

Wheelchairs: What Life Care Planners Should Know

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Abstract. *Wheelchairs are common and necessary items included in life care plans for people with disabilities who have ambulation impairments and must rely on wheeled mobility. The need for and types of wheelchairs vary widely depending on numerous variables making selection of the most appropriate mobility equipment complex. In order to plan for appropriate costs for purchase, replacement, and maintenance of this vital equipment, it is important for life care planners to have knowledge of the wheelchair technology currently available to people with disabilities and the personnel best able to assist with mobility choices.*

History of Wheelchairs

Solutions for independent mobility for people with disabilities are not new. As far back as 530 B.C., a Greek vase was found that revealed an art etching depicting wheels on the bed of a child. In third century China, the wheelbarrow was invented and was designed to transport people too sick or physically unable to walk themselves (Sawatzky, 2004). Early wheelchair designs were constructed so that the user was dependent on another person to push them from behind (Scherer, 2003). In 1933, Everest & Jennings introduced the first “modern” wheelchair that, at 55 pounds, was considered lightweight. The manufacturer’s goal was to have a chair that could be folded and put into an automobile for easier transport (Sawatzky, 2004). There was very little change in manual wheelchairs until the 1970s and most still weighed around 50 pounds. Power wheelchairs, first introduced in the 1950s, were slow, had poor steering, and often no brakes (Scherer, 2003). Fortunately for people with disabilities, wheelchair technology has improved greatly and continues to evolve today. Chairs have become lighter, more reliable, and far more technologically sophisticated.

Wheelchair Prescription

It is critical to have experienced and qualified people involved in the wheelchair selection process to ensure that the person getting the wheelchair receives the mobility equipment that is appropriate for them. The selection and fit of a wheelchair and seating is complex. The typical physician, with the exception of psychiatrists, knows little about the specifics of wheelchairs even though physicians are needed to sign the prescription for external payers. The RESNA (Rehabilitation Engineering and Assistive Technology Society of North America) has developed a credentialing program to “ensure consumer safeguards and to increase consumer satisfaction” (www.resna.org, 2004). These certifications, the ATP (Assistive Technology Practitioner) and ATS (Assistive Technology Supplier) ensure that professionals involved in the wheelchair selection process have specific training and have passed an examination assur-

ing baseline knowledge of assistive technology. Certified practitioners can be found on the RESNA website. These certifications can be a starting place in finding qualified professionals to help with wheelchair and seating selection. In the author's experience, however, there are also many well-qualified therapists and wheelchair vendors who offer wheelchair and seating assessments who have not pursued these certifications. In some seating clinics, a therapist, wheelchair vendor, seating specialist, or rehabilitation engineer, and sometimes a physiatrist, work together with the client to perform a multidisciplinary evaluation. This ideal team approach is likely to provide a comprehensive and thorough assessment of the client's mobility challenges and goals, but may not be an option in some geographic locations. In cases where a comprehensive team is not available, a competent and experienced therapist in wheelchair and seating assessments along with a knowledgeable wheelchair vendor may be an appropriate alternative choice. Input from a treating occupational or physical therapist or physiatrist will be helpful to the life care planner in locating competent professionals to assist in the process.

Wheelchair Costs

While the base price of any wheelchair is a starting point in determination of the cost, needed options can add greatly to the price of the chair. A history of the individual's previously used options and/or a discussion with a qualified wheelchair vendor is helpful to the life care planner in establishing the final cost of the wheelchair. It is important that the life care planner understand that the seating that comes with a wheelchair is typically inadequate for the user who occupies the chair for several hours a day. The seating is a separate yet complimentary purchase from the wheelchair frame and will be discussed in more detail later in this article. Additionally, average cost ranges for various wheeled mobility will be included, where applicable, throughout the article.

Many manufacturers' websites list models, options, and costs which give life care planners helpful information as a starting point to discuss with the vendor and/or client. The following websites are those of some of the major wheelchair manufacturers:

- www.invacare.com
- www.pridemobility.com
- www.sunrisemedical.com

These websites are not all inclusive of wheelchair manufacturers and are not intended to be the final or actual cost resource for the client's wheelchair. Collaboration with qualified vendors and equipment providers is recommended.

