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Stability of Disruptive Mood Dysregulation Disorder Symptoms (Irritable-Angry Mood and Temper Outbursts) Throughout Childhood and Adolescence in a General Population Sample

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Abstract DSM-5 Disruptive Mood Dysregulation Disorder (DMDD) is a controversial new diagnosis. The DSM-5 conceptualizes DMDD as persistent and chronic, but the stability of the two DMDD symptoms (irritable-angry mood and temper outbursts) over time is not known. Mothers rated DMDD symptoms in a population-based sample of 376 children (54 % male) evaluated at 6–12 years (*M* 9) and again an average of 8 years later (*M* 16). Mean scores on irritable-angry mood plus temper outbursts at baseline and follow-up were below sometimes a problem, but were higher at baseline than follow-up. Irritable-angry mood and temper outbursts were both often or very often a problem for 9 % of children at baseline, 6 % at follow-up, and 3 % at baseline and follow-up. Only 29 % of children whose baseline symptoms were often or very often continued to have follow-up symptoms at this level (remission rate 71 %). Less than half (45 %) of the children whose symptoms were often or very often at follow-up had these symptoms 8 years earlier (55 % new cases). Our finding of 71 % remission and 55 % new cases indicates instability of DMDD symptoms over an 8-year period. However, the finding that 29 % still had symptoms often or very often 8 years later is clinically significant. DMDD symptoms were found in only one child who did not have symptoms of oppositional defiant disorder (ODD), conduct disorder, ADHD, anxiety, or depression. This suggests that DMDD symptoms are a feature of multiple disorders, particularly ODD, and do not occur in isolation, questioning the validity of DMDD as a unique and independent diagnosis.

Keywords Disruptive mood dysregulation disorder · Irritability · Temper · Stability

One of the most significant and controversial changes in the Diagnostic and Statistical Manual of Mental Disorders-5th edition (DSM-5, American Psychiatric Association 2013) is the creation of the child diagnostic category Disruptive Mood Dysregulation Disorder (DMDD). The two DMDD symptoms are irritable-angry mood and temper outbursts. DMDD was added to the DSM-5 "to address the considerable concern about appropriate classification and treatment of children who present with chronic, persistent irritability relative to children who present with classic (i.e., episodic) bipolar disorder" (DSM-5, p. 157). However, the addition of DMDD is criticized because it was created without the support of published validity studies (Copeland et al. 2013; Roy et al. 2014; Ryan 2013), because DMDD symptoms are common in multiple psychiatric disorders (Axelson et al. 2012; Leibenluft et al. 2012; Mayes et al. 2011, 2012a; Roy et al. 2014; Safer 2009; Stringaris 2011), and because agreement between clinicians on DMDD diagnoses in the DSM-5 field trials was poor (Regier et al. 2013). Furthermore, the two DSM-5 DMDD symptoms are also two of the eight DSM-5 symptoms of oppositional defiant disorder (ODD). Research suggests that DMDD and ODD are not separate and distinct disorders (Axelson et al. 2012; Mayes et al. 2015), because of which the World Health Organization's International Classification of Diseases (ICD-11) panel of experts recommended that chronic irritability and anger should be an ODD specifier in

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the 2017 ICD-11, and not a separate diagnosis, as in the DSM-5 (Lochman et al. 2015). An additional concern is that clinicians may diagnosis DMDD and inappropriately ignore and not treat co-occurring ODD, attention deficit hyperactivity disorder (ADHD), autism, anxiety, or mood disorders, which all have empirically proven psychosocial and pharmacological treatments (Axelson et al. 2011). Indeed, stimulant medication has been shown to decrease irritability, as well as ADHD symptoms, in children with ADHD (Fernandez de la Cruz et al. 2014; Waxmonsky et al. 2008).

Earlier studies have investigated "temper dysregulation disorder with dysphoria" (a proposed DSM-5 category which was replaced with DMDD), "severe mood dysregulation," and "emotional lability," which all differ from DMDD. Our study focuses only on DMDD symptoms as currently defined by the DSM-5 and not previous definitions of mood dysregulation. Irritability has been investigated in some studies, but this has been confounded by other symptoms, as most diagnostic interview schedules and behavior rating scales used in research combine irritability with symptoms of oppositional defiant disorder (ODD) or depression in one item or prompt. For example, Copeland et al. (2013, 2014) analyzed "negative mood" (defined as "depressed, sad, irritable, or angry mood or low frustration threshold," 2013, p. 174), which differs from DMDD because of its inclusion of sadness and depression as symptoms. Similarly, Leibenluft et al. (2006) studied "chronic irritability" which was the total score on the Diagnostic Interview Schedule for Children home and school items "arguing a lot" and "temper tantrums." In order to accurately define and understand DMDD, separating irritable-angry mood and temper outbursts from other symptoms of ODD or depression and from "emotional lability" and "mood dysregulation" is important.

