

Intervention Studies to Reduce Musculoskeletal Disorders at Work

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Which way is the tide going?
Disability Island



2003 STAR Symposium
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Two views of the world



Cure Disease



Why did my patient get this disease?

Find causes of disease



Why does this population have so much disease?

Epidemiology

Clinical trials



Medical thinking largely concerned with responding to the needs of sick individuals

Population studies



Public health thinking focuses on the distribution of health and disease in populations to identify factors/behaviors that can improve health for the population

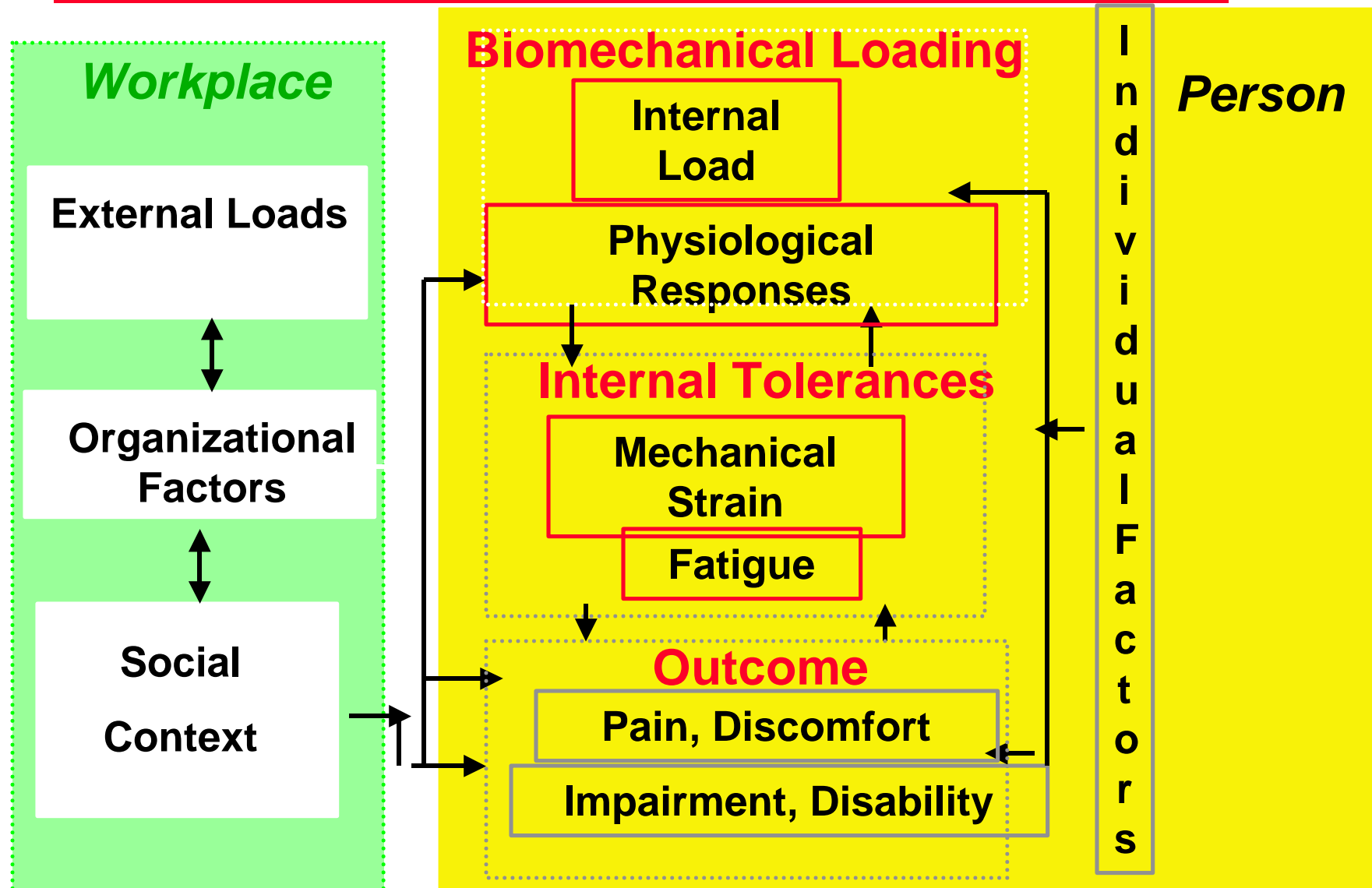
Comparisons are critical

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Conceptual Model of Contributors to Musculoskeletal Disorders (NAS, 2001)



Types of Intervention Studies

Randomized Controlled Trials (RCTs)

Controlled trials or quasi-experimental with comparison group

Prospective pre-post without comparison group:

