Manual Wheelchair Skills

Guidelines for Instructing

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Vancouver CoastalHealth
Promoting wellness. Ensuring care.
G. F. Strong Rehab Centre

MANUAL WHEELCHAIR SKILLS
GUIDELINES FOR INSTRUCTING

By Ian Denison PT ATP

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Also a volunteer, whose name escapes me, who took at least half of the photographs in this manual. And whose energy finally got me moving on this document.

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Foreword

This document is intended to provide clinicians with the tools needed to teach a wheeler how to handle their wheelchair as efficiently as possible. In every skill covered in this document, efficiency is the goal. Mastery of each skill occurs when the wheeler can complete each task using the least amount of energy possible.

All too often wheelchair skills are taught by clinicians who do not understand the fundamental principles behind each skill they are asked to teach. Often relying on tried and trusted activities, they have seen other clinicians using and repeating them until their wheeler succeeds, or feels the skill is beyond their potential.

In teaching wheelchair skills the clinician must help the wheeler develop the ability to problem-solve and figure out how to cope with situations by themselves. By being aware of the principles underlying the basic skill as well as strategies which make it easier or more challenging, a good clinician will be able to help their wheeler achieve their greatest potential level of wheelchair handling. Just as importantly, it will also provide them with the tools to achieve greater independence following discharge.

These guidelines are based on the following premises:-

- Potential should not be restricted or predefined by the clinician
- Clinicians do not need to demonstrate the skills being taught
- Wheelers need to be challenged
- Wheelers need to succeed
- Wheelers need variety
- Wheelers need to develop a problem-solving attitude
- Understanding enhances skill development
- The ultimate objective is to complete a task with the least expenditure of energy

I believe any task which challenges the wheeler's comfort envelope in their wheelchair has the potential to pay dividends down the road when they are confronted with an unexpected situation.

This document describes skills progressing from basic to advanced. However, it must not be assumed a wheeler who is unable to perform Skill 3 (for example) is incapable of performing any other skills besides 1 and 2. The only exception to this is Skill 10. Ability to hold a wheelchair in a balance position (wheelie) is a prerequisite for skills 11 through 18.

Wheelchair skills should be taught in an environment appropriate to the wheeler and the skill being taught. For the most part a large open area with a smooth hard surface such as a gymnasium is ideal. Consideration should be given to minimizing distractions and obstructions. The skills should be taught when the wheeler has the necessary energy and is motivated to learn.

All wheelchair skills described in this document and are broken down as follows:-

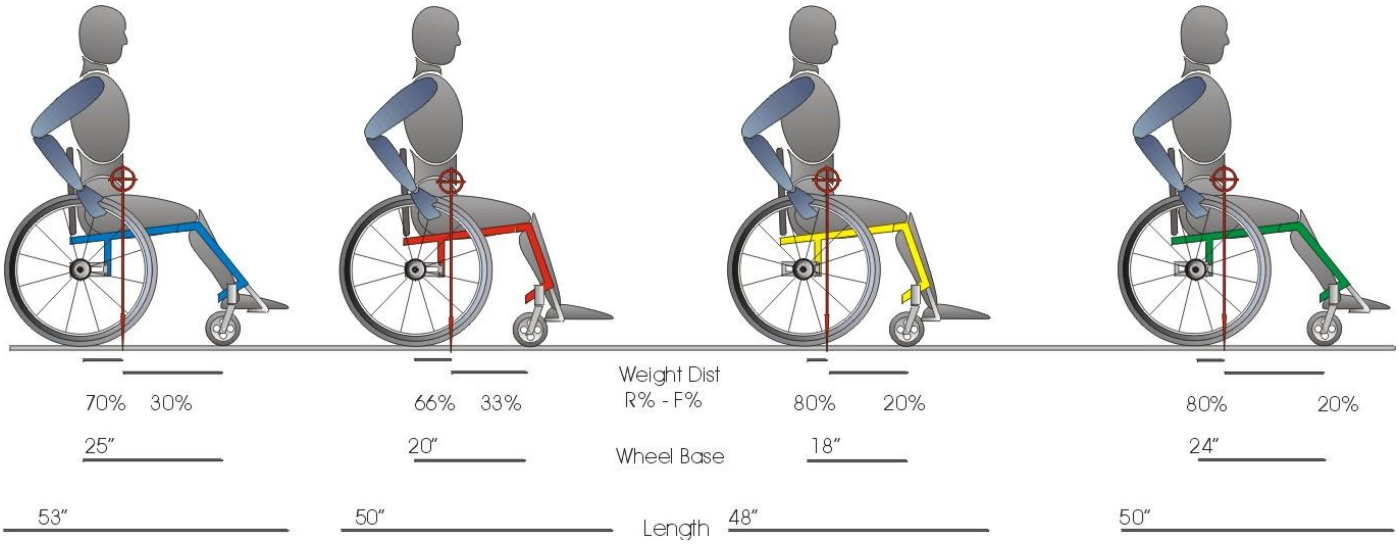
Description of skill
A basic description of what the skill looks like.

Justification
Reason(s) why skill is valuable for wheeler to learn.

Ideal Set up
How the chair should be set up to make the skill easier to learn.

Teaching points
Factors the clinician should consider drawing the wheelers attention to, in order to increase their understanding of how to improve.

Configuration
For ease of writing, I refer to tippy chairs, stable chairs, and short and long wheelbase chairs. Many elements contribute to making a chair tippy or stable; what follows is a brief summary of the characteristics each configuration possesses.



Stable chair/long wheelbase	Stable chair/short wheelbase	Tippy chair/short wheelbase	Tippy chair/long wheelbase
Stable platform for transfers	Stable platform for transfers	Easy to push	Easy to push
More room to slide transfer	More room to slide transfer	Easy to turn	
Easiest to do high curbs	Easier to do high curbs	Easier to wheelie	Easiest to wheelie
	Less caster flutter	Shortest configuration	
Easier to climb hills	Easier to climb hills	Softer ride	Softest ride
		Low rolling resistance	Low rolling resistance
Allows for large caster	Allows for large caster		Allows for largest casters
		Best arm position	Good hand position
Tends to pitch forward least		Tends to pitch forward less	Tends to pitch forward least
Accommodate long legs			Accommodate long legs

Common Elements

Regardless of the skill being taught there are elements common to each skill which should be optimized to improve the chances the wheeler will have the best possible chance of success.

Appropriate Area

Space being used is appropriate to the task, in most cases an area clear of obstructions and distractions.

Appropriate Time

When the wheeler has energy, and is motivated.

Appropriate Chair Set up

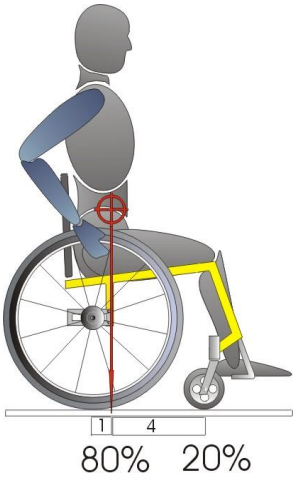
The set up of the chair has a significant impact on the wheelers ability to perform a task. During the early phases of learning the chair should be set up with minimal rolling resistance and the wheeler is in the best position to be able to apply power to the wheels.

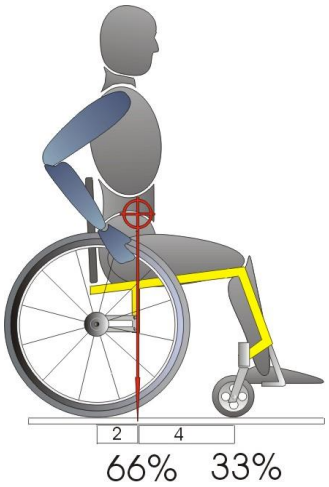
Tire Pressure

Inflate tires to maximum on hard surfaces.

Deflate to 10 to 20 psi on soft ground or carpet.

Centre of Gravity

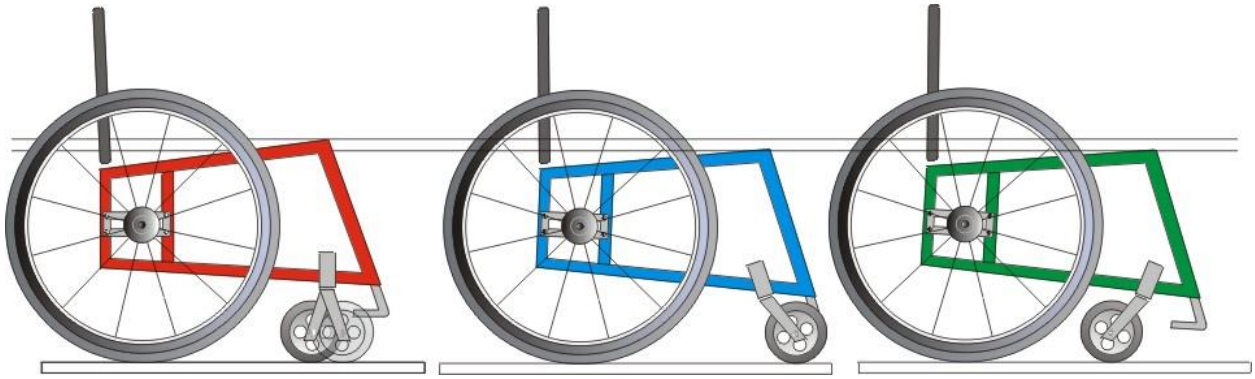




More weight on the drive wheels and less on the auxiliary wheels (casters and anti tippers) makes the chair roll with less effort. NB: Some skills are easier to learn with a chair set up in a more stable configuration

Caster stem

Stems should be vertical when viewed from the front and side except in exceptional circumstances.



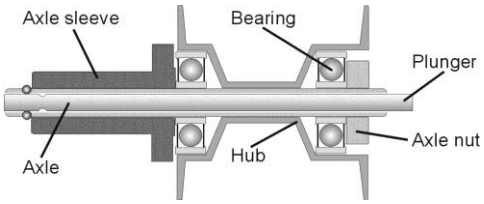
Stem vertical | Stem leaning backward | Stem leaning forward

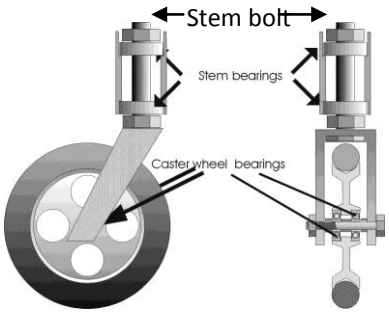
Bearings

The large wheels should spin freely and should roll back a little after they stop spinning. Axle nuts should be tightened to reduce sideways play at the bearing without making the bearing bind. (If this happens the wheel will not spin back when it stops after being gently spun.)

When tightening the axle nut of a quick release wheel ensure the plunger extends fully when the wheel is in place (the wheel can fall off if the plunger doesn't extend).

The caster stem bolt can be slightly over tightened to help reduce flutter.

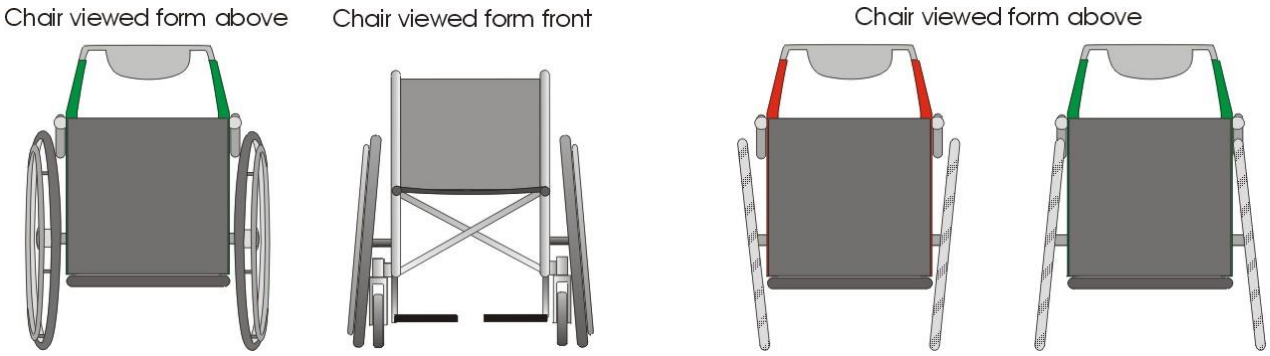




Cross section of wheel axle | Plunger extended (foreground) | Caster cross section

Toeing

The contact patch of the wheels should be parallel to, and pointing in the same direction as the wheeler. Not toed in or out.



Correct toeing from above Correct toeing from front Toed out Toed in

Hand position

Camber and offset can be adjusted to make holding the push rim more comfortable. Sometimes armrest pads interfere with the wheelers ability to wheel and can be removed temporarily or reversed to allow longer contact. Generally 3-6 degrees of camber is comfortable. Having the tops of the wheels positioned directly below the shoulders and the middle finger resting over the axles when the arms are hanging is a good starting position.

Handrim interface

Ensure adequate friction. Use of mitts, gloves, dycem, or surgical tubing all impact a wheelers control over the chair. Also consider if the hand rim is suitable friction coated handrims, rims with lugs, and rims with different cross sections may make a significant difference

Wheeler Feels Secure

Someone with compromised balance may benefit from a chest strap until they develop confidence in their technique and skill. Seat belts for the most part have little effect on trunk stability.

