

permobil



THE ADVANTAGES  
OF STANDING WITH  
WHEELCHAIRS

## TABLE OF CONTENTS

<i>Medical benefits of standing</i>	4
<i>Breathing easier</i>	6
<i>Enhancing blood circulation</i>	8
<i>Improving bladder function</i>	10
<i>Improving bowel function</i>	12
<i>Stronger bones</i>	14
<i>Reducing contractures and spasticity</i>	16
<i>Relieving the pressure</i>	18
<i>Psycho-social benefits</i>	20
<i>Health economics</i>	24
<i>Reference list</i>	30

## WHY STAND?

*Man has been defined as a “featherless biped” by Plato.*

Over time, the human being has developed into a creature able not only to stand erect, but – in addition – able to ambulate this way. Standing and walking has become our default way of unassisted moving about for most of our lives. Not having this basic functionality, due to disease, injury or just ageing, will have significant physical and psychological consequences.

Standing – even without the possibility for walking – will make a significant difference for those who have lost or never had this ability, and who, by way of technical aids, once again are able to do so. In this booklet, the focus is on standing integrated into a wheelchair, as this provides an easy way to obtain a standing position without the need to transfer, and it provides a more functional reach when performing activities in daily life.

The following text will comprise both physical and psychological aspects. The fundamental structure reflects the current World Health Organization (WHO) taxonomy used in rehabilitation medicine – the International Classification of Functioning, Disability, and Health (ICF).

Please keep in mind that not every benefit relates to every person and/or disease or injury. It is also important to conduct an appropriate individual assessment.





**MEDICAL BENEFITS  
OF STANDING**

## BREATHING EASIER

### Body function and structure

The respiratory system comprises those organs that provide oxygen and remove carbon dioxide from the body: trachea, lungs and respiratory muscles. Dysfunction of this system may jeopardize a fundamental prerequisite for living. In fact, many people with a physical disability will suffer from some degree of respiratory compromise, ranging from insignificant to severe.

### Functional impairment

Respiratory dysfunction can be due to restrictive and/or obstructive disorders:

- **Restrictive disorders** include paralysis of respiratory muscles – i.e. the diaphragm, the intercostal muscles and/or the auxiliary breathing muscles of the neck and shoulders. It weakens the bellows function of rib cage expansion and contraction, which creates the vacuum to inhale or the overpressure to exhale.
- **Obstructive disorders** lead to decreased diameter of the windpipes e.g. due to spasm or swelling – as in asthma and chronic obstructive pulmonary disease.

Both forms of disorders reduce the amount of fresh air available for gas exchange in the alveoli of the lungs. Consequences may include fatigue, headache, high blood pressure and cognitive dysfunction. Severe impairments are life threatening. Additionally, mucus often accumulates in the airways, leading to potentially serious pulmonary infections.

***“I really feel the difference, when I stand, I can really breathe deeply and it helps me feel more comfortable.”***

Kevin, person with paraplegia.

**Facts about people with:**

- **Rheumatological conditions** typically have a degree of restrictive ventilatory impairment due to stiffness of the rib cage and spine,
- **Neurological conditions**, also typically suffer restrictive impairment, in this case due to paralysis of the respiratory muscles,
- **Congenital and hereditary neurological disorders** often develop scoliosis, which further restricts respiratory function,
- **Respiratory impairment** are often more vulnerable to various pulmonary complications.

**Benefits of Standing**

Standing causes a pelvic anterior tilt, resulting in an increased lumbar lordosis and thereby more erect posture and more stabilized spine. In this position, intra-abdominal pressure decreases. This allows better translation of the diaphragm and improved expansion of the thorax, resulting in a direct improvement of the lung volume.

So, by achieving a greater expansion of the lungs during each breath (i.e. by increasing the so-called tidal volume), clearance of mucus from the airways will improve, partially due to increased power when coughing.

Finally, improved blood oxygenation may also have beneficial effects on the cardiovascular system (see next section) and reduces fatigue significantly – it is well known that chronic respiratory insufficiency is a significant risk factor for high blood pressure.