Case Studies

Laboratory studies

Outcomes of interest

Health: *musculoskeletal discomfort, symptoms, disorders, health care utilization, claims, lost time, surgery, RTW, psychosocial health*

Work: *exposure reduction, productivity, quality, satisfaction, cost, turnover*

Life: *fatigue, social interactions*

Basic Issues in Epidemiological Studies including Intervention Studies

***Is the study population representative of
the population you want to generalize to?***

Comparison

Selection bias

Measurement bias

***Confounding (other factor associated with
disease & exposure)***

Power to detect a significant difference

Appropriate statistical analysis



Things to think about in looking at studies (a)

- If association is weak, usually won't be able to detect it in epi studies
- Effect of Misclassification of exposure, disease, or important confounders
 - Random variation vs Systematic
- Bias
 - Selection
 - Observation
 - Confounding

Things to think about in looking at studies

(b)

- **Comparability among groups:**
 - methods used in data collection, analysis & interpretation the same?
 - Errors that might have been committed
 - Magnitude of the effect caused by any error
- **Collection of data**
 - Why was study done, prior hypotheses?
 - Type of study?
 - Size of population adequate?
 - Bias in subject selection?, how affect data?
 - Bias in collection of info? How affect data? **Reporting bias with self-reports: injured vs not injured?**

Things to think about in looking at studies

(c)

- **Analysis of data**
 - How control for confounding
 - Methods to measure association
 - How stable is the estimate of association
 - Is there internal consistency among data presented
- **Interpretation of Data**
 - What are the major results?
 - How could bias affect the results?
 - How does random misclassification affect results?
 - To whom can the results be generalized?
 - Is the interpretation of the data conservative?

Methods for Systematic Search (a)

Electronic database search: PubMed, OSH-ROM 1, EMBASE, Ergo Abstracts On-line, Social Science Index

Key words: ergonomic* intervention* prevention* AND musculoskeletal*, back pain, work-related upper extremity disorders, carpal tunnel, neck pain, shoulder pain, RSI

Randomized controlled trial, work organization AND ergonomics

Note: prevention and intervention are key words in lots of papers not addressing either

Methods for Systematic Search (b)

Abstract review:

- Review articles of MSDs 1990-2003
- Randomized controlled trials of musculoskeletal discomfort, pain, disorder, lost time injury between 1999-2003
- Quasi-experimental studies with control group with outcome as above, 1999-2003
- **Excluded:** laboratory studies, non-health outcome studies, prospective studies without control group, case studies, studies not in peer-reviewed journals in the interests of brevity.

Results

- 15 systematic reviews between 1990-2003
- 19 randomized controlled trials between 1999-2003
- 17 quasi-experimental studies with comparison group
- 36 pre-post studies without comparison group between 1999-2003 (*excluded from further consideration for brevity, not quality issues*)

Example of exclusion effect: Spiegel et al 2002. Ceiling lifts –return on investment within 3 years due to injury reduction...but no comparison facility

Systematic Reviews of Randomized Controlled Trials (n=15)

9 had some primary prevention interventions included in the reviews

Most extensive reviews including primary prevention were by Westgaard & Winkel (1997) and Karsh et al (2001):

Included case studies and conference proceedings

Summary of primary prevention reviews

(a)

Karsh : “some positive results”

Back belts (8) 50%

Training + exercise (8)
67%

Tools/tech (10) 90%

Exercise (14) 86%

Job design (1) ¼

Multiple(47) 97%

W & W

Workstation design: 8+ 1-

Repetition: 3+

Program: 7+

Rationalization: 3+ 4-

Organizational culture:
19+, 5 +/-, 1-

PT: 2+ 1-

Health education: 5 –

Exercise :13+, 1 +/-, 2 –

Work technique: 3+ 1+/-

Multiple: 8+, 1 +/-

Summary of primary prevention reviews

(b)

Lincoln: CTS/UEMSD

Engineering only (12)-
primarily lab studies
without measure of
CTS

Personal (4)

Splints increase risk

Biofeedback: -

Exercise –

Multiple(8) engineering &
training 7+ short
term results, 1 +/-

Linton 2001 neck/back RCTs

Lumbar support: strong
evidence of no effect

Back schools & education:
strong evidence of no
effect

Exercises: strong evidence of
effectiveness

Ergonomics: no RCTs so no
good evidence

Risk factor modification: no
RCTs so no good
evidence

Summary of secondary (nonsurgical) prevention reviews

Return to work after LBP via RCTs:

- Small effect of **training/ exercise** in short term (Lagerstrom, Gebhardt, Elders, Maier-Reihle, Martocchio, Scheer).
- Negative for **CBT** alone (Scheer).
- Positive effect of **ergo job mods** in combination with rehab (Staal)

Clinical improvement in CTS via RCTs:

