

Assessment of sensory, emotional, and attentional problems in regulatory disordered infants

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IN RECENT YEARS, growing attention has been directed to the clinical importance of fussy or difficult behaviors in infants. Two lines of investigation currently are contributing to the understanding of these behaviors. One view integrates clinical and theoretical perspectives. Greenspan¹⁻³ described infants with homeostatic and regulatory disorders and postulated that they are at risk for specific types of psycho-

pathology and learning difficulties. The other view has focused on temperament as an important variable that affects a child's behavioral style.⁴ Infants with difficult temperament have been described as reacting negatively to social interactions,⁵ to demonstrate aggressive and conflictual behaviors at 2 year of age,⁶ and to display a heightened reactivity to negative environmental overstimulation such as noise confusion.⁵ The etiology of difficult temperament has often been debated; however, studies of parental personality and home environments have found that these variables do not seem to influence difficult temperament,⁷ thus supporting the notion that there are distinct infant characteristics that account for difficult behaviors.

Research investigating the clinical significance of negative temperamental characteristics has been limited, primarily due to the heavy reliance on parent report measures and lack of reliable and valid observational techniques.^{8,9} Although some constitutionally based traits are transient in nature and resolve once the child develops internal self-organizational mechanisms,¹⁰ other traits are not transient. The developmental histories of preschool and school-aged children with learning and perceptual difficulties often include an early history of difficult temperament including symptoms such as irritability, poor self-calming, and sensitivity to touch.¹¹ Similarly, it has been reported that infants with early sensorimotor deficits, particularly hypersensitivity to stimulation, developed emotional difficulties in the school-age years.^{12,13} Additionally, negative temperamental traits (eg, distractibility, difficult temperament) in infancy have also been linked with reactive depression in late adolescence.¹⁴

Recent theorists view constitutionally based individual differences as reflecting individual reactivity and self-regulatory processes.^{15,16} Many young infants' problems in attaining homeostatic functions resolve with maturity. For example, infants frequently display sleep disturbances or colic that resolves spontaneously by 5 or 6 months of age. At the same time, there is increasing interest in infants older

than 6 months who exhibit fussiness, irritability, poor self-calming, intolerance for change, and a hyperalert state of arousal. Using Greenspan's¹⁻³ clinical constructs, these infants recently have been recognized as regulatory disordered.¹⁷ Often these infants are hypersensitive or hyposensitive to sensory stimuli including auditory, tactile, visual, and vestibular stimulation.¹⁸ Regulatory disordered infants are commonly observed in clinical practice and exhibit deficits in psychological processes (eg, sustained attention) and physiological organization (eg, lack of appropriate physiological suppression to cognitive or sensory challenges).¹⁷ It has been suggested that disorders of regulation involve maladaptive responses to early organization of sensory and affective-thematic experiences.¹⁹

Research has substantiated that difficult or fussy infants have different behavioral and psychophysiological profiles¹⁸; however, there is virtually no research investigating the clinical significance of these negative characteristics. Therefore, a series of clinical studies of regulatory disorders was initiated. An initial study of the psychophysiological characteristics of regulatory disordered infants revealed that as a group, the sample did not differ significantly from their normal counterparts at 8 to 11 months of age; however, the regulatory disordered infants tended to have higher baseline vagal tone with a lack of suppression of vagal tone during sensory and cognitive stimulation.¹⁸ This finding suggests that some regulatory disordered infants have difficulty regulating autonomic nervous system functions and have physiological hyperreactivity to environmental stimulation.

A longitudinal study was recently conducted to investigate the long-term significance of fussy babies diagnosed as regulatory disordered at 8 to 11 months of age (DeGangi GA, Porges SW, Sickel R, Greenspan SI. June 1990. Unpublished data). These infants exhibited sleep disturbances, hypersensitivities to sensory stimulation, irritability and poor self-calming, and mood and state deregulation. Examination of group differences revealed that children initially identified as regulatory disordered differed significantly from their normal peers in perceptual, language, and general cognitive skills at 4 years of age. Although the regulatory disordered sample did not differ from their normal counterparts in developmental parameters during infancy, at 4 years of age, five of the nine regulatory disordered infants displayed either motor or overall developmental delays. A high incidence of vestibular-based sensory integrative deficits (eg, poor bilateral coordination and postural control), tactile defensiveness, motor planning problems, hyperactivity, and emotional and behavioral difficulties were present in the regulatory disordered population. The findings imply that regulatory disordered infants are at high risk for later perceptual, language, sensory integrative, and behavioral difficulties in the preschool years.

