

motivation

quality of life

Appropriate Technologies for Assistive Devices

Motivation – October 2005

Key Points: Appropriate technology; Low-income countries; Assessment and prescription; Wheelchair provision approaches.



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1 Wheelchair provision in low-income countries

It is commonly accepted that there are in excess of 20 million people in desperate need of a wheelchair. Millions more need other mobility aids. The adverse effects of this basic lack of mobility are exaggerated by the fact that the majority of people with mobility disabilities in low-income countries are from the poorest sections of the community. Poor people with disabilities are caught in a vicious cycle of poverty and disability, each being both a cause and a consequence of the other.

Disabled people in low-income are disenfranchised, marginalized and generally devoid of access to their most basic human rights. It is important to recognise that an appropriate wheelchair is merely a tool that enables people with mobility impairments greater opportunity to access their rights to an integrated lifestyle within their own communities, leading to greater independence and an improved quality of life.

1.1 Current wheelchair provision

Why the Independent living model should replace the Charity model:

An inherent problem is that most donors operate under a charity model rather than an independent living model. Wheelchair users in low-income countries often cannot afford to pay for their own wheelchairs, so government agencies, development organisations, and charitable and religious institutions act as consumers instead. The usual market forces of consumer-based supply and demand are absent with the result that end users are disenfranchised from the design, production and selection processes and become passive recipients of charity rather than empowered consumers. When donors focus their attention on the product instead of the end users, the distribution of wheelchairs takes precedence over the socio-economic integration of people with disabilities into their communities.

Why the Social model should replace the Medical model:

The Medical model defines mobility disability solely as a matter of impairment to be solved with wheelchairs. It is a common perspective of donors; however, it is problematic because disability is a problem of socio-economic immobility as much as physical immobility. The issue is not simply that millions of people are physically immobilized, but that this often prevents them from receiving an education, marrying, having families, working to support themselves or their families, or otherwise participating in their communities. The Social model advocates that disability must be seen as an ongoing part of life within local social, cultural, economic, and political contexts—and not as a medical emergency to be solved if

we can only charitably give away enough wheelchairs to those in need. The technology is only part of the solution.

Why appropriate service models should replace the industrialised health service model: Wheelchair provision in low-income countries is currently based on industrialised countries service models which are inappropriate and ineffective. Health professionals and commercial wheelchair manufacturers, infrastructure are lacking and the largely rural population in low-income countries are not served effectively by an institutional type health service. As a result many wheelchair users do not have access to official health systems (See Table 1).

Table 1: Comparison of industrialised and low-income countries service models

| Service models | Industrialised country | Low-income country |
|-----------------------|---|---|
| Beneficiary | é Wheelchair User ↑ | é Wheelchair User ↑ |
| Service | € Occupational Therapist € Physiotherapist € Rehabilitation Engineer € Clinical Assistant ↑ | Few integrated services or professionally trained staff ↑ |
| Product | F Commercial Wheelchair manufacturer | Local workshop or donated wheelchairs |

1.2 Evaluation of wheelchair provision approaches

In order to provide a comprehensive and responsible service and long lasting appropriate wheelchairs, the approach to provision must meet these four criteria:

1. **Adjustability:** The wheelchair must either be made to the measurements of the user or should be easily adjusted to fit the user. It must always come with a pressure relief cushion.
2. **Suitability:** The wheelchair must be able to navigate the terrain that the wheelchair user must push through. There must be a range of wheelchair to ensure user choice to meet individual needs and ensure quality of life and independence.
3. **Durability:** The wheelchair must be well made, long lasting and easily repaired. Replacement parts should be easily available.
4. **Sustainability:** The wheelchair should be supplied in a way that provides wheelchairs to the community in the long term.

Four types of wheelchair provision are outlined below. The strengths and weaknesses of each approach are assessed with consideration to the issues involved in providing wheelchairs for low-income countries.

A - Donation of recycled wheelchairs from industrialised countries

A substantial number of organisations, particularly in higher income countries, have responded to the critical need for wheelchair distribution in low-income countries by refurbishing orthopaedic hospital style wheelchairs and delivering them overseas.

