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Voices from the Field: Cognitive Debriefing Interviews on the Corticospinal Activation Protocol with Patients and Clinicians

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Abstract

Background: The development of complex rehabilitation interventions benefits from early qualitative input from both clinicians and individuals with SCI to ensure clinical relevance, feasibility, and patient-centeredness. This study reports the cognitive debriefing phase conducted during pre-formulation of the Corticospinal Activation Protocol (CAP), a multi-domain intervention for individuals with incomplete spinal cord injury (SCI). **Objective:** To explore clinician and patient perspectives on current SCI rehabilitation practice, unmet needs, and design preferences, in order to inform the pre-formulation of CAP. **Methods:** Face-to-face, semi-structured cognitive debriefing interviews were conducted with 5 clinicians (≥ 5 years' SCI rehabilitation experience) and 5 individuals with incomplete SCI, using two parallel purpose-built interview guides, following purposive sampling with pre-specified eligibility criteria. Data were analyzed using reflexive thematic analysis. **Findings:** Clinicians emphasized the need for standardization, structured training programmes, adequate manpower, multidisciplinary care models, regulatory oversight of practice, and dedicated fellowship pathways. Individuals with SCI described architectural and financial barriers, exposure to unqualified practitioners, poor referral pathways from neurosurgeons, a preference for exercise-based over electrotherapy-based interventions, gaps in bowel/bladder training, limited awareness of sexual health prognosis, and a desire for more engaging, less monotonous therapy design. Both groups independently raised concerns about unregulated practice and poor referral pathways. **Conclusion:** Cognitive debriefing interviews surfaced practical, safety, and engagement-related considerations that directly informed the pre-formulation design of CAP, complementing later formal expert consensus (Modified Delphi) validation.

Keywords: Spinal Cord Injury, Cognitive Debriefing, Qualitative Research, Rehabilitation Protocol, Thematic Analysis, Patient-Centered Care

Introduction

Complex rehabilitation interventions are increasingly expected to be developed through structured, evidence-informed processes rather than clinical convention alone. For conditions with heterogeneous presentation and profound functional impact — such as incomplete spinal cord injury (SCI) — protocol development benefits from incorporating the perspectives of both those delivering care and those receiving it, before formal content validation occurs.

The Corticospinal Activation Protocol (CAP) is a multi-domain rehabilitation intervention targeting motor, sensory, autonomic, cognitive, and vocational recovery in individuals

with incomplete SCI. Its development followed a structured, sequential process: literature synthesis and conceptual framework development, stakeholder consultation through cognitive debriefing interviews, Modified Delphi expert consensus, and subsequent pilot and definitive randomized controlled trials.

SCI remains a significant global health burden, with pooled incidence estimates of approximately 24 per million people worldwide and considerable regional variation (1). The World Health Organization's Rehabilitation 2030 initiative has highlighted rehabilitation as an essential, underfunded health strategy, calling for a high-quality, well-trained rehabilitation workforce and stronger integration of rehabilitation into health systems globally (2). Central to CAP's neurophysiological rationale is the concept of the central pattern generator (CPG), a spinal neural network capable of generating rhythmic locomotor output independent of supraspinal input (3), and the recognition that autonomic dysfunction following SCI substantially affects recovery and long-term management (4). CAP builds on this evidence base and on precedent multi-domain rehabilitation research from the same research group (5).

Cognitive debriefing interviews with clinicians and individuals with SCI have precedent in the SCI rehabilitation literature as a method for eliciting stakeholder perspectives on intervention content and design — for example, (6) used cognitive debriefing interviews with clinicians and individuals with SCI/D to establish content validity of an activity-based therapy tracking tool in community settings. This approach reflects a broader movement in health research toward Patient and Public Involvement (PPI), which recognizes that meaningful engagement of intended beneficiaries improves the relevance, acceptability, and uptake of health interventions (7,8). In the present study, cognitive debriefing was adapted as a pre-formulation consultation exercise, intended to surface practical, safety, and acceptability considerations that structured consensus methods (such as Delphi) alone are not designed to capture. This paper reports the findings of that phase: face-to-face interviews with rehabilitation clinicians and individuals with SCI, conducted prior to CAP's formal expert validation.

