Enhancing Assessment and Treatment of Challenging Behaviors in Autism using Physiological Sensors

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Objectives

1. Recognize how contextual variables can elicit a physiological response often associated with stress and anxiety.

2. Identify how physiological responses can be measured using wearable technology.

3. Describe how physiological sensors can be used as part of a functional behavior assessment and to evaluate treatment effects.

4. Explain how wearable technology can be used to self-monitor stress and cue the individual that it is time to engage in a coping strategy.
A New York State recognized Center of Excellence for the care and treatment of individuals with autism and other complex conditions.

An internationally recognized provider of, medical, clinical, educational and residential services for children and adults with complex developmental disabilities.

Located in the Sullivan County just 90 minutes northwest of New York City.

We serve 433 adults and children in our school and residential programs.
HealthE6

Environment
- Physical
- Temporal
- Social & Community

Eating
- Quality of Food
- Quantity of Food
- Timing of Meals

Energy Regulation
- Exercise
- Sleep
- Daily Rhythm

Emotional Regulation
- Emotional Self-Regulation
- Empathy
- Self-Efficacy

Evidence-Based
- Qualitative
- Quantitative
- Integrative

Education
- Individual
- Immediate Network
- Extended Network
CONTENT EXPERTS

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Neumitza Inc.
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CFD Research Faculty
Anxiety in ASD

- Many studies indicate prevalence at around 40% (e.g., Gjevik, Eldevik, Fjaeran-Granum & Sponheim, 2011, Lefer et al, 2006. Simonoff et al., 2008, Bradley et al., 2004)

- There is variability across studies, which is likely due to different samples and problems with measuring this construct in those with impaired insight and language.
Data from large scale study of adults

Medical & Psychiatric Conditions Among Adults with ASD

- Gastrointestinal Disorders: 24% higher
- Hypertension: 42% higher
- Diabetes: 50% higher
- Obesity: 24% higher
- Sleep Disorders: 117% higher
- Anxiety: 433% higher
- Depression: 123% higher

Figures are estimated in adults with ASD.

2014, Lisa Croen, Kaiser Permanente, sponsored by Autism Speaks
## Comorbid Conditions in Pediatric Program at The Center for Discovery (TCFD)

<table>
<thead>
<tr>
<th>Condition</th>
<th>TCFD n=99</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seizure Disorder</td>
<td>82%</td>
</tr>
<tr>
<td>GI issues</td>
<td>72%</td>
</tr>
<tr>
<td>Vit. D Deficiency</td>
<td>77%</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>7%</td>
</tr>
<tr>
<td>Constipation</td>
<td>78%</td>
</tr>
<tr>
<td>Seasonal / Env. Allergies</td>
<td>62%</td>
</tr>
<tr>
<td>Food/Med Allergies</td>
<td>38%</td>
</tr>
<tr>
<td>Eczema</td>
<td>39%</td>
</tr>
<tr>
<td>Aggression</td>
<td>72%</td>
</tr>
<tr>
<td><strong>Anxiety</strong></td>
<td><strong>86%</strong></td>
</tr>
<tr>
<td>Self-Injury</td>
<td>58%</td>
</tr>
<tr>
<td>Sleep Problem</td>
<td>79%</td>
</tr>
<tr>
<td>Lack of Exercise/physical fitness</td>
<td>78%</td>
</tr>
<tr>
<td>Obese / Overweight*</td>
<td>65%</td>
</tr>
<tr>
<td>Underweight*</td>
<td>29%</td>
</tr>
</tbody>
</table>

* Prior to / At Admission
2014-2015 Grant Results
Student Profiles at risk for restrictive placements

Analysis of Comorbidities

Comorbid Conditions

Anxiety 47%
Operationalizing stress and anxiety

Diagnostic overshadowing

Diagnosis problematic in those who are nonverbal, limited verbal or have poor insight

This led us to look at what is going on inside rather than sorting out based on behaviors...
Electrodermal Activity

- Electrodermal Activity (EDA) represents changes in electrical conductance of the skin as a result of sympathetic nervous system activity (Boucsein, 1992).

- Sweating is one of the first physiological responses to occur when the sympathetic nervous system is activated such as in the “Fight or Flight” response.

- The skin momentarily becomes a better conductor of electricity when either external or internal stimuli occur that are physiologically arousing.

- An EDA response can be indicative of stress/anxiety, a strong emotion, focus or biothermal regulation. Contextual information is needed to sort this out.
Stress/Anxiety and Maladaptive Behavior

- High physiological arousal can be evident in those exhibiting challenging behaviors (Moskowitz et al., 2013).

- Those who have more extreme physiological reactions to stimuli are more likely to engage in reactive aggression (Lorber, 2004).

- Higher autonomic reactivity to stressful events in aggressive children and adolescents (Patrick, 2008)

- Those in a heightened state of arousal are more likely to have more extreme reactions to environmental stressors such as noise (Donnerstein & Wilson, 1976)
Participants

- 25 students ages 12 to 21
- All presented with ASD and Intellectual Disability
  - 88% moderate or severe
  - 12% mild
- 88% had limited verbal skills or were nonverbal
- 48% were also placed residentially at the school
- 52% displayed aggressive behaviors
- 40% presented with self-injurious behaviors
Incorporating Physiological Monitoring into FBA and Treatment

The addition of physiological monitoring allows clinicians to examine:

- Physiological responses to the environment,
- Precursors to maladaptive behaviors,
- Protective factors, and
- Physiological responses to treatment.
Phase I - Deep Data

People
- Wearable sensors
- Physiological data
- Accelerometers

Environment
- Basler Cameras
- Shure Microphones
- Capture software for automated, frame-synchronized multi-camera video and audio

Technology
- Video, audio, and physiology data - synchronized within 1 sec.
- Data visualizations for intuitive clinical review
Co-regulation Impact - Stress is contagious

Aggression

Intervention

SIB

Recovery
Anticipatory Response
EDA Detection Leads to Prevention

Before
High stress response during peer’s behavior

After
Seating reconfigured to support student

Stable low stress level
Environmental Intervention

Before
High stress responses during small group lessons

After
No stress responses during station-based lessons
Phase II – From Insights to Innovation

The Goal: develop a more scalable technology that is available for parents, professionals, and children.
Neuma and TCFD
Contextual Physiology
Granularity and Patterns
Future Uses

- Scalable availability and use
- Incorporating into functional analysis
- Monitoring caregiver stress
- Group analytics
- Analysis of data for sub typing
- Live classroom dashboards
- Applicability to students with other diagnoses and general population
Thank you

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References


