
QP3
ergosystems
Quality • Productivity • Performance • Profitability

Job Rotation:

Are We Doing the Right Thing?

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2024 Assembly Show

Rosemont, IL

QP3 ergosystems

Quality • Productivity • Performance • Profitability

Fun Facts!

Agenda

What's going on with ergonomics

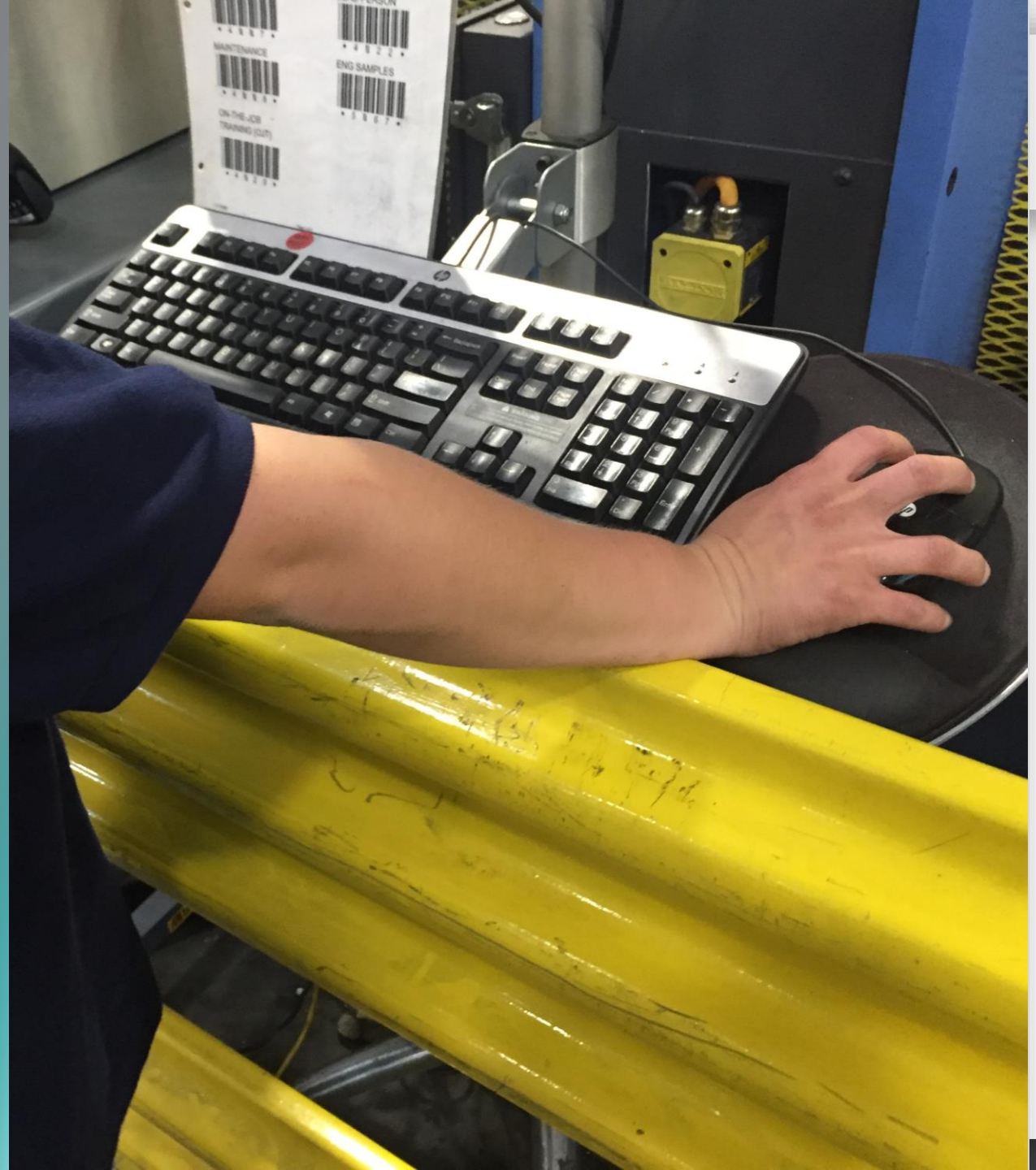
Traditional job rotation & fatigue failure

Prevention through design

QP3 ergosystems
Quality • Productivity • Performance • Profitability

Ergonomics

"Designing things for safe, efficient, and comfortable human use



Risk Factors

- Awkward postures
- Force exertion
- Extreme temperatures
- Glove use
- Vibration (hands/body)
- Repetition
- Extended duration of exposure
- Contact stress

Soft Tissue Days Away Claims

40% frequency

40% severity

Financial Impact

Average case $25,000

Deductibles $250,000+

Profit margin?

