


The 36th International Seating Symposium  
 March 4, 2020  
 The Westin Bayshore, Vancouver, BC, Canada

## It Depends

### The Answer to Most Wheelchair Seating and Positioning Questions

Breaking down the guidelines for measuring wheelchairs and seating. Is there only one answer?



Presented by:  
**Jane Fontein, OT**  
 Motion Composites



## Faculty Disclosure

Jane Fontein, OT


- Occupational therapist for 35 years
- Independent manufacturer educator
  - Dynamic Health Care Solutions-NXT seating
  - Motion Composites
- “Roger That”
- Lives in Vancouver, BC, Canada

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## Faculty Disclosure

- Presenter: Jane Fontein, OT
- Independent Manufacturer Educator for
- Dynamic Health Care Solutions – NXT seating
  - and Motion Composites



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## Jane Fontein Federer




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## Course Objectives

By the end of the presentation, participants will be able to:


- List at least three critical bony prominences for measuring width and depth for a wheelchair
- List three clinical pros and cons of a wheelchairs prescribed too wide or too narrow
- List the bony prominences and or body areas to measure for cushion and back supports and the possible connection to the product



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## A workshop – not a lecture

- Group participation
- In the time... obviously can not address all the measurements
- Will focus on:
  - Seat Width
  - Seat Depth
  - Back Height



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## Why “It Depends”



- After several years of presenting... One of the things is everyone wants an answer... And has asked me often what would you do.. And inevitably my answer is it depends
- And if we go to what is taught – it is not always the answer either
- Things change... From when I went to school – for me a lot (OLD) Which is why we need to stay up to date but we can not always get to conferences

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## Why “It Depends”



- We want the answer but in reality each case is uniquely different and so the answer to most questions is “It depends”
- It could depend on the diagnosis, the environment, the funding, the culture any number of issues – personal choice
- There are guidelines and we will review – but again where did these guidelines come from.. Is there evidence ?

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## My History of Wheelchair prescription



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## My History of Wheelchair prescription



- First one ever for a client who weighed 350 Pounds (referral said 500)
- In those days one Wheelchair manufacturer – so I ordered an E & J extra heavy duty ! Truly do not remember making any measurements
- We did NOT have evidence base practice at that time
- I was lucky, when I did actually work in a seating clinic the team was part of the assessment including OT, PT Prosthetist and Physiatrist. We as a team looked at possible solutions and one of us followed up. We had more time than today

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## Where We Find “Answers”



- So we might look to our peers – some of whom may be stuck in a rut
- We might look to the internet – gives a variety of answers
- We might look to the guidelines but again any guideline can be limiting but a good place to start

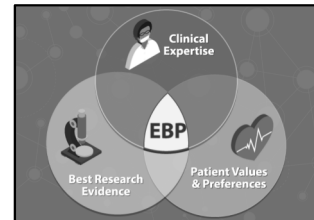
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## Evidence Based Practice



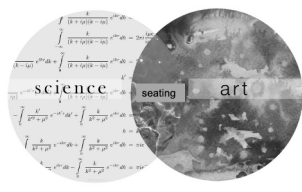
“Integrating individual clinical expertise with the best available external clinical evidence from systematic research.”

David Sackett 1996



Slide compliments of Duke University Medical Center Library and the Health Sciences Library at the University of North Carolina at Chapel Hill

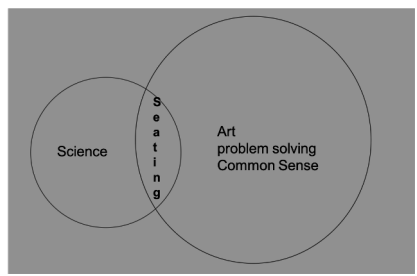
### Seating: Art or Science?



There are no absolutes

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### Seating: Art or Science?



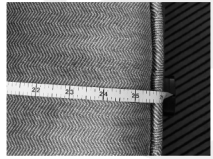
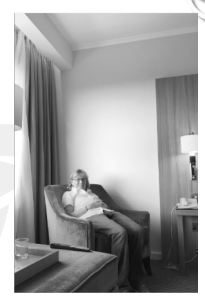
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### I found my perfect "public" seat



Normally public seats never fit me

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26 inches  
66 centimeters

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### Why is this the perfect seat?



