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The Future of Injury Prevention in Logistics Facilities – One Worker, One Wearable Exoskeleton at a Time

New Strategy to Reduce Musculoskeletal Disorders and Empower Your Workforce

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Executive Summary

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Exoskeletons are the game changer for workers' health and productivity in your warehouse operations

Heavy burden of manual load handling in logistics

Effect of one week of lifting on a worker's back equals

400,000 lbs,
the equivalent of a Boeing 747.

Economic cost of back injuries

Workplace injuries have resulted in an economic loss of over

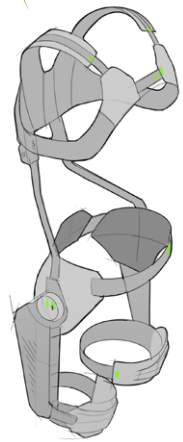
$50 billion
annually[1].

Root cause of problem

Employees in logistics miss up to

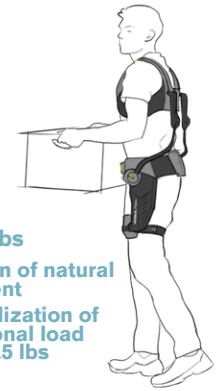
32 days
of work per year due to occupational injuries[2]

Solution Paexo Back



The wearable exoskeleton, Paexo Back, reduces strain and helps prevent injury.*

Value



Significant load reduction up to 55 lbs

Zero inhibition of natural movement

100% neutralization of additional load up to 15 lbs

Variety of manual load handling jobs

De- and repalletizing, loading and unloading of trucks/containers, commissioning jobs.

Next Step:

Order your experience package from Ottobock.
www.paexo.com

*according to a new scientific study

Introducing the Issue and the Science

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New study reveals an effective way to address work-related injury

Imagine lifting heavy boxes to help your child move into a dormitory on a college campus. Consider the stress and strain on your back with each lift, compounded through repetition. Now, imagine doing it every day, all day, for years. Think ahead to lifting your grandchildren up in your arms after retirement from years of strenuous manual labor without proper back support. These real-world scenarios are similar to the experiences for millions of workers in logistics facilities in the United States and around the world, feeling the aches and pains in their backs – or worse – from lifting objects at work. And companies are feeling the effects of increased liabilities and spiraling costs from workers' injuries on the job.

The Issue

Resulting from repeatedly lifting heavy objects on the job is a type of chronic, physical issue called **musculoskeletal disorder (MSD)**. It is the cause of an inordinate amount of missed workdays, workers compensation claims, skyrocketing medical bills and lost productivity – and even early retirement.

Approximately 33% of all injuries involve MSDs due to physically intense work. In the US, over 600,000 disabilities[3] and illnesses were reported as MSDs, which are the leading cause of compensable injuries.

In his Letter to Shareholders on April 15, 2021, Amazon's Jeff Bezos revealed that 40% of Amazon's work-related injuries are MSDs.

New Scientific Study

A scientific study was conducted to analyze the effectiveness of wearing an exoskeleton while lifting boxes and other objects in a logistics facility. Without Paexo Back, an employee who lifts 33 lbs on piecework a day has moved a total of over 300,000 lbs across his back at the end of one week. With Paexo Back, however, it is only approximately 75,000 lbs. This is a 75% improvement in reducing the stress and strain on a person's back while doing the same amount of work. For a worker who moves 11 lbs, the lifting support of Paexo Back neutralizes the package weight.

Discover figure

The back is relieved by 55 lbs, according to a scientific study that has been conducted.

Did you know?

Ottobock offers products and services to help people maintain or regain their freedom of movement. Ottobock has been active in ergonomics and industrial exoskeleton research for the past decade.
Ottobock applies its 100+ years of prosthetic and orthopedic excellence to its product designs.

→ **Ottobock's exoskeletons are designed to empower the workforce in logistics**

Economic Impact of Back Injuries

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The high cost of back pain and spinal injuries for companies and personnel

Workers in the logistics industry, as well as manufacturing and healthcare, are particularly prone to higher rates of back injuries. Organizations face the challenges of this reality: manual material handling is the leading cause of compensable injuries in the U.S.