Much needs to be learned about irritable-angry mood and temper outbursts, particularly the stability of these symptoms across childhood and adolescence. The DSM-5 conceptualizes DMDD symptoms as persistent and chronic (DSM-5, p. 157), but the degree of chronicity of DMDD symptoms is unknown. Previous studies have investigated the chronicity of internalizing problems (anxiety and depression) and externalizing problems (ADHD, ODD, conduct disorder, and aggression), but none have yet focused on DMDD symptoms, with one exception. Axelson et al. (2012) conducted a longitudinal study of psychiatric referrals and found that DMDD symptoms were transient. Of those with DMDD symptoms at baseline (6–12 years of age), only 53 % continued to have DMDD symptoms at 12 months follow-up and only 19 % had DMDD symptoms at both 12 and 24 months follow-up. The stability of DMDD was much less than that for ADHD (61 % of children with ADHD at baseline had ADHD at both 12 and 24 months follow-up).

Ours is the first general population longitudinal study to use individual ratings of the two DSM-5 DMDD symptoms, irritable-angry mood and temper outbursts, in a sample spanning the DSM-5 DMDD age range. Our goal is to determine the stability of irritable-angry mood and temper outbursts from baseline (6–12 years) to follow-up approximately 8 years later, to assess the correspondence between the two DMDD symptoms, and to investigate the relationship between DMDD symptoms and other psychological problems. We hypothesize that (1) the stability of DMDD symptoms over time in a general population sample is relatively low (similar to the findings of Axelson et al. 2012 in a psychiatric sample), (2) irritable-angry mood and temper outbursts are strongly correlated but are also unique (i.e., unexplained variance is large), and (3) DMDD symptoms do not occur independent of other psychological problems.

Methods

The study was approved by the Institutional Review Board, and informed consent was obtained from the parents and assent from the children.

Sample

The sample comprised 376 children evaluated at 6–12 years (*M* 8.7, *SD* 1.6) and again an average of 7.7 years later (range 5–13, *SD* 1.4) at ages 12–23 (*M* 16.4, *SD* 2.2). In all, 54.3 % were male, 82.2 % were white, and 50.3 % had a parent with a professional or managerial occupation. IQs on the Wechsler Abbreviated Scales of Intelligence (Wechsler 2005) ranged from 78 to 147 (*M 107.8*, *SD* 13.1). Children were from a population-based epidemiologic study of the prevalence of sleep disorders in children (Bixler et al. 2009). Questionnaires were sent home to the parents of every elementary school student in 18 public schools in three school districts ($n=7312$), with a 78.5 % response rate. One thousand children were invited for further evaluation in the sleep laboratory using stratified random sampling so that the sample matched the original survey group in age, gender, race, and risk of sleep disordered breathing. Seventy percent of the invited families agreed to participate. An attempt was made to contact these 700 original baseline subjects to participate in the follow-up study. Of the original 700, 13.1 % could not be located, 19.5 % declined to participate, and 7.2 % were not seen because of scheduling conflicts, yielding a response rate of 60.1 % of the original sample. The original and follow-up samples did not differ significantly ($p>0.05$) in baseline DMDD symptoms ($M=1.2$ and $SD=1.4$ for both samples), gender (52.2 % and 54.1 % male, $\chi^2=0.3$), race (80.7 % and 82.4 % white, $\chi^2=0.5$), or parent

occupation (48.9 % and 50.3 % parent with a professional or managerial occupation, χ^2=0.2).

