SOCIODEMOGRAPHIC AND CLINICAL PROFILE OF PATIENTS WITH SPINAL CORD INJURY AT A PUBLIC HOSPITAL IN BRAZIL

Alliny do Nascimento Martins[1], Eric Ferreira Santana[2], Elizabeth Guimarães de Castro Neves[3], Débora Santos Lula Barros[4], Kamila Soares Lopes[5], Jamila Trevizan Teixeira[6], Vanessa Fenili Fraianelli[7], Rinaldo Eduardo Machado de Oliveira[8], Filipe Carvalho Matheus[9] and Emília Vitória da Silva[10]

ABSTRACT
Purpose: Spinal cord injury (SCI) can result in the partial or total loss of motor, sensory, and autonomic functions, along with various psycho-emotional complications, impacting both individuals and their families. The objective of this study was to examine the sociodemographic and clinical profile of patients with SCI at hospital discharge from a rehabilitation and long-term care unit.

[1]Master's Student in the Graduate Program in Pharmaceutical Assistance at the Federal University of Santa Catarina, Florianópolis, Brazil
Pharmacist at the State Health Department of the Federal District, Federal District, Brazil
E-mail: allinymartins@yahoo.com.br
ORCID: https://orcid.org/0009-0004-7294-8914
[2] Pharmacist
University of Brasilia, Federal District, Brazil
E-mail: eric.ferreira@aluno.unb.br
ORCID: https://orcid.org/ 0009-0009-4210-5277
[3] Doctor at the State Department of Health of the Federal District, Federal District, Brazil
E-mail: bethcastroneves@gmail.com
ORCID: https://orcid.org/0009-0008-7696-702X
[4] Professor at the University of Brasilia, Federal District, Brazil
E-mail: deborasantoslulabarros@gmail.com
ORCID: https://orcid.org/0000-0001-6459-7457
[5] Pharmacist at the State Department of Health of the Federal District, Federal District, Brazil
E-mail: kamila.s.farma@gmail.com
ORCID: https://orcid.org/0009-0002-5484-923X
[6] Social Worker at the State Department of Health of the Federal District, Federal District, Brazil
E-mail: jamilatrevizant@gmail.com
ORCID: https://orcid.org/0009-0001-1644-9342
[7] Physiotherapist at the State Department of Health of the Federal District, Federal District, Brazil
E-mail: vanessafenili@gmail.com
ORCID: https://orcid.org/0009-0006-0777-0085
[8] Professor at the University of Brasilia, Federal District, Brazil
E-mail: rinaldo.eduardo@unb.br
ORCID: https://orcid.org/0000-0003-1684-1456
[9] Professor at the Department of Pharmaceutical Sciences / Health Sciences Center, Federal University of Santa Catarina, Florianópolis, Brazil
E-mail: filipe.matheus@ufsc.br
ORCID: https://orcid.org/0000-0003-3525-5954
[10] Professor at the University of Brasilia, Federal District, Brazil
E-mail: emiliavitoria@unb.br
ORCID: https://orcid.org/0000-0003-0664-0554

Methods: This was an observational, descriptive, and retrospective study with a cross-sectional design. Data were collected from hospitalized patients between January and December 2022.

Results: The mean age of patients was 42.4 ± 13.7 years, and most were male (84.9%). More than half the participants (56.6%) had not completed high school, and 56.6% were single. Traumatic SCI accounted for 83.0% of cases, and the primary causes were falls from height (31.8%), gunshot wounds (25.0%), and automobile accidents (22.7%). Younger patients had better functional outcomes, while those with intermediate hospitalizations (91–180 days) demonstrated the highest percentage of improvement in functional dependence (60.0%) compared with other patient groups. Medications commonly prescribed at hospital discharge included those for pain and gastrointestinal symptom management.

Conclusion: Our findings provide crucial insights for managing this health service and contribute to the epistemological advancement in a relatively underexplored area.

Keywords: Spinal Cord Injury. Drug Utilization. Polypharmacy. Neurological Rehabilitation. Subacute Care.

INTRODUCTION

Spinal cord injuries (SCI) involve damage to the spinal canal, which includes the spinal cord, the conus medullaris, and the cauda equina. This damage results in neurological changes that affect motor, sensory, and autonomic functions, as well as substantially impact the psychosocial well-being of individuals and their families (Vasco & Franco, 2017).

These injuries can be classified into two categories: traumatic spinal cord injury (TSCI), typically caused by mechanical trauma and accounting for about 80% of cases, and non-TSCI (NTSCI), related to dysfunction or injury not caused by mechanical trauma, such as neoplasms, with an incidence of 20% (Alizadeh et al., 2019).

Consequences of SCI include partial or total loss of motor, sensory, and autonomic functions, with complications ranging from neuropathic pain to vascular alterations, such as deep vein thrombosis. The severity varies according to the level and region of the lesion and may result in paraplegia or quadriplegia. Quadriplegia affects the upper limbs, trunk, lower limbs, and pelvic organs following cervical injuries. In turn, paraplegia affects the trunk and lower limbs, resulting from thoracic, lumbar, or sacral injuries. Both conditions involve loss of motor and/or sensory functions in the affected segments. On the other hand, tetraparesis (quadriparesis) and paraparesis refer to incomplete lesions (Lianza et al., 2001; Rupp et al., 2021).

For a more detailed and accurate evaluation of the extent of the injury, the American Spine Injury Association (ASIA) developed a standardized classification that allows for a more accurate description of the severity of SCI, covering both complete and incomplete injuries. The scale ranges from A to E: ASIA A refers to the total absence of motor and sensory function below the level of the lesion; ASIA B indicates sensory preservation without motor function; ASIA C describes incomplete lesions with partial preservation of sensory and motor functions; ASIA D indicates significant preservation of motor function; and ASIA E characterizes patients with normal motor and sensory function (Rupp et al., 2021).

Functional Independence Measure (FIM) is an essential tool for evaluating rehabilitation. It was developed in the 1980s in the United States of America to assess the functional capacity and level of independence in activities of daily living (ADLs). In Brazil, the FIM was translated and validated by Riberto *et al*. (2004). The scale has also been effectively utilized in other populations, including older patients (Viana et al., 2008).