DEVELOPMENT OF REGULATORY PROCESSES

The early regulation of arousal and physiological state is critical for successful adaptation to the environment. The development of homeostasis is important in

the modulation of sensory reactivity, emotional responsivity, and attentional capacities.²⁰⁻²⁴ The foundations of self-regulation lie in the infant's capacity to develop homeostasis in the first few months of life when the infant learns to take interest in the world while simultaneously regulating arousal and responses to sensory stimulation.¹⁹ Self-regulatory mechanisms continually develop and refine over the first two years of life. Some of the important milestones include the formation of affective relationships and attachments, purposeful communication, an understanding of causal relationships, and development of self-initiated organized behaviors.

It is generally recognized that self-regulatory mechanisms are complex and develop as a result of physiological maturation, caregiver responsivity, and the infant's adaptation to environmental demands.²⁵ In the early stages of development, the caregiver soothes the young infant when distressed and facilitates state organization.²⁶ As the child develops, the caregiver attaches affective meanings to situations and provides social expectations and values related to specific emotional responses.²⁷ The development of action schemes (eg, vocalizations, self-distractions, or other motor responses), cognitive organization (eg, representational thinking, self-monitoring) and motivation, and external support from caregivers have been proposed as key elements in attainment of emotion regulation, a key element in the development of self-regulation.²⁸

SYMPTOMS OF REGULATORY DISORDER

A regulatory disorder is defined by persistent symptoms that interfere with adaptive functioning. Typically, the regulatory disordered infant displays problems in sleep, self-soothing, feeding, arousal, mood regulation, or transitions. Some infants may exhibit minor transitory difficulties in any of these areas due to maturational difficulties or parental mismanagement.

An initial investigation of the epidemiological factors related to regulatory disorders examined the perinatal and medical histories of 27 regulatory disordered infants and 59 normal infants. The presence of frequent headaches during the pregnancy ($\chi^2 = 4.66, p < .05$) and the wrapping of the umbilical cord around the infant's neck during delivery ($\chi^2 = 10.25, p < .01$) occurred in a high proportion of the sample of regulatory disordered infants. The presence of headaches during pregnancy may reflect stress or anxiety in the mother. Medical diagnoses of eating problems ($\chi^2 = 4.05, p < .05$), elimination problems ($\chi^2 = 5.34, p < .05$), colic ($\chi^2 = 10.24, p < .01$), and frequent colds ($\chi^2 = 6.74, p < .01$) were present as well in the regulatory disordered sample (DeGangi GA. June 1990. Unpublished data).

Sleep disturbances

A large number of children with regulatory disorders have difficulty regulating sleep-wake cycles. Persistent sleep disorders have been found to result in bio-

chemical changes in stress hormones and biological rhythms and in states of arousal.²⁹ Fussy and irritable behaviors may occur during the day because the infant is overtired and unable to fall and stay asleep. Some sleep disorders are physiologically based, while others result from parental mismanagement. Children with sleep deficits exhibit a high state of arousal and are unable to inhibit their alert state to allow for sleep. Sometimes the child is not able to fall into a deep rapid eye movement sleep and wakes frequently throughout the night.

Difficulty self-consoling

Most infants can self-calm by bringing their hand to their mouth to suck, touching their hands together, rocking, or looking or listening to preferred visual or auditory stimuli. These behaviors are often unavailable to regulatory disordered infants. Once upset, the infant requires extreme efforts to calm down. The caregiver may spend from two to four hours a day attempting to calm the infant. With older infants, severe temper tantrums are often present.

Feeding difficulties

The feeding problems exhibited by the regulatory disordered infant usually include difficulty establishing a regular feeding schedule, distress related to feeding including regurgitation, refusal to eat, and other feeding problems not related to specific allergies or food intolerance. Resistance to eating a variety of food textures often emerges after nine months. Some infants spit out lumpy food or refuse to eat anything but a few preferred foods, usually with firm and crunchy or pureed textures. Occasionally growth retardation or failure to thrive may be diagnosed secondary to the feeding disturbance.

Hyperarousal

Along the continuum of sleep disturbances is the problem of hyperarousal. Many regulatory disordered infants become very disorganized during the transition from one activity to the next. Strong reliance on routines and constant need for structure are common problems. A common characteristic of hyperarousal is a high need for novelty and distractibility to sights, noise, or movement. Some regulatory disordered infants notice details in the environment that are not normally noticed. The infant may appear overwhelmed by sensory input and may cry or avert his or her gaze to avoid contact. Parents often describe their infant as intense, wide-eyed, or "hyper." Frequently the child will go from one toy to another, often not playing with any toy long enough to develop a toy preference.

Mood lability

The most pervasive traits of the regulatory disordered infant are fussiness, irritability, an unhappy mood state, and a tendency to quickly escalate from contentment to distress. Often the parents are unable to determine what causes the fussiness. Maternal perception of difficultness may be confirmed through the use of temperament scales (eg, Bates' *Infant Characteristics Questionnaire*, fussy-difficult subscale³⁰). When the parents do not view their child as difficult despite clinical evidence of mood deregulation, further investigation is needed to determine if such problems as parental inexperience, denial, or maternal depression exist. In many cases, the fussiness and irritability are very disruptive to the family and result in a high degree of family stress.