Transportation Safety

People with disabilities have long been transported in their wheelchairs, but the established safety of this method of transportation is another matter. A standard was developed by the American National Standards Institute and RESNA, titled the WC/19 as a voluntary industry standard and not a government requirement (www.wheelchairstandards.pitt.edu, 2005). The standard gives specifics for performance and design requirements that allow manufacturers to label a wheelchair which has a "transit option." Many, but not all, wheelchairs have the transit option. Some wheelchairs are labeled as "crash tested" yet do not meet the WC/19 stan-

dards. A wheelchair vendor that knows the product well is critical in the selection of products that are most safe for the client.

The challenge for manufacturers in providing “transit option” or “crash tested” wheelchairs is the variety of ways that wheelchairs are used. For example, to be crashworthy, a chair in the tilt mode should be brought to a more upright position which may not be the most comfortable or medically optimal position for the occupant. Custom seating, discussed later in this article, can also make the wheelchair’s crashworthiness null and void. Deborah Davis Stewart (2003), editor of *Safe Ride News* wrote, “Crashworthiness concerns must be balanced against other therapeutic, developmental, and legal factors, such as pressure sore prevention, degree of tilt for stability, and implications for independence and control with differing tasks” (p. 3).

Mobility Options

Specialized Strollers

Children with mobility impairments often use the types of strollers used by all children as their first mobility devices. But those strollers may not provide adequate support and are quickly outgrown. Depending on the child’s size and disability, another option is often needed by the age of two or three but can occur even younger if the child needs a ventilator or has severe positioning needs. Strollers designed for children with disabilities should be the first mobility device chosen for a child with long term mobility equipment needs. These strollers can offer far more supportive seating than typical strollers (see Photo 1).

Photo 1: Pediatric Adapted Stroller

Photo of Kid Kart Adapted Stroller courtesy of Sunrise Medical, Inc., www.sunmed.com.



The purchase of a first wheelchair is often an emotionally charged event for children and families. It is a clear and visible acknowledgment of the disability of the child. However, the stroller may offer a more comfortable transition into the world of mobility equipment for many parents of children with disabilities. Additional advantages for strollers include the ability to fold easily, and they are light weight. This advantage makes the stroller a convenient back up to a manual wheelchair because it can be easily placed into the truck of a car making it an easier option for the caregiver. Strollers are made in larger sizes (some models for people up to 170 pounds) and some caregivers use them into adolescence because of their convenience.

Although there are many benefits to using a stroller, children who have significant seating needs because of poor trunk control or spasticity concerns will have more limited stroller options, and additional supportive seating in strollers add weight. Strollers also limit the independence of the child because they lack ability for the child to self propel. Further, as some pre-schoolers begin to use school busing, strollers may not be the most appropriate means to transport the child. When a child reaches school age, transportation and the crash testing of mobility equipment should also be consid-

ered in determining the most effective mobility option for them.

Manual Wheelchairs

The huge variety of manual wheelchair types and options is too vast for a thorough discussion in this article. However, some basic information is included to educate the reader on what to generally look for in selection of a manual wheelchair. Among many factors important to consider include:

- The individual's ability to self propel,
- Their ability to transfer themselves,
- The physical environments where the chair will be used, and
- How the chair will be transported.

Manual wheelchairs come in the following general sizes:

Standard weight	Greater than 36 pounds
Lightweight	30-36 pounds
Ultra lightweight	Less than 30 pounds

Source: Centers for Medicare and Medicaid Services, 2004

Chair selection generally depends on the person's functional abilities, strength, and/or the need to make specific adjustments to the chair for maximizing stroke propulsion and positioning. Along with weight, other important considerations are the need for the chair to fold, its suspension, and its ability to accept the E-Z lock mechanism for accessible van or bus transport, which provides an easily accessible anchor or locking point to attach the chair during transportation. Costs for manual wheelchairs vary greatly and can range from approximately \$400 to \$2,700, without seating.

