NATIONAL ERGONOMICS Conference & ErgoExpo®

Quantifying the Financial Impact of Ergonomics Interventions & Initiatives

Virtual: December 16th, 2020 (2pm EST)

Presented by: Blake McGowan, CPE – Director of Ergonomics Research – VelocityEHS | Humantech – bmcgowan@ehs.com

Need to Demonstrate ROI to Leadership

"This means that today, safety and health practitioners are much more valued by their organizations. The key challenge for us as a profession is to really demonstrate the significant return on investment of good safety, health and wellbeing management. This can be achieved to some degree by improved reporting standards; making sure boards get reports on safety and health." - Craig Foyle, outgoing president of IOSH, the Institution of Occupational Safety and Health.

At the 2018 Institution of Occupational Safety and Health's (www.iosh.com) conference in the United Kingdom

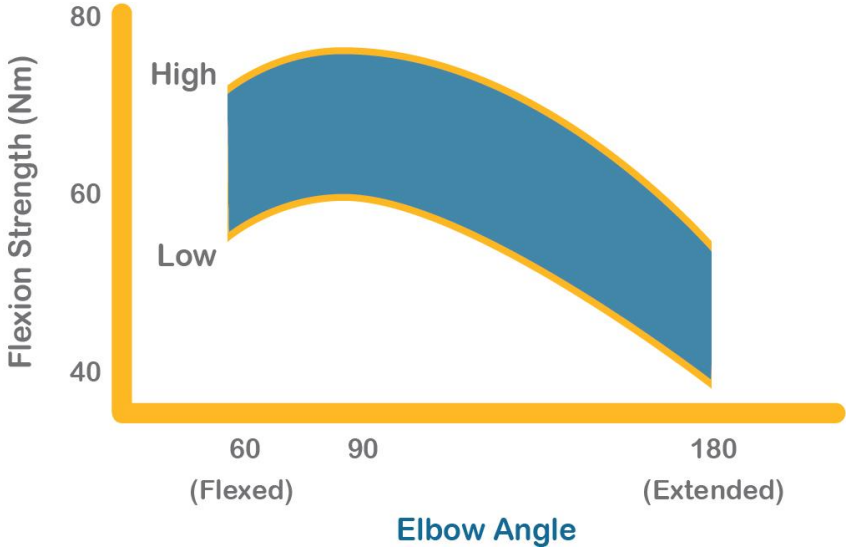
Speak the Language of the Boardroom

"It is crucial that safety and health professionals can combine their key technical skills with a firm understanding of how a business works and are able to speak the language of the boardroom. We need more people coming into the profession armed with leadership skills and the ability to influence decision-makers at the highest level." - Craig Foyle, outgoing president of IOSH, the Institution of Occupational Safety and Health.

At the 2018 Institution of Occupational Safety and Health's (www.iosh.com) conference in the United Kingdom

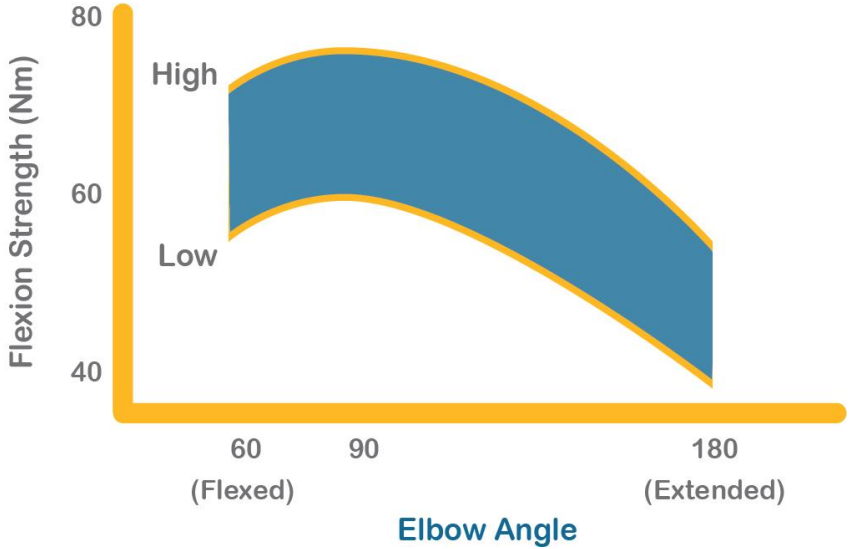
Fundamentals - Definition of Ergonomics

Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance.



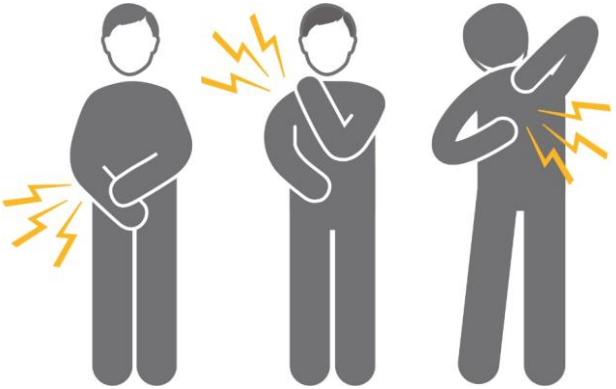
International Ergonomics Association (IEA) and Human Factors & Ergonomics Society (HFES).

Optimize Human Performance



Is this Part of the Problem?

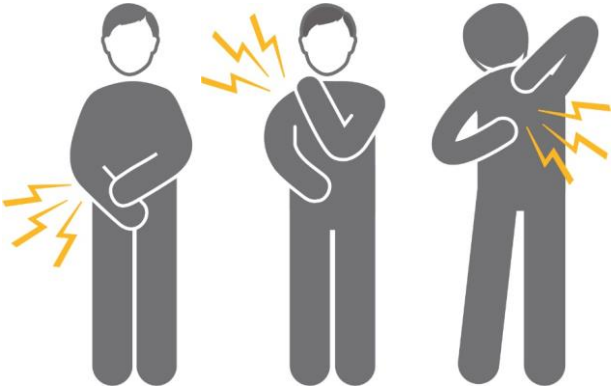
The goal of ergonomics is to prevent soft tissue injuries and musculoskeletal disorders (MSDs) caused by sudden or sustained exposure to force, vibration, repetitive motion, and awkward posture.



Centers of Disease Control and Prevention (CDC) and National Institute for Occupational Safety and Health (NIOSH).

Is this Part of the Problem?

An ergonomics program is a systematic approach and a management system that is designed to reduce risk from ergonomic hazards in the workplace.



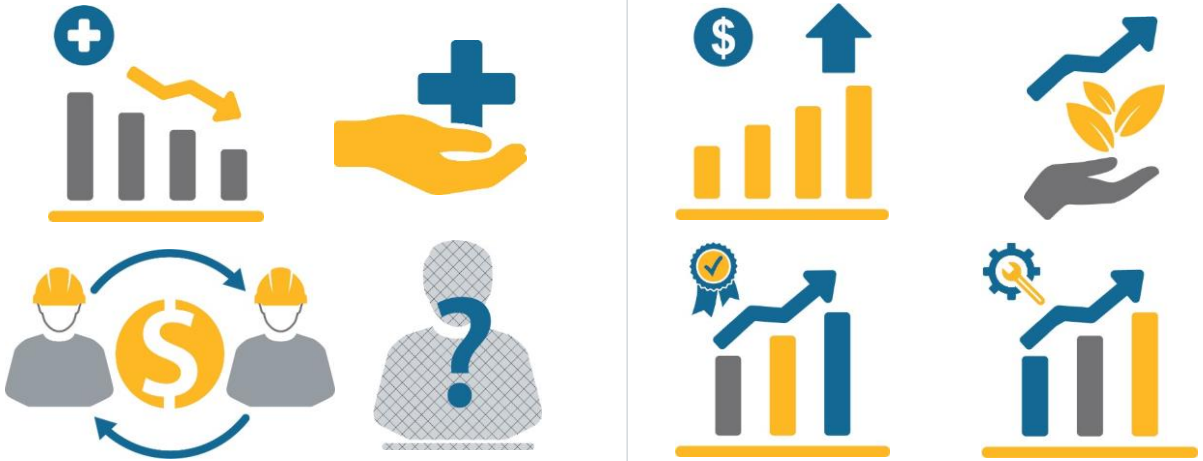
Canadian Centre for Occupational Health & Safety (CCOHS).

Benefactors & Benefits

Dul J, Bruder R, Buckle P, Carayon P, Falzon P, Marras WS, Wilson JR, van der Doelen B. (2012). A strategy for human factors/ergonomics: developing the discipline and profession. Ergonomics. 2012;55(4):377-95.