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**SUMMARY OF BENEFITS**

- Standing reduces pressure on internal organs and lung volume improves.
  - With an increased lung volume, blood oxygenation improves.
  - The overall breathing will be easier.
  - By standing, individuals can prevent fatigue, headache, chest infections, and high blood pressure.
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**FACTS**

In a survey with spinal cord injured individuals, 31% of the respondents reported improved breathing while standing. (*Nordström et al. 2014.*)

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In reference list: 2, 3, 18.

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## ENHANCING BLOOD CIRCULATION

### **Body function and structure**

The circulatory system is closely connected to the respiratory system. The circulatory system is responsible for distributing the oxygen provided by the lungs as well as collecting carbon dioxide for disposal out of the body.

### **Functional impairment**

#### ***Cardiovascular deconditioning***

Immobilization will inevitably lead to cardiovascular deconditioning. In cases of lower limb paralysis, there will be an additional disadvantage from a circulatory point of view, as the leg muscle pump, normally facilitating venous blood return from the lower extremities to the heart, will be lost. To this clearly disadvantaged situation, several additional impairments – e.g. disturbances in autonomic function – further contribute to a vulnerability and a propensity for cardiovascular complications in many wheelchair users.

#### ***Edema and chronic venous insufficiency***

The venous system is a low-pressure system and blood flow is less depending on the pumping system of the heart. The venous return from blood in the lower extremities (LE) is dependent on the valves in the veins and the muscle-pump function. Individuals with mobility restrictions can experience problems with the venous flow from the LE back to the heart due to the absence of the muscle-pump function. The amount of blood in the LE increases (pooling effect), which will elicit more internal pressure in the veins. Due to increased pressure in the capillaries, blood fluid and cells are leaking out of the capillaries, causing edema. This edema is the result of fluid overload that overwhelms the functional capacity of the lymphatic system and is a primary symptom of chronic venous insufficiency (CVI).

Dead blood cells and their waste cannot be evacuated in an efficient way from the tissue, causing pain, hyperpigmentation and venous ulceration as secondary symptoms of chronic venous insufficiency. Remaining red blood cells and fibrin can clot and cause a venous thrombus, which can lead to a possible life-threatening deep vein thrombosis.



***“When I stand for an hour, I notice that my legs are much better. The swelling is gone and the color is much better.”***

Esther, person with dystrophy.

### **Benefits of Standing**

We still have a lot to learn regarding the effects of standing as a means of positively affecting circulatory function. As a minimum, beneficial effects of posture on respiratory function should also have a positive effect on circulatory function. It is clear that enabling the wheelchair user to achieve an upright position will facilitate compensatory physiological mechanisms that once again makes it possible for the cardiovascular system to adapt.

Venous blood flow in the LE is caused by a combined effect of muscle contractions and the back flow valves in the veins. Standing increases tone in the plantar flexors, knee- and hip extensors, thus improving the muscle blood-pump and decreasing blood congestion in the distal part of the LE. Blood pooling effect in feet and ankles will be reduced, resulting in a lower risk for edema and chronic venous insufficiency. The additional benefit from an improved circulatory function is the reduced risk for deep vein thrombosis (DVT).

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### **SUMMARY OF BENEFITS**

- Standing has beneficial effects on breathing which as a result also can give positive effect on circulatory function.
- Standing reduces blood pooling effects in feet and ankles by activation of the muscle pump.
- Upright position helps to prevent edema as a primary symptom of chronic venous insufficiency and the possible risk of deep vein thrombosis.

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### **FACTS**

According to Huston et al. (2001), 42% of the respondents (SCI) reported decreased swelling in leg and feet.

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In reference list: 2, 18, 19.

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## IMPROVING BLADDER FUNCTION

Normal urological function requires, among other things, a normally functioning nervous system. Urological function and dysfunction is a focus of much concern among many wheelchair users.

Of course, this population is very heterogeneous, and generalizations are bound to be ill-advised. However, it is correct to state that disturbances in urological function, generally speaking, are very common in this group.

