

OSC | 11
Ohio Safety Congress & Expo



#251 – NIOSH's latest research in ergonomics

Brian Lowe, CPE and Steve Wurzelbacher, CPE

Thursday, March 31, 2011
8 to 9 a.m.



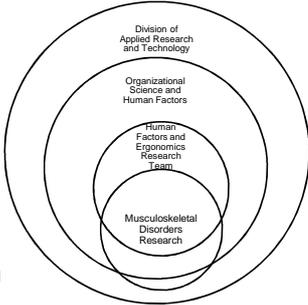
The NIOSH Division of Applied Research and Technology
Ergonomics Research Program

Brian Lowe, PhD, CPE

Division of Applied Research and Technology

- o Cincinnati, Ohio
- o Formed in 2000
- o 164 staff
- o 4 branches
 - Biomonitoring and Health Assessment
 - Chemical Exposure and Monitoring
 - Engineering and Physical Hazards
 - Organizational Science and Human Factors



Professional Areas of Expertise

- Industrial Engineering
- Safety Engineering
- Applied Physiology/Biomechanics
- Industrial/Organizational Psychology
- Industrial Hygiene

Projects in Most Sectors

Sector	Project(s)
Manufacturing	preventing injuries among forklift operators
Construction	preventing injuries from pneumatic nail guns; guidelines for selecting non-powered hand tools; interventions to prevent MSDs in Construction
Services	preventing injuries from computer input devices
Transportation	preventing injuries from baggage handling
Healthcare	preventing injuries from patient handling
Wholesale/Retail Trade	preventing injuries from pushing/pulling
Public Safety	bicycle saddle health for police bicycle officers
Agriculture	safe workloads for children on farms

Best Practices for Bariatric Patient Handling Traci Galinsky



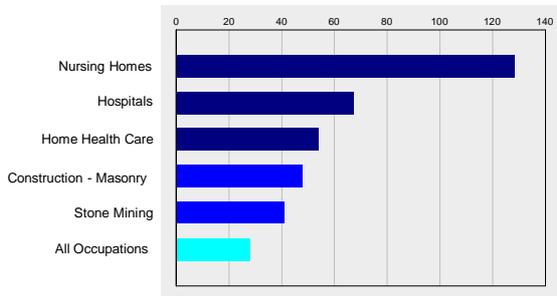
The term "bariatric" is used to describe weight loss (e.g., gastric bypass) surgery. It's also used generally to refer to patients who are limited in health, mobility, or environmental access due to their weight and/or size.



Photos courtesy of Susan Gallagher, Ph.D.

- Lifting/handling of morbidly obese ("bariatric") patients is an increasing problem
- Project goal is to identify and promote safe practices for bariatric patient handling

Overexertion Injuries per 10,000 Workers Bureau of Labor Statistics (2007)



Patient Handling Risk Factors



Manually lifting and moving patients ("Patient Handling" and "Patient Transfers") is characterized by forceful exertions and awkward postures – the two primary risk factors for musculoskeletal injury.

Interventions – Lift Assist

Design all components of the work environment . . .
Furniture Equipment Tools Tasks
. . . to best accommodate the capabilities of the worker.

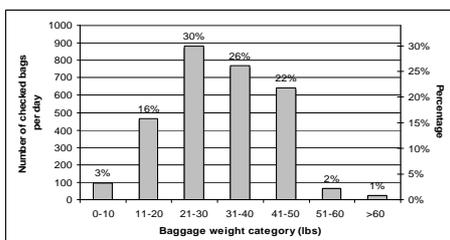


Reduction of MSDs in Baggage Screeners at TSA Jack Lu

Inter-agency collaboration with Transportation Security Administration (TSA)

- \$47 M in total injury costs; 80% of claims are for MSDs
- Risk associated with repetitive manual baggage handling
- Lack of MSD risk assessments for baggage screeners
- Provide TSA with information about baggage screeners exposure to risk factors and interventions for reducing injuries

