

# Assistive Device to Help Users Pull Their Pants All the Way Up

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**Client:** Dan Dorszynski

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# Overview

- Problem Statement
- Background
- Competing Designs
- Project Design Specifications
- Design Choices & Design Matrix
- Future Work

# Problem Statement

- The client, Dan Dorszynski, has Becker's Muscular Dystrophy which causes physical limitations that make it difficult to perform the standard activity of pulling up his pants
- Current process of pulling pants up is tedious and takes an excessive amount of time and effort
- The device must improve the ability of the client to effectively and efficiently pull up their pants

# Background

- Becker's Muscular Dystrophy [1], [2]
- Leads progressive muscular degeneration and proximal muscle weakness. [3]
- Client Limitations
- Client Struggles



*Figure 1: Client, Dan Dorszynski*

# Competing Designs



Figure 2: The Pants Up Easy [6]



Figure 3: No Limbits Adaptive Mens Wheelchair Pant[7]



Figure 4: Wings-Pant Dressing Aid[8]

# Product Design Specifications

- Assist user with Becker's MD and limited arm strength in pulling their pants up while in a wheelchair
- Support weight and height of user
- Minimize time taken to pull up pants
- Weight must not exceed 50 lbs
- 1 prototype in a \$300 budget

# Product Design Specifications

## Lean and Lift Device

1. Support 230 lb, 6-ft-2in male
2. Fully functionable for 5 years
3. Allow lower body to lift off of wheelchair
4. Materials must be compatible with indoor environment temperature and humidity [1]
5. Class I medical device according to FDA [2]
6. Handle bar for user to grab onto

# Product Design Specifications

## Suspenders Device

1. Must pull pants up to desired length
2. Must be attachable to any style of pant
3. Must not require over 8.4 lbs of pulling
4. Must be adjustable in length for comfort



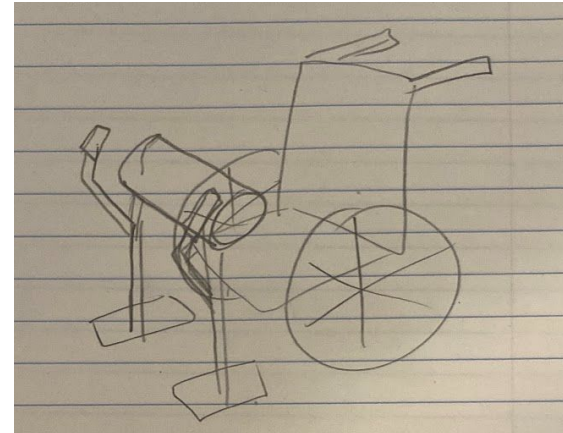
# Current Designs

# Lean and Lift Design

- Metal frame supported beam with a cushion for client to lean on and pull pants up
- Handles and straps for stability
- Pros/Cons



