

Regulation disorders of sensory processing in infants and young children

A child's growth and development can be adversely affected by dysfunctional sensory, motor, and behavioral responses.

ABSTRACT: Regulation disorders of sensory processing constitute important and intriguing patterns of behavior that are usually diagnosed in infancy and early childhood. The empirical research does not provide a conclusive answer to whether such a disorder is a harbinger of other childhood disorders. However, clinical interventions, such as changes in parental responses, can help these challenging children and their families. Health professionals working with children can offer assistance in these cases by knowing more about the main characteristics of regulation disorders, diagnostic criteria, and assessment and treatment techniques.

Although childhood diagnostic categories have only recently included regulation disorders (RD) of sensory processing, babies described as “colicky” or observed to have extreme reactions to sensory input have always existed.

In the past, a health professional's common response to parental concerns took the form of recommending a “wait and watch” approach and saying that the baby would “grow out of it.” This advice may have worked for at least one-third of the infants who eventually progressed on to a typical pattern of physiological maturation. However, for the remaining infants and their parents, months of frustration and growing concern often ensued.

During the past 15 years, researchers have contributed to an increased understanding of the dysfunctional sensory, motor, and behavioral responses that certain infants, toddlers, and young children experience. Once the responses are accurately identified, management strategies involving a multidisciplinary approach can help parents and children to adapt to or alter the responses that interfere with the typical development of the child.

Diagnosis

There is no description of or provision for the diagnosis of regulation disorders of sensory processing in the *International Statistical Classification of Diseases (ICD-10)*¹ or the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR)*.² This diagnosis is a category in the *DC: 0-3R*,³ which is a diagnostic classification manual frequently used by infant mental health clinicians. In 2003, the *Infant Mental Health Journal* published a special issue devoted to *DC: 0-3R* diagnostic classifications, and noted that active controversy exists regarding the diagnostic criteria of RD.⁴ This diagnosis continues to be one of the most discussed within the infant literature and an increasing number of children are receiving the diagnosis. In the Infant Psychiatry Clinic at BC Children's Hospital (BCCH), approximately 8% (14/170) of those referred in a given year met the *DC: 0-3R* diagnostic criteria for RD.⁵

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Infants with regulation disorders of sensory processing are defined as children having a set pattern of responses and behaviors, observable over time and across settings, that interfere with normal growth and development. Difficulties in the three areas of sensory, motor, and behavioral responses are necessary for diagnosis. Physiological difficulties involving sleep, eating, and elimination as well as difficulty in the domain of language (expressive and receptive) and cognitive function may also be present, but these problems are not included as diagnostic criteria. Sleep and feeding disorders in infancy and early childhood are very common. However, if they extend beyond infancy they may constitute a specific disorder.⁶ For example, if a baby has a sleeping disturbance but no behavioral, sensory, or motor difficulties, then this infant is *not* considered to have a regulation disorder. However, if a baby is fussy and difficult to soothe (behavioral response) and seldom goes to sleep unless rocked or jiggled (motor response) and needs auditory input of white noise (sensory response) to settle, then these three responses, not just the sleep disturbance, might result in a diagnosis of RD. A toddler whose diet is restricted to crunchy food (sensory response), who fights wearing clothes (sensory response), and is hyperactive (motor response) and irritable (behavioral response) also exhibits the three aspects of RD required for diagnosis.

Types of disorders

The issue of subtypes represents the biggest problem in assessing a child with regulation disorders of sensory processing, since children with mixed features are frequently encountered in clinical practice. The *DC: 0-3R* diagnostic classification system recognizes the usefulness of classifications but also emphasizes that “at this stage

in our knowledge,” the system can “neither provide detailed criteria for subtypes of regulation disorders of sensory processing nor specify the number of criteria [within a subtype] needed for diagnosis.”²³

Type I: Hypersensitive subtype

These infants and young children show hypersensitivity to various stimuli, making them either fearful/cautious or negative/defiant. The children are over-reactive to touch, sound, visual stimuli, and sensory input involving smell or taste. They may reject movement and have difficulty with motor planning and gross motor play. Their extreme responses interfere with self-care, play, and learning activities. Transitions from one activity to another may precipitate anxiety or negative reactions.