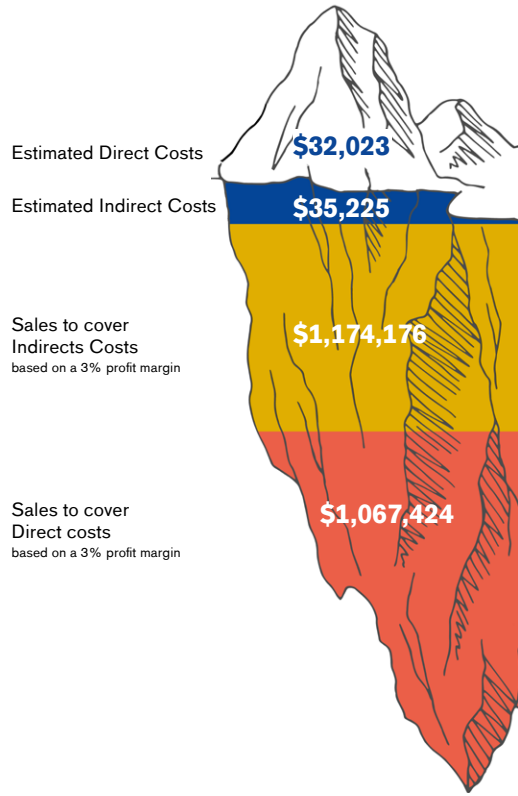
In 2013, there were 60 million days lost to work-related injuries. Approximately 33% of all reported work injuries were related to the back. Workplace injuries have resulted in an economic loss of over $50 billion annually. The direct cost of musculoskeletal disorders is reported at $20 billion per year, but the total cost is estimated to be between $45 billion and $54 billion for worker replacement and training. Furthermore, the indirect costs for lost productivity, product defects, etc, due to back injuries, can be as much as five times the direct costs. This means that a logistics company needs to generate **over $8 million in additional sales in order to cover $260,000 in back pain-related costs**[1].

Logistical challenge to hire new employees

With an aging workforce, the risk of MSDs is increasing. More than 90% of all logistics companies in the U.S. have difficulty finding and hiring new employees. This is a difficult challenge and might hinder the industry's growth in the future. The expanded number of warehouses in the last 10 years makes competition for qualified workers even tougher. With working conditions becoming more transparent, pressure on companies is increasing to create better working environments in order to reduce MSDs and to protect their workforce.

While automation is ideal for repetitive tasks, people are needed for a variety of tasks that require human skills, flexibility, perception and judgment, Alternatively, easy-to-use, wearable exoskeletons, such Paexo Back, can help workers reduce fatigue and strain. Exoskeletons are easy to put on and fit many workers. They can be worn throughout the shift, and there is no need for a major reorganization of work activities. This type of preventive support can help prevent cost-intensive injuries to stressed parts of the body, particularly the back.

Estimated annual total cost of a single strain (e.g. lower back disorder)[5]:



Numbers on warehousing[4]

- **6 million employees** in warehousing 2018 in the U.S. (incl. transportation)
- **20% more warehouses** in 10 years in the U.S.
- **90% of warehouses** have difficulty attracting & retaining qualified hourly workers
- **60 million days' time lost** to work-related injuries in 2013
- **35 million days** productive time loss, cause of prior permanently disabling injuries

The Future is Here: Paexo Back

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Wearable exoskeleton as a practical, people-centric solution

