PROGNOSTIC APPROACH FOR MANAGING ADVERSE OUTCOMES IN UPPER EXTREMITY FRACTURES

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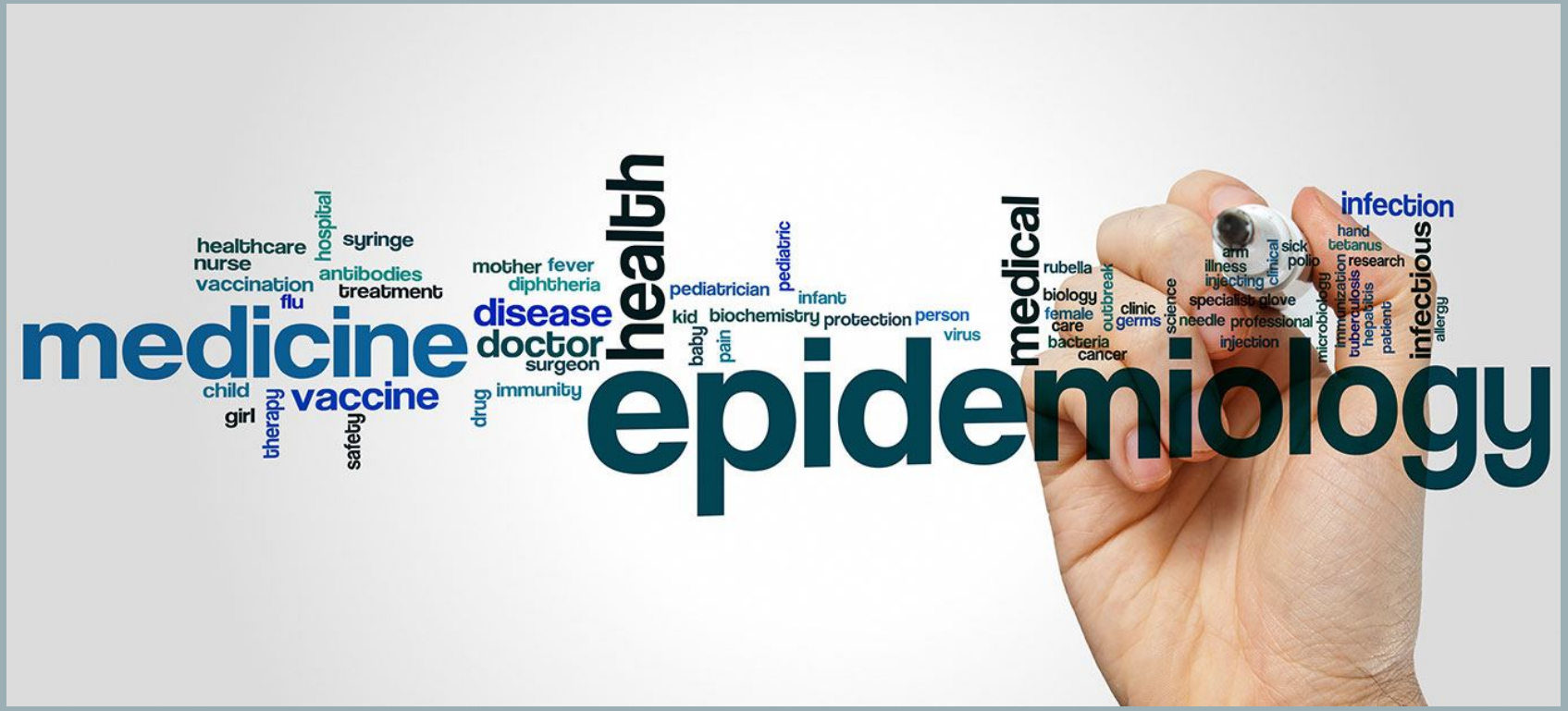
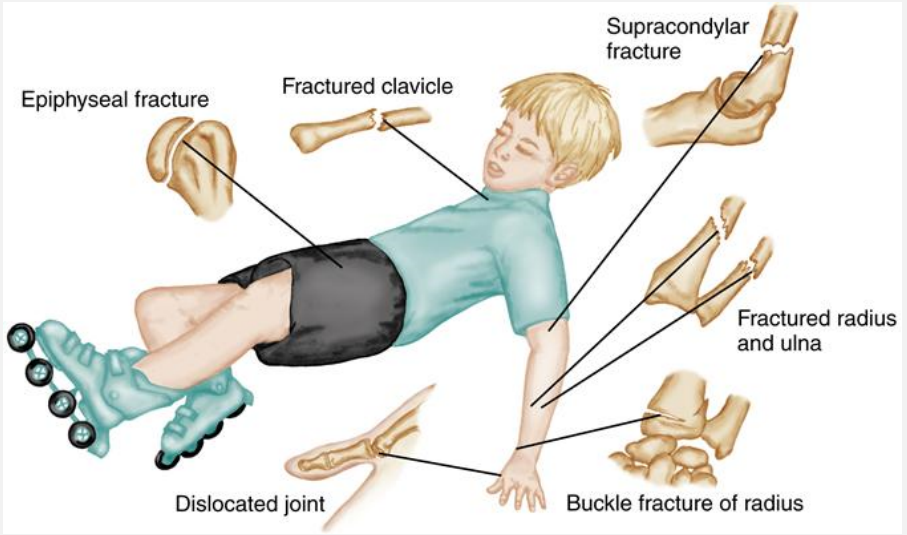
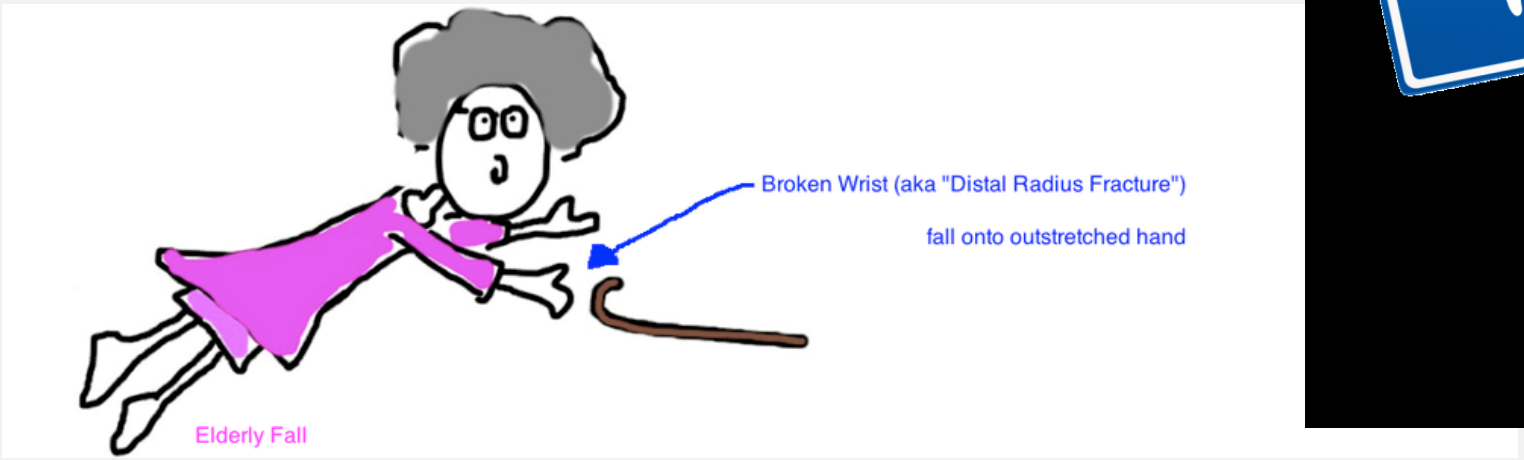
UPPER EXTREMITY FRACTURES EPIDEMIOLOGY

