CGAS)* (Shaffer et al., 1983). The CGAS is a measure of childrens (ages 6–17 years) global level of psychosocial functioning in the last month, with scores ranging from 0 (lowest functioning, in need of 24-hour care) to 100 (superior functioning in all areas). In this study CGAS was scored by the interviewer in conjunction with the K-SADS-PL interview.

*Achenbach System of Empirically Based Assessment (ASEBA)* (Achenbach & Rescorla, 2001). ASEBA is a well-established and widely used questionnaire of adaptive and maladaptive functioning and facilitates a broad assessment of children’s adaptive, emotional, and behavioral problems. The Child Behavior Check List (CBCL) for parents and Teacher Report Form (TRF) for teachers were employed at the point of referral. The questions are answered by the caregiver or teacher on a three-point Likert scale; 1 (“not correct”), 2 (“sometimes or slightly correct”), and, 3 (“absolutely correct”) respectively. Together, the item scores are combined into three overarching scales: Internalizing, Externalizing, and Total Problems. Raw scores transformed to T-scores include a cut point at T-score  $\geq 65$  ( $M = 50$ ,  $SD = 10$ ) indicative of clinical problems for the internalizing, externalizing, and total scores (Achenbach, 1991). Furthermore, the CBCL and TRF provide Total Competence and Adaptive Functioning scales that provide indices of the child’s overall functioning. The Total Competence scale consists of questions about the number of activities, social functioning, and school performance (cut-point for clinical problems  $T < 31$ ), while Adaptive Functioning scale assesses the child’s functioning in school with questions about academic achievements (on a scale from 1–5), as well as working hard, behaving appropriately, learning, and happiness compared to other children same age on a scale from 1–7 (*much less to much more*). The clinical cut-point for adaptive function is set at  $T < 37$ .

*Wechsler Intelligence Scales (WISC-IV/V and WASI)* (Wechsler, 2014). WISC-IV/V is an individually administered test of intellectual abilities for children and youth. Data on WISC-IV/V was collected from the subjects’ clinic records.

*Socio-Demographic Data.* Parents answered questions about their living conditions and annual income based on the Norwegian Central Statistical Bureau index’ of income levels from 2019 (SSB, 2019). Poverty levels for families with children are incomes less than 60% of the median income in a specific country. In Norway, for a family with at least one child, the poverty level in 2019 was an annual income of  $< 314.500$  NOK.

### *Statistical Analyses*

Descriptive statistics were used to summarize the data. Chi-square tests with Yates Correction for Continuity was used to examine associations between DMDD and other categorical variables such as comorbidity and socio-demographic factors. Independent sample *t*-test was used to examine group differences between continuous clinical variables (e.g., number of diagnoses and CGAS scores). Analysis of variance (ANOVA) tested for differences between DMDD and other diagnostic groups on dimensional measures of psychopathology (e.g., CBCL scale scores). In analyses of group differences on these psychopathology measures, socio-demographic variables that differed between the DMDD and non-DMDD groups (e.g., gender, parental income) were controlled for as covariates. All significance tests were two-sided. Alpha was set at 0.05.

## Results

### DMDD Prevalence and Socio-Demographic Characteristics

Fifty-three children (24%) met all diagnostic criteria for DMDD. There were significantly more boys (77%) in the DMDD group than in the group without DMDD. There were no significant group differences in ethnicity, age or IQ. Parents of children with DMDD were significantly more likely to share custody of their child ( $\phi = .14$ ) and live below the Norwegian poverty level ( $\phi = .16$ ) than parents of children without DMDD (see [Table 1](#)).

### Comorbidity

Of the children with DMDD, 79% had a co-occurring diagnosis, while 53% of the children without DMDD. Children with DMDD had most often ADHD (58%), an anxiety disorder (25%), or a depressive disorder (15%). As ODD is excluded when the DMDD criteria are fulfilled ([APA, 2013](#)), comorbidity with conduct disorders other than ODD (e.g., Intermittent Explosive Disorder, Conduct Disorder not otherwise specified) was 9% (see [Figure 1](#)). An overview of diagnostic distribution in the overall sample can be seen in [Figure 1](#) and [Table 2](#).