### Body function and structure

The bladder is an expandable saclike organ that contracts when it is emptying. The inner lining of the bladder tucks into the folds and expands to accommodate liquid. When empty, the bladder's muscle wall becomes thicker and the entire bladder becomes firm. As the ureters (two tubes that expel urine from the kidneys to the bladder) fill the bladder, the muscle wall thins and the bladder moves upward, toward the abdominal cavity. An internal sphincter – a type of muscular valve – helps to prevent urine from leaking out. When signaled, the bladder releases urine through the urethra. Healthy bladders hold urine until people have time to relieve themselves, but problems can arise for varying reasons.

### Functional impairment

Bladder dysfunction is an abnormality of either the filling or emptying of the bladder. It may be caused by involuntary muscular activity in the muscles of the bladder wall, the muscles that control the starting or stoppage of the flow of urine out of the body (sphincters), or the muscles of the pelvic floor. Neurological impairment and certain medications can also contribute to bladder dysfunction, and many wheelchair users have diseases or injuries to their nervous system.

Common urological dysfunction is incontinence and infection, and the risk of infection becomes much increased in case there is incomplete emptying of the bladder.

Example: people with spinal cord injury (SCI) experience increased bone resorption as a result of osteopenia or osteoporosis.

***“Standing helps me to fight urinary tract infections because I can empty my bladder more easily.”***

Fabien, person with myopathy and arthrodesis.

This can lead to hypercalcemia, which in its turn can cause hypercalciuria, a major cause of renal and bladder stones. Bladder stones can prevent a complete emptying of the bladder, and increase the risk of bladder- or urinary tract infections (UTI).

### **Renal stone**

Renal (or kidney) stones can affect any part of your urinary tract – from the kidneys to the bladder. Renal stones can be quite painful and reduce the comfort significantly. They can also cause hematuria (blood in urine). In some case, stones become lodged in the urinary tract or cause complications and surgery may be needed. If a blockage occurs, there is a risk of infection, which in rare cases can damage the kidney.

### **Bladder stone**

Bladder stones are hard masses of minerals in your bladder. Bladder stones develop when urine in your bladder becomes concentrated, causing minerals in your urine to crystallize. Symptoms can range from abdominal pain to blood in your urine. Small bladder stones sometimes pass on their own, bigger ones need to be removed by a doctor. Left untreated, bladder stones can cause infections and other complications.

### **Benefits of Standing**

Standing will reduce bone resorption and the corresponding hypercalcemia and hypercalciuria, preventing the possible formation of renal and bladder stones.

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### **SUMMARY OF BENEFITS**

- Standing reduces the risk of hypercalcemia and hypercalciuria and the potential kidney- and bladder stones.
  - Standing reduces the risk for urinary tract infections (UTI).
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### **FACTS**

Kaplan et al. reported already in 1981 that standing exercises had a positive impact on the calcium balance in urine of spinal cord injured individuals. According to the survey of Huston et al. (2001), 53% of the respondents with a spinal cord injury reported an improved bladder function.

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In reference list: 2, 5, 7, 18.

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## IMPROVING BOWEL FUNCTION

As in the case with the urinary system, even the gastro-intestinal system is typically affected in many wheelchair users, particularly those with neurological disorders. Both immobilisation and paralysis contribute to the common problem of constipation.

### Body function and structure

The large intestine and its resident bacterial population have key roles to play in determining our health and wellbeing. It is much more than just a waste storage facility. Important functions are:

- Reabsorption of water and mineral ions.
- Formation and temporary storage of feces.
- Maintaining a resident population of over 500 species of bacteria.

### Functional impairment

The formation of feces are triggered by peristalsis. It pushes the contents of the large intestine ahead. They will often trigger a bowel movement, or at least the urge to have a bowel movement. Constipation is usually described as infrequent bowel movements (less than 3 per week). The sensations associated with constipation can include a constant feeling of needing to go, or a sensation of bloating or fullness.

### Benefits of Standing

Standing stretches the colon and stimulates bowel movement. Transit time in the colon will be reduced, and the gravitational load on the descending colon will create a natural urge to empty the bowel. Studies in able-bodied individuals without bowel dysfunctions show that food empties from the stomach better when individuals alternate between sitting and standing, and worse when individuals just sit, stand or lie. According to some studies, up to about 50% improvement in regularity of bowel function with standing programs has been reported as gravity assists with digestion, bowel movement and also bladder emptying.