Skills

1. Wheeling forward

Description of skill

Propelling a manual wheelchair over flat hard ground in an efficient manner.

Justification

This is a basic skill around which all others are based. By developing good habits at this point the wheeler is more likely to attain a higher level of functioning in a manual wheelchair.

Ideal Set up

Minimal rolling resistance.
Anti tippers and chest straps can be used to make the wheeler feel secure.

Teaching points

Researchers at the University of Pittsburgh [cite or point to www as footnote] identified 4 distinct wheeling techniques.

Arc | Single Loop Over Propulsion SLOP | Semi Circular SC | Double Loop Over Propulsion DLOP

Most wheelers will be able to wheel using an ARC stroke. In fact this is the way most people automatically start to wheel their chairs.
Single loop over propulsion requires better coordination.
Semicircular requires better balance or trunk stability.
Double loop over propulsion requires better coordination.

Each technique is a valuable tool to the wheeler. No particular style is the “best”. The most efficient technique is dependent on the speed, terrain, and ability of the wheeler. The wheeler should be taught as many ways of propelling the chair as possible.
The objective, as always, is to move as efficiently as possible.

Regardless of the technique being taught the following teaching points apply:
Some people like to grip the push rim and wheel, this provides increased traction and a lower gear ratio (like the big gear ring on the back of a bike). Once underway, the wheeler should be encouraged to use the push rims.

When starting to wheel the wheeler should hold the push rim slightly forward of the top.
As speed increases encourage the wheeler to reach further back and hold on longer to increase the arc
Keep the cadence down, encourage coasting. This is, after all, the main benefit of a wheel.
Keep the chair rolling; initiation of movement takes much more energy than maintaining it.
Keep the chair straight, making large corrections decreases effectiveness of stroke.

When teaching forward wheeling, do not confuse the wheeler with detailed descriptions of the four techniques. Let the wheeler wheel naturally, then use your knowledge to help refine technique, efficiency, and introduce alternatives if the situation and their ability warrant. Do not limit your wheeler to these techniques; there are other wheeling styles appropriate to different circumstances. Use this information to help your wheeler develop various wheeling styles which are efficient in different situations.

Arc

This is a basic style where the wheeler grasps the push rims and moves their arms forward in an arc to achieve propulsion. The recovery phase involves releasing the push rims and allowing the hands to slide back along the rims to the starting point.

The Arc technique is particularly suited to manoeuvering in tight confines or while travelling slowly. It is also a good technique for people who, for whatever reason, have difficulty finding the push rims. The reciprocal (forward-backward) motion of the shoulders is tough on the shoulders and may lead to early repetitive strain injuries (RSIs) if used for travelling over long distances at speed.

During the recovery phase (hands move backward) do not let the wheeler drag their hands on the push rims excessively since this has a braking effect which slows down the chair.
In confined spaces the fact that the wheelers hands are on the rims all the time allows very precise control of the chair.

Single Loop Over Propulsion (SLOP)

With the SLOP style of wheeling, the wheeler completely releases the wheel and recovery occurs above the rim. Flexing the shoulder joint and extending the elbows produce propulsion. Recovery involves extension of the shoulder and flexion of the elbows.

Generally SLOP is a little more efficient than the Arc style. There is no braking effect from having the hands in contact with the rim during recovery. However, the limited time spent in contact with the rim during each

stroke makes it an inefficient technique for long distance wheeling. It is often used when the wheeler has to reach a long way for the rims. For example, armrest pads are in the way, or the chair is too wide, or the seat is high relative to the wheels.
It can be an effective technique to use on carpet or other soft surface since most of the wheeler's weight is kept over the drive wheels, which offer less rolling resistance than the casters.
Encourage longer contact with the rim at the end of the stroke by leaning forward a little. The wheeler can help to get their trunk back to vertical by a strong push at the end.

Semi Circular (SC)

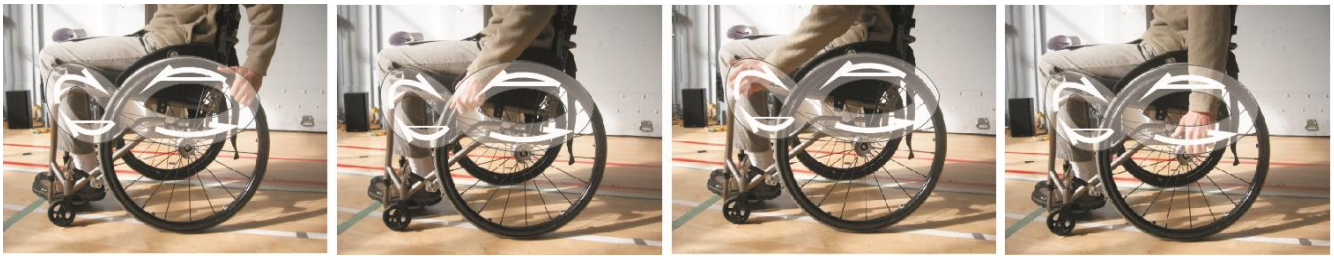
The SC style is characterized by a longer push stroke; the rim being released and recovery occurring below the push rim.

This style is used when the wheeler is in an open space and doesn't have to keep changing direction. It is an efficient technique similar to the one used by track athletes. The wheeler spends more time in contact with the rim and the recovery phase allows for the shoulders and elbows to relax a little. The circular action at the shoulder joint is probably less traumatic than either the Arc or SLOP styles of wheeling. In order to wheel using the SC technique the wheeler must have good trunk stability either through motor control, seat/back design, or postural alignment.

Slow down the cadence of the stroke.
Relaxing the arms during the brief recover phase is important.
Pick up the push rim as far back as possible.

Double Loop Over Propulsion (DLOP)

With the DLOP style of wheeling, the wheeler completely releases the wheel with a bit of a flick and initial recovery occurs above the terminal contact point on the rim. The arms then relax and are allowed to swing back using their own pendular action to pick up the push rim behind the line of the shoulders ready for the next stroke. It sounds and looks complicated but is probably the most efficient stroke for wheeling distances.



This style of wheeling is most effective when the wheeler incorporates a fore/aft motion of his centre of gravity. As the hands approach the end of the push phase the wheeler leans forward to add their body weight to the propulsive effort, trunk recovery and extra propulsive effort is achieved by pushing down hard on the rims and flicking the wrists to push the trunk back into sitting.

Slow down the cadence of the stroke.
Lean forward to lengthen the push stroke.
Flick the push rims down as you release to aid in returning back to an upright position.
Relaxing the arms during the brief recovery phase is important.
Pick up the push rim as far back as possible.

Caster loading can be a problem on carpet or other soft surface. On soft terrain the benefit of using the weight of the trunk to aid in pushing can be overwhelmed by the drag created by weighting the casters.

2. Wheeling Backward

Description of skill

Propelling a manual wheelchair backward over flat hard ground in an efficient manner.

Justification

This is a basic skill all wheelers must attain a level of competency if they are to become "functional". It is not necessary to wheel great distances backward but knowledge of various strategies and the chairs response when going backward will pay dividends down the road.

Ideal Set up

Low rolling resistance.

The wheeler may feel better in a slightly stable chair since slowing down when wheeling backward may have a tendency to make the chair tip.

Anti tippers and chest straps may be used to make the wheeler feel secure.

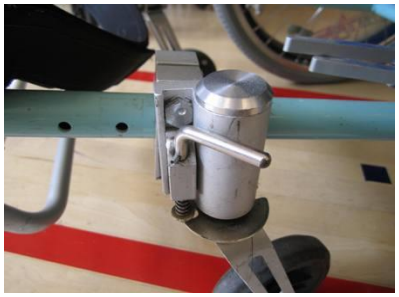
Teaching points

It is important to teach as many alternative techniques as possible to give the wheeler more alternative methods of getting out of situations.

Keep the chair straight

Bear in mind a wheelchair does not want to go backward at speed and given the chance will suddenly turn so the casters are at the front. Applying caster locks or tightening a caster stem bolt, forcing the chair to roll straight will allow the wheeler to work on technique.

Keep the chair straight



Caster lock deployed

Stem bolt

Asymmetric arm action

Asymmetric arm action

As previously mentioned it is easier to keep the chair rolling than coasting to a halt and starting again every push. Once the chair is rolling many people find asymmetric arm action provides better control and power.

Alternative Techniques

If grip strength is compromised there are a number of alternative techniques which may be employed.

Hooking arms behind push handles

If balance is compromised flexible wheelers can hook both elbows behind the push handles and push down on the tops of the wheels. By effectively fixing the wrists the wheeler can use reverse origin / insertion action of their biceps to extend the elbow.

Using tops of hands to hook under push rims

Allows the wheeler to pull the wheels backward using biceps in a more conventional way.

Hooking one arm at a time

This is slow but may be the best way for some people to move backward if they have difficulty balancing.

Hooking arms behind push handles

Top of hands under push rims

3. Turning Corners

Description of Skill

Changing the direction of a moving wheelchair by a given amount at a specific location, using as little energy as possible.

Justification

This is a basic skill without which a wheeler is confined is restricted to non functional wheeling, e.g. exercise only. Different circumstances call for different techniques to efficiently negotiate hazards. The correct method for a given circumstance is one which allows the wheeler to enter, negotiate, and exit from a turn at the speed they choose while expending the minimum amount of energy.

Ideal Set up

Minimal rolling resistance.
Anti tippers and chest straps may be used to make the wheeler feel secure.

Teaching points

Decelerating Inside Wheel

From a medium speed roll; slowing down one wheel will turn the chair, this is the method of choice if the chair has to be slowed to make a turn. The resulting turn is fairly sharp.

Accelerating Outside Wheel

If the chair does not need to be slowed and the turn only needs to be gentle; less energy is wasted by increasing the speed of the outside wheel.

Combination of Two Wheels

This type of turn is most effective when the chair is stationary. One wheel is pushed forward while at the same time pulling the other backward. The turn is very sharp and requires the least amount of space.


Braking inner wheel


Accelerating outer wheel



Combined braking inner and accelerating outer

Using Walls, Posts, etc.

Making a turn with a radius whose fixed point is outside the base of the chair allows the wheeler to turn without significantly reducing speed, thus conserving energy. This is achieved by holding walls and pillars as you pass them. If the wheelers hand contacts the wall in front of the axle the chair will turn away from the wall. Conversely, if the hand is behind the axle the chair will turn into the wall.


Slide hand along wall


Press to initiate turn


Adjust pressure …


… to control direction

There are other ways to turn a wheelchair which are not used every day, but nevertheless being familiar with them will not hurt and may help in some circumstances.

Using Wheel Locks

A chair speed and direction can be controlled by gentle application of the wheel locks while descending a moderate incline. This technique reduces wear and tear on wheelers' hands at the expense of wear and tear on the tires.

Using Casters

On a gentle grade the wheeler can lean forward on their thighs and steer by grasping the caster forks and gently turning them. The wheeler should take care to avoid putting fingers in the caster wheel. Only one fork needs to be turned. This is more of a trick than a practical technique but it never hurts to know alternatives.


Using wheel locks on moderate incline


Steering with the casters

Timing of Turn (Axle Past Obstacle)

When practicing turns, for example zig zagging through pylons, many wheelers are unclear when to commence their turn. The turn should be started after the rear wheel axle passes each pylon, keeping the axle in front of the pylon throughout the turn.

Keep straight past pylon

Initiate turn when rear wheel past

Keep both wheels rolling

4. Ascending inclines

Description of skill

Propelling wheelchair up slopes of varying grade and fall lines.

Justification

Ability to contend with sloped surfaces is a basic requirement for independent outdoor wheeling. Teaching alternate strategies for steep slopes and developing a problem solving approach to obstacle negotiation will open up more of the wheeler's environment.

Ideal Set up

Low rolling resistance.
A slightly stable platform will make the chair less likely to pop a wheelie when applying power.
Anti tippers and chest straps may be used to make the wheeler "feel" secure.
Hill holders may help wheelers with a slow arm stroke recovery phase.
More traction between the hand and hand rim may be needed compared to wheeling on level terrain.

Teaching points

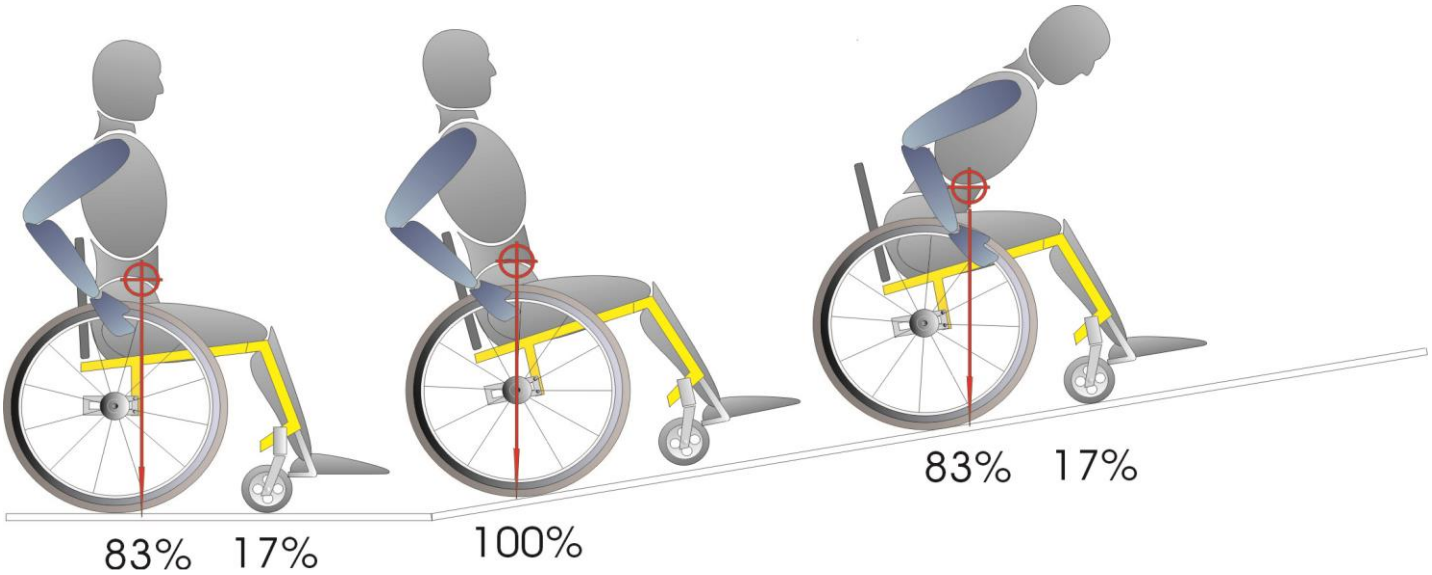
Spotting

The clinician should always position themselves below the wheeler. A runaway chair is easier to stop that way.

