

# Clinical Perspectives on Wheelchair Selection

## Factors in Functional Assessment

*by Andrea L. Behrman, MS PT*

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### INTRODUCTION

The recommendation process that results in an appropriate wheelchair selection begins with a clinical evaluation of the potential user's medical profile consisting of medical history and physical assessment; and a personal profile that includes social history and user goals, functional abilities, and environment. A goal list is developed from this information to identify the specific needs that the wheelchair recommendation and selection must address. Once the needs are identified, the clinician selects from the available market the chairs, components, and accessories that most closely meet the individual's requirements.

Physical measurements of the user for a wheelchair and trial use by the user of prospective chairs and components provide vital feedback to the clinician for matching wheelchair performance with identified abilities and needs. As part of this procedure, the clinician should instruct the potential user on the advantages and disadvantages of various wheelchair components and features so that he/she may become an active and effective contributing member of the recommendation team. The final wheelchair selection may then be based on a professional assessment combined with direct input from the potential user.

### CLINICAL ASSESSMENT

The physician, together with the clinician, constructs the medical profile that includes the diagnosis of disease or disability and prognosis, e.g., the impact of the disease or disability on the user's physical status, and ultimately on his or her function and mobility. The clinician also needs to evaluate the individual's range of motion, neuromuscular status, posture and balance, degree of sensation, and skin integrity.

Although assessment of the user's medical and physical history assists in determining the ability to perform a purposeful motor task directed toward self-mobility, such physical descriptors cover only some of the considerations needed for optimal wheelchair selection. The personal profile, which includes the user's social history, environment, functional abilities, and personal preferences, forms the other set of considerations necessary in making a selection. From a combination of clinical evaluation of the medical record and direct interface with the client, the recommendation team (clinician, physician, and other relevant professionals) learns "who" the potential user really is and how best to meet his/her needs in designing the wheelchair prescription.

## Medical Profile

*Medical history.* The medical history includes the diagnosis of disease or disability, date of onset, prognosis, and identification of any associated conditions. However, the diagnosis or disease classification alone affords the clinician limited information toward the accomplishment of the wheelchair recommendation. More important is the impact of the disease or disability on the physical functional and mobility abilities. For example, an initial diagnosis of arthritis (painful, limited range of motion) does not specifically inform the clinician of the severity of the arthritis (number and location of joints involved) and its impact on the individual's level of functioning. The diagnosis of a disease or disability serves to focus the clinician on the limiting elements inherently associated with that disease or disability. Individuals with the following diseases and disabilities may require a wheelchair for function and mobility:

Diseases—Multiple sclerosis, muscular dystrophy, amyotrophic lateral sclerosis, Guillain-Barré syndrome, poliomyelitis, cancer (spinal or brain).

Congenital disabilities—Cerebral palsy, spina bifida, arthrogryposis, osteogenesis imperfecta, limb deficiency.

Acquired disabilities—Brain injury, cerebrovascular accident, amputation, spinal cord injury.

General debilitation—Cardiac dysfunction, pulmonary dysfunction.

The duration of the disability is an important consideration when assessing the awareness or education of the individual toward his/her disability and potential mobility and function in a wheelchair. An individual with recent spinal cord injury will have different needs concerning education as part of the rehabilitation process than a person with a 30-year wheelchair dependency as a result of childhood poliomyelitis.

Whether or not the user's present physical and medical condition is permanent, progressive, deteriorating, or temporary will impact directly on the quality and durability of the wheelchair to be recommended. For example, an individual with amyotrophic lateral sclerosis will likely require a wheelchair that will accommodate a deteriorating physical condition, including loss of neck and trunk musculature function. An individual with resolving

Guillain-Barré syndrome will probably require short-term use of a wheelchair for propelling long distances, or full-time use on an interim basis during rehabilitation. Anticipated functional gains may warrant use of a rental wheelchair on a temporary basis. An individual with T-4 paraplegia, complete, will require a permanent wheelchair for use on a full-time basis. Thus, the expected outcome of the rehabilitation program and prognosis for change will direct choices concerning short-term or long-term need for a wheelchair. Such prognostic indications, though, are not disability specific; they are specific to individual needs.

