Prescribing Power Wheelchair Features to Correspond with Function

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Learning objectives:

- Brief introduction to prescribing power wheelchairs and the assessment processes required to set functional outcome goals
- Discuss the how and why mapping the pelvis and postural assessments as essential components in power wheelchair prescriptions
- Reintegrate how to communicate the client's goals with the supplier to start the process of collaboration
- Gain a better understanding of power wheelchair features to assist in refining prescription processes which will assist in reaching therapeutic outcomes
- Develop clinal pathways to ensure we are not "over prescribing"
- Understand the adaptability in power wheelchairs that can be tweaked to improve function
- Determine that outdoor mobility is not the same as off road mobility
- Ensuring our prescriptions in the long term don't cause harm

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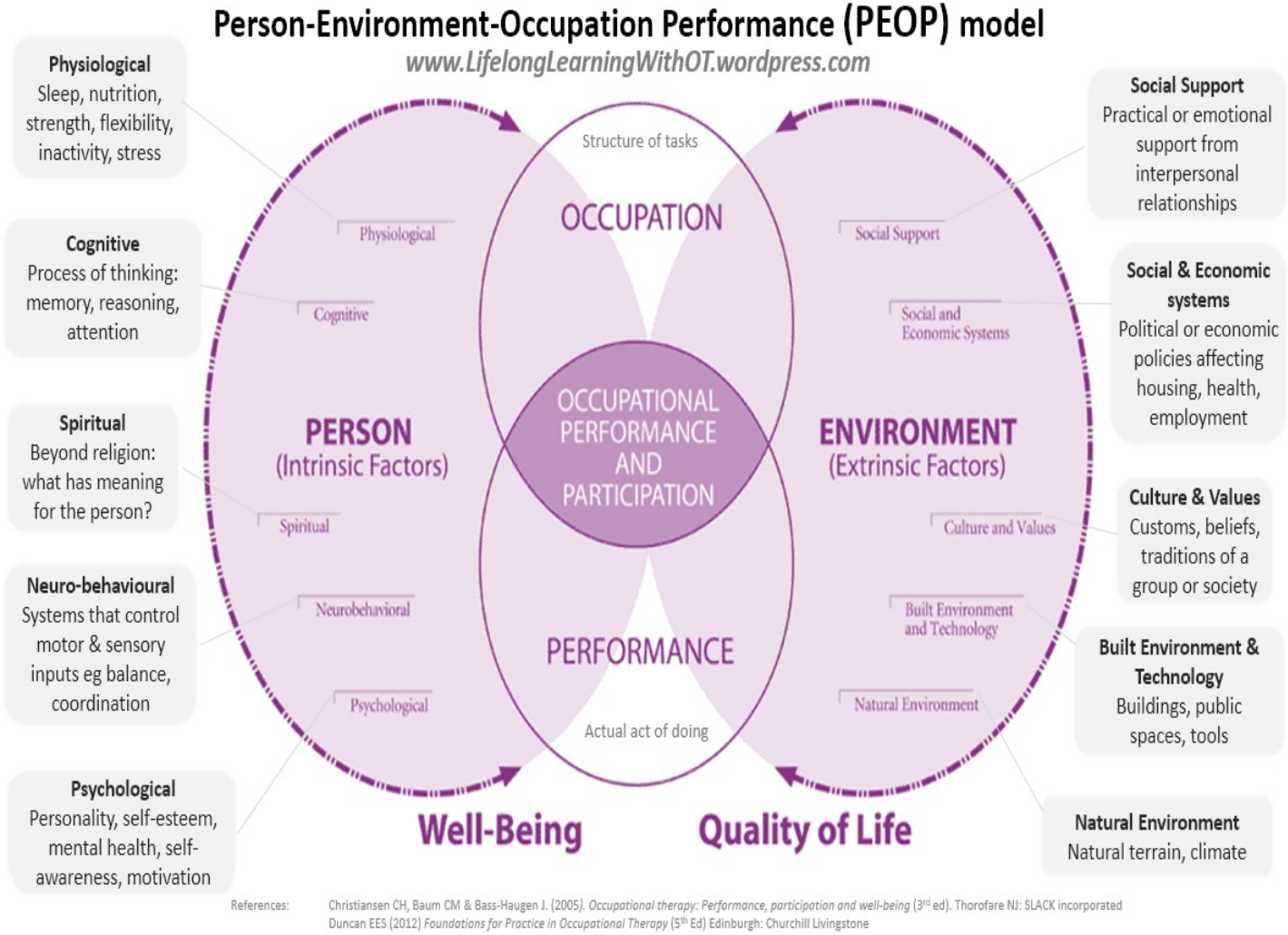
Brief overview on assessments for power wheelchair prescription



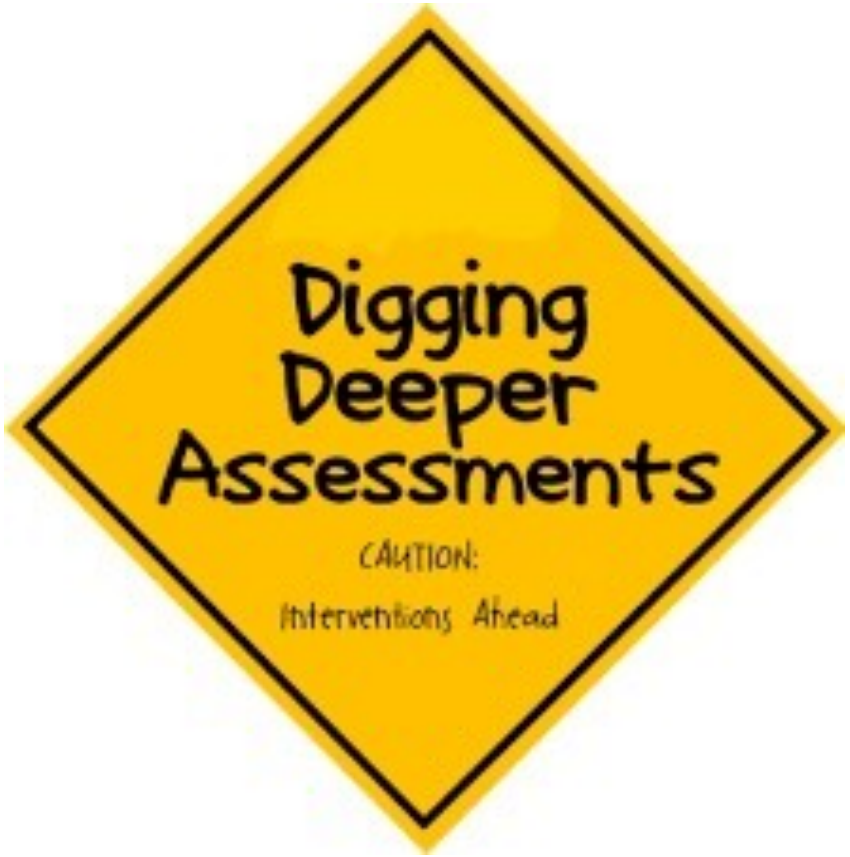
- Standard comprehensive occupational therapy assessment will explore the intrinsic/extrinsic factors to identify occupational performance issues for individuals within our models of theory. This allows us to produce a client profile.

Standard initial assessment practices help to identify:

- Medical Hx (clinical condition, comorbities, acute, progressive or palliative)
- Physical and cognitive symptoms
- Level of independence (pre-morbid, current, foreseeable)
- Other assistive technology used
- Their life roles and responsibilities
- The environments they frequently interactive in

You will already be starting to put this information into context of what type of mobility is going to be the most suitable from the information you have gathered in this process

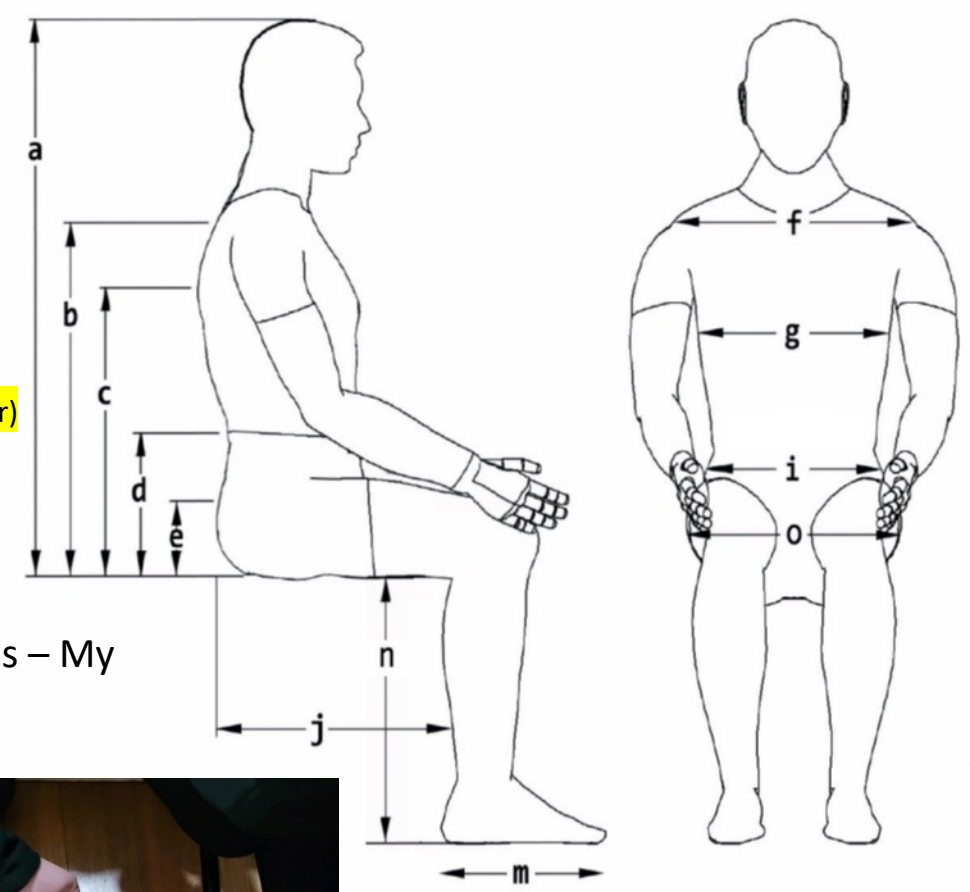
Other assessments specific to wheelchair prescriptions