Baggage Weights

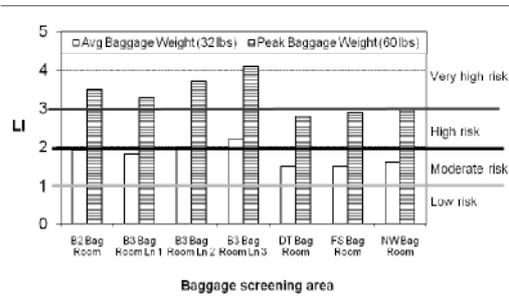


Cincinnati Northern/Kentucky International Airport (CVG):
~500 bag lifts/day

Bag Size and Shape



Results for a Cat X Airport

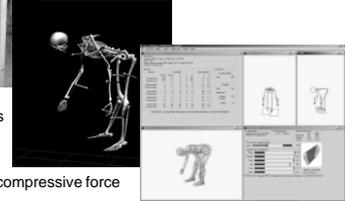


Posture Simulation Method

Step 1 – Videotape worker doing job at worksite



Step 2 – Simulate video of worker in lab



Step 3 – Collect body angles from simulation

Step 4 – Calculate LI and back compressive force

Ergonomic Interventions for Manual Baggage Lifting



The Overweight Baggage Mover system

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Ergonomic Interventions for Manual Baggage Lifting

Vacuum lift assist



Development of the NIOSH Pushing and Pulling Equation

Tom Waters

- Wholesale/Retail Trade Sector
- Develop an easy-to-use equation for assessing the physical demands of pushing/pulling
- Similar in structure to the NIOSH Lifting Equation (NLE)
- Criteria from biomechanics, physiology, psychophysics, epidemiology

Validation of Ergonomic Design Criteria for Hand Tools

Brian Lowe

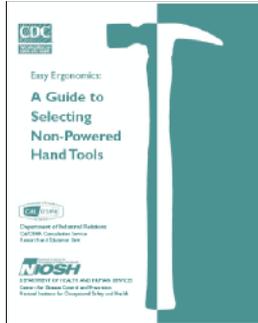
Best, Best, Best. The Tool will do the job with the desired quality and will last and equated your score with the check list, NO request the tool.



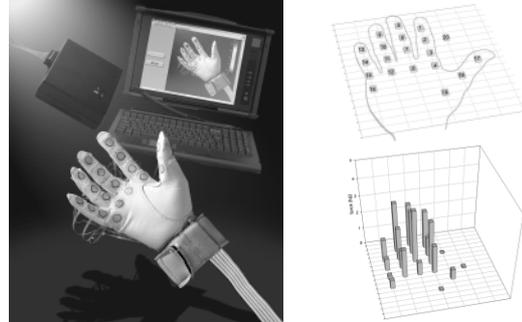
Considering the job the tool is designed for and the work environment, respond to each item on the checklist by "Yes", "No", or "N/A" (Not Applicable). Place the score that corresponds to your response in the Score column. Add the scores of all items to get the total score of the tool. Maximum score is 100. (Please use the tool for validation)

