Development of portable assisted mobility device to increase activity levels of COPD patents for effective management strategy and long-term health improvement

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Presentation outline

- Introduction
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Introduction

- Chronic lower respiratory disease is the third leading cause of death in the U.S. The most deadly of these is chronic obstructive pulmonary disease (COPD).
- Cigarette smoking is the main cause of COPD. COPD is a condition which makes it increasingly difficult to breathe due to permanent damage of the lungs and constricting airways.

Introduction

- Symptoms such as dyspnea and muscle fatigue, lead to exercise intolerance, which triggers physical inactivity, a key feature of COPD.

Specific Aims

- The goal of the proposed project is to design and fabricate a prototype portable assisted mobility device (PAMD) for COPD patients.
- The PAMD enables COPD patients to take parts in outdoor activities, meeting friends, dinning out and maintain their independent lifestyle.

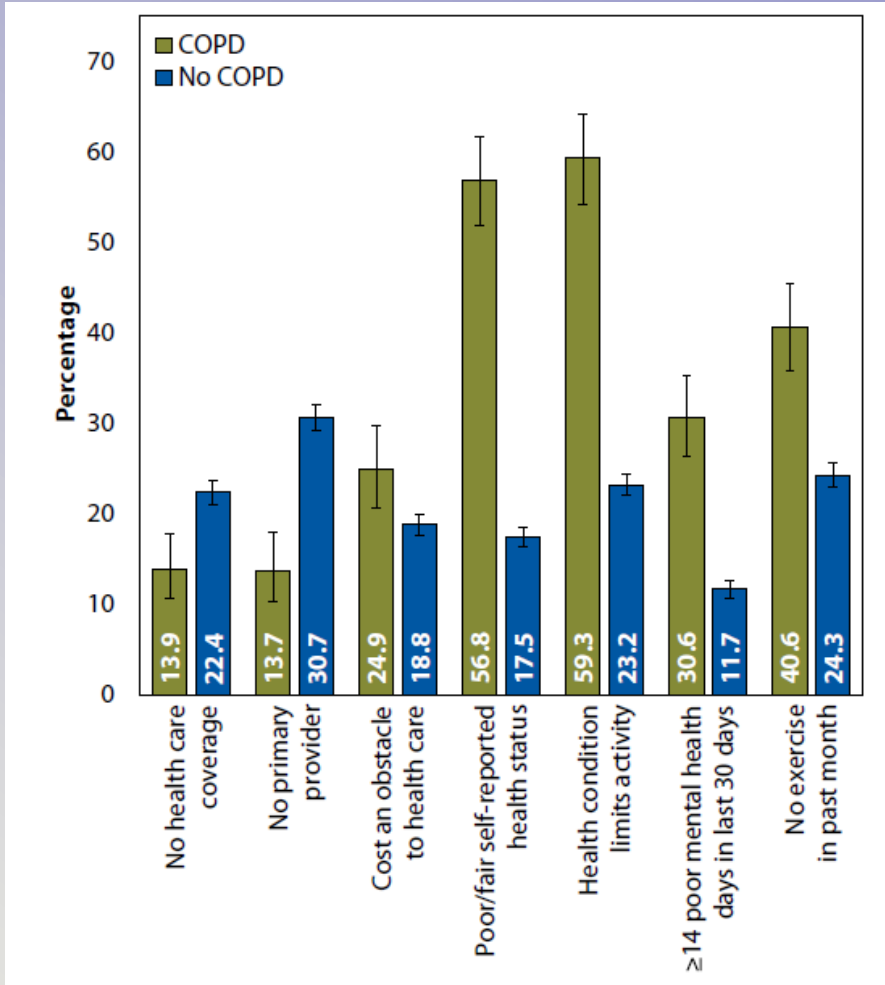
Specific Aims

- The PAMD also helps COPD patients to re-integrate themselves into the society, hence improves their quality of life.
- This project will provide product tests of meaningful scale to allow for technology transfer that could benefit public health in New Mexico.

Significance

- 6.1% of New Mexico residents surveyed in 2011 reported having been told by a health care professional that they have COPD.

Health characteristics by COPD status: New Mexico



US Centers for Disease Control and Prevention (CDC); COPD among adults in New Mexico, 30 July 2013.

Significance

- The proposed PAMD permits patients to get out of the confines of their home and be able to exercise some degree of independence.
- The proposed project has a potential to launch an inexpensive portable mobility device which can increase activity levels of COPD patients, which is crucial for effective management strategy and could lead to improved long-term outcomes.

Innovation

- Motorized mobility devices are available in market such as electric wheelchairs and electric mobility scooters.
- Electric wheelchairs tend to be quite heavy. In order to get the wheelchair outside, ramps are usually required. For transport, patients must have a lift on the back of their car.

Innovation

- Mobility scooters are designed for outdoor use. However, carrying the scooter in the back of an SUV or truck or a carrier on the back of the vehicle still means patients to dismantle or lift it out, which makes it problematic for short trip for shopping or quick stops.

