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Liberty Mutual Research Institute for Safety

Circumstances of Occupational Same-level Falls and Risk of Wrist, Ankle and Hip Fracture in Women Over 45 Years of Age

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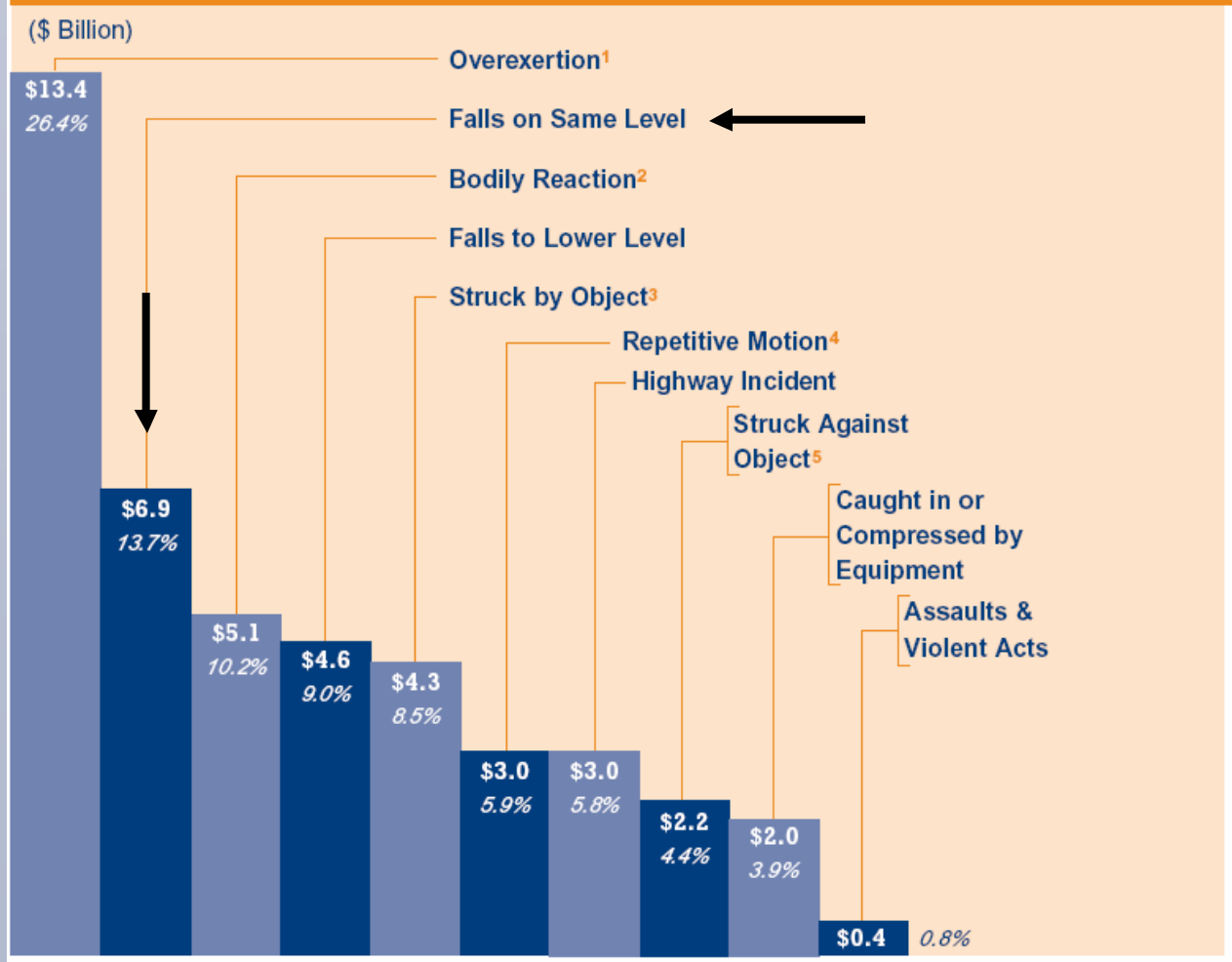
Burden of same-level falls in the workplace

The 2005 Liberty Mutual Workplace Safety Index Findings



The 10 leading causes of workplace injuries in 2003

FOOTNOTE KEY

[1] Overexertion Injuries caused from excessive lifting, pushing, pulling, holding, carrying, or throwing of an object.

[2] Bodily Reaction Injuries from bending, climbing, slipping or tripping without falling.

[3] Struck by Object Such as a tool falling on a worker from above.

[4] Repetitive Motion Injuries due to repeated stress or strain.

[5] Struck Against Object Such as a worker walking into a door.

Fall and Fracture

- 17% of workers with days away from work due to a fall on the same level sustained a fracture.

  (Bureau of Labor Statistics, 2005)

- Fractures are one of the most disabling injuries resulting from same-level falls.

