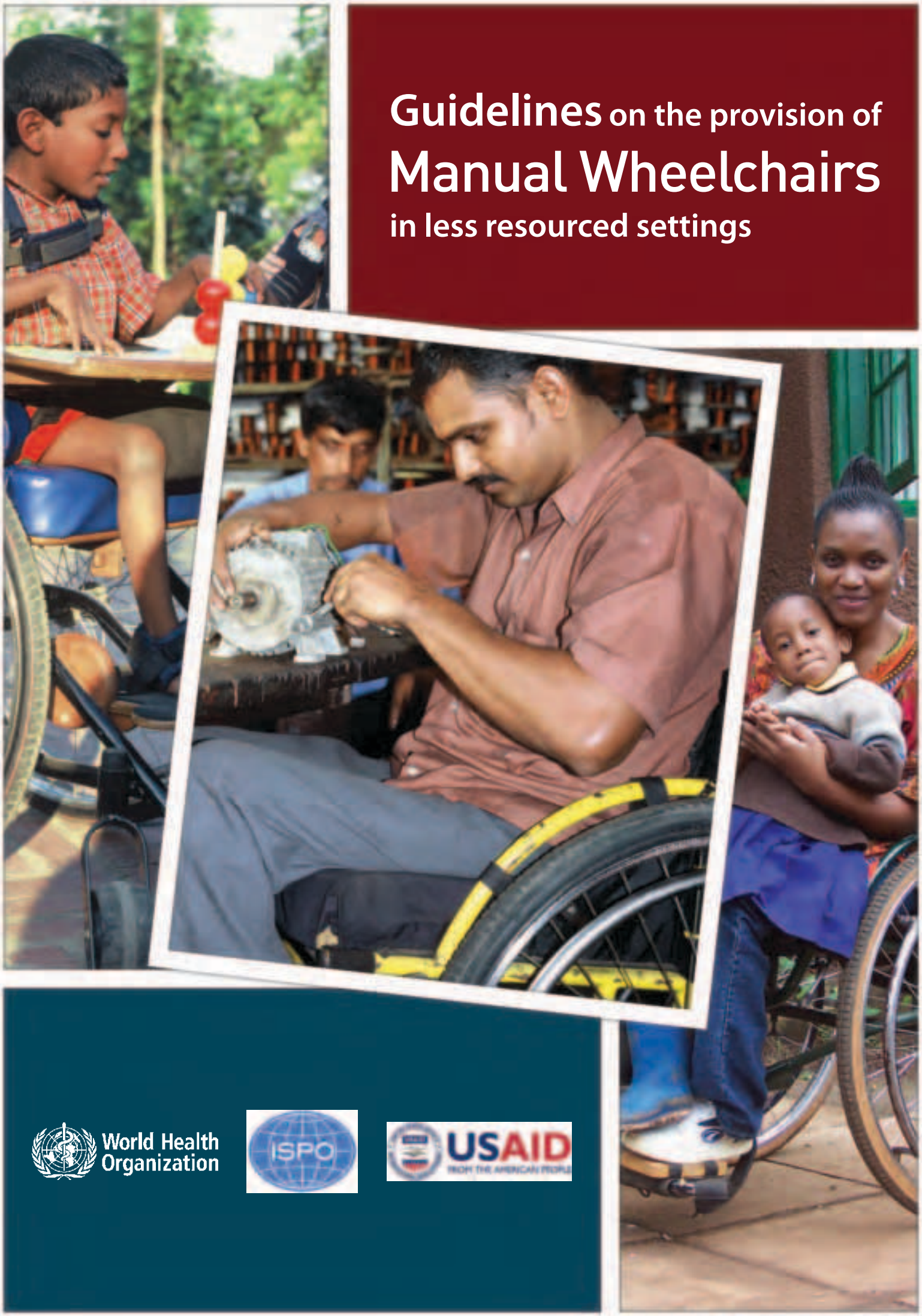
Guidelines on the provision of Manual Wheelchairs in less resourced settings



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Guidelines on the provision of Manual Wheelchairs in less resourced settings

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PREFACE

The wheelchair is one of the most commonly used assistive devices for enhancing personal mobility, which is a precondition for enjoying human rights and living in dignity and assists people with disabilities to become more productive members of their communities. For many people, an appropriate, well-designed and well-fitted wheelchair can be the first step towards inclusion and participation in society.

The United Nations Standard Rules on the Equalization of Opportunities for Persons with Disabilities, the Convention on the Rights of Persons with Disabilities and World Health Assembly resolution WHA58.23 all point to the importance of wheelchairs and other assistive devices for the developing world, where few of those who need wheelchairs have them, insufficient production facilities exist, and all too often wheelchairs are donated without the necessary related services.

When the need is not met, people with disabilities are isolated and do not have access to the same opportunities as others within their own communities. Providing wheelchairs that are fit for the purpose not only enhances mobility but begins a process of opening up a world of education, work and social life. The development of national policies and increased training opportunities in the design, production and supply of wheelchairs are essential next steps.

In the light of the realities of the developing world and the immediate need to develop functioning systems of wheelchair provision in less-resourced parts of the world, the World Health Organization (WHO), the US Agency for International Development, the International Society for Prosthetics and Orthotics and Disabled Peoples' International, in partnership with the Centre for International Rehabilitation, the Motivation Charitable Trust and Whirlwind Wheelchair International, have developed this document to assist WHO Member States to create and develop a local wheelchair provision system and thereby implement Articles 4, 20 and 26 of the Convention on the Rights of Persons with Disabilities. We extend our thanks to the US Agency for International Development's Patrick Leahy War Victims Fund for its support in producing these guidelines and assisting in their implementation.

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World Health Organization	**US Agency for International Development**	**International Society for Prosthetics and Orthotics**	**Disabled Peoples' International**

EXECUTIVE SUMMARY

These guidelines seek to promote personal mobility and enhance the quality of life of wheelchair users by assisting Member States in developing a system of wheelchair provision to support the implementation of the Convention on the Rights of Persons with Disabilities (and specifically Articles 4, 20 and 26) and World Health Assembly resolution 58/23 of 25 May 2005.

The guidelines focus on manual wheelchairs and the needs of long-term wheelchair users. The recommendations are targeted at those involved in wheelchair services, ranging from design and planning, to providing or supplying wheelchairs and their maintenance.

The guidelines are divided into five chapters:
1. Introduction
2. Design and production
3. Service delivery
4. Training
5. Policy and planning

1. Introduction

The introductory chapter describes the need for and benefits of wheelchairs, types of wheelchairs, and systems for their provision. It also defines the requirements of adequate wheelchairs and introduces the reader to the stakeholders and their roles.

A wheelchair must meet the user's individual needs and environmental conditions, provide postural support, and be safe and durable. The wheelchair must be available and affordable and be maintainable and sustainable in the country of use. This is not always easy, because wheelchair users are a diverse group with different requirements and environmental and socioeconomic conditions.

The chapter argues that a wheelchair is more than an assistive device for many people with disabilities; it is the means by which they can exercise their human rights and achieve inclusion and equal participation. A wheelchair provides mobility, ensures better health and quality of life, and assists people with disabilities to live full and active lives in their communities.

2. Design and production

Chapter 2 sets out guidelines on the design and selection of wheelchairs and how to produce and supply them. The focus here is to increase the quality and range of manual wheelchairs available in less-resourced settings. Health and safety, strength and durability, suitability for use, and effective production methods are the main design criteria. The design of a wheelchair determines its functional performance in matters of stability, manoeuvrability, pushing and transferring efficiency, transport and reliability.

The guidelines address the design process, including the need for product testing, field trials and long-term follow-up. The need to involve wheelchair users in the design process is highlighted, as they are the most knowledgeable about their physical, environmental, social and cultural needs. Minimum guidelines and corresponding evaluation methods are given in the areas of functional performance, seating and postural support elements, and strength and durability.

Governments are encouraged to develop and adopt national wheelchair standards to ensure a reasonable level of quality, for instance by using the ISO 7176 series of wheelchair standards as a basis.

3. Service delivery

In this chapter, structural guidelines for systems that provide wheelchairs and that improve access to wheelchairs are described. The need to provide wheelchairs together with other related services is shown to be essential. Careful planning and management of services and well-thought-out strategies for wheelchair provision, user instruction and care are needed to facilitate the important link between the user and the wheelchair.

Guidelines in this chapter look at good practice at all stages of the service delivery process, from referral to assessment and prescription, funding, ordering, product preparation, fitting, user training and maintenance. The chapter includes a discussion of the roles of those involved in wheelchair service delivery, from manufacturers and clinicians to technical and training personnel. Recommendations are made on monitoring, how to obtain feedback from wheelchair users, and evaluating and analysing information on wheelchair service delivery.

4. Training

Chapter 4 looks at training requirements for those involved in the delivery of wheelchair services, with the aim of improving the level of skill of local people providing these services. Strategies are provided for identifying trainers, linking to existing training programmes, developing modular training packages, and capacity building at the local level. The guidelines set out the training requirements for those involved in referral networks, managers of wheelchair services, and clinical and technical personnel at basic and intermediate levels.

5. Policy and planning

Chapter 5 looks at the role of policy and policy-makers in wheelchair provision, with a special focus on cost-effectiveness and sustainability. Suggestions are made about financing options and ways of linking wheelchair services to other sectors. A national policy on wheelchair provision is recommended, with mechanisms for monitoring and evaluation, to ensure that users receive wheelchairs that meet minimum requirements for safety, strength and durability and are appropriate for their individual needs. Such a policy would look at need assessment, planning at the national level, collaboration among service providers, the integration of wheelchair services with existing rehabilitation services, and the adoption of national standards, with the aim of empowering users and their families and facilitating user participation in community life.

Terminology

For the purpose of these guidelines, the following terms are used in this document as defined below.

wheelchair	**a device providing wheeled mobility and seating support for a person with difficulty in walking or moving around**
less-resourced setting	**a geographical area with limited financial, human and infrastructural resources to provide wheelchairs (a common situation in low- and middle-income countries, but also in certain areas of high-income countries)**
manual wheelchair	**a wheelchair that is propelled by the user or pushed by another person**
appropriate wheelchair	**a wheelchair that meets the user's needs and environmental conditions; provides proper fit and postural support; is safe and durable; is available in the country; and can be obtained and maintained and services sustained in the country at the most economical and affordable price**
wheelchair user	**a person who has difficulty in walking or moving around and uses a wheelchair for mobility**
personal mobility	**the ability to move in the manner and at the time of one's own choice**
wheelchair provision	**an overall term for wheelchair design, production, supply and service delivery**
wheelchair service	**that part of wheelchair provision concerned with providing users with appropriate wheelchairs**

ABOUT THE GUIDELINES

… on provision of manual wheelchairs in less-resourced settings.

This part of the guidelines:

- outlines the purpose and scope of the guidelines
- presents the target readers
- describes the structure of the guidelines

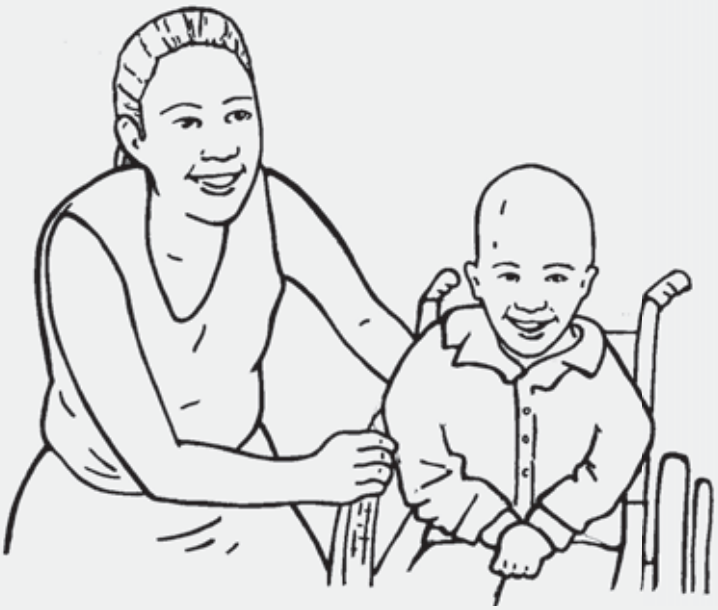
Box 1.

Wheelchairs changing lives …

Testimonial from a user in Colombia

Franber is an eight-year-old boy who lives in Medelline, Colombia. He cannot walk and his normal growth is affected.

Franber used to spend his days in bed while his mother worked around the house. One day he received a wheelchair through a local organization. He can now move around and – best of all – he can go to school and enjoy breaks with his classmates.



testimonial

Purpose

The Convention on the Rights of Persons with Disabilities and its Optional Protocol *(1)* were adopted by the United Nations General Assembly on 13 December 2006 to promote, protect and ensure the full and equal enjoyment of all human rights and fundamental freedoms by all persons with disabilities, and to promote respect for their inherent dignity.

Articles 20 and 26 of the Convention affirm that States Parties (i.e. governments or authorities) shall take effective measures to ensure personal mobility and rehabilitation by facilitating access to good quality mobility aids, devices and assistive technologies at an affordable cost, and to encourage entities that produce mobility aids, devices and assistive technologies.

Wheelchairs are the most common assistive or mobility devices for enhancing mobility with dignity. Besides the Convention, these guidelines are an expression of WHO's commitment at the Fifty-eighth World Health Assembly to provide support to Member States in building up a system for producing, distributing and servicing assistive devices *(2)*. WHO gives priority to the provision of affordable assistive devices of good quality.

The goals of these guidelines are:

- to promote personal mobility with the greatest possible independence for people with disabilities;
- to enhance the quality of life of users in less-resourced settings through improved access to wheelchairs; and
- to assist Member States in developing a system for wheelchair provision in support of Articles 4, 20 and 26 of the Convention and of Health Assembly resolution WHA58.23 of 25 May 2005.

Scope

These guidelines focus on manual wheelchairs and the needs of long-term users. Some of the recommendations in the guidelines, however, are equally applicable to other types of mobility aid or device (such as hand-powered tricycles) and for other types of user (such as temporary users). In these guidelines, "wheelchair" means "appropriate manual wheelchair" unless otherwise indicated. The guidelines have been developed for use in less-resourced settings.

This document is not a wheelchair manual. The scope is limited to addressing key areas – not all aspects – of wheelchair provision, focusing on the design, production and distribution of wheelchairs, wheelchair services, and training of related personnel. The recommendations are not intended to be comprehensive or prescriptive. Flexibility is required, owing to the many different contexts in which they may be applied and implemented.

Target readers

The intended readers include:

- government and nongovernmental policy-makers;
- planners, managers, providers and users of wheelchair services;
- designers, testers, donors, purchasers and adapters of wheelchairs;
- planners and managers of wheelchair production;
- planners, developers and implementers of training programmes;
- developers of communication and advocacy materials;
- disabled people's organizations;
- groups of users; and
- individual users and their families.

Structure

The guidelines are presented in five chapters.

1. The *Introduction* gives an overview of the need for wheelchairs, users of wheelchairs, types of wheelchair, wheelchair provision and stakeholders.
2. *Design and production* provides recommendations on how to design, evaluate and select wheelchairs.
3. *Service delivery* suggests the tasks and structure of a system for providing wheelchair services.
4. *Training* provides assistance in the design, development and implementation of training opportunities for personnel involved in wheelchair provision.
5. *Policy and planning* provides information to guide decisions on wheelchair provision.

Development process

Following consultations with a wide range of stakeholders, WHO formed a small task force to develop the guidelines, contracting Johan Borg as editorial consultant and coordinator of the group. The main areas of the work were divided among various interested groups and their respective partners from developing countries. Whirlwind Wheelchair International accepted responsibility for the "Design and production" section, the Center for International Rehabilitation for "Service delivery" and the Motivation Charitable Trust for "Training".

More than 25 wheelchair experts took part in the development of the guidelines. A complete draft of all the sections was prepared for a three-day discussion and review at WHO headquarters in Geneva on 28–30 August 2006. Further revisions and external reviews took place during the two months preceding the International Society for Prosthetics and Orthotics (ISPO) Consensus Conference on Wheelchairs for Developing Countries, and a third draft was presented during the Conference for further feedback in Bangalore on 6–11 November 2006 *(3)*.

Following the ISPO Consensus Conference, the guidelines were further revised to reflect the discussion and consensus reached at the Conference. They were then peer reviewed by 21 wheelchair experts, whose views were considered in finalizing the document. WHO also collected the Declaration of Interests(DOI) from all the experts involved in the development of this document and none of them declared any kinds of Conflicts of Interests with the subject matters.

These guidelines were approved by the WHO's Guidelines Review Committee on 16 April 2008, having met the minimum reporting requirements in place at that time. It is anticipated that the recommendations in this guideline will remain valid until 2013. The Department of Violence and Injury Prevention and Disability at WHO headquarters in Geneva will be responsible for initiating a review of this guideline at that time.

References

1. *Convention on the Rights of Persons with Disabilities*. New York, United Nations (http://www.un.org/disabilities/default.asp?id=259, accessed 6 March 2008).
2. *Resolution WHA58.23. Disability, including prevention, management and rehabilitation*. Geneva, World Health Organization, 2005 (http://www.who.int/disabilities/publications/resolution/en/index.html, accessed 6 March 2008).
3. Sheldon S, Jacobs NA, eds. *Report of a Consensus Conference on Wheelchairs for Developing Countries, Bangalore, India, 6–11 November 2006*. Copenhagen, International Society for Prosthetics and Orthotics, 2007 (http://homepage.mac.com/eaglesmoon/WheelchairCC/WheelchairReport_Jan08.pdf, accessed 8 March 2008).

1 INTRODUCTION

… to promote personal mobility and enhance quality of life.

The introduction to the guidelines:

- defines an appropriate wheelchair;
- introduces users;
- points out the needs for and rights to wheelchairs;
- describes the benefits of wheelchairs;
- describes basic types of wheelchair and common systems of wheelchair provision; and
- describes different stakeholders and their roles in wheelchair provision.

Box 1.1.

Wheelchairs to enhance quality of life …

Testimonial from a user in Afghanistan

Zahida lives in Afghanistan, in a tent in her brother's yard. She became paraplegic in 2001, but has had two children since then. She was referred to a hospital outpatient physiotherapy department in Jalalabad and arrived pushed in a wheelbarrow. The physiotherapists worked with the technicians of a local wheelchair workshop to provide Zahida with a three-wheel wheelchair.

Without a wheelchair, Zahida could do very little at home without the help of her husband and children. She just lay on the bed. Her wheelchair has enabled her to successfully look after her children in a very rough and hilly compound. Zahida says, "My wheelchair – it is like my feet – I won't go anywhere without it! With my wheelchair I can cook, make bread, visit the neighbours. When we go to a family wedding in the village I take it with me in the back of the taxi. My older daughter and son help to push me up the steep places."

testimonial

1.1 Appropriate wheelchairs

These guidelines focus on appropriate manual wheelchairs. Manual wheelchairs are here defined as wheelchairs propelled by the user or pushed by another person. A wheelchair is appropriate when it *(1)*:

- meets the user's needs and environmental conditions;
- provides proper fit and postural support;
- is safe and durable;
- is available in the country: and
- can be obtained and maintained and services sustained in the country at an affordable cost.

Throughout these guidelines, the term "wheelchair" means "appropriate manual wheelchair" unless otherwise indicated.

1.2 Users of wheelchairs

In these guidelines, the term "users" refers to people who already use a wheelchair or who can benefit from using a wheelchair because their ability to walk is limited. Users include:

- children, adults and the elderly;
- men and women and girls and boys;
- people with different neuromusculoskeletal impairments, lifestyles, life roles and socioeconomic status; and
- people living in different environments, including rural, semi-urban and urban.

Users represent a wide range of mobility needs, but they have in common the need for a wheelchair to enhance their mobility with dignity.

1.3 Need for wheelchairs

About 10% of the global population, i.e. about 650 million people, have disabilities *(2)*. Studies indicate that, of these, some 10% require a wheelchair. It is thus estimated that about 1% of a total population – or 10% of a disabled population – need wheelchairs, i.e. about 65 million people worldwide.

In 2003, it was estimated that 20 million of those requiring a wheelchair for mobility did not have one. There are indications that only a minority of those in need of wheelchairs have access to them, and of these very few have access to an appropriate wheelchair *(1)*.

1.4 Rights to wheelchairs

States Parties to the Convention on the Rights of Persons with Disabilities have the obligation "to take effective measures to ensure personal mobility with the greatest possible independence for persons with disabilities". This is a commitment to provide mobility aids, such as wheelchairs, that

make personal mobility possible. In 1993, the Standard Rules on the Equalization of Opportunities for Persons with Disabilities *(3)* expressed the same commitment, demanding that countries ensure the development, production, distribution and servicing of assistive devices for people with disabilities in order to increase their independence and to realize their human rights.

These two important international declarations create rights to wheelchairs because it is universally recognized that an appropriate wheelchair is a precondition to enjoying equal opportunities and rights, and for securing inclusion and participation. Personal mobility is an essential requirement to participating in many areas of social life, and wheelchairs are for many the best means of guaranteeing personal mobility.

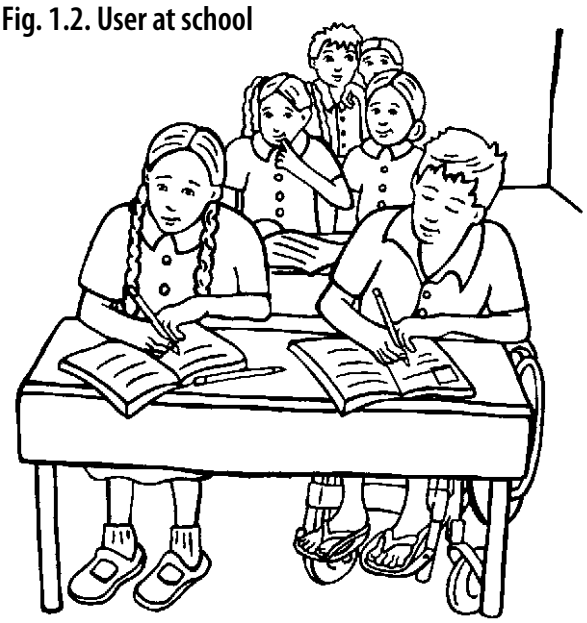
Independent mobility makes it possible for people to study, work, participate in cultural life and access health care. Without wheelchairs, people may be confined to their homes and unable to live a full and inclusive life. We know that eliminating world poverty is not possible unless the needs of those with disabilities are taken into account. Without wheelchairs, these individuals are unable to participate in those mainstream developmental initiatives, programmes and strategies that are targeted to the poor, such as are embodied in the Millennium Development Goals *(4)*, the Poverty Reduction Strategies *(5)* and other national developmental initiatives.

It is a vicious circle: lacking personal mobility aids, people with disabilities cannot leave the poverty trap. They are more likely to develop secondary complications and become more disabled, and poorer still. If they are children they will be unable to access the educational opportunities available to them, and without an education they will be unable to find employment when they grow up and will be driven even more deeply into poverty.

On the other hand, access to appropriate wheelchairs allows people with disabilities to work and participate in mainstream development initiatives that will reduce their poverty (see Fig.1.1.). Similarly, a wheelchair can enable a child to go to school, to gain an education and, when the time comes, to find a job (see Fig.1.2.).

Fig. 1.1. User at work

Fig. 1.2. User at school



The right to a wheelchair must be an essential component of all international endeavours to secure the human rights of people with disabilities.

1.5 Benefits of wheelchairs

Wheelchair provision is not only about the wheelchair, which is just a product *(6)*. Rather, it is about enabling people with disabilities to become mobile, remain healthy and participate fully in community life. A wheelchair is the catalyst to increased independence and social integration, but it is not an end in itself *(6–8)* (see Fig.1.3.).

Fig.1.3. Participation in community life

The benefits of using an appropriate wheelchair include those outlined below.

Health and quality of life

In addition to providing mobility, an appropriate wheelchair is of benefit to the physical health and quality of life of the user. Combined with adequate user training, an appropriate wheelchair can serve to reduce common problems such as pressure sores, the progression of deformities or contractures, and other secondary conditions *(9)*. A wheelchair with a proper cushion often prevents premature death in people with spinal cord injuries and similar conditions and, in one sense, is a life-saving device for these people. A wheelchair that is functional, comfortable and can be propelled efficiently can result in increased levels of activity. Independent mobility and increased physical function can reduce dependence on others. Other benefits, such as improved respiration and digestion, increased head, trunk and upper extremity control and overall stability, can be achieved with proper postural support. Maintenance of health is an important factor in measuring quality of life. These factors combined serve to increase access to opportunities for education, employment and participation within the family and the community.

Economy

A wheelchair often makes all the difference between being a passive receiver and an active contributor. Economic benefits are realized when users are able to access opportunities for education and employment. With a wheelchair, an individual can earn a living and contribute to the family's income and national revenue, whereas without a wheelchair that person may remain isolated and be a burden to the family and the nation at large. Similarly, a wheelchair that is not durable will be more expensive owing to the need for frequent repairs, absence from work and eventual replacement of the wheelchair. Providing wheelchairs is more cost-effective if they last longer *(10)*. It is also more cost-effective if users are involved in selecting their devices and if their long-term needs are considered *(11)*.

For society, the financial benefits associated with the provision of wheelchairs include reduced health care expenses, such as those for treating pressure sores and correcting deformities. A study from a developing country reported that in 1997, 75% of those with spinal cord injuries admitted to hospital died within 18–24 months from secondary complications arising from their injuries. In the same place, the incidence of pressure sores decreased by 71% and repetitive urinary tract infections fell by 61% within two years as a result of improvements in health care training and appropriate equipment, including good wheelchairs with cushions *(12)*.

1.6 Challenges for users

Users face a range of challenges, which must be considered when developing approaches to wheelchair provision.

Financial barriers

Some 80% of the people with disabilities in the world live in low-income countries. The majority of them are poor and do not have access to basic services, including rehabilitation facilities *(13)*. The International Labour Organization (ILO) reports that the unemployment rates of people with disabilities reach an estimated 80% or more in many developing countries *(14)*. Government funding for the provision of a wheelchair is rarely available, leaving the majority of users unable to pay for a wheelchair themselves.

Physical barriers

As many users are poor, they live in small houses or huts with inaccessible surroundings. They also live where road systems are poor, there is a lack of pavements, and the climate and physical terrain are often extreme. In many contexts, public and private buildings are difficult to access in a wheelchair. These physical barriers place additional requirements on the strength and durability of wheelchairs. They also require that users exercise a high degree of skill if they are to be mobile.

Access to rehabilitation services

In many developing countries, only 3% of people with disabilities who require rehabilitation services have access to them *(15)*. According to a report of the United Nations Special Rapporteur *(16)*, 62 countries have no national rehabilitation services available to people with disabilities. This means that many wheelchair users are at risk of developing secondary complications and premature death that could be avoided with proper rehabilitation services. In many countries, wheelchair service delivery is not included in the national rehabilitation plan.

Education and information

Many users have difficulty in accessing relevant information, such as on their own health conditions, prevention of secondary complications, available rehabilitation services and types of wheelchair available. For many, a wheelchair service may be their first access to any form of rehabilitation service. This places even more emphasis on the importance of user education.

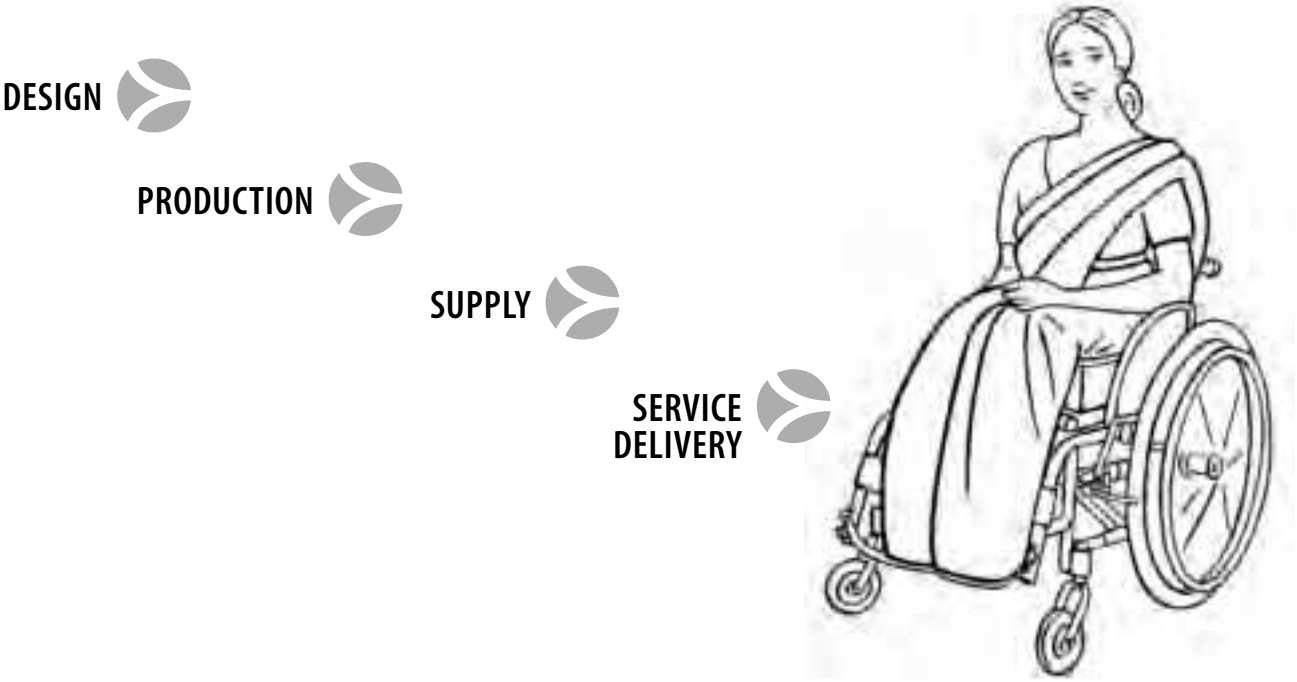
Choice

Users are rarely given the opportunity to choose the most appropriate wheelchair. Often there is only one type of wheelchair available (and often in only one or two sizes), which may not be suited to the user's physical needs, or practical in terms of the user's lifestyle or home or work environment. According to the Convention on the Rights of Persons with Disabilities, "States Parties shall take effective measures to ensure personal mobility with the greatest possible independence for persons with disabilities … by facilitating the personal mobility of persons with disabilities in the manner and at the time of their choice, and at affordable cost" *(17)*.