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## Seating Assessment

- Focus on the measurements, not ROM etc
- Where and what to measure primary
- Raise your hand if you have measured a client in their current wheelchair - Joan's story
- Get out of the chair

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## The Mat Physical Assessment



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## The Mat Physical Assessment



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## The Mat Physical Assessment



Measure everyone

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## Measurements

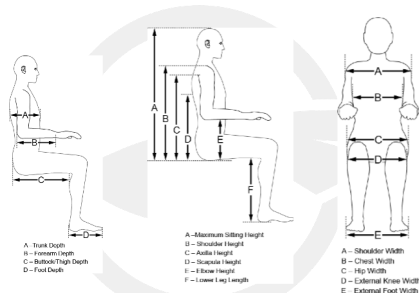


Figure 4.2 below shows all of the Level I measures, and some of the more common Level II measures included in this chapter. The first figure on the left includes depth measures; the middle figure includes height and length measures, and the figure on the right shows width measures.

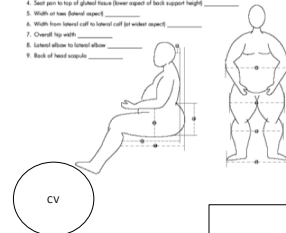
A Clinical Application Guide to Standardized Wheelchair Seating Measures of the Body and Seating Support Surfaces  
 Kelly Waugh and Barbara Criss

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### ADDITIONAL MEASUREMENTS FOR BARIATRIC CLIENTS

Current weight \_\_\_\_\_ Weight history \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

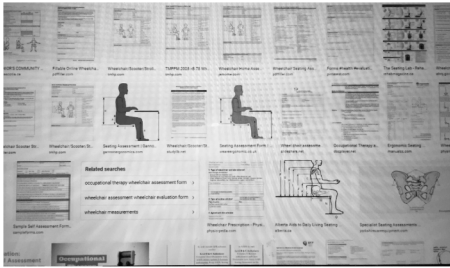
1. Back of knee/calf to back of buttocks (seat pan depth)
2. Back of knee/calf to thoracic-lumbar level (for seat depth)
3. Seat pan to under femoral tunnel height
4. Seat pan to top of gluteal folds (over support height)
5. Width of knee (several aspects)
6. Width from lateral calf to lateral calf (for wheel space)
7. Overall hip width
8. Lateral elbow to lateral elbow
9. Back of head width



Ref:  
 Jane Fontein and  
 Stephanie Tanguay

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### Google seating assessment



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### Seat Width



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### Experiment / Measure me



Survey – how many people have measured a client for a wheelchair?

3 people come and measure me for seat width – but do not say the width you measure – use regular method

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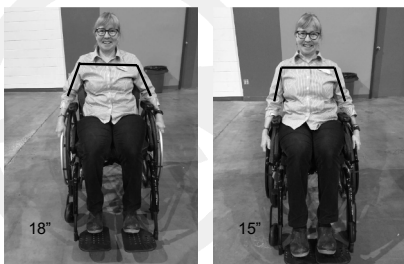
### What size chair should I have discussion



- What were the measurements of me?
- Now survey what size chair I should get?
- Yes it depends....
- My history over the years from 15" to 21"

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### What size chair should I have discussion



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### What size chair should I have discussion



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## Seating assessment



- What do you measure with

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## How do we measure? Reliability



### Hardware:

- Soft tape measure
- Hard tape measure
- Caliper
- Use hard sides? Vs eyeball
- From the front from the back

### Where to measure

- Hips / thighs Literature says at trochanter or in some cases the widest point
- Knees...
- Widest point

If there is time at the end a short experiment

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## Seating assessment forms



- Often it shows how to measure but then not what to do once you have the measurement

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## After the measurement



Wheelchair width vs measurement  
Maybe the guideline should say:

- Add 2"
- Add 1"
- Equal
- Minus 1"
- Minus 2"

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## Evidence guidelines for width



Studies on wheelchair width have been about propulsion efficiency

- To my knowledge there aren't any "studies" about how wide the wheelchair should be after the measurement only guidelines
- There are recommendations – Resna position papers ,PVA to fit as – but it is not specific (but can you be?)
- Internet : Found many presentations or assessment forms stating add 2"or add1"
- I did find some that did say to keep it as small as possible
- (information from Therapists, txt books, internet.. Manufacturers)

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## What is the answer



It Depends

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## Explore Seat Width



- Wheelchair width is not always determined by “hip” width
- Cushion width not always determined by wheelchair width

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## Too wide can lead to:



- Compromise posture
- Lead to postural issues – space to move into
- Decrease propulsion efficiency
- Decrease maneuverability
- Over all width – 1” can decrease efficiency by 5-10%

Denison

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## Too Narrow can lead to:



- Unable to sit straight
- Pressure on bony prominence/ skin risk – just like a shoe that is too small Too narrow – uncomfortable
- Uncomfortable

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## So why do we add 1”

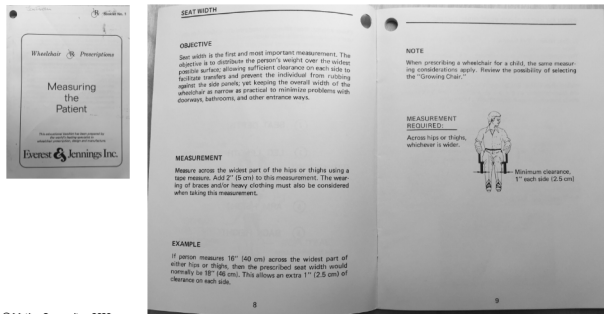


It seems most add 1” on each side or 2” to the overall measurement

BUT WHY?

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## History of Width Measurement



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## History of Audience



- Who was taught to add 2” overall?
  - Who was taught to add 1” overall?
  - Who was taught to be the same?
  - Who was taught to squeeze?
- What is the recommended? Most
- My experience – most common answer is to add at least 1” per side or 2” overall

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### Why add width – common reasons - explore

- **Winter clothes** –(seems the most common reason)
- Percentage of time wearing winter clothing... 1-2% of time
- Shoe Analogy –buying high healed shoes for an event but now have to wear them all the time
- Or you buy shoes that fit heavy socks but you wear those socks 10 days a year and the rest of the time thin or no socks...

As with all things seating always need to ask why and time ...

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### Why add width – common reasons - explore

- **Skin protection** – Depends on where the pressure is... –
- Doesn't mean you have to squeeze – it depends on where you squeeze and personal choice
- Shoe analogy – do you tend to get blisters with shoes that are too big or when they fit?

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### Why add width – common reasons - explore

- **Weight gain potential** – what if client doesn't gain weight now the client has a wheelchair too big for several years
- Prosthesis analogy – are they made to fit - or do they make them bigger incase they gain weight – what if they do they get a new prosthesis – the chair is a prosthesis and should be ordered to fit – Not sure why it is OK to have a wheelchair to big just in case (friend)
- I understand funding but it should be education .....

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### Why add width – common reasons - explore

- **Chest width** larger than hip width – but that doesn't mean has to be wider... Depending on the back support needed and length and or height of the back support

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### Reason why might add width

- For seating components
- Windswept posture
- Personal choice
- Chair options Chair classification – some only 2" increments – like a shoe store only has 6 8 10
- Purse/Kleenex box - personal choice

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### Reason why might make as narrow as possible

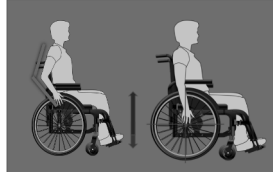
- For better propulsion – Analogy carrying grocery bags
- For positioning
- Vertical Axle position

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### Vertical Axle Position

- Angle between the arm and forearm between 100-120 degrees (60-80 degrees of elbow flexion) with hand on top of push rim
- Middle finger touches the center of the axle with arms hanging
- Demonstration



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NO BLANKET STATEMENTS

IT DEPENDS

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### Seat Depth



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### Anatomy of the Pelvis

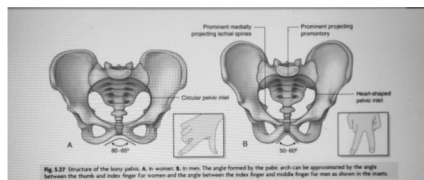
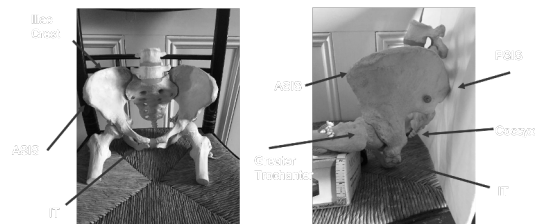


Fig. 9.27 Morphology of the bony pelvis. A, in women; B, in men. The angle formed by the pubic arch can be approximated by the angle between the fourth and sixth finger for women and the angle between the sixth finger and middle finger for men as shown in the inserts.