Joy C MacDermid PT PhD



WHO, WHEN, WHERE, HOW





FRACTURE LIST ICD10

- Proximal Humerus Fracture Open
- Proximal Humerus Closed
- Proximal Humerus
- Humeral Shaft Open
- Humeral Shaft Closed
- Humeral Shaft
- Distal Humeral fracture open
- Distal Humeral fracture closed
- Distal humeral fracture
- Any humeral fracture
- Multiple shoulder fractures
- Upper radius and ulna
- Shaft of ulna open
- Shaft of ulna closed
- Shaft of ulna
- Shaft of radius open
- Shaft of radius closed
- Shaft of radius
- Shafts of radius and ulna open
- Shafts of radius and ulna closed
- Shafts of radius and ulna
- Distal radius open
- Distal radius closed
- Distal radius

ıpper-extremity ractures	DAD SDS NACRS OHIP	ICD-10 OHIP fee	Ref date=Index date	Multiple fracture types as defined (in Appendix A); (in Appendix A) Use alldx

- Multiple fractures of forearm open
- Other carpal bone
- 1st metacarpal open
- 1st metacarpal closed
- 1st metacarpal
- Other metacarpal open
- Other metacarpal closed
- Other metacarpal
- Multiple metacarpals open
- Multiple metacarpals closed
- Multiple metacarpals
- Any metacarpal
- Proximal phalanx open
- Proximal phalanx closed
- Proximal phalanx
- Distal phalanx open
- Distal phalanx closed
- Distal phalanx
- Multiple digits open
- Multiple digits closed
- Multiple digits

INCIDENCE IN US

- DRF
- Finger
- MC
- PHF
- Clavicle
- R/U
- Carpal
- Humeral Shaft
- Scaphoid
- Scapula

Incidence and National Estimate of Upper Extremity Fractures

Diagnosis	National Estimate	Incidence (per 10,000 person-years)
All Upper Extremity Fractures	2,088,895	67.7
Distal Radius/Ulna Fractures	501,298	16.2
Finger Fractures	385,176	12.5
Metacarpal Fractures	258,627	8.38
Proximal Humerus Fractures	183,901	5.96
Clavicle Fractures	178,411	5.78
Distal Humerus Fractures	133,469	4.32
Proximal Forearm Fractures	128,605	4.16
Forearm Fractures	111,086	3.60
Other Carpal Fractures	73,555	2.38
Humeral Shaft Fractures	53,557	1.74
Scaphoid Fractures	33,673	1.09
Scapula Fractures	27,214	0.881
Misc/Mult Fractures	20,323	0.658