Centre of gravity changes

Be aware of the change in the chair and wheeler's centre of gravity. Inclines make a chair more likely to tip.

Encourage the wheeler to lean into their power stroke more than they do on the flat; the weight of their trunk will assist in the climb, and recovery will be easier since the wheels provide more resistance allowing the wheeler to push their trunk back up. Leaning forward will also help to keep the casters on the ground.



Weight distribution on flat Chair tippy on incline Leaning forward allows extra power to be used

Keep the wheels rolling

Initiation of movement takes a lot more energy than maintaining it. Take a run up and try to keep the wheels turning.

Zig zag

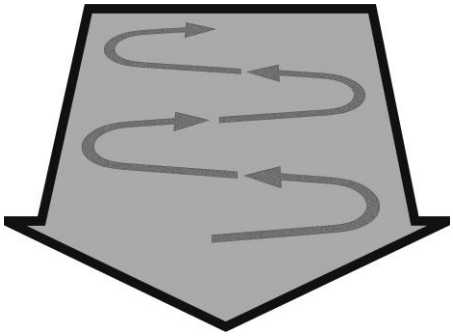
Ascending a hill in a series of switch back turns provides a series of less steep 'slopes'. If possible the wheeler should try to turn uphill at the end of each traverse; if the wheeler isn't strong enough they can put on their down hill wheel lock and let the chair roll back to face the other way. The effective pitch of the hill decreases in proportion to how wide you make your zigs. So when ascending a 10 degree side slope at a shallow angle it may effectively become a 2 degree hill. Remember however, the wheeler then has to deal with a significant side slope - see Section 6 page 22.

Hill holders

Hill holders can be applied to stop the chair rolling backward during the recovery phase.
If hill holders are not fitted the clinician may use their foot to prevent the chair from rolling backward after each forward stroke.

Fail Safe

If the chair begins to roll backward it is safer to stop one wheel and have the chair turn across the hill rather than jamming on the wheel locks and risking a tip.



ZIg zag up the hill

Side slope has to be handled

Hill holders prevent roll back

5. Descending Inclines

Description of Skill

Controlling wheelchair down slopes of varying grade and fall lines at a chosen speed.

Justification

Ability to contend with sloped surfaces is a basic requirement for independent outdoor wheeling. Teaching alternate strategies for steep slopes and developing a problem solving approach to obstacle negotiation will open up more of the wheeler's environment.

Ideal Set up

Minimal Rolling Resistance.
A chair which is tippy on flat surfaces will be easier for the wheeler to control while descending hills.
Anti tippers and chest straps may be used to make the wheeler feel secure.
More traction between the hand and hand rim may be needed compared to flat wheeling.

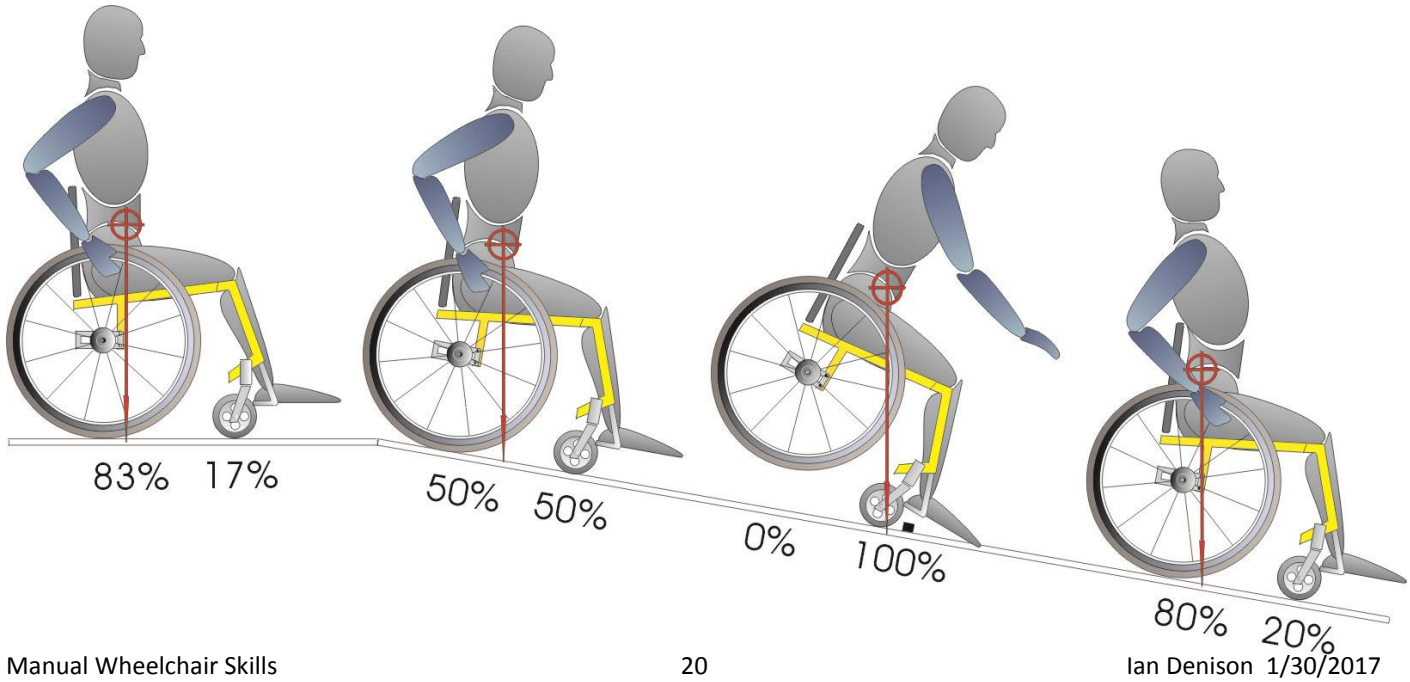
Teaching Points

Spotting

The clinician should generally position themselves to the side of the wheeler; this allows the spotter to prevent a runaway chair and/or stop the client from losing their balance forward. A runaway chair is easier to stop that way. It might be more appropriate in some instances to be behind the wheeler and control them with the push handles. If this is the case ensure the push handles are secure. Or secure a spotting strap to a secure point on the frame, the lower the better to reduce the chance of tipping backward.

Centre of Gravity Changes

Be aware of the change in the chair and wheeler centre of gravity. Reduced weight on the rear wheels equates to less traction and control. Descents make a chair more likely to tip forward particularly a chair with a short wheelbase and small casters. Leaning backward will aid in maintaining traction and reduce pitching tendency.



Wt. dist. on level ground Less weight and traction Increase pitch tendency Leaning restores control

Speed Control is Critical

Keep speed to a level where you know the wheeler can stop safely.
Use gloves if friction burns are a possibility.
If the chair starts rolling forward too quickly, it is often easier to stop one wheel and have the chair turn across the hill rather than trying to grab both rims.
Caster flutter can be beneficial; the fluttering will slow the chair to a more manageable speed.

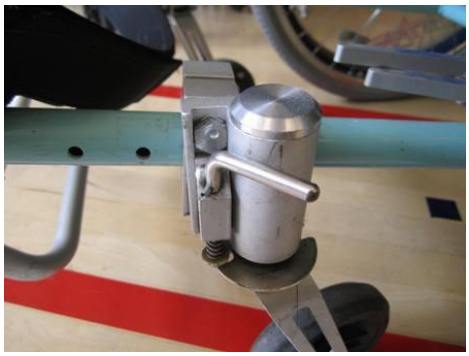
Zig zag

Descending a hill in a series of switch back turns makes the incline less steep. If necessary, the wheeler should come to a complete stop before trying to turn downhill at the end of each traverse because this is where the chair will speed up. If the wheeler isn't strong enough to hold the chair they can put on their down hill wheel lock and let the chair roll back to face the other way.

Caster Lock

If the wheeler uses their caster locks to keep the chair from turning down hill as described in Section 6; do not forget to take off the caster lock after applying the wheel lock to make the turn at the end of the traverse.


Zig zagging down a hill reduces the effective steepness



Caster locks can prevent turning

6. Side inclines

Description of skill

Propelling wheelchair along side slopes of varying grades at a chosen speed

Justification

Ability to contend with cambered sidewalks and roads is a basic requirement for independent outdoor wheeling. Teaching strategies for side slopes will open up more of the wheelers environment and reduce the amount of energy needed to wheel any distance.

Ideal Set up

Minimal rolling resistance.
A chair which is tippy on level terrain will have less inherent tendency to turn down hill.
More camber makes the chair less prone to turning down hill on a side slope.
Anti tippers and chest straps can be used to make the wheeler feel secure.
More traction between the hand and hand rim may be needed compared to flat wheeling.

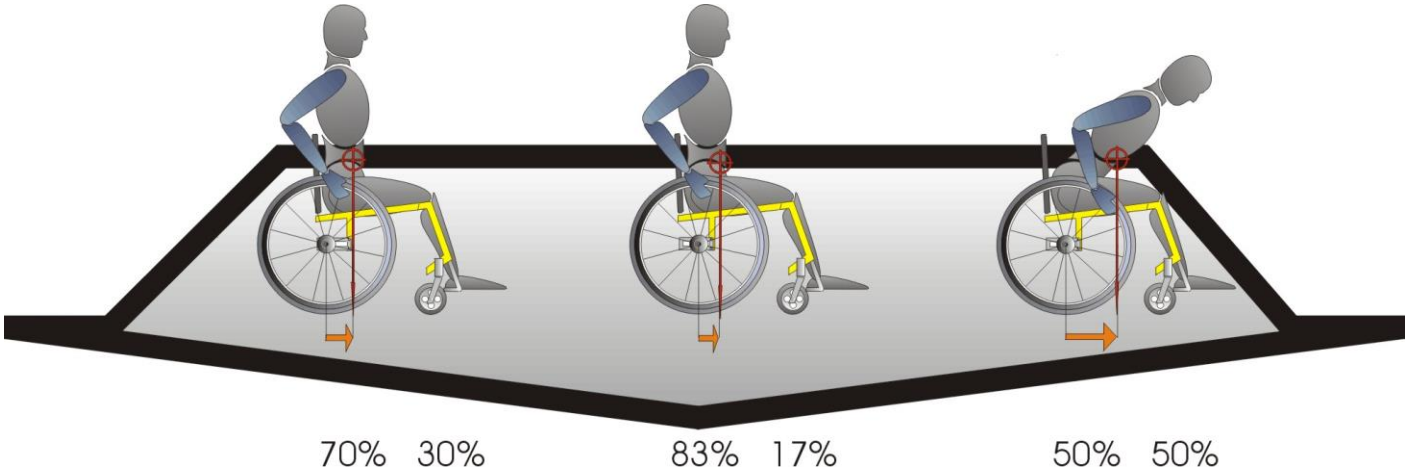
Teaching points

Spotting

The clinician should generally position themselves on the downhill side of the wheeler. This allows them to prevent a runaway chair and/or stop the wheeler from losing their balance sideways. If the wheeler loses control of the chair it will turn toward the spotter and be easier to set back on track. It might be more appropriate in some instances to be behind the wheeler and control them with the push handles. If this is the case ensure the push handles are secure.

Centre of gravity

More weight on the casters will make the chair turn down hill. The wheeler needs to keep their weight as far back as possible; this can be achieved by leaning back over the seat back as you wheel. Avoid leaning into push strokes to get more power.



Stable chairs turn down hill Tippy chairs tend to track better Leaning forward increases turn tendency

Wheel Speed Differential

If the side slope tends to turn the chair to the right it is due to the left wheel going faster and the right wheel has to have more power applied to it to keep the chair rolling in a straight line. If the side slope happens to be on a downhill stretch applying braking effort to the left wheel will achieve the same effect with less effort.

Cadence

Increasing the frequency of push strokes with a little more oomph on the down-slope wheel will help to keep the chair running straight which in the long run requires less effort than getting the chair back on track after it has deviated significantly.

Caster locks (if fitted)

Applying the caster lock on the down slope side will tend to keep the chair running straighter. It might be a good idea to set the right caster lock to give the cheer a slight tendency to turn left when deployed and vice versa for the left one.

