

THE INVISIBLE ARCHITECTURE OF WELL-BEING

An integrated systems framework for whole-person health, mental health, resilience, recovery, and performance

John Thomas Paruch, MD

Internal Medicine • Psychiatry • Lifestyle Medicine • Sports Psychiatry

Version 2.0 | October 2026

CORE PREMISE Outcomes emerge from interacting biological, developmental, relational, behavioral, cognitive, environmental, existential, and societal conditions. The useful question is not only “What diagnosis is present?” but “What architecture is generating, maintaining, buffering, or amplifying the current state?”

Integration statement. The Invisible Architecture of Mental Health (IAMH) is incorporated into IAWB as its mental-health and psychiatric application. Mental health is not treated as a separate silo: it is one expression of the same coupled whole-person system.

Executive Summary

The Invisible Architecture of Well-Being (IAWB) is a transdiagnostic, whole-person formulation framework designed to make complex health and performance problems more actionable. Well-being is treated as an emergent property of a dynamic system rather than the simple absence of disease, symptoms, or distress.

IAWB combines two complementary maps: **eight domains** that describe where relevant conditions reside and a **five-level model** that describes how those conditions become pressure, adaptation, current function, and future trajectory. Governing dynamics include weighted load, reserve and reserve accessibility, coupling, feedback, bottlenecks, compensation, redundancy, thresholds, adaptive challenge, path dependence, hysteresis, time delay, and recovery.

The framework is intended to complement—not replace—diagnosis, evidence-based treatment, risk assessment, disease-specific evaluation, or specialty care. Its practical aim is to identify the smallest feasible set of high-leverage changes capable of improving the larger system while preserving strengths and avoiding unnecessary intervention.

1. Why a Unified Framework Is Needed

Clinical medicine, psychiatry, psychotherapy, lifestyle medicine, rehabilitation, and performance programs often organize care around diagnoses, organ systems, symptoms, or isolated variables. Those categories are useful, but real-world outcomes frequently reflect interactions among sleep, physiology, training, pain, cognition, behavior, relationships, environment, meaning, and structural constraints.

A person can therefore receive technically appropriate treatment for one component while the larger architecture continues to regenerate the adverse state. Conversely, a modest intervention at the correct bottleneck can propagate across several domains.

2. The Five-Level Model

1. Architecture	What is the system made of? Eight domains, vulnerabilities, protective structures, resources, constraints, and their arrangement.
2. Dynamic Pressure	What is the system carrying? Weighted effective load relative to effective reserve and remaining adaptive margin.
3. Adaptive Remodeling	How is experience changing capacity? Learning, mastery, conditioning, recovery, sensitization, deconditioning, and biological embedding.
4. Functional State	How is the system operating now? Robust, adaptive, compensated, fragile, decompensated, or reconstructing.
5. Time & Feedback	What happens next? Trajectory, recurrence, delay, feedback, path dependence, hysteresis, aging, and recovery.

3. The Eight Domains

Biological / Body. Sleep, circadian function, cardiometabolic health, pain, illness, neurobiology, autonomic and endocrine state, nutrition, physical capacity, recovery.

Developmental / Shaping. Early experience, attachment, adversity, learning history, developmental opportunity, identity formation, prior adaptation, path dependence.

Relational / People. Family, peers, teammates, coaches, clinicians, intimacy, belonging, conflict, support, co-regulation, isolation.

Behavioral / Daily Acts. Movement, training, nutrition, substances, routines, recovery behaviors, adherence, digital habits, time allocation, skill practice.

Cognitive / Mind. Appraisal, attention, expectations, beliefs, agency, self-efficacy, flexibility, rumination, threat interpretation, decision-making.

Physical Environment. Housing, light, noise, temperature, nature, commute, ergonomics, pollution, safety, training facilities, affordances.

Existential / Meaning. Purpose, values, identity, spirituality, coherence, contribution, hope, meaning, alignment with what matters.

Societal / Systems. School, work, health care, economics, policy, discrimination, scheduling, transportation, access, organizational culture.

Interpretation rule: a domain is not inherently “good” or “bad.” Its effect depends on timing, dose, context, interactions, reserve, and the person’s goals. The eight domains should not be reduced to eight independent symptom scores.

