

The Impact of Robotic-Assisted Ambulation on the Cardiopulmonary System: A Systematic Review

Alex Steele · Zach Johnson · Alanna O'Malley · Laurie Brogan · Nicole Evanosky

INTRODUCTION

Robotic Exoskeleton - A robotic unit consisting of a lightweight brace support suit, motorized joints, rechargeable batteries, and an array of sensors within a computer-based control system which allows control of all or part of the movement required for gait.

FDA approved for use for individuals with SCI and CVA

Features of Robotic Exoskeletons

- Controlled via watch or smart device
- Provides different modes of assistance

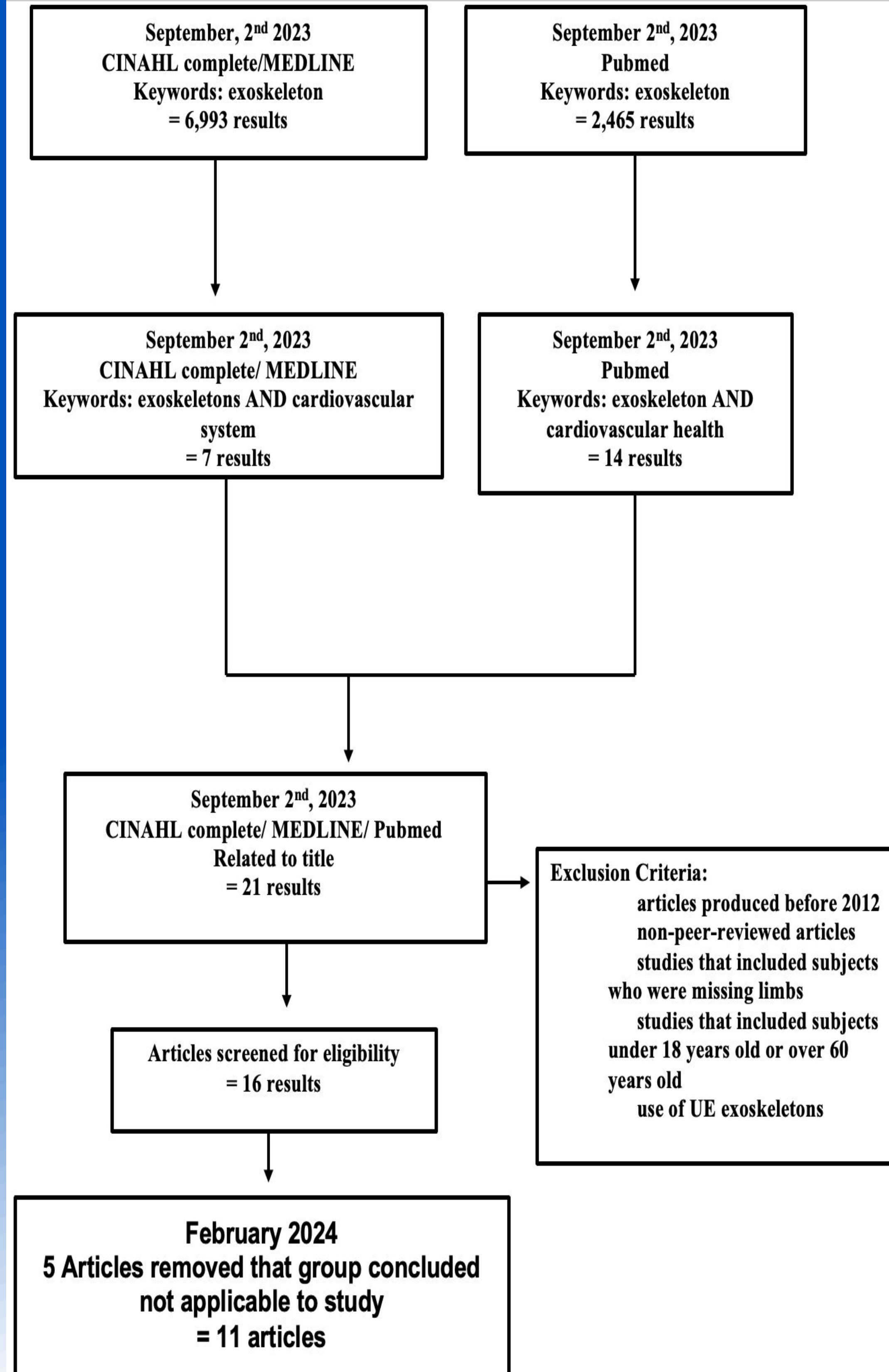
Use of Robotic Exoskeletons

- Increases upright mobility which helps to decrease risk of adapting sedentary lifestyle
- Decreases risk of developing cardiac complications
- Decreases risk of skin breakdown
- Increases blood flow
- Increases bone density via Wolff's Law

PURPOSE

The purpose of this study was to conduct a systematic review and explore the effects of robotic exoskeletons on cardiopulmonary health in individuals with neurological diagnoses.

