



ARTICLE

“What should a rehabilitation hospital be like?” Priorities and expectations of people with spinal cord injury in Türkiye

Mucahit Atasoy^{1✉}, Eser Kalaoglu², Omer Faruk Bucak³ and Evrim Coskun³

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STUDY DESIGN: Survey study**OBJECTIVES:** To understand the priorities and expectations of individuals with disabilities caused by spinal cord injuries (SCI) who require long-term inpatient rehabilitation at a rehabilitation hospital.**SETTING:** Başakşehir Çam and Sakura City Hospital, İstanbul, Türkiye**METHODS:** This cross-sectional clinical study included individuals over the age of 18 with SCI who had previously been hospitalized in a rehabilitation hospital. The 18-question survey, titled “What should a rehabilitation hospital be like according to persons with spinal cord injuries?” was administered to individuals hospitalized in the inpatient service of Çam Sakura City Hospital. It was also disseminated to people with SCI through social media. The participants’ demographic data was recorded.**RESULTS:** The survey was completed by 120 participants, comprising 70 males and 50 females. The mean age was 37.47 ± 11.63 years. The time since the SCI was less than one year for 20 individuals and more than one year for 100 individuals. The results showed that robotic rehabilitation and psychological support were the most requested rehabilitation domains, while interest in sexual rehabilitation was less than that in other rehabilitation domains. Furthermore, in the correlation analysis, elderly participants indicated that there should be more specialized services and outpatient clinics exclusive to the SCI.**CONCLUSIONS:** The study revealed a striking trend – participants expressed a strong desire for SCI-specific rehabilitation units and robotic rehabilitation. Additionally, the significance and necessity of sexual rehabilitation should be conveyed to people with SCI.*Spinal Cord* (2025) 63:38–42; <https://doi.org/10.1038/s41393-024-01049-7>**INTRODUCTION**

Spinal cord injury (SCI) is defined as a severe neurological condition that occurs due to traumatic and nontraumatic etiologies, resulting in motor, sensory, and autonomic dysfunctions, which can dramatically affect people’s lives. Rehabilitation after spinal cord injury is a process that significantly affects the survival of people with SCI [1], independence in activities of daily living [2], prevention of complications [3] and return to work [4]. It is recommended that a rehabilitation program be started in the early period after acute interventions of post-traumatic patients [5]. In published studies, different outcomes such as the time of rehabilitation admission after injury, complication rates, and length of hospital stay have been reported, but there is a lack of global standardization of specialized rehabilitation services for people with spinal cord injury [6]. It has been stated that the participation of persons with SCI in rehabilitation processes can increase the awareness of professionals about their own roles and persons with SCI about their goals and can personalize rehabilitation [7]. The staff members working in SCI rehabilitation also stated that the participation of individuals with SCI would positively affect the rehabilitation process [8].

In a review exploring the perspectives of individuals with SCI, the desire to be “heard” and the importance of person-centered

rehabilitation were emphasized [9]. Overall, our study, which investigated the perspectives and priorities of people with SCI in the rehabilitation domains, will make a significant contribution to the “co-decision making” principle.

METHODS

The findings presented here are part of a larger project to understand the views and expectations of individuals with SCI at rehabilitation hospital. In this study, we included the findings regarding domains of rehabilitation.

The inclusion criteria were being equal to or greater than 18 years of age, at least 6 months post spinal cord injury, and history of minimum 2 weeks admission to a rehabilitation hospital. People who were admitted to a rehabilitation hospital for other neurological (Parkinson’s disease, multiple sclerosis, etc.), orthopedic (amputation, etc.), oncological or rheumatological reasons were excluded. Our survey, which included questions about participants’ demographic information, clinical conditions, and priorities for specialized rehabilitation units, was created as a result of an intensive exchange of ideas between spinal cord injury patient association managers and our specialist physician group. Informed consent forms were obtained from participants at the beginning of the online survey, allowing them to proceed to the survey only if they provided their consent. The survey consisted of 18 questions: 8 questions addressing demographic and clinical information and 10 questions assessing participant preferences for specific rehabilitation domains. The survey

