THE PERFECT STEP®
PARALYSIS RECOVERY CENTERS

Fit Habits
RETENTION ANALYTICS & RESEARCH

Participation and Functional Outcomes in Neurological Recovery

A multi-year observational analysis of frequency, severity, age, and time

A multi-year analysis of clients in exercise-based recovery training at The Perfect Step: frequency, response, and functional improvements. With expert clinical commentary.

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Activity. Neuroplasticity. Possibility. October 2026

SECTION ONE

The Question

For nearly two decades, The Perfect Step has operated on a conviction: recovery does not end when traditional rehabilitation does.

The Perfect Step is a neurological recovery center. Its clients live with spinal cord injuries, stroke, traumatic brain injury, cerebral palsy, multiple sclerosis, Parkinson's disease, and other neurological conditions. What happens inside the facility looks like exercise, and it is, but exercise is the vehicle, not the destination. Every session is a delivery mechanism for neurological stimulus: repeated, intentional demands on the nervous system designed to promote adaptation, preserve function, and push back against the secondary complications that follow neurological injury.

Across nineteen years and thousands of clients, the team observed the same clinical pattern: the people who keep showing up tend to keep improving. Consistency has been the through-line of nearly every success story at The Perfect Step and shapes how we train, schedule, and motivate our clients.

While that clinical intuition was built over decades, it had never been tested systematically against the facility's own records. This analysis represents the first rigorous look at whether the data supports what we've seen in practice.

The research questions are as follows:

> **Does consistent participation in exercise-based recovery training correspond to measurable functional improvement? Do clients who attend more frequently improve more? Does the relationship hold regardless of injury severity? And how does improvement behave over time, does it fade after an early window, or does it compound?**

The approach to measurement matters as much as the questions. This analysis tracks whole-person functional progress, the movements and capacities that determine what daily life actually looks like: rolling, sitting, standing, transferring, walking. It is a deliberately broad lens, aimed at what a person can do rather than any single isolated measure. Recovery, as The Perfect Step understands it, isn't just about strength, it's the means to affect the trajectory of our clients' lives.

Here are our results.

SECTION TWO

The Data

This analysis draws on The Perfect Step's complete operational and clinical records: roughly 300 clients with session histories spanning nearly six years, from late 2020 through mid-2026.

It is real-world data collected in the course of running the facility, not constructed for a study. The strength is that nothing here is hypothetical; every data point represents an actual person who trained, or didn't, and whose abilities changed, or didn't. The limitation is that observational data requires care in interpretation, a point we return to throughout.

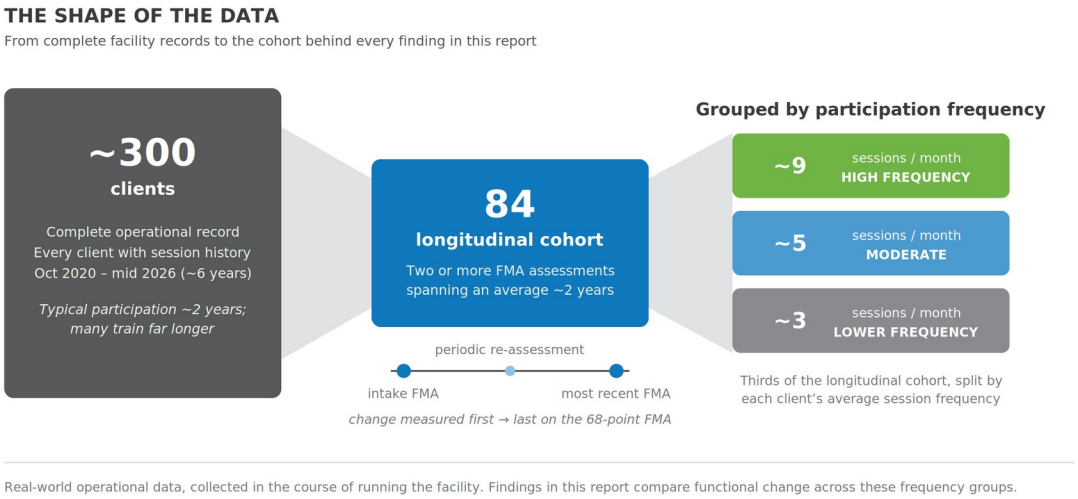
Short-term engagements with this population were relatively rare. The typical client's participation spans about two years (mean 2.0 years, median 1.5), and many train far longer, including clients with six or more continuous years of sessions. This isn't a group of transient rehabbers; it is a community of people doing sustained work.

The measurement instrument

Functional progress is tracked with The Perfect Step's Functional Movement Assessment (FMA), a 68-point evaluation of functional capacity across the developmental movement spectrum: rolling, sitting, kneeling, standing, walking, and progression through assistive devices. The FMA measures what a person can actually do, the capacities that determine independence in daily life. It is administered at intake and periodically re-administered as clients progress.

The longitudinal cohort

The core of the analysis is the group of clients with two or more FMA assessments over time and a linkable session history: 84 clients whose functional trajectories can be measured directly, and who form the basis for every analysis involving participation frequency. For each, we linked session attendance records to the change between their first and most recent assessment. The assessments span an average of roughly two years, meaning the changes reported here reflect sustained participation, not short-term fluctuation.



The shape of the data: complete facility records feed the cohorts behind every finding in this report.

What this study does and doesn't answer

This is an observational analysis of a single facility's records. It identifies relationships between participation and outcomes; it is not a randomized controlled trial, and we are careful throughout to describe findings at the population level. Where the data allows a stronger causal footing (and in one important place, it does) we say so and show why. Where it does not, we say that too.

EXPERT COMMENTARY

Filling the evidence gap

Formal rehabilitation typically ends at administrative endpoints (insurance benefits exhaust, basic compensatory milestones are met) endpoints that bear no necessary relationship to biological capacity. The central nervous system retains activity-dependent neuroplasticity for years after injury, and high-density mechanical loading directly counters the secondary complications that drive long-term cost and decline. Yet acute health systems capture data only during admission or episodic complication; once discharged, the person living with a chronic neurological condition effectively disappears from the record. Community-based facilities hold the only continuous observation of what happens next. Read this dataset as an early form of the surveillance layer the field is missing, imperfect, but pointed exactly where the evidence gap is.

— Gil Spitz, MS, MBA/MHA, CSCS · Founder and CEO, Surgical Strong

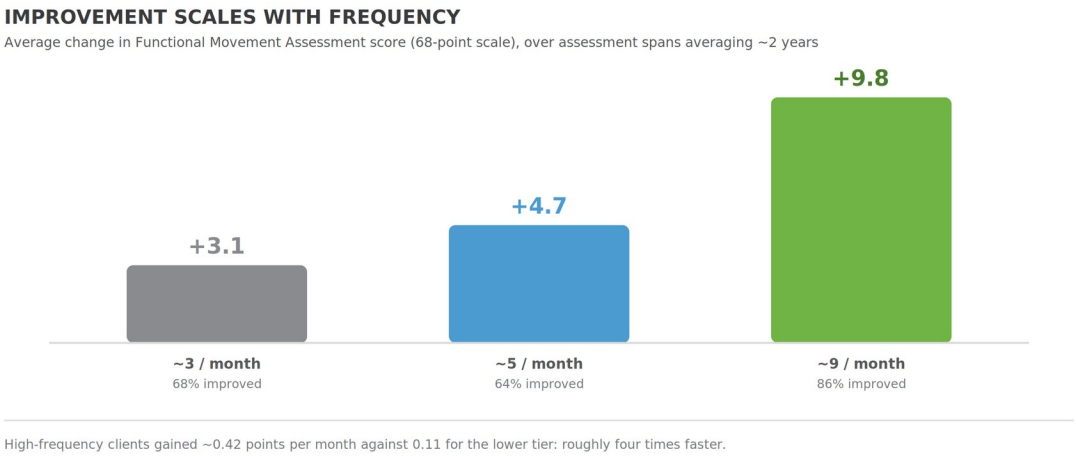
SECTION THREE · FINDING ONE

Improvement Is Real and Scales with Frequency

The central question first: do clients who attend more frequently improve more?

Yes, and the gradient is steep.

We grouped the longitudinal cohort into three tiers by average session frequency: high (roughly 9 sessions per month), moderate (roughly 5), and lower (roughly 3). Then we measured each group's average change in FMA score between first and most recent assessment.