- **brace and ergo keyboards** =/-
- limited evidence for **ultrasound, oral steroids, tendon gliding exercises, yoga** for short term relief (O'Connor)

RCTs in health care workers, 1999-2003

- Exercise & training reduced LBP intensity and medication in short term (Alexandre)
- CBT reduced ,medication but not pain intensity of LBP (Dahl)
- No difference in LBP between stress management, exercise and controls in home health workers (Horneij)
- No difference in LBP development with abdominal muscle strengthening (Helewa)
- No difference in LBP claims rates but lower percent back injuries with modern lifting equipment in hospital (Yassi)

RCTs in computer workers, 1999-2003

- Participatory training and workstation modification significantly reduced symptoms and disorders in younger workers (Brisson)
- Intensive ergo training and participation reduced symptoms in the short term, but not long term (contamination) (Ketola)
- No significant difference in symptoms with simple workstation changes after 3 months (Mekhora)
- No difference in symptoms with software stimulated breaks and microbreaks (van den Hout)
- No difference in symptoms in electronic workers with biofeedback or CBT.

RCT 3+ mo lost time back injury- 6 year follow-up, Loisel, 2002

1) Usual rehab, 2) occupational (ergo job mod), 3) clinical, 4) Sherbrooke=2+3

Sherbrooke

- returned to work faster, mostly due to job mods
- Initially cost more but saved more at 6 years than other models, especially normal care

Occupational

- cost less than clinical at one year but was similar at 6 years.

Usual care had 4 expensive cases and occupational had one.

RCT: Active Case Management & Ergonomics in RTW for MSDs, Arnetz, 2003^(a)

Swedish law: by 4 weeks of sick leave, employer must do rehab investigation-> insurance agency (FK) by 8 weeks

Intervention: by 1 week; visit FK case manager & OT/Ergonomist. 1 week later: worker, case manager & ergonomist visit workplace: assess ergonomics (physical & psychosocial stressors): introduced ergo improvements if necessary

Referents & Intervention group similar on all key variables

RCT: Active Case Management & Ergonomics in RTW for MSDs, Arnetz, 2003^(b)

<i>Variable</i>	<i>Intervention</i>	<i>Referent</i>	<i>p</i>
<i>Sickdays 0-6mo</i>	110 (6.5)	131 (5.9)	<0.05
<i>Sickdays 6-12mo</i>	96 (13.1)	150 (8.8)	<0.01
<i>Sickdays 0-12mo</i>	145 (11.8)	198 (14.0)	<0.01
<hr/>			
<i>Ins reimburse \$</i>	9,600 (754)	12,196 (970)	
<i>Total cost \$</i>	623,500	878,200	
<i>Per person interv\$</i>	1,410	B:C 6.8	

RTW at 6 mo: OR 1.9, p=0.06, at 12 mo OR 2.5, p<0.01)



Workplace RCT in aluminum workers, Morken et al 2002 (a)

Large sample size (thousands)

Intervention: training in participatory ergonomics approach, coping, psychosocial factors- 3 intervention groups: supervisors only, workers only, workers and supervisors. 2 control groups

94% had symptoms 12 months prior to baseline

Changes: redesign, aids and tools, reduced repetitive motion, increased job variety

Results: psychosocial parameters: no change
coping skills increased for workers group only
no significant reductions in symptoms in any intervention group.

What happened???

Workplace RCT in aluminum workers, Morken et al 2002 (b)

Behind the scenes: *What happened???*

Contamination between control group A and intervention groups

Follow-up survey: completed almost immediately after interventions

Restructuring of the 8 plants took place while the interventions were being implemented, perhaps overwhelming modest job improvements

Important to document planned and unplanned changes



17 quasi-experimental studies 1999-2003

(a) All primary prevention interventions

Computer users: combination of providing forearm support, improved lighting and optometric corrections: reduced musculoskeletal symptoms 6 years later (Aaras) Improved workstation parameters alone gave mixed results (Demure)

Health care workers: significant improvement in WC rates for cleaners, orderlies where manual handling risks reduced (Carrivick, Evanoff).

Ergo training alone not effective (Fanello)

Reduced hours of work for elder care workers in 3 cities reduced neck-shoulder pain but not LBP in intervention but not control groups. Improved job satisfaction and social life, higher labor costs (Wergeland)

17 quasi-experimental studies 1999-2003

(b)

Participatory ergonomics intervention for nursing staff (Smedley 2003): patient handling polices, lots new equipment, link nurses to take ownership

Results: no change in LBP prevalence at follow-up.
Psychosocial factors improved at both hospitals.
Reduced manual handling at both hospitals

What happened???

HSE inspection at control hospital-> increased equipment and policies

High turnover made analysis two cross-sectional rather than prospective.