Type II: Hyposensitive/under-responsive subtype

These infants may appear self-absorbed or withdrawn and are difficult to engage. They are under-reactive to sound, taste, smell, touch, visual stimuli, and proprioception. They may appear inattentive or sad. In

preschool, the child may demonstrate a diminished range of fantasy and seek repetitive sensory patterns (which are often dictated by sensory peculiarities). These types of responses, along with the child’s unresponsiveness to the environment and to peers

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or adults, require diagnostic differentiation to distinguish a child with RD from a child with developmental delay or autism.

Type III: Sensory stimulation-seeking/impulsive subtype

This subtype is most frequently represented in the clinic-referred population. Infants and young children present with impulsive and disorganized behaviors in the areas of motor responses. They are accident prone, probably due to poor motor planning skills. These children may be counter-phobic and lash out at their peers before the peers can be aggressive toward them. Their attention-seeking and impulsive stimulus-seeking behaviors mimic children with attention deficit hyperactivity disorder (ADHD). However, parents of children with RD report that their children

demonstrated these behaviors from early infancy, while parents of children with ADHD often observe that the behaviors only emerged once their children became mobile.

Comorbidity and stability

As with any condition, regulation disorders of sensory processing can exist with other disorders, such as ADHD. The hypersensitive subtype who is fearful/cautious may also have separation anxiety disorder, while the hypersensitive subtype who is negative/defiant may also have oppositional defiant disorder.³ The sensory, motor, and behavioral responses of the child with a regulation disorder interact with and compound the problems presented by the symptoms of the additional diagnosis.

One important clinical question regardless of the diagnosis is whether a regulation disorder is a harbinger of later difficulties in a child's life. If so, what could be done to prevent the progression of symptoms?⁷

Over a 4-year period at the BCCH Infant Psychiatry Clinic, the majority of children initially diagnosed with RD as preschoolers were later diagnosed with either ADHD or autism spectrum disorder (ASD). These clinical observations have prompted data analysis in an ongoing methodical fashion. Eventually, this research should help determine whether regulation difficulties in which sensory integration problems are more prominent are a harbinger of ADHD or ASD.

Controversies surrounding the diagnosis of RD

There is no single assessment that specifically distinguishes children with RD from the typically developing child, since there are no observational signs that are pathognomonic of RD. However, standardized assessments define aspects of the disorder

such as sensory irregularities, gross and fine motor skill disorders, and behavioral disorders. Most of the information required for diagnosis has to be obtained from the child's parents and other caregivers.

There are a number of conditions that mimic or share features of RD, including infantile colic, excessive crying, and sleep disorders. Similarly, drug-exposed babies may appear jittery and fussy in early infancy. However, crying, fussing, and colic are self-limited conditions in most infants, while the behaviors and responses seen in RD continue throughout infancy.

Sensory tolerance does not appear to be uniform even across the subtypes, with each child presenting with a unique mix of responses, which leads to criticisms about how to judge these sensitivities and the quantification required for determining a diagnostic subtype.³

Finally, there is an ongoing debate about how cultural and parenting practices may affect developmental progression in children with RD. The 1994 *DC: 0-3* diagnostic system made a point of describing parental styles that may be useful in parenting children with RD.⁸ Some support for the influence of parenting practices comes from researchers who are proponents of interventions such as parent guidance and parent-child play.⁹

What causes regulation disorders?

There is no clear-cut answer to the question of causality. Regulation disorders are multifactorial in origin. Theories focus on causes ranging from difficult temperament to central nervous system irritability. Parents are often surprised that all the children in their family show some type of regulation disturbance involving either sleep, feeding, or sensory responses. That observation often gives rise to

fears that RD may be a genetic disorder. At the time of writing, there is no support for this notion in the literature. It is important to reassure the stressed parents of a child with a regulation disorder that their parenting style did not cause their child to be dysregulated. However, we do know that parenting, as a powerful environmental input, can be a decisive factor in assuring a near normative developmental course in at least a portion of the predisposed infants.⁹ Recognition that infants with RD are probably hard-wired for sensory irregularities may help parents and other caregivers to understand that the child needs specific sensory input on a daily basis.

Who can diagnose this disorder?

