



RESNA Wheelchair Service Provision Guide

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Approved by RESNA Board of Directors 1/26/11

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According to the U.S. Census Bureau's Survey of Income and Program Participation (SIPP) an estimated 2.8 million Americans residing outside of institutions utilize wheelchairs as an assistive technology device for mobility impairments (LaPlante & Kaye, 2010). For these individuals, wheeled mobility devices are considered one of the most important Assistive Technology (AT) Devices (Kirby, et al., 2002).

Experts in the AT community have recommended the development of a standard of practice for wheelchair assessment to aid clinicians in the provision of wheelchairs (Cohen, 2007; Geyer, et al., 2003; Finalyson & Hammell, 2003; Mills, Holm, & Schmeler, 2007; Scherer & Glueckauf, 2005; Sprigle, Cohen, & Davis, 2007). Availability of advanced wheelchair technology, inconsistent reimbursement regulations, demands for evidence-based practice, diagnosis and disability specific issues, users' personal preferences (Mortenson & Miller, 2008) and appropriate referrals and funding for the recommended devices (Carey, DelSordo, Goldman, 2004) all influence the wheelchair procurement process.

Prescribing an appropriate mobility device for a client requires the professionals involved to remain current and informed regarding technological advances, to balance reimbursement and productivity management issues, and to accurately assess their client's needs and goals. Wheelchair prescription is complex and involves the intersection of three variables: the wheelchair user, the wheelchair technology, and the environment or context of the user (Batavia, Batavia & Friedman, 2001). The final choice of wheelchair and seating system often involves a compromise between meeting the client's goals, environmental and reimbursement constraints, and the best choice of technology (Lenker & Paquet, 2003).

AT devices facilitate quality of life (Devitt, Chau, & Jutai, 2003) and psychosocial and functional health. Given the known benefits and associated costs of wheeled mobility and seating, it is critical that people with mobility impairments be provided with the most appropriate equipment to meet their specific needs. Consumers have reported that poorly fitted devices have resulted in unnecessary expenses, duplication of effort, injury, and abandonment of the wheelchair (Batavia, Batavia, & Friedman, 2001). Inappropriate devices, a lack of access to trained personnel, a poor assessment, current reimbursement policies and an untutored assistive technology preference can negatively affect one's health (Day & Jutai, 1996; Day, Jutai & Campbell, 2002; Scherer & Glueckauf, 2005). Therefore, evaluation strategies should reflect the individual's priorities and preferences, physical and functional needs, knowledge of product features that will meet those needs, physical and social environments, and related issues (Johann, & Shea, 2004; Scherer & Cushman, 2001).

PURPOSE

The purpose of the Wheelchair Service Provision Guide is to provide an appropriate framework for identifying the essential steps in the provision of a wheelchair. It is designed for use by all participants in the provision process including consumers, family members, caregivers, social service and health care professionals, suppliers, manufacturers, funding source personnel and policy makers. This Guide does not specifically address requirements associated with any particular funding source. It provides guidance regarding when funding issues should be addressed in the process, and how to address them with the client, so that he or she is able to make informed decisions.

For the purpose of this document, the following terminology will be used. The “wheelchair” is an assistive technology device used to assist an individual with his/her mobility needs. It is inclusive of all wheeled mobility devices including manual and powered wheelchairs, strollers, and powered scooters. The terms “seating” and “seating system” refer to the seat and back components on a wheelchair that facilitate postural support, function and skin integrity. The term “positioning components” refers to the parts of the seating system that are added to the seat and back support to facilitate increased postural support, alignment, pressure distribution, and safety. The term “supplier” refers to the professional employed by the company who sells and services the wheelchair. In some service delivery models, the supplier may also be the manufacturer. The term “therapist” refers to an individual who is employed by an organization such as a school, hospital, or home health agency to independently evaluate and address a client’s functional mobility needs throughout the wheelchair service provision process. Lastly, the consumer/patient will be referred to as the “client”. Due to age, or cognitive or communication issues, some clients may be unable to articulate their needs. In these situations, the “client” will be inclusive of a caregiver and/or family member.

Terminology from the International Classification of Functioning, Disability, and Health (ICF) model is used throughout this Guide due to its increasing recognition, acceptance, and use amongst health care professions (WHO, 2002). The ICF model provides a framework (e.g. terminology, concepts) for incorporating the individual, the activity, the technology and the environment into the service provision process.

The concept of Evidence Based Practice (EBP), employed throughout this guide, entails applying external evidence (e.g. scientific studies) and prior knowledge and experience to the specific requirements of the individual client (Rappolt, 2003; Sackett, Richardson, Rosenberg & Haynes, 1997). This practice involves supporting clinical decision making by identifying the practices, processes, strategies and technologies that lead to optimal outcomes. The use of peer reviewed research serves to guide practice more than opinion, leading to reduced cost, greater efficiency and more functional outcomes. EBP is thus employed in this guide to help ensure that the recommendations are supported by the best available evidence provided in the literature.

WHEELCHAIR SERVICE PROVISION PROCESS

The wheelchair service provision process is not simply assessment followed by prescription; rather, providing a client with an appropriate wheelchair requires a full spectrum of services. The wheelchair service delivery model described below includes the following components: Referral, Assessment, Equipment Recommendation and Selection, Funding and Procurement, Product Preparation, Fitting, Training and Delivery, Follow-up Maintenance and Repair, and Outcome Measurement.

REFERRAL

A wheelchair evaluation is necessary when a current wheelchair no longer meets a client’s needs, when a current wheelchair is beyond repair, when a client is unable to ambulate, or when there is concern about his/her ability to ambulate safely or functionally.

Identification of Need

An established screening process is necessary for all wheelchair service delivery models. This process will include a method of identifying the potential needs of the client to ensure appropriate scheduling for the wheeled mobility service. This screening process should include basic demographic information and an initial determination of the complexity of the client's need in order to identify and recommend the appropriate referral pathway.

“Referral” to Qualified Professionals

Clients who require a wheelchair and/or seating system on a long-term (more than 6 months) or permanent basis should be referred to a therapist and supplier who collaborate toward a common goal. Both the therapist and the supplier should be skilled, qualified professionals with specific training and experience in seating and mobility. The participation of both the therapist and the supplier is critical, as they possess different and complementary skill sets. In addition, the involvement of both team members removes the potential for a conflict of interest between the professionals making the recommendations and the professionals selling the wheelchair and/or seating system.

ASSESSMENT

A wheelchair assessment consists of multiple components. The order in which these components are addressed will depend on the nature of the client's needs and the specific service delivery setting. The assessment is arranged into three broad categories reflecting the domains and classification structure of the ICF: Body Structure and Functions; Activities and Participation; and Environment and Current Technology. Within each of these domains, a number of items should be explored with the client. Depending on the clinical judgment of the professionals and the complexity of client needs (e.g. diagnosis, prognosis, and environmental considerations), some domains may require additional assessment while other domains may require only a screening and no further exploration.

