(Demo) Rewire Stress Risk Scoring: Rule-Based Logic & Future Machine Learning Integration

1. Current Rules Overview (as of v0.4)

Rewire's risk assessment engine uses a transparent, rule-based logic grounded in peer-reviewed psychophysiological research. These heuristics allow for explainable results while building trust and safety with therapists and patients.

Scoring Inputs & Rationale:

Metric	Threshold	Score	Rationale
Sleep Duration	< 6 hours	+25	Correlated with elevated cortisol and emotional reactivity [Van Reeth et al., 2000]
Activity Level	< 30 mins	+20	Linked to increased anxiety and poor mood regulation [Gerber et al., 2014]
Resting HR	> 85 bpm	+20	Elevated RHR is a marker of acute stress [Shaffer & Ginsberg, 2017]
HRV	< 50 ms	+20	Lower HRV reflects reduced vagal tone/emotional resilience [Kim et al., 2018]
Medication Adherence	No	+15	Missed meds disrupt psychological stability

Risk Levels

- Low (0–30)
- Moderate (31–60)
- High (61–100)

2. How to Incorporate Machine Learning

To move toward adaptive, patient-specific insights, a ML model can be trained to replace or augment the rule-based logic.

Proposed Workflow:

1. Data Collection
   - Store biometric inputs (sleep, HR, HRV, activity, adherence) + EEG + diagnosis + final stress label (clinician input or proxy).

2. Model Development
   - Supervised learning (e.g., RandomForest, XGBoost, or fine-tuned BERT if including session notes).
   - Input: Multivariate biometric data + optional EEG summary features (FAA, TBR).
   - Output: Predicted risk level (Low/Mod/High) + SHAP explainability.

3. Clinician Feedback Loop
   - Let clinicians confirm or override predicted risk.
   - Save overrides to fine-tune future versions.

4. Deployment Path
   - Gradually replace static thresholds with ML risk estimates.
   - Ensure human-in-the-loop and fallback logic always present.

3. Adding Real-Time Sensor Integrations

To future-proof Rewire, biometric and neurodata should flow directly from validated sources.

A. Wearable (HR, HRV, Sleep, Activity)
   - Source: Apple HealthKit / Google Fit / Fitbit / Garmin APIs
   - Steps:
     1. OAuth 2.0 user authentication
     2. Schedule background sync jobs (e.g., daily fetch)
     3. Normalize to same units (e.g., BPM, minutes, ms)
     4. Cache per patient ID in secure cloud storage

B. EEG API (FAA/TBR)
   - Source: Muse SDK / OpenBCI / Cognionics
   - Steps:
     1. Stream real-time data via BLE or file export
     2. Extract FAA = log(alpha_right) − log(alpha_left)
     3. Compute TBR = theta / beta (Fz channel)
     4. Sync summary stats to Rewire DB

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