

The wheelchair and its essential components for the mobility of quadriplegic persons with spinal cord injury

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ABSTRACT

Objective: This study sought to understand which items are essential to the wheelchair from the perspective of a person with quadriplegic spinal cord injury (SCI). **Method:** The study was qualitative with semi-structured interviews and discourse analysis, as well as a checklist of the wheelchair being used and the wheelchair provided by the government's Unified Health System (SUS). **Results:** The causes of SCI were motor vehicle accidents (60%), diving into shallow waters (30%) and being struck by a vehicle (10%), respectively and the injury time averaged 16.3 years (± 7.14). All of the subjects were in physiotherapy. The number of wheelchairs tested before finding the proper one were two to five and some participants practiced adapted sports with the wheelchair. The checklist showed that the government wheelchair had insufficient items and the discourse analysis resulted in four categories: Items, materials, and conditions; Learning functionality; Advantages and disadvantages of the wheelchair; and Feelings experienced. The wheelchair is essential to acquiring mobility for people with quadriplegia and trying out different models and getting orientation on the items are important for their acquisition. Suitable items facilitate acceptance, better adaptation, mobility and enable autonomy. **Conclusion:** The wheelchair from the government's health system was insufficient, leading to its being abandoned, and wheelchairs acquired for their functionality, with essential items, responsive to the user's individuality and taste proved to be useful and appropriate, despite their high cost.

Keywords: Spinal Cord Injuries, Quadriplegia, Wheelchairs, Locomotion, Personal Autonomy

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INTRODUCTION

Spinal cord injuries (SCI) lead to total or partial loss of motor and/or sensory functions below the impaired spinal segment. SCI in the cervical column segments causes quadriplegia.¹ People with quadriplegia caused by SCI are mostly young adults, active in society. Among the main functional disorders after the injury is the inability to walk and the consequent need to use a wheelchair for locomotion.^{2,3}

The wheelchair, by providing support to the skeleton, maintaining physical integrity, and providing a means of locomotion, is an important factor in community integration and social participation. Therefore the wheelchair is among the support technologies used by people who have walking disabilities.⁴⁻⁷

The Brazilian Unified Health System (SUS) in the city of Londrina, state of Paraná, assures the acquisition of a wheelchair, however, up until 2013 only one manual model was available for quadriplegic individuals with no possibility of adapting the chair to their needs and individualities.⁸

To be considered adequate, a wheelchair must have personalized ergonomic characteristics in its design and configuration. This is an important factor that must be considered in its prescription by the professionals involved. This adaptability guarantees greater mobility, acceptance, stability, comfort, and maneuverability to the user.⁹

Most persons with SCI abandon their first wheelchair mainly because it is not adequate for locomotion. There are also problems with the recommendation, prescription, and training to use the chair in question. When the wheelchair is recommended and training is given by a rehabilitation center or a physiotherapist, it becomes adequate and prevents unnecessary purchases, since the objectives of a wheelchair go beyond locomotion—the goal is functional independence, especially in maneuvering and transferences. Gaining mobility, even if on wheels, facilitates the reorganization of basic functional activities and other more complex tasks. It allows one to partake in social, educational, professional, and recreational opportunities, leading the person to social participation in a productive and rewarding lifestyle.⁶

OBJECTIVE

In this context, this study proposed to understand which items are essential to a wheelchair from the perspective of a person with

quadriplegia caused by SCI, considering neuro-motor difficulty and the possibility of mobility.

METHOD

The study was qualitative and descriptive with interviews using a structured checklist of the wheelchair equipment and a semi-structured script concerning the experience with the wheelchair. It was carried out at the University Hospital of the Londrina State University (HU/UEL), in the years 2012 and 2013, approved by the HU/UEL Committee on Ethics in Research Nº 23/10. The choice of sampling in qualitative research is guided by the participation of individuals connected to the issue investigated: patients with quadriplegia caused by SCI and wheelchair users;¹⁰ the interviews were made to the saturation of data.¹¹

The wheelchair checklist with items and accessories for quadriplegic individuals was applied to the chair being used by the participants at the time of the interview and also to the chair supplied by an orthopedics to the SUS in the city of Londrina. The wheelchair checklist in question is shown as P11.

The semi-structured interview was done to obtain information on the participants' experiences with the wheelchair and the script was composed of the following guiding questions:¹² What are the essential wheelchair items that guarantee your locomotion? Talk about the wheelchair in your life, from the recommendation and acquisition of the first chair until now. Does the wheelchair available through the SUS have the essential items for your locomotion? Does your current wheelchair give you locomotion and autonomy?