Benefits (or Value)

Benefit (or Value) of Ergonomics	
Traditional - Perceived	**Actual - Potential**
Well-being	Business Performance



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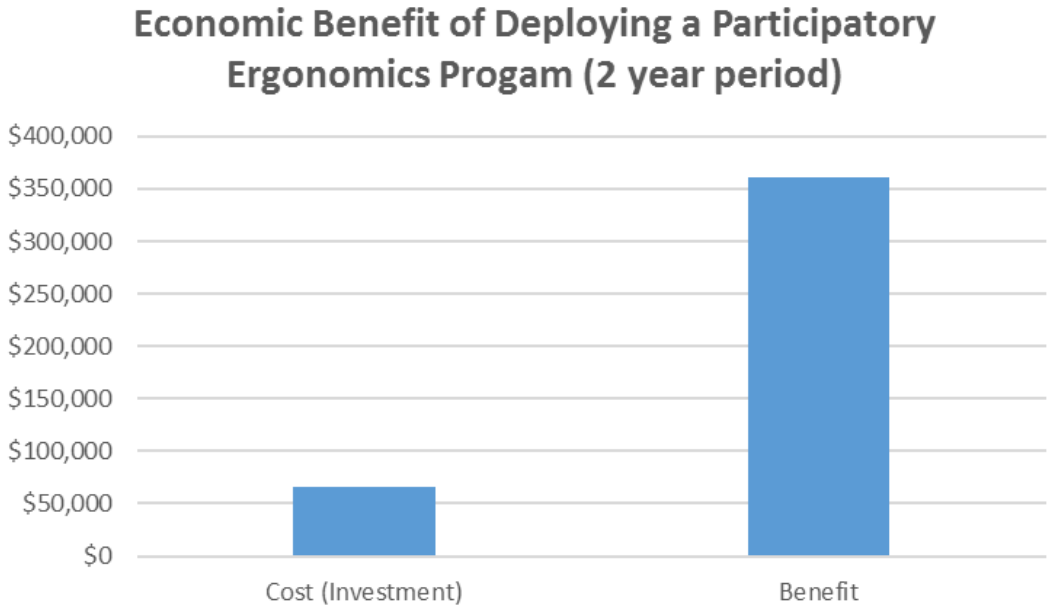
Economic (Business) Benefits



5X

Tompa E, Dolinschi R, Natale J. (2013). Economic evaluation of a participatory ergonomics intervention in a textile plant. Appl Ergon. 2013 May;44(3):480-7.

Economic (Business) Benefits

Participatory ergonomic intervention shows statistically significant improvements in performance outcomes:

1% Increase first-time quality production

5% Increase productivity efficiency

Tompa E, Dolinschi R, Natale J. (2013). Economic evaluation of a participatory ergonomics intervention in a textile plant. Appl Ergon. 2013 May;44(3):480-7.

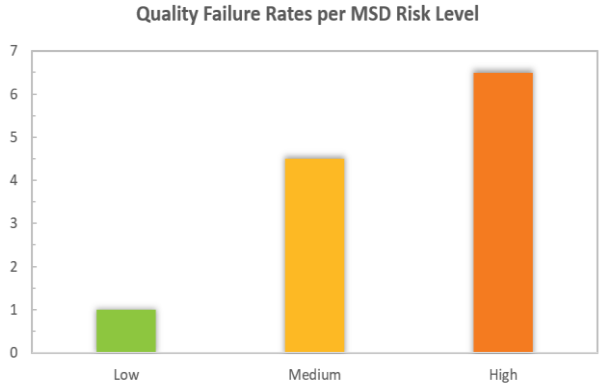
risk level

=

quality failure rates

=

cost to correct errors

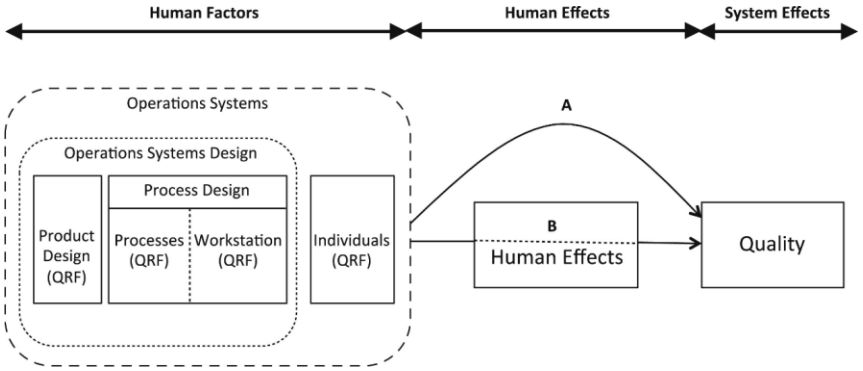


Ann-Christine Falck, Roland Örtengren and Dan Högberg. (2010). The impact of poor assembly ergonomics on product quality: A cost–benefit analysis in car manufacturing. Human Factors and Ergonomics in Manufacturing & Service Industries, Volume 20, Issue 1, pages 24–41, January/February 2010.

Ann-Christine Falck, Roland Örtengren, Mikael Rosenqvist. (2014). Assembly failures and action cost in relation to complexity level and assembly ergonomics in manual assembly (part 2). International Journal of Industrial Ergonomics 44 (2014) 455-459.

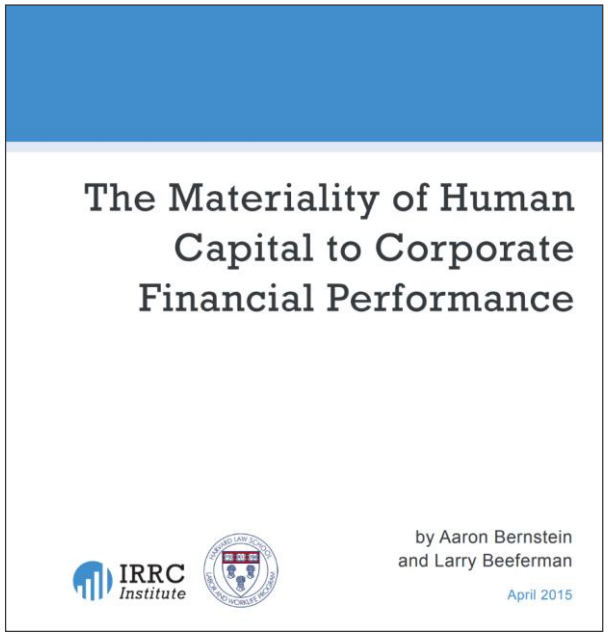
Is Ergonomics an Analog for Poor Quality?

- Fatigue is an intermediary factor between HF and manufacturing quality.
- Fatigue accounts up to 42% of the variance in quality deficits.



Yung M, Kolus A, Wells R, & Neumann P. (2019). Examining the fatigue-quality relationship in manufacturing. Applied Ergonomics. Volume 82, January 2020, 102919. https://doi.org/10.1016/j.apergo.2019.102919

Improved Human Capital Management



Human Capital management is material to company financial performance.

- Term understood by Senior Management Teams and Financial Investors.
- Skills, knowledge, and abilities employees bring to their work - viewed in terms of their value or cost to the company.

Bernstein, Aaron and Larry Beeferman, The Materiality of Human Capital to Corporate Financial Performance, Pensions and Capital Stewardship Project, Labor and Worklife Program, Harvard Law School, 2015

Improved Stock Performance

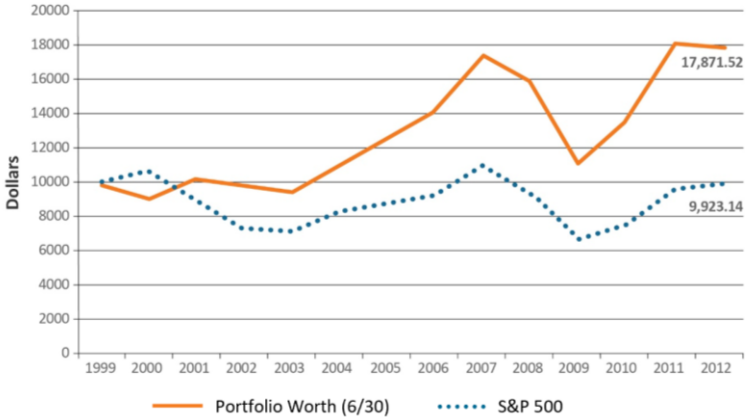
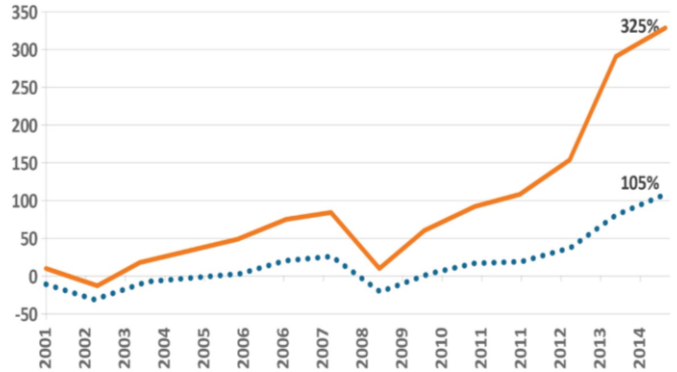


Figure 1. Portfolio starting at five winners versus S&P 500.



Cumulative stock performance (in %) of Koop Award Winners compared with the S&P 500 Index (2001-2014).

Fabius R, Thayer RD, Konicki DL, Yarborough CM, Peterson KW, Isaac F, Loeppke RR, Eisenberg BS, Dreger M. (2013). The link between workforce health and safety and the health of the bottom line: tracking market performance of companies that nurture a "culture of health". J Occup Environ Med. 2013 Sep;55(9):993-1000.

Goetzel RZ, Fabius R, Fabius D, Roemer EC, Thornton N, Kelly RK, Pelletier KR. (2016). The Stock Performance of C. Everett Koop Award Winners Compared With the Standard & Poor's 500 Index. J Occup Environ Med. 2016 Jan;58(1):9-15.