- Wheelchair assessment proforma
- MAT (mechanical assessment tool) evaluation for complex clients
- Pressure risk tools
- Cognitive screen
- Wheelchair skill specific

Wheelchair assessment proforma

a) Top of head to seat
b) Top of shoulder to seat
c) Underarm to seat
d) Elbow to seat
e) Top of pelvis to seat
f) Shoulder width
g) Trunk width
i) Hip width
j) Actual sitting depth (shorter)
m) Foot length
n) Lower leg length
o) Actual seat width (wider)



Permission to take photos – My Measures PRO

Record Weight and Height!

- Allows you to capture further detailed information specific to prescribing wheelchairs
- Capture functional capacity in relation to physical control
- Go into details of intended use
- Capture anthropometric measurements, joint range of motion and muscle tone specific to seated function, skin integrity details…
- Describe the relationship between the equipment and the environment in more detail (circulation space available for wheelchair footprint, narrow access, transfer equipment, furniture access)
- How will the wheelchair be transported and stored
- What are the independent functions of the user in the wheelchair and what will they need assistance with from others
- Capture 24hr positioning profile

Why do MAT Evaluations ?

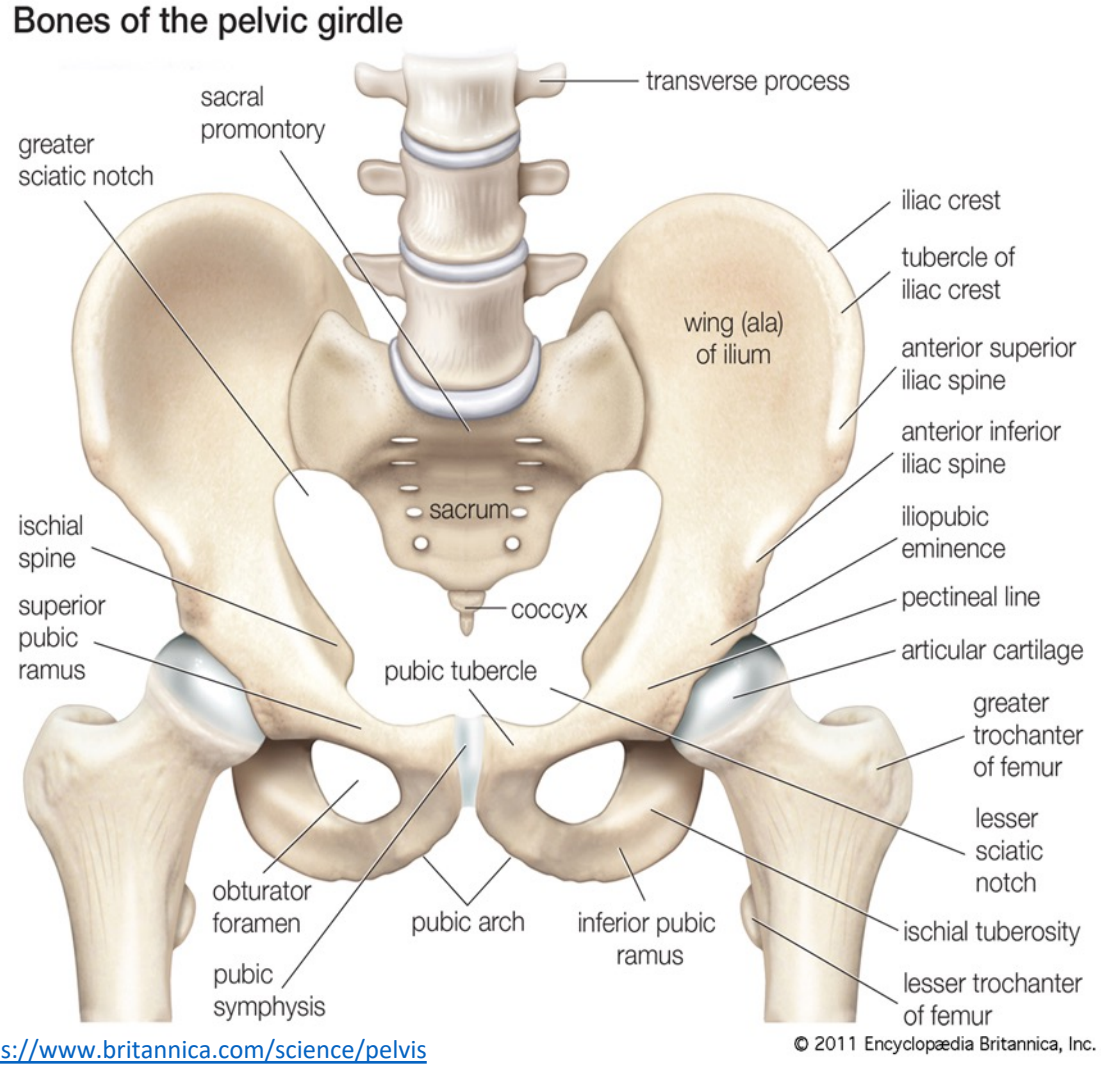
- To gain a deeper understanding of why the wheelchair user sits the way they do, to understand their full potential to participate in physical tasks, and to complete the client profile of biomechanical assessment and physical examination.
- Only then can we truly develop client centered goals with meaningful pathways of interventions. It can't be all about the equipment!
- It leads us on a journey of history about current and previous equipment, postural changes, skin integrity and pressure care management. It is the catalyse that helps us to dig deeper about sitting balance, functioning from the wheelchair and 24hr postural management.

When to do MAT Evaluations?

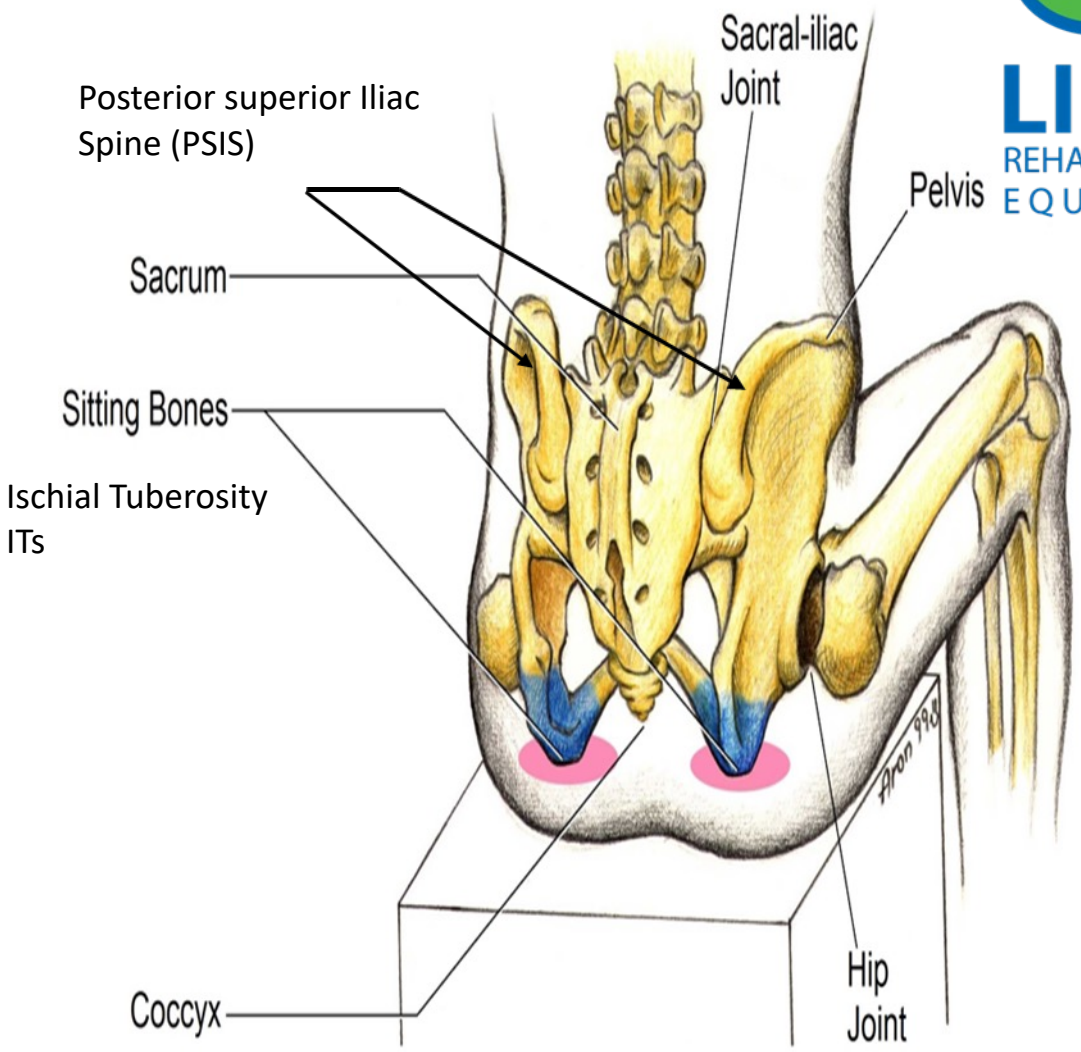
- As therapists, we should be asking “why am I not doing a full MAT assessment on this client”
- It maybe because your client is:
  - Currently ambulating
  - Is able to sit on the side of a plinth or bench with no balance problems
  - Has full sensation and the ability to move if uncomfortable and report pain
  - Is able to actively complete a set of hip and spine ROM activities
  - Physical assessment can occur through observation and analysis of activities of daily living
- As a “rule of thumb” map everyone’s pelvis