The total FIM score is categorized into four sub-scores: complete dependence (requiring total assistance); modified dependence with up to 50% assistance; modified dependence with up to 25% assistance; and complete or modified independence (where no assistance is needed to perform activities) (Marcelo Riberto, 2005).

Data on the sociodemographic and clinical profile of patients undergoing rehabilitation is crucial for planning more effective interventions and promoting more targeted and inclusive care (Araújo Junior et al., 2021; Roberts et al., 2017). Although studies in Brazil involving patients with SCI remain scarce, data indicate the occurrence of 8,000 new cases annually, representing 40 new cases per 1000 inhabitants, thereby increasing healthcare expenditure. The most common causes include automobile accidents, diving in shallow places, and falling from a height. In general, patients with SCI are male (four males for every female), with low education and young age (Araújo Junior et al., 2021; Roberts et al., 2017). SCI, particularly due to trauma, represents a considerable portion of health-related morbidities, substantially influencing the quality of life of affected individuals. The increase in automobile accidents, in association with violence, has contributed to the growing incidence of SCI, substantially impacting public health (Pereira et al., 2022).

Globally, according to the World Health Organization (WHO), one in three individuals is currently estimated to have a health condition that would benefit from rehabilitation (Cieza et al., 2020). Thus, multidisciplinary rehabilitation is a fundamental approach, encompassing, in addition to physicians and nurses, pharmacists, physiotherapists, occupational therapists, psychologists, and other professionals (Waterworth et al., 2024).

Accordingly, in this study, we aimed to clarify the sociodemographic and clinical profile of patients with SCI at hospital discharge in a Rehabilitation and Long-Term Care Unit of the State Department of Health of the Federal District (SES-DF).

METHODS

This is an observational, descriptive, and retrospective study with a cross-sectional design. The sample included patients hospitalized at the Rehabilitation and Long-Term Care Unit of the Hospital de Apoio de Brasília (URCP-HAB) from January to December 2022. Eligible participants were individuals aged ≥18 who had experienced a loss of motor function in one, two, or four limbs due to TSCI or NTSCI. Patients with communication disabilities were excluded from the study.

The HAB is a district reference hospital unit specializing in rehabilitation and palliative care, subordinated to the SES-DF. The institution has 30 beds for rehabilitation and long-term care, receiving patients referred to or transferred from several public hospitals in the Federal District. The multidisciplinary team comprises doctors from different specialties, dentists, nurses, pharmacists, physiotherapists, speech therapists, psychologists, social workers, and occupational therapists.

Data was collected using the computerized medical record management system of the SES-DF - TrakCare® Integrated Health System. Variables collected included age, sex, education, marital status, place of residence, race/color, unit of origin, cause of injury, diagnosis, neurological evaluation, level of dependence, functional impact, hospitalization outcome, time between injury and the beginning of the rehabilitation program, and length of hospitalization. Regarding medications, prescriptions at hospital discharge were analyzed, and data on quantity, name of drugs according to the Brazilian Nonproprietary Name (BNN), previous use, Anatomic Therapeutic Chemical (ATC) code, anatomical group, and pharmacological group according to the ATC classification were collected (Norwegian Institute of Public Health, 2024). Data collection was conducted by four researchers and reviewed by two others to minimize information loss and avoid errors in data collection. This procedure allowed a cross-check, ensuring greater accuracy and reliability of the results.

Data analyses were conducted using the statistical programming language R version 4.4.1. Initially, sociodemographic, clinical, and medication use variables were described using frequency distributions and calculating central tendency and dispersion measures. Associations were assessed using Fisher's exact test due to the presence of expected values < 5. Results with $p < 0.05$ were considered statistically significant. The strength of the associations was quantified using Cramer's V coefficient.

The sample size varied between the analyses owing to specific inclusion and exclusion criteria, in addition to the absence of information in some medical records. To calculate the time between injury and the start of rehabilitation, only patients admitted for functional rehabilitation were included, excluding those admitted for pressure injury repair surgery, given the longer injury times that could distort the results. These adaptations were considered in statistical planning, ensuring the adequacy and relevance of the data analyzed at each stage of the study.

The study was approved by the Research Ethics Committee of the Foundation for Teaching and Research in Health Sciences (CEP-FEPECS), under opinion No. 6.322.702

and Certificate of Presentation for Ethical Consideration (CAAE) 71118923.3.3001.5553. The requirement for informed consent was waived for deceased patients or cases where contact was not feasible. The research upheld all national and international ethical principles involving human beings, ensuring that participants' confidentiality and anonymity were protected.

RESULTS

A total of 53 patient medical records were analyzed, and patient characteristics are described in table 1.

Table 1. Characterization of patients with spinal cord injury, hospitalized between January and December 2022 at the URCP - HAB (n=53)

Variable	TSCI	NTSCI	Total
Number of patients (n, %)	44 (83.0)	9 (17.0)	53 (100.0)
Sex (n, %)			
Male	38 (86.4)	7 (77.8)	45 (84.9)
Female	6 (13.6)	2 (22.2)	8 (15.1)
Age in years (m, sd)			
	40.9 (13.0)	49.8 (15.8)	42.4 (13.7)
Education (n, %)			
Incomplete kindergarten to elementary school	12 (27.3)	4 (44.5)	16 (30.2)
Complete elementary school to incomplete high school	12 (27.3)	2 (22.2)	14 (26.4)
Complete high school to incomplete higher education	12 (27.3)	3 (33.3)	15 (28.3)
Complete higher education	7 (16.0)	0.0	7 (13.2)
No schooling	1 (2.1)	0.0	1 (1.9)
Marital status (n, %)			
With partner	17 (38.6)	6 (66.6)	23 (43.4)
Without a partner	27 (61.4)	3 (33.4)	30 (56.6)
Place of residence (n, %)			
Federal District	36 (34.4)	7 (77.8)	43 (81.1)
Other state	8 (7.6)	2 (22.2)	10 (18.9)
Race/color (n, %)			
White	1 (2.3)	1 (11.1)	2 (3.8)
Non-white	43 (97.7)	8 (88.9)	51 (96.2)
Unit of origin (n, %)			
Domicile	24 (54.5)	4 (44.5)	28 (52.8)
General Hospital	20 (45.5)	5 (55.5)	25 (47.2)
Cause of injury (n, %)			
Fall from height	14 (31.8)	-	14 (26.4)
Automobile accident	10 (22.7)	-	10 (18.9)
Firearm injury	11 (25.0)	-	11 (20.8)
Falls	5 (11.4)	-	5 (9.5)
Run over	3 (6.8)	-	3 (5.7)
Postoperative	1 (2.3)	-	1 (1.9)
Infection	-	2 (22.2)	2 (3.7)
Cancer	-	2 (22.2)	2 (3.7)
Immune	-	3 (33.4)	3 (5.6)
Neurodegenerative	-	2 (22.2)	2 (3.7)