- **How many more sales are required?**
- **Production Impact?**
  - Overtime

Opioid Epidemic

- **MSDs are a key contributor**
- **Women disproportionately affected**
- **Policies matter (public healthcare & insurance)**
- **Construction/Farming/Manufacturing/Nonprofits**
- **Job design is key**
- **Address pain & inflammation within 6 weeks**
- **Narcan helps but . . . .**
- *(My other talk)*

Issues with MSDs

MSD Accelerators		
Gender	Obesity	Fatigue/lack of sleep

Injury => Inflammation => Fibrosis (connective tissue scars) => Excessive Deposits (cartilage)

US Ergo Requirements

Federal OSHA

- General duty clause—must address hazards

Minnesota (Jan 1, 2024)

- Healthcare facilities (hospitals, outpatient, nursing homes)
- Warehouse distribution center (more than 100 employees)
- Meatpacking/poultry processing site (more than 100 employees)

California

- IIPP--conduct claims-related assessments
- Ergonomics Program Standard-general industry
- Seating Standard
- Hotel Housekeeper MIPP Standard-annual requirements

Maine

- VDT training

Many States

- Patient handling requirements

New Hampshire

- "Shall evaluate all incidences of ergonomically related injuries"

Washington (Jan 1, 2024)

- Authorized to issue standards

Select International Requirements

Brazil

- Assess EACH workstation
- Gender & age specific MMH requirements

Mexico—all companies

- Must assess EACH workstation
- Ergonomics risk factors
- Material handling requirement

UK

- Comprehensive Standards & Requirements
  - Display screens
  - Material handling

EU

- Hazard Assessments of jobs
  - Ergonomics
  - Safety/Machine Guarding
  - IH

Traditional Job Rotation

Moving employees between jobs to reduce physical stresses on people in “high stress” jobs

Challenges with Job Rotation

Need to use different parts of the body

Need to rotate frequently enough

- Visual tasks
- High intensity tasks

Fatigue Failure

Tacoma Narrows Disaster

Fatigue Failure

Science Direct:

“A failure that occurs below the stress limit of a material when it has been exposed to repeated loadings”

Shoulders, Upper Extremities, Lifting

Unintended Consequences of Rotation

Rotating through a “high risk” job increases the risk for employees coming from “lower risk” jobs.

The entire rotation cycle must be assessed

Why? Fatigue Failure is at play

Damage per cycle is exponential, not linear

High Risk Job 60%

Low Risk Job 1 40%

Low Risk Job 2 20%

AFTER ROTATION (ex)

HRJ 50%

LRJ1 50%

LRJ2 50%

High Risk Job—Fatigue Failure Model

The Shoulder Tool 0.1.2 Home Instructions LiFFT DUET

The Shoulder Tool

Unit: English | Metric

Task #	Type of Task	Lever Arm (inch)	Load (lb)	Moment (ft.lb)	Repetitions (per work day)	Damage (cumulative)	% Total (damage)
1	Horizontal Push or Pull	45	11	41.2	750	8.89300	100.0
2	Handling Loads			0.0		0.0	0.0
3	Handling Loads			0.0		0.0	0.0
4	Handling Loads			0.0		0.0	0.0
5	Handling Loads			0.0		0.0	0.0
6	Handling Loads			0.0		0.0	0.0
7	Handling Loads			0.0		0.0	0.0
8	Handling Loads			0.0		0.0	0.0
9	Handling Loads			0.0		0.0	0.0
10	Handling Loads			0.0		0.0	0.0
					Total Cumulative Damage:	8.89300	
					Probability of Shoulder Outcome (%):	85.1	

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Bani Hani, D., Huangfu, R., Sesek, R., Schall Jr, M. C., Davis, G. A., & Gallagher, S. (2020). Development and validation of a cumulative exposure shoulder risk assessment tool based on fatigue failure theory. *Ergonomics*, 1-16.

Low Risk Job—Fatigue Failure

The Shoulder Tool 0.1.2 Home Instructions LiFFT DUET

The Shoulder Tool

Unit: English | Metric

Task #	Type of Task	Lever Arm (inch)	Load (lb)	Moment (ft.lb)	Repetitions (per work day)	Damage (cumulative)	% Total (damage)
1	Horizontal Push or Pull	20	11	18.3	375	0.00841	100.0
2	Handling Loads			0.0		0.0	0.0
3	Handling Loads			0.0		0.0	0.0
4	Handling Loads			0.0		0.0	0.0
5	Handling Loads			0.0		0.0	0.0
6	Handling Loads			0.0		0.0	0.0
7	Handling Loads			0.0		0.0	0.0
8	Handling Loads			0.0		0.0	0.0
9	Handling Loads			0.0		0.0	0.0
10	Handling Loads			0.0		0.0	0.0
					Total Cumulative Damage:	**0.00841**	
					Probability of Shoulder Outcome (%):	**25.7**	

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Bani Hani, D., Huangfu, R., Sesek, R., Schall Jr, M. C., Davis, G. A., & Gallagher, S. (2020). Development and validation of a cumulative exposure shoulder risk assessment tool based on fatigue failure theory. *Ergonomics*, 1-16.

Rotate Between the Two?

