Length of Stay Following Spinal Cord Injury: Associations with Predictors, Outcomes, and Stakeholders Experiences in Inpatient Rehabilitation

Alex Wong, PhD, DPhil[1,2]
Sherri LaVela, PhD, MPH, MBA[2,3]
Allen Heinemann, PhD[1,2]

1. Center for Rehabilitation Outcomes Research, Shirley Ryan AbilityLab
2. Department of Physical Medicine and Rehabilitation, Northwestern University Feinberg School of Medicine
3. U.S. Department of Veterans Affairs, Edward Hines, Jr. VA Hospital

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Disclosures

- Presenters have no financial interest to disclose.
- The views expressed in this presentation are those of the authors and do not necessarily reflect the position or policy of the Department of Veterans Affairs or the United States government.
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Learning Objectives

- To review the literature on the length of stay (LOS) following spinal cord injury (SCI) and discuss the importance of LOS on patient experiences in inpatient rehabilitation and how this influences outcomes, including post-discharge and community living
- To appraise associations of LOS with personal and contextual factors and SCI outcomes
- To appraise the inpatient SCI rehabilitation experiences of Veterans and civilian with SCI and their care partners
- To discuss implications and future directions to enhance patient experiences and outcomes of inpatient SCI rehabilitation

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Presentation Overview

Time	Agenda	Speakers
0:00 – 00:05	Welcome and Project Overview	Allen Heinemann, PhD, ABPP
00:05 – 00:20	Reviews: Associations of Length of Stay with Predictors and Outcomes	Alex Wong, PhD, DPhil
00:20 – 00:35	Inpatient Rehabilitation Experiences from Civilians and Veterans with SCI	Sherri LaVela, PhD, MPH, MBA
00:35 – 00:50	Rehabilitation Experiences of Care Partners	Allen Heinemann, PhD, ABPP
0:50 – 1:00	Discussion, Wrap-up, and Final Comments	All presenters

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NIDILRR's Research Priorities

A. R1: Conduct a systematic review of the existing international research literature regarding acute care and medical rehabilitation length of stay and intensity following SCI.

B. R2: Conduct comparative international research to generate new knowledge about current international variation in acute care and medical rehabilitation length of stay and intensity following SCI.

C. R3: Conduct comparative international research to generate new knowledge about the experiences and outcomes of people with SCI, and how those experiences and outcomes are related to the rehabilitation length of stay and intensity they experienced.

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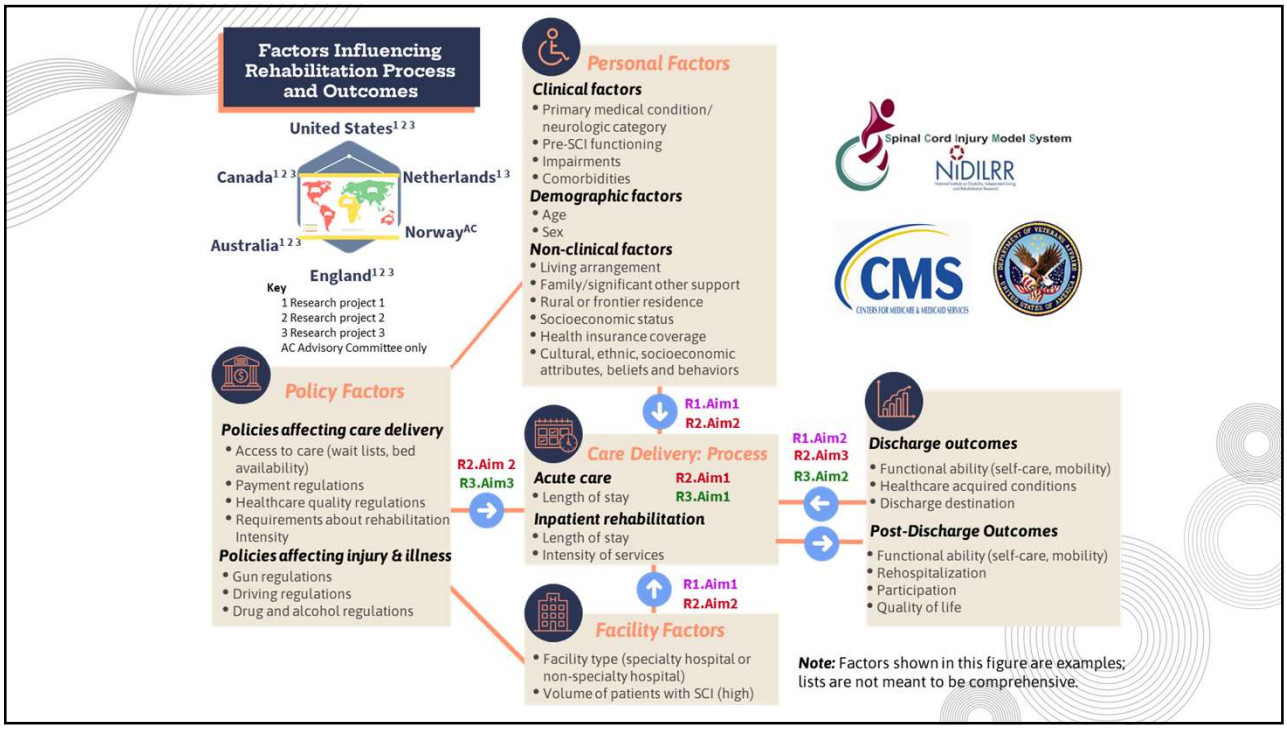

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Priority A (R1) Objectives

1. Review international research literature regarding acute care and medical rehabilitation length of stay and intensity following SCI and how they are associated with personal- and hospital-level factors.

2. Review international research literature regarding acute care and medical rehabilitation LOS and intensity following SCI and how they are associated with patient outcomes.

