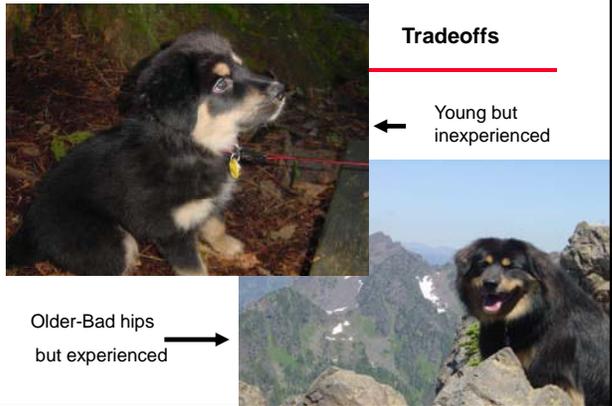


**Achieving A Healthy Balance in the Work System for Older Workers**

**Barbara Silverstein,**  
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**Tradeoffs**



← Young but inexperienced

Older-Bad hips but experienced →



**As Bodies Mull Retirement, 2 Aging Baseball Stars Play On.** *A Schwartz NYTimes 9/28/05*



Mike Piazza, 37



Bernie Williams, 37

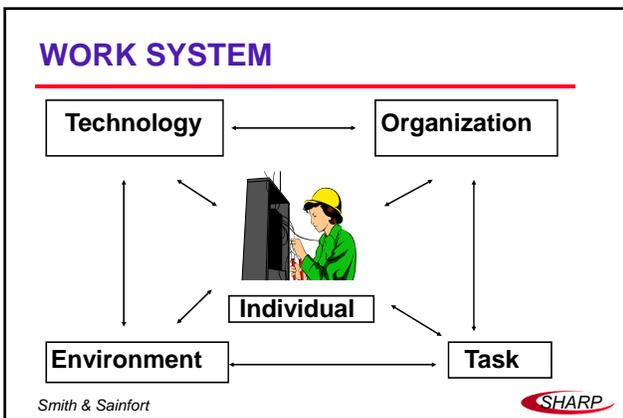
Williams & Piazza were perennial All-Stars, but somewhere along the line, there was a shift in power...joints and muscles stopped taking orders; soon the body did the instructing, setting ever-decreasing limits of what the players could do.....Neither feels old enough to retire.

"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?

**Results of Broken Connection**

- ↑ WMSDs/Acute Injury
- ↑ Near misses
- ↑ Turnover
- ↓ Productivity
- ↓ Quality
- ↓ Turnover
- ↓ Morale

