CE

Disruptive Mood Dysregulation Disorder

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ABSTRACT

This article is an overview of disruptive mood dysregulation disorder (DMDD). It reviews history, diagnostic criteria, prevalence, comorbidities, treatment, and recommendations for clinical practice. The diagnosis of DMDD was created to separate the symptoms of chronic irritability punctuated by short-term outbursts in young children. Although controversy exists around DMDD as a sole diagnosis due to comorbidity with other psychiatric disorders, there is evidence of its unique traits. There are limited data regarding treatment, although the efficacy of cognitive behavioral therapy shows potential for first-line treatment. Providers need to support families, validate parental concerns, and teach behavioral modification to complement therapy and pharmacotherapy.

Keywords: disruptive mood dysregulation disorder, irritability, treatment options

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When faced with the ongoing explosive tantrums seen with disruptive mood dysregulation disorder (DMDD), some parents may feel helpless and unsure of how to manage their child's behavior. One mother described her child as being continually "on edge" throughout the week and prone to outbursts with minimal provocation, sometimes leading to physical aggression.[1] The persistent pattern of outbursts and severe irritability are characteristic of the newly accepted DMDD diagnostic criteria.[2] This article provides an overview for primary care providers (PCPs) regarding the challenging and controversial diagnosis of DMDD from its background, diagnosis and differentials, treatment options, and implications for PCPs.

OVERVIEW AND BACKGROUND

DMDD was initially created to differentiate and reduce the number of children diagnosed with the pediatric bipolar disorder (PBD).[3] Researchers found PBD and adult bipolar disorder (BD) varied in their presentation, with PBD characterized by chronic, nonepisodic irritability rather than classic manic episodes, which led to an increase in the diagnosis of PBD.[4] The concern of increasing prevalence of PBD between 1994 and 2004 was attributed to using a broad-based phenotype for diagnosis and its application with younger children.[5] At that time, children diagnosed with broad phenotype PBD were characterized by manic episodes associated with chronic irritability, while

This CE learning activity is designed to help improve knowledge about disruptive mood dysregulation disorder and appropriate treatment as demonstrated by a score of at least 70% on the CE evaluation quiz.

At the conclusion of this activity, the participant will be able to:

A. Describe current research on DMDD diagnostic dilemma
B. Review the risk factors and pathophysiology of the disease
C. Discuss the treatment of children with DMDD and NP role in management

The authors, reviewers, editors, and nurse planners all report no financial relationships that would pose a conflict of interest.

The authors do not present any off-label or non-FDA-approved recommendations for treatment.

This activity has been awarded 1 Contact Hours of which 0.25 credits are in the area of Pharmacology. The activity is valid for CE credit until September 1, 2020.

those with a narrow phenotype presented with distinct episodes of hypomania, mania, elevated mood, or grandiosity.[6] Severe irritability, therefore, became the focus of research and the beginning of DMDD.

The disorder of DMDD was added to the *Diagnostic and Statistical Manual of Mental Disorders* (5th edition; *DSM-5*) based largely on the work of Dr. Ellen Leibenluft and her definition of severe mood dysregulation. Abnormal baseline mood, symptoms of hyperarousal, and increased reactivity were isolated from PBD and proposed as a new set of standards; first called severe mood dysregulation (SMD), which then morphed into DMDD.[5] Children who displayed symptoms of chronic irritability with explosive tantrums were subsequently diagnosed with DMDD rather than PBD. Separation by diagnosis was meant to encourage the development of targeted interventions for both groups. Further studies revealed that nonepisodic irritable broad phenotype PBD did not correlate with a progression of BD into adulthood[7] and that future hypomanic and manic episodes were 50 times more likely in children with narrow phenotype PBD than SMD.[8]

DIAGNOSTIC DILEMMA

The current diagnostic criteria for DMDD is characterized by persistent and pervasive irritability, underlying and punctuated by frequent temper outbursts.[2] As defined in the *DSM-5*, these intense and prolonged outbursts must occur more than 3 times per week, in at least 2 settings, and last more than a year.[2] This diagnosis, made by mental health specialists, relies most heavily on history. In addition to irritability, the age of onset and ability to function are crucial to meet full diagnostic criteria. DMDD should not be used before age 6 or after age 18, and onset must occur by age 10 through historical account without any manic or hypomanic episodes.[2] One of the key distinguishing features of narrow phenotype PBD is the cyclic nature of hypomanic and manic episodes. BD has episodes of mania, which is not a criterion for DMDD.