Manual Assist Wheelchairs

Physiological shoulder burnout is a common problem for people aging with disabilities (Mitchell, 2004a). For example, Petland and Twomey (1994) reported arm pain in a study of 52 subjects, mean age 44 years, who had long term spinal cord injury and paraplegia, and who also used manual wheelchairs. Another randomized study found shoulder pain in 75% of people using manual wheelchairs (Curtis, K. A., Tyner, T. M., Zachary, L., Lentell, G., Brink, D., Didyk, T., Gean, K., Hall, J., Hooper, M., Klos, J., Lesina, S., Pacillas, B.1999). McColl, Charlifue, Glass, Lawson, & Savic (2004) found in a study of 134 people with spinal cord injury, equally matched for sex, age, and duration of disability, no difference by sex in reports of shoulder pain. The study noted that complaints of shoulder pain are more common in people with tetraplegia, and their study included more men than women with higher level spinal cord injuries.

The manual assist or push rim activated power assist wheelchair can be a helpful solution to prevent or minimize the overuse of shoulder muscles needed for wheelchair mobility and prolong the need for a power wheelchair. Manual assist wheelchairs are new technology and the choices are significantly more limited than they are for other types of wheelchairs. The

appearance of these chairs is like a typical manual chair with a battery pack located near the back wheels. Some manufacturers have a device that can be added to certain manual chairs, others are sold as a unit. Such wheelchairs operate like a manual wheelchair but with significantly less effort (see Photo 2).

Photo 2: Manual Assist Wheelchair

Photo of Xtender Manual Assist Wheelchair courtesy of Sunrise Medical, Inc., www.sunmed.com.



The manual assist wheelchair can also be helpful for people with weak upper extremities or those with limited cardiovascular reserve. Cooper, Fitzgerald, Boninger, Prins, Rentschler, Arva, & O'Connor (2001), found significantly lower heart rates and oxygen consumption in 10 individuals tested using manual assist wheelchairs when compared to using standard manual wheelchairs. The researchers also noted increased comfort and ergonomic positioning. This technology is often a beneficial step before the introduction of a power wheelchair in that it continues to offer range of motion and exercise to those who cannot burn calories easily because of their physical limitations.

In considering life care planning implications for use of manual assist wheelchairs, Mitchell (2004a) suggests the introduction of the manual assist wheelchair approximately 10-15 years after the onset of a spinal cord injury. Also noted is the helpfulness of manual assist wheelchairs for long-term wheelchair users in individuals with spina bifida (Mitchell, 2004b). Some additional considerations for manual assist wheelchairs include:

- Weight is significantly heavier than for a chair without manual assist. For example, the Extender (an add on unit) adds 35 pounds to the weight of the chair.
- Units are battery powered and the life care plan should include an additional battery pack as back-up.
- Wheels can be removed and chair can be folded and placed into the trunk of a car (however, it may be significantly more difficult to transfer into a car for the person who performs independent car transfers because of the weight of the wheel axles).
- An additional set of manual wheels should be included in the life care plan (unless the manual assist unit is added to a chair that is ordered separately).
- User can drive in chair or use tie downs for transportation
- Cost of a manual assist wheelchair is similar to a low-end power chair (see later section that describes power wheelchairs).

Scooters

Scooters have become a more common mode of mobility. They are battery operated, with

a handlebar design, and come in three or four wheel designs (see Photo 3). Scooters offer several advantages over power wheelchairs, and they are often used for people who have the ability to ambulate but not for long distances or for those unable to push their manual wheelchairs in the community. They are less expensive, have lower maintenance costs, and can be easier to transport than a power chair (Daus, 1999). Daus (1999) also reports that it can be easier to teach a person to use a scooter than a power chair. Good upper body mobility and endurance is needed for successful operation and transfers on to a scooter can be more difficult than to a wheelchair because of the platform design. Disadvantages to scooters are that they are often not functional in the home environment because of their relatively large turning radius and customization of seating is typically not an option. Scooters generally are designed for lighter use than power chairs and may be less durable. Scooter costs begin at approximately \$1,400 and can range as high as \$3,500 or more.

Photo 3: Power Scooter

Photo of Guardian Trek 4 Scooter courtesy of Sunrise Medical, Inc., www.sunmed.com.



