Centre intégré universitaire de santé et de services sociaux du Centre-Sud-de-l'Île-de-Montréal Québec

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Biomedical Research and Informatics Living Laboratory for Innovative Advances of New Technologies

McGill Faculty of Medicine and Health Sciences
Patient at heart, Science in hand

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CIHR IRSC Canadian Institutes of Health Research / Instituts de recherche en santé du Canada

Centre intégré universitaire de santé et de services sociaux du Centre-Ouest-de-l'Île-de-Montréal Québec

Co-design, Implementation and Evaluation of a Digital Health Platform to Support Transitions in Rehabilitation

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Scientific Director, BRILLIANT, CRIR – Lethbridge-Layton-Mackay Rehabilitation Centre
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The BRILLIANT Lab Team



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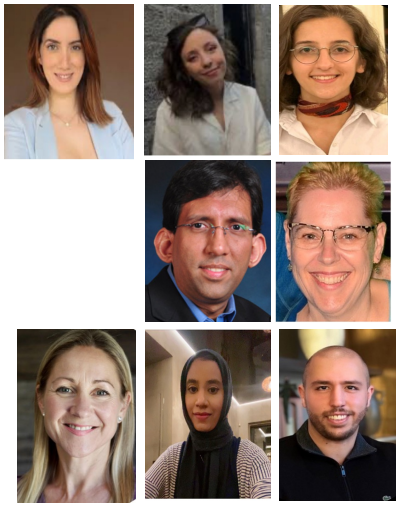


The Rehabilitation Imperative

The Growing Need for Rehabilitation

1 in 3 people require rehabilitation at some point (WHO) (1)
8 Million Canadian (15+) Live with a Disability

Early & Intensive Rehabilitation Is Critical

19% of patients start within 30 days post-stroke (2)
Higher 90 day return home time
Lower likelihood discharge to long-term care

Access Remains Fragmented and Delayed

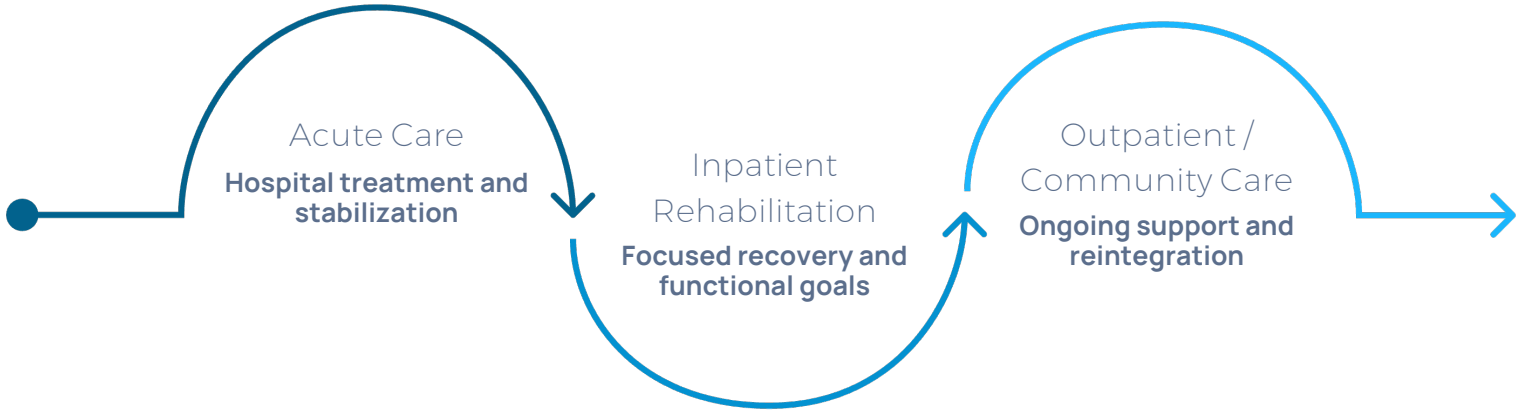
46% report **at least one unmet health care need**, including rehabilitation services
49% of Canadians with long-term conditions or disabilities reported unmet rehabilitation needs – first wave of COVID (3)
62% of stroke patients experience delayed inpatient rehabilitation (1)

(Fondation des maladies du cœur et de l'AVC, 2015 ; Alhasani et al., 2022)

The Gains from Action: Optimal Transition of Care

Care transition Teams readmissions 18%-› 9% (1)

ESD increased intensity by 2% 95% CI, 0.3%–4%]) (2)



Assessment - Discharge Planning- Communication-Follow-up-Self-management-Health Equity

(Alhasani et al., 2022)

Why Digital Tools Are Needed?

Rehabilitation care transitions requiring digital tools

Acute Setting

- Real-time monitoring (50% reduction readmissions)
- Data driven discharge decisions

Rehabilitation

- Progress tracking
- Therapy protocols
- Outcome reporting

Community

- Home-based care/ Resources
- Social integration
- Patient support

Increase Access and Intensity of Rehabilitation

Patient Portal

Personalized discharge plans reduces readmissions and improves following intervention plan

Clinician Portal

40% cost reduction by connecting providers across transitions-home

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Mobility, Technology and Rehabilitation

Identifying Transitional Care Needs

Transitional care needs analysis and translation into digital functionalities

1	2	3
Needs analysis	**Needs Identification**	**Needs translation into functionalities**
Previous work from our team on: a) identifying the rehabilitation needs; b) the co-design of digital health solutions with individuals with disabilities and their caregivers. **(Alhasani et al., 2022a[; 2022b, Guay et al., 2017, Gelinas-Bronsard et al., 2018)**	24 Needs identified: synthesised from multiple prior studies on rehabilitation and digital health	24 Needs translated into functionalities using **WHO Digital Health Interventions V1.0 (2018)** and classified into 4 categories: (1) Treatment plan and progress (2) resources (3) health social network and community (4) scheduling of health professional visits.

How do we prioritize?

Informing the development of an outcome set and banks of items to measure mobility among individuals with acquired brain injury using natural language processing

Rehab Alhasani[1,2,3], Mathieu Godbout[4], Audrey Durand[4,5], Claudine Auger[2,6,7], Anouk Lamontagne[1,2,8] and Sara Ahmed[1,2,9,10*]

Clinicians and individuals with acquired brain injury perspectives about factors that influence mobility: creating a core set of mobility domains among individuals with acquired brain injury

Rehab Alhasani[a,b,c], Dennis Radman[a,b], Claudine Auger[b,d,e], Anouk Lamontagne[a,b,f] and Sara Ahmed[a,b,g,h]

What's behind the Dashboard? Intervention Mapping of a Mobility Outcomes Monitoring System for Rehabilitation

Claudine Auger [1,2,*], Cassioppée Guay [1,2], Alex Pysklywec [1,2], Nathalie Bier [1,3], Louise Demers [1,3], William C. Miller [4], Dominique Gélinas-Bronsard [1,2] and Sara Ahmed [2,5]

Quality of mobility measures among individuals with acquired brain injury: an umbrella review

Rehab Alhasani[1,2,6] · Claudine Auger[2,4,5] · Matheus Paiva Azevedo[1] · Sara Ahmed[1,2,3]

Digital Functionalities for supporting transitional care

Based on identified needs, we've translated key requirements into four core categories of digital functionalities.