7. Escalators

Description of skill

Using an escalator both up and down

Justification

In department stores, transit systems, and airports escalators are usually located centrally and are easy to see compared to elevators, which are generally tucked away in a corner. Since learning to independently use an escalator is a fairly simple task many people will find more independence and improved access. In some areas wheeled devices like strollers and wheelchairs are not allowed on escalators, so check your local listings.

Ideal Set up

Longer wheelbase makes the angle the chair assumes less steep.
A stable chair will be easier to hold mid span.
No anti tippers, the chair may even go beyond the balance point.
Large casters may make the dismount at the top less perilous.

Teaching points

Demonstration

This is one skill where a demonstration proves well worthwhile. Some degree of reticence may exist and the assurance of observing successful technique is frequently appreciated.

Spotting

The clinician should always be below the chair on the escalator. Anticipate what the possible consequences are at each stage of the process and be prepared to provide appropriate physical support. Most likely to occur spotting interventions are described in the text adjacent to each segment.

Ascent

Spotter stands behind the wheelchair.
Don't rush - there is a natural tendency to panic.
As the front wheels are lifted upward allow the chair to roll back slightly as it finds a stable configuration.
Wheeler must lean forward and grasp the moving handrail to prevent rolling or tipping.
It is not necessary to hang on providing you lean forwards far enough to prevent tipping. This is only mentioned to emphasize how little strength is needed. I do not suggest you try this at home.

Spotting

Spotter stands behind chair to prevent tipping (note short wheelbase chairs go up and down escalators in a steeper attitude than long wheelbase chairs).
Do not stop the chair from finding its stable configuration.

Roll on to the escalator letting the chair settle

Lean forward to prevent tipping

Technique is more important than strength

Sit up at the top to lighten the casters

Dismount at top

At the top, the escalator naturally flattens out and the chair regains a level attitude, the wheeler sits up. If the wheeler has no trunk muscles; they can put their hands on wheels and push up the little step.
If the wheeler has trunk control; hold on to rail and pop the front end over little step with an abdominal contraction. There is no need to panic at the top the chair will just stay there with the casters resting against the little transition until you push up over it.
The only urgency at this point occurs if there is someone behind the chair who will likely rear end the wheeler when they get to the top.

Spotter

Beware of the little lip at the top. If the wheeler has weight on the casters and is holding on to the moving rail the chair will stop and they could be pulled out of the chair. If this happens the spotter can give the chair a push to get it over the transition, naturally you should try and avoid this by making sure the wheeler knows not to hang on to the moving rail at all costs. The wheeler can actually sit up nearly all the way and stay in place with wheels spinning backward indefinitely. The spotter must walk backward at this point otherwise they will fall over the stationary chair.

Descending

Wheeler backs on and holds on to the moving hand rail. Allow the chair to roll back slightly until a stable configuration is achieved. Chair will naturally tip until it reaches the appropriate attitude the spotter just stops the chair from tipping too far, the wheeler leans forward holding onto the rail.

Dismount at bottom

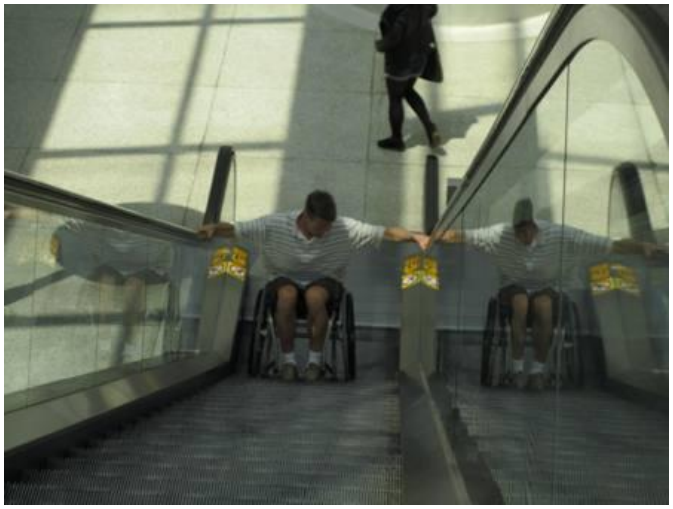
At the bottom, the wheeler sits up almost all the way and allows the rail to push them off.
Beware of the little lip at the bottom; if the wheeler sits up too straight the chair could tip backward. There is no need to panic at this point since the wheels will continue to roll backward until enough force to get over the transition is applied.

Spotter

Before the wheeler gets on the escalator the spotter backs on to the escalator and walks forward to keep station at the top facing the wheeler. Their job is to prevent the chair from tipping backward. Just as with ascending the spotter should let the chair settle once on the escalator. At the bottom there is a tendency for the chair to tip backward at the transition particularly if the wheeler sits up too straight and lets the moving hand rails push them back.

Roll back , hold on, let the chair settle

Lean forward to prevent tipping



Sit up part way and use the moving rail movement to bump the chair over the transition

8. Soft and/or Uneven Terrain

Description of skill

Negotiation of various surfaces such as grass, carpet, gravel, sand, etc.

Justification

Being exposed to these surfaces gives the wheeler an opportunity to develop a problem solving approach to situations which will stand them in good stead for unexpected circumstances.

Ideal Set up

Minimal rolling resistance, wide soft tires on casters and drive wheels, which will minimize resistance.
Reducing tire pressure will make the chair easier to push.
A chair which is tippy on flat surfaces will tend to wheelie in soft terrain which removes any induced drag from the casters.
More traction between the hand and hand rim may be needed compared to flat wheeling.


Soft tire(L) floats on surface

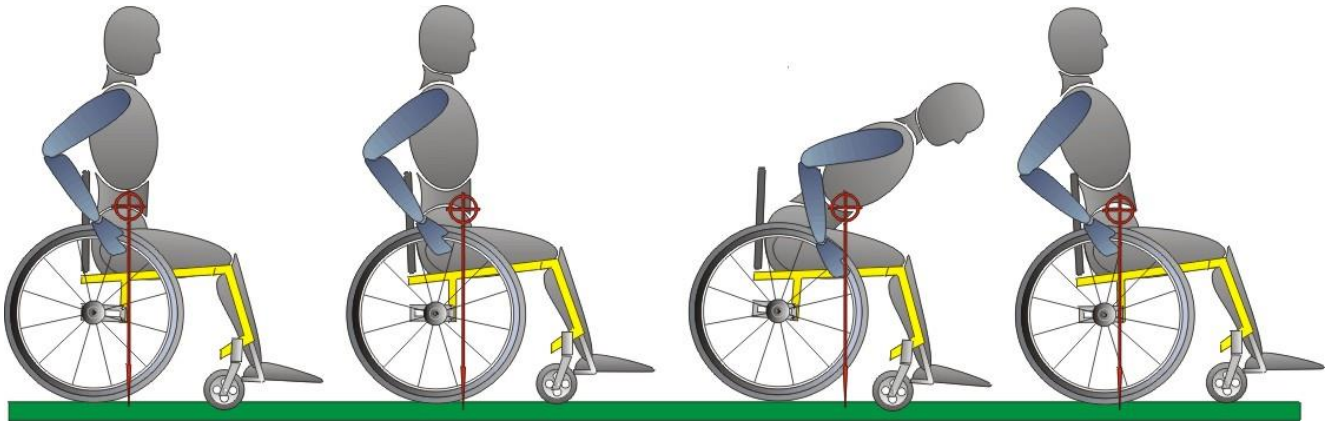

Tippy chairs casters tend to float


Weight on casters causes drag

Teaching points

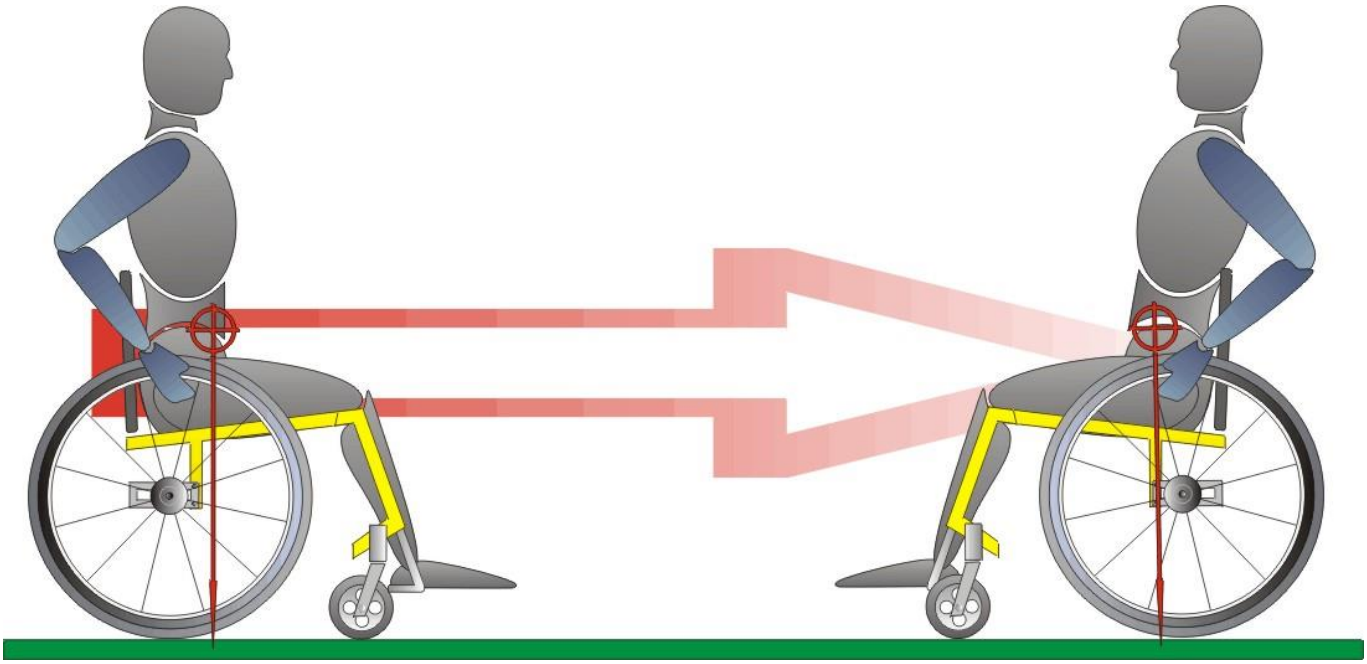
Weight on the big wheels

The large rear wheels offer less rolling resistance than casters. The wheeler should use body lean to transfer as much weight as possible onto the driving wheels.
The wheeler should not be encouraged to perform a forward trunk lean to get more power into his stroke. Leaning forward provides diminishing returns, due to increased weight on casters.


Stable chair casters drag Tippy chair, less drag More power & drag (net –ve) Less power, less drag (net +ve)

Backward may be easier

Wheeling backward takes less energy as the casters are pulled up and over obstacles rather than being pushed down and into them. Most people lean backward while wheeling backwards, shifting weight onto the drive wheels. With the casters trailing; the wheelbase is longer and the ratio of weight on the casters is reduced. However, the wheeler may be significantly stronger at wheeling forward so this needs to be assessed on an individual basis.



80% on rear, leaning into stroke pushes casters down 90% on rear power leaning into stroke lifts casters up

Keep rolling

It is much easier to keep a chair rolling than to have to start from a dead stop each time; encourage a speedy recovery phase to keep the wheels turning.

Make gradual changes of direction while rolling or pop the front wheels to turn sharply if stopped.

9. Small Curbs

Description of skill

Ascending a curb without the wheeler being able to hold their wheelchair in the balance position.

Justification

Small surface irregularities are a fact of life and being able to cope with them without using significant energy is a necessary skill for outdoor wheeling.

Ideal Set up

A chair which is tippy on flat surfaces will be easier to "pop" than a stable one.
Anti tippers and chest straps may be used to make the wheeler feel secure.
Large casters will be more forgiving of poor timing.
Back height should be a compromise; providing support and allowing adequate trunk range.

Teaching points

It is beneficial for the wheeler to learn a number of ways to pop the wheels so when faced with the situation in real life they will hopefully be more prepared to cope. Accelerating the chair would seem to be the most logical technique; in fact, it is only useful when travelling at relatively slow speeds. If for instance a wheeler is rolling along a sidewalk at a fast clip and notices an irregularity the casters need to clear, they may not be able to accelerate the wheels adequately to lift the front end. It is also counter intuitive in that the natural tendency is to slow down when approaching an obstacle not speed up. Shifting centre of gravity quickly will lighten the casters regardless of speed.

Practice lightening front end while moving

Transferring weight from the casters to the rear wheels will allow them to roll up and over the face of the small curb. This can be achieved by:

- Acceleration of the chair (a quick push);
- Swinging the arms back; and
- Quick extension of the trunk against the seat back.

