PREDICTIVE ANALYTICS AND ARTIFICIAL INTELLIGENCE IN BEHAVIORAL HEALTH TRANSFORMING CARE THROUGH EARLY DETECTION, RISK PREDICTION, AND PERSONALIZED INTERVENTION

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NATIONAL DIALOGUES ON BEHAVIORAL HEALTH CONFERENCE

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PRESENTER

- **Jeff Greenberg, PhD, is a clinical psychologist and senior health executive known for leading innovation at the intersection of behavioral health, research, and emerging AI technologies.** He previously directed the Eating Disorder Center of Excellence, where he oversaw multidisciplinary clinical programs, advanced outcomes-driven research, and guided national best-practice development for complex eating-disorder cares.
- Dr. Greenberg's career spans federal health systems, large-scale research operations, and digital health strategy. He brings deep clinical training including pre-doctoral and post-doctoral fellowships in evidence-based treatment, behavioral medicine, and clinical research paired with executive experience modernizing care models and integrating AI-enabled tools into behavioral health. In his current role with **Clarity Wellness Technologies**, he focuses on responsible AI, clinical decision support, and scalable digital solutions that strengthen access, quality, and patient engagement across the behavioral health continuum.
- Dr. Greenberg completed his PhD in clinical psychology at the Drexel University School of Medicine. He completed his pre-doctoral internship and post-doctoral fellowship at the National Center for PTSD, Boston VAMC with fellowships at Harvard and Boston University Schools of Medicine.

STATEMENT OF INTEREST

- **Dr. Greenberg is the Co-Founder and Chief Clinical and Ethics Officer of Clarity Wellness Technologies, Inc. This is an early-stage health technology corporation which applies AI to addressing behavioral health challenges. He holds a financial equity agreement with this organization.**

WHY PREDICTIVE ANALYTICS MATTER?

Behavioral Health Faces Several Persistent Challenges

- **Mental health and substance use disorders are often identified late**
- **Symptoms frequently emerge gradually and unpredictably**
- **Clinicians must integrate large amounts of fragmented information**
- **Workforce shortages limit access to care**
- **Relapse and crisis events can occur before warning signs are recognized**



WHAT IS PREDICTIVE ANALYTICS?

Definition

Predictive analytics uses:

- Historical data
- Statistical modeling
- Machine learning algorithms
- Pattern recognition techniques
- to estimate the probability of future events.

Examples

Predicting:

- Suicide risk
- Substance use relapse
- Treatment dropout
- Psychiatric hospitalization
- Medication non-adherence
- Crisis escalation

WHY AI EXCELS AT PATTERN RECOGNITION

Human Strengths

- Empathy
- Clinical reasoning
- Contextual understanding
- Relationship building

AI Strengths

- Processing vast datasets
- Detecting subtle correlations
- Recognizing patterns across time
- Continuous monitoring
- Learning from millions of data points

THE DATA SOURCES POWERING PREDICTIVE MODELS

Clinical Data

- Diagnoses
- Medication history
- Treatment attendance

Behavioral Data

- Sleep
- Activity levels
- Physiological indicators

Communication Data

- Speech
- Language
- Text

Digital Data

- App engagement
- Wearables
- Digital phenotyping

Social Context Data

- Social interaction patterns
- Environmental factors

SPEECH AND LANGUAGE ANALYSIS

What Can Be Measured?

Speech patterns may reveal:

- Depression
- Anxiety
- Psychosis
- Cognitive impairment
- Substance use risk

Indicators Examined

- Speech rate
- Pauses
- Vocal energy
- Sentiment
- Word choice
- Linguistic complexity

Example

A gradual reduction in verbal energy and increasing negative emotional language may signal worsening depression.

BEHAVIORAL DATA AND DIGITAL PHENOTYPING

Behavioral Signals as Early Warning Indicators

Examples include:

- Reduced physical activity
- Increased sedentary behavior
- Sleep disruption
- Irregular daily routines
- Missed appointments
- Social withdrawal

Digital Phenotyping

The collection of behavioral information through digital devices to understand mental health status.



SOCIAL MEDIA AND TEXT ANALYTICS

- **AI Can Analyze**
- Emotional content
- Sentiment changes
- Social withdrawal
- Crisis language
- Communication frequency
- **Potential Benefits**
- Early warning indicators
- Monitoring treatment progress
- Population health surveillance
- **Important Limitation**
- These approaches require strong ethical safeguards and informed consent



