

Individual Factors and Musculoskeletal Disorders

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Outline

- Approach
- What are individual factors?
- What do individual factors represent?
- Where do individual factors operate in the course of a MSK disorder?
- How can we estimate contribution?
- Summary of why to consider individual factors
- Directions



Approach

- Aim is to share a framework
- Framework builds on my background: primary care MD, occupational medicine & community medicine specialist, epidemiologist
- As multiple questions involved, citation of evidence is illustrative, citing other systematic reviews and individual studies, rather than pattern of evidence based



What are Individual Factors?

- Non-workplace when thinking of work-related MSK disorders (Appendix B in Bernard et al., 1997)
- Physiological and psychological characteristics versus biomechanical (NRC/IOM Panel on Musculoskeletal Disorders, 2001)
- One level in a nested hierarchy e.g., society, sector, workplace, group, individual, task, tissue, ...



What Do Individual Factors Represent? Work-Related (1)

- Job assignment e.g., gender-based allocation of job tasks (Messing et al. 1995; Mergler et al. 1987).
- Duration of exposure e.g., age as indicator of cumulative loading
- Anthropometric mismatches e.g., taller or shorter people in “average” unadjustable workstations (Botha & Bridger, 1998; Chung et al, 1997).



What Do Individual Factors Represent? Work-Related (2)

- Particular way of carrying out tasks e.g., lifting methods (McGill presentation), work style (Feuerstein, 1996), skill and training (Vezina et al., 2000)
- Differential responses to biomechanical loads e.g., muscle bulk/physical capacity (Oh & Radwin, 1998), motor stabilization patterns (McGill presentation)
- Differential response to biomechanical and psychosocial stressors e.g., gender and personality (MBTI) (Marras et al, 2002)



What Do Individual Factors Represent?

Concomitant external/internal exposures

- External:
 - Physical e.g., sports (except for athletes!), , hobbies, vibration while driving
 - Chemical e.g., smoking and low back pain (Leino-Arjas, 1999)
- Internal
 - Physiologic e.g., circulating hormone levels with pregnancy for carpal tunnel syndrome (Weimer et al, 2002)
 - Pathophysiologic e.g., diabetes for shoulder disorders (Balci et al, 1999).



What do Individual Factors Represent? Vulnerabilities (1)

- Physical
 - Injury e.g., prior MSK episode
 - Genetic variability e.g. familial contribution to arthritis (Hirsch et al, 1998) and CTS (Hakim et al, 2002)
- Psychological
 - Childhood experiences e.g., British birth cohort
 - Distress or depression (table 4.8 NRC/IOM report)