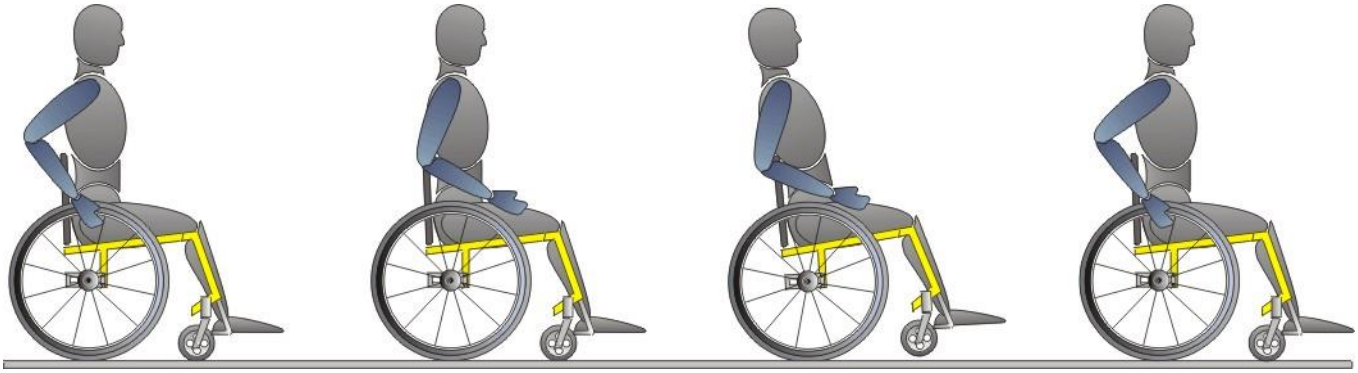
Momentum reduces the energy required to ascend a small curb. Acceleration becomes more difficult as the speed of the chair increases; the wheeler will have to rely more on weight shifts. Encourage the wheeler to use their trunk to lift or at least lighten the casters since this will allow a more relaxed, energy efficient completion of the task. Wheelers can hold onto their seat if necessary for balance. Allow just three pushes, and then let go of wheels, coast for a short distance, then "pop" casters off the ground without touching the wheels.

Pop wheelie over lines

Once the wheeler is able to lighten the casters sufficiently to pop a small wheelie they need to practice popping the casters at a predetermined spot. E.g., roll forward and lift the front wheels over a line on the floor. Practicing this skill with painted lines rather than real curbs means the wheeler will not get pitched forward out of the chair if they miss their timing. This skill should be mastered before progressing to actual obstacles.

Timing of Weight Shifts

Once the wheeler has figured out how to pop the casters at a predetermined point; separate wheeling and popping. Allow three pushes then let go of the wheels, coast for at least two chair lengths , then pop casters over line.



Push three times | Coast with hands off | Pop casters off ground | Resume pushing - repeat

Then try three pushes, let go of wheels, pop casters over threshold of a 1” curb.

Concentrate on timing and caster clearance first, getting the back wheel up does not require a push; it requires a well timed weight shift from the rear wheels to the casters at the appropriate time. If the wheeler pops the casters too much, the rear wheels will hit the obstacle with the casters in the air and cause the front end to pitch down quite violently. Ideally the casters should have landed on the upper surface before the rear wheels hit. If the wheeler also leans forward a little before rear wheels hit, the chair will roll up a medium sized bump without any arm effort.

Perfecting this skill pays dividends and the wheeler will find they are safer and less tired if they can pop the casters at will without the use of their arms.

Pop rolling wheelie | Casters land before rear wheels hit | Lean forward to roll up

The same skill can be accomplished with anti tippers in place if the casters can clear the obstacle. This allows the wheeler to be less subtle with his weight shift.

Client throws weight back | On approach to curb | Landing on top | then leans / falls forward

Hard Surface

Use therapy mats to increase the size of the assumed curb in 1” increments. This is handy to tailor the curb to the wheelers ability and allows practice indoors - the soft surface of the mat makes the skill more difficult. A ¼” sheet of plexiglass or lexan or an under desk carpet protector on top of the mat will serve to stop the casters from digging in when the weight is transferred forward and makes the task easier.

10. Down Curbs Backwards

Description of skill

The wheeler is able to safely descend curbs with as much as a 6" drop.

Justification

This is a relatively simple skill which allows people access to more of their environment. It does not require great strength, balance, or timing and should be taught to all manual wheelchair users.

Ideal Set up

Minimal rolling resistance.
A stable chair will provide the wheeler more control descending the curb.
Pneumatic tires and casters will make the landing softer.

Teaching points

Establish hip flexion

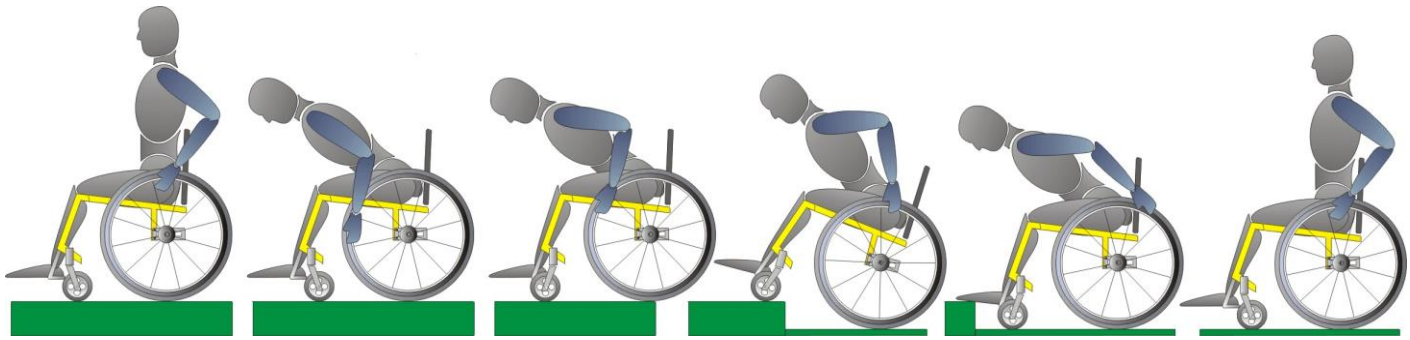
To prevent tipping over backward on larger curbs the wheeler must flex at the hips. If possible it is desirable to rest the wheeler's trunk along their thighs.

Get comfortable on the edge

Practice getting the feel of both wheels teetering at the edge together. Roll back and forth to feel when both wheels are lined up. Descending one wheel at a time should be discouraged; it really challenges the wheeler's balance and can tip the chair on higher curbs.

Clinician should stand behind the chair

Roll backward off the curb with both wheels at the same time and let the chair continue to roll; do not let the wheeler sit up until the chair stops.
Sitting up while the casters are on the higher surface or stopping the chair too quickly could cause an unexpected wheelie and subsequent headache.



Lean forward the entire time; ensure both wheels come off the edge simultaneously.

Control descent; try to stop roll before casters drop.
Once the previous step is mastered, try stopping the chair before the casters hit the ground. (Do not sit up until the chair has stopped, even if the casters drop off.) This allows the wheeler to control the speed of the descent and subsequent distance rolled. It is also easier on the equipment, environment, and ears.

Turn chair off to side or scrape off by dragging backward

Reversing the chair off is easy to do, but hard on the wheeler's body as the casters bang down, and hard on the chair as the footrests scrape the curb. Turning off to the side lowers the chair down slowly and orients the chair appropriately for the wheeler's continued journey.

Lean Forward

Roll backward until both wheels touch lip

Make sure both wheels at edge

Stop chair before casters fall

Turn keeping one caster up

Continue turn, sit up as casters lower

11. Balance Position (aka Wheelie)

Description of skill

Ability to maintain a balanced position with only the rear wheels in contact with the floor.

Justification

This is the gateway to advanced skills. The ability to achieve, hold, and roll while in a wheelie position is fundamental to the following skills.

Ideal Set up

A chair which is tippy on flat surfaces will be much easier to wheelie.
More traction between the hand and hand rim may be needed.

Teaching points

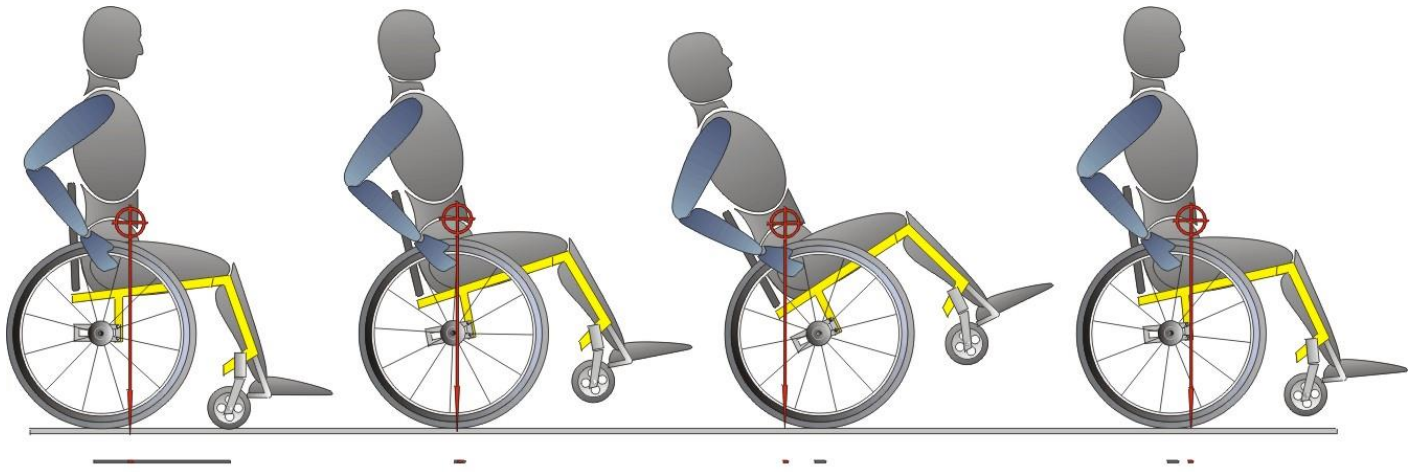
* Separate attaining a wheelie and holding wheelie.

Holding the wheelie

Many people struggle with learning to do a wheelie because they fail to break the skill down into the fundamental parts. Instead of starting with all wheels on the ground, the wheeler should be put into the balance position and given an opportunity to practice holding their balance.

Centre of gravity within base of support

For a chair to balance, the centre of gravity of the chair and wheeler must be within the base of support. If the base of support is the rear wheels, the wheeler and chair must be put in a position where half their combined weight is behind and half is in front of the tires contact patch.

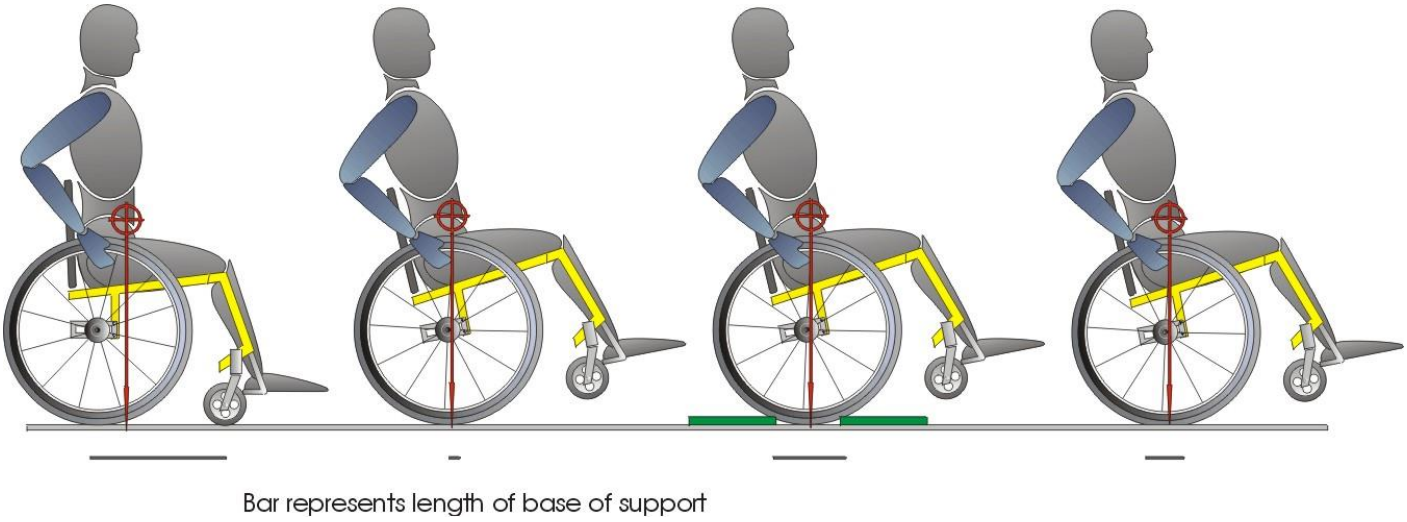


Grey shows base of support red shows rellative position of c of g

C of G within base | Chair is stable | Wheeler will tip back | Wheeler will tip forward

Increase base of support

The time taken to learn a wheelie can be dramatically shortened by providing the wheeler with a large base of support and incrementally reducing it. This can be achieved with therapy mats on either side of the rear wheels, or by letting air out of the tires. The increased contact patch makes maintaining the balance point much easier and gives the wheeler an opportunity to feel what effect his corrections have without falling out of the wheelie.



Chair on four wheels Tires pumped up (100psi) Mat on either side of tire Deflated tires (- 10psi)

Show how balance position varies with wheeler and configuration

When learning to balance, people often want to know how high the caster is supposed to be above the floor. This is not a fixed value, it varies based upon chair configuration and the wheeler position. Someone else should demonstrate this, so the wheeler can observe how the balance point is affected by trunk position.

Sitting straight Leaning forward Different person same chair

Isolate input

Arm action, trunk lean, and swinging legs all affect balance. Work on one element at a time; do not permit the wheeler to swing their legs or lean forward until they have mastered maintaining balance with hands only.