Irritability can be hard for clinicians to delineate and a challenge for patients and families to define. Irritability is considered in light of intensity, frequency, duration, context, and functional impairment.[4] In addition, temper outbursts are related to developmental age, with preschoolers having the highest incidence, frequency, and intensity and decreasing in both incidence and intensity by later childhood.[8] In later childhood and adolescence, the average temper outburst lasts 5–7 minutes and occurs no more than once a week.[4] Table 1 (available online) is a review of the studies related to obstacles in DMDD diagnosis. Some studies show difficulty in establishing the diagnosis, symptoms in children younger than age 6, and difficulty with interrater reliability.[9-13]

Although considered separate from PBD, many clinicians continue to question the validity of DMDD as a distinct condition because of its high comorbidity with other diagnoses such as oppositional defiant disorder (ODD) and attention-deficit/hyperactivity disorder (ADHD).[3] The data from studies indicate the rates of comorbidity with DMDD are wide ranging with percentages varying from 13% to 93% (mean = 69%) for ODD and 21% to 81% (mean = 52%) for ADHD.[14-20] In a recent study, 98.4% of children (n = 665, aged 6–12, 52.6% male, 80.5% white) diagnosed with DMDD (n = 61) met criteria for ODD or had a T score > 65 for ADHD, conduct disorder (CD), depression, or anxiety.[17] In another, 96% of DMDD-positive youth (n = 184, aged 6-12) met criteria for ODD or CD.[13] In an earlier study, only 5% of participants (n = 1593) with DMDD symptoms ($P < 0.0001$) did not have comorbidity with ODD.[19] Mulraney et al. reported 1 in 5 children (n = 179, aged 6–8) met criteria for ADHD and DMDD, and 89.7% of that group was comorbid with ODD.[20] These rates of comorbidity pose a problem and suggest that DMDD does not stand alone diagnostically. DMDD may be considered a more severe form of ADHD and ODD.[21] Lochman et al proposed the addition of a specifier for ODD that encompasses chronic irritability and anger in these patients.[22]

Meanwhile, other studies support DMDD as a separate entity. In one study, only 19% of children (n = 21, ages 6–16, 76.2% male) were diagnosed with ODD, indicating DMDD as both different and detectable in countries outside of the United States and Europe.[23] Likewise, in the Copeland et al studies, comorbidity rates of DMDD with ODD were 37% in the Duke Preschool Study (n = 918, $P < 0.0001$),

23.3% in the Great Smoky Mountain Study (GSMS) ($n = 5336$, $P < 0.0001$), and 27.0% in the Caring for Children in the Community (CCC) Study ($n = 1627$, $P < 0.0001$).[14] Even when comorbidity was high, there were characteristics of DMDD not explained solely by ODD or other diagnoses. In one study in which DMDD was highly comorbid with ODD and ADHD, symptoms of DMDD were associated with higher aggressiveness and reduced language competency.[12] Another study ($n = 473$, aged 6–9, 88.6% white, 54.5% male) reported an association with DMDD and later psychopathology and impairment not explained by other comorbidities.[15] Mulraney et al. affirmed ($n = 179$, 85.6% male, mean age 7.3/SD 0.4) that DMDD independently exacerbated social difficulties, including bullying, self-control, and family quality of life ($P < 0.0001$), in children diagnosed with ADHD.[20] In an alternative study, parents of children with DMDD, compared with parents of children with ADHD, identified their children as being more oppositional, hyperactive, impulsive, emotionally labile, and having social problems.[24] These studies suggest distinct characteristics of DMDD that put affected children in a higher-risk category regarding functional impairment.