Average change in Functional Movement Assessment score by participation frequency tier, measured over assessment spans averaging ~2 years.

Clients in the high-frequency tier improved by an average of **+9.8 points** on the 68-point scale, and 86% of them improved. The moderate tier averaged **+4.7 points** (64% improved). The lower tier averaged **+3.1 points** (68% improved). The gradient is orderly: each step up in frequency corresponds to a larger average improvement.

The rate difference is starker than the totals. High-frequency clients gained about **0.42 points per month**, against 0.11 for the lower tier, roughly **four times faster**. Because these improvements accrued over assessment spans averaging two years, the compounding is substantial: at these rates, the gap between a client who attends at a high-frequency vs. a low-frequency widens by more than seven points over the typical two-year span.

> ### Higher-frequency clients improved roughly 4x faster than lower-frequency clients

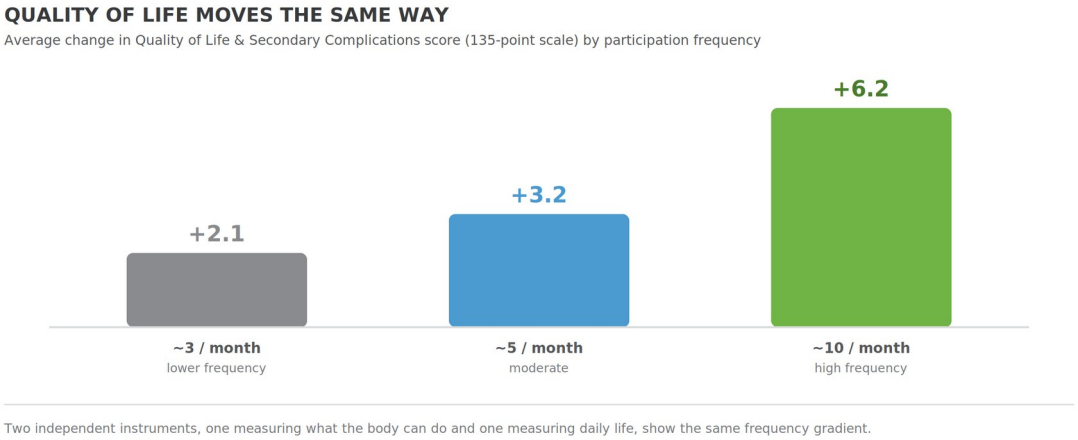
Moreover, the link between session frequency and improvement on the Functional Movement Assessment survives multivariable adjustment: +1.18 FMA points per

additional session per month ($p = 0.036$) holding baseline function, age, time since injury, and diagnosis constant.

Two things are worth underlining about this result. First, a majority of clients improved in every tier, even at three sessions per month, more clients gained function than lost it. Participation at any consistent level is associated with functional gains in this population. Second, the relationship is graded rather than binary. There is no cliff below which training does nothing and above which it works; more consistent stimulus corresponds to more improvement across the observed range.

A similar pattern appears for quality of life

Functional movement is not the only outcome The Perfect Step tracks. A separate instrument measures quality of life and secondary complications like pain, independence, bladder management, and pressure sores; the dimensions of daily health that neurological injury disrupts the most. On that instrument, high-frequency clients improved by an average of **+6.2 points**, versus +3.2 for the moderate tier and +2.1 for the lower tier.



Average change in Quality of Life & Secondary Complications score by participation frequency.

This is consistent with the functional finding. The quality-of-life instrument showed that the highest-frequency group improved most, but the difference between them and the other groups wasn't large enough to distinguish statistically at this sample size. We report the quality-of-life gradient as directionally supportive (a second instrument, measuring something different that points the same way) of our Functional Movement Assessment results.

> **Across this population, more frequent participation is associated with greater and faster functional improvement. Quality-of-life outcomes point the same direction, though less decisively.**

EXPERT COMMENTARY

Why a steep dose-response is biologically expected

A steep, non-linear dose-response is what excitable tissue should produce once critical activation thresholds are crossed. Three interdependent axes drive it. Neuroplastic thresholds: long-term potentiation and neurotrophin upregulation (BDNF) require high within-session repetition density, sustained across sessions. Musculoskeletal and vascular remodeling: high-volume, repetitive loading reverses post-injury deconditioning through time under tension and session frequency. Autonomic and metabolic priming: contraction-mediated glucose clearance and shear-stress-mediated endothelial function scale with volume. The steepness of the gradient reflects the unmasking of latent capacity, reactivating native motor engrams and overcoming learned non-use. Seen through that lens, a several-fold difference between frequency tiers is not surprising; it is what crossing a biological threshold looks like in operational data.

— Gil Spitz, MS, MBA/MHA, CSCS · Founder and CEO, Surgical Strong

The careful reader may ask themselves, “Does participation *cause* improvement? Or is something subtler going on?” We tested those questions directly and the results of that analysis, some of the most consequential in this report, come later in these pages. Before we get there, let’s examine two more dimensions of the pattern: the severity of injury and age of the participant.

SECTION FOUR · FINDING TWO

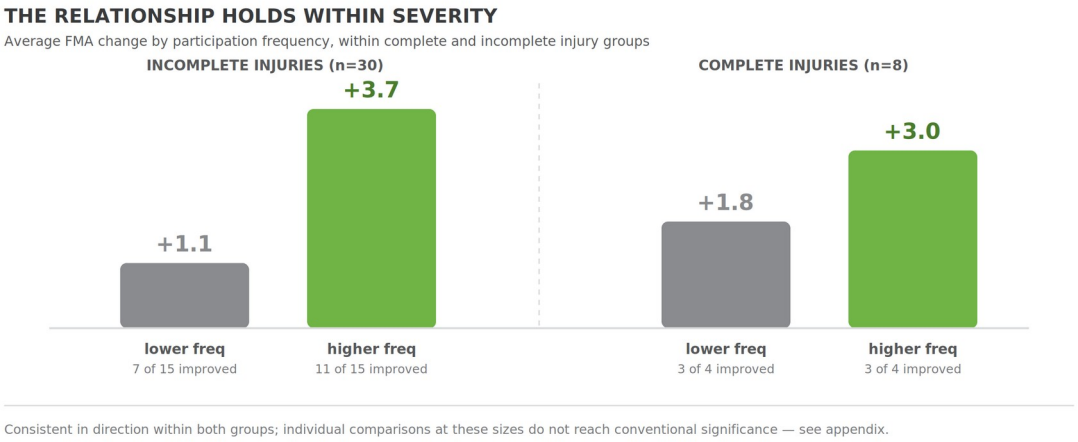
Benefits Hold Across the Spectrum of Injury

The finding that functional and QoL improvements match participation frequency led us to unpeel the next layer.

The theory: clients with less severe injuries might attend more often *and* improve more, not because training more produces more improvement, but because a milder injury makes both things easier. If that were the case, the gradient in Finding One would be an illusion of composition: severity would be driving both the attendance and the outcomes, while participation frequency is simply along for the ride.

Spinal cord injuries are classified as either **complete** (no motor or sensory function preserved below the level of injury) or **incomplete**, where some function remains. These are fundamentally different starting points with different recovery ceilings. If the frequency relationship is real, it should appear *within* each group, not just across the blended population.

It appears within both.



Average FMA change by participation frequency, within complete and incomplete injury groups.

Among clients with **incomplete injuries** (30 clients), those training at higher frequency improved by an average of **+3.7 points**, while lower-frequency clients improved by **+1.1**. Eleven of 15 in the higher-frequency group improved, against 7 of 15 in the lower. Among clients with **complete injuries** (8 clients), higher-frequency participation was associated with an average gain of **+3.0 points**, with 3 of 4 improving; lower-frequency clients gained **+1.8**, with 3 of 4 improving.