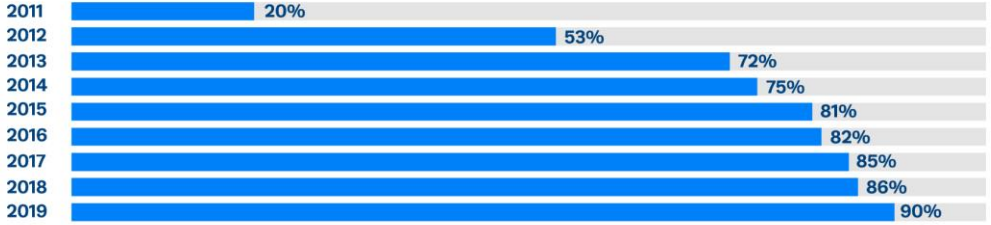
Importance of (Human) Sustainability

2020 FLASH REPORT S&P 500®

HIGHLIGHTS

THE 9-YEAR TRACK RECORD OF S&P 500 COMPANIES REPORTING

In the just-completed analysis of the 2019 publication year, G&A analysts determined that 90% of the S&P 500 companies are now reporting, while the non-reporters now make up a percentage of only 10%. The analysis included a breakdown of reporting and non-reporting by GICS® classification.



Governance & Accountability Institute, Inc. 2020 Research. (2020). Trends on the sustainability reporting practices of S&P 500 Index companies. 2020 Flash Report S&P500.

Impact on Corporate Credit Ratings

4% of all credit changes are influenced by social factors

human capital management and safety management are the most important social factors impacting credit quality

75% of these changes were negative or downgrades in credit rating. A downgrade typically results in a 10% to 20% drop in stock price.

De La Gorce N, Williams J, Wilkens M, Martin ND, and Burks B. (2018). How Social Risk And Opportunities Factors Into Global Corporate Ratings. S&P Global Market Intelligence.

Benefactors & Benefits

Dul J, Bruder R, Buckle P, Carayon P, Falzon P, Marras WS, Wilson JR, van der Doelen B. (2012). A strategy for human factors/ergonomics: developing the discipline and profession. Ergonomics. 2012;55(4):377-95.

Cost Justification

Cost Justification is a broad term that can refer to a wide range in level of detail.

- Cost justification "can mean simply that the proposed action is the most cost-effective solution to a problem or need that absolutely must be addressed."

- Two common tools used in cost justification are:
  - Cost-benefit analysis (CBA)
  - Return on investment (ROI)

Cost Benefit Analysis vs. Return on Investment

Cost Benefit Analysis	Return on Investment
Emphasizes financial feasibility	Emphasizes financial return
More flexible	More stringent
Multiple formulas	Specific formula
Longer-term benefits	Time sensitive
More comprehensive – includes intangibles	Focused on tangible costs and benefits
Benefits to affected parties	Benefits to investor

Is Using a Financial Estimator Valid?

Every cost justification is an estimation of the benefits.

A simple, standardized approach can efficiently accomplish one of the goals of cost justification: "Are we selecting the most effective approach?"

A request for more information isn't a negative outcome.

Example of a Financial Estimator (WS DLI)

Number of employees in this job/dept./org.: 9

Average hourly salary for these employees: ##### per hour

Number of WMSD claims for this job/ dept./ org. per year:

This past year:	Type	Back strain	Number	2	Typical costs:	$ 17,446
	Type	Shoulder strain	Number	1		$ 11,565
	Type	Back strain	Number			$ -
	Type	Back strain	Number			$ -
	Type	Back strain	Number			$ -
					Total costs for year:	$ 29,011
The year before:	Type	Back injury w/ surgery	Number	1	Typical costs:	$ 57,688
	Type	Shoulder strain	Number	1		$ 11,565
	Type	Back strain	Number			$ -
	Type	Back strain	Number			$ -
	Type	Back strain	Number			$ -
					Total costs for year:	$ 69,253
2 years before:	Type	Back strain	Number		Typical costs:	$ -
	Type	Back strain	Number			$ -
	Type	Back strain	Number			$ -
	Type	Back strain	Number			$ -
	Type	Back strain	Number			$ -
					Total costs for year:	$ -

Average annual WMSD claim costs: $ 32,755

Estimated annual indirect costs: $ 36,030

Washington State Department of Labor & Industries

Puget Sound Human Factors and Ergonomics Society

Option 2: Pallet lift

Purchase cost:	$ 5,500
Engineering cost:	
Training cost:	
Recurring costs:	
Other costs of change:	
Total cost of intervention:	$ 5,500

- ○ Eliminates exposure to hazard
- ◉ Reduces level of exposure
- ○ Reduces time of exposure
- ○ Relies on employee behavior
- ○ No reduction in injuries expected

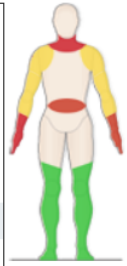
- ○ High - speeds up entire process
- ◉ Medium - reduces wasted motion
- ○ Low - improves comfort/reduces fatigue
- ○ No productivity gains expected

https://pshfes.org/cost-calculator

MSD Risk-Based Financial Estimator

Baseline

Risk Priority Score (RPS) **32.0**



Whole-Body Assessment

Hands/Wrists		Elbows		Shoulders				
Left	Right	Left	Right	Left	Right	Neck	Back	Legs
3	3	2	2	2	2	3	3	0

Physical Stressors:

Time on Task per Week: **20-40 hours**

Manual Material Handling

Lift/Lower	0.4	Push	(N/A)
Pull		Carry	

Projected

Risk Priority Score (RPS) **16.0** 50% Reduction

Whole-Body Assessment

Hands/Wrists		Elbows		Shoulders				
Left	Right	Left	Right	Left	Right	Neck	Back	Legs
2	2	1	1	1	1	2	2	0

Physical Stressors:

Time on Task per Week: **20-40 hours**

Manual Material Handling

Lift/Lower	(N/A)	Push	(N/A)
Pull		Carry	(N/A)

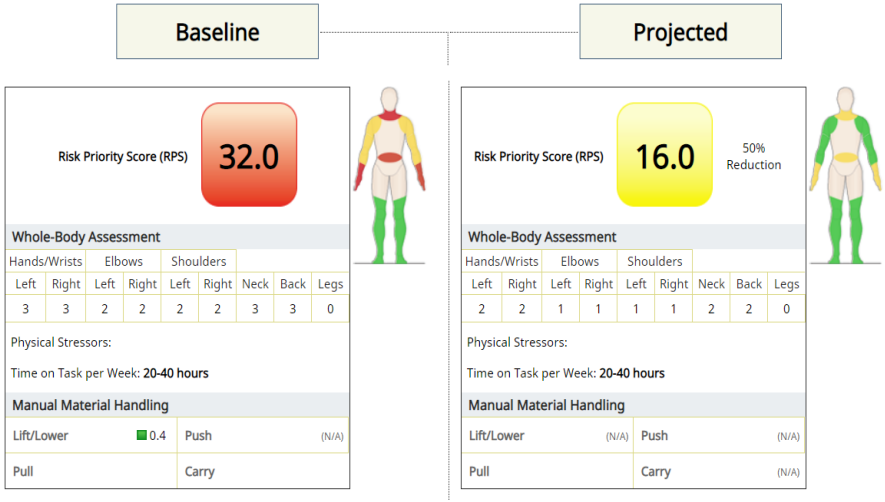
ROI of a Single Ergonomics Intervention

Current		Projected		Anticipated Savings
RPS Score	# of High-Risk Body Areas	RPS Score	# of High-Risk Body Areas	
32	4	16	0	**$5,885**

**Cost savings are based on averages reported in research literature for jobs with similar risk reductions. Individual projects will vary in actual savings. This data is intended to guide decisions about the appropriate next steps, which may include conducting a formal ROI.*

Breakdown of Anticipated Savings	
Injury Costs	$1,088
Productivity	$2,560
Scrap/Rework	$1,510
Turnover	$469
Absenteeism	$257

ROI of a Single Ergonomics Intervention



Current		Projected		Anticipated Savings
RPS Score	# of High-Risk Body Areas	RPS Score	# of High-Risk Body Areas	$5,885
32	4	16	0	

**Cost savings are based on averages reported in research literature for jobs with similar risk reductions. Individual projects will vary in actual savings. This data is intended to guide decisions about the appropriate next steps, which may include conducting a formal ROI.*

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Turnover	$469
Absenteeism	$257

Comparing ROI of Potential Solutions

	Option 1 Two Person Lift	Option 2 Lift Tables	Option 3 Vacuum Hoist
Anticipated Year 1 Cost	$6,000	$10,000	$25,000
Ongoing Annual Cost	$6,000	$0	$0
Projected Risk Reduction	2 points	5 points	15 points
Projected Annual Savings	$1,014	$2,535	$7,605
CBA1	17%	25%	30%
Breakeven	Never	3.9 Years	3.3 Years

ROI of an Overall Ergonomics Initiative

- Company X improved and completed follow-up assessments on 53 jobs, with average RPS improvement of 15.2 points
- The number of high RPS score jobs was reduced from 48 to 0
- Based on this reduction in risk, Company X has achieved an estimated annual savings of $355,672 or just under $7,409/job improved

Annual Projected Savings				
Injury Reduction	Productivity Improvement	Quality Improvement	Turnover Reduction	Absenteeism Reduction
$52,227	$211,552	$62,143	$19,172	$10,578

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How can science confirm or deny that you are making the right ergonomic changes at your workplace?

Dr. Patrick Carley
Dr. Susan Lachowski
Joe Kessler, MBA, Ergonomist Hasbro Games

Ergonomics

It’s a good thing!

Challenging prior assumptions and mindsets of “but we have always done it that way” is the work of Ergonomics.