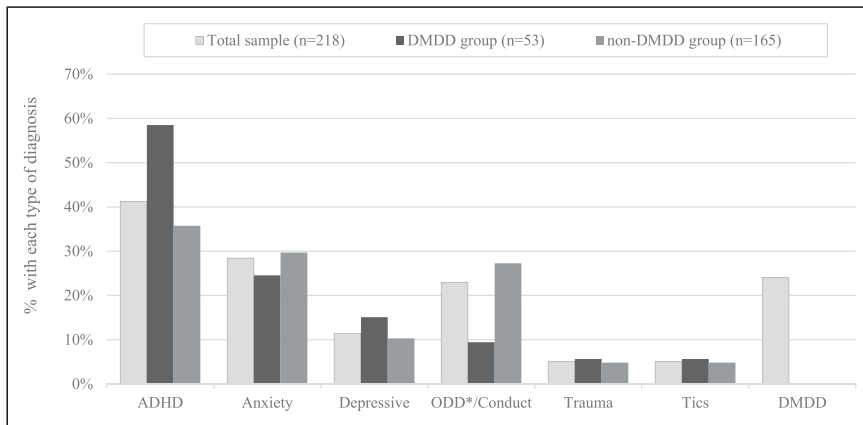
DMDD children showed significantly higher number of comorbid diagnoses ( $M = 2.5$ ,  $SD = 1.2$ ) than children without DMDD ( $M = 1.5$ ,  $SD = 1.1$ ;  $t(216) = 5.4$ ,  $p = .001$ , Cohen's  $d = .8$  (95% CI 1.1 to .5)).

**Table 1.** Socio-Demographic Characteristics of Children With Disruptive Mood Dysregulation Disorder (DMDD) Compared to a Non-DMDD Clinical Group.

Characteristic	Overall ( $n = 218$ )	DMDD ( $n = 53$ )	Non-DMDD ( $n = 165$ )	Statistic Test $t$ or $\chi^2$	$p$ -Value
Age ( $M$ , $SD$ )	9.6 (1.8)	9.3 (1.9)	9.7 (1.8)	$t_{(216)} = 1.4$	.135
IQ ( $M$ , $SD$ )	99 (15.4)	99 (13.1)	99.7 (16.1)	$t_{(143)} = .08$	.94
Sex, % male	132 (60)	41 (77)	91 (55)	$\chi^2_{(2, 218)} = 6.99$	<b>.008*</b>
Ethnicity	( $n = 197$ )	( $n = 46$ )	( $n = 151$ )	$\chi^2_{(1, 197)} = .00$	.100
Norwegian	152 (77)	35 (76)	117 (78)		
Other nationality	45 (23)	11 (24)	34 (23)		
Parental living situation	( $n = 213$ )	( $n = 52$ )	( $n = 161$ )	$\chi^2_{(1, 213)} = 4.6$	<b>.032*</b>
Married/cohabitant	183 (86)	40 (77)	143 (89)		
Single parent	30 (14)	12 (23)	18 (11)		
Family income	( $n = 187$ )	( $n = 44$ )	( $n = 143$ )	$\chi^2_{(1, 187)} = 4.8$	<b>.028*</b>
At or above poverty level	172 (92)	37 (84)	134 (94)		
Below poverty level	15 (8)	7 (16)	8 (6)		

Note. Children in foster care/other ( $n = 1$ ) were not included in the living situation analysis. Norwegian/other nationality: child's parents originate from Asia, Africa, America, or other parts of Europe. In 2019, the poverty level for families with children in Norway was defined as annual income <314,500 NOK.

\*Significance level < .05.



**Figure 1.** Distribution of diagnosis and comorbidity in total sample, DMDD and non-DMDD group. *Note.* ADHD = Attention Deficit/Hyperactivity Disorders, including inattentive type, hyperactivity/impulsivity type and ADHD not otherwise specified. ODD = Oppositional Defiant Disorder. ODD is excluded if DMDD criteria is fulfilled, so comorbidity in the DMDD group are other conduct disorders than ODD. Conduct = Conduct Disorder and not otherwise specified. Anxiety = Anxiety Disorders; social anxiety, separation anxiety, generalized anxiety disorder, panic disorder and phobias. Depressive (DMDD excluded): depressive episodes, dysthymia and depression not otherwise specified. Trauma = Post-Traumatic Stress Disorder and Acute Stress Disorder. Tics = Tic Disorders; persistent motor and/or vocal tics, and provisional motor and/or vocal tics. Diagnoses occurring in  $\leq 5$  cases were excluded from the analysis: psychotic disorders (1), encopresis (1), Tourette's (4), adaptive disorders (5).