¹Department of Physical Medicine and Rehabilitation, İstanbul Medipol University, İstanbul, Türkiye. ²Department of Physical Medicine and Rehabilitation, İstanbul Physical Medicine and Rehabilitation Hospital, İstanbul, Türkiye. ³Department of Physical Medicine and Rehabilitation, Başakşehir Çam and Sakura City Hospital, İstanbul, Türkiye. ✉email: dr.mucahitatasoy@gmail.com

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employed a 5-point Likert scale ranging from “Definitely should be” to “Definitely should not be” for each question regarding various rehabilitation domains (e.g., psychological support, robotic rehabilitation, sexual rehabilitation). People with spinal cord injury, whom we reached through social media and spinal cord injury patient associations, and people with spinal cord injury in our hospital were included in the study. The responses were collected via Google Survey. All of the participants had a history of hospitalization in our hospital.

For the descriptive statistics of the data, the mean, standard deviation, median, minimum, maximum, frequency, and ratio values were used. The distribution of variables was measured with the Kolmogorov-Smirnov test. The chi-square test was used in the analysis of qualitative independent data, and Fisher’s Exact test was used when the chi-square test conditions were not met. Spearman’s test was used for ordinal qualitative data, and Pearson’s test was used for normally distributed quantitative data for correlation analysis. SPSS 22.0 program was used in the analysis.

Groupings were made to evaluate the relationships between the participants’ clinical and sociodemographic characteristics and their wishes. The individuals were divided into a series of two comparator groups: marital status (married or single); education level (high school or university); length of stay (less than or greater than 1 month); and duration of SCI (less than or greater than 1 year).

RESULTS

A total of 150 people with SCI were included in the study. Thirty people were excluded from the evaluation because they stated that they were hospitalized in a rehabilitation hospital for other neurological, orthopedic, oncological, or rheumatological reasons. The demographic and current clinical status data are shown in Table 1.

Among the questions we asked about the rehabilitation process, participants gave the highest “Definitely should be” choice to “Should there be robotic rehabilitation?”. The second most popular option that received a “definitely should be” response was related to the provision of psychological support. For the sexual rehabilitation question “definitely should not be” was the most common option, and the “definitely should be” was the least common option among all other questions on priorities for specialized domains of rehabilitation. Additionally, the most frequent “I had no opinion” answer was for sexual rehabilitation. The answers of the participants to the survey questions are listed in Table 2.

Correlation analysis revealed a slight trend in which older participants were more likely to favor a rehabilitation unit

Table 1. Demographic and clinical information of the participants.

	Mean ± SD	N	%
Age	37,47 ± 11,63		
Sex	Male	70	58.4
	Female	50	41.7
Martial Status	Single	79	65.9
	Married	41	34.2
Education	Less than college graduate	95	79.2
	Collage graduate	25	20.9
Duration of SCI	Less than 1 year	20	16.7
	1 year and above	100	83.4
Urinary Continence	Continent	32	26.7
	Incontinent	88	73.4
Rectal Sensation	Present	60	50
	Absent	60	50
Length of Stay in Hospital	Less than 1 month	31	25.9
	1 month and more	89	74.2

Table 2. Answers to questions about special rehabilitation domains.

	Definitely should be n %	Should be n %	No idea n %	Shouldn't be n %	Definitely shouldn't be n %
Should there be robotic rehabilitation?	91	20	7	1	1
Should there be psychological support specialists (psychologists, psychiatrists, etc.)?	88	22	6	3	1
Should there be pressure ulcer training?	80	24	12	10	3
Should there be bladder rehabilitation?	78	32	9	7.5	0
Should there be specialized “spinal cord injury outpatient clinics” for your checkups?	78	25	12	10	2
Should there be occupational therapy?	77	30	8	6.67	3
Should there be bowel rehabilitation?	71	34	13	10.84	1
Should there be hand rehabilitation?	67	37	12	10	3
Should there be virtual reality rehabilitation?	55	32	29	24.17	2
Should there be sexual rehabilitation?	43	31	37	30.84	0

Table 3. Correlation between ‘Should be’ Responses on specialized rehabilitation questions and length of hospital stay in individuals with SCI.