A team including an infant psychiatrist, occupational therapist, speech-language pathologist, and developmental psychologist is essential for an accurate differential diagnosis, assessment, and treatment suggestions. Team members can provide the following:

- Infant psychiatrist. An overall assessment, with a specific focus on a relational and social-emotional assessment. The psychiatrist can also establish grounds for the diagnosis and rule out sleep disorders and feeding disorders in isolation, along with other developmental difficulties, such as autism spectrum disorder.
- Occupational therapist. A focused assessment of sensory, motor, and perceptual and early cognitive skills, as well as self-help activities, social interactions, and play skills.
- Speech-language pathologist. Assessments of expressive and receptive language, and identify communication deficits and social pragmatic language.
- Developmental psychologist. An assessment of the child's overall cognitive skills and define difficulties

that may be linked with a communication deficit.

While it is essential that *all* clinicians working with young children be able to identify RD, a multidisciplinary team is best qualified to provide a firm diagnosis of this condition and make ensuing recommendations.

Assessment

Parental reports of an infant's difficulties may not be clinically objective, but the parents' information does provide some context and a history of the child's problems, a description of what happens and when with the child, and a perspective on how the family is functioning. Parents are often as distressed in their responses to their child as their child is from his or her own sensory responses. The parents may have suffered from disrupted sleep for months, or their attempts to respond to their child's needs may mean they are stuck with very rigid routines that lessen their enjoyment of parenting. Building rapport and taking a clinical history in an unhurried manner will provide support and acknowledge the parent's perceptions.

Clinicians should use clinical guidelines rather than subjective experience when assessing a crying, fussing baby (an infant RD behavior frequently described by parents). Crying for more than 3 hours a day for 3 days in a week is considered excessive.⁶ Similarly, agitated behavior marked by less vocalization and more motor activity and a lack of response to soothing is considered indicative of dysregulation. Knowledge of the age-appropriate developmental sequences of activity levels and attention can guide decisions related to the intensity of these symptoms.

After recording a careful history, the clinician should observe the infant and caregiver on at least three different occasions in different contexts. This

practice can yield important objective information about the frequency and pervasiveness of dysregulated behaviors, sensory response patterns and context, and stressors that perpetuate the infant or child's problems. This assessment process should be used by all diagnosing clinicians. Enlisting

Treatment

Therapeutic approaches may focus on the child or the parent and child. Treatment may also include direct education of parents, caregivers, and educators. Thoughtful consideration of the need for medication may be necessary, along with an assessment of the child's

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the aid of a community health nurse or preschool teacher to describe behaviors in school and home settings can help provide important additional information.

In addition to carefully orchestrated multidisciplinary observational assessments, standardized tools can assist in the process of diagnostic clarification. The following assessment tools use parent reports and focus on the child's daily living skills, sensory responses, and problem behaviors:

- The Infant/Toddler Symptom Checklist¹⁰
- The Sensory Profile¹¹
- Dunn's Quadrant Model¹²
- The Temperament and Atypical Behavior Scale (TABS)¹³

ecological fit with his or her environment (see Ecological fit, below, for more information). Finally, ongoing follow-up will be an essential component of effective treatment.

Child-focused therapies

Sensory integration therapies help parents to understand and respond to the sensory needs of the child. Dunn's Sensory Profile assessment and Quadrant Model can be used to classify children who are poor registrants, sensation avoidant, sensation seeking, and sensitive to stimuli, and can be used to construct individualized sensory interventions.^{11,12} An occupational therapist with training in sensory integration can provide treatment and suggest additional approaches to address

social skills, improve parent-child interactions, and increase the child's self-esteem.

Experiential therapies involve the parent and a trained therapist providing cognitive "bridges" and structure to help the child shift his or her behavior and expand his or her skills in play situations and interactions with others.

Specific social interventions, such as the Floortime approach developed by Stanley Greenspan and Serena Weider, may help children who are withdrawn.¹⁴

Parent-child-focused therapies

Infant-parent psychotherapy helps parents to understand their own emotions and their child's characteristics, and how these factors affect their parenting skills.

Parent-infant interaction guidance uses family play experiences to help develop an understanding of the child's behavior and development.

Infant-led guidance using intuitive approaches helps parents to understand and respond to the direct and indirect cues given by the baby.

Short-term dynamic psychotherapy provides a brief intervention to resolve any core conflict that is upsetting the parent-child relationship. Such therapy might be used to help parents who perceive their children as deliberately trying to make them angry.