Instrument and Variables

Mothers rated their children's behavior during the past 2 months on a 4-point scale (0=*not at all or almost never a problem*, 1=*sometimes a problem*, 2=*often a problem*, and 3=*very often a problem*) on the Pediatric Behavior Scale (PBS, Lindgren and Koeppl 1987). The two PBS items ("irritable, gets angry or annoyed easily" and "loses temper, has temper tantrums") corresponding with the two DSM-5 DMDD symptoms ("irritable-angry mood" and "temper outbursts") were the dependent variables and were analyzed separately and combined as a total DMDD score (irritable-angry mood plus temper outbursts). The PBS has been used to diagnose and measure psychological problems in several published studies (Conrad et al. 2010; Mattison and Mayes 2012; Mayes et al. 2011, 2012a, b; Nichols et al. 2000; Wolraich et al. 1994). Internal consistency for the PBS subscale scores is high, with a median coefficient of 0.91 (Lindgren and Koeppl 1987). Validity studies show the PBS differentiates diagnostic groups, and PBS scores correspond well with those on established measures of psychological functioning (Bixler et al. 2009; Mayes et al. 2012c).

Plan of Analysis

The linear relationship between irritable-angry mood and temper outburst scores at baseline and follow-up was determined with Pearson correlations and explained variance. The difference between baseline and follow-up scores was analyzed with dependent *t*-tests and Cohen's *d*. Baseline minus follow-up difference scores were calculated for each child to determine the degree and direction of change. Irritable-angry mood versus temper outburst scores were compared using Pearson correlations. To determine if age at baseline and at follow-up and duration of time between baseline and follow-up were related to the stability of the irritable-angry mood plus temper outburst score, difference scores were correlated with baseline and follow-up ages and time between assessments. To investigate the influence of comorbid psychological problems, DMDD scores were compared using independent *t*-tests between children who scored at or below versus above a T-score of 65 on the PBS ODD, ADHD, conduct disorder, anxiety, and depression subscales. The relationship between DMDD scores and gender and IQ was determined with Pearson and partial correlations (controlling for comorbid psychological problems).

Results

DMDD Baseline and Follow-up Scores

The correlation between the total irritable-angry mood plus temper outburst score at baseline and at follow-up was moderate (r=0.38, p<0.0001), explaining 14.4 % of the variance between baseline and follow-up scores. The mean irritable-angry mood plus temper outburst score at both baseline and follow-up was below *sometimes a problem*, but was higher at baseline (M=1.2, SD 1.4) than at follow-up (M=0.9, SD 1.3), t=4.6 (375), p<0.0001, d=0.3. Irritable-angry mood and temper outburst scores were both *often or very often a problem* for 9.3 % of the children at baseline, 5.9 % at follow-up, and 2.7 % at both baseline and follow-up (Table 1). Irritable-angry mood scores were greater at baseline than at follow-up, t=2.9 (375), p=0.004, d=0.2, as were temper outburst scores, t=5.2 (375), p<0.0001, d=0.3.

DMDD Symptom Stability and Age, IQ, Gender, and Psychological Problems

The difference between baseline and follow-up irritable-angry mood plus temper outburst scores was 0 for 40.7 % of the sample. For 20.5 %, the score was worse at follow-up than baseline and for 38.8 %, the score improved. Irritable-angry mood plus temper outburst difference scores were not significantly (p>0.73) related to age at baseline (r=0.01), age at follow-up (r=−0.001), or duration of time between baseline and follow-up (r=−0.02), nor did difference scores differ between the younger (6–8 years) and older (8–10 years) children at baseline, t=0.6 (374), p=0.56. The correlation between IQ and DMDD difference scores was nonsignificant (r=0.07, p=0.18). DMDD change scores were marginally greater in males than in females, t=2.1 (374), p=0.04), but were not significantly different (p>0.05) when the presence versus absence of psychological problems (ODD, ADHD, conduct disorder, anxiety, or depression) was controlled, F=3.8 (1, 374). Children with a psychological problem at baseline had significantly greater DMDD change scores than children without baseline psychological problems, t=6.0 (374), p<0.0001. This occurred because only one child without symptoms of ODD, ADHD, conduct disorder, anxiety, or depression had DMDD symptoms (0.4 %), compared with 25.0 % of children who had one or more of these psychological problems (χ^2=62.1, p<0.0001).