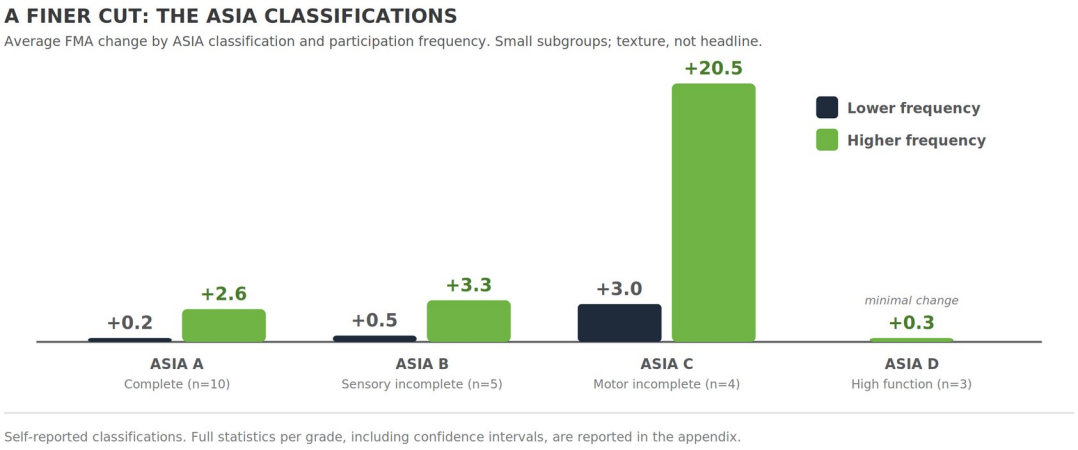
The effect is larger for incomplete injuries, which we believe clinical reasoning would predict: a better preserved neural pathway allows the nervous system to reorganize more effectively. But the direction is the same in both groups. Within a

fixed level of severity, the clients who trained more were the clients who improved more.

This is the result that answers the objection. The direction is the same in both groups, but at these subgroup sizes the within-severity differences do not individually reach conventional statistical significance (the appendix reports each). The argument rests on consistency across every stratum rather than on any single comparison, and on the multivariable analysis, which finds frequency a significant predictor after adjusting for baseline function, age, time since injury, and diagnosis. The frequency relationship is not severity in disguise.

A finer cut: the ASIA classifications

The complete/incomplete distinction can be sharpened using the ASIA Impairment Scale, which grades spinal cord injury from A (complete) through D (motor incomplete with substantial preserved function). At this resolution the subgroups become small at only a handful of clients each, so what follows is texture rather than headline, offered as a suggestive pattern and not a settled finding.



Average FMA change by ASIA classification. Small subgroups; self-reported classifications; suggestive pattern rather than settled finding.

Even at the most severe grade (ASIA A, 10 clients), higher-frequency clients improved more than their lower-frequency counterparts (+2.6 against +0.2), modest gains, but in the expected direction. In the sensory-incomplete grade (ASIA B, 5 clients), 4 of 5 improved, and higher frequency was again associated with larger gains. The largest improvements appear in the motor-incomplete grade (ASIA C, 4 clients): an average of +11.8 points with every client improving, where enough pathway is preserved to respond to stimulus, but enough deficit remains to leave substantial room for gain. If there is a window where consistent neurological stimulus finds its greatest purchase, the data suggests it may be here. At the highest-functioning grade (ASIA D, 3 clients), when clients start close to the assessment's ceiling, change was minimal, which we'd expect if there's little measurable room left to gain.

At these sample sizes, the comparisons within ASIA severity bands are consistent in direction but do not individually reach conventional statistical significance; the statistical appendix reports each. The pattern's credibility rests on its consistency across every stratum, not on any single comparison.

EXPERT COMMENTARY

What a few points mean in a complete injury

On paper, a two- or three-point gain on a motor score looks minor. For a person with a complete injury, those points can mark the boundary between dependence and independence. Restoring trace activation in the triceps or core pelvic stabilizers transforms a transfer from a two-person assist into an independent movement. Incremental gains in seated trunk balance enable self-directed pressure relief, directly mitigating pressure injuries and the rehospitalizations that follow. The central error among stakeholders is treating a complete diagnosis as an absolute biological zero. True anatomical transection is rare; most clinically complete injuries retain dormant circuitry below the lesion. Small measured gains in this population are not a rounding error, but some of the highest-value gains in recovery.

— Gil Spitz, MS, MBA/MHA, CSCS · Founder and CEO, Surgical Strong

Across every classification, the through-line holds: wherever there was room to improve, more frequent participation was associated with more improvement.

A note on classification: The Perfect Step does not perform ASIA examinations or assign injury classifications. The grades used in this analysis were reported by clients from information provided by their physicians and medical teams, and serve here as grouping variables rather than clinical determinations.

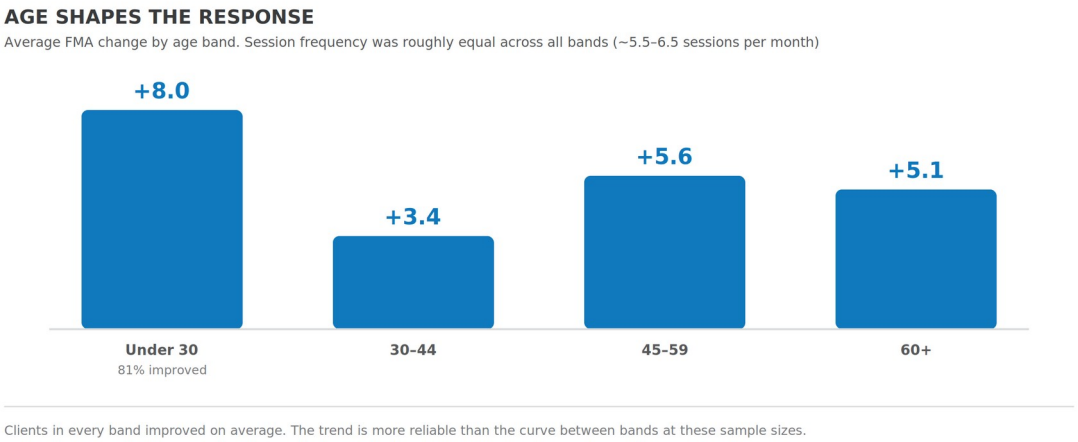
SECTION FIVE · FINDING THREE

Age Shapes the Response

If participation frequency matters independent of injury severity, does it work the same way for all ages?

Not quite, though the picture is clearer at one end of the age range than across it.

We grouped the longitudinal cohort by age at the time of assessment and measured functional improvement within each band.



Average FMA change by age band. Session frequency was roughly equal across all bands (~5.5–6.5 sessions per month).

Clients under 30 improved most, gaining an average of **+8.0 points**, with 81% of them improving. Improvement was more modest in the 30–44 band (**+3.4 points**), and rose again through the 45–59 band (**+5.6 points**) and the 60-and-over band (**+5.1 points**).

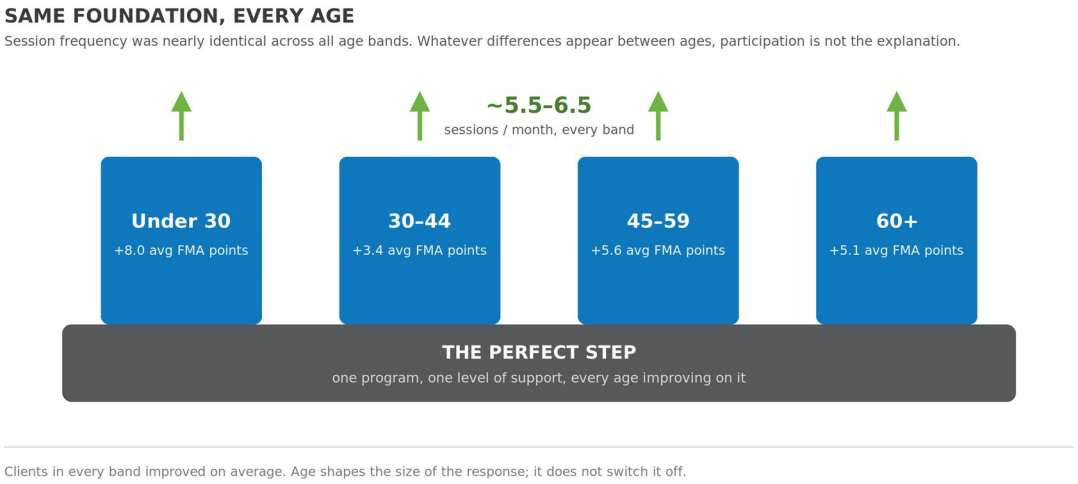
The clearest result comes from the youngest group. Clients under 30 showed the largest and most consistent gains (29 of 36 improved). This aligns with our understanding of the nervous system: younger systems tend to reorganize more readily. Neuroplasticity, the capacity of neural tissue to form new connections and reassign function, isn't fixed across the lifespan. Across older age groups, the pattern appeared less orderly (sample variation likely accounts for the differences among them). The finding is best stated narrowly: the youngest clients gained the most, consistent with their neuroplastic potential, though gains weren't distributed smoothly across every age group.