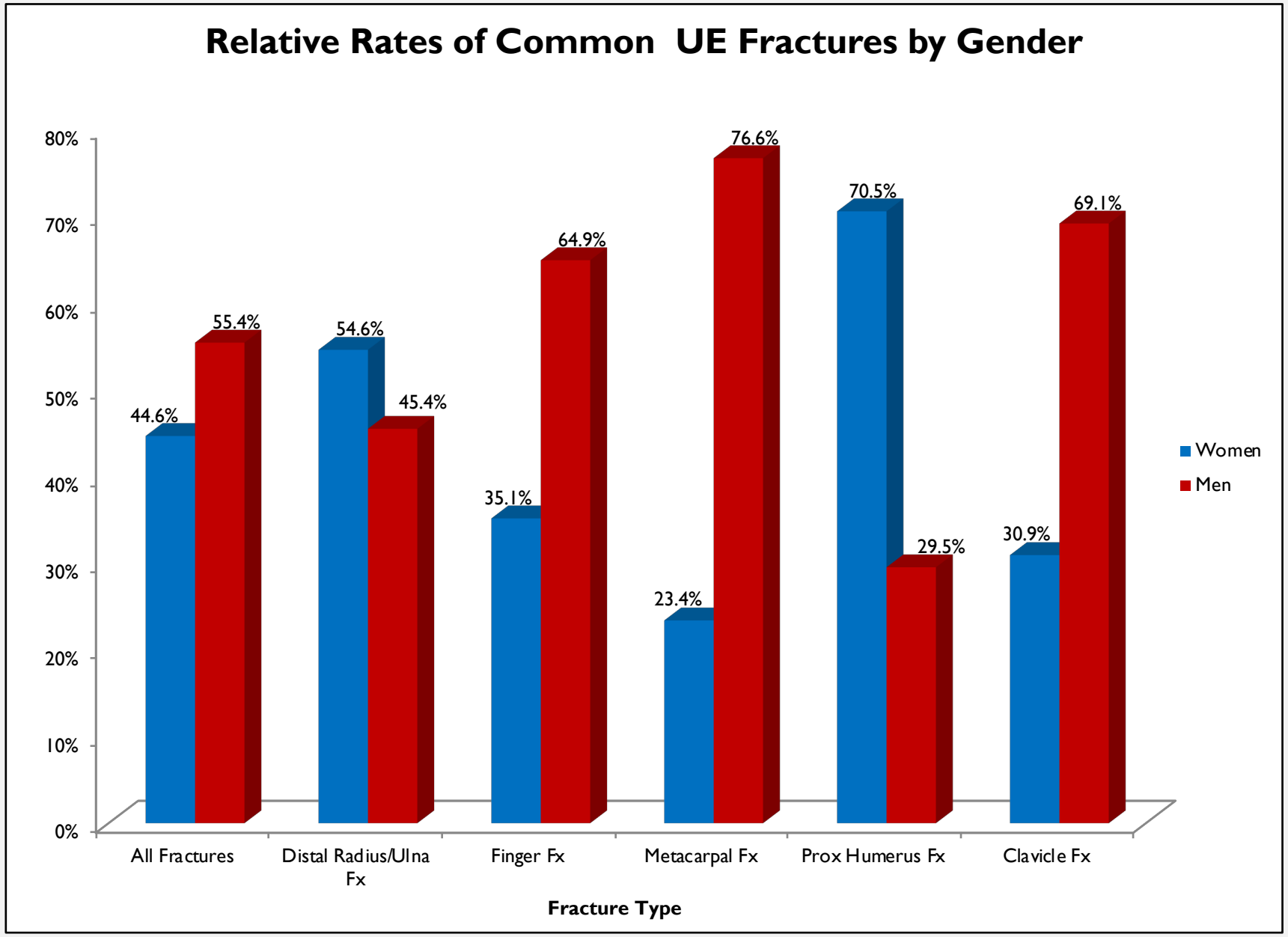
DOI 10.1007/s11552-011-9383-z

SURGERY ARTICLES

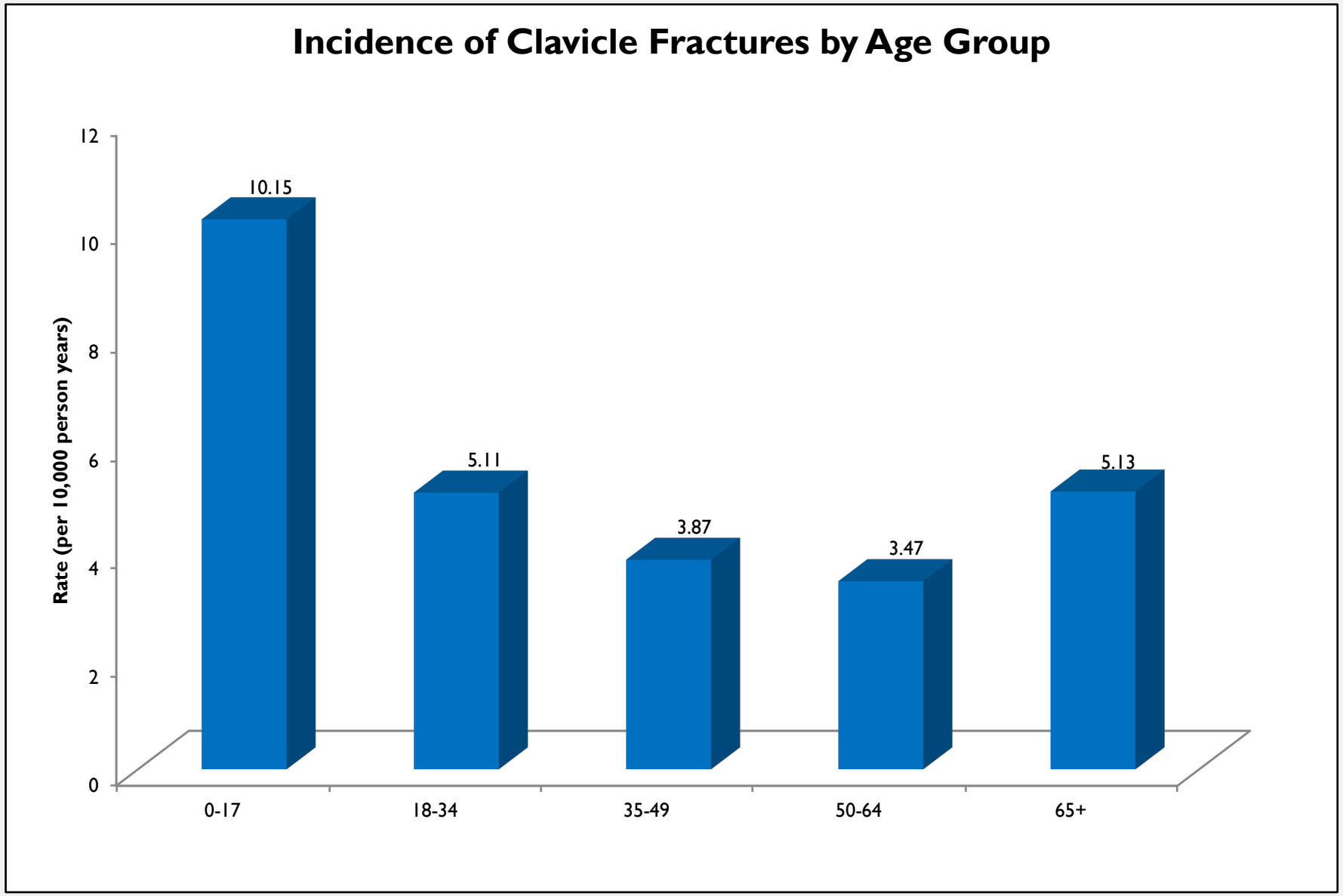
The epidemiology of upper extremity injuries presenting to the emergency department in the United States

Daan Ootes · Kaj T. Lambers · David C. Ring

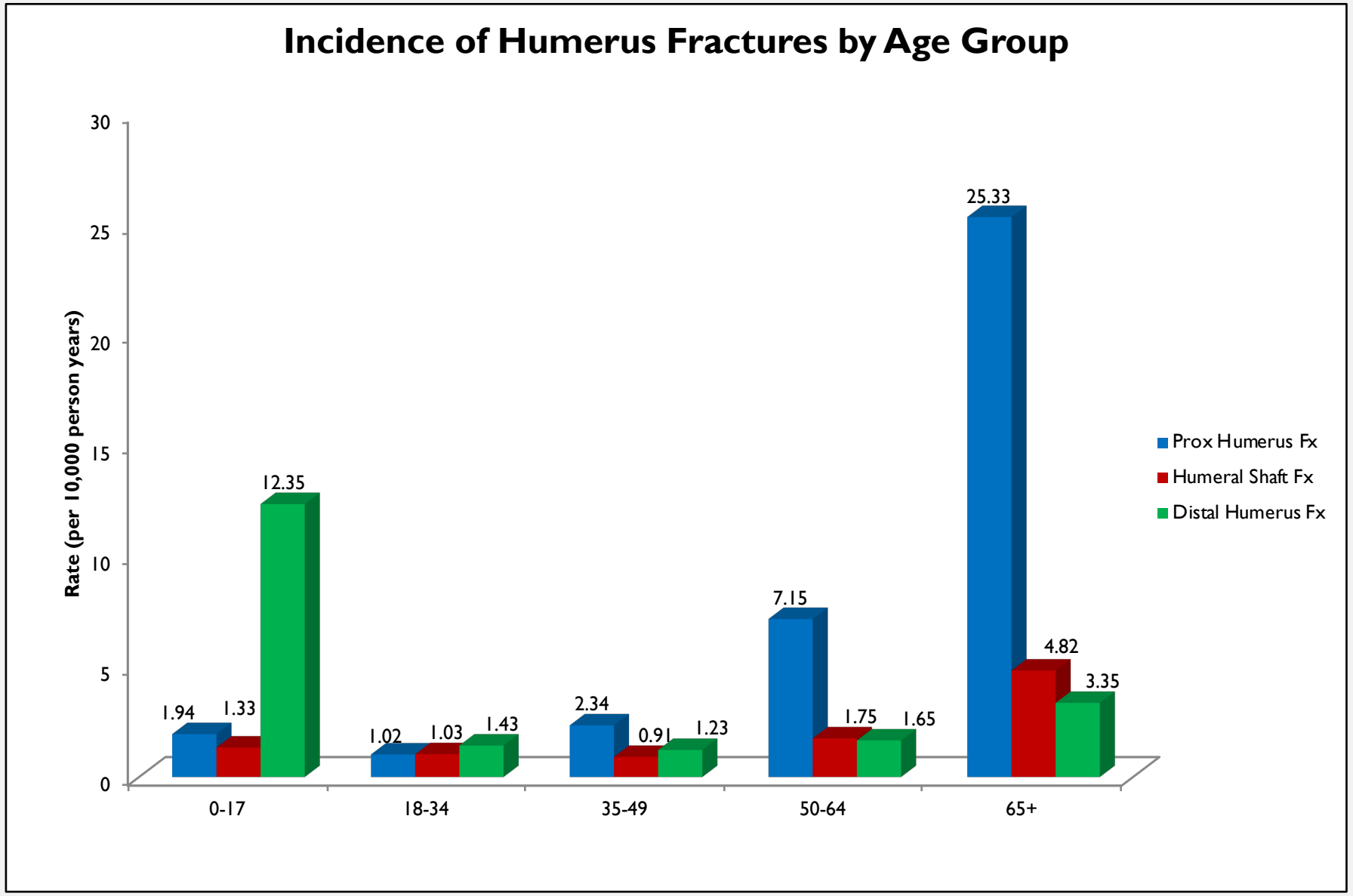
- The National Electronic Injury Surveillance System (NEISS)
- Incidence of 1,130 upper extremity injuries per 100,000 persons per year.
- The most common upper extremity injury was a fracture (29.2%).
- Specific injuries with high incidence rates:
- finger lacerations(221),
- wrist fractures (72),
- finger fractures (68),
- And lower arm fractures (64).
- Home is the most common setting for an upper extremity injury.