Besides the primary diagnosis, other factors that impact on functional ability can influence or determine the choice of a particular type of wheelchair. For instance, susceptibility to, a history of, or an existing condition of skin breakdown may necessitate specialized seating or use of a recliner wheelchair for pressure relief. The presence of edema may indicate the use of elevating legrests. Impaired or lack of bowel and bladder control will affect the choice of upholstery and cushion. Personal hygiene, comfort, and longevity of the cushion or upholstery fabric become important considerations. Also, maintenance factors should be considered. Will the user himself be physically able to maintain the wheelchair? If not, low maintenance wheelchairs may require special consideration.

*Physical assessment.* The clinical process also includes an objective evaluation of the individual's range of motion, neuromuscular status, posture and balance, sensation, and skin integrity. The physical status is critical in determining the optimal interface among the wheelchair, the user, and the user's environment.

Range of motion evaluation describes the range available for function and the limitations, fixed or nonfixed, in the examination of the joints of the neck, trunk, and extremities. Range limitations are discerned as to their current impact on function and potential impact over time. Range limitations identified as critical may require accommodation or correction through wheelchair positioning or seating, further attention through therapy, or surgical intervention. For example, consider a wheelchair user with a right above-knee amputation, a right below-elbow amputation, a left above-elbow ampu-

tation, and left knee range of motion of 0 to 60 degrees of flexion. This range limitation is significant to the individual's ability to transfer in and out and propel a wheelchair. Mobility is functional within the range of left knee flexion, yet the clinician must also consider the wheelchair seat height in order to optimize the user's lower extremity wheelchair propulsion.

The neuromuscular status of the musculature of the head, neck, and upper and lower extremities is observed. Knowledge of strength, coordination, patterns of movement, and tone (spasticity) will help the clinician determine the user's potential for present level of functional performance in a wheelchair. A person with C-6 complete lesion of the spinal cord who exhibits normal deltoids, biceps, and wrist extensor musculature strength should be able to propel a manual wheelchair with standard push rims on level and slightly uneven terrain. However, expected performance based on physical status must be verified by actual performance and observed function. This same individual, with elbow contractures of -15 degrees from full extension, would show a deficit in wheelchair propulsion performance.

In an actual instance, a person with multiple sclerosis exhibited good strength in all extremities. Coordination was impaired throughout, but lower extremity involvement was greater than upper extremity involvement. Extensor tone dominated movement of the left lower extremity, rendering it nonfunctional for flexion-extension, reciprocal movements. The individual's physical status indicated that upper extremity movement for function, as in wheelchair propulsion, would be better. Functional performance (propelling the wheelchair with the upper extremities alone) verified that this was the case.

Deficits in range of motion and neuromuscular function will also create deficits in postural stability, mobility, and balance. Such dysfunctions will limit functional ability in a seated position, whether the individual is stationary or mobile. For example, a 20-year-old brain-injured female exhibits a sacral seating posture with a posteriorly tilted pelvis. She is unable to sit independently of support. She can sit with her right arm in extension and propped to hold her body upright. Her right upper extremity is dominant at this time, although its motion is characterized by ataxia and weakness. However, it cannot be used for function because it is needed to

maintain balance for sitting in a wheelchair. Tone and strength of her trunk musculature are inadequate for support and balance. Her initial needs seem to require a sufficient base of support and foundation to free her right arm for function and mobility. Such a need becomes a critical determinant in her wheelchair recommendation.

The integrity of the user's sensation is critical when we realize that a person does not typically sit in one position for a long period of time without subconsciously adjusting position to relieve pressure. The effectiveness of this subconscious ability is dependent on intact sensory feedback, which alerts the individual of the need to adjust, and the physical ability to alter the seated position in response to this feedback. Should either or both of these components be compromised, accommodations for seating and positioning must be considered. This need is perhaps inversely related to the individual's relative degree of independence. The more dependent the individual, the more important it becomes for the interface between the wheelchair and the individual to meet the need of skin tolerance, comfort, and prevention of skin breakdown. The person who cannot perform an independent pressure relief movement is susceptible to problems associated with impairment of circulation.