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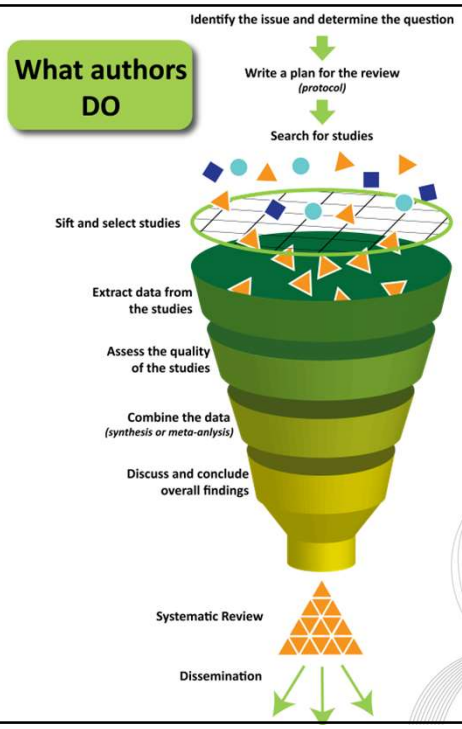
Design & Procedures

1. Identify research questions
2. Write and register the protocol
3. Conduct literature search
4. Screen & select studies
5. Extract data from included studies
6. Assess the quality of studies
7. Synthesize extracted data
8. Conduct meta-analysis (overall effect, subgroup analysis by countries)



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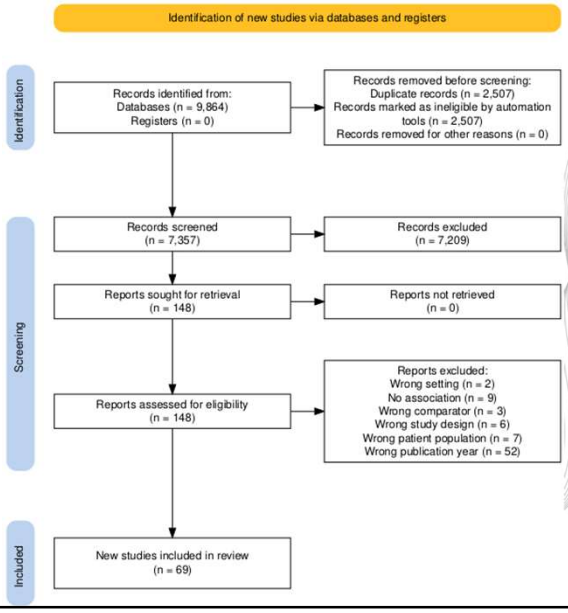
Literature Search & Screening

- Registered 2 protocols at PROSPERO
- Worked with a librarian to search for studies
  - MEDLINE, Cochrane Library, CINAHL, & PsycINFO
  - MeSH thesaurus *LOS*, *intensity*, *hospital/rehab*, & *SCI*
  - Excluded animal studies, comments/letters, & conf. proceedings
  - Limited to English studies published Jan 2009 to Mar 2024 (2009 - CMS issued a 3-hour rule)
- Initial n=9864; full-text review n=148
- 69 studies included; further limited publications year to Jan 2014 after considering the effect of the Affordable Care Act in 2014



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Data Extraction, Quality Ax, and Data Synthesis

- Created a data extraction table to support data extraction
  - Study characteristics (e.g., authors, pub years, country, setting, sample)
  - Definition and quantity of LOS/intensity
  - Demographics; Injury and clinical characteristics; Hospital characteristics
  - Control, covariate, or stratified variables
  - Results (magnitudes and directions of relationships)
- Used the Newcastle-Ottawa Scale (NOS) to assess the quality of studies (at least 6 out of 9, indicating medium to high quality)
- Completed data synthesis & meta-analysis (overall effect; subgroup analysis by countries)

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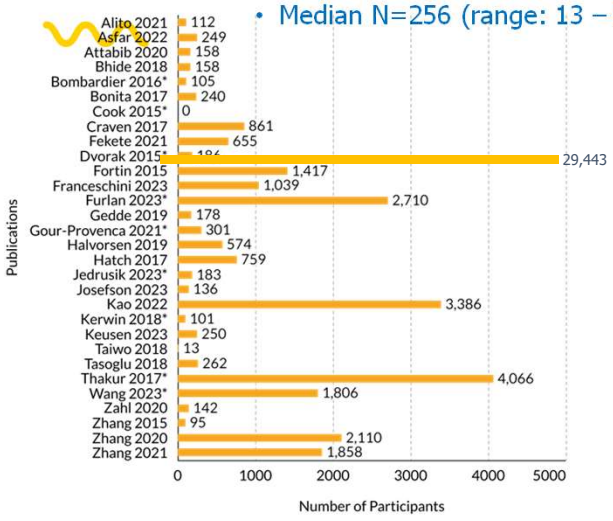
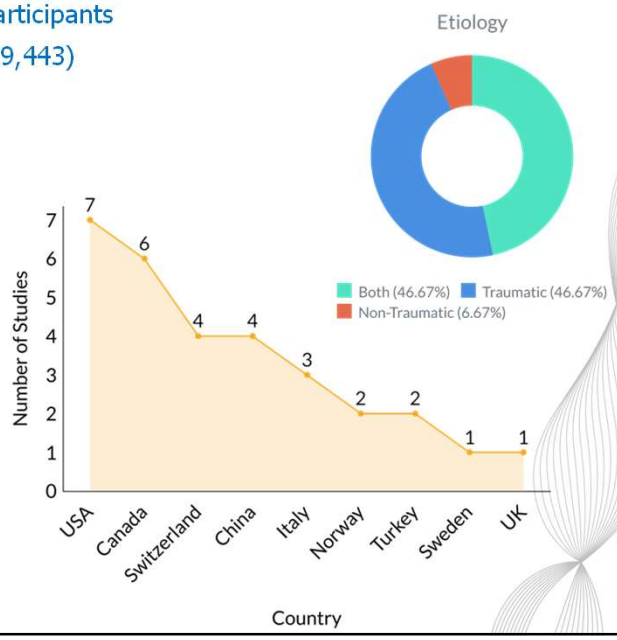
Associations of personal & hospital factors with LOS/intensity (n=30)

- 30 studies involving 53,553 participants
- Median N=256 (range: 13 – 29,443)





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Positive associations with longer acute LOS

- Injury factors
  - Worse ASIA grade — N=186, T, Canada; N=1806, T, China
  - Non-cervical injury — N=1806, T, China
  - Injury caused by fracture/dislocation — N=1806, T, China
- Non-clinical factors
  - Minority Status (American Indians, Alaska Natives) — N=29,443; T, USA
- Clinical factors
  - Medical complications — N=183, Both, Switzerland
    - Pressure ulcer — N=301, T, Canada
    - Urinary tract infection — N=301, T, Canada
    - Pneumonia — N=301, T, Canada
  - TBI-comorbidity — N=105, T, USA
- Hospital factors
  - Without receiving early surgical intervention — N=186, T, Canada
  - Without receiving the Diaphragm Pacing System (DPS) implementation — N=101, T, USA
  - Lower daily therapy time — N=301, T, Canada

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Positive associations with longer rehab LOS

- Injury factors
  - Traumatic N=112, B, Italy N=655, B, Switzerland N=249, B, Turkey N=574, B, Norway
  - Complete/higher severity N=240, B, Italy N=250, B, Switzerland N=158, T, Canada N=262, B, Turkey N=112, B, Italy N=655, B, Switzerland N=574, B, Norway N=1,039, T, Italy
  - Tetraplegic/Cervical/Higher level N=861, T, Canada N=112, B, Italy N=655, B, Switzerland N=158, T, Canada N=240, B, Italy N=2,110, T, China
  - Non-fall (object striking, motor vehicle collision) N=2,110, T, China N=1,858, T, China
  - Shorter disease duration (<12 months) for NTSCI N=262, B, Turkey