Comparable participation makes this finding credible

Could younger clients simply be training more often? If so, then age stands in for frequency all over again, the same way severity might have. But it's not. Session frequency was remarkably even across age bands, ranging roughly between 5.5 and 6.5 sessions per month. Younger and older clients showed up at near identical rates and the younger clients improved more anyway.

A caution about precision

The age bands here contain modest numbers of clients so the middle band's lower average shouldn't be over-read. At these sample sizes, the overall trend is more reliable than the shape of the curve between bands. The data supports a general pattern consistent with what we know about neuroplasticity, not a precise dose curve mapping years of age to points of expected gain.



Session frequency was nearly identical in every age band: the same foundation under every age.

EXPERT COMMENTARY

The lifespan dimension to capture in a prospective study

Lifespan timing is two distinct variables: chronological age at injury, and chronicity: the time elapsed from injury to intake. Age governs baseline plasticity, prior motor engrams, and physiological reserve: pediatric clients bring high plasticity but incomplete skeletal maturity; young adults sit at peak reserve; older adults often carry sarcopenia, osteopenia, and reduced cardiorespiratory reserve into the same program. Chronicity adds compensatory movement patterns, contractures, and overuse pathologies. Congenital conditions differ entirely: therapy is not reactivating previous motor engrams but establishing novel representations. An analysis by age at participation, like this one, is the right first cut; separating age at injury from chronicity is the next, and it belongs in prospective intake design.

— Gil Spitz, MS, MBA/MHA, CSCS · Founder and CEO, Surgical Strong

PROSPECTIVE INTAKE — WHAT TO CAPTURE

- Age at injury vs. age at intake
- Pre-morbid functional status
- Injury chronicity at enrollment
- Baseline bone mineral density (DXA)
- Surgical history
- Diagnosis and classification verified at intake

A minor caution about the wrong conclusion

Nothing here suggests older clients don't benefit, or should train less. Clients in the two oldest bands improved meaningfully, by five points or more on average, at the same participation levels as everyone else. The frequency relationship established in the earlier findings applies to them exactly as it applies to younger clients. The age pattern adds context, not a filter: aging influences the size of the response, but it doesn't switch it off.

> **The youngest clients improved the most, consistent with what we know about neuroplasticity: session frequency was consistent across age groups, younger participants didn't simply "train more."**

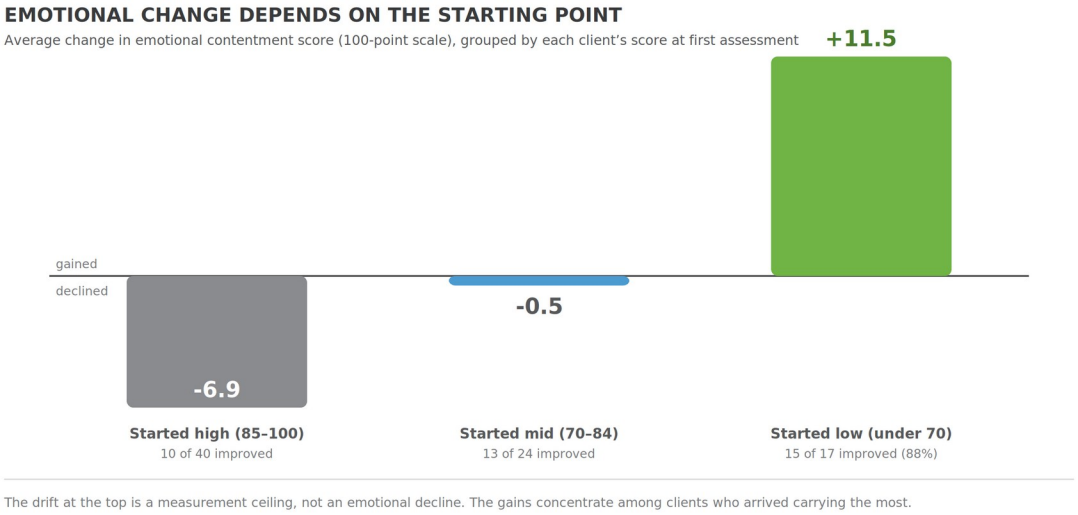
SECTION FIVE B · A SECONDARY FINDING

Emotional Wellbeing: Who Benefits Most?

Not all of our analyses followed the same gradient: more participation leads to more improvement. One of them refused, and understanding why turned a confusing result into one of the more human findings in the dataset.

Alongside its functional assessments, The Perfect Step administers an emotional contentment questionnaire: a 100-point instrument capturing how clients are actually doing beneath the physical work (scoring tension, discouragement, hopelessness, energy, confidence, and pride). When we first looked at these scores against participation frequency, the pattern was muddled. Some of the most consistent, hardest-training clients appeared to be *declining* emotionally. Taken at face value, that could be a troubling result.

But the reality turned out to be different. The right question wasn't "how often do clients train?" It was "where did their emotional well-being begin?"



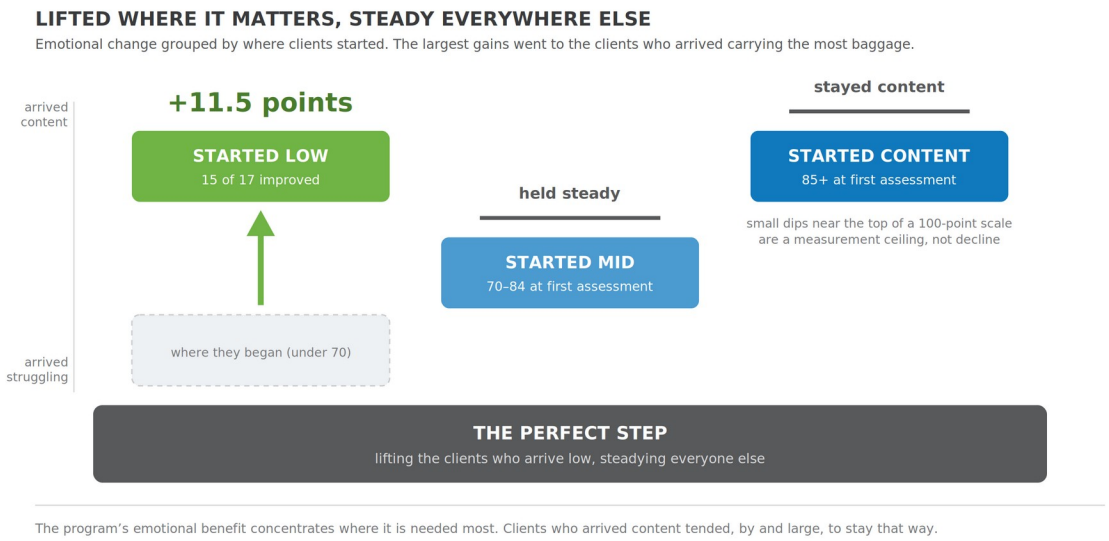
Average change in emotional contentment score, grouped by each client's score at first assessment.

We regrouped the same clients by their emotional score at their first assessment, and the picture snapped into focus. Clients who arrived scoring high already, 85 or above on the 100-point scale, drifted down an average of **6.9 points**. Clients who arrived in the middle range held essentially steady. And clients who arrived below 70, the group carrying the most emotional weight through the door, improved by an average of **+11.5 points**, with 15 of 17 reporting improvement.

We believe the downward drift at the top is a measurement phenomenon, not an emotional one. A client who begins at 92 on a 100-point scale has almost nowhere to go but down; ordinary fluctuation from week to week can only register in one

direction. Statisticians call this a ceiling effect, and it fully accounts for the apparent decline among high-scoring clients, including those training at high frequency. Those clients walked in content and, by and large, stayed content. The scale simply has no room to say so.

The real signal is at the lower end. The clients who arrived in distress and stood the most to gain from their recovery improved substantially and almost uniformly. **The program's emotional benefit is real, and concentrates precisely where it's needed most.**



The largest emotional gains went to the clients who arrived carrying the most baggage; those who arrived content stayed content.