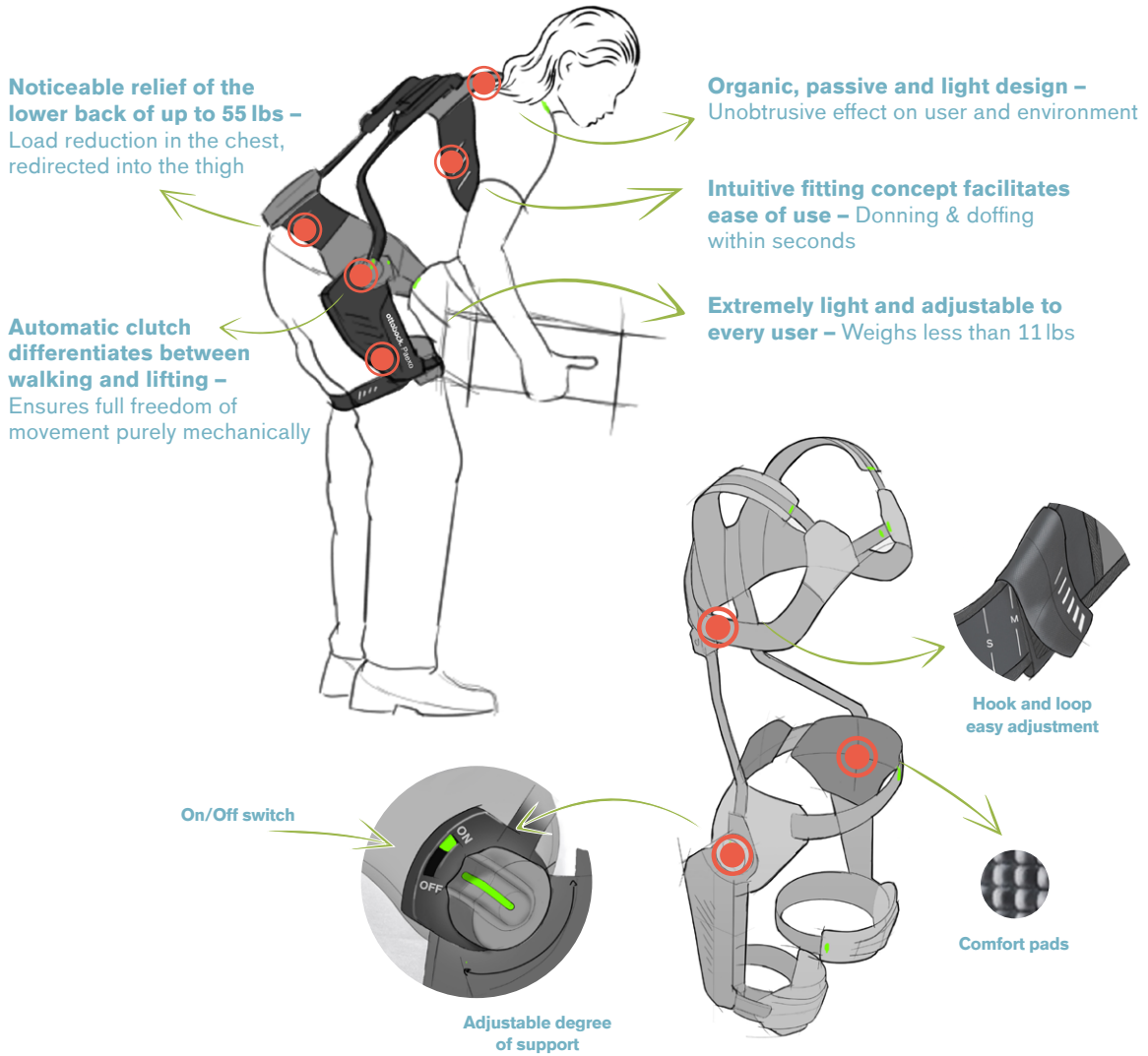
The Paexo Back is a wearable support system for the lower back, providing physical support for people performing physically demanding tasks. It was developed in warehouses and parcel distribution centers, together with logistics experts and users. It is aimed at logistics companies and warehouses that are looking for practical measures to support their employees in the manual handling of loads.

How can Paexo Back protect and empower your workforce?

Paexo Back uses the most natural energy source readily available that Ottobock has successfully leveraged in a wide variety of prosthetic devices and the growing Paexo family. Paexo Back harnesses energy from kinematic movement and that of gravity, which is then returned to the body when it is needed most. This ultimately allows Paexo Back to stay extremely light and agile. At the same time, the size adjustment is quick – it is just like a backpack, as a one-fits-many system for both men and women. This makes it easier for people to get comfortable with it immediately.

How does it work?

Energy harvesting comes by bending down. The force is shifted via the bars to the legs. Being stored in an expander-spring, it gives an additional energy boost by straightening up with a relief of up to 55 lbs to lift loads. Paexo Backs' biomechanical is designed to give relief to the lower back/spine and takes the strain off the wearer by reducing stress and fatigue. Injuries can be prevented to the parts of the body that are most stressed at work, including muscles and discs.



