**THE IMPORTANCE OF EMOTION IN ADHD**

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Sources:


**OBJECTIVES**

- Briefly review the nature of emotion and emotional self-regulation
- Discuss the 7 lines of evidence for the important role of emotional impulsiveness and deficient emotional self-regulation in the core symptoms of ADHD
- Summarize the results of research on the impact of poor emotion regulation in ADHD on various domains of functioning in children followed to adulthood and adults with ADHD
- Discuss the implications of these findings for the diagnosis and treatment of ADHD

**WHAT IS ADHD? THE CURRENT CLINICAL VIEW**

A disorder of age-inappropriate behavior in two neuropsychological domains:

**Inattention**
- Poor persistence toward goals or tasks
- Impaired resistance to responding to distractions
- Deficient task re-engagement following disruptions
- Impaired working memory (remembering so as to do – what is to be done)

**More on ADHD THE CURRENT CLINICAL VIEW**

Hyperactivity-Impulsivity (Inhibition)
- Impaired verbal and motor inhibition
- Impulsive decision making; cannot wait or defer gratification
- Decreased valuing of future (delayed) consequences over immediate ones
- Excessive task-irrelevant movement and verbal behavior
- Fidgeting, squirming, running, climbing, touching
- Restlessness decreases with age, becoming more internal, subjective by adulthood

**EMOTIONAL SELF-REGULATION**

- Retirement Pension: State of Massachusetts (UMASS Medical School)
- Speaking Fees Received From (for 2010):
  - Puerto Rico Association of Pediatricians (San Juan)
  - Canadian Attention Deficit Disorders Resource Alliance (Toronto)
  - Region V School District of Houston, TX
  - PACER Center (Minneapolis, MN)
  - Berkshire Area Health Education Cooperative (Pittsfield, MA)
  - Association of Educational Therapists (Los Angeles, CA)
  - Premier Education Solutions (PESI, Eau Claire, WI)
  - Texas A&M University
  - American Professional Society for ADHD and Related Disorders (APSARD)
  - Southern Connecticut State University
  - Fitchburg State College
  - University of South Carolina Medical School – Pediatrics Dept.
  - Springfield School – Cincinnati, OH
  - Macon County Mental Health Center
  - The Lovett School – Atlanta, GA
  - Premier Educational Seminars, Inc. (PESI)

Royalties:
- Guilford Publications (books, videos, newsletter)
- Jones & Bartlett Publishers (books & products)
- J & K Seminars (videotapes), New England Educational Institute (audiotapes), PESI (CDs)
- ContinuingEdCourses.net (internet CE courses)

Speaker/Consultant/Expert Witness for these Pharmaceutical Companies:
- Eli Lilly, Shire, Janssen-Cilag, Janssen-Ortho, Janssen-Cilag, Novartis
WHAT IS AN EMOTION?

✓ A relatively short-duration change in our intentional state that entrains changes in behavior, cognition, subjective experience, physiological arousal, and motivation
✓ Emotions usually comprise 3 elements:
  ✓ Approach – withdrawal actions & cognitions (Action Gradient)
  ✓ Opportunity vs. threat (intention vs. appraisal)
  ✓ Reinforcement – punishment (Motivational Gradient)
✓ Desires vs. fear, commitment vs. frustration
✓ Physiological activation (intensity) (Biological Gradient)
✓ Emotions serve various functions
  ✓ Corrective: Feedback concerning goals and current actions toward them that serve to initiate self-corrective action as needed
  ✓ Communicative: Signals intention to others
  ✓ Cathartic: Expressive -- physiological release & habituation


WHAT IS EMOTIONAL SELF-REGULATION?