ICD-10 Diagnosis			
S14 - Trauma to nerves and spinal cord at the cervical level	18 (40.9)	-	18 (34.0)
S24 - Thoracic trauma to nerves and spinal cord	18 (40.9)	-	18 (34.0)
S34 - Lumbar trauma to the nerves and spinal cord	7 (15.9)	-	7 (13.2)
G37.3 - Acute transverse myelitis in demyelinating diseases of the central nervous system	-	1 (11.1)	1 (1.9)
G360 - Neuromyelitis optica [Devic's disease]	-	2 (22.2)	2 (3.7)
Other	1 (2.3)	6 (66.7)	7 (13.2)
ASIA classification upon admission (n, %)			
ASIA A	15 (34.1)	2 (22.2)	17 (32.1)
ASIA B	9 (20.5)	3 (33.4)	12 (22.7)
ASIA C	11 (25.0)	2 (22.2)	13 (24.5)
ASIA D	3 (6.8)	2 (22.2)	5 (9.4)
No data	6 (13.6)	0.0	6 (11.3)
FIM on admission (n, %)			
Complete dependence	19 (43.2)	4 (44.5)	23 (43.4)
Modified dependency	13 (29.5)	4 (44.5)	17 (32.1)
Complete/modified independence	5 (11.4)	1 (11.0)	6 (11.3)
No data	7 (15.9)	0.0	7 (13.2)
Functional impact on admission (n, %)			
Quadriplegia and tetraparesis	19 (43.2)	3 (33.3)	22 (41.5)
Paraplegia and paraparesis	19 (43.2)	6 (66.7)	25 (47.2)
No data	6 (13.6)	0.0	6 (11.3)
Denouement			
Discharge	40 (90.9)	9 (100.0)	49 (92.5)
Transfer to general hospital	4 (9.1)	0.0	4 (7.5)
Death	0.0	0.0	0.0
Medications prescribed per patient at discharge* (m±sd)	8.25 (2.97)	10.6 (2.87)	8.69 (3.07)
Time between injury and start of rehabilitation program in days (m±sd)	82.4 (66.9)	61.3 (36.5)	79.6 (62.3)
Length of hospital stay in days (m±sd)	96.8 (60.6)	105.7 (37.1)	98.3 (57.1)

Legend: absolute (n) and relative (%) frequency; mean (m) and standard deviation (sd); TSCI: traumatic spinal cord injury; NTSCI: non-traumatic spinal cord injury; FIM: Functional Independence Measure; ASIA: American Spinal Cord Injury Association Classification
*Only patients who were discharged from the rehabilitation program were considered

Among the 53 medical records analyzed, 16 did not include records on the level of dependence evaluated using the FIM. Among the remaining 37 patients, 20 (54.1%) showed improvement in the level of dependence, whereas 17 (45.9%) had no progress. No cases of worsening functionality were observed throughout the rehabilitation program.

We noted a significant association between age group and change in functional dependence ($p < 0.05$), with a Cramer's V coefficient of 0.46, indicating a very strong association. The analysis of factors associated with changes in the level of dependence is detailed in table 2.

Table 2. Univariate analysis of factors associated with changes in the level of dependence of patients with spinal cord injury hospitalized between January and December 2022 at the URCP-HAB (n = 37)

Variable	Improvement in the level of dependence		No improvement		p-value*
	n	%	n	%	
Sex					1.00
Female	4	20.0	4	23.5	
Male	16	80.0	13	76.5	
Age group					<0.05
18 to 39	12	60.0	6	35.3	
40 to 49	3	15.0	4	23.5	
50 to 59	2	10.0	7	41.2	
60 and over	3	15.0	0	0.0	
Schooling					0.54
No schooling	0	0.0	1	5.9	
Elementary school	7	35.0	7	41.2	
Middle school	11	55.0	6	35.3	
Higher education	2	7.7	3	13.0	
Length of hospital stay					0.36
Up to 90 days	7	35.0	9	52.9	
91 to 180 days	12	60.0	6	35.3	
181 days and more	1	5.0	2	11.8	

Legend: absolute frequency (n) and relative frequency (%)
*Fisher's exact test; $p < 0.05$

Regarding the prescription of medications at hospital discharge, the average number of medications per prescription was 8.69 ± 3.07 per patient, targeted to treat complications associated with SCI. One patient was prescribed 16 medications at the time of discharge, while only 4 patients were prescribed less than 5 medications. In total, 437 medications were prescribed, with the highest prevalence of those acting on the nervous system (188 prescriptions, 43%), followed by the alimentary tract (138 prescriptions, 31.6%), musculoskeletal system (30 prescriptions, 6.9%), cardiovascular system (25 prescriptions, 5.7%), and genitourinary system and sex hormones (23 prescriptions, 5.3%), as detailed in table 3.

Table 3. Therapeutic classification of drugs prescribed at discharge to patients with spinal cord injury hospitalized between January and December 2022 at URCP-HAB (n=437)

Anatomical classification of prescribed drugs	(n)	(%)
Nervous system	188	43
Alimentary tract and metabolism	138	31.6
Musculoskeletal System	30	6.9
Cardiovascular system	25	5.7
Genitourinary system and sex hormones	23	5.3
Blood and blood-forming organs	12	2.7
Dermatological drugs	7	1.6
Systemic anti-infective agents	5	1.1
Systemic hormonal preparations, excluding sex hormones and insulins	5	1.1
Antineoplastic and immunomodulators	2	0.5
Respiratory system	1	0.2
Sensory organs	1	0.2

Legend: absolute frequency (n) and relative frequency (%)

Upon analyzing the incidence of prescribed medications, we identified pain as the most commonly treated condition, with gabapentin being the most frequently prescribed drug, accounting for 42 prescriptions (9.6%), primarily used in the management of neuropathic pain (table 4).

