EMS Stair Chair Wheel Attachment

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THE PROBLEM
EMS providers are frequently required to move patients both up and down stairs but are poorly equipped when moving patients up stairs. All of these devices require the providers to bear the patient’s full weight for transport up stairs. Essentially, the current models redistribute weight for downstairs movement, but not at all for upstairs movement.

THE STATUS QUO
- Reeves Stretcher (A)
  - Providers bundle and lift patient for movement
  - Effective movement of unconscious patients
- Scoop Stretchers (B)
  - Detaches into 2 halves lengthwise
- Stair Chairs (C)
  - Controlled descent on stairs

CONSEQUENCES
- 11% of EMS provider injuries are due to lifting\textsuperscript{1}
- 25% of EMS providers suffer career-ending back injuries within the first 4 years\textsuperscript{2}

CURRENT STAIR CHAIRS
- Straps to secure patient in the seat
- Treads to rest the weight on the stairs and make a controlled descent
- Two provider lift and carry to go up stairs

The same propensity for EMS personnel injury persists when providers need to ascend stairs.

NEEDS STATEMENT
A stair chair attachment that enables prehospital providers to move conscious and alert patients smoothly and easily up and down stairs during extrication from a prehospital scene.

FACTORs TO CONSIDER
- Lightweight
- Durable
- Low-cost
- Compact design
- Maximize smooth travel

DESIGN VALIDATION
EMS personnel at Monroeville Fire Department (right) tested our attachment and indicated that the attachment improved patient movement up stairs.

Likert Scale Ratings (1 = best rating)
- Intuitive Use: Avg. 1.5 (very intuitive or somewhat intuitive)
- Ease of Patient Movement: Avg 1 (very easy)
- Effort Required Compared to Current Models: Avg 1 (noticeably less effort)

REIMBURSEMENT
- Cost of extrication and patient transport is included in the base cost of an ambulance therefore, we introduce no additional cost
- Cost of purchasing the device will be negligible because of the 7 year life expectancy of the device

PATENTS
- Key features are novelty, utility, and non-obviousness → five wheel rotary design of the machine for stair climbing for medical applications as mechanical device

COSTS
- Raw materials ~ $150/chair
- Manufacturing ~ $10/chair
- Assembly ~ $2/chair

Thank you to
Dr. Zapanta and TA Eric Shiao for project guidance
CMU Biomedical Engineering Department for funding
Monroeville Fire Department Company 1 for testing & clinical feedback
2019-2020 Team 4: Bryant Chung, Dani Delgado, Mia Keyser, Renee Morton, Olivia Olshefski, Laurel Pereira, Rosie Zhang
TechSpark staff for machining assistance and advice

References

All materials (aluminum clamps & hubs, polypropylene wheels) were selected to minimize weight.

Weight: 30.2 lbs (60.2 lbs total)

Each side of our device is attached via aluminum clamps. The axles and bike brakes are mounted on the clamps. When the brakes are pulled, the pads clamp down on the axis, braking the downward descent of the stair chair.

ABOVE: Close up of the brake mount and mechanism system

ABOVE: The complete stair chair plus attachment

ABOVE: Close up of the brake mount and mechanism system

BELOW: The device on stairs

ABOVE: The complete stair chair plus attachment

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