Item	Yes	No	N/A	Score
1. Ergonomic features				
2. Grip surface is non-slippery	+20	0	0	
3. Grip surface does not have sharp edges, under cuts, deep ribs or other sharp grooves	+20	0	0	
4. Grip surface is electrically insulated. Tool handle is either made of wood, or coated with rubber or dielectric.	+20	0	0	
5. Grip surface is electrically insulated. A voltage test or cold test when voltage is hot or cold temperature.	+20	0	0	
6. Handle is made of wood or other surface is coated with non-slip material, not too hard and not too soft, similar to the palm and wrist area of your hand.	+20	0	0	
7. Ergonomic handle angle: Size of handle cross section is not too much or too little. The angle between the handle is designed to provide for 20° when carrying the necessary of weight for tool, weight of 17.5 kg (40 lbs).	+20	0	0	
8. Ergonomic handle design: The handle cross section is oval or round with a diameter of 40-50 mm.	+20	0	0	
9. Ergonomic handle: The back shape of handle cross section is circular, rectangular, square or triangular.	+20	0	0	
10. Ergonomic handle: The handle cross section is square or round less than 3" when fully closed and less than 2" when fully open.	+20	0	0	
11. Length of the handle is designed so that the work can be done using a straight wrist.	+20	0	0	
12. The tool weight is less than 20.	+20	0	0	
13. The tool can be used with either hand.	+20	0	0	
14. The tool can be used with the weaker/dominant hand.	+20	0	0	
15. The tool will allow a two-handed operator, using both hands at the same time.	+20	0	0	
16. The tool and accessories are clearly marked and/or color coded so they are easy to identify, when no legend/number compares with the nomenclature of the work area.	+20	0	0	
Total Score of the Tool (200 points possible)				

Research Dissemination – joint document with Cal-OSHA



Finger force measurement in hand grip



Optimal Grip Sizes



Maximum comfort for high grip force

(female)

(male)

hand length	diameter (inches)	hand length	diameter (inches)
small	1.24 - 1.31	small	1.35 - 1.44
medium	1.31 - 1.40	medium	1.44 - 1.52
large	1.40 - 1.47	large	1.52 - 1.59

Optimal Grip Sizes



Maximum comfort for high torque task

(female)

(male)

hand length	diameter (inches)	hand length	diameter (inches)
small	1.47 - 1.56	small	1.61 - 1.70
medium	1.56 - 1.65	medium	1.70 - 1.80
large	1.65 - 1.74	large	1.80 - 1.88

Adoption and Diffusion of Safety Improved Nail Guns

Steve Hudock
Jim Albers
Brian Lowe



Pneumatic nail guns - safety problem

- 22,000 U.S. workers treated annually in ER for pneumatic nail gun (PNG) injuries between 2001-2005 (MMWR, 2007)
- Consumer (non-occupational) injuries averaged 14,800
- High injury rates in residential carpentry (70% in wood framing)
- 66% of injuries - arm/hand/fingers; 24% - lower extremity
- \$338 million annually in medical/compensation costs

Pneumatic Nail Guns - Traumatic Injury Risk Factors



Holding short pieces in place with hand close to nailing point

Nailing from unstable standing surfaces

Nailing in awkward positions with face near nail application

Major contributing factor – trigger

Contact Actuation Trigger (CAT) – *bump fire, bounce fire, bottom fire, automatic*

Sequential Actuation Trigger (SAT) – *restrictive, single shot, two-stage*



- Use of the CAT trigger significantly increases the risk (RR=2.0) of traumatic injury (Lipscomb et al., 2006).
- 67% of CAT injuries were avoidable

Project Motivation

Traumatic injury risk reduced by sequential trigger, but concerns about productivity and cumulative trauma disorders

- Field observations
- Focus groups with carpenters and crew supervisors
- Study of nailing productivity and ergonomics
 - Replicate activities representative of stud fastening (wall building) and decking flatwork (subflooring application)
 - Compare sequential actuation and contact actuation triggers

Ergonomics and Reproductive Health

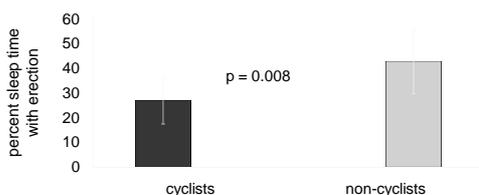
Health Effects Associated with Occupational Cycling (ended 2009)

Steve Schrader
Brian Lowe

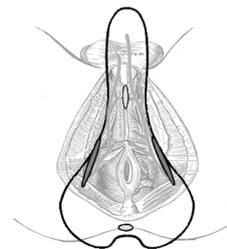


NIOSH Health Hazard Evaluation (2000)