Table 2: Donation of recycled wheelchairs approach evaluation

| Strengths | |
|-----------------------|--|
| Recycled | Discarded wheelchairs the “anything is better than nothing” approach. |
| Low cost | Recycled and refurbished fairly cheaply (through volunteer programmes). |
| Fast | Large numbers can be delivered quickly. |
| Weaknesses | |
| Adjustability | Rarely adjustable to fit the individual. Often incorrect size for children. High risk of secondary complications due to poor fit. |
| Suitability | Wheelchairs designs from industrialised countries for use in hospital or indoor settings not uneven or unpaved roads and sandy terrain predominant in low-income countries. There is no choice in wheelchair design for individual needs. |
| Durability | Wheelchairs unsuitable for environmental conditions break easily. Repairs are extremely expensive because replacement parts are usually not available locally. |
| Sustainability | Working with a ‘charity’ model approach. A large influx of free donated wheelchairs can put local wheelchair producers out of business, eliminating the long-term source of wheelchairs for that community. There is no follow-up or support for wheelchair users after the distribution. Health authorities do not take responsibility or make provisions for wheelchair services. The “ceremonies” that hand wheelchairs out free to the users is demeaning and patronising. |

B - Mass production and export of free wheelchairs to low-income countries

There are advantages of utilizing mass production and export of free wheelchairs if the design and distribution have been carefully considered. However, in the past it has been unsuccessful due to poor wheelchair designs and little consideration to the distribution system and the needs of users.

Table 3: Mass production and export of free wheelchairs approach evaluation

| Strengths | |
|-----------------------|--|
| Appropriate | Designs have the potential to be appropriate (but they rarely are). |
| Low cost | Mass production helps to lower the price of the wheelchairs. |
| Large numbers | Large numbers can be delivered quickly. |
| Weaknesses | |
| Adjustability | Wheelchairs are often not-prescribed. Ex-patriot staff are not based in country and therefore are not available for review or follow-up (if wheelchairs are prescribed). |
| Suitability | If designs are not appropriate then they will often not be suitable. |
| Durability | Repairs are difficult because replacement parts are usually not available locally and can be very expensive. |
| Sustainability | Working with a 'charity' model approach. Mass distribution of chairs is damaging to local producers, this may eliminate the long-term source of wheelchairs for that community. The "ceremonies" that hand wheelchairs out free to the users is demeaning and patronising. There is no follow-up or support for wheelchair users after the distribution. Health authorities do not take responsibility or make provisions for wheelchair services. The considerable transportation costs could have been spent on strengthening local production. |

C - Local workshops

Local workshops in low-income countries have been providing a service to wheelchair users for many years. They are often established by disabled people's organisations (DPOs) who have been frustrated by the lack of appropriate wheelchairs in their own communities.

Table 4: Local workshops approach evaluation

| Strengths | |
|-----------------------|--|
| Adjustability | Individually fitted wheelchairs. Can be custom built. Can make individual adaptations particularly important for children. Follow-up service available. |
| Suitability | Assess the needs of the individual to prescribe the most appropriate design. Training in wheelchair use to maximize the mobility of the user. |
| Durability | Local staff can provide designs and adaptations that are appropriate to the local environment and the user's needs. Repairs can be made because designs are made from local materials. |
| Sustainability | Workshops can become more efficient and cost-effective by design and technology input. The workshops are a source of employment and support the economy through the purchase of local materials and resources. Local workshops can potentially integrate their services to join or establish the national rehabilitation system. |
| Weaknesses | |
| High cost | Small workshops may not be able to take advantage of economies of scale; keeping costs down and quality high can be difficult. |
| Suitability | Local producers often copy designs of imported wheelchairs due to limited training and information on appropriate designs. |
| Sustainability | Lack institutional stability due to small scale of operations. Vulnerable to competition from free or very low-cost wheelchair providers. Funding scarcity due to inability of receipts to significantly contribute towards the costs, and lack of governmental or donor support. Production levels are very low without regular sales, or a wheelchair financing system. |

D - Mass production/distribution of low-cost wheelchairs working with local organisations in low-income countries

There is an important difference between mass producing wheelchairs for donation as opposed to mass producing wheelchairs for effective distribution through local partner mobility provision services. Effective provision systems can be established in collaboration and consultation with local wheelchair producers, Disabled Peoples Organisations (DPOs) and local rehabilitations centres. This involves training in assessment, seating and mobility skills, provision of a range of wheelchairs with pressure relief cushions and access to financing schemes for the wheelchairs to ensure that those most in need have access to a wheelchair.