Ref: Grays Anatomy

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### Anatomy of the Pelvis and Landmarks



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## Relationship of Trochanter to IT



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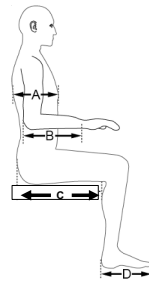
## Critical landmarks and their relationships for seating

- Ischial tuberosity's - well of the cushion
- ASIS – determine obliquity /rotation/Post and Anterior pelvic tilt
- PSIS – Posterior anterior tilt / Back support
- Greater Trochanter – thigh support/ off loading
- Coccyx – sitting support increases with PPT
- Femur – length – thigh support – Length of cushion

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## Measure for seat depth

- What is the general guide for seat depth
- Is that cushion depth?
- Buttock thigh depth - from back of bum to Popliteal fossa



A – Trunk Depth  
B – Forearm Depth  
C – Buttock/Thigh Depth  
D – Foot Depth

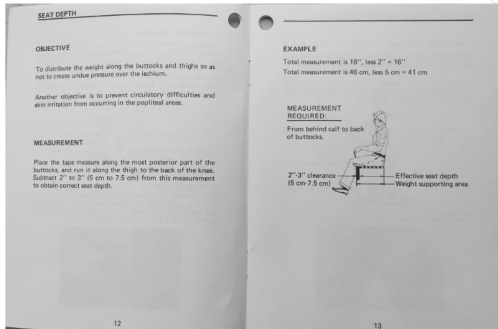
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## Measure each other

- How long should the seat depth be? Subtract 2"???

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## Seat Depth History



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## Seat Depth

- Most information: subtract 2" from seat depth measured  
**BUT WHY?**

Cut off circulation – but maybe have sensation? Cushion waterfall edge

Transfers – to get hand under leg

It Depends – the longer the better for positioning and weight distribution but it depends

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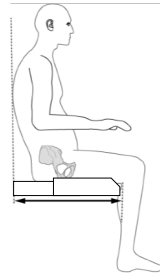
### Seat Depth too short too long

- Seat depth – rarely longer than 18" (Josh)  
depends on the angle of the seat pan (dump)
- Too long – ppt kyphosis fwd head...  
- longer frame – limits manoeuvrability
- Too short – leg position  
- pressure relief/redistribution

Betz and Boninger

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### Issue with seat depth (fixed kyphosis)

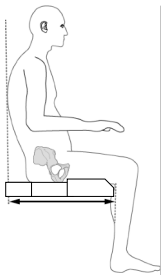


Maximum Sitting Depth

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- Cushion is the right length according to the measurement but doesn't fit.....
- The IT's are not landing in the well of the cushion

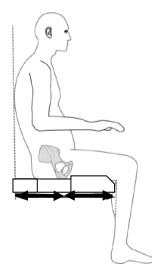
### Issue with seat depth (fixed kyphosis)



Maximum Sitting Depth

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### Issue with seat depth (fixed kyphosis)



Maximum Sitting Depth

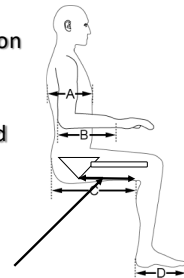
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- Need to know where the IT's are with respect to the front of the cushion

### Need to know where IT's are

- If E measures 10" but the cushion measures 13" from the front to the middle of the well
- The client will be pulled forward into PPT
- Not just for Kyphosis

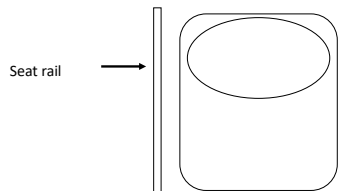
E – IT to Popliteal



A – Trunk Depth  
B – Forearm Depth  
C – Buttock/Thigh Depth  
D – Foot Depth

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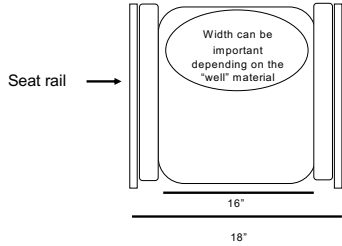
### Width of cushion



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### Width of cushion

Does it have to be the same width as the wheelchair?