Table 4. List of medications prevalent in the discharge prescriptions of patients with spinal cord injury hospitalized between January and December 2022 at the URCP-HAB (n=437)

Drug	ATC code	Pharmacological Group	(n)	(%)
Gabapentin	N02BF01	Analgesic and antipyretic agent	42	9.6%
Dipyrone	N02BB02	Analgesic and antipyretic agent	34	7.8%
Omeprazole	A02BC01	Medications for peptic ulcer disease and gastroesophageal reflux disease	31	7.1%
Ondansetron	A04AA01	Antiemetics and antinauseants	28	6.4%
Lactulose	A06AD11	Laxative agent	26	5.9%
Simethicone	A03AX13	Medications for bowel function disorder	24	5.5%
Clonazepam	N03AE01	Hypnotics and sedatives	21	4.8%
Oxybutynin	G04BD04	Other urological, including antispasmodics	21	4.8%
Baclofen	M03BX01	Central-acting muscle relaxants	18	4.1%
Amitriptyline	N06AA09	Antidepressants	16	3.7%
Fluoxetine	N06AB03	Antidepressants	12	2.7%
Bisacodyl	A06AB02	Laxative agent	11	2.5%
Cyclobenzaprine	M03BX08	Centrally acting muscle relaxants	10	2.3%
Losartan	C09CA01	Angiotensin II antagonists, isolated	10	2.3%
Codeine + Paracetamol	N02AJ06	Opiates	9	2.1%
Amlodipine	C08CA01	Selective calcium channel blockers with primarily vascular effects	8	1.8%
Paracetamol	N02BE01	Analgesic and antipyretic agent	8	1.8%
Methadone	N07BC02	Medications used in addictive disorder	7	1.6%
Chlorpromazine	N05AA01	Antipsychotics	6	1.4%
Domperidone	A03FA03	Gastroprokinetic agent	5	1.1%
Quetiapine	N05AH04	Antipsychotics	5	1.1%
Other			85	19.5%

Legend: absolute frequency (n) and relative frequency (%)

DISCUSSION

In the current study, the mean age of patients was 42.4 ± 13.7 years, with a significant prevalence of males (84.9%). Consistent results were reported in recent studies employing a similar approach, such as the study by Silvia et al. (2018), conducted in São Paulo, which reported an incidence of 83.91% male patients and a mean age of 37.8 years. However, international studies, such as the one by Kim et al. (2021) conducted in Seoul, South Korea, indicate a change in the age pattern of patients with SCI, reporting a mean age of 52.8 years while maintaining the male predominance (83.22%).

Notably, the observed higher prevalence of male patients is, to a certain extent, well-documented in epidemiological studies and literature reviews (Maas et al., 2020; Paiva et al., 2023). Preventive measures and a stronger focus on public policies aimed at this patient demographic are required.

The collected data revealed that several patients with SCI did not complete high school (56.6%), which is one of the most common barriers to the inclusion of this population in the labor market, especially considering that the most affected age group is within the economically active group. These findings reinforce the need for public policies that, in addition to focusing on health recovery, encourage the inclusion of these individuals in the labor market. It is essential to implement reintegration and professional training programs that guarantee equitable opportunities for patients with SCI to contribute fully to the economy and society (Sturm et al., 2020).

In addition, most patients included in this study did not have partners (56.6%), which can substantially influence their quality of life, given that the absence of a solid family support network can increase social isolation and hinder access to continuous care and emotional support. Therefore, health services must adopt strategies that reinforce family support to improve the well-being of these patients and their ability to deal with the challenges imposed by SCI (McLeod & Davis, 2023).

Regarding the type of injury, there was a high incidence of traumatic injuries (83.0%), with high-level falls identified as the most frequent etiology (31.8%), followed by firearm trauma (25.0%), automobile accidents (22.7%) and low-level falls (11.4%). These findings confirm data provided by the WHO, which reports higher mortality and disability-adjusted years of life lost among males, attributed to more common risk behaviors and greater exposure to dangerous occupational conditions, such as working at elevated heights (World Health Organization, 2021). In addition, the "Global Burden of Disease 2019" study (Guan

et al., 2023) underscored falls as the leading cause of TSCI globally, in agreement with the findings of the current study. However, Pereira et al. (2022) identified car accidents as the predominant cause of trauma (47.5%), followed by falls from a height (30.83%), suggesting the existence of regional and contextual variations in the mechanisms of injury.

In cases of firearm injuries, falls, and car accidents, similar to other studies, they are strongly related to the context of violence and drug abuse in the country (Araújo Junior et al., 2021; Pereira et al., 2022). Violence in Brazil is a complex and multifaceted problem, which not only results in high mortality rates but also contributes substantially to the increase in SCI. Exposure to violent situations, such as robberies, assaults, and accidents linked to organized crime, is frequently associated with severe SCI. These injuries have a devastating impact on the lives of affected individuals, often resulting in permanent paralysis and severe physical disabilities, and considerably burden the Unified Health System with complex demands for rehabilitation and long-term care (Faleiros et al., 2020, 2023).

In the current study, we identified that, at the time of admission, 56.8% of the patients had lesions in the thoracic and lumbar regions, while 40.9% had lesions in the cervical region. Regarding functionality, 47.2% of patients developed paraplegia or paraparesis, while 41.5% had tetraplegia or tetraparesis. According to the ASIA classification, most patients (32.1%) were classified as ASIA A level. In addition, 43.4% of patients exhibited complete dependence to perform ADLs. Previous studies have reported similar results, which can be explained by the fact that higher lesions tend to cause more severe neurological dysfunctions, according to the ASIA classification, resulting in lower FIM scores and greater difficulties in functional independence (Pereira et al., 2022; Silva et al., 2012).

Initially, most patients had a high level of dependence, close to "complete dependence". However, at hospital discharge, we observed a progression toward modified or complete independence, highlighting the positive impact of the rehabilitation program. These results are consistent with those of previous studies that demonstrate the efficacy of rehabilitation in promoting the autonomy and functionality of patients with SCI, reinforcing the importance of suitable interventions to improve quality of life and reduce dependence when performing ADLs (Gedde et al., 2019; Kao et al., 2022; Osterthun et al., 2009).