4. Dynamic Pressure: Load, Reserve, and Adaptive Margin

Load is demand placed on the system. It can be physical, psychological, relational, environmental, developmental, existential, or structural. Counting stressors equally is inadequate. Effective load should be considered in relation to intensity, duration, frequency, predictability, controllability, developmental timing, personal meaning, and interaction with other loads.

Conceptual relationship: $L_{\text{eff}}(t) = \Sigma \text{ weighted within-domain loads} + \text{interaction load}$. This is a formulation device, not a validated quantity with common units.

Reserve is capacity to absorb perturbation, recover, adapt, and continue functioning. It may be physiologic, psychological, relational, material, environmental, or existential. Low load does not guarantee health when reserve is also low.

Available, accessible, and functional reserve. A resource may exist but be inaccessible under stress. Assessment should distinguish resources present; perceived ability to use them; organizational capacity to initiate, sequence, sustain, and adjust action; and observed mobilization during challenge.

Net Adaptive Pressure (NAP). $NAP(t) = \text{weighted effective load} - \text{effective reserve}$. **Adaptive Margin.** $\text{Margin}(t) = \text{vulnerability threshold}(t) - NAP(t)$. These equations express framework logic only. The weights, units, thresholds, and cut points are not validated and should not be used as numerical risk calculators.

A narrowing adaptive margin helps explain nonlinear deterioration: a final stressor may be small while the system has already lost substantial reserve. Thresholds are person-, outcome-, and time-specific.

5. Adaptive Remodeling and Challenge

The framework distinguishes **underload, adaptive challenge, and overload**. Not all load should be removed. Appropriately dosed challenge, followed by adequate recovery, can build capacity through learning, conditioning, mastery, and tissue adaptation. Insufficient challenge may fail to develop reserve; excessive, uncontrollable, poorly timed, or unrecovered load may produce sensitization, depletion, injury, or persistent dysregulation.

Recovery is not necessarily linear. Early stabilization may precede slower reconstruction of sleep, confidence, conditioning, relationships, identity, participation, and reserve. Relapse or transient worsening does not automatically invalidate the formulation; the trajectory and recovery kinetics matter.

6. Governing System Dynamics

- **Coupling:** domains influence one another; tight coupling can accelerate deterioration or improvement.
- **Feedback loops:** reinforcing loops amplify a trajectory; balancing loops stabilize it. Treatment may target a loop rather than every component.
- **Bottlenecks:** one constrained capacity can limit the benefit of otherwise appropriate interventions.
- **Leverage points:** feasible changes capable of producing disproportionate downstream effects.
- **Redundancy:** backup supports reduce single-point failure.
- **Compensation:** function may be preserved at increased cost, rigidity, effort, avoidance, or dependence on scaffolding.
- **Thresholds and nonlinearity:** apparent stability can persist until reserve is exhausted.
- **Path dependence:** prior states and adaptations shape current responses.
- **Hysteresis:** removing the initiating stressor may not restore the prior state after remodeling.
- **Time delay:** causes and consequences may be separated in time, obscuring causal inference.

7. Functional States

Robust	High reserve, flexible regulation, rapid recovery.
Adaptive	Meaningful challenge handled within available capacity.
Compensated	Function preserved at greater cost or with scaffolding; sustainability becomes a central question.
Fragile	Limited adaptive margin; small perturbations can produce disproportionate effects.
Decompensated	Persistent impairment, danger, or inability to meet core needs; stabilization may dominate.
Reconstructing	Uneven rebuilding of function, identity, participation, confidence, and reserve.

These are descriptive states, not diagnostic criteria or a validated severity scale. Different functions can occupy different states simultaneously, and appropriate support is not itself evidence of unhealthy compensation.

8. Multiscale Biological Integration

IAWB can trace a clinically important pathway downward to biology when evidence supports doing so: **intervention/exposure → behavior and context → organ/system response → cellular/molecular response → reserve/accessibility → function/outcome**. Causation can also operate upward: pain, inflammation, metabolic instability, sleep loss, or autonomic state can alter attention, emotion, motivation, behavior, and social engagement.