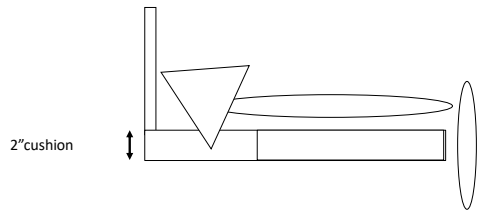
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### Relationship of Trochanter to IT



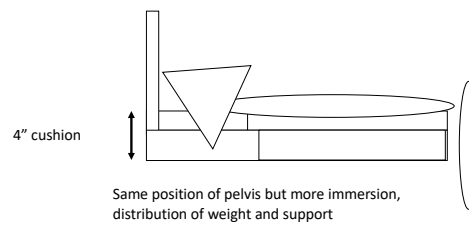
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### Thickness of cushion measurement

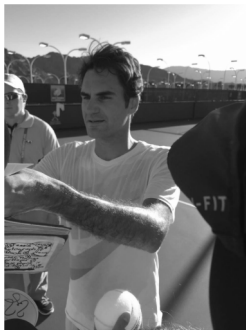


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### Thickness of cushion measurement



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### Back Supports

- How important is the back support?
- When it comes to discussion about pressure injury – the cushion is blamed for everything and it is also the solution... the cushion is only one aspect of skin health and positioning.

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### Quote ....

• “Just because the evidence base is currently limited, does not mean that our clinical knowledge base is unfounded. Clearly an opportunity for research is evident and critical to demonstrate the efficacy and effectiveness of our interventions, improve patient outcomes and justify costs.

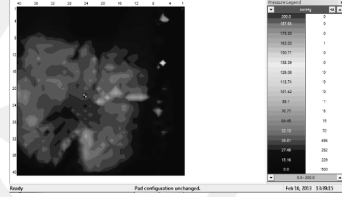
#### • Conclusion

• The prescription process is only two thirds complete when the mobility base and cushion have been chosen. According to Engstrom[2] “for the seat to be fully functional, it needs to be in harmony with the backrest”. The seat provides the base of stability, the backrest stability and balance for function. While seating is always the essential first step, it is always essential to think beyond the seat. “

Do You Have Your Client's Back?  
 Jacqueline Macaulay PT., ATP  
 27th International Seating Symposium • March 3-5, 2011

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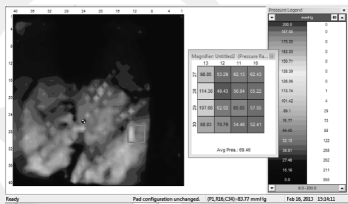
### Is it the cushion? The back? Or both



Ed on Ride after 10 min

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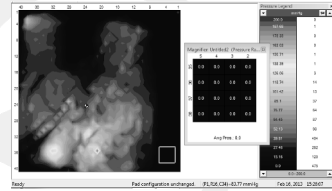
### Is it the cushion? The back? Or both



Jay fusion 16 x 16 after 5 min – with his back

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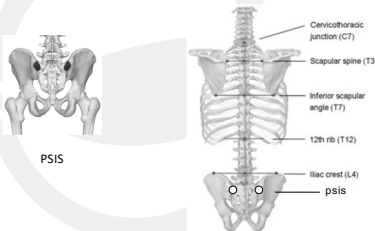
### Is it the cushion? The back? Or both



Different chair with more recline, lower backrest, less contoured backrest, jay fusion.. Bigga difference  
 Different set up same cushion (Jay fusion) , note peak pressure over right ischial, less so on left is ischial

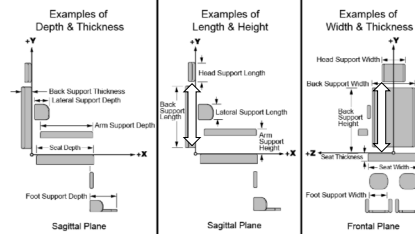
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### Bony Prominences



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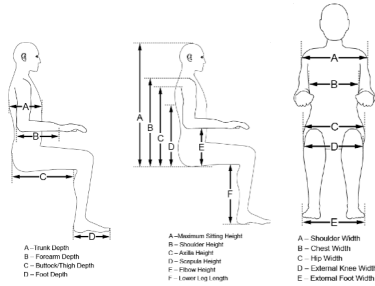
### Back Support Terminology



A Clinical Application Guide to Standardized Wheelchair Seating Measures of the Body and Seating Support Surfaces  
 Kelly Vaughn and Barbara Crane

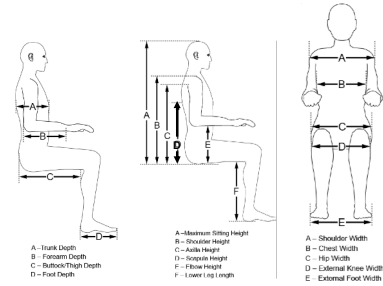
### What to measure.....