The assessment should begin by addressing the reason for the referral and the desired outcome of the intervention. At a minimum this should include the client's primary problems/issues related to his/her mobility status, postural support, health, safety, and ability to function within the environment. Assessment should also include the treatment strategies previously used to address the mobility impairments and the outcomes of that intervention. For the service provision team, understanding the client's articulated goals and expectations is a fundamental outcome of the assessment.

A close relationship exists between the wheelchair features/components and a client's functional ability and safety while using the wheelchair. The type of wheelchair and frame design, individual wheelchair options, seating and positioning components, and the overall configuration have a direct influence on a client's independence, comfort, and safety in different environments and settings of anticipated use. The professional should remain aware of this throughout the assessment process.

Current Technology and the Environment

This section of the assessment serves to identify any problems specific to the assistive technology device currently used by the client to facilitate mobility within the environment(s) of use. Such devices include canes, walkers, scooters, manual wheelchairs and power

wheelchairs. Through this assessment, important issues relative to environmental context can be identified, which are then taken into consideration during new equipment recommendation and selection.

Current Technology Used for Mobility

Current mobility technology should include a list all of the mobility devices currently and previously used by the client, along with the device manufacturer, make, and model for any products currently in use. The age and condition of the devices should be noted including specific features, dimensions, safety and reliability of the wheelchair, as well as options, accessories, seating system and positioning components. Particular attention should be given to the set-up of the client's current equipment and its components. When a client has been using equipment long-term, he or she may adapt to the configuration of the equipment and seemingly small changes in equipment can result in significant functional changes for the client.

All issues or limitations of the current wheelchair experienced by the client, including seating and positioning components, should be documented. In addition, the use of other assistive technologies, especially those used in conjunction with the wheelchair, should be documented (e.g. an augmentative and alternative communication device).

Environments of Use

Consideration of the various environments in which the equipment will be used is a critical step in identifying wheelchairs that will potentially meet the individual client's needs. In addition to collecting information regarding the client's home, school, work and other community environments, the client's transportation requirements, characteristics of indoor/outdoor terrain, and typical weather conditions should also be addressed.

At minimum, an environmental assessment should include:

1. Ability to enter/exit settings of routine use
2. Ability to maneuver within the current /anticipated environments
3. Ability to reach and/or access all items, furnishings, and surfaces necessary to carry out daily activities.
4. Ability to transfer to/from the wheelchair
5. Ability to use personal or public transportation

Family, Social Support and Caregivers

Many clients have a support system to assist them with activities of daily living. This may include assistance or performance of transfer into the wheelchair, positioning in the wheelchair, putting the physical components in place, and maintenance of the wheelchair and seating technology. It is important to ascertain a client's support system and its influence on successful outcomes with the wheelchair and seating system technology.

Attitudes towards Disability and Technology

People who use wheelchairs are more likely to abandon products when they are not active participants in the selection process (Kittel, DiMarco, & Stewart, 2002). When a user abandons a product, this demonstrates a failure in the provision process. It is important to consider clients' and caregivers' attitudes towards disability and assistive technology, their

tolerance for change, and their ability to support complex devices in order to facilitate acceptance of the wheelchair and seating system technology.

Activity and Participation

The client's functional abilities should be assessed with regard to his or her current and desired level of activity and participation in basic activities of daily living (ADLs) and instrumental activities of daily living (IADLs). ADLS include eating, grooming, dressing, bathing, toileting, transferring, communicating and engaging in sexual activity. In addition, ADLS extends to the ability to position or re-position oneself in the wheelchair, inspect ones skin, and perform a pressure relief technique. IADLs include safety procedures and emergency response, telephone use, parenting, directing caregivers, caring for service animals, house cleaning, laundry, meal preparation, use of transportation and community mobility for school/work, shopping, banking, socializing, and recreation.

An understanding of the client's assistive technology use/needs, how daily activities are performed, and their relationship to the wheelchair and seating technology is critical to ensure that the wheelchair design and components facilitate maximum functional ability. For example, it may be important for the client to be able to store personal items on the wheelchair for independent access. These items could include a feeding utensil, catheterization supplies, medications, or a laptop computer.

Functional mobility needs should be assessed with particular attention to the movement pattern/technique used to control the ambulatory device or wheelchair, assistance needed for mobility, and types of terrain encountered. Functional mobility includes potential for ambulation with or without an assistive device, manual wheelchair propulsion patterns or safe operating techniques for powered mobility.

Body Functions and Structures

According to the ICF, body functions are the physiological and psychological functions of body systems, whereas impairments are problems in body function as a result of significant deviation or loss (WHO, 2002). When performing a wheelchair assessment, it is important to consider both body functions and impairments. The evaluation should include consideration of anatomical alignment, postural control (sitting balance), skin integrity, the neuromuscular system (strength, range of motion, tone, co-ordination and sensation), vision, cognition, speech and language, as well as the cardiovascular, respiratory, digestive and urinary systems. When an initial screening reveals an abnormality or impairment, further physical assessment is warranted as it relates to wheelchair positioning and operation. It should be noted that this further assessment may include referral to other professionals prior to completion of the evaluation, such as a referral to the client's physician for spasticity management.

The following aspects of body function and structures should be assessed.

- The neuromuscular system including muscle strength, gross and fine motor control and coordination, muscle tone and spasticity, and sitting and standing balance.
- Range of motion and flexibility of the full body including the pelvis, hips, knees, ankles and spine, and the presence of skeletal alignment/deformity such as a flexible postural scoliosis.
- Current and past skin integrity issues such as persistent redness, pressure ulcers, open areas, or scar tissue.
- Current mobility skills, including client's ability to functionally ambulate, propel a manual wheelchair and/or operate a power wheelchair. These skills include such factors as

independence, safety, timeliness, quality of the client's ability as related to his or her daily activities, and his or her ability to move safely and efficiently through the environment. Visual processing, cognitive awareness of the environment, and motor control should also be taken into account.

- Each client's need for accommodation of other devices or strategies to meet basic functional needs, such as mounting an alternative augmentative communication device or providing a component that would provide the client with the ability to self-catheterize.

A client's medical status and history needs to be identified and should include:

1. Primary diagnosis and prognosis
2. Past medical history, secondary diagnoses, and co-morbid conditions
3. Past surgical history on all body systems that would affect mobility or seating
4. Future surgical/medical/therapeutic intervention planned or being considered
5. Whether appropriate rehabilitative measures have been attempted
6. Medications and allergies

EQUIPMENT RECOMMENDATION AND SELECTION

The information gathered from the assessment process should be used to generate a list of the client's functional requirements, and accordingly, a list of seating and mobility goals. Products that have the desired capabilities/features to address these goals are then discussed and reviewed as options. After reviewing the possible product options, a product trial should be arranged for the client to determine whether the product meets the client's needs and to assist him/her in selecting the final product.