Get to know the boney prominences

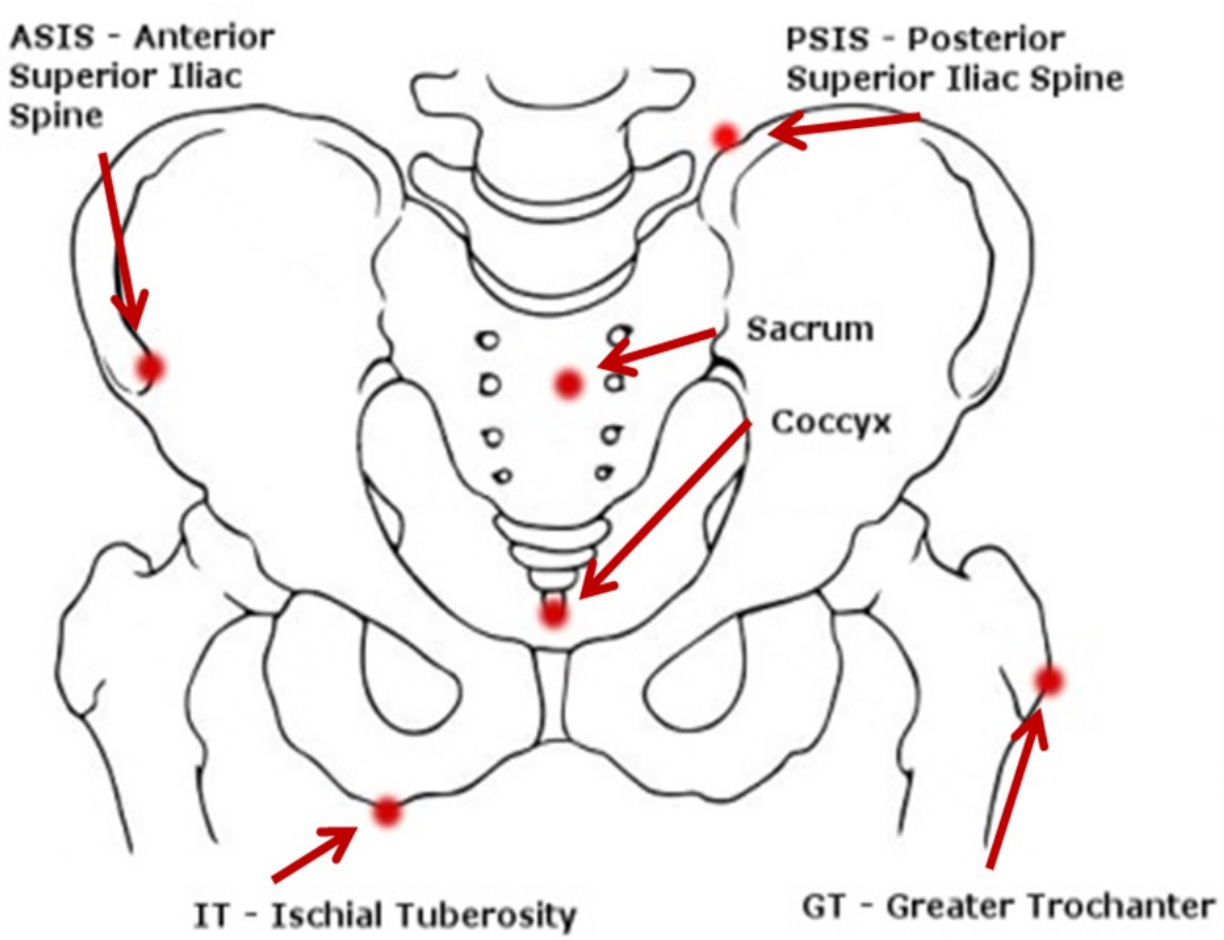
- Pelvis and hips

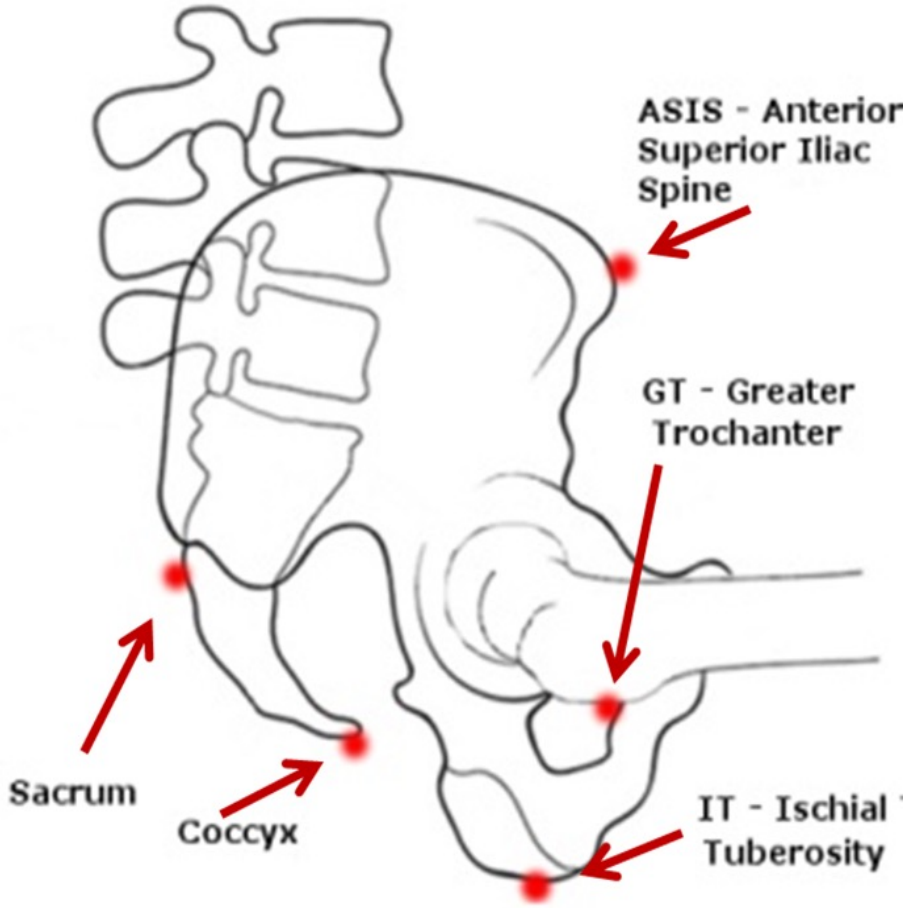


https://www.britannica.com/science/pelvis



https://alexanderteachingstudio.com/your-bottom-belongs-behind-you/





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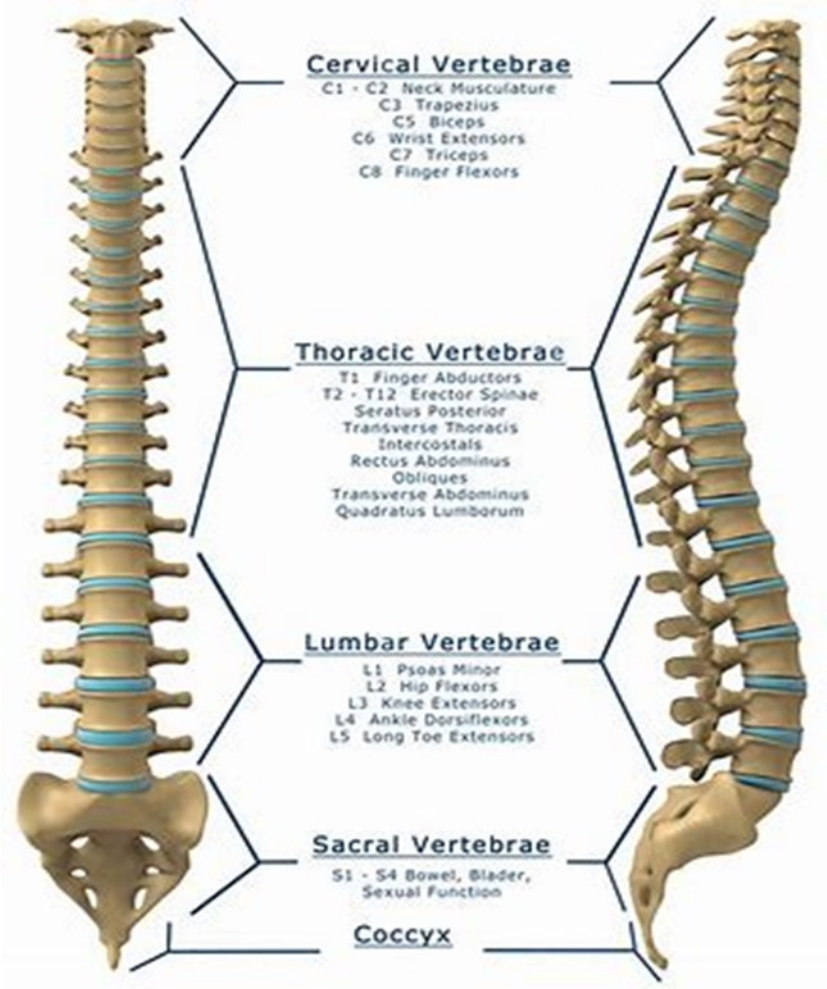
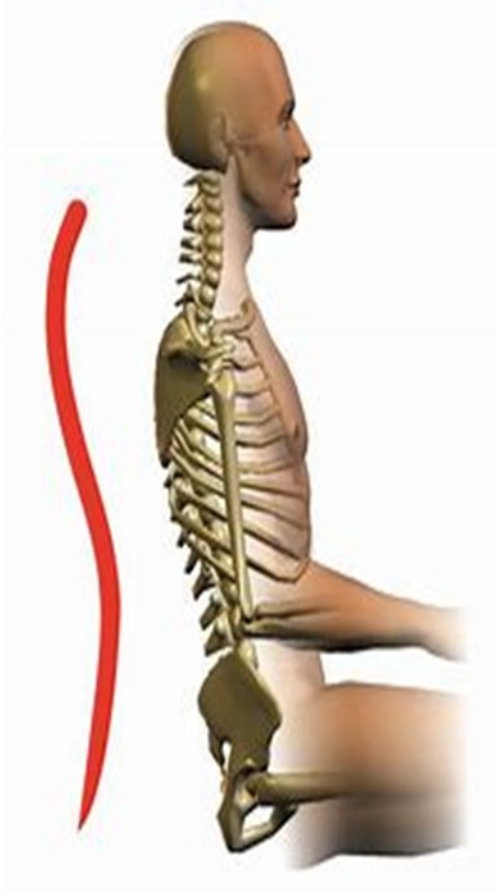
https://aci.health.nsw.gov.au/networks/spinal-cord-injury/spinal-seating/module-3/the-mechanical-assessment-tool-mat#:~:text=The%20MAT%20is%20a%20musculoskeletal%20examination%20of%20the,noted%20as%20they%20affect%20posture%20and%20muscle%20length