1. Ability to inhibit inappropriate behavior related to strong negative or positive emotion (response suppression)
2. Self-soothe and down-regulate physiological arousal related to #1 above
3. Refocus attention from the emotionally provocative events (distraction & reappraisal)
4. Organize emotions for coordinated action in the service of goals and long-term welfare


GROSS’ PROCESS MODEL OF EMOTION

Sequence of an Emotional Response

Situation → Attention → Appraisal → Response

Feedback Loop

Enhance or Prolong

Self-Calm, Distract, Re-Appraise, Leave, or Otherwise Down-Regulate

Create a Competing Emotional Response

Humans vary in their emotional sensitivity – the speed, intensity and prolongation of their primary emotional reactions – it is largely biological in origin

Adapted from Figure 2.1, Koole, S. L. et al. (2011). The self-regulation of emotion. In K. Vohs & R. Baumeister (Eds.), Handbook of Self-Regulation (2nd ed.) (pp. 22-40). New York: Guilford Press.

TWO STAGE MODEL OF HUMAN EMOTION

IF EMOTIONAL SELF-REGULATION IS DEFICIENT IN ADHD, WHAT WOULD WE EXPECT?

✓ Emotional impulsiveness (EI) – Part of Poor Inhibition
✓ Poor inhibition of inappropriate behavior related to strong emotions (weak expressive suppression)
✓ Low frustration tolerance, impatient
✓ Quick to anger and become hostile
✓ Greater emotional susceptibility, reactivity, & raw expression
✓ Difficulties self-regulating (moderating) emotional reactions to evocative events (DESR)
✓ Deficient in effortful, cognitive “top-down” regulation of induced emotions (self-soothing, refocusing attention, distraction, etc.)
✓ Difficulties inducing positive, more acceptable mood states (i.e. cognitive reappraisal, proactive situation selection/modification)
✓ Impaired self-motivation and activation (arousal) when needed to support goal-directed action


WHY MAKE EI/DESR A CORE FEATURE OF ADHD?
7 LINES OF EVIDENCE

✓ History
✓ Neuro-anatomy of ADHD
✓ Neuropsychological Models of ADHD
✓ Psychological Evidence of EI in ADHD
✓ Importance for Understanding Comorbid Oppositional Defiant Disorder
✓ Distinct Contributions of EI to Impairment in Major Activities Beyond What ADHD Predicts
✓ Clarifies Important Issues in Diagnosis and Management

EI/DES R HAS BEEN INCLUDED IN CONCEPTS OF ADHD FOR 170 YEARS

✓ 1798 – Alexander Crichton includes emotional frustration as part of disorders of attention persistence in first medical paper on attention disorders
✓ 1902 – George Still includes emotional impulsiveness and poor regulation of emotions by “moral control” in his conceptualizations of defective moral control of behavior (historical precursor to ADHD)
✓ 1960s – Clinical researchers repeatedly included symptoms of DESR in their concepts of MBD and the hyperactive child syndrome
✓ 1970 – Mark Stewart includes low frustration tolerance, quickness to anger, and emotional excitability in his description of the hyperactive child syndrome
✓ 1975 – Dennis Cantwell includes poor emotion regulation as a core feature of the hyperactive child syndrome
✓ 1976 – Paul Wender makes poor emotional control a key feature of his work on MBD in children and adults
✓ 1968 – DSM-II fails to note DESR as a feature of ADHD and it stays out of DSMs since that time

EI/DES R WOULD BE EXPECTED FROM THE NEURO-ANATOMY OF ADHD?

✓ 3-10% reduced regional volumes in these 5 regions:
  ✓ Orbital-Prefrontal Cortex (primarily right side)
  ✓ Genetics contributes to under-development of this region while acquired ADHD may be related to smaller inferior dorsolateral frontal region
  ✓ Basal Ganglia (mainly striatum & globus pallidus)
  ✓ Cerebellum (central vermis area, more on right side)
  ✓ Anterior cingulate cortex (mostly shows under-activity)
  ✓ Corpus callosum – forward aspect or splenium
  ✓ Size of this network is correlated with degree of ADHD symptoms, particularly inhibition
  ✓ No gender differences
  ✓ 2-3 year lag in brain development but achieving typical brain volumes by age 16
  ✓ Results are not due to taking stimulant medication