High-Quality Study Design

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Data collection and evaluation out of 4 different measurements to analyze process

The full-body 3D-model “Anybody” was used to show details of the spine and muscles in stress. The body model was fed with the kinematic data recorded by the optical markers during the experiment. The box weight and the measured compressive forces from the bottom plate were added. In this way, calculations of the acting forces on the lumbar spine of a human body during motion were done – with and w/o Paexo Back.

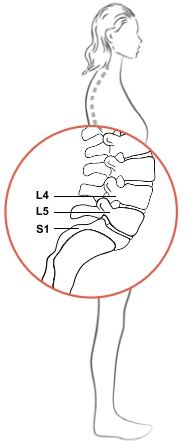
Focus was on two lumbar vertebrae, medically called L5/S1 and L4/L5, because the maximum force of the joint pressure forces apply at these points.

Scientific approach to study back pressure reduction

Five men and five women were tested in a scientific study, conducted by Dr. Schmalz et al, to analyze the Paexo Back exoskeleton.
An environment simulating a real logistics facility was used.

Findings on force relief in picking and dip of load

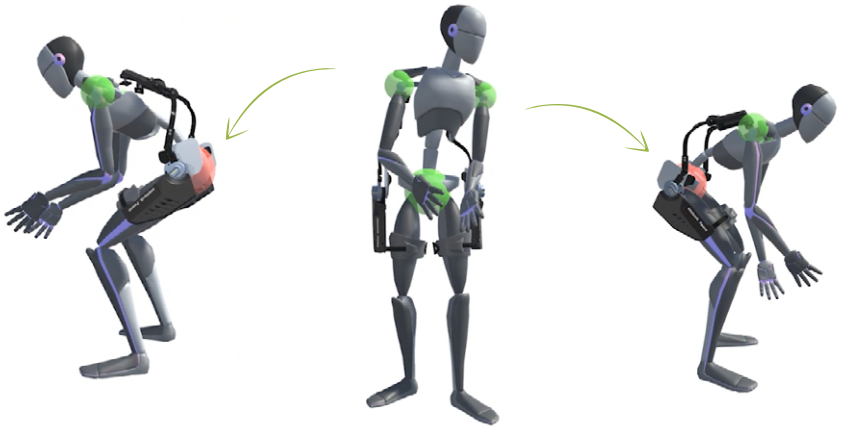
- Working with Paexo Back eases back pressure from lifting, clearly demonstrated in the kinetic movement analysis of the body model.
- A highly significant force relief due to Paexo Back could be seen for the lumbar spine vertebrae L5/S1 and L4/L5.
- The simulated peak force of the compression in L4/L5 was reduced from 2900N without Paexo Back to 2293N in the measurement with Paexo Back.



The maximum force of the joint pressure forces applies there

Working with Paexo Back:

- → **Significant load reduction up to 55 lbs**
- → **Zero inhibition of natural movement**
- → **100% neutralization of additional load up to 15 lbs, plus support for upper body**



The testers lifted a 22 lbs box from the floor to a table and then back to the floor several times. The test measurements were performed with Paexo Back as well as without Paexo Back. Data, including metabolic data, kinematic data and electrical-measurable signals (EMG), was gathered for a biomechanical body model to estimate the forces in the low back pressing on the joints. Reduction of stress on the lower back was assessed.

Engineering the Relief of Back Pressure

Aligned with NIOSH recommendations

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According to the NIOSH recommendation, loads may only be carried in certain vertical and horizontal positions from the body in order not to cause damage to health. The higher the weight, the closer it must be carried in front of the body. The more the angle of flexion of the spine increases, the lighter the weight must become that presses on the spine. NIOSH allows 50 lbs additional load while standing – not bending. That means people need weight relief to stay healthy.

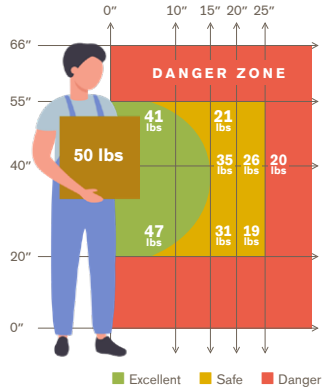
Figure below: The greater the flexion angle, the greater and more dangerous the pressure on the spine. When a Paexo Back is worn, only 1.2 kN presses on the intervertebral discs in a straight stance **(1)**. Just 3.0 kN act on the spine with a package of 50 lbs and a flexion angle of 59 degrees with Paexo Back, but 3.8 kN without **(3)** – the wearer falls into the red risk range. The support force of Paexo Back compensates and keeps the pressure acting on the vertebrae in the safe yellow range of the NIOSH scale. Reference: Scalefit/NIOSH