If a product is readily available, a trial may occur during the assessment session itself. In many cases, separate sessions in the clinic or in other environments will be needed. This will be dependent on the complexity of the client's needs and consideration of specific environments of use.

The recommendation, trial and selection process should be an educational experience for the client/caregiver(s) to assist them in making informed decisions. The process should include a discussion of options, including the range of products available to meet the client/caregivers' specific needs and goal(s).

In accordance with EBP, it is important to use an objective set of measures to select and evaluate the wheelchair and seating technology that may best meet a client's seating and mobility goals. Ultimately, these measures can be used to determine the success of the outcome of the chosen technology intervention. These objective measures should identify and quantify problem areas at baseline and at re-evaluation and may include digital photography, skills performance (transfers and/or propulsion), propulsion analyses and pressure analyses. Assessments may also be used to compare and contrast wheelchairs, seat cushions, back supports, positioning components, or to compare control systems for powered wheelchairs regarding comfort, safety and client acceptance of use.

The results of the evaluations should be used to establish priorities based on the client's needs, goals and activities. For example, when choosing the seat to floor height of a wheelchair seating system, priorities may be set by a consideration of surface height for ADL participation versus wheel access. These options and the subsequent compromises they entail should be included in the documentation.

Clients should be made aware of the full range of options available, which may include items that are not routinely covered by the client's own funding support. The goal of the recommendation process is to assist the client in determining the equipment that will best meet his/her needs and goals. The recommendations should be made based on this objective, and any compromises based on funding limitations or stipulations should be discussed with the client and documented as an addendum to the initial recommendations. Whenever possible, the client should be given the information needed to make personal resource allocation decisions.

Equipment Trial/Equipment Simulation

When feasible, it is helpful for a client to have an opportunity to use the wheelchair for a short period of time to determine if it meets his or her mobility needs in the various environments he/she needs to function. This is especially important for clients who are not familiar with the wheelchair technology and for those pursuing a power wheelchair for the first time. Training on safe use of the wheelchair may also be needed prior to a short term, natural environment trial. Mobility skills training in a controlled environment is important to improve the client's safety and independent functioning in the home, school, workplace and other environments (Kirby et al, 2004, Best, Kirby, Smith & MacLeod, 2005, & Kirby, Smith, Seaman, MacLeod & Monroe, 2006). Once a client demonstrates the potential for safe mobility using the trial device, a recommendation can be made and additional training can be scheduled to maximize his/her abilities.

When possible, it is important for a client to trial the seating system products to ensure that they also meet his/her needs. If these products are not available, or if a client has very complex needs, seating simulation is essential. Seating simulation refers to the process of "mocking up" the desired seated posture in order to confirm and delineate the seating technology and features required to address the client's postural/movement objectives. This can be done on a seating simulator or in a "trial" wheelchair.

Client Funding Education and Exploration

It is important to assist the client in obtaining the optimal equipment recommended to meet his/her medical and functional goals. To that end, the team must address all aspects of client-specific funding resources, including coverage criteria, benefit requirements and limitations. When coverage is limited, the team should discuss additional available funding resources with the client, such as personal resources for private payment, state/federal agencies, religious institutions, philanthropic and non-profit organizations, and community service organizations. This is important to assist the client in obtaining the optimal equipment recommended to meet his or her medical and functional goals. It is also important to address the client's priorities and assist him or her in making any necessary product compromises/decisions due to funding parameters. Some products have unique features that may provide benefits that other products do not offer. Discussions with the client may then include identifying components or features that can be added later if funding becomes available as well as reviewing items that are inherent components of the wheelchair system and cannot be added later.

Documentation

Documentation should be client-specific and refer to the client's identified problems and goals, providing a clear account of the client's physical, functional, and environmental needs. Documentation should also include limitations of any equipment currently used by the client, the intended goals of the new wheelchair and seating technology, the recommendations made based on the assessment, and the rationale for those recommendations.

Outcome measures are necessary in order to compare seating and mobility technology (existing versus recommended) at the individual level, and to evaluate the effectiveness of the overall service delivery structure and process (Cook & Polgar, 2008). Outcome measures may also be documented to demonstrate the efficacy of the recommended equipment. Example instruments include pain scales, respiratory function measures, functional performance measures, user satisfaction measures, and quality-of-life measures. Functional performance measures include, but are not limited to, distance propelled in a fixed time, stroke/push frequency, velocity of propulsion, speed of propulsion, peak force generated, efficiency of propulsion, and accuracy (Cowan, Boninger, Sawatky, Masoyer, & Cooper, 2007; Kirby, 2007; Cooper, 2009; Mills, Holm, & Schmeler, 2007). Surveys are typically utilized to measure user satisfaction and quality-of-life (Day, Jutai, Campbell, 2002; Demers, Weiss-Lambrou, Ska, 2000; Mortenson, Miller, & Auger, 2008). Other evidence-based information such as before and after photographs or video may also be instrumental in illustrating the need for seating/positioning interventions. Outcome measures play a critical role, providing baseline information to document changes in the individual that would necessitate changes to the wheelchair and seating system.

When specific products, features or upgrades are recommended, and are to be purchased by a third party payer, the documentation must indicate why other less-expensive or standard options would not meet the client's needs. Documentation should briefly describe the products that were evaluated and failed to meet the client's needs/goals as well as products that were considered and ruled out. It is important to provide specific, detailed information on the clinical rationale for the selected product(s) and components.

FUNDING AND PROCUREMENT

Pre-Determination

In an effort to ensure success with a funding source in obtaining the wheelchair and all needed components, it is imperative that all coverage criteria, policies and protocols of the funding source are followed. When appropriate to the service provision process, the supplier should submit the client's information for prescreen, pre-certification, pre-determination and/or prior authorization from the funding source(s). The supplier should submit the specific documentation to meet all funding source requirements in order to maximize the likelihood of obtaining authorization.

When there is a funding source limitation on the wheelchair or components, any exclusions or restrictions should be discussed with the client. Any adverse decision made by the funding source should be discussed with the client and an appeal strategy should be developed. If there are any changes in the funding expectations, the client should be immediately notified.

Ordering and Receiving Equipment

The supplier should follow the manufacturer requirements for ordering all necessary components of the wheelchair and seating system. Quotes should be reviewed for specific product accuracy, completeness and compatibility with all of the components included in the seating/mobility system. Upon receipt, the supplier should inspect all equipment to confirm accuracy, completeness, quantity and quality of all items so that any discrepancies can be dealt with in a timely manner.

