Achieving A Healthy Balance in the Work System for Older Workers

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As Bodies Mull Retirement, 2 Aging Baseball Stars Play On. A Schwartz NYTimes 9/28/05
Williams & Piazza were perennial All-Stars, but somewhere along the line, there was a shift in power...joints and muscles stopped taking orders; soon the body did the instructing, setting ever-decreasing limits of what the players could do.....Neither feels old enough to retire.

"You are who you are. Embrace it. Maybe what I lack in pure motor response of what I had 10 years ago, I feel like I bring a lot of other different things.....I still feel like I can squeeze the lemon a little bit more." Piazza

Impact of population changes

- How will fundamental population changes in age and size affect the workplace-
  - Design of work- physical effort,
  - Workstations- Space and clearance,
  - Products
- What does it mean for new work systems (e.g., lean)?
- What do we need to know and what do we need to do to ensure healthy, safe, productive work environment?

Work System

Technology Organization

Environment Task

Individual

Results of Broken Connection

WMSDs/Acute Injury
Near misses
Turnover
Productivity
Quality
Turnover
Morale
Prevalence of Right Carpal Tunnel Syndrome [symptoms + NCV], (n=733)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Point Estimate</th>
<th>95% Wald Confidence Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age group &gt;40</td>
<td>2.9</td>
<td>1.5 5.4</td>
</tr>
<tr>
<td>BMI</td>
<td>1.1</td>
<td>1.0 1.1</td>
</tr>
<tr>
<td>High General Health</td>
<td>0.7</td>
<td>0.6 0.9</td>
</tr>
<tr>
<td>Hi Exertion duration &gt;6s</td>
<td>2.8</td>
<td>1.5 5.0</td>
</tr>
<tr>
<td>Hi Force push-pull</td>
<td>2.8</td>
<td>1.4 5.8</td>
</tr>
</tbody>
</table>

Point estimate is predictor of risk. If more than 1=increased risk, less than 1=decreased risk.

**WORK SYSTEM**

- Technology
- Organization
- Environment
- Task
- Individual

**System Changes-Individual: Potential Impacts on Physical Load & Response**

- **Older**: decreasing muscle force
- **Heavier**: more space
- Female
- Ethnically diverse
- Educationally diverse
- Experience
- Expectations

**Who is elderly how soon?**

**Fig 3a. Incidence of Compensable WMSDs in the Neck, Back & Upper Extremity Disorders by Age: Males**

**SF Compensable WMSDs 1995-2002. Mean Lost Work Days by Age & Industry: Males**
Workers with Chronic Conditions by Age (U.S.)

Age-specific Prevalence of MSDs among Females with Stable Exposure to Physical Work

Back Complaints by Age: 4-Year Follow-up (Workers Engaged in Heavy Physical Labor)

Work Capacity and Age
- Physical Capacity
- Mental Capacity
- Individual Capacities
- Chronic Conditions
- Performance/Experience

Exposure to Physical Stressors

Handling Heavy Loads (EU-2000)
(Carry or Move Heavy Loads ~1/2 Time)
Older adults decline in motor output

- **Strength:** Decline in maximum contraction force is largely a result of decrease in muscle mass.
- **Fine motor skills:**
  - Motor unit number decreases and size increases.
  - Motor control strategies change -> performance deteriorates (steadiness, output variability).
- **Fatigue:** More readily for some tasks (eccentric contractions) but not others.

Older Workers: Physical Capacity

- Maximal strength at 20-30 years
  - ~25% decrease by 60, Decrease greater in lower limbs.
- Maximum oxygen uptake 70% of maximum by 65 years.
- Explosive physical efforts most affected
  - Large muscle groups.
- Older adults work closer to capacity.
- General decrease in physical function:
  - Eye, hear, heat/cold intolerance, skin, bone, metabolic, immune changes.
- Increase in co-morbid conditions.

Workplace Exercise Programs

- Effects reduced from experimental situation.
  - Lab promise - workforce gets 20% improvement in aerobic power.
  - Workforce result - may be only 1%.
- Why reduced impact?
  - Attract only small fraction (e.g. 20%).
  - Drop-outs reasonably high (e.g. 50%).
  - Time for exercise shorter than lab design.
  - Best participants already functioning well.

Mental Capacity: Laboratory Findings

- Reaction time stable up to 60 yrs.
- Information retrieval slower unless information is familiar.
- Learning & recall rate slower but equally successful.
- Perceptual information
  - Slower processing under complex conditions or with confusing stimuli.
  - Problems allocating attention to task-relevant information.

Mental Capacity: Relevance to Working

- Lab tests don’t translate well to work.
- Factors other than psychometric cognitive abilities appear important (e.g., experience, confidence, motivation).
- Individual measures are quite sensitive to occupational class.

Trends in Mental/Psychological Function at Individual Level

- Decreased function
  - Perceived job stress.
  - Depression.
  - Sleep problems.
- Positive Developments
  - Psychological
    - Personality traits appear stable with age.
    - Self-confidence appears to increase.
  - Motivation.
  - Expertise and Experience.