  (Courtney and Webster, 2001)

Risk Factors for Fracture

- Personal or Intrinsic risk factors
  - Older Age
  - Female Gender
  - Osteoporosis
  - Physical Activity
  - Hormone Replacement Therapy
- Environmental or Extrinsic risk factors
  - Fall on hard surface (Keegan et al. 2004)
  - High-heeled shoes (Keegan et al. 2004)
  - Winter months (?) (Jacobsen et al. 1991,1999)
  - Manual material handling (?) (Suen 1998, Verma et al. 2007)

Hypothesis

- Falling during manual material handling, falls on ice, falling outdoors, and falls due to slipping are associated with risk of wrist, ankle and hip fracture.

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Study Design and Study Population

- Matched case-control study
- All workers' compensation claimants who filed a claim with a large US insurer for an injury resulting from falling on the same level between January 1, 2000-September 30, 2006.
- Female workers over 45 years of age
- N=122,289

Case and Control Selection

- Selected from the 122,289 eligible claimants, based on ICD-9 codes.

- Cases: At least 2 medical services with ICD-9 codes associated with hip fracture, wrist fracture or ankle fracture within 90 days and total amount paid > $200

  n (wrist) = 1578, n (ankle) = 1111,

  n (hip) = 373

- Eligible Controls: No medical service with ICD-9 code associated with fracture (800-829)

  n ***=113,388***

Matching

- Age (± 3 years)
- Jurisdiction State
- Standard Industry Classification Code (SIC) at the divisional level
- Season of the fall incident (Spring/Summer - April to September, Fall/Winter - October to March)
- 1:1 match for wrist fracture (n=1565)
- 2:1 match for ankle fracture (n=2191)
- 4:1 match for hip fracture (n=1360)

Exposure Assessment

- Injury event narratives

  Average number of characters = 69

  - "EE was carrying box to truck, slipped on ice in parking lot."
    - Manual Material Handling (carry, lift, lower, push, pull)
    - Fall Hazard (Ice/snow, wet surface, uneven surface…)
    - Initiating event (slip, trip)
    - Place of fall (outdoor, indoor)
- Two trained coders blinded to outcome extracted and classified exposure information.
- Inter-rater reliability tested on a sample

  Kappa =>.96

Analysis

- Multivariable conditional logistic regression
  - To examine the effect of each exposure while controlling for others.
  - To eliminate bias introduced due to matching.
- Included length of injury event narratives in the model to control for information bias.

Characteristics of Wrist, Ankle and Hip Fracture Cases

	Wrist	Ankle	Hip
Age (mean, sd)	56.64 (7.56)	54.36 (6.48)	63.23 (9.59)
SIC category (n,%)			
Manufacturing	286 (18.12)	195 (17.55)	49 (13.14)
Retail trade	275 (17.43)	126 (11.34)	106 (28.42)
Services	560 (35.49)	414 (37.26)	112 (30.03)
Season of fall (n,%)			
Spring/Summer	725 (45.94)	466 (41.94)	172 (46.11)
Fall/Winter	853 (54.06)	645 (58.06)	201 (53.89)

Adjusted Odds Ratios and 95% Confidence Intervals

	Wrist Fracture	Ankle Fracture	Hip Fracture
Manual Task (No Manual Task)			
Carry/Lift/Lower	0.96 (0.7-1.3)	1.28 (0.9-1.8)	1.20 (0.8-1.9)
Push/Pull	1.73 (1.1-2.9)	0.71 (0.3-1.5)	0.98 (0.4-2.4)
Fall Hazard (No Hazard)			
Ice/Snow	1.19 (0.8-1.7)	0.94 (0.7-1.3)	1.53 (0.8-3.1)
Wet Surface	1.21 (0.9-1.6)	0.83 (0.6-1.1)	1.04 (0.6-1.7)
Uneven Surface	0.71 (0.5-1.0)	1.42 (1.1-1.9)	0.48 (0.3-0.8)
Clutter	0.70 (0.5-0.9)	1.22 (0.9-1.6)	1.14 (0.7-1.8)
Large Object	0.78 (0.6-1.0)	0.93 (0.6-1.4)	0.65 (0.4-1.1)
Initiating Event (Slip)			
Trip	1.31 (1.0-1.7)	0.56 (0.4-0.7)	1.32 (0.9-2.1)
Miss Step	1.11 (0.8-1.6)	1.10 (0.7-1.7)	1.06 (0.6-2.0)
Place (Indoor)			
Outdoor	1.66 (1.3-2.1)	3.34 (2.7-4.1)	0.65 (0.4-1.0)

Discussion

- Only place of fall (outdoor) was associated with risk of all three fractures.
  - It is unclear why outdoor falls were found to be associated with a decreased risk of hip fracture.
  - Majority of hip fractures occur indoors. (Norton et al. 1997)
- Initiating events and fall hazards that increased risk of wrist fracture were generally associated with decreased risk of ankle fracture and vice versa.

Discussion

- Effect of fall due to ice/snow was confounded by place of fall.
  - Falling due to ice/snow was associated with increased risk of all three fractures in the univariable analysis. (data not shown)
  - This association was not significant in multivariable analysis that controlled for place of fall.
- Ice and snow may increase risk of falling and these falls are more likely to result in fracture because they tend to happen outdoors.

Limitations

- Administrative data
  - Data not collected for research purposes
- Compared falls that resulted in fracture to falls that resulted in other injuries
- Did not control for occupation

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