PRODUCT PREPARATION

Once equipment is received, the wheelchair base/frame, options, accessories, and seating and positioning components should be assembled and set-up according to the preliminary specifications detailed in the recommendation and selection process. This includes fabrication and installation of custom items and assessment of the function and operation of all mechanical and electronic components. An initial set up of electronic parameters, based on the client's functional skills and abilities, should be performed if specialty power wheelchair controls have been recommended.

FITTING, TRAINING AND DELIVERY

Fitting

The fitting involves the adjustment of the mechanical components of the wheelchair and seating components to optimize the client's function, comfort and safety. The evaluation team should be present during the final fitting of the client with the wheelchair. Quantitative measures should be used to provide documentation of the training and follow-up services required after the fitting.

For powered wheelchairs, mechanical and electronic adjustments should be made to maximize the client's control in order to ensure safe operation of the wheelchair. In addition, the fitting may involve the adjustment of other components and devices such as positioning components for the feet, arms, trunk and/or head, upper extremity support surfaces (lap trays), or communication devices. The extent of the fitting and adjustment is dependent upon the complexity of the client's needs and the parameters of the seating and wheeled mobility device. It may be necessary to make seating adjustments incrementally over time to increase tolerance, to allow the client to adjust to these changes, and to ensure safe and appropriate management of the equipment.

Training and Delivery

Training involves client education regarding safe use of the equipment in accordance with seating and mobility goals. The amount of training will depend upon the capacity of the client/caregivers for learning, the complexity of the client's needs, and the complexity of wheelchair and seating system. Training should include the following:

1. Instruction in power or manual wheelchair mobility skills to optimize function and safety.
2. Education regarding the set-up of the seating system including the specific postural support features and their impact on skin integrity, posture, function and overall health.

3. Education regarding wheelchair parts management (e.g. removal and attachment of components), and care (proper charging, applying and disconnecting wheel locks) to insure maximum safety and positive long-term outcomes.
4. Education regarding maintenance, follow-up, repair, and available resources including the funding coverage.
5. Education and training specific to the integration of the wheelchair into the client's lifestyle. This may include techniques for travel in accordance with known standards for wheelchair transportation (charging, folding, etc.), instruction in securing the wheelchair, occupant safety restraints when being transported in a motor vehicle, and safety (wheel lock and anti-tipper application).

Delivery includes a final check of the equipment, provision of necessary documentation (e.g. warranty, owner's manuals, contact information if a problem should arise), and the official transfer of the wheelchair into the client's responsibility.

FOLLOW-UP, MAINTENANCE AND REPAIR

As the client's needs and goals evolve, adjustments and further training may be required to ensure that the wheelchair continues to match the client's environment as well as his/her medical, physical and lifestyle needs. Follow-up is an ongoing process in which the wheelchair service provision team follows the client to monitor and reassess the client's Body Structure and Function, Activities and Participation, and the Environment and Current Technology. Initial follow-up may include additional training for the client to demonstrate safe competence in wheelchair and seating system use and maintenance. Specifically, follow-up may include training in high level manual wheelchair skills, modification of powered mobility performance parameters, or high-level maintenance training.

Follow-up should always occur if the client experiences changes due to weight gain/loss, growth, progression of the disability, improvement in motor or sensory status, onset of a new medical condition, or difficulties integrating the wheelchair into new environments. The client, caregiver or any other member of the wheelchair provision team can initiate the follow-up process. The evaluation team should determine the follow-up plan and schedule upon delivery of the wheelchair.

Maintenance and repair is necessary to keep the wheelchair and seating system in safe, optimal working condition. It is important for the client to inspect the equipment often to correct a problem before it becomes an emergency. The client should perform or schedule maintenance at regular intervals based on the complexity of his/her needs and the equipment being used. This should include a check to ensure that the wheelchair and seating components still appropriately fit and to ensure that both mechanical and electronic components are functioning as intended. If this check indicates the need for modifications to the original equipment, a member of the original evaluation team should be notified for follow-up. If not, a technician in the repair shop can specify replacement parts that are necessary.

OUTCOME MEASUREMENT

Outcomes should be established and measured at various points throughout the wheelchair service delivery process. At minimum, a baseline should be measured prior to any intervention and following the delivery of a device. Outcomes can be established for both the

equipment and the provision of service. Several variables can be measured including: client satisfaction with his/ her ability to perform tasks; ease, efficiency and speed of mobility; postural alignment; pressure distribution; sitting tolerance; and physiological abilities such as breathing, swallowing, digestion or comfort/sitting tolerance.

Standardized and validated measures should be used whenever possible to allow comparison of identified variables before, during and after the process. Standardized tools also allow for comparisons across clients, types of equipment, and various service delivery models.

Several standardized outcome tools related to wheeled mobility and seating exist. These range from simple, self-reported satisfaction questionnaires to more complex observational and/or self-report tools that require specific apparatuses. The choice of tool can also depend on the variable measured and the level of detail sought. Professionals involved in the provision of wheelchairs should apply outcome measures to raise the standard of practice, to support evidence-based practice, and to improve the level of accountability.

CONCLUSION

This Guide is intentionally broad and is not intended to replace clinical judgment related to specific client needs. The committee that developed the Guide represents the various stakeholders in the wheelchair service provision process. They developed the guide using a review of the literature and best practice concepts, as expressed by content experts. This document identifies the necessary steps for the provision of a wheelchair and ensures that all stakeholders understand the various components in high quality wheelchair service delivery, regardless of the setting or funding.

Case Examples

Case Example 1

REFERRAL

Bob is a 50-year-old man with a diagnosis of T8 American Spinal Injury Association (ASIA) A spinal cord injury (indicating a complete injury, with no movement or sensation below the middle of his chest). He is 30 years post injury and presents with several upper extremity repetitive strain injuries (RSIs) including pain in both shoulders, which limits his ability to propel his ultra-lightweight manual wheelchair. Due to his mobility problems and pain, Bob was referred by his primary care physician to the outpatient wheelchair clinic in a rehabilitation facility for a wheelchair assessment. He was seen by an interdisciplinary team that included a licensed therapist and supplier who have ready access to a physiatrist and rehabilitation engineer, all with experience and credentials in the assessment and provision of wheeled mobility and seating intervention.

ASSESSMENT

Body Structures and Function

Bob is 6' 1" tall and weighs 210 pounds. He presents with numerous RSIs throughout his upper extremities. Bob has had surgical release of both carpal tunnels and several courses of physical and occupational therapy for his upper extremity symptoms. Unfortunately, his symptom relief has been temporary due to his need to rely on his upper extremities for all

functional activities. Currently, his function is most limited by 6/10 shoulder pain and carpal tunnel symptoms, particularly numbness in the palms of his hands. At this time, Bob is not interested in additional surgery. Another concern is that over the past two years, Bob has presented with recurrent Stage I right ischial tuberosity pressure ulcers. Bob currently sits in his wheelchair with a collapsed trunk and scoliosis with the apex on the right side. A supine mat assessment was significant for flaccid muscle tone in his trunk and lower extremities, a 1” flexible right pelvic obliquity, a mild scoliosis with apex in his lower right thoracic spine, a left shoulder obliquity, and a right shoulder rotation. A seated mat assessment was significant for the above deformities to a more moderate level and poor dynamic sitting balance. Bob required maximum assistance from the therapist to sit upright against gravity with more neutral pelvic and trunk alignment. With trunk support, Bob has functional active range of motion in both upper extremities without pain. He has no muscle function or sensation below his level of injury and is therefore non-ambulatory. Bob presents with dependent edema in his lower extremities. He uses a suprapubic catheter for bladder management and has good success with an everyday bowel routine.