The interviews were recorded in MP3 format, transcribed completely with only grammatical corrections, and discourse analysis based on what has been preconized by Martins & Bicudo.¹³ First, we sought the intelligibility articulated in the meanings present in each discourse, in its interrelations, and in its structure. Second, we sought to reach the general structure through understanding and articulating the individual information with specific examples and arrive at something more general and complex.¹⁰ Thus, the testimonies were considered individually, revealing meanings, and were later grouped into pre-categories for a preliminary analysis, and finally into categories to fulfill the objectives of the study.

Both the checklist and the interview were validated by two judges of the specialty, and by a pilot interview, which were made by one only interviewer.

RESULTS

Ten people were interviewed: one female and nine males. All of them were independent wheelchair users for their SCI level, considering the quadriplegia. Their mean age was 42.3 years (\pm 9.23). Three of them had college degrees, concluded after their SCI. There was a retired educator, a lawyer, and an economist, the latter two still active; the others were retired by disability. The SCIs were caused by traffic accidents (60%), diving into shallow water (30%), and being struck by a vehicle (10%), respectively. Regarding the affected spinal segment, three (30%) had damage at the C7, three (30%) at C6, three (30%) at C5, and one at C4 (10%). According to the ASIA (American Spinal Cord Injury)¹⁴ classification, via the damage scale (ASIA Impairment Scale - AIS), three (30%) were A, one (10%) was B, five (50%) were C, and one (10%) was D. The data found corroborated the study by Custódio et al.¹⁵ in which the main etiology had been traffic accidents in 44.7% of the cases. The average time with the spinal cord injury was 16.3 years (\pm 7.14) and all the participants started physiotherapy soon after the SCI, and they continue now twice a week. The minimum number of wheelchairs that they tried out before finding the one they considered adequate was two, although some participants needed to change their wheelchairs five times. All the participants practiced some sport or leisure activity as entertainment and depended on the wheelchair to perform them. The data referring to this information can be seen in Charts 1 and 2.

The checklist characterized the wheelchair equipment of the participants as different from those offered by the SUS. They are shown in Charts 3 and 4.

The four categories that emerged from their discourses were: necessary items, materials, and conditions; the achievement of functionality; advantages and disadvantages of wheelchair; and feelings experienced.

The first category necessary items, materials, and conditions dealt with the items indicated by the participants as necessary and essential to deem the manual wheelchair adequate. Removable arms and pedals, air-filled tires, projection hand-rims, rubberized rim, good quality seat and back, being foldable, being lightweight, and options such as a pillow, shock absorbers, and resilient rims were the most reported items. Below there are some reports that gave meaning to the category:

Chart 1. Participants' data

	Gender	Age (years)	Education	Profession	Motor Level	AIS	Etiology
P1	Male	42	Incomplete High School	Retired	C7	C	Accident
P2	Male	40	Incomplete Junior High	Retired	C7	D	Diving
P3	Male	61	Incomplete Junior High	Retired	C5	C	Accident
P4	Male	35	Incomplete High School	Retired	C4	A	Accident
P5	Male	42	Incomplete High School	Retired	C7	C	Accident
P6	Male	52	Complete High School	Retired	C6	B	Struck by a vehicle
P7	Male	33	Complete High School	Retired	C5	A	Accident
P8	Female	49	Complete College	Retired	C6	C	Accident
P9	Male	37	Complete College	Economist	C6	A	Diving
P10	Male	32	Complete College	Lawyer	C5	C	Diving

Chart 2. Participants' data (continuation)

	Time w/injury (years)	Time receiving physiotherapy (years)	Sport/Leisure	Had how many wheelchairs	How many wheelchairs currently
P1	21	21	Yes	4	2
P2	4	4	Yes	2	2
P3	21	21	Yes	4	2
P4	17	17	Yes	3	2
P5	10	10	Yes	5	3
P6	26	26	Yes	6	2
P7	9	9	Yes	3	2
P8	23	23	Yes	5	1
P9	20	20	Yes	5	1
P10	12	12	Yes	4	2

Chart 3. List of the participants' wheelchair items

Wheelchair Items	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11*
Removable arms	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Pedal w/height adjustment	yes	yes	yes	yes	yes	yes	yes	no	yes	yes	no
Removable Pedal	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no
Removable back wheels	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no
Removable front wheels	yes	no	no	yes	yes	yes	yes	no	yes	no	no
Folding brake lever	no	no	no	yes	yes	no	no	no	no	no	no
Adjustable system to incline the seat	no	no	no	no	no	no	no	no	no	no	no
Side guards	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no
Adjustable brakes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Rigid back	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Folding back	no	no	no	no	no	no	no	no	no	no	no
Rigid seat	yes	yes	no	yes	no	yes	yes	yes	yes	yes	yes
Adjustable seat	no	no	no	no	yes	no	no	no	no	no	no
Smooth rim	yes	no	yes	yes	no	yes	no	yes	yes	yes	yes
Rim with pins	no	no	no	no	no	no	no	no	no	no	no
Rim with rubberized cover	yes	yes	no	no	yes	no	yes	no	no	no	no

* Characterizes the wheelchair supplied by the SUS, Londrina/PR.