1.7 Wheelchair provision

Wheelchair provision usually includes the design, production and supply of wheelchairs and delivery of wheelchair services.

Fig. 1.4. Overview of wheelchair provision



Wheelchair provision can only enhance a wheelchair user's quality of life if all parts of the process are working well. This includes ensuring users have access to:

- wheelchairs of an appropriate design;
- wheelchairs that have been produced to appropriate standards;
- a reliable supply of wheelchairs and spare parts; and
- wheelchair services that assist the user in selecting and being fitted with a wheelchair, provide training in its use and maintenance, and ensure follow-up and repair services.

Personnel involved in each area of wheelchair provision need to have the correct skills and knowledge. This means that training is essential for those involved in wheelchair provision.

Design, production and supply

The design of a wheelchair depends on a number of factors:

- the physical needs of users;
- the way and the environment in which the wheelchair will be used; and
- the materials and technology available where the wheelchair is made and used.

Wheelchairs can be produced in the country or outside the country. Those produced outside the country are often mass produced and imported as new or used wheelchairs. Wheelchairs can be supplied to wheelchair service providers by manufacturers, agents or distributors, or by organizations specializing in wheelchair supply.

Information on design, production and supply is provided in Chapter 2.

Service delivery

Appropriate provision of wheelchairs is most important in the successful rehabilitation of people who need a wheelchair for mobility. Historically, however, wheelchair service delivery has not been an integral part of rehabilitation services. This is due to many factors, including poor awareness, scarce resources, a lack of appropriate products, and a lack of training for health and rehabilitation personnel in wheelchair service delivery.

In many countries, users depend on charity or external donations. Donated wheelchairs are often inappropriate and of poor quality, giving further problems for the user and for the country in the long run. Users are not in a position to demand good quality from charities. A study in India revealed that 60% of wheelchair users who had received donated wheelchairs stopped using them owing to discomfort and the unsuitability of the wheelchair design for the environment in which it was used *(18)*.

The result is that many people who require a wheelchair do not receive one at all, while those who do often get one without any assessment, prescription, fitting and follow-up. Many users, even people with spinal cord injury, often get wheelchairs without a cushion or basic instructions, which can lead to pressure sores and even premature death.

There is, however, increasing awareness of the importance of providing individual assessment, fitting and training in how to use a wheelchair. In a number of less-resourced settings, wheelchair services have been established using different models of service delivery. Such models include

centre-based or community-based services, outreach services, mobile "camp"-style services and donations of imported wheelchairs. In countries where user groups are well informed and service providers have the necessary knowledge and support, wheelchair services are becoming integrated into existing rehabilitation activities. The common aim is to ensure that users are given skilled assistance in selecting the most appropriate wheelchair for their needs.

Information on wheelchair services is provided in Chapter 3.

Training

In less-resourced settings, limited training opportunities result in few people being trained to manage the provision of wheelchairs and other assistive devices. Scarcity of trained personnel to assist in choosing and obtaining a wheelchair becomes a barrier to participation *(19)*.

Existing courses for health and rehabilitation professionals provide little input on wheelchair service delivery and related issues. In some instances, national personnel may have had informal training from expatriate personnel, but such training is often limited to the products available in the country and the trainer's own experience and abilities. If the training is not recorded it is not replicable, and the resulting skill levels are not measurable. It is difficult for local personnel to continue practising skills derived from this type of informal training once the trainers and original users leave the service.

The lack of formal training has resulted in a lack of recognition of specialist skills in wheelchair provision. In an attempt to address these needs, some initiatives have been taken by development organizations.

Detailed information on training is provided in Chapter 4.

1.8 Types of wheelchair

No single model or size of wheelchair can meet the needs of all users, and the diversity among users creates a need for different types of wheelchair. Those selecting wheelchairs, in consultation with the user, need to understand the physical needs of the intended user and how he or she intends to use the wheelchair, as well as knowledge of the reasons for different wheelchair designs.

The physical needs of users

The ability to adjust or customize a wheelchair to meet the user's physical needs will vary, depending on the type of wheelchair. Often, wheelchairs are available in at least a small range of sizes and allow some basic adjustments.

Wheelchairs designed for temporary uses (for example, to be used in a hospital to move patients from one ward to another) are not designed to provide the user with a close fit, postural support or pressure relief. Orthopaedic or "hospital" wheelchairs are an example of this type (see Fig. 1.5).

Fig. 1.5. Wheelchair designed for temporary user

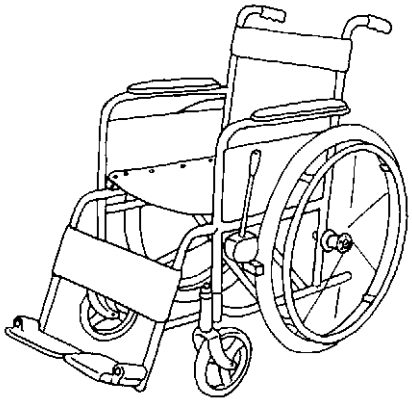
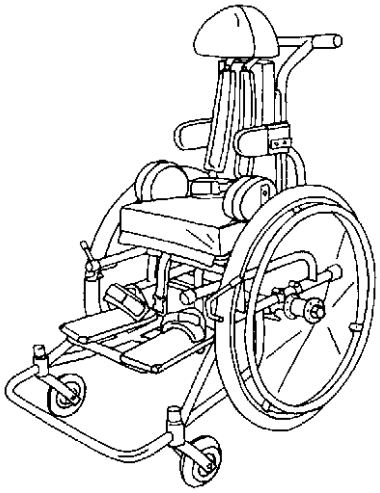


Fig. 1.6. Wheelchair designed for long-term user

Fig. 1.7. Wheelchair designed for user with postural support needs



For long-term users, a wheelchair must fit well and provide good postural support and pressure relief (Fig. 1.6). A range of seat widths and depths, and the possibility to adjust at least the footrest and backrest height are important in ensuring that the wheelchair can be fitted correctly. Other common adjustments and options include cushion types, postural supports and an adjustable wheel position.

Highly adjustable or individually modified wheelchairs are designed for long-term users with special postural needs (Fig. 1.7). Such wheelchairs often have additional components added to help support the user.

How the wheelchair is used

Wheelchair designs vary to enable users to safely and effectively use their wheelchair in the environment in which they live and work.

A wheelchair that is used primarily in rough outdoor environments needs to be robust, more stable and easier to propel over rough ground. Fig. 1.8 illustrates an example of a three-wheeled wheelchair that would be well suited to outdoor use. In comparison, a wheelchair that is used indoors on smooth surfaces needs to be easy to manoeuvre in small indoor spaces.

Fig. 1.8. Wheelchair suitable for outdoor use

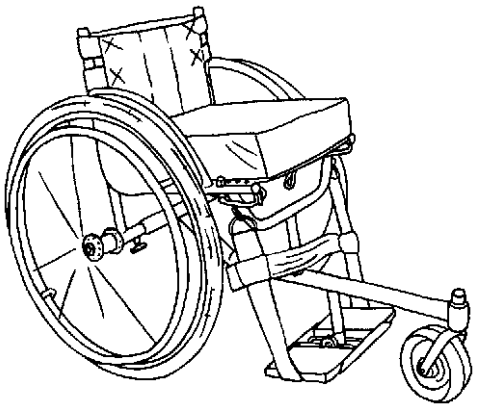
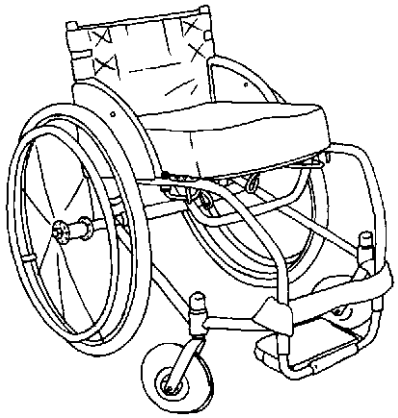


Fig. 1.9. Wheelchair suitable for indoor and outdoor use



Many users live and work in a range of settings, and a compromise is therefore often necessary. Fig. 1.9 shows a robust wheelchair with a relatively short wheelbase but large castor wheels. This wheelchair could be used both indoors and outdoors.

Users need to be able to get in and out of the wheelchair easily, to propel it efficiently and to repair it. Users may need to transport their wheelchair, for example in a bus or car (Fig. 1.10). Different wheelchair designs allow for wheelchairs to be made more compact in different ways. Some are cross-folding (Fig. 1.10), while others have quick-release wheels (Fig.1.11. and Fig.1.12.) and the backrest folds forwards.

Fig. 1.10. Folding wheelchair

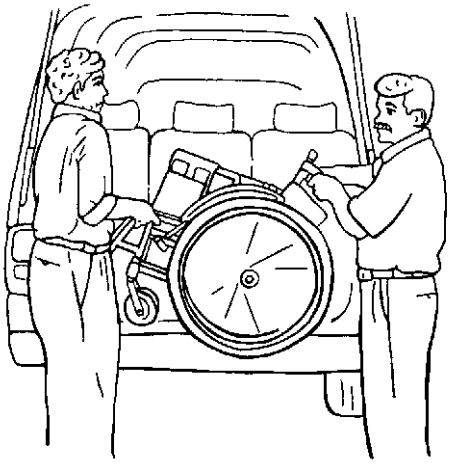


Fig. 1.11. Quick-release wheels

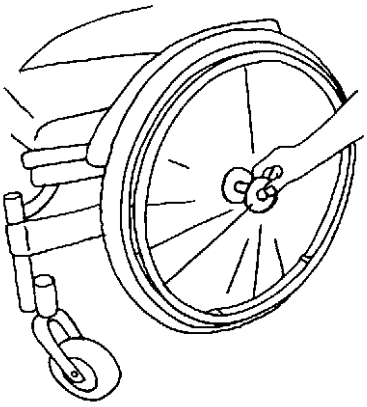
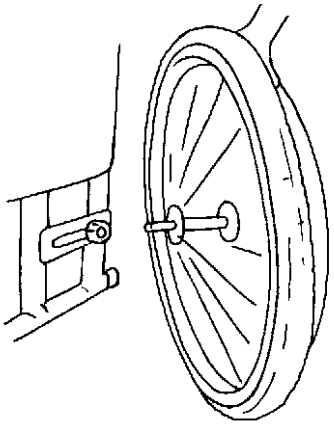


Fig. 1.12. Detachable wheels



These needs and their related wheelchair design features are discussed in Chapter 2.

Materials and technology available

Wheelchair designs vary, depending on the materials and technology available for production and repair, For example, wheelchair designers must take into account the strength and variability of the available materials to avoid premature failure. In the case of failure, the wheelchair should be easily repairable *(20)*. See Chapter 2 for more information on this topic.

1.9 Stakeholders and their roles

1.9.1 Policy planners and implementers

Policy planners and implementers are directly involved in the planning, initiation and ongoing financial, advisory and legislative support of wheelchair provision. The role of policy planners includes the following.

- Wheelchair provision policy is developed in consultation with other stakeholders, aiming at effective measures to ensure personal mobility with the greatest possible independence for people with disabilities. This includes:
  - facilitating the personal mobility in the manner and at the time of their choice and at an affordable cost;
  - access to wheelchairs, including making them available at an affordable cost;
  - providing training in mobility skills to people with disabilities and to rehabilitation personnel; and
  - encouraging entities that produce wheelchairs and other mobility aids within the country
- Standards for wheelchair products, service delivery and training are adopted, promoted and enforced.
- Measures are taken to ensure that wheelchair provision is equitable and accessible to all, including women and children, the poorest and those in remote areas.
- Wheelchair services are developed as an integral part of health care structures and in coordination with associated services, such as rehabilitation, prosthetic, orthotic and community-based rehabilitation services.
- Sustainable funding policies for wheelchair provision are developed.
- Wheelchair user groups and disabled peoples' organizations are involved at every stage from planning to implementation.

According to United Nations Standard Rules and the Convention, it is the primarily responsibility of countries to make wheelchairs available at an affordable cost. Ensuring the availability of wheelchair services within a country does not necessarily mean the direct provision of services by the government. Nevertheless, the government can work closely with nongovernmental and international nongovernmental organizations, development agencies, user groups and the private sector to develop national policies and a provision system. Furthermore, in developing the policy one needs to ensure that wheelchair services are cohesive and closely linked with national health and rehabilitation strategies.

Box 1.2. Wheelchair provision and government ministries

Which ministry is typically responsible for wheelchair provision?
Wheelchair provision impacts on a number of government ministries and authorities. Ministries of health are generally responsible for health care and rehabilitation services, and therefore have a primary responsibility for wheelchair provision. In some countries, however, other ministries take a leading role. In India, wheelchair services are provided by the Ministry of Social Justice and Empowerment and in Ghana by the Ministry of Labour and Social Welfare. In Kenya, a consortium of the Ministry of Health, social welfare services and nongovernmental organizations facilitates wheelchair service delivery within the country. Other ministries can also play a role, as the needs of users include economic and social issues that may be addressed by the ministry of social welfare or similar.

Ministries responsible for employment and education have a role in ensuring the rights of wheelchair users. Thus, unless the responsible ministries or authorities ensure that wheelchair users have access to buildings and public transport, they will not be able to participate in educational, economic and social activities.

1.9.2 Manufacturers and suppliers

An organization may be involved in one or more of the areas of manufacturing and supplying wheelchairs. Supplying means delivering wheelchairs to service providers, either through sale or donation. The role of manufacturers and suppliers of wheelchairs is to develop, produce or supply wheelchairs that meet the needs of users in different contexts. This includes:

- manufacturing or supplying products that are appropriate for the use to which they will be put;
- ensuring their products meet or exceed relevant wheelchair standards;
- providing wheelchairs through wheelchair services that offer, as a minimum, assessment, fitting, user training and follow-up; and
- ensuring that wheelchairs can be repaired locally.

Irrespective of the service model used to provide wheelchairs, it is recommended that suppliers exercise their responsibility by ensuring that:

- the service provider has the capacity to provide the supplied wheelchairs in a reasonable and responsible manner; and
- the supply is based on an assessment of the situation in the country or region and considers the impact on local manufacturers and service providers.

1.9.3 Wheelchair services

Wheelchair services provide the essential link between the users and the manufacturers and suppliers of wheelchairs. Service providers include:

- government wheelchair services
- nongovernmental organizations that provide such services
- the private sector
- hospitals and public health centres.

The main role of a wheelchair service is to assist users to choose the most appropriate wheelchair, to ensure that it is adjusted or modified to suit their individual needs, to train users, and to provide follow-up and maintenance services. Service providers also play a role in:

- giving feedback to manufacturers and suppliers about wheelchair design;
- developing referral networks; and
- developing and finding sustainable funding sources for wheelchairs and services.

1.9.4 Professional groups

Rehabilitation is a question of teamwork. Professionals such as therapists, health/nursing personnel, orthotists/prosthetists, physiatrists and others can play a major role in providing quality services, training personnel as well as users, enhancing the quality of life of the users, and sharing and documenting best practices. A team comprising all groups of rehabilitation personnel can ultimately benefit the user and has in particular proven useful in the development of the new profession or discipline of wheelchair provision. More professional groups need to be involved in wheelchair provision in less-resourced settings. A good example of such involvement is the International Society for Prosthetics and Orthotics (ISPO), which has supported the development of structured professional training for wheelchair technologists.

The role of professional groups includes:

- guiding and supporting the activities of those responsible for wheelchair services;
- advancing the practice and standards of wheelchair service delivery;
- facilitating the placement and secondment of wheelchair professionals;
- facilitating the exchange of information; and
- promoting the education and training of wheelchair professionals.

Box 1.3. Wheelchair industry association in Africa

In Africa, the Pan Africa Wheelchair Builders Association represents those involved in wheelchair design, production, funding and distribution. The Association was formed following a meeting of African wheelchair producers in Zambia in 2003 and is now established in Moshi, United Republic of Tanzania. One of its main activities is networking among wheelchair builders to support each other and to share resources.

1.9.5 International nongovernmental organizations

International nongovernmental organizations are often involved in facilitating wheelchair provision where there is little or no national service delivery. The policies and practices of these organizations should promote coordinated wheelchair provision that is equally accessible to all.

The role of international nongovernmental organizations in wheelchair provision includes:

- meeting the immediate needs of users where local wheelchair provision is lacking;
- supporting the state to fulfil its obligations concerning wheelchair provision;
- assisting the national authorities to develop a proper wheelchair service delivery system within the country;

- ensuring their activities are part of a broader long-term strategy acknowledged and supported by relevant authorities (e.g. the government);
- building the capacities of disabled people's organizations in accessing wheelchairs and developing partnerships;
- facilitating links between the various stakeholders – users, wheelchair service providers and governments;
- implementing wheelchair services by providing training expertise where none is available locally, and building capacities for both the technical and organizational aspects of wheelchair service delivery; and
- establishing services or pilot projects that include best practices for replication by governmental, nongovernmental and international nongovernmental organizations.

1.9.6 Disabled people's organizations

Disabled people's organizations have a crucial role to play in the planning, initiation and ongoing support of wheelchair service delivery. As organizations, they are able to advocate more effectively than individuals for users' needs.

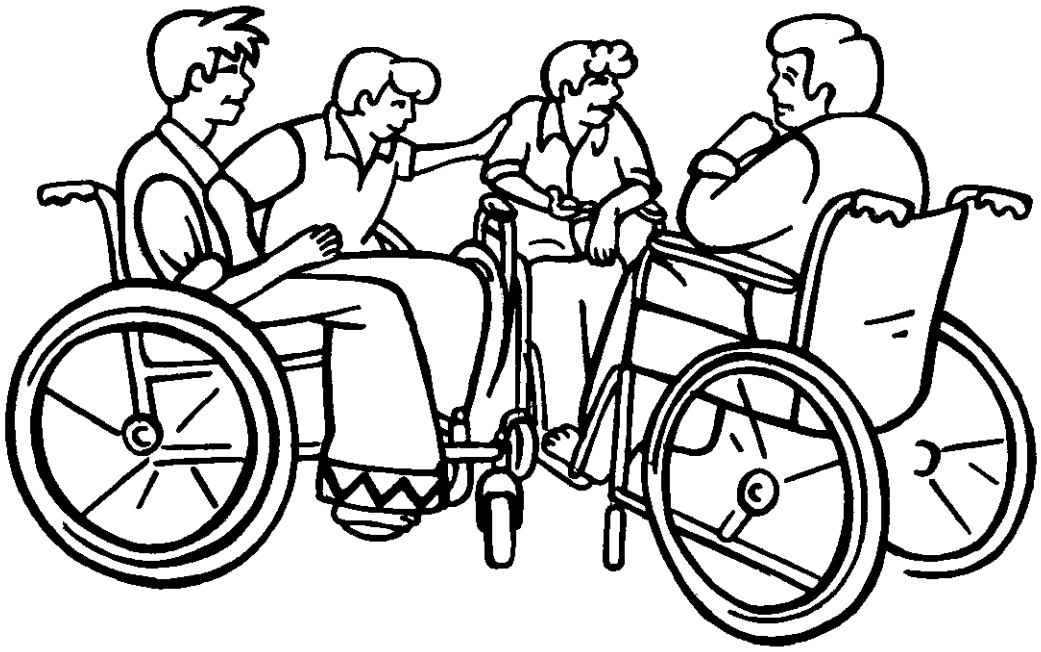
To be effective, disabled people's organizations need knowledge and experience with appropriate products and services. Such organizations played an important role in preparing the Convention on the Rights of Persons with Disabilities and will continue to be involved in its implementation in the future. Wheelchair users have an important role to play in implementing Article 20 of the Convention concerned with personal mobility and of Article 26 addressing habilitation and rehabilitation.

The role of disabled people's organizations in wheelchair provision includes:
- defining user's needs and barriers to equal participation;
- raising awareness of the need for effective wheelchair provision and financing;
- consulting with policy planners and implementers in the development of wheelchair services;
- raising awareness of wheelchair services, and identifying people who need wheelchairs and linking them with wheelchair services;
- monitoring and evaluating wheelchair services;
- advocating against inappropriate wheelchair provision, and that wheelchair services comply with agreed guidelines; and
- supporting users by providing peer support and training.

1.9.7 Users, families and caregivers

Users and their groups are at the centre of developing and implementing wheelchair provision (Fig.1.13). They can help ensure that wheelchair services meet their needs effectively.

Fig. 1.13. Users group



The role of users includes:

- participating in the planning, implementation, management and evaluation of wheelchair provision;
- participating in the development and testing of wheelchair designs;
- working within wheelchair services in clinical, technical and training roles; and
- supporting and training new users.

Some users permanently rely on members of their family to assist with day-to-day activities of living, while others may be more independent. Where a family member or caregiver is responsible for assisting a user on a daily basis, such as a parent of a child with cerebral palsy, he or she should also be involved in all the roles listed above for users.

Family groups for parents, siblings and other relatives of children with disabilities are encouraged to undertake the activities listed under in Section 1.9.6.

Box 1.4. Wheelchair user at policy and implementation level in Uganda

In Uganda, a wheelchair provision stakeholders' meeting was held in 2004, hosted by the Ministry of Health and sponsored by the Norwegian Association for the Disabled. This allowed users, disabled people's organizations, producers, government departments and donors to contribute their perspectives on the current situation of wheelchair provision, to agree on long-term goals, and to plan how to achieve them. The meeting led to the appointment of a wheelchair user as Wheelchair Project Officer within the Ministry of Health. This person's own experience has enriched the process of wheelchair service development in the country by bringing a user's perspective to the policy and implementation level.

Summary

- About 1% of a population need a wheelchair.
- Rights to wheelchairs are outlined in the United Nations policy instruments "Convention on the Rights of Persons with Disabilities" and "Standard Rules on the Equalization of Opportunities for Persons with Disabilities".
- Using an appropriate wheelchair benefits the health and quality of life of the user, and can lead to economic benefits for the user, the user's family and society as a whole.
- Wheelchair provision includes the design, production and supply of wheelchairs and wheelchair service delivery.
- When developing approaches to wheelchair provision, it is necessary to consider financial and physical barriers for users, their access to rehabilitation services, and user education, information and choice.
- There is a need for different types and sizes of wheelchair owing to the diversity of needs among users.
- Stakeholders involved in wheelchair provision include policy planners and implementers; manufacturers, suppliers and donors of wheelchairs; providers of wheelchair services and professional groups; national and international nongovernmental organizations and disabled people's organizations; and users, their families and caregivers.

References

1. Sheldon S, Jacobs NA, eds. *Report of a Consensus Conference on Wheelchairs for Developing Countries, Bangalore, India, 6–11 November 2006*. Copenhagen, International Society for Prosthetics and Orthotics, 2007 (http://homepage.mac.com/eaglesmoon/WheelchairCC/WheelchairReport_Jan08.pdf, accessed 8 March 2008).
2. *Concept note. World Report on Disability and Rehabilitation*. Geneva, World Health Organization, 2008 (http://www.who.int/disabilities/publications/dar_world_report_concept_note.pdf, accessed 8 March 2008).
3. *The Standard Rules on the Equalization of Opportunities for Persons with Disabilities. Preconditions for Equal Participation*. New York, United Nations, 1993 (http://www.un.org/esa/socdev/enable/dissre03.htm, accessed 8 March 2008).
4. *Millennium Development Goals*. New York, United Nations, 2000 (http://www.un.org/millenniumgoals, accessed 8 March 2008).
5. *Poverty reduction strategies*. Washington, DC, World Bank. 2007 (http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTPOVERTY/EXTPRS/0,,menuPK:384207~pagePK:149018~piPK:149093~theSitePK:384201,00.html, accessed 8 March 2008).
6. Krizack M. 2003. *It's not about wheelchairs*. San Francisco, CA, Whirlwind Wheelchair International, 2003 (http://www.whirlwindwheelchair.org/articles/current/article_c02.htm, accessed 8 March 2008).
7. Rushman C, Shangali HG. *Wheelchair service guide for low-income countries*. Moshi, Tanzanian Training Centre for Orthopaedic Technology, Tumani University, 2005.
8. Rushman C et al. *Atlas of orthoses and assistive devices: appropriate technologies for assistive devices*, 3rd ed. Rosemont, IL, American Academy of Orthopaedic Surgeons, 2006.
9. Howitt J. *Patronage or partnership? Lessons learned from wheelchair provision in Nicaragua* [thesis]. Washington, DC, Georgetown University, 2005.
10. Fitzgerald SG et al. Comparison of fatigue life for 3 types of manual wheelchairs. *Archives of Physical Medicine and Rehabilitation*, 2002, 82:1484–1488.
11. Phillips B, Zhao H. Predictors of assistive technology abandonment. *Assistive Technology*, 1993, 5:36–45.
12. Beattie S, Wijayaratne L. *A study of the cost of rehabilitation of spinal cord injured patients in Sri Lanka*. Colombo, Motivation, 1999 (http://www.motivation.org.uk/_history/History_SriLankaTotalRehab.htm, accessed 25 March 2008).
13. Disability and Rehabilitation Team (DAR). Geneva, World Health Organization, 2006 (http://www.who.int/disabilities/introduction/en/, accessed 26 July 2006).
14. *Time for equality at work. Global Report under the Follow-up to the ILO Declaration on Fundamental Principles and Rights at Work*. Geneva, International Labour Office, 2003 (http://www.ilo.org/dyn/declaris/DECLARATIONWEB.DOWNLOAD_BLOB/Var_DocumentID=1558, accessed 8 March 2008).
15. Helander E. *Prejudice and dignity: an introduction to community based rehabilitation*, 2nd ed. New York, United Nations Development Programme, 1999.
16. *Global Survey on Government Action on the Implementation of the Standard Rules on the Equalization of Opportunities for Persons with Disabilities*. New York, United Nations, 2006 (http://www.un.org/disabilities/default.asp?navid=9&pid=183, accessed 8 March 2008).
17. *Convention on the Rights of Persons with Disabilities*. New York, United Nations (http://www.un.org/disabilities/default.asp?id=259, accessed 6 March 2008).
18. Mukherjee G, Samanta A. Wheelchair charity: a useless benevolence in community-based rehabilitation. *Disability and Rehabilitation*, 2005, 27:591–596.
19. Scherer MJ, Glueckauf R. Assessing the benefits of assistive technologies for activities and participation. *Rehabilitation Psychology*, 2005, 50:132–141.
20. McNeal A, Cooper RA, Pearlman J. Critical factors for wheelchair technology transfers to developing countries – materials and design constraints. In: *Proceedings of the 28th Annual RESNA Conference* [CD-ROM]. Atlanta, GA, RESNA, 2005:25–27

2 DESIGN AND PRODUCTION

… to increase the quality and range of wheelchairs.

This chapter:

- outlines methods for designing or selecting a wheelchair;
- describes different types of wheelchair production and supply;
- sets out the advantages and disadvantages of different wheelchair designs; and
- suggests how to describe and evaluate wheelchairs in terms of functional performance; seating and postural support; and strength, durability and safety.

Box 2.1.

Wheelchairs changing lives …

Testimonial from a user in Cambodia

In 1982, Reth stepped on a landmine. He later had both of his legs amputated. He received vocational training at a Thai refugee camp, where he stayed for 13 years. In 1993, Reth moved back to Cambodia and was employed and trained as a wheelchair builder in a local wheelchair workshop. Reth himself received a three-wheeled active-style wheelchair and a tricycle through the workshop.

The mobility provided by both the wheelchair and the tricycle has enabled Reth to work, care for his wife and six children, and become an active campaigner against landmines. Reth is an ambassador for the International Campaign to Ban Landmines (ICBL), an initiative that was awarded the Nobel Peace Prize in 1997. He has travelled the world urging governments to make landmines history.

Reth says: "I have to admit that what happened to me, being a landmine victim, helped me realize that life does not end in one or more difficulties. Also, through the help of so many people around me I was able to go beyond the tragedy in my life. Now I am an active spokesperson for ICBL. Whenever there's an opportunity to speak about advocacy to ban landmines, I make a sincere appeal to people and governments, asking them to support this campaign, to give more assistance to help the victims and their families. Also, at present I am working in the Jesuit Service Cambodia – Siem Reap team, in the wheelchair team and outreach programmes. As of now, we are able to reach people in 222 villages, 90 communes and 12 districts. It is not an easy job for a double amputee, but I am happily fulfilled."

testimonial

2.1 Introduction

Purpose and outputs

The purpose of the design and production guidelines is to increase the quality and range of manual wheelchairs available in less-resourced settings.

Implementation of these guidelines will lead to:
- a wider variety of wheelchair types and designs
- wheelchairs that are safe and meet minimum requirements
- lower long-term costs of wheelchairs
- more available information about wheelchairs
- national standards for wheelchairs.

The guidelines have been developed to apply to manual wheelchairs with a variety of features. These include all levels of adjustability, three- and four-wheeled wheelchairs, folding and rigid wheelchairs, and adult and paediatric wheelchairs. While the guidelines are not written specifically for devices such as hand-powered tricycles, the principal recommendations may nevertheless be applicable.

These guidelines can be used to design wheelchairs and select pre-existing wheelchair designs for production and supply to wheelchair services.

Strategies

Design

The aim of wheelchair design is to produce wheelchairs that perform well and can provide appropriate seating and postural support without compromising strength, durability and safety. This can be achieved when government authorities, manufacturers, engineers, designers, service providers and users fulfil their respective roles with respect to design.