Treatment Plan & Progress

- Treatment plan addresses all symptoms
- Explanation of treatment plan
- Independent exercises/tasks
- View plan/goals/progress in details
- Shared goals & progress updates
- Enter progress in tech (exercise, difficulty)
- Expectations for recovery explained
- Wearable movement tracking
- Share progress with clinical team

Resources

- Understand roles/wait times
- Identify community services
- Info on managing symptoms
- Better recovery information
- Book appointments with tech
- Auto-recommended information
- Look up: exercises, services, education
- Look up contact info: clinic/professionals
- Access to someone for exercise questions
- Record videos of exercises with provider

Social & Communication

- Share recovery story
- Communicate easily with clinical team
- Discuss feelings/acceptance
- Automatic reminders for exercises

Calendar

- Automatic calendar for appointments/tasks

Co-Design: Needs Analysis

Need analysis- Patients and caregivers

Semi structured interviews

Allegue, D. R., Giroux, C., Peron, M., Kengne Talla, P., Kairy, D., Rochette, A., Plouffe, V., Nabelsi, V., Gumboc, I., Lattas, M., Cox, N., & Ahmed, S. (in preparation). *Patients' and caregivers' acceptability and care experiences with telehealth in an early supported discharge program for stroke rehabilitation: A pragmatic qualitative case study*. Manuscript in preparation for submission to *Clinical Rehabilitation*.

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Three Core Needs Emerged as the Blueprint for an Empowered Recovery

Our analysis revealed a clear consensus around three fundamental pillars of need. These pillars form the strategic foundation for the platform's features and overall design.

I Need to Understand & Be in Control

Empowering patients through clarity and autonomy.

I Need to Act & See Results

Turning intention into tangible action and progress.

I Need to Connect & Feel Supported

Breaking down silos in communication and care.

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Pillar 1: I Need to Understand and Be in Control

Empowering Patients Through Clarity and Autonomy

Need: Understand the full recovery picture. (Needs: N01, N02, N07, N10)
Supporting Quote: *"The fact that they explained to you step by step, what's gonna happen... I find that really reassuring."* (EMMI07-PA)

Functionality: Centralized Care Plan & Educational Resource Hub.

Need: See and track my own plan and progress. (Needs: N04, N05)
Supporting Quote: *"it gives... it's encouraging for me and for him [the patient]... some motivation."* (EMMI03-CG, translated)

Functionality: Interactive Progress Dashboard with visual data (graphs, goal tracking).

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Information Must Be Timely, Trusted, and Tailored

Need: Get information on managing fluctuating symptoms. (Needs: N12, N13)

"to have access to these documents later on... because, you know, like I think it comes in waves sometimes." (EMMI07-PA)

Functionality: On-Demand Access to Clinician-Vetted Documents and Resources.

Critical Insight: Patients distrust purely automated recommendations.

"I wouldn't like the technology to automatically recommend information to me... it's not like a human being who's like gonna actually listen to yo-" (EMMI07-PA)

Implication: AI-driven suggestions must be paired with human validation and clear rationale.

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Pillar 2: I Need to Act and See the Results

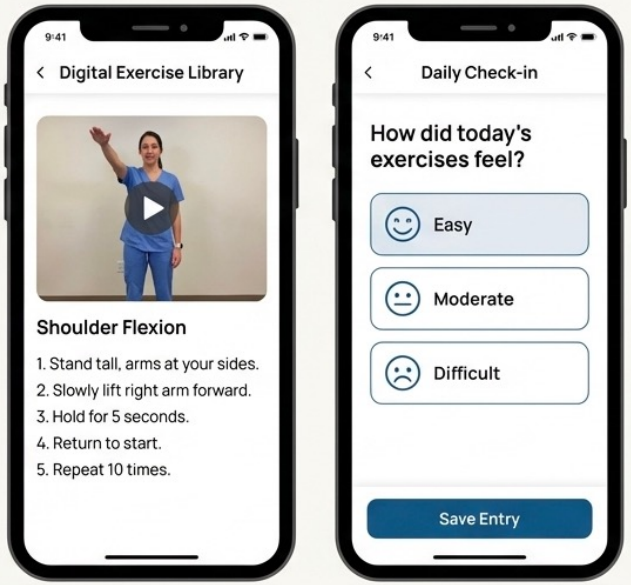
Turning Intention into Action and Progress

Need: Access and structure daily exercises and tasks. (Needs: N03, N19)

Supporting Quote: *"Well, because to have it, to look at it. It helps me structure my day."* (EMMI03-PA, translated)

Need: Record my adherence and how I feel. (Need: N06)

Supporting Quote: *"digital journal... For the follow-up to be done... because it must be... that it is immediate."* (EMMI03-PA, translated)



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Motivation is Personal.
Technology is a Tool, Not a Mandate.

Need: Use wearables for automatic tracking. (Need: N08)

Supporting Quote: *"I like certain things. Like, my husband used to have a watch for me, and it would check my heart rate... it would vibrate. So I knew that I had to stop."* (EMMI11-PA)

Functionality: Wearable Device Integration (e.g., smart watch).

Critical Insight: Wearables are not for everyone; privacy and comfort are major concerns.

Supporting Quote: *"it's like you're under surveillance, you're not free... it can lead to fear in fact."* (EMMI12-PA, translated)

Implication: Offer manual entry and occasional testing as alternatives to constant monitoring. Choice is paramount.

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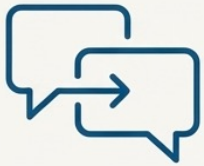
Pillar 3: I Need to Connect and Feel Supported

Breaking Down Silos in Communication and Care



Need: Easily communicate with my clinical team. (Needs: N18, N21, N25)

Supporting Quote: *"if it was done via a platform [post-rehab]... I would definitely want to be able to access someone to answer my questions."* (EMMI07-PA)

Functionality: Secure, Multi-Format Communication (Chat, Video, Email) & Document Sharing Hub.

Need: Connect with peers for support and validation. (Needs: N20, N22)

Supporting Quote: *"May be a form of the the patients that had a stroke you can include a section with the forum... I can ask. Hey guys, did you have this problem as well or not?"* (EMMI08-CG)

Functionality: Moderated Peer Support Forum & Testimonial Library.