- Spine



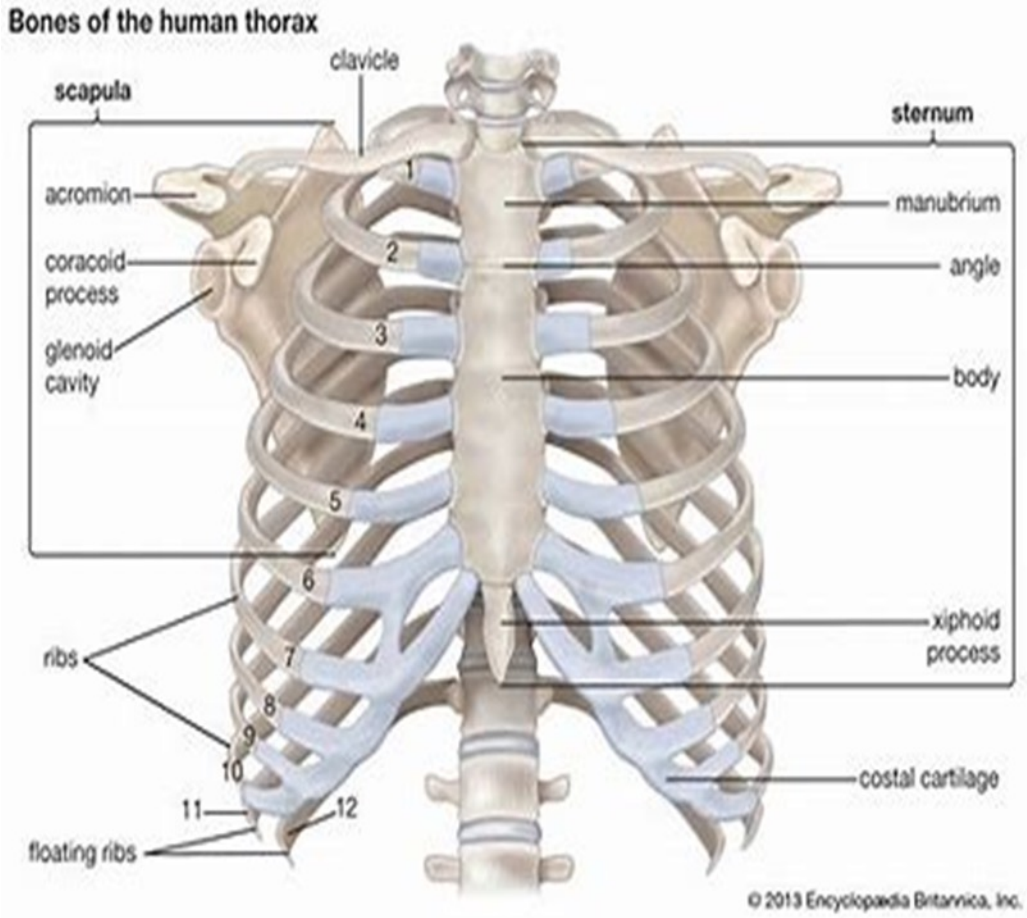
https://anatomy-medicine.com/nervous-system/116-the-spinal-cord.html



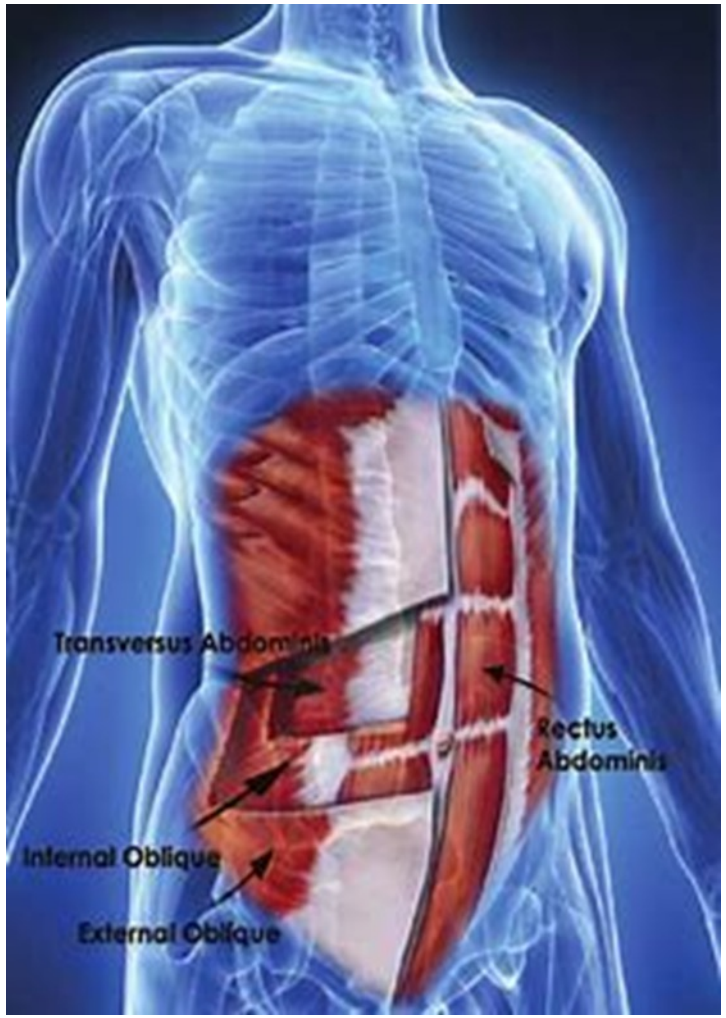
http://www.seat-specialists.com/products/knoedler-air-chief-seat-choose-your-options.html

https://karo.co.za/knowledge-center/what-happens-when-you-sit-and-how-it-affects-your-body/

- Thoracic – Apexes
  Abdominal Wall



https://www.britannica.com/science/thoracic-cavity



https://www.researchgate.net/figure/The-anatomy-of-the-abdominal-wall_fig1_283209177