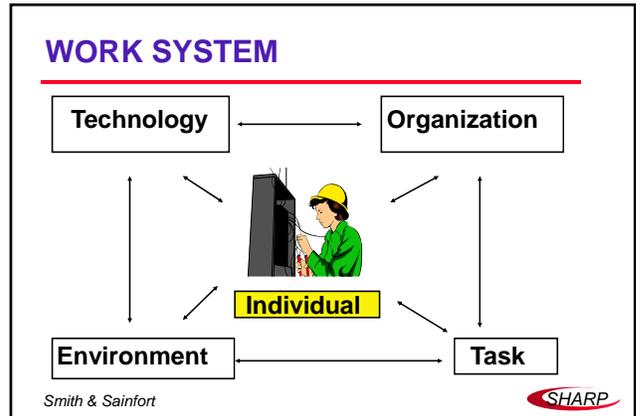



### Prevalence of Right Carpal Tunnel Syndrome [symptoms + NCV], (n=733)

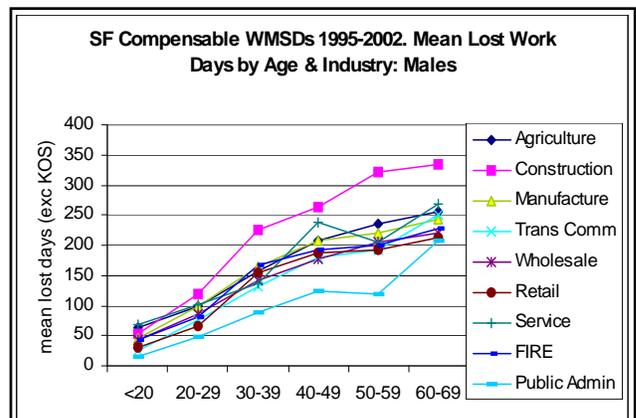
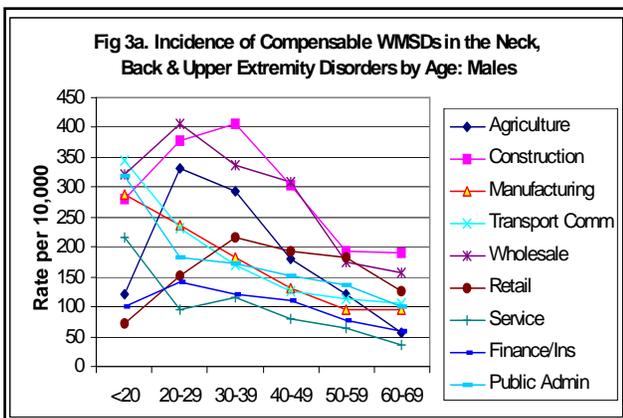
Variable	Point Estimate	95% Wald Confidence Limits	
Age group >40	2.9	1.5	5.4
BMI	1.1	1.0	1.1
High General Health	0.7	0.6	0.9
Hi Exertion duration >6s	2.8	1.5	5.0
Hi Force push-pull	2.8	1.4	5.8

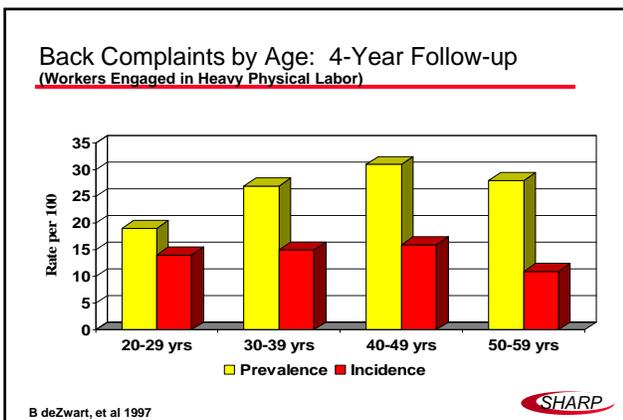
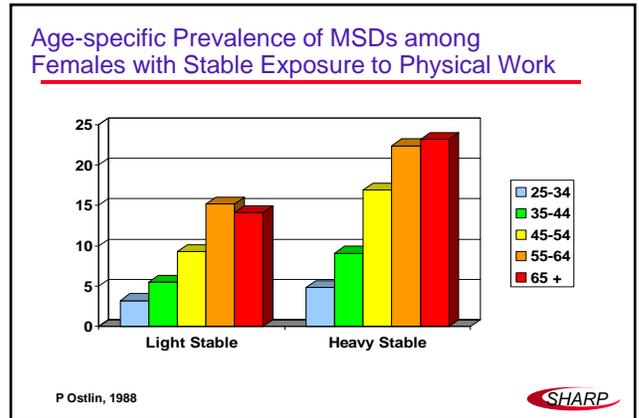
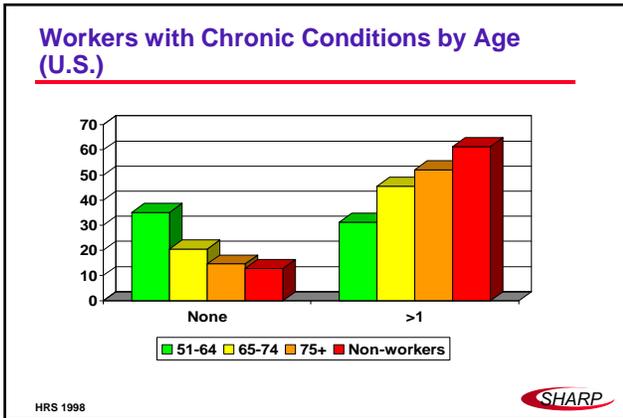
>44.3N  
Point estimate is predictor of risk. If more than 1=increased risk, less than 1=decreased risk