Question	P value	R value
Should there be specialized “spinal paralysis outpatient clinics” for your checkups?	<0.01	0.25
Should there be psychological support specialists (psychologists, psychiatrists, etc.)?	<0.05	0.18
Should there be pressure ulcer training?	<0.05	0.21
Should there be hand rehabilitation?	<0.01	0.23
Should there be robotic rehabilitation?	<0.05	0.19
Should there be virtual reality rehabilitation?	<0.01	0.30
Should there be bladder rehabilitation?	<0.05	0.21
Should there be sexual rehabilitation?	<0.05	0.18
Should there be occupational therapy?	0.19	0.09
Should there be bowel rehabilitation?	0.12	0.05

dedicated solely to persons with SCI ($p < 0.01$, $r = 0.24$). Additionally, there was a weak positive correlation between older individuals and those who selected more “should be” options in the question “Should your outpatient service be specialized for only spinal cord injuries?” ($p < 0.01$, $r = 0.18$). A positive but weak correlation was found between high education levels and selecting more “should be” options for occupational therapy ($p < 0.01$, $r = 0.3$) and hand rehabilitation ($p < 0.05$, $r = 0.22$). The correlation between positive responses to some questions and length of hospital stay in persons with SCI is shown in Table 3.

There was no gender difference in the answers given to the question “Should there be sexual rehabilitation?”. There was no significant difference between incontinent and continent participants in the answers to the question “should there be bladder rehabilitation?” ($p = 0.93$). There was no significant difference in bowel rehabilitation preferences between persons with SCI with and without sensation in the anus ($p = 0.57$). No significant correlations were detected between the answers given to the other questions and the other groupings.

DISCUSSION

This study investigated the perspectives and priorities of individuals with spinal cord injury (SCI) regarding rehabilitation domains in a rehabilitation hospital in Türkiye. We found that participants highly valued access to a dedicated SCI outpatient clinic, with a stronger preference expressed by those with longer hospital stays. Robotic rehabilitation was the most desired intervention, followed by psychological support. Interestingly, responses regarding bladder and bowel rehabilitation did not reveal strong preferences, while sexual rehabilitation was the least desired intervention, with many participants expressing uncertainty.

According to a review of specialized SCI centers, early transfer of individuals with SCI to an integrated multidisciplinary care center is recommended because it reduces the total length of stay, overall mortality, and the number and severity of complications [10]. In a multicenter study, it was found that people with SCI were functionally better at the end of rehabilitation in specialized centers [11]. It has been shown that the environment and the approach of the rehabilitation team, as well as the accurate understanding of their current medical condition and possible prognosis, have an impact on the decisions made by individuals with SCI when dealing with the complex health problems they face [12]. In this study, we investigated participants’ expectations for the rehabilitation centers that will play a crucial role in their lives after the acute period. Although participants’ medical

expectations after rehabilitation and general hospital expectations have been investigated, to our knowledge no expectations of persons with SCI studies have been reported for specialized rehabilitation services as in our study.

The European Spinal Cord Injury Federation recommends that individuals with SCI receive treatment from the acute stage and lifelong follow-up in specialized centers [13]. Additionally, with results similar to our study, individuals with SCI also prefer specialized centers [14]. In a study investigating the applications of individuals with SCI to specialized SCI outpatient clinics, it was found that more than half of the 1294 persons with SCI (51%) underwent annual check-ups [15]. In our study, the majority of the persons with SCI (85.84%) responded that there should be a specialized outpatient clinic, while the older people stated that there should be specialized units in both the inpatient and the outpatient clinic. It has also been reported that the needs of individuals with SCI are not adequately met in primary health care services [16]. Considering these findings, we believe that specialized SCI outpatient clinic services for routine checks should be increased.

A meta-analysis of robotic rehabilitation conducted in 2020, which included 18 studies, revealed that robotic rehabilitation could improve spasticity and walking ability in people with SCI. No significant change in pain was detected after robot-assisted walking training [17]. Individuals with SCI have reported a high satisfaction rate of 95% with robotic rehabilitation [18]. Furthermore, advancements in exoskeleton technology are promising in terms of enhancing functional independence for individuals with SCI [19]. Most of the robots commercialized today are based on the basic idea that walking is an automatic subcortical ability [20]. However, this needs to be reconsidered in the near future from the neuromechanical perspectives, and physiatrists need to determine appropriate treatment methods for the appropriate persons with SCI. In this study, 91% of the participants answered the robotic rehabilitation question that it “should be”. The participants were most interested in robotic rehabilitation. The superiority of robotic rehabilitation over classical rehabilitation is controversial in the literature [21]. In our country, studies are needed to determine whether robotic rehabilitation meets the expectations of both doctors and people with SCI.

