Rizun Resilience Therapy
WHERE TRAINING BECOMES TREATMENT

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RESEARCH PROPOSAL · SEPTEMBER 2026

Heart rate variability as a modifiable target for mental health in rural paid-on-call firefighters

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In one paragraph

Firefighters carry a documented mental-health burden, and the rural paid-on-call end of the service carries it with the least support. Low heart rate variability is already established as a correlate of anxiety and depression in this population. What is not established is whether HRV is the **mechanism** through which physical training improves mental health, or a number that happens to move alongside it. This proposal sets out a twelve-month observational cohort with nested single-case experiments in twenty to thirty rural paid-on-call firefighters, measuring HRV daily and mental health every four weeks, to test that question in a population that is almost entirely absent from the literature.

1. The problem

The Canadian Institute for Public Safety Research and Treatment reports that **32.3% of Canadian firefighters endorse symptoms consistent with at least one mental health condition**, and that **11.5% experienced suicidal ideation, a plan or an attempt in the past year**. Probable PTSD runs at roughly 14% against a general-population figure of 3.5% over one year.

Those numbers are not in dispute. What follows from them is.

Almost every intervention trialled in this population is psychological: peer support, resilience education, cognitive behavioural therapy, and more recently HRV biofeedback. Each has a place. None of them addresses the thing most firefighters already do, already value, and already have a culture around — physical training.

2. The gap, stated precisely

Most Canadian firefighting is not done by career firefighters. Cramm and colleagues put it plainly:

> **"Most firefighting (83%) in Canada is done by volunteers in rural areas."**

Eighty-three per cent of the work, and a small fraction of the research. The same paper — co-authored by the scientific director of the Canadian Institute for Public Safety Research and Treatment — names its own volunteer sample as a limitation and closes with a recommendation that reads like a brief for this proposal:

> **"Future researchers should explore the differences in the sleep and health between volunteer and professional firefighters."**

That call was published in 2021. It is still substantially open.

The national picture bears it out. CIPSRT's qualitative work on mental health impacts and priorities interviewed **thirty-nine career firefighters**. Valuable, and career-focused by design. Rural paid-on-call responders are the **understudied** majority of the Canadian fire service.

Their support gap is documented separately: in one Canadian province 92% of volunteer firefighters had been exposed to a critical incident and 35% to more than twenty, yet only 3% had received an individual debriefing. Rural responders routinely attend calls involving people they know by name.

Sleep and insomnia data show no significant difference between volunteer and career firefighters, so this is **not** a claim that rural responders are worse off. It is a claim that they are the larger group, the less supported group, and by some distance the less studied one.

Three specific absences:

1. **No longitudinal HRV data** in rural paid-on-call firefighters.
2. **No trial of physical training as the mental-health intervention** in firefighters, with HRV proposed as the mediator.
3. **No separation of the components.** Resistance work, aerobic work, time outdoors and deliberate down-regulation are treated as one lump called "exercise." They are four different interventions with four different signatures.

3. The question

> **Is heart rate variability the mechanism by which physical training changes mental health, or a marker that moves alongside it?**

Falsifiable in both directions, which is the point:

- If HRV is raised by a **non-exercise** route — paced breathing at resonance frequency, HRV biofeedback — and mental-health scores do not follow, HRV is a fitness gauge and not a lever.
- If mood improves reliably under training while HRV does not move, the mechanism lies somewhere else.

Either result is worth publishing. A proposal that can only succeed is not research.

4. Design

An observational cohort with nested single-case experiments. The cohort answers whether HRV tracks mental health *within* a person over time; the nested experiments test whether changing one input changes the outcome.

Participants. Twenty to thirty rural paid-on-call firefighters. The Columbia Shuswap Regional District operates fifteen halls with over three hundred active members, who answered 380 calls in 2025, so the recruitment pool is real without being overstated.

Duration. Twelve months minimum. Four twelve-week training blocks, with full assessment at every boundary. Twenty-four months preferred.

Daily measures. Overnight HRV and resting heart rate, sleep duration and quality, respiration rate, from a wrist wearable. A one-minute morning HRV reading, taken supine on waking, from a validated phone application. Single-item mood and anxiety ratings. Hours of resistance training, aerobic work, time outdoors, social contact and deliberate down-regulation. Alcohol the previous night, and illness.

Every four weeks. PHQ-9 and GAD-7, with item order randomised to reduce practice effects.

Every twelve weeks. Measured VO2 max, body composition, blood pressure, spirometry, lactate threshold, and a standardised eleven-group strength assessment.

The nested experiment. Within participants who consent to it, an ABAB withdrawal design on a single input — the first candidate being one hour of evening outdoor walking, added, withdrawn and added again, while everything else is held constant. Removal is stronger evidence than addition: an outcome that degrades when something is taken away and recovers when it is returned is difficult to explain any other way.

Analysis. Multilevel models separating within-person from between-person effects, which matters here — published wearable data shows sleep relating to mental health in *opposite directions* within and between people. Single-case data analysed by visual analysis and non-overlap methods, with randomised phase-start where feasible.

5. What this is not

It is not a randomised controlled trial and does not pretend to be. It is not blinded, and it cannot be: nobody can be blinded to whether they went for a walk. Expectancy effects in exercise-and-mood research are large, and the presence of objective physiological markers alongside self-report is part of the answer to that, not a cure for it.