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The Right Support Extends Beyond the Patient and Requires Control

Need: Find and access community resources. (Need: N11)

Supporting Quote: *"you could just write your address or your postal code, and you would have like all the different services in your close area that could help you out."* (EMMI07-PA)

Functionality: Geo-Located Community Resource Finder.

Critical Insight: Patients need granular control over who sees their information.

Supporting Quote: *"I won't necessarily share the same information with each clinician... what I share with like a psychiatrist is not going to be shared with, like the physical thera-""* (EMMI07-PA)

Implication: The platform must feature robust, user-friendly privacy and selective sharing controls.

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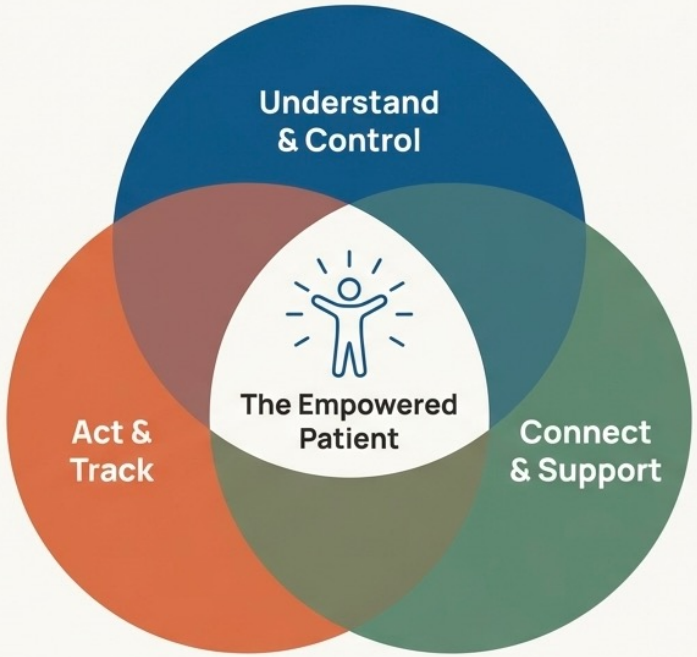
From Fragmented Acts to a Cohesive Ecosystem



By integrating these pillars, we create a solution that is more than the sum of its parts—transforming a fragmented experience into a proactive partnership in recovery.

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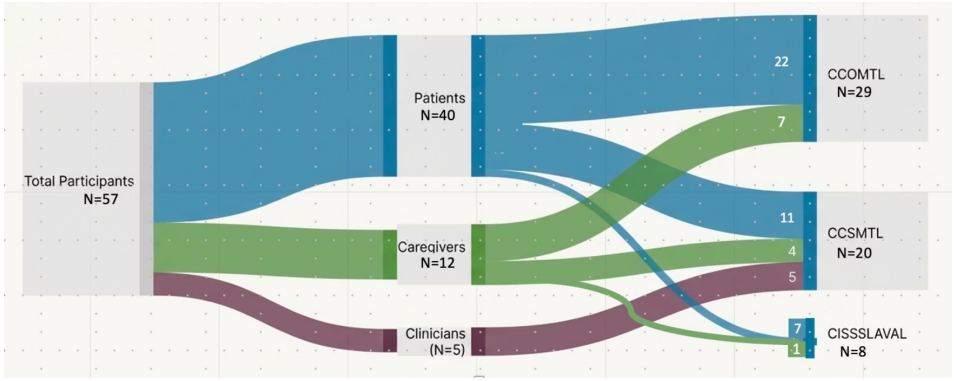
Co-Design: Prioritizing What Matters Most

Transitional care Needs prioritization

A survey listed all 24 needs, asking participants to rate each on a 5-point importance scale — from **"not important at all"** to **"extremely important."**



Sequential Collection

Data from each health center was analyzed before moving to the next, enabling real-time refinement

Caregiver Adaptation

Needs were reformulated to reflect caregivers' own perspectives and support roles

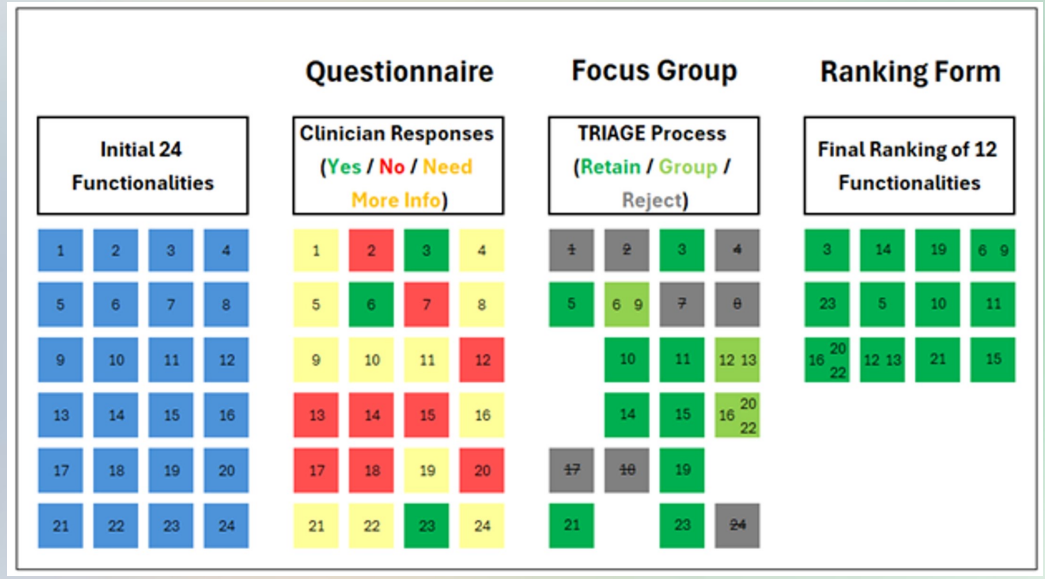
Emergent Needs

New needs surfaced during analysis were added to the survey for validation at subsequent sites

Survey Completed by Patients & Caregivers

Functionalities related to the treatment plan and progress received **the highest importance ratings** from both patients and caregivers, followed by resources, social/community, and calendar-related functionalities.

