

Ergonomic Assessment

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Task analyzed: Pushing force required to move the Envella bed on a leveled surface.

Identified problem:

Transporters and Nursing staff are concerned for risk of injuries when pushing the Hill ROM Envella bed. Some team members are complaining of back pain when moving this bed in the room, from room to room as well as maneuvering it in the hallway, on/off elevators and up ramps when needed.

Description of Envella bed:

The Hill ROM Envella bed is an air fluidized therapy bed used for patients with advanced wounds. It is ordered by the TGH wound care team and approximately 9 beds are used each month for varying length of times.

Dimension of bed: 92.5" long X 40" wide

Bed features: height adjustable from 22" to 31.5"

Steer feature available: YES

Wheels: Four 6" wheels

Power drive available: NO

Weight of bed: **1400 pounds**



Brief description of job site analysis:

Using a digital push/pull gauge, the initial pushing force required to move an unoccupied envella bed was measured (initial push force). This was performed with wheels aligned (task one) and NOT aligned (task 2) and task was repeated 5 times.

The force required to keep the bed moving (sustained force) was then measured and repeated 5 times (task 3).

All tasks were performed on leveled laminate flooring with push gauge at 42" distance from the floor.

Pulling force, pushing force up ramp and force to get bed on/off elevators were not measured during this job site since initial pushing forces exceeded recommended safe pushing limits and those tasks would be more strenuous.

Task # 1:

INITIAL Pushing force required to move envella bed on leveled surface with **wheels aligned in steer mode**.

Trial #	Initial force (lbs)
1	48.2
2	49.8
3	49.0
4	50.8
5	49.2
AVERAGE	49.4

Task #2:

INITIAL Pushing force required to move envella bed on leveled surface with **wheels NOT aligned in neutral**. (*simulates moving bed in room*)

Trial #	Initial force (lbs)
1	90.4
2	74.2
3	111.8
4	96.2
5	74.8
AVERAGE	89.48

Task #3:

SUSTAINED Pushing force required to move envella bed on leveled surface.

Trial #	Initial force (lbs)
1	58.6
2	49.0
3	52.0
4	49.0
5	52.0
AVERAGE	52.12

Results:

Liberty mutual were utilized to analyze this task and their goal design is to accommodate 75% of females.

Measurements used for liberty mutual tables (see table 1 on page 6):

- Vertical distance from floor to handle was 42', therefore used 36" on the table.
- Used one push every 8 hrs for frequency (i.e one bed run every 8 hours)
- Distance pushed used > 194 feet for pushing on leveled surface.

According to the liberty mutual tables for pushing objects,

- if an object is being pushed or pulled at a 36" height, > 194 feet, the **initial push and pull force should not exceed 42 pounds and the sustained push force should not exceed 20 pounds.**

The **average initial push force** required to move unoccupied envella bed was:

- 49.4 pounds with wheels aligned = **17% higher** than recommended value to accommodate 75% percentile females. (**1.2 times higher than recommended limit**).
- 89.48 pounds with wheels NOT aligned = **113% higher** than recommended value to accommodate 75% percentile females. (**2.1 times higher than recommended limit**).

The **average sustained push force** required to keep unoccupied envella bed moving was:

- 52.12 pounds with wheels aligned in steer = **160% higher** than recommended value to accommodate 75% percentile females (**2.6 times higher than recommended limit**).

TGH Injury Data:

Employee Health worker's compensation data for activity:

"Pushing & pulling beds" in past 5 years at TGH (*this includes all beds*)

	2014	2015	2016	2017	2018	Total for past 5 years
Number of Injuries reported due to pushing and pulling beds (includes all dept)	12	13	16	19	8	68
Cost \$ (includes internal, external and indemnity cost for pushing and pulling beds)	\$22,726	\$24,003	\$14,339	\$17,242	\$18,236	\$96,546

** There have been many initiatives in the past year to change the culture of bed Transportation at TGH, hence a decrease in injuries in 2018. Our goal is to only transport Patients in beds if they are on a motorized bariatric bed, have severe orthopedic injuries or are medically unstable.*

Summary of findings:

Pushing an unoccupied envella bed on leveled surfaces places team members at risk of injury.

The average **initial pushing force** required to push an unoccupied envella bed with wheels aligned was 17% higher than what is recommended to accommodate 75% of females and was 113% higher (**2.1 times higher**) with the wheels NOT aligned.

The **average sustained pushing force** required to keep unoccupied envella bed moving down the hallway in steer mode was 160% higher than what is recommended to accommodate 75% of females (**2.6 times higher**).