Relative Rates of Common UE Fractures by Gender
80%
70%
60%
50%
40%
30%
20%
10%
0%
44.6%
55.4%
54.6%
45.4%
35.1%
64.9%
23.4%
76.6%
70.5%
29.5%
30.9%
69.1%
All Fractures
Distal Radius/Ulna Fx
Finger Fx
Metacarpal Fx
Prox Humerus Fx
Clavicle Fx
Fracture Type
Women
Men

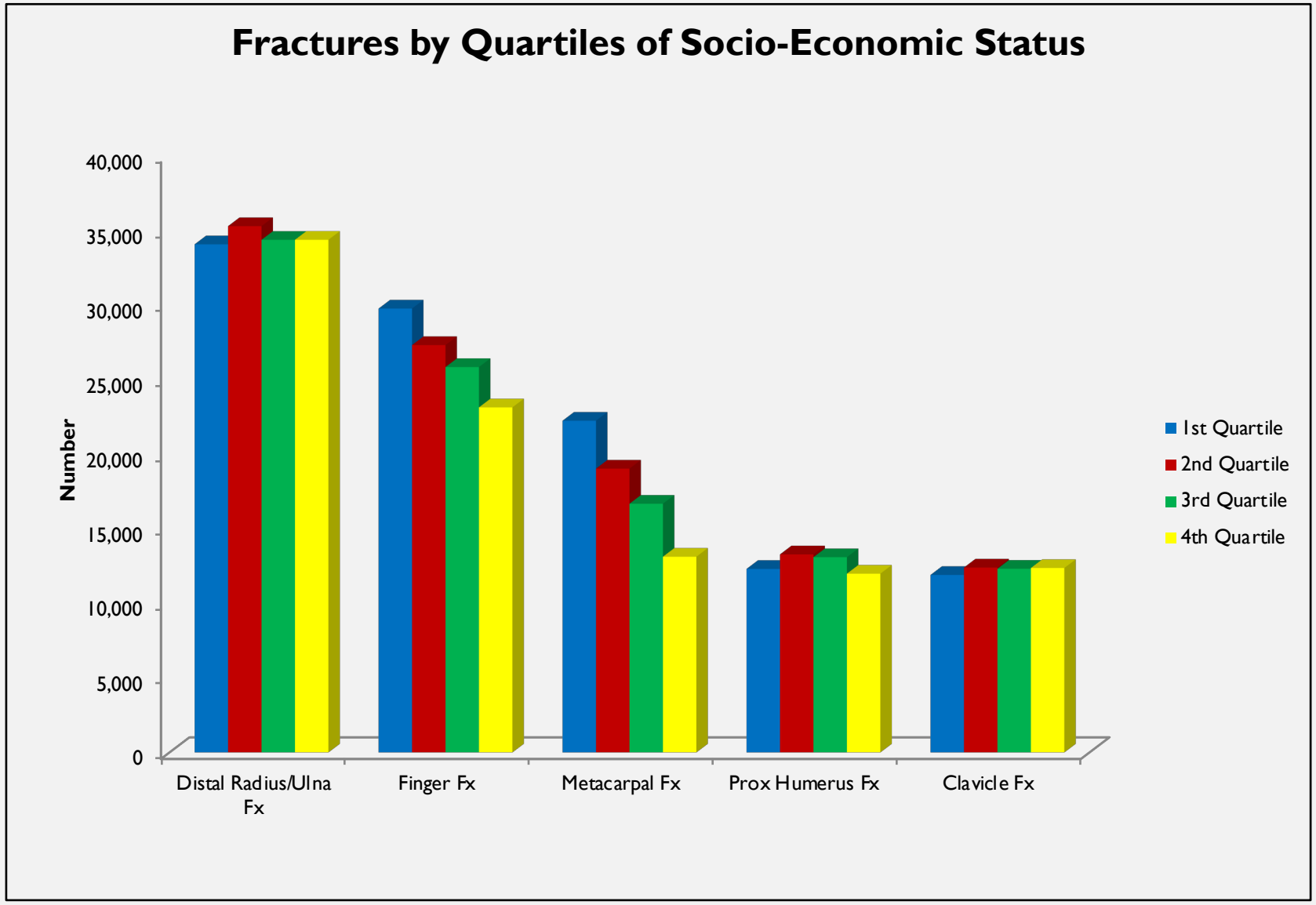
Figure, Supplementary Digital Content 7.



