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Assistive Device for Floor-to-Wheelchair Transfer

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Background



1 in 100 individuals worldwide use wheelchairs, and for them floor-to-wheelchair transfers are one of the most difficult and life-threatening tasks.

Average wheelchair seat height: 18-20 inches

Common transfer injuries: Cuff tears, shoulder and wrist pain, and could potentially cause a permanent or life threatening injury

Current Solutions

	Assist Handle	Stapleladder Products	Lift Sling Products
Safe	✓	✓	✓
Independent Use	✓	✓	...
Portable	✓
Affordable	✓
Versatile	✓

TABLE 1: Existing devices (stapleladder products [1], lift sling products [2]) and Assist Handle.

Project Goals

- Develop portable assistive device to independently assist wheelchair users with various mobility needs
- Stress testing and clinical trials of new manufactured prototype

Assist Handles



FIGURE 1: Illustration of the assembled device.

Assembled State

- Maximum hip height by more than 10in
- Safer and less strenuous transfers
- Used as hard-to-reach door handles and lowered crutches for crawling support



FIGURE 2: Illustration of the disassembled device.

Disassembled State

- Disassembled in matter of seconds
- Compact, pocket-sized device
- Directly attached to the wheelchair frame using universal snap-fit mechanism

Device Validation

Test Category	Customer Requirements	Engineering Requirements	V&V
Functionality	Supporting weight	Up to 400lb weight support	Fatigue testing
	Assist with floor transfer	At least 10 in increase in maximum achieved hip height.	Free body diagrams
Durability	Device can last for years	10,000 assemblies (~ 4 years)	Assembly test
	Survive any temperature	Extreme temperatures (0 - 100 °F)	Temperature test
Comfort	Limited wear after prolonged usage	Survive applied weight over a designated period of time	Usage test
	Comfortable to use on the daily	Assemble under 15 seconds	Validation testing
Shipping	Can be shipped without any issues	Cushioning rubber handle	Drop test
	Surviving real transportation conditions and potential hazards		Vibration test
			Compression test
			Impact test

TABLE 2: A table of our proposed validation testing.

FDA Standards:

Class 1 medical device & 510k exempt classification: Aid, Transfer product code: IXK

ISO Standards:

ISO 14971 Medical devices — Application of risk management to medical devices
ASTM F04.15 Material Test Methods
ISO 13485 Medical devices — Quality management systems
ISO 9001 Quality management systems — Requirements
ISO 9999 Assistive products for persons with disability — Classification and terminology

Timeline

Tasks	Fall 2021						Winter 2022						Spring 2022					
	W1	W2	W3	W4	W5	W6	W1	W2	W3	W4	W5	W6	W1	W2	W3	W4	W5	W6
Customer Segments Round 1																		
Create Preliminary Prototype																		
Work on Prototype Design																		
Prototype testing																		
1-Design Customer Segments Online																		
Necessary Adjustments																		
Final Prototype Testing																		
Final Product Design Briefing Session																		

TABLE 3: A table of our project timeline throughout the academic year.

Team Organizational Chart



References:

1. "How to use a Hoyer lift," Preferred Health Choice - Mobility & Patient Aid Center. [Online]. Available: https://www.phc-online.com/How_to_use_Hoyer-Lift_a/146.htm. [Accessed: 22-Nov-2021].
2. "Wheelchair Transfers," Wheelchair Transfers - Hesperian Health Guides. [Online]. Available: https://en.hesperian.org/hhg/Disabled_Village_Children/Wheelchair_Transfers. [Accessed: 22-Nov-2021].

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