Category	Functionality	Patients (Avg)	Caregivers (Avg)
Treatment Plan & Progress	Treatment plan addresses all symptoms	**4.3**	**5.0**
	Explanation of treatment plan	**4.4**	**4.9**
	Independent exercises/tasks	**4.4**	**5.0**
	View plan/goals/progress in tech	**4.0**	**4.6**
	Shared goals & progress updates	**4.2**	**4.8**
	Enter progress in tech (exercise, difficulty)	3.7	4.0
	Expectations for recovery explained	**4.2**	**4.8**
	Wearable movement tracking	3.6	4.0
	Share progress with clinical team	3.5	4.0
Resources	Understand roles/wait times	**4.2**	**4.7**
	Identify community services	3.9	4.2
	Info on managing symptoms	**4.0**	**4.8**
	Better recovery information	3.9	**4.9**
	Book appointments with tech	3.8	4.4
	Auto-recommended information	3.5	4.1
	Look up: exercises, services, education	3.7	4.4
	Look up contact info: clinics/professionals	3.6	**4.7**
	Access to someone for exercise questions	3.9	**4.7**
	Record videos of exercises with provider	3.2	4.0
Social & Community	Share recovery story	2.8	2.8
	Communicate easily with clinical team	3.3	4.3
	Discuss feelings/acceptance	2.8	3.2
Calendar	Automatic reminders for exercises	3.4	4.3
	Automatic calendar for appointments/tasks	3.5	4.2



Clinician Decision-Making Process

- Starting from **the initial 24 functionalities prioritized by both patients and caregivers,** clinicians individually responded (**Yes / No / Need More Info**) regarding whether to keep each functionality.
- Then engaged in a **TRIAGE focus group (Retain / Group / Reject)** each functionality, arriving at a **final ranking of 12 retained functionalities**.

Final Priority Ratings: Patients, Caregivers & Clinicians

The table below presents average importance ratings from patients and caregivers alongside clinician rankings, highlighting convergence and divergence across stakeholder groups across all four WHO categories.

Highest Consensus

Independent exercises/tasks rated **1st** by clinicians; avg. 4.4 (patients) & 5.0 (caregivers)

12 Retained

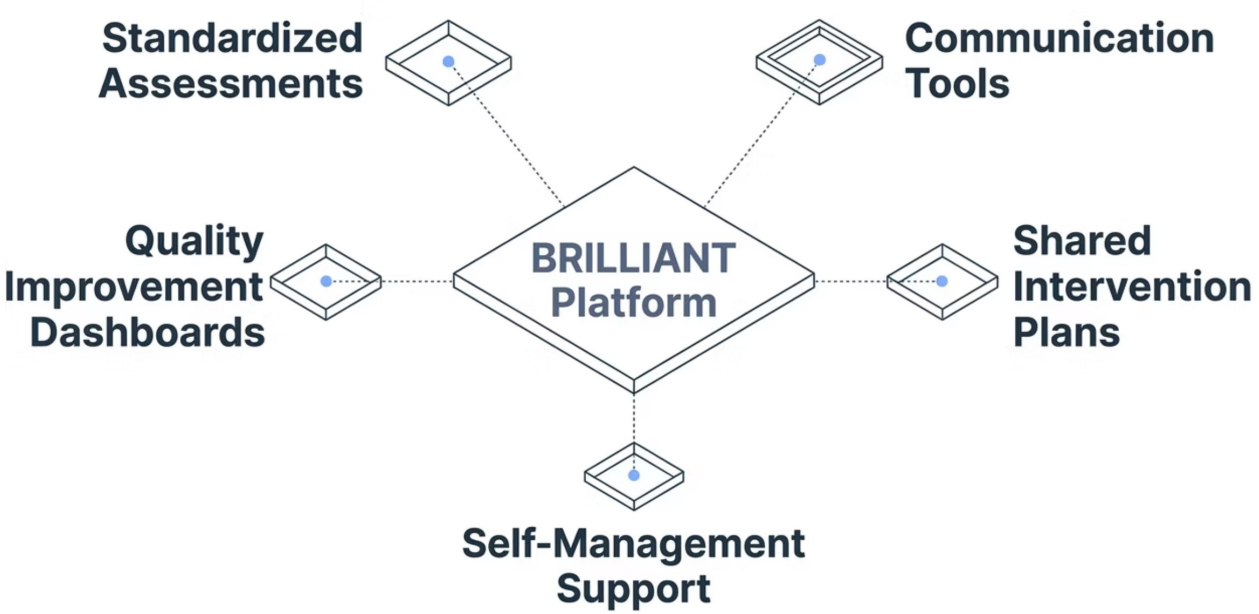
Final platform scope refined through iterative stakeholder triangulation

Category	Functionality	Patients (Avg)	Caregivers (Avg)	Clinicians (Ranked)
Treatment Plan & Progress	Treatment plan addresses all symptoms	**4.3**	**5.0**	X
	Explanation of treatment plan	**4.4**	**4.9**	X
	Independent exercises/tasks	**4.4**	**5.0**	**1st**
	View plan/goals/progress in tech	**4.0**	**4.6**	X
	Shared goals & progress updates	**4.2**	**4.8**	**6th**
	Enter progress in tech (exercise, difficulty)	3.7	4.0	**4th**
	Expectations for recovery explained	**4.2**	**4.8**	X
	Wearable movement tracking	3.6	4.0	X
	Share progress with clinical team	3.5	4.0	X
Resources	Understand roles/wait times	**4.2**	**4.7**	7th
	Identify community services	3.9	4.2	8th
	Info on managing symptoms	**4.0**	**4.8**	10th
	Better recovery information	3.9	**4.9**	10th
	Book appointments with tech	3.8	4.4	**2nd**
	Auto-recommended information	3.5	4.1	12th
	Look up: exercises, services, education	3.7	4.4	9th
	Look up contact info: clinics/professionals	3.6	**4.7**	X
	Access to someone for exercise questions	3.9	**4.7**	X
	Record videos of exercises with provider	3.2	4.0	**3rd**
Social & Community	Share recovery story	2.8	2.8	X
	Communicate easily with clinical team	3.3	4.3	11th
	Discuss feelings/acceptance	2.8	3.2	X
Calendar	Automatic reminders for exercises	3.4	4.3	**5th**
	Automatic calendar for appointments/tasks	3.5	4.2	X

From Priorities to Platform Design

Core Platform Architecture

The BRILLIANT Platform integrates five interconnected modules designed to support every stakeholder across the rehabilitation continuum.



Grounding Technology in Clinical Reality

Study Objectives

Evaluate whether implementing the BRILLIANT platform:

1. Increases rehabilitation intensity

   More minutes of direct therapy per week per patient.

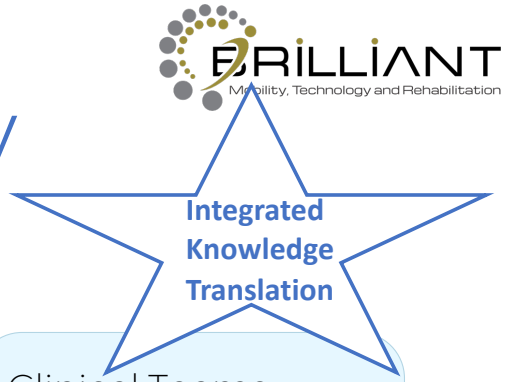
2. Improves coordination of care

   Reducing delays and information gaps across teams and settings.