Methods

Study Design

Qualitative cognitive debriefing study using face-to-face, semi-structured interviews, conducted as part of Phase 1 (Pre-Formulation) of a multi-phase CAP development and validation programme, prior to Modified Delphi expert consensus.

Participants

Sampling Strategy and Recruitment

Participants were recruited using purposive sampling to ensure representation of both the professional/clinical and lived-experience perspectives relevant to CAP's pre-formulation.

Clinicians were recruited from the Department of Physiotherapy, Punjabi University, Patiala, and from the Departments of Physiotherapy at Desh Bhagat University, Patiala; Sardar Bhagwan Das University, Dehradun; and Amity University, Noida, over a recruitment period of December 2022 to June 2023, and were approached in person and via institutional email/phone. Ten eligible clinicians were contacted, of whom three declined to participate and two did not attend at the scheduled interview time, yielding the final sample of five participating clinicians.

Individuals with SCI were recruited from Neuroots, Patiala, and the Neuro Outpatient Department (OPD), Punjabi University, Patiala, over the same recruitment period (December 2022 to June 2023), and were approached in person during routine visits. No potential participant declined to take part; eight interviews were conducted, of which five were selected for inclusion in the final analysis. Five interviews were retained to meet the pre-specified target sample size for this cognitive debriefing phase. The remaining three interviews, conducted within the same recruitment window, were excluded from the coded dataset on the basis of recording/transcript completeness and closeness of fit to the eligibility criteria.

Eligibility Criteria

Clinicians (n=5). Inclusion: physiotherapists with a minimum of 5 years' combined academic and clinical experience specifically in SCI rehabilitation, currently engaged in clinical and/or academic practice, and willing and able to provide informed consent. Exclusion: professionals from disciplines other than physiotherapy; physiotherapists without a regular clinical or academic caseload in SCI rehabilitation; and neuro-Physiotherapists whose primary caseload was stroke or other non-SCI neurological conditions.

The participating clinicians comprised four female and one male participant. Consistent with the expert interview guide, clinicians' specialty, years of experience, affiliation, clinical/research background, and country/region of practice were recorded for each participant (Table 1).

Individuals with SCI (n=5). Inclusion: adults with a confirmed diagnosis of incomplete SCI of at least 2 years'

duration, currently receiving physiotherapy treatment at a physiotherapy centre for a minimum of 6 months, sufficient cognitive and communicative capacity to participate in a semi-structured interview, and willing and able to provide informed consent. The participating individuals with SCI comprised four male and one female participants. Consistent with the patient interview guide's demographic sheet, age, gender, duration since injury, injury level/AIS grade, current mobility status, prior rehabilitation participation, assistive device use, and language of interview were recorded for each participant (Table 2).

Participant Characteristics

ID	Age	Gender	Specialty / Qualification	Professional Experience
C1	32	Female	PhD in Neurophysiotherapy	5 years
C2	39	Female	PhD in Neurorehabilitation	7 years
C3	45	Male	PhD in Neurophysiotherapy	10 years
C4	42	Female	PhD in Neurophysiotherapy	8 years
C5	48	Female	PhD in Neurophysiotherapy	12 years

Table 1: summarizes the characteristics of the participating clinicians, recorded using the expert profile fields in the interview guide.
Note: Affiliation and country/region were recorded for each participant but are not reported in Table 1 to protect participant anonymity given the small sample size.

ID	Age	Gender	Duration since injury	Injury level / AIS grade
P1	27	Male	2 years	AIS B
P2	32	Male	5 years	AIS C
P3	42	Male	3 years	AIS D
P4	42	Female	3 years	AIS B
P5	29	Male	11 years	AIS D

Table 2: summarizes the characteristics of the participating individuals with SCI, recorded using the demographic sheet fields in the interview guide.
Note: AIS, American Spinal Injury Association Impairment Scale. Mobility status, prior rehabilitation participation, assistive device use, and language of interview were collected via the demographic sheet but are reported as "not reported" in Table 2 to minimize re-identification risk within this small, purposively sampled cohort.