Nursing assistants inadvertently removed from follow-up survey at control hospital [at higher risk]



Quasi-experimental studies c

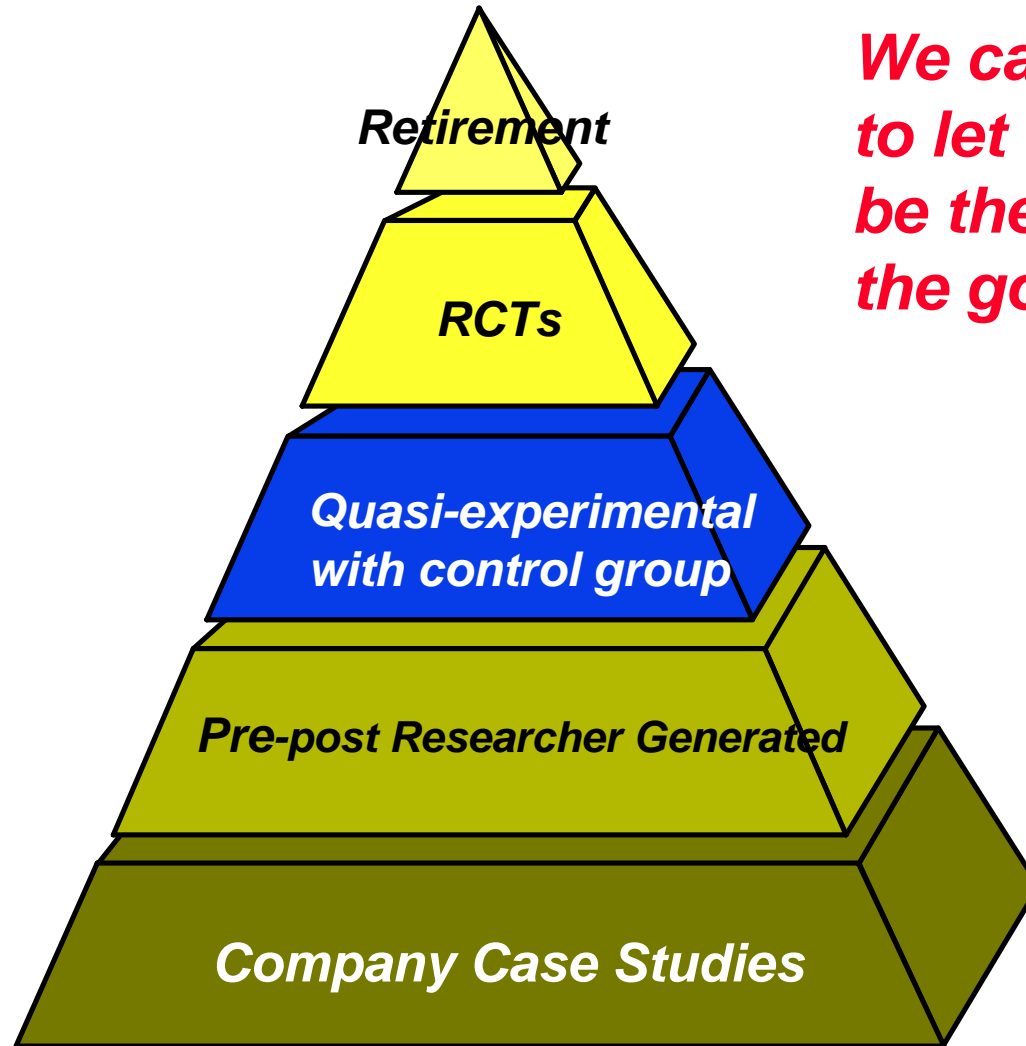
Manual handling jobs

- Back belts to do not reduce back injury claims or symptoms (Wassell)
- Documented reduction in loads on the back is associated with lower OSHA recordable LBDs. [10% of subjects were analyzed pre and post intervention]. The more effective controls included lift tables and lift aids (Marras,2000).

Conclusions: Absence of evidence \neq evidence of absence

- Much progress has been made in strengthening intervention study designs, more needs to be done
- All designs are plagued with the possibility of being overwhelmed by external factors
- Primary prevention interventions that address multiple components continue to be the most promising but it remains difficult to assess individual components with a “shotgun” approach.
- Individual tool/technology intervention studies are hampered by small samples and short durations
- Put back belts and back schools to bed
- Use a hierarchical approach for workplace intervention studies

Hierarchical approach to intervention studies (Zwerling et al, 1997)



We cannot afford to let the “perfect” be the enemy of the good

Science & Public Health

"All scientific work is incomplete...All scientific work is liable to be upset or modified by advancing knowledge. That does not confer upon us a freedom to ignore the knowledge we already have, or to postpone the action that it appears to command at a given time."

Hill, AB.

Proc Royal Soc Med. 1965