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Positive associations with longer rehab LOS

- Non-clinical factors
  - Whites N=3,386, T, USA
  - Single N=2,110, T, China
  - Males N=240, B, Italy
  - Higher education N=3,386, T, USA
  - Higher household income N=3,386, T, USA
  - Private Insurance N=3,386, T, USA
  - Younger age N=861, T, Canada N=574, B, Norway N=2,110, T, China
- Clinical factors
  - Medical complications N=250, B, Switzerland
    - Osteoporosis N=2,110, T, China
    - Urinary tract infection N=2,110, T, China N=178, B, Norway
    - Respiratory infection/ Pneumonia N=2,110, T, China N=136, B, Sweden
    - Neuropathic pain N=2,110, T, China
    - Spasticity N=2,110, T, China
  - Use of ventilation N=861, T, Canada
  - Presence of associated injury N=3,386, T, USA
  - TBI-comorbidity N=105, T, USA
  - > 1 causes of re-admission N=1,039, T, Italy
  - Lower functional status at admit N=112, B, Italy N=13, non-T, UK
  - Worse lower limb motor scores N=861, T, Canada
- Hospital factors
  - Longer time to rehab admission N=249, B, Turkey N=158, T, Canada

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Associations with therapy intensity

- Patients with more co-morbidities reduced daily therapy time (total time by OT, PT, & Sport Therapy)
  N=250, B, Switzerland
- NO significant associations were found between illness severity and Recreation Therapy time
  N=142, B, USA

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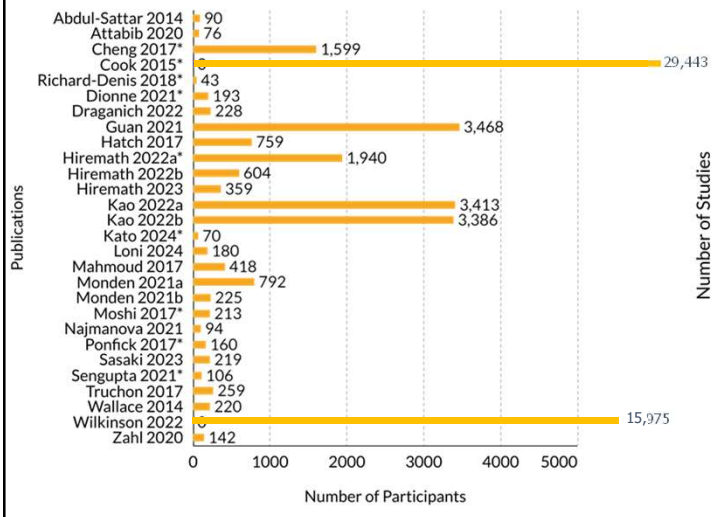
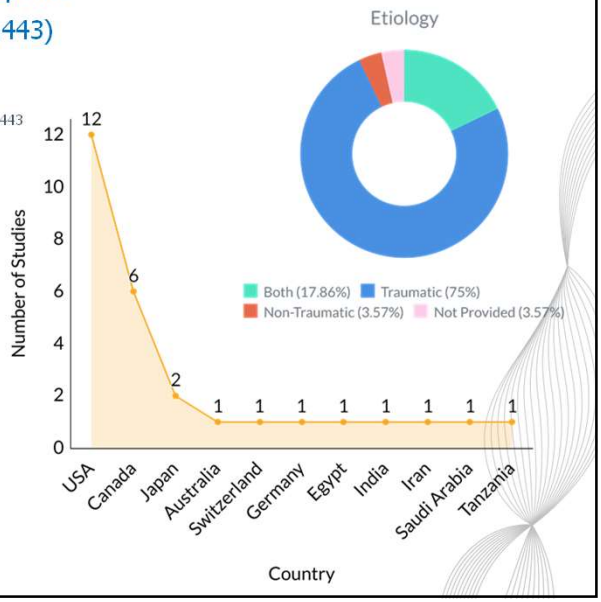
Associations of LOS/intensity with patient outcomes (n=28)

- 28 studies involving 64,664 participants
- Median N=226.5 (range: 43 – 29,443)





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Associations of longer acute LOS with outcomes

Favorable

- Greater chance of discharge to rehab services or an institution (IRF, SNF, or LTC) N=1599, T, Canada; N=1940, T, USA
  - But 1 study found no association N=70, B, Japan

Unfavorable

- Lower motor functional score (more dependent) at discharge from acute hospital N=1,940, T, USA; N=160, B, Germany
- Lower functional outcome following tetraplegia N=43, T, Canada
- Higher mortality N=106, T, India
- Lower chance of discharge to home after inpatient functional rehab N=193, T, Canada
- Greater chance of wheelchair dependent N=213, T, Tanzania

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Associations of longer rehab LOS with outcomes

Favorable

- Greater changes in motor FIM score (functional improvement) during IRF stay N=90, T, Egypt; N=180, T, Iran
- Greater functional outcomes at discharge N=160, Both, Germany
  - But 1 study found no association N=418, Both, Saudi Arabia
- Reduced assistance needed at discharge N=15,975, T, USA
- Greater improvements in bladder functioning N=76, T, Canada
- Greater home discharge destination N=219, T, Japan
- More personal goal identification N=220, T, Australia
- Reduced opioid use at 1-year post-injury N=3,468, non-T, Canada

No associations

- Survival N=759, B, USA

Unfavorable

- Higher risk of developing complications
  - Deep venous thrombosis (DVT) N=228, T, USA
  - Pressure injury N=94, Both, Switzerland
- Lower % of motor FIM score change (i.e., lower FIM improvement efficiency) N=604, T, USA; N=359, T, USA
- Greater injustice appraisals and stigma N=225, T, USA
- Less community access and vocational goal identification N=220, T, Australia

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Associations of therapy intensity with outcomes

Favorable

- Greater therapy hours linked to greater motor FIM score change at discharge N=259, T, Canada
- Greater Recreation Therapy time linked to greater cognitive FIM score change at discharge N=142, NA, USA
- Greater PT hours linked to greater motor FIM score a 1- & 5-year post-injury N=792, T, USA
- Greater Psychology hours linked to higher home residence at 1- & 5-year post-injury N=792, T, USA
- Greater PT hours linked to greater physical independence at 1- & 5-year post-injury N=792, T, USA
- Greater Recreation Therapy hours linked to greater social integration at 1- & 5-year post-injury N=792, T, USA
- Greater Recreation Therapy hours linked to greater occupation at 1- & 5-year post-injury N=792, T, USA
- Greater Recreation Therapy hours linked to greater mobility at 1- & 5-year post-injury N=792, T, USA