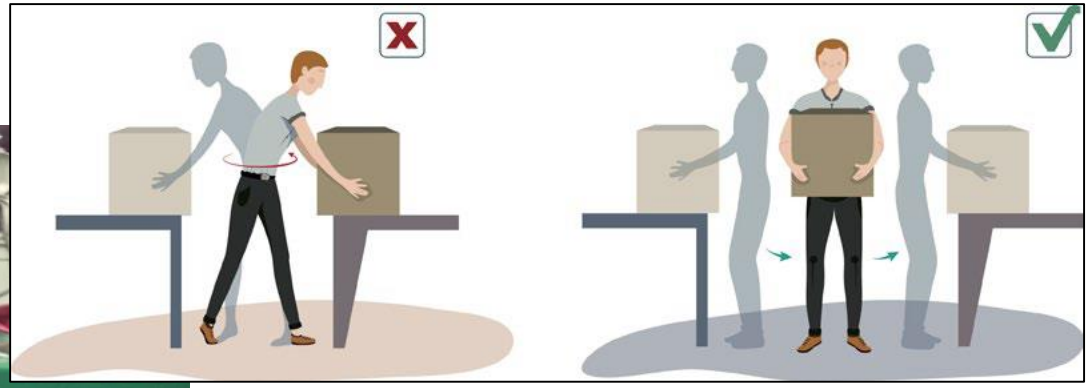
It is a continuous process supported by science!

Otherwise, it is just guessing, which … anyone can do.

REAL LIFE SCENERIO #1 US TSUBAKI

- Work tasks required this operator to flex their back to 90 degrees, reach to change parts, and periodically alternate use either hand for additional support
- The stability of the operator's position required excessive use of his/her lower extremities bracing the knees against the machine, using neck and back muscles to a high degree
- This operation caused a lot of strain on the worker's legs, back, shoulders, and neck. In addition, this area becomes a bottleneck in the manufacturing process
- Thus, the worker could only complete two machines an hour

SUBTLE FACTORS CAN MAKE WORK SAFER!

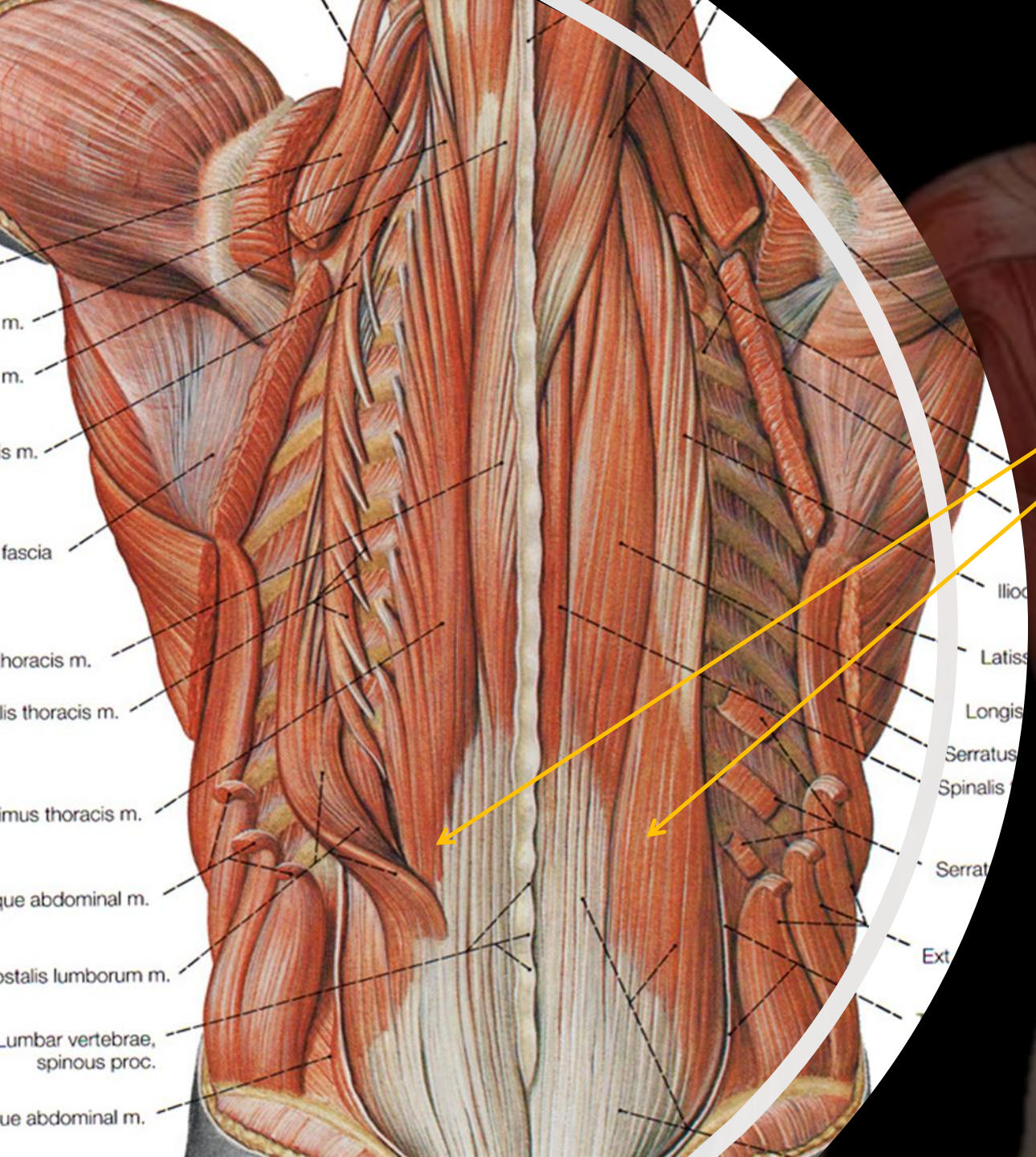


1. Becoming more aware of work forcing the employee to position him/herself in awkward positions to work is the first step in ergonomics

2. Intervening to change results in less risk for sprains and strains to neck, back, and shoulders applying basic ergonomic principles

3. Our Ergonomic Collaboration Team listened and produced a solution – a simple solution

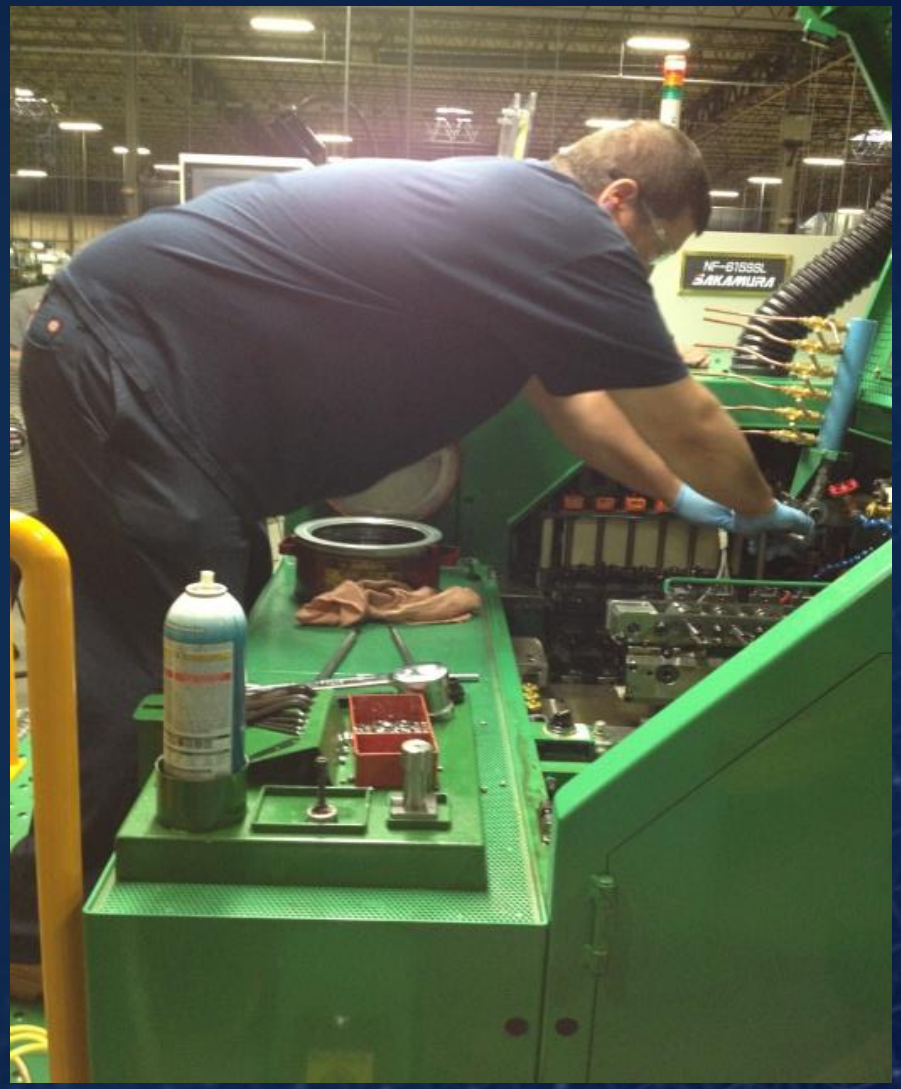
4. Management wanted confirmation to see if it would be the right solution - quite reasonable…



Electrodes placed on these back muscles

APPLYING AND TESTING THE ERGONOMIC PRINCIPLES AND SOLUTIONS EMPLOYS SCIENCE

NO ERGO – SAME OLD WAY OF DOING THINGS



NO PLATFORM

VS

WITH ERGONOMICS ENGAGEMENT AND RESULTING POSTURES

WITH THE NEW PLATFORM

CONCLUSIONS FROM THIS ERGONOMIC INTERVENTION

- EMG data was gathered showing much less low back muscle activity during the tasks lowering the implications for less fatigue throughout the workday.