Innovation

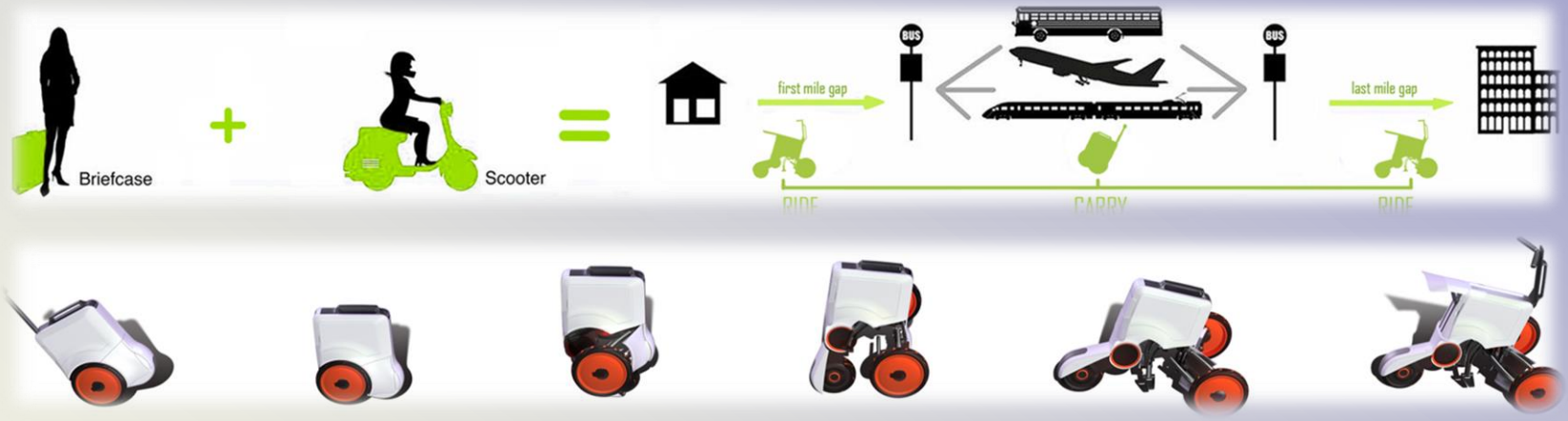
- The PAMD will be light in weight, small, and be able to be carried by other transportation while having the ability to be stored in small places.
- American anthropometric measurement data will be incorporated into the PAMD design, which would allow 90 % of US population to ergonomically interact with the device.

Approach

- The PIs have been involved in Partners for the Advancement of Collaborative Engineering Education (PACE) CubO project.
- The CubO is a portable vehicle which can fold into the size of a small carry-on luggage case with a weight of 35 lbs. and acquire a top speed of 15 mph while unfolded.

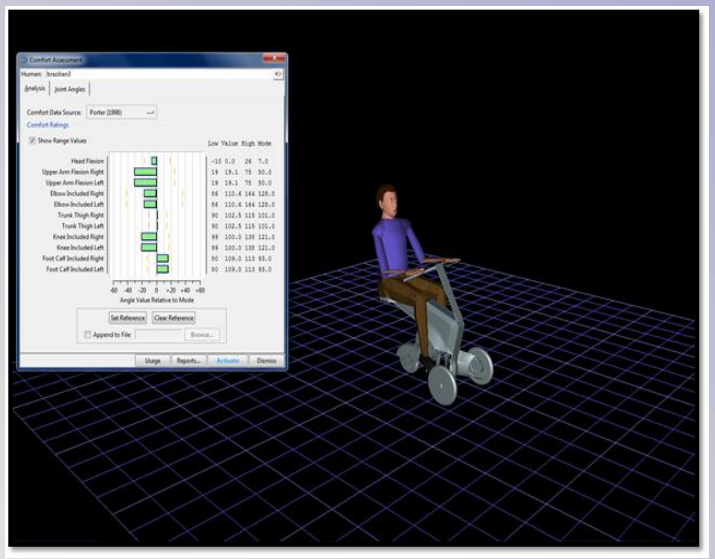
Approach

- The CubO was designed to travel short distances, such as a trip from the bus stop or train station to the final location.



Approach

- Deployment mechanisms of the wheel, the seat, foot rests, and steering of the CubO were developed and tested. Human factors were considered by using “Jack” software.



Approach

- The working deployment mechanisms and human factor practices used in the CubO design will be implemented into the design of the proposed PAMD.
- Human factors analysis will be performed using digital human models in JACK to ensure that the design is ergonomically sound, with minimal fatigue due to the rider's posture.

Approach

- Posture and reach-ability will be tested in correlation with steering, seating and foot support.
- For safe driving, the maximum voltage over the motor will be limited in function of the steering angle by adding a sensor in the handlebar to detect its angle.

Approach

- In order to select the best materials to manufacture it, durability, comfort, accessibility, and weight will be taken into account.

Manufacturing

- Most of the components used in the PAMD prototype are standard parts that can be purchased from external suppliers.
- Special parts will be either machined in the Mechanical & Aerospace Engineering Student Project Center or built by 3D printers in Aggie Innovation Space (AIG).

Summary

- The PAMD will be a personal gadget that can take one person and medical unit such as an oxygen tank per trip, fitting perfectly on the necessities of a COPD patient.

Project Timeline & Budget

Task (PIs)	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Conceptual design (Park, Valles, Sullivan, Ruble)												
Preliminary design (Park, Ruble)												
Ergonomic analysis (Valles, Sullivan)												
Engineering analysis (Park)												
Detailed design (Park)												
Prototype manufacturing (Ruble)												
Test												

Total budget requested: $100,000