Relaxation is crucial

If the wheeler has a death grip on the push rim, they will not be able to produce the fine control needed to keep a chair balanced. Any time a wheeler shows white knuckles they must be encouraged to relax.

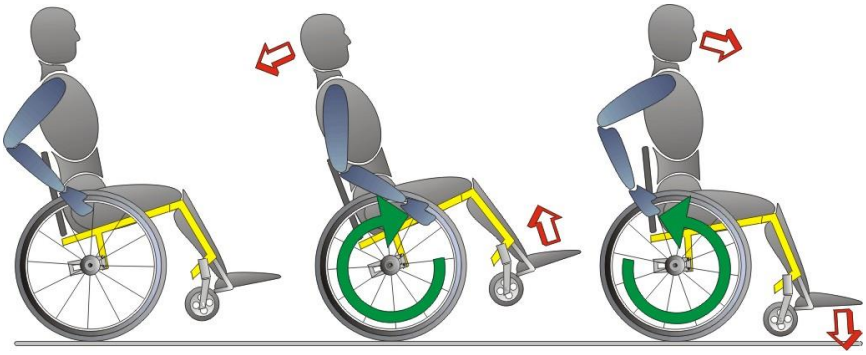
Anticipate movement

When someone relaxes they are able to anticipate movement of the chair and make very small corrections.

Hand action

Push forward if falling forward / pull backward if falling backward. If in doubt pull back.
The wheeler should let the push rims rim slide through their hands, keeping hands close to mid range. This allows them to make either a forward or backward correction.

No white knuckles



Pushing forwards will tip the chair back, pulling back tips chair forward

Spotting

Stand behind if wheeler has poor trunk control, spotter can hold handles or a strap attached securely to the chair; usually the rigidizer bar or the axle bar. You can also spot by kneeling to one side of the chair. This technique provides the added benefit of assuring the wheeler that you are indeed paying attention.
Touch shoulders for feedback.
When the wheeler has some sense of the balance point, they need to be able to feel how much help the clinician is providing and in which direction. The clinician can place their hands on the wheelers shoulder to provide anterior and posterior pressure as needed. The wheeler will feel this and know when they are being helped. The spotter can make some corrections using this technique but it is not as secure as the other two methods.

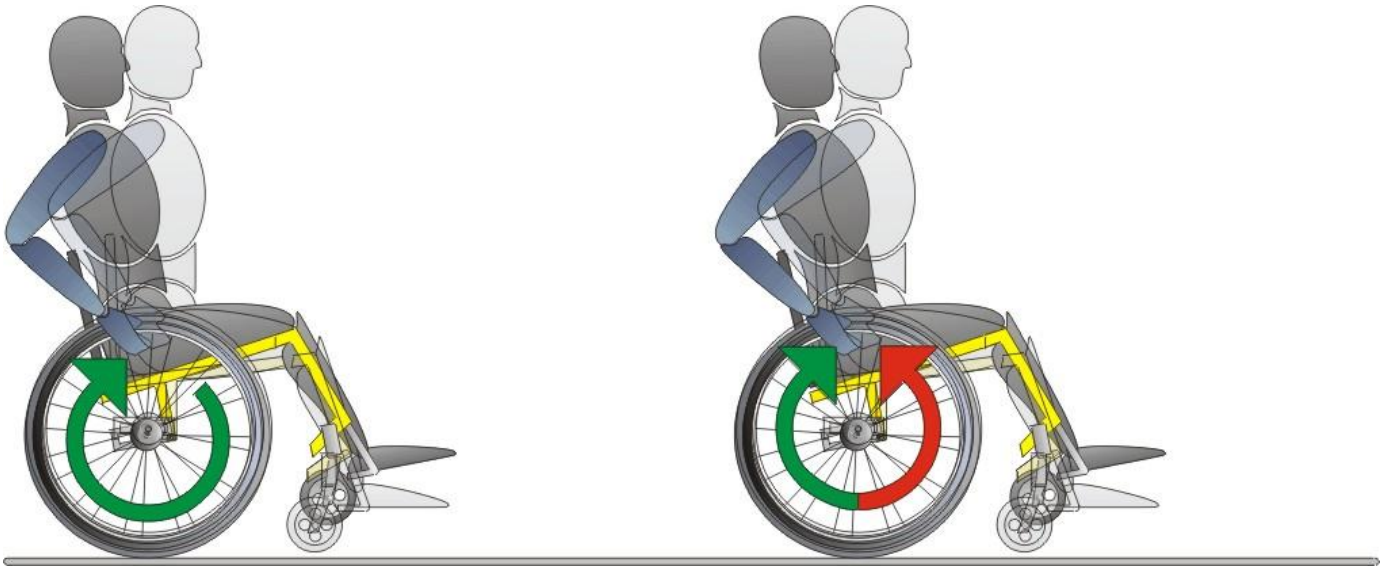
Hold handles or a strap

Spotting from the front/side

Provide feedback through shoulders

Attaining the wheelie

Once the wheeler has become proficient at balancing, the next step is to learn how to get up there.
A wheelie is the result of acceleration on an appropriately set up chair.
Rolling backward then firmly forward takes the least effort to provide the needed acceleration,
Rolling backward at 1 unit followed by a smooth, quick transition to 1 unit forward is the same as accelerating by 2 units from a standing start.



Wheeler can push quickly forward Or roll backward and then forward with much less power

Relax before failing

When the wheeler holds the balance position for a few seconds, take over and put them back down onto all four wheels before they lose their balance, success breeds confidence.

Moving forward in a wheelie

Once a wheeler is able to maintain the balance position they can practice balancing while rolling. This is achieved by falling forward slightly and then rolling forward to keep the chair balanced.

Moving backward in a wheelie

Once a wheeler is able to roll forward in the balance position they can try balancing while rolling backward. This is achieved by falling backward slightly and then rolling backward to keep the chair balanced. This is much more difficult than rolling forward and the spotter should be ready to catch the wheeler even though they may be very good at maintaining a stationary wheelie.

A variety of challenging tasks can increase the wheelers comfort and competence in the balance position.
Balancing with one hand makes the wheeler really concentrate on finding the exact balance position.
Balancing while clinician applies displacing forces to chair make the wheeler really focus and make quick albeit accurate corrections.
Balancing with the casters at different heights illustrates how trunk position affects the balance position
Slaloming around obstacles while balancing challenges rolling control.

Leaning forward increases the balance angle

Leaning back decreases it

12. Up high curbs

Description of skill

Ability to ascend a curb more than 3” or 4" high.

Justification

This is an advanced skill which requires mastery of small curbs and the ability to pop the casters over the curb while moving.

Ideal Set up

See “How to Make it Easier”

Tires should be fully inflated to protect the tubes from “snake bite” flats which happen when the tire compresses against the curb and pinches the tube between the rim and concrete.

Teaching points

Timing

Mastery of this skill requires the wheeler to combine a sequence of discreet, precisely timed elements into one apparently smooth skill. The sequence is as follows:

Propel the chair at an appropriate speed directly toward the curb;
Coast for a short time;
Pop a wheelie so the casters clear the curb;
Land the casters on top of the curb;
Lean forward when the rear wheels hit the curb;
Push the rear wheels forward to get up the curb; and
Sit up as the rear wheels reach the top.

Coast at appropriate speed

Pop wheelie

Land before wheels hit

Lean forward Push on wheels Sit up

Start popping over line no hands

A trunk-initiated wheelie (pop) frees the hands to provide power and balance adjustment at the appropriate time. Rolling along in an open area lifting the casters off the ground at pre-determined lines is good practice. Ensure the wheeler is popping casters over the line not just the footrests.

Low curb - no hands

Progressively increase height of curb until unable to get back wheels up. Concentrate on timing so the casters land on the top of the curb before the rear wheels hit the vertical face. Increased speed makes the timing more critical but it also allows the chair to climb a higher curb.

Allow wheeler to use hands after the casters land

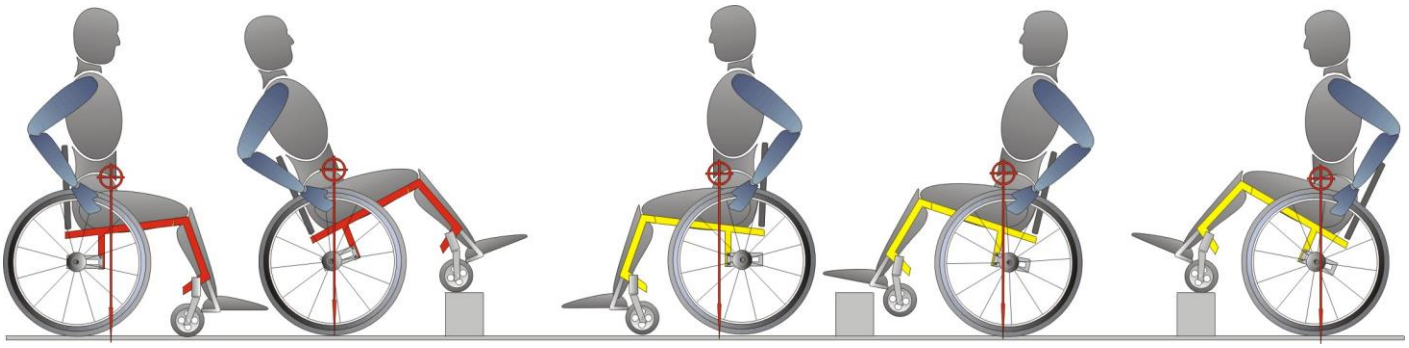
Once the wheeler has consistently demonstrated an ability to pop the casters and land them on the curb prior to the rear wheels hitting, they can then use arm action to roll up and onto the curb. This should occur at the same time as their weight is pitched forward due to the rear wheels contacting the curb.

Technique trumps Power

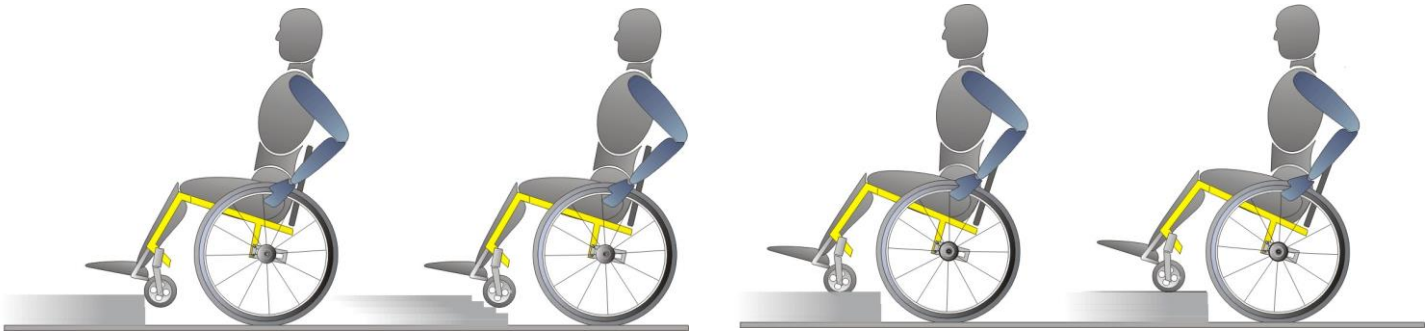
Keep practicing at lower levels to reduce speed and force by improving technique.
Stop pushing well before curb.

How to make it easier

Chair with long wheel base is harder to pop but the casters clear the curb without risk of tipping backward.
Use a tippy chair if difficulty in initiating wheelie.
Use stable chair if difficulty getting adequate clearance; it is harder to pop but the casters clear the curb without risk of tipping backward.
Ramp curb, this allows the rear wheel to roll up with less effort from the wheeler.
If using mats to simulate a curb; put a board on top to allow casters to roll rather than dig in.



Stable chair hard to pop, easy to clear high curb Tippy chair, easy to pop, hard to clear high curb



Straight curb - fail Ramped curb - success Soft curb top – fail Hard curb top - success

How to make it more difficult

Increase height of curb
Minimize run up
Cause run up to occur in a curve
Make riser vertical and hard
Make top of curb soft
Run up on incline

13. Down curbs forward

Description of skill

Descending a curb without having to turn around and reverse down. Some, but not all methods described here require the user to be competent in holding the balance position.

Justification

Mastering this skill allows the wheeler to negotiate curbs quickly i.e. time is not wasted turning around, the technique allows the user to cope with high curbs, or in extreme circumstances a 3 foot loading dock can be negotiated, provided the wheels and wheeler's body are able to cope with the landing impact.

Ideal Set up

A chair which is tippy on flat surfaces will be much easier to wheelie.
Tires should be fully inflated to protect the rims.

Teaching points

Practice getting the feel of both wheels at the edge together

Practice can be done on a 1"- 2" curb. The wheeler must develop a feel for when both wheels are parallel and ensure the chair does not tip to the side. Practice on a low curb reduces the severity of the consequences. Wheels can break if a chair is allowed to land on one wheel and the wheeler may be pitched out even if the wheel does not break.