Clearly there are challenges around the diagnosis of DMDD. Current guidelines suggest that children who meet criteria for DMDD and ODD or intermittent explosive disorder be diagnosed with DMDD.[1] It is unclear how many clinicians follow these guidelines. These challenges may, in part, be due to the lack of standardized screening for DMDD. The Affective Reactivity Index is a concise, 6-item scale that allows for use in clinical primary care practices to help providers assess irritability.[4] McTate and Leffler's review of existing structured interview instruments has suggested the Children's Interview for Psychiatric Syndromes, while diagnostically narrow, as a useful screening tool for DMDD.[25] The Mini-International Neuropsychiatric Interview for Children and Adolescents is considered weak due to a lack of items specific for DMDD symptoms.[25] Other tools such as Development and Wellbeing Assessment or Clinical Global Impression scale are much broader and are used as part of psychiatric evaluation. These scales are not diagnostic for irritability in DMDD because the symptom is considered a nonspecific indicator and is related to several other psychiatric disorders.[10]

EPIDEMIOLOGY AND PSYCHOPATHOLOGY

DMDD is a new diagnosis and incidence data is unavailable. Using the National Comorbidity Survey Replication—Adolescent Supplement and the *DSM-5* criteria for DMDD, 10,123 U.S. adolescents (aged 13–18) were interviewed and assessed for mood and anxiety disorders. The reported prevalence in youth 13–18 was 5.26% using relaxed criteria and 0.12% using a strict criteria. During a 3-month study period, rates of DMDD ranged from 3.3% in the Duke Preschool Anxiety study (ages 2–6) to 1.1% in the GSMS (ages 9–17), with the lowest prevalence of 0.8% in the older sample (ages 9–17) in the CCC Study.[14]

Although the etiology of DMDD is unclear, researchers have strived to uncover patterns indicative of psychopathology. Recent studies indicate that abnormalities of neural pattern activation are likely the psychopathological cause of DMDD. Kessel et al. found that children at age 9 ($n = 425$, 166 female, 94.9% white) who demonstrated enhanced reward processing were the same as those that presented with symptoms of DMDD at age 3.[26] This points to enhancement rather than impairment of reward learning as causing chronic irritability. Abnormal activation impacts affective arousal, cognitive control, physiology, and dopaminergic processes, linking irritability to the dorsal anterior cingulate cortex, anterior insula, and amygdala.[27] One theory states hypersensitivity could amplify stimulus-responses, resulting in patterned thinking, consequently leading to the increased probability of goal blockage and, ultimately, anger and frustration.[26]

One study determined children with symptoms of SMD ($n = 19$) have reduced activation in brain areas associated with reward processing while completing frustrating and nonfrustrating tasks compared with the control group ($n = 23$) using functional magnetic resonance imaging (fMRI).[28] Similarly, Meyers et al. concluded that children with DMDD showed impairment of reward prediction error, the difference between expected and received rewards, which led to difficulties in adapting to changing conditions and

environments, leading to eventual temper outbursts.[27] In these studies, different imaging methods, such as fMRI[28] and electroencephalography,[26] and functional tasks were used to assess brain activation and processing. These studies imply an alteration of reward processing is related to mood dysregulation disorders and provide insight into the physiological impact of DMDD, although more research is needed to construct a comprehensive etiological model.

Apart from brain studies, there has been more research into genetics and irritability. In a twin study (n = 2620) by Roberson-Nay et al., genetics were found to have an influence on irritability, with males being more affected by genetic contributions than females as they grew older.[29] Insight into genetic factors related to irritability may contribute more heavily to our understanding of the psychopathology of DMDD as our knowledge base grows.

Although there is a working child psychopathological model of DMDD, there is no evidence regarding its lifetime prevalence. Mayes et al. found only 29% of children with frequent problems at baseline were symptomatic at an 8-year follow-up.[18] This implies DMDD may have limited long-term stability and decreasing symptoms over time. Researchers studied 631 youths, mean age 13.8 (SD 2.6), and found that irritability may predict major depressive disorder (odds ratio 1.48, $P < 0.001$), dysthymia (odds ratio 2.11, $P < 0.001$), and generalized anxiety disorder (odds ratio 2.01, $P < 0.001$) in adulthood at 20-year follow-up.[30] These results indicate that even while behavioral problems diminish, these children may need future mental health services.