Table 5: Mass production of low-cost wheelchairs with local organisations approach evaluation

| Strengths | |
|-----------------------|---|
| Adjustability | Provision of a range of appropriate wheelchairs, individually prescribed and fitted by trained local staff that are available for follow-up and repairs. |
| Suitability | The prescription process includes an assessment of the needs of the user to prescribe an appropriate wheelchair. Training in wheelchair skills is an integral part of the service and can be provided by wheelchair users of the local DPO or workshop. |
| Durability | Designs appropriate for the environment are provided. Repairs can be made because designs ensure that materials are available locally and at low-cost. |
| Sustainability | Importing appropriate low-cost wheelchairs can reduce service costs, by removing the pressure wheelchair fabrication. Local services can ensure effective distribution of suitable wheelchairs to match demand and identify those most in need. Local services can maintain wheelchair provision by strengthening and integrating the rehabilitation services and DPOs. There is the potential to create an integrated national rehabilitation system. |
| Weaknesses | |
| Sustainability | Transport costs and logistics must be funded and organised. Funding for activities and capacity building local partners. Close links with local DPOs and local workshops are essential to ensure provision is effective. |

Whichever approach is adopted, a comprehensive finance system to help fund wheelchairs for those who cannot afford them is critical to ensure access to them for the poorest members of society. It has been proven that giving wheelchairs away free of charge can cause an attitude of 'easy come, easy go' and the wheelchair is often not looked after or maintained. Paying for at least a part of the equipment creates a sense of ownership and value for the wheelchair.

2 Wheelchair assessment and prescription

In the context of most developing countries there is a lack of wheelchair services offering wheelchair users with an individual assessment, wheelchair prescription and basic instruction in how to use and maintain their wheelchair. This lack has a number of negative consequences for wheelchair users:

- Many wheelchair users receive a wheelchair which does not fit them, and is not appropriately adjusted. For people who use a wheelchair more than a few hours a day, a badly fitting wheelchair can lead to a range of physical problems including postural deformities, shoulder pain and pressure sores.
- Many wheelchair users receive no information or education about how to use their wheelchair or how to maintain it. Without this information, the benefits of the wheelchair are greatly reduced. In this context, many wheelchair users, who would otherwise be very able, are not aware that, with the right techniques, they have the potential to propel themselves, to transfer independently.
- Wheelchair users tend to be ill-informed about wheelchairs as a product, having little awareness of the range of wheelchairs and component options which are available in developed countries. In many cases this can make wheelchair users hugely grateful for what is, in reality, an in-appropriate wheelchair for their lifestyle, disability or physical context. The lack of information reduces the potential of wheelchair users as a group to actively lobby for better, more suitable products.

Creating opportunities for wheelchair users in developing countries to access wheelchair services is a challenging task. In many countries there are limited rehabilitation services, a severe shortage (and in some cases absence) of physical and occupational therapists, a lack of Government commitment and / or capacity to run wheelchair services, and a shortage of finances to sustain such services. On the more positive side however, there is a growing recognition from development agencies, International non governmental organisations (INGOs), and National non governmental organisations (NGOs) and disabled people's organisations (DPOs) that the provision of wheelchairs cannot be carried out without addressing the individual needs of wheelchair users; and that this requires the development of wheelchair services which offer, as a minimum, wheelchair assessment, prescription and basic instruction of wheelchair users.

2.1 Wheelchair design considerations for users

The majority of low-income countries have a severe shortage of trained rehabilitation staff and there are often no professional therapists. Due to the absence of professionals, this prescription Table 6 has been specifically designed for use by non-professional staff who may not be able to identify a specific disability but can recognise characteristics of a disability that will enable effective assessment and prescription.

Table 6: Prescription chart for wheelchair user characteristics

| User characteristic | Wheelchair part | Why |
|---|---------------------------|---|
| § Not good sitting balance. | § High backrest | § Provides support and good sitting posture. |
| § Average sitting balance. | § Middle backrest | § Provides some support but also allows for mobility. |
| § Good sitting balance. | § Low backrest | § Provides less support but allows for much more mobility. |
| § Needs a lot of support in their back in sitting. | § Solid backrest | § Long lasting; solid surface encourages good sitting posture. |
| § Needs support but a lightweight wheelchair to assist with mobility. | § Fabric backrest | § Increasing tension can give back support. |
| § Need accommodating backrest. | | |
| § Decreased sensation and is at risk of getting pressure sores. | § Pressure relief cushion | § Provides pressure relief. |
| § Problems with bladder and/or bowels. | § Waterproof cover | § Can wash and dry cover easily. § Can wipe down or wash cushion. |
| § Very active user with good sitting balance. | § Active wheel position | § Wheelchair less stable therefore, easier to balance on back wheels, which allows for greater mobility and makes it easier moving over obstacles and up and down steps |
| § Active user who needs equal amounts of stability and mobility. | § Middle wheel position | § Allows wheelchair to be equally stable and mobile |
| § User gets sudden uncontrolled movements | § Safe wheel position | § Makes the wheelchair very stable and less able to tip back. |
| § Bilateral amputee with less sitting balance. | | |
| § First time in wheelchair and not confident in | | |