***“Not an exciting topic to talk about but it was a recurrent problem for me, it’s the constipation. I really felt the difference when I started to use my standing wheelchair.”***

Guillaume, person with hemiplegia.

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**SUMMARY OF BENEFITS**

- Gravitational load resulting from a standing position can create a natural urge to defecate.
- Standing can reduce the risk for constipation.

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**FACTS**

According to Huston et al. (2001), 53% of respondents reported an improved bowel function and for 45% of them an improved digestion.

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In reference list: 1, 2, 5, 7, 8, 18.

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## **STRONGER BONES**

### **Body function and structure**

Weight bearing is important for maintaining bone strength. Astronauts in weightless conditions have quickly reduced bone mineral density. Similarly, the risk of bone fractures, even from minor trauma, increases due to bone demineralization. Such fractures are called fragility fractures, and are common in chronic wheelchair users. Adequate bone density is dependent on several factors including calcium, vitamin D, and physical activity (i.e. weight bearing).

### **Functional impairment**

#### ***Osteoporosis***

Due to their situation, many wheelchair users are immobilized and some are unable to perform physical activity. Additionally, people with for example rheumatic disorders or multiple sclerosis may have to use drugs (e.g. cortisone) that increase the risk of osteoporosis.

#### ***Skeletal deformities***

People with congenital disorders affecting the neurological and musculoskeletal systems tend to develop skeletal deformities (e.g. scoliosis and joint deformities). Deformities are caused by fractures that do not heal well or spasticity/contractures.

### **Benefits of Standing**

- In the absence of other physical activity, weight bearing by standing reduces loss of bone mineral density.
- Extension of the upper body and alignment of the hip during standing assists in delaying skeletal deformities.
- Better positioning of shoulders improves a user's grip and upper extremity mobility.

***“Standing has a positive effect in terms of osteoporosis, because active muscles produce bone activity.”***

Xavier, Orthopedic surgeon since 1992.

Additionally, in children, physiological joint development relies on weight loading. In the absence of this children using wheelchairs will suffer hip joint malformation, as well as others secondary orthopedic impairments.

The impact of standing on bone mineral density is one of the most researched benefits. Results are often inconclusive, but pointing in the same direction. Depending on pathology, age and time since injury results can differ. According to Goemaere et al. (1994), there is a better preservation of BMD of the standing group compared to the non-standing group. Thompson et al. reported in 2000 that a decreased level of weight bearing is related to lower BMD in the lower extremities. Alekna et al. noticed in 2008 a significant higher BMD in the standing test group.

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**SUMMARY OF BENEFITS**

- Standing can reduce bone resorption resulting from reduced gravitational loading.
- Standing can reduce the risk of fragility fractures.
- Standing can reduce deformation risk resulting from fractures.

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**FACTS**

Udenfelt et al. concluded in 2013 that not using a standing device is associated with significantly higher fracture risk.

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In reference list: 6, 9, 10, 11, 12, 13, 14, 18, 20.

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## REDUCING CONTRACTURES AND SPASTICITY

People with congenital disorders affecting the neurological and musculoskeletal systems tend to develop skeletal deformities, e.g. scoliosis of the spine and joint deformities. This is to a lesser extent also true in many acquired disorders leading to wheelchair use. Deformities in lower extremities are often caused by abnormal muscle tone. Muscles grow with the bone, but in the case of spasticity or contractures resulting from spasticity, muscles will apply too much force on the bone, causing deformations (for e.g. children with moderate or severe CP are at high risk).

### **Contractures**

#### ***Body function and structure***

Every joint in the body has an optimal passive and active mobility. This is called the range of motion (ROM) of the joint.

#### ***Functional impairment***

Several factors may decrease the ROM, e.g. joint inflammation, paralysis of the muscles acting across the joint, spasticity (see below) etc. One or several of these factors commonly occur in wheelchair users. The resulting restriction in joint mobility due to decreased ROM is called a contracture.

### **Benefits of Standing**

The standing position requires stretch of our hip flexors, knee flexors and plantar flexors. Standing improves movement ability and range of movement, and also provides proprioceptive input (=physical sensation). Muscle stretch combined with weight loading improve muscle tone more than stretching alone.