Twenty to thirty participants gives reasonable power for within-person effects across roughly 1,500 repeated observations, and **poor power for between-person moderators.** That is a limitation to state at

the outset, not to discover at peer review.

6. Feasibility, and what makes this possible at all

The literature is blunt about why firefighter mental-health programmes struggle: resistance to asking for help, a culture that prizes not needing it, and leadership that does not always understand it. Recruitment is the bottleneck.

This proposal does not ask firefighters to enrol in a mental-health study. It offers them a fitness assessment, delivered by a certified strength and conditioning specialist who is also a paid-on-call firefighter in the same regional district. The wellbeing questionnaires travel inside something the crew already wants. That door is open to the investigator and effectively closed to most others, and it is the single strongest feasibility argument here.

Testing is intended to be delivered at the hall rather than requiring attendance at a laboratory. **The mobile testing capability is not yet built**, and nothing in this proposal depends on it: the portable equipment is the affordable component and can be carried.

7. Ethics

Nothing begins before ethics approval.

- The investigator is **not currently affiliated** with an institution and is seeking an academic partner and an REB of record.
- Approaches are being made to university research ethics offices in British Columbia to establish eligibility and the correct route.
- A plain-language **consent form has been drafted** in advance of any collection: optional, separate from intake, with training and price explicitly unaffected by the answer, and withdrawal available at any time.
- Records are **coded, not anonymised** — the distinction is deliberate, since following one person across years requires a key — with the key held separately from the data.
- Participants are colleagues of the investigator, which creates a real **dual-role and perceived-coercion risk**. This needs explicit management and an REB's view: recruitment should not run through the chain of command, and declining must carry no consequence.
- Clinically significant screening scores trigger referral, not treatment. The investigator is a strength and conditioning coach, not a clinician, and says so in writing to every participant.

8. Contribution to knowledge

If it runs, this produces:

- **The first longitudinal record of daily HRV alongside validated mental-health screening in rural Canadian paid-on-call firefighters.**
- A test of whether HRV mediates or merely accompanies the effect of training on mental health.
- Evidence on whether the components of "exercise" separate — whether outdoor aerobic work, resistance training and deliberate down-regulation leave different signatures.
- A dataset from a population the national research effort acknowledges it reaches least well.
- Feasibility evidence for a recruitment route that uses fitness assessment as the entry point rather than mental-health framing.

9. Publication and doctoral intent

The intention is peer-reviewed publication, not a private report. Candidate outputs, in order of likelihood:

1. A **protocol paper**, pre-registered on the Open Science Framework before collection begins.
2. A **feasibility and recruitment paper** at twelve months.
3. The **cohort analysis** at twenty-four months.

The investigator's intention is to pursue this work as the basis of a doctorate. He holds a B.A. in Psychology and is completing the NSCA Certified Strength and Conditioning Specialist qualification in 2026, and recognises that entry to a doctoral programme will require either a master's or a supervised research route. **This proposal is written to find a supervisor, not to substitute for one.**

10. The approach to Regina

The Canadian Institute for Public Safety Research and Treatment at the University of Regina is the national knowledge-exchange hub for public safety personnel mental health, and most of the Canadian figures cited above originate there.

There is a specific reason to approach Regina rather than anywhere else. **A paper co-authored by CIPSRT's own scientific director recommends exactly this research** — the differences in health between volunteer and professional firefighters — and identifies a small volunteer sample as a limitation of its own work. The gap named in that paper is the gap this proposal exists to start filling, in the 83% of the Canadian fire service that does the majority of the work.

The approach is deliberately narrow. Not a request for funding, and not a proposal for review. One question:

> **Is there anyone in your network working on this, or close to it, who would want a rural paid-on-call cohort in interior British Columbia?**

The investigator brings the cohort, the access, the equipment and the cultural standing to recruit. What he does not have is an institution, an ethics board or formal methods training. The gap in their coverage and the gap in his capability are complementary, and that is the basis of the approach.

What is being asked for

1. An academic partner willing to act as supervisor and REB of record.
2. Guidance on protocol and analysis before collection begins.
3. Nothing financial at this stage.

Sources for the figures quoted

- Cramm H, Richmond R, Jamshidi L, Edgelow M, Groll D, Ricciardelli R, MacDermid JC, Keiley M, **Carleton RN**. Mental Health of Canadian Firefighters: The Impact of Sleep. *International Journal of Environmental Research and Public Health*, 2021;18(24):13256. doi:10.3390/ijerph182413256 — the 83% figure, and the recommendation on volunteer versus professional research.
- Canadian Institute for Public Safety Research and Treatment. *Mental health impacts and priorities for Canadian career firefighters* — the 32.3% and 11.5% figures, and the thirty-nine career firefighters interviewed.
- Hoffmann MD, Colley RC, Doyon CY, Wong SL, Tomkinson GR, Lang JJ. Normative-referenced percentile values for physical fitness among Canadians. *Health Reports* (Statistics Canada), 2019;30(10):14–22. doi:10.25318/82-003-x201901000002-eng — the Canadian fitness percentiles against which participants would be compared.
- Columbia Shuswap Regional District, fire services. Fifteen halls, over three hundred active paid-on-call members, 380 calls in 2025.

Prepared September 2026. No data has been collected. No ethics approval is in place. Every figure above is drawn from a published source and every one was checked against that source rather than quoted from memory.