Activity

Using his ultra-lightweight wheelchair, Bob is independent with his lighter activities of daily living (ADL) including feeding, hygiene, light meal preparation, and upper body dressing. He propels his manual wheelchair independently on flat indoor surfaces including tile, low pile carpet and thresholds using a semicircular propulsion pattern (long smooth stroke on the rim with recovery of the arm below the rim). Due to pain, he requires moderate assistance from his caregivers for transfers, lower body bathing and dressing, and instrumental ADLs such as laundry, house cleaning, and shopping. Bob’s shoulder pain is exacerbated by performing a “push up” pressure relief technique, reaching activities, transferring to/from his wheelchair, and propelling his wheelchair on surfaces with a high rolling resistance (e.g. carpet, grass), ramps and uneven surfaces.

Participation

Bob is a computer software engineer and works full time from a home office. He has a well-designed ergonomic computer and office equipment set-up. Bob conducts most meetings with his colleagues via teleconferencing. Due to pain, his participation in work and community activities has decreased from a full 16-hour day to a 9-hour day. He is exhausted from mobility and cannot participate in other functional activities on a weekday. This includes participation in meetings in his office and participation in leisure interests of computer gaming, hunting, and working as a disability advocate.

Activities and Participation

On a standardized, self-report satisfaction questionnaire, Bob reported that he only slightly agreed with his ability to perform necessary functions using his wheelchair. This was consistent with clinical observation; his chronic upper extremity pain limits his performance.

Environment

Bob lives with his wife and teenage daughter in a wheelchair accessible single family home with ramped entrances, wide doorways, a roll-in shower, and a kitchen with lowered

counters. The house is situated on a hillside in a semi-rural community with a long sloped concrete driveway.

Support and Caregiver

Bob's wife and daughter are his primary caregivers. He lives in the northeastern portion of the United States with four seasons, which necessitates the need to negotiate snow in the winter and to tolerate the heat in the summer. Outings into the local community, including shopping and visits with friends require the use of a personal vehicle. He has a full-sized van with a lift, which he is able to drive from his wheelchair using hand controls. In his van, he is restrained with an appropriate wheelchair transportation occupant restraint system.

Current Technology

Bob's current ultra-lightweight wheelchair is five years old as confirmed with the manufacturer serial number. It is in worn condition due to the age of the device and typical use. His wheelchair is optimally configured for manual propulsion with a forward axle position and he propels with an ideal semicircular stroke pattern. A propulsion analysis was performed with a force and moment measuring handrim (Cowan, Boninger, Sawatky, Masoyer, & Cooper, 2007). The analysis was performed with wheelchair propulsion on a flat tile surface, a carpet surface, and a ramp. The force, speed and stroke frequency data for all three environments revealed that his wheelchair was not safe or effective for functional manual propulsion. The pressure between his buttock and seat cushion was assessed using a pressure mapping system. This revealed that Bob's cushion provides adequate pressure distribution. However, the analysis also revealed that Bob is not able to adequately perform an independent weight shift due to pain in the upper extremities. Bob is at a significant risk of additional and recurrent pressure ulcers due to prolonged sitting, lack of sensation, and inability to perform a sufficient weight shift.

Client Goals

Bob reports the following as his goals:

1. Get around on uneven surfaces including mobility over outdoor terrain, without depending on others
2. Increase his ability to maneuver in his home without pain, including the ability to function within his home office
3. Be able to continue use of current van for transportation
4. Reduce upper extremity pain and be able to fall asleep after a full day of activity
5. Resolve pressure ulcer issues
6. Improve ability to transfer and reach surfaces
7. Increase his ability to function as he used to

EQUIPMENT RECOMMENDATION AND SELECTION

Discussion of Options

Following assessment, options were discussed with Bob that included further optimization of an ultra-lightweight manual wheelchair, pushrim activated power assist wheelchair, and power wheelchairs.

Equipment Trial

Bob tried each of these options in his clinic visit. Bob's ability to perform wheelchair related skills was documented using the Wheelchair Skills Test (Kirby, 2007). Due to pain with propulsion even with the "assist" products, he ruled out every option except the power wheelchair. Due to his upper extremity pain and subsequent inability to perform a sufficient pressure relief, recurrent pressure ulcers, and lower extremity edema, Bob was further educated and trained in pros/cons of various power seating products including tilt in space, recline, elevating legrests, and seat elevation. Due to Bob's postural impairments and pressure ulcer history, back supports with increased pelvic and lateral trunk support and various pressure re-distributing cushions were trialed with a combination of some postural correction and some postural accommodation with overall excellent pressure re-distribution. After careful consideration of power wheelchair base and seating system options, Bob demonstrated a good understanding of the pros and cons of the individual options. Bob decided that he would benefit from a power wheelchair that would accommodate most of the above components. He was given an opportunity to try various configurations (rear, mid and front wheel) of power wheelchairs equipped with these features. He was able to operate each model safely and effectively both in the clinic and his home. The specific base model he chose provided him with a combination of good outdoor performance and maximum maneuverability in his home, work, and van. The power seating system decided upon included tilt, recline, a contoured back support to minimize his scoliosis, and a pressure distributing cushion with a right hip guide for correction of his pelvic obliquity and more symmetrical pressure distribution. Bob also reported less upper extremity pain with transfers when he adjusted the seat height on the wheelchair. In addition, to eliminate several transfers a day, the plan is for Bob to modify his van to drive from his new power wheelchair. The wheelchair team will work with the certified van modifier regarding the docking system, to insure the seat to floor height is appropriate for driving and to insure that the armrest style can properly accommodate the lap shoulder occupant safety belt.