Power wheelchairs

The term “electric wheelchair,” may be familiar to some life care planners; however, this is no longer considered correct terminology. The more commonly accepted and used term to describe wheelchairs that are run by battery is a power wheelchair. Two important considerations in the determination of need for a power wheelchair are the client’s inability to effectively push a manual wheelchair for needed distances and their ability to safely operate a power chair. Children as young as two years of age have been provided with a power wheelchair and trained to safely use them with supervision. Tefft, Guerette, & Furumasu (1999)

report, “Independent mobility allows young children with physiological disabilities to be more fully integrated into appropriate educational programs and can lead to enhanced psychological and cognitive development (p. 669).” Nevertheless, a power chair can be dangerous to the person who drives it; especially young children or individuals with cognitive impairments, and to the general public unless the person has the skills to operate the chair safely. Powered mobility driving assessments and powered mobility training may be important (Brighton, 2003) to include in the life care plan.

Power chairs now come in rear, mid, and front wheel drive configurations. Each option offers pluses and minuses to the user and differs in control or in the ability to turn in tight quarters. A power tilt in space option adds significantly to the cost of the chair but is helpful for independent weight shifts and pressure management, positioning, comfort, and a host of other benefits. Recently, some limited power chairs offer lateral tilt (for maximal pressure management) and anterior tilt (to assist with transfers like a lift chair). Power recline is often used for positioning for catheterizing or diaper changes, hypotension issues, or the need to transfer in a flat position, and some people use a combined tilt/recline feature. Lacoste, Weiss-Lambrou, Allard, & Dansereau (2003) reported 97.5% of the 40 subjects they surveyed used the tilt/recline feature of their chairs on a daily basis and felt the main benefits of this feature were

the ability to independently obtain comfort and to rest. Power elevating leg rests also are used for range of motion, edema control, and comfort in the lower extremities and can be used in combination with the power tilt and/or recline feature.

There are many switch options available to the power wheelchair user. A joystick is typically included in a power chair purchase, but this option may not be appropriate for some users. The numerous other switch options available can add significantly to the cost of the chair and the need for alternative switches must be considered. For example, a head array is used for the person who has no functional control of their extremities but has control of their head. Products such as these can add \$4,000 or more to the cost of a power chair. As with manual wheelchairs, options for the power chair can significantly affect the final cost of the chair. The price of power chairs generally range from \$4,200 to \$35,000 with the full range of options and seating.

Specialty wheelchairs

- Travel chairs:** Light weight travel chairs weigh as little as 17 pounds and are useful for individuals who travel frequently. In addition to their light weight, they fold smaller for travel and are easier to store and transport. However, these chairs generally do not serve well as primary chairs due to lower durability. Additionally, the seating provided in these chairs generally does not provide the needed support for long term use and may be totally inappropriate for individuals needing significant seating support.
- Bariatric:** All wheelchairs have weight restrictions and the increasing problems with obesity in our society have opened a market for durable medical equipment for people with severe problems with weight. Bariatric wheelchairs (wheelchairs for people who are too heavy for typical wheelchairs) are increasing, with some chairs now having up to a 700 pound weight capacity. The weight capacity of wheelchairs varies and there is no specific weight amount that makes a wheelchair “bariatric.” Generally, wheelchairs go up to a 22” width and chairs wider than that are considered bariatric. The width of a chair can obviously impact accessibility, particularly in the home environment. These chairs are offered in both manual and power options with a variety of manufacturers (www.usatechguide.org/, 2004).
- Sports:** There are a variety of sports chairs available to athletes who use wheelchairs and these vary in type depending on the sport being played. It is important for sports chairs to be as light in weight yet as durable and stable as possible, and because of the need for stability, these chairs typically cannot fold for transport. Many people use the sports chair for their sporting activity and a different chair for everyday use. It is important to consider including a sports chair in a life care plan for the competing or serious athlete. However, not all sports need a special chair. For example, a fishing pole holder can be added to a person’s regular wheelchair at minimal additional cost. The cost of sports wheelchairs is
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variable and averages approximately \$2,000 (www.quickie-wheelchairs.com, 2004).