SHARP 2005



- ### System Changes-Individual: Potential Impacts on Physical Load & Response
- **Older:** decreasing muscle force
  - **Heavier:** more space
  - Female
  - Ethnically diverse
  - Educationally diverse
  - Experience
  - Expectations
- SHARP

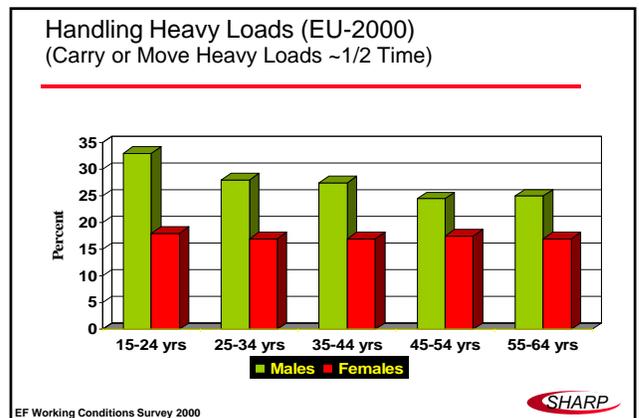
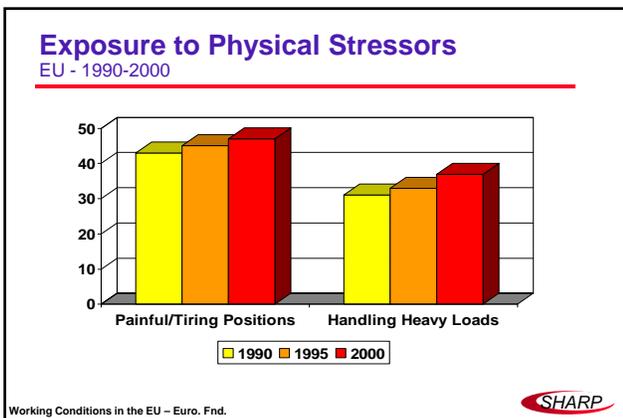




### Work Capacity and Age

- Physical Capacity
- Mental Capacity
- Individual Capacities
- Chronic Conditions
- Performance/ Experience

Are physical loads really decreasing in workplaces?



### 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 decrease and size increases
- Motor control strategies change ->performance deteriorates (steadiness, output variability)

Fatigue more readily for some tasks (eccentric contractions) but not others

Ekola 2005



### 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

Shephard R.J. - Ind Erg 2000



### 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

Wegman 2005



### 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

Wegman 2005



### 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

Wegman 2005



### Impact of Age on Work Performance

(adapted from P. Warr, courtesy of D. Wegman)

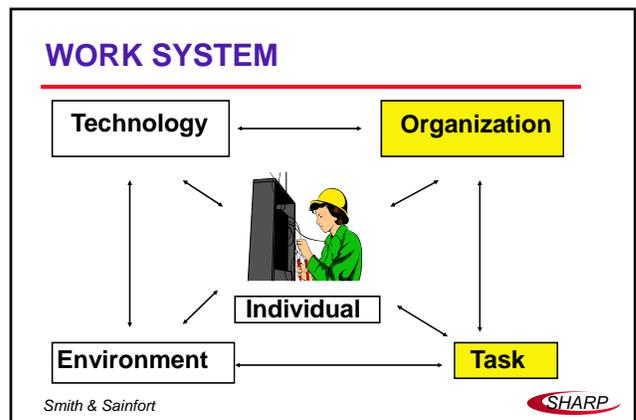
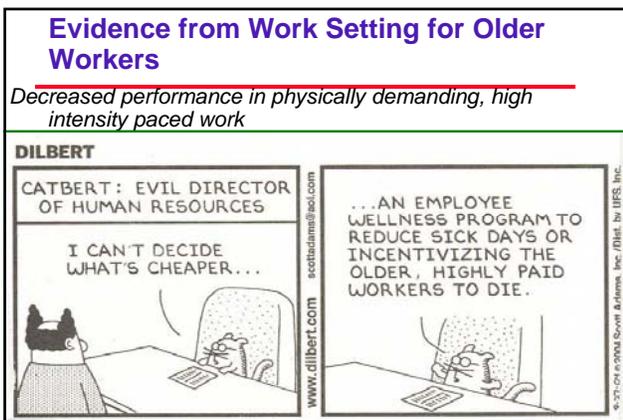
Age Related Task Type	Changes with Age		Relation-ship w Age	Job Content
	Capacities Exceeded	Experience Matters		
Age Enhanced	No	Yes	Positive	Knowledge based judgment w/o time pressure
Age Neutral	No	No	None	Actions relatively undemanding
Age Counteracts	Yes	Yes	None	Skilled manual work
Age Impaired	Yes	No	Negative	Continuous paced data processing