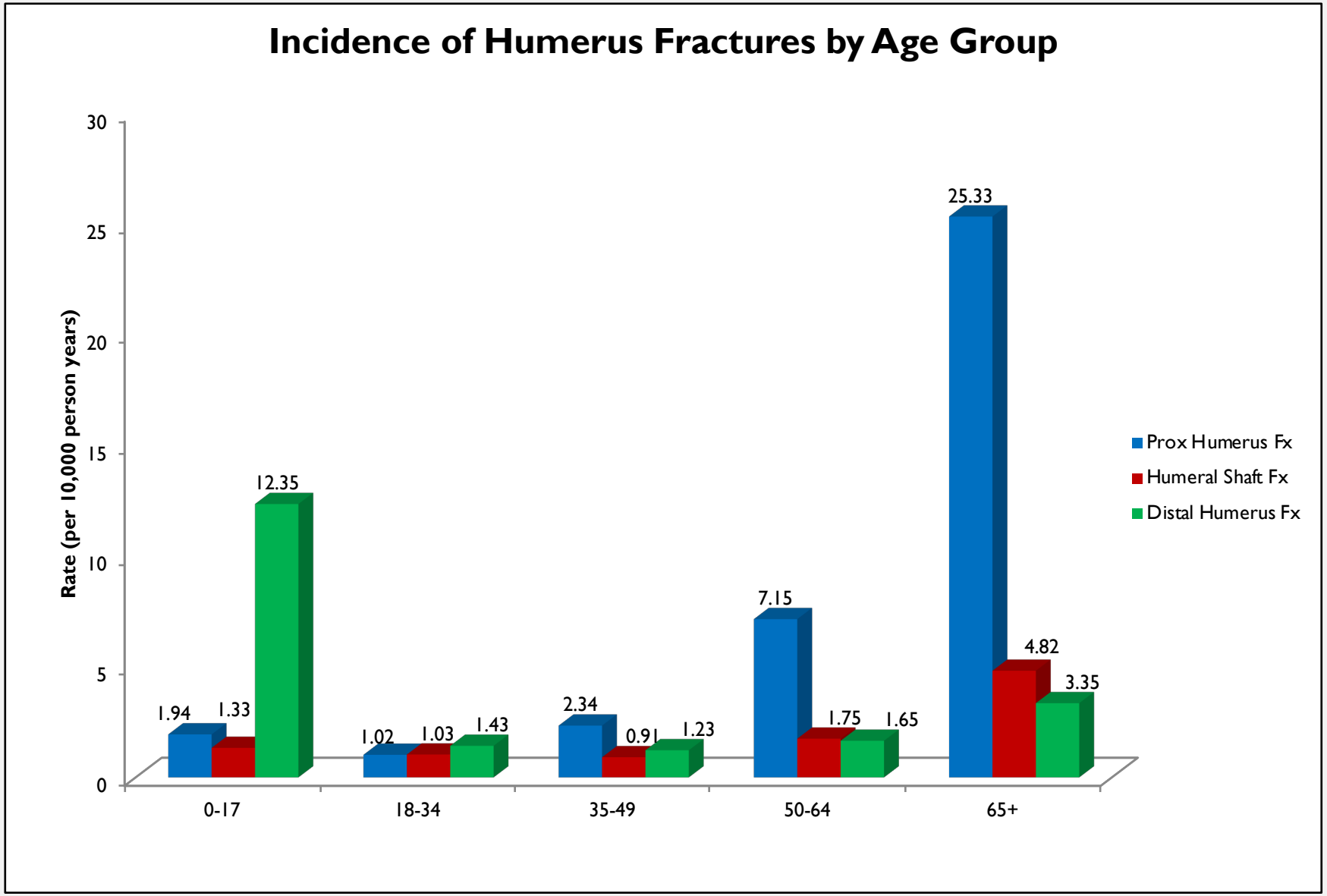
Figure


Incidence of Humerus Fractures by Age Group
Rate (per 10,000 person years)
30
25
20
15
10
5
0
1.94
1.33
12.35
1.02
1.03
1.43
2.34
0.91
1.23
7.15
1.75
1.65
25.33
4.82
3.35
0-17
18-34
35-49
50-64
65+
Prox Humerus Fx
Humeral Shaft Fx
Distal Humerus Fx

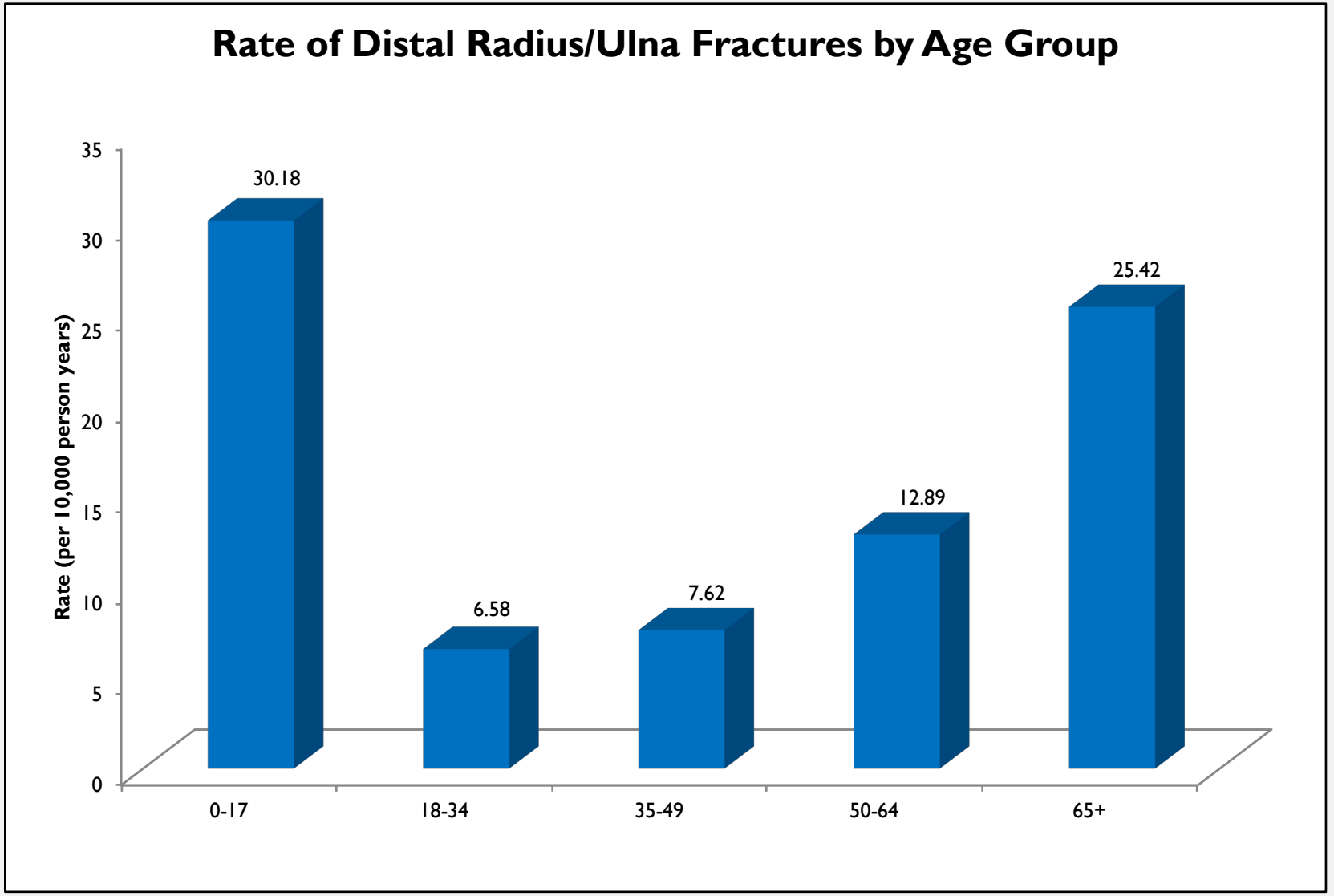
Figure, Supplementary Digital Content 9.



Figure, Supplementary Digital Content 6.



Figure, Supplementary Digital Content 4.



RISK OF FRACTURE

INCREASED RISK

- Smoking, excess alcohol,
- Higher Charlson Comorbidity
- Living alone, unmarried/divorced
- Previous fracture
- OP
- Female

DECREASED RISK

- Higher grip strength
- Higher income
- Living in an urban area
- Diabetes (Vilica 2018)

TABLE 1: IMPACT OF OSTEOPOROSIS-RELATED FRACTURES

From the *Primer on the Metabolic Bone Diseases and Disorders of Mineral Metabolism, 7th Edition*. www.asbmrprimer.org

	Hip	*Spine*	*Wrist*
Lifetime risk (%)			
Women	14	28	13
Men	3	6	2
Cases per year	70,000	120,000	50,000
Hospitalization (%)	100	2–10	5
Relative survival	0.83	0.82	1.00

Costs: all sites combined ~£1.7 billion.