RISK FACTORS

It is uncertain whether familial psychiatric history put youth at risk for DMDD. In the Longitudinal Assessment of Manic Symptoms (LAMS) study of 706 children aged 6–12, there was no connection with parental psychiatric history (95% CI).[13] Perich et al. were unable to replicate findings of higher rates of DMDD and chronic irritability in children aged 12–18 with an increased familial risk for developing BP (n = 29) against control subjects (n = 13).[31] Conversely, Sparks et al. studied 375 parents with BD and 241 of their offspring (aged 6–17, 52% female, 20% nonwhite) and determined that ($P = 0.001$) children of parents with BD were at higher risk to develop DMDD in the future.[32] There is a dearth of studies related to perinatal risk factors and development DMDD. One Brazilian study (n = 3490, aged 1–11) suggests maternal factors such as mood during pregnancy ($P < 0.001$), postpartum depression ($P < 0.001$), and low education ($P < 0.001$) are associated with higher risk of DMDD development before age 11.[33]

In terms of environmental risks, one study assessing children aged 2–16 years (n = 2,256) found more symptoms of DMDD in preschoolers versus school-age children ($P < 0.0001$) with a higher prevalence in males than females ($P < 0.001$) and symptoms in youth whose parents had nonprofessional careers ($P < 0.001$).[19] Despite these findings, demographics only explained 2%–3% of the variances in the DMDD score.[14] In the GSMS, there were significant correlations ($P < 0.05$) with DMDD including impaired sibling and teacher relations, use of general medical or school system services, low socioeconomic status, and single-parent families. The most significant of these correlations ($P < 0.0001$) included impaired parental relations, school suspension, and use of mental health or child welfare services. The CCC Study showed similar associations ($P < 0.0001$) in youth with DMDD and a higher prevalence of poor relations with siblings, parents, and teachers, school suspension, mental health services utilization, and juvenile justice services.[14]

TREATMENT OF DMDD

The current empirical evidence for effective treatment of DMDD is limited. Early studies support cognitive behavioral therapy (CBT) with parental training as first-line treatment. Encouraging results were reported with interpretation bias therapy (IBT) and dialectical behavioral therapy (DBT).[34] Pharmacological intervention has not shown clear benefits and should treat a comorbid disorder.[34] In children with DMDD, clinical traits causing the most impairment are irritability, temper outbursts, and aggression. Aggression has been studied more due to its prevalence of mood disorders such as SMD, ODD, PBD, and ADHD. Only 1 randomized controlled trial has researched the outcome of psychosocial therapy in youth with DMDD symptoms using

parent and child group sessions with a focus on connecting mood, behavior, and decision-making.[35] Waxmonsky et al. studied 31 children diagnosed with SMD, aged 7–12 years old (65% male), who attended the majority of therapy sessions. These children, premedicated with stimulants for ADHD symptoms, had a reduction in score from baseline on the Children's Depressive Rating Scale—Revised ($P < 0.05$) and Mood Severity Index ($P < 0.05$), although irritability did not differ from baseline to end point between the groups.[35] Because irritability is the primary concern for DMDD, new studies must focus on this component. A behavioral approach shows the best evidence for improvement and has no side effects. The recommendation for CBT and similar therapies is practical because it focuses on skill building through the lifespan.

The next intervention is pharmacological treatment with continued CBT, IBT, or DBT. All prescriptions are considered off-label use since no past trials have used DMDD patients. Therapy for known comorbid disorders is started before treatment for DMDD. One study used stimulants as their method of treatment in children with ADHD and SMD. In the study ($n = 38$, mean age 9.4 [SD 1.7], 72% male), there was a significant reduction in scores for the Disruptive Behavior Disorders Rating Scale (DBDRS) for ADHD, ODD, and CD ($P < 0.001$) in parent-rated externalizing symptoms after psychotherapy. However, baseline and end point irritability were comparable even after optimizing medication levels.[36] The results suggest that ADHD treatment is initiated first. Tourain et al. (2015) found methylphenidate most effective in decreasing aggression in children with ADHD while risperidone was best for those with CD, autism, and intellectual disability.[37] Table 2 (available online) provides an overview of the proposed treatment methods and results found in treatment studies related to DMDD and DMDD symptoms.

