Self-Regulation, Executive Functions, and Chronic Pain


Mayo Clinic  University of Kentucky
Self-Regulation

- Ability to exert control over psychological & physiological processes
  - Cognitive
    - Control thoughts, urges, impulses, make decisions, set goals
  - Emotional
    - Control feelings and moods
  - Physiological
    - Homeostatic processes, fight or flight, quiet down, replenish resources
- Any effort to control or alter internal or external, mental or physical, activities
- Essential when aiming to overcome obstacles and cope with challenges
Self-Regulatory Capacity

- Ability to self-regulate varies
- Self-regulatory strength or capacity is a limited resource that can be depleted or fatigued
Self-Regulatory Fatigue

- Decreased ability to
  - Inhibit urges
  - Make decisions
  - Suppress thoughts or emotions

- May lead to
  - Decreased ability to persist at subsequent tasks

(Baumeister et al., 1998)
Executive Functions

- Enables control and regulation of
  - Lower-level cognitive processes
  - Goal-directed behavior

- Prefrontal Cortex
  - Modify thoughts & actions
  - Execute proper behavior

EXAMPLES:
- Verbal reasoning
- Problem solving
- Planning
- Judgment
- Inhibition/Impulsivity
- Persistence
- Ability to sustain attention
Fatigue of Executive Functions

- Loss of executive control
  - Problems controlling and regulating behavior
  - Difficulties functioning in day to day life

- May lead to
  - Decreased ability to perform and persist at subsequent tasks
Self-Regulatory Fatigue & Executive Functions

Self-regulatory effort impacts:
- Overall Self-Regulatory Capacity
- Capacity for intelligent reasoning
- Performance on Cognitive tasks
Self-Regulatory Fatigue & Executive Functions

**TRAIT vs. STATE**

**TRAIT**
- Individual Differences
  - Self-regulation
    - HRV, blood glucose, personality?
  - Executive functions
    - Cognitive tasks; Cognitive flexibility, inhibition, planning, problem solving

**STATE**
- Nonconstant resources prone to fatigue
Chronic Multi-Symptom Illnesses
FMS, TMD, CFS, IBS, RA, Back pain, Headaches

- Pain, tissue damage, fatigue (Aaron et al., 2000; Bennett, 1999; Carlson et al., 1998; De Leeuw et al., 2005)

- Complex interactions
  - Cognitive
  - Emotional
  - Physiological

- Symptoms overlap
  - CFS & FMS; 75%
  - FMS & TMD; 42-75%

- Demands cross biopsychosocial boundaries
  - Exhaust self-regulatory resources?
  - Increased vulnerability to self-regulatory fatigue?
Chronic Multi-Symptom Illnesses and Self-Regulation: A Review

Pain/Illness

Individual Differences (Trait capacity)

Self-Regulatory Demands

Thought Regulation

Emotion Regulation

Social Regulation

Coping

Self-Regulatory Fatigue

Executive Functions

Solberg Nes, Roach, & Segerstrom (2009)
Self-Regulatory Deficits in Fibromyalgia Syndrome (FMS) and Temporomandibular Disorders (TMD)

- Patients with FMS & TMD (N=50)
  - FMS (N=18)
  - TMD (N=16)
  - FMS/TMD (N=16)

- Pain free matched controls (N=50)
  - Matched on age, BMI, time of day, condition

Solberg Nes, Carlson, Crofford, de Leeuw, & Segerstrom (in press)
Self-Regulation & Persistence

- Self-Regulation
  - High or Low
  - Video Clip
    (Gilbert, Krull, & Pelham, 1988)

- Persistence
  - Anagram Task
    (Solberg Nes, Segerstrom & Sephton, 2005)
Hypotheses

1. High self-regulatory effort induces self-regulatory fatigue
PERSISTENCE

Self-Regulatory Fatigue

Solberg Nes, Carlson, Crofford, de Leeuw, & Segerstrom (in press)
Hypotheses

1. High self-regulatory effort induces self-regulatory fatigue
2. **Patients have less capacity to persist on the subsequent task than controls**
PERSISTENCE

Patients vs. Controls

Persistence Anagram (seconds)

Solberg Nes, Carlson, Crofford, de Leeuw, & Segerstrom (in press)
Hypotheses

1. High self-regulatory effort induces self-regulatory fatigue
2. Patients have less capacity to persist on the subsequent task than controls
3. Patients are more vulnerable to self-regulatory fatigue than pain free controls in the same condition
PERSISTENCE
Self-Regulation & Patients vs. Controls

Solberg Nes, Carlson, Crofford, de Leeuw, & Segerstrom (in press)
Mediation by Group Differences?
Patients vs. Controls

- Baseline group differences
  - Pain
  - Fatigue
  - Anxiety
  - Depression
  - Interpersonal sensitivity
  - Positive affect

- Mediation by

PAIN
Impact of Pain on Persistence

- Main effect of pain on persistence \((p < .001)\)
- Dose-response relationship
- Also in patient groups alone \((p < .03)\)

ALL PARTICIPANTS

PATIENTS
Possible Implications

- Enhance understanding of contributing factors to the manifestations of Chronic Multi-Symptom Illnesses or Chronic Pain Conditions

- Demonstrates:
  - FMS & TMD patients suffer from SR fatigue

- Take self-regulatory resources into account when treating these conditions
Future Directions

- Expand research to other target populations
- Include more complex tasks of executive functions in order to explore relations with self-regulation further
- Develop interventions to enhance self-regulatory capacity
Self-Regulatory Fatigue and Chronic Illness; From Scale Development to Improving Self-Regulatory Strength - I
(Solberg Nes, Segerstrom, de Leeuw, Schmidt, & Carlson)

- **Self-Regulation Scale**
  - Factor analysis; 22 items (Cronbach’s α = .93)
  - Attentional Control (Cognitive)
    - “I have trouble paying attention”
  - Worry and Emotion Control (Emotional)
    - “Repeated unpleasant thoughts”
  - Hostile Aggression Control (Behavioral)
    - “Urges to break or smash things”

- **Self-Regulatory Fatigue & Pain Severity**
  - (N=980)

![Bar chart showing self-regulatory fatigue and pain severity](image)
Physical Self-Regulation
(Charles R. Carlson, PhD)
- 3-session intervention
- Enhance awareness & control
- Relaxation techniques

Pre-Post Intervention
N = 20
Conclusion

- Patients with chronic pain conditions appear vulnerable to self-regulatory fatigue.
- Likely also suffer from chronic fatigue of self-regulatory resources as a consequence of their condition.
- Impact of self-regulatory capacity or fatigue on patient populations may be more pervasive than first expected.