For example: : If your normal weight puts a pressure of 2.4 kN on your spine and 55 lbs load additional 1.4kN – with the pressure relief of Paexo Back, this is only 0.7kN more. This is a pressure relief of 50% on each 55 lbs package you carry. Moreover, lifting 55 lbs feels like only 33 lbs when wearing a Paexo Back. With a Paexo Back, a sandbag of 33 lbs feels like lifting only 11 lbs and is reduced in pressure on your spine by 75%. You lift only 0.2kN extra, so it's only 2.6kN, instead of 3.2kN pressing on the discs.

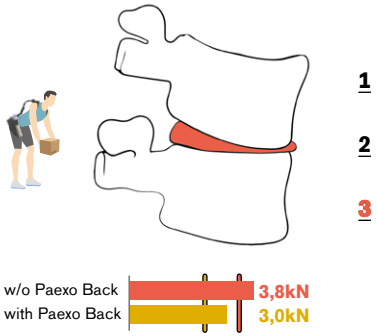
If you put 11 lbs on your spine – equivalent to a small package and only 0.2kN additional load – the support of Paexo Back makes it all up and even reduces the pressure of your bodyweight on your spine.

That means, instead of 11 lbs, you feel like lifting zero pounds throughout the day!

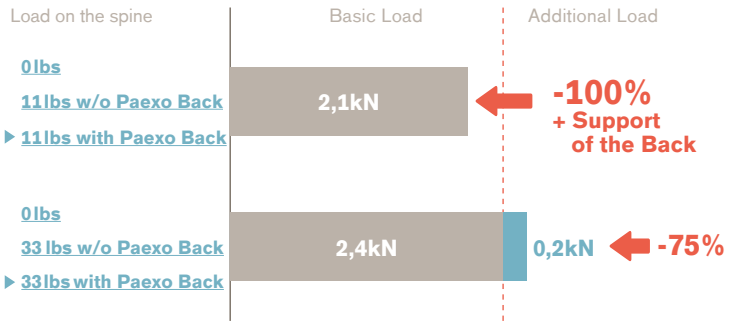
NIOSH recommendation load limits: The recommended weight limit that can be loaded safely at different vertical and horizontal distances



Support force of Paexo Back



The significant percentage relief is derived from the relative consideration of the additional load on the spine



Conclusion: The Impact.

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Paexo Back empowers logistics companies to turn safety into trust

Envision a logistics company that cares enough about its employees to equip them with wearable exoskeletons, such as Paexo Back, for their own protection and health. Action to prevent injury builds trust. More workers will want to work at your company and be physically well to do manual load handling, helping to reduce the recruiting burden and injury-related absences.

- → Improve productivity
- → Decrease risk
- → Improve employee morale
- → Increase safety and transparency
- → Ensure the health of the workforce

Expectations are changing. Injury prevention needs to be taken to the next level. The right solution is needed to make it happen.

Paexo Back represents the future of the logistics industry.

Book your experience package now: **www.paexo.com**

What our customers say:

"Paexo Back has exceeded our expectations for enabling our company to take more of a preventative approach to work-related injuries. Employees love wearing the lightweight exoskeletons because they know the product protects them. We are already starting to see the beneficial trend of lower number of missed workdays and higher employee satisfaction, while reducing risk. Paexo Back is perfect for a logistics work environment."

Jeff Collins, CEO, Cascade Orthopedic Supply

"As a logistics business, our use of the wearable exoskeleton Paexo Back will help prevent work-related injuries and give our workers the support they need to stay healthy. New tools for injury prevention have been needed in the logistics industry for a long time."

Logistics manager at a large furniture retailer

Contact Information

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About Ottobock

Since 2012, Ottobock has been researching solutions to relieve the strain on people with physically demanding jobs and to create healthier working conditions. The medical technology company offers a wide range of exoskeletons and ergonomic solutions: Paexo Back and Paexo Soft Back for back relief, Paexo Shoulder and Paexo Neck for overhead support, and Paexo Thumb and Paexo Wrist for thumb and wrist relief, respectively.

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