**Table 2.** Comorbidity for Major Diagnostic Groups Other than DMDD (ADHD, Anxiety Disorders, ODD and Depressive Disorders).

Comorbid Diagnoses	DMDD (n = 53)	ADHD (n = 90)	Anxiety (n = 62)	ODD (n = 39)	Depressive (n = 25)
ADHD, n (%)	31 (34.4)	90 (100)	19 (21.1)	15 (16.7)	7 (7.8)
Anxiety disorder, n (%)	13 (21.0)	19 (30.6)	62 (100)	11 (17.7)	10 (16.1)
ODD, n (%)	n/a	15 (38.5)	11 (28.2)	39 (100)	4 (10.3)
Depressive disorder, n (%)	8 (32.0)	7 (28.0)	10 (40.0)	4 (16.0)	25 (100)

*Note.* Total sample (n = 218). DMDD: = disruptive mood dysregulation disorder. ADHD = attention deficit/hyperactivity disorders, including inattentive type, hyperactivity/impulsivity type and ADHD not otherwise specified. ODD = oppositional defiant disorder. Anxiety disorders: social anxiety, separation anxiety, generalized anxiety disorder, panic disorder and phobias. Depressive disorders (DMDD excluded): depressive episodes, dysthymia and depression not otherwise specified. n/a = not applicable because DMDD excludes ODD.

### Functional Levels and Symptom Load

Clinicians' evaluations indicated that children with DMDD had a significantly lower functional level than children without DMDD (see Table 3). This finding is also significant when comparing DMDD to two other major diagnostic groups (ADHD and anxiety disorders), but not for ODD and depressive disorders. Furthermore, children with DMDD were found to have significantly lower adaptive functioning in life (based on parental reports) and in school (based on teacher reports), than children without DMDD (see Table 3).

**Table 3.** Functional Level and Total-, Externalizing and Internalizing Symptom Loads, as Reported by Parents and Teachers, for Children With DMDD Compared to an Overall Non-DMDD Clinical Group, ADHD, Anxiety Disorders, Depressive Disorders and ODD.