Remission

For children with irritable-angry mood and temper outbursts *often or very often* at baseline, 28.6 % had the same scores at

Table 1 Maternal ratings of irritable-angry mood and temper outbursts at baseline (mean age 8.7) and follow-up (mean age 16.4) (N=376)

	% of children with both irritable-angry mood and temper outbursts at different symptom severity thresholds		
	Sometimes to very often	*Often or very often*	*Very often*
Baseline and follow-up	34.0	2.7	0.3
Baseline only	24.7	6.6	0.5
Follow-up only	11.4	3.2	0.8
Neither baseline nor follow-up	29.8	87.5	98.4

	% of children with irritable-angry mood				% of children with temper outbursts			
	Never or almost never	*Sometimes*	*Often*	*Very often*	*Never or almost never*	*Sometimes*	*Often*	*Very often*
Baseline	48.1	36.2	13.6	2.1	59.8	28.2	10.4	1.6
Follow-up	57.4	31.1	9.0	2.4	75.8	17.8	5.1	1.3

follow-up (71.4 % remission), 48.6 % had irritable-angry mood and temper outbursts at a lower threshold (*sometimes to very often*) at follow-up, and 51.4 % were symptom free (*never or almost never*). For children whose irritable-angry mood and temper outburst scores were both *not at all or almost never a problem* at baseline, 72.3 % continued to have scores at this level at follow-up.

New Cases

For children whose irritable-angry mood and temper outbursts were *often or very often a problem* at follow-up, 45.4 % had irritable-angry mood and temper outbursts *often or very often* at baseline (54.6 % new cases), 77.3 % had irritable-angry mood and temper outbursts *sometimes to very often* at baseline, and 22.7 % were symptom free (*not at all or almost never*). For children whose irritable-angry mood and temper outburst scores were *not at all or almost never a problem* at follow-up, 54.6 % were also symptom free at baseline.

Irritable-Angry Mood versus Temper Outbursts

Irritable-angry mood and temper outburst scores were significantly (p<0.001) and moderately correlated with each other at baseline (r=0.34) and at follow-up (r=0.32). Irritable-angry mood scores were worse for 19.7 % and temper outburst scores were worse for 10.1 % at follow-up than at baseline. For 30.6 and 28.8 %, respectively, scores improved. The majority of children without irritable-angry mood (69.6 %) and without temper outbursts (85.8 %) at baseline continued not to have these problems at follow-up. Conversely, the majority of children without irritable-angry mood (58.3 %) and without temper outbursts (67.7 %) at follow-up were symptom free at baseline.

Discussion

Frequency of DMDD Symptoms

Maternal ratings of DMDD symptoms (defined by the DSM-5 as irritable-angry mood and temper outbursts) were analyzed in a population-based sample of 376 children evaluated at baseline (mean age 9 years) and an average of 8 years later. The two DMDD symptoms were both rated by mothers as often a problem for 9 % of the children at baseline, 6 % at follow-up, and 3 % at baseline and follow-up. The percentage of children with chronic DMDD symptoms (at baseline and follow-up) falls within the 2–5 % prevalence range estimated by the DSM-5 (DSM-5, p. 157).

Stability of DMDD Symptoms

The DSM conceptualizes DMDD as persistent and chronic. In our study of DMDD symptoms occurring during the preceding 2 months, only 29 % of children whose symptoms were often or very often a problem at baseline had symptoms at this level 8 years later at follow-up. Low stability was also reported by parents of 6- to 12-year-old children referred for psychiatric evaluations in a study by Axelson et al. (2012). Of those with baseline DMDD symptoms (present for at least 6 months during the 12 months preceding the evaluation), 53 % continued to have DMDD symptoms at 12 months follow-up and only 19 % had DMDD symptoms at 12 and at 24 months follow-up.

Our findings of 71 % remission and 55 % new cases suggest that DMDD symptoms were not very stable over an 8-year period. However, the fact that 29 % still had severe symptoms 8 years later is clinically significant, suggesting that for one-third, childhood symptoms may persist into late adolescence and early adulthood. The percentage of children with severe DMDD symptoms at baseline who continued to have symptoms at follow-up in our study is far lower than stability

percentages for ADHD (Axelson et al. 2012; Ercan et al. 2013) and autism (Kleinman et al. 2008) and lower than the percentage of children who have a recurrence of depressive episodes (Kovacs et al. 1984). However, 29 % is within the ranges reported for the persistence of ODD (Biederman et al. 2008; Ercan et al. 2013) and anxiety disorders (Last et al. 1996).