| | | |
|--|--|--|
| <p>wheelchair mobility yet. § User lives in a very hilly area.</p> | | |
| <p>§ User needs to use wheelchair on sandy, muddy ground. § User needs to use wheelchair on flat, concrete ground.</p> | <p>§ Wide castor wheel § Thin castor wheel</p> | <p>§ Wider surface of wheel means wheels do not sink into the ground. § Narrow surface of wheel good for speed on hard surfaces.</p> |
| <p>§ User needs to use chair on rough ground.</p> | <p>§ Large diameter castor wheel</p> | <p>§ Large castor wheel can roll over small obstacles such as stones very easily.</p> |
| <p>§ For standing transfers.</p> | <p>§ Flip up footrests</p> | <p>§ Allows user to stand up.</p> |
| <p>§ Different leg lengths.</p> | <p>§ Separate footrests</p> | <p>§ Allows for correct footrest height if the legs are different lengths.</p> |
| <p>§ User does not need to stand up.</p> | <p>§ Rigid footrests</p> | <p>§ Footrest does not need to move means that it is stronger.</p> |
| <p>§ Feet fall off footrest backwards. § Feet fall off footrest forwards.</p> | <p>§ Calf strap/ankle strap § Foot strap</p> | <p>§ Protects feet from getting knocked and wounded.</p> |
| <p>§ Active user transfers using sideways transfer. § Less active user transfers using sliding transfer.</p> | <p>§ Fixed curved armrest § Short lever brakes § Removable armrest § Short lever brakes</p> | <p>§ Follows line of chair. § Do not interfere with transfers. § Can remove armrest from wheelchair. § Do not interfere with transfers.</p> |
| <p>§ For small spaces § For working under desk/table.</p> | <p>§ 24" wheels</p> | <p>§ Smaller turning circle. § Wheelchair lower to the floor.</p> |
| <p>§ Lives in area where 24" wheels not available.</p> | <p>§ 26"</p> | <p>§ Wheels cheap and easily available</p> |
| <p>§ Need to transport wheelchair often.</p> | <p>§ Quick release wheels</p> | <p>§ Wheels easily removable.</p> |
| <p>§ For sport.</p> | <p>§ Camber</p> | <p>§ Wider base provides more stability required for active sports.</p> |
| <p>§ Assistant needs to push wheelchair. § Assistant needs to push wheelchair but high push handles get in the way of the user self propelling.</p> | <p>§ High push handles § Adjustable push handles</p> | <p>§ Protects assistant from getting back problems. § Low height allows mobility for the user, high push handles allows assistant to push.</p> |
| <p>§ User has difficulty with hand and arm function.</p> | <p>§ Long lever brakes</p> | <p>§ Longer lever is easier to put on and off.</p> |

| | | |
|---|---------------------|---|
| § User only able to use one arm, for example, stroke. | § One sided brakes | § Both brakes activated from one side only. |
| § User is weak and condition is likely to get worse. | § Resting arm rests | § Additional support for the user with padding for comfort. |


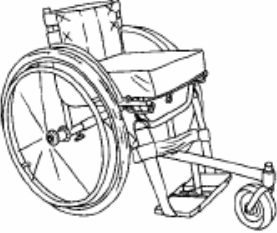

2.2 Psychological issues for wheelchair users and wheelchair design


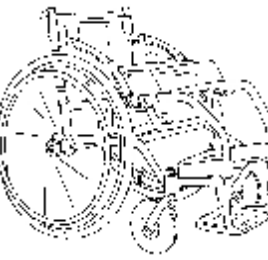

Disability in low-income countries is often seen in a negative way, and in some traditional belief systems, may be seen as a result of a curse. Many people regard wheelchair users as a burden because they believe that being in a wheelchair means that someone cannot be independent and contribute to society. Since the appearance and performance of the wheelchair can have a positive or negative effect on the psychological well-being of the user and the reaction of other people, it is very important to consider these factors in the design of appropriate products. A wheelchair that is big and bulky affects the appearance of the user, causing them to 'disappear' into the wheelchair. If the wheelchair is difficult to use, uncomfortable or broken, it will not encourage the user to be independent or to feel good about themselves. A wheelchair that is well made, that fits the user correctly and meets the needs of the disability and the environment it is used in, will enhance the appearance and independence of the user, increasing their confidence and self-esteem. This will also generate a more positive reaction in other people towards the user, further increasing their confidence and self-esteem.