OP MORTALTITY HAZARD

Osteoporosis International
https://doi.org/10.1007/s00198-018-4653-z

ORIGINAL ARTICLE

Osteoporosis and osteopenia in the distal forearm predict all-cause mortality independent of grip strength: 22-year follow-up in the population-based Tromsø Study

A. V. Hauger[1] · A. Bergland[1] · K. Holvik[2] · A. Ståhle[3,4] · N. Emaus[5] · B. H. Strand[2,6,7]

- The study population constituted 6565 participants aged 50–79 years at baseline
- all-cause mortality as the outcome over 22 years of follow-up was performed for men and women separately, adjusting for health-related factors, as well as BMD by grip strength interaction.
- During follow-up, 3176 of participants died (47%).
- OP higher mortality hazard ratio men HR = 1.37 women HR = 1.32 adjusted for age, body mass index, physical activity, smoking habits, education, health status, chronic diseases, and grip strength

JOURNAL OF BONE AND MINERAL RESEARCH
Volume 15, Number 4, 2000

Patients with Prior Fractures Have an Increased Risk of Future Fractures: A Summary of the Literature and Statistical Synthesis*

CAROLYN M. KLOTZBUECHER, PHILIP D. ROSS, PAMELA B. LANDSMAN, THOMAS A. ABBOTT III, and MARC BERGER

ORIGINAL INVESTIGATION

10-Year Probability of Recurrent Fractures Following Wrist and Other Osteoporotic Fractures in a Large Clinical Cohort

An Analysis From the Manitoba Bone Density Program

Anthony B. Hodsman, MBBS, FRCPC; William D. Leslie, MD, FRCPC, MSc; James F. Tsang, BSc; Greg D. Gamble, MSc

TABLE 1. POOLED ASSOCIATIONS OF PRIOR AND SUBSEQUENT FRACTURES

Location of prior fracture	*Population*	*Location of subsequent fractures*				
		Wrist	*Vertebral*	*All (or nonspine)*	*Hip*	*Pooled*
Wrist	Peri/postmenopausal	3.3 (2.0, 5.3)[a]	1.7 (1.4, 2.1)[a]	2.4 (1.7, 3.4)[a,d]	1.9 (1.6, 2.2)	2.0 (1.7, 2.4)[d]
	Other	3.6 (1.9, 6.7)	7.2 (3.6, 14.6)	2.0 (1.7, 2.4)	1.5 (1.3, 1.7)	2.6 (1.9, 3.5)

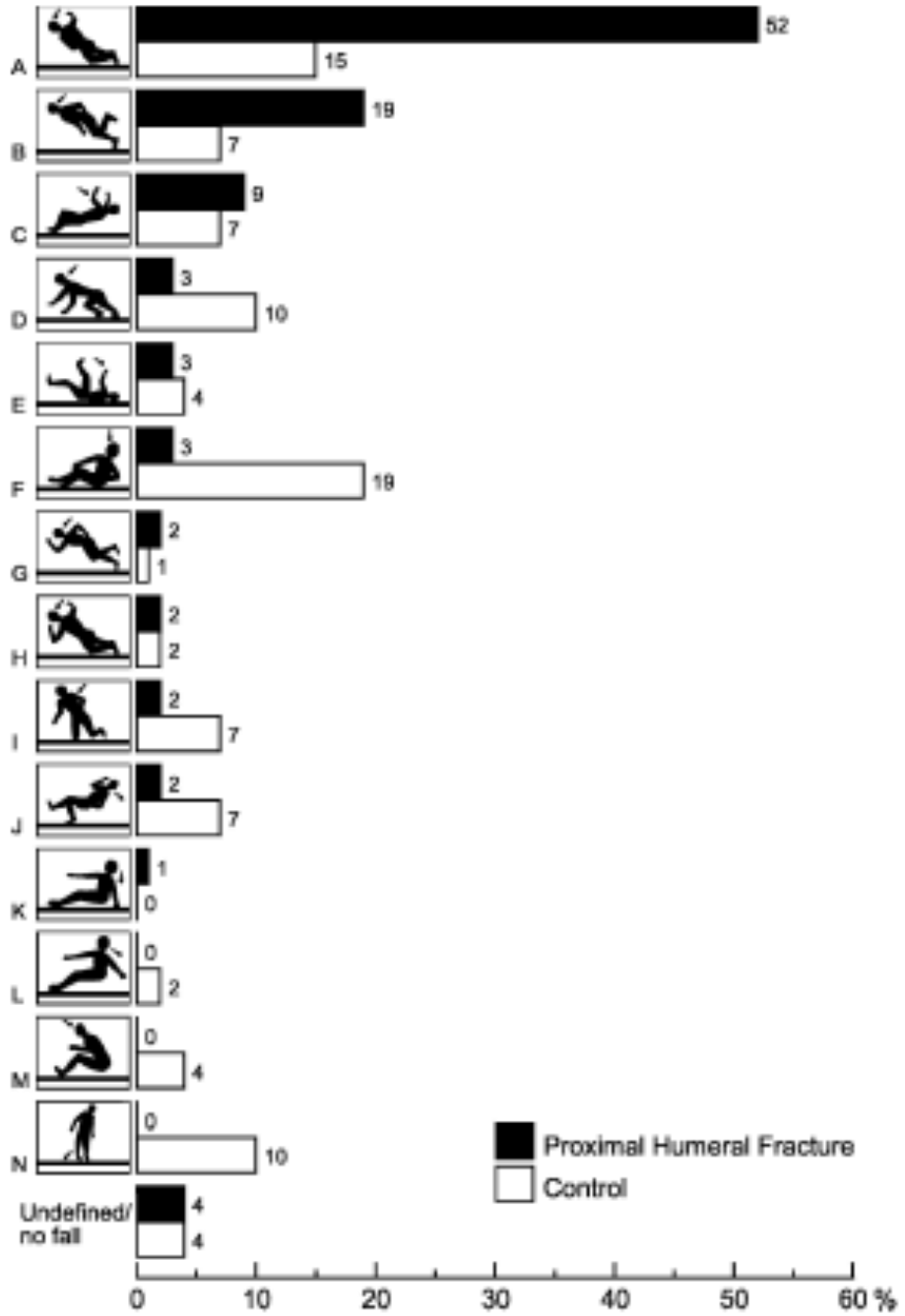
Table 3. Age-Adjusted HRs for Femoral Neck BMD to Predict Incident Fractures After BMD Testing According to Primary Fracture Status

Site of Primary Fracture	HR (95% CI) per SD	*P* Value
None	1.80 (1.68-1.93)	<.001
Wrist	2.20 (1.72-2.80)	<.001
Any nonwrist	1.21 (1.05-1.40)	.01
Humerus	1.25 (0.99-1.57)	.06
Spine	1.35 (1.07-1.71)	.01
Hip	1.04 (0.74-1.45)	.83

Abbreviations: BMD, bone mineral density; CI, confidence interval; HR, hazard ratio; SD, standard deviation.