Relevant levels may include organ/system physiology; autonomic nervous system; HPA and other neuroendocrine signaling; metabolic/endocrine regulation; immune/inflammatory signaling; vascular/endothelial function; circadian biology and sleep physiology; brain networks and neurotransmitter systems; cellular energetics/mitochondrial function; oxidative stress/redox biology; proteostasis/autophagy when relevant; epigenetic/gene-regulatory mechanisms when supported; and tissue/musculoskeletal adaptation.

Mechanistic guardrail: do not force every intervention to molecular detail. Distinguish established human mechanisms from correlates/biomarkers, plausible inference, and preclinical evidence.

9. Mental Health as an Embedded Application

The earlier Invisible Architecture of Mental Health is retained as a focused application of IAWB. Psychiatric symptoms and diagnoses remain clinically important, but they are interpreted within the same whole-person architecture. Similar symptom profiles can arise from different configurations; similar exposures can produce different outcomes because reserve, timing, coupling, and protective factors differ.

Mental–physical coupling. Trauma and chronic disease, depression/anxiety and cardiovascular disease, stress and immune/inflammatory signaling, serious mental illness and metabolic disease, sleep and cognition, pain and mood, and social connection and physiology illustrate why mental and physical health should not be modeled as independent systems. Behavioral and psychological interventions may also affect physical outcomes through behavioral, autonomic, endocrine, inflammatory, sleep, and adherence pathways, although effect sizes and causal certainty vary by intervention and endpoint.

Agency and self-efficacy. These may function as cross-domain mechanisms affecting perceived access to reserve, treatment engagement, persistence, problem-solving, and resource mobilization. They should be assessed as context-sensitive capacities, not used to individualize structural failure or imply that outcomes are solely under personal control.

10. Allostatic Load and Measurement Tiers

Allostatic load (AL) is among the better-developed biologically measurable constructs relevant to cumulative multisystem physiological dysregulation. Within IAWB it is best treated as **one downstream composite indicator of biological embedding** that can arise through interacting autonomic, neuroendocrine, immune/inflammatory, metabolic, cardiovascular, behavioral, and other pathways. It is not a single universal pathway through which all loads register.

For practical assessment, measures can be grouped loosely into: (1) exposures or responses with objective/physiological measures available, including selected environmental exposures, physiological stress responses, sleep/activity measures, and multisystem biomarker composites; and (2) constructs often measured primarily through validated self-report or behavioral instruments, including perceived stress, caregiving burden, occupational strain, and financial strain. Many constructs are genuinely multimethod and should not be forced into one tier.

Objective exposure, subjective appraisal, biological response, and functional effect may diverge. The measurement strategy should therefore follow the formulation question rather than assume one metric captures the entire construct.

11. Clinical Formulation Workflow

- **1. Stabilize danger and preserve disease-specific assessment.** Urgent medical and psychiatric conditions take priority.
- **2. Map the architecture.** Identify salient conditions, strengths, protective factors, load, reserve, and what changed over time.
- **3. Separate load from reserve.** Do not infer usable capacity from the mere presence of a resource.
- **4. Identify coupling and feedback.** Describe self-reinforcing and stabilizing loops in plain language.
- **5. Locate the bottleneck.** Ask what would still prevent improvement if everything else were technically correct.
- **6. Estimate state and trajectory.** Describe current operation and direction of travel.
- **7. Choose the minimum effective intervention set.** Match treatment burden to current capacity and preserve adaptive challenge.
- **8. Run a low-burden real-world test.** Use response to intervention as information about the formulation.
- **9. Reassess dynamically.** Track function, variability, recovery time, participation, and reserve mobilization.

Two-visit method. Visit 1: build the load/resource map, identify coupling and feedback, and state a bottleneck hypothesis. Between visits: run one low-burden mobilization experiment. Visit 2: review what happened, revise the formulation, and choose the next leverage point.

12. Intervention Sequencing

1	Stabilize danger	Suicide/violence risk, delirium, mania, psychosis, withdrawal, abuse, severe deprivation, urgent medical illness.
2	Remove major destabilizers	Severe sleep loss, medication toxicity, substances, untreated disease, ongoing trauma or unsafe conditions.
3	Restore regulatory foundations	Sleep opportunity and timing, hydration/nutrition, daylight, movement, medication access, pain/medical care.
4	Increase co-regulation and support	Trusted people, family work, peer support, case management, accommodations, practical access.
5	Build skills and flexibility	Behavioral activation, exposure, emotion regulation, motivational interviewing, cognitive and attentional skills.
6	Restore participation and meaning	Roles, identity, contribution, purpose, valued activity, belonging.
7	Modify environments and systems	Scheduling, workflow, transportation, housing, training design, school/work structure, access barriers.
8	Build redundancy and maintenance	Backup supports, relapse plans, durable routines, reserve-building, monitoring of early-warning indicators.