3. Enhances patient outcomes

   Including quality of life, caregiver experience, and system efficiency.

Study Population



Patients

Adults with cardiovascular, neurological, and orthopedic conditions are undergoing rehabilitation transitions.

Clinical Teams

Clinicians, care coordinators, and facility managers across participating sites.

Caregivers & Families

Those navigating care transitions alongside patients and supporting self-management.

Implementation Strategy and Co-Design

A two-phase approach ensures the platform is built with — not just for — the people who use it, from frontline clinicians to patients and their families.

Phase I — Implementation Preparation

- **Workflow mapping to understand local clinical contexts**
- **Design thinking workshops engaging clinicians, clients, and caregivers**
- **Identifying systemic barriers, change management needs, and implementation facilitators**

Phase II — Evaluation

Assessing the immediate and longitudinal impact on rehabilitation intensity, time to admission, quality of life, care experience, and system costs — providing rigorous evidence for scale-up decisions.

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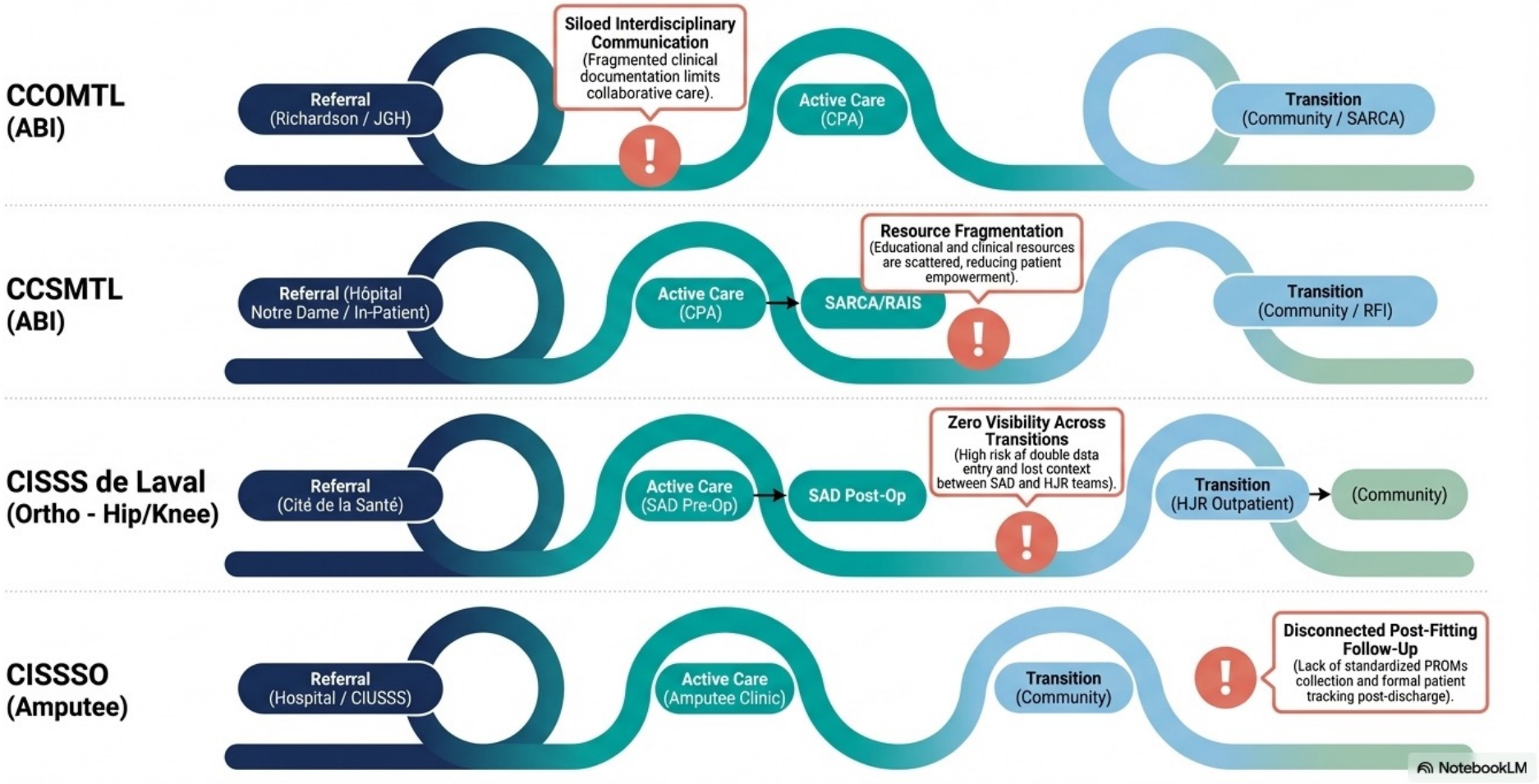
Rehabilitation Trajectories: Mapping the Patient Journey & Clinical Friction



réadaptation LCA Centre-Ouest & Centre Sud	Genoux et Hanches Laval	Prothèse Outaouais

Portail clinicien et patient – BRILLIANT OU STANDARD
Module calendrier (BRILLIANT OU STANDARD)
Module ressources (BRILLIANT avec WIBBI - OU STANDARD)
Outils de PII

A CONFIGURER A LA TRAJECTOIRE

Gestion des rôles et accès			
P.I.I. template	P.I.I. template	P.I.I. template	P.I.I. template
Quest/Forms (30)	Quest/Forms (Mini 8)	Quest/Forms (Mini 5)	Quest/Forms (?)
Cycle de vie patient (2)	Cycle de vie patient (3)	Cycle de vie patient (2)	Cycle de vie patient (?)
Gestion notifications / alertes	Gestion notifications / alertes (++)	Gestion notifications / alertes (++)	Gestion notifications/alertes (?)

SPECIFIQUES A LA TRAJECTOIRE

Pre op - Interop Opera	Portail PROF : suivi RDV	Refonte UI/UX possible Condition medicale
Pre op – Interop iCLSC sig+	PI (par discipline)	
Interop REPERE	Module suivi plaie / Interop i SAT?	Module assistance vocale
Interop Quanum (archives)		
Module télé-consultation	Interop avec plateforme partage Quest/Form	