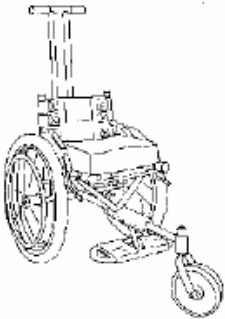



3 Appropriate wheelchair design for low-income countries

There are many types of wheelchair that are suitable to meet the physical and lifestyle needs of individual users in low-income countries. Table 7 outlines the main wheelchair types, identifies who they should be prescribed for and evaluates their advantages and disadvantages.

Table 7 Appropriate wheelchair design and prescription

| | Type of wheelchair | When should this wheelchair be prescribed? | Advantages | Disadvantages |
|---|--|--|--|---|
|  | Orthopaedic | If the user needs a wheelchair for transportation purposes. For hospital use. | For short-term users within a hospital or rehabilitation set-up. | No postural adjustment. No rear wheel adjustment. Unsuitable for rough terrain. Heavy. |
|  | Three-wheel wheelchair: Two large wheels and a single front castor wheel. Often the front castor wheel is quite large. Usually the footplates do not move out of the way. | Good for rural life; For sand, mud and rough ground; For hilly areas; Good for going over small obstacles and going down small steps. | Very stable and provides a smooth ride over rough ground. Good control over rough ground (all three wheels stay in contact with the ground). Easy to navigate over or around obstacles. Excellent stability when going down slopes (due to extended castor wheel). Negotiate steps without back-wheel balancing due to the frame length. | The frame is usually quite long: Problem in small spaces and more difficult to transport. Larger turning circle than a compact four-wheel chair. Sometimes look unusual, in places where people are not used to seeing them. The central beam is located between the wheelchair user's legs which is not always popular. Standing transfers are difficult due to the position of the central beam. For most wheelchair users this is difficult. |
|  | Four-wheel wheelchair: Two large rear wheels, and two front castor wheels. | Non-folding; If a strong frame is needed; For indoor use; For urban areas; Durability needed.. | More compact than the three-wheel wheelchair due to shorter wheel base. Some models have a smaller turning circle than a three-wheel wheelchair. | Four-wheel wheelchairs are not as stable as a three-wheel wheelchair, or as easy to push over rough or bumpy ground. |

| | | | | |
|---|--|--|--|--|
|  | <p>Four-wheel folding: 'Cross-folding': Slung seat and back to allow the wheelchair to fold. Flip-up footplates. Originally designed for short-term use in a hospital environment.</p> | <p>If the user needs to fold the wheelchair for storage; Short-term use; For urban areas; For folding up on transport; If flip up foot rests are needed; For indoor use.</p> | <p>Easy to store and to transport. Flip up footrests make it easier to make a 'standing transfer'.</p> | <p>Not are durable as fixed fame chairs as moving parts wear with time and use. Slung seats can 'stretch' and will sag and it is very difficult to re-tighten the fabric. Once this happens the seat is no longer provides good postural support and pressure relief cushions will not work correctly. Folding mechanism can be more complicated to produce. Folding mechanism adds weight. Worn Folding mechanism can result in wheelchair instability.</p> |
|  | <p>Fixed-frame wheelchair: They do not fold at all and can be three-wheel or four-wheel wheelchairs. Many do have a fold down backrest and 'quick release' wheels.</p> | <p>Active users who need a sturdy and robust wheelchair. Good over rough ground. For someone who does not travel around much.</p> | <p>The frame is stronger than a cross folding frame. Provides reliable postural support and cushion pressure relief for the wheelchair user. Can be quite light, due to absence of a folding mechanism. Perform better than a folding frame for sports activities.</p> | <p>It can be bulky and difficult to transport if the wheelchair does not have a fold down backrest and quick release wheels.</p> |
|  | <p>Low rider</p> | <p>Good for users who need to work on the ground, for example, cooking. Domestic environment.</p> | <p>Countries where daily activities are carried out on the floor, cooking, washing, food preparation etc.</p> | <p>Restricts the user to low-level, making it difficult to negotiate market situations and crowds. Not good for travelling long distances.</p> |