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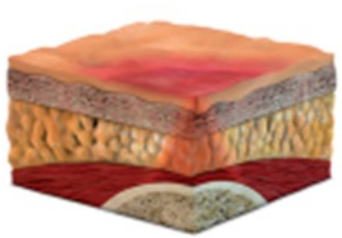
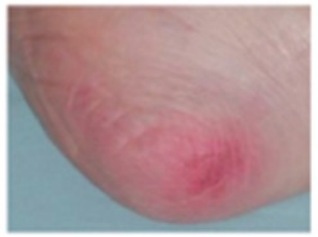
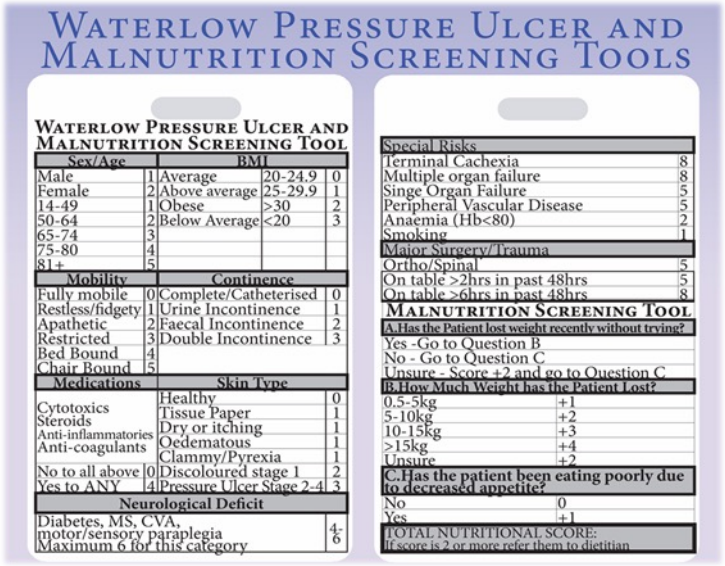
Pressure Injury Risk Screen





- What is the past history of pressure injuries?
- Has a pressure injury screening tool been completed?
- Pressure care is more then just equipment, pressure areas occur for many reasons and all areas need to be addressed:
  - sheer and/or friction (impact of postural displacement)
  - mechanical tissue loading (pressure points)
  - age and medication related changes
  - poor nutrition
  - decreased mobility
  - chronic disease
  - incontinence
  - and restraint



WATERLOW PRESSURE ULCER AND MALNUTRITION SCREENING TOOLS

WATERLOW PRESSURE ULCER AND MALNUTRITION SCREENING TOOL

Sex/Age		BMI		
Male	1	Average	20-24.9	0
Female	2	Above average	25-29.9	1
14-49	1	Obese	>30	2
50-64	2	Below Average	<20	3
65-74	3			
75-80	4			
81+	5			
Mobility		**Continence**		
Fully mobile	0	Complete/Catheterised		0
Restless/fidgety	1	Urine Incontinence		1
Apathetic	2	Faecal Incontinence		2
Restricted	3	Double Incontinence		3
Bed Bound	4			
Chair Bound	5			
Medications		**Skin Type**		
Cytotoxics Steroids Anti-inflammatories Anti-coagulants		Healthy		0
		Tissue Paper		1
		Dry or itching		1
		Oedematous		1
		Clammy/Pyrexia		1
No to all above	0	Discoloured stage 1		2
Yes to ANY	4	Pressure Ulcer Stage 2-4		3
Neurological Deficit				
Diabetes, MS, CVA, motor/sensory paraplegia Maximum 6 for this category				4-6

Special Risks	
Terminal Cachexia	8
Multiple organ failure	8
Singe Organ Failure	5
Peripheral Vascular Disease	5
Anaemia (Hb<80)	2
Smoking	1
Major Surgery/Trauma	
Ortho/Spinal	5
On table >2hrs in past 48hrs	5
On table >6hrs in past 48hrs	8

MALNUTRITION SCREENING TOOL

A.Has the Patient lost weight recently without trying?	
Yes -Go to Question B	
No - Go to Question C	
Unsure - Score +2 and go to Question C	
B.How Much Weight has the Patient Lost?	
0.5-5kg	+1
5-10kg	+2
10-15kg	+3
>15kg	+4
Unsure	+2
C.Has the patient been eating poorly due to decreased appetite?	
No	0
Yes	+1
TOTAL NUTRITIONAL SCORE: If score is 2 or more refer them to dietitian	

- Identify increased risk of skin injury during indoor mobility (postural displacement during ADL tasks, periods of immobility, heating and air circulation)
- Identify increased risks of skin injury during outdoor mobility (postural displacement, repetitive impact stress on mechanical tissue loading, bottoming out in seating systems, humidity and heat)
- Physical skin checks assessments, who is assessing?

Cognitive Screen

- Used to understand cognitive strengths and weakness
- Identifies risk that will need to be managed (short term memory, visual spatial awareness, ability to problem solve)
- Allows for interventions to ensure prescription doesn't fail and individuals are given a chance to achieve their mobility goals; they are not a pass or fail test
- Common screening tools MOCA or RUDAS. There are many others; AMPS, Cognista, CAM, CCT…
- Task based cognitive assessment e.g. problem solving and safety

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Wheelchair Specific Skills

- Why? To ensure safety of the user, attendant carer and those around them
- Ensure the equipment is being used to its full capacity and the user is achieving their goals – it's not just about driving!
- Functioning Everyday with a Wheelchair (FEW) self administered questionnaire designed to measure perceived functional performance for individuals who use a wheelchair or scooter as their primary seating and mobility device http://www.few.pitt.edu/FEW_Doc/FEW_Final.pdf
- Assessing manual wheelchair skills for both the independent user and the attendant propeller using the Wheelchair Skills Program (WSP) https://wheelchairskillsprogram.ca/
- Assessing power wheelchair skills for both the independent user and attendant driver using the Powered Mobility Device Assessment Training Tool (PoMoDATT) https://pomodatt.com/

Goal Setting

- Collaboration between therapist/s & consumer/their support network
- Will it be independent or assisted mobility? Or a combination of both.
- How long is the end user seated in the seating system? (Tolerance, posture management and skin integrity)
- What are the Activities of Daily Living performed from the wheelchair independently or assisted?
- What are the environments the wheelchair most frequently interacts with?
- How is the wheelchair transported and is the occupant transported in the wheelchair?
- What goals will be set for the trial vs long terms post prescription

Wheelchair Outcome Measure (WhOM) https://millerresearch.osot.ubc.ca/tools/mobility-outcome-tools-2/the-wheelchair-outcome-measure-whom/

Identify the features in the assistive technology that are MUST HAVES to achieving the consumer goals

- It helps if you can develop a consumer priority list and a therapist priority list
- As the therapist; our priority should also be to protect the life box, protect the skin, create function & reduce risk to further disability.
- Communicate with your suppliers using the outcomes of your assessments, collaborative goals, and the priority lists.
- Develop a method of communication that allows you to discuss features in terms of benefits and compromises in relation to client specific goals.

Corresponding function capacity outcomes with features

Where does your client fit on the spectrum at prescription and in 5years time???

Intact physical capacity/ reduced endurance

Compromised physical capacity

Severely limited to no physical capacity

Features

Power Wheelchair Base Configuration

Starts with identifying the drive wheel location.

- Mid Wheel Drive
- Rear Wheel Drive
- Front Wheel Drive
- Hybrid Wheel Drive
- Rear Wheel Folding
- All-terrain/off-road

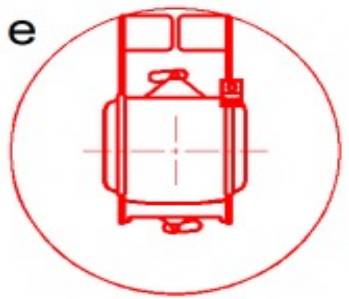
Do the base dimension matter? Base width and length circulate around the drive wheel to create the turning circle. Does turning radius matter?

Does the wheelchair need to be transported? Does base weight matter? Will the wheelchiar user be transported in the wheelchair?

Mid Wheel Drive Clinical Implications

- Mid wheel drive (MWD) positions the client's center of gravity over the drive wheel.
- Consists of two large drive wheels and four casters; six-wheel balancing and contact system
- Popular “all-round” performer with the smallest turning circle option.

- With the end user positioned over the wheel, the MWD is consider more intuitive and easiest to learn how to drive.
- Performance over obstacles rely on the caster wheels dynamic articulation (movement) to make way for contact of the larger drive wheel; allow the drive wheel to stay loaded and "push" up the obstacle with support from a variety of suspension systems.
- Good traction both up and down inclines if the drive wheel remains loaded, so its performance is very dependent on good suspension (articulation of the casters). If the weight gets shifted to front and rear casters, this type of chair can lose traction
- Can be programmed to perform quite well with directional control at higher speeds. Considering how intuitive it is to drive, the MWD becomes an easy chair to control.