- Subjective data supported improved workers reporting more stability, less back muscle strain, and the safe use of both hands for better work tasks completion (from two machines to four machine an hour) a 100% gain in productivity.

Ergonomics is all about challenging the “status quo”

What to do ergonomically about the common complaint of standing at the workplace?

REAL LIFE SCENARIO #2 HASBRO GAMES

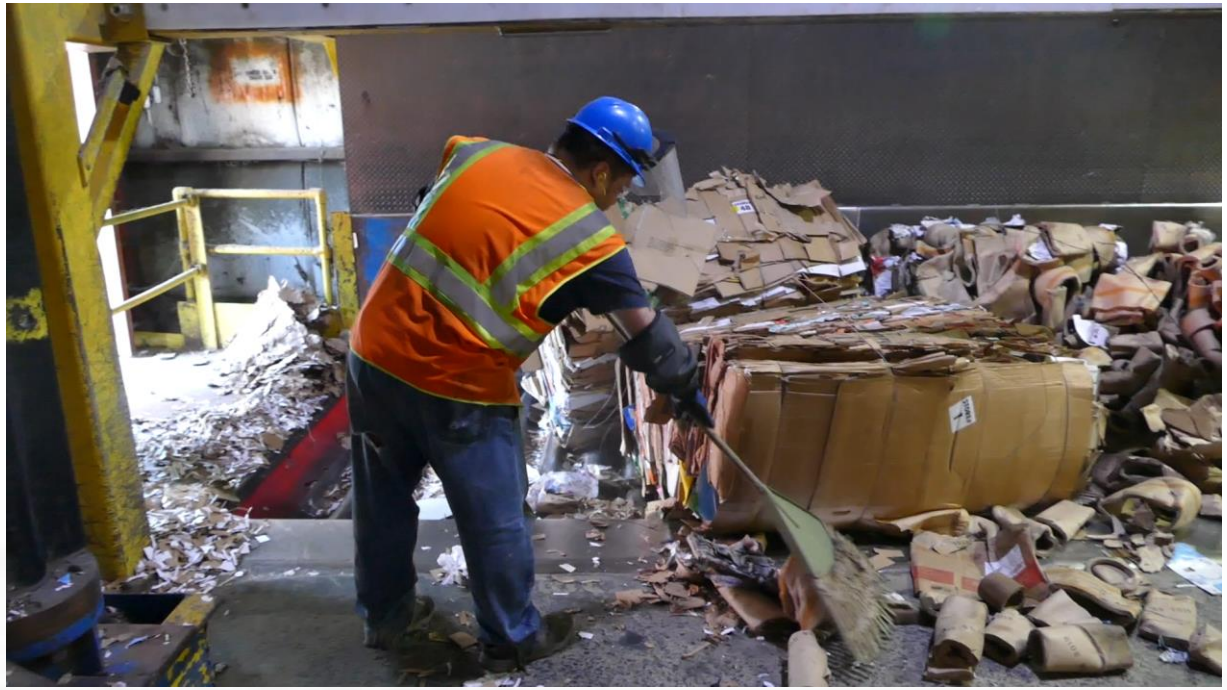
The old “Status quo” would be to throw a floor mat down and problem solved

Today’s world of ergonomics calls for deeper thinking for better solutions

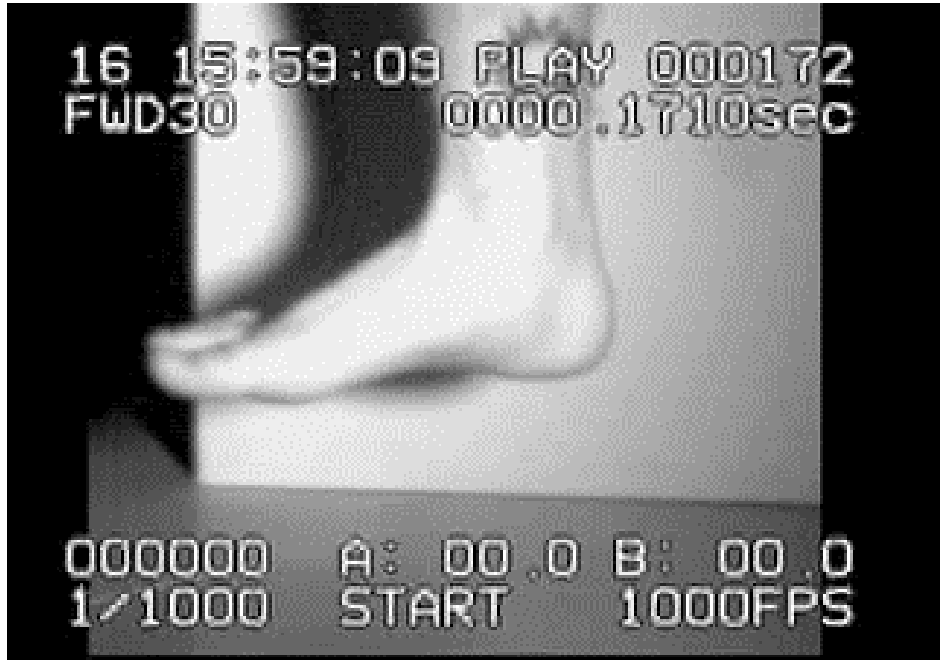
Standing at the workplace occurs in all over the place and lots in manufacturing

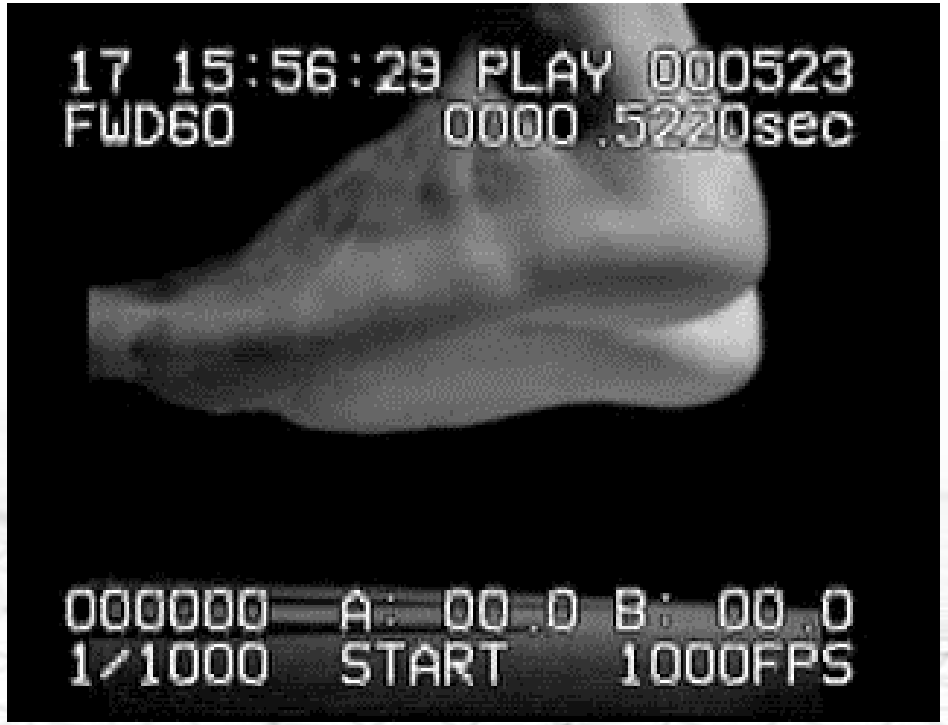
This example shows thinking through an ergonomic challenge truly makes sense and saves money

A worker’s body absorbs forces applied to it all throughout the workday



Considering materials that can absorb those forces close to the body to lessen the work done by muscles





Patented 100% Dual Layer Memory Foam Technology

- All MEGAComfort® products are uniquely designed patented* combination of high density 100% DUAL LAYER memory foam technology.
- The dual layers compress together and gently rebound with every step of the walking cycle for 100% surface contact of the foot.
- Top layer of memory foam reduces harmful shear force and molds to the person's foot profile.

Balance Control

Sensory

Where am I?

Motor

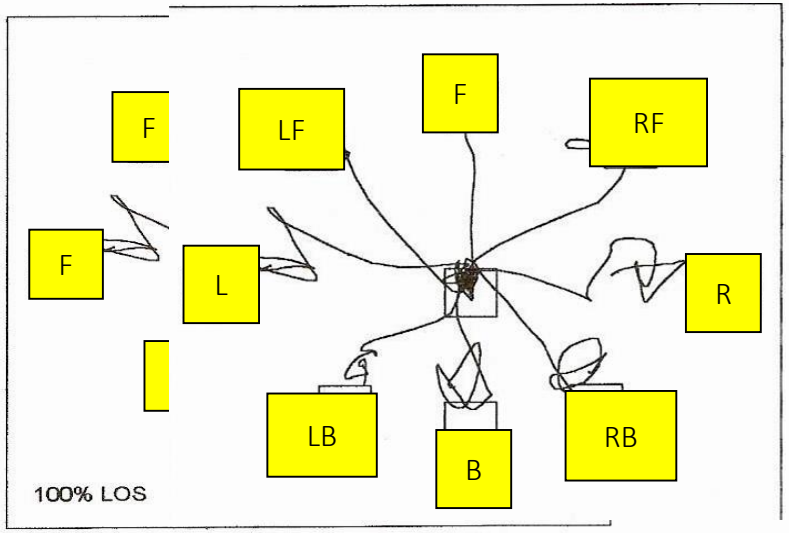
What am I going to do?