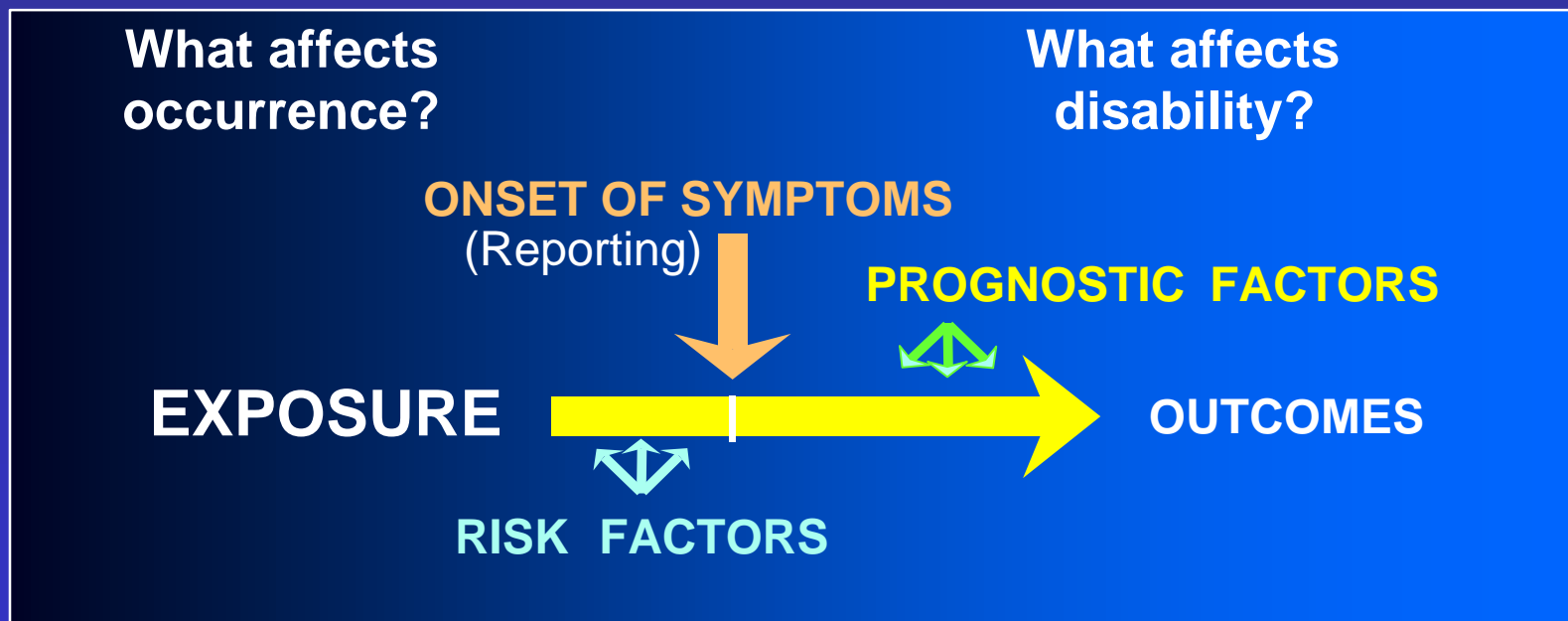


What do Individual Factors Represent? Vulnerabilities (2)

- Social
 - Marital status e.g., divorced/widowed (Clarke et al., 1999)
 - Racial discrimination e.g., blacks for pain and reduced diagnostic assessment (Carey & Garret 2003)
 - Complex socio-economic & health e.g., greater health-care and income support utilization prior to and subsequent to workers' compensation claim (Hertzman et al., 1998)



Where Do Individual Factors Operate in the Course of a MSK disorder?



Etiology

Prognosis

Burden

Intervention Effectiveness



Individual Factors in Etiology

- Main focus of Bernard et al., NIOSH and NRC/IOM Panel report
- Multiple other reviews which include individual factors e.g., age, personality, work technique for shoulder-neck complaints, Winkel & Westgaard (1992)
- Age and gender in Laura Punnet's presentation



Individual Factors in Prognosis

(1) Low back pain

- Multiple reviews e.g. Frank et al, (1996); Carey et al, (2003); van Tulder et al, (2002)
 - Condition related most important e.g., duration of symptoms, initial pain severity, radiation below knee
 - Individual response characteristics e.g., depression, expectations



Explained Variance* in Time on 100% Benefits for Workers' Compensation MSK claims

Worker expectations factors	Marginal effects (only this factor)	Partial effects (adds to model)
Progressing as expected	8.1%	3.0%
Anticipated change in condition	6.1%	1.2%
Expected time until return to usual activities	9.2%	3.4%
Expecting to return to usual job	2.5%	0.7%

* Explained variation for full model = 15.5%. Cole et al, (2002a)



Individual Factors in Prognosis

(2) Other disorders

- Upper limb disorders e.g.,
 - Duration of symptoms for non-specific disorders, Cole & Hudak (1996)
 - Location of pain for lateral elbow pain, Hudak et al., (1997)
 - Mental health status for CTS, Katz et al, (1997)
- Neck pain e.g.,
 - Age, gender, baseline pain intensity for whiplash, Cote et al, (2001)



Similarities and Differences

- Individual factors may make similar or different contributions, depending on where in the course of a disorder they are operating e.g. Cole et al, (2002b)
 - Two surveys of newspaper workers, one year apart
 - Modeling transitions in “case-ness”
 - Positive coefficients for better outcomes negative coefficients for worse outcomes