Table 4. Adjusted[a] HRs for Incident Fractures After BMD Testing According to Site of Primary Fracture

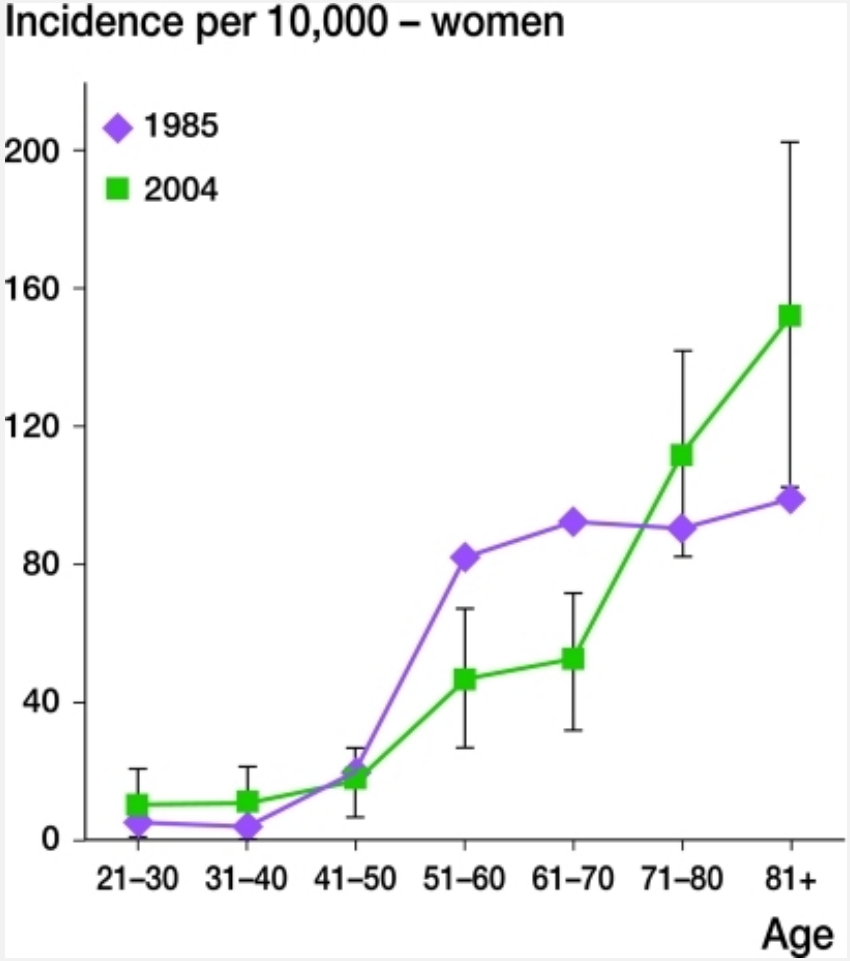
Site of Primary Fracture	HR (95% CI) for Any Osteoporotic Fracture[b]	*P* Value	HR (95% CI) for Hip Fracture[b]	*P* Value
Wrist	1.58 (1.29-1.93)	<.001	1.29 (0.88-1.89)	.19
Any nonwrist	2.66 (2.30-3.08)	<.001	1.72 (1.31-2.26)	<.001
Humerus	3.18 (2.56-3.94)	<.001	2.06 (1.35-3.15)	<.001
Spine	2.73 (2.21-3.36)	<.001	1.52 (1.01-2.30)	.046
Hip	2.00 (1.53-2.63)	<.001	1.67 (1.08-2.58)	.02



FALLS PATTERNS IN PHF

- About
- 75% of falls occur from standing height or less in women >65 yo
- walk slowly, fall sideways, and are not able to slow down or break the fall with an outstretched arm
- sideways fall and subsequent direct impact at the fractured site
- most typical fall direction is obliquely forward (Fig 1).

CHANGING DEMOGRAPHICS



Epidemiology and treatment of distal radius fractures in Reykjavik, Iceland, in 2004. Comparison with an Icelandic study from 1985.

Sigurdardottir K, Halldorsson S, Robertsson J - Acta Orthop (2011)

ELSEVIER

Bone Vol. 18, No. 3, Supplement
March 1996:209S–213S

The Epidemiology of Peripheral Fractures

J. A. BARON,[1,2] J. A. BARRETT,[2] and M. R. KARAGAS[2]

WHITE FEMALES - DRF AND PHF

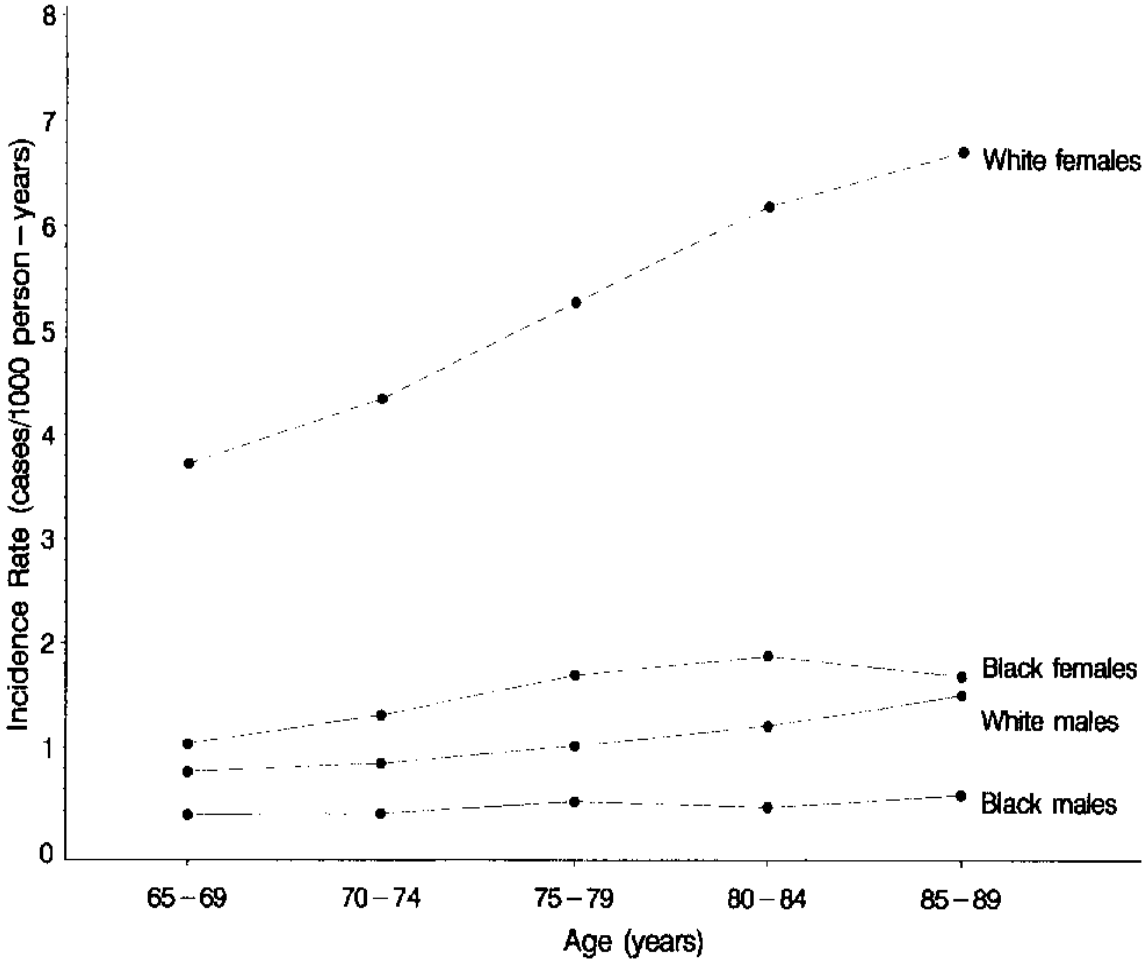


Figure 4. Incidence of fracture of the distal forearm by age, race, and gender. U.S. Medicare population, 1986–1989. Reprinted with permission from Reference 3.