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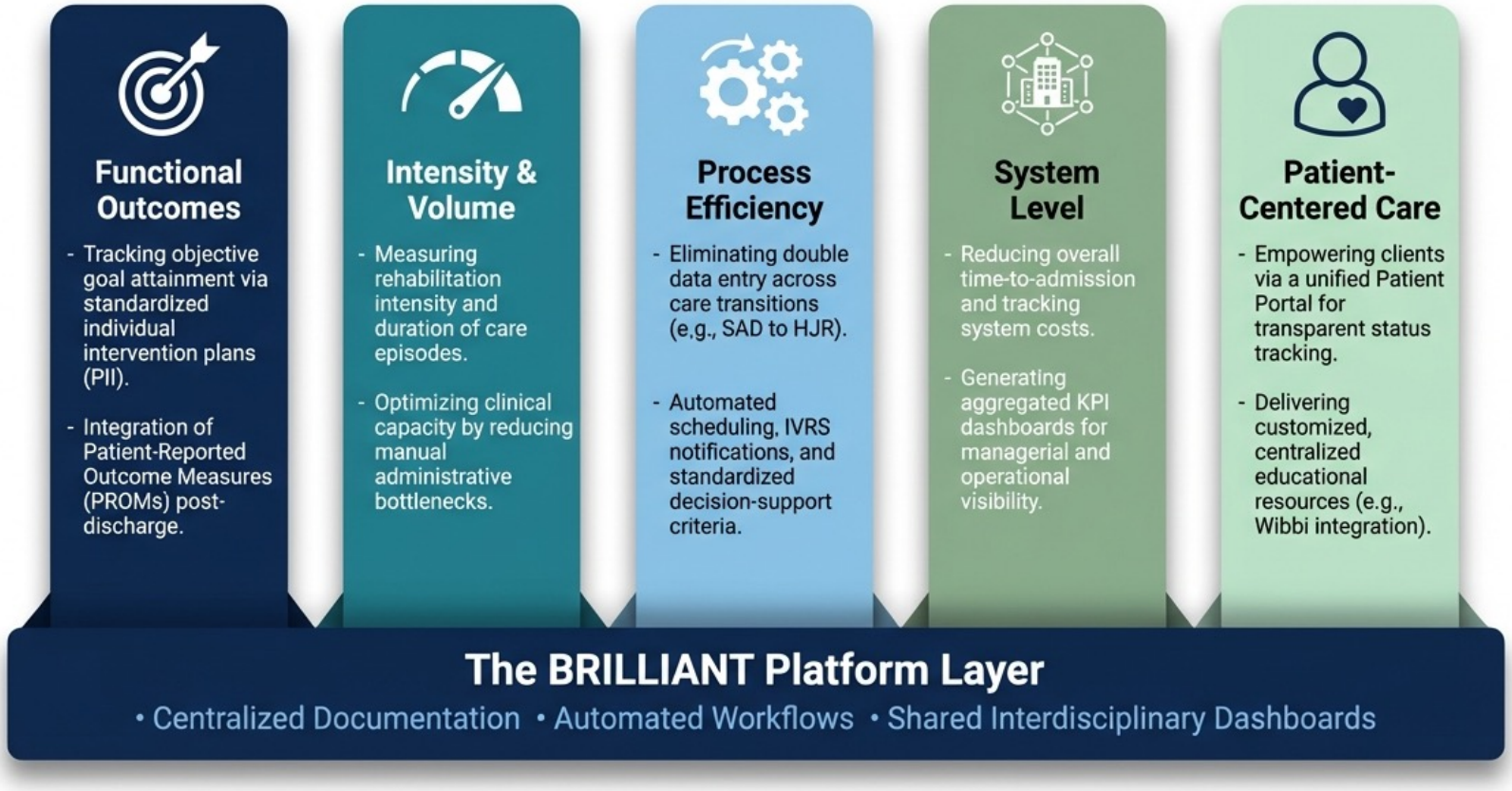
The BRILLIANT Value Layer: Driving & Measuring Impact

A unified digital infrastructure transforming fragmented workflows into **measurable**, high-value outcomes.



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Evaluating the Platform in Real-World Care

Implementation Strategy and Co-Design

A two-phase approach ensures the platform is built with — not just for — the people who use it, from frontline clinicians to patients and their families.

Phase I — Implementation Preparation

- **Workflow mapping to understand local clinical contexts**
- **Design thinking workshops engaging clinicians, clients, and caregivers**
- **Identifying systemic barriers, change management needs, and implementation facilitators**

Phase II — Evaluation

Assessing the immediate and longitudinal impact on rehabilitation intensity, time to admission, quality of life, care experience, and system costs — providing rigorous evidence for scale-up decisions.

Rigorous Evidence: The Stepped-Wedge Trial

Design

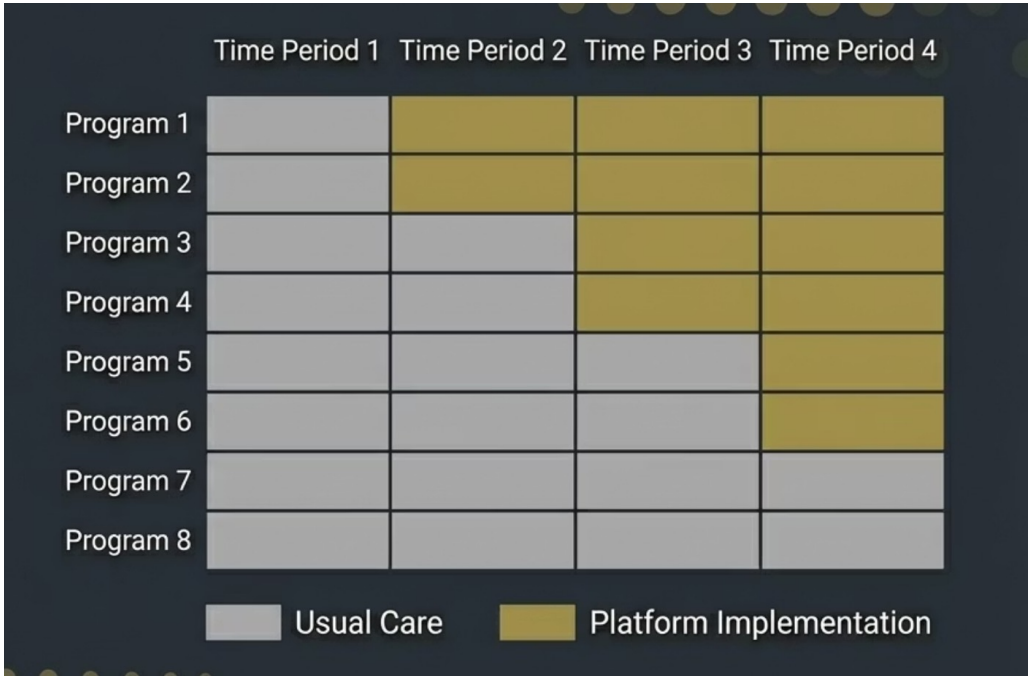
Programs randomized, allowing comparison of outcomes before and after platform implementation.

Scope

Conducted across 4 health regions in Quebec, encompassing 8 distinct rehabilitation programs.

Mechanism

Sites stagger their transition from usual care to full platform implementation, ensuring equitable access while maintaining scientific validity.



