Measuring and Optimizing Stress in Simulated and Clinical Environments

Raaj K. Ruparel
New Paradigm

100 hr/wk x 48 weeks x 5 years...

~24,000 hours

64 hr/wk x 48 weeks x 5 years...

~15,000 hours...
Objectives

Stress and Learning

Stress and Performance

Stress Measurement
stress

noun \'stres\': the response that ensues once a situation is assessed as a threat to maintaining or achieving a primary goal
The effects of stress and stress hormones on human cognition: Implications for the field of brain and cognition

S.J. Lupien a,*, F. Maheu b, M. Tu c, A. Fiocco a, T.E. Schramek a

Norepinephrine
• Amygdala (BLA)

Cortisol
• Amygdala
• Hippocampus
• Frontal Lobes
Stress is Good For Learning.
Yerkes-Dodson Law (1908)

Performance vs. Stress

- Performance
- Stress
Impact of stress on resident performance in simulated trauma scenarios

Adrian Harvey, MD, MEd, Glen Bandiera, MD, MEd, Avery B. Nathens, MD, PhD, and Vicki R. LeBlanc, PhD, Toronto, Canada

13 Residents (EM, GS)

- Trauma Hx Form
- Performance Review

High and Low Stress Simulated Scenarios

HS = Salivary Cortisol

Recall

Performance Scores

P < 0.05
The Effects of Acute Stress on Performance: Implications for Health Professions Education
Vicki R. LeBlanc

Systematic Review

↓

1000 Articles

↓

99 Articles

↓ Performance

• Divided Attention
• Working Memory
• Information Retrieval
• Decision Making
Stress is Not Good For Performance.
Measuring Stress
• Cheap (ish)
• Reliable
• Objective
• (-) Specific

• Cheap
• Long-term
• Subjective

• Cheap (ish)
• Reliable
• Objective
• Real-time
• Cumbersome
Cath Lab

Sim Lab

% > Baseline

Time

200%

0%
In Summary

Stress = **Good** and **Bad**

Various measurement tools

Keep improving - in and out of OR
Use of skin conductance changes during mental stress testing as an index of autonomic arousal in cardiovascular research

Mental stress testing is used to study the cardiovascular changes caused by psychologic stress. To examine the effects of cardiac drugs on mental stress-induced changes, it is useful to attain a degree of arousal that can be replicated in serial studies. Skin conductance level, a cholinergically mediated index of arousal, was assessed for its stability in serial studies and under conditions of β-blockade. In normal subjects, skin conductance increased in response to mental stress ($p < 0.001$) and was stable across three sessions. In patients with mild hypertension, skin conductance was elevated during mental stress during both placebo and nadolol therapy ($p < 0.001$). As expected, nadolol reduced baseline and stress-induced peak arterial pressure and heart rate but had no significant effect on skin conductance. Thus skin conductance level can serve as a stable and useful index of autonomic arousal in clinical trials, even in patients using β-blocking medications. (Am Heart J 1994;128:1170-7.)

Sue C. Jacobs, PhD, a,e Richard Friedman, PhD, a,d,e John D. Parker, MD, g Geoffrey H. Tofler, MD, b,e Alfredo H. Jimenez, MD, f James E. Muller, MD, b,e Herbert Benson, MD, a,e and Peter H. Stone, MD c,e Boston, Mass., and Stony Brook, N. Y.
Salivary cortisol, heart rate, electrodermal activity and subjective stress responses to the Mannheim Multicomponent Stress Test (MMST)

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ABSTRACT

The availability of effective laboratory paradigms for inducing psychological stress is an important requirement for experimental stress research. Reliable protocols are scarce, usually laborious and manpower-intensive. In order to develop an economical, easily applicable standardized stress protocol, we have recently tailored the Mannheim Multicomponent Stress Test (MMST). This test has been shown to induce relatively high stress responses without focusing on social-evaluative components. In this study we evaluated changes in electrodermal activity and salivary cortisol in response to the MMST. The MMST simultaneously combines cognitive (mental arithmetic), emotional (affective pictures), acoustic (white noise) and motivational stressors (loss of money). This study comprised two independent experiments. For experiment 1, 80 female subjects were recruited; 30 subjects (15 females) participated in experiment 2. Significant changes in electrodermal activity and salivary cortisol levels in response to MMST exposure were found. Subjective stress and heart rate responses were significantly increased in both experiments. These results indicate that the MMST is an economical stress paradigm which is also applicable in larger cohorts or multicenter studies for investigating stress reactions. As social-evaluative threat is not the main stress component of the MMST, this procedure represents a useful and complementary alternative to other established stress protocols.

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Dr. Fortuin’s TAVR