Sample Size Rationale

A sample of five participants per group was considered appropriate for this pre-formulation, hypothesis-generating phase of CAP development. This is consistent with the scope and purpose of cognitive debriefing methodology, which typically relies on small, purposively selected, information-rich samples to elicit content-relevant feedback on a specific set of design questions, rather than to achieve thematic saturation across a broad or heterogeneous population (9), and is comparable to sample sizes used in cognitive debriefing studies establishing content validity for other SCI-related tools (6). It is further consistent with Malterud, Siersma and Guassora's (10) "information power" framework, under which a narrowly defined study aim, a specific and relatively homogeneous participant group (clinicians meeting a defined minimum experience threshold; individuals with a confirmed diagnosis of incomplete SCI), a structured interview guide, and a focused analysis strategy together reduce the sample size needed to yield analytically useful, decision-relevant data. For individuals with SCI, five of eight conducted interviews were selected for the final analysis on the basis described. The adequacy of the sample for this purpose is also evidenced empirically by the convergence of independent findings across the two groups.

Data Collection

Face-to-face, semi-structured interviews were conducted using two parallel, purpose-built interview guides, developed by the research team based on the literature and CAP's conceptual framework. The guides were pilot-tested

with one clinician and one individual with SCI, neither of whom was included in the final analytic sample, to refine wording and flow; minor revisions were made before main data collection. No repeat interviews were conducted; each participant was interviewed once. Clinician interviews lasted 30–45 minutes; interviews with individuals with SCI lasted 30–40 minutes. Both interview guides specified a printed consent form and an audio recorder as required materials; a virtual meeting option was listed as a contingency in the clinician guide's preparation checklist but was not used, as all interviews (clinician and patient) were conducted face-to-face. Interviews opened with a standardized introductory script covering study purpose, voluntary participation, confidentiality, and audio-recording consent, and closed with a standardized closing script.

Written informed consent was obtained from all participants prior to interview, using the printed consent form specified in both interview guides.

The language of interview was recorded individually for each participant with SCI as part of the demographic sheet (Table 2).

Clinician interviews explored: the perceived importance of the corticospinal tract and central pattern generators (CPG) in neurorehabilitation for incomplete SCI; perceived gaps in current SCI rehabilitation protocols; evidence-based suggestions for interventions to integrate into CAP; recommended dosage, frequency, and intensity of sessions; cultural and contextual considerations for the Indian/LMIC setting; recommended outcome measures; feasibility and implementation challenges in hospital or community settings; preferred instructional format for protocol documentation and training; integration of CAP with existing therapies or assistive technology; and final recommendations before formulation.

Interviews with individuals with SCI explored: daily functional challenges, prior rehabilitation experience, barriers to participation, personal recovery goals, preferred exercise types, tolerance/intensity, motivation, support preferences, instruction format, and suggestions for a new protocol.

Data Analysis

Interview audio recordings were transcribed verbatim with transcripts checked against the original recordings for accuracy. Data were analysed using reflexive thematic analysis following Braun and Clarke's (11) six-phase framework: familiarization with the data, generation of initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the report.

Coding was conducted using a hybrid approach, combining inductive (data-driven) coding with deductive coding guided by the a priori domains in the interview guides (e.g., current practice, unmet needs, intervention preferences, feasibility). Coding was led by the first author (SK), a physiotherapist and doctoral researcher with training in qualitative methods. All transcripts were independently double-coded by the second author (NA), an experienced researcher in neurorehabilitation and qualitative methodology. Discrepancies in coding and theme development were resolved through discussion to consensus, with the third author (HSC) available for arbitration if agreement could not be reached. Coding was conducted manually using printed transcripts and margin notes, with final code lists and theme maps compiled in Microsoft Word and Excel. The interviewer made brief field notes immediately after each interview to document contextual observations (e.g., setting, participant comfort, any interruptions) and initial analytic reflections; these notes informed reflexivity memos but were not coded as primary data. Transcripts were not returned to participants for comment or correction, owing to time and resource constraints; illustrative quotations selected for reporting were reviewed internally by the research team to check they reflected participants' intended meaning.

The cognitive debriefing approach followed established qualitative frameworks for establishing content validity through stakeholder interviews (9).

