The IntuBed: Upper Body Positioning for Surgical Intubation
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BME 4002W Senior Design • Group 16: Anesthesiology
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Clinical Background & Need
In the practice of anesthesiology, great care must be taken to position patients properly for endotracheal intubation. This includes extending and flexing the patient’s neck and lifting the head to visualize the vocal cords by aligning the pharyngeal and laryngeal axes (Fig. 1), achieving what is known as the sniffing position. Such positioning becomes difficult when patients are overweight or have excess tissue around their necks, posing the risk of soft tissue collapse which can fully obstruct view of the vocal cords. To combat this issue, ramped positioning is often used to open the chest and allow excess tissue to fall back. While multiple devices exist to aid in reaching these positions, they are ignored in favor of towels and linens (Fig. 2). Not only is this system imprecise, but it forces the care team to manually lift and position patients. This poses the risk of improperly positioning the patient for intubation which can lead to stroke, nerve/brain damage, or even death and puts the medical staff in risk of musculoskeletal injuries arising from excess strain.

Proposed Solution
- High-pressure air tank
- Pressure decreased by regulator
- Airflow reaches manifold
- Air to bladders controlled via inlet solenoid valves by user
- Air moves into 1-3 bladders until reaching hydrostatic equilibrium or until valve is closed by user
- Patient is lifted
- Air flows out once switch flipped down to open outlet solenoids
- Bladder moves from high pressure to lower atmospheric room pressure
- Patient is lowered

Materials
- 8-gage Polyvinyl chloride (PVC)
- Compliant, water-resistant, inert
- Edges heat-sealed
- ½” quick-connect and nut fastener
- Form dual inlet/outlet
- Able to withstand weighted cyclic strains
- Dimensioned to fit the head, shoulders, and upper back of a 1.741 m male

Market Gap & Goals
- Intended users: anesthesiologists and certified nurse anesthetists performing intubations on severe obesity to obese patients
- 42 Million+ procedures requiring intubation in the US alone
- Comorbidities associated with common surgical causes often stem from excess weight
- Adverse outcomes can yield longer hospital stays at $2,300/night, with the potential of $100,000s more in bills depending on severity
- $1 Billion forecasted market size for surgical beds in the US by 2022 with 3.9% annual growth

Current Solution Limitations
- Solutions include gel head donuts/rings, foam blocks, a ramp under the patient, and a jaw elevation device
- Multiple options: pet towels and linens are mostly used in the operating room. Why?
- Current solutions aren’t adjustable, segmented, or precise, still require physical labor, and cannot be easily removed for surgery
- These limitations form the basis of the requirements for The IntuBed

Project Goal
- To create a stand-alone system that can adequately lift and lower a patient incrementally at the flip of a switch, thus providing a safe and effective way to achieve proper positioning during surgical intubation

Stanford Case Studies
- Mechanical
- Adjustable
- No physical labor
- Diverse
- Precise

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