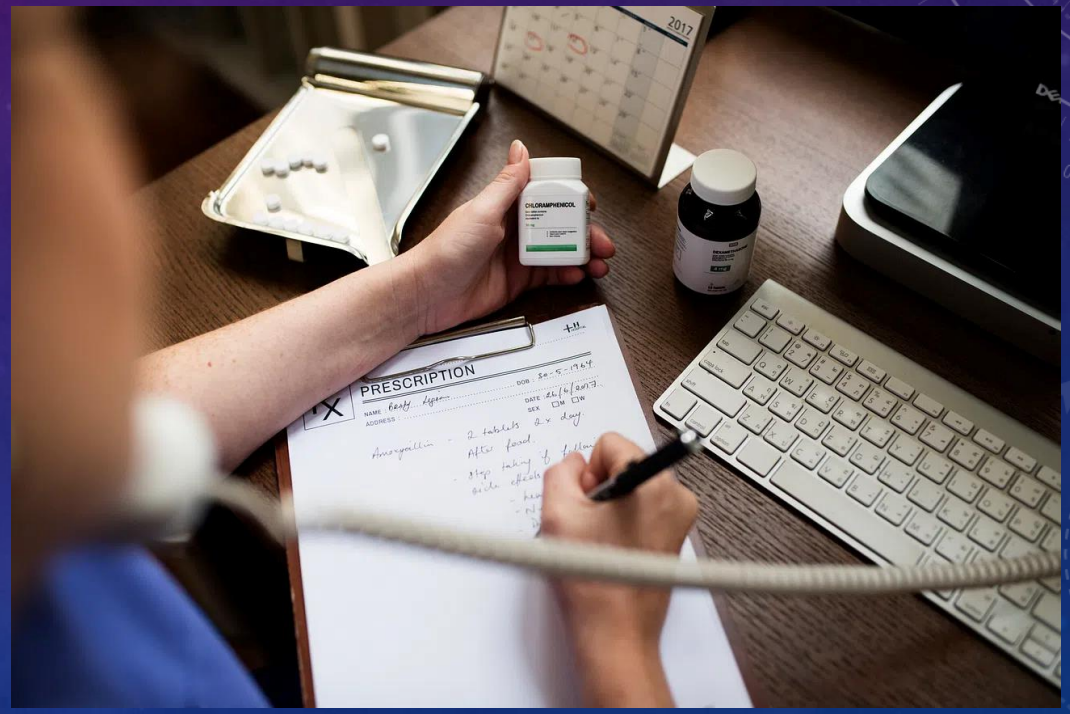
CLINICAL DATABASES AND THERAPEUTIC RECORDS

- **Examples of Databases**
- Therapy notes
- Treatment plans
- Medication records
- Substance use treatment data
- Recovery outcomes
- **AI Applications**
- Risk stratification
- Relapse prediction
- Treatment matching
- Resource allocation
- Population management
- **Goal**
- Convert historical clinical knowledge into actionable insights.



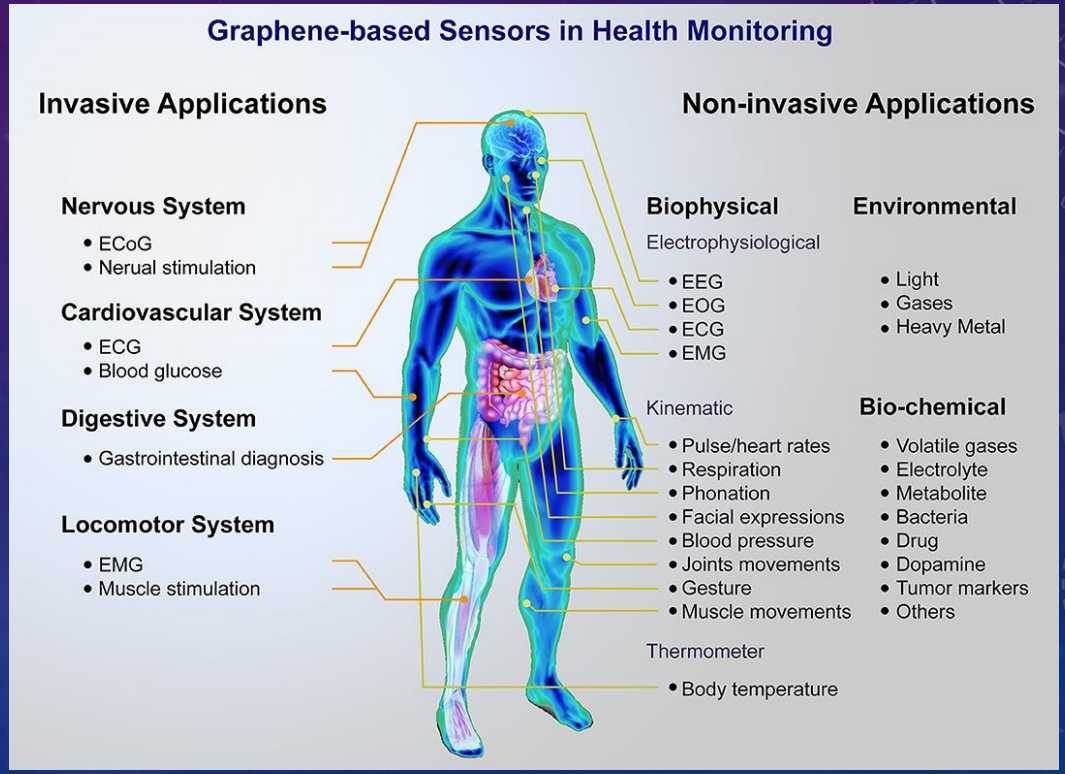
PRESCRIPTION MONITORING AND RISK PREDICTION

- **AI Models May Evaluate**
- Multiple prescriptions
- Medication adherence
- Refill patterns
- Drug interactions
- Escalating utilization
- **Potential Outcomes**
- Earlier intervention
- Improved safety monitoring
- Better coordination across providers
- **Value**
- Prevention rather than reaction.