According to the literature, which indicates a positive correlation between the length of hospital stay and the improvement in patients' functionality (Kao et al., 2022) , we also observed that patients with intermediate hospitalizations (91–180 days) experienced the

highest percentage of improvement in functional dependence (60.0%) compared with patients with other lengths of hospitalization. Additionally, in accordance with the study by Osterthun et al. (2009), younger patients demonstrated better functional outcomes.

However, patients with NTSCI who started rehabilitation earlier had longer hospitalization times, in contrast with that reported in the literature, which generally associates traumatic injuries with prolonged hospitalization periods and links early rehabilitation to shorter hospitalization times (Gedde et al., 2019; Osterthun et al., 2009).

Patients with SCI often experience multiple complications, including chronic pain, gastrointestinal problems, cardiovascular disorders, muscle spasms, and mental health conditions such as depression and anxiety (Gerber et al., 2021; Gupta et al., 2021).

These factors warrant the need for multiple medications, leading to polypharmacy. Polypharmacy, the administration of more than five drugs by a single patient (Nascimento et al., 2017), was observed in 92% of patients with SCI, indicating the need for a range of drugs owing to the multifaceted impact of the lesion, highlighting the intricacy of complications associated with this type of lesion; this finding is consistent with that of Jutzeler et al. (2023). In this study, the evaluation of polypharmacy was based on the prescriptions at the time of hospital discharge, without considering over-the-counter medications, herbal medicines, or supplements, such as vitamins and minerals. The inclusion of these items would result in even higher polypharmacy rates.

Herein, an average of 8.69 ± 3.07 medications were prescribed per patient at discharge, with one patient prescribed up to 16 medications. Most prescribed drugs targeted the nervous system (43%) and the alimentary tract (31.6%). Likewise, Jensen e Biering-Sørensen (2014) reported a 3.29-fold increase in the use of medications in patients after injury, with an emphasis on medications aimed at the alimentary tract and nervous system. Conversely, Hand, Krause e Simpson (2018) suggest that well-managed care would facilitate better-controlled polypharmacy, reducing related adverse events. Continuity of care, for example, has been identified as a protective factor against polypharmacy, as reported by Guilcher et al. (2018), associating greater continuity of care with a reduction in the excessive use of medications.

Pain was the most predominant complication treated, with 35 of the 49 patients prescribed gabapentin (71.4%), in agreement with clinical guidelines for pain management in patients with SCI (Varghese et al., 2020). Other medications prescribed for analgesic purposes were baclofen, dipyrone, amitriptyline, cyclobenzaprine, codeine with

paracetamol, paracetamol, and methadone (table 4). The use of these therapeutics has been well-documented in prescription patterns of patients with SCI (Yuan et al., 2021). For example, Dietz et al. (2024) reported that opioid analgesics were the most common medications and were prescribed to 57% of patients with SCI, followed by antidepressants (46%) and muscle relaxants (40%).

The complexity of pain management in SCI, which involves various types of pain (neuropathic, inflammatory, and visceral), underscores the need for a combination of analgesics, including opioids, antidepressants, and muscle relaxants (Huang et al., 2019).

Neuropathic pain affects between 50 and 60% of patients with SCI, while approximately 70% experience spasticity. Owing to the similarities between central neuropathic pain and spasticity, some researchers call it "sensory spasticity." However, differentiating between neuropathic pain and musculoskeletal pain, which often occurs along with spasticity, is a common challenge in treating these patients (Finnerup, 2017).

Another relevant point is the prescription of drugs that act on the gastrointestinal system, with more than 60% of patients using omeprazole, a proton pump inhibitor indicated for ulcers and other conditions related to excessive acid production in the stomach (Neal Shah & William Gossman, 2023) and 53% using lactulose, a laxative recommended to treat constipation (Park et al., 2023). Regarding nausea and vomiting, more than 57% of the patients were prescribed ondansetron, a serotonin receptor antagonist indicated for these conditions (Alexandria Griddine & Jeffrey S. Bush, 2023).

In addition, the psychological impact of SCI, including conditions such as depression and anxiety, was addressed with specific medications (table 4), highlighting the importance of a multidisciplinary approach addressing both the physical and emotional needs of these patients. Adapting to a new physical condition, frequently characterized by mobility restrictions and dependence on caregivers, can markedly contribute to psychological instability, further underscoring the need for comprehensive care (Hearn & Cross, 2020; Mofatteh et al., 2024).

Considering these results and the large number of complications associated with SCI, it is critical that healthcare professionals adopt approaches that integrate non-pharmacological strategies, such as physical activity, nutritional interventions, and lifestyle adjustments, along with pharmacotherapy. In the long term, these methods can reduce the amount of medication needed, reducing the risk of drug interactions and adverse effects,

which directly contributes to improving quality of life after hospital discharge (Jutzeler et al., 2023).

Additionally, the use of assistive technologies, such as medication management apps and electronic reminder devices, has been shown to be effective in improving treatment adherence, especially among patients with SCI, who face severe motor and sensory limitations, as well as additional challenges due to polypharmacy (Cadel et al., 2020, 2023; Cooper et al., 2023; Hayakawa et al., 2013; McCall et al., 2013; Mira et al., 2014; Sarkar et al., 2015). Nevertheless, it is essential to ensure that these tools are accessible to individuals with limited technological experience, such as older adults (Mira et al., 2014). There is still a lack of research on the demand for devices supporting self-management of health conditions and medications at home, as well as practical and accessible solutions for effective self-management in home settings (McCall et al., 2013).

Finally, collaboration between patients and healthcare providers is critical to the successful therapeutic management of patients with SCI, allowing for continuous adjustments to treatment plans as needs evolve. Strengthening rehabilitation in primary care can be an effective solution for improving the management of patient's health conditions (Gemperli & Essig, 2023) and preventing costly hospitalizations and readmissions (Nishani Umasutha et al., 2024).

Considering that SCI often triggers a wide range of health complications, pharmacological treatments are essential for patient care in the rehabilitation area. However, this scenario exposes patients to polypharmacy and potential drug interactions, among other risks associated with the simultaneous use of several drugs.

In this context, a promising strategy involves developing more comprehensive clinical protocols within the HAB to enhance therapeutic management and standardize clinical practices, particularly by integrating non-pharmacological measures with pharmacotherapy. Such an approach aims not only to promote the rational use of medications but can also deliver clinical, humanistic, and economic benefits to patients following hospital discharge.