Individual Multivariate Predictors of Symptom Level Transitions

	Baseline	Symptom	Level
Predictors	Non-case	Mild	Severe
Female gender	1.69 (0.79-3.62)	1.49 (0.65-3.40)	0.90 (0.38-2.10)
Job tenure (per year)	1.04 (1.00-1.09)	1.02 (0.98-1.06)	0.92 (0.88-0.97)
Own workstation	1.20 (0.51-2.84)	1.73 (0.60-5.00)	1.70 (0.69-4.22)
Work social support (per point)	1.21 (0.94-1.55)	1.06 (0.84-1.33)	0.87 (0.71-1.07)



Individual Factors in Intervention Effectiveness

- Other than prior morbidity, less researched
- Some key examples:
 - Age. >40 less response to an office equipment and ergonomic training program (Brisson et al, 1999)
 - Height. Shorter assembly line workers experienced greater reductions in discomfort in legs and low back when flooring was modified. King PM, (2002)



How Can We Assess the Contribution of Individual Factors? (1)

- Not thought causal i.e. confounding
 - based on prior conceptualization e.g., Szabo dissent in NRC/IOM Panel report
- Independent cause:
 - controlling for covariates as per population attributable fraction among exposed as per NRC/IOM Panel report, chapters 3 &4
 - progressive proportion of variance explained e.g., Kerr et al (2001)



Relative Contribution of Different Risk Factor Domains to reporting LBP at work

Domain(s) in Model	-2LL X ² for covariates	Adjusted R ² (%)
Individual characteristics: BMI*, prior WC claim for LBP	7.92	4.7
Workplace psychosocial	19.89	11.5
Workplace psychophysical	20.39	11.8
Workplace biomechanical	32.47	18.3
Full model (all above domains)	85.93	43.2

* Body Mass Index Kerr et al., (2001)



How Can We Assess the Contribution of Individual Factors? (2)

- Effect modification
 - Using interaction terms e.g. Hogg-Johnson & Cole (2003) between workplace offers of special arrangements to help them return to work (workplace offers) and change in pain intensity between baseline and 4 weeks (20 points on 0-100 scale)
- Causal pathways & intermediate variables
 - Numerous examples in work stress literature but few in MSK disorders literature e.g., Evers et al, (2001)



Interaction in Prediction* of Time on 100% Benefits

Factor	β	Hazard Rate Ratio (95% CI)
Change in Pain Grade	0.012	1.27 (1.11,1.44)
Workplace Offers	0.645	1.91 (1.49,2.43)
Change in Pain Grade X Workplace Offers	-0.018	0.70 (0.58,0.85)

* Only selected factors from full model. Hogg-Johnson & Cole (2003)



Median days on benefits (95% CI) for combinations of key factors

C h a n g e i n P a i n G r a d e ^a	F u n c t i o n a l S t a t u s ^b	R e c o v e r y E x p e c t a t i o n s	W o r k p l a c e O f f e r s f o r R T W	
			Y e s	N o
im p r o v i n g	h i g h	s o o n	14 (7, 25) N = 57	14 (13, 19) N = 95
		n o t s o o n	26 (15, 35) N = 49	29 (23, 42) N = 93
	l o w	s o o n	30 (21, 49) N = 11	49 (27, 67) N = 28
		n o t s o o n	50 (31, 76) N = 39	93.5 (78, 131) N = 94
stable ^c	h i g h / l o w	s o o n / n o t s o o n	47.5 (36, 68) N = 88	84 (70, 102) N = 259
w o r s e n i n g ^c	h i g h / l o w	s o o n / n o t s o o n	32.5 (16, 113) N = 18	112.5 (86, 150) N = 76



So why should we take account of individual factors?

- To better understand mechanisms and contribution of different domains i.e., changing conceptions
- To protect the vulnerable i.e., better prevention and accommodation
- To match contexts, people and interventions, i.e., improve 1ry and 2ndy intervention effectiveness



Directions

- Conceptualize level and mechanism of individual factors
- Distinguish where in the course of the disorder the individual factor may operate
- Think web of causation (Krieger, 1994) versus single cause
- Think independent contribution, effect measure modification, and pathways versus confounding
- Incorporate our understanding in ethical ways into practice and policy



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