HUMAN BRAIN

CONSCIOUS (TOP DOWN) REGULATION OF BEHAVIOR AND EMOTION


From Scientific American Mind, July 2010, p. 61
ROLE OF NON-FRONTAL CORTEX AND ANTERIOR CINGULATE IN SELF-AWARENESS

From Scientific American Mind, July 2010, p. 62

ROLE OF THE ACC IN DOWN-REGULATING THE AMYGDALA

THEORIES OF THE NEUROPSYCHOLOGICAL NETWORKS FOR ADHD INCLUDE EMOTIONAL DYSREGULATION

- The frontal-striatal circuit: Associated with deficits in response suppression, freedom from distraction, working memory, organization, and planning, known as the "cool" or "what" EF network
- The frontal-cerebellar circuit: Associated with motor coordination deficits, and problems with the timing and timeliness of behavior, known as the "when" EF network
- The frontal-limbic circuit: Associated with symptoms of emotional dyscontrol, motivation deficits, hyperactivity-impulsivity, and proneness to aggression, known as the "hot" or "why" EF network


IEEE/DESR IS INCLUDED IN CURRENT NEUROPSYCHOLOGICAL THEORIES OF ADHD

- There are 6 EFs:
  - Self-Awareness, Inhibition, Nonverbal and verbal working memory, Emotional inhibition and self-regulation, Planning and problem-solving
  - They can be redefined as actions-to-the-self:
    - Attention to the self
    - Self-restraint
    - Sensing to the self (visual imagery & re-hearing)
    - Speech to the self
    - Emotion and motivation to the self
    - Play to the self


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EMOTION REGULATION IS A MAJOR COMPONENT IN BARKLEY’S EF THEORY OF ADHD

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EMOTIONAL SELF-REGULATION IS A MAJOR DIMENSION OF EF IN DAILY LIFE ACTIVITIES

- Self-Management to Time
  - Consideration of future consequences including those related to strong emotions
- Self-Organization & Problem-Solving
  - Self-distraction, down-regulation of emotions, using self-imagery and speech
- Self-Restraint (Inhibition)
  - Cognitive, behavioral, verbal, emotional
- Self-Motivation
  - Substituting positive goal-supporting emotions for negative goal-destructive ones
- Self-Regulation of Emotion

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SELF-MANAGEMENT TO TIME

- Research on child behavior rating scales shows elevations on subscales reflecting low frustration tolerance, anger, and emotional excitability
- Direct observation studies of emotional control during emotional eliciting events show poor inhibition of emotions and low frustration tolerance
- Recent research shows flattened profiles of parasympathetic nervous system response to emotional conditions that normally increase or decrease PNS activity – this indicates abnormal regulation of brain regions contributing to emotion regulation
- Follow-up studies of ADHD children into adulthood find the majority of EI/DESR and it is a function of persistence of ADHD
- Studies of adults with ADHD show EI/DESR symptoms in the majority (This finding was replicated recently by Surman et al., 2011 - American Journal of Psychiatry, 168, 617-623)
- ADHD and DESR co-segregate in the same families suggesting that their combination may be a familial subtype, possibly due to shared genetics in these symptom domains. (Surman et al., 2011)

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EMOTIONAL IMPULSIVITY IN ADHD

EMOTIONAL IMPULSIVITY IN ADULTS WITH ADHD

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OPPOSITIONAL DEFIAN'T DISORDER (40-80%)

- A pattern of hostility, anger, defiance, stubbornness, low frustration tolerance and resistance to authority (usually parental)
- Comprises a two-dimensional disorder
- ADHD cases are 11x more likely to have ODD**
- ADHD contributes to and likely causes ODD
- This likely occurs through the impact of the hyperactive-impulsive dimension of ADHD and its strong association with emotional dysregulation (executive dysfunction)***
- This can account for the well-established findings that ADHD medications reduce ODD symptoms nearly as much as they do ADHD symptoms