Researcher Reflexivity

The first author (SK), a physiotherapist with clinical experience in neurorehabilitation and a member of the CAP development team, conducted all clinician and patient interviews. The author had no treating clinician–patient relationship with the individuals with SCI who participated; recruitment was facilitated through outpatient departments and rehabilitation centres where the author was known in a research capacity but not as a primary therapist. Some clinician participants were colleagues from affiliated universities and rehabilitation centres, though none were directly involved in the day-to-day development of CAP content.

To manage potential influence on data collection and interpretation, several strategies were employed. First, a structured, semi-structured interview guide was used for both groups to ensure consistent coverage of topics and to reduce the risk of leading questions. Second, the author maintained reflexive memos throughout data collection and analysis to document assumptions, emerging interpretations, and any potential biases related to her role in CAP development. Third, independent double-coding by the second author (NA), who was not involved in

participant recruitment and had no clinical relationship with participants, provided an external check on code application and theme development. Finally, the research team explicitly bracketed prior assumptions about CAP's intended content during early analysis meetings, focusing initially on participants' own language and priorities before mapping findings onto the developing protocol.

Reporting

This study is reported in line with the Consolidated Criteria for Reporting Qualitative Research (COREQ) guidelines (12); a completed COREQ checklist is provided as a supplementary file. Reporting also considered relevant guidance on the use of cognitive debriefing interviews to establish content validity of health-related instruments and interventions (9), particularly with respect to describing participant characteristics, data collection procedures, and the link between stakeholder feedback and intervention design.

Results

Themes from Clinician Interviews

Six initial codes were grouped into two overarching categories: systemic and workforce gaps, and care delivery models.

Systemic and workforce gaps

- Need for standardization. Clinicians emphasized the absence of standardized, protocol-driven rehabilitation approaches for SCI, contrasting with ad hoc, practitioner-dependent current practice.
- "Right now, every therapist is doing their own thing… there is no standard protocol which everyone follows for SCI." (Clinician, C1)
- Structured training programmes for clinicians. Participants identified a gap in formal training pathways for physiotherapists working with SCI populations.
- "Therapist needs to have training to administer the standard of care to these patients." (Clinician, C2)
- Manpower and human resource shortages. Clinicians noted a shortage of adequately trained personnel with SCI-specific expertise.
- "We have so many patients, but very few therapists who actually know how to handle SCI cases in a structured way." (Clinician, C3)
- Regulatory oversight and patient safety. Clinicians raised concern about unregulated practice, with unqualified individuals delivering interventions "in the name of physiotherapy," in some cases resulting in secondary complications. This was framed as requiring oversight from a regulatory body.
- "Many people are practicing in the name of physiotherapy without proper qualification, and sometimes patients end up with complications because of that." (Clinician, C4)
- Need for specialized fellowship/certification pathways. Clinicians recommended dedicated fellowship programmes and formal certification specific to SCI rehabilitation.
- "There should be some kind of fellowship or certification specifically for SCI, so that therapists are properly trained before they handle these patients." (Clinician, C5)

Care delivery models

Multidisciplinary care models and early referral. A recurring recommendation was for SCI rehabilitation to be delivered through multidisciplinary, coordinated care rather than isolated physiotherapy input, with early referral identified as critical to outcomes.

"Neurosurgeon should refer a patient to trained PT in the acute stages so we can give the maximum recovery." (Clinician, C5)

Themes from Interviews with Individuals with SCI

Eight initial codes were grouped into four overarching categories: access and structural barriers, care quality and safety concerns, intervention design preferences, and unmet clinical education needs.

Access and structural barriers

- Architectural and environmental barriers. Participants described physical/architectural barriers limiting access to facilities and community participation.
- "Even if I want to go out, there are stairs everywhere, no ramps, no proper toilets… it becomes very difficult to move around." (Patient, P1)
- Financial barriers and absence of insurance coverage. Lack of insurance policies covering SCI rehabilitation was a major barrier to sustained care.
- "There is no insurance for long-term physiotherapy; everything is out of pocket, so after some time it becomes very hard to continue." (Patient, P2)
- Poor referral pathways. Participants described inadequate referral from neurosurgeons to specialized SCI rehabilitation centres, partly attributed to referring physicians' limited awareness of physiotherapy's role.
- "After surgery, the doctor just discharged me; he didn't tell me where to go for proper rehabilitation or that physiotherapy could help this much." (Patient, P3)

Care quality and safety concerns

Exposure to unqualified practitioners. Participants reported encountering unqualified individuals practicing under the guise of physiotherapy — converging independently with the clinician group's finding on regulatory oversight.