"It must have a front shock absorber, air-filled rear tire, a good seat, a back rest too, to be comfortable so that you don't keep falling [...]. For me, it must have projection hand-rims so I can push the chair." [P7].

"[...] is such that it has two small gloves back there, so the person can hold it and push me. But the other chairs don't even have that curve to hold onto, that I see, right?, other people that go through their routines... the

metal rim my hand passes by, I can't touch it, it's too slippery [...]" [P2].

The second category achievement of functionality appeared in discourses that revealed that the wheelchair was the condition for independence of locomotion and accessibility, including being simple. The participants mention the high price of helpful accessories and that the most relevant is that they promote independence. With that purpose, the motorized wheelchair is essential to the participant with greater motor impairment.

"Ah yeah, it is essential, like this: if you want to go to a birthday party or wedding or party, it is really essential [...] it's very good, there is nothing better." [P3].

"But, wow, if they made the motorized chair available, very expensive, I wouldn't stay home, you know? ... many people would start going out." [P5].

"For me, my chair has to be motorized-it allows me to leave the house, to go in the street, go up ramps, to go to the market if I have to take a bus." [P7].

The third category described in the discourses by the patients was the advantages and disadvantages of wheelchairs. Those interviewed highlighted the differences between the SUS wheelchairs and those acquired privately. The latter were considered adequate, for they have important items necessary to the individualities of those with quadriplegia caused by SCI, while the SUS wheelchairs are inferior.

"The difference is great: the one from SUS doesn't offer much to the disabled person who needs a good chair because they are heavy, the material is fragile, they don't have the characteristics that a person needs to make transfers, the arms are not removable, and the pedals also can't be removed for the transfers..." [P6].

"I think that the chair has to be adapted to the patient; the patient has to try the chair and know which is the right chair. So I think that the chair depends on the patient. Two years ago I bought a monoblock wheelchair and couldn't adapt myself to it-I think I used it for only one month and returned it." [P1].

"Look, I already tried a chair-you know, those for quadriplegics available on the market, and didn't want to get out of it anymore. When I got home and sat in the chair I had just got from SUS, I looked at my wife and started to cry." [P2].

The fourth and last category was feelings experienced. This emerged from the feelings experienced by the quadriplegic individuals using a wheelchair, necessary

Chart 4. List of the participants' wheelchair items (continuation)

Wheelchair Items	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11*
Impermeable nylon upholstery	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Upholstered back	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no
Adjustable head rest	no	no	no	yes	no	no	no	no	no	no	no
Bilateral trunk support	no	no	no	no	no	no	no	no	no	no	no
Calf support	no	no	no	no	no	no	no	no	no	no	yes
Adjustable leg abductor	no	no	no	no	no	no	no	no	no	no	no
Occipital headrest	no	no	no	no	no	no	no	no	no	no	yes
Knee blocker	no	no	no	no	no	no	no	no	no	no	no
Adductor	no	no	no	no	no	no	no	no	no	no	no
Ankles support straps	no	no	no	no	no	no	no	no	no	no	no
Pelvic belt	no	no	no	no	no	no	no	no	no	no	no
Gutter armrest	no	no	no	no	no	no	no	no	no	no	no
Armrest pad	no	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Pillow	no	yes	no	yes	yes	yes	yes	yes	yes	yes	yes

* Characterizes the wheelchair supplied by the SUS, Londrina/PR.

strive for autonomy and for the capacity to self-govern. That is only possible with the appropriate equipment and early and supervised training.^{6,22,23}

A few of the participants did not have items considered as locomotion facilitators in their wheelchairs. The importance and recommendation of the propulsion pins or rubberized adhesive rims are necessary. According to the Health Ministry,²⁴ these items are essential for the locomotion of people with reduced grip strength.