For children, a prolonged standing session significantly improves extensibility of hamstrings, and studies/research also show that it enables the child to carry out ADLs more easily. However, standing programs must be followed to really have benefits.

A standing wheelchair can be a way some individuals can treat and prevent contractures independently.

Numerous studies reported the benefit of preventing contractures with positive results, varying from increased ankle dorsiflexion (*Tsai et al. 2001*), increased ankle mobility of 4° (*Ben et al. 2005*), increased ankle and hip ROM (*Baker et al. 2007*) to improvement of stiffness reported by 59% of the respondents (*Nordström et al. 2014*).



***“Very quickly, I noticed that I had less spasticity. Now I can better sleep and I’m less tired at the end of the day.”***

Luc, person with paraplegia.

## **Spasticity**

### ***Body function and structure***

Spasticity is a state of increased involuntary tone in a muscle (and an increase in the deep tendon reflexes), characterized by increased resistance to passive stretch. Spasticity accompanies paralysis due to brain- or spinal cord disorders.

### ***Functional impairment***

Spasticity denotes a peculiar reaction in the central nervous system after loss of control from its upper motor neuron in the brain. Although the affected muscles will be paralysed (e.g. losing volitional movement) those muscles nevertheless will be subject to an increased involuntary tension. This increased tension can be painful and promote the development of contractures (see above), and may limit any residual voluntary motor function.

## **Benefits of Standing**

Standing has definitive positive effects on reducing excessive spasticity. These are immediate and significant for standing wheelchair users, because they can stand frequently throughout the day when spasticity management is needed. Studies show that reducing spasticity contributes to safer transfers, better sleeping and improved positioning in the wheelchair.

A considerable amount of published research highlights the beneficial effect of standing on spasticity. Some examples: Zabel et al. (2005) noticed improved muscle tone in individuals with CP, Wai-mun Pin et al. (2007) found favorable evidence for static weight-bearing exercises and temporary reduction of spasticity.

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## **SUMMARY OF BENEFITS**

- Standing offers active mobilization and stretch of the joints of the lower extremities.
- Active mobilization performed by standing reduces the risk for contractures.
- Stretch performed by standing reduces spasticity.
- Standing reduces spasticity-induced contractures.

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## **FACTS**

Garrett (2008) et al. concluded that standing reduced spasticity and Adams et al. (2011) noticed that extensor spasms were reduced.

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In reference list: 2, 4, 5, 6, 7, 15, 18, 20, 21, 24.

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## RELIEVING THE PRESSURE

### Body function and structure

The skin and underlying soft tissues all require a constant supply of movement, oxygen and nutrients, in order for the tissues to survive.

### Functional impairment

Many wheelchair users are paralysed, and thus immobilised, due to their predicament. In addition, people suffering from neurological disorders often have diminished sensation as well. When sitting or lying down, the skin and soft tissues will become squeezed between the sitting or lying surface and any bony prominences in the person's body. When the tissues stay squeezed for prolonged periods, tissue damage will occur. Such wounds are called *pressure ulcers*.

Many wheelchair users tend to develop pressure ulcers due to:

- **Improper sitting** – e.g. concentration of weight at the ischial tuberosities and/or shearing forces due to forward slipping.
- **Urinary incontinence** – moisture causes maceration of skin tissue. This weakens tissue resilience and will accelerate the deterioration of an incipient lesion.
- **Fecal incontinence** – the moisture and acidity of the feces will accelerate the deterioration of an incipient lesion. Additionally, and importantly, feces contains large amount of bacteria that may easily infect an incipient ulcer.

### Benefits of Standing

By offering the option of standing to a wheelchair user, he or she will have additional means of regular pressure relief of pressure areas that are active when sitting.

Standing in a wheelchair can help prevent health complications that cost society a lot of money – preventing one serious pressure ulcer in a patient can cover the whole cost of the wheelchair. In addition there are benefits through functional improvements and increased participation.

***“We see better results in the treatment of pressure ulcers with a standing program compared to other methods.”***

Estelle, occupational therapist since 2011.