| | | | | |
|---|--|--|---|--|
|  | <p>Childs wheelchair (Three-wheels. NB. four-wheel wheelchair also available).</p> | <p>Small size to fit children properly; Easy to push; For rural life; Good on sand, mud and rough ground; Good for hilly areas; Good for going over small obstacles and small steps.</p> | <p>More suitable than an adult wheelchair for an active child. Child can self-propel (can be more independent).</p> | <p>Child will grow out of it.</p> |
|  | <p>Special seat</p> | <p>Gives good support and posture to children who cannot sit by themselves.</p> | <p>Very good support children with Cerebral palsy. Suitable for high levels of Cerebral palsy needs.</p> | <p>Sometimes more expensive than standard wheelchairs. Requires a high level of seating knowledge to give a good fit. Not suitable for all disabilities.</p> |
|  | <p>Tricycle</p> | <p>Only for outdoors; Excellent for travelling long distances.</p> | <p>Efficient to travel. Can travel on the road with traffic. Long-term use it is better for shoulders. Can be used as a method of income, such as a market stall.</p> | <p>Can't get in house. Large. Can get them on public transport easily.</p> |
|  | <p>Sports wheelchair</p> | <p>Lightweight and stable. Easy to move for sports. Camber makes wheelchair very stable.</p> | <p>More suitable for sport than everyday wheelchair. Allows users to take part in team/individual activities. Enhancing integration and fitness.</p> | <p>Not suitable for daily use. Few users can afford a second chair.</p> |

3.1. Specific wheelchair features important for low-income countries

There are specific features of a wheelchair which make some wheelchairs more suitable for low-income countries than others. These key features include rear wheels, tyres, front castors and pressure relief cushions.

Types of wheels

24" Wheels: 'Standard' wheelchairs (from more industrialised countries) are usually made with 24" wheels.

Advantages:

- Wheelchairs that have a 24" wheel are slightly smaller, and therefore can be slightly lighter and more manoeuvrable.
- These wheelchairs will fit under tables and desks more readily than wheelchairs with larger wheels.

Disadvantages:

- 24" wheels are specially produced for wheelchairs; in some countries they are not easily available, which can make replacement when something goes wrong with the wheel, a problem. A 26" or 28" wheel cannot be used on a wheelchair designed for a 24" wheel, without making many alterations to the frame.
- 24" wheels are usually more expensive than 26" or 28" wheels.

26" or 28" Wheels: Many wheelchairs are designed to use bicycle (26") or rickshaw (28") wheels, as these wheels are much more readily available in some countries.

Advantages:

- In most countries 26" wheels are readily available. In countries where rickshaws are used, 28" wheels are readily available. This means that the wheelchair user can easily have a wheel repaired or replaced if something goes wrong, almost anywhere in the country.
- Larger wheels are easier to push on rough ground.

Disadvantages:

- Wheelchairs with a 26" or 28" wheel are slightly larger. This is particularly true of the 28" wheel.

Front castor

The front castors support the front of the wheelchair, and enable the chair to turn smoothly.

Types:

There are different types of castor wheel in all shapes and sizes to cope with different terrain.

There are 2 main types of castor wheel:

Pneumatic - These give a smooth ride, but can be punctured. Spare parts can be expensive and difficult to obtain.

Solid - These last a long time and are usually cheaper than pneumatic.

Table 8 shows some advantages and disadvantages of different wheel shapes and sizes.

Table 8: Evaluation of wheelchair wheels

| | Advantages | Disadvantages | Who / where |
|---------------------|---|--|--|
| Wide wheel | Travels most effectively over soft ground – such as sand / mud. | Heavy. | A large wide wheel is good for a person living in a rural area. |
| Narrow wheel | Lightweight Travels well over hard smooth ground. | Digs into soft ground. | A large narrow wheel is good for a person living in a pot-holed urban area. |
| Large wheel | Travels most effectively over rough ground. | Heavy Larger turning circle which can make the whole wheelchair larger. | A large wide wheel is good for a person living in a rural area. |
| Small wheel | Lightweight Small wheels have a smaller turning circle, which makes the chair smaller. | Will 'stick' in potholes or bumps in the road that a large wheel would ride over. This could cause a wheelchair user to tip out of their wheelchair. | Used on sports wheelchairs For user's who live in well-maintained urban areas, or use their wheelchair indoors. |

Pressure relief cushion

The design of an appropriate wheelchair cushion is a major concern in the overall design of a wheelchair. A well designed cushion can reduce the risk of pressure sores which are one of the most common life threatening complications that occur to people who use a wheelchair particularly in low-income countries. People with a Spinal Cord Injury (SCI) are particularly vulnerable to pressure sores.