Our study also revealed that psychological support was the second most frequently selected rehabilitation domain among participants. This finding underscores the importance of integrating comprehensive psychological support into SCI rehabilitation programs. Psychological support can help individuals with SCI cope with the emotional and psychological challenges of their condition, foster resilience, and ultimately enhance their quality of life [22]. By incorporating psychological support into rehabilitation services, we can provide a more comprehensive and effective approach to improving the overall well-being of individuals with SCI.

Virtual reality was the second type of therapy that participants most frequently selected as the “I have no idea” option. A review investigating the effects of virtual reality devices and movement-based game consoles such as the Wii in stroke rehabilitation reported that virtual reality contributed to functional results compared to traditional treatment, but no difference was detected with game consoles [23]. Due to participants’ limited knowledge about new technology treatments, introducing virtual reality (VR) in rehabilitation hospitals could increase motivation and improve outcomes. Our study found that persons with SCI who had longer durations of inpatient rehabilitation were more willing to use new technologies such as virtual reality.

The presence of a neurogenic bladder is as important as physical movement for the quality of life of people with chronic SCI [24]. An individualized bladder management plan to protect the upper urinary tract, support continence, and prevent complications [25]. In our study, we expected participants with incontinence to be more interested in bladder rehabilitation, but no significant difference was detected. However, the low number

of negative answers to the bladder rehabilitation question, compared to other questions, suggested that people had achieved awareness. Another important complication, neurogenic bowel, occurs in 80% of people with SCI and has an impact on the quality of life [26]. No significant difference was found in the response to bowel rehabilitation between people with SCI who had sensation in the anal area and those who did not.

Participants chose “I have no idea” and “It definitely should not be” more frequently for the sexual rehabilitation question than for any other question. This contrasts with findings from other studies, such as Anderson’s work, where regaining sexual function was a high priority for some individuals with SCI [27]. However, it has been reported that sexual education and information are provided at low rates during the rehabilitation process for individuals with SCI, and while only 18% are satisfied, 36% are dissatisfied [28]. A Turkish study revealed high rates of sexual dysfunction in persons with SCI, but only 10% of participants reported the impact of SCI on sexual function [29]. This lack of awareness may contribute to the low demand for sexual rehabilitation. Additionally, sexuality can be a sensitive topic for individuals with a disability, particularly in cultures where open discussion is discouraged. In countries such as ours, sexual life is a life activity that should be hidden and not shared. Expressing the sexual problems of individuals with a disability and expecting a solution are not requests that we, healthcare professionals, encounter frequently [30]. Further research is needed to determine whether individuals with SCI prioritize sexual rehabilitation differently than other aspects of care, and how healthcare professionals can best support their individualized needs.

Limitations

Given the online survey format, a limitation of this study is the inability to establish clear correlations between specific questions and participants’ clinical conditions. Additionally, the study may be subject to selection bias due to reliance on online participation, which could limit the generalizability of the findings to individuals without internet access or social media use. Furthermore, the wording of the survey questions may have introduced some bias, and the single-site recruitment may limit the applicability of the results to a broader population.

CONCLUSION

The rehabilitation of individuals with SCI can be improved by incorporating their wishes and priorities. Our study highlights the expectations of people with SCI from rehabilitation hospitals, particularly their significant interest in robotic rehabilitation. Furthermore, these findings underscore the necessity of communicating about the importance of sexual rehabilitation. This work contributes to the literature by emphasizing the individuals’ perspective; however, it is important to acknowledge that the feasibility of implementing all expressed priorities needs to be considered alongside resource limitations and the availability of specialized rehabilitation services. Additionally, the single-site recruitment of participants may limit the generalizability of the findings. Future research could explore these priorities in a broader SCI population.