EARLY WARNING SYSTEMS

- **Traditional Model**
- Crisis → Treatment
- **AI-Enabled Model**
- Risk Signal → Early Warning → Intervention → Risk Reduction
- **Potential Early Indicators**
- Sleep disruption
- Mood language shifts
- Activity decline
- Missed appointments
- Social withdrawal
- **Vision**
- Move behavioral healthcare upstream



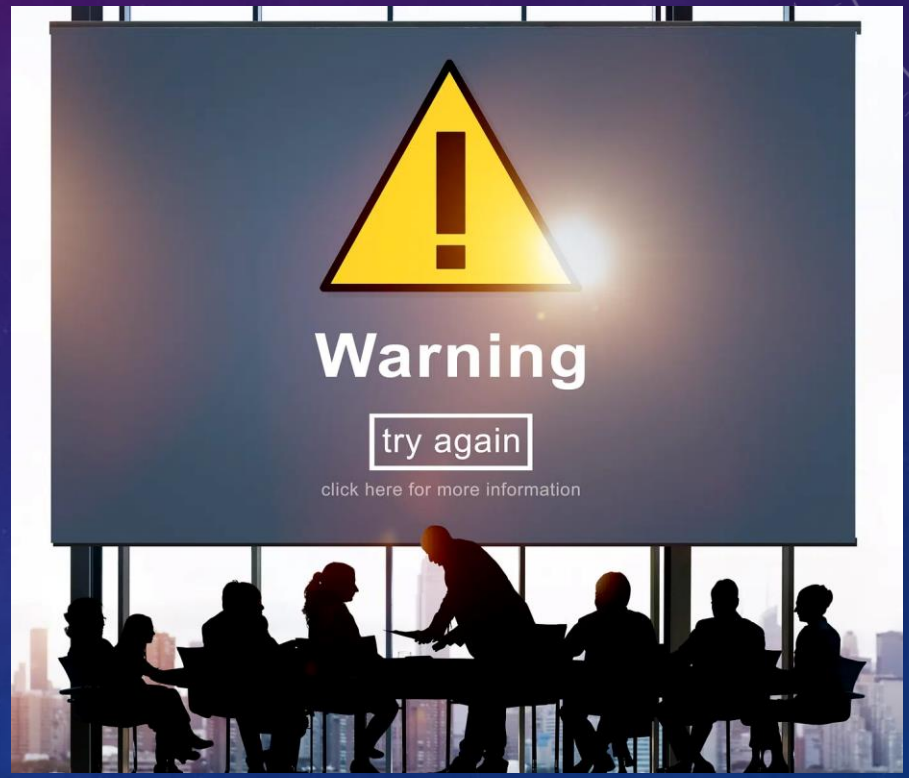
HOW MACHINE LEARNING MODELS WORK

- **Inputs**
- Clinical history
- Behavioral metrics
- Communication patterns
- Treatment records
- **Processing**
- Pattern recognition
- Statistical modeling
- Neural networks
- Ensemble prediction

- **Outputs**
- Risk scores
- Alerts
- Recommendations
- Decision support
- **Important Note**
- AI predicts probabilities, not certainties.

RISKS AND LIMITATIONS

- **Potential Concerns**
- Algorithmic bias
- False positives
- False negatives
- Data quality problems
- Overreliance on automation
- **Clinical Reality**
- AI should support human judgment, not replace it.
- **Core Message**
- Responsible implementation matters as much as technical capability



PRIVACY, ETHICS, AND SAFEGUARDS

- **Privacy**
- HIPAA compliance
- Secure data storage
- Encryption
- **Governance**
- Clinical oversight
- Transparency
- Explainability

- **User Rights**
- Informed consent
- Data access controls
- Ability to opt out
- **Equity**
- Bias monitoring
- Representative datasets
- Fairness assessment

RESPONSIBLE AI FRAMEWORK

- **Human-Centered Design**
- Technology serves people.
- **Safety**
- Do no harm.
- **Transparency**
- Users understand how systems function.
- **Accountability**
- Humans remain responsible.
- **Privacy**
- Protect sensitive information.
- **Equity**
- Deliver fair outcomes across populations.

FUTURE VISION

- **The Next Generation of Behavioral Healthcare**
- **Integrated Data Ecosystems**
- Combining:
- Clinical records
- Digital health signals
- Behavioral observations
- Patient-reported outcomes
- **Precision Behavioral Health**
- The right intervention, for the right person, at the right time.



CLOSING MESSAGE

AI and databases together create the foundation for earlier detection, better prediction, personalized treatment, and improved behavioral health outcomes when implemented responsibly. They can dynamically alter how we address behavioral health if we have the wisdom, ethics, and clarity to use for the broad public good.