Ekola 2005

Wegman 2005

Shephard RJ. - Ind Erg 2000
Impact of Age on Work Performance
(adapted from P. Warr, courtesy of D. Wegman)

<table>
<thead>
<tr>
<th>Age Related Task Type</th>
<th>Changes with Age</th>
<th>Experience Exceeded</th>
<th>Knowledge based judgment w/o time pressure</th>
<th>Job Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age Enhanced</td>
<td>No</td>
<td>Yes</td>
<td>Positive</td>
<td>Continuous paced data processing</td>
</tr>
<tr>
<td>Age Neutral</td>
<td>No</td>
<td>No</td>
<td>None</td>
<td>Actions relatively undemanding</td>
</tr>
<tr>
<td>Age Counteracts</td>
<td>Yes</td>
<td>Yes</td>
<td>None</td>
<td>Skilled manual work</td>
</tr>
<tr>
<td>Age Impaired</td>
<td>Yes</td>
<td>No</td>
<td>Negative</td>
<td>None</td>
</tr>
</tbody>
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Task Type and Aging-Related Injury Risks
(adapted from Laflamme & Menckel, courtesy of D Wegman)

<table>
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<tr>
<th>Age Related Task Type</th>
<th>Relationship w Age</th>
<th>Performance Injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age Enhanced</td>
<td>Positive</td>
<td>Negative</td>
</tr>
<tr>
<td>Age Neutral</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Age Counteracts</td>
<td>None</td>
<td>None or Inverted U</td>
</tr>
<tr>
<td>Age Impaired</td>
<td>Negative</td>
<td>Positive or U</td>
</tr>
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</table>

Evidence from Work Setting for Older Workers

Decreased performance in physically demanding, high intensity paced work

WORK SYSTEM

Technology → Organization

Environment → Individual → Task

Work Ability

- Work environment accommodations
  - Ergonomics & human factors engineering to eliminate hazards before they arise, modify work for those impaired
- Work organization accommodations
  - Flexible hours, job sharing, telecommuting
- Individual accommodations
  - E.g., eye glasses, fitness programs
- Social accommodations
  - Health services access, community support programs, public transportation, anti-discrimination laws, etc.

Organization: Task level effects on physical load: impact on older workers

- Dynamic physical requirements tend to decrease with increasing skill level, however, static low level may increase
- Increasing variability tends to decrease cumulative load
- Control over method and pace of work tends to decrease overload unless paid by piece

Variability and control help all workers
Organization: Work Group Job Content - Effects on physical load factors

- Flexible group work arrangements allows accommodation based on skill, experience, seniority, etc.
- Job Content Structural Constraints → Physical Load
  - Minor: worker determines (e.g., freelance artist)
  - Little: personal freedom to organize to meet general requirements (scientist, sales rep)
  - Average: work method occasionally restricted (teacher)
  - Strong: performs largely predetermined sequence of tasks
  - Very strong: sequence precisely determined (parts assembly)

Older workers do better with fewer structural constraints

Embed ergonomics considerations into lean process-get involved early!

- Inventory: Organization of flow and space
- Waiting: Don’t let recovery time be compromised in heavy or repetitive work
- Transport: Reduce MH by using moving, adjustable fixtures throughout process for heavy/awkward objects
- Processing: Preventive maintenance reduces high forces
- Inventory: flow systems can eliminate MH, awkward postures
- Motion: Micro pauses, task variability necessary for recovery if eliminate motions. If reduce walking and increase standing - static loading
- Defect: Rework usually requires more forceful, repetitive work

Healthier work life needs: Variability of motions, human interaction, involvement in decision-making, design

WORK SYSTEM

Technology → Organization → Environment → Individual → Task

Environment: Effects on Physical Load greater for older workers

- Cold: dexterity, fatigue, flexibility
- Heat: energy expenditure
- Illumination: posture, positioning, rework due to errors
- Noise: tension, miss alarm cues
- Whole Body Vibration: spinal loads
- Housekeeping: balance recovery, trips, awkward manual handling

WORK SYSTEM

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Specific Accommodation? - Improves quality for everyone

- Precision and Fine Motor Control

Hand tremors make setting screws difficult
Fixture with cone shaped guides
Specific Accommodations for Balance & Postural Stability - Improves safety for all

- Handrails
- Replace stairs with ramps
- Housekeeping
- Lighting
- Slip resistant materials
- Repairs and maintenance
- Color contrast
- Clearly marked, unobstructed walkways

Specific Accommodations for Temperature Regulation -

- Localize controls
- Localize sources
- Shields
- Space for additional clothing

Specific Accommodations for Vision

- Increase general lighting level
- Good task lighting
- Reduce glare
- Increase contrast for important objects
- Enhance color discrimination
- Increase font size

Specific Accommodations for Hearing

- Redundant signals
- Reduced speed of speech
- Eliminate speech compression
- Amplifying devices
- Decrease background noise

Specific Physical Load Accommodations: Improves work for all

- Use mechanical force (slides, suction, lifts, tool balancers, wheels)
- Reduce repetition
- Allow adequate recovery time
- Avoid static and awkward postures (don’t put boxes of paper on the floor)
- Job rotation and enlargement

Job Training and Retraining

- Older workers are further away from early education and job training
- Training approaches
  - Discovery (“hands on”) learning
  - Self pacing vs. forced pacing
    »Better for all ages
  - Physical fitness and posture training as well as skills and knowledge training

M Silverstein
Work-Life Balance Policies

- Flexibility in benefits
  - Child care to elder care
  - Disability
- Flexible work hours
  - Need to take care of self and family members
  - Job share
- Flexible work location
- Retirement counseling early

Achieving a Healthy Balance in the Work System

- Work is important but only one part of life
- Recognize demographic, cultural and organizational changes in work & society

Maintain links to balance work system

- Injuries (impaired performance, poor quality, etc) result when system is unbalanced
- Integrate ergonomics into the design and maintenance of new systems through a participatory approach

The play part is particularly important to balancing the life system!