- Determination of Body Position
- Choice of Body Movement
- Compare, Select and Combine Senses
- Select and Adjust Muscle Contractile Patterns
- Visual System
- Vestibular System
- Somato Sensation
- Ankle, Thigh
- Trunk, Neck
- Eye, Head
- Environmental Interaction
- Generation of Body Movement

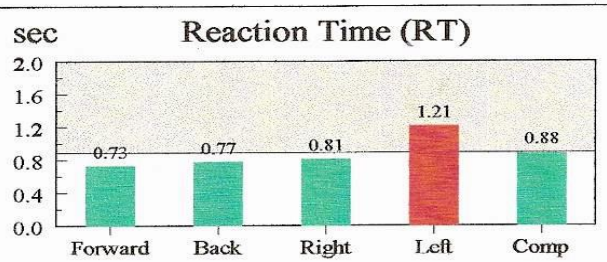
Balance Direction Challenge at 100% LOS

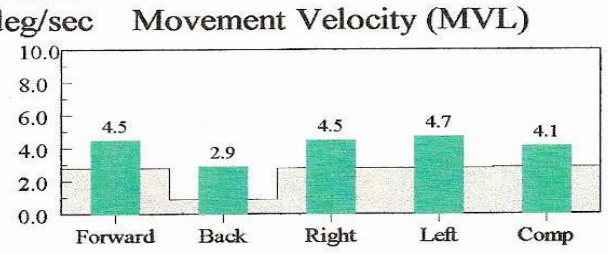
DOB: 7/24/1972 **Referral Source:** Amer. Inter. College **Test Time:** 12:49:38 PM
Height: 5'10" **Comments:** B - C - A - D

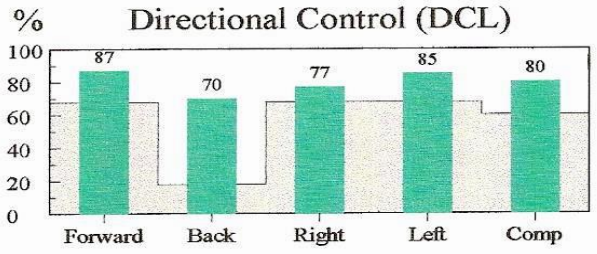
LIMITS OF STABILITY TEST



RT (sec)	MVL (deg/sec)	EPE (%)	MXE (%)	DCL (%)
0.40	4.5	101	103	91
1.26	4.6	94	111	87
0.52	5.0	47	83	76
0.78	3.6	86	86	70
0.51	2.6	88	88	77
1.61	3.7	68	86	84
1.07	4.9	79	96	74
0.73	4.8	107	107	88







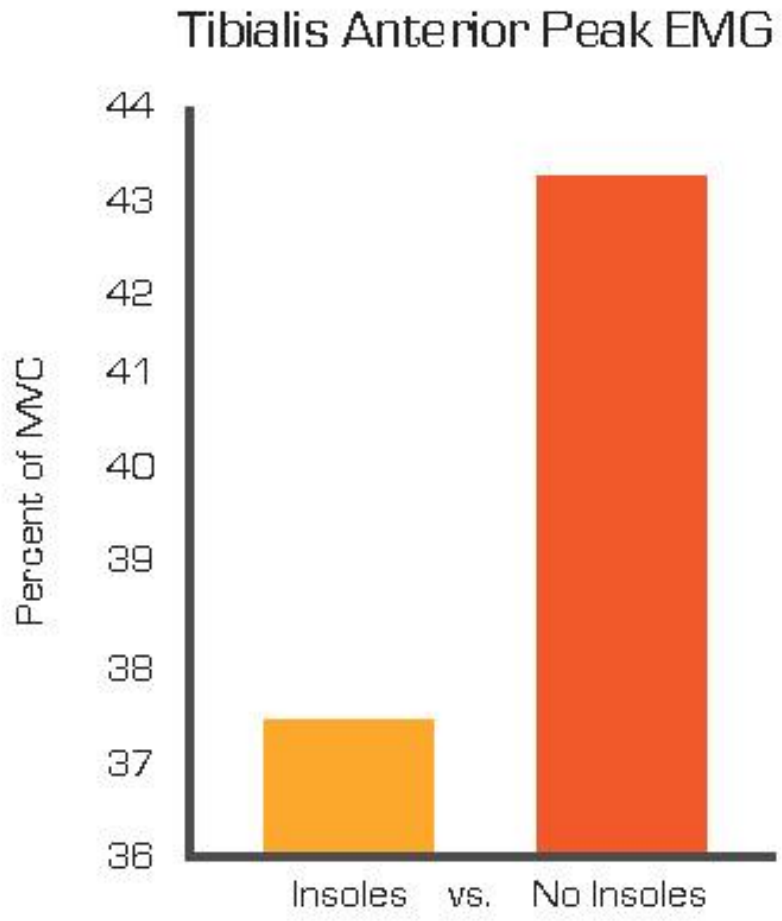
HOW DO WE ASSESS THE IMPACT OF ERGONOMIC DECISIONS?

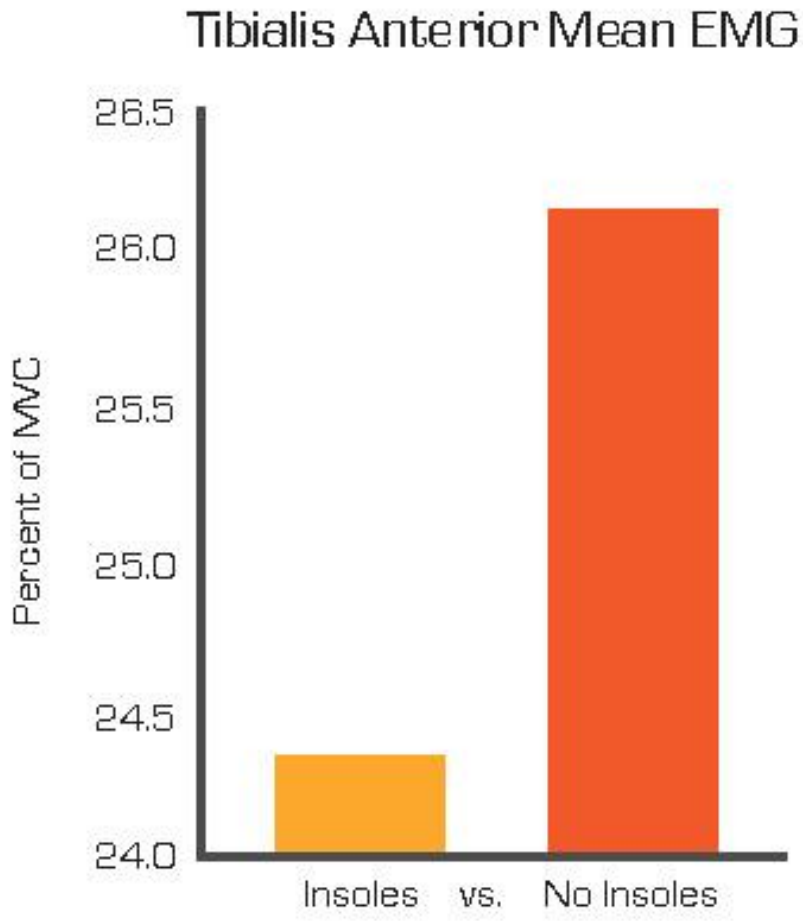
- As an initial step a trial can be conducted with a small group to assess the subjective reaction, perceived discomfort, interaction and adjust or expand the intervention to a larger group of employees
- Hasbro Games used such a group to assess the transitioning from floor mats to cushioned insoles (MEGAComfort)
- With the help of a local college, they monitored muscle activity (EMG), shared the results with employees, and made the transition entirely

Peak Tibialis Anterior Activity

$t(45) = -3.962, P < .01$

High EMG levels: The more the muscle groups are working (negative - more fatigue)