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EI/DESR EXPLAINS THE LINKAGE OF ADHD TO HIGH RISK FOR ODD


MORE ON ODD

- Some variance in ODD severity is also related to disrupted parenting
- Inconsistent, indiscriminate, emotional, and episodically vacillating between harsh and permissive (lax) consequences teaches social coercion as a means of social interaction
- Poor parenting can partly arise from parental ADHD and other high risk parental disorders in ADHD families (e.g., depression, ASP, SUDS)
- Emotional dysregulation component predicts later MDD and anxiety disorders
- Social conflict component predicts later CD

4-FACTOR MODEL OF DEFIANCE

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4-FACTOR MODEL OF DEFIANCE

- Parental Psychopathology
- Disrupted Parenting
- Child defiance and social aggression
- Family Stressors
- Child ADHD & Negative Temperament

VARIous DOMAINS OF IMPAIRMENT PREDICTED BY IMPULSIVE EMOTION

- Social rejection in children with ADHD
- Interpersonal hostility and marital dissatisfaction in adults with ADHD
- Greater parenting stress and family conflict in parents of children with ADHD; greater stress in ADHD parents
- Road rage, DUIs, and crash risks during driving
- Number of job dismissals (being fired) and workplace interpersonal problems (with co-workers and bosses)
- Dating/cohabiting relationship conflict, dissatisfaction, (and probably violence?)
- Impulse buying, exceeding credit card limit, poor credit
- Parent EI symptoms predict EI symptoms and ODD in their children

EI/DESR PREDICTS IMPAIRMENT IN MAJOR LIFE ACTIVITIES BEYOND WHAT IS PREDICTED FROM TRADITIONAL ADHD SYMPTOMS

- EI/DESR predicts impairment in major life activities beyond what is predicted from traditional ADHD symptoms

IMPLICATIONS FOR DIAGNOSIS AND TREATMENT

- EI/DESR predicts impairment in major life activities beyond what is predicted from traditional ADHD symptoms

FACTORS CONTRIBUTING TO EMOTIONAL ADJUSTMENT IN ADHD

- Core ADHD Symptoms:
  - Emotional Impulsivity
  - Deficient Self-Regulation of Emotions

- Secondary Effects of ADHD-related Failures:
  - School
  - Peers
  - Family
  - Work
  - Other Domains

- Comorbid Emotional Disorders:
  - Anxiety
  - Depression & Suicidality
  - Bipolar

- Secondary Effects of Comorbid Disorders:
  - LDs
  - ODD
  - CD & SUDS
  - OCD
  - Tics & TS
  - Sleep Problems

- Impact of Social Ecology:
  - Parenting
  - Parent Disorders
  - Family Stressors
  - Traumatic Events
  - Deviant Peers
  - School
  - Poverty

Emotional Adjustment
DIAGNOSTIC & TREATMENT IMPLICATIONS

- Don't mistake emotional impulsivity (EI) and deficient emotional self-regulation (DESR) as being the result of comorbidity or reactions to previous failure experiences -- they are central to ADHD itself.
- Don't mistake mood disorders as arising from EI-DESR.
- EI-DESR is a "top-down" deficit in regulating rational emotional responses to events probably via the L-PFC and ACC.
- Many mood disorders are "bottom-up" excessive expressions of emotions and probably of underlying amygdala-limbic system activities.
- Others may be an excessive enhancement of emotions by the EF system such as in cognitive rumination (over or excessive event appraisal).
- What is the difference? In ADHD, emotions are time limited (not moods), setting specific, rational (reasonable), provided.
- Comorbid mood and other disorders may require separate management methods targeting them directly.