ASSESSMENT STRATEGIES

An expanded model of assessment should include three stages: (1) evaluation of infant performance in sensorimotor and regulatory processes affecting functional learning and behaviors, (2) incorporation of parental observations regarding the influence of an infant's behaviors on his or her functioning within the family and home environment, and (3) examination of parental characteristics (eg, personality dimensions, interaction styles) and parental availability to be involved in the assessment and treatment process.

The intake interview

The diagnostic process begins with a comprehensive intake interview conducted by a child psychiatrist and a pediatric nurse to evaluate parental concerns and parental perception of the child. The interview is useful in determining the presence of primary or secondary parental emotional problems, marital conflicts, or other contributing factors that may affect the parent-child dyad. The parent's presenting concerns are assessed through the use of a comprehensive symptom checklist that contains questions related to sleep, self-calming, feeding, sensory responses (ie, touch, movement), communication and language, and emotional responses. The checklist is structured in such a way that it is possible to determine the extent of the problem and changes in behavioral patterns over development. In addition, the *Parenting Stress Index*³¹ is administered to provide a measure of child characteristics (eg, adaptability, demandingness) and dimensions of parent stress (eg, depression and sense of competence).

The home visit

A home visit is conducted by a pediatric nurse to observe characteristics of the home environment, resources available to the family, and any particular life styles

or cultural values that may affect the family's management of their difficult child. The child's behaviors, as well as mother-child interactions, are observed in the familiar setting of the home. In addition, further parental concerns can be ascertained. Parents often feel free to discuss personal issues that may affect their relationship to the child in the security of their home.

Clinical assessment of the fussy infant

A comprehensive diagnostic assessment is conducted to evaluate constitutional factors that may contribute to the child's regulatory difficulties. Instruments are used to provide five different types of information related to the development of infants, toddlers, and young children with regulatory difficulties:

1. sensory processing and reactivity, including measures of responses to touch, movement, tactile discrimination, and adaptive motor functions, evaluated with the *Test of Sensory Functions in Infants*³²;
2. sustained attention, including the ability to initiate and hold interest in novel tasks;
3. mother-infant interactions during symbolic and sensory play activities, evaluated with the *Greenspan-Lieberman Observation Scale (GLOS)*³³;
4. developmental cognitive and communication skills, evaluated with the *Bayley Scales of Infant Development* mental scale³⁴; and
5. physiological responses using cardiac vagal tone³⁵ (eg, the interaction of the rhythmic component of the heart rate pattern, transitory respiratory changes), a potential index of the quality of arousal and attentional responses.

DIFFERENTIATION OF TYPES OF REGULATORY DISORDERS

Using the information derived from the intake interview, symptom checklist, home visit, and various diagnostic tests, the child's adaptive developmental mechanisms, organizational behaviors, and regulatory difficulties can be described. A "neurobehavioral" model, originally developed by Porges,³⁵ is useful in explaining the different types of regulatory disorders. Four levels of regulatory disorders have been delineated based on the level of organizational mechanisms available to the child. In addition, a distinct category has been defined to explain the "late regulator," or the infant with transitory regulatory difficulties.

Level 1 represents basic organization of physiological and sensory systems. It refers to the infant's capacity to regulate a rhythmic heart rate and respiration pattern and his or her ability to register sensory inputs (eg, basic perception of touch, movement, sound, and sights). A disorder at this level would involve a severe developmental disorder with dysfunction of major neurological and sensory functions (eg, blindness, profound retardation).

Level 2 reflects the dynamic coordination of physiological and sensory systems and provides the basis for homeostatic functioning. Functions at this level involve arousal or alertness to stimuli and coordination of respiration and heart rate needed for state control or basic information processing. Intersensory integration, such as the capacity to organize inputs from two or more sensory channels (eg, visual and tactile), occurs at this level.

Severe and persistent regulatory disorders are observed when developmental processes are compromised at this level. Such disorders include significant sleep and state control problems (eg, hyperalertness to sights, noises, touch) and severe behavioral distress (eg, high degree of irritability). The child is unable to self-soothe or to internalize soothing experiences from the caregiver. Symptoms include extreme hypersensitivity to sensory stimulation and inability to synthesize sensory inputs from two or more modalities (eg, visual-tactile integration). As a result, difficulty tolerating touch and movement from the caregiver and inability to explore objects through the senses are common. Physiological deregulation may occur, causing the child to be hyperactive to incoming stimuli. Hyperactivity and attentional deficits may result as well.