While this finding doesn't link participation frequency to improvements in emotional well-being, for a family asking whether this kind of program can help a loved one's outlook (a question families ask constantly, and one that matters as much to them as any movement score) the data offers an honest and specific answer. If they are struggling, the odds are strongly in their favor.

> **Emotional gains concentrate among clients who need it the most: 15 of 17 of the most distressed participants improved, by an average of more than 11 points. Those who arrived content tended to stay content.**

We might have expected a participation-frequency gradient across emotional assessments, but real-world data is rarely so obliging. This is what it looks like to meet a messy result head-on, find the mechanism underneath it, and report what's actually there. The same discipline applies to our strongest findings, which we're about to test directly…

But first, one more dimension of the main pattern: Time.

SECTION FIVE C · FINDING FOUR

Improvement Continues Over Time

There is an assumption buried in how most people think about recovery: that improvement is an early-window phenomenon. A client arrives, begins training, and makes gains while the nervous system responds to a new stimulus before the window closes and the work becomes maintenance. It is an intuitive picture, and it shapes real decisions: clients and families who believe the window has closed choose differently from those who believe the work still pays.

The data does not support it.

Across the longitudinal cohort, clients gained an average of roughly **+3.3 FMA points per year** of participation, measured over the full span between their first and most recent assessment: the cleanest single statement this data supports about improvement over time.



And the gains didn’t stop at the twelve-month mark. Among the clients with enough assessments to look past their first year, functional gains were still accruing in later periods. The first year was not where improvement ended. How the *rate* of recovery behaves over the years is a question this dataset can raise but not settle; it is one a prospectively designed study, with assessments on a fixed schedule, is built to answer. The appendix details the analysis.

EXPERT COMMENTARY

Administrative endpoints are not biological endpoints

Human biology operates on a continuum of cellular and neural adaptation; healthcare administration answers to fiscal calendars. Rehabilitation is budgeted as an acute, episodic event: therapy front-loads, discharge milestones are hit, coverage ends. Nothing in that sequence corresponds to a biological endpoint. Transplant medicine offers the counter-model: institutional funding and survival metrics are bound to mandatory one- and three-year cohort outcomes, so the system commits to multi-year surveillance. Neuro-recovery needs the same operational frame of value-based reimbursement tied to one-, three-, and five-year functional cohorts; medical necessity redefined to include bone density, autonomic regulation, and transfer independence; and community exercise data integrated as a clinical-grade registry. A finding that gains continue past year one is precisely the evidence that reframing requires.

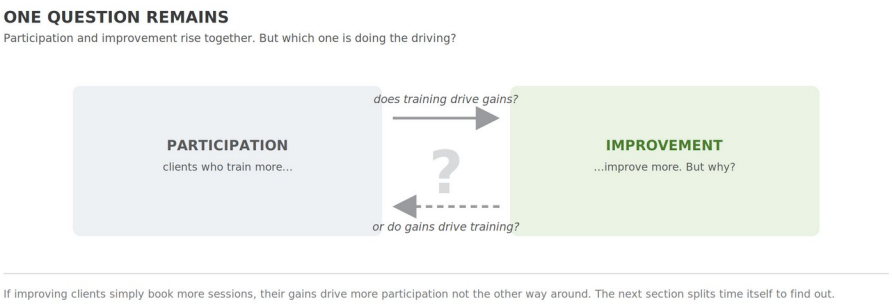
— Gil Spitz, MS, MBA/MHA, CSCS · Founder and CEO, Surgical Strong

This is consistent with the premise the program rests on: neurological reorganization is a slow structural process that rewards repetition over long horizons when a client's second and third years are not just a holding pattern. It also completes the picture the earlier findings began. Frequency answers *how often*; this answers *how long*. Both dimensions of sustained participation point the same direction.

> **Functional gains do not stop after the first year. Across this population, improvement continued with sustained participation. The year-one window does not close.**

For clients and families, this may be the most practical finding in the report: a plateau is not necessarily an ending, and the instinct to measure success against the first few months is not supported by our records.

Everything reported so far describes a relationship between participation and improvement. Whether that relationship reflects participation actually *producing* improvement is a different and much harder claim, the question a skeptical clinician should ask, and the one we set out to test directly.



Participation and improvement rise together. The final section tests which one is doing the driving.

SECTION SIX · THE TEST

Why We Believe This Is Real

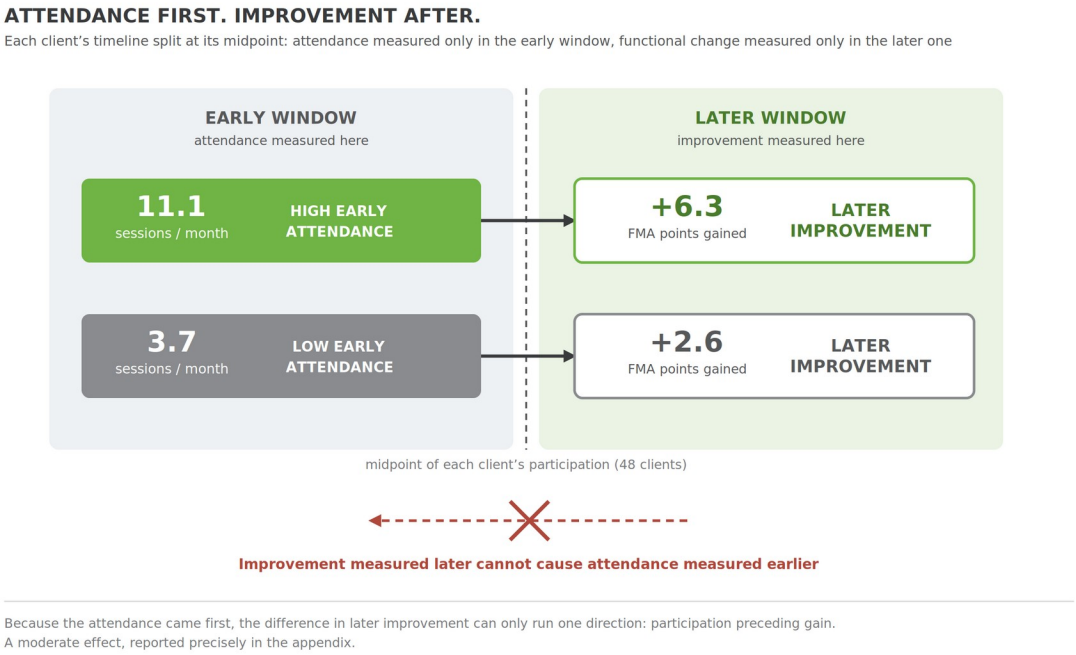
To convince ourselves the results were real we had to consider the alternative.

Perhaps the causation runs backward. An improving client *feels* the improvement: transfers get easier, standing lasts longer, progress is visible week to week. Progress is motivating, and motivated clients book more sessions. Meanwhile, a client who isn't improving gets discouraged, and discouraged clients taper off. If that's the mechanism, then improvement drives attendance rather than the other way around.

The test

The rival explanation has a structural weakness: it requires improvement to come *first*, so it can drive the attendance that follows. That makes it testable. Instead of comparing each client's overall attendance to their overall improvement, where cause and effect are tangled together in the same window, we split the timeline. We measured each client's attendance during an *early* period, and their functional improvement during a *later* one. Then we asked whether early attendance predicted later improvement.

But if improvement drives attendance instead, we'll prove the rival explanation true. In other words, later improvement cannot reach backward in time and cause earlier attendance. Whatever relationship survives this split has the arrow pointing in only one possible direction.



The temporal design: attendance measured in an early window, functional improvement measured in a later one.

The result

The relationship survived the split. Among the 48 clients with enough history to test, those with high attendance in the early period (averaging 11.1 sessions per month) went on to improve by an average of **+6.3 points** in the later window. Those with low early attendance (averaging 3.7 sessions per month) improved by **+2.6 points** in the same later window. The effect is moderate in size and, at 48 clients, sits at the edge of conventional statistical significance; the appendix reports the figures. What matters is the direction and the design: attendance measured first was associated with improvement measured afterward.

Early training predicted improvements that came later while the reverse story didn't hold.

What we can now say

The relationship between participation frequency and improvement in this population is unlikely to be an artifact of hypermotivated clients booking more sessions. The temporal design cannot produce that pattern, and the relationship persisted within it. Attendance measured before the fact predicts improvement after it, the signature of participation doing causal work, not riding along. The multivariable analysis in the appendix adds a second line of support: frequency remains a positive, statistically significant predictor of improvement after accounting for baseline function, age, time since injury, and diagnosis.