Justification

Bob requires a power wheelchair for functional mobility because he can no longer propel an optimally configured manual wheelchair including a geared or power assist system, in all of his routine environments without causing upper extremity pain and limitation of function. Bob can no longer perform effective pressure relief or re-position himself with good alignment in his wheelchair due to upper extremity pain. According to the interface pressure mapping results, he was unable to obtain sufficient pressure re-distribution with the tilt in space or power recline seat functions individually. As a result, Bob requires a powered seating system with both tilt in space and recline to optimize pressure redistribution and postural re-positioning. In conjunction with the tilt and recline, he requires power elevating legrests to elevate his feet above his heart level to effectively manage his lower extremity edema. A power seat elevator is necessary to raise Bob's body up in space to reduce upper extremity strain with transfers from his wheelchair and reaching activities. The medical justification for these seat functions is consistent with the RESNA Position Papers on these seat function interventions (Diciano et al., 2009). These seat functions will also reduce upper extremity strain per the Paralyzed Veterans of America Guidelines for upper limb preservation following spinal cord injury (Boninger, et al., 2005). The contoured back support is essential to provide sufficient lateral contour to maximize his postural alignment and minimize his tendency for a

scoliosis and other secondary complications. The pressure distributing seat cushion with a right lateral hip guide is essential to “correct” his pelvic obliquity and maximize his pressure distribution to minimize his significant risk of additional or recurrent pressure ulcers.

FUNDING AND PROCUREMENT

Following education by the therapist and the supplier, Bob demonstrated a good understanding of the specific documentation process his insurance company required. The supplier submitted all documentation for authorization and the wheelchair was “approved”. The supplier reviewed all the quotes and ordered the wheelchair. When the wheelchair came in, the supplier insured all components were received as specified.

PRODUCT PREPARATION

The supplier configured the wheelchair and seating system to the preliminary specifications the team decided upon.

FITTING, TRAINING AND DELIVERY

Bob was seen by the clinical team for fitting and delivery of his new mobility assistive equipment. He was transferred into the new device and adjustments were made to optimize his support, function and performance. This included adjustment to the armrest height, legrest length, back support angle, headrest, and distribution of pressure on his seat cushion. Following adjustment of the joystick drive parameters, he was able to safely and effectively perform basic wheelchair skills.

He and his caregivers were trained in the care and maintenance of the device including proper positioning in the seating system, use of the seat functions, and charge of the batteries. He was advised to contact the supplier for more involved electronic or mechanical issues and the clinic if he encountered any postural, pressure or functional issues with use of the device.

Bob agreed to return for power mobility skills training to learn full control and maneuverability with this wheelchair to negotiate environments that he typically encounters in his home, work and community environments. Following mobility skills training, his ability to perform relevant skills was documented via the Wheelchair Skills Test (Kirby, 2007).

FOLLOW-UP MAINTENANCE AND DELIVERY

Bob will perform all basic care and maintenance as he was trained by the supplier and therapist. As needed, he will initiate maintenance with the supplier for replacement parts. Bob and the supplier will refer any issues beyond routine maintenance to the clinical team.

OUTCOME MEASUREMENT

One month after the delivery of the new wheelchair, a member of the clinical team contacted Bob to re-administer the self-report satisfaction questionnaire based on his new wheelchair. With the new wheelchair, Bob reported a greater satisfaction with his ability to function. He reported that he can now function for a full 16 hour day which includes full-time work and meeting his parenting responsibilities including attendance at school meetings and his daughter’s softball games.

The questionnaire is administered on an ongoing basis by any member of the clinical team upon any encounter with Bob to identify any issues and to provide customization of the

mobility device to meet his changing needs. The questionnaire also provided feedback on the effectiveness of the overall service delivery program.

Case Example 2

REFERRAL

Susie is a 15-year-old with a diagnosis of spastic quadriplegic cerebral palsy. She has used a wheelchair for all functional mobility throughout her life. She was referred by a physiatrist in the community for an evaluation of a new manual wheelchair. The interdisciplinary team present included a licensed therapist and a supplier.

ASSESSMENT

Body Structures and Function

Susie is 5'4" and weighs 130 pounds. She has had hamstrings and Achilles' tendon lengthening surgeries and an adductor tenotomy in the past. Susie takes anti-spasticity medication regularly.

She has normal strength in her upper extremities but she has mildly impaired gross and moderately impaired fine motor coordination. Her lower limb strength is graded at a poor level and she presents with increased tone in both legs.

A mat assessment in supine was significant for a right hip subluxation and bilateral hamstring tightness. In sitting, her hamstring tightness causes her to sit with a posterior pelvic tilt, and her right hip subluxation results in a right pelvic obliquity. She can sit with a more neutral pelvic tilt when her knees are flexed to 95 degrees. She has good trunk control but fatigues over time. Susie has no history of skin problems.

Activity

Susie currently propels her lightweight wheelchair independently at home and for short distances at school and in the community. She propels using an inefficient arc pattern (short quick strokes on the front of the rim only). Susie requires assistance for propelling functional distances. At a wheelchair level, with set up, assistive devices, and compensatory techniques, Susie is independent with feeding, grooming, and toileting at home. She transfers independently to level surfaces using a lateral scoot technique. When she needs to transfer to high surfaces and uneven surfaces such as her bath chair, she requires minimum assistance. Susie also requires minimal assistance with bathing on her padded bath chair and with fine motor dressing activities including tying her shoes. She can retrieve most food from her refrigerator but cannot reach her freezer.

Participation

Susie is in 9th grade and is transported to school in a school bus. She attends regular classes except physical education, which is modified. Susie wants to participate in adapted sports but her current wheelchair is too wide and cumbersome for her to be able to play sports.

Environment

Susie lives in a first floor apartment that is accessible for her wheelchair. Her parents have a sport utility vehicle for transportation.

Support and Caregiver

Susie lives with her parents and her brothers. She is very motivated to be more independent with her ADLs without assistance from her family.

Current Technology

Susie's current lightweight wheelchair is five years old as confirmed with the manufacturer serial number. The wheelchair is a folding frame lightweight wheelchair with a planar back, planar foam cushion, lateral trunk supports, lateral pelvic supports, flip-down headrest, padded anterior pelvic support, anterior trunk support, multi-axial footplates with foot straps and heel loops.

This wheelchair is no longer appropriate for her, as she has grown beyond the current seat depth; the frame of the chair is too short and it cannot be grown any larger to fit her properly. In addition, due to increased independent sitting balance, which has been acquired through therapy and maturity, she no longer requires the maximum support that her current seating system provides. The wheelchair design along with the seating system and positioning components make the chair very heavy and difficult to propel.

Client/Family Goals

1. Be seen as a normal kid
1. Propel as independently as possible at home, school, and in the community
2. Improve independent transfers
4. Participate in sports

EQUIPMENT RECOMMENDATION AND SELECTION

Discussion of Options

Following the assessment, product options were discussed with Susie and her parents that included a back supports, cushions, and rigid and a folding ultra-lightweight manual wheelchairs with an adjustable axle position and various wheelchair seat angles.