Education and skill development for parents and educators

Help for parents in managing the child's overt behaviors is especially important. The dysfunctional behaviors demonstrated by the child are usually related to sensory-input responses. Rigid behaviors often develop and are used to quell anxiety or compensate for a lack of social skills and awareness of others in their environ-

ment. Infants and toddlers in particular need support and understanding when they are not able to cope with transitions, or conform to socially accepted behaviors due to sensory integration difficulties. Guidelines in managing aggressive and oppositional behaviors are also helpful for parents, since these types of behaviors in particular result in rejection of the child and family from involvement in community and school activities. The 1994 *DC: 0-3* diagnostic system⁸ identifies parenting styles that may be helpful to children with RD. For example, hypersensitive children who are fearful/cautious may need caregiver patterns that enhance flexibility and assertiveness, whereas hypersensitive children who are negative/defiant may need caregiver patterns that enhance flexibility but do so through soothing empathic support of gradual change and avoidance of power struggles. Family therapists who have skills in child behavior management strategies and a willingness to learn about the effect of RD upon a child's behavior are a good treatment resource.

Individual instruction and support groups for parents serve both an educational and supportive purpose. For parents who themselves have various sensitivities, dyadic instruction with clinical team members is a preferred mode. It is important to help parents understand how normal progression of emotional, behavioral, and sensory integration occurs. Both print information and electronic resources such as web sites can provide help for parents and can be offered in group or one-to-one settings.

At BC Children's Hospital, we continue to facilitate groups for parents of children with RD. Using psycho-educational principles, we give the parents current research and treatment information about the disorder, address empowering parents and

strengthening the parent-child relationship, as well as provide an opportunity for stressed parents to vent their frustrations and gain support and learn management strategies from other parents in similar situations.

Education of educators needs to occur before the child enters school, since the school system poses many challenges for a child with RD and his or her family. A collaborative and informed group of parents, teachers, and school support personnel can more easily develop adaptations and responses within classrooms, playgrounds, and the school building.

Medications

Medication can help some children with RD to manage their behaviors when these are at their most extreme. Judicious use of medications is important because RD in preschoolers can mimic ADHD and emotional outbursts can be seen as aggressive tendencies, resulting in early social isolation.¹⁵ Several researchers have remarked on the hyperkinesis in children with RD. However, the sensory integration and self-regulation dysfunction that may be contributing to the hyperactive behaviors cannot always be helped with medications.

Ecological fit

The child's environment (ecology/context) may consist of home, day care, or preschool, and various other places. It may contain extended family members, community members, and teachers. The match between what these places and people can provide to meet the needs of the child is known as ecological fit. All of the caregivers need to be aware of the quality of the fit. They also need to agree on management strategies for the child with RD, since confusion and disorganization of the adults in the child's life can prove harmful for the child's develop-

ment. Uncoordinated care can also lead to sharing of misinformation and misperceptions, misdiagnosis of the condition, and inappropriate use of medications.

For instance, a child who refuses to have anything solid at the preschool snack time should not be pushed to conform to snack routines until possible reasons for the child's responses to the preschool environment have been taken into account (oral or tactile sensitivities, change of eating routine, anxiety caused by sensory reactions to a noisy school setting, or loss of a secure parental base). After ecological fit is considered, alternate ways of addressing this behavior can be explored, using the nutritionist and the occupational therapist as consultants.

Follow-up

Treatment of regulation disorders does not end with the initial interventions led by trained professionals or by use of medications. Vigilant interdisciplinary follow-up is essential and provides an ongoing evaluation of the child's developing capacities. Tracking over time allows observations of how the child manages regulation of different stimuli, sensory cues, and organization of motor and behavioral skills as he or she responds to increasing expectations for competence and self-management within his or her family and the community.

Case history

The preceding information about assessment and treatment is best illustrated by the case history of Jane, who was 4½ years old when she was brought to the BCCCH Infant Psychiatry Clinic.

Jane first came to the clinic when her behaviour at preschool was perceived as persistently aggressive (despite her pleas that she didn't mean to

hurt the other children). This resulted in her peers rejecting her, her teachers being confused about the origins of her behaviors, and her parents feeling desperate and helpless when dealing with their daughter.