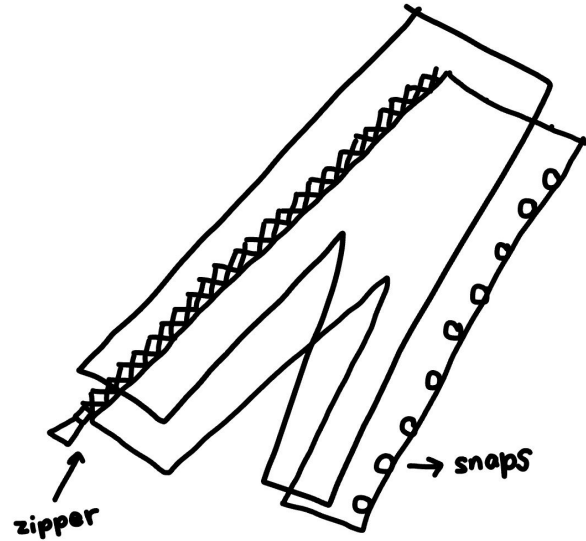
**Figure 5:** Lean and Lift Diagram



**Figure 6:** Lean and Lift Device with Wheelchair Drawing

# Snap/Zip Pants Design

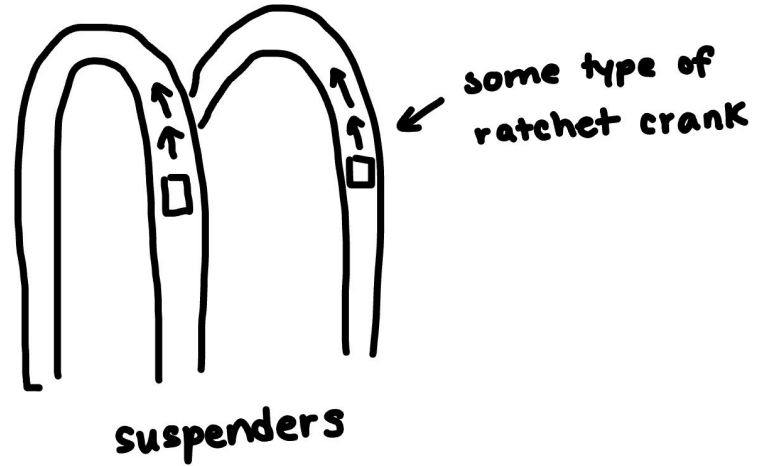
- Modify client's existing pairs of pants
- Base placed before the client transfers
- Alignment issues when attaching together



*Figure 7: Snap/Zip Pants Design Drawing*

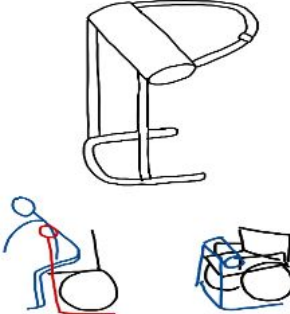
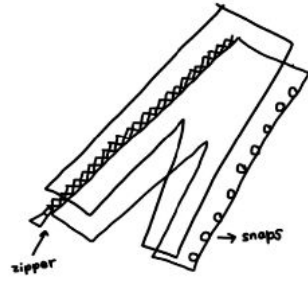
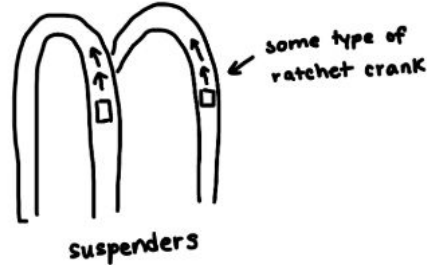
# Suspender Design

- Worn over shoulders and clips to pants waist
- Length adjusted via ratchet crank
- Potential to incorporate electric assist
- Does not help client lift bottom off chair



*Figure 8: Suspender Design Drawing*

# Design Matrix

									
			Design 1: Lean and Lift		Design 2: Snap/Zip Pants		Design 3: Suspenders		
Rank	Criteria	Weighted Score	Score (out of 10)	Weighted Score	Score (out of 10)	Weighted Score	Score (out of 10)	Weighted Score	
1	Effectiveness	25	9	22.5	6	15	7	17.5	
2	Ease of use	25	8	20	4	10	6	15	
3	Ease of fabrication	20	7	14	6	12	8	16	
4	Comfort	15	10	15	9	13.5	6	9	
5	Price	10	5	5	10	10	10	10	
6	Safety	5	9	4.5	10	5	9	4.5	
		<b>Sum</b>	<b>100</b>	<b>Sum</b>	<b>81</b>	<b>Sum</b>	<b>65.5</b>	<b>Sum</b>	<b>72</b>

**Table 1:** Design Matrix

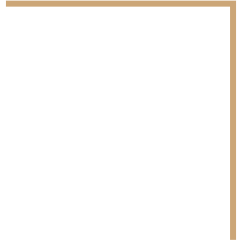
# Future work

- Decide on Final Design
  - Combination of Lean and Lift and Suspenders
- Motorized Design
- Research Materials
- Prototype



**Figure 9:** Model Prototype

Questions?



# References and Acknowledgements

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- [3] C. R. Heier *et al.*, “The X-linked Becker muscular dystrophy (*bm*x) mouse models Becker muscular dystrophy via deletion of murine dystrophin exons 45–47,” *Journal of Cachexia, Sarcopenia and Muscle*, vol. 14, no. 2, pp. 940–954, Jan. 2023, doi: <https://doi.org/10.1002/jcsm.13171>.
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- [5] Center for Devices and Radiological Health, “Classify Your Medical Device,” U.S. Food and Drug Administration, [https://www.fda.gov/medical-devices/overview-device-regulation/classify-your-medical-device#:~:text=Class%20I%20includes%20devices%20with,I%2C%20II%2C%20and%20III](https://www.fda.gov/medical-devices/overview-device-regulation/classify-your-medical-device#:~:text=Class%20I%20includes%20devices%20with,I%2C%20II%2C%20and%20III.). (accessed Sep. 19, 2023).
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