### Task Type and Aging-Related Injury Risks

(adapted from Laflamme & Menckel, courtesy of D. Wegman)

Age Related Task Type	Relationship w Age	
	Performance	Injuries
Age Enhanced	Positive	Negative
Age Neutral	None	None
Age Counteracts	None	None or Inverted U
Age Impaired	Negative	Positive or U

- ### 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.
- Ilmarinen
- 

- ### 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

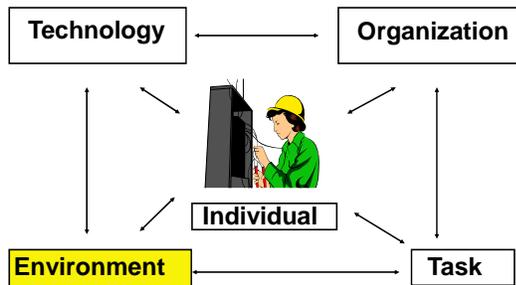
**Motion:** Micro-pauses, task variability necessary for recovery if eliminate motions. If reduce walking and increase standing - static loading

**Defect:** Rework usually requires more forceful, repetitive work

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



### WORK SYSTEM



Smith & Sainfort

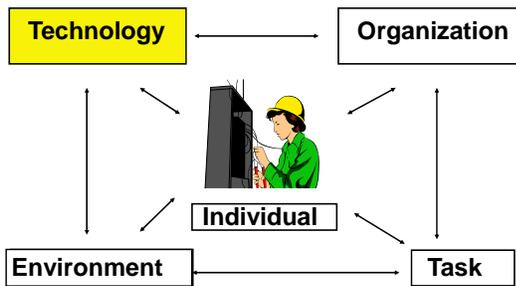


### Environment: Effects on Physical Load greater for older workers

- **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

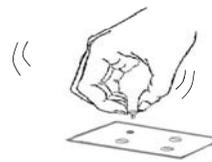


Smith & Sainfort



### Specific Accommodation?-Improves quality for everyone

- **Precision and Fine Motor Control**



Hand tremors make setting screws difficult



Fixture with cone shaped guides



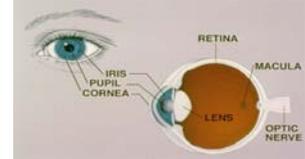
### Specific Accommodations for Balance & Postural Stability - Improves safety for all

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



### Specific Vision Accommodations

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



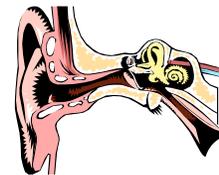
### Specific Accommodations for Temperature Regulation -

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



### Specific Accommodations for Hearing

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



M Silverstein



### 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

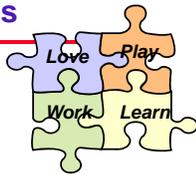
- Older workers are further away from early education and job training
- Training approaches
  - **Discovery** ("hands on") learning
  - **Self pacing** vs. forced pacing
    - » Better for all ages
  - **Physical fitness and posture training** as well as skills and knowledge training

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!