What we're holding for the future

Why a prospective study comes next. This is an observational analysis, not a randomized trial. No client was assigned a training frequency; every pattern here emerged from choices people made in their own lives, and unmeasured factors (resources, support at home, overall health) surely influence both attendance and outcomes in ways this design cannot fully separate. It is a single facility's records, and a population of one facility's clients; the findings describe The Perfect Step and may or may not generalize beyond it. There is no non-participating comparison group and we cannot say what would have happened to these clients had they not trained at all, only that among those who did, more training preceded more improvement. Every finding in this report is a population-level pattern: it describes the cohort, not a guarantee for any individual, whose trajectory may run faster, slower, or differently shaped than any average printed here.

The temporal test moves this work from "consistent with the program's belief" to "difficult to explain any other way." The next step is a prospectively designed study: defined cohort, scheduled assessments, comparison benchmarks; a step The Perfect Step intends to take.

> **Attendance measured early was associated with improvement measured later, in a design where the improvement could not**

> **have caused the attendance. The relationship persists with the arrow of time pointing only one way: a moderate effect, and the strongest causal evidence observational data of this kind can offer.**

What remains is a question for every reader of this report: what does all of this mean for a client deciding how to train, a family deciding what to support, and a physician deciding what to make of a program like this one?

SECTION SEVEN · IMPLICATIONS

What It Means

Our findings are only as useful as the decisions they inform and they inform several, depending on who's asking the questions.

For clients and families

The most practical implication is also the simplest: how often you train matters, and it matters more than most people expect. The difference between attending roughly three times a month and roughly nine wasn't marginal, it was a fourfold difference in the rate of functional gain. For a client weighing whether the added sessions are worth the cost, the transportation, the fatigue, and the coordination they require, that is the honest number to weigh against.

The second implication may matter more. Progress in this population is a long arc. Clients in this analysis were still gaining function two and three years in. The instinct to judge a program by its first few months, and to read a slow stretch as the ceiling, is not supported by what these records show. A plateau doesn't necessarily signal the end. For families deciding whether to sustain a commitment that is genuinely demanding, this distinction is worth a great deal.

And for anyone arriving at a low point emotionally: the clients who came in carrying the most weight were the ones who improved most on that measure. Fifteen of seventeen got better. Whatever else the program does, it appears to do the most emotional good for the people who need it most.

For referring physicians

The finding most relevant to referral decisions is the one in Finding Two. Functional improvement was not confined to clients with favorable injury profiles. It appeared within complete injuries as well as incomplete ones. The gains were smaller than in the incomplete group, as clinical reasoning would predict, but they were consistent and real.

This is worth stating directly because expectations for clients with complete injuries are often calibrated toward maintenance. These records suggest that measurable functional improvement remains available to that population under conditions of consistent, sustained training. The frequency relationship applies to them as it does to everyone else.

The Functional Movement Assessment tracks capacities that determine independence: rolling, transferring, sitting, standing, walking, and progression through assistive devices. A gain on this scale is not an abstraction. It describes what a person can do without help.

For the field

Two observations warrant further study rather than conclusions.

The first is that clients with incomplete injuries appear to be the highest-leverage population for frequency-driven functional gains. The difference between higher and lower participation was larger in that group than in the complete-injury group. If neurological reorganization depends on a preserved pathway, that's expected; but the size of the gap suggests the return on additional sessions may vary considerably by injury profile, which has implications for how programs allocate resources and capacity.

The second is the timing question. That improvement continues well past the first year runs against a common assumption about recovery trajectories. But the current data cannot resolve how the *rate* of recovery behaves over years, and the subgroup that was followed the longest is small and not representative. Whether gains hold steady, slow, or build over time is an open and, we think, important question that only a prospective design with scheduled assessments can answer.

A third observation emerged from examining diagnosis. Clients with cerebral palsy and stroke showed the largest average gains, while clients with other diagnoses improved more on average functional movement than clients with spinal cord injury after adjusting for frequency, baseline function, age, and time since injury. These subgroups are too small to support conclusions, but they point clearly at diagnosis-specific response as a primary question for prospective work.

What comes next

Thus far, we've distilled the observational data and established a frequency-improvement relationship, showed that the relationship holds in direction within each level of injury severity, layered in age and time, and tested the central causal objections.

The next step is a study designed as a study. The Perfect Step is investing in the data infrastructure that makes one possible: richer intake, structured tracking, and aligned assessment cadences. With that foundation, a prospective analysis with defined cohorts and appropriate comparison benchmarks becomes achievable, and our questions become directly answerable. The clinical commentary in these pages sharpens what that study's central question should be: what is the minimum effective dose of participation required to produce lasting functional gain, what does it take to maintain it, and what is the downstream health and economic impact of meeting it?

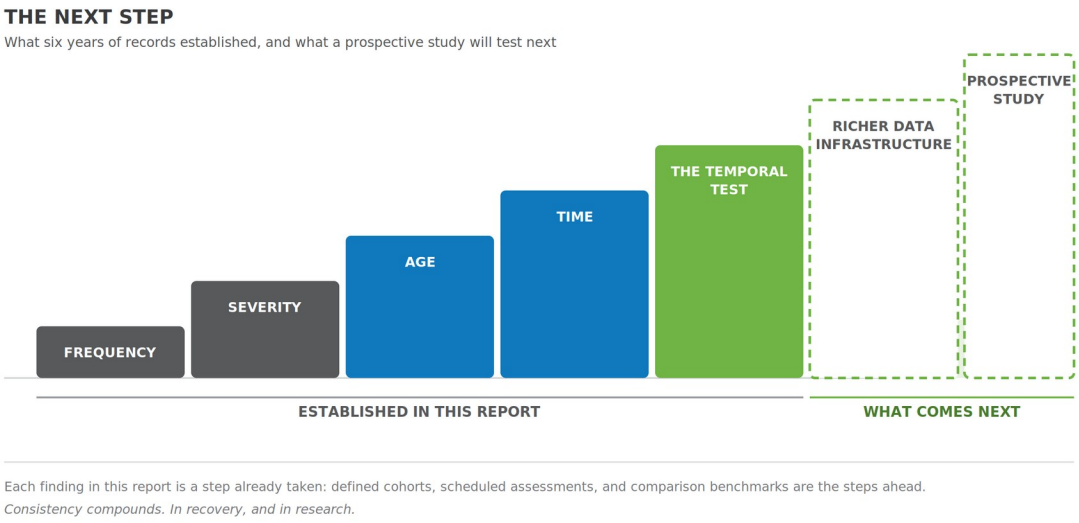
EXPERT COMMENTARY

The question the prospective study should be built around

What strikes me most is that this dataset provides empirical evidence that chronic neurological recovery does not encounter a biological barrier at twelve months. Exercise in this population is a lifetime clinical necessity, not optional wellness. Any prospective study should be organized around one primary objective: establish the minimum effective dose, and the retention rate, required to convert transient neuroplastic signaling into durable functional independence. Three outcomes follow. Map the dose thresholds where remodeling converts into landmark functional transitions. Define decay kinetics, or the rate of regression when volume decreases, to set lifetime maintenance dosing. And quantify the economic offset in rehospitalizations, pressure injuries, and caregiver hours, in terms actuaries can use.

— Gil Spitz, MS, MBA/MHA, CSCS · Founder and CEO, Surgical Strong

For a population that is traditionally underserved by outcomes research, we believe that is worth doing.



Each finding is a step already taken. A prospective study is the next one.

Consistency is not a slogan in this data. It is the variable most closely associated with functional improvement across severity levels, across age, and across years of participation.

ABOUT THE PROGRAM

Inside The Perfect Step

The Perfect Step is a community-based neurological recovery center and wellness program serving individuals living with paralysis and other neurological conditions. Our programming includes comprehensive evaluations designed to measure each client's progress against their baseline performance and goals, while improving secondary complications, quality of life, and daily function. The Perfect Step's Functional Movement Assessment (FMA), in parallel with other assessments and client-reported outcomes, allows us to develop individualized programs based on neurological presentation, functional abilities, and opportunities for progression.