TREATMENT IMPLICATIONS

- Core ADHD EI-DESR problems are improved by ADHD meds -- EI is part of HI (Inhibitory) dimension, DESR overlaps with IN (Meta-cognitive) dimension.
- Drug types may differ in their effects on EI/DESR.
- Secondary impairments from DESR on major life activities may also be improved by ADHD meds.
- Comorbid ODD may improve with ADHD meds given that 3 of its 8 symptoms are related to EI-DESR.
- Residual ODD may require behavioral parent training.
- Social ecology factors will require separate psychosocial interventions and possibly family relocation.

What is the difference? In ADHD, emotions are time limited (not moods), setting specific, rational (reasonable), provided.

Comorbid mood and other disorders may require separate management methods targeting them directly.

SELF-REGULATORY STRENGTH IS A LIMITED RESOURCE POOL

- Use of EF/SR reduces the pool temporarily.
- So Does: Stress, Alcohol, Drug Use, & Illness.

REPLENISHING THE EF/SR RESOURCE POOL

- The S-R Fuel Tank (Willpower) includes Greater Rewards and Positive Emotions, Statements of Self-Efficacy and Encouragement, 10 minute breaks between EF/SR tasks, 3+ minutes of relaxation or meditation, Visualizing and talking about future rewards before and during emotional settings, Routine physical exercise, and Glucose ingestion.
- Regular limited practice using Emotional Self-Regulation Strategies and the Willpower Pool can increase later pool capacity and improve performance in later emotionally charged settings. However, the capacity may eventually diminish once practice is terminated.

GROSS' PROCESS MODEL OF EMOTION

Self-Regulation Strategies to Modify the Emotional Response:
- Situation Selection
- Situation Modification
- Attention Deployment
- Cognitive Change
- Response Modification

Sequence of an Emotional Response

Feedback Loop

GROSS' 5 EMOTION REGULATION STRATEGIES – PROACTIVE STRATEGIES

- **Proactive Situation Avoidance:** Identify likely emotionally provocative situations and avoid or minimize participation in them.
- **Proactive Situation Modification:** When such situations cannot be avoided, examine how you might change the structure of the situation that could reduce the exposure to the provocative event (where you sit, who you sit next to, who you talk to, what alternative tasks to bring with you for self-calming, etc.).


**REACTIVE STRATEGIES**

- **Attention deployment:** Distract your attention by:
  - Looking away from the provocative stimulus
  - Focusing on some informational "cool" features of the stimulus (as a stranger might)
  - Visualizing and describing a relaxing, calming situation as an alternative
  - Counting objects in the room to yourself

- **Cognitive change:** Talk to yourself using reason, logic, and evidence to re-appraise the event downward in its significance

- **Response modulation:** Try to actively suppress the unwanted strong emotion

**ALL STRATEGIES ARE NOT EQUALLY EFFECTIVE IN CONTROLLING EMOTION**

- Strategies may activate some common brain regions yet each strategy also activates different brain regions
- Because of the neuro-anatomy of ADHD, some strategies may be more effective than others (e.g., distraction and re-appraisal may work better than emotional suppression)
- In general, the earlier in the sequence the intervention occurs, the greater the control exerted over the subsequent emotion

**CONCLUSIONS**

- Emotional Dysregulation has been a core deficit in ADHD since the beginning of its medical history
- Emotional impulsiveness arises from the disinhibited (hyperactive-impulsive) dimension of ADHD
- Deficient emotional self-control arises from the executive functioning dimension (inattention) of ADHD
- The neuro-anatomy and neuropsychology of ADHD indicate that EI/DESR must be a central part of ADHD

**MORE CONCLUSIONS**

- The psychological evidence shows problems with EI and DESR in ADHD
- Returning EI/DESR back into ADHD helps to better understand its comorbidity with other disorders like ODD
- Understanding that EI and DESR are part of ADHD helps to better understand and predict life course impairments in ADHD
- Recognizing that EI and DESR are involved in ADHD can improve diagnostic and treatment practices