Beach: For individuals living in a beach community and enjoying a lifestyle of frequent use of the waterside, a beach wheelchair may be an important consideration for the life care plan. For the occasional user, rentals are available in some beach communities. Beach wheelchairs are specially designed with oversized wheels to manage a sandy beach or gravel environment, and look significantly different from typical wheelchairs (see Photo 4). They typically have mesh seats and backs and often come with optional sunshades and other options that will impact their final cost. Beach wheelchairs come in both manual and powered models and there are several websites to view product and pricing, for example, www.beachwheelchair.com or www.hotshotproducts.org.

Photo 4: Beach wheelchair

Photo courtesy of Deming Designs Inc., www.beachwheelchair.com.



Standing: Standing wheelchairs, which position the user in both seated and standing positions are available in both manual and power models. Many advantages of standing wheelchairs are the same as the use of a standing frame: preservation of skin integrity and bone density, contracture prevention and assistance with elimination. An additional benefit is allowing a person to assume a standing position. The life care planner is cautioned that the inclusion of a standing wheelchair and a standing frame in a life care plan may be duplicative.

Elevated seats: Wheelchairs with elevating seats keep the user in a seated position and allow them to access upper cupboards, cabinets, and drawers. The author found this a useful feature for a patient in her clinical practice and the elevating feature allowed the patient to independently don and doff her shoes. The client was unable to reach her feet because of spasticity but could slide in and out of her shoes with the use of a dressing stick and

this wheelchair feature. The ability to move the chair to a height to perform a level surface transfer may be another important feature in saving wear and tear on shoulders.

Stair climbing: Johnson & Johnson has designed the well-publicized iBOT™ mobility system (www.jnj.com, 2004) which is a power wheelchair with the unique feature that allows the user to climb stairs and curbs that are up to 4 inches in height. The iBOT™ is very functional for outdoor and more rugged use, including construction sites and rural environments. The iBOT™ can drive in a seated position, allowing the user to be at eye level (www.jnj.com, 2004). However, its current high seat to floor height of 21" can be a disadvantage to some users. Also, not every power chair user is a candidate for the iBOT™. Potential users need to be aware of several considerations including that they will need functional arms with good grasp to hold a hand rail to guide the chair when climbing stairs, be a low risk for fractures because of jarring in the climbing mode, and not be ventilator dependent (see Photo 5). People should not drive a vehicle from this wheelchair or be transported while sitting in the chair but must transfer to a seat in the vehicle because the iBOT™ has not been crash tested. Users will need special training and meet other specific qualifying rules (www.usatechguide.org) to allow safe operation of the iBOT™. In this author's opinion, if an iBOT™ is included in a life care plan, the client must be expected to be a realistic candidate for it and the cost of the initial evaluation and training must also be included in the plan. Current cost with very basic seating is approximately \$26,100.



Photo 5: iBOT™ wheeled mobility system with stair climbing capability

Photo courtesy of Independence Technology, a Johnson and Johnson Company, <http://www.independencenow.com/ibot/motion.html>.

Pediatric Considerations

Children grow quickly and this can mean frequent changes are needed in the size of a child's wheelchair and seating. Most pediatric wheelchairs have growth kits that can be ordered to extend the life and size of a wheelchair. While growth kits generally are free or inexpensive options (depending on the chair manufacturer) and can prolong a child's ability to use a given wheelchair, they only affect the frame of the chair. When the frame size is made bigger, the seating will need to be changed at that time as well. While some seating provides growth potential, at times the seating must be completely changed when a chair is grown. This

can be a significant replacement cost factor, particularly with customized seating, included in the life care plan.

Wheelchair Replacement Schedules

Planning for the cost of replacement wheelchairs in a life care plan is not a clear-cut issue. Amsterdam (2002) developed estimated replacement schedule forms that provide five (5) years as a general replacement time with age of user, physical, and environment as factors that add or subtract to the life of a wheelchair. While the author found these guidelines useful, they did not appear to address the issues of multiple wheelchairs. The author polled ten local, respected, wheelchair vendors used by the author in her clinical work doing wheelchair and seating evaluations about their recommended replacement frequencies (see Table 1). The poll is not based on research but, like Amsterdam's projections, based on industry standards and the experience of the vendors.