For participating clients, our program typically consists of recurring one-on-one sessions with trained paralysis recovery specialists utilizing The Perfect Step's STEP Method®, which incorporates purposeful neurological activity, load-bearing, repetitive functional movement, exercise-based training, and other activity-based strategies. Programming evolves with individual progress and may incorporate mobility and transfer training, standing and gait-related activities, plus strength and conditioning, FES and other technologies, and supplemental wellness opportunities. We periodically reassess our clients to measure progress against their starting baseline, set goals, and customize programming. Unlike a short-duration rehabilitation program, TPS is designed to provide an opportunity for sustained participation months and years beyond injury or diagnosis.

What The Perfect Step is, and isn't. TPS is an activity-based neurological recovery and wellness organization, not a licensed skilled-therapy or medical provider. ASIA classifications in our dataset were self-reported by clients based on assessments from their physicians or rehabilitation providers; TPS did not perform the ASIA examinations or assign classifications.

APPENDIX · METHODS

Methods, Measures, and Limitations

This appendix is written for readers who want the methodological detail behind the findings. It adds precision; it does not change any conclusion stated in the body of the report.

Data source. All data derives from The Perfect Step's operational and clinical records: client rosters, session-level attendance records spanning October 2020 through mid-2026, and clinical assessments administered as part of routine practice. Records were cleaned and linked prior to analysis: client identities reconciled across systems, duplicate records resolved, scheduling and administrative entries excluded, and assessment records joined to attendance histories through client-level identifiers. The analytical population comprises approximately 300 clients with at least one recorded training session.

Primary outcome measure. Functional status is measured with The Perfect Step's Functional Movement Assessment (FMA), a 68-point instrument developed by the facility to evaluate functional capacity across the developmental movement spectrum: rolling, seated control, elbows-and-knees and hands-and-knees positions, kneeling, standing, walking, and progression through assistive devices. Higher scores indicate greater functional capacity. The FMA is a proprietary internal instrument; it has not been externally validated against standardized clinical measures, a limitation noted below. It is administered at intake and re-administered periodically over the course of participation.

Secondary measures. Quality of life and secondary complications are measured with a separate multi-item instrument covering pain, independence, bladder management, and pressure-related complications. Emotional wellbeing is measured with a 100-point questionnaire spanning negative-affect and positive-affect items. Both are administered alongside the FMA at assessment points.

Longitudinal cohort. Findings involving change over time are computed on the cohort of clients with two or more FMA administrations and session records linkable to their assessment history: 84 clients. All analyses in the body use this cohort.

Representativeness of the cohort. The 84 clients in the longitudinal cohort were compared with the 220 analytical clients who did not receive a second assessment. On session frequency, the variable central to this analysis, the two groups were essentially equivalent (5.7 vs. 5.4 sessions per month). The cohort differed in other respects: longer tenure, which follows from the requirement for a repeat assessment; lower baseline functional scores (13.6 vs. 19.4 among clients with a baseline); younger average age (37 vs. 42); and a diagnosis mix with proportionally fewer spinal cord injuries and more cerebral palsy. The frequency findings are therefore representative of the facility's population; the absolute improvement magnitudes may be somewhat larger than the full population would show, given the cohort's greater room to gain. For each, change is computed as the difference between the first and most recent assessment. Assessment spans average

approximately two years (mean ~26 months). The same two-plus-administration rule defines the longitudinal cohorts for the secondary measures.

Participation frequency. Each client's session frequency is computed as total recorded sessions divided by the months elapsed between their first and last session. For the frequency-tier analyses, the longitudinal cohort is divided into thirds by this measure, yielding groups averaging approximately 9, 5, and 3 sessions per month. Tier boundaries are data-driven rather than prescriptive; they describe this population's actual distribution of participation.

Multivariable adjustment. To test whether frequency's relationship to improvement is independent of other client characteristics, an ordinary least squares model was fit on the 81 cohort clients with complete covariate data, regressing FMA change on session frequency, baseline FMA score, age, years since injury, and diagnosis (spinal cord injury vs. other). Frequency remained a positive and statistically significant predictor (+1.18 FMA points per additional session per month; 95% CI +0.08 to +2.28; $p = 0.036$). Diagnosis was the only other significant term (spinal cord injury, $p = 0.016$). A second model restricted to the 36 clients with a complete/incomplete classification added injury severity; frequency's coefficient remained significant (+0.99; $p = 0.027$). These are robustness checks on a modest sample rather than definitive models; together the five predictors explain roughly a quarter of the variation in improvement.

Improvement over time. The comparison of first-year and later-period improvement rates is computed on the 32 cohort clients with at least two assessments in their first year and at least one afterward. This subgroup had lower baseline function (mean FMA 9.0 vs. 16.4 for the remainder of the cohort) and lower first-year gains than clients who did not continue past year one, indicating both a selection effect and a regression-to-the-mean component in later-period rates. Within this subgroup, the average first-year rate was approximately +1.3 points per year and the later-period rate approximately +4.4 points per year; given the selection and regression effects described, these rates are not directly comparable, and the finding is accordingly stated as continuation of improvement past the first year.

Severity classification. Complete/incomplete status and ASIA impairment grades derive from the facility's intake evaluations. The Perfect Step does not perform ASIA examinations; classifications were reported by clients from information provided by their physicians and medical teams. Where a client had multiple evaluations, the earliest recorded classification was used. Severity analyses were run within classification groups, comparing above-median to below-median participation frequency inside each group.

Age and time analyses. Age is grouped into four bands (under 30, 30–44, 45–59, 60 and over). Session frequency was verified to be approximately equal across bands (range ~5.5–6.5 sessions per month) before interpreting age-band differences as age effects. The improvement-over-time analysis compares each client's rate of FMA change during their first year of participation against their

rate in subsequent periods, computed for clients with sufficient assessment coverage in both windows.

The temporal-precedence test. To test the direction of the frequency-improvement relationship, each eligible client's participation window was split at its midpoint. Attendance frequency was computed on the first half only; functional change was computed from the assessment nearest the midpoint to the final assessment; that is, entirely within the second half. Clients were then grouped by early-window attendance, and later-window improvement was compared across groups. This design ensures the attendance being measured precedes the improvement it is compared against, ruling out later improvement as a cause of earlier attendance. Clients required a sufficient participation span and an assessment near the midpoint to be included.

Annualized improvement. The per-year improvement figure (+3.3 FMA points per year) is computed at the population level: each client's total change divided by their assessment span in years, averaged across the cohort. We deliberately report this figure for the population only and do not break annualized rates down by frequency tier. Total improvement and time-normalized improvement are different quantities; assessment spans vary systematically across clients, and at this cohort's size, per-tier annualized rates are unstable and invite comparison against the total-change figures in Finding One, which they do not measure. The two framings are kept separate by design.

Limitations. Stated in the body and restated here for completeness. This is an observational, retrospective analysis of a single facility's records; participation levels were chosen by clients, not assigned, and unmeasured factors plausibly influence both attendance and outcomes. There is no non-participating comparison group. The primary outcome instrument is internal to the facility and not yet externally validated. Several subgroup analyses (notably the ASIA-grade breakdown) rest on small samples and are presented as suggestive. All findings are population-level descriptions of this cohort and are not individual predictions. Assessment timing was determined by practice circumstances rather than a fixed schedule, which limits resolution on questions of timing and is a primary target of the facility's ongoing data-infrastructure improvements. Several of the within-subgroup comparisons, including the severity strata, the age bands, and the temporal-precedence test, show consistent direction and small-to-moderate effect sizes without reaching conventional significance thresholds at their sample sizes; the appendix table reports each comparison's statistics.

Summary statistics for principal comparisons

Finding	n	Comparison	Effect size	Test
FM by frequency tier	84 (28/28/28)	High +9.8 vs Low +3.1	d = 0.65	p = 0.011 (across tiers p = 0.021)
Frequency, continuous	84	Spearman	rho = +0.29	p = 0.008
Frequency, adjusted (Model 1)	81	per +1 session/mo	+1.18 [+0.08, +2.28]	p = 0.036
Incomplete: high vs low freq	30 (15/15)	+3.7 vs +1.1	d = 0.34	p = 0.23
Complete: high vs low freq	8 (4/4)	+3.0 vs +1.8	d = 0.57	p = 0.56
Age: Under-30 vs 30–44	60 (36/24)	+8.0 vs +3.4	d = 0.51	p = 0.086
Emotional: low vs high start	57 (17/40)	+11.5 vs −6.9	d = 1.28	p < 0.0001
Temporal precedence	48 (24/24)	+6.3 vs +2.6	d = 0.41	p = 0.12 (rho +0.28, p = 0.050)
Annualized (population)	77	+3.3 pts/yr	CI [+1.6, +5.6]	—

All confidence intervals are bootstrap (5,000 resamples); tests are nonparametric (Mann-Whitney, Kruskal-Wallis, Spearman). Tertile cut-points: low ≤ 3.74 sessions/month < mid ≤ 6.26 < high.