The outcomes explored in this study involve a poorly investigated research field in Brazil. Our study included a limited number of participants, given that it was conducted in a single hospital and was based on electronic medical records, which may present incomplete or missing information in some cases. Another limitation is that the assessment of improvements in the level of dependence relied on the descriptions documented in the medical records. Although these records included the overall assessment outcomes, they

lacked detailed information on specific items within the various functional domains, such as those related to motor skills and cognitive/social abilities. This lack of specificity may limit a more nuanced understanding of factors contributing to the observed improvements.

Despite these limitations, the methodology utilized in this study can serve as a valuable reference for future research and aid in the development of targeted clinical management guidelines for patients with SCI.

CONCLUSIONS

This study not only offers valuable insights into the healthcare management of patients with SCI but also represents a notable advancement in epistemological knowledge in a poorly investigated area. By highlighting essential information for management, such as the sociodemographic profile of patients and their clinical characteristics at hospital discharge, this study contributes substantially to the improvement of care practices. Moreover, by filling gaps in an underexplored area, the study broadens theoretical and practical understanding, stimulating new research and potentially influencing local public health policies aimed at patients with SCI.

To advance this research, multicenter studies involving diverse rehabilitation units are recommended to improve sample representativeness and enable more robust analyses. Longitudinal studies with larger sample sizes could offer deeper insights into rehabilitation interventions, treatment intensity, and outcomes. Future research should focus on drug therapy, emphasizing pharmaceutical interventions that encourage the rational use of medications, adherence to treatment, and challenges faced by patients and caregivers in accessing and managing medications.

REFERENCES

1. Griddine, A., & Bush, J. S. (2023). Ondansetron. In *StatPearls*. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK499839/

2. Alizadeh, A., Dyck, S. M., & Karimi-Abdolrezaee, S. (2019). Traumatic spinal cord injury: An overview of pathophysiology, models and acute injury mechanisms. *Frontiers in Neurology, 10*. https://doi.org/10.3389/fneur.2019.00282

3. Araújo Junior, F. A. de, Matsubara, A., Pereira, L. H. C., Schmidt, E. H. B., & Kondlatsch, G. L. de S. (2021). Epidemiology of spinal cord injury in references trauma center in Curitiba (Paraná, Brazil). *Coluna/Columna, 20(2)*, 123–126. https://doi.org/10.1590/s1808-185120212002240563

4. Cadel, L., Cimino, S. R., Bradley-Ridout, G., Hitzig, S., Packer, T., McCarthy, L. M., Patel, T., Lofters, A., Hahn-Goldberg, S., Ho, C. H., & Guilcher, S. (2023). A scoping review of medication self-management intervention tools to support persons with traumatic spinal cord injury. *PLoS ONE*. https://doi.org/10.1371/JOURNAL.PONE.0284199

5. Cadel, L., Everall, A. C., Packer, T., Hitzig, S. L., Patel, T., Lofters, A., & Guilcher, S. J. T. (2020). Exploring the perspectives on medication self-management among persons with spinal cord injury/dysfunction and providers. *Research in Social & Administrative Pharmacy*. https://doi.org/10.1016/J.SAPHARM.2020.01.014

6. Cieza, A., Causey, K., Kamenov, K., Hanson, S. W., Chatterji, S., & Vos, T. (2020). Global estimates of the need for rehabilitation based on the Global Burden of Disease study 2019: A systematic analysis for the Global Burden of Disease Study 2019. *The Lancet, 396(10267)*, 2006–2017. https://doi.org/10.1016/S0140-6736(20)32340-0

7. Cooper, L., Fuzesi, P., Jacob, S. A., Kamalakannan, S., Lennon, M., Macaden, L., Smith, A., Welsh, T., Broadfoot, K., & Watson, M. C. (2023). Assistive technologies and strategies to support the medication management of individuals with hearing and/or visual impairment: A scoping review. *Disability and Health Journal*. https://doi.org/10.1016/J.DHJO.2023.101500

8. Dietz, N., Alkin, V., Agarwal, N., Bjurström, M. F., Ugiliweneza, B., Wang, D., Sharma, M., Drazin, D., & Boakye, M. (2024). Polypharmacy in spinal cord injury: Matched cohort analysis comparing drug classes, medical complications, and healthcare utilization metrics with 24-month follow-up. *Journal of Spinal Cord Medicine*. https://doi.org/10.1080/10790268.2024.2375892

9. Faleiros, F., de Oliveira Braga, D. C., Schoeller, S. D., Henriques, S. H., Cunha, N. B. F., Videira, L. G. N., & da Silva Grillo, A. C. L. (2023). Surveying people with spinal cord injuries in Brazil to ascertain research priorities. *Scientific Reports, 13(1)*, 654. https://doi.org/10.1038/s41598-022-26733-7

10. Faleiros, F., Silva, J. C. F. e, Cordeiro, A., Tholl, A. D., Fumincelli, L., & Tate, D. (2020). Quality of life and traumatic spinal cord injury: A study using international data sets. *Rev Eletr Enferm, 22*. https://doi.org/10.5216/ree.v22.56256

11. Finnerup, N. B. (2017). Neuropathic pain and spasticity: Intricate consequences of spinal cord injury. *Spinal Cord, 55(12)*, 1046–1050. https://doi.org/10.1038/sc.2017.70

12. Gedde, M. H., Lilleberg, H. S., Aßmus, J., Gilhus, N. E., & Rekand, T. (2019). Traumatic vs non-traumatic spinal cord injury: A comparison of primary rehabilitation outcomes and complications during hospitalization. *The Journal of Spinal Cord Medicine, 42(6)*, 695–701. https://doi.org/10.1080/10790268.2019.1598698

13. Gemperli, A., & Essig, S. (2023). Editorial: The role of primary and community care in rehabilitation. *Frontiers in Rehabilitation Sciences, 4*. https://doi.org/10.3389/fresc.2023.1235049

14. Gerber, L. H., Deshpande, R., Prabhakar, S., Cai, C., Garfinkel, S., Morse, L., & Harrington, A. L. (2021). Narrative review of clinical practice guidelines for rehabilitation of people with spinal cord injury. *American Journal of Physical Medicine & Rehabilitation, 100(5)*, 501–512. https://doi.org/10.1097/PHM.0000000000001637