Measurable Endpoints

Primary Outcome: Rehabilitation Intensity — Measured as direct minutes of rehabilitation per week, sourced via the SIPAD administrative database recording clinician-patient contact time.

Time to Rehabilitation

Days from hospital admission to first rehabilitation contact.

Health-Related Quality of Life

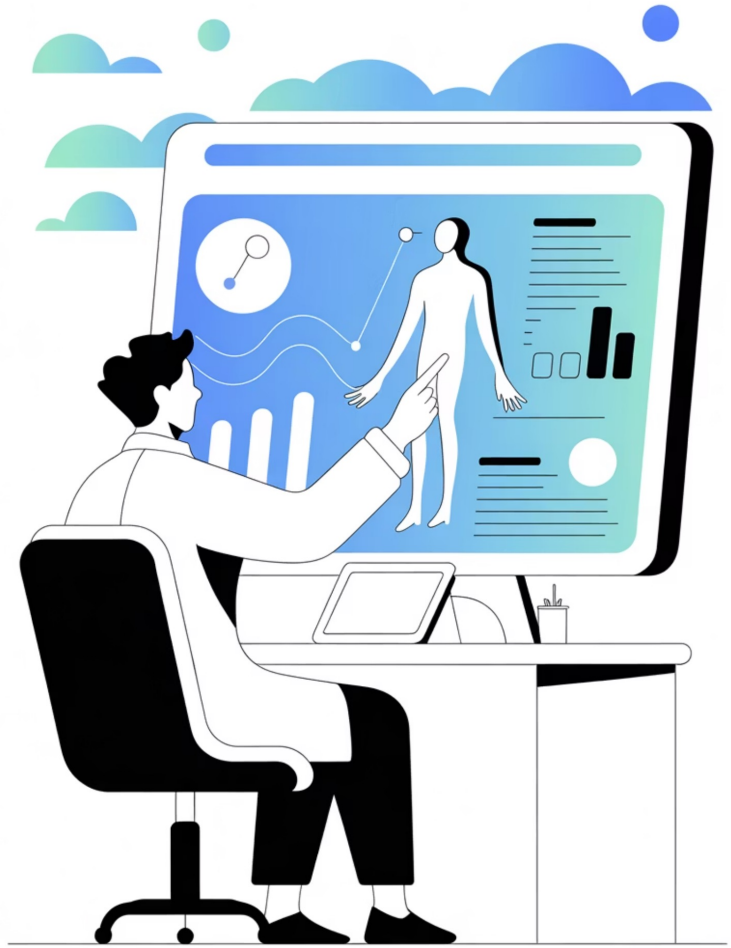
Measured via validated HRQoL instruments at multiple time points.

Patient & Caregiver Experience

Capturing lived experience of care transitions and platform use.

Cost-Effectiveness

Implementation factors and system-level cost analysis for scalability decisions.

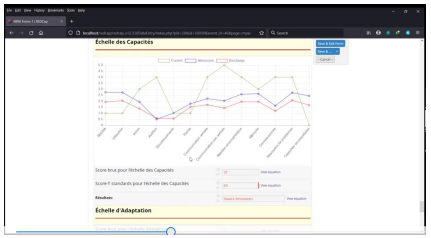


Toward a Learning Health System

Learning Health System: Implementing MPAI-4 in the Platform

Example: Clinician interface

- Automatic score interpretation
- Decision support for clinical treatment during the rehabilitation trajectory
- Embedding best practices within the recommendations
- Linking scores to service and intervention recommendations



Continuous improvement cycle for brain injury rehabilitation outcomes

1. Standardize

Embed MPAI-4

29-item validated assessment • 3 subscales • 1,012 TBI validation

2. Measure

Feedback Loops

Dashboards track progression • Monitor adherence • Compare settings

3. Improve

Intervention

Adjust care plans • Patient-centred goals • Evidence-based changes

4. Scale

System Impact

3 Quebec centres • Knowledge translation • Improved outcomes

Insight: *Embedding standardized outcome measurement into daily practice enables continuous learning and improvement—cycle after cycle.*

Co-created with GenAI

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Roll out of PROMs at an Organizational Level

Cardiovascular, Stroke IPU, COPD, Pulmonary rehabilitation….eventually CORE set for all clients that reflects social determinants of health, function, health-related quality of life, and participation

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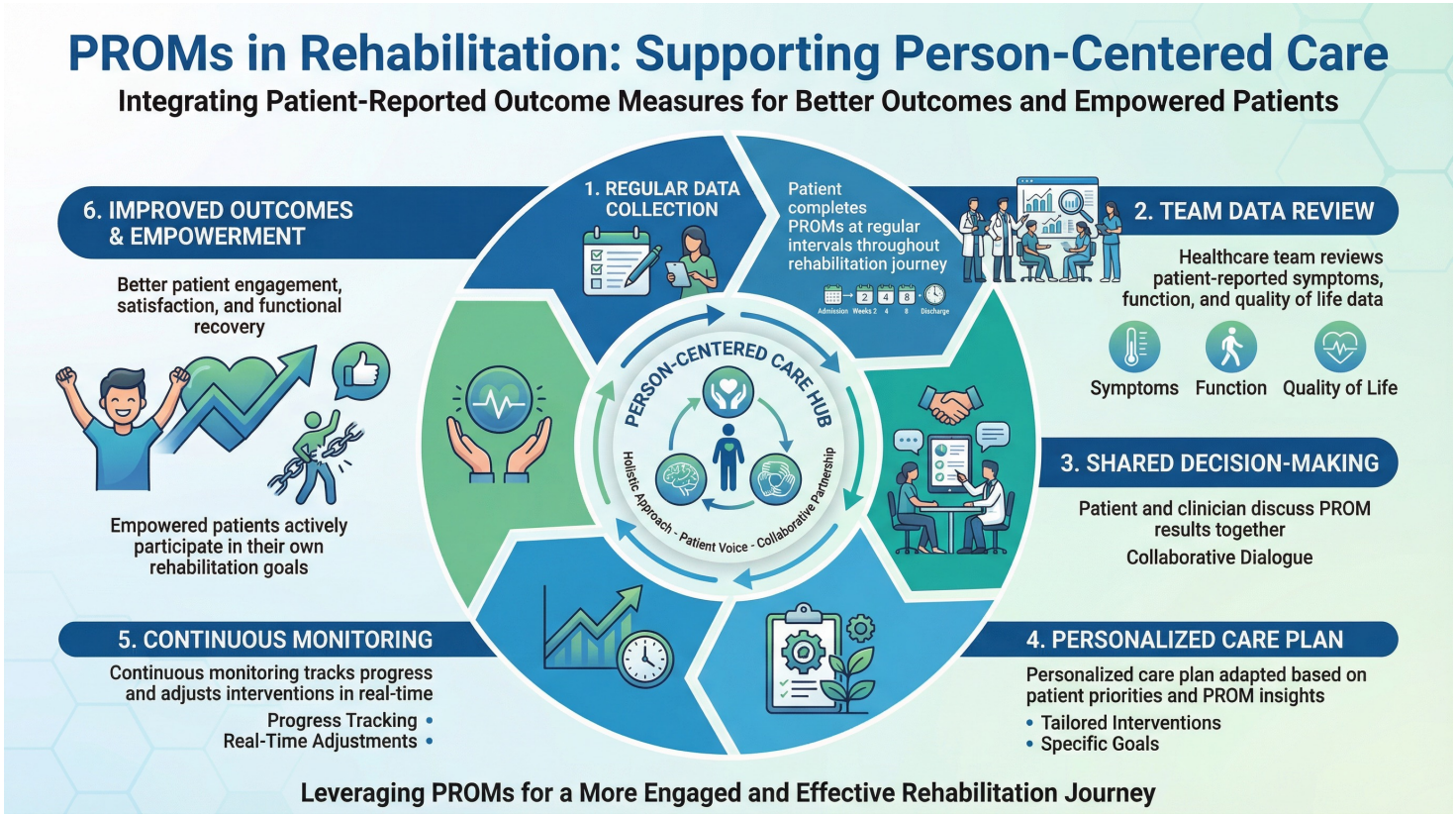
Québec