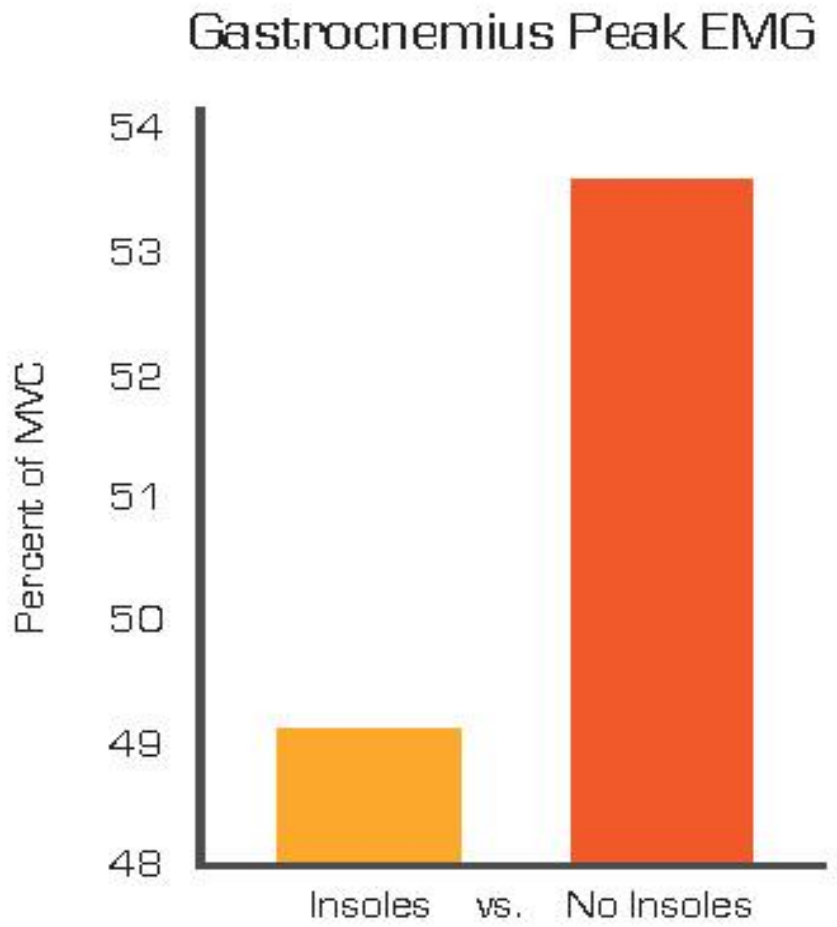


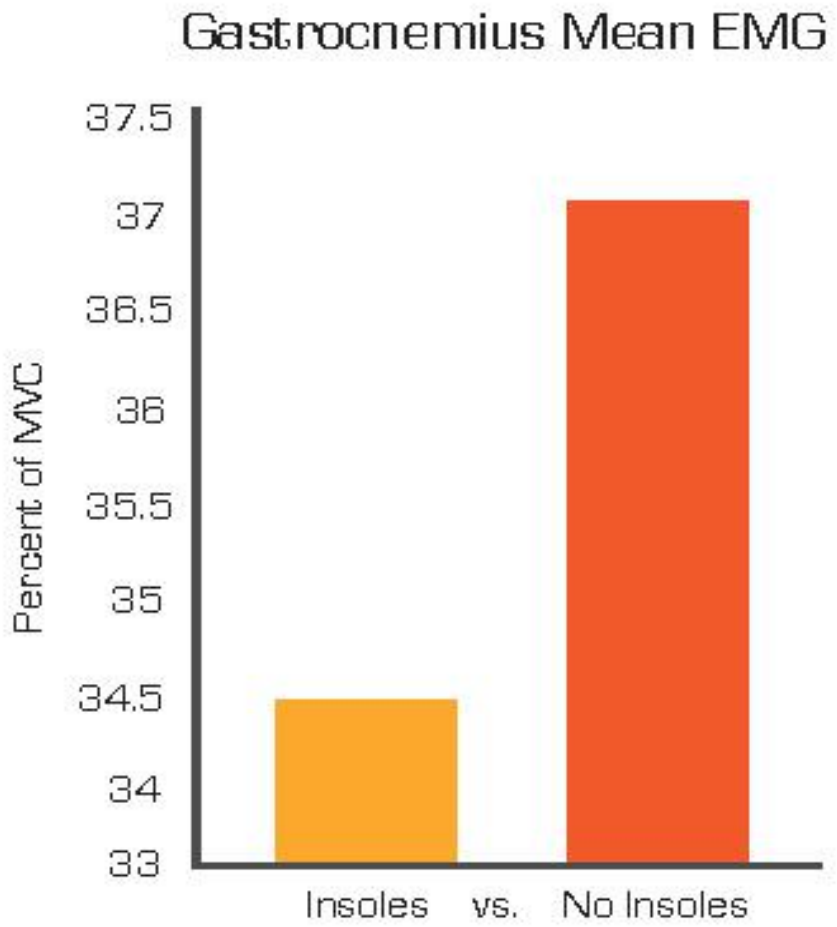
Peak & Average Gastroc Activity

t (45) = -3.77, P < .01

t (45) = -2.48, *P* < .05

Low EMG levels: The less the muscle groups are working (positive - less fatigue)





Statistical Analysis of the EMG Activity Tibialis Anterior & Gastrocnemius

***Repeated Measures t-test was the statistical analysis most appropriate to determine if there was a difference in average and peak EMG readings for TA and Gastroc muscles if they were significantly different with participants either wearing insoles or no insoles.

Tibalis Anterior Peak - $t\,(45) = -3.962,\ P < .01$**

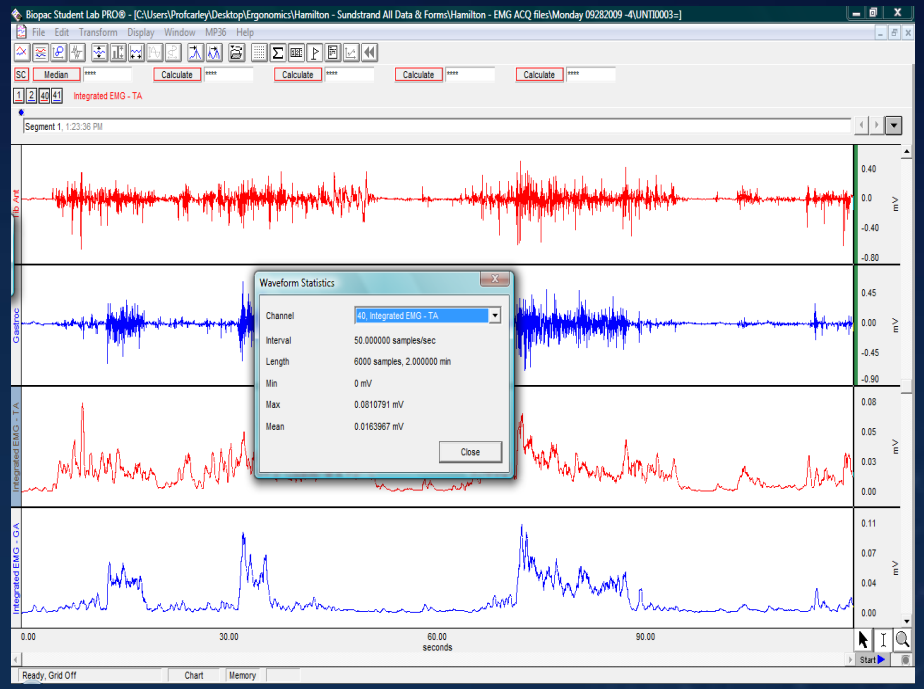
Tibalis Anterior Mean - $t\,(45) = -2.48,\ P < .05$*

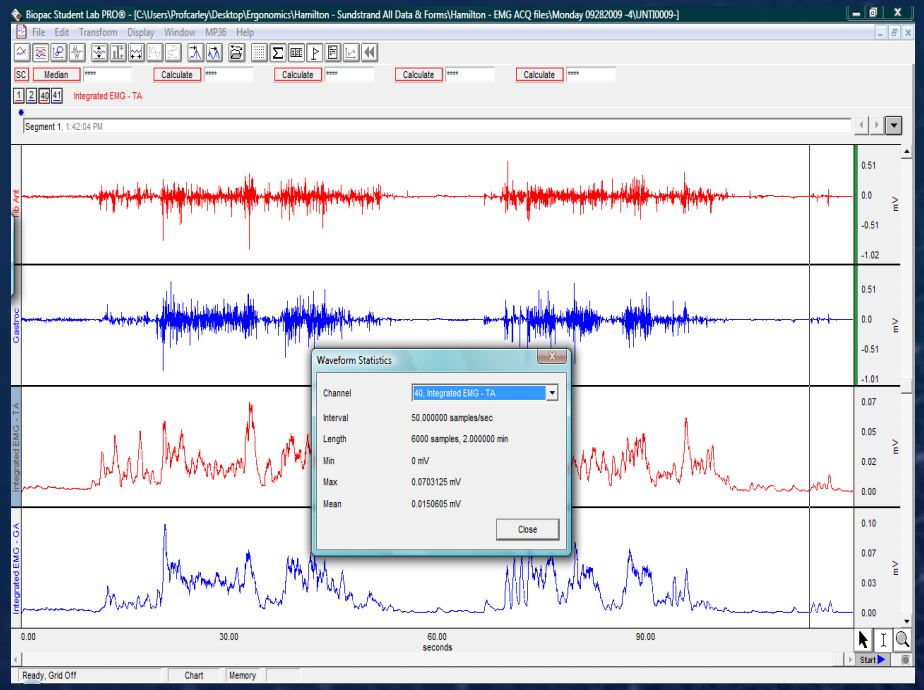
Gastroc Peak - $t\,(45) = -3.77,\ P < .01$**

