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## Comparing Frames of Ultra Lightweight Wheelchairs (ULWC)

One of the first steps in selecting a wheelchair is to determine the type of wheelchair frame that is required. According to clinical practice guidelines, a fully configurable, ultra lightweight wheelchair is recommended for an individual who uses a manual wheelchair for independent mobility.<sup>1,2</sup> The ability to fully tailor a wheelchair for an individual will have an effect on positioning/postural support, ease of propulsion, and wheelchair stability and maneuverability. Different choices are available in ultra lightweight wheelchair frames – from those that fold with a cross-brace to those that are fully rigid. It is important to understand the similarities and differences in the wheelchair frames so that the initial choice of type of wheelchair frame is optimal for individual clients.

### Frames Choices in Ultra Lightweight Wheelchairs

When choosing between folding and rigid, consider:

- Stability of individual's condition; e.g., anticipated change in client's size or function
- Level of postural support required
- Method of propulsion; e.g., bilateral upper extremities; hand-foot propulsion; foot propulsion
- Discrepancy of lower leg length or contractures of lower extremities
- Transfers; e.g., standing transfer, sliding board transfer
- Activity level of the individual; e.g., distance propelled daily and in what environments
- Transportation; e.g., ability to fold/lift the wheelchair or crash-worthiness for occupied transit



**Folding**



**Rigid**

# Folding and Rigid Frame Comparison

## Frame Choices in Folding and Rigid Wheelchair Frames

### Folding



### Rigid



FOLDING	RIGID
<ul style="list-style-type: none"><li>• Cross-brace permits lateral (side-to-side) folding, for ease of transport or storage</li><li>• Lighter in weight than traditional, standard wheelchairs</li><li>• Appropriate for hand propulsion, hand-foot propulsion or foot-propulsion</li><li>• Appropriate for all transfers, including standing transfers</li><li>• Adjustable configurations<ul style="list-style-type: none"><li>— Choice of wheels, tires, handrims, wheel locks, casters, arm supports, lower leg support assembly (hangers and foot plates), center of gravity</li></ul></li><li>• Available in box frame, modular frame, and open frame models</li><li>• Better opportunity to suit active clients with greater positioning needs</li></ul>	<ul style="list-style-type: none"><li>• No cross-brace for lateral folding; however, back posts may fold down for ease of transport</li><li>• Lighter than folding wheelchairs due to material and design</li><li>• Appropriate for independent, active user who propels with the upper extremities</li><li>• Appropriate for side-to-side/sliding board transfers</li><li>• Adjustable configurations<ul style="list-style-type: none"><li>— Choice of wheels, tires, handrims, wheel locks, casters, arm supports, frame angles, frame insets, foot boards, center of gravity</li></ul></li><li>• Available in closed/box frame and open frame models</li><li>• Available in adjustable and fixed/welded models</li><li>• Greater efficiency of propulsion compared to folding due to: lighter weight, fewer moving parts, greater rigidity, which transfers the energy of propulsion into movement</li></ul>

# Folding Frame Comparison

## Frame Choices in Folding Wheelchair Frames

**Modular Frame**



**Box Frame**



**Open Frame (Folding)**



MODULAR FRAME	BOX FRAME	OPEN FRAME (Folding)
<ul style="list-style-type: none"> <li>• Side frame is made up of front frame, cross brace and rear frame</li> <li>• Allows for choices in rear frame (e.g., square or rounded) and in front frame (e.g., hemi frame, fixed frame) to suit various needs</li> <li>• Allows for change in frame components to accommodate change in size or function/condition</li> <li>• Seat rail sits above cross-brace and wheelchair frame, providing dual rails for mounting positioning components, if required</li> </ul>	<ul style="list-style-type: none"> <li>• Side frame is one piece</li> <li>• Cross brace is integrated into side frame to connect the two sides</li> <li>• Allows for lower seat-to-floor height as seat rail is flush with wheelchair frame</li> </ul>	<ul style="list-style-type: none"> <li>• Cross brace is more compact than traditional folding wheelchairs</li> <li>• Choice of fixed front end for greater rigidity or swing away lower leg assembly for ease of standing transfers</li> <li>• Allows for greater efficiency of propulsion compared to modular or box frame folding wheelchairs due to lower weight, fewer moving parts, rigidity in cross brace and seat rail</li> </ul>

# Ultra Lightweight Frame Comparison

## Frame Choices in Ultra Lightweight Rigid Wheelchair Frames

### Open Frame




### Closed Frame



### Box Frame





OPEN FRAME	CLOSED FRAME	BOX FRAME
<ul style="list-style-type: none"><li>• Tends to be lower in weight than closed frame as fewer components in frame</li><li>• Easier to transport as lower section of frame is absent; can lift wheelchair across the body into a vehicle</li></ul> 	<ul style="list-style-type: none"><li>• Greater rigidity than open frame due to tube from camber well to caster housing</li><li>• Greater rigidity offers greater efficiency of propulsion</li><li>• Could be more challenging to transport into a vehicle due to shape of frame</li></ul>	<ul style="list-style-type: none"><li>• Tends to offer greater rigidity than open frame due to structural design of frame creating the shape of a "box"</li><li>• Tends to be heavier than open frame and closed frame wheelchairs</li><li>• Could be more challenging to transport into a vehicle due to shape of frame</li><li>• Allows for optional swing out lower leg assembly due to box design</li></ul>

# Adjustable and Fully Welded Frame Comparison

## Frame Choice of adjustable or fully welded model

Rigid wheelchairs, whether open-, closed- or box-framed, can come in adjustable or fully fixed/welded versions. Which one is right for an individual?

	
ADJUSTABLE RIGID	FIXED/FULLY WELDED RIGID
<ul style="list-style-type: none"><li>• Allows for limited adjustments to be made after the purchase of the wheelchair; e.g., rear seat to floor height, center of gravity (CoG), back post angle</li><li>• Appropriate for an individual whose condition may change after the purchase of the wheelchair to allow for changes to the wheelchair to accommodate current and ongoing needs (e.g., change in CoG on wheelchair to accommodate change in balance; change in back support angle to accommodate positioning/postural needs)</li><li>• Greater efficiency of propulsion compared to folding wheelchairs due to lighter weight, and greater rigidity than folding wheelchairs</li></ul>	<ul style="list-style-type: none"><li>• Components are fixed in position, according to individualized specifications on order form</li><li>• Appropriate for an individual who is an experienced manual wheelchair user and team (therapist, supplier, client, etc.) knows exactly what is required for client for wheelchair set up; client's condition or function is not expected to change during length of wheelchair ownership</li><li>• Allows for improved efficiency of propulsion over adjustable rigid wheelchair; increased rigidity from welded parts translates to movement when force is applied to the handrims</li></ul>

## References/Resources:

1. Rehabilitation Engineering and Assistive Technology Society of North America. (2012). RESNA Position on the Application of Ultralight Manual Wheelchairs.
2. Consortium for Spinal Cord Medicine. (2005). Preservation of Upper Limb Function Following Spinal Cord Injury: A Clinical Practice Guideline for Health-Care Professionals. Paralyzed Veterans of America.
3. Bjornson, A. (2019). An Overview of Ultralight Manual Wheelchair Frame Styles. Retrieved from <http://www.sunrisemedical.ca/education-in-motion/blog/october-2019/overview-ultralight-manual-wheelchair-frame-styles>
4. Sherman, S. (2019). Understanding Choices in Rigid Wheelchairs. Retrieved from <http://www.sunrisemedical.ca/education-in-motion/clinical-corner-archive/march-2019/understanding-choices-in-rigid-wheelchairs>

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