In our study, less than half (45 %) of children whose symptoms were often or very often a problem at follow-up had symptoms at this level 8 years earlier, and 55 % were new cases. Axelson et al. (2012) found that only 64 % of children with psychiatric disorders who had DMDD symptoms at 12 months follow-up also had these symptoms at baseline, and 36 % were new cases. Half (52 %) had symptoms at only one of the three assessments (baseline, 12 months follow-up, and 24 months follow-up).

The association between the baseline and follow-up irritable-angry mood plus temper outburst score in our study was significant, but the correlation explained only 14 % of the variance between baseline and follow-up scores. Therefore, the baseline irritable-angry mood plus temper outburst score was only moderately predictive of follow-up score and vice versa.

Improvement over Time

The mean irritable-angry mood and temper outburst score was significantly higher at baseline than at follow-up, and change scores showed that scores improved for 39 % and were worse for 20 %. This suggests that symptoms are more likely to decrease than increase with time. This is consistent with findings from both cross-sectional and longitudinal studies showing that rating scale scores for externalizing behavior problems decrease more than they increase throughout childhood and adolescence (Bongers et al. 2003; Gilliom and Shaw 2004; Keiley et al. 2000; Leve et al. 2005; Miner and Clarke-Stewart 2008; Owens and Shaw 2003; Shaw et al. 2003; Spieker et al. 1999; Stanger et al. 1997). In contrast, internalizing problem scores were stable across childhood and early adolescence in the study by Keiley et al. (2000), and they increased for girls in the study by Leve et al. (2005). This suggests that our finding and the findings for externalizing problems are not simply an artifact of regression to the mean.

Limitations and Directions for Future Research

Our study used maternal ratings of the two individual PBS items that correspond with the two DSM-5 DMDD symptoms because the DSM-5 has defined DMDD as consisting of only these two specific symptoms. However, the likelihood of measurement error increases when only two items are used. Our study used subjective maternal ratings, which are susceptible to rater bias and the influence of other factors (e.g., maternal stress affecting ratings of child behavior). Our study is a single site study, which needs to be replicated at other locations with more racially diverse samples. DMDD symptoms were based on ratings of the child's behavior during the preceding 2 months. The DSM-5 specifies that, for a DMDD diagnosis, the symptoms must be present for at least 12 months, without a symptom free period of 3 or more consecutive months. This criterion, along with the other DSM-5 criteria (tantrums averaging three or more times per week, symptoms in at least 2 of 3 settings: home, school, and with peers, and onset before age 10) need to be investigated in future studies. Research is needed to objectify and operationalize the DSM-5 DMDD definition so that it is a valid and reliable diagnosis. Diagnostic reliability for DMDD using current DSM-5 criteria is poor. In DSM-5 field trials, the degree to which two clinicians agreed on a DMDD diagnosis was unacceptably low at two of the three sites, in contrast to good to very good agreement at all sites on diagnoses of autism, ADHD, and ODD (Regier et al. 2013).

The DSM-5 states that comorbidity is common in DMDD, but the DSM-5 is inconsistent about how DMDD and comorbid conditions are diagnosed. For autism, DMDD is not diagnosed if the symptoms are better explained by the autism. For ADHD, co-occurring DMDD is diagnosed. For children who meet criteria for both ODD and DMDD, only DMDD is diagnosed. Until more is known about the validity of DMDD, it would seem wise to note the presence of co-occurring DMDD symptoms with all disorders, as an additional diagnosis or specifier. This would help tremendously in determining if DMDD occurs independent of other disorders and in determining which disorders are likely to involve DMDD symptoms. In our study, only one child without symptoms of ODD, ADHD, conduct disorder, anxiety, or depression had DMDD symptoms (0.4 %), compared with the presence of DMDD symptoms in 25.0 % of children who had one or more of these psychological problems. This suggests that DMDD symptoms are a feature of multiple disorders and do not occur in isolation, questioning the validity of DMDD as a unique and independent diagnosis. Research by Axelson et al. (2012) suggests that DMDD is not a distinct phenotype with a course, outcome, long-term stability, or associated family history of mood or anxiety disorders that differs from disruptive behavior disorders (Axelson et al. 2012). Unless the presence or absence of DMDD symptoms is noted with all disorders, it will not be possible to determine the validity of DMDD and learn how DMDD symptoms, alone or together with other symptoms, impact functioning, impairment, treatment, and outcome.

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Conflict of Interest The remaining authors have no conflicts of interest.

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