After the initial shock of living with the new condition, people start seeing the wheelchair as indispensable for daily life activities. To summarize, the better the quality of the chair, the better will be the user's locomotion.⁶

In the declarations of the participants with greater motor deficits, the motorized wheelchair facilitates their locomotion and social participation. According to Reid et al.²⁵ the use of a motorized wheelchair or scooter guarantees the user a sensation of freedom, locomotion, independence, better posture, impact reduction, and body alignment. However, the motorized wheelchair for quadriplegic patients with low cervical injuries should be very carefully considered, for its use favors physical atrophy, difficulty in crossing barriers, and incapacity to drive vehicles, when compared to the users of manual wheelchairs.²⁶

For some users, the wheelchair should be tested. In case of no adaptation, it should be possible to return the chair and exchange it, regardless of the wheelchair coming from the SUS or bought privately; its use for a trial period should prevent feelings of sadness, especially frustration and dissatisfaction. It is extremely important to consider the perception and satisfaction of the user concerning the wheelchair, in addition to performance tests, so that this highly important assisting device is not abandoned.^{19,24,27,28,29}

All the participants received physiotherapy specialized for persons with SCI with a multiprofessional support. These point out the importance of training with the wheelchair. The training focused on transferences and locomotion with the wheelchair allows the experience with it, which develops their abilities and minimizes frustrations.³⁰

The appropriate wheelchair, early on, with supervised training under real conditions, facilitates their quality of life; that is, it goes from a symbol of disability to being the extension of the lower limbs that, after the SCI, had become paralyzed, proving its importance for locomotion and independence.^{6,28} The appropriate wheelchair prevents the appearance and/or evolution of pressure ulcers,²⁴ allows locomotion, favors

equipment, the symbol of their disability, access barriers, and essential for their new condition in life.

"[...] that is why for an adequate chair you have to go on adapting to it, day after day, the guy goes on finding the way of the chair. So that's why we say, the chair is a part of you, like a woman: you lay your eyes on it, you like it, you get it! You sit in it, see that it's comfortable, you know that you will do well with it." [P1].

"[...] there is no alternative, it's either the wheelchair or the bed." [P9].

DISCUSSION

The most significant differences found between the participants' paid-for wheelchairs and those supplied by the SUS in the city of Londrina, were the accessories and removable items. The accessories and items that made it possible to assemble and disassemble the chair are the items most credited with the satisfaction with the wheelchair, as well as durability according to Medola et al.¹⁶ Among those items, the participants revealed that the arms must be adjustable to allow safety without interfering with the transferences and removable to help caregivers to transport the chair. Adjustable and removable arms provide safety, since the study by Kirby et al.¹⁷ suggests that, in addition to being adjustable and removable, the arms do not surpass the dimensions of the wheelchair, for this may lead to its being abandoned, which would leave the patient vulnerable and in danger of falling.

The first wheelchairs were provided to quadriplegic patients by SUS with no specificities and only one participant interviewed still has his, being unable to afford another chair. The others replaced it with chairs they bought privately-custom made and with optional accessories because the SUS chairs either lack the necessary items or the specificities for quadriplegic patients were not prescribed. The participants also reported that these accessories in a wheelchair meant that it is to be pushed by caregivers and not touched by the user, which either indicates the lack of ability of the patient or presumes an even greater motor impairment, which many times is not true. The wheelchair should be safe, comfortable, and lightweight to optimize its use and facilitate independence in locomotion and movement strategies. It should also provide a more active life and social participation that will result in an improved quality of life.^{9,18-20}

Quadriplegic individuals, those with impaired trunk control, need higher backs on their wheelchairs when compared to those who have more trunk control. According to Cherubini & Melchiorri,²¹ the back should be positioned 20mm below the lower angle of the scapula, in order to guarantee greater stability to its user. It is noteworthy to remember that, similar to paraplegics, the wheelchair configuration must be appropriate, for its influence is observed in the capacity for mobility and demand of upper limbs during locomotion.⁹

The wheelchair has to go from a symbol of disability to a means of locomotion. The adaptation to the new condition is difficult and the person with SCI needs to establish concrete goals that are possible, as well as

participation, and helps in the practice of sports and leisure, which aids in facing this new condition in life.²³ For those paraplegic individuals who have less available motor abilities, the architectural barriers are greater disadvantages for their locomotion. Thus, it is necessary to increase the awareness of the population concerning accessibility for this class of citizens, a situation in which respect for differences is preserved.^{23,31}

CONCLUSION

The appropriate wheelchair is essential equipment for the locomotion of people with paraplegia caused by SCI. To learn about models, to experiment with them, and have guidance on the adequate items such as weight, removable arms, adjustable feet, comfortable seat and back, and safety are important for the purchase. The adequate items facilitate the person's acceptance, better adaptation, well being, and satisfaction. The wheelchairs provided to quadriplegic patients by the SUS in the city of Londrina, state of Paraná, were considered insufficient and thus, abandoned. In contrast, wheelchairs that were purchased privately, prescribed with essential items and corresponding to the functional individuality and taste of the user, by model or comfort, have proven to be useful and appropriate, despite their high cost. We suggest that health professionals that prescribe wheelchairs to quadriplegic patients do so based on their functional independence, with a list of items and accessories so that their objectives are achieved. Therefore, the wheelchair in question must be, above all, a piece of equipment that provides wide social participation and autonomy.

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