Table 1: Recommended Wheelchair Replacement Schedules Rounded Up or Down to Nearest Year of Replacement

Type of Wheelchair	Replacement Recommendation (average number of years)
Pediatric (During growth years) manual	4 years
Pediatric (During growth years) power	5 years
Pediatric (During growth years) manual back-up for power chair	5 years
Adult manual	5 years
Adult power	5 years
Adult manual back up to power	7 years
Sports chair	6 years

The use of chair, physical environment chair will be used in, activity level of user, and transportation of wheelchair continue to be important considerations in general replacement recommendations. However, the author has numerous "exceptions to the rule" in her clinical practice including an individual who aggressively and continuously rocked his chair. In spite of heavy duty construction and frequent repairs, the chair needed frequent replacement. For another client who lived in a nursing home, used the wheelchair a few hours a day and rarely went into the community, the longevity of the chair was longer than the typical replacement schedule.

In the author's training as a life care planner, the generally accepted guideline to allow funds for maintenance was to include a yearly 10% average of the cost of the wheelchair (except on years of wheelchair purchase/replacement). The same ten vendors who were polled agreed this is a reasonable figure to use. Several noted that maintenance costs on power chairs are typically greater on a percentage basis than for manual chairs but suggested the 10% average cost per year was a fair number to use overall. Maintenance costs on chairs that are used infrequently may be less.

Wheelchair Seating

It is important for the life care planner to understand that most wheelchair users do not use the seating that comes with the wheelchair. Standard seating typically does not offer the support needed for the person who spends a significant amount of the day in their chair. During a comprehensive wheelchair and seating evaluation, the actual chair selected and the seating needed are considered separately and yet must also work together. Custom seating, not available in many locations because of a lack of providers, can be very important for people with significant deformities, poor muscle control, or potential for evolving skeletal changes such as severe scoliosis to prevent further deformity and provide intimate positioning. Custom seating options are critical to include in the life care plan and can be very expensive, including cost of replacements. Off the shelf seating can sometimes be an appropriate option and is significantly less expensive. This seating is pre-made and not custom fit for the individual. Trying or sampling a few different seating systems may be necessary in complex cases in order to find the one most effective for the client's individual needs. This process, although time consuming, is critical to identifying the most appropriate seating system for the client.

Conclusion

It is important for life care planners to understand what wheeled mobility technology is currently available for people with mobility impairments. A given chair may seem to offer great advantages to a particular client but, in fact, be inappropriate when all factors are considered. The input of knowledgeable providers such as those with ATP or ATS certifications from RESNA or therapists experienced in wheelchair and seating assessments or client's previous history with a given chair is often critical for an appropriate chair to be included in a life care plan. Costs for wheelchairs and seating can vary greatly and the appropriate wheelchair written into a life care plan is vital to the accuracy of projected costs and long term comfort of the client.

Appendix 1: Comparison of Most Common Types of Wheeled Mobility Devices

Mobility Equipment	Advantages	Disadvantages
Specialized Strollers	• Lightweight • Typically fold easily • “Normal” appearance for young children	• Complex or custom seating not available • Not all have been crash tested • Childlike appearance for adolescents and adults • No ability to self propel • Some difficulty with very heavy or bulky equipment
Manual wheelchair	• Many options available • Many can be folded for transport • Very light weight options are available	• Requires arm strength and endurance or another person to push the chair • May not be practical for long distance mobility • Contributes to shoulder burn out over time
Manual assist wheelchair	• Reduces wear and tear on shoulder joints • More portable than a power chair • Appearance looks much like a manual chair	• Few options available • Significantly heavier than most manual chairs • May be difficult for those doing independent car transfers • As expensive as a low end power chair
Scooter	• Minimal repair problems • Easy to learn to operate • Easier to transport than a power chair • Much less expensive than a power chair	• Requires upper extremity endurance • Need to step on to platform for transfers • Large turning radius for home environment • Most need a lift for transport that doesn’t work for all vehicles
Power wheelchair	• Provides independent mobility and weight shifting for people with severe physical disabilities • Many options available • Documented cognitive development advantage to children • Ability to find a comfortable position without assistance	• Very heavy • Cannot be bumped up stairs • Need to be transported in an accessible van • Need back up manual chair • Can have expensive repairs
Specialty wheelchairs	• See individual descriptions elsewhere in article	

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