Unfavorable

- Greater Social Work hours linked to higher depression at 1- & 5-year post-injury N=792, T, USA
- Greater Social Work hours linked to lower motor FIM score change at 1- & 5-year post-injury N=792, T, USA

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Summary of Systematic Review Findings - Predictors

- Longer Length of Stay
  - Traumatic injury
  - Complete injury
  - Tetraplegia
  - Non-fall cause of injury
  - Younger age
  - Medical complications
  - TBI co-morbidity
  - Lower functional status at admission
  - Longer time to rehab hospital admission
- Greater Therapy Intensity
  - Fewer comorbidities

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Summary of Systematic Review Findings - Outcomes

- Longer Length of Stay
  - Greater functional improvement
  - Greater home discharge
  - Higher risk of developing complications
  - Reduce opioid use at 1-year post-injury
- Greater Therapy Intensity
  - Greater functional gains at discharge
  - Greater functional improvement at 1- & 5-year post-injury (PT)
  - Greater participation at 1- & 5-year post-injury (PT, RT)
  - Greater home residence at 1- & 5-year post-injury (Psych)

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Inpatient rehabilitation and discharge preparedness experiences of individuals living with SCI/D

- Objectives
  - Describe initial inpatient rehabilitation and discharge preparedness experiences after a spinal cord injury or disorder
    - Identify similarities and differences in veterans vs. civilians with SCI/D experiences

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Methods

- Sample(s)
  - Purposeful criterion sampling to include a diverse mix of participants (veterans and civilians) across sex, age, and injury factors; target 5-10 each focus group
    - Inclusion: Adult, injured > 1 year
- Data collection
  - Pre-focus group survey: demographic characteristics, injury details, and basic information about their initial rehabilitation, e.g., length of rehabilitation stay.
  - Focus group: Conducted virtually, about 90 minutes, used semi-structured focus group guide

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Excerpt from Individuals with SCI/D Focus Group Guide

1. What goals did you hope to achieve during inpatient rehabilitation? [probe for mobility, ADL, psychosocial, community living goals] How did you prioritize these goals? What therapies did you find helpful? What, if any, therapies were unnecessary or unhelpful? How were nurses or other members of the health care team helpful in preparing you and your care partner for discharge? How well aligned were your goals with those proposed by the rehabilitation health care team?

2. How well prepared were you for discharge? What skills did you learn during rehabilitation that were helpful? What were you taught on how to transfer knowledge and skills that you learned during rehabilitation to your home setting (or other residence after discharge)? Can you discuss situations for which rehabilitation did not prepare you adequately?"

3. What do you think about the length of time you were in initial rehabilitation and whether it prepared you for discharge and community living? [Too short? Too long?] Can you describe anything that may have caused your length of stay to be extended? [shortened?] How was your length of stay decided? Who was involved in this decision? [probe: you, your family]

.

11. In what ways did rehabilitation help you prepare to return to activities you were interested in participating in before your injury, such as work or further education or training? Volunteering? Other roles? How?

12. If you knew during rehabilitation what you know now, how could rehabilitation have prepared you better?

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Data Analysis

- Descriptive statistics
  - Demographic and injury characteristics
- Thematic analysis
  - 3 qualitative researchers conducted coding & analysis
  - mixed deductive-inductive approach (pre-established codes from Multidimensional Model of Transition from Health Care to Community as Influenced by Length of Stay) and constructs driven by data
  - Based on meaningful interpretation of the data, emphasized content quality vs. quantity

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Results. Demographic and Injury Characteristics of Individuals with SCI/D Focus Group Participants

	Veterans with SCI/D (n=7)	Civilians with SCI/D (n=9)
Sex		
Male	57.1	55.6
Female	42.9	44.4
Race		
White	57.1	66.7
Black/African American	14.3	22.2
Other/mixed	28.6	11.1
Age (mean, range, sd)	51.7, 39-61, sd=8.0	47.1, 19-73, sd=20.1
Etiology		
Traumatic	42.9	100
Non-traumatic	57.1	0
SCI/D level		
Paraplegia	0	55.6
Tetraplegia	57.1	44.4
AIS D	43.9	0
SCI duration (mean, range, sd) years	4.4, 1-10, sd=2.7	18.1, 4-48, sd=15.1
IP LOS (mean, range, sd) days	94.3, 30-180, sd=53.2	100.4, 29-210, sd=66.1

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Individuals with SCI/D Focus Group Themes

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	US Veterans with SCI/D (n=7)	US Civilians with SCI/D (n=9)	Veteran vs. civilian perspectives
Suitable length of stay	57% identified their LOS as suitable "I think I was there [IP Rehabilitation] long enough. I mean, it was perfect timing. I actually ended up leaving early because there was **nothing else for them to teach me**." [P03, F]	22% identified their LOS as suitable "I was at (model systems) for 5 months and I, I think that was **essentially adequate.**" (Cory)	*A greater proportion of veterans identified their LOS as suitable (57%) vs. civilians (22%). Both veterans and civilians indicated that they think they would be able to advocate successfully for a longer stay if they insisted.*
Unsuitable length of stay	29% identified their LOS as **un**suitable "**More time** in [inpatient rehab/therapy] would gain more function back." [P04, F] "A little bit of rehab and off you go home and have a good night. I **don't think I was ready to face the world without further rehab**. I don't think I was ready at all." [P05. F]	78% identified their LOS as **un**suitable "I think **my stay could have been a lot longer**.... I think where I'm at now had I, benefited from longer therapy. **I think I'd be a lot further along** today. So, it was too short." (Doris) "I feel like I **could have benefited from staying longer**." (Grace)	*Unsuitable LOS: veterans (29%), civilians (78%)* *Both groups felt that more therapy was needed during the initial LOS and both groups felt that they would have had better outcomes with more therapy , e.g., "fared a better chance" and "be further along in the present day"*
Gaps/lapses in rehabilitation and transition from IP stay	Gaps in therapy were potentially harmful "The transition was the biggest challenge from hospital to quote outpatient. There's that gap and **you just drop off the charts** for 2 or 3 months because those initial appointments they give you when you leave, they're used up... And so you lose, or at least **I lost, a good couple months of what I consider important therapy**. Most important thing would have been a continuation." [P01, M]	No concerns with gaps identified "I feel like 2 months should be like minimum. And then they should split it, **go home for 5 months. And then try 2 months again** and see how differently you are." (Amber)	*While Veterans wanted more continuity and less gaps between rehabilitation and OP/post-discharge therapy and services, at least one civilian advocated for a deliberate gap, meaning participate in IP rehab, go home for a few months, then come back for another rehab stay to work out remaining concerns – and with more strength.*