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Scale, Collaborate, and Transform

Key Takeaways

- Co-creation allows for learning and improvement
- There is a core set of digital health needs common across rehabilitation trajectories.
- Results directly inform the scaling of digital health solutions across rehabilitation systems province-wide.

Call to Action

Shape the Future

Join our citizen partner committee to guide data collection and tech implementation (apps, VR).

Scale the Science

Join our Learning Health System (LHS) consortium and contribute to pan-Canadian evidence.

Build the FRQS Network

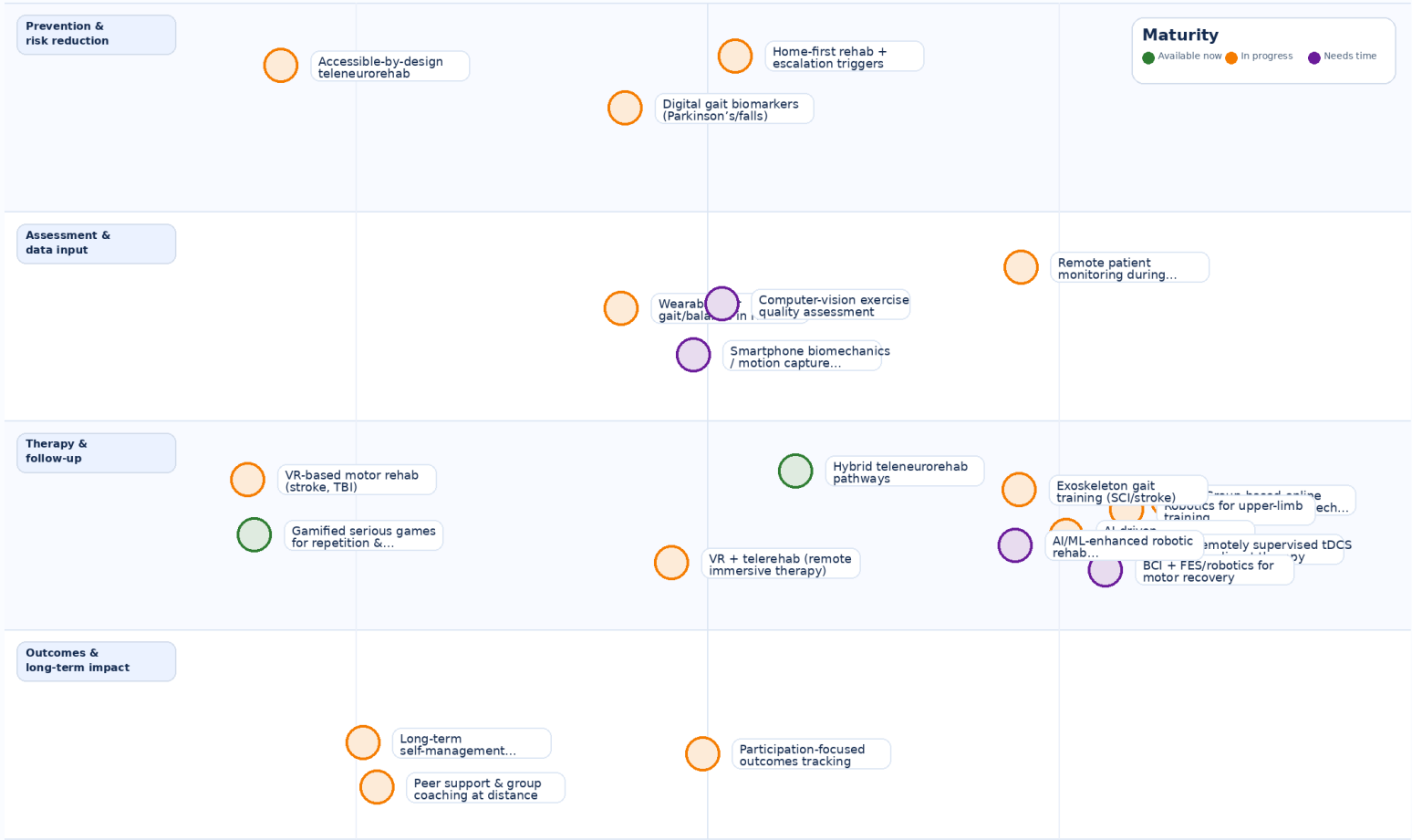
Connect with Réseau Santé Numérique (RSN) to share resources and advance needs-based science across regions.

BRILLIANT

RSN

NeuroRehabTech: trends shaping neurorehabilitation

Futurist-style map: Who is impacted (Patients ↔ Professionals) × Care stage (Prevention → Outcomes) × Maturity



Selected sources

- Telerehab directions (JMIR Rehabil Assist Technol, 2025)
- RPM impacts during transitions (npj Digit Med, 2024)
- Exoskeleton/robot-assisted gait training reviews (Ann Rehabil Med, 2024)
- Group-based neurorehab implementation (DIGITAL HEALTH, 2024)
- OpenCap smartphone biomechanics (PLOS Comp Biol, 2023)
- VR telerehab in stroke meta-analysis (J Stroke Cerebrovasc Dis, 2023)
- Accessible telehealth toolkit (WHO–ITU, 2024)
- AI/ML in robotic rehabilitation review (J NeuroEng Rehabil, 2025)
- BCI efficacy overview (Frontiers Hum Neurosci, 2025)

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Partners

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BRILLIANT Research Network

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The clinicians, patients, and caregivers who make this work possible

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