***“Thanks to standing, I get fewer pressure sores on my back and elbows.”***

Maria-Pia, person with brittle bone disease.

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#### **SUMMARY OF BENEFITS**

- Standing concentrates the body weight on the lower extremities.
- Standing offers the best reduction of the load on ischial tuberosities and sacrum.
- Standing reduces the risk for pressure ulcers and fits in a regimen to prevent pressure ulcers.

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#### **FACTS**

Sprigle et al. concluded in 2009 that there is a maximum decrease of seat load in the standing position.

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In reference list: 2, 7, 18, 20, 22.

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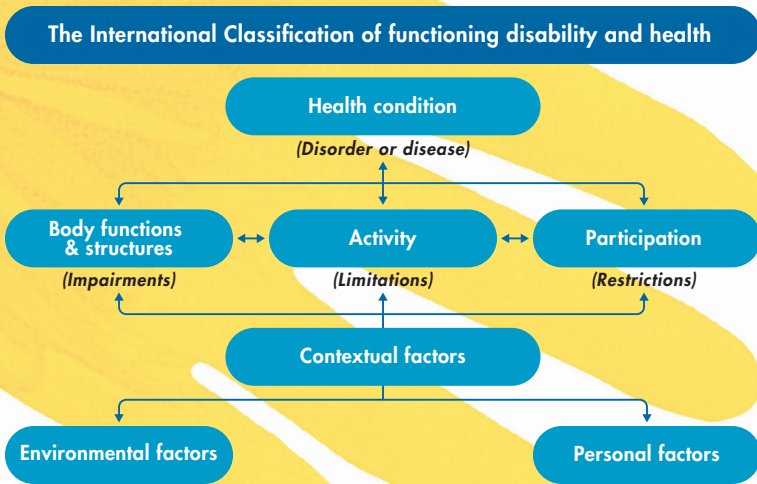




## PSYCHO-SOCIAL BENEFITS OF STANDING

Beyond the physical benefits of standing, psycho-social benefits must also be highlighted as they represent an important part of the standing benefits. The human being is designed to be able to stand, and most of the situations of daily life require us to stand: at home, at work, having a conversation to name a few examples. Being able to stand is often considered a part of an active lifestyle, which gives standing wheelchair users a sense of self-confidence, enabling increased participation and independence in their everyday life.

Participation is actually the key word when it comes to psycho-social benefits. The ICF, International Classification of Functioning, Disability, and Health (ICF), current World Health Organization (WHO) taxonomy used in rehabilitation medicine, shows the connections that impact the level of participation.



***“For me, a standing wheelchair is synonymous with freedom. Standing has many instantaneous and beneficial effects on my everyday life. I have better work conditions in my engine shop, and that’s really great!”***

Xavier, person with paraplegia.

The level of participation is not only impacted by internal or external factors, it is also impacted by the interface the person is using.

Participation, which is an important social dimension of life, relies on two things:

- **Function:** A person must have a function available to them, such as a standing function integrated into the wheelchair.
- **Ability:** Possible only if the function is operational. Thanks to the standing wheelchair, the user will have the possibility to stand when they choose and to do daily activities more independently.

The function and the ability then make the participation possible. Once the person knows they have the possibility of standing consistently, and thereby, the ability to be more active, it enables them to increase participation.

Thereby, a wheelchair with a standing function should not be considered only as a mobility and training device, but also as a social tool.

***“It’s the feeling of being independent, being able to hug my wife when I want.”***

Lucas, person with paraplegia.

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#### **SUMMARY OF BENEFITS**

- Standing with a wheelchair offers the individual the possibility to increase their functional level, which can lead to greater independence, greater participation in their environment, social life and other activities.
- When standing is performed with a wheelchair, compliance and the following medical benefits will be greater due to the personal and functional need to stand, as standing happens naturally for task completion without the need to transfer to a standing device.
- The combination of medical, functional, psycho-social and economic benefits positively influences a persons self-esteem and psychological well-being, resulting in an overall improvement in quality of life.

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In reference list: 2, 7, 16, 17, 18, 20.