This is not a rigid staircase. Several interventions may proceed in parallel. The principle is to match the demands of treatment to the current architecture and capacity.

13. Athlete and Performance Application

Athletic performance is a useful stress test of the architecture because training deliberately adds load to stimulate adaptation. Performance and durability depend on dose, timing, recovery, reserve, and context—not simply motivation or training volume.

Sleep illustrates cross-domain coupling. Training finish time, duration, school schedules, transportation, meals, homework, physiological arousal, and recovery demands can constrain sleep opportunity. The leverage point may therefore be organizational scheduling rather than “sleep hygiene” alone. Similar reasoning applies to injury risk, return-to-play, overreaching, nutrition, travel, identity, team climate, and performance anxiety.

14. Assessment Strategy

IAWB should be operationalized as a measurement stack rather than one global score. Depending on the formulation, useful layers can include symptoms/risk; function and well-being; sleep/circadian measures; developmental history; relationships and loneliness; cognitive-emotional processes; meaning and purpose; environment and structural conditions; targeted physical examination, laboratory testing, sleep testing, wearable/actigraphy data, and relevant performance metrics.

Repeated measures are especially valuable when the hypothesis concerns trajectory, within-person coupling, state transition, recovery kinetics, or response to a leverage-point intervention. A single score is a photograph; many systems questions require a short film.

15. Scientific and Clinical Guardrails

- Do not present a composite IAWB score as validated for diagnosis, prognosis, or treatment selection until psychometric and prospective validation support such use.
- Do not infer causality from cross-sectional associations, network diagrams, or temporal coincidence alone.
- Do not equate allostatic load with a single common pathway.
- Do not assume more intervention is better; some challenge is adaptive and some apparent deficits are normal variation.
- Preserve urgent and disease-specific evaluation. Systems formulation must not delay highly treatable or dangerous conditions.
- Distinguish objective exposure, subjective appraisal, biological response, and functional effect.
- Use repeated assessment when the clinical question is dynamic.
- Do not force molecular mechanisms beyond the level supported by human evidence.
- Treat structural and environmental constraints as part of the architecture rather than converting every barrier into an individual coping deficit.

16. Research Agenda

- Define domain-level constructs and determine which are formative versus reflective.

- Develop measurement models that separate load, available reserve, accessible reserve, functional reserve, and observed mobilization.
- Operationalize NAP and adaptive margin cautiously, or determine whether qualitative use is superior to numerical scoring.
- Test whether bottleneck-targeted intervention selection outperforms non-prioritized multi-domain recommendations.
- Use longitudinal intensive sampling to estimate within-person coupling and feedback.
- Identify markers of state transition from compensation to fragility and from decompensation to reconstruction.
- Test whether variability and recovery time predict outcomes beyond mean symptom levels.
- Validate athlete-specific modules against sleep, training load, injury, availability, well-being, and performance.
- Determine when simple clinical formulation is sufficient and when network/dynamical-systems modeling adds incremental value.
- Test multiscale mechanism chains without treating biomarkers as proof of causation.

17. Conclusion

The Invisible Architecture of Well-Being proposes that health, mental state, resilience, distress, recovery, and performance are best understood as properties of an interacting system. Its contribution is not another list of wellness domains. It is a method for reasoning about how conditions interact: what the person is carrying, what capacity exists, what reserve can actually be mobilized, where the system is tightly coupled, what loops sustain the state, how prior adaptation constrains the present, and where feasible change may alter the trajectory.

By integrating the earlier Invisible Architecture of Mental Health into a broader whole-person model, IAWB provides a common formulation language across internal medicine, psychiatry, lifestyle medicine, sports psychiatry, rehabilitation, coaching, and performance optimization. The central aim is precision in context: identify the architecture that matters for this person, in this environment, at this point in time—and intervene at the level most likely to change the trajectory.