ROLE OF THE PCP

As fewer children are diagnosised with PBD or ODD, more will be diagnosed with DMDD. Faheem, Petti, and Mellos showed a decline in the diagnosis of BD in children and adolescents since the introduction of DMDD.[38] Consulting with a mental health specialist should be the first step when caring for patients with suspected DMDD. Differentiating DMDD from other diagnoses is essential for both prognosis and treatment. A history should be conducted to quantify the duration of symptoms, distinguish baseline mood from outbursts, and to rule out PBD with any manic or hypomanic episodes.

Psychoeducation in primary care can confirm parental concerns, allow for treatment acceptance, and aid in the ongoing management of the condition. The PCP can be most helpful by educating parents on the underlying principles behind behavioral modification. The Antecedent, Behavior, Consequence (ABC) model is a mainstay of positive parenting and can be used to encourage parents to understand behavior triggers, recognize concerning behaviors, and take action in response to unwanted behaviors.[39] The flowchart in Figure 1 (available online) represents how the ABC model can influence behavioral change.

Behavioral modification and childhood discipline have many common factors. DMDD is primarily a diagnosis for school-age children; therefore, we must be cognizant of which techniques work by age-group. In younger children, the intervention focus is the caregiver to improve parenting skills. In older children, the child learns to modify thoughts, actions, and emotions.[40] Successful techniques used with younger children include positive reinforcement, redirection, concise verbal instruction, and time-outs.[41] Positive reinforcement is useful and nurturing for the relationship between the parent and the child. Box 1 (available online) lists parental behavioral suggestions to help their child achieve greater self-control, self-direction, and a sense of caring.

CONCLUSION

DMDD is a new clinical diagnosis developed to categorize children with irritability and delineate them from patients that present with manic episodes seen with PBD. Primary care clinicians should focus on psychoeducation and continued support of individual behavioral modifications techniques. Children with DMDD have higher rates of comorbidity with diagnostic instability, and thus it is critical for families to develop behavior-based skills. Studies of patients with mood disorder dysfunction have shown improvement with CBT and parent training.

Pharmacological intervention for comorbid disorders in these patients can be useful. Patients with symptoms of DMDD should be referred to a mental health provider who specializes in child and adolescent psychiatric disorders for both diagnosis and prescription of psychotropic medications. Ongoing research should yield new guidelines for management and more options for treatment. JNP

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1555-4155/18/$ see front matter

https://doi.org/10.1016/j.nurpra.2018.07.007

Table 1. Studies Related to Diagnostic Difficulties

Source	Sample	Purpose	Study Design	Conclusions
Tufan et al.[9]	36 male patients, average onset age 9	Evaluated patients for DMDD criteria	Retrospective study	• 77.8% fulfilled criteria • 0.68 k value for consensus
Regier et al.[10]	11 academic centers with 3 targeted for DMDD diagnosis; exact number of children evaluated not given	Looked at patients with psychiatric diagnosis to assess the accuracy of their diagnosis using 2 blinded examiners	Field trial	• Two of 3 clinical sites had unacceptable test −retest reliability related to interrater agreement (kappa = 0.06, 0.11) • Concerns when site findings were pooled (kappa = 0.25) in regard to DMDD diagnosis
Fristad et al.[11]	140 children with DMDD and 77 children with bipolar not otherwise specified (BP-NOS)	Evaluated differences and similarities between DMDD and PBD over 36 months	Longitudinal study	• Irritability maintained its level over time in BP-NOS while decreasing in DMDD (n = 140) compared with baseline • Mania symptoms and parental history difference noted
Martin et al.[12]	139 children admitted to a day treatment program	Evaluation to justify DMDD minimum age of onset	Cohort prospective study	• Recurrent temper tantrums and irritability common • High rate of severe aggression and decreased language competency in children with DMDD
Axelson et al.[13]	706 children, aged 6−12 years, 26% met criteria for DMDD	Evaluated children for criteria of DMDD	Cohort prospective study	• DMDD could not be deliniated from oppositional defiant disorder or conduct disorder