- Scapula height
- Axilla height ,
- Shoulder height,
- Shoulder width,
- Chest width,
- Hip width
- Trunk depth
- Lumbar curve depth,
- Thoracic curve depth
- PSIS height,
- Waist width
- Other



### What to measure.....Most Common

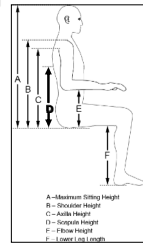
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- Waist width
- Other



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### Experiment #1 for scapular height

- Breakout groups – time dependent
- Measure the person beside you
- Survey



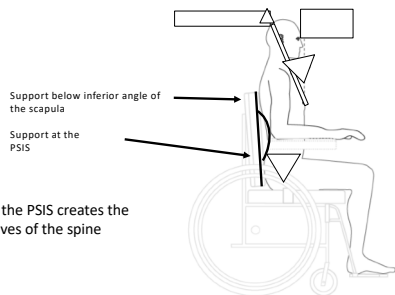
### What creates the natural curves

- Stems from the pelvis! And the bony prominence is the PSIS
- If we don't support the PSIS naturally fall into posterior pelvic tilt



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### Neutral Pelvis to create Natural curves

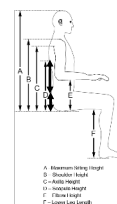


Ref:  
A Clinical Application  
Guide to Standardized  
Wheelchair Seating  
and Seating Support  
Surfaces  
Kelly Waugh and  
Barbara Crane

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### What to measure.....For Natural Curve

- Scapula height
- Axilla height ,
- Shoulder height,
- Shoulder width,
- Chest width,
- Hip width
- Trunk depth
- Lumbar curve depth,
- Thoracic curve depth
- PSIS height,
- Waist width
- Other

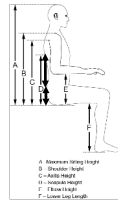


Need to know from  
seat to PSIS and  
PSIS to Inferior  
angle of scapula

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## Tallest person in Audience

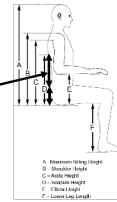
- Measure from PSIS to Inferior angle



## Audience measure

Everyone Measure their neighbor and vice versa if time

- Measure from PSIS to Inferior angle of scapula
- the RED arrows

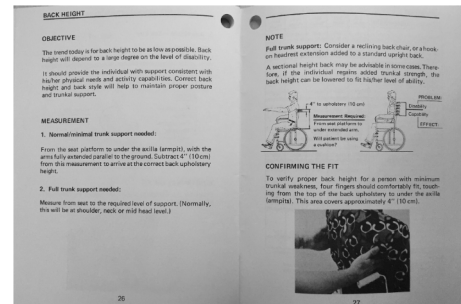


## What is the average....

- Average of the group

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## History of Back support height



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## Back Height (Length) Too high too low

- Too low – no trunk or pelvic support - it depends
  - poor posture – it depends
  - instability – it depends
- Too high – limit arm movement –
  - diminish propulsion
  - force trunk into forward flexion
  - kyphosis with PPT
  - sliding out of the chair

## Not opposed to tall backs

- It depends on where you need support
- It depends on the mobility device – ie tilt chair
- It depends if need Lateral support
- It depends if need a head support .... For transport?
- But I am opposed to a tall back just because client is tall – Look at the reasons.

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## Back Length



Ted is 6'5" and I am 5'0"



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## Measure everyone



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## My 6'7" (200cm) tall nephew



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## Arm span



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## Summary



- There are no answers – It Depends
- There are guidelines
  
- Width – equal, greater or smaller than what measured
- Depth – equal or -2" – know IT in relation to front of cushion
- Back Height – not necessarily tall because client is tall – measure to PSIS if appropriate.



Questions?



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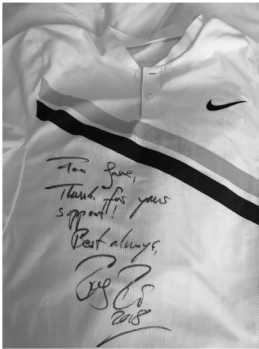
MOTION  
COMPOSITES  
GO BEYOND

Thank You!



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"For Jane  
Thanks for  
your support!  
Best always  
Roger Federer  
2018"



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Thank you



Guess  
who?



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