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**HEALTH ECONOMICS**

## HEALTH ECONOMICS

When talking about economics in health care, it is important to consider the overall health costs and not just the cost of the wheelchair. The assessment of the wheelchair being made needs to be holistic and made over time in order to grasp every aspect of a person's life.

Looking at the following four areas from ICF, it is obvious that a standing wheelchair can make a difference in all four and have a positive effect on a person's life, consequently reducing costs.

- **Body structures and Functions:** A standing wheelchair can help the user to change position in-chair and therefore help with tone management, weight distribution and bladder function. Being able to stand enables better eye-to-eye contact, which can decrease pain in the shoulders and head due to looking up, and also makes it easier to communicate with people around you. So, as the body starts to be in better shape, less treatment, preventive or curative, will be needed. This has a positive impact on costs.
- **Activity & Participation:** A standing wheelchair helps people be more active and participate in social activities. The possibility to be active in mind and body helps to reduce the risk of depression, a very costly condition for society.
- **Personal factors:** The choice of being able to stand when you want to helps increase independence in personal and instrumental ADL. The person will be more autonomous and require less assistance.
- **Environment:** As well as providing a means of ambulation, choosing a standing wheelchair provides increased functional benefits which can help to reduce the need for adaptation of a person's home and workplace, thus reducing costs.

*Continued on next page >*



So how can we understand rehabilitation technology in terms of wheelchairs with standing feature from a health economic perspective? The answer is all in the above and can be summarized as follows:

- **Quantitatively** – prevention of complications (eg. pressure ulcers, edema, contractures)
- **Qualitatively** – increased functional ability, independence, empowerment, participation

The cost of a standing wheelchair actually covers much more than only a mobility solution.

Last but not least, when talking about health economics, it is difficult to not talk about numbers. Before taking any decision, the consideration needs to be made between

- the level of the risk,
- the prevention cost,
- the cost for a possible treatment,
- the additional outcome.

When talking about cost-of-illness and treatment, a lot of research has been done. A few examples:

- In the USA, total health care costs per patient were \$73 021 higher for patients with pressure ulcers and annual hospitalizations were nearly 52 days longer (*Stroupe et al. – 2011*).
- Pressure ulcers represent the most common medical complication and the most common reason for hospitalization within the first year post-injury. The financial cost of treatment depends on its severity and ranges from \$2 000 to \$70 000 per wound (*Makhsous et al. – 2009*).
- The median length of stay was seven times greater for fracture admissions than for non-fracture. Individuals also required increased levels of assistance for transfers and self-care during immobilization of a fractured limb. Prevention of fractures would therefore decrease health care costs and promote independence in this population (*Morse et al. – 2009*).
- The costs from stage IV pressure ulcers are much greater than previously estimated. Halting the progression of early stage pressure ulcers has the potential to eradicate enormous pain and suffering, save thousands of lives, and reduce healthcare expenditures by millions of dollars (*Brem et al. – 2010*).

Besides the economic costs, we need to consider the possible risks that accompany hospitalization (e.g. immobilization, UTI, pressure ulcers), as well as the risks that affect each individual's personal situation (e.g. employment, discomfort, additional load on family, reduced participation, self-esteem).

Making the choice for functional standing as a part of a life-long rehabilitation program is not only beneficial in preventing secondary complications from immobilization, it also offers functional and psycho-social benefits without any additional cost. From this perspective, the cost of a standing wheelchair has also an enabling characteristic by facilitating and increasing in activities (e.g. ADL's with less assistance, work-related activities).

***“At home you can live normally with a standing wheelchair, you don't need as many adjustments done to your home, like closets and kitchen for example.”***

Jean-Paul, person with paraplegia.

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#### **SUMMARY OF BENEFITS**

- Standing with a wheelchair leads to a greater independence, implying that the person will need less assistance, less modification to their home, less care, less medication.
- Standing reduces the risk of costly and painful physical complications
- A standing wheelchair is a mobility device and a standing device, a combination offering much more advantages than the classic devices.
- The combination of medical, functional, psycho-social and economic benefits can influence a person's self-esteem and the psychological well-being in a positive way, resulting in an overall improvement of quality of life.

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In reference list: 25, 26, 27, 28, 29.

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