Selected Evidence Base for the Integrated Framework

1. McEwen BS. Physiology and neurobiology of stress and adaptation: central role of the brain. *Physiol Rev.* 2007;87:873-904.
2. Felitti VJ, et al. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. *Am J Prev Med.* 1998;14:245-258.
3. Hughes K, et al. The effect of multiple adverse childhood experiences on health: a systematic review and meta-analysis. *Lancet Public Health.* 2017;2:e356-e366.
4. Levine GN, et al. Psychological health, well-being, and the mind-heart-body connection: a scientific statement from the American Heart Association. *Circulation.* 2021;143:e763-e783.
5. Lichtman JH, et al. Depression and coronary heart disease: recommendations for screening, referral, and treatment. *Circulation.* 2008;118:1768-1775.
6. Cohen S, et al. Chronic stress, glucocorticoid receptor resistance, inflammation, and disease risk. *Proc Natl Acad Sci USA.* 2012;109:5995-5999.
7. Kiecolt-Glaser JK, et al. Chronic stress and age-related increases in the proinflammatory cytokine IL-6. *Proc Natl Acad Sci USA.* 2003;100:9090-9095.
8. Mezuk B, et al. Depression and type 2 diabetes over the lifespan: a meta-analysis. *Diabetes Care.* 2008;31:2383-2390.
9. Vancampfort D, et al. Metabolic syndrome and metabolic abnormalities in severe mental illness: systematic review and meta-analysis. *World Psychiatry.* 2015;14:339-347.
10. Unützer J, et al. Collaborative care management of late-life depression in the primary care setting: IMPACT randomized controlled trial. *JAMA.* 2002;288:2836-2845.
11. Archer J, et al. Collaborative care for depression and anxiety problems. *Cochrane Database Syst Rev.* 2012;10:CD006525.
12. Cherkin DC, et al. Effect of mindfulness-based stress reduction vs cognitive behavioral therapy or usual care on back pain and functional limitations. *JAMA.* 2016;315:1240-1249.
13. Tate T, Roberts S, Main LC, Bruce L. The influence of training load and schedule on youth athletes' sleep. *J Sleep Res.* 2025;34:e70013.
14. Fullagar HHK, et al. Sleep and athletic performance: effects of sleep loss on exercise performance and physiological and cognitive responses. *Sports Med.* 2015;45:161-186.
15. Hirshkowitz M, et al. National Sleep Foundation's sleep time duration recommendations. *Sleep Health.* 2015;1:40-43.

STATUS. This white paper presents a developing conceptual framework intended for education, formulation, program design, and research development. It is not a validated diagnostic instrument or a substitute for individualized medical or mental health care.

THE INVISIBLE ARCHITECTURE OF WELL-BEING

Version 2.1 | October 17, 2026 | Research and implementation supplement

John T. Paruch, MD | Internal Medicine, Psychiatry, Lifestyle Medicine

Scope and version note

This supplement extends the existing IAWB v2.0 white paper. The consolidated PDF retains the original v2.0 pages intact and appends this v2.1 material; the older page headers retain their original version numbers. It is an annotated update, not a silently rewritten source.

Scientific status

IAWB is a proposed integrative clinical and performance formulation framework. Evidence for component pathways does not validate its composite constructs, six proposed states, weighting scheme, or predictive utility. The eight domains are descriptive; the governing dynamics and cross-domain predictions require independent prospective testing.

New integration: adaptive challenge and stress appraisal

Adaptive challenge is not synonymous with stress elimination. The 2022 randomized student experiments by Yeager and colleagues support the possibility that coordinated beliefs about growth and the meaning of stress can change selected stress responses and performance-related outcomes. IAWB application: consider perceived controllability, interpretation of challenge, support, and actual resource availability as distinct potential moderators of effective load. These results do not validate IAWB states or justify a one-size-fits-all intervention.

New integration: training dose and reserve

Refalo and colleagues synthesized 15 hypertrophy studies and found no clear superiority of momentary muscular failure over non-failure training. Higher velocity-loss thresholds were not consistently superior. IAWB application: exercise stimulus should be considered jointly with recovery resources, injury risk, sport demands, and accumulated load. This evidence informs a training-design principle, not a quantitative IAWB reserve metric or athlete-specific prescription.