Areas of previous skin breakdown, graft sites, and present skin breakdown are to be noted. The interface between the wheelchair and the individual is an intimate one that serves to maintain the health integrity of the skin, accommodate for present breakdown, and prevent future problems.

Physical descriptors from the evaluation of a user's medical history and physical assessment assist in determining his/her ability to perform a purposeful motor task directed toward self-mobility. But, further examination of individual characteristics to acquire a complete picture of the wheelchair user's needs is necessary for making the proper wheelchair recommendation.\*

### **Personal Profile**

*Social history/user goals.* Social history includes age, place of residence, education, vocational his-

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\**Editor's Note.* As part of the total evaluation process by the entire team, the psychologist and/or neurologist will evaluate any cognitive or perceptual problems and report them to the clinic team. This is especially important with closed head injury clients as well as those who have had cerebral vascular accidents (hemiplegia).

tory and expectations, family history, present living arrangements, and recreational interests. Interview questions like the following help elicit information. "What is a typical day for you?" "What percentage of your day do you spend on physical versus mental activities?" "What do you see as your greatest need in a wheelchair?" And, if applicable, "What does your present wheelchair do or not do for you?" If the user already owns a wheelchair at the time of the evaluation, the clinician should question him/her on its functional pros and cons, as well as its age, condition, and description in order to determine the need, relative use, and maintenance concerns of the user. (*Wheelchair User Profile*, page 28) If appropriate, the clinician may question family members or the caregiver on matters related to the user's needs.

From such interviews, the clinician will learn valuable social information relating to the user's requirements. For example, the user may indicate

that he/she must have a wheelchair that will fit behind the front seat of an automobile while keeping that seat in a set position. Thus, transportability and size upon folding become critical elements. (**Figures 1a-1d**) Caregivers may express concern about the ease of loading the wheelchair into a car. Weight and dimensions of the chair then become significant needs that must be met by the recommended chair.

*Functional abilities.* Two areas of functional ability need to be assessed: wheelchair mobility and transfers. The primary and secondary uses of the wheelchair must be identified (i.e., full-time, part-time, community, self-propelled or by caregiver). The type of wheelchair, manual or powered, will be determined by the individual's level of independence in manual wheelchair propulsion.

**Mobility.** A "hierarchy of mobility skills" checklist is a useful tool when examining and



**Figures 1a-1b.**

Loading the wheelchair into the car. Weight and space requirements must be considered, especially when independent transfers are intended.



**Figures 1c-1d.**  
Completing the process of loading the wheelchair into the car.

describing a person's performance of wheelchair mobility skills. (Figures 2-5) This checklist (*Wheelchair Mobility*, page 29) starts with the easiest skill to perform and progresses to those requiring a high degree of physical function and motor skill to perform. The wheelchair user's ability to perform the mobility skill should be noted, along with comments concerning equipment and techniques that could be of assistance. (Figures 6-8)

**Transfers.** A "hierarchy of transfer skills" checklist (*Transfers*, page 30) begins with level surface transfers that require the minimum skill levels to perform and progresses to floor-to-wheelchair transfers that require the most advanced skill levels to perform. Again, the wheelchair user's ability to perform the transfer should be noted. Comments concerning transfer equipment and techniques are of assistance in

discerning wheelchair components and features required for optimal function by the user. (Figure 9)

*Environment.* The environment in which the wheelchair user lives and functions encompasses the home, vocational/educational settings, and community/recreational settings.

In describing the home environment, it is necessary to consider the widths of door frames, the bathroom arrangements, floor surfaces, accessibility (ramps, doorsteps, stairs), and the user's access to personal or community transportation from the home (access to the garage or carport, or to the terrain to the street). (Figure 10)

Accessibility to the vocational and educational environments involves the parking area, the route and terrain from the parking area to the entrance of



**Figure 2.** Wheelchair propulsion with full hand function indicates this wheelchair user has potential for function at an advanced level of wheelchair mobility.



