



Trine University
Biomedical Engineering

Parkview Repositioning Sling

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Introduction:

- Parkview Hospital has a wide variety of bedridden, long-term patients.
- Bedridden patients are confined to a bed due to an injury, illness, or age.
- If patients are in the same position for a long period of time, they can develop pressure ulcers.
- Pressure ulcers (bedsores) are injuries to the skin and underlying tissue where there is a long amount consistent pressure, complications of pressure ulcers [1]:
- Severe Pain, decreased health, pneumonia, kidney Stones, urinary Stasis, etc.
- Nurses are required to move bedridden patients several times a day to mitigate any pressure ulcers.
- Current design for repositioning patients is a disposable sling:
- Manually positioned under patient each time for repositioning, only a one-time-use, difficult at times to find in hospital, inefficient.
- Nurses resort to manually moving patients when needed, causing pain, injuries, and long-term musculoskeletal disorders.

Table 1: Avg. Maximum Breaking Force

A = Against grain W = with grain	Average Maximum Load [lbf]	Average Load at Break [lbf]
Airknit A	38.68	28.57
Airknit W	90.00	73.85
Duck Fabric A	94.49	53.66
Duck Fabric W	72.46	63.46
Nylon A	80.21	44.01
Nylon W	103.86	83.63
Original Sling A	72.57	16.45
Original Sling W	15.69	12.48
Sunbrella A	95.76	22.28
Sunbrella W	112.68	60.10
WeatherMAX 3D Mist A	92.42	22.88
WeatherMAX 3D Mist W	82.92	19.42
WeatherMAX 3D White A	99.64	24.86
WeatherMAX 3D White W	76.43	24.34
WeatherMAX 80 A	112.91	106.97
WeatherMAX 80 W	128.38	106.41