DATA AVAILABILITY

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

REFERENCES

- Thietje R, Pouw MH, Schulz AP, Kienast B, Hirschfeld S. Mortality in patients with traumatic spinal cord injury: descriptive analysis of 62 deceased subjects. *J Spinal Cord Med.* 2011;34:482–7.
- Kirshblum S, Brooks M. Rehabilitation of spinal cord injury. In: Gans B, Walsh N, Robinson L, editors. *DeLisa’s Physical Medicine and Rehabilitation*, Philadelphia: Lippincott, Williams & Wilkins; 2010. 665–717
- Haisma JA, van der Woude LH, Stam HJ, Bergen MP, Sluis TA, Post MW et al. Complications following spinal cord injury: occurrence and risk factors in a longitudinal study during and after inpatient rehabilitation. *J Rehabil Med.* 2007;39(5):393–398. <https://doi.org/10.2340/16501977-0067>.
- Yasuda S, Wehman P, Targett P, Cifu DX, West M. Return to work after spinal cord injury: a review of recent research. *NeuroRehabilitation.* 2002;17:177–86.
- Sumida M, Fujimoto M, Tokuhiko A, Tominaga T, Magara A, Uchida R. Early rehabilitation effect for traumatic spinal cord injury. *Arch Phys Med Rehabil.* 2001;82:391–5.
- Maharaj MM, Hogan JA, Phan K, Mobbs RJ. The role of specialist units to provide focused care and complication avoidance following traumatic spinal cord injury: a systematic review. *Eur Spine J.* 2016;25:1813–20.
- Pellatt GC. Patients, doctors, and therapists perceptions of professional roles in spinal cord injury rehabilitation: do they agree? *J Interprof Care.* 2007;21:165–77.
- Melin J, Persson LO, Taft C, Kreuter M. Patient participation from the perspective of staff members working in spinal cord injury rehabilitation. *Spinal Cord.* 2018;56:614–20.
- Simpson B, Villeneuve M, Clifton S. The experience and perspective of people with spinal cord injury about well-being interventions: a systematic review of qualitative studies. *Disabil Rehabil.* 2022;44:3349–63.
- Silva FAR, Barbosa MA, Prudente COM, Morais LA, Moraes KL, Vila VSC, et al. Health literacy of people with spinal cord injury: a systematic review. *Spinal Cord.* 2023;61:409–14.
- Parent S, Barchi S, LeBreton M, Casha S, Fehlings MG. The impact of specialized centers of care for spinal cord injury on length of stay, complications, and mortality: a systematic review of the literature. *J Neurotrauma.* 2011;28:1363–70.
- Scheel-Sailer A, Post MW, Michel F, Weidmann-Hügler T, Baumann Hölzle R. Patients’ views on their decision making during inpatient rehabilitation after newly acquired spinal cord injury—A qualitative interview-based study. *Health Expect.* 2017;20:1133–42.
- European Spinal Cord Injury Federation. ESCIF Policy statement on the treatment, rehabilitation and life-long care of persons with spinal cord injuries (SCI). 2008. [Accessed 27 March 2022]. Available from: http://www.escif.org/ESCIFpolicy_statement.htm
- Braaf SC, Lennox A, Nunn A, Gabbe BJ. Experiences of hospital readmission and receiving formal carer services following spinal cord injury: a qualitative study to identify needs. *Disabil Rehabil.* 2018;40:1893–9.
- Ronca E, Scheel-Sailer A, Eriks-Hoogland I, Brach M, Debecker I, Gemperli A. Factors influencing specialized health care utilization by individuals with spinal cord injury: a cross-sectional survey. *Spinal Cord.* 2021;59:381–8. <https://doi.org/10.1038/s41393-020-00581-6>.
- McColl MA, Aiken A, McColl A, Sakakibara B, Smith K. Primary care of people with spinal cord injury: scoping review. *Can Fam Physician.* 2012;58:1207–e635.
- Kinnert-Hopkins D, Mummisettey CK, Ehrlich-Jones L, Crown D, Bond RA, Applebaum MH, et al. Users with spinal cord injury experience of robotic Locomotor exoskeletons: a qualitative study of the benefits, limitations, and recommendations. *J Neuroeng Rehabil.* 2020;17:124.
- Gagnon DH, Vermette M, Duclos C, Aubertin-Leheudre M, Ahmed S, Kairy D. Satisfaction and perceptions of long-term manual wheelchair users with a spinal cord injury upon completion of a locomotor training program with an over-ground robotic exoskeleton. *Disabil Rehabil Assist Technol.* 2019;14:138–45.
- Fazekas G, Tavaszi I. The future role of robots in neuro-rehabilitation. *Expert Rev Neurother.* 2019;19:471–3.
- Morone G, Paolucci S, Cherubini A, De Angelis D, Venturiero V, Coiro P, et al. Robot-assisted gait training for stroke patients: current state of the art and perspectives of robotics. *Neuropsychiatr Dis Treat.* 2017;13:1303–11.
- Fabbri I, Betti F, Tedeschi R. Gait quality after robot therapy compared with physiotherapy in the patient with incomplete spinal cord injured: A systematic review. *eNeurologicalSci.* 2023;31:100467.
- Cardile D, Calderone A, De Luca R, Corallo F, Quartarone A, Calabrò RS. The quality of life in patients with spinal cord injury: assessment and rehabilitation. *J Clin Med.* 2024;13:1820. <https://doi.org/10.3390/jcm13061820>.
- Lohse KR, Hilderman CGE, Cheung KL, Tatla S, Van der Loos HFM. Virtual Reality Therapy for Adults Post-Stroke: A Systematic Review and Meta-Analysis Exploring Virtual Environments and Commercial Games in Therapy. Quinn TJ, editor. *PLoS ONE.* 2014 Mar 28;9:e93318. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3969329/>
- Ku JH. The management of neurogenic bladder and quality of life in spinal cord injury. *BJU International.* 2006;98:739–45.
- Al Taweel W, Seyam R. Neurogenic bladder in spinal cord injury patients. *Res. Rep. Urol.* 2015;7:85.