Standards

It is recommended that government authorities develop and adopt national wheelchair standards applicable to all wheelchairs supplied in a country. This includes all locally produced wheelchairs and imported wheelchairs, whether donated or purchased.

The International Organization for Standardization (ISO) has developed international standards for wheelchairs, known as the ISO 7176 series *(1)*. This series specifies a terminology and testing methods for evaluating wheelchair performance, size, strength, durability and safety. Many national standards committees have adopted the ISO 7176 series, or an individually tailored form of the series, as their own wheelchair standards.

All requirements in the ISO 7176 series may not reflect typical conditions in less-resourced settings, as some of the requirements were designed to simulate the conditions in city environments with smooth roads. When developing national standards, it is therefore important to consider environments, the weights and sizes of users, typical uses, and the available wheelchair and allied technologies (such as bicycle/tricycle) within the country.

Production and supply

Governments, manufacturers and suppliers need to work together to establish a sustainable supply of wheelchairs that meet national standards. Whether produced in the country or imported, it is important that the range of wheelchairs meets the diverse needs of users.

Governments and organizations are encouraged to support manufacturers in using test equipment to improve the quality of their wheelchairs, to make efforts to minimize the costs of testing for local manufacturers, and to support the dissemination of wheelchair quality evaluations

Collaboration

The resources needed to implement these guidelines can be minimized through joint planning and cooperation among government authorities, nongovernmental organizations, international nongovernmental organizations, disabled people's organizations, foreign governments, bilateral aid agencies and the private sector. As much as possible, existing infrastructure and expertise should be used, supported and further developed.

Training

Individuals need to be trained to design, produce and test wheelchairs that meet these guidelines. This can be done by introducing these guidelines to students or practitioners of related disciplines.

Information collection and dissemination

Wheelchair evaluation and testing results should be recorded and made available to all stakeholders. Such information will help stakeholders to select the most appropriate wheelchair for a given use. Service providers, users and advocacy groups are also encouraged to use the information provided to communicate with wheelchair manufacturers and suppliers about their specific needs and how available wheelchairs meet their needs.

Stakeholders and resources

Stakeholders involved in the design and production of wheelchairs include purchasers, manufacturers, designers, evaluators and users. Experienced wheelchair users can often contribute substantially in designing wheelchairs. Key resources required to implement the design and production guidelines include:

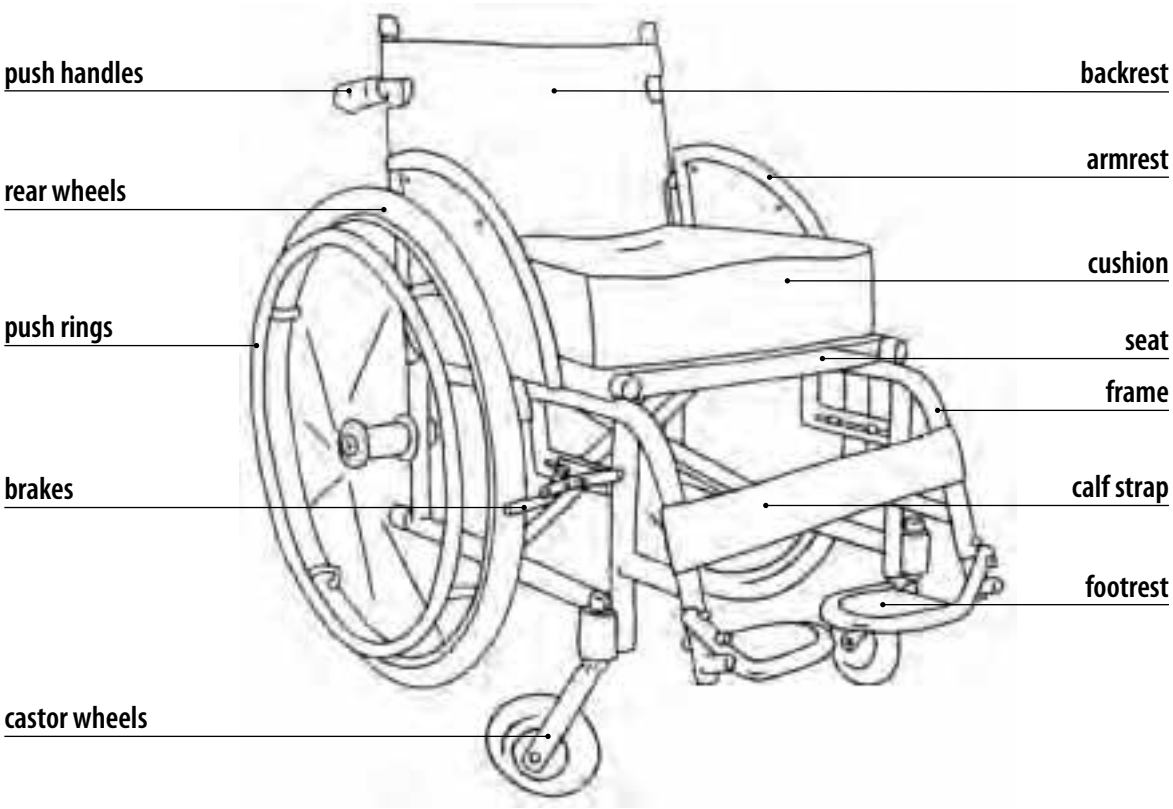
- engineers, designers, users, technicians and manufacturers
- product evaluators
- facilities and equipment to produce or assemble wheelchairs
- facilities and equipment to evaluate wheelchairs.

2.2 Wheelchair design

Wheelchair designs vary greatly to take account of the diverse needs of users. To ensure wheelchairs are appropriate, designers and providers must thoroughly understand the needs of the intended users and their environments. Users' needs are best met when there is a variety of models from which to choose.

The names of common wheelchair parts are shown in Fig. 2.1. A cushion is to be considered an integral part of a wheelchair, and is therefore to be included with all wheelchairs. People with spinal cord injuries or similar conditions require pressure relief cushions that prevent the development of life-threatening pressure sores.

Fig. 2.1. Example of a manual wheelchair and its parts



2.2.1 General considerations in wheelchair design

Wheelchairs should be designed to enable their users to participate in as many activities as possible. As a minimum, a wheelchair should enable the user to lead a more active life without having a negative effect on their health or safety. Comfort and safety are two important factors affecting the quality of life of long-term users *(2)*.

The user's health and safety

The health and safety of users should never be compromised in order to reduce costs. Although it may seem that any wheelchair is better than no wheelchair, this is not true when the wheelchair causes or contributes to injury or other health risks.

A wheelchair should be designed to ensure the user's safety and health. There are many ways in which users can be injured by their own wheelchairs, as illustrated by the following examples:

- A wheelchair without a cushion or with an inadequate cushion can cause pressure sores. This in turn may require the user to spend many months in bed; without appropriate care and treatment this often leads to bedsores, secondary complications and even premature death.
- Unstable wheelchairs can tip and lead to users falling and injuring themselves.
- Wheelchairs that are too wide or are unduly heavy can cause shoulder injuries.
- Sharp edges on surfaces can cause cuts that in turn can lead to infection.
- Poor design can result in places on the wheelchair where the user or others can get their fingers or skin pinched.
- Wheelchairs that cannot endure daily use in the user's environment may fail prematurely and can injure the user.

Strength and durability

Wheelchairs used outdoors are subjected to greater wear and tear than those designed for indoor use or use on smooth roads and paths. A wheelchair must be strong enough not to suffer a sudden failure while being used. The wheelchair should be built to have the longest possible useful life and require the fewest repairs. A wheelchair should be designed so it can be repaired near the user's home if it fails, and replacement parts should be easily available.

Suitability for use

Wheelchairs should be appropriate for the environment in which they will be used and for the specific people who will use them. One wheelchair design will not suit everyone. When designing or selecting wheelchairs, it is necessary to think about the environment and the way in which the wheelchair may be used (Box 2.2).

Box 2.2. Some environments and uses to consider when designing or selecting a wheelchair

- **Riding for long distances over rough roads.**
- **Going up and down many kerbs every day.**
- **Accessing built environments: narrow doorways, small turning areas, steep ramps, desks and tables, bathroom facilities (e.g. sitting and squatting toilets).**
- **Exposure to moisture such as rain, high humidity, snow, ice, hail and body fluids such as urine and sweat.**
- **User showering while sitting in the wheelchair.**
- **Exposure to extreme temperatures.**
- **User transporting goods on the push handles, upholstery, footrests or other parts of the wheelchair.**
- **Passengers riding on footrests and armrests.**
- **People lifting the wheelchair by one armrest, footrest or push handle when the wheelchair is occupied.**
- **Transporting the wheelchair in confined spaces or other cramped or crowded conditions.**

How the wheelchair will be produced

When designing a new wheelchair, or selecting a pre-existing wheelchair design, it is important to know where the wheelchair will be produced. In different locations, the technical skills, available technology, materials and components available for production will vary. For this reason, a wheelchair designed for one region may not be suitable in another region. However, the fundamental design might be quite similar.

2.2.2 Introducing wheelchair design

The following categories can be used to describe and evaluate wheelchair designs.

- **Functional performance**: how a wheelchair performs for different users in different environments. The functional performance of a wheelchair is determined by its design and features.
- **Seating and postural support**: how a user's body is supported by the wheelchair. This includes comfort and pressure relief.
- **Strength, durability and safety**: considers the safety of the user, the resistance to breaking and the durability of the wheelchair.

Design features, minimum guidelines and evaluation methods related to each category are described in more detail in Sections 2.4, 2.5, and 2.6, respectively.

2.2.3 The design process

Wheelchair users are strongly encouraged to be involved in the design and selection process. From experience, users are the most knowledgeable about their own physical, social and cultural needs *(3)*.

The steps in wheelchair design are:

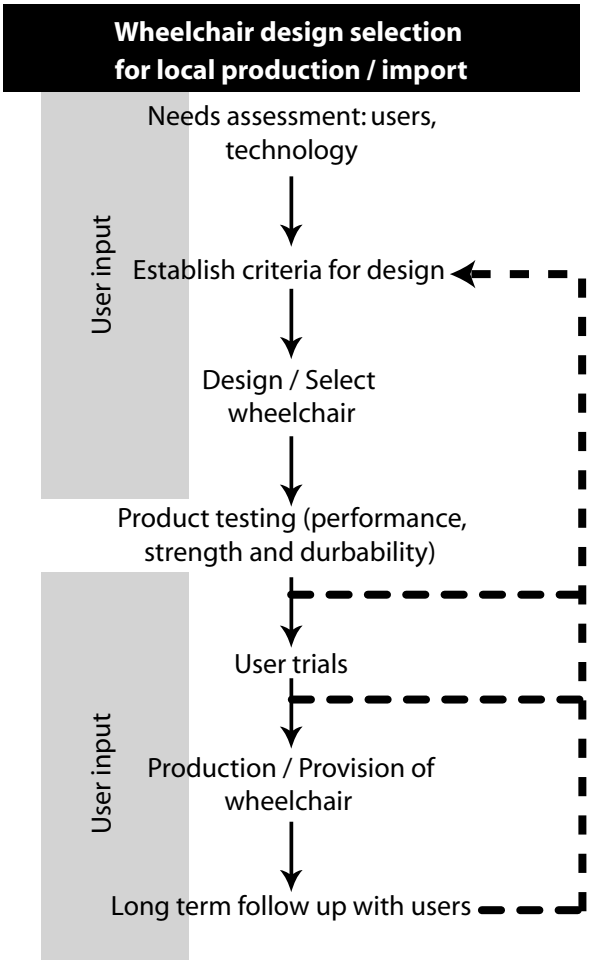
Step 1: design brief. This is a written statement of the needs and criteria for the wheelchair. The criteria include:

- environmental constraints (physical, cultural, social);
- local production resources, such as materials and human resources;
- performance requirements; and
- target price.

Design briefs should be developed in consultation with users and others familiar with the needs of intended users, and according to available resources.

Step 2: design/select wheelchair. After the design brief is written, design ideas are developed and prototypes are built and tested in the workshop. The process of designing, prototyping and testing may need to be repeated several times until the prototype meets the performance requirements of the brief. A design brief can also be helpful in selecting a wheelchair.

Fig. 2.2. Wheelchair design selection process



Step 3: product testing. When a prototype meets the performance criteria, it should be tested to ensure it meets strength and durability requirements. If the wheelchair fails the tests, the design may need to be changed.

Step 4: user trials. Once the prototype has met all the performance, strength, durability and safety requirements, it should be tested by users who live in the environment the wheelchair is designed for. User trials allow for feedback from users, who are the most knowledgeable about the performance of the device. (User trials are described in Section 2.7.)

Step 5: production and supply. If the user trials are successful, production and supply of the wheelchair may begin.

Step 6: long-term follow-up. At this point, long-term follow-up should be used to assess the performance of the wheelchair over time (for example, over several months). The feedback thus obtained should then be used to improve the design. (Long-term follow-up studies are described in Section 2.7.)

Local production resources

As highlighted above in the design brief, an important element of the design process is to identify local production and repair resources. A number of factors determine whether a particular design of wheelchair can be produced or repaired in a particular region, including:

- the materials and spare parts available in that region;
- the human resources and skilled technical labour available; and
- the production equipment available.

Designers can use the above determinants to ensure the designed wheelchairs can be manufactured or repaired in the region in question. These parameters also influence the type of production facilities that can be used to manufacture the wheelchair.

Box 2.3. Using the design process for wheelchair selection

The design process can be an effective tool for selecting wheelchairs for large-scale provision to a region or for individual users. The steps in Fig. 2.2 can be followed to determine the wheelchair(s) that best meet the users' needs.

Design brief. In cases where previously designed wheelchairs are being purchased (either locally or through importation), a design brief can be used to outline which features a wheelchair should have for the intended user groups.

Testing. If reliable test results are available, they can be reviewed to ensure the wheelchair's strength, durability and performance. If such results are not available, product testing is recommended.

User trials and long-term follow-up. Even if the wheelchair has proved successful in other regions, it is strongly recommended that it is tested by users living where it will actually be used. Long-term follow-up should be carried out to ensure that the wheelchair continues to meet the needs of the users over time.

2.3 Wheelchair production and supply

Wheelchairs may be produced nationally or imported. To provide a range of wheelchairs, some countries may choose to support both national production and importation. Each supply method has an appropriate application (Table 2.1).

Table 2.1. Different methods of wheelchair production and supply

National production	**Small-scale**	**Production of small numbers of wheelchairs using locally available materials and low technology production methods to supply local wheelchair services.**
	Large-scale	**Production of large numbers of wheelchairs to supply wheelchair services nationally, regionally or locally.**
Imported	**Used wheelchairs**	**Collection of used wheelchairs from high-income countries, refurbished and supplied to less-resourced settings. Selection of the correct model is crucial in this process. Often, such wheelchairs have been hospital-style wheelchairs designed for temporary users.**
	Large-scale production	**Wheelchairs designed and produced for sale or donation in less-resourced settings, sometimes assembled locally.**

With many different needs within a region, a variety of supply methods may be suitable, the long-term goal being sustainable solution. It is recommended that all wheelchairs, irrespective of supply method, meet or exceed national wheelchair standards and be repairable locally.

When determining whether to acquire wheelchairs via import or local production, decision-makers are advised to balance a variety of factors. These include:

- the needs of local wheelchair users;
- the quality and variety of wheelchair models;
- the long-term reliability of supply of wheelchairs and spare parts;
- the possibility of influencing the design, features, materials, etc.;
- the purchase price;
- the cost of repair and replacement;
- the effect on local employment and wheelchair production;
- coordination of supply with an overall plan for wheelchair provision;
- the amount and term of the funding available; and
- policies and strategies, including long-term sustainability.

2.4 Functional performance

Functional performance is how a wheelchair performs for different users in different environments. The functional performance of a wheelchair is determined by its unique design and features. There are many compromises to consider when designing or selecting for different uses.

This section provides information on the key features of a wheelchair that affects the main categories of performance and how to evaluate them. It also outlines compromises that need to be considered when choosing different design features.

To meet the functional performance needs of individual users, a range of wheelchair designs and sizes are needed.

2.4.1 Wheelchair stability

Wheelchair stability affects how safe the wheelchair is, and how well the user can carry out activities in the wheelchair. Wheelchair tipping causes many injuries for users *(4)*.

- *Static stability* relates to the stability of the wheelchair when it is not moving. This determines whether the wheelchair will tip over (where some wheels lose contact with the ground) when the user, for example, leans over to pick something up off of the ground or transfers into or out of his or her wheelchair.
- *Dynamic stability* relates to the stability of the wheelchair when moving. This determines whether the user can ride over bumps or sloped surfaces without tipping.

The design features used to increase wheelchair stability have secondary effects on other functional performance characteristics. For example, moving the front castor wheel forward *increases* stability but *reduces* the manoeuvrability of the wheelchair in confined spaces. These relationships are described below.

General stability is affected by the position of the combined centre of gravity of the user and the wheelchair relative to its wheelbase. A way of increasing general stability and its associated advantages and disadvantages are shown in Table 2.2.

Table 2.2. Aim: to increase stability in all directions

Advantages	Disadvantages
By lowering the seat and thus the centre of gravity of the user	
▪ It may be easier for the user to reach objects on the floor. ▪ The seat (and the user's knees) will be more likely to fit under desks and tables. ▪ Users will be more able to use their feet to assist with propulsion (if they are able).	▪ Being lower may make it harder to reach objects above. ▪ The posture may be less comfortable and may increase the pressure on the user's seat (a cause of pressure sores). ▪ The user's pushing position may be worse and access to the hand rims more difficult.

Apart from seat height, stability in each direction is sensitive to several design factors, as described below.

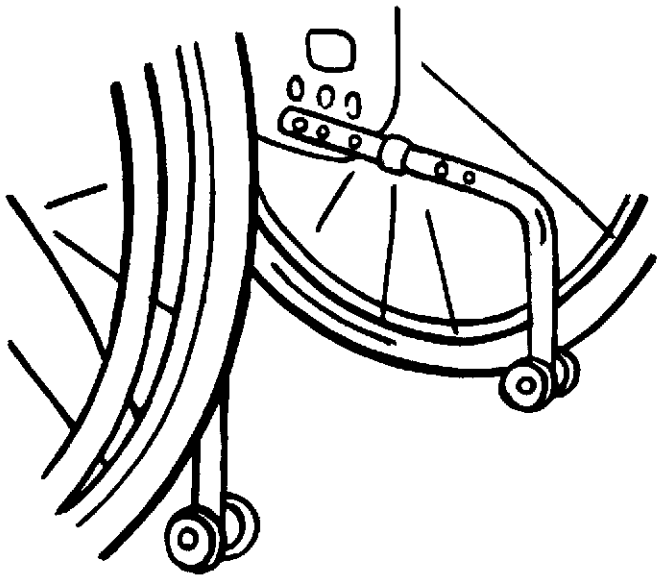
Rearward stability (resistance to tipping backwards) is affected by the rear axle position in relation to the user's centre of gravity. Ways of increasing rearward stability and their associated advantages and disadvantages are shown in Table 2.3.

Table 2.3. Aim: to increase rearward stability

Advantages	Disadvantages
By moving the rear wheel further behind the user's centre of gravity	
▪ Some people, such as some double above-knee amputees, require increased rearward stability because their centre of gravity is further back.	▪ Increased tendency to turn downhill on side slope. ▪ User will have poorer access to the hand rim and a shortened push-stroke, making it more difficult to push the wheelchair and harder on the upper extremities. ▪ It will be more difficult to perform a "wheelie" to negotiate obstacles. ▪ Wheelchair is harder to manoeuvre in confined spaces.
By using anti-tip devices to prevent a wheelchair tipping over backwards (see Fig. 2.3)	
▪ Anti-tip devices can be useful for some users who are unstable or are learning to perform "wheelies" (whereby the user raises the front castor wheels and balances on the rear drive wheels).	▪ Most anti-tip designs restrict the wheelchair's ability to travel over uneven surfaces (such as kerbs or dips).

Note: A bag, backpack or any weight hanging behind the wheelchair will move the centre of gravity back and make the wheelchair more likely to tip backwards.

Fig. 2.3. Anti-tip device



Forward stability is affected by the size and position of the front castor wheel in relation to the user's centre of gravity. Ways of increasing forward stability and their associated advantages and disadvantages are shown in Table 2.4.

Table 2.4. Aim: to increase forward stability

Advantages	Disadvantages
By moving the front castor wheel forward of the user's centre of gravity	
▪ The wheelchair will resist tipping forward when the castors are stopped suddenly by an object they cannot roll over. ▪ Less weight on the front wheels will reduce the rolling resistance of the front wheels, allowing the wheelchair to roll more easily.	▪ Overall wheelchair length is longer, making it harder to manoeuvre in confined spaces.
By using larger front castor wheels	
▪ Front castor size significantly affects dynamic stability; with larger front wheels the wheelchair will be able to roll over larger obstacles without being stopped and tipped forward.	▪ Larger front castor wheels need more room to swivel; the wheelchair design will need to be much longer or wider to allow room for the user's feet.

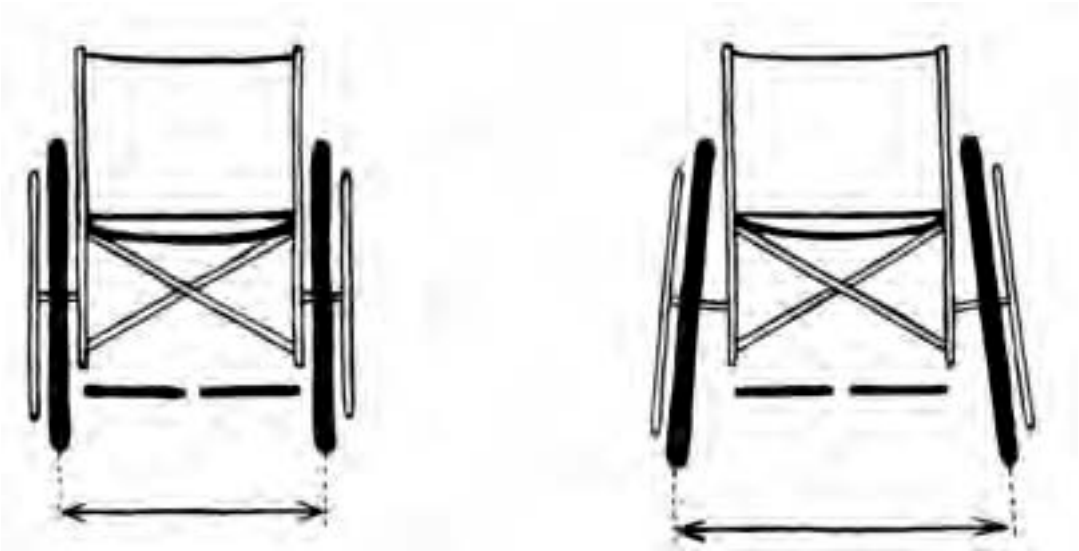
Note: If the footrests are ahead of the front wheels, a weight placed on the footrests (a heavy child, for example) can tip the wheelchair forwards..

Sideways stability is affected by wheelchair width. The further out to the side of the wheelchair the front and rear wheels touch the ground, the more the chair will resist tipping over sideways. Ways of increasing sideways stability and their associated advantages and disadvantages are shown in Table 2.5.

Table 2.5. Aim: to increase sideways stability

Advantages	Disadvantages
By increasing the width of the wheelchair	
▪ Provides more stability. ▪ Comfortable seating. ▪ Better for overweight people.	▪ A wide wheelchair is more difficult to get through narrow doorways. ▪ Not efficient for pushing and hard on upper extremities because the user has to reach out to push the hand rims.
By adding camber to the wheels (see Fig. 2.4)	
▪ Camber brings the wheels closer to the user and more in line with the user's forward push stroke, thus making it easier to push. This can be especially helpful for women, who usually have narrower shoulders but wider hips than men. ▪ Traction is better when traversing slopes.	▪ A wide wheelchair is more difficult to get through narrow doorways. ▪ Camber increases the width of the wheelchair when it is folded.

Fig. 2.4. Wheelchair without camber (left) and with camber (right)



Users with advanced mobility skills and with good trunk control can partially compensate for some of the wheelchair's instability if they can balance on the rear wheels (perform a "wheelie") and if they can shift their weight forwards, backwards or to the side to prevent tipping.

2.4.2 Manoeuvrability

Manoeuvrability has been divided into two categories: manoeuvrability around obstacles and manoeuvrability over obstacles.

Manoeuvrability around obstacles determines the user's ability to manoeuvre in an environment with confined spaces, such as a toilet with a narrow door and very limited space.

- **Moving through narrow passageways.** The narrowest space through which a wheelchair can pass is determined by its width, measured from the outermost point on each side. The ability to move through narrow passageways can be improved by making the wheelchair narrower. See Table 2.6 for related design solutions and effects.
- **Pulling up close to surfaces and objects**. How close users can get to surfaces and objects they cannot roll under, such as toilets, low tables, counter tops, centre-post tables and bathtubs, is determined by how far the wheelchair extends both forwards and to the side of the seat. A user can get closer to surfaces and objects if the wheelchair is shorter in height (see Table 2.6).

- **Rolling under surfaces**. The user's ability to pull up to a table is determined by the height of the user's knees (the length of the user's lower leg plus the minimum safe height of the footrest above the ground). Some types of fixed armrest also prevent users from pulling up to tables and counters.
- **Turning around in confined spaces**. The smallest area in which a wheelchair can turn around is determined by its maximum diagonal measurement (see Table 2.6).

Table 2.6. Aim: to improve the ability to turn round in confined areas

Advantages	Disadvantages
By making the wheelchair shorter and narrower	
▪ Reduced weight. ▪ Easier to handle and transport.	▪ A shorter and narrower wheelchair will be less stable. Wheelchairs can only be as narrow as the user's width plus the wheels.
See Tables 2.4, 2.7 and 2.8 for related effects.	
By moving the rear wheel forward in relation to the user	
▪ Improved access to hand rims. With a longer push stroke, both forwards and backwards, the user is able to use fewer strokes to turn in confined spaces. ▪ With more of the user's weight directly over the rear turning wheel, the wheelchair is more responsive to turning.	▪ Reduced rearward stability.
See Table 2.7 for related effects.	
If the wheelchair has easily removable footrests	
▪ Increased ability to pull up close to surfaces and objects.	▪ Removable parts can be lost or broken.

Manoeuvrability over obstacles determines the user's ability to negotiate obstacles such as soft ground or raised obstacles. When negotiating obstacles, the user is at risk of tipping backwards or forwards and falling out of the chair (a common cause of injury); thus it is also important to consider stability when evaluating a wheelchair's ability to manoeuvre over obstacles (see Tables 2.3 and 2.4).

- **Manoeuvring over soft ground**, such as mud, sand, grass, gravel and snow, depends on the area of contact that the wheels have with the ground and the amount of weight on the wheel. Ways of improving manoeuvrability over soft ground and their associated advantages and disadvantages are shown in Table 2.7.

Table 2.7. Aim: to improve manoeuvrability over soft ground

Advantages	Disadvantages
By increasing the width, diameter and softness of the castor wheel to increase the contact area, thus helping to prevent the wheelchair from sinking into soft ground[a]	
▪ A wide wheel with a raised point on the centre of its tread can combine low rolling resistance on hard surfaces with good flotation over soft ground. ▪ Less weight on the front wheels will reduce the rolling resistance of the front wheels, allowing the wheelchair to roll more easily.	▪ Increasing the contact area of the castor wheel with the ground can make it more difficult to turn, especially in tight, slow turns.
By increasing the width, diameter and softness of the rear wheel to increase the contact area, thus helping to prevent the wheelchair from sinking into soft ground[a]	
▪ Larger-diameter rear wheels can make it easier to roll over rough terrain. ▪ In many less-resourced settings, 28-inch bicycle tyres are widely available; 26-inch tyres are somewhat less common, and 24-inch tyres are more difficult to find.	▪ Wider and softer rear wheels can make it more difficult to turn, especially in tight, slow turns. ▪ Larger-diameter rear wheels make the wheelchair more difficult to transport.
By moving the front castor wheel(s) forward to reduce the weight on the smaller castor wheel(s) and make it less likely to sink into soft ground	
▪ More of the user's weight on the rear wheels will provide more traction on the rear wheels to drive through soft ground.	▪ Overall wheelchair length is longer, making it harder to manoeuvre in confined spaces.
See also Table 2.4 for related effects.	
By moving the rear wheels forward in relation to the user to reduce the weight on the front castor wheel(s) and make it less likely to sink into soft ground	
▪ More of the user's weight on the rear wheels will provide more traction to the rear wheels to drive through soft ground. ▪ Reduced tendency to turn downhill on side slope, which requires less energy from the user to correct for downhill turning. ▪ User has better access to the hand rim and a longer push stroke, making it easier to push the wheelchair and better for the upper extremities. ▪ Easier to perform "wheelies" to negotiate obstacles. ▪ Wheelchair is easier to manoeuvre in confined spaces.	▪ Reduced rearward stability.
By using rear wheels with knobs, such as those on mountain bike tyres, to increase traction on soft ground and keep wheels from slipping	
	▪ Spikes or knobs on tyres cause additional flexing of the tyre and thus higher rolling resistance. ▪ Mud will collect more on tyres with knobs than on smoother tyres.

[a] Substituting larger castor and/or rear wheels on a wheelchair not designed to take them can change important functional performance features, including seat angle, castor barrel angle and seat height (user's centre of gravity).

- **Manoeuvring over raised obstacles**, such as bumps, kerbs or rocks, depends on many factors. The size of the castor wheel, the distance of the castor wheel from the user's centre of gravity and the springiness of the castor wheel all have a significant effect. Castor flutter is also a result of hitting bumps at speed. Ways of improving manoeuvrability over raised obstacles and their associated advantages and disadvantages are shown in Table 2.8.