15. Guan, B., Anderson, D. B., Chen, L., Feng, S., & Zhou, H. (2023). Global, regional and national burden of traumatic brain injury and spinal cord injury, 1990–2019: A systematic analysis for the Global Burden of Disease Study 2019. *BMJ Open, 13(10)*, e075049. https://doi.org/10.1136/bmjopen-2023-075049

16. Guilcher, S., Hogan, M., Calzavara, A., Hitzig, S. L., Patel, T., Packer, T., & Lofters, A. (2018). Prescription drug claims following a traumatic spinal cord injury for older adults: A retrospective population-based study in Ontario, Canada. *Spinal Cord*. https://doi.org/10.1038/S41393-018-0174-Z

17. Gupta, S., McColl, M., Smith, K., & McColl, A. (2021). Prescribing patterns for treating common complications of spinal cord injury. *Journal of Spinal Cord Medicine (JSCM)*. https://doi.org/10.1080/10790268.2021.1920786

18. Hand, B. N., Krause, J. S., & Simpson, K. (2018). Polypharmacy and adverse drug events among propensity score matched privately insured persons with and without spinal cord injury. *Spinal Cord*. https://doi.org/10.1038/S41393-017-0050-2

19. Hayakawa, M., Uchimura, Y., Omae, K., Waki, K., Fujita, H., & Ohe, K. (2013). A smartphone-based medication self-management system with real-time medication monitoring. *Applied Clinical Informatics*. https://doi.org/10.4338/ACI-2012-10-RA-0045

20. Hearn, J. H., & Cross, A. (2020). Mindfulness for pain, depression, anxiety, and quality of life in people with spinal cord injury: A systematic review. *BMC Neurology, 20(1)*, 32. https://doi.org/10.1186/s12883-020-1619-5

21. Huang, Q., Duan, W., Sivanesan, E., Liu, S., Yang, F., Chen, Z., Ford, N. C., Chen, X., & Guan, Y. (2019). Spinal Cord Stimulation for Pain Treatment After Spinal Cord Injury. *Neuroscience Bulletin, 35(3)*, 527–539. https://doi.org/10.1007/s12264-018-0320-9

22. Jensen, E. K., & Biering-Sørensen, F. (2014). Medication before and after a spinal cord lesion. *Spinal Cord.* https://doi.org/10.1038/SC.2014.20

23. Jutzeler, C. R., Bourguignon, L., Tong, B., Ronca, E., Bailey, E., Harel, N. Y., Geisler, F., Ferguson, A. R., Kwon, B. K., Cragg, J. J., Grassner, L., & Kramer, J. L. K. (2023). Pharmacological management of acute spinal cord injury: a longitudinal multi-cohort observational study. *Scientific Reports, 13(1)*, 5434. https://doi.org/10.1038/s41598-023-31773-8

24. Kao, Y.-H., Chen, Y., Deutsch, A., Wen, H., & Tseng, T.-S. (2022). Rehabilitation length of stay and functional improvement among patients with traumatic spinal cord injury. https://doi.org/10.1038/S41393-021-00686-6

25. Kim, H. S., Lim, K.-B., Kim, J., Kang, J., Lee, H., Lee, S. W., & Yoo, J. (2021). Epidemiology of Spinal Cord Injury: Changes to Its Cause Amid Aging Population, a Single Center Study. *Annals of Rehabilitation Medicine, 45(1)*, 7–15. https://doi.org/10.5535/arm.20148

26. Lianza, S., Casalis, M. E. P., Greve, J. M. D., & Eichberg, R. (2001). Spinal cord injury. In S. Lianza, *Rehabilitation Medicine* (4th ed.; pp. 304-326). Rio de Janeiro, RJ: Guanabara Koogan.

27. Maas, F., Moser, G. A. S., Goettens, D. A., Lima, J. F., Souza, S. S., & Aguiar, D. C. M. (2020). Characterization of traumatic spinal cord injuries: an integrative review of the literature. *Scientific Electronic Archives, 13(5)*, 90. https://doi.org/10.36560/1352020936

28. McCall, C., Maynes, B., Zou, C. C., & Zhang, N. J. (2013). An automatic medication self-management and monitoring system for independently living patients. *Medical Engineering & Physics.* https://doi.org/10.1016/J.MEDENGPHY.2012.06.018

29. McLeod, J., & Davis, C. G. (2023). Community peer support among individuals living with spinal cord injury. *Journal of Health Psychology, 28(10)*, 943–955. https://doi.org/10.1177/13591053231159483

30. Mira, J. J., Navarro, I., Botella, F., Borrás, F., Nuño-Solinís, R., D, O., Iglesias-Alonso, F., Pérez-Pérez, P., Lorenzo, S., & Toro, N. (2014). A Spanish pillbox app for elderly patients taking multiple medications: randomized controlled trial. *Journal of Medical Internet Research.* https://doi.org/10.2196/JMIR.3269

31. Mofatteh, M., Mashayekhi, M. S., Arfaie, S., Chen, Y., Malhotra, A. K., Skandalakis, G. P., Alvi, M. A., Afshari, F. T., Meshkat, S., Lin, F., Abdulla, E., Anand, A., Liao, X., McIntyre, R. S., Santaguida, C., Weber, M. H., & Fehlings, M. G. (2024). Anxiety and Depression in Pediatric-Onset Traumatic Spinal Cord Injury: A Systematic Review. *World Neurosurgery, 184*, 267-282.e5. https://doi.org/10.1016/j.wneu.2023.12.092

32. Nascimento, R. C. R. M. do, Álvares, J., Guerra Junior, A. A., Gomes, I. C., Silveira, M. R., Costa, E. A., Leite, S. N., Costa, K. S., Soeiro, O. M., Guibu, I. A., Karnikowski, M. G. de O., & Acurcio, F. de A. (2017). Polypharmacy: a reality in primary care of the Unified Health System. *Revista de Saúde Pública, 51*, 19s. https://doi.org/10.11606/S1518-8787.2017051007136

33. Neal Shah, & William Gossman. (2023). Omeprazole. In *StatPearls.* StatPearls Publishing. https://pubmed.ncbi.nlm.nih.gov/30969608/

34. Nishani Umasutha, Katherine Stead, Martin Brodsky, Katherine Rouleau, Jo Lewis, Abena Tannor, & Pauline Kleinitz. (2024, February). The Integration of Primary Care and Rehabilitation. *Wonca Global Family Doctor.* https://www.globalfamilydoctor.com/News/WorldRehabilitationAlliance.aspx