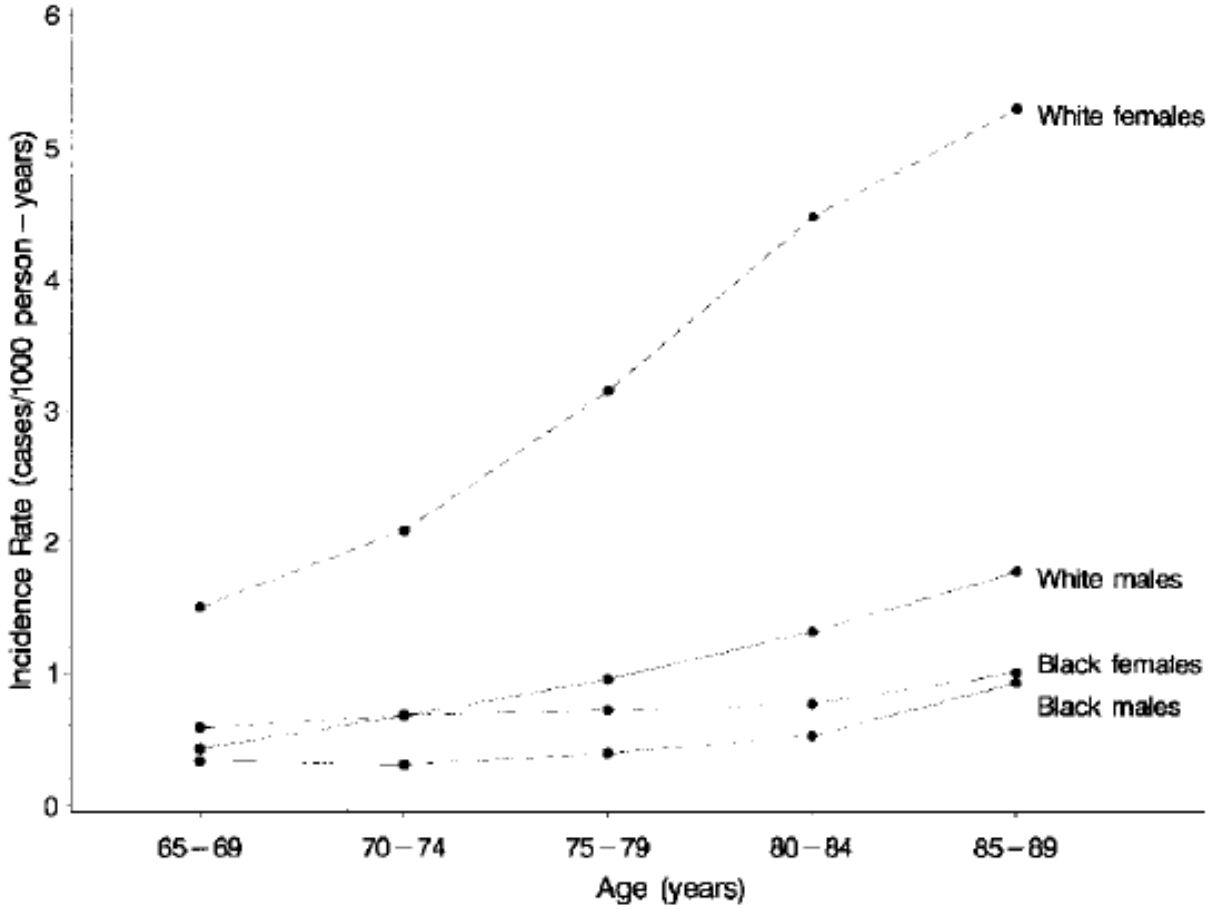
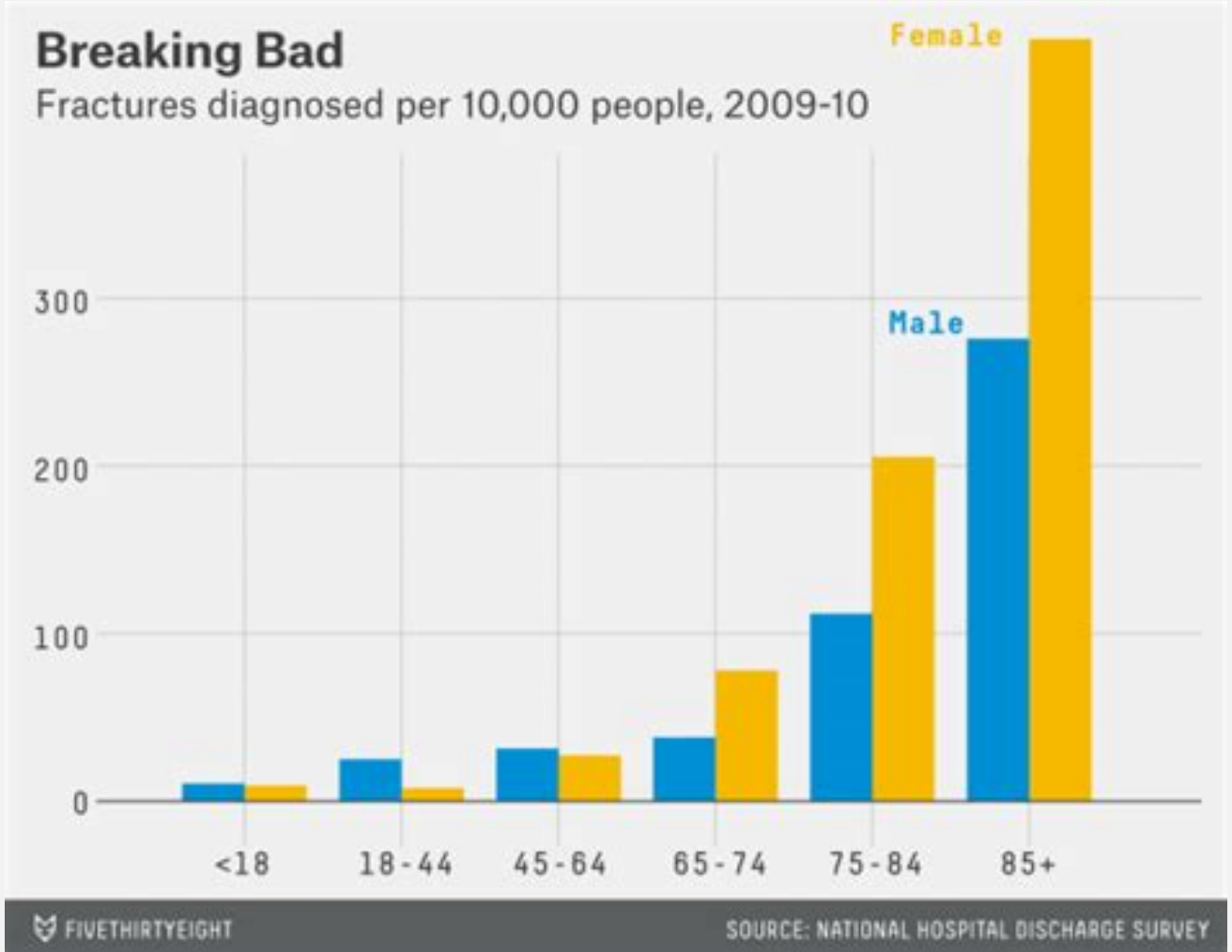


Figure 3. Incidence of fracture of the proximal humerus by age, race, and gender. U.S. Medicare population, 1986–1989. Reprinted with permission from Reference 3.

PHF AND AGING POPULATION