	M (SD)	M (SD)	Analysis of Variance	p-Value
DMDD versus non-DMDD clinical group				
	DMDD (n = 53)	Non-DMDD (n = 164)		
CGAS <sup>a</sup>	47 (8.5)	57 (11.4)	F (1,214) = 13.1	<b>&lt;.001</b>
Total competence	35.5 (8.4)	39.7 (10.7)	F (1,531) = 2.3	<b>&lt;.027</b>
Adaptive functioning	39 (4.9)	42.8 (7.1)	F (6,088) = 3.7	<b>&lt;.001</b>
CBCL (raw scores) <sup>b</sup>	n = 47	n = 145		
Total problems	68.2 (23.1)	50.9 (23.1)	F (1,188) = 16.5	<b>&lt;.001</b>
Externalizing	24.3 (8.8)	13.9 (9.3)	F (1,188) = 36.3	<b>&lt;.001</b>
Internalizing	16.6 (10.5)	16.1 (8.1)	F (1,188) = .73	.389
TRF (raw scores) <sup>b</sup>	n = 40	n = 146		
Total problems	66.2 (28.2)	47.6 (31.8)	F (1,182) = 7.3	<b>.007</b>
Externalizing	24.9 (14.2)	11.9 (12.7)	F (1,182) = 22.8	<b>&lt;.001</b>
Internalizing	11.3 (10.2)	11.9 (8.9)	F (1,182) = .006	.938
DMDD versus ADHD <sup>c</sup>				
	DMDD (n = 22)	ADHD (n = 59)		
CGAS	50 (9)	56 (10)	F (1,78) = 4.9	<b>.03</b>
Total competence	35 (8.8)	36.7 (8.7)	F (.002) = .545	.58
Adaptive functioning	38.6 (3.9)	39.7 (5.4)	F (3,835) = .67	.49
CBCL (raw scores) <sup>b</sup>	n = 18	n = 50		
Total problems	56.1 (18.1)	55.8 (18.4)	F (1, 64) = .47	.83
Externalizing	20.9 (6.8)	16.1 (9.1)	F (1, 64) = 3.66	<b>.05</b>
Internalizing	15.4 (9.0)	12.9 (9.2)	F (1.64) = 1.97	.165
TRF (raw scores) <sup>b</sup>	n = 18	n = 54		
Total problems	65.9 (31.8)	59.1 (31.3)	F (1.68) = .48	.492
Externalizing	26.9 (17.5)	15.5 (13.1)	F (1.68) = 8.04	<b>.006</b>
Internalizing	13.8 (13.5)	10.8 (8.7)	F (1.68) = 1.37	.246
DMDD versus anxiety disorders <sup>c</sup>				
	DMDD (n = 40)	Anxiety (n = 49)		
CGAS	48 (7.4)	53 (12)	F (1,87) = 4.32	<b>.04</b>
Total competence	35.3 (6.4)	42.6 (12.5)	F (4,86) = 2.9	<b>.005</b>
Adaptive functioning	38.5 (4.7)	44 (7.4)	F (6,54) = 4.1	<b>&lt;.001</b>
CBCL (raw scores) <sup>b</sup>	n = 34	n = 46		
Total problems	62 (18.2)	55.1 (24.8)	F (1,76) = 1.2	.28
Externalizing	23 (8.0)	11.6 (9)	F (1,76) = 25.8	<b>&lt;.001</b>
Internalizing	14.3 (7.4)	22.6 (10.3)	F (1,76) = 11.0	<b>.001</b>
TRF (raw scores) <sup>b</sup>	n = 30	n = 47		
Total problems	62.3 (26.0)	40.1 (27.4)	F (1,73) = 9.0	<b>.004</b>
Externalizing	24.7 (15.0)	6.7 (8.9)	F (1,73) = 30.5	<b>&lt;.001</b>
Internalizing	9.7 (9.8)	16 (10.1)	F (1,73) = 6.1	<b>.015</b>

(continued)



**Table 3.** (continued)

	M (SD)	M (SD)	Analysis of Variance	p-Value
DMDD versus depressive disorders <sup>c</sup>				
	DMDD (n = 47)	Depressive (n = 14)		
CGAS	47 (8)	47 (10)	F (1,59) = .088	.768
Total competence	35.7 (8.2)	39.3 (8.8)	F (.014) = .96	.341
Adaptive functioning	39.1 (4.9)	44.3 (6.6)	F (1,35) = 2.8	<b>.006</b>
CBCL (raw scores) <sup>b</sup>				
	n = 42	n = 12		
Total problems	68.0 (23.6)	63.2 (25.8)	F (1,50) = 1.3	.717
Externalizing	25.0 (9.1)	12.6 (10.2)	F (1,52) = 16.1	<b>&lt;.001</b>
Internalizing	15.8 (7.8)	28 (10.9)	F (1,52) = 8.2	<b>.006</b>
TRF (raw scores) <sup>b</sup>				
	n = 38	n = 11		
Total problems	66 (28.5)	45.5 (22.6)	F (1,47) = 4.8	<b>.020</b>
Externalizing	25.1 (14.6)	6.5 (8.1)	F (1,47) = 16.4	<b>&lt;.001</b>
Internalizing	10.9 (9.5)	19 (8.7)	F (1,47) = 6.4	<b>.015</b>
DMDD versus ODD <sup>c</sup>				
	DMDD (n = 53)	ODD (n = 39)		
CGAS	46 (8.5)	49 (10)	F (1,90) = 1.2	.275
Total competence	35.5 (8.4)	36.7 (11.9)	F (.812) = .45	.65
Adaptive functioning	39.2 (4.9)	41.1 (6.1)	F (1,84) = 1.4	.157
CBCL (raw scores) <sup>b</sup>				
	n = 47	n = 37		
Total problems	68 (23)	63 (17)	F (1,80) = 1.1	.29
Externalizing	24 (8.8)	20 (8)	F (1,80) = 3.0	.086
Internalizing	16.6 (8.1)	18 (9.7)	F (1,80) = .06	.797
TRF (raw scores) <sup>b</sup>				
	n = 40	n = 32		
Total problems	66.2 (28.2)	56.3 (31.7)	F (1,68) = .69	.522
Externalizing	25 (14.2)	14 (12.8)	F (1,68) = 7.7	<b>.007</b>
Internalizing	11.3 (10.2)	13.1 (9.6)	F (1,68) = .55	.45

Note.