Table 2.8. Aim: to improve manoeuvrability over raised obstacles

Advantages	Disadvantages
By increasing the distance between the front castor wheel(s) and the user's centre of gravity	
See Table 2.4 for related effects.	
By increasing the diameter of the castor wheel	
See Table 2.7 for related effects.	
By increasing the diameter of the rear wheel	
See Table 2.7 for related effects.	
By increasing the amount of deflection/springiness of the castor wheel	
	▪ A softer wheel can make it more difficult to turn, especially in tight, slow turns. ▪ A pneumatic castor wheel can be difficult to repair or replace.

Note: Although users with advanced mobility skills can compensate for a wheelchair's lack of manoeuvrability over objects by moving their body posture to balance the wheelchair, unseen obstacles can put the user's safety at risk.

2.4.3 Pushing efficiency

Pushing efficiency is related to the amount of energy required for the user to push the wheelchair over a given distance. Lighter wheelchairs are normally easier to push, but there are many factors and wheelchair features that affect how difficult or easy it is to push one's wheelchair. Ways of improving the pushing efficiency and their associated advantages and disadvantages are shown in Table 2.9.

Table 2.9. Aim: to improve pushing efficiency

Advantages	Disadvantages
By moving the rear wheels forward in relation to the user	
See Table 2.7 for related effects.	
By optimizing seat width and putting the push rims in line with shoulders	
▪ User will not have to reach out for hand rims.	
By putting camber in the rear wheels	
▪ Brings the top of the hand rims closer to the body and more in line with the user's natural push stroke.	
See also Table 2.5 for related effects.	
With an aligned wheelchair; wheelchair is in good condition and working order	
Note: A wheelchair with a broken or misaligned component (e.g. untrue wheels, distorted frame, broken bearings causing friction, unparallel wheels or poorly inflated pneumatic tyres) resists the user's forward motion, thereby wasting much of the user's pushing energy.	
For use on smooth ground, use harder tyres	
▪ Harder tyres (which deform less) have lower rolling resistance on smooth ground than softer tyres, all other factors being equal. ▪ Solid tyres can never fail the user by being punctured.	▪ Harder/solid tyres provide little shock absorption. ▪ Solid tyres are difficult to repair or replace (unless a supply of replacement parts is available).
For use on imperfect surfaces (such as outdoors), use tyres that return energy and "spring back" (such as pneumatic tyres)	
▪ Tyres that return energy have lower rolling resistance than those that dissipate energy (i.e. they deform but return to shape slowly, such as solid foam tyres or inserts). ▪ Pneumatic bicycle tyres are relatively easy to repair with the right facilities.	▪ Spikes or knobs, such as those on mountain bike tyres, cause additional flexing of the tyre and thus higher rolling resistance. ▪ Pneumatic bicycle tyres can be punctured.
For use on imperfect surfaces, use larger-diameter wheels that have lower rolling resistance than smaller wheels of similar construction	

2.4.4 Other functional performance characteristics

Ability to transfer into and out of the wheelchair depends on the type of transferral that is easiest for the user and whether the wheelchair's structure impedes transferral. Ways of making transfer easier and their associated advantages and disadvantages are shown in Table 2.10.

Table 2.10. Aim: to make transferral easier

Advantages	Disadvantages
By having removable or folding armrests	
▪ There is more room for the user to be in an easy position for transferring sideways into or out of the wheelchair.	▪ Removable components can get lost. ▪ Mounting locations can become bent or damaged, making them difficult to put on and take off. ▪ Locking mechanisms can fail, creating a dangerous situation when an assistant tries to lift the wheelchair and user up stairs while holding the armrests.
By having fixed armrests that do not extend to the front of the seat	
▪ Greater comfort. ▪ It helps to transfer upwards into a taller vehicle. ▪ Ability to raise the body and take the weight from pressure-sensitive areas during prolonged sitting.	▪ Creates obstacles to easy transferral.
By having detachable armrests	
▪ Easy to transfer.	▪ Armrests can be easily lost or damaged.
Note: For users who transfer by pivoting their bottom about their knees (side transfer), there must be sufficient space at the end of the seat surface to be able to move their body past the armrest.	
By having removable footrests	
▪ Removable footrests can allow a user to pull up closer to surfaces to which the user wishes to transfer. ▪ For standing transfers, removable or flip-up footrests are needed to get out of the way of the user's feet.	▪ Removable components can get lost. ▪ Locking mechanisms can fail, creating a dangerous situation when an assistant tries to lift the wheelchair and user up stairs while holding the footrests.
See also Table 2.6 for related effects.	
By having, for standing transfers, a seat with little to no backward tilt (reclined seat angle)	
▪ Dependent on user's abilities in transferring.	▪ Insufficient backward tilt of the seat (seat angle) can lead to poor posture and to pressure sores in users without full sensation in their buttocks. ▪ *Note*: Too much tilt will cause high localized pressure on the buttocks. ▪ Less backward tilt shifts the user's centre of gravity forward, which makes the wheelchair less stable in the forward direction. ▪ During an impact, if the wheelchair does not tip forward, the seat angle and surface material (of seat and seat cushion) will affect whether or not the user slides out of the seat.

Note: Transferring in and out of a three-wheeled wheelchair requires a different technique to avoid the central frame tube at the front. In a three-wheeled wheelchair, users can get closer to objects by approaching them at an angle.

Transporting the wheelchair. For long-distance travel by, for example, bus, taxi or train, it is important to take account of the design and size of the wheelchair and the materials used in its construction. Weight is a crucial factor in transporting a wheelchair, and weight is determined by the types of component (wheels/frames) used and by the construction materials (e.g. steel, steel/aluminium alloy or other metal). Reducing weight has a direct effect on durability and cost. Design and size are equally important, foldable and smaller wheelchairs being easier to carry. Ways of making it easier to transport a wheelchair and their associated advantages and disadvantages are shown in Table 2.11.

Table 2.11. Aim: to make it easier to transport the wheelchair

Advantages	Disadvantages
By reducing the weight of the wheelchair	
▪ Greater convenient for the user and family members/caregivers. ▪ Greater mobility and productivity.	▪ Reduced durability.
By using folding mechanisms built into the frame (i.e. cross-folding frame, folding backrest) to make the wheelchair more compact for transporting	
▪ Makes the wheelchair easier to carry and transport.	▪ Makes the wheelchair comparatively heavier.
By having components (i.e. wheels, footrests, armrests) removable to help reduce the overall weight and size for lifting, transport and storage	
▪ Reduced weight and volume. ▪ Makes the wheelchair easier to carry and transport.	▪ Removable parts can get lost, bent or broken. ▪ Standard push-button quick-release axles are not available everywhere and are expensive compared to fixed axles. ▪ Standard push-button quick-release axles have a shorter life where conditions of use are rough, whereby sand, dust and moisture can cause the locking mechanism to seize. This can allow the axle to slip out of the axle socket and the wheel to fall off the wheelchair.
Other factors	
	▪ Wheel camber increases the folded width of the wheelchair. ▪ More stable wheelchairs with long frames are more difficult to transport. ▪ Spiked or knobbly "mountain bike" style tyres tend to collect more mud and soil than smooth tyres, which may reduce cooperation from taxi drivers and bus passengers.

Reliability. A wheelchair's reliability is determined by its durability and the length of its useful life. In the case of failure, the frequency and difficulty of repair also determines the reliability of a particular model of wheelchair. Ways of improving the reliability of a wheelchair include:

- better materials and technologies at an affordable cost;
- fewer removable parts;
- non-folding design where folding is not a necessity;
- use of materials that can be repaired or replaced locally;
- regular servicing, repair and maintenance; and
- knowledge by the user of the product and its use, care and maintenance.

2.4.5 Evaluating functional performance

It is recommended that a wheelchair be evaluated based on the functional performance measures and that the results be available to the users and purchasers. The functional performance areas in which a wheelchair should be evaluated or reported on are:

- static stability
- dynamic stability
- rolling resistance
- ability to repair/availability of components
- overall dimensions, mass and turning space.

Static stability and overall dimensions, mass and turning space tests and reporting techniques are covered in ISO standards 7176-1, 7176-5 and 7176-7.

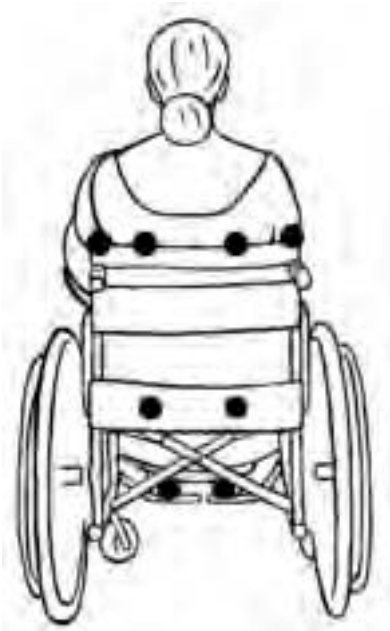
2.5 Seating and postural support elements

All wheelchairs provide seating and postural support as well as mobility. Good postural support is important for everyone, especially for people who have an unstable spine or are likely to develop secondary deformities. The significance of good seating and postural support can mean the difference between the user being active and an independent member of society and the user being completely dependent and at risk of serious injury or even death.

All body contact surfaces provide seating and postural support. Together, these parts of the wheelchair help the user to maintain a comfortable and functional posture and to provide pressure relief. This is very important for users who have problems with skin sensation. The common areas where likely problems might occur are shown in Fig. 2.5 and 2.6.

Fig. 2.5. Common pressure sensitive areas (side view)

Fig. 2.6. Common pressure sensitive areas (back view)



The recommendations set out in Box 2.4 can be used as a guide in the design and selection of basic wheelchairs. They do not cover wheelchairs that provide a higher level of adjustability or custom adaptations for users who require more complex postural support.

Box 2.4. General seating and postural support guidelines

- **A wheelchair and cushion should meet the seating and postural support requirements of the user(s). This includes the size of the wheelchair, the type of cushion, and the adjustability and ergonomic factors of the wheelchair.**
- **All wheelchairs should be provided with a cushion that is appropriate to manage the user's risk of developing pressure sores.**
- **A wheelchair should be evaluated based on the seating and postural support measures, and the results should be available to the users and purchasers.**
- **Cushions should be evaluated and rated based on their ability to provide comfort, pressure relief and postural support, and the results should be available to the users and purchasers.**

2.5.1 Seat bases

The two most common types of seat base are sling seats (Fig. 2.7.) and solid seats (Fig. 2.8.). Sling seats (also known as slung seats) are made of a flexible material such as canvas or vinyl. Solid seats are not flexible and are often made of wood, metal plate or plastic. The list set out in Box 2.5 provides recommendations for each seat type.

Box 2.5. Guidelines for seat bases

- **Wheelchair seats should have a continuous surface with no breaks that might cut or pinch the user's skin.**
- **The angle of the seat, in relation to the horizontal, should be between 0 and 12 degrees (with the front portion of the seat higher than the rear portion of the seat).**
- **The seat must be level from side to side.**
- **A range of seat sizes should be available to fit a range of body sizes.**
- **Sling seats should be designed with materials that do not stretch over time from the weight of the user.**
- **Sling seats and solid seats should be used with cushions designed or modified for use on a sling seat and solid seat, respectively (Fig. 2.9.).**

Fig. 2.7. Sling or slung seat

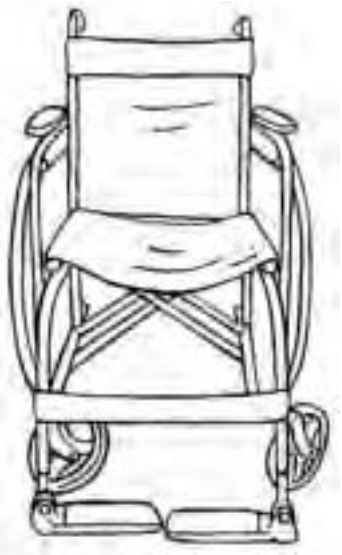


Fig. 2.8. Solid seat

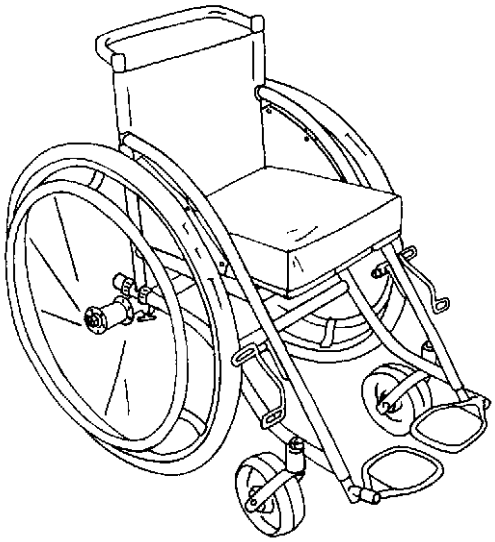


Fig. 2.9. Seat with detachable cushion

Failure of the wheelchair seat and the cushion is a common problem. Sling seats made of poor quality or inappropriate materials can quickly stretch, sag and tear. Wheelchair cushions are not designed to work on such seats made of poor quality or inappropriate materials. This means that the user ends up sitting on an unstable seat without pressure relief. The result can be that the user will develop pressure sores or stop using the wheelchair owing to discomfort. Some design solutions include:

- tension-adjustable sling seats made with straps and stretch-resistant fabric; and
- pressure-relief cushions for wheelchairs with sling seats provided with a contoured bottom surface to accommodate the curve of the sling.

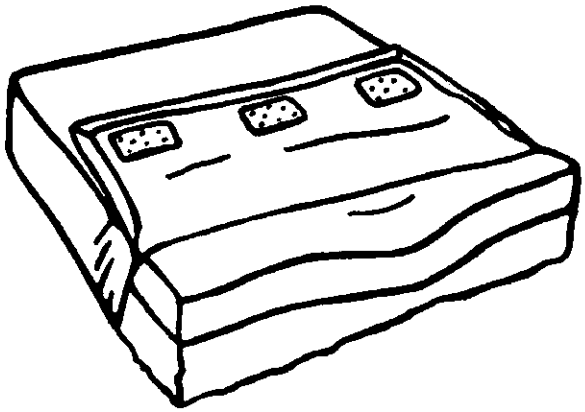
Many cushions can easily be modified for use on a sling seat by cutting off the lower, outer edge from front to back on each side to accommodate the seat rail and the curve of the sling.

2.5.2 Cushions

An inadequate pressure-relief cushion is the one component of a wheelchair that is most likely to cause pressure sores, serious injury or premature death. Wheelchair cushions are used for three reasons: comfort, pressure relief and postural support. For many users, a cushion that provides some comfort will help them to use the wheelchair for a longer time. Users with limited or no skin sensation are always at risk of developing pressure sores when using a wheelchair without a proper cushion. These users must use a pressure relief cushion to help reduce this risk as shown in Fig. 2.10 and Fig.2.11.

Fig. 2.10. Wheelchair cushion

Fig. 2.11. Wheelchair cushion



Many users require some adaptations or modifications to their cushion to help provide additional postural support or pressure relief. Wheelchair manufacturers need to either keep a good stock of different types and sizes of cushion or have the capacity to produce and modify a cushion as and when needed. Recommendations for cushions are given in Box 2.6.

Box 2.6. Guidelines for cushions

- **The cushion should be removable from the wheelchair.**
- **The cushion should be easy to clean using basic materials such as soap and water.**
- **The cushion should be an appropriate size to fit on the seat base.**
- **Correct cushion use and the way in which it should be placed on the wheelchair seat (which side is up, and which is the front of the seat) should be clearly indicated.**
- **Information on how the cushion should be used and maintained should be available.**

Pressure relief cushions

- **A pressure relief cushion should reduce pressures at the high-risk areas for pressure sore development (commonly at ischial tuberosities and sacrum).**
- **A pressure relief cushion should minimize the build-up of moisture between the cushion and the user's skin.**
- **Information should be available on how to use the cushion, how to maintain it, the expected life of the cushion, when to replace the cushion or parts of it, and any particular risks when using the cushion.**
- **The cushion and cushion cover material should not cause high pressures, thereby reducing the effectiveness of the cushion in distributing pressure over the seat surface.**
- **Pressure relief cushions should maintain their pressure relief properties in the climates where the cushion is expected to be used.**

2.5.3 Backrests

The backrest provides users the necessary postural support. It needs to be of different heights but usually available in two sizes as shown in Fig. 2.12 and Fig. 2.13.

Some users require more support from a backrest than others. For some users, a high backrest can reduce their ability to propel themselves effectively. Backrests may be sling or solid types with foam cushioning and upholstery. Recommendations for backrests are given in Box 2.7.

Fig. 2.12. Low backrest

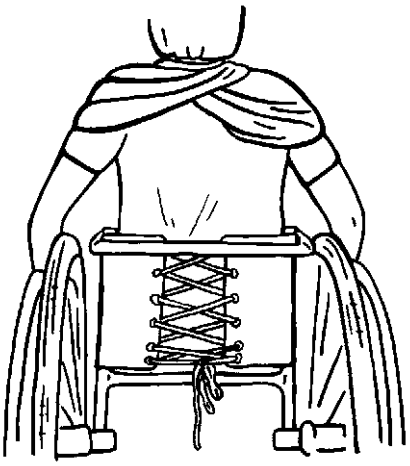
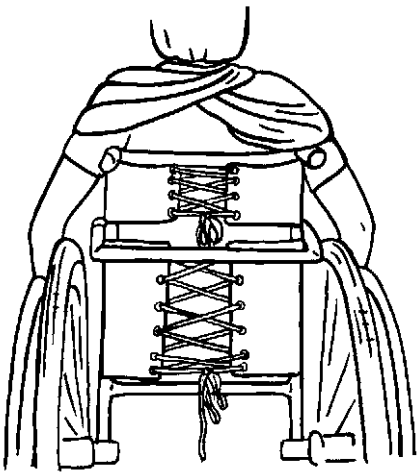


Fig. 2.13. High backrest



Box 2.7. Guidelines for backrests

- **The angle between the seat and the backrest (seat to back angle) should be between 80 and 100 degrees.**
- **Different backrest heights should be available.**
- **The backrest should support the normal curvature of the spine. The middle of the back should be able to rest further back than the back of the pelvis.**

2.5.4 Footrests

The footrest provides users with support for their feet and legs. Footrests must be individually adjusted for each user. Correctly adjusted, the footplate reduces pressure on the user's seat and puts the user in a healthy sitting posture. Footrests may also include a calf strap to keep the foot on the footplate. Sufficient ground clearance needs to be maintained to prevent the footrest hitting obstacles or catching and tipping the wheelchair on uneven ground. The height of the footrest should be adjustable. Footrests need to be long or wide enough to support the foot but, at the same time, should not create difficulty while folding or moving around. For other performance factors related to the footrest see Table 2.10.

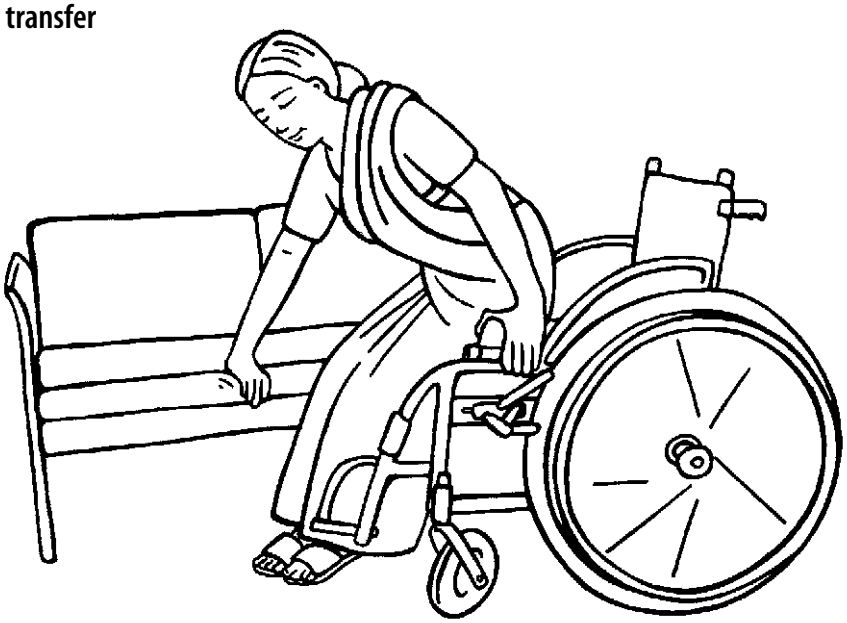
2.5.5 Armrests

Users should use armrests only for temporary postural support. If needed, other postural support options should be used to keep the user's arms free for activities such as propelling. Armrests assist in transferring into and out of the wheelchair, for example by pushing up on the armrest (Fig. 2.14).

Fig. 2.14. Low profile armrest

Many users find it easier to transfer into and out of their wheelchair if the armrests are "low-profile" (closely following the profile of the rear wheel) or removable (Fig. 2.15.). In other words, armrests should be removable, folding or low-profile for easy transferral in and out of the wheelchair. For other performance factors related to the armrest see Table 2.10.

Fig. 2.15. Easy to transfer



2.5.6 Rear wheels

The rear wheel should be in a position that allows the user to have the best push stroke as possible and keeps the user safely balanced according to his or her skill level and ability. The position of the rear wheel should allow the user to have a good push stroke and provide the necessary stability.

2.5.7 Evaluating seating and postural support elements

It is recommended that wheelchairs and cushions be evaluated based on the seating and postural support performance measures, and the results be available to the users and purchasers. The areas in which a wheelchair and cushion should be evaluated or reported on are:

- seating dimensions and adjustability
- cushion type and characteristics.

Seating dimensions and cushion characteristics tests and reporting techniques are covered in ISO standards 7176-7 and 16840-2 *(5)*.

2.6 Strength, durability and safety

The goal of this section is to help define what makes a safe and reliable wheelchair, and how to evaluate and report these attributes to stakeholders (see Box 2.8). When a wheelchair fails, the user is not only at risk of injury but may not be able to go anywhere or do anything until the wheelchair is repaired or replaced.

Apart from ensuring that the wheelchair is safe and effective, evaluating strength and durability is a way of gathering important information that can be useful for all stakeholders – users, designers, providers, manufacturers and funding agencies. Keeping accurate records of the results of strength and durability tests will help wheelchair designs evolve so that their quality and effectiveness continually improve.

Box 2.8. Strength, durability and safety guidelines

- **All wheelchairs should meet the strength, durability and safety requirements of user(s) in their own environment(s).**
- **It is recommended that each country develop its own wheelchair standards to ensure a reasonable quality, for instance by using the ISO 7176 series of standards as a basis. When developing national standards, it is important to consider the weights and sizes of the users, typical use, available testing equipment and available wheelchair technology. The standards should be available to manufacturers, purchasers and users, and be reviewed from time to time.**
- **All wheelchairs should be evaluated based on the strength, durability and safety requirements set by the country, and the results should be available to users and purchasers.**

2.6.1 Requirements

A wheelchair should be strong and durable enough to withstand the wear and tear placed on it by the user and to keep the user safe. Wear and tear consists of:

- static forces
- impacts
- fatigue stresses from use over time.

Simple testing device can be developed to ensure strength and durability, as shown in Fig. 2.16.

The flammability of the wheelchair, the effectiveness of the brakes and the safety of the surfaces on the wheelchair also affect the safety of the user.

Fig. 2.16. Testing device

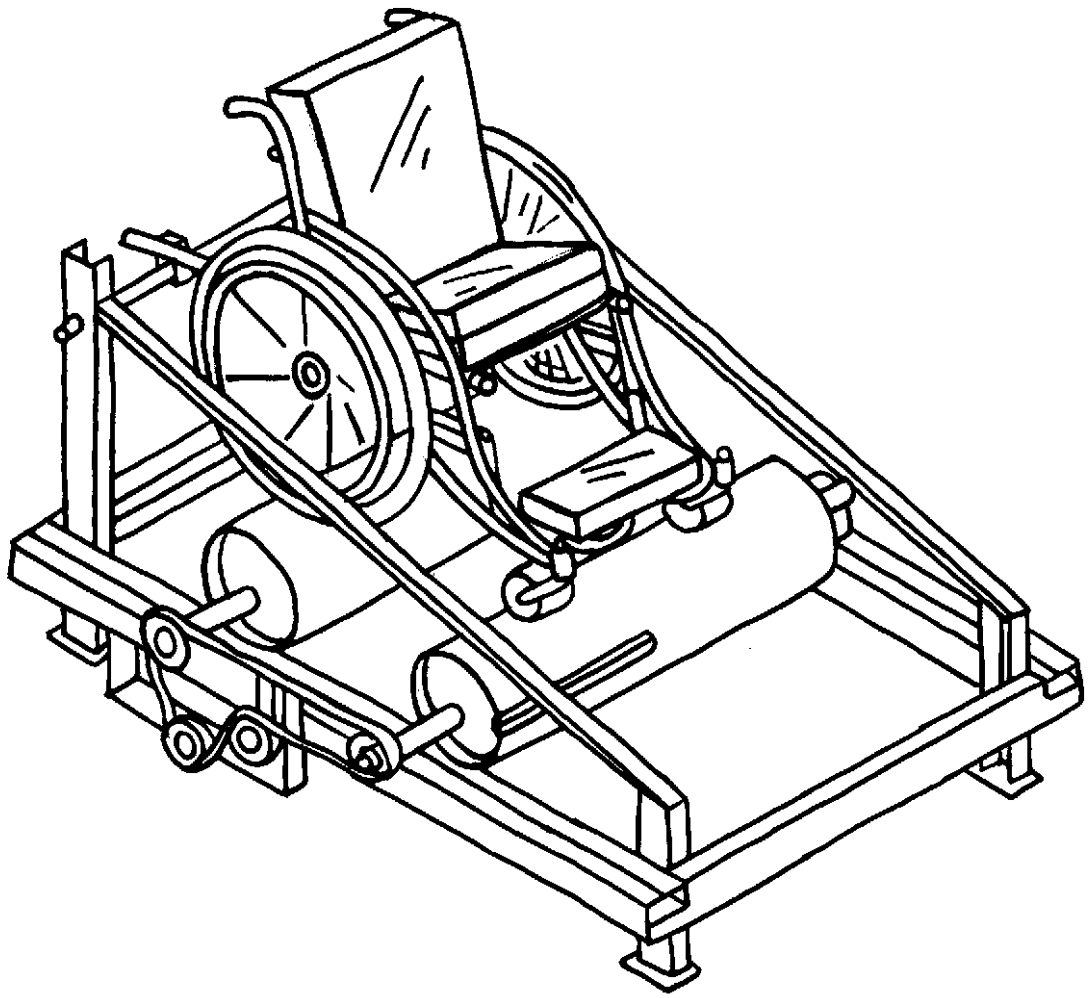


Table 2.12 provides a list of ways in which wheelchairs are used and the related strength and durability requirements for each component.

Table 2.12. Wheelchair uses and required durability and strength requirements

Part	Need for strength, durability and safety
Footrest	Footrest should fold with a reasonable amount of force.
	Footrest should not break or bend when used to lift user and wheelchair.
	Footrest should not break or bend when additional passengers or packages are loaded.
	Footrest should not break or bend when hitting an object such as a wall or curb.
Brake	Brakes should stop a wheelchair from sliding when on an incline.
	Brakes should not suddenly release while in use.
Armrest	Armrest should be removable with a reasonable amount of force.
	Armrest should not break or bend under the user's body weight.
	Armrest should not break or bend when used to lift user and wheelchair.
Push handles	Push handles should not break or bend when used to lift user and wheelchair.
	Handgrip should not slide off of push handle when user is being assisted up stairs or curb.
Frame	Frame should not break or bend when used on uneven terrain.
Backrest and seat	Backrest, seat and frame should not break or bend during transferrals or while riding on uneven terrain.
Rear wheel and axle	Frame, wheels or axles should not break or bend when user goes over a normal kerb.
	Wheels, axles or wheel-mounting hardware should not fail when user drops off kerb at angle.
	Axles or wheel-mounting hardware should not break or bend when under typical forces.
Castor assembly	Castor should not fail when the castor wheel hits an object (e.g. a curb).
General	Surfaces should not have sharp edges, sharp points or pinch points.
	Wheelchair should not be flammable, i.e. easily combustible materials should not be used.
	Wheelchairs should be equipped with front and rear reflecting stickers or signs for increased road safety.
Miscellaneous	Tipping levers should not break when assistant uses levers to tip user back.
	Hand rim should not break or bend when it hits an object.
	Wheelchair should not break when it falls or is dropped by handler loading or unloading it from bus or car.
Fatigue test	Wheelchair should not break in normal use.

2.6.2 Evaluating strength, durability and safety

It is recommended that a wheelchair be evaluated based on the strength, durability and safety requirements, and the results be available to the users and purchasers. Static strength, impact resistance, durability and brake effectiveness tests and reporting techniques are covered in ISO standards 7176-8, 7176-3 and 7176-16 *(6)*.

National testing. It is recommended that testing according to national wheelchair standards be made easily accessible to all manufacturers and providers. One method for making testing accessible is to use testing methods that are simple and inexpensive.

Fatigue tests. Fatigue testing is critical for ensuring the reliability and safety of a wheelchair. Where fatigue testing is not possible, it is especially important to carry out well-monitored user trials and long-term follow-up to evaluate safety, reliability and durability.

Even those who do perform fatigue testing need to be aware that the testing equipment and prescribed cycles of the standards do not necessarily reflect the actual loads the wheelchair will endure over its lifetime. Monitoring the use of the wheelchair in the field will help to determine the durability and performance of the wheelchair over time.

Environmental testing. Workshop testing does not subject wheelchairs to environmental conditions that they typically endure. Many wheelchairs fail as a consequence of dirty or worn bearings, rusty bolts or frames, etc. Therefore, long-term follow-up of users is of great importance.

2.7 User trials and follow-up

User trials. User trials are performed after workshop tests to provide feedback about the durability, effectiveness and functional performance of a wheelchair in the context and environment in which it will be used. User trials involve the selection of users who agree to use pre-production or pre-distribution wheelchairs over a given period of time. The users provide feedback at set intervals during the trial, answering specific questions about the wheelchair's performance. Focus groups can also be used to ensure as much feedback is gained as possible.