"I went to one centre, and later I came to know the person giving treatment was not even a proper physiotherapist." (Patient, P4)

Intervention design preferences

Preference for exercise-based over electrotherapy-based interventions. Participants favoured active, exercise-based approaches over passive electrotherapy.

- "I feel more improvement when I do active exercises and walking practice than when I am just lying down with machines." (Patient, P2)
- Desire for engaging, non-monotonous therapy design. Participants described current rehabilitation as repetitive and unengaging.
- "I got bored from the passive exercises." (Patient, P3)
- This quotation reinforces the preceding preference for exercise-based intervention as well — the boredom described was specifically linked to passive modalities, directly supporting participants' independently expressed preference for active, exercise-based intervention over electrotherapy.
- Unmet clinical education needs
- Gaps in bowel and bladder management training. Participants identified insufficient attention to bowel/bladder training despite its impact on quality of life.
- "Nobody explained properly how to manage my bladder and bowels; I had to learn mostly by trial and error." (Patient, P5)
- Lack of awareness regarding sexual health and prognosis. Participants felt sexual function/prognosis education was inadequately addressed.
- "No one talked to me about sexual health or what to expect in the future; these things were completely ignored." (Patient, P4)

Convergent and Divergent Findings

Both groups independently raised concerns about unregulated practice and unqualified providers, a consistent finding across independently interviewed groups that lends support to this concern through triangulation. Clinicians described unqualified individuals practicing "in the name of physiotherapy" and causing complications, while individuals with SCI reported seeking care from providers who later turned out to be inadequately trained. This convergence across independently interviewed groups lends additional support to the concern that unregulated practice is a patient-safety issue in SCI rehabilitation.

A second point of convergence emerged around referral pathways: the clinician who called for neurosurgeons to refer patients to trained physiotherapists "in the acute stages" for "maximum recovery" was echoing, from the clinical side, what individuals with SCI described as a lived barrier — being routed away from qualified rehabilitation care. Participants with SCI described being discharged without clear direction to specialized rehabilitation, while clinicians emphasized that early, appropriate referral is critical to optimizing outcomes. This convergence across independently interviewed groups lends additional support to both findings, though, given the qualitative design and small sample, this should be read as a consistent pattern across perspectives rather than as external validation in a statistical sense.

Divergence was evident in emphasis: clinicians focused on systemic/structural issues (training, regulation, workforce), while individuals with SCI emphasized lived-experience barriers (access, engagement, specific care gaps). Clinicians spoke primarily about the need for standardized protocols, formal training, and regulatory oversight, whereas individuals with SCI highlighted day-to-day challenges such as inaccessible environments, financial strain, monotonous therapy, and unmet education needs around bowel/bladder and sexual health.

Linking Cognitive Debriefing Findings to CAP Design

Cognitive debriefing finding	Source	CAP design consideration
Preference for exercisebased over electrotherapybased intervention	Individuals with SCI	Active, exercisebased components adopted as a core modality rather than a passive/electrotherapydominant design. CAP prioritizes taskspecific, activitybased training (e.g., overground gait training, strength and endurance work, balance and postural control) with electrotherapy used only as an adjunct where clinically indicated.