<sup>a</sup>controlled for number of comorbid diagnoses and sex.

<sup>b</sup>Controlled for sex and age.

<sup>c</sup>the two groups exclude the compared diagnose in each group.

CGAS = childrens global assessment scale. CBCL = child behavior checklist. TRF = teacher report form.

Parent reports (CBCL) and teacher reports (TRF) on Total Problems, externalizing and internalizing symptoms indicate that children with DMDD have significantly higher scores on both the Total Problem and Externalizing scales compared to children without DMDD (see Table 3). Parents score their child with DMDD above the clinical T-score level on all symptom load dimensions (internalizing ( $M = 66.2$ ,  $SD = 11.6$ ), externalizing ( $M = 70.3$ ,  $SD = 9.6$ ) and total ( $M = 70.2$ ,  $SD = 6.1$ )), and teachers score children with DMDD above clinical levels on externalizing ( $M = 67.3$ ,  $SD = 11.4$ ) and total ( $M = 65.5$ ,  $SD = 8.6$ ) symptom loads, but not internalizing ( $M = 60$ ,  $SD = 10.7$ ).

Comparisons of DMDD to ADHD, anxiety disorders, depressive disorders, and ODD show that *externalizing symptom load* is consistently higher for children with DMDD, as reported by parents and teachers, except that there were no differences in parent reports for children with DMDD compared to those with ODD (see Table 3). *Total symptom loads* are significantly higher for children with DMDD compared to those with anxiety and depressive disorders according to teacher reports, but there were no group differences based on parent reports.

## Discussion

The main objective of this study was to examine the prevalence and characteristics associated with DMDD in a clinical sample of Norwegian children. More specifically, we described their socio-demographic characteristics, comorbidities, functional outcomes, and symptom load. To our knowledge, the present study is the first report of children with DMDD in a Nordic sample.

Our results show that children with DMDD comprise 24% of the children in this clinical sample. The prevalence of children with DMDD in this sample matches previous research (e.g., [Axelson et al., 2012](#); [Freeman et al., 2016](#)), suggesting that DMDD is a highly prevalent diagnostic category that manifests itself across the world, and the validity of the diagnosis appears strengthened by this consistency.

We found that most children with DMDD are boys. This is in accordance with other studies showing male predominance of DMDD in clinical samples ([Lin et al., 2020](#); [Tufan et al., 2016](#)). Age might explain some of the sex differences. Higher levels of irritability are found in boys rather than girls in childhood, whereas girls present higher irritability than boys in adolescence ([Caprara et al., 2007](#)). Research has shown that the variance in irritability is largely explained by non-shared environmental factors (70%) ([Roberson-Nay et al., 2015](#)). It has been suggested that sex differences in externalizing behavior may be due to gender differences in socialization around emotional expression ([Lin et al., 2020](#)). This might also be true for the Norwegian child population. Therefore, non-shared environmental factors such as socialization in emotional expression may limit the presentation of anger and irritability in girls, resulting in a similar pattern of male predominance in DMDD diagnoses in this Norwegian sample.

Children with DMDD were significantly more likely to live in a split-custody parental situation and below poverty levels compared to children without DMDD. This is only an association but corresponds with other findings indicating higher family risk factors for these children ([Uran & Kilic, 2020](#); [Lin et al., 2021](#)). Perhaps experiencing multiple concerns or economic stressors in a family makes it harder to manage a child's externalizing symptoms. Existing studies find that externalizing behavior problems and caregiving situations, family dynamics, and parent risk factors are related (e.g., [Forsman & Långström, 2012](#)). However, none of these studies has examined DMDD specifically, so this topic needs to be addressed more thoroughly in future research.