Recommendations:

1. It is recommended to **transfer patients from the envella bed onto a stretcher when transporting patients**, not only due to risk of team member injuries, but due to manufacturer recommendations NOT to move bed with a patient in it.
2. If an unoccupied envella bed needs to move from one location to another, it is recommended to **utilize 4 team members** to reduce the risk of injuries until Hill ROM develops a motorized version of the bed or until TGH purchases an electric bed mover. It is recommended to avoid ramps when possible.
3. Recommend TGH **purchase an electric “Bed mover”** which can hook onto the envella bed to motorize this task (~\$20,000-\$25,000).
 - a. **Stamina lift company** has such device (*used at Sutter health and Aurora.*)
 - b. Vendor is willing to fly to TGH to provide us with a demonstration of the product provided there are capital funds to purchase if product meets our needs.
 - c. If demonstration takes place, the following should be evaluated prior to purchase:
 - i. Does bed and mover fit in bayshore and west pavilion elevators (*it will NOT fit in F tower as elevators only 93” long which will only fit bed*)
 - ii. Ease of use
 - iii. Can mover be hooked onto bed inside a patient room

- d. Vendor contact information:

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Table #1: LIBERTY MUTUAL TABLE for pushing:

Liberty Mutual Design Goals for Pushing

US Traditional units

Forces in pounds (OR = Out of Range of Tables)

High Push Point

(hands about 55 in)

Frequency		Push Distance (ft)											
		7		24		48		97		145		194	
Initial	Sustained	Initial	Sustained	Initial	Sustained	Initial	Sustained	Initial	Sustained	Initial	Sustained	Initial	Sustained
1/8 h	1/8 h	59	46	53	35	46	29	46	26	46	24	42	20
1/30 min	2/1 h	55	37	51	29	44	24	42	20	42	18	37	13
1/5 min	12/1 h	53	35	48	26	42	22	37	20	37	18	33	13
1/2 min	30/1 h	48	31	44	24	37	20	35	18	35	16	31	13
1/1 min	1/1 min	46	31	44	24	37	20	33	15	33	15	OR	OR
1/30 s	2/1 min	44	31	42	22	37	18	OR	OR	OR	OR	OR	OR
1/15 s	4/1 min	42	26	37	20	OR	OR	OR	OR	OR	OR	OR	OR
1/12 s	5/1 min	40	26	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR
1/6 s	10/1 min	37	20	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR

Middle Push Point

(hands about 36 in)

Frequency		Push Distance (ft)											
		7		24		48		97		145		194	
Initial	Sustained	Initial	Sustained	Initial	Sustained	Initial	Sustained	Initial	Sustained	Initial	Sustained	Initial	Sustained
1/8 h	1/8 h	59	42	55	37	46	31	46	29	46	26	42	20
1/30 min	2/1 h	55	35	51	29	44	24	42	22	42	20	37	15
1/5 min	12/1 h	53	33	48	29	42	24	40	20	40	18	35	13
1/2 min	30/1 h	48	29	44	24	37	22	35	20	35	18	33	13
1/1 min	1/1 min	46	29	44	24	37	20	33	18	33	15	OR	OR
1/30 s	2/1 min	44	29	42	22	35	18	OR	OR	OR	OR	OR	OR
1/15 s	4/1 min	42	26	37	20	OR	OR	OR	OR	OR	OR	OR	OR
1/12 s	5/1 min	40	24	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR
1/6 s	10/1 min	37	18	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR

Low Push Point

(hands about 24 in)

Frequency		Push Distance (ft)											
		7		24		48		97		145		194	
Initial	Sustained	Initial	Sustained	Initial	Sustained	Initial	Sustained	Initial	Sustained	Initial	Sustained	Initial	Sustained
1/8 h	1/8 h	46	37	46	33	40	29	40	26	40	24	35	18
1/30 min	2/1 h	44	31	44	26	37	22	35	20	35	18	31	13
1/5 min	12/1 h	42	29	42	26	35	22	33	18	33	18	29	13
1/2 min	30/1 h	37	26	37	24	33	20	31	18	31	15	26	13
1/1 min	1/1 min	37	24	37	22	31	20	29	15	29	15	OR	OR
1/30 s	2/1 min	35	24	35	22	29	18	OR	OR	OR	OR	OR	OR
1/15 s	4/1 min	33	22	31	18	OR	OR	OR	OR	OR	OR	OR	OR
1/12 s	5/1 min	33	20	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR
1/6 s	10/1 min	31	15	OR	OR	OR	OR	OR	OR	OR	OR	OR	OR

Adaptation of the Tables published by Snook and Ciriello in 1991.

The Design Goal is 75% Acceptable for Women.

Adjustment Factors

The Design Goal for Men only may be 1.5 times higher than the table values, with variation from 1 to 2.

The Upper Design Limit for Lifting (equivalent to 25% Acceptable for Men) is about 1.5 times the table value, with variations of 1 to 3.

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