Level 3 represents the infant's ability to organize overt behaviors in response to environmental stimulation and involves his or her capacity to organize psychological processes in noncontingent situations (eg, manipulation of objects in play). An infant with a level 3 regulatory disorder is unable to develop self-regulatory mechanisms and relies strongly on other-regulation (eg, structure from the caregiver, routines). The infant may be able to be soothed by others, but he or she can only remain regulated as long as the mother or caregiver provides this input. Hypersensitivities are often present but are less pervasive than those observed at level 2. For instance, the child may learn to use one particular sensory channel to develop self-soothing (eg, rocking), but the child may overuse the behavior, weakening its capacity to soothe the child. The infant displays a very limited range of adaptable behaviors and intense frustration. Play behaviors tend to be stereotypic and show little diversity (eg, banging or mouthing objects rather than engaging in symbolic play). When presented with a challenging situation, the child may lack the problem-solving ability needed to develop strategies to act effectively on the object.

Level 4, the highest level of organization, reflects the infant's ability to integrate and respond to contingent events and situations. This level is highly dependent on the infant's capacity to regulate affective expression and to respond to social interactions adaptively. The level 4 regulatory disorder is manifested in high reactivity to affective or social situations. The child may respond aversely to affective expressions from others. For instance, the parent may find that raising his or her voice to discipline the child even slightly provokes a temper tantrum. As a result, parents often find it very difficult to set limits. The child has a high need for

Table 1. Types of regulatory disorders

Neurobehavioral level of development	Type of regulatory disorder
1. Basic organization of physiological and sensory systems	Severe sensory or developmental disorder
2. Dynamic coordination of physiological and sensory systems; basic homeostatic functions	Persistent and severe regulatory disorder with sensory hypersensitivities, mood and state deregulation; difficulties utilizing regulation from others
3. Organization of overt behaviors in noncontingent situations	Mild to moderate regulatory disorders; ability to utilize regulation from others; may be able to use one sensory regulatory mechanism
4. Organization of contingent responses in social situations	Affective and mood deregulation with or without sensory component

predictability and structure in the environment and resists changes in routine or new challenges. Often the child exhibits extremes in moods with a limited range of affective modulation.

Children who do not necessarily fit the classic picture of regulatory disorders are termed "late regulators." The child's affect changes from an unhappy, unsettled state to a happy and content state once the child masters a developmental challenge such as crawling, walking, or talking. The late regulator's need to be in charge or to be his or her own self-regulator seems extremely important. A discrepancy or unevenness in development seems to cause the child to be frustrated or unhappy, but once development levels, the child self-regulates. Generally, the late regulator is highly intense and overreactive to the environment but not hypersensitive to sensory stimulation. Table 1 presents the author's working model of the types of regulatory disorders.

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Disorders of regulation appear to be based in problems associated with sensory processing, communicative intent, state control and arousal, physiological regulation, and emotion regulation. Identifying infants with regulatory difficulties is crucial in light of recent research suggesting that this group of infants is at high risk for later perceptual, language, sensory integrative, and emotional and behavioral difficulties in the preschool and school-age years.

During infancy, the regulatory disordered infant is often normal in developmental skills; however, difficulties are apparent in behavioral organization and adaptive functioning. A comprehensive assessment of the regulatory disordered infant

should include measures of sensory processing, mother-infant interactions during play, sustained attention, communication, and physiological responses. Parent characteristics (eg, personality dimensions, interactional styles) and the parent's availability to be involved in the assessment and treatment process need to be addressed.

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Use of parent-completed developmental questionnaires for child-find and screening

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COMPLETION OF developmental questionnaires by parents of infants and young children is a promising strategy to improve current child-find and screening systems. Public Law 99-457 requires that comprehensive child-find systems be developed and that systematic screening of infants for early identification be undertaken. One potentially effective and economical way to meet these specifications is through parent involvement in the developmental assessment of their children. The Revised Parent Developmental Questionnaire (RPDQ),¹ the Infant/Child Monitoring Questionnaires (ICMQ),^{2,3} and the Revised Denver Prescreening Developmental Questionnaire (RDPDQ)⁴ are all examples of parent-completed questionnaires currently used in child-location programs and for developmental screening in medical offices.

This article reviews the advantages of involving parents in the developmental assessment of their infants and children and outlines guidelines for eliciting valid and reliable information from parents. Current tools are reviewed, and examples of their implementation in child-find and screening programs are described.

WHY USE PARENTS?

Parental input in screening and assessment systems for infants and toddlers is advantageous for several reasons. First, parents possess information often unavailable to professionals, such as developmental histories, personality characteristics, social-emotional adjustment, and functioning in the home environment. Parents witness a larger sample of their children's behavior than is observed in a classroom, clinic, or assessment situation. Information from parents assists in providing a comprehensive picture of the children and enhances the validity and reliability of a developmental assessment, especially for very young children. Multisource assessments, with information contributed by parents and family