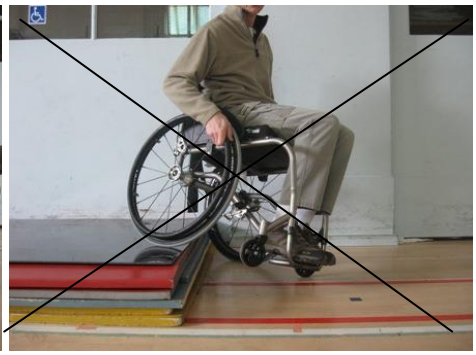
Spotting

Stand to one side of the chair facing the wheeler. This gives the wheeler confirmation you are alert. As the chair rolls off the curb, it will roll toward the clinician rather than away.

Get comfortable on the edge

Spend time balancing with the rear wheels right on the edge of the curb and the casters overhanging. Change the height of the casters by trunk position changes.

Practice on edge of low curb



Ensure both wheels roll off together

Spot from side, facing wheeler

Let front-end start to fall then roll both wheels off together

Try to land on the back wheels just before the casters, or all four wheels simultaneously. If the front end is not allowed to fall forward prior to descent, the chair could tip over backward. If the chair falls forward too much before rolling off the curb, the casters will land first which is harder on the chair and wheeler. It also reduces directional control. Try to land on all four wheels, definitely not front first.

Balance on edge and lower casters

Push forward

Try to land on all four wheels

For smaller drops, pop a wheelie just before the curb and continue: i.e. do not stop.

This makes timing and judgment much more critical. The wheeler accelerates the chair sufficient to pop the casters but not enough to attain the balance point. As the rear wheels clear the edge the casters must be just starting their descent, so the rear wheels land slightly before or at the same time as the front ones. The exact timing is dictated by the height of the curb.

14. Down Stairs backward

Description of skill

Negotiating narrow stairs backward with all four wheels in contact with the stairs.

Justification

A slightly more advanced version of down curbs backward but it is relatively easy if the wheeler has good arm function.

Ideal Set up

The configuration of the chair needs to be matched to the slope of the stairs to make this skill easier. There are too many variables to consider for it feasible to describe here. If the footrests drag raise them up a little, if the casters come off the upper step at the wrong time; change the wheelbase etc.

Teaching points

Wheel backward until able to reach handrail

Establish a position where the rear wheels of the chair are level with the edge of the top step. Holding on to the handrail on each side of the chair controls the descent.

Lean forward onto thighs

As the rear wheels drop down the first step, it is quite possible the chair will tilt beyond the balance position; leaning forward prevents tipping.

Both wheels off together

Keeping straight makes balance much easier and reduces the likelihood of tipping sideways.

Roll to edge of top step

Both wheels down together

May tip beyond balance point

Rear wheels and front casters hit step at different times so be prepared for up to three phases .
First, the rear wheels roll off the step down to the next lower step.
Second, the casters roll off the step and the footrest bangs down onto the top step.
Third and finally, the footrest scrapes off the step.
The phases may overlap depending on the ratio and size of the riser and tread and the wheelbase of the chair.
At the end of one of the phases the chair will be quite stable.
Chair angulations change throughout the phases.
Expect it to be noisy if and when the footplates hit.

Note the difference in angulation at the same point due to the different chair geometries

15. Down Stairs forward

Description of skill
The wheeler descends a flight of stairs, keeping the chair in a balanced position and rolling down the steps. Depending upon the slope the descent may be a free fall or simply a series of curbs.

Justification
This skill allows an advanced wheeler to descend stairs without the use of a hand rail. It is an advanced skill with serious consequences if you fail. Going down stairs forwards should be avoided if possible, but if it is necessary in the wheelers environment it might be necessary to develop the skill in a safe and controlled environment progressing incrementally as the wheeler's mastery of each stage improves.

Ideal Set up
A chair which is tippy on flat surfaces will be much easier to wheelie and balances in a flatter attitude. Tires should be fully inflated to protect the rims.

Teaching points

Spotting
Spot with two people; one above for balance position one below and to side for catching wheeler. The spotter must be careful not to interfere with the chair position unless the wheeler has lost control. Spotter must be careful not to hurt themselves in an effort to save the wheeler. The wheeler has to assume the risk of injury if they choose to practice this skill.

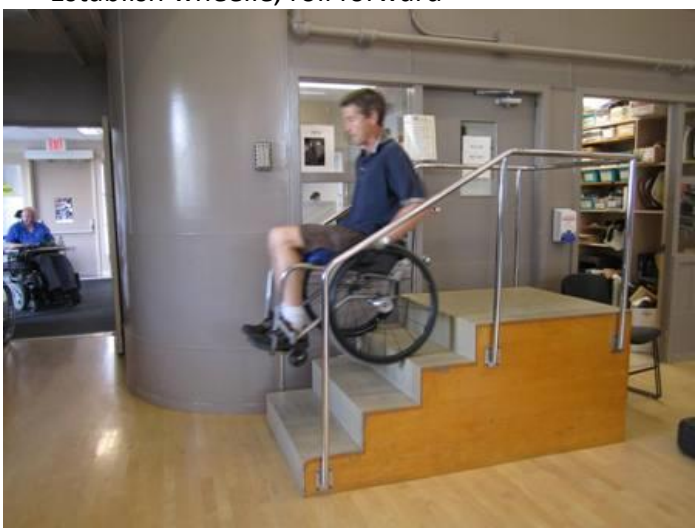
Approach steps straight on
Letting one wheel down before the other can easily pitch the wheeler out of their chair.

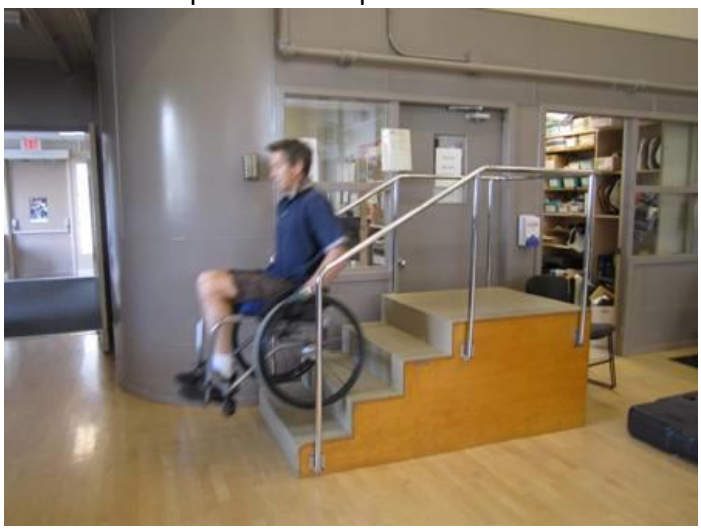
Establish balance position
Pop a wheelie, then roll forward so the casters hang over the top step and the wheeler can feel both rear wheels at the edge of the riser.

Let front end fall slightly then roll off the step
The descent angle depends on speed and slope. It is very difficult to adjust the angle once you set off because everything happens very quickly. What little control a wheeler has is achieved by gripping and releasing the pushrims; gripping the rim tends to pitch wheeler forward.

Establish wheelie, roll forward

Let front drop a little and push





Then cross your fingers and make small grip adjustments to maintain attitude during the descent

If possible start with one step, then two, then three, etc. Make sure you are in complete control and know what angle you need to be at before increasing the number of steps.

16. Up Stairs

Description of skill
Backward ascent of stairs using a hand rail.

Justification
This skill is an advanced one which requires good arm and trunk function; mastering it opens up many otherwise inaccessible areas.

Ideal Set up
Tires should be fully inflated to protect the rims. The configuration can have a huge impact on the ability to perform this skill. (The author has been in chairs which completely inhibited his ability to get up the first step; upon switching to a different chair with different configuration the obstacle was managed relatively easily. Unfortunately he hasn't figured out the specific reason.)

Teaching points

Spotting
Stand behind if chair has push handles. Stand in front and a little to the side holding the frame if low back and no push handles.

Roll up to stairs backward
Make sure both rear wheels contact the first step together with the right rear wheel about 6" from the hand rail.

Use strongest hand on rail
Reach as far back as possible and grasp the rail.

Reach across your body and grasp the wheel
Hold on to the wheel closest to the handrail side as far forward as possible.

Keep the chair in a flat position i.e. not wheelie position
Pull the wheel back with one hand, while pulling on the rail with the other and keep the chair in a flat position. If the chair tips backward too much it will have a tendency to roll forward off the step.

Reposition hands
When the wheeler gets to the next tread as long as they keep the chair relatively flat it will tend to roll back toward the riser which makes the chair stable. Hands can be repositioned one at a time.

Be careful at the top
Make sure the casters are on solid ground before lowering them.

Reach as far as possible with both hands

Keep chair relatively flat for stability

Keep chair flat and reach back as far as possible

Repeat step 1

Technique beats power

This is a difficult skill to learn requiring a good deal of strength and reasonably good abdominal muscle control. Once the wheeler manages to get up one step they should focus on improving their technique rather than increasing strength

17. Fast stops and turns

Description of skill
Stopping and turning the chair a set amount in the minimum time and distance from the greatest speed is achieved by popping a wheelie and completing the skill on the rear wheels exclusively. Any deceleration tends to throw weight onto the casters resulting in less friction i.e. more skidding of the rear wheels.

Justification
This used to be a valuable skill for people who used chairs in games such as basketball, rugby, and tennis where rapid changes of direction at high speeds are frequent. It is also useful for people who wheel quickly in busy areas such as malls.

Ideal Set up
Tires should be fully inflated to protect the rims. The chair should have lots of weight on the rear wheels. More camber will make the chair less likely to tip sideways when making the fast turn. A low centre of gravity will also help.

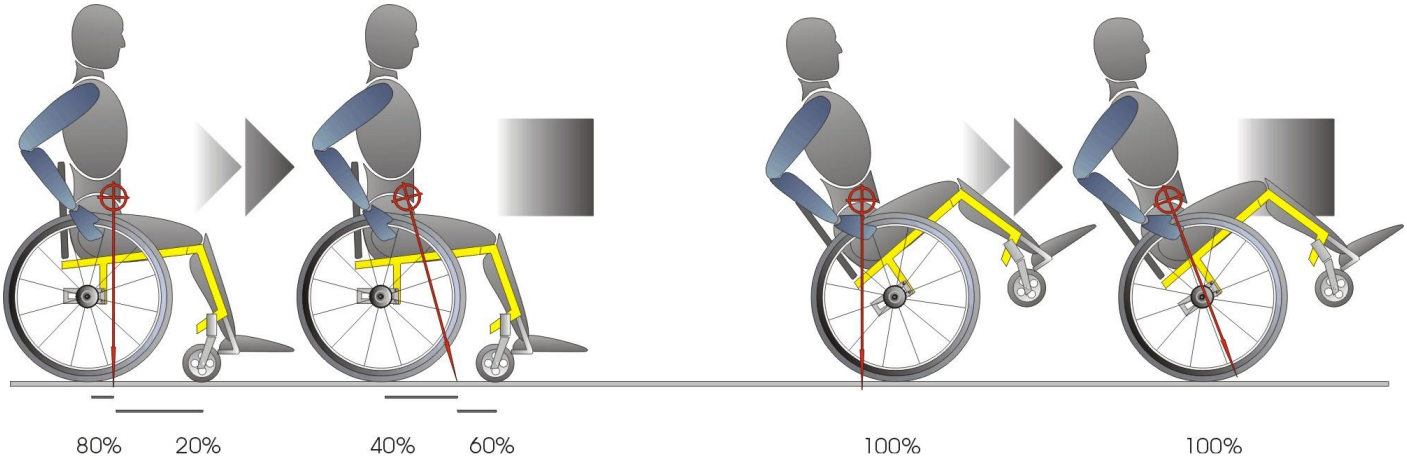
Teaching points
Illustrate normal skid and show distance covered before stopping or completing turn.

Practice popping a wheelie without hand use while rolling
This type of wheelie can be done at any speed since it does not rely on acceleration.
Pop wheelies which tip the chair beyond the balance point and squeeze the push rim firmly to prevent tipping over.

Increase speed of roll
Practice popping at all speeds including flat out.

Fast stop
Pop an excessive wheelie and use hands to brake quickly to bring casters back down on to the floor. The wheeler has to go way beyond the normal balance point temporarily. For quicker stops get more aggressive with speed wheelie and braking. To stop as quickly as possible the chair is tipped a long way past the balance point in anticipation of the strong braking then try to stop the wheels from turning by grabbing them rather than slowing gradually. This is easier on the hands and stops the chair more quickly. Overall, stopping distance can be further reduced after coming to a halt by wheeling backward while lowering the casters to the ground.

Spotting
Spotter stand behind for spotting and on the inside of the turn, if wheeler is thrown out it is difficult to catch them since they will tip to the outside of the turn, so content yourself with righting the chair. More often than not the wheeler stays connected.