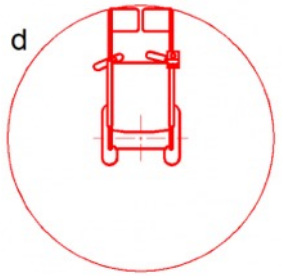


https://www.sunrisemedical.com.au/education-in-motion/resources/powerchair-drive-wheel-position

Figure adapted from Wien & Ziegler (2003); https://wheelchairnetwork.org/kb/dim-mass-space/

Rear Wheel Drive Clinical Implications

- Rear wheel drive (RWD) base positions the end user's center of gravity ahead of the drive wheel
- RWD can have one of the largest turning circles because of the forward positing of the foot plates to clear the front casters
- Wide turning girth is required, users must drive through the doorway before they can begin the turn as the front end of the wheelchair swings around
- Smaller caster wheels will encounter an obstacle first, so the chair will have to rely on suspension to keep the drive wheels loaded to push up the obstacle
- Considered to have good traction, especially on inclines because center of gravity shifts towards the drive wheels. On steeper declines, it can lose traction and perform poorly if too much weight is shifted to the casters
- Considered to have the best directional control at high speeds



rear wheel drive and full differential steering

rear wheel drive and direct steering

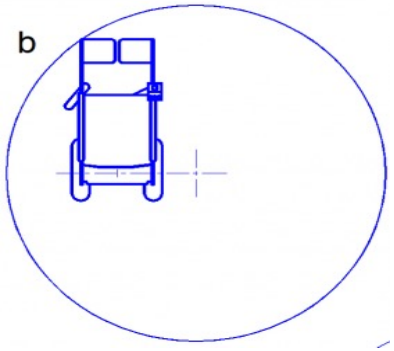


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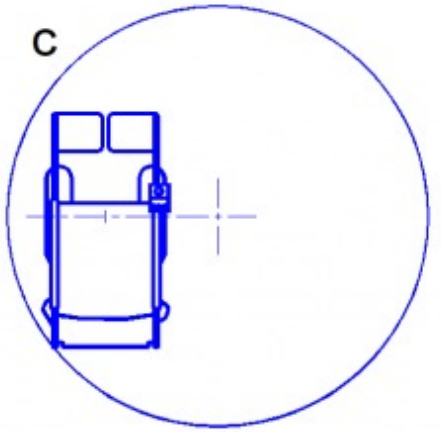
Figure adapted from Wien & Ziegler (2003); https://wheelchairnetwork.org/kb/dim-mass-space/

Front Wheel Drive Clinical Implications

- Front wheel drive (FWD) has the end user's center of gravity behind the drive wheel
- Longer turning radius than MWD due of the base length. Shorter than RWD because foot plate position can be closer to the base
- Drivers must learn to "turn late", proving to be more challenging for clients with cognitive or perceptual difficulties. The back-end swings during turning. The front drive wheel must clear the doorway before the turn can start.
- The drive wheels in a FWD should contact the obstacle first allowing them to manage obstacles well. If the front hangers are positioned low, this might reduce the ability of the drive wheel to reach the obstacle, reducing its performance.
- Tractions well on inclines until very steep, then the chair can lose traction as weight shifts to the smaller casters. Steeper declines can perform poorly as chair can feel tippy forward.
- Worst directional control at higher speeds. Chair may "fishtail," although advanced electronics and programming can help.

front wheel drive and direct steering



https://www.sunrisemedical.com.au/education-in-motion/resources/powerchair-drive-wheel-position

Figure adapted from Wien & Ziegler (2003); https://wheelchairnetwork.org/kb/dim-mass-space/

Hybrid Wheel Drive Clinical Implications

- Hybrid wheel drive (HWD) has the drive wheel position in between that of a MWD and RWD.
- HWD is more intuitive to drive than a RWD but not quiet as intuitive than MWD. The end user is sitting a bit in front of the drive wheel, it will have some of the feel of a RWD with the increased maneuverability of the MWD
- The base is a bit shorter and has dynamic back stabilizers, so the chair will be able to navigate obstacles better than its RWD counterpart.
- The rear caster arms assist to increase traction as it combines the benefits of a RWD with the suspension of the rear casters.
- HWD is ideal for users that demand the outdoor performance, speed, and comfort of a traditional rear-wheel drive but need the maneuverability provided by mid-wheel drive.

https://www.sunrisemedical.com.au/education-in-motion/resources/powerchair-drive-wheel-position

All-Terrain 4WD and Track Base Drive Systems

- When pure off-road loose/ immersive terrains with large obstacles are the destination choice and all-terrain powered mobility aid is the solution.
- Poor manoeuvrability and turning radius for indoor settings
- Increased stability laterally and with centre of gravity balance when negotiating step inclines and declines
- Stable when driving a high speed
- 4WD option in the X8 with steering lock for larger obstacles to assist with traction
- Trackmaster has independent articulating tank wheels to increase surface contact on larger obstacles and loose terrains.

Rear Wheel Drive Folding Frame

- Folding frames with motors attached to the rear wheels that are joystick controlled allow increased accessibility to transportation options
- Average any where between 25kg – 52kg transfer weight
- Reduced overall configurability in the larger majority of available options. Consider “out of the box” models vs scriptable frames and the impact on functional limitations
- Smaller battery sizes, no suspension systems, and smaller pole motors lead to compromises in outdoor settings
- No power rehab seating options
- Reduced ability to add postural supports and no always ergonomically well designed

Configuration – Width

- Measured from the outside of the backcane to backcane Or outside of seat rail to seat rail; mindful of inset backcanes
- Seat width – redundant tissue, shaping and positioning in cushions, greater trochanter to greater trochanter, allowing for growth, blocking asymmetry, accommodating asymmetry, air flow considerations.
- Assess the impact of the armrest mount positions and any added “free space” of the seat surface.
- Overall width – environmental impact: base width outside of drive tyres (drive tyre size), arm rest mounts, wider arm pad configurations, accessories..
- Consider lateral stability on drive quality with narrow base
- Consider functional width, i.e. armrest position for neutral shoulders, access to drive controller, repetitive task to one side of the body

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Configuration - Depth

- Measured from the front of the backcanes to the end of the seat upholstery/pan
- Measurement of everything you want to sit in-front of the backcanes – Gluteal shelf, backrest, position aids…
- Leg length discrepancy – accommodated in the seat pan, frame length considerations to accommodate the shorter length for foot plate positioning to the accommodate the long length in cushion with rigidiser
- Maximise thigh contact 1-2 fingers shy of the popliteal fossa; consider calf clearance and contractor management
- Swing away legrest powerbase – impacts on overall depth: angle of the legrest hangers and depth of the foot, consider push handles, drive wheel position and users orientation (perceived depth), swing away elevating legrest configuration
- Centre mount foot plate powerbase - impacts overall depth: determined by legrest angle and foot depth, caster arm length, user orientation over the drive wheel (perceived depth), elevating legrest forward position.

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Configuration – Seat Height

- Measured from the top of the seat pan/rail to the floor from the forward most position (consider tilt range and fixed rake)
- Measure from the top of the seat pan/rail at the rear most position to determine rear seat and degree of rake in rehab seat options (no power functions).
- Controlled by battery size, rehab seat options (no power functions), lift OR tilt only, combination of power functions.
- Folding frames caster/fork and rear wheel size options may apply
- How does the end user transfer in/out? Does a carer assist?
- What tables do they need access to the most?
- Consider what cushion is in use (2”, 3”, 4”+)
- Does this need to be dynamic? Functional considerations of power options: Elevation, anterior tilt, anterior lift and reach, standing function…
- Consider carer/support worker interaction, ADL assistance and manual handling requirements

Configuration – Base Front End

- Contributes to functional accessibility to a variety of environments as well as floor based transfer equipment
- Positioned to support engineering for balance, suspension engagement and influence climbing ability
- Choice of caster wheels size (6”, 7”, 8”, 9”); front and rear on mid wheel base; choice pneumatic – foam filled – solid tyre.
- Environmental access consideration; soft surfaces require increase surface contact to prevent immersion; AKA “bogging”. If the casters immerse on a midwheel drive the drive wheel will continue to “dig deeper” until there is a solid surface drive out on.