35. Norwegian Institute of Public Health. (2024). WHO Collaborating Center for Drug Statistics Methodology. *Index ATCDDD-ATC/DDD.* In *Fhi.no.* Norwegian Institute of Public Health. https://atcddd.fhi.no/atc_ddd_index/

36. Osterthun, R., Post, M. W. M., & Asbeck, F. W. A. van. (2009). Characteristics, length of stay and functional outcome of patients with spinal cord injury in Dutch and Flemish rehabilitation centres. *Spinal Cord.* https://doi.org/10.1038/SC.2008.127

37. Paiva, V. C. de, Nunes, C. V., Antonialli, C. V., Moraes, P. H. C., Foizer, G. A., Vasconcelos, I. T. de, San Juan Dertkigil, S., Cliquet Junior, A., & Miranda, J. B. de. (2023). Epidemiology of Post-Traumatic Spinal Cord Injury in a Tertiary Hospital. *Acta Ortopédica Brasileira, 31(5).* https://doi.org/10.1590/1413-785220233105e264492

38. Park, C. W., Lee, J., Hong, Y. H., Kim, Y. S., Suh, H. J., & Ahn, Y. (2023). Coadministration of Lactulose with Probiotics Ameliorates Loperamide-Induced Constipation in Mice. *Preventive Nutrition and Food Science, 28(4)*, 427–435. https://doi.org/10.3746/pnf.2023.28.4.427

39. Pereira, T. G. G., Castro, S. L. S. de, & Barbosa, M. O. (2022). Epidemiological profile of spinal cord injury in a reference hospital in the federal district a retrospective study. *Brazilian Journal of Development, 8(2)*, 8708–8729. https://doi.org/10.34117/bjdv8n2-020

40. Riberto, M. (2005). Functional orientation for the use of the FIM. *Hospital das Clínicas Faculty of Medicine of the University of São Paulo.* Available at https://toneurologiaufpr.wordpress.com/wp-content/uploads/2013/03/manual-mif.pdf. Accessed on 24 Sep 2024.

41. Riberto, M., Miyazaki, M.H., Jucá, S.S.H., Sakamoto, H., Pinto, P.P.N., & Battistella, L.R. (2005). Validation of the Brazilian Version of the Functional Independence Measure. *Acta Fisiatr, 11(2)*, 72–76.

42. Roberts, T. T., Leonard, G. R., & Cepela, D. J. (2017). Classifications In Brief: American Spinal Injury Association (ASIA) Impairment Scale. *Clinical Orthopaedics & Related Research, 475(5)*, 1499–1504. https://doi.org/10.1007/s11999-016-5133-4

43. Rupp, R., Biering-Sørensen, F., Burns, S. P., Graves, D. E., Guest, J., Jones, L., Read, M. S., Rodriguez, G. M., Schuld, C., Tansey-MD, K. E., Walden, K., & Kirshblum, S. (2021). International Standards for Neurological Classification of Spinal Cord Injury. *Topics in Spinal Cord Injury Rehabilitation, 27(2)*, 1–22. https://doi.org/10.46292/sci2702-1

44. Sarkar, S., Sivashankar, P., & Seshadri, H. (2015). Mobile SMS Reminders for Increasing Medication.

45. Silva, G. A. da, Schoeller, S. D., Gelbcke, F. L., Carvalho, Z. M. F. de, & Silva, E. M. de J. P. da. (2012). Functional assessment of people with spinal cord injury: use of the functional independence scale - FIM. *Texto & Contexto - Enfermagem, 21(4)*, 929–936. https://doi.org/10.1590/S0104-07072012000400025

46. Silva, O. T. da, Ghizoni, E., Tedeschi, H., & Joaquim, A. F. (2018). Epidemiology of Spinal Trauma Surgically Treated at the Unicamp Hospital das Clínicas. *Coluna/Columna, 17(1)*, 55–58. https://doi.org/10.1590/s1808-185120181701179262

47. Sturm, C., Bökel, A., Korallus, C., Geng, V., Kalke, Y. B., Abel, R., Kurze, I., & Gutenbrunner, C. M. (2020). Promoting factors and barriers to participation in working life for people with spinal cord injury. *Journal of Occupational Medicine and Toxicology, 15(1)*, 37. https://doi.org/10.1186/s12995-020-00288-7

48. Varghese, J., Anderson, K. D., Widerström-Noga, E., & Mehan, U. (2020). A Primary Care Provider's Guide to Pain After Spinal Cord Injury: Screening and Management. *Topics in Spinal Cord Injury Rehabilitation, 26(3)*, 133–143. https://doi.org/10.46292/sci2603-133

49. Vasco, C. C., & Franco, M. H. P. (2017). Paraplegic Individuals and the Meaning Constructed for Spinal Cord Injury in Their Lives. *Psychology: Science and Profession, 37(1)*, 119–131. https://doi.org/10.1590/1982-3703000072016

50. Viana, F. P., Lorenzo, A. C. de, Oliveira, É. F. de, & Resende, S. M. (2008). Measure of functional independence in activities of daily living in elderly people with sequelae of stroke at the Sagrada Família Gerontological Complex of Goiânia. *Rev Bras Geriatr Gerontol, 11(1)*, 17–28. https://doi.org/10.1590/1809-9823.2008.11013

51.   Waterworth, C. J., Smith, F., Kiefel-Johnson, F., Pryor, W., & Marella, M. (2024). Integration of rehabilitation services in primary, secondary, and tertiary levels of health care systems in low- and middle-income countries: a scoping review. *Disability and Rehabilitation, 46(25)*, 5965–5976. https://doi.org/10.1080/09638288.2024.2317422

52.   World Health Organization. (2021, April 26). Falls. https://www.who.int/news-room/fact-sheets/detail/falls

53.   Yuan, H., Chang, Q.-Y., Chen, J., Wang, Y.-T., Gan, Z.-J., Wen, S., Li, T.-T., & Xiong, L.-L. (2021). A retrospective analysis of the effects of different analgesics on the pain of patients with traumatic thoracolumbar fractures in the peri-treatment period. *Journal of Orthopaedic Surgery and Research, 16(1)*, 268. https://doi.org/10.1186/s13018-021-02401-w