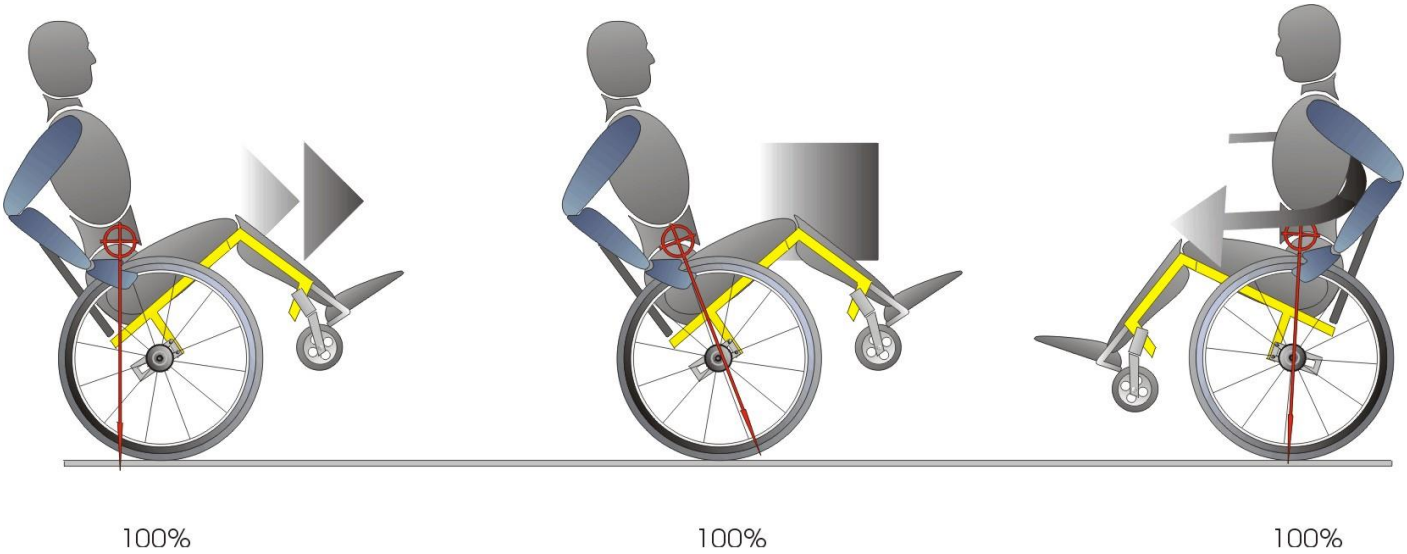


Grabbing wheels at speed transfers weight on to casters Popping keeps the weight on the drive wheels

Fast turn

Start the skill as though it is a fast stop then while the chair is still on two wheels and almost stopped pull back on the inside wheel and push forward on the outside wheel. Pulling the inside wheel backward too early results in skidding.

Try to maintain chair on two wheels throughout the turn or stop. As soon as the casters touch the floor traction and therefore control are decreased. Casters need to be lowered to the ground when the wheeler is ready to accelerate.



Pop to put weight on drive wheels Brake hard to stop tipping Turn as you come to a stop

18. Ascending steep slopes

Description of skill

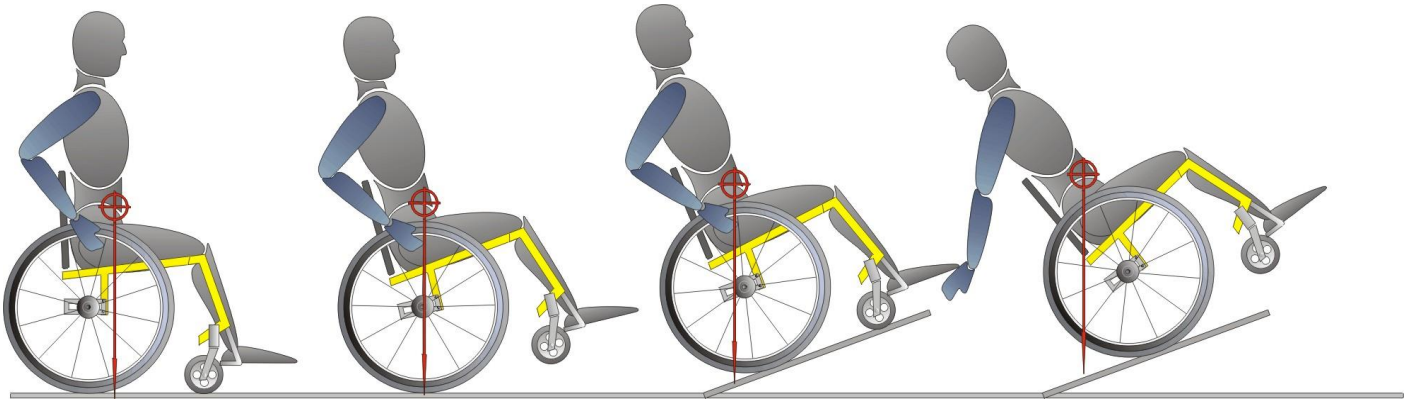
Ascending a slope which is too steep for the wheeler to negotiate by traditional methods, (see Ascending Inclines Section) due to lack of traction or excessive chair tippiness, is accomplished by reversing up the hill in a wheelie position.

Justification

On occasion, strong wheelers with good balance are faced with short steep inclines which are too steep to ascend using a conventional approach because they are unable to prevent the chair from tipping backward. This is particularly true when the configuration of the chair makes it tippy.

Teaching points

The only way adequate traction can be achieved is to have all the weight over the rear wheels and the only way the chair can be prevented from tipping over backward is to proceed in reverse.



If a chairs balance point goes behind the rear wheels and the wheeler can't lean forward enough he will tip

Spotting

Spotter should stand in front and to the side; it is not far to fall backward but it is a long way forward.

Practice going backward in a wheelie until very comfortable

Practice going up progressively steeper inclines.

Back up to incline with chair at right angles to the slope.

Assume wheelie position

This places the wheeler in a more balanced position as far as his or her trunk is concerned, preventing any tendency to pitch out. It also provides the driving wheels maximum traction.

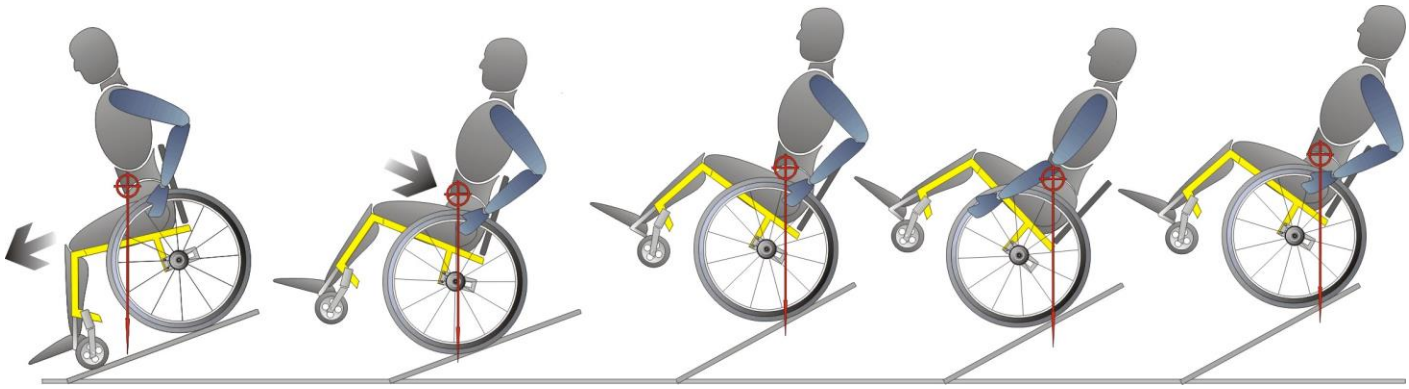
Wheel backward until slope becomes too steep

Wheelers will find themselves leaning uncomfortably far forward with the chair tipped way back to prevent falling forwards or the rear wheels slipping.

Reach arms all the way forward on the rims

The arms are going to have to produce a very powerful, yet finely controlled contraction, and need to be in an advantageous position.

Over balance backward, then pull your rims firmly backward to regain the balance position.
The chair does not want to ascend the hill; any contraction of the arms will tend to make the chair rotate forward rather than the wheels rotate backward. To counter this tendency it is necessary to counteract with a pre-emptive lean back.



Tendency to slide out is negated in a wheelie. On steep slope get balance, reach forward, lean back and pull

This chair is very tippy and yet on an incline…

It has to be tipped a long way back to hold position

The effort and timing required is very high…

And you progress up the hill in small increments

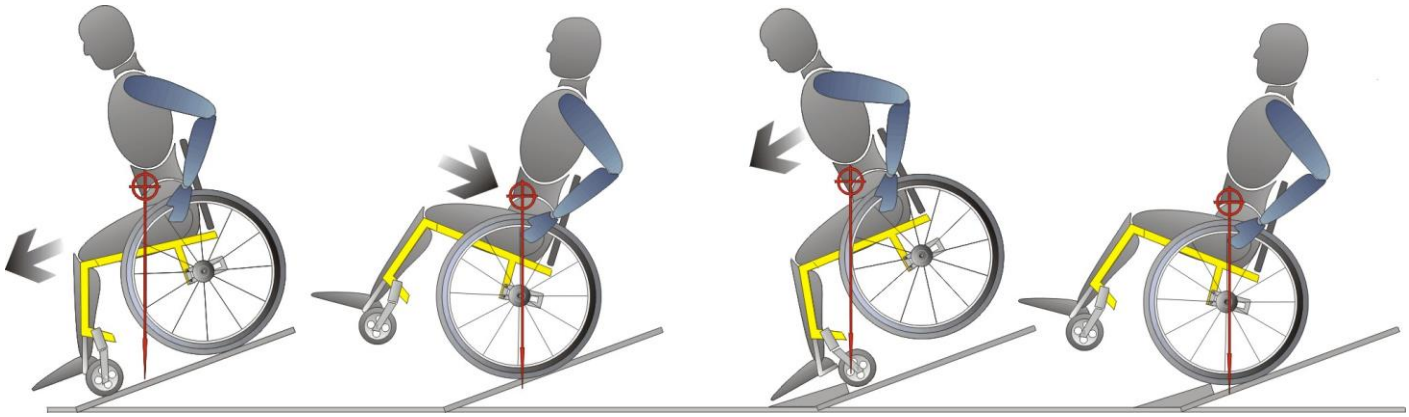
19. Descending steep slopes

Description of skill

Descending a slope which is too steep for the wheeler to negotiate by traditional methods, (see Descending Inclines Section) due to lack of traction or excessive chair tippiness, is accomplished by rolling down the hill in a wheelie position.

Justification

Once a wheeler has acquired the necessary balance and speed control; descending even moderate slopes in a wheelie position is safer than being on all four wheels for the following reasons:-
The angle of the seat tends to keep the wheelers butt back in the seat, rather than sliding out;
All the weight is directly over the drive wheels, optimizing traction and therefore control; or
The casters are off the ground so there is less chance that a small obstacle will pitch a wheeler out.



Tendency to slide out | No sliding in wheelie | Small bump can pitch out | Small bump, no problem

Teaching points

Spotting

Spotter should stand to the side helping to control speed and prevent pitching forward if the wheeler loses balance forward

Once a wheeler is able to perform a fairly consistent stationary wheelie descending inclines is pretty easy since the chair tends to roll forwards by itself.
Practice holding a wheelie until very comfortable, spotter can try applying displacing forces to challenge wheelers ability to balance.
Begin with short smooth inclines with flat run off at the bottom.
Practice going down progressively steeper inclines.
Challenge the wheeler by doing the skill on slopes with surface irregularities.

Assume wheelie position on flat section before slope

Attaining the wheelie position from a pitched forward attitude is harder than from the flat.
A wheelie places the wheeler in a more balanced position as far as his or her trunk is concerned, preventing any tendency to pitch out. It also provides the driving wheels maximum traction.

Roll down slope in a wheelie

The balance position is maintained by modulating the braking pressure applied by the hands on the push rims.

Avoid going too fast because it is difficult to stop from tipping forwards on to the casters and if you are on a steep slope this could cause loss of control.

Done properly this skill requires very little energy expenditure; the hands should rest comfortable on the rims at about the 12 o'clock position.

20. Doors

Description of skill
Opening, passing through, and closing conventional and spring loaded doors.

Justification
Ability to open and pass through doors while seated in a wheelchair significantly increases the wheelers independence.

Teaching points
The technique used for a specific door depends on so many factors it is very difficult to describe particular techniques which will work for every individual. The factors impacting on the task include:-
Dimensions of chair;
Wheelers reach compared to his footprint;
Ability to transfer forces through trunk; or
Space available around door.

This skill is probably best attempted when the wheeler has developed some problem solving skills and has become relatively adept at many of the other skills listed in this document.

In most instances the wheel locks on the chair are left off to allow the wheeler to pass through the door immediately after opening it, particularly spring loaded doors. If the door stays open once the latch is released the wheeler can position his chair in an optimum position to open the door and put his wheel locks on then once the door is open they can release the locks and manoeuvre through.

Approach each door as a challenge to your combined problem solving skills.

Door Opens Away
Position the wheelchair immediately in front of the door if it opens away.
The wheeler can use their hand or footrest etc to apply force to open the door.



Approach straight on turn handle use push rim for power and handle for steering

Door Opens Toward

Generally speaking with doors that open towards you, start to the side of the door, out of the way of its swing.

If the door opens toward the wheeler can use one hand to control the door and the other to control the wheelchair.



Start at side of door so swing misses chair. Use a combination rim and door handle to move chair

Summary

This information should help you teach the fundamental skills to become a proficient wheelchair user. Use the techniques described to develop variations of your own, I encourage you to analyze techniques, experiment with alternative ideas and develop new strategies to get the message across to people using wheelchairs for mobility.

Some of this information applies to all wheelers but for the most part it is directed to people who use both arms. If you work with foot propellers or those using one hand and one foot you will have to wait for the next version of this publication. In the meantime pay particular attention to setting the chair up for minimal rolling resistance. By reducing the amount of effort required to complete a task you will reduce positioning issues and minimize the effect wheeling has on hypertonicity.