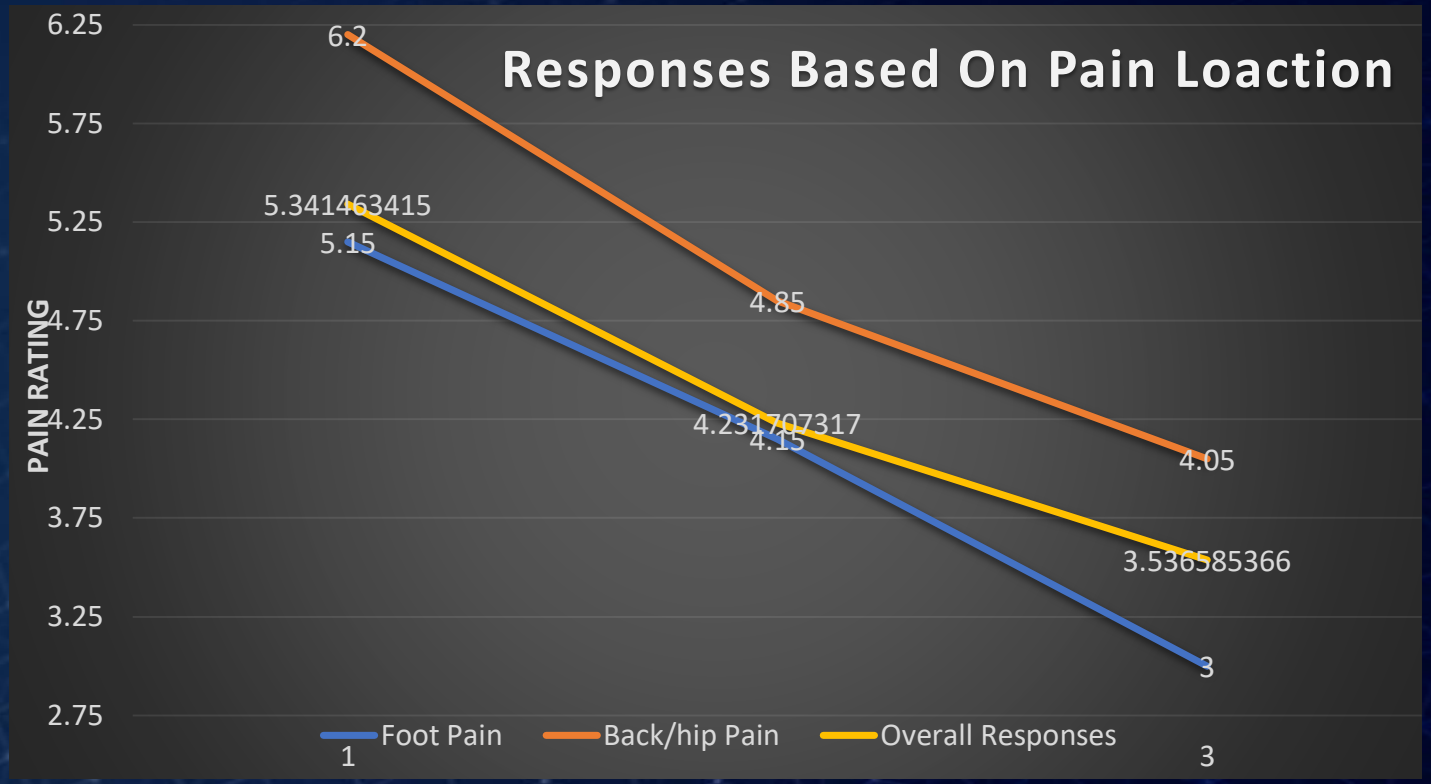
Gastroc Mean - $t\,(45) = -1.76,\ P = .09$

(statistically significant at: ** 0.01% level * At 0.05% level)

NO INSOLES**


Biopac Student Lab PRO® - [C:\Users\Profcarley\Desktop\Ergonomics\Hamilton - Sundstrand All Data & Forms\Hamilton - EMG ACQ files\Monday 09282009 -4\UNTI0003=]
Waveform Statistics
Channel
40, Integrated EMG - TA
Interval
50.000000 samples/sec
Length
6000 samples, 2.000000 min
Min
0 mV
Max
0.0810791 mV
Mean
0.0163967 mV
Close
0.00
30.00
60.00
seconds
90.00
Ready, Grid Off
Chart
Memory


Biopac Student Lab PRO® - [C:\Users\Profcarley\Desktop\Ergonomics\Hamilton - Sundstrand All Data & Forms\Hamilton - EMG ACQ files\Monday 09282009 -4\UNTI0009-]
Waveform Statistics
Channel
40, Integrated EMG - TA
Interval
50.000000 samples/sec
Length
6000 samples, 2.000000 min
Min
0 mV
Max
0.0703125 mV
Mean
0.0150605 mV
Close
0.00
30.00
60.00
seconds
90.00
Ready, Grid Off
Chart
Memory


Responses Based On Pain Loaction
PAIN RATING
6.25
5.75
5.25
4.75
4.25
3.75
3.25
2.75
6.2
4.85
4.05
5.341463415
4.231707317
3.536585366
5.15
4.15
3
1
3
Foot Pain
Back/hip Pain
Overall Responses

EFFECTIVE PERSONAL ANTI-FATIGUE SOLUTION

VS

ANTI-FATIGUE MATTING	EFFECTS	MEGAComfort Solution
Shared between multiple employees	Risk of cross contamination	**Personal** – each employee wears their own pair **(No Sharing)**
Difficult to clean and disinfect	Extra burden on cleaning staff and materials	**Hygienic** - Not exposed to the air Machine Washable. (**No Contamination)**
Requires multiple mats to cover one area	Hinders physical distancing	**360° coverage**. Goes where the employee goes.

7 WAYS TO FIT INTO A CORPORATE BUDGET

HEALTH & SAFETY BUDGET

Reduce slips, trips, and falls and improve employee safety by adding MEGAComfort insoles to your health and safety budget. Our personal anti-fatigue mat insoles are clinically designed to include numerous health and safety benefits.

HR BENEFITS

Whatever the goals of your HR Benefits budget include, they probably allow room for increasing the quality of life for your employees. Adding a pair of MEGAComfort insoles ensures that employees will experience less pain and fatigue on the job.

STARTER KIT FOR NEW EMPLOYEES

What better way to welcome new employees, than to give them PPE that will truly make a difference in their lives! Providing new employees with MEGAComfort insoles ensures they start their employment off on the right foot.

UNIFORM BUDGET

Make your uniform budget go further, by adding MEGAComfort insoles. Our insoles are designed to reduce pain and fatigue with every step. It's one piece of your employee's uniform that will keep them comfortable and productive at work.

HEALTH & WELLNESS

Give your employees the physical support they deserve. MEGAComfort insoles are clinically designed to reduce pain and fatigue and fit perfectly into health and wellness budgets.

PPE BUDGET

Personal Protective Equipment is wearable equipment that protect you against health or safety risks, while working. These items include safety footwear, harnesses, gloves, hard hats, and dual layer 100% memory foam insoles.

REPLACE ANTI-FATIGUE MATTING

Worn out anti-fatigue matting can cause more harm than good. They can lead to slips, trips, and falls and only provide support to those standing on the mat. MEGAComfort insoles are the affordable replacement for matting, and they support wearers all day, wherever they go.

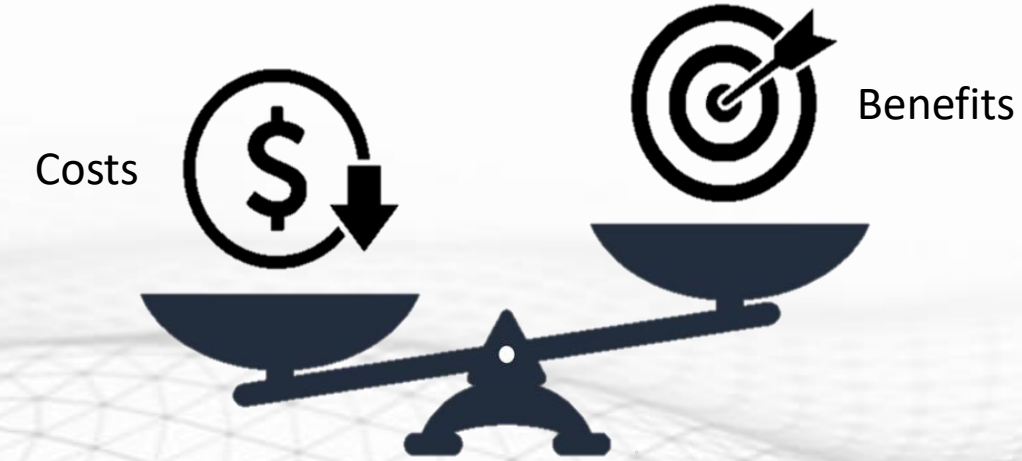
CONCLUSIONS FROM THE SECOND ERGONOMIC INTERVENTION

Ergonomic Collaboration Group - Mat Cost vs. Insole Cost Estimator

Number of Standing or Mobile Employees	300	(enter your estimate)
Facility Size (in Square Feet)	100000	(enter your estimate)
Percentage of Facility using Mats	10%	(enter your estimate)
Injury Incidence Rates (1) https://www.bls.gov/news.release/pdf/osh2.pdf	0.001790	
Total Cost per Slip-Trip-Fall Incident Page 66 Injury Facts (see above)	$45,016.00	
Matting Incident Filter Percent Slip, Trip and Falls - Same Level Incidents due to Matting	5%	
Cost per Mat- Cost of 3 by 6 ft mat https://www.matsonline.com/diamond-plate-runner-black	$69.80	
Matting Cost	$38,800.00	
Estimated Total Current Cost	$39,607.04	
Insole Cost (Giving two pairs to employees per year)	$16,170.00	
Estimated Total Cost Savings Per Year	$23,437.04	

THE BENEFITS OF ERGONOMICS

- 1st example: observing and recognizing poor postures lead to an ergonomic intervention that reduced the risk of injury while improving productivity
- 2nd example: placing the cushioning close to the foot surface improved employee responses in addition to lowering muscle activity and costs associated with floor mats
- Ergonomics –a continuous process supported with science!



Challenging prior assumptions and the way “we have always done it” is the work of Ergonomics

Otherwise, it is just guessing, which really, anyone can do…

Thank you for your time and your interest in Ergonomics!

Questions or Request for Excel worksheet

can always be sent to:

ecgsafetytraining@gmail.com

413-885-0574


NATIONAL
ERGONOMICS
Conference
&
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