Stress Management for Allied Health Professionals

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Theme of the presentation

- Understanding the underlying physiology of stress is useful in managing it.
- “If our brain was simple enough for us to understand, we would be too dumb to understand it”
## What is Stress?

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>Response</th>
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</thead>
<tbody>
<tr>
<td>– Work</td>
<td>– Physiological</td>
</tr>
<tr>
<td>– Time</td>
<td>• Autonomic</td>
</tr>
<tr>
<td>– People</td>
<td>• Central</td>
</tr>
<tr>
<td>– Conflicting demands</td>
<td>• Endocrine</td>
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<tr>
<td></td>
<td>• Respiratory</td>
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<td></td>
<td>– Psychological</td>
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<td></td>
<td>• Anxiety</td>
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<td></td>
<td>• Depression</td>
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<td>– Behavioral</td>
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</table>
Interactional Models of Stress

- Perception/appraisal
- Physiological Mediators
- Phenomenological experiences
- Responses
Nature of Modern Stressors

• Few require massive mobilization (fight/flight)
• Most involve interpersonal challenges, social hierarchies, rejection/acceptance
• Often characterized by internal rumination and worry states; anticipatory anxiety
• Strong involvement of negative or critical self-judgement
Raymond puts an end to his critical inner dialog.
Physiology of Stress

- Four most important systems:
  - Sympathetic Nervous System/Adrenal Medullary system
    - Fight/Flight/Fright
  - Parasympathetic Nervous System
    - Rest/Digest
  - Hypothalamic Pituitary System
    - Cortisol
  - Respiratory System
    - Hyperventilation
Figure 2-29

This diagram shows the pathways of the sympathetic and parasympathetic nervous systems.
The hypothalamus receives information from almost all parts of the brain including the limbic system, the emotional brain.
The hypothalamus responds to signals of stress by recruiting the **sympathetic division** of the autonomic nervous system, also called the fight or flight response.
Cortisol helps to supply cells with amino acids and fatty acids for energy supply while diverting glucose from muscles for use by the brain.

- The Stress Response
Cortisol and related compounds are sometimes used to reduce inflammation, but the concentration necessary for inflammation reduction is toxic to the body. These drugs must be carefully monitored.

-The Stress Response
The body prepares for the fight or flight response by:
1) Shunting blood from the skin and digestive organs to the muscles.
2) Providing more fuel through an increase in glucagon action, in other words, releasing glucose from stored glycogen. The hypothalamus stimulates a release of ACTH from the anterior pituitary gland to increase cortisol levels from the adrenal glands.

- The Stress Response
Figure 2-29
This diagram shows the pathways of the
Parasympathetic (PSNS) Activity

- Parasympathetic activity:
  - Decreases heart rate, polarizes cells.
  - Acts through acetylcholine, high turnover in cells means beat-to-beat regulation.
  - Acts to stabilize the cardiac membrane and re-establish homeostasis.
  - Usually exceeds SNS activity.
# Phylogenetic Hierarchy in Cardiovascular Response to Stress

<table>
<thead>
<tr>
<th></th>
<th>Chromaffin</th>
<th>DMNX</th>
<th>SNS</th>
<th>Adrenal Med</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cyclostomes</strong></td>
<td></td>
<td>↑</td>
<td></td>
<td></td>
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<tr>
<td><strong>Cartilaginous fish</strong></td>
<td></td>
<td>↑</td>
<td>↑</td>
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<tr>
<td><strong>Advanced fish</strong></td>
<td></td>
<td>↑</td>
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<tr>
<td><strong>Amphibians</strong></td>
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<tr>
<td><strong>Reptiles</strong></td>
<td></td>
<td>↑</td>
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<td>↑</td>
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<tr>
<td>**Mammals *</td>
<td></td>
<td>↑</td>
<td>↓</td>
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</tr>
</tbody>
</table>

DMNX = dorsal motor nucleus
SNS = sympathetic nervous system
NA = nucleus ambiguous

*Allows rapid regulation of metabolic output: useful in social regulation
<table>
<thead>
<tr>
<th>Stage</th>
<th>ANS Component</th>
<th>Behavioral Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>Myelinated vagus <em>(ventral vagal complex)</em></td>
<td>Social communication, self-soothing and calming, inhibit symp-adrenal-influences</td>
</tr>
<tr>
<td>II</td>
<td>Sympathetic-adrenal-system <em>(sympathetic nervous system)</em></td>
<td>Mobilization, fight/flight, active avoidance</td>
</tr>
<tr>
<td>I</td>
<td>Unmyelinated vagus <em>(dorsal vagal complex)</em></td>
<td>Immobilization, death feigning, passive avoidance, shutdown.</td>
</tr>
</tbody>
</table>
Respiratory Sinus Arrhythmia

Young female subject with strong respiratory sinus arrhythmia
Heart rate is almost constant in denervated hearts and intrinsic heart rate is ~100 bpm

Sands, KEF et al., Circulation 70:78-82, 1989
10s oscillation in heart rate

Spontaneous HR fluctuations with a period duration of ~10s.
Vagal Withdrawal: An alternative to Sympathetic Activation

Cardiac vagal tone: a physiological index of stress.