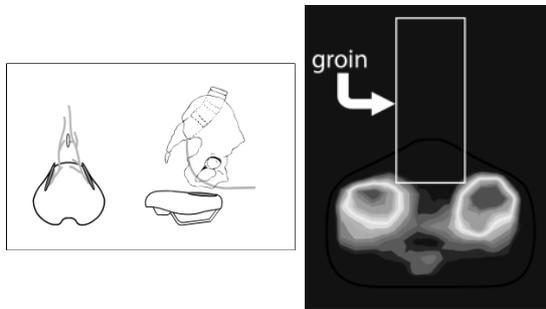
- 90% of police cyclists experienced numbness to buttocks, scrotum, testicles, or penis
- Pressures on saddle nose exceeding 180 mm Hg
- RigiScan assessment for nocturnal erectile events:



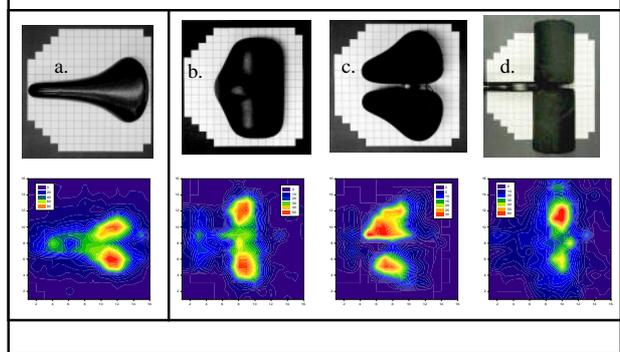
Injury Mechanism – Compression of Nerves/Restriction of Blood Flow



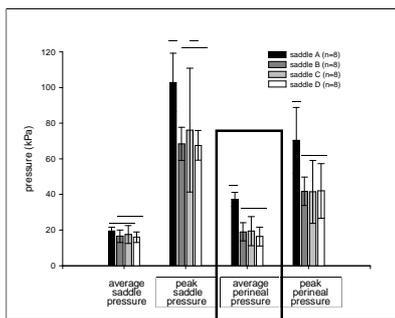
Solution - Removal of Protruding Nose ("No-nose" saddle)



Saddles Tested



Saddle Pressure Results



Results – 6 month study of no-nose saddles

- Reduction in groin pressure by >60%
- Improvement in International Index of Erectile Function Questionnaire (IIEF) score (p=0.015)



Research Translation

See www.cdc.gov/niosh/topics/bike for multi-media content

WORKPLACE SOLUTIONS
From the National Institute for Occupational Safety and Health

No-nose Saddles for Preventing Genital Numbness and Sexual Dysfunction from Occupational Cycling

Summary
Workers who ride a bicycle as part of their job may be at risk for genital numbness or more serious sexual and/or reproductive...

under the pelvic sit bones. However, part of the weight is supported where the groin contacts the saddle nose. Bearing weight on this region of the saddle compresses the nerves and arteries in the groin (see Figures 1 and 2). These arteries and veins...

Other DART Projects in MSDs/Ergonomics

Title	
Forklift Operators MSD	Tom Waters
Translate MSD Intervention Research for Residential Construction	Jim Albers
Long Term Study of Ergonomic Computer Input Device Effectiveness	Naomi Swanson
Translating NIOSH Rest Break Research Into Practice	Jessica Streit
Adapt and Validate Spanish Ergo Job Exposure Tools	Kellie Pierson
Updating "Elements of Ergonomics Programs"	Chris Gjessing

Partnerships

- Always seeking partnership opportunities
- NORA Strategic Goals as Guide
 - Industry Sector-Specific Goals:
<http://www.cdc.gov/niosh/nora/comment/agendas/>
 - Musculoskeletal Disorders Cross-Sector Program Goals:
<http://www.cdc.gov/niosh/programs/msd/goals.html>

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