If user trials reveal that failures are likely to occur, then design changes should be made or a different wheelchair should be found, and testing should begin again. In the case of production, if significant design changes are called for, strength and durability testing should be performed again, followed by more user trials. If only minor changes are called for, then it may be appropriate to skip the strength and durability testing and perform the user trials again.

Long-term follow-up. After workshop and user trial testing has proven the wheelchair design is safe and effective, the wheelchair will be put into production and then sent to wheelchair services for provision. A sample of wheelchairs should be followed over time. This could be done, for instance, by contacting selected users six months, one year and three years after they received the wheelchair to determine the typical failures and maintenance requirements and their general opinion on the functional performance of the wheelchair.

Recommendations for user trials and long-term follow-up are given in Box 2.9.

Box 2.9. Recommendations for user trials and follow-up

- **Wheelchairs should be tested by users in the context and environment in which they will be used, before they are supplied to services or users (before production or before large-scale purchase)** *(7,8)*.
- **Long-term follow-up studies should be used to ensure the wheelchair is safe and effective over longer periods of use** *(9)*.

Summary

- Governments are recommended to develop and adopt national wheelchair standards to ensure a reasonable quality of wheelchairs, for instance by using the ISO 7176 series of wheelchair standards as a basis.
- It is recommended that the national wheelchair standards are applicable to all wheelchairs supplied in a country, whether produced within the country or imported.
- General design considerations include user health and safety, strength and durability, suitability for use and production methods.
- Wheelchair designs should be evaluated in three areas: functional performance; seating and postural support; and strength, durability and safety.
- Results of the evaluation and testing of wheelchairs must be available to users and purchasers.
- A variety of factors need to be considered when determining whether wheelchairs should be acquired through national production or importation.
- Wheelchairs and spare parts need to be available, accessible and affordable.

References

1. *ISO 7176-24:2004. Wheelchairs – Part 24: Requirements and test methods for user-operated stair-climbing devices*. Geneva, International Organization for Standardization, 2004 (http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=31276, accessed 9 March 2008).
2. Chan SC, Chan AP. User satisfaction, community participation and quality of life among Chinese wheelchair users with spinal cord injury: a preliminary study. *Occupational Therapy International*, 2007, 14:123–143.
3. Krizack, M. The importance of user choice for cost-effective wheelchair provision in low-income countries. In: *Proceedings, 12th World Congress of the International Society for Prosthetics and Orthotics, Vancouver, 29 July – 3 August 2007*. Copenhagen, International Society for Prosthetics and Orthotics, 2007.
4. Kirby RL, Ackroyd-Stolarz SA. Wheelchair safety – adverse reports to the United States Food and Drug Administration. *American Journal of Physical Medicine & Rehabilitation*, 1995, 74:308–312.
5. ISO 7176-7:1998. Wheelchairs – Part 7: *Measurement of seating and wheel dimensions*. Geneva, International Organization for Standardization, 1998 (http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=13783, accessed 9 March 2008).
6. ISO 7176-8:1998. Wheelchairs – *Part 8: Requirements and test methods for static, impact and fatigue strengths*. Geneva, International Organization for Standardization, 1998 (http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=13784, accessed 9 March 2008).
7. Armstrong W et al. Evaluation of CIR-Whirlwind Wheelchair and service provision in Afghanistan. *Disability and Rehabilitation*, 2007, 29:935–948.
8. Pearlman J et al. Lower-limb prostheses and wheelchairs in low-income countries: an overview. *IEEE Engineering in Medicine and Biology Magazine*, 2008 (in press).
9. Reisinger KD et al. Whirlwind Wheelchair in Afghanistan: nine-month follow-up. In: *Proceedings, 12th World Congress of the International Society for Prosthetics and Orthotics, Vancouver, 29 July – 3 August 2007*. Copenhagen, International Society for Prosthetics and Orthotics, 2007.

3 SERVICE DELIVERY

… to ensure that users receive appropriate wheelchairs.

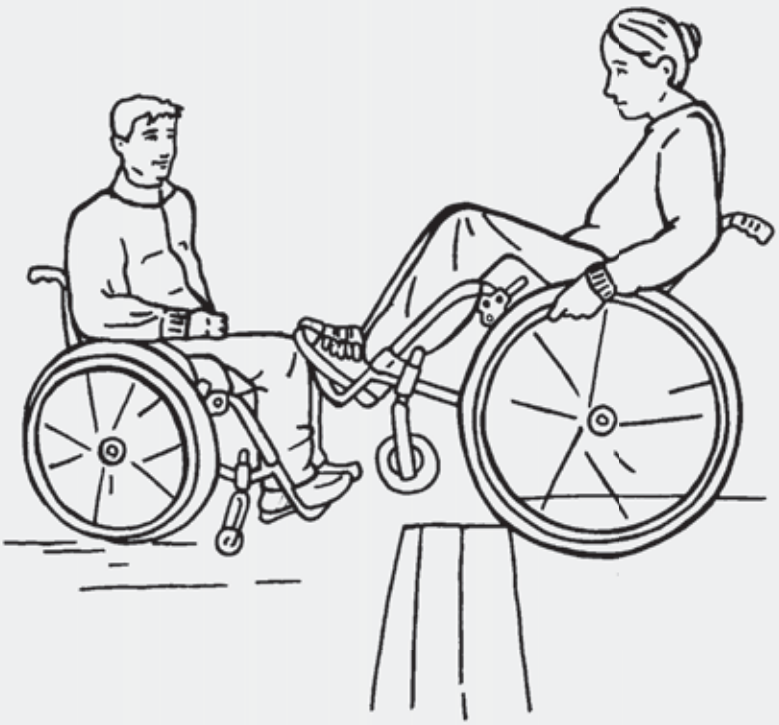
The service delivery guidelines:

- suggest strategies for introducing wheelchair service delivery;
- describe basic wheelchair service delivery;
- provide practice guidelines;
- suggest roles for the personnel involved; and
- make recommendations on monitoring and evaluation.

Box 3.1.

Wheelchairs changing lives …

Testimonial from a user in Romania



Ciprian is 25 years old and lives in Sfantu Gheorghe, Romania. Three years ago he became paraplegic after falling from a roof while at work and lost any hope that he would ever have a normal and active life again. Some time after the accident, however, he heard about a local nongovernmental organization that provided support for users. Through the wheelchair service run by the organization, Ciprian received an active-style manual wheelchair that was fitted for him. He was also invited to participate in a peer group training camp.

Ciprian says: "Once I got there I realized that I could have an independent life. Through the peer group training, I learnt to use my wheelchair very well. I also had the chance to talk with other users involved in the programme. At the end of the camp, I was asked if I would like to become a peer group trainer. Of course, I was very happy about this chance that had just been offered to me. In January 2006, I started my work as an instructor.

Through my wheelchair, and peer training, I have recovered the independence I thought I had lost because of the injury. In addition to my peer group training work, I take part in various competitions and sports activities for people in wheelchairs. Working with people with disabilities makes me feel that I am useful again and that I finally have a normal life after I had had such a hard time overcoming the health problems brought about by the injury."

testimonial

3.1 Introduction

Purpose and outputs

The purpose of the service delivery guidelines is to improve the way in which users receive wheelchairs and to ensure that the wheelchairs are appropriate.

Implementation of the recommendations in this chapter will contribute to:

- a greater number of wheelchair services;
- better knowledge of wheelchair service delivery among health care and social service workers;
- better service quality delivered by existing wheelchair services;
- a greater number of appropriate wheelchairs provided to users;
- a greater number of users able to make informed decisions about the most appropriate wheelchair for them;
- a greater number of users and caregivers receiving training in the use and maintenance of wheelchairs, and on how to stay healthy in a wheelchair;
- links between users and producers, leading to producers obtaining feedback on the wheelchairs they produce; and
- coordinated efforts in the planning, implementation and support of wheelchair service delivery among stakeholders.

What is a wheelchair service?

In the rehabilitation of a person with a walking limitation, the provision of an appropriate wheelchair is critical. It is important that the wheelchair fits correctly and meets the user's physical, functional and environmental needs as much as possible *(1)*. This requires an approach that responds to individual needs. An effective way of meeting the individual needs of users is to promote the provision of wheelchairs through wheelchair services.

Wheelchair services provide the framework for assessing individual user needs, assist in selecting an appropriate wheelchair, train users and caregivers, and provide ongoing support and referral to other services where appropriate.

- **Assessment**. This is a process of mutual consultation between a person with disability and service personnel, the aim being to assist the user to select the right product. The outcome is often a prescription detailing the features of the wheelchair most suitable for the person in question.
- **Provision**. Following assessment, wheelchair services provide an appropriate wheelchair. This includes ordering, assembly if needed, and fitting of equipment.
- **Training**. In order for users to gain maximum benefit from their wheelchair, the services provide them and their caregivers training in how to maintain the wheelchair and how to use it effectively.
- **Support**. For all users, the services offer continuing clinical and technical support. This includes providing basic health care advice, especially on how to avoid pressure sores or any further deformities or complications, and follow-up and repair services.
- **Referral**. Where appropriate, the services will refer users to other services that may be of benefit to them, such as physiotherapy, peer group training and vocational training.

In addition to the key functions listed above, providers of wheelchair services will play a role in:

- ***awareness***: disseminating basic information about the needs for and benefits of using a wheelchair (this can also be done by personnel involved in community-based rehabilitation, health and education programmes as well as by disabled people's organizations); and convincing policy-makers about the benefits of investing in wheelchair provision rather than leaving people with disabilities to survive on charity;
- ***identification***: using a screening tool to identify those who can benefit from available services;
- ***awareness of referral networks and suppliers***: promoting the role of wheelchair services, including participation in activities aimed at educating referral networks and raising the awareness of suppliers and funding agencies regarding the role and importance of wheelchair services;
- ***sustainability***: developing sustainable financial solutions for the continuing provision of mobility equipment through wheelchair services;
- ***training***: providing or supporting the training of wheelchair service personnel;
- ***standards***: raising wheelchair standards within the country or region through being aware of current wheelchair availability and advocating for improvements in and a greater variety of wheelchair products; and
- ***accessibility***: supporting or facilitating the adaptation of homes (including toilets, furniture and fittings) and public buildings and places, and lobbying for a barrier-free environment.

Strategies

Wheelchair service delivery requires careful planning and management of resources. There follow a number of strategies that can be employed to initiate or further develop wheelchair services.

Providing wheelchairs together with services

There are different methods of wheelchair supply to meet the range of contexts in which users live (see Sections 1.7 and 2.3). Whatever the method or structure chosen, it is important to deliver essential wheelchair services *(2,3)*.

Utilizing existing personnel

It is not necessary to create a new profession to provide wheelchair services. With additional training, many health and rehabilitation personnel would be able to take on the duties required for basic wheelchair service delivery. For example, community health care workers, community-based rehabilitation workers, nurses, physiotherapists, occupational therapists, orthotists and prosthetists could be trained to fulfil the clinical role in wheelchair services. Likewise, with additional training, skilled craftspeople, mechanics and orthotic and prosthetic technicians could fulfil the technical role.

Meeting the needs of users at community level

Some aspects of wheelchair provision can be carried out in the community, through a network of community-based organizations (for example rehabilitation and health programmes) supported by a local wheelchair service centre. The personnel of the community-based programmes could be trained by wheelchair service personnel in basic service delivery. This system of service delivery would best suit users who require a basic wheelchair, without modifications, postural support or pressure management care.

Users with more complex needs are likely to require the skills of personnel with greater training than can be provided to all community-level personnel. This need can be addressed by outreach services coordinated by the wheelchair service centre. If outreach services are not developed, these users would need to travel to the wheelchair service centre. However, once provided with an appropriate wheelchair, they may be supported by community-based personnel.

A wheelchair service can make use of the skills, technologies and capacities of local industries. For example, bicycle repair shops can also repair wheelchairs, and tubular furniture makers have the basic skills and knowledge to build wheelchairs.

Table 3.1 provides a summary of a "two-tier" wheelchair service approach. This shows a possible model linking a wheelchair service centre with a number of community-based wheelchair services. To provide adequate support to the community-based centres, it may be necessary to first develop the wheelchair service centre. Alternatively, a collaborative effort between existing community-based centres could work towards the development of the wheelchair service centre. In either case, the development process should be based on a needs assessment and other aspects of the local context.

Table 3.1. Description of a two-tier wheelchair service approach

	Characteristics	Key functions
Wheelchair service centre	Centre-based. **Facilities** (possibly shared with existing health or rehabilitation services): clinical and user training facilities; workshop facilities. **Staff**: dedicated wheelchair service centre personnel trained to meet the needs of all users.	Wheelchair service delivery for all users. Community outreach; linking with community-based wheelchair services and referral networks. Training, support and supervision of community-based wheelchair services and personnel. Education of referral sources. Linking with education, employment and other key development sectors.
Community-based wheelchair services	Centre-based, with some wheelchair service delivery carried out entirely in the community. **Facilities** (shared with other community health and rehabilitation programmes): access to clinic, user training facilities, basic workshop facilities. **Staff**: community health and rehabilitation workers trained in basic wheelchair service delivery, supervised and supported by wheelchair service centre personnel.	Wheelchair service delivery for users requiring basic wheelchairs without custom modifications or postural support components. Identification of users with complex needs, and referral to wheelchair service centre. Where appropriate, support of users with more complex needs for follow-up, maintenance and repair in the community. Support of accessibility, including adaptation of user's environment such as wider doors and ramps.

Integrating wheelchair services into existing health or rehabilitation services

A wheelchair service centre or department can be established within existing rehabilitation services. Such services are already likely to have users accessing the service for health or rehabilitation needs. They would therefore already have much of the infrastructure required. Examples of rehabilitation services well suited to the integration of a wheelchair service include prosthetics and orthotics services and spinal injury centres.

Wheelchair services could play a dual role, providing wheelchairs directly to users and supporting basic services in the community through partnerships with community-level programmes and organizations.

Stakeholders and resources

Stakeholders directly involved in the planning, implementation and participation in service delivery include:

- users and their families or caregivers;
- government authorities, including ministries responsible for health, social welfare and education and other relevant departments and local authorities;
- existing health and rehabilitation services (including referral networks) managed by governmental, private, nongovernmental, international nongovernmental or disabled people's organizations;
- supporting organizations providing technical input or funding;
- rehabilitation personnel and their organizations; and
- wheelchair service personnel.

The resources required to implement the recommendations include:

- a reliable supply of wheelchairs that meet agreed standards;
- access to different types and sizes of wheelchair to meet the varied needs of individual users;
- personnel with training in wheelchair service delivery;
- facilities (which may be shared with existing rehabilitation or health services):
  - clinical facilities providing sufficient space for assessment, basic user training and storage of wheelchairs, and
  - workshop facilities, particularly where modifications to wheelchairs are offered or postural support is provided;
- materials for wheelchair modifications and custom components; and
- funding to support wheelchair service delivery (products and services).

Box 3.2. A wheelchair service network in Papua New Guinea

In Papua New Guinea, an estimated 50 000 people need a wheelchair. Throughout 2003 and 2004, governmental health and rehabilitation organizations and national and international nongovernmental organizations developed a strategy for wheelchair provision. As a result, a pilot wheelchair service network, closely linked to the existing health and rehabilitation services, was set up.

The wheelchair service network consists of a "regional wheelchair service" supporting four "satellite wheelchair services". The regional service is based at the National Orthotics and Prosthetics Service in Lae. At the regional service, technical personnel from the National Orthotics and Prosthetics Service team and physical therapy personnel from Lae's Angau Hospital together carry out assessment, prescription, fitting, user training and follow-up. The National Orthotics and Prosthetics Service provides repair services for users. This mixture of clinical and technical facilities has made the setting up of the wheelchair service relatively easy, and the recent provision of dedicated premises for the service has given it a stronger identity.

Two of the satellite services are based in local hospitals, one in a local prosthetic unit and one in a local community-based rehabilitation service. The community-based rehabilitation link with each service is strong. The community-based rehabilitation networks provide excellent referral, and the personnel work with hospital-based personnel to provide users with a wheelchair.

Training in basic wheelchair service delivery for all of the clinical and technical personnel involved in the service network was provided over two weeks by the international nongovernmental organization Motivation. Further support for both clinical and technical personnel for one year was provided by a volunteer physiotherapist.

The network has the capacity to provide 25 wheelchairs per month. This is still not sufficient to meet the needs in Papua New Guinea. However, through the success of this pilot exercise in using existing services and personnel, much has been learnt about the role of wheelchair services. In future, all stakeholders are keen to see the establishment of more satellite services, as well as an increase in the capacity of the network to meet the needs of users with more complex needs.

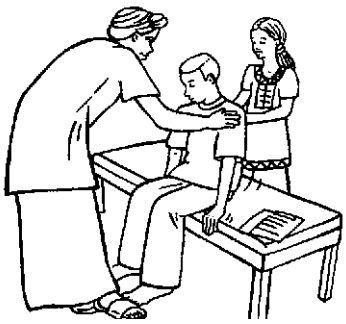
3.2 Wheelchair service delivery

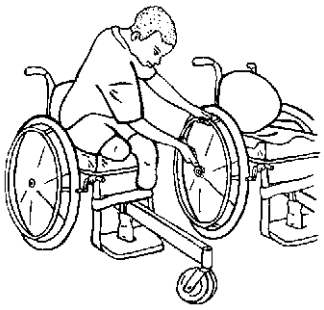
3.2.1 Steps in service delivery

The functions of wheelchair services are described in Section 3.1. Wheelchair services are commonly delivered in a sequence of steps. A summary of eight key steps typically involved in wheelchair service delivery is given in Table 3.2 *(4,5)*. Further details about each step and recommendations on good practice are provided in Section 3.3.

Table 3.2. Key steps typically involved in wheelchair service delivery

Step	Summary
1. Referral and appointment	The system of referral will depend on existing services in the country. Users may self-refer or be referred through networks made up of governmental or nongovernmental health and rehabilitation workers or volunteers working at community, district or regional level. Some services may need to actively identify potential users if they are not already receiving any social or health care services or participating in school, work or community activities.
2. Assessment	Each user requires an individual assessment, taking into account lifestyle, vocation, home environment and physical condition.
3. Prescription (selection)	Using the information gained from the assessment, a wheelchair prescription is developed together with the user, family member or caregiver. The prescription details the selected wheelchair type, size, special features and modifications. Also detailed is the training the user needs to effectively use and maintain the wheelchair.
4. Funding and ordering	A funding source is identified and the wheelchair is ordered from stock held by the service or from the supplier.
5. Product preparation	Trained personnel prepare the wheelchair for the initial fitting. Depending on the product and service facilities, this may include assembly, and possible modification, of products supplied by manufacturers or production of products in the service workshop.
6. Fitting	The user tries the wheelchair. Final adjustments are made to ensure the wheelchair is correctly assembled and set up. If modifications or postural support components are required, additional fittings may be necessary.
7. User training	The user and caregivers are instructed on how to safely and effectively use and maintain the wheelchair.
8. Follow-up, maintenance and repairs	Follow-up appointments are an opportunity to check wheelchair fit and provide further training and support. The timing depends on the needs of the user and the other services that are available to them. The service may also offer maintenance and repairs for technical problems that cannot be easily solved in the community. It is appropriate to carry out follow-up activities at the community level as much as possible. If the wheelchair is found to be no longer appropriate, a new wheelchair needs to be supplied starting again from step 1.





3.2.2 Understanding individual user needs

When planning wheelchair service delivery, it is important to recognize that each user has a unique set of needs. These needs can be categorized as:

- physical – the user's health situation and postural and functional needs;
- environmental – where users live and where they need to use the wheelchair; and
- lifestyle – the things users need to do in the wheelchair to lead their chosen way of life.

Physical needs. Some users will have a more complex mix of physical needs than others. Users with postural deformities, reduced skin sensation and problems with muscle tone (for example spasticity) will require an assessment conducted by personnel with appropriate skills and knowledge. These users will also require more frequent follow-up and support. Three degrees of postural need and their relationship to the skill and support required from the personnel are described in Table 3.3.

Table 3.3. Postural needs of users related to the need for personnel skill and support

User		Needs
	Users of manual wheelchairs without modifications **Children or adults who can sit well without any postural deformities or abnormalities.**	**Mobility and postural support for comfort, function and the prevention of postural problems associated with permanent wheelchair use.** **Mobility and postural support provided through a well-fitted wheelchair and seat cushion.**
	Users of manual wheelchairs with supportive seating **Children or adults with mild to moderate postural deformities or tendencies. If unaddressed, these deformities will limit comfort, health and function.**	**Mobility and postural support to stabilize posture for comfort, function and prevention of further postural problems.** **Supportive seating provided through individual modifications to a basic wheelchair, or a specialized seating system.**
	Users of complex supportive seating and mobility equipment **Children or adults with complex, fixed postural deformities. Even with support, many cannot sit normally.**	**Mobility and individually prescribed and customized wheelchairs to provide postural support and accommodate fixed deformities.**

Environmental and lifestyle needs. These factors require consideration during the assessment. They will influence the choice of a wheelchair, based on performance characteristics, durability and other features. This is discussed in Chapter 4.

Box 3.3. Needs for wheelchair modifications and postural support additions in South Africa

How many users require more than basic wheelchair provision?
Owing to a general lack of statistics, it is not possible to state accurately how many users fall into each of the groups described in Table 3.3. However, in a survey of 147 users conducted at the Western Cape Rehabilitation Centre in South Africa in 2006, it was found that 58% of users required some form of wheelchair modification or basic postural support. Some 22% required complex postural support, while only 20% were able to use a basic manual wheelchair without any modification.

A supervisory chief physiotherapist states: "Since our service began, we have found that many users need more than just a basic wheelchair. Many have deformities from living so long without a wheelchair and now need their wheelchair modified so that it fits them. We also have more and more children with cerebral palsy coming to us, and they need wheelchairs with extra postural support."

3.3 Good practice in wheelchair service delivery

This section of the guidelines can be used to help in planning and initiating wheelchair services and in evaluating existing services. Recommendations are presented in nine areas: good practice in overall service and for each of the eight key steps in wheelchair service delivery.

3.3.1 Overall service

Good practice in wheelchair service includes the following.

- Wheelchair services recognize users as clients of the service and adopt a "client-centred approach". This means, *inter alia*, that:
  - users receive information about the process the wheelchair service will use to provide a wheelchair, and the rights and responsibilities of the user in this process;
  - users are actively involved as members of the service team in all steps leading to the provision of their wheelchair; and
  - services actively collect feedback from users about their opinion of the service and how it may be improved.
- The service is equally accessible to all users, regardless of gender, age, ethnicity, religion or social status.
- The service has personnel trained in its clinical, technical and training roles, who work closely with users to provide advice, assessment, prescription, fitting, training and follow-up.
- The service has a designated service manager or coordinator.
- A referral network is in place.
- The service is well integrated with other rehabilitation and health services.
- Services are knowledgeable about the range of wheelchairs available locally.
- Services are able to offer more than one type of wheelchair, giving the user a choice based on the assessment.

- Wheelchairs are sourced from a range of suppliers, including local and international, depending on their appropriateness and affordability.
- Services carry out quality control to ensure that every wheelchair is assessed for safety before the user tries it and for safety and correct fit before each user leaves the workshop or rehabilitation centre with the wheelchair.
- Repair services are available to provide continuing support to users.
- Services identify local needs and measure their effectiveness in meeting these needs through regular monitoring and evaluation (see Section 3.5).
- Services promote teamwork between clinical and technical personnel in providing service to users.

3.3.2 Referrals and appointments

Objective

The objective of good practice in referrals and appointments is to ensure that users have equitable access to wheelchair service delivery, to increase the efficiency and productivity of the service, and to minimize waiting lists.

Referral system

This pertains to the way in which users access the service. This may be through "self-referral", whereby users contact the service directly, or through a "referral network", whereby users are referred by another organization.

Appointment system

This refers to the method of establishing appointment times with users for assessment and prescription, fitting, basic user training and follow-up. The most common method is to list appointment times in a service diary, which are then filled as users are referred. The benefits of an appointment system include reduced waiting times and increased work efficiency.

Waiting lists

Where there is high demand for the wheelchair service, a waiting list will need to be established. Users on the waiting list can be offered an appointment as the service works through the list. The administration of appointments will depend on the context.

Box 3.4. Good practice in appointment and referral systems

- **When a user is referred to the service, a file is established and an appointment is made or the user is put on the waiting list.**
- **Services provide training for referral network personnel to increase their awareness of wheelchair service delivery and to show them how to refer users to the service.**
- **Services develop and distribute a form for referral network agencies to complete when referring users.**
- **Services use clear guidelines to prioritize appointments. This is particularly important where there are waiting lists. Examples of high-priority users include those with a terminal illness and those at risk of developing life-threatening secondary complications such as a pressure sores.**
- **Services set targets and measure their performance in relation to the number of referrals, the length of time between referral and appointment, and reduction of waiting lists.**
- **Services have a screening procedure to minimize the scheduling of inappropriate referrals.**

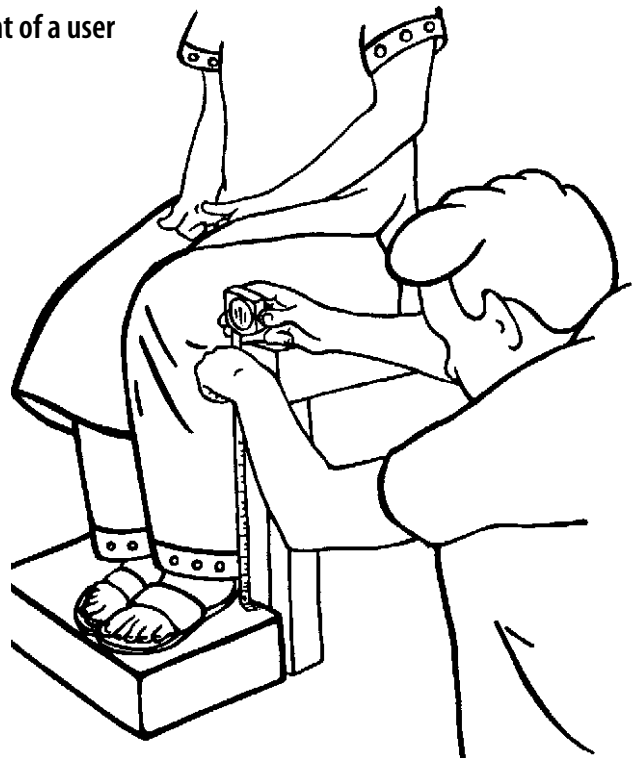
3.3.3 Assessment

Objective

The objective of good assessment practice is to accurately assess the needs of each individual user in order to prescribe the most appropriate wheelchair available.

Every user requires an individual assessment, carried out by a person or persons with the appropriate skills. The assessment should be holistic, taking into account the lifestyle, living environment and physical condition of the user. It is important that the user and, if appropriate, the family are fully involved in the assessment. Depending on the complexity of the needs, an assessment can take up to 2 hours.

Fig. 3.1. Assessment of a user



Box 3.5. Good practice in assessment

- **Assessments are carried out in a private, quiet and clean space. This may be a dedicated space within the wheelchair service, at another health care or community facility, or at the user's home.**
- **Assessments are carried out by trained personnel. Culture, age and gender sensitivity while carrying out assessments increases credibility and acceptability.**
- **Equipment for the assessment is readily available, including an assessment bed (plinth, mat, table), measuring tape, device for measuring angles (goniometer), foot blocks and infection control supplies.**
- **Assessment takes into consideration the user's physical condition; home, school, work and other environments where the wheelchair is used; lifestyle; size and age.**
- **Assessments are clearly documented on an assessment form and filed for future reference.**
- **Where a service is unable to meet the user's needs owing to the lack of an appropriate product or personnel with sufficient skills, the service either:**
  - **refers the user to another service that is staffed and equipped to serve the user (where available);**
  - **hosts outreach visits of more qualified personnel, or**
  - **documents the user's needs to help build a picture of unmet needs to guide future service development.**

3.3.4 Prescription

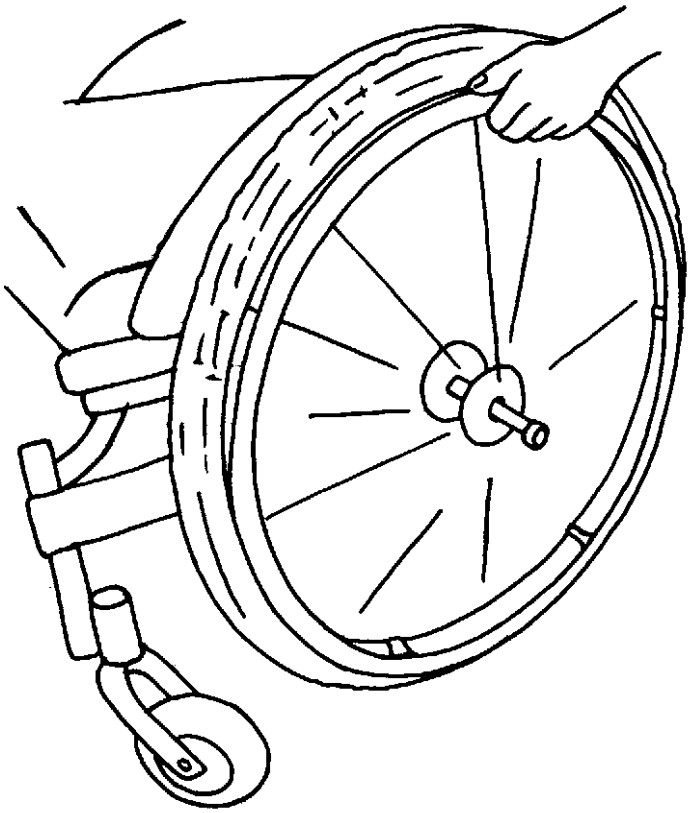
Objective

The objective of good prescription practice is to match the needs of the user, as identified through the assessment, with the most suitable wheelchair available.

