**Visualization of Time-Series Sensor Data to Inform the Design of Just-In-Time Adaptive Stress Interventions**

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**DATA COLLECTION & EVALUATION**

Two mobile-health studies
- **Phase 1:**
  - Study 1: 40 drug users
  - Study 2: 30 university students

**Phase 2:**
- Two mobile-health studies

Evaluation Study
- Six Expert Health Researchers
- 90-minute session
- 2 phases
  - Phase 1: Explore Visualizations
  - Phase 2: Usability and Effectiveness

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**KEY FINDINGS**

- Abstraction Highlights Factors Contributing to Stress
- Temporal representation helps in personalization
- Spatio-temporal and Contextual Representation Aids Personalized Intervention design
- Temporal and Contextual Profiles Aid in Selecting Timing, Content, and Modality of Intervention

**EFFICACY OF STRESS VISUALIZATION**

<table>
<thead>
<tr>
<th>Visualization Technique</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spatio-temporal</td>
<td>Highlights stress-patterns and contextual factors</td>
<td>Non-aggregated data can be overwhelming</td>
</tr>
<tr>
<td>Temporal</td>
<td>Helps in determining the time of intervention</td>
<td>Complexity increases with large amounts of data</td>
</tr>
<tr>
<td>Contextual</td>
<td>Helps in visualizing data in a meaningful way</td>
<td>Data quality and selection is crucial</td>
</tr>
<tr>
<td>Event-Centric</td>
<td>Highlights stress events in real-time</td>
<td>Doesn't scale well with large amounts of data</td>
</tr>
</tbody>
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**STATE OF STRESS MANAGEMENT**

- Previously only available stress data sources
  - Self-Reports
  - Surveys

- With Sensors and wearable Technology
  - Continuous Stress and Contextual data
  - EMA

How to make sense of stress-related data?

**STRESS VISUALIZATION CHALLENGES**

- Volume and Variety of Relevant Data
- Identifying Stressor(s) is Complex
- Multifaceted Relationship between Stress and Time
- Difficult to Create Generalized Stress Models
- Scalability of Space
- Need for Analysis at Different Levels of Granularity

**HOW TO AID THE DESIGN OF JUST-IN-TIME STRESS INTERVENTIONS (JITSTs)?**

- Increase stress Awareness
- Help Identify stress Patterns
- Assist in detecting Stressors

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**ADVANCED BIOMEDICAL DISCOVERY AND IMPROVING HEALTH THROUGH MOBILE SENSOR BIG DATA**

**MD2K** is supported by the National Institutes of Health Big Data to Knowledge Initiative Grant #1U54EB020404

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**NATIONAL INSTITUTES OF HEALTH**

- Advancing biomedical discovery and improving health through mobile sensor big data

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