Porges SW.

Institute for Child Study, University of Maryland, College Park 20742, USA.

Cardiac vagal tone is proposed as a novel index of stress and stress vulnerability in mammals. A model is described that emphasizes the role of the parasympathetic nervous system and particularly the vagus nerve in defining stress. The model details the importance of a branch of the vagus originating in the nucleus ambiguus. In mammals the nucleus ambiguus not only coordinates sucking, swallowing, and breathing, but it also regulates heart rate and vocalizations in response to stressors. In mammals it is possible, by quantifying the amplitude of respiratory sinus arrhythmia, to assess the tonic and phasic regulation of the vagal pathways originating in the nucleus ambiguus. Measurement of this component of vagal tone is proposed as a method to assess, on an individual basis, both stress and the vulnerability to stress.
transvenous wires in the atria. RSA experiments obtained at high heart rate were chosen for adrenergic stimulation. The experiments were done at the rate of respiration (Hz) in a healthy volunteer pre-treated with bisoprolol. Respiration was timed at 0.25 Hz.

Fig. 1 Typical example of the effect of a slow infusion of atropine on systolic and diastolic arterial blood pressure (ABP, mmHg), heart rate (HR, beats/min) and amplitude (arbitrary units) and rate of respiration (Hz) in a healthy volunteer pre-treated with bisoprolol. Respiration was timed at 0.25 Hz.

with no fluctuations in spontaneous breathing amplitude. This procedure of slow atropine administration did not result in a significant change in BP.

The BP and respiration signals were digitized (500 Hz) using a 12-bit A/D converter and processed by an algorithm based on feature extraction to detect and measure the characteristics of a BP or respiration cycle (Figure 3).
Worrying about being late for an appointment. See FFT B

Driving. See FFT A
Anxiety attack while driving home
1.1.3. Respiratory Muscles

When we breathe, our chest rises and falls, and/or our abdominal area moves outward and back inward. The muscles of respiration accomplish these movements. Man uses two different sets of muscles as primary inspiratory mus-
“As a consequence of hyperventilation, the decrease in PCO$_2$ will reduce the caliber of the arteries and thereby impede the flow of blood to body tissue (ischemia), and the increase in blood pH will reduce the amount of oxygen that hemoglobin can release to the body tissue (hypoxia). Therefore, the heart must pump more frequently and with greater vigor in order to compensate for the decrease in pCO$_2$ and increase in pH.” {Ley, 1987, p.309}
This is your brain on normal breathing.

This is your brain on hyperventilation.
cles. "Primary" refers to the fact that the muscles are the only ones used under normal circumstances. These are the external intercostal muscles, located between the ribs, and the diaphragm, which forms the floor of the chest cavity and divides it from the abdominal cavity. The intercostals are responsible for chest, or thoracic, breathing. They operate by lifting the ribs up and out (Fig. 3), diaphragm is responsible for abdominal, or "belly" breathing and operates by pushing abdominal contents down, allowing the lungs to expand downward.

Accessory muscles are normally used only when one is making a maximal effort at inspiration. These muscles are the sternocleidomastoids, scapular elevators, and scaleni. They lift the collarbones (clavicles) and shoulder blades (scapulae). Abnormal use of these accessory muscles is characteristic of certain diseases or malfunctions of the respiratory system, e.g., emphysema or hyperventilation.

At rest expiration is usually passive; we simply relax the inspiratory mus-

Figure 1. Movement of rib cage and diaphragm during quiet breathing: (A) Descent of the diaphragm and outward movement of rib cage and abdomen during inspiration; (B) a more detailed side view; and (C) a view, from the top looking down, of movement of a rib during inspiration. The ribs move much like bucket handles, up and out. From Selkurt (1978), with permission.
Stress Management

• Using our knowledge of stress physiology
Stress Management Approaches I Physiological

- Exercise
- Nutrition
- Mind/Body Techniques
  - Yoga
  - Tai Chi
  - Mindfulness Meditation
  - Breathing
EFFECTS OF HRV BIOFEEDBACK ON HEART RATE
Respiration
Heart Rate
Pacer set at 7.0 bpm
Valley = 63
Peak = 79
Stress Management Techniques II: Cognitive

- Reframing/ humor
- Decatastrophizing
- Reducing the duration of “stress attacks”
  - Acceptance of flawed self
  - Acceptance of early engrams
  - Reduction of duration
  - Experiential avoidance can’t work
- Cognitive workbooks (Ex. Mind over Mood)
- *Get Out of your Mind and into your Life*
  - Hayes