Wheelchairs need to be available in different types and sizes and with different options. The prescription (or selection) represents the process of matching the needs of the user with the most suitable available wheelchair. The completed prescription form is a full description of the wheelchair required and selected by the individual user.

Box 3.6. Good practice in prescription (or selection)

- **Users are given the opportunity to see and, where possible, try samples of wheelchairs, cushions and postural support components. This assists users and personnel together in selecting a wheelchair and the necessary features.**
- **The importance of features is prioritized to help to make the most appropriate choice from what may be a limited range of available wheelchairs.**
- **Each wheelchair prescription is documented, either on the assessment form or on a dedicated prescription form. The prescription details:**
  - **the type and size of wheelchair;**
  - **any additional components required (for example pressure-relief seat cushion);**
  - **any modifications or custom components required; and**
  - **the information or skills that the user needs to know, or be able to perform, before leaving the service with a new wheelchair.**
- **Wheelchair service personnel are given time to write up assessment and prescription notes immediately after each appointment.**
- **Services give users an estimate of when their wheelchair will be ready (depending on funding, see below). Where possible, an appointment for the user's fitting is made at the time the prescription is made.**



3.3.5 Funding and ordering

Objective

The objective of good practice in funding and ordering is to order or procure the selected wheelchair for the user, as early as possible.

Funding

Following prescription, it is possible to closely estimate the cost of the product being recommended. For most services, it will be essential to ensure a funding source has been identified before an order can be placed for equipment. Wherever possible, this should be in the hands of administrative rather than clinical or technical personnel. See section 5.4 for more information on funding.

Ordering

When not in stock, wheelchairs need to be ordered from an external supplier or procured from the wheelchair service workshop, which usually maintains a stock of different sizes and types of wheelchair.

Box 3.7. Good practice in ordering

- **If a wheelchair is not immediately available, services inform the user when the wheelchair will be ready for fitting.**
- **Services maintain a stock of wheelchairs and components to ensure faster delivery times.**
- **Services encourage suppliers to develop clear order forms and procedures.**
- **Services agree with suppliers on delivery times and aim to minimize delays.**
- **Services ensure ordering is completed within two working days of completing the user's prescription, provided that funding is in place.**
- **Services have a system in place to monitor pending orders from suppliers.**
- **Services have a system for providing feedback to suppliers about quality issues.**

3.3.6 Product preparation

Objective

The objective of good practice in product preparation is to prepare the wheelchair for the fitting, including modifications or custom postural support components.

Box 3.8. Good practice in product preparation

- **Each wheelchair being prepared is labelled with the user's name and a serial number or bar code.**
- **Modifications to wheelchairs (permanently altering the frame or a component of the wheelchair) are carried out only by personnel with the appropriate knowledge and skills, since any such modification may have structural and functional implications.**
- **The production and installation of custom seating systems or individual postural support components should be carried out by personnel with the appropriate knowledge and skills. This work should also be done in close collaboration with the assessment personnel.**
- **All mobility equipment is checked for quality and safety before the user tries it.**

3.3.7 Fitting

Objective

The objective of good practice in fitting is to ensure that the selected wheelchair has been correctly assembled and to make final adjustments to ensure the best fit.

Fitting is a critical step. At the fitting, the user and clinical and technical personnel ensure that the wheelchair fits correctly and supports the user as intended. A fitting may take between 30 minutes and 2 hours or more, depending on the complexity.

During fitting, the user and competent personnel together check that:

- the wheelchair is the correct size;
- the wheelchair is correctly adjusted for the user;
- any modifications or postural support components are fitting correctly; and
- the wheelchair meets the user's mobility and postural support needs and minimizes the risk of the user developing secondary deformities or complications.

Fig. 3.2. Fitting the wheelchair to its user

Box 3.9. Good practice in fitting

- **All users have their wheelchair individually fitted by personnel trained to do so.**
- **Whenever possible, fitting is carried out by the same personnel that assessed the user.**
- **The fit of the wheelchair (including any seating or postural components) is first assessed with the user sitting in the stationary wheelchair. When the fit is acceptable, it is then further assessed while the user self propels or is pushed.**
- **If the wheelchair fit is not acceptable, further adjustments are made. If an acceptable fit cannot be achieved, alternative equipment or a reassessment may be necessary. The wheelchair cannot be provided to the user until the fit is acceptable.**
- **There is provision for more than one fitting appointment for users with more complex needs, such as those with postural deformities.**

3.3.8 Training of users, families and caregivers

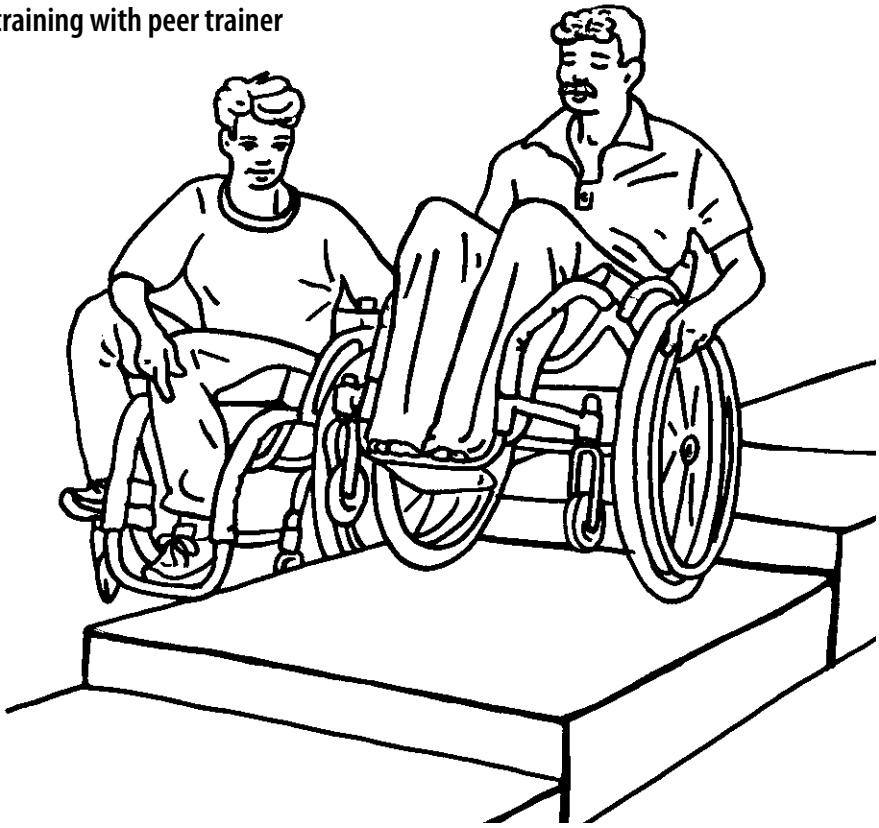
Objective

The objective of good practice in training is to ensure that all users are given the information and training they need to be able to use their wheelchair safely and effectively.

Key areas of user training include:

- how to transfer in and out of the wheelchair,
- how to handle the wheelchair;
- basic wheelchair mobility;
- how to stay healthy in the wheelchair – for example prevention of pressure sores;
- how to look after the wheelchair and cushion and, if appropriate, dismantle and reassemble the wheelchair; and
- who to contact in case of problems.

Fig. 3.3. Wheelchair mobility training with peer trainer



Box 3.10. Good practice in basic training of users

- **A user training checklist is completed together with the user, covering the skills the user needs to have in order of priority. The checklist is used by the trainer, and as each skill is taught and demonstrated by the user it is checked off.**
- **Where possible, peer trainers (active users with strong wheelchair skills and training in how to teach and support other users) provide basic user training, with supervision by clinical personnel.**
- **Wheelchair services link closely with any user groups in the community, providing peer training to strengthen training given at the service.**
- **Written or visual materials, including pamphlets or posters in local languages, are used to assist the training of users.**

3.3.9 Follow-up, maintenance and repair

Objective

The objective of good practice in follow-up, maintenance and repair is to evaluate the effectiveness of the wheelchair in maximizing the user's functioning, comfort and stability, and to ensure that the equipment has been maintained appropriately and is in good condition.

Follow-up should include a review of:

- how well the wheelchair has worked for the user;
- any problems the user has had in using the wheelchair;
- the wheelchair's fit, in particular checking that the wheelchair is providing good postural support for the user;
- the user's skills, and whether further training is required;
- the condition of the wheelchair and whether any adjustments or repairs are required; and
- the user's ability to care for and maintain the wheelchair, and whether any further training is required.

The frequency of follow-up will depend on the individual needs of the user. Some users should be followed up more frequently than others. As a guide, follow-up appointments are usually made within six months of receiving a wheelchair. Basic wheelchair repair work can often be done locally at bicycle or car repair workshops.

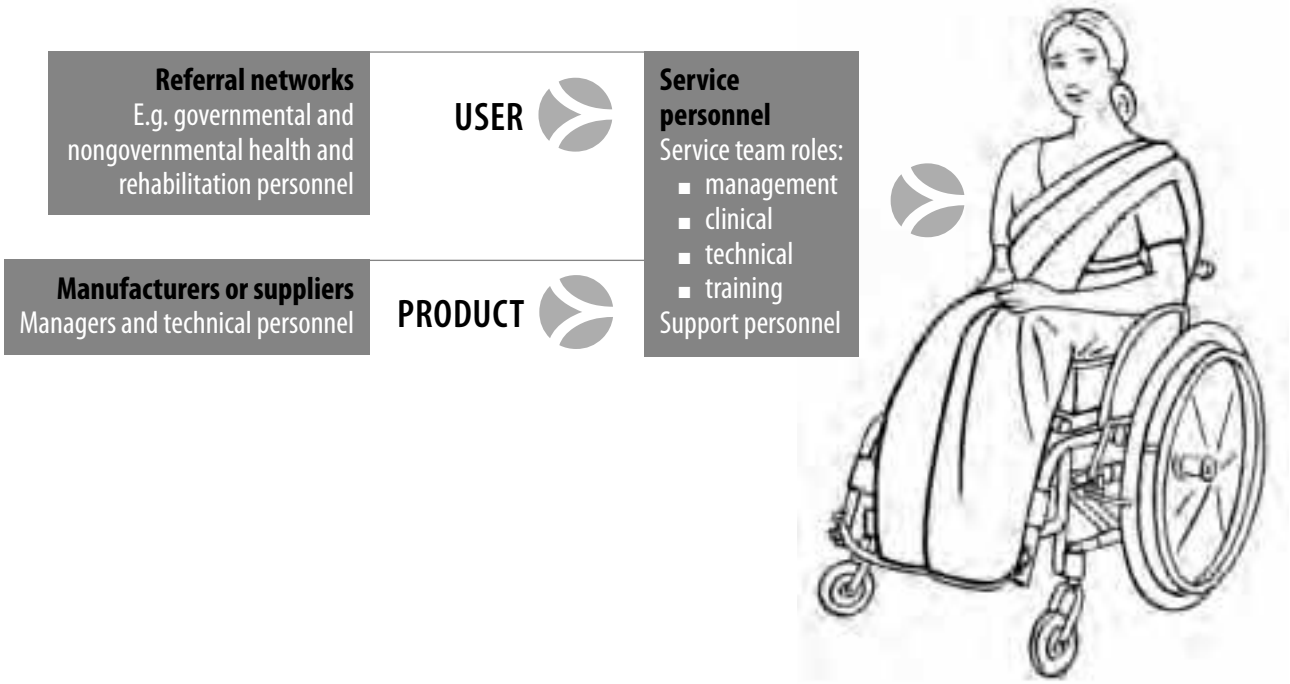
Box 3.11. Good practice in follow-up

- **Whenever possible, all members of the wheelchair service team are involved in follow-up appointments. This includes clinical, technical and training personnel.**
- **The frequency of follow-up is determined by the individual needs of the users.**
- **Follow up appointments are given as a priority to users in the following categories:**
  - **children (whose needs change quickly as they grow);**
  - **users at risk of developing pressure sores;**
  - **users who have a wheelchair with postural support modifications or additions; and**
  - **users (or family members/carers) who have had difficulty in following the basic training given at the service.**
- **Services use follow-up appointments as an opportunity to gather feedback from the user to help evaluate the quality of the service provided.**

3.4 Personnel in wheelchair service delivery

A summary of the major groups of personnel involved in wheelchair service delivery, including manufacturers and suppliers, referral networks and service personnel, is shown in Fig. 3.4.

Fig. 3.4. Organizations and personnel involved in providing an appropriate wheelchair to a user



3.4.1 Manufacturers or suppliers

Wheelchair services usually receive wheelchairs from manufacturers or suppliers. The scope of these guidelines does not allow a discussion of all production and supply personnel, but a few points are made here concerning managers and technical production personnel.

Management

As well as day-to-day management, managers of wheelchair production facilities are responsible for design selection and production quality. It is therefore important that managers receive feedback from users and wheelchair services about how well their wheelchairs meet their needs.

Technical production personnel

Technical production personnel are concerned with the technical side of wheelchair production. They are not necessarily involved in the fitting or modification of wheelchairs for individual users. This differs from technical personnel in wheelchair services, who are involved in the assembly, modification and fitting of wheelchairs for specific individuals. Nevertheless, some technical personnel, typically those in smaller workshops, may be involved in both the manufacture and fitting of wheelchairs. The term "technical production personnel" as used in these guidelines is limited to wheelchair manufacturers and does not include the provision of services to individual users.

3.4.2 Referral networks

Referral networks play a crucial role in wheelchair service delivery. Well-functioning referral networks help to ensure services are accessible to users. Referral networks may consist of health and rehabilitation personnel or volunteers working at community, district or regional level.

The importance of a strong link between specialist services and rehabilitation or health care programmes is stressed in a joint statement of the International Society for Prosthetics and Orthotics and WHO *(6)*.

Wheelchair services are an example of a specialized service that cannot always be fully provided within every community. In developing countries, the majority of those people with disabilities live in rural areas and find it difficult to access rehabilitation services, which are often restricted to large cities *(7,8)*. Health and rehabilitation workers therefore need to play a proactive role in ensuring that people living in rural areas can also access wheelchair services without difficulty.

The role of referral networks in wheelchair service delivery can include:

- identifying and referring people requiring wheelchairs;
- liaising between the users, their families and the wheelchair services to facilitate assessment, fitting and follow-up;
- reinforcing wheelchair service training such as pressure sore prevention, prevention of secondary complications, wheelchair maintenance and mobility skills;
- providing support, advice and possibly assistance in adapting the user's home environment;
- encouraging measures to facilitate accessibility in the community;
- providing information to the wheelchair services about the acceptability and use of prescribed wheelchairs;
- assisting the user to arrange repairs, and
- promoting the benefits of wheelchairs.

3.4.3 Service personnel

Wheelchair service personnel carry out managerial, clinical, technical and training duties (see Fig. 3.4). These roles may be fulfilled by personnel from a range of training and educational backgrounds. They may also overlap: in a small service, for example, one person could carry out both the clinical and technical roles. In another scenario, one person could carry out the clinical, training and management roles with the support of a part-time technician.

At times, particularly when working with users who have complex needs, personnel may draw on the expertise of other specialists such as occupational therapists, physiotherapists, speech and language therapists, paediatricians, neurologists, physiatrists, orthotists, prosthetists and orthopaedic specialists.

Management role

For a wheelchair service to operate effectively, a designated manager is critical. The manager ensures a framework is in place to enable the wheelchair service to operate. This includes adequate staffing, facilities, funding, products, referrals and appointment systems. Managers also play a key role in promoting wheelchair services. The manager therefore requires a thorough understanding of wheelchair service delivery in addition to general management skills.

The duties of wheelchair service managers should include:

- building awareness of wheelchair service delivery among all stakeholders;
- developing a referral network through promotion of the wheelchair service and its functions;
- organizing training opportunities for referral network personnel;
- ensuring the service is accessible to all users within the service area, including women, children and minority groups;
- managing waiting lists;
- identifying and securing sources of funding to support the service;
- facilitating the development and training of service personnel;
- evaluating the effectiveness of the service in meeting users' needs;
- continuously improving service quality;
- developing links with disabled people's organizations and community-based rehabilitation programmes; and
- assisting in the formation of wheelchair users' groups.

Clinical role

Clinical personnel work directly with the user in assessment, prescription, fitting and follow-up. Ideally, the clinical personnel work closely with technical personnel, particularly on prescription and fitting.

The main duties of clinical personnel include:

- wheelchair service delivery, following the eight-step process described in Table 3.2;
- quality control to ensure equipment is adjusted correctly and is safe for each user;
- training users in mobility and health issues, or supervision of such training provided by a trainer;
- follow-up with users to ensure that equipment continues to be appropriate to their needs;
- record keeping and documentation;
- education of referral network personnel;
- keeping up to date with the range of available wheelchairs; and
- participation in overall service evaluation.

Technical role

Technical personnel ensure that the technical requirements of the prescription are met through the correct assembly or modification of the wheelchair. Technical personnel have direct contact with users, at least in the prescription and fitting stages. When working with a user who requires modifications or postural support, it is increasingly important that technical personnel are directly involved in the user's assessment, fitting and follow-up.

The main duties of technical personnel include:

- assembling or preparing wheelchairs according to prescription;
- making or assembling modifications or custom postural support;
- training users in wheelchair maintenance and basic repair, or supervising such training provided by a trainer;
- ensuring that each wheelchair and any modifications are technically safe before each fitting and before the user leaves the service with the new equipment;
- keeping records and documentation;
- following up users to ensure equipment continues to be appropriate;
- facilitating maintenance and repairs of wheelchairs and associated equipment; and
- participating in overall service evaluation.

Training role

One of the key steps in wheelchair service delivery is basic skills training for wheelchair users. The bulk of the training may be fulfilled by clinical or technical personnel or by dedicated trainers. They also provide users with the necessary advice on maintaining their wheelchair. Experienced, well-trained wheelchair users ("peer trainers") are useful in training other users (see Box 3.12). Provided with the right resources and training, peer trainers may have some advantages over trainers who are not users. Such advantages include an ability to empathize and to draw on first-hand experience. For those receiving a wheelchair for the first time, there is added value in training given by a peer trainer. By working with peer trainers, users are better able to recognize their own potential.

The main duties of trainers include:

- training users and caregivers, individually or as a group, in:
  - transferral in and out of the wheelchair
  - wheelchair handling
  - basic wheelchair mobility
  - health issues specific to wheelchair use (pressure sore prevention, etc.)
  - wheelchair maintenance;
- participating in routine and more intensive follow-up for those users at risk, or who require additional training and support;
- educating referral network personnel; and
- participating in service evaluation, focusing on the needs of users.

In addition, trainers could become involved in:

- activities to promote the wheelchair service;
- liaison with disabled people's organizations and community-based organizations; and
- referral of users to relevant community programmes such as disabled people's organizations, vocational schemes and peer group training.

Box 3.12. Peer training in Romania

For 11 years now, the Motivation Romania Foundation (MRF) based in Bucharest has provided peer training. The MRF wheelchair service and peer training programme is based on the principle that all wheelchair recipients should undergo peer training (including, but not limited to, wheelchair skills) to maximize their independence. The peer training team currently consists of four users and a physiotherapist. Each year, some 160 users access the peer training programme, which includes:

- training in wheelchair skills;
- individual and group discussions, in which users can talk about the challenges they have faced and try to find solutions together;
- provision of information, for example about dealing with health problems; and
- participation in sports and social activities to facilitate the development of outgoing, people-oriented attitudes and prevent isolation.

Peer training is carried out at the MRF centre and through regular peer training camps. Peer trainers are recruited from among former recipients of peer training. They receive training in teaching and counselling from experienced peer group trainers, thus enabling them to take on the role themselves.

The costs of the peer training programme are covered by the Romanian Ministry of Labour and Social Protection, the National Authority for People with Disabilities, and national and international donors.

Overview

Table 3.4 provides an overview of the clinical, technical, training and management duties of wheelchair service personnel.

Table 3.4. Overview of the duties of wheelchair service personnel

	Clinical	Technical	Training	Management
Service management and development				
Promoting the service	✓	✓	✓	✓
Sourcing funding				✓
Developing referral base	✓	✓	✓	✓
Liaising with other organizations	✓	✓	✓	✓
Service evaluation	✓	✓	✓	✓
Key steps in service delivery				
1. Referral and appointment	✓	✓		✓
2. Assessment	✓	✓		
3. Prescription	✓	✓		
4. Funding and ordering	✓	✓		✓
5. Assembly and/or production		✓		
6. Fitting	✓	✓		
7. User training	✓	✓	✓	
8. Follow-up, maintenance and repairs	✓	✓	✓	
Training and professional development				
Training referral network personnel	✓	✓	✓	
Training service delivery personnel	✓	✓	✓	

3.5 Monitoring and evaluation

3.5.1 The need to measure performance

Monitoring and evaluation of a wheelchair service can help identify those areas that are successful and those that can be improved. *Monitoring* is the regular ongoing collection and analysis of information to track the quality and effectiveness of the wheelchair service. *Evaluation* refers to an overall evaluation, usually conducted over a short period of time. Evaluations are often carried out annually or sometimes biannually. Information gained through regular monitoring is often used as part of an overall evaluation.

It is recommended that services establish a system for regularly monitoring the service, and conduct annual overall evaluations to assess service performance and impact.

Box 3.13. Purpose of monitoring and evaluating wheelchair services

Monitoring and evaluation can provide important information that enables services to:

- **improve the quality of services and products**
- **improve service processes such as referral, appointments and follow-up**
- **contain costs by increasing efficiency**
- **demonstrate the benefits of wheelchair service delivery for users**
- **demonstrate the effectiveness of the service**
- **identify and quantify unmet needs**
- **plan further development of the service**
- **allocate resources appropriately**
- **justify current and proposed service funding**
- **develop stronger partnerships with service recipients**
- **enhance credibility and funding opportunities.**

3.5.2 Monitoring

Regular monitoring can be established as follows.

1. Identify the areas and activities of the service that should be routinely monitored. Examples are the rate of referrals, waiting times, the number of users receiving wheelchairs, the types of wheelchair prescribed, the number of follow-ups and the level of user satisfaction.

2. Set "performance targets" for these areas and activities. A performance target is a statement of how well the service would like to perform in that area. This may often be linked to funding. For example, funding may have been provided to the service based on agreed objectives or targets. Performance targets should be realistic, taking into account the resources available.

3. Identify the information that needs to be collected in order to be able to monitor service performance for each area – and how it will be collected. Ideally, gathering information should be part of the service's normal record keeping, and should thus require very little additional work by service personnel.

Table 3.5 provides an example of service areas that could be monitored, performance targets, and ways to collect information for each service area. It is important to note that the performance targets are examples only; actual targets need to be worked out according to the resources available to each service.

Table 3.5. Examples of service areas that could be monitored, performance targets, and ways of collecting information

Areas and activities	Example performance targets	Information collection
Referral		
Number of users referred	The service will receive 30 referrals per month	Record referrals received
Average waiting time from referral to appointment	Waiting time from referral to appointment should be less than 1 month	Record date referral received and assessment date on user file
Wheelchair provision		
Number of users who receive a wheelchair	The service will prescribe and fit wheelchairs for 20 users per month	Wheelchair prescriptions recorded on users' files
Number of follow-up appointments carried out	Follow-up appointments will be carried out for at least 15 users per month	Follow-up appointments documented in users' files
Impact of wheelchair provision on users	Users receiving wheelchairs through the service have a demonstrated improvement in quality of life as a result of their wheelchair	Assessment notes should indicate areas of desired improvement (e.g. function, posture) Follow-up notes should indicate improvements achieved User feedback
Wheelchair population served		
Details of users referred to the service, such as age, gender, disability, postural support needs	The service will encourage equal access The service will aim to meet the needs of users requiring basic wheelchairs and those requiring modifications and postural support	Number of men and women accessing the service – recorded on user files Types of postural need presented and wheelchairs prescribed – recorded on user files
Geographical area covered by the service	The service will provide wheelchairs for people living within (defined region/area)	Home address of users accessing the service – recorded on user files
Service costs		
Cost of products supplied, including modifications made within the service	The individual cost of each wheelchair will be less than (amount specified according to budget and realistic cost of available products)	Cost of products purchased – recorded in service accounts Cost of materials and labour spent on assembly and modifications – recorded on workshop "job sheet" for each wheelchair prescribed
Amount of time spent by personnel on service activities (assessment, follow-up, training, etc.)	Staff are to spend ___% of their time on direct service delivery and ___ % of their time providing education for referral sources	Staff time sheet, completed daily

Feedback from users

In addition to the routine collection of monitoring information, it is recommended that services establish methods of regularly gathering feedback from users and their families. There are several ways in which such feedback can be gathered.

- A few questions about the service can be formulated and put to users after they have received their wheelchair.
- A short questionnaire can be developed, asking users for their thoughts on the performance of the service. This could be offered to every user or to a specified number of randomly selected users each month.
- Users can be encouraged to write down their impressions of the service and post them in a "feedback box". Feedback can be anonymous, thus allowing people to feel more comfortable about providing honest feedback. It is important to note that this type of system is open only to those with a sufficient level of literacy, and should therefore not be the only method used to gather feedback.

Analysing collected information

The information collected through regular monitoring and user feedback will be most useful if it can be centrally stored and organized. A basic database can be very useful for this where computers and personnel are available. Alternatively, information can be organized and analyzed manually.

Once information is organized, it is possible to measure how the service is performing against the performance targets. A regular analysis of information can be used to identify problems and action can be implemented to solve the problems. For example, if fewer referrals than expected are being received, a service may choose to contact all referral sources to remind them about the service or offer additional training.

3.5.3 Evaluation

An overall evaluation is more comprehensive than ongoing monitoring. An evaluation provides an overview, highlighting the service's strengths and weaknesses. Previous evaluation reports can be used as a basis for subsequent evaluations.

Service evaluations can be carried out externally or internally. An external evaluation involves having one or more people from outside of the service carrying out the evaluation. This can be useful, as external evaluators will view the service from a different perspective. Internal evaluations can be carried out by one or more personnel who have been designated the responsibility to gather and analyse the necessary information. The use of computers in data collection, programme monitoring and follow-up will facilitate the evaluation of service provision.

Table 3.6 provides some suggestions for gathering evaluation information for some key service areas.

Table 3.6. Suggestions for gathering evaluation information for some key service areas

Service area	Evaluation information
Quality of service delivery	The good practice recommendations made in Section 3.3 of these guidelines can be used as criteria to assist in evaluating the quality of service delivery.
Users served and the intervention they received	Information from ongoing monitoring should enable evaluators to quantify the number of users provided with a wheelchair, training and follow-up; the different types of wheelchair provided; and the number of users with needs that could not be met by the service. A thorough evaluation would also include information on users accessing the service, including age, gender, ethnicity, disability and home location.
Cost of service, including cost of products and service delivery	Information from ongoing monitoring should enable evaluators to review and summarize the cost of the service. An audit of accounts may also be used to determine the cost of products and services.
Staffing (numbers of personnel and their roles and competences)	Evaluators can assess numbers and roles of personnel by talking to service management or reviewing personnel records. Staff competences can be assessed by observing personnel carrying out their duties. Some of the good practice recommendations in Section 3.3, the personnel roles described in Section 3.4.3 and the clinical competences summarized in Section 5.3.3 can be used as criteria to assist in evaluating personnel competence. Staff educational records should be reviewed to help determine competences and professional development. Feedback from users and individual interviews with personnel can help to identify strengths and weaknesses in the staffing structure.
Facilities and equipment available to the service	Evaluators can assess the suitability of facilities and equipment by observing the service in practice. Feedback from users and individual interviews with personnel can help to identify any strengths and weaknesses in service facilities.
Impact on users and their families	Information may be gathered from users and their families on the impact of the service. Measures can include increased participation in family or community activities (for example education, employment in or outside of the home, participation in social activities) and increased earning potential of wheelchair users or their families. Methods of gathering information include the following. • Evaluators may review assessment and follow-up forms. Assessment forms can provide information about users and their families before they receive a wheelchair through the service. Follow-up reports can provide information about how the service has affected the lives of the user and his/her family. • Home visits will enable evaluators to meet the users of the service and see for themselves what impact there has been. Home visits may provide additional information not gained through a follow-up appointment carried out at the service. • A detailed survey may be developed to assess the service impact on the quality of life of users, including participation in school, employment and other activities. • Users (and family members) may be gathered as a focus group to provide evaluators with information about how they believe the service has affected them.

Summary

- Wheelchairs need to be provided together with services.
- Existing rehabilitation personnel can be utilized to provide wheelchair services.
- Integrating wheelchair services with existing health or rehabilitation services is recommended.
- Where possible, the needs of users should be met at community level.
- Wheelchair services facilitate the assessment of individual user needs, provide an appropriate wheelchair, train users and caregivers, and provide ongoing support and referral to other services.
- Each user has a unique set of physical, environmental and lifestyle needs..
- Groups of personnel involved in wheelchair service delivery include manufacturers and suppliers, referral networks and service personnel.
- The main roles of service personnel are managerial, clinical, technical and educational.
- Peer trainers play an important role in wheelchair provision
- Wheelchair provision should be regularly monitored and evaluated, especially in helping to identify those areas that are successful and those that need to be improved.