The Shoulder Tool 0.1.2 Home Instructions LiFFT DUET

The Shoulder Tool

Unit: English | Metric

Task #	Type of Task	Lever Arm (inch)	Load (lb)	Moment (ft.lb)	Repetitions (per work day)	Damage (cumulative)	% Total (damage)
1	Horizontal Push or Pull	20	11	18.3	187	0.00420	0.1
2	Horizontal Push or Pull	44	11	40.3	375	3.46018	99.9
3	Handling Loads			0.0		0.0	0.0
4	Handling Loads			0.0		0.0	0.0
5	Handling Loads			0.0		0.0	0.0
6	Handling Loads			0.0		0.0	0.0
7	Handling Loads			0.0		0.0	0.0
8	Handling Loads			0.0		0.0	0.0
9	Handling Loads			0.0		0.0	0.0
10	Handling Loads			0.0		0.0	0.0
					Total Cumulative Damage:	3.46438	
					Probability of Shoulder Outcome (%):	79.7	

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Bani Hani, D., Huangfu, R., Sesek, R., Schall Jr, M. C., Davis, G. A., & Gallagher, S. (2020).
Development and validation of a cumulative exposure shoulder risk assessment tool based on fatigue failure theory.
Ergonomics, 1-16.

Difficult to Do
1000 times/shift

Another Look

DUET 1.3.1 Home Instructions LiFFT The Shoulder Tool

The Distal Upper Extremity Tool

Task #	OMNI-RES Scale	Repetitions (per work day)	Damage (cumulative)	% Total (damage)
1	8: Hard	1000	1.05374	100.0
2	Please select ...		0.0	0.0
3	Please select ...		0.0	0.0
4	Please select ...		0.0	0.0
5	Please select ...		0.0	0.0
6	Please select ...		0.0	0.0
7	Please select ...		0.0	0.0
8	Please select ...		0.0	0.0
9	Please select ...		0.0	0.0
10	Please select ...		0.0	0.0
		Total Cumulative Damage:	1.05374	
		Probability of Distal Upper Extremity Outcome (%):	64.3	

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The Distal Upper Extremity Tool

Task #	OMNI-RES Scale	Repetitions (per work day)	Damage (cumulative)	% Total (damage)
1	4: Somewhat Easy	1000	0.01262	100.0
2	Please select ...		0.0	0.0
3	Please select ...		0.0	0.0
4	Please select ...		0.0	0.0
5	Please select ...		0.0	0.0
6	Please select ...		0.0	0.0
7	Please select ...		0.0	0.0
8	Please select ...		0.0	0.0
9	Please select ...		0.0	0.0
10	Please select ...		0.0	0.0
		Total Cumulative Damage:	0.01262	
		Probability of Distal Upper Extremity Outcome (%):	30.0	

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Rotating from A to B

DUET 1.3.1 | Home | Instructions | LiFFT | The Shoulder Tool

		(per work day)	(cumulative)	(damage)
1	4: Somewhat Easy	500	0.00631	1.2
2	8: Hard	500	0.52687	98.8
3	Please select ...		0.0	0.0
4	Please select ...		0.0	0.0
5	Please select ...		0.0	0.0
6	Please select ...		0.0	0.0
7	Please select ...		0.0	0.0
8	Please select ...		0.0	0.0
9	Please select ...		0.0	0.0
10	Please select ...		0.0	0.0
		Total Cumulative Damage:	0.53318	
		Probability of Distal Upper Extremity Outcome (%):	59.1	

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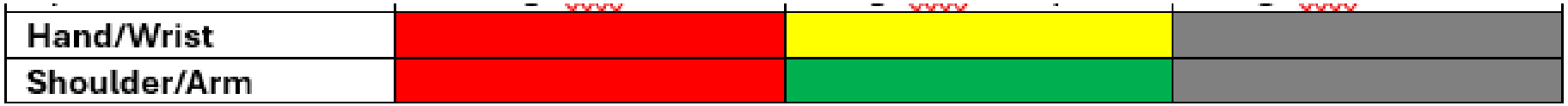
Please cite this paper to support the authors:

Gallagher, S., Schall Jr, M. C., Sesek, R. F., & Huangfu, R. (2018).
An Upper Extremity Risk Assessment Tool Based on Material Fatigue Failure Theory: The Distal Upper Extremity Tool (DUET).
Human factors, 60(8), 1146-1162.


Hand/Wrist
Shoulder/Arm


Hand/Wrist
Shoulder/Arm


Hand/Wrist
Shoulder/Arm


Hand/Wrist
Shoulder/Arm

So Now What?!

Get "Professional" Ergonomics Help

- Onsite Assessments & Recommendations*
  - Detailed analysis
  - Risk to parts of the body
- Awareness Training/Coaching*
- Engineer/Team Training*
- Prevention through Design (PtD) Help*

- *From Credentialed Ergonomists

What Does (PtD) Do?

Skips "administrative" controls

Focuses on design & development phase

How Does PtD Work?

Looks long-term

- Reduces variability
- Process control

Increases successful outcomes

How Do We Do PtD?

Training of engineers designing/spec'ing out equipment & processes

Formal ergonomics assessments of projects

- Not just a "cursory" look
- Before equipment ordered
- Before construction

Training cross-functional teams

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Q & A

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(The “Ergo Tim!”)

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