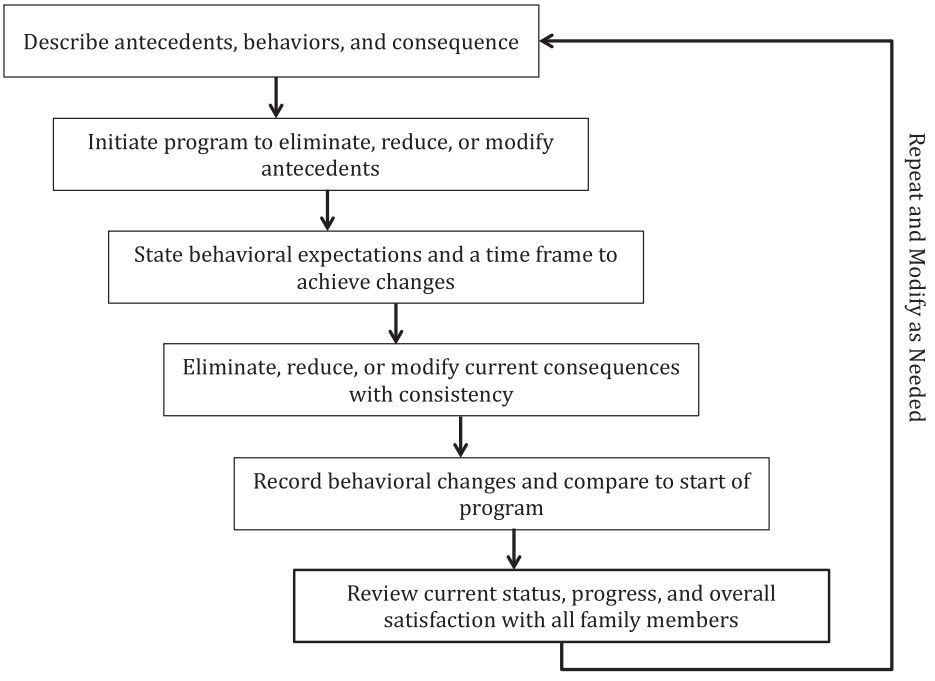
DMDD = disruptive mood dysregulation disorder.

Table 2. Proposed Treatment Methods for DMDD and Symptoms

References	Study Type	Main Results
Benarous et al.[34]	Qualitative systematic review	• SMD symptom reduction may be associated with behavioral or cognitive behavioral therapy when used with parental training in youth with ADHD or SMD. • IBT may be beneficial. • Risperidone may decrease irritability and externalized symptoms of SMD. • Monotherapy of stimulants are partially effective in treating SMD symptoms in youth with ADHD and SMD. • Selective serotonin reuptake inhibitors may be an add-on therapy in children with comorbid ADHD already treated with stimulants.
Tourain et al.[37]	Review of peer-reviewed studies	• Divalproex or valproate may improve symptoms of explosive temper and mood lability. • Lithium, valproate, clonidine, risperidone, and haloperidol may be useful in reducing signs of aggression. • Methylphenidate is useful in reducing aggression in patients with ADHD.
Waxmonsky et al.[35]	Randomized controlled trial	• Psychosocial integrative therapy may be useful in reducing irritability in patients with SMD and ADHD as measured by Parental Disruptive Behavior Disorder Rating Scale ($P = 0.234$), Mood Severity Index ($P = 0.055$), and Children's Depression Rating Scale—Revised ($P = 0.065$).

ADHD = attention-deficit/hyperactivity disorder; IBT = interpretation bias therapy; SMD = severe mood dysregulation.

Figure 1. Step-based approach to ABC principles in action.



Adapted from "The ABC System." In Caring for Your School-Age Child: Ages 5 to 12 *by the American Academy of Pediatrics, 2004. https://www.healthychildren.org/English/family-life/family-dynamics/communication-discipline/Pages/The-ABC-System.aspx.*

Box 1. Parent Recommendations for Behavioral Modification

- Use specific examples to commend children rather than generalized statements.
- Look for "little things" to appreciate and praise.
- Use a star chart or token system.
- Role model appropriate behaviors.
- Choose positive reinforcement before using other means of discipline.
- Establish a loving, supportive relationship with your child.
- Be consistent.
- Be aware of your child's behavior patterns.
- Implement appropriate consequences.
- Remember that parental attention is a powerful reinforce.