References

1. Rushman C, Shangali HG. *Wheelchair service guide for low-income countries*. Moshi, Tanzanian Training Centre for Orthopaedic Technology, Tumani University, 2005.
2. Sheldon S, Jacobs NA, eds. *Report of a Consensus Conference on Wheelchairs for Developing Countries, Bangalore, India, 6–11 November 2006*. Copenhagen, International Society for Prosthetics and Orthotics, 2007 (http://homepage.mac.com/eaglesmoon/WheelchairCC/WheelchairReport_Jan08.pdf, accessed 8 March 2008).
3. McCambridge M. Coordinating wheelchair provision in developing countries. In: *Proceedings of the RESNA 2000 Annual Conference: Technology for the New Millennium, Orlando, Florida, 28 June – 2 July 2000*. Atlanta, GA, RESNA, 2000:234–236.
4. *The manual wheelchair and its use*. Stockholm, Swedish Institute of Assistive Technology, 1990 (In Swedish).
5. Oderud T. Design. In: *Report of a Consensus Conference on Wheelchairs for Developing Countries, Bangalore, India, 6–11 November 2006*. Copenhagen, International Society for Prosthetics and Orthotics, 2007.
6. *The relationship between prosthetics and orthotics and community-based rehabilitation. A joint ISPO/WHO statement*. Copenhagen/Geneva, ISPO/WHO, 2003 (http://www.who.int/disabilities/technology/po_services_cbr.pdf, accessed 10 March 2008).
7. Helander E. *Prejudice and dignity: An introduction to community based rehabilitation*, 2nd ed. New York, United Nations Development Programme, 1999
8. *Empowering the rural disabled in Asia and the Pacific*. Rome, Food and Agriculture Organization of the United Nations, 1999 (http://www.fao.org/sd/PPdirect/PPre0035.htm, accessed 10 March 2008).

4 TRAINING

… to develop the skills and knowledge of personnel involved in wheelchair provision.

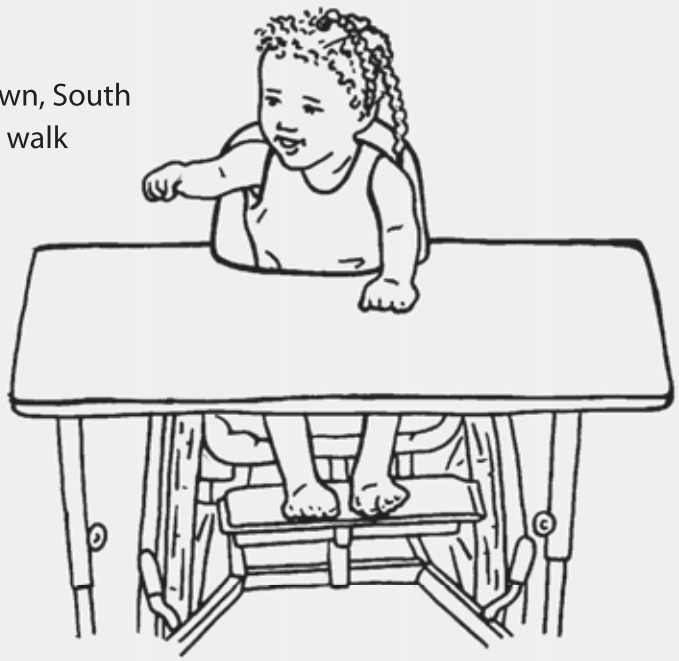
The training guidelines:

- offer recommendations on how training programmes may be provided; and
- suggest training requirements and recommend course content for personnel involved in wheelchair provision.

Box 4.1.

Wheelchairs changing lives …

Testimonial from a user in South Africa



Caitlin is three years old and lives in Cape Town, South Africa. Caitlin has cerebral palsy, is unable to walk and has great difficulty speaking. When she turned two, Caitlin's physiotherapist suggested her parents get her a special child's wheelchair. At that time, Caitlin spent most of the day lying on the floor or in her parents' arms. She was very frustrated and irritable, and cried often. Her parents were referred to a small wheelchair service in Cape Town, where Caitlin was assessed. The service prescribed a wheelchair with a special insert to help support Caitlin. Her parents had to raise funds to pay for the wheelchair, which she received just as she turned two.

Caitlin's parents say: "When we first sat Caitlin down in her new wheelchair, to our amazement she immediately knew what to do. Ever since then we have noticed a major difference and improvement in Caitlin. She is less frustrated, more motivated, enjoys being independent, loves chasing other kids while sitting in her wheelchair and thoroughly enjoys the outdoor life. The chair has given Caitlin and us new found hope for the future, and a normal life as far as possible. Believe it or not, for two years we did not know we had a child in the house, but with this chair our princess is doing her thing and is always up to mischief."

Caitlin is happier and more active since she received her wheelchair. She is also making good physical progress. Her therapists report that her overall posture has improved, that she is stronger and that she has better trunk and head control. Caitlin's speech has improved, owing to her improved posture and mobility, and she is also learning sign language as a means of broadening the ways she can communicate.

testimonial

4.1 Introduction

Purpose and outputs

The purpose of the training guidelines is to develop the skills and knowledge of personnel involved in wheelchair provision.

Implementation of the training guidelines will contribute to:

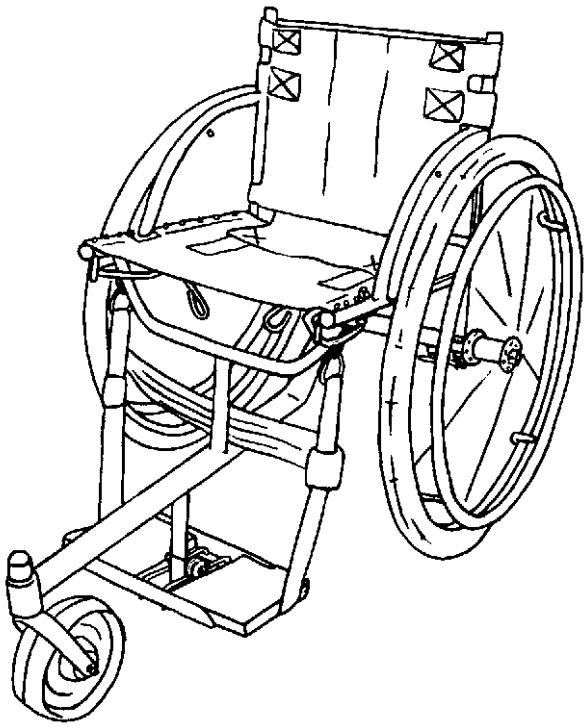
- an increase in the number of personnel trained in wheelchair provision;
- an improvement in the competences of wheelchair provision personnel;
- greater recognition for personnel trained and practising in the field of wheelchair provision;
- greater integration of wheelchair provision within rehabilitation services; and
- increased collaboration among those involved in the development, implementation and maintenance of wheelchair provision training programmes.

Strategies

Effective wheelchair provision requires that personnel have the appropriate knowledge and skills. The following provides some strategies to assist in developing training opportunities and initiatives *(1)*. The United Nations Standard Rules concerning "personnel training" indicate that countries are responsible for ensuring the adequate training of personnel, at all levels, involved in planning and providing programmes and services for people with disabilities *(2)*. This is confirmed in Article 4 of the Convention on the Rights of Persons with Disabilities *(3)*.

Identifying candidates for training

Existing health or rehabilitation personnel could be easily trained for wheelchair provision. Possible candidates for training usually are: community health care workers, community-based rehabilitation workers, occupational therapists, physiotherapists, prosthetists, orthotists, local craftsmen and technicians. Users comprise another group of potential candidates: although they may lack professional training, users already have a fundamental understanding of their needs and may be highly motivated. Studies indicate that wheelchair skills training for manual wheelchair users is efficacious, safe and practical *(4)*.



Linking with existing training programmes and schools

Linking with existing rehabilitation training programmes and schools provides an opportunity to conserve resources. Links may be established with many of the training programmes currently being implemented in less-resourced settings, including community-based rehabilitation training programmes, training programmes for middle-level rehabilitation workers, occupational therapy and physiotherapy schools, and prosthetics and orthotics training schools. Existing rehabilitation training schools may offer separate programmes in wheelchair provision (exclusive training approach) *(5)*, as well as accommodate some modules related to wheelchair provision into existing training programmes (integrated training approach).

Box 4.2. Examples of exclusive and integrated approaches to wheelchair-related training

Exclusive training	Integrated training
The one-year Wheelchair Technologists Training Course at the Tanzanian Training Centre for Orthopaedic Technologists is an example of exclusive wheelchair training. Another example is the three-week courses on wheelchair prescription and wheelchair assembly offered by Mobility India.	At the Centre for the Rehabilitation of the Paralysed in Bangladesh, training on wheelchair services is integrated into the curriculum for occupational therapy students. Also, Mobility India has integrated a three-week module on wheelchairs into its one-year training programme for rehabilitation therapy students.

Developing modular training packages

To minimize the time and financial resources required for training, it is suggested that training be developed and provided in modules at different levels, starting with basic wheelchair service delivery. After the successful completion of the first-level modules, personnel would be able to provide basic wheelchair services. Each successive level would enable personnel to provide wheelchairs for users with increasingly complex needs. Suggested content for the basic and intermediate levels are provided in Section 4.3. Recognizing that many users require more than basic wheelchair provision, it is suggested that training programmes plan that at least some personnel progress to an intermediate level of training as soon as possible.

Training packages that include a trainer's guide and student workbooks can enable training to be repeated consistently by different trainers. Such packages could be developed to support training in more than one setting, with small adaptations made to match the specific context. This approach can reduce the time required to plan and prepare training and thus help reduce the resources required.

Exploring ways to ensure training is recognized

Recognition of skills attained is an important incentive for personnel undergoing training. It also helps to increase the perceived importance of wheelchair provision. It is therefore recommended that those developing and running training courses seek official recognition of their courses. Recognition can be sought nationally, through educational bodies such as schools providing health care or rehabilitation training, or through international professional associations or organizations.

Building the capacity of local personnel to provide training

To maintain training programmes locally, it is important to develop the capacity of local trainers *(6)*; and in order to train effectively, practical experience in the field is necessary. Some strategies for developing local trainers include the following.

- When setting up a training programme, select strong candidates with the potential to become trainers. Train these people in basic wheelchair provision and, after field practice, in more advanced wheelchair provision. After two or three years, these personnel should have the potential to train others in basic wheelchair provision. To assist them in this role, training in "how to deliver training" would be of benefit.
- Ensure local trainers continue to practise their skills in the field. This will increase the quality of the training they are able to deliver.

In the absence of local trainers, there are international organizations that may assist in providing training (see Annex A). An example of such training is given in Box 4.3.

Box 4.3. "Fit for Life" wheelchair prescription training package

Motivation has developed a training course aimed at wheelchair service personnel working in less-resourced settings. To enable it to be delivered consistently by different trainers, the course has been documented and "packaged". The training package includes a student workbook, a trainer's guide and teaching aids such as poster-size visual aids, assessment methods and card games.

Fictitious characters are used throughout the course to provide a range of different case study scenarios to reinforce the trainees' learning. In the first version of the package, illustrations have been designed to represent a range of Asian nationalities and religions, allowing the course to be used in a wide range of settings in Asia. For settings outside this region, it would be appropriate to adapt the illustrations.

The trainer's guide contains overall information on how to deliver the course, as well as lesson plans for each session. Each lesson plan includes the time and materials required for that session and step-by-step instructions on how to teach the session.

The development of the course took two years. The training package enables different trainers to deliver the course, and provides a consistent level of training and student assessment. The training package has also been used by other organizations, made possible by the development of the trainer's guide and teaching aids.

Stakeholders and resources

Stakeholders involved in planning, implementing and participating in training programmes include:

- national government authorities responsible for health and education, and other relevant departments and local authorities;
- supporting organizations providing technical input and funding; and
- trainers and trainees.

Key resources required to implement the training guidelines include:

- training packages and training materials;
- training facilities, including premises for delivering interactive theoretical training, workshop and clinic facilities for practical sessions, and areas for wheelchair mobility training;
- a reliable supply of wheelchairs that meet minimum requirements;
- trainers with experience in wheelchair provision; and
- users willing to participate in sessions.

4.2 Training requirements

This section describes the training requirements for referral network personnel and those directly fulfilling management, clinical, technical and training roles in a wheelchair service. See Section 3.4 for a description of the different roles and Section 4.3 for recommended course content.

4.2.1 Referral networks

Basic training for personnel working within referral network organizations (for example health and rehabilitation personnel and volunteers working at community, district or regional level) will increase the effectiveness of a referral network. Ideally, training would provide referral personnel with a combination of:

- core knowledge and skills (relevant to all referral personnel regardless of context), including the ability to identify those who would benefit from being referred to a wheelchair service and an understanding of how best to support users in the community; and
- local knowledge, including familiarity with the operations of local wheelchair services and an awareness of locally available products.

Training for referral network personnel can be delivered in a number of ways.

- Wheelchair services can host "referral network training" run by the clinical, technical and possibly training personnel of the service. Such training programmes would help to strengthen the referral network for that service as well as providing an opportunity to strengthen the working relationships between referral and service personnel.
- Existing training programmes for health and rehabilitation employees can choose to include basic wheelchair referral for all personnel. This would serve to ensure that all personnel passing through these programmes have a greater awareness of the needs of users, how to refer users, and how to support users in the community. Training should cover the function of a wheelchair service and the value of assessment, prescription, user training and follow-up.

For both of these approaches, preparations for training could be reduced by the development of training packages covering the core knowledge required by referral network personnel, including guidelines for adapting the package to include local knowledge.

4.2.2 Role of wheelchair service providers

Management

Managers require generic skills in service management, such as financial and personnel management. These skills are not unique to wheelchair provision: management training opportunities exist in many settings. In addition to generic management skills, wheelchair service managers require a good overall understanding of wheelchair provision. Such an understanding will enable a manager to support service personnel, promote the wheelchair service, and evaluate the effectiveness of the service.

The availability of short courses for wheelchair service managers would be an asset in the development of wheelchair services. Such training should include elements of wheelchair provision, fundraising, development of referral networks and wheelchair service evaluation.

Clinical and technical

Trainee selection: Selection of candidates for training should be flexible and in accordance with existing rehabilitation and health care staffing structures. Ideally, training should be accessible to applicants from a broad range of backgrounds and not wholly dependent on formal pre-entry qualifications. Nevertheless, for the training to be recognized, the relevant training regulations may have to be followed.

Wherever possible, entry requirements should take into account:

- candidates' practical, hands-on experience with users and wheelchair provision;
- any informal training they have received;
- the level of formal education they have attained; and
- their experience in the delivery of any health care service.

Given quality training and support, personnel from a range of professional/clinical/technical backgrounds can competently carry out the duties required in providing wheelchairs to most users. Box 4.4 describes possible candidates. It is important to note that the technical role in a wheelchair service requires the personnel to work directly with the user. Those selected to train in the technical field should therefore have skills in working with people as well as technical skills. All candidates will need to be able to read and write competently in their mother tongue.

Box 4.4. Professional/clinical/technical candidates for training

- **Community-based rehabilitation workers or volunteers.**
- **Personnel working in a wheelchair service with no previous training or academic qualifications.**
- **Qualified nurses, physiotherapists, occupational therapists, prosthetists, orthotists, doctors and other health and rehabilitation workers.**
- **Users interested in working with other users in a clinical role.**

In clinical roles it is better to have qualified medical, paramedical or rehabilitation professionals with a good knowledge of anatomy, physiology, different health conditions, rehabilitation needs and possible solutions. While the clinical role concentrates on the user, the technical role has more to do with the wheelchair, such as selecting the correct size and components, assembly and necessary modifications.

Candidates for courses in wheelchair provision for users with complex needs must hold a degree or diploma in occupational therapy, physiotherapy, prosthetics or orthotics. This will provide them with the depth of knowledge required to meet the needs of such users. Alternatively, personnel that have worked in a wheelchair service in a clinical or technical role and have demonstrated strong competence may be able to undertake such training.

Competence-based training

Effective training programmes will focus on developing the knowledge and skills required for clinical and technical personnel to safely and effectively fulfil their roles. A list of competences for clinical and technical personnel working in wheelchair service delivery, agreed by stakeholders, would assist in the development of consistent training programmes for these personnel. Table 4.2 provides a summary of suggested competences structured in three levels – basic, intermediate and advanced.

Table 4.2. Clinical and technical competences at basic, intermediate and advanced levels of wheelchair service delivery

Service delivery level	Clinical role	Technical role
Basic	Able to carry out basic user assessment, prescription, fitting and follow-up for users with basic needs (not requiring modifications or postural support). Able to identify and refer users who require wheelchair modifications and postural support; able to follow up these users once they are provided with a wheelchair. Able to carry out basic training in wheelchair provision for referral network personnel. Able to keep records of individual users (case files).	Able to participate in team assessment, prescription, fitting and follow-up of users with basic needs. Able to assemble or set up manual wheelchairs according to the manufacturer's instructions and prescribed components (without modification). Able to carry out modifications of some wheelchair or postural components as directed by the supervisor.
Intermediate	Able to carry out user assessment, prescription, fitting and follow-up for users requiring basic wheelchairs, wheelchairs with modifications, and wheelchairs with postural support. Able to identify users who require complex seating; able to follow up these users once they are provided with a wheelchair. Able to carry out training in wheelchair provision for referral network personnel. Able to train, supervise and support clinical personnel in basic wheelchair provision. Able to keep records of individual users (case files).	Able to participate in team assessment, prescription, fitting and follow-up of users requiring basic wheelchairs, wheelchairs with modifications, and wheelchairs with postural support. Able to assemble and set up manual wheelchairs, including the design and production or assembly of modifications to meet prescribed needs. Able to carry out basic training in wheelchair provision for referral network personnel. Able to train, supervise and support technical personnel in basic wheelchair provision.
Advanced	Able to lead the service team in wheelchair provision for all users, including those with the most complex need. Able to work with a high level of professionalism, including record keeping, service development and supervision of less qualified personnel. Able to develop and deliver training for clinical wheelchair service personnel at all levels.	Able to carry out a full assessment of user needs, either independently or as a member of the service team. Able to identify appropriate commercial products or to design and make custom products to meet the needs of all users, including those with the most complex needs. Able to work with a high level of professionalism, including record keeping, research and development, quality control and supervision of service workshop and technicians. Able to develop and deliver training for technical wheelchair service personnel at all levels.

4.2.3 Trainers

Training programme development

Trainers working in wheelchair service delivery require knowledge of different impairments and chronic conditions. They need to understand who can benefit from using a wheelchair and which wheelchair model and features are most suitable for an individual. Also, they need a clear understanding of how to prevent further deformities and complications, and a broad understanding of disability in general and environmental factors. Trainers also require skills in wheelchair use, effective communication and training, and knowledge of the rights of persons with disabilities.

Users and delivery of training

Active users may effectively teach wheelchair mobility skills and transferral, demonstrating what an actual user can do. Users may also be able to explain to trainees what it was like when they first received a wheelchair, and what training or instruction they found most beneficial or would have found most beneficial had it been available.

Box 4.5. Wheelchair service delivery training in Africa

Abdullah Munish had a spinal cord injury due to a car accident in 2000. He was in the Kilimanjaro Christian Medical Centre in the United Republic of Tanzania for nearly eight months. It was a very frustrating time for him as he learnt that he would not be able to walk again – it was almost like the end of the world for him. From his therapists, he heard of a training opportunity for him to become a wheelchair technologist. This gave him a ray of hope. With the help of his therapists and supporters, he joined the one-year Wheelchair Technologists Training Course at the Tanzanian Training Centre for Orthopaedic Technologists (TATCOT).

The course, which is accredited by the International Society for Prosthetics and Orthotics, teaches the technical skills of wheelchair production as well as anatomy and physiology, the pathology of different impairments, technical drawing, workshop management and disability studies. This enabled Abdullah to build on his production skills and learn how to assess people and prescribe them with the right wheelchair, as well as the essential management skills needed to run a small business.

Abdullah has said of the course "I had no idea there was so much to learn about wheelchair production and distribution. Now I can produce good quality wheelchairs, but I can also ensure that a wheelchair is right for the person using it. The more you learn, the more you realize that the provision of wheelchairs is a complex subject and we need to continuously develop our skills and extend our knowledge. We need more knowledge in supportive seating, for example, and to continuously improving our designs and our services."

Abdullah finished the course in 2001 and was employed as a wheelchair technologist by the Kilimanjaro Christian Medical Centre. His first challenge was to set up a wheelchair workshop at the hospital, which took nearly a year to complete. Since then, he and his colleagues have been producing appropriate wheelchairs and providing services to people living in the Kilimanjaro region. Abdullah teaches wheelchair skills and disability issues to students at TATCOT and at a college for occupational therapists. At the Kilimanjaro Association of the Spinally Injured, he gives training to others as a peer trainer. Abdullah has also been a guest lecturer in wheelchair design for developing countries at the Massachusetts Institute of Technology in the United States.

4.3 Course modules and contents

4.3.1 Course modules

Considering needs and available resources, these guidelines focus on the training of personnel at basic and intermediate levels only. An overview of suggested course modules for personnel involved in wheelchair services at these two levels is provided in Table 4.3. The modules for the training, clinical and technical roles are structured in two sequential levels: basic and intermediate. It is not necessary to provide the training in modules, but it may be more efficient to provide the same training module to more than one group at a time.

Table 4.3. Suggested training modules for fulfilling different roles in wheelchair services at basic and intermediate levels

	Role				
Level	**Referral network**	**Management**	**Training**	**Clinical**	**Technical**
Basic	1. Users, wheelchairs and services for referral personnel	2. Users, wheelchairs and services for managers	3. Users, wheelchairs and services - I		
				4. Services for clinicians – I	5. Services for technicians
				6. Health care – I	
			7. Training skills		
			8. User training – I		
Intermediate			9. User training – II		
				10. Health care – II	
				11. Users, wheelchairs and services – II	
				12. Services for clinicians – II	13. Wheelchair technology

4.3.2 Course contents

Recommended contents of the course modules are described below. Content descriptions may be the same in different modules, but the coverage of different modules may differ depending on the needs of particular roles.

Trainees undertaking the intermediate level should either have completed the basic level or be able to demonstrate full competency at that level. The recommended course content is not intended to be definitive but rather a guide for those involved in developing training packages or programmes. The modules and contents are not necessary taught in the order given in Table 4.3 or in the following list.

Generic management training (for example, personnel and budget management) and generic workshop training (for example, tools and machinery, workshop safety, quality control and stock management) are not included in the modules.

Module 1. Users, wheelchairs and services for referral personnel
Recommended content: users; wheelchairs; impairments; wheelchair-related health issues; general wheelchair service provision; wheelchair provision in the trainee's local area.

Module 2. Users, wheelchairs and services for managers
Recommended content: needs of users; wheelchairs; wheelchair service overview; wheelchair service costing and funding; wheelchair service personnel and facilities; wheelchair service promotion; service monitoring and evaluation; waiting list management.

Module 3. Users, wheelchairs and services
Recommended content: introduction to users; impairments; posture; introduction to wheelchairs; introduction to cushions; introduction to wheelchair mobility; referral network; introduction to assessment, prescription, fitting, user training, follow-up, repairs and maintenance; introduction to service evaluation.

Module 4. Services for clinicians – I
Recommended content: benefits and dangers of different postures; assessment and prescription; fitting; follow-up; quality checking; service evaluation.

Module 5. Services for technicians
Recommended content: assessment and prescription; wheelchair assembly; fitting; follow-up; repairs and maintenance; quality checking; service evaluation.

Module 6. Health care – I
Recommended content: health care issues, focusing on hygiene and preventing pressure sores.

Module 7. Training skills
Recommended content: presentation skills.

Module 8. User training – I
Recommended content: basic wheelchair mobility and transfers; self health care; wheelchair handling and maintenance; adaptations to environments.

Module 9. User training – II
Recommended content: advanced wheelchair mobility and transfers.

Module 10. Health care – II
Recommended content: health care issues, focusing on care, management and rehabilitation.

Module 11. Users, wheelchairs and services – II
Recommended content: users; impairments; human anatomy; normal and abnormal postures; wheelchair types and components; wheelchair cushions; wheelchair mobility; referral network; training of referral personnel; methods of service evaluation.

Module 12. Services for clinicians – II
Recommended content: prescription of cushions; evaluation of cushion performance; local referral network; intermediate assessment, prescription, fitting, user training and follow-up for clinicians; support and supervision of clinical personnel; how to complete clinical service evaluations.

Module 13. Wheelchair technology
Recommended content: wheelchair design; cushion modifications; construction of basic and pressure relief cushions; wheelchair preparation and modification; fabrication of postural support; intermediate assessment, prescription, fitting, user training and follow-up for technicians; support, supervision and training of technical personnel; workshop management; how to complete technical service evaluations.

Summary

- Effective wheelchair provision requires personnel with knowledge and skills in the provision of wheelchairs.
- When developing training opportunities and initiatives:
  - spend time identifying suitable candidates for training;
  - give preference to people with disabilities, especially wheelchair users where possible;
  - explore possibilities of linking with existing rehabilitation training programmes;
  - develop modules and training packages for integrated or exclusive training;
  - explore ways to ensure training is recognized, and
  - build the capacity of local trainers.
- Referral network personnel and those who fulfil managerial, clinical, technical and training roles in a wheelchairs service require different types of training.

References

1. Gyundi YE, Cornick C. Training: formal training; TATCOT/Motivation. In: Sheldon S, Jacobs NA, eds. *Report of a Consensus Conference on Wheelchairs for Developing Countries, Bangalore, India, 6–11 November 2006*. Copenhagen, International Society for Prosthetics and Orthotics, 2007 (http://homepage.mac.com/eaglesmoon/WheelchairCC/WheelchairReport_Jan08.pdf, accessed 8 March 2008).
2. *The Standard Rules on the Equalization of Opportunities for Persons with Disabilities. Rule 19. Personnel training*. New York, United Nations, 1993 (http://www.un.org/esa/socdev/enable/dissre05.htm#Rule%2019, accessed 11 March 2008).
3. *Convention on the Rights of Persons with Disabilities. Article 4 – General obligations*. New York, United Nations (http://www.un.org/disabilities/default.asp?id=264, accessed 11 March 2008).
4. Best KL et al. Wheelchair skills training for community-based manual wheelchair users: a randomized controlled trial. *Archives of Physical Medicine and Rehabilitation*, 2005, 86:2316–2323.
5. *Certificate Course in Wheelchair Technology*. Moshi, Tanzania Training Centre for Orthopaedic Technologists, 2007 (http://www.tatcot.org/certificate%20WCH.htm, accessed 11 March 2008).
6. Sheldon S, Jacobs NA, eds. *Report of a Consensus Conference on Wheelchairs for Developing Countries, Bangalore, India, 6–11 November 2006*. Copenhagen, International Society for Prosthetics and Orthotics, 2007 (http://homepage.mac.com/eaglesmoon/WheelchairCC/WheelchairReport_Jan08.pdf, accessed 8 March 2008).

5 POLICY AND PLANNING

… to implement sustainable wheelchair provision.

The policy and planning guidelines:

- present key activities for the planning and implementation of wheelchair provision;
- suggest strategies for costing and financing wheelchair provision; and
- suggest links between wheelchair services and other sectors.

Box 5.1.

Wheelchairs changing lives …

Testimonial from a user in the Philippines

Michelle lives on the rural island of Masbate, a remote area of the Philippines. She is 20 years old, and was born without legs and with only one arm. Unable to propel a standard wheelchair, Michelle has lived without one for most of her life. For mobility she has had to "walk" with one arm and her torso.

In 2005, Michelle was referred by community workers to a mobile wheelchair service operated by an international nongovernmental organization. The service team saw that for a wheelchair to be useful to Michelle, it would need to be operable by one arm, be suitable for rough surfaces, and be easily portable on public transport for travel into town. A local wheelchair factory that operates in partnership with the wheelchair service team was able to create a wheelchair to these specifications.

Michelle is now able to propel herself in her wheelchair, and no longer has to move herself along at ground level. She uses the wheelchair to attend church, make social visits and play basketball. Most importantly, Michelle, who has a keen entrepreneurial spirit, aims to improve the economic well-being of her family. With improved mobility, her opportunities for this are greater.

testimonial

5.1 Introduction

Purpose and outputs

The purpose of the policy and planning guidelines is to develop and implement policies for cost-effective and sustainable wheelchair provision. Implementation of these guidelines will lead to:

- develop a national wheelchair policy;
- plan wheelchair provision programmes at national level in collaboration with all stakeholders, based on identified needs;
- integrate wheelchair services into existing health and rehabilitation services;
- develop national standards for wheelchair provision;
- calculate costs and establish sources of funding; and
- link wheelchair provision with existing sectors and institutions in society.

Stakeholders and resources

- Stakeholders involved in policy and planning include policy-makers, planners and implementers, manufacturers and suppliers of wheelchairs, providers of wheelchair services, disabled people's organizations and users.

5.2 Policy

5.2.1 Developing a policy

A national policy on wheelchair provision can ensure that users receive wheelchairs that meet minimum requirements for safety, strength and durability and that are appropriate for their individual needs. A national policy can also ensure that wheelchairs are provided by trained personnel who know how to properly assess users' needs and how to train users and caregivers on how to use and care for the wheelchairs.

When developing a national policy, it is recommended that the following areas are considered:

- issues addressed by relevant international policies (see Section 5.2.2);
- design, supply, service delivery, training and user involvement (see Section 5.2.3);
- funding (see Section 5.4); and
- links with other sectors (see Section 5.5).

To avoid a separate policy for wheelchair provision, wheelchairs can be included in a general policy for provision of assistive devices. However, specific issues related to wheelchair provision may need to be addressed in additional policy documents.

5.2.2 International policies

The two main international policy instruments related to wheelchair provision are:

- the Convention on the Rights of Persons with Disabilities; and
- the Standard Rules on the Equalization of Opportunities for Persons with Disabilities.

The Convention

The Convention on the Rights of Persons with Disabilities consists of 50 articles. Articles 4, 20, 26 and 32 are particularly applicable to wheelchair provision (see Box 5.2).

Box 5.2. Articles 4, 20, 26 and 32 of the Convention

Article 4. General obligations

1. States Parties undertake to ensure and promote the full realization of all human rights and fundamental freedoms for all persons with disabilities without discrimination of any kind on the basis of disability. To this end, States Parties undertake:

(a) To adopt all appropriate legislative, administrative and other measures for the implementation of the rights recognized in the present Convention;

(g) To undertake or promote research and development of, and to promote the availability and use of new technologies, including information and communications technologies, mobility aids, devices and assistive technologies, suitable for persons with disabilities, giving priority to technologies at an affordable cost;

(h) To provide accessible information to persons with disabilities about mobility aids, devices and assistive technologies, including new technologies, as well as other forms of assistance, support services and facilities;

(i) To promote the training of professionals and personnel working with persons with disabilities in the rights recognized in this Convention so as to better provide the assistance and services guaranteed by those rights.