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	US Veterans with SCI/D (n=7)	US Civilians with SCI/D (n=9)	Veteran vs. civilian perspectives
Helpful rehabilitation therapies 	Noted that PT, OT, and RT were helpful "The **OTs** had me do my home laundry and wash dishes. So they wanted to make sure I had enough **strength to do my chores that I normally would do**. But more than the physical**, I wasn't prepared mentally** how different I am. All of that [rehabilitation] was great except the mental piece of it." [P03, F] "**OT/PT** was the best for me. Oh, between PT and **rec therapy**, huge things to get me back to the things I like to do." [P04, F]	Noted that PT, OT, and mental health were helpful "**Occupational therapy really was big game changer** because I'm an artist... it's like they know you better than PT. And they do like, **your life needs to start with what you need to do in life** versus, you know, walking, running, doing all the things that are, I would say extracurricular." (Amber) "I had to go through mental health [therapy] and I think, with **having the mental health in place** that it educated me a little bit about what I was going through and what the expectation would be and it was more realistic for me to where I could put the puzzles and pieces together." (Heidi)	*Both groups highly praised the rehab services/therapy efforts that (1) allowed them to return to or continue their pre-injury hobbies and interests, such as art, journaling (with or without adaptations) and (2) prepared them to perform basic life activities, e.g., home chores, dishes, laundry* *Veterans with SCI/D felt that they did not receive enough mental/emotional preparation during rehabilitation. Alternatively, civilians with SCI/D specifically noted the value they found from working with mental health providers, in that they were provided with education, and encouraged to think about expectations, and what was realistic.*

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	US Veterans with SCI/D (n=7)	US Civilians with SCI/D (n=9)	Veteran vs. civilian perspectives
Preparedness for discharge	"I was very prepared. You know, we had a dedicated wound care nurse. We had a **dedicated bowel, bladder**, etcetera. So, I couldn't ask for better for that side of it." [P01, M] "They trained, you know, they kind of **took me through the steps to perform the B&B routine once home**." [P05, F]	"My wife was with me most of the time, I was still with her, and they prepared her quite a bit for how to deal with the whole thing you know **they talked about all these different procedures for bowel movement**..." (Cory) "I think **I did feel prepared** in terms of like the education, like I said. I had twice as much of the class that I needed for that." (Amber)	*For both cohorts, preparedness for discharge largely centered around discharge planning and education, a major piece of this for both groups included readiness for secondary condition management, especially bowel care*

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How could inpatient rehabilitation have prepared individuals with SCI/D better?

	US Veterans with SCI/D (n=7)	US Civilians with SCI/D (n=9)	Veteran vs. civilian perspectives
Facilitate early connections with peers (so they can learn from others about work arounds, ways to deal with obstacles)	"And so it's interesting, like, you know, sometimes people have been around, you know, in this condition for years and it's just, I just **never knew that was available**. And so sometimes it was just, for me, getting with other people that have been in the in the chair longer and **being able to talk with them and find out what they've dealt with** and what they've, you know, come across as workarounds and things." [P07, M]	"A couple of things that could have prepared me better. I think was having more education and maybe, **peer to peer. Not always coming from a completely unrelated experience**. Not only having like an inpatient support group, but **support that involved people that were further along with their injuries** already living in the community coming into the rehab and giving their experience." (Grace)	*Both cohorts wanted peer options introduced to them **early on** during the initial IP rehabilitation* 
Inform/Empower people with information about advocacy/peer support groups	"So the PVA, Unite 2 Fight for Paralysis, GUSU, and soon to be peer mentor at VA." [P04, F] "The PVA are amazing when it comes to education. When it comes to advocacy. When it comes to navigating the system. Also, peer support is very important. So it's been a good thing to join the PVA ... it just gives me a sense of purpose." [P05, F]	No specific advocacy groups identified.	*Veterans, in particular, found PVA and other advocacy groups to be **empowering**. However, similar to above, they would have liked to be made aware of peer/advocacy groups earlier on.*

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	US Veterans with SCI/D (n=7)	US Civilians with SCI/D (n=9)	Veteran vs. civilian perspectives
Prepare in advance for mental/emotional implications that one may face	Not prepared mentally "**Preparing me** to, how to **mentally** force myself to go to the public because inherently with our injuries, so many of us will just stay home bound and so that sort of intense therapy beforehand…I think that **would have been very important**." [P01, M] "All of that [rehabilitation] was great **except the mental piece** of it." [P03, F]* "The emotional impact was way bigger than the physical one. Physically into the mission, I'm fine, but the emotional one, I felt like a toddler, the **emotional part was very difficult**." [P04, F]	No concerns with mental health receipt identified, felt mentally prepared "Just going home, it's just getting there because you can have all these things in your head, and then there are problems that you have to overcome once you get there and learn how to get around them **but mentally, I thought I was ready** to go." (Doris) "I had to go through mental health [therapy] and I think, with **having the mental health in place** that it educated me a little bit about what I was going through and what the expectation would be and it was more realistic for me to where I could put the puzzles and pieces together." (Heidi)	*Veterans with SCI/D identified not feeling prepared mentally/emotionally for what they might face after discharge. Alternatively, civilians with SCI/D commended the mental health preparation they received prior to discharge.*

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	US Veterans with SCI/D (n=7)	US Civilians with SCI/D (n=9)	Veteran vs. civilian perspectives
More focus on public/real-world practice	"I think that there could be more focus on the going out aspect **being out in public**." [P01, M] "The first time we went out to eat, I remember it was just atrocious. **Nobody prepared me** for it. I remember our first outing was IHOP and I had food everywhere and I was embarrassed and my husband helped me and you know, it was just I wasn't prepared for that. I really was not." [P05, F] So I guess during IP rehabilitation I **would have liked to have had more encouragement of, just get out there**. You're gonna run through, it's gonna be difficult. And just getting out and about, you realize that not only you know there are [other] people in wheelchairs. [P07, M]	"I was able to **get back into the community to do the things that I'd like to do**. They take you on trails and they use the special DME equipment. I was able to go ice skating with someone having me in a bucket seat and the person is on the bike I'm able to basically do any and everything that a normal person would be able to do today." (Heidi) "My first rehab prepared me in letting me know what is possible in terms of art, you know, making me, having me just say okay, art is your occupation, so just like keep doing it. But my second [rehab] actually **gave me the will and the physicality, I guess is what I'm saying, to actually do** it." (Amber)	*Consistent across veterans and civilians with SCI/D was a strong desire to practice skills before going home, this included, for many, actually going out in public/real world to practice (during the IP rehab stay period).* *Another big factor (across groups) was wanting to make use of technology and practice using various adaptive equipment for preparedness for community activities, (technology, tools, devices).* 