26. Ozisler Z, Koklu K, Ozel S, Unsal-Delialioglu S. Outcomes of bowel program in spinal cord injury patients with neurogenic bowel dysfunction. *Neural Regen Res.* 2015;10:1153.
27. Ture SD, Ozkaya G, Sivrioglu K. Relationship between neurogenic bowel dysfunction severity and functional status, depression, and quality of life in individuals with spinal cord injury. *J Spinal Cord Med.* 2022;1–9.
28. New PW, Seddon M, Redpath C, Currie KE, Warren N. Recommendations for spinal rehabilitation professionals regarding sexual education needs and preferences of people with spinal cord dysfunction: a mixed-methods study. *Spinal Cord.* 2016;54:1203–9.
29. Koyuncu E, Taşoğlu Ö, Özgirgin N. Investigation of sexual function in men with spinal cord injury in a rehabilitation hospital in Turkey. *Neurol India.* 2022;70:S239–S244. <https://doi.org/10.4103/0028-3886.360933>.
30. Celik EC, Akman Y, Kose P, Arioglu P, Karatas M, Erhan B. Sexual problems of women with spinal cord injury in Turkey. *Spinal Cord.* 2014;52:313–5.

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AUTHOR CONTRIBUTIONS

All the authors conceived and designed the research and conducted the interviews. MA and EC wrote the study protocol, including conceptualization and design. MA, EK and ÖFB collected the data. MA and EK analyzed the data. MA wrote the first draft of the manuscript, directed by EC. The manuscript was then reviewed by MA, EK, ÖFB and EC. All the authors have read and approved the final version of the manuscript accepted for publication.

COMPETING INTERESTS

The authors declare no competing interests.

ETHICS

This study was performed in compliance with the Declaration of Helsinki. We certify that all applicable institutional and governmental regulations concerning the ethical use of human volunteers were followed during the course of this research. The study was approved by the Ethics Committee of Bakırköy Dr. Sadi Konuk Training and Research Hospital Local Ethics Committee (No: 2020-14-26, dated 07.07.2020). Informed consent forms were obtained from participants at the beginning of the online survey, allowing them to proceed to the survey only if they provided their consent.

ADDITIONAL INFORMATION

Correspondence and requests for materials should be addressed to Mucahit Atasoy.

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