The wheelchair and cushion act together to form a seating system, which should:

- promote good posture
- Maximise the user's functional potential
- Provide adequate skin protection.

If the wheelchair is ill-fitting or badly adjusted, it will affect all these factors. For instance if the seat depth is too short, or the footplates are too high, the area over which the weight can be distributed is reduced, as shown below, and pressure over vulnerable areas (ischial tuberosities, coccyx and sacrum) will increase.

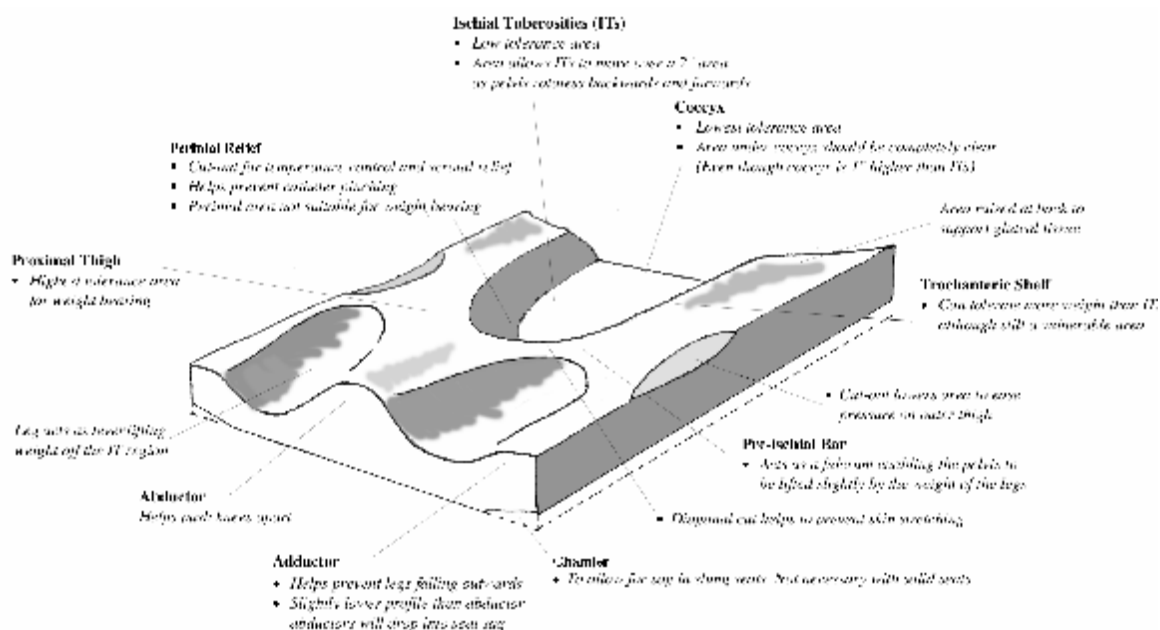
The wheelchair (especially the height of the footplate) **must be readjusted** for every different cushion it is used with in order to distribute the user's weight evenly over the cushion. Even if a cushion is a similar height to another, different material properties or cushion shape will cause the user to sit differently.

To achieve the best distribution of pressure, the wheelchair and cushion must be considered together at the initial design stage.

A cushion will add up to 100mm to the seat height and this extra height needs to be taken into account especially when considering:

- the relationship between the user and the push-rims
- the overall height of the wheelchair in relation to tables etc.
- Position of user's arms and lap are altered with a cushion

Figure 9: Sculpted Cushion Base – Key Points



References

This chapter has been written with material and illustrations selected from Motivation publications and training courses:

- § Motivation The Wheelchair service guide for low-income countries
- § *Fit for Life* Prescription course and Technical training course
- § The Wheelchair Technologists Training course, TATCOT, Tanzania
- § Donated wheelchair Fact sheets

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