**Figure 3.** Wheelchair propulsion with partial arm function may warrant use of various rim options to increase rim friction and maximize energy expended in propulsion.



**Figure 4.** Wheelchair propulsion for this individual is most efficient and effective by utilizing the lower extremities only. Appropriate height of the wheelchair seat from the floor can facilitate optimal wheelchair propulsion.



**Figure 5.** Propelling a wheelchair by use of one's upper and lower extremities, unilaterally, may be indicated. The height of the wheelchair seat is critical to the success of this function.



**Figure 6.**

Propelling a wheelchair up an incline for this individual may necessitate a wider base of support (anterior to posterior) through use of an amputee chair, posterior axle position, amputee adapter, or anti-tip bars for safety in function.



**Figure 8.**

Descending stairs utilizing a railing also indicates advanced wheelchair maneuverability on the part of the wheelchair user.



**Figure 7.**

Descending a moderate incline in a "wheelie" position indicates this user functions at an advanced level of wheelchair mobility. This skill is helpful in descending steep inclines, as well as negotiating uneven terrain.



**Figure 9.**

A particular transfer technique by the wheelchair user may necessitate recommendation of certain features to promote ease in the transfer, i.e., removable armrests, swing-away leg rests.



**Figure 10.**

Narrow passages within the home or work environment may limit the width of one's wheelchair, if the environment cannot be adjusted. This may require the choice of a non-cambered wheelchair.

the facility, and the entrance of the facility itself.\* To assure independent mobility the user's needs within the facility must be identified, with attention to the following considerations: **(Figures 10-11b)**

- floor surfaces;
- access to the classroom or work station (including examination of the tasks and physical access for performance of the tasks, such as design of the work station, shelf height, and access to needed texts, notepads, and utensils); and
- access to the restroom (including entrance-way and maneuverability within the restroom).

\**Editor's Note.* As part of the user's lifestyle evaluation, transportation to and from work, school, hospital outpatient treatment facility, the prescriber must consider fitting the wheelchair into community vans, city buses, metros, etc.

The environments of the wheelchair user's recreational, leisure, and sports activities also define criteria for determining wheelchair needs. The wheelchair selected must be equipped with the special features that will allow for the fullest possible participation in and enjoyment of such activities.

## RECOMMENDING THE WHEELCHAIR

The end product of the clinical assessment is an explicitly defined list of the user's needs that must be considered in developing the final wheelchair recommendation. Each need is considered separately, as well as in relation to all other needs. The clinician's next task is to contrast and match the identified needs of the user with manufacturers' lists of available wheelchairs and options, noting the applicability or nonapplicability of each type of chair. A comprehensive view of the total scope of needs, in light of the impact that each single need and option has on the total needs, provides the information necessary to making the best recommendation.

To illustrate this process, the individual needs of several hypothetical wheelchair users are analyzed below.

**CASE A:** Three needs have been identified by the clinician through the examination of a hypothetical individual's medical and personal profiles.

*Need #1:* The caregiver must lift the wheelchair into the trunk of the car when the family travels. For ease in transport of the wheelchair, the clinician has suggested the following options:

- (1) a lightweight wheelchair;
- (2) removable legrests;
- (3) a folding wheelchair;
- (4) a strap on the upholstery to assist in folding and lifting.

*Need #2:* For ease in dependent, manual mobility both indoors over carpet and outdoors over grass and gravel, the clinician has suggested the following options:

- (1) push handles;
- (2) pneumatic tires;
- (3) pneumatic casters.



**Figures 11a-11b.**

The height and depth of components in the work site may need to be adjusted to accommodate the use of a wheelchair.

*Need #3:* To assist the caregiver in dependent handling for transfers, the clinician has suggested the following options:

- (1) swing-away legrests;
- (2) brakes with a pull-to-lock mechanism;
- (3) removable armrests.

Individually and collectively, the options identified by the clinician support one another and are not in conflict. However, the case would change if a fourth need—such as the need to provide a frame for attaching a seating system—had been identified. Let us say that the clinician had suggested a standard wheelchair to accommodate this need. In this case, the options required to meet the fourth need and those to meet the first need would be in conflict. Attachment of a seating system is not compatible with a lightweight frame, and folding the wheelchair may become a problem, depending on the type of seating system required. Thus, priorities would have to

be reassessed and options reviewed in order to resolve this conflict. After user trial of the various features and options, the final recommendation is made.

