// ENME301 ASSIGNMENT 1 – Jackson Crawford 79117073

Description, features and benefits:

The proposed concept is for a system to allow a single elderly carer to use existing Hoyer lift and sling systems to facilitate the movement of an elderly patient from lying down to a seated position. The concept consists of a pair of pneumatic bladders that are installed onto the patient's bed, similar to a bedsheet. Inflating and deflating these air bladders through the use of a compressor and electrically actuated valves allows an elderly carer to roll over the patient and place the sling underneath them, to then be attached to the lift. This process normally would require at least two carers, one to roll the patient and another to place the sling. With an assisted Hoyer lift, this design would allow a single carer to care for the patient in their own home.

This approach has several benefits:

- Existing sling and harness systems can be used with no compatibility issues.
- The approach is mechanically simple and low-cost.
- Operable by a single carer. This carer could be the patient's partner, as the apparatus does not require any meaningful physical strength to operate.
- Simple to install.
- Compliant nature of the airbag greatly reduces risk of injury to a frail elderly patient.
- The airbag can easily be removed from the bed and machine washed, with one connection between the airbag and the pneumatic controls.

Possible risks or problems:

- The apparatus requires a compressor to provide air, which may be loud.
- There is a risk of the apparatus being punctured and deflating.
- May require the patient's bed to be re-made between uses.
- A guard rail may be required to ensure patients are not rolled off the bed.
- The process would be slower than with two carers.

Closest existing concept:

Airbag systems exist for use with cars to get them out of sand, mud, etc, though the proposed concept differs in complexity and purpose, if not basic principle. Alternating pressure air mattresses (APAM) exist for reducing pressure sores in patients that are bedridden for extended periods, which is a similar concept in a similar field, though the application differs greatly.

Selling price estimate:

Item	Justification	Price
Airbag	High-end commercially available air-beds retail around this price. Lower production volume and novel geometry increasing price are likely offset by much less material required.	$150
Compressor	Large budget is dedicated to the compressor unit, as high-performance to increase speed of operation while maintaining low noise is important.	$800
Pneumatic Fittings	Pneumatic hardware is ruinously expensive. It is unknown to what degree commercial quantities would lower prices.	$700
Controller unit, HMI	Microcontroller, electronics, housing, etc.	$150
		Total: $1800

The average cost of full time resthome care in New Zealand is currently $1119 weekly, so a retail price in the range of $2500-3500 seems reasonable, to account for design work, profit, and unforeseen costs.

References:

https://www.ncbi.nlm.nih.gov/books/NBK76153/ - APAM study.

https://www.arjo.com/int/products/pressure-injury-prevention---pip/alternating-pressure/alpha-active-3/ - retail APAM.

https://lcpshop.net/product/air-jack-inflatable-bag-car-lifter/?gclid=Cj0KCQiAvvKBBhCXARIsACTePW99EWVlJ8klvg4o8tXwB3AVkcuOgNNy7wLygZFRENgZU3upHPZy97UaAkvqEALw_wcB – airbag car jack.

https://gazette.govt.nz/notice/id/2020-go2874 - resthome pricing, see appendix A