Equipment Trial

Susie tried various equipment options with properly configured ultra-lightweight wheelchairs. A rigid wheelchair was chosen over a folding wheelchair due to the ability meet her lower extremity positioning needs and because it was more energy efficient for Susie to propel due to the lighter weight and design of the frame with less moving parts. The wheelchair was configured with the push wheel moved as far forward as possible without having the front casters lift off the ground when Susie takes a "start up" push. Susie demonstrated the best results with a more forward wheel position, an ergonomic handrim, a tight wheelchair footrest angle, a rigid contoured back and a foam cushion. With the angle adjustable footplate and tighter footrest angle on the rigid wheelchair, Susie's lower extremities were positioned at 95 degrees of knee flexion to accommodate her hamstring tightness. With this accommodation, the seat slope with adjustable axle, the contour of the back support for midline guidance, and a foam cushion with a build up under her right buttocks to support her right hip subluxation, Susie demonstrated increased pelvic alignment to neutral and good postural support, sitting balance, and wheel access. In addition, with lighter weight of the ultra-light wheelchair and rigid frame, Susie demonstrated increased efficiency with propulsion. Susie remarked that this wheelchair was so much easier to propel.

Justification

Susie requires an optimally configured ultra-lightweight wheelchair with contoured seating for increased postural support, alignment, and maximum independence with functional mobility at home and in the community. She requires the adjustability of the axle so that the center of gravity can be placed in the correct location for optimal sitting balance, stability, and safe and efficient mobility. The weight of the wheelchair and the seating system needs to be as light as possible due to her decreased coordination and her decreased ability to propel long distances.

FUNDING AND PROCUREMENT

Following education by the therapist and the supplier, Susie and her parents demonstrated a good understanding of the specific documentation process her insurance company required. The supplier submitted all documentation for authorization and the wheelchair was “approved”. The supplier reviewed all the quotes and ordered the wheelchair. When the wheelchair came in, the supplier insured all components were received as specified.

PRODUCT PREPARATION

The supplier configured the wheelchair and seating system to the preliminary specifications the team decided upon.

FITTING, TRAINING AND DELIVERY

Susie’s wheelchair was delivered to her at the wheelchair clinic with the therapist and supplier present. Adjustments were made to the rear wheel position to place the center of gravity in the most optimal position, and the anti-tippers were placed downward in the activated position until mobility skills training can be completed in follow-up appointments. The back angle, back support height, seat cushion placement, footplate angle and footrest height were adjusted to support her body properly. Susie and her parents were trained how to dis-assemble the wheelchair for transportation and on full wheelchair and seating system parts management, care, and maintenance. They demonstrated a good understanding of how to dis-assemble a rigid wheelchair for car transport after Susie transfers to the vehicle seat with its build in safety during travel. For transportation on the school bus, Susie will transfer to the typical bus seat and the unoccupied wheelchair will be secured using the appropriate tie down straps.

Susie and her mother returned to the therapist for outpatient therapy visits for wheelchair mobility skills training. This included training with propulsion technique using a semicircular pattern, how to adjust her trunk position when going up and down ramps and curb cuts, how to lift the front casters off the ground, how to perform a “wheelie” for safe and independent curb negotiation, and assisted high curb and stair negotiation.

FOLLOW-UP MAINTENANCE AND REPAIR

Susie and her parents will perform all basic care and maintenance as they were trained by the supplier and therapist. As needed, they will initiate more involved maintenance or parts replacement with the supplier. Susie and her parents will refer any issues beyond routine maintenance to the clinical team.

OUTCOME

One month after delivery of the new wheelchair, a member of the clinical team contacted Susie and her parents to administer a self-report satisfaction questionnaire based on her new wheelchair. With the new wheelchair, they reported increased energy, increased self-esteem and greater satisfaction with her ability to transfer, mobilize herself, and participate in activities with her friends including socialization and sports.

Case Example 3**REFERRAL**

Linda is a 62-year-old female who has a right-sided hemiplegia as the result of an ischemic stroke that occurred 8 months ago. Upon discharge to home from a sub-acute rehabilitation facility, she received the wheelchair described below. Linda is being followed by home-health services. The home-health therapist and her physician requested that Linda be referred for a wheelchair and seating system evaluation because she is not independent with ambulation. Linda demonstrated the mental ability to self-propel a manual wheelchair, but is unable to functionally self-propel herself in her current chair and is not expected to reach a level of independence with additional therapeutic intervention.

ASSESSMENT**Body Structures and Function**

Linda is 5'4" and weighs 217 pounds. Her past medical history is significant for hypertension, peripheral vascular disease, diabetes, and renal insufficiency. On the left side of her body, Linda presents with normal strength, range of motion, tone, movement, coordination and sensation. On the right side of her body, Linda's passive range of motion is within functional limits with the exception of her shoulder, which is limited to 70 degrees of abduction and flexion. Her sensation is impaired for sharp/dull, light touch, and deep pressure. Prior to her stroke, Linda was right handed however, she now presents with spasticity, no active movement, impaired sensation, shoulder subluxation, and edema throughout the right side of her body. She is able to follow commands but has non-fluent expressive aphasia and difficulty communicating her needs to strangers. Linda's daughter functions as her mother's representative to clarify expressive communication.

A supine mat assessment was significant for a partially reducible thoracic kyphosis with decreased lumbar lordosis and forward head positioning. In sitting, the mat assessment was significant for a C-curve kyphoscoliosis with an apex at her right mid-thoracic spine, a posterior pelvic tilt with right pelvic obliquity and rotation, increased weight bearing under the right ischial tuberosity, left shoulder depression and forward head position. Linda has poor endurance, fair static sitting balance, and poor dynamic sitting balance, which limits her reach and participation in tasks. Linda was positioned in short sit with an open hip angle to accommodate her kyphosis, slight seat rearward orientation in space, moderate support at the posterior pelvis to decrease the posterior tilt and on both sides of her trunk and right side of her pelvis to reduce her scoliosis. With this moderate level of support Linda demonstrated the ability to sit upright with relatively neutral spinal-pelvic alignment. Additional support under her right elbow and forearm reduced the degree of shoulder subluxation.

Activities and Participation

Prior to the stroke, Linda was independent with all household and community activities and drove her car locally. Linda and her husband enjoy spending time with their children, grandchildren and friends. Linda sits in her wheelchair 6-8 hours a day. Her sitting tolerance is currently limited due to pain in the right shoulder and redness at the thoracic vertebral spinous processes, sacrum and right ischial tuberosity. She is unable to stand and ambulate due to her dense right hemiplegia. Despite training, due to her poor balance and endurance, Linda is dependent for all mobility in any manual wheelchair. Consequently, she requires maximum assistance to participate in all of her activities of daily living. Due to her dependence with mobility, Linda is now unable to participate in activities with her friends and family and unable to continue in her life role as a wife, mother, and grandmother.