Jane's prenatal development and birth were unremarkable, with no obstetric difficulties and full-term gestation. From the beginning, she was persistently fussy and unhappy (behavioral). She needed to be held and rocked in a vertical position almost constantly (motor, sensory). Behaviors that mimicked severe colic would disappear if she was taken for a car ride (sensory: vestibular, auditory). She had difficulty nursing so she was switched to formula early on, but no formula could give her full satiation. She looked miserable both before and after feeding (physiological). If she was fed in a soundproof darkened bedroom (sensory: auditory, visual) her feeding improved. Attempts to wash her hair or take her out of the bath (which she loved) led to screams. Her clothes had to be lightweight, soft, and fleecy and without foot or hand coverings (sensory: tactile).

If Jane had been assessed as an infant, a psychiatrist would have considered whether her sensory, motor, and physiological responses were but one facet of a disturbed parent-child relationship. The most appropriate parenting style for Jane would have been explored to help her to self-soothe more efficiently. Strategies would have been suggested by an occupational therapist to decrease the intensity of sensory responses.

As a toddler, Jane demonstrated increasing and impulsive motor activity along with some motor clumsiness—falling and having an unsteady gait and little interest in manipulative toys (behavioral, motor). She continued to be resistant to wearing many clothes, having her nails cut, or brush-

ing her teeth (sensory: tactile). She was late to eat solid food and restricted her food intake to items with a particular texture (sensory: tactile). Temper outbursts were frequent and the cause unpredictable (behavioral: affect).

If Jane had been assessed as a toddler, a psychiatrist would have completed a differential diagnosis to determine if she had early ADHD symptoms. An occupational therapist would have completed the sensory profile and helped develop strategies for dealing with motor and sensory issues in conjunction with the treating psychiatrist. If language or cognitive problems had been observed, a speech-language or psychological assessment would have been completed.

When Jane entered preschool her teachers noted that she did not like to play in sand or to use glue or finger-paints. She did not like noisy toys or the singing circle. She was very active—often running around the classroom and singing to herself (motor, sensory: tactile, auditory). These restricted play choices began to limit her social interactions. She only shared toys if children approached her from a particular angle (sensory: visual, perceptual). If a child approached her suddenly, she responded as though that child had been aggressive toward her (behavioral). She hugged children very intensely and at times seemed to deliberately run into them (sensory: proprioception). Jane developed one friendship and enjoyed playing imaginative games with this child. Preschool teachers did not have concerns about her memory or general cognitive development. At home, Jane ate only mushy foods such as pasta, soft bread, and potatoes and other foods that had a very bland flavor and smell (sensory: tactile, olfactory, gustatory). She often ran around the house and threw pillows or jumped on sofas and beds (behavioral, motor, sensory: vestibular).

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When Jane was finally assessed at the clinic as a preschooler, her parents had already made many adaptations to her unique responses. However, they felt demoralized and condemned by other parents as “inadequate” and contributing to Jane’s erratic behaviors. The psychiatrist diagnosed Jane as having RD, took a long-term perspective in assessing whether Jane demonstrated symptoms of ADHD, educated the parents about the condition and about behavior management strategies, and gave support to the parents. Referral was made to a nutritionist to ensure that Jane’s food intake was adequate and to reassure the grandparents who were very critical of Jane’s eating habits. Occupational therapy was commenced to help with fine and gross motor skill development and visual perceptual skills, and to develop strategies for management of her sensory and attention issues. Medication information was shared with the parents, although a decision to use medication was put off until environmental modifications and behavioral interventions had been tried. An important strategy was consultation and monitoring by members of the multidisciplinary team to ensure that Jane’s school integration was a success.

Jane may be a child who outgrows her symptoms or learns to manage them effectively so that they no longer interfere with her life, or she may be a child who later receives a diagnosis of ADHD. Either way, the early intervention and continued loving care of her family will increase her ability to reach her own potential.

Conclusions

By being alert to the possibility of regulation disorders of sensory processing within clinical settings, health professionals can facilitate early diagnosis of infants and young children

and can initiate interventions that increase the child’s developmental potential.

Medical and educational professionals need to develop an integrated awareness of the emotional, behavioral, physiological, and sensory capacities of the child with RD over time and to maintain ongoing assessment and treatment from infancy to early school age. They need to both educate and support parents about RD, as they emphasize the child’s strengths and encourage acceptance of the child’s limitations. An additional role for medical practitioners is to participate in health policy decisions that ensure adequate resources and funding for parents and those who work with these challenging and unique children.

Competing interests

None declared.

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