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Summary: Perspectives of individuals living with SCI/D

- Individuals with SCI/D sought highest functional gains/readiness as possible
  - Longer LOS → more therapy: for both basic functions and life interests
  - Actual real-world practice (during IP stay)
- Avoid gaps in therapy during transition from IP to community
- Veterans identified a need for more mental health services during IP rehab
- General interest during this early time post-injury → connection with SCI/D peers

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Presentation Overview

Time	Agenda	Speakers
0:00 – 00:05	Welcome and Project Overview	Allen Heinemann, PhD, ABPP
00:05 – 00:20	Reviews: Associations of Length of Stay with Predictors and Outcomes	Alex Wong, PhD, DPhil
00:20 – 00:35	Inpatient Rehabilitation Experiences from Civilians and Veterans with SCI	Sherri LaVela, PhD, MPH, MSW
00:35 – 00:50	**Rehabilitation Experiences of Care Partners**	**Allen Heinemann, PhD, ABPP**
0:50 – 1:00	Discussion, Wrap-up, and Final Comments	All presenters

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Experiences of care partners: Inpatient rehabilitation and discharge preparedness

- Objectives
  - Describe inpatient rehabilitation and discharge preparedness experiences of care partners
  - Identify similarities and differences in care partners of Veterans vs. civilians

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Methods

- Eligibility criteria
  - Involved in inpatient rehabilitation
  - Maintained a relationship with a former patient for at least one year
- Recruitment strategies
  - Veterans nominated primary care partner
  - SCI Model Systems
  - Consumer organizations

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Focus Group Guide for Care Partners

- Tell us about the inpatient rehabilitation your family member/loved one received. Where? How long did they stay? What were the rehabilitation goals?
- How were you involved in their rehabilitation? In goal setting? Can you describe any services, education or training that you received? How was it helpful or unhelpful?
- How well prepared were you for your family member to leave rehabilitation? What could have been done to prepare you better?
- How has your relationship with this family member changed – or not – following SCI? Can you describe if and how the rehabilitation program helped you deal with these relationship changes?
- Can you describe if and what peer SCI organizations you or your family member sought help from to help transition home? Please describe any services they offered. How helpful/unhelpful were they? What support did you find to be helpful? (Unhelpful?)

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Care Partners' Focus Group Results

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Care Partner Sample Characteristics (N=14)

Characteristic	Veterans (n=3) Mean ± SD or N	Civilians (n=11) Mean ± SD or N
Age (mean ± SD)	53.3±4.2	47.5 ±16.1
Sex		
Male	1	5
Female	2	6
Race		
Asian	0	1
Black or African American	0	5
White	3	5
Working status		
Full-time	0	2
Part-time	1	5
Retired due to age	1	3
Retired due to disability	0	1
Unemployed/homemaker	1	0
Relationship to person with SCI		
Spouse/partner	3	6
Family	0	4
Friend	0	1
Years since inpatient rehabilitation (mean ± SD)	8.5±4.8	4±2.5
Years providing care (mean ± SD)	8.5±4.8	3 ±2.6
Rehabilitation at Specialty Hospital	3	8

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Involvement during Inpatient Stay

Veterans' Care Partners	Civilians' Care Partners
• I was able to come up. Spent the night up here and **went through bowel and bladder program**. Kind of learned how to do that. **Learned how to transfer** into the car. I think we practiced what to do if he fell out of his chair. [CP02, F] • With my husband at the time, we were only dating, so I wasn't able to be part of any of the decision- making process or anything, but I was at every hospital visit every time I could get there. I was there **watching and learning**. [CP01, F]	• I **learned a lot just by watching** how nurses, doctors, and therapists paid attention to him. It taught me patience, and I had to learn how to help with mobility exercises, moving him from the bed to the shower or bath. They taught me techniques to make it easier for me and less painful for him. I was also trained on how to administer his drugs at the right time and was taught some home mobility exercises he could do to help him now that he's back at home. But above all, I think **the biggest lesson I learned was patience and empathy**. It takes a lot to be there emotionally and mentally for someone (Robbie)

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Emotional Challenges

Veterans' Care Partners	Civilians' Care Partners
• **Anger and bitterness** and just go through the gambit of the whole grieving process. It's also the **anxiety** that I have because if something happens to me, what happens to my husband, so I stopped doing a lot. I don't even like driving anymore because I'm **afraid I'm going to get in an accident**. [CP01, F] • I think I personally was not prepared for that, I guess that that **grief**, if you will, of letting go. Our last child had just left for college. We were pretty excited about being on our own, and that just hits you. And of that overwhelmingness of, you know, with my husband's level with, you know, not even not having fine motor or anything like that, we **literally anything that gets done is, I do**. [CP02, F]	• We suffered. I suffered a lot of anger. It's a grief, like the death of the person you once knew. That person isn't there anymore. I still **grieve** occasionally, and almost eight years later, **I still need to walk away sometimes and cry.** (Amy) • Suddenly, I was the one who had to do it all and was still working. **I was exhausted. I was angry**. Oh my gosh, I should have gotten psychotherapy — it would have helped a ton, but I didn't because I'm a strong woman. But it would have helped immensely. It was just really hard. I still do everything. (Renee) • I mean, **I didn't sleep for a very long time because I was afraid he was going to die**. (Kate)

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Relationship Dynamics

Veterans' Care Partners	Civilians' Care Partners
• I think we're probably closer and stronger than ever. And I think a lot of it is just kind of that **we have to figure it out together.** We're not going to figure it out separately, that's for sure. [CP02, F] • A lot of, limits your mobility and stuff. Definitely more, more [responsibilities] on the caretaker side of it now, you know, versus us splitting up a lot of stuff that we used to split up. [CP03, M]	• There's a TBI component to his injury, so decision-making and motivation are very difficult for him. I just power through…I retired a couple of years ago, so things are a lot easier now that I have more time. And we get help. **I've learned to say, yes, I need help**, and that was huge for me because we've always been really independent. (Renee)

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Lack of Preparation for Discharge