**CASE B:** Four separate needs of another hypothetical wheelchair user have been identified.

*Need #1:* The user desires the appearance of a lightweight wheelchair. The clinician has provided a list of lightweight wheelchairs currently on the market.

*Need #2:* Standard-type armrests with side panels are required to prevent rubbing of the user's thighs on the tires. The clinician has provided a list of manufacturers offering standard-type armrests with side panels for lightweight chairs.

*Need #3:* The user performs independent tub transfers in a limited space using a front-on ap-

proach to the tub. Accessibility to the tub is necessary for safety in performance of this transfer. The clinician has recommended the following options:

- (1) removable legrests;
- (2) caster locks;
- (3) brakes;
- (4) standard-type armrests.

*Need #4:* To improve wheelchair propulsion efficiency by the user, the clinician has suggested the following options:

- (1) provide for an adjustable back height to 14 inches:
  - (a) adjustable back height,
  - (b) modular back height,
  - (c) custom back height.
- (2) utilize wheel position adjustability to optimize upper extremity position for propulsion;
- (3) select pneumatic tires because of the varying terrain encountered by the user.

Each separate need generates a list of the advantages and disadvantages of a possible option: first, in relationship to other options; and second, in relationship to all the other needs. In this case, *Need #4* identifies several wheelchair options to improve the user's propulsion effectiveness. Pros and cons exist for the various back height options. An advantage to the adjustable back is the range of heights the user can choose and install quickly and with minimal effort. But the disadvantage is the additional moving part required which may loosen with use. The modular back height system allows flexibility in back height but it may be more costly, and it allows only limited height options (i.e., 12, 14, 16, and 18-inch modular inserts). Use of the custom back height offers durability in the frame, yet no flexibility in back height and perhaps additional cost. Such pros and cons must be considered and weighed against the user's needs and preferences. In situations such as this, where multiple viable options to answer specific needs exist, user preference will determine the final selection.

In examining the needs in relationship to one another, *Need #1* and *Need #2* are compatible, although only certain manufacturers offer products that will meet both of these needs. Thus, the option list becomes more clearly defined based on this information.

Again, user trials in the chair (or caregiver, as indicated) are beneficial in validating the effectiveness and necessity of possible options to be included in the final wheelchair recommendation. For example, trial use of brakes with and without caster locks to optimize this wheelchair user's performance in an independent tub transfer indicated that caster locks were not necessary because the brakes provided the adequate stability and safety during the transfer. Thus, the option of caster locks could be eliminated from the final recommendation.

## MANUFACTURER/CLINICIAN CONCERNS

Ideally, wheelchair manufacturers should be aware of the functional requirements most often identified by users and clinicians. At present, many needs are not being met by available designs. Through improved communication, manufacturers could customize product designs and develop such options for the general market. On the other hand, in order for clinicians to adequately inform prospective wheelchair users, they must be familiar with the full range of wheelchairs and options, and remain up-to-date on the availability, serviceability, and performance of the equipment currently on the market. Information about equipment must be readily available to the clinician and the prospective user to ensure the optimal wheelchair selection.

## SUMMARY

The list of individualized needs of the wheelchair user as developed by the medical and personal profile assessment can be categorized under the general goals to be accomplished through the process of the wheelchair recommendation:

### *Medical Profile*

#### Medical History:

- (1) Compensate for loss or absence of function.
- (2) Promote good health through prevention of problems.

#### Physical Assessment:

- (1) Maintain proper seating and posture of the individual in the wheelchair.

(2) Correct or accommodate for deformity through positioning in the wheelchair.

(a) home, vocational/educational, community and recreational settings, and  
(b) transportation of the wheelchair.

### *Personal Profile*

#### Social History/User Goals:

- (1) Minimize mobility limitations as they apply to educational, vocational, socialization, and recreational pursuits.
- (2) Minimize mobility limitations as they apply to communication.
- (3) Promote positive self-image.