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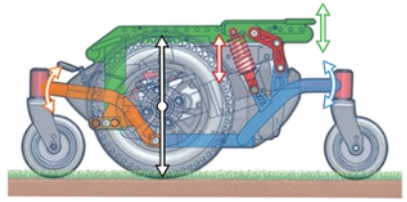
Configuration – Drive wheels

- Refers the largest wheels on the base. The drive wheels of a power wheelchair are connected to the motor.
- Defined by profile. 12.5” or 14” diameter with common references to Urban, Crossover and Off-road wheel hub and tyre depth configurations
- Profile considerations: hub sizes ration to tyre volume, tyre width and tread patterns
- Narrow configuration bases run a 12.5” drive wheel
- All terrain 4WD runs on 4x pneumatic low pressure off-road tyres
- Direct relationship to the caster size options
- Environmental accessibility; benefits and considerations in most accessed environments vs spontaneity of all-terrain access??
- Maintenance consideration for pneumatic wheels vs benefits to ride quality.
- Model options to interchange between indoor and outdoor drive wheels; consider the who will support this? Task analysis…

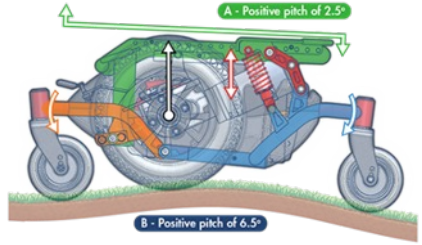
https://www.magicmobility.com.au/wheelchairs/magic360-offroad-electric-wheelchair/

Configuration - Suspension

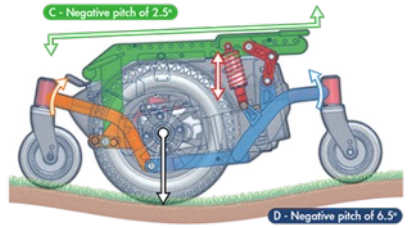
- There are many different “suspension” designs available with each brand changing the way they implement suspension.
- There is a clinical spectrum on how well the suspension works, starting with the lack of suspension in most folding travel power wheelchair options.
- Suspension is important to user comfort, user safety, drivability, obstacle climbing, and durability of the power chair. Experiencing high amounts of vibration in a power wheelchair has been linked to user fatigue and discomfort.
- At the higher end of the market there are Dual-Action Suspension systems which increases ride quality, decreasing road noise to increase seating tolerance, reducing pain and postural displacement.
- End user feedback is important in determining their experiences during trial process, ensuring we are allowing adequate access to terrains that put the wheelchair to the test as required.
- Assessing and measuring postural displace while driving and before and after driving assist you as the therapist in clinically determining which suspension has been better in comparative trials.
- Close evaluation of all wheel components to remain on the ground at all times OR provide a counter acting balance is another way to assess the different actions of the suspension systems.
- Discuss the “theory of design” with the supplier to ensure the suspension action is right



Normal view on a flat surface



For a positive incline of 6.5° (B), the seat plate is only affected by 2.5° (A). The articulation of the 6 wheels minimizes the effect on the seat and user



For a negative slope of -6.5° (D), the seat plate is only affected by -2.5° (C). The articulation of the 6 wheels minimizes the effect on the seat and user.

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Configuration – Motors

- A power wheelchair has two motors attached to the drive wheel. The motor draws down power from the batteries to move the drive wheels. Some models with give choice of a 2pole motor vs 4pole motor
- 2pole motors are lighter, drive smoother at lower speeds and drain the battery slower. They are best suited to indoor users and predicable outdoor environments at a moderate speeds with the end user's body weight of 70kgs or less. More economical option.
- 4pole motors are heavier and offer more torque, requiring more power and draining the batteries quicker. They perform better on uneven terrains then 2pole and came standard on wheelchairs with higher weight capacities. 4pole motors are more stable when driving at high speed.
- Option to consider Smart-track assistive driving packages to increase tracking capabilities with enhanced traction and steering precision, ideal for end users with marginal function or switch control

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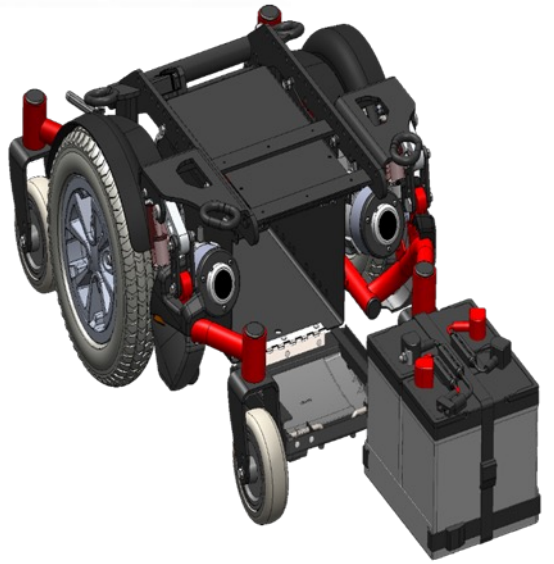
Configuration – Batteries



- Battery size assists in determining the range of a wheelchair
- There are many different battery configurations that are particular to certain makes and models of power wheelchair
- Battery size does impact narrow configurations and lower floor to seat heights of power bases, a smaller battery size (50Amp)
- It's important to determine the with the supplier if there are options and what benefits and compromises their applications have.
- When considering the "transport weight" of a wheelchair, be aware that manufactures do not include the battery weight in their specification weights. This can impact on boot hoists and wheelchair trailer applications.
- Battery location can also impact on base system balance. Bariatric, paediatric and/or amputees end user's can change the centre of gravity balance over the drive wheels. Alltrack Series has a COG battery box adjustment to balance the system for these and many other end users.
- Talk maintenance of batteries and provide a plan for routine services and battery checks with your supplier. Ask questions on your client's behalf regarding the battery life indictors and how often can the battery be charged…

Configuration – Electronics and corresponding controller options

- Programable modular electronic systems that allow end users to operate a power wheelchair; VR2, R-Net and Q-Logic
- VR2 is a simple and easy system allowing the unit to be turn on/off, changes in speed, battery life and access to up to two power seat functions. It is settings programable. Available with a lights package option
- R-net is a multi-module control system for the control of rehab-type powerchairs. While being simple and easy to install and use, the system is highly flexible and expandable with connection of up to fifteen modules being possible. Bluetooth compatible for environmental control hook up
- Q-Logic which is Quantum specific. Highly customizable, adaptable, expandable control system designed to increase and maximize independence. Bluetooth and infrared compatible for environmental control hook up
- Programmers can be accessed to make changes to acceleration, deceleration, joystick sensitivity, joystick throw, torque and turning speed; modified to suit the driving needs of the end user.

Configuration – Joystick Mounts, Handles, Positioning and Specialty Controls

- Joystick mounts determine the functional location of the controller, ability to stabilise the control for precision driving (fixed/heavy duty mount), midline mounted and the ability to swing or drop it out of the for functional access to the ends of the armrests (transfers and/or table access etc..).
- Joystick handles are available to accommodate a wide range of upper limb functions. Understanding the range of control and release for the proposed upper limb for use will assist in determining the shape and size for trial.
- Active Controls is an adaptive controls system promoting true centre drive positing and the associated benefits to for the end user.
- Switch- It alternative power drive controls gives more solutions to complex situations, specialising in proportion control solutions.
- Assessment for specialty controls must start with understanding functional capacity, neuro-muscular control and postural stability requirements.
- Wheelchair drive sensors are also available to provide depth perception support, assist to navigate tricky environments, support retraining of neglect… Emergency remote buttons
- Reversing cameras are also available

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Configuration – Seating

- Determined by time spent in wheelchair, functional capacity to support and adapt posture, ability to function from the wheelchair and perceived progression and deterioration.
- Growth and adaptive of seating frame vs fixed sizes
- Slung seat/backrest surfaces; captain seat designs; off the shelf postural supports (backrest, cushions, headre etc), custom options and molding seating…
- Determining the need to add power seat function, moving into “rehabilitative power wheelchairs” and determining the benefits and compromises if you don’t.
- Prepare the argument for NOT prescribing a tilt function for any end user who intends on spending 2hrs+ positioned in the wheelchair; intends to use the power wheelchair for outdoor mobility.

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Configuration – Power Rehab Options

TILT

- Tilt-in-space refers to changing the orientation of one sitting in a wheelchair, but keeping the hip, knee, and ankle angles the same.
- Designed to provide very specific benefits for both the wheelchair user and the caregiver to overcome the effects of gravity
- Management of tone and abnormal reflexes
- Assists in positioning during initial transfer and repositioning throughout the day
- Assists in maintaining posture to reduce the need for repositioning throughout the day reducing shear forces
- Up to 20° of tilt used for postural positioning, promoting open postures aids in physiological functioning, improves line of vision, fight the effects of gravity with the ability to come flat for function, swallowing and transfers
- 30° of tilt proven to be beneficial for weight shifting posture in conjunction with recline and leg elevation, as well as managing the effects of gravity on the posture over time
- 45°- 50° best practice for pressure relief every hour for > 15 seconds and < 2 minutes
- It is also function to increase the clearance of foot plates in challenging environments and provide weight support backward going down declines and coming forward to negotiate inclines

Configuration – Power Rehab Options

Vertical Lift

- Lift refers to the increase floor to seat height of the seat surface, allowing the end user to change their seat height respective to their functional need.
- Clinical need to raise the height to assist with transfers (Muscular Dystrophy, slide board transfers…)
- Environmental access, spontaneous access in the community (shopping center shelves, reception desks…)
- Social eye level interactions
- 30cm vertical on average, measure the functional impact (positive) on this range. Have comparable functional outcome measures ready.
- Vertical lift prescribed in combination with tilt will increase the lowest floor to seat height.