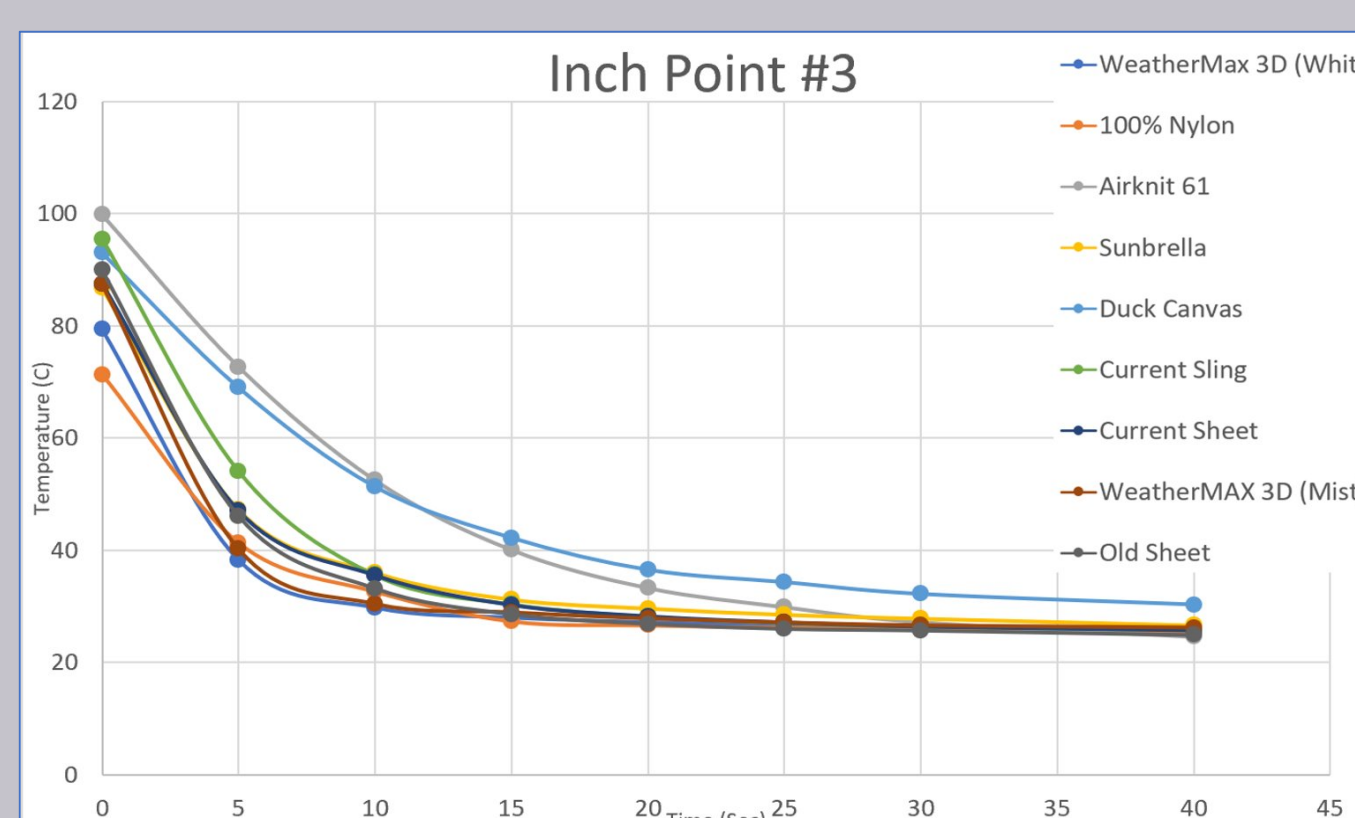


Figure 3: Heat Release at Middle of Hot Plate

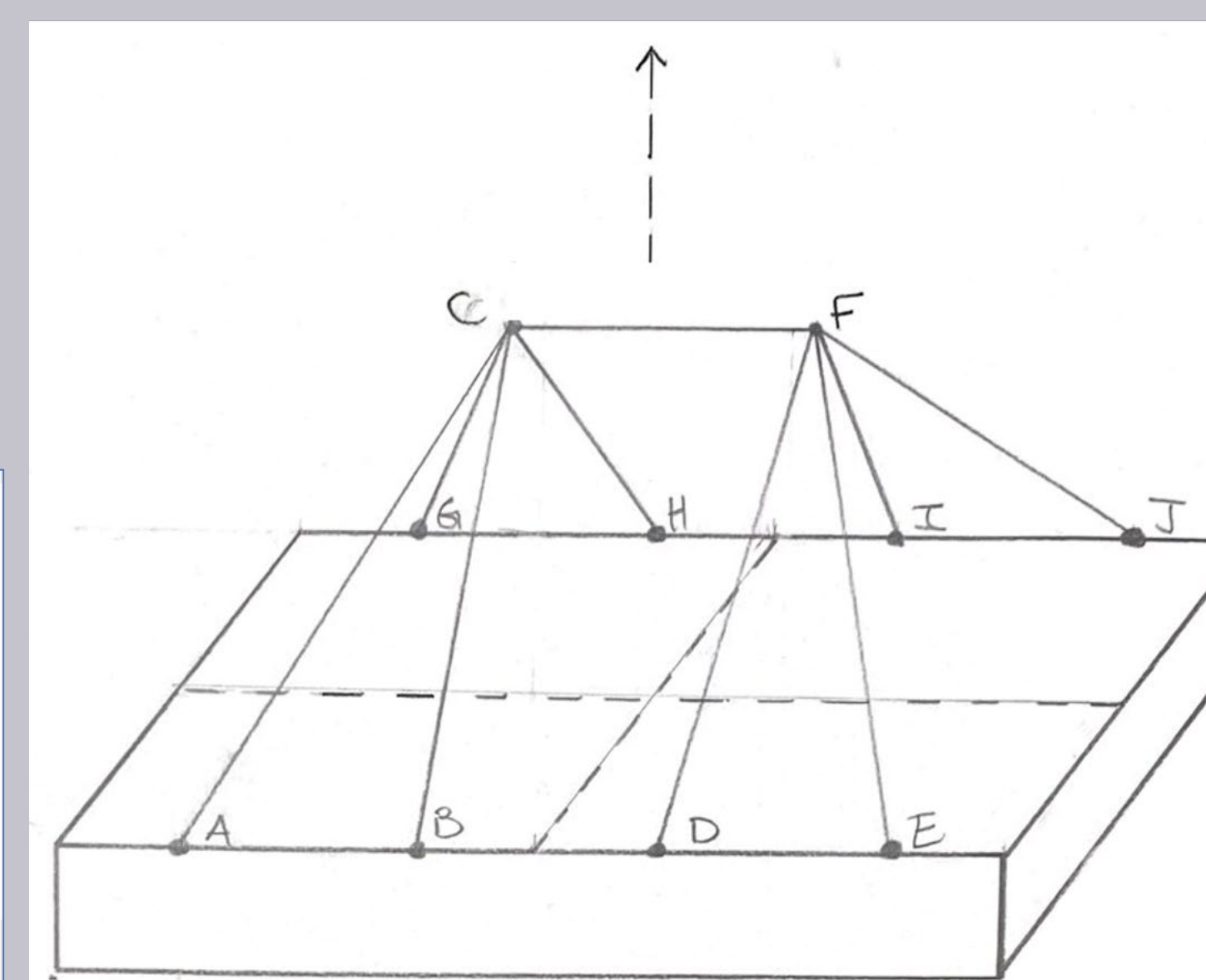


Figure 4: Basic Modeling of Design

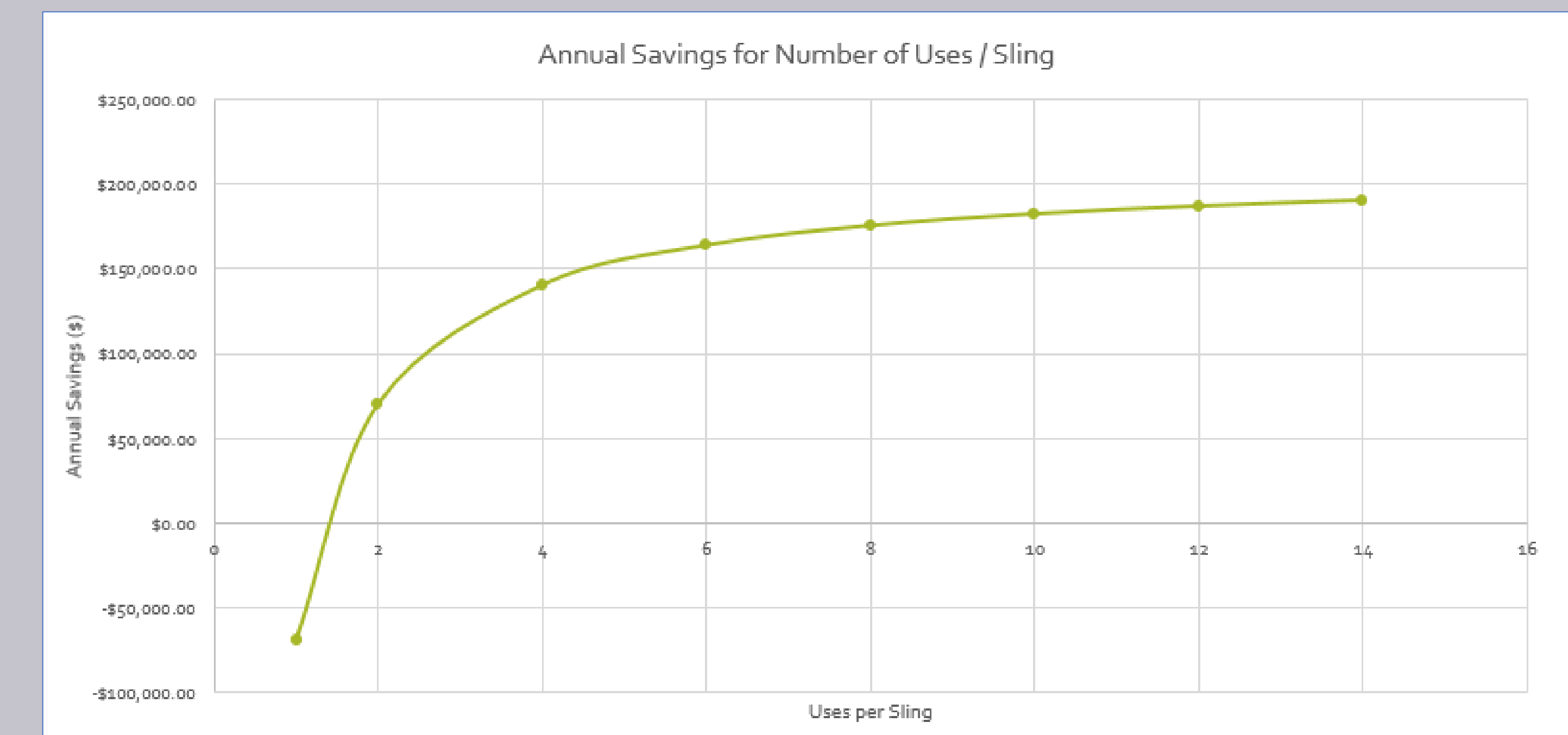


Figure 7: Annual Savings of Uses per Sling

Results and Discussion:

- Based off testing results, our chosen material was WeatherMAX 80:
- Material had the following properties:
 - High strength
 - High durability
 - High breathability
 - Quick heat release
 - Water resistant
- Decided to incorporate current bedsheet with design which Parkview did approve of decision.
- Prototype would be able to focus on the strength, durability and keeping the patient cool.
- Current Bedsheet would focus on great skin contact and increased comfortability, and ability to wick away any moisture.

Conclusion:

- Patients require periodic repositioning to prevent health complications.
- Nurses are becoming injured due to manually moving patients.
- Created a repositioning sling to permanently stay underneath patients.
- Only requires 1 nurse to use sling
- Decreased time to use sling from 6 – 10 minutes to 3 – 4 minutes
- Sleek, simple device that is safe, strong, durable, washable, and fitted.
- New sling can safely hold a patient weighing 600 pounds or less
- Hospital Laundry Service can easily wash sling

Future Work:

- For wound care, contact with the doctor in charge of the wound care units would be ideal to get their opinion on how the sling and layers would work.
- The number of uses can be tracked by adding barcodes to each sling and allowing the computer to track the uses.
 - Another recommendation would be to add a zipper along the edge of the design for any patients that would pass away while the sling is under them.
 - Allows for easy transport of deceased patients.

Materials and Testing:

- Materials used were: Sunbrella, WeatherMAX 3D, Airknit, Duck Canvas, Nylon, and WeatherMAX 80.
- Material Testing:
 - ASTM D5035, Breaking Force and Elongation of Fabric
 - Used for determining strength of fabrics
 - ASTM E96, Water Vapor Transmission Rate Testing
 - Evaluates evaporation rate through fabric
 - AATCC TM197, Vertical Wicking Test
 - Determines how well fabric wicks moisture
 - Heat Release Testing
 - Used to determine breathability and how well the fabric removes heat



Figure 1: Ceiling lift system with hanger



Figure 2: Patient suspended in current slings



Figure 5: Initial Prototype Testing with Load



Figure 6: Initial Prototype Testing with Load

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