#### Functional Abilities:

- (1) Optimize physical performance of wheelchair user for:
  - (a) wheelchair mobility, and
  - (b) transfers.
- (2) Assist family or caretaker in performance of:
  - (a) dependent mobility, and
  - (b) handling.
- (3) Provide means of dependent, manual mobility.

#### Environment:

Minimize the impact of the environment on mobility in:

### **CONCLUSION**

The goal of the clinician, working closely with the prospective wheelchair user, is to identify, through medical and personal profiles, the specific needs that serve as the foundation for the development of an appropriate wheelchair recommendation. The wheelchair recommendation is needs based: based on individual wheelchair user needs. The wheelchair designs and features that exist today have been developed to meet those needs. The task remains to match the wheelchair with the need.

### **ACKNOWLEDGMENTS**

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WHEELCHAIR USER PROFILE

Primary means of propulsion: manual \_\_\_\_\_ power \_\_\_\_\_

Purpose for wheelchair user: medically necessary \_\_\_\_\_  
educational \_\_\_\_\_  
vocational \_\_\_\_\_  
recreational \_\_\_\_\_  
long distance \_\_\_\_\_  
household \_\_\_\_\_  
community mobility \_\_\_\_\_  
other \_\_\_\_\_

Is a second chair used? yes \_\_\_\_\_ no \_\_\_\_\_

If yes, what is the purpose of the second chair?

medically necessary \_\_\_\_\_  
educational \_\_\_\_\_  
vocational \_\_\_\_\_  
recreational \_\_\_\_\_  
long distance \_\_\_\_\_  
household \_\_\_\_\_  
community mobility \_\_\_\_\_  
other \_\_\_\_\_

Describe present chair(s), including condition and length of time in present chair:

Primary wheelchair \_\_\_\_\_  
\_\_\_\_\_

Secondary wheelchair \_\_\_\_\_  
\_\_\_\_\_

Means of manual wheelchair propulsion: \_\_\_\_\_

WHEELCHAIR MOBILITY

	<u>Manual</u>			<u>Power</u>		
	<u>I*</u>	<u>D*</u>	<u>Comments</u>	<u>I*</u>	<u>D*</u>	<u>Comments</u>
Level Surface	_____	_____	_____	_____	_____	_____
Maneuverability in limited space	_____	_____	_____	_____	_____	_____
Uneven Terrain						
Carpet	_____	_____	_____	_____	_____	_____
Grass	_____	_____	_____	_____	_____	_____
Gravel	_____	_____	_____	_____	_____	_____
Inclines						
Standard						
Ascend	_____	_____	_____	_____	_____	_____
Descend	_____	_____	_____	_____	_____	_____
Greater than Standard						
Ascend	_____	_____	_____	_____	_____	_____
Descend	_____	_____	_____	_____	_____	_____
Curbs						
Doorsills	_____	_____	_____	_____	_____	_____
Two-inch	_____	_____	_____	_____	_____	_____
Four-inch	_____	_____	_____	_____	_____	_____
Six-inch	_____	_____	_____	_____	_____	_____
Stairs						
Descend	_____	_____	_____	_____	_____	_____
Able to instruct others in the negotiation of environmental obstacles						
Curbs	_____	_____	_____	_____	_____	_____
Inclines	_____	_____	_____	_____	_____	_____
Stairs	_____	_____	_____	_____	_____	_____

\*I: Independent  
\*D: Dependent

TRANSFERS

	<u>I*</u>	<u>D*</u>	<u>Comments**</u>
Bed			
Level Surface			
Uneven Surface			
Car			
Truck/Van			
Loading Wheelchair			
Car			
Truck/Van			
Tub			
Shower/Commode Chair			
Commode			
Wheelchair to and from sofa			
Wheelchair to and from floor			

\*I: Independent

\*D: Dependent

\*\*Include specific requirements for successful accomplishment of the transfer relative to the wheelchair requirements, e.g., chair must be folded to a maximum rim to rim width of 13" to fit behind the driver's car seat.