Environment

Linda receives social, emotional, and physical support from her husband and from her daughter, who lives down the street. Linda and her husband live in a small, ranch style home with wood floors and carpeting throughout and a wheelchair accessible ramp to enter/exit. Her husband works full-time and Linda is home alone for several hours at a time. Linda is transported by her family either in a 4-door sedan or a mid-sized minivan. A wheelchair accessible community access or Para transit van is available for additional transportation needs.

Current Technology

Linda's current rental hemi-height manual wheelchair is 17 ½ inches from the seat rail to the floor. It has a 2 inch drop seat, 3" foam cushion, a right elevating legrest, height adjustable, desk length armrests with a half lap tray on her right side and sling back upholstery. She sits with poor postural alignment and is at significant risk for increased postural deformity, pain, pressure ulcers, and other secondary complications.

Linda is able to initiate self-propulsion with her left upper and lower extremities but is unable to sustain the repetitive motion necessary to self-propel due to poor endurance. The increased effort with attempted wheelchair propulsion results in an increase in blood pressure, heart rate, and respiration and marked postural deformity. She can only traverse 5-15 feet at a time, depending on the surface, before tiring. It is important to note that this requires significant time and effort to keep the wheelchair traveling straight and renders her non-functional in her use of this mobility device for participation in her activities of daily living. Use of this wheelchair is medically contra-indicated as she is at significant risk for another stroke and other secondary medical complications.

Team/Patient goals:

1. Increase postural alignment, support and pressure distribution to minimize her risk of increased deformity, pain, pressure ulcers, and other secondary complications
2. Increase independence and safety with mobility
3. Increase independence with performing her activities of daily living
4. Increase her ability to actively participate and return to her life roles

EQUIPMENT RECOMMENDATIONS AND SELECTION

Discussion of Options

Linda and her family were educated and trained in the pros and cons of mobility device options. This included manual wheelchairs, power mobility devices, and various options, accessories, seating and positioning components. A manual wheelchair was trialed and failed to meet her safe mobility needs. A scooter was considered and not chosen because Linda does not have adequate upper extremity function, sufficient balance or postural support, and the scooter cannot accommodate the seating system support components necessary to meet her needs. A power wheelchair was considered and trial was set up.

Equipment Trial

After careful consideration of Linda's postural support, mobility and home accessibility needs, rear wheel drive and front wheel drive power wheelchairs were ruled out and a mid-wheel drive power wheelchair was decided upon. Due to joystick use with her non-dominant upper extremity, additional programming requirements for safe use, consideration of environments of anticipated use, including uneven indoor and outdoor terrain with 2-3" door saddles, curbs, curb cuts and ramps, a power wheelchair without enhanced performance characteristics and electronics capabilities was considered and ruled out. After careful consideration of the pros and cons of various seating system options, a wheelchair with a tilted seating system, an open seat to back angle and lateral support was deemed essential to accommodate her partially fixed kyphosis, provide Linda with increased torso support and balance, and provide her with an adequate visual field to function from a wheelchair.

The trial wheelchair included a power tilt in space seating system, power articulating, elevating legrests, an expandable controller and the ability to operate the power seating system functions through the drive control. A seat elevator feature was also considered and Linda, her physical therapist and her family felt this would enhance her ability to perform stand pivot transfers. The chair was programmed for softer acceleration and deceleration, individual configuration of right and left speed, and responsiveness to turns for increased balance and stability. Suspension under the drive wheels was used to minimize pain in her right shoulder and limit the effects of jarring forces on her balance and posture.

A positioning and skin protection cushion, anterior pelvic support and slightly reclined positioning back support with lateral thoracic supports provided Linda with increased postural alignment and control to function from the power wheelchair. These components provided her with the ability to reach above her head, to the left and forward across midline to participate in numerous daily living tasks. It also eliminated the buttock redness she was experiencing under her bony prominences and increased her sitting tolerance to 12 hours. An upper extremity support surface with elevating, swivel hardware, mounted on adjustable height armrest placed her right upper extremity in anatomical alignment and reduced her shoulder pain. Linda will be using four-point strap type securement when traveling in her family minivan and in a Para transit vehicle where passengers travel seated in wheelchairs. For this reason, care was taken to specify a power wheelchair that is compliant with the RESNA WC19 transportation standards to decrease her risk for injury when traveling.

FUNDING AND PROCUREMENT

Following education by the therapist and the supplier, Linda and her husband demonstrated a good understanding of the specific documentation process her insurance

company required. The supplier submitted all documentation for pre-determination and following several clarifications about Linda's ability to function with the recommended equipment, the wheelchair was "approved". The supplier reviewed all the quotes and ordered the wheelchair. When the wheelchair came in, the supplier insured all components were received as specified.

PRODUCT PREPARATION

The supplier configured the wheelchair and seating system components from the different manufacturers to the preliminary specifications the team decided upon.

FITTING, TRAINING AND DELIVERY

An appointment was coordinated for delivery, fitting, and training. Following adjustments to the back support, armrest, right support, footrest, and anterior pelvic support, Linda was seated with good spinal-pelvic alignment and balance to safely function from her wheelchair. Following training on wheelchair and seating system parts management, care, and maintenance, she and her caregivers demonstrated excellent understanding and performance.

Once the wheelchair and postural supports were adjusted, Linda was trained in power wheelchair mobility skills indoors and outdoors. Following modifications to the electronic parameters and mobility skills training, Linda demonstrated excellent control in three skilled therapy sessions. She was independent with negotiating her wheelchair indoors in tight spaces around her home and outdoors on transitions including up/down curb cuts, curbs, and sidewalk to grass for gardening.

Following wheelchair and seating system parts management, care, and basic maintenance, Linda and her husband reported good understanding of procedures with the new power wheelchair.

FOLLOW-UP MAINTENANCE AND REPAIR

A one-month follow up appointment with the evaluation team was performed and Linda reported good success with wheelchair fit and function. Linda's husband demonstrated good performance with all basic care and maintenance as he was trained by the supplier and therapist. As needed, he will initiate maintenance with the supplier for replacement parts. Linda and her husband will refer any issues beyond routine maintenance to the clinical team.

OUTCOME

Following fitting and training with the new power wheelchair, Linda demonstrated increased postural alignment and comfort and had no signs of deformity and pressure ulcers. She also demonstrated increased independence with mobility and performance of her activities of daily living in her home. This included accessing the table for feeding and meal preparation, performing grooming activities in the bathroom and cooking. In addition, Linda reported increased ability to participate in leisure activities with her husband and family activities with her daughter and grandchildren.

To document changes in mobility, an outcome measure was administered during the initial evaluation, at the fitting, and at the one-month follow-up appointment. In this case, the Quebec User Evaluation of Assistive Technology (Demers, Weiss-Lambrou, & Ska, 2000), was utilized not only to document effectiveness of the services and devices provided for Linda, but also to provide feedback on the entire service delivery program.

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Developed through RESNA's Special Interest Group in Wheeled Mobility and Seating