Veterans' Care Partners	Civilians' Care Partners
• I think one of our biggest challenges was just **it would have been super helpful for us to have someone come to our house** and maybe bring a wheelchair and try to wheel it around and maybe put me in a wheelchair because my husband happens to be really tall, so his foot plate was really low. We bought a portable ramp to get him in the house. We got home and because of how low his foot plate is, the ramp wouldn't work, so he had to sit out in the driveway for two hours while my mom and I drug concrete blocks around and some old plywood that we found and build a ramp to get him in the house the first day we got him home. [CP02, F] • That would have been **helpful to at least learn to expect the personality change** that came with it. He the anger that he has towards it [the injury, his body] himself, his body not working the way it was. [CP01, F]	• At first, I thought I was prepared. I thought I'd gotten enough information where I was able to get and understand how I was going to handle all of that, all the activities at the time…Not until I actually got there, and **I came to realize that I wasn't really prepared**. (Eddie) • Although I had training on how to be a caregiver, I just kind of felt I was way over my head with what I was obligated to do. The specialists at the care center made it seem easy to help with mobility, help him move around, and give him his medications while managing his pain. But with me being the one to do that, I just felt I wasn't prepared enough…but later on, I managed with his mood swings, anxiety, and helping him move. It took a lot of strength. (Bryan)

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How Rehabilitation Could Have Prepared You Better

Veterans' Care Partners	Civilians' Care Partners
• Seek help for yourself 'cause it's a lot, it is a lot of extra…So **seek help**. Don't try and do it on your own [CP01, F] • Yeah, I think that would be great to, yeah, kind of set up a caregiving thing. Caregiving mentor kind of program at the same time and I think that could actually go both options [online or virtual group] and probably would have to entail both options. And **things are, you know, difficult to overcome to get connected with someone who's in a similar situation** than you because SCI injuries are so different and the needs are so vastly different. [CP02, F]	• I think it would have been nice to know that there are case managers, like insurance case managers and medical case managers, who can help you out there in the world. I found that out later when I was struggling with insurance issues. They asked, **would you like a case manager to help you? I said, "Oh my gosh, yes! Anyone who can help me!"** (Amy)

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Suitability of Rehabilitation Length of Stay

Veterans' Care Partners	Civilians' Care Partners
• The first two weeks was at the [university] Medical Center and then he was able to transfer into this spinal cord injury unit at the [city] VA. And he was there initially for 14 weeks, I think. [CP02, F] • So, she had a spinal stroke also and the spinal fusion. Was at [hospital]. Was never really part of the VA, she was referred by the VA, but it was just like **there was no real inpatient rehab**. **She just had surgery and was sent home.** [CP03, M]	• My brother did a two-week stint at **a local inpatient facility, but it was terrible,** so I won't even go into that. We then got him to [specialty hospital] in a western state, where he was inpatient for about a month. (Annette) • He was only there for four weeks, so he didn't do much. (Amy) • By the time he got to rehab, he was there for only 2 months. (Kate) • He was so sick he just couldn't even make physical therapy, you know, multiple days in a row, so he never really got that full rehabilitation time. And **before you know it, we were like out the door.** (Carmen)

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Summary

- Most care partners participated in rehabilitation; work demands limited others' participation.
- Care partners at specialty hospitals received effective training, in contrast with nonspecialist hospitals.
- All described coping and emotional challenges during and after rehabilitation.
- Care partners described positive and negative relationship changes.
  - Some relationships grew stronger.
  - New responsibilities sometimes resulted in stress and anger.
  - Maintaining one's role while taking on caregiving was a challenge.
- Most thought they were ready for discharge, but realized they weren't fully prepared after discharge.
- Care partners of Veterans and civilians experienced similar challenges.

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Conclusions

- Regardless of how prepared care partners felt at discharge, all encountered challenges that they did not anticipate.
- Care partners needed additional resources to prepare for community transition.
  - Navigating relationship changes; accessing case managers, peer support, and psychotherapy.
- Findings provide insights into the organization of rehabilitation services and highlight opportunities to enhance rehabilitation services and policy.

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Discussion

Shirley Ryan Abilitylab

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Thank You

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Associations of personal & hospital factors with LOS/intensity (n=30)

Study	N	SCI	Country	NOS	Key Findings
Alito 2021	112	Both	Italy	9	Patients with poorer functional status, motor complete injury, tetraplegic and traumatic lesion had longer rehab LOS
Asfar 2022	249	Both	Turkey	7	Patients with traumatic SCI had longer rehab LOS than those with neoplastic SCI.
Attabib 2020	158	T	Canada	7	Patients with longer rehab admission had longer rehab LOS than those with shorter admission
Bhide 2018	158	T	Canada	9	Patients with longer rehab onset (>18 days), cervical level injury, motor complete injury had longer rehab LOS
Bombardier 2016*	105	T	USA	7	Patients with co-morbid TBI tended to have longer acute and rehab LOS than those without co-morbid TBI
Bonita 2017	240	Both	Italy	9	Patients who were males, with cervical level injury, and AIS A (complete injury) had longer rehab LOS
Cook 2015*	294 43	T	USA	7	Patients who were American Indians or Alaska Natives had longer acute LOS compared to non-American Indians or non-Alaska Natives.
Craven 2017	861	T	Canada	9	Patients with younger age, higher injury level, lower LE motor scores at admission to rehab care, ventilation in acute care, indwelling catheter use at discharge had longer rehab LOS
Fekete 2021	655	Both	Switzerland	7	Patients with traumatic injury, higher injury level, and higher severity had longer rehab LOS
Dvorak 2015*	186	T	Canada	9	Patients without receiving early surgical intervention at acute care, especially those with AIS A & B had longer acute LOS.

* Articles related to acute LOS; **Bold sentences:** Findings related to treatment intensity

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Study	N	SCI	Country	NOS	Key Findings
Fortin 2015	141 7	non-T	Switzerland	7	Patients with malignant spinal cord compression and with other causes of non-traumatic SCI had similar rehab LOS.
Franceschini 2023	103 9	T	Italy	9	Patients from other places than home, from regions different from rehab center's location, not classified in the "all D" group and having >1 cause of readmission had longer rehab LOS
Furlan 2023*	271 0	T	Canada	8	Sex was NOT associated with acute and rehab LOS.
Gedde 2019	178	Both	Norway	9	Patients with UTI or pressure ulcers had longer rehab LOS
Gour-Provenca 2021*	301	T	Canada	9	Patients with presence of medial complications (UTI, pneumonia, or pressure injury) and lower daily therapy time had longer acute LOS, after controlling the level and completeness of injury.
Halvorsen 2019	574	Both	Norway	7	Patients with traumatic injury had longer rehab LOS than non-traumatic injury. Ad-hoc analyses found that patients with traumatic injury were younger and had more severe injury.
Hatch 2017	759	Both	USA	7	Patients with traumatic injury had longer rehab LOS than non-traumatic injury.
Jedrusik 2023*	183	Both	Switzerland	9	Causes of admission and medical complications were associated with acute LOS.
Josefson 2023	136	Both	Sweden	7	Patients who required breathing aids or with respiratory complications had longer rehab LOS.
Kao 2022	338 6	T	USA	8	Patients who were Whites, with higher education, higher household income, private insurance, presence of associated injury and had spinal surgery had longer rehab LOS.
Kerwin 2018*	101	T	USA	9	Patients without receiving the Diaphragm Pacing System (DAP) implementation had longer acute LOS than those receiving it.