Gaps in bowel and bladder management training	Individuals with SCI	A dedicated bowel and bladder management module incorporated into CAP, including: (i) structured assessment of bowel/bladder function; (ii) patient and caregiver education on timed voiding, fluid and fibre management, digital stimulation, and catheter care where relevant; and (iii) integration of pelvic floor and trunk activation exercises within the broader activitybased programme.
Lack of awareness of sexual health and prognosis	Individuals with SCI	A patienteducation component on sexual health and prognosis embedded within CAP, comprising: (i) routine, sensitive enquiry about sexual concerns; (ii) provision of age and injuryappropriate information on sexual function after SCI, available options, and referral pathways; and (iii) inclusion of partners/caregivers in education sessions when desired by the patient.
Desire for engaging, nonmonotonous design	Individuals with SCI	CAP sessions designed to be varied and engaging through: (i) progressionbased, goaloriented task practice; (ii) incorporation of music, rhythm, or gamified elements where feasible; (iii) regular rotation of activities across motor, sensory, autonomic, and functional domains; and (iv) periodic review of personal goals to maintain relevance and motivation.
Need for standardization	Clinicians	CAP developed as a structured, manualized protocol with clearly defined: (i) inclusion/exclusion criteria; (ii) session structure, dosage, frequency, and intensity; (iii) progression rules; and (iv) outcome measures, to reduce ad hoc, practitionerdependent variation in SCI rehabilitation.
Need for structured training / fellowship pathways	Clinicians	CAP delivery linked to defined training and certification requirements, including: (i) a standardized training workshop or course for therapists; (ii) competencybased assessment of therapists before independent CAP delivery; and (iii) recommendation for inclusion of CAPrelated content in postprofessional fellowships or certificate programmes in neurorehabilitation.
Regulatory oversight / unqualified practice concerns	Both groups	CAP implementation incorporates fidelity and safety safeguards, such as: (i) delivery only by qualified physiotherapists with specified minimum training/experience in SCI rehabilitation; (ii) use of a treatment manual and session checklists to support adherence; and (iii) periodic supervision or audit of CAP delivery to mitigate risks associated with unqualified or unsupervised practice.
Multidisciplinary care and early referral	Clinicians	CAP positioned within a multidisciplinary care model, with: (i) explicit referral criteria for early involvement of physiotherapy after medical/ surgical stabilization; (ii) defined roles for collaboration with neurosurgery, urology, rehabilitation medicine, psychology, and vocational services; and (iii) structured communication pathways (e.g., shared care plans, regular team discussions) to support coordinated management.
Architectural, financial, and referral barriers	Individuals with SCI	These structural barriers are retained as implementation and dissemination considerations rather than core CAP content. CAP documentation highlights the need for: (i) accessible facilities and transport; (ii) exploration of insurance, government schemes, or subsidized programmes to reduce outofpocket costs; and (iii) advocacy for improved referral pathways from acute care to specialized SCI rehabilitation services.

Table 3: summarizes how findings from the cognitive debriefing phase were carried forward into specific design considerations for CAP's pre-formulation draft, which was subsequently submitted to Modified Delphi expert consensus (Section 4.3).

Discussion

The cognitive debriefing interviews conducted during CAP's pre-formulation phase surfaced considerations that extended beyond what structured expert consensus alone typically captures, directly shaping the protocol's subsequent design.

Interpretation in Relation to Existing Literature

The convergent finding — both clinicians and individuals with SCI independently identifying unregulated, unqualified practice as a serious concern — is a notable point of convergence between the two stakeholder groups. Individuals with SCI described direct exposure to individuals practicing "in the name of physiotherapy" without appropriate qualification; clinicians corroborated this from the professional side. This aligns with the broader literature on global SCI rehabilitation systems, which identifies workforce and education as critical gap areas requiring specialized training, certification, and ongoing capacity-building support (13).

The call for structured training programmes and dedicated fellowship pathways reinforces that protocols like CAP cannot function in isolation — they require a trained workforce capable of safe, competent delivery. Similarly, the emphasis on multidisciplinary care models and early referral aligns with evidence that multidisciplinary approaches to SCI rehabilitation are central to reducing preventable complications and improving patient outcomes, particularly in resource-limited settings (13). Family and caregiver involvement, though not a primary focus of this study, is a related consideration for future protocol delivery: structured caregiver training has been shown to improve competence and confidence in supporting SCI rehabilitation and self-care tasks (14).