Configuration – Power Rehab Options

Recline and Elevating/Extending Legrests

- Recline systems provide a change in seat to back angle orientation while maintaining a constant seat angle with respect to the ground.
- Anti-shear recline systems are designed to minimise this sliding movement associated with the recline action.
- Tilt, recline and elevating leg rests together provide a means for gravity assisted positioning. Most individuals generally need recline angles that can be changed, especially with poor trunk or head control and pain responses in the hips, lower back, neck, shoulders, knees and ankles (passive supported range of motion).
- Tilt and recline together can alter the user's center of gravity to gain balance and stability for functional tasks and positioning, with feet properly supported through the leg rests.
- Opening back angels on active systems can also provide functional opportunities to don/doff pants for toileting and self catherization / assisted catharized in the chair, support sling positioning.
- Proper postural alignment using tilt and recline may also aid in maintaining vital organ capacity and has several physiological implications including managing orthostatic hypotension; visual orientation, speech, alertness, arousal, respiration, and eating; as well as bowel and bladder management
- Recline functions can be prescribed as manual release or tool adjusted as well as powered
- Education to protect against shearing for compromised users when prescribing dynamic recline options

Configuration – Power Rehab Options

Recline and Elevating/Extending Legrests

- Elevating/extending legrest are available in center mounted or swing away positions and move through actuators.
- Manual elevating legrest are available in swing away options, they do not include extension be mindful of compromising knee and thigh positions.
- On their own they can offer changes in lower limb position for comfort in knee joints and to protect from excessive swelling of the feet and ankles
- Provide positioning for NWB limbs, distributing weight through the calf muscle instead of the foot
- Work in conjunction with other seating functions to offer weight shift and pressure off load opportunities for occupants as brace to prevent pelvic tilt
- Know the client's tone patterns and joint limitations to set achievable angels without increasing shear forces. Assess postural displacement that occurs when moving through the seating functions.
- **MEMORY SETTINGS –** electronically programmed through expandable electronics and allows home positions and functional positions to be named and saved through the controller and on a switch panel

Configuration – Special Functions

- **Anterior Tilt –** supports functional reach; supports standing transfers; supports standing machine transfers; supports anterior pressure relief
- **Anterior lift and reach –** combines elevation with anterior tilt to increase functional access
- **Transfer Tilt –** Combines anterior tilt with and articulating foot plate flush to the ground to eliminate moving the foot plate out of the way
- **Lateral Tilt –** changes the orientation of the seat pan laterally (left to right; right to left) to correct fixed postures supporting airways and swallowing; remove the effects of gravity to assist in correcting low tone postures; its an active seating solution allowing for pressure management changes
- **Standing** – provides many physiological benefits which support maintenance of current levels of function through musculoskeletal health, organ tissue oxygenation reducing the impact of further disability from continued wheelchair use; supports functional reach and social interactions.
- **Latitude System –** features 14" of forward travel and a 5" seat to floor height from the pan to the ground for a sit-floor transfers and floor positioning for functional engagement
- **Power Flip-up Foot Platform –** to support independent transfers and improve access around tight corners and into benches
- **Power Swing Away Elevating Legrest -** to support independent transfers and improve access around tight corners and into benches
- ……

Case Study – Lateral Tilt

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Configuration – Back canes

- Straight vs 8° bend vs Endomorphic
- Different height back canes effect push handle height and scapular clearance in some position backs and agitated behaviours or extension tone
- Attend drive controller access: Where is it mounted/ accessibility to walk “behind” the wheelchair to operate
- Push Handles vs stroller handles vs rigidizer bars
- Rear end configurations for bag hooks, cane holders, O2 holders, tow bars, scooter bags…
- Foldable back canes from the seat base, can make transportation easier
- Dynamic Backcanes for strength, tone management and to control agitation and sensory seeking behaviours

Configuration – Leg supports and foot plates

- Measurements are taken in relation to the flat floor surface determining leg rest angle
- 90°- 60° range determined by comfort and postural abnormalities
- 60° with increase overall length of the wheelchair increasing risk of them being damaged, 90° will make it shorter but risk interface with casters
- Consider using the leg rest to protect lower limbs and accommodate foot placement using a depth and angle adjustable foot plate
- Is a central foot plate position required? If so, how does that impact on transfers and leg rests flipping away? (measure distance from surface to transfer clearance)
- Is the strength of the foot plate important?
- Does the foot plate need to padded?
- Are foot supports required? Heel loops, calf strap, foot box, shoe strap, ankle huggers
- Dynamic Legrests and footplate for extensor tone, agitation and sensory seeking movements

Configuration – Armrests

- Full length (14”) vs desk length (10”), typically 2.5” wide
- Flip back, take out, cantilever, dual post, transfer bar access, clothing guards, open air flow or fixed in position custom made. Does the end user need to have access to flipping or removing the armrest themselves?
- Do the armrests need to be wider? Do they need to be soft? (Gel Ovations, waterfall arm pad)
- Arm troughs to support residual limbs. Does it need to come across the body and move away for transfers? Does the elbow need to be blocked to stop the limb falling off the arm pad? Does the hand need position support?
- Does the end user use the armrests to transfer? What impact does this have on where the arm pad finishes on the frame?
- Height adjustable vs fixed height. Consider the impact on swing away laterals..
- Consider tray access, mounting hardware in conjunction with controller mounts
- Accessibility under tables and ease of removal/flip back
- Consider mounting accessories for the armrest or seat rail?

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Configuration - Accessories

- Accessories add function
- Transit tie downs occupied/unoccupied or retractable docking pin; with/without seatbelt necessary for taxi/modified vehicle transport
- Wheelchair trays to provide a stable surface within function reach
- Transfer bars mounted to seat rails to provide a functional support surface to grab during transfers
- Amputee stump supports configured to stump range, removable or fix, curved or flat
- Tow bar hitch configured on the rear of the wheelchair, luggage rack
- Cup holder/water bottle holder provides access to independently rehydrate
- Phone holders; iPad holder; trays… Increased independent accessibility to technology
- USB charger ports to change mobile phones etc on the go.
- Cane carriers/crutch holders, walking frame holders provides access to transfer/walking aids
- Oxygen tank holders increases community access for those who need oxygen
- IV poles increases accessibility for peg feeds or IV fluids
- Ventilator trays to provide supportive and stable surfaces for the machinery
- Mobility bags, armrest glove box and pouches increases accessibility to most used items, keys, phone, wallet…
- Safety flag and light kits allows the wheelchair use to be seen
- Umbrella holder, fishing rod holder, camera holder to increase independent participation in ADLs….

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Reasons for non-use

Guidelines for the prescription of seated wheelchair or mobility scooter for people with traumatic brain injury or spinal cord injury examined research studies for the the reasons why people provided with assistive technology continue to use it, do not ever use it or stop using it.

Assessment and intervention (AT support)

- Non-use occurred when there was a lack of follow-up service; poor instruction and training, including wheelchair maintenance knowledge; limited client participation throughout the prescription process and the client's opinion was not proactively taken into account; delays in delivery of the definitive (final) equipment or wheelchair; delays with required modifications.
- Continued use occurred when the provision process was well-managed with correct selection, installation and measurement.

Personal factors related to the client

- Non-use occurred because of changes that could not be accommodated by the equipment, for example, progression of disability, change in severity of the disability, change in needs or function; severe disability with multiple devices used; changes in client demand (e.g. need for outings); feelings of user insecurity about wheelchair safety.
- Continued use occurred when the user was comfortable; the user was satisfied and their expectations were met; the user accepted their disability; the equipment was consistent with the expectations of their social circle; the user was emotionally mature and motivated.

Device-related

- Non-use occurred when the device was poor quality, leading to failure or a short fatigue life; the person and the equipment were poorly matched, for example, a conflict between form and function or inappropriate features that did not meet functional needs; the appearance of the device did not appeal to the user.

Environmental

- Non-use occurred when there were physical barriers.
- Continued use occurred when there was attendant care worker and social circle support.

Recommendation

“The factors identified in research related to non-use of provided assistive technology (as listed) should be considered by the therapist during the wheelchair prescription process, as these may influence the outcomes.”

https://www.aci.health.nsw.gov.au/__data/assets/pdf_file/0003/167286/Guidelines-on-Wheelchair-Prescription.pdf Page 25

Collaboration is the key to a successful wheelchair prescription!

- Everyone has roles and responsibilities in this process
- Therapist has responsibility to know the client
  - Know what it means to have their diagnosis
  - Know the impacts of the diagnosis, now and ongoing
  - What their goals are
  - To know how the client will interact with certain features of the wheelchair
  - Work with the client to set expectations
  - Refining skills and functional use of the wheelchair
- Client and/or their nominee has the responsibility to be honest and keep communication open
  - Understanding and patience with funding process
  - Express their like and dislikes throughout the process
  - Inform all parties if their circumstances change
  - Accept parameters of the equipment capabilities
- Supplier has the responsibility to provide all options available to meet the identified need
  - Educate the therapist, client and significant others on the products features
  - Ensure the products that are delivered are in good working order and match the prescribed outcomes agreed upon by all parties
- Significant others, such as support works in home or community, have a responsible to support the process
  - To communicate their interactions and roles with the equipment and express concerns as they arise
  - Be a part of the problem-solving process

Conclusion…

- Setting meaningful, client centred goals requires a comprehensive client profile
- Mapping the pelvis is a must to create stability
- Knowing what function you want the end user to have from prescribing a power wheelchair is key to a successful prescription
- The wheelchair technicians will help you match the feature for these functional outcomes; that determines the makes, models, power features etc… are then prepared for trial
- Anticipate any compromises that may occur, e.g. lowering foot plates brings them closer to the ground, not prescribing tilt, folding for transport equals no suspension…
- Strive to be the kind of therapist that puts functional outcomes first. Costs will always need to be considered, but they should not be the first thing that is considered. That takes away options from the end user.
- Team work makes the dreamwork!

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References / Supporting Documentation

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