SEARCH METHODOLOGY



RESULTS

Respiratory System

- Vo₂ significantly increased throughout multiple sessions
- Respiratory exchange ratio and tidal volume increased
- Statistically significant difference regarding FVC and FEV₁

Cardiovascular System

- Some participants reached a moderate level of exercise intensity according to HRR while others reached a light exercise intensity with little to no change to heart rate

Walking Tests

- Groups that used the exoskeletons performed better on these tests overall when compared to those who did not use exoskeletons

Borg RPE/METs

- RPE reported was equivalent to light to low-moderate intensity level.
- METs measured were equivalent to a light to low-moderate intensity level of activity

CONSIDERATIONS

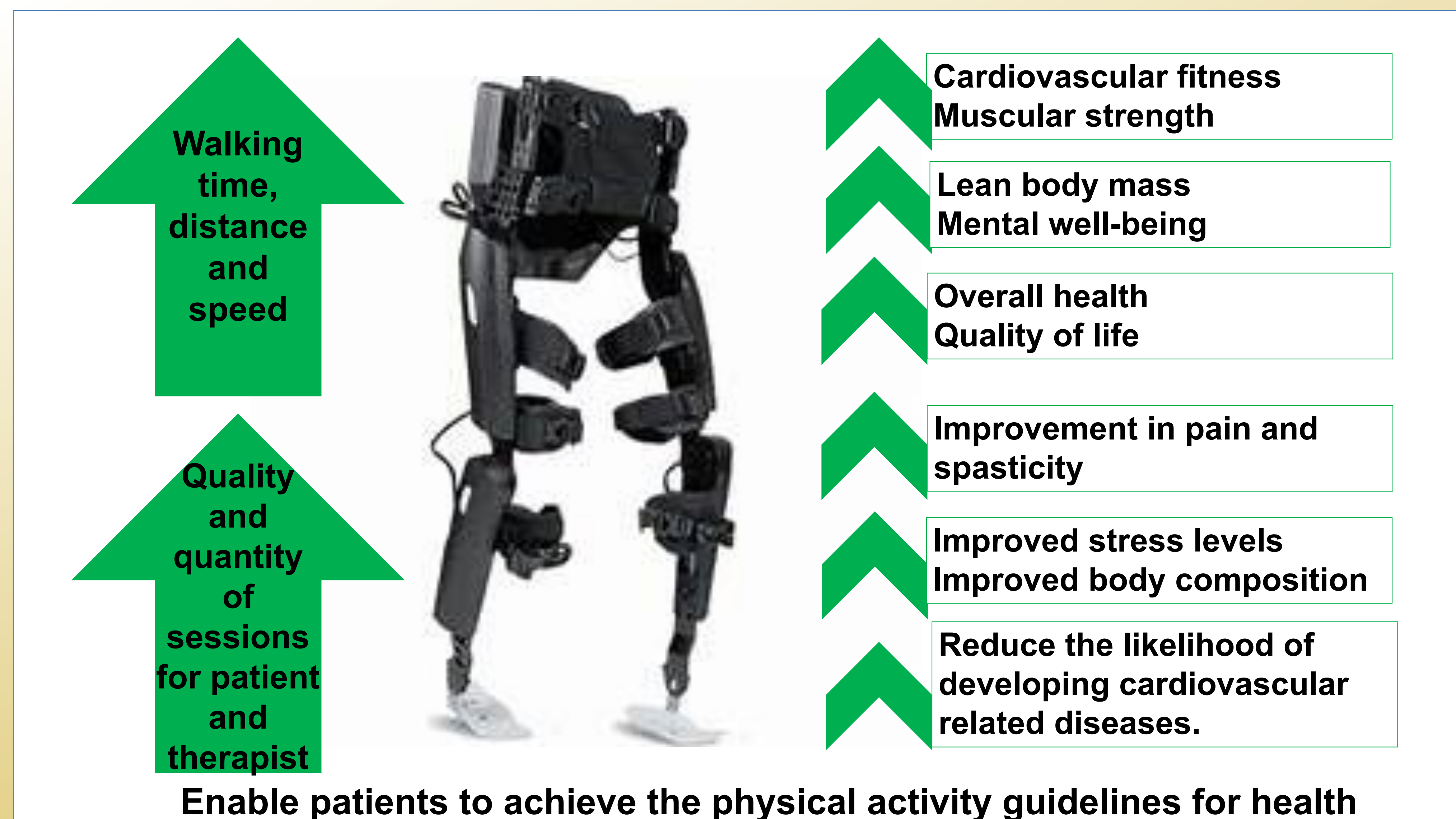
- Cost of exoskeletons limit accessibility
- Specific qualifications for use and insurance coverage
- Specialized training required
- Client issues: availability, distance, cost of travel
- Robotic exoskeletons found to assist with light to moderate exercise intensity

RATING OF PERCEIVED EXERTION (RPE)		
Borg's Scale	(Gunner borg 1982):	Modified Borg Scale:
6-		0- at rest
7- very, very light		1- very easy
8-		2- somewhat easy
9- very light		3- moderate
10-		4- somewhat hard
11- fairly light		5- hard
12-		6-
13- somewhat hard		7- very hard
14-		8-
15- hard		9-
16-		10- very, very hard
17- very hard		
18-		
19- very, very hard		
20-		

CONCLUSION

Robotic exoskeletons:

- are able to achieve a low-moderate activity level
- have shown no detrimental effects with use
- will continue to evolve as technology advances
- require additional research for better understanding of their impact on the cardiopulmonary system



REFERENCES