From the perspective of individuals with SCI, several findings directly informed CAP's content and delivery design. The preference for exercise-based over electrotherapy-based intervention — reinforced by one participant's account of boredom with passive exercises — reflects participant preference and acceptability, rather than evidence of superior clinical efficacy of exercise-based over electrotherapy-based modalities, and should be interpreted accordingly. Understood in these terms, it is consistent with a broader, well-documented shift in physiotherapy practice away from passive, modality-dominant care toward active, patient-centred, exercise-first approaches, driven by the introduction of evidence-based practice principles across the profession (15). The identified gaps in bowel/bladder training are consistent with evidence that excretory dysfunction substantially affects quality of life after SCI, with bladder and bowel self-management training identified as a priority area for strengthening (16); activity-based exercise training itself has also been shown to benefit bladder, bowel, and sexual function directly (17). The reported gap in sexual health awareness mirrors a well-documented and persistent finding internationally: sexual health, despite being a top priority for people with SCI, is frequently overlooked in rehabilitation care (18). The request for more engaging, less monotonous therapy — incorporating playful or music-based elements — speaks directly to adherence and long-term engagement; music interventions have been shown to increase motivation in the majority of studies examining this relationship in clinical and rehabilitation settings (19).

Structural barriers identified by individuals with SCI — architectural inaccessibility, absence of insurance coverage, and poor referral pathways — fall largely outside what a rehabilitation protocol alone can address, but are important context for implementation feasibility. Out-of-pocket expenditure dominates injury-related care costs in North India, with catastrophic health expenditure disproportionately affecting lower-income households in the absence of adequate financial risk protection (20). Similarly, poor referral pathways and resource shortages have been identified elsewhere as key barriers limiting access to rehabilitation services for people with physical disabilities (21). These structural findings suggest that even a well-validated protocol like CAP will face adoption barriers rooted in healthcare system structure rather than clinical content — an important consideration for future implementation and dissemination planning.

Implications for CAP Development

As summarized in Table 3, findings from the cognitive debriefing phase were synthesized into a structured set of design considerations — spanning intervention content (e.g., emphasis on active exercise components, inclusion of bowel/bladder and sexual health education, engagement-oriented session design) and delivery-model considerations (e.g., training and certification needs, multidisciplinary referral pathways) — which informed the initial conceptual draft of CAP. This draft was subsequently submitted, alongside supporting literature, to the Modified Delphi expert panel described in the companion validation study, where individual design elements were formally rated and refined through iterative expert consensus.

Strengths and Limitations

This study's strength lies in triangulating clinician and patient perspectives during the earliest stage of protocol development, before formal consensus methods

were applied — allowing findings to meaningfully shape CAP's design rather than merely validating a fixed draft. The convergence of independent findings across groups (particularly regarding unregulated practice and referral pathways) lends support to these themes, within the limits of a qualitative design.

Limitations include the modest sample size (n=5 per group). As discussed in Section 4.3.4, this is consistent with cognitive debriefing methodology and the information-power rationale for a narrowly focused, purposively sampled study (10), but it nonetheless limits claims of thematic saturation or generalizability beyond this context. Interviews were conducted within a specific geographic and healthcare system context (India), which may limit transferability of findings — particularly structural barriers such as insurance coverage — to other settings. As noted in Section 1, the term "cognitive debriefing" in this study reflects broader usage as structured pre-formulation stakeholder consultation, rather than the narrower technical sense (testing comprehension of an existing draft instrument) used in some of the qualitative methods literature.

Conclusion

Cognitive debriefing interviews with clinicians and individuals with SCI surfaced practical, safety-related, and engagement-related considerations that directly informed the pre-formulation design of the Corticospinal Activation Protocol. Findings highlighted a shared concern across stakeholder groups regarding unregulated SCI rehabilitation practice and inadequate referral pathways, alongside patient-centered priorities — including exercise-based intervention preference, bowel/bladder and sexual health education gaps, and engaging therapy design — that shaped CAP's subsequent content and structure. These findings underscore the value of qualitative stakeholder consultation as a complement to formal expert consensus methods in complex intervention development.

Declarations

Ethics Approval and Consent to Participate: This study was approved by the Institutional Ethics Committee, Punjabi University, Patiala (Ref: 28/55/IEC/PUP/2022, dated 08/11/2022). Written informed consent, using a printed consent form, was obtained from all participants prior to interview. This study was conducted as part of the broader CAP research programme registered with the Clinical Trial Registry of India
(CTRI/2023/02/049536, dated 08/02/2023).
Consent for Publication: Written informed consent was obtained from all participants (clinicians and individuals with SCI) for their anonymized interview responses, including illustrative quotations, to be used for research and publication purposes. No identifying information is disclosed in this manuscript.
Competing Interests: The authors declare that they have no competing interests.
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