Article 20. Personal mobility

States Parties shall take effective measures to ensure personal mobility with the greatest possible independence for persons with disabilities, including by:

(a) Facilitating the personal mobility of persons with disabilities in the manner and at the time of their choice, and at affordable cost;

(b) Facilitating access by persons with disabilities to quality mobility aids, devices, assistive technologies and forms of live assistance and intermediaries, including by making them available at affordable cost;

(c) Providing training in mobility skills to persons with disabilities and to specialist personnel working with persons with disabilities;

(d) Encouraging entities that produce mobility aids, devices and assistive technologies to take into account all aspects of mobility for persons with disabilities.

Article 26. Habilitation and rehabilitation

3. States Parties shall promote the availability, knowledge and use of assistive devices and technologies, designed for persons with disabilities, as they relate to habilitation and rehabilitation.

Article 32. International cooperation
1. States Parties recognize the importance of international cooperation and its promotion, in support of national efforts for the realization of the purpose and objectives of the present Convention, and will undertake appropriate and effective measures in this regard, between and among States and, as appropriate, in partnership with relevant international and regional organizations and civil society, in particular organizations of persons with disabilities. Such measures could include, inter alia:
(b) Facilitating and supporting capacity-building, including through the exchange and sharing of information, experiences, training programmes and best practices;
(d) Providing, as appropriate, technical and economic assistance, including by facilitating access to and sharing of accessible and assistive technologies, and through the transfer of technologies.

The Standard Rules

The Standard Rules on the Equalization of Opportunities for Persons with Disabilities consists of 22 rules. With regard to preconditions for equal participation, Rules 3 and 4 apply to wheelchair provision (see Box 5.3).

Box 5.3. Rules 3 and 4 of the Standard Rules

Rule 3. Rehabilitation	Rule 4. Support services
"States should ensure the provision of rehabilitation services to people with disabilities in order for them to reach and sustain their optimum level of independence and functioning."	"States should ensure the development and supply of support services, including assistive devices for people with disabilities, to assist them to increase their level of independence in their daily living and to exercise their rights."

With regard to implementation measures, Rules 14, 19 and 20 are applicable (see Box 5.4).

Box 5.4. Rules 14, 19 and 20 of the Standard Rules

Rule 14. Policy-making and planning	Rule 19. Staff training	Rule 20. Monitoring and evaluation
"States will ensure that disability aspects are included in all relevant policy-making and national planning."	"States are responsible for ensuring the adequate training of personnel, at all levels, involved in the planning and provision of programmes and services concerning people with disabilities."	"States are responsible for continuous monitoring and evaluation of the implementation of national programmes and services concerning the equalization of opportunities for people with disabilities."

Both the Convention and the Standard Rules clearly state that the government has the primary responsibility for wheelchair provision. It is therefore recommended that wheelchair provision be an integral part of national strategies.

5.2.3 Specific wheelchair provision issues

There are five areas to be considered when developing a policy for basic wheelchair provision.

1. Design

Each person has a unique set of individual or environmental needs that dictate the wheelchair design that is best for him or her. Because user needs are so diverse, no single wheelchair design will be appropriate for all users under all conditions. It is recommended that policies:

- require that several types of wheelchair be made available to service providers to ensure that each user receives a wheelchair that meets his or her needs; and
- specify minimum national requirements to ensure that wheelchairs will be safe, durable and locally maintainable (see Chapter 2).

2. Production and supply

Wheelchairs can be produced and acquired in a number of ways. They should be tested for strength, durability and suitability for the context in which they will be used. Decisions will need to be made on how wheelchairs will be produced and acquired (see Chapter 2). It is recommended that policies:

- approach the overall need for wheelchairs in relation to the funding available, the sustainability of supply over time, local economic development, and the impact on the local wheelchair provision infrastructure;
- encourage assessment of wheelchairs against minimum guidelines;
- encourage participation of users and service providers in the selection of wheelchairs; and
- take into account other national policies on related issues, such as support of local production and local employment.

3. Service delivery

Providers of wheelchair services play an important role in liaising between the users and the wheelchair manufacturers. They can ensure that individual users are provided with an appropriate wheelchair. They provide education and training about the user's needs, as well as ongoing support and referral to other services. It is recommended that policies:

- promote user empowerment and choice *(1)*;
- require that wheelchairs be provided through a proper wheelchair service delivery system;
- require that all wheelchair service providers follow recommended practices regarding of wheelchair availability, prescription, fitting, training of users and follow-up services (see Chapter 3); and
- require wheelchair service providers to demonstrate transparency, fair pricing, and monitoring and evaluation of their services.

4. Training

Training of all personnel involved in wheelchair provision (see Chapter 4) ensures that service delivery can be maintained at a nationally accepted level. It is recommended that policies:

- encourage that training be made available for all individuals directly associated with the development and implementation of wheelchair provision, including those involved in design, production, testing and service delivery.

5. Financing

Each of these four areas of basic wheelchair provision requires funding. Different funding strategies are described in Section 5.4. Typically, the costs of designing, producing and supplying a wheelchair, the delivery of wheelchair services and training of personnel are included in the price of the provided wheelchair, unless the costs are covered in other ways. It is recommended that policies:

- specify funding mechanisms;
- set eligibility criteria for funding;
- specify the categories and standards of wheelchairs and services that are funded under the scheme; and
- promote user empowerment and choice.

Other support mechanisms for consideration in a policy

Governments could also consider:

- waiving import duties on raw materials used to build wheelchairs;
- waiving import duties on wheelchairs if they are not available in the country;
- supporting local nongovernmental and disabled people's organizations that provide wheelchairs and related services through direct grants, or by facilitating relationships between local and international nongovernmental organizations, business communities and other stakeholders;
- supporting private wheelchair manufacturing businesses through competitive tender offers, loans and training grants;
- promoting the participation of users at every level of service planning and implementation;
- removing architectural barriers to increased mobility, independence and participation, thus stimulating interest in, use of and demand for better wheelchairs; and
- including wheelchair provision and allied issues (such as accessible environments and accessible transport) in other national policies.

Boxes 5.5 and 5.6 give examples of policies related to wheelchair provision in India and Afghanistan, respectively.

Box 5.5. Example of a policy in India related to wheelchair provision

In India, the Persons with Disabilities (Equal Opportunities, Protection of Rights and Full Participation) Act (2) was adopted in 1995 as a result of continual lobbying by disability activists and nongovernmental organizations. This lobbying involved extensive consultations with officials, protest marches and press conferences (3). Regarding wheelchairs, the Act states in Chapter VII: "The appropriate Governments shall by notification make schemes to provide aids and appliances to persons with disabilities."

On the basis of this Act, the Indian Government introduced the Assistance to Disabled Persons of India scheme, under which people with a monthly income of less than US$ 160 can get a wheelchair free of charge. If the monthly income is between US$ 161 and US$ 250 the user has to pay 50% of the cost, and if the income is above US$ 250, the user has to pay the full cost of the wheelchair.

Box 5.6. Example of a policy in Afghanistan related to wheelchair provision

In October 2003, the Ministry of Martyrs and Disabled in Afghanistan published a Comprehensive National Disability Policy. The policy was "developed in collaborative manner by all stakeholders including primarily disabled people organizations and self help groups; disability NGOs both national and international; major line ministries including Ministry of Education, Ministry of Public Health, Ministry of Labor and Social Affairs, Ministry of Women Affairs, and Ministry of Martyrs and Disabled (MMD); related UN agencies including UNOPS/CDAP, WHO, ILO, UNICEF, and UNHCR; National Constitution Commission; and President Office" (4). It is expected that the initial policy will lead to a more detailed and prioritized plan of action that needs to be developed in order to achieve the ultimate objectives of this policy. The policy goes on to state:

Provisions for people with physical disability for example, should include orthopedic rehabilitation centers; physiotherapy services; and orthopedic, assistive and mobility devices. These services should be close to a regional or provincial hospital with orthopedic surgical services so that the local population has easy access. They could be located ideally, in cities with medical teaching faculties such as in Kabul, Mazar, Herat, Kandahar and Jalalabad. Future services should provide for an expansion in orthotics as this is underserved.

All patients have the right to receive devices. Devices should be well-made, well-fitting, of local materials whenever possible and repairable locally. Appropriate technology should be standardized throughout the country. A mechanism for national standardization should be created with relevant experts in collaboration with MOPH [the Ministry of Public Health].

5.3 Planning

There are six key activities in planning and implementing wheelchair provision.

1. Identifying the need for wheelchairs and services

Identifying the need for wheelchairs is necessary to determine the numbers of services and personnel required and where to locate services. Such assessments also provide information on user satisfaction with wheelchairs that are in use and may have been distributed with or without service provision *(5)*. Statistics should include the number of users, prevalence of different health conditions, impairments and restrictions in participation, and the geographical location of these individuals. Collection of data can often be facilitated by collaborating with community-based rehabilitation programmes and disabled people's organizations. Where collection of data is not possible, the conservative estimate that 1% of the population will require wheelchairs can be used.

2. Planning wheelchair provision at national level

It is recommended that governments be actively engaged in the planning, establishment and continuing development of wheelchair services. Governments are advised to consider funding wheelchair services along with other rehabilitation services. Where government funding is already allocated to wheelchair provision, it is recommended that the services be assessed to determine whether they are being provided in accordance with the recommendations made in these guidelines.

3. Encouraging collaboration between governmental and nongovernmental service providers

Wherever possible, national and international nongovernmental organizations involved in wheelchair provision are encouraged to collaborate closely with relevant ministries and departments to assist in developing and implementing the national plan for wheelchair provision. A coordinated plan can help to make maximum use of resources and ensure that the appropriate services are accessible to those who need them.

4. Integrating wheelchair services into existing rehabilitation services

Wheelchair services will be enhanced by integrating them into other rehabilitation and health care services where possible. Integration helps to coordinate efforts among key stakeholders, make the best use of resources such as health centres and personnel, and facilitate strong referral and consulting networks. A good example is that of the Kilimanjaro Christian Medical Centre, where a multidisciplinary group of medical professionals have established a wheelchair committee to address issues related to production, service delivery, distribution and maintenance *(6)*.

Referral networks are critical to the sustainability of wheelchair services, and help to ensure that the services are accessible to those who need them. Consulting networks and access to health care professionals such as physicians, occupational therapists, physiotherapists, speech and language therapists and other specialists help to ensure that appropriate services and equipment are provided to users. This is particularly important for those with complex needs.

5. Adopting national standards of wheelchair provision

National authorities and providers of wheelchair services are urged to develop and adopt national standards. National standards need to address issues associated with the quality and testing of wheelchairs, personnel training and service delivery. These guidelines may serve as a starting point for developing standards. It is also recommended that monitoring and evaluation be carried out to ensure wheelchair services meet the established standards.

6. Empowering consumers

National governments and international development agencies can create and support an enabling environment. Users need to have the opportunity to choose the right product for themselves from among a variety of products. A good information package about these products, including possible sources of funding or subsidy, could be very useful for the user in making the right decision.

The best strategy for developing a national wheelchair provision programme will depend on the current state of wheelchair services in the country, the available resources and the needs the service has to meet. It is useful to consider the following questions when planning wheelchair provision.

- What are the characteristics and specific needs of the user population?
- Do stakeholder groups exist and, if so, what are their interests and opinions?
- Do wheelchair services already exist (through local workshops, community-based rehabilitation, disabled people's organizations, other nongovernmental organizations, the private sector or government)?
- Is there any wheelchair provision outside the formal infrastructure, for example provision of mass imported wheelchairs?
- What can be done with existing resources?
- What are the current funding mechanisms?

Box 5.7 sets out various possible strategies for developing a wheelchair provision programme in different situations.

Box 5.7. Possible strategies for developing a wheelchair provision programme

1. ***The government wants to establish a national wheelchair service programme.*** **The government may contact interested nongovernmental and disabled people's organizations, users, training programmes for health professionals, international organizations such as WHO and the International Society for Prosthetics and Orthotics and relevant international nongovernmental organizations to help in developing an appropriate plan for a national wheelchair service. The government may look at its own prosthetic and orthotic services and use these as a basis for developing a wheelchair service. It may also contact government bodies in other countries to learn from their experience and seek advice.**

2. ***Wheelchair provision exists but on a small scale through independent organizations; there is no collaboration.*** **The government, local organizations or an international nongovernmental organization could assess the possibility of scaling up the operation. A resource centre can be set up to involve people from the different organizations in a collaborative effort. The resource centre can then evolve into either a coalition of organizations interested in wheelchair services or an independent nongovernmental organization in its own right.**

3. ***There are organizations in the country but no wheelchair service delivery.*** **An interested nongovernmental or disabled people's organization can serve as the nucleus for a resource centre. The organization needs to identify an appropriate organization with wheelchair provision experience as a partner (e.g. a governmental or nongovernmental organization in a neighbouring country or an international nongovernmental organization) and should follow the other initial steps in scenario 4 below. Alternatively, this process may be started by an international nongovernmental organization, which then seeks out local nongovernmental and disabled people's organizations as partners. Efforts should be made to identify and network with other countries or organizations that have had similar experience in initiating wheelchair services.**

4. ***There are no organizations in the country and no regular wheelchair service delivery.*** **An international nongovernmental organization, either on its own initiative or at the invitation of or in partnership with the government, could establish a resource centre in the capital or other major city. The resource centre could be an integral part of an already existing rehabilitation institute. The resource centre should begin by providing important information to users, their families or caregivers and health professionals about mobility needs and wider issues pertaining to mobility. The international nongovernmental organization should develop a stakeholder analysis and survey people who use or require wheelchairs, in order to identify gaps and determine the need for wheelchairs and services. Preliminary participatory research will present options for meeting the needs. Funding should be secured to begin wheelchair provision. Efforts should be made to establish a working relationship between the resource centre and relevant governmental bodies as a first step in establishing a national wheelchair service.**

5.4 Funding strategies

An important part of setting up a wheelchair service comprises costing and establishing sources of funding in order to ensure the financial sustainability of the service.

5.4.1 Costing

The first step towards financial sustainability is the accurate calculation of the direct and indirect costs of wheelchair services. It is important that the cost of service delivery and the cost of the product are accounted for. Initial costs of setting up a wheelchair service should also be provided for but do not need to be included in the calculation of running costs. When estimating funds needed to establish and sustain wheelchair services, planners are advised to consider the total cost of wheelchair provision. The total cost is the sum of all direct and indirect costs.

Direct costs

Product

- Manufacturing cost or purchase price of wheelchair
- Shipping and transportation of wheelchair

Initial service

- Personnel costs (clinical, technical, training) for assessing, ordering, fitting and training
- Personnel costs for ordering and inventory of wheelchairs
- Materials and equipment for assembly and modifications
- Supplies (assessment forms, record-keeping, etc.)

Follow-up service

- Personnel costs
- Maintenance and repair

Indirect costs

- Management
- Administration
- Overheads
- Capacity building – training of service personnel

5.4.2 Sources of funding

Many individuals who need a wheelchair cannot afford to buy one. Nevertheless, everyone who needs a wheelchair is entitled to one, regardless of his or her ability to pay for it. Thus, funds will need to be made available to users needing financial assistance. Different funding mechanisms are described below.

Government funding

Government funding is usually the most reliable funding source where the government is committed to wheelchair services. Where wheelchair services are being established or provided by nongovernmental groups, it is recommended that there be continued consultation with the relevant government departments. Consultation should include long-term planning to determine when, how and to what extent the government is able to assume overall responsibility for the service in the future, including financial contributions.

Donor funding

In many contexts, the initiation of a wheelchair service may depend on funding from national and international donors. Owing to its usually short-term nature, donor funding should be complemented by advocacy for government and other more sustainable sources of funding.

Wheelchair funds managed by committee

A local "wheelchair fund" may be established to subsidize the cost of wheelchairs for individual users. Wheelchair funds exist to source funding and equitably manage donations secured for wheelchair provision. Users apply to the fund committee for a full or partial subsidy of the cost of a wheelchair. It is recommended that such funds apply a means test to determine how much financial assistance should be given. Government funding may also be channelled through a wheelchair fund. Committees should comprise a cross-section of individuals who have a vested interest in sustainable wheelchair provision, such as (though not limited to) users, representatives of disabled people's organizations, clinicians and technicians, government representatives and local dignitaries.

Contributions from users

Unless full government funding is provided for wheelchair purchase, it is recommended that any financing system incorporates an element of financial contribution from users themselves. Contribution programmes should be run in conjunction with individual means tests to ensure that users contribute no more and no less than they can realistically afford. Users' contributions also stimulate demand for products and services of appropriate quality.

A credit scheme is an option that allows users to borrow funds to purchase a wheelchair and to repay it over a period of time. Another option is an employment scheme, linking wheelchair provision with the opportunity for the user to obtain a job or funds to start a business and to pay for the wheelchair over time.

Fees on donated or imported wheelchairs

Even when a wheelchair is donated free of charge, there are costs associated with its responsible provision to the user, including follow-up with the user and maintenance of the wheelchair. Organizations that import wheelchairs on a large scale without ensuring the necessary services, as described in Chapter 3, could be required to pay a fee to support the services.

Income generation

Wheelchair services can be subsidized through income from the sale of other products such as canes, crutches, walkers, and toilet and shower chairs.

Voucher system

A voucher system may enable users to make their own purchasing decisions. The user is assessed and receives a prescription for a wheelchair with certain features. The user is given a voucher to the value of the cheapest wheelchair that fits the user's prescription and that also meets minimum standards for safety, strength and durability. Users who want a more expensive chair that meets the prescription have to find the additional funds themselves.

5.5 Links with other sectors

Wheelchair service stakeholders are encouraged to collaborate with other sectors and institutions. These linkages reduce the cost of establishing and operating a wheelchair service and allow the service to grow more rapidly. Professionals in these other sectors will learn about wheelchair services, while the services will benefit from the increased involvement of educated and trained professionals. Collaboration will also facilitate more enabling or barrier-free environments, and a higher level of inclusion and participation.

5.5.1 Health services and community outreach campaigns

Existing health services provide an infrastructure into which wheelchair services can be integrated at the lowest possible cost. Information services can be expanded to include wheelchairs, thus facilitating the identification and follow-up of users. The advantages include a common location for all services, the use of existing referral networks, and greater awareness among health and rehabilitation workers. Visits by health services to outlying areas (for HIV/AIDS awareness, community-based rehabilitation programmes and vaccination campaigns, for example), as well as literacy, voter registration/political participation campaigns and any other outreach programmes, also provide an opportunity to provide wheelchair services.

5.5.2 Education

Linking wheelchair provision with the education sector can facilitate the development of training materials and implementation of training programmes. In some instances, core subjects may already exist within the academic institution. In these situations it may be possible to integrate training for wheelchair provision into existing courses. Similarly, manufacturing and testing laboratories may exist, which can help facilitate the design, production and testing of wheelchairs. University students in a variety of technical and health disciplines can be recruited for careers in wheelchair provision. Service providers can engage students for field placements to obtain experience. Finally, academic institutions will be familiar with methods of accreditation, which may help in establishing nationally recognized, accredited training for wheelchair provision.

Wheelchair services can also work with the education sector to ensure education is accessible to people with disabilities, as stated in Article 9a of the United Nations Convention on the Rights of Persons with Disabilities. With a wheelchair and a barrier-free environment, a person with disability can access education in school or college. Schools and colleges need to have, as a minimum, easy access to classrooms, wide doorways and accessible toilets.

5.5.3 Livelihood

It is likely that new wheelchair users will need help in finding a job or acquiring the necessary skills to find a job or return to work. Article 27 of the United Nations Convention states:

Parties recognize the right of persons with disabilities to work, on an equal basis with others; this includes the right to the opportunity to gain a living by work freely chosen or accepted in a labour market and work environment that is open, inclusive and accessible to persons with disabilities.

Policies that encourage employment training, job referral programmes and mainstream education for people with disabilities can help to increase the employment opportunities for users. There are benefits for both users and society when users are able to secure their own livelihood. Through employment, users and their families can better secure the necessities of life and improve their economic and social situation (see Fig. 5.1.).

Fig. 5.1. Living with dignity

The Standard Rules on the Equalization of Opportunities for Persons with Disabilities notes that users have obligations as well as rights. With mobility, and a greater opportunity for work, users are in a better position to fulfil their obligations to society.

5.5.4 Social

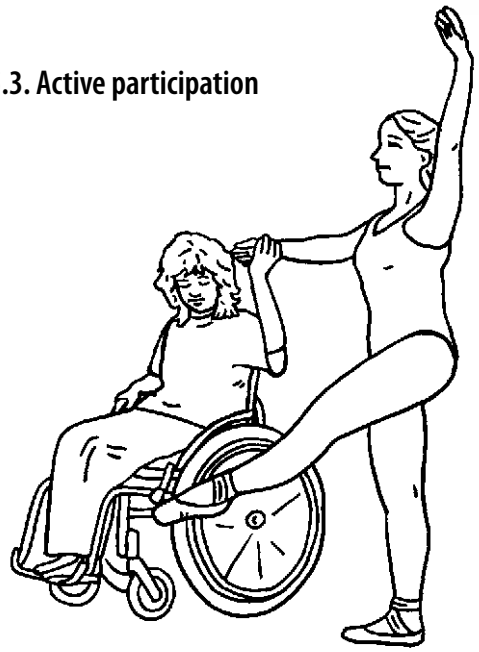
With a wheelchair and a barrier-free environment, a person with disability can easily participate with dignity in social and community life. Active participation in the social, spiritual and cultural life of a community has a strong impact on the quality of users' lives and their self-perception and self-esteem. Both participation in and appreciation of the arts, sports and recreational activities, can greatly contribute to a positive self-image and well-being (see Fig. 5.2.).

Fig. 5.2. Good quality of life

Barriers to participation of users include negative attitudes held by the public, the users' families and sometimes the users themselves. An effective way of overcoming attitudinal barriers is for users to become more visible, demonstrating to family, friends and the broader public that they can participate in social activities (see Fig. 5.3.). Through direct experience, users and those around them learn the full extent of a user's abilities. Users have the same rights and opportunities as others to have a family. In fact, a wheelchair makes family life easier and less stressful for a person with disability and his or her family.

Governments are encouraged to assist users in accessing wheelchairs and services that allow them to function as independently as possible. Users and their families also need to receive the social benefits to which they are entitled.

Fig. 5.3. Active participation



5.5.5 Infrastructure

Barrier-free environments create opportunities for users to exercise their rights, opportunities and freedoms, to become productive members of the family and to fulfil their duties to their family and community. The success and optimization of wheelchair provision in any country largely depend on the environment: a barrier-free environment will benefit not only wheelchair users but also others, especially older people. Basic aspects of the infrastructure that need to be accessible include:

- buildings, i.e. housing and public buildings providing, for example, health services, education, employment, banking, government services and other public services;
- public transport, such as buses, trains and ferries;
- roads, streets and footpaths;
- food, water and sanitation facilities such as open-air restaurants and markets, water taps, tube wells and toilets; and
- facilities for culture and recreation, for example stadiums, cinemas, theatres, parks, public halls and community centres.

It is recommended that experts on wheelchair accessibility, for example users with adequate knowledge, be represented on local, regional and national committees that determine planning and construction. Universal design, including wheelchair access, could be included as a requirement in university programmes for civil engineering, architecture, urban planning and design.

Box 5.8. Access for all in Sri Lanka

In Sri Lanka, a consortium of disability organizations was formed to support a campaign to promote the inclusion and participation of all people with disabilities in tsunami relief, reconstruction and development work. The Access for all campaign asks for the inclusion of people with disabilities when rebuilding the nation. This means rebuilding an accessible nation: making all public buildings, transport, places of employment, services and infrastructure accessible to all. It also means including people with disabilities in plans for the nation.

5.6 Inclusion and participation

The ultimate aim of wheelchair provision is to facilitate inclusion and participation. Mobility is often a precondition for participation in society. Hence, provision of wheelchairs that enhance personal mobility is an essential element of interventions to ensure that all citizens of a country get equal opportunities to enjoy all human rights and fundamental freedoms.

Inclusion and participation of people using wheelchairs will require:

- barrier-free environments and disabled-friendly products and services;
- general services and systems such as housing, health care, transportation, schools and income-generating activities are made accessible; and
- specific services and systems such as medical treatment, rehabilitation, wheelchairs and other assistive devices and support services are made accessible and affordable *(7)*.

It is important that all stakeholders in wheelchair provision are aware of and understand the ultimate aim of providing wheelchairs, and translate this understanding into appropriate action to ensure sustainable inclusion and participation. When the wheelchair needs of people in less-resourced settings begin to be met, this will benefit not only the individuals and their families but also their countries.

Summary

- Countries have the primary responsibility for wheelchair provision, as stated in United Nations policy instruments.
- Areas to consider when developing a policy for wheelchair provision include design, production and supply, service delivery, training and financing.
- Key activities in planning and implementation wheelchair provision are:
  - identification of needs
  - planning at national level
  - collaboration among stakeholders
  - integration of wheelchair services in existing health care or rehabilitation services
  - adoption of national standards
  - empowerment of users.
- Linking wheelchair provision to other sectors of the society can be effective.
- Infrastructure and transport systems need to be accessible to all.
- The ultimate aim of wheelchair provision is to facilitate inclusion and participation.

References

1. Scherer MJ. The change in emphasis from people to person: introduction to the special issue on assistive technology. *Disability & Rehabilitation*, 2002, 24:1–4.
2. *The Persons with Disabilities (Equal Opportunities, Protection of Rights & Full Participation)* Act, 1995. New Delhi, Ministry of Social Justice and Empowerment, 1995 (http://socialjustice.nic.in/disabled/welcome.htm, accessed 11 March 2008).
3. Wong-Hernandez I. Moving legislation into action: the examples of India & South Africa. *Disability World*, 2001, No. 6 (http://www.disabilityworld.org/01-02_01/gov/legislation.htm, accessed 11 March 2008).
4. *The Comprehensive National Disability Policy in Afghanistan*. Kabul, Ministry of Martyrs and Disabled, 2003 (http://www.disability.gov.af/npad/publications.htm, accessed 11 March 2008).
5. Oderud T et al. User satisfaction survey: an assessment study on wheelchairs in Tanzania. In: *Report of a Consensus Conference on Wheelchairs for Developing Countries, Bangalore, India, 6–11 November 2006*. Copenhagen, International Society for Prosthetics and Orthotics, 2007.
6. Munish A. Follow-up, service and maintenance (including repairs and maintenance), sustainability of service, service delivery system. In: *Report of a Consensus Conference on Wheelchairs for Developing Countries, Bangalore, India, 6–11 November 2006*. Copenhagen, International Society for Prosthetics and Orthotics, 2007.
7. Wiman R. et al. *Meeting the needs of people with disabilities: new approaches in the health sector*. Washington, DC, World Bank, 2002.

ANNEX A

Training resources

Organizations

Mobility India
Address: 1 & 1 "A" Cross, 2 Phase, JP Nagar, Bangalore – 560 078, India
Phone: +91-80-2649 2222 / 26597337 / 26491386
Fax: +91-80-26494444
E-mail: e-mail@mobility-india.org
Web site: www.mobility-india.org

Motivation Charitable Trust
Address: Brockley Academy, Brockley Lane, Backwell, Bristol BS48 4AQ, United Kingdom
Phone: +44-1275-464019
E-mail: info@motivation.org.uk
Web site: www.motivation.org.uk

Prosthetics and Orthotics School
Address: University Don Bosco, P.O. Box 1611, San Salvador, El Salvador
Phone: +503-291-9593 / 292-4440
Fax: +503-291-9593, ext. 3050
E-mail: isrigtz@es.com.sv
Web site: www.ortotec.com

Tanzanian Training Centre for Orthopaedic Technologists (TATCOT)
Address: PO Box 8690, Moshi, United Republic of Tanzania
Phone: +255-27-2753986/7
E-mail: tatcot@kilinet.co.tz

Western Cape Rehabilitation Centre
Address: Private Bag X19, Mitchell's Plain, 7789, South Africa
Phone: +27-21-370 2300
Fax: +27-21-370 2400
E-mail: info@wcrc.co.za
Web site: www.wcrc.co.za

Whirlwind Wheelchair International
Address: San Francisco State University, 1600 Holloway Avenue, SCI 251, San Francisco, CA 94132-4163, USA
Phone: +1-415-338-6277
Fax: +1-415-338-1290
E-mail: info@whirlwindwheelchair.org
Web site: www.whirlwindwheelchair.org

Other resources

Cooper RA. *Wheelchair selection and configuration*. New York, NY, Demos Medical Publishing, 1998 (ISBN 1-888799-18-8).

Engstrom B. *Ergonomic seating – a true challenge*. Stellarholmen, Posturalis Books, 2002 (ISBN 0-919723793-0-1).

Pope PM. Severe and complex neurological disability: management of the physical condition. Butterworth-Heinemann, 2006 (ISBN 978-0-7506-8825-3).

Pountney TE et al., eds. *The Chailey approach to postural management*, 2nd ed. Lewes, Chailey Heritage Clinical Services, 2004 (ISBN 0954825802).

Wheelchair Skills Program (WSP). Halifax, Nova Scotia, Dalhousie University Faculty of Medicine (http://www.wheelchairskillsprogram.ca, accessed 15 December 2007).

Zollars JA. *Special seating*. Santa Cruz, CA, PAX Press, 1993 (ISBN 1-882632-01-X).

Rushman C, Shangali H. *Wheelchair service guide for low income countries*. Bristol, Motivation/TATCOT, 2006.

Health and mobility guide for wheelchair users. Bristol, Motivation, 2007.

Fit for life (Wheelchair Assessment, Prescription and Assembly), Bristol, Motivation, 2007.

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