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Study	N	SCI	Country	NOS	Key Findings
Keusen 2023	250	Both	Switzerland	9	Patients with secondary complications and higher SCI severity had longer rehab LOS. **Patients with more co-morbidities reduced daily therapy time (total time by OT, PT, & Sport Therapy).**
Taiwo 2018	13	non-T	UK	9	Patients with lower functional status at admission and had higher nursing time needed had longer rehab LOS.
Tasoglu 2018	262	Both	Turkey	7	TSCI patients with motor complete injury and NTSCI patients with shorter disease duration (<12 months) had longer rehab LOS
Thakur 2017*	4066	Both	USA	9	Patients without receiving early surgical intervention at acute care had longer acute LOS.
Wang 2023*	1806	T	China	7	Patients with worse ASIA grade and non-cervical level injury had longer acute LOS. TSCI caused by fracture/dislocation had longer acute LOS than disc herniation/bulging.
Zahl 2020	142	Both	USA	7	**NO significant associations were found between recreational therapy time and severity of illness measured by the Comprehensive Severity Index (CSI).**
Zhang 2015	95	Both	China	7	Patients with lumbar SCI who received shorter surgical intervention had longer rehab LOS
Zhang 2020	2110	T	China	9	Patients with younger age, single, complete injury, injury caused by object striking or motor vehicle collision, and presence of medical complications (osteoporosis, urinary tract infection, respiratory infection, neuropathic pain, and spasticity) had longer rehab LOS.
Zhang 2021	1858	T	China	7	Patients with non-fall-induced injury had longer rehab LOS . Among patients with fall-induced injury, high-fall group had longer rehab LOS.

* Articles related to acute LOS; **Bold sentences:** Findings related to treatment intensity

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Associations of LOS/intensity with patient outcomes (n=28)

Study	N	SCI	Country	NOS	Key Findings
Abdul-Sattar 2014	90	T	Egypt		Longer rehab LOS linked to greater change in motor FIM score at rehab discharge
Attabib 2020	76	T	Canada		Longer rehab LOS linked to greater improvement in bladder function score.
Cheng 2017*	1599	T	Canada		Longer acute LOS linked to higher chance of discharge to rehab services.
Cook 2015*	29443	T	USA		Longer acute LOS linked to higher chance of discharge to rehab services.
Richard-Denis 2018*	43	T	Canada		Longer acute LOS linked to lower functional outcome following tetraplegia.
Dionne 2021*	193	T	Canada		Longer acute LOS linked to lower chance of discharge to home after inpatient functional rehab
Draganich 2022	228	T	USA		Longer rehab LOS linked to higher risk of developing deep venous thrombosis (DVT) complication
Guan 2021	3468	non-T	Canada		Longer rehab LOS linked to reduced opioid use at 1-year post-discharge from rehab
Hatch 2017	759	Both	USA		NO significant association was found between rehab LOS and survival.

* Articles related to acute LOS; **Bold sentences:** Findings related to treatment intensity

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Study	N	SCI	Countr y		Key Findings
Hiremath 2022a*	1940	T	USA		Longer acute LOS linked to lower motor functional score (more dependent) at discharge from an acute hospital. Longer acute LOS linked to higher chance of discharge to an institution (IRF, SNF, or LTC).
Hiremath 2022b	604	T	USA		Longer rehab LOS linked to lower % of motor FIM score change (efficacy) during IRF stay
Hiremath 2023	359	T	USA		Longer rehab LOS linked to lower % of motor FIM score change (efficacy) during 1-year post-discharge
Kao 2022a	3413	T	USA		Regardless to BMI status, longer rehab LOS linked to greater change in motor FIM score at rehab discharge. Besides, this observation was more robust in patients with C1-4 AIS ABC
Kao 2022b	3386	T	USA		Longer rehab LOS linked to greater change in motor FIM score at rehab discharge. These observations were observed in patients among selected groups, including C5-C8 AIS D; T1-T10 AIS A-B; T11-S3 AIS A-B, T11-S3 AIS C, and T11-S3 AIS D.
Kato 2024*	70	Both	Japan		NO association was found between acute LOS and discharge destination.
Loni 2024	180	T	Iran		Longer rehab LOS linked to greater improvements in functional outcomes
Mahmoud 2017	418	Both	Saudi Arabia		NO association was found between rehab LOS and motor score at rehab discharge
Monden 2021a	792	T	USA		**Greater PT hours linked to greater motor FIM score at 1- & 5-year post-injury** **Greater SW hours linked to lower motor FIM score at 1- & 5-year post-injury** **Greater Psych hours linked to higher home residence at 1- & 5-year post-injury** **Greater PT hours linked to greater physical independence at 1- & 5-year post-injury** **Greater TR hours linked to greater social integration at 1- & 5-year post-injury** **Greater TR hours linked to greater occupation at 1- & 5-year post-injury** **Greater TR hours linked to greater mobility at 1- & 5-year post-injury** **Greater SW hours linked to higher depression at 1- & 5-year post-injury**

* Articles related to acute LOS; **Bold sentences:** Findings related to treatment intensity

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Study	N	SCI	Country	NOS	Key Findings
Monden 2021b	225	T	USA		Longer rehab LOS linked to greater stigma Greater stigma linked to greater injustice appraisals. Longer rehab LOS linked to greater injustice appraisals. Stigma fully mediated the positive relation between rehab LOS and injustice appraisals.
Moshi 2017*	213	T	Tanzania		Longer acute LOS linked to wheelchair dependent
Najmanova 2021	94	Both	Switzerland		Longer rehab LOS linked to higher risk of developing pressure injury complication
Ponfick 2017*	160	Both	Germany		Longer acute LOS linked to lower functional outcome at discharge Longer rehab LOS linked to better functional outcome at discharge
Sasaki 2023	219	T	Japan		Longer rehab LOS linked to home discharge destination
Sengupta 2021*	106	T	India		Longer acute LOS linked to higher mortality.
Truchon 2017	259	T	Canada		**Greater therapy hours linked to greater motor FIM change**
Wallace 2014	220	T	Australia		Longer rehab LOS related to more personal care goal identification Longer rehab LOS related to lower community access and vocational goal identification
Wilkinson 2022	15975	T	USA		Longer rehab LOS related to reduced assistance needed at discharge
Zahl 2020	142	NA	USA		**Greater recreation therapy time linked to greater cognitive FIM score change**

* Articles related to acute LOS; **Bold sentences:** Findings related to treatment intensity

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