Commentary references

Sources cited in support of the expert commentary appearing throughout this report.

American Academy of Physical Medicine and Rehabilitation. (2025). Respiratory impairment in spinal cord injury. AAPM&R KnowledgeNow.

Burnham, R., Martin, T., Stein, R., Bell, G., MacLean, I., & Steadward, R. (1997). Skeletal muscle fibre type transformation following spinal cord injury. Spinal Cord, 35(2), 86–91.

Cao, Y., Murday, D., Corley, E. H., DiPiro, N. D., & Krause, J. S. (2022). Rehospitalization during the first 5 years after the onset of traumatic spinal cord injury: A population-based study using administrative billing records. Archives of Physical Medicine and Rehabilitation, 103(7), 1263–1268.

Chilibeck, P. D., Bell, G., Jeon, J., Weiss, C. B., Murdoch, K., Burnham, R., & Steadward, R. (1999). Functional electrical stimulation exercise increases GLUT-1 and GLUT-4 in paralyzed skeletal muscle. Metabolism, 48(11), 1409–1413. Côté, M. P., Azzam, G. A., Knikou, M., & Houle, J. D. (2011). Peripheral adaptations to activity-based therapies after spinal cord injury. Physical Medicine and Rehabilitation Clinics of North America, 22(2), 241–255.

DeVivo, M., Chen, Y., Mennemeyer, S., & Deutsch, A. (2011). Costs of care following spinal cord injury. Topics in Spinal Cord Injury Rehabilitation, 16(4), 1–9.

Fiedler, I. G., Joshi, M., & Ning, P. (2011). Causes and costs of unplanned hospitalizations among persons with spinal cord injury. Topics in Spinal Cord Injury Rehabilitation, 17(3), 73–80.

French, D. D., Campbell, R. R., Sabharwal, S., Nelson, A. L., Palacios, P. A., & Gavin-Dreschnack, D. (2007). The costs of informal caregiving for veterans with spinal cord injury. The Journal of Spinal Cord Medicine, 30(5), 486–492.

Galeiras Vázquez, R., Rascado Sedes, P., Mourelo Fariña, M., Montoto Marqués, A., & Ferreiro Velasco, M. E. (2013). Respiratory management in the patient with spinal cord injury. BioMed Research International, 2013, 1–12.

Gater, D. R., Farkas, G. J., & Berg, A. S. (2011). Aging with spinal cord injury: Physical activity, sarcopenia, and metabolic dysfunction. Topics in Spinal Cord Injury Rehabilitation, 17(2), 43–49.

Gorgey, A. S., Mather, K. J., Cupp, H. R., & Gater, D. R. (2014). Skeletal muscle hypertrophy and decreased visceral adiposity after functional electrical stimulation cycling in persons with spinal cord injury. Journal of Applied Physiology, 116(4), 438–449.

Green, D. J., Hopman, M. T. E., Padilla, J., Laughlin, M. H., & Thijssen, D. H. J. (2017). Vascular adaptation to exercise in humans: Role of hemodynamic stimuli. Physiological Reviews, 97(2), 495–528.

Harkema, S. J., Schmidt-Read, M., Lorenz, D. J., Edgerton, V. R., & Behrman, A. L. (2012).

Locomotor training: As a practice of recovery. Topics in Spinal Cord Injury Rehabilitation, 18(2), 112–117.

Harvey, L. A. (2008). Management of spinal cord injuries: A guide for physiotherapists. Churchill Livingstone / Elsevier.

Kakulas, B. A. (1999). A review of open post-mortem studies in 2,000 cases of spinal cord injury. The Journal of Spinal Cord Medicine, 22(2), 119–125.

Lang, C. E., MacDonald, J. R., Reisman, D. S., Boyd, L., Jacobson Kimberley, T., Schindler-Ivens, S. M., Hornby, T. G., Ross, S. A., & Scheets, P. L. (2009). Observation of amounts of movement practice provided during stroke rehabilitation. Archives of Physical Medicine and Rehabilitation, 90(10), 1692–1698.

National Spinal Cord Injury Statistical Center. (2025). Traumatic spinal cord injury facts and figures at a glance. University of Alabama at Birmingham.

Parent, S., Mac-Thiong, J. M., Roy-Beaudry, M., Sosa, J. F., & Labelle, H. (2011). Spinal deformity in children with spinal cord injury: A long-term follow-up study. Spine, 36(7), 540–546.

Phillips, A. A., Krassioukov, A. V., Ainslie, P. N., & Warburton, D. E. (2015). Hemodynamic regulation and neuroplasticity after spinal cord injury. Exercise and Sport Sciences Reviews, 43(1), 39–45.

Sherwood, A. M., Dimitrijevic, M. R., & McKay, W. B. (1992). Evidence of subclinical brain influence in clinically complete spinal cord injury: Discomplete SCI. Journal of the Neurological Sciences, 110(1–2), 90–98.

Van, J., Nelson, R. E., & Pevow, S. (2021). Healthcare utilization and costs associated with pressure injuries in veterans with spinal cord injury. The Journal of Spinal Cord Medicine, 44(4), 582–590.

Vaynman, S., Ying, Z., & Gomez-Pinilla, F. (2004). Hippocampal BDNF mediates the efficacy of exercise on synaptic plasticity and cognition. European Journal of Neuroscience, 20(10), 2580–2590.

Waters, R. L., Adkins, R. H., Yakura, J. S., & Sie, I. (1994). Functional and economic implications of voluntary muscle recovery in spinal cord injury. Archives of Physical Medicine and Rehabilitation, 75(11), 1165–1172.

Wijker, B. J., de Groot, S., Boertje, A., & Post, M. W. M. (2025). Healthcare costs of pressure injuries among patients with a spinal cord injury within a Dutch rehabilitation center. Advances in Skin & Wound Care, 38(1), 19–24.

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Hal Hargrave is the President and CEO of The Perfect Step, an activity-based neurological recovery organization focused on providing long-term opportunities for individuals living with paralysis and other neurological conditions. After sustaining a spinal cord injury at age 17 that resulted in quadriplegia, Hal's personal experience with neurological recovery helped shape his commitment to expanding what is possible beyond the traditional rehabilitation continuum. He holds a Master's degree in Leadership and Management and has spent nearly two decades working in paralysis recovery, nonprofit leadership, education, advocacy, and program development. Hal is also the Founder and Executive Director of the Be Perfect Foundation, which has raised more than $10 million to support individuals and families affected by paralysis. His work with The Perfect Step centers on advancing long-term neurological recovery, improving outcomes measurement, and building evidence around the role that activity, consistency, and sustained participation can play in the lives of individuals living with neurological conditions.



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Matthew Goforth is a lifelong athlete, big wall climber, and certified trainer who spent 15 years in corporate governance consulting, advising Fortune 500 executives and publishing research on shareholder class-action and SEC enforcement. He studied biochemistry at Stanford, where he earned contributing authorships in Nature and Cell Metabolism for work at the intersection of metabolism and immunology. He founded Fit Habits, a retention-analytics software and research firm, after discovering a half-billion-dollar annual retention gap hidden across 28.5 million members during the post-pandemic rebuild. Fit Habits' current research with The Perfect Step aims to learn what a population managing paralytic injury reveals about behavior, recovery, and retention.

Expert Commentator



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Gil Spitz, MS, MBA/MHA, CSCS, is a clinical exercise physiologist whose work focuses on bridging intensive physiological conditioning with complex clinical medicine. Recognized as a pioneering voice in solid organ transplant prehabilitation, Gil established early conditioning protocols at a premier Houston transplant center and frequently presents on clinical durability, surgical ergonomics, and pre-operative optimization. As the founder of Surgical Strong, he brings an extensive background in human performance and health administration to diverse acute environments. His collaboration with The Perfect Step leverages these insights from critical care and prehabilitation science to build evidence around long-term neuromuscular adaptation and sustained activity in neurological recovery.

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