Furthermore, the present study corroborates with previous research indicating high comorbidity levels for children with DMDD. We found that 79% of children with DMDD had one or more comorbid diagnoses, while the non-DMDD group had 53% comorbid diagnoses. Similar studies have reported that 90% of cases with DMDD were accompanied by other mental health diagnoses, with mood disorders and disruptive behavior disorders being the most common ([Dougherty et al., 2014](#)). High overlap with other established diagnoses could indicate that the severe irritability characterizing DMDD can be better explained by other diagnoses. On the other hand, irritability is a general sign of distress, with perhaps a variety of different underlying mechanisms ([Brænden et al., 2022](#)), which explains the high comorbidity rates ([Leibenluft & Kircanski, 2021](#)). Or, the overlap could be explained by the fact that the diagnosis is new, and few clinicians are trained or accustomed to evaluating externalizing behavior as an internalizing problem (mood disorder). Extending this argument, the validity of DMDD has been questioned, precisely because of high comorbidity levels. In this regard, it is important to note that high comorbidity is the rule rather than the exception when it comes to mental health diagnoses. Comorbidity rates are 74–98% for having a second disorder across most established mental health diagnoses ([Gedermann et al., 2012](#)).

In our sample, children with DMDD showed significantly lower global functioning than children without DMDD, as evaluated by clinicians, and by the child's parents and teachers. The effects were

also strong when controlling for comorbidity levels, indicating a larger disease impact when suffering from DMDD. Lower global functioning among children with DMDD is consistent with findings from multiple studies (e.g., Axelson et al., 2012; Copeland et al., 2013; Uran & Kilic, 2020).

Perhaps not surprisingly, parents and teachers report clinically elevated levels of externalizing behavior for the DMDD group, and significantly higher than other diagnostic groups. These results also correspond with previous research (e.g., Copeland et al., 2014; Freeman et al., 2016). We expected that children with DMDD would also have elevated scores on internalizing symptoms, given that DMDD is considered an affective disorder (depressive). Indeed, parents report clinically elevated scores on internalizing symptoms. However, there are no significant differences from the non-DMDD group. Teachers, on the other hand, report internalizing symptoms below clinical levels for the DMDD group. One could suspect that clinically-elevated externalizing symptoms in the school setting mask possible internalizing difficulties and are therefore not reported. Presumably, parents have a closer relationship with their children than teachers do and are therefore more likely to recognize and report possible internalizing symptoms.

In sum, our study shows that children with DMDD represent a substantial subset of children in the clinic setting and have worse global functioning than most other children in the clinic. Children with frequent temper tantrums and irritability are described as “moving against the world”, and with a downward social mobility and poor functional outcomes (Copeland et al., 2014). These children also often have one or more comorbid mental health disorders, and this calls for extensive treatment programs for this group of children in out-patient mental health treatment settings.

Although our study’s comparable results to previous research on the prevalence and associated challenges faced by children with DMDD may support the diagnostic validity of this condition, further research is needed to fully validate the construct and ensure its clinical utility.

### ***Strengths and Limitations***

This study has several strengths, such as all of the children being carefully and systematically diagnosed at the time of referral, resulting in a well-defined group of clinically referred youth. However, there are some limitations. First, even though the diagnostic distribution is in accordance with national data on children in Norwegian mental health clinics (Helsedirektoratet, 2022), we cannot exclude the possibility the sample is biased as subjects with problems in line with the research project’s aims may have been more likely to participate.

Not all children referred to the clinics in the given time period were included in our study. We have not been able to investigate differences between the children included in this study and those who were not. Secondly, the relatively small sample size may have limited our power in analyses of diagnostic group differences with respect to functional outcomes and symptom loads. Furthermore, fairly low interrater reliability in the diagnosis of anxiety disorders may undermine the certainty of some statistical conclusions.

Although the present study contributes to further knowledge about DMDD and its associated characteristics, future studies should include more extensive information about demographical and family factors to broaden our understanding of these children.

### **Declaration of Conflicting Interests**

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## Data Availability Statement

According to Norwegian legislation, the Norwegian Data Protection Authority, and the Committee of Ethics, we are not allowed to share original study data publicly.

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