Athlete performance: proposed cross-domain application

Performance optimization is framed as building functional and accessible capacity through individualized training, sleep opportunity, nutrition adequacy, supportive relationships, attention skills, agency, and recovery planning. Underload, productive challenge, and overload should be treated as context-dependent hypotheses rather than fixed universal thresholds. Mental health, development, injury and structural constraints remain relevant to athletes.

Measurement and validation priorities

Pre-register operational definitions for effective load, available/accesssible/functional reserve, adaptive margin, and six states. Test inter-rater reliability of state classification; discriminant and predictive validity beyond established clinical measures; within-person sensitivity to change; fairness across populations; and whether bottleneck-targeted strategies outperform standard prioritization. Allostatic load biomarker composites should remain separate from clinical prediction

models.

Updated reference notes

R01 — Yeager DS, Bryan CJ, Gross JJ, et al. A synergistic mindsets intervention protects adolescents from stress. *Nature*. 2022. doi:10.1038/s41586-022-04907-7

Evidence: A brief combined growth-mindset and stress-can-be-enhancing intervention improved selected stress-related cognitions, physiological and academic/psychological outcomes in studied student settings. Application: Adolescent stress appraisal; agency; adaptive challenge; performance Limitations: Student populations; outcomes and intervention effects vary; do not extrapolate as universal athlete or clinical treatment.

R02 — Refalo MC, Helms ER, Trexler ET, Hamilton DL, Fyfe JJ. Influence of resistance training proximity-to-failure on skeletal muscle hypertrophy: A systematic review with meta-analysis. *Sports Med*. 2023;53:649-665. doi:10.1007/s40279-022-01784-y

Evidence: No clear hypertrophy superiority of momentary muscular failure over non-failure training; greater velocity loss was not consistently superior. Application: Adaptive challenge; movement; fatigue management; reserve; athlete programming Limitations: Healthy adults; heterogeneity and limited comparisons; not direct evidence for the IAWB model.

R03 — McCrory C, et al. *Psychoneuroendocrinology*. 2023. doi:10.1016/j.psyneuen.2023.106117

Evidence: Candidate parsimonious allostatic load biomarkers include CRP, resting heart rate, HDL-C, waist-to-height ratio and HbA1c. Application: Measurement tier A; biological load Limitations: Not a universal clinical score; biomarker thresholds and study population require justification.

R04 — Reynolds A, et al. Carbohydrate quality and human health: a series of systematic reviews and meta-analyses. *Lancet*. 2019. doi:10.1016/S0140-6736(18)31809-9

Evidence: Higher dietary fiber and whole-grain intake are associated with better major health outcomes. Application: Nutrition; metabolic and cardiovascular reserve Limitations: Not proof that short-chain fatty acids mediate all benefits.

R05 — Felitti VJ, et al. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: the ACE Study. *Am J Prev Med*. 1998.

Evidence: Childhood adversity is associated with later-life behavioral and health outcomes. Application: Developmental domain; path dependence Limitations: Associations are not deterministic and do not validate individual-level prediction.

R06 — Prather AA, Janicki-Deverts D, Hall MH, Cohen S. Behaviorally assessed sleep and susceptibility to the common cold. *Sleep*. 2015.

Evidence: Shorter objectively assessed sleep was associated with higher susceptibility to a common cold in the studied sample. Application: Sleep; immune function; cross-domain coupling Limitations: Specific population and endpoint; not proof of broad causal disease prevention.

R07 — Unutzer J, et al. Collaborative care management of late-life depression in the primary care setting: a randomized controlled trial. *JAMA*. 2002.

Evidence: Collaborative care improved depression outcomes compared with usual care in the trial setting. Application: Integrated mental/physical health care; systems Limitations: Supports care model, not the full IAWB theoretical

structure.

R08 — Cohen S, et al. Chronic stress, glucocorticoid receptor resistance, inflammation, and disease risk. Proc Natl Acad Sci USA. 2012.

Evidence: Supports stress-related immune regulation mechanisms, including altered glucocorticoid sensitivity.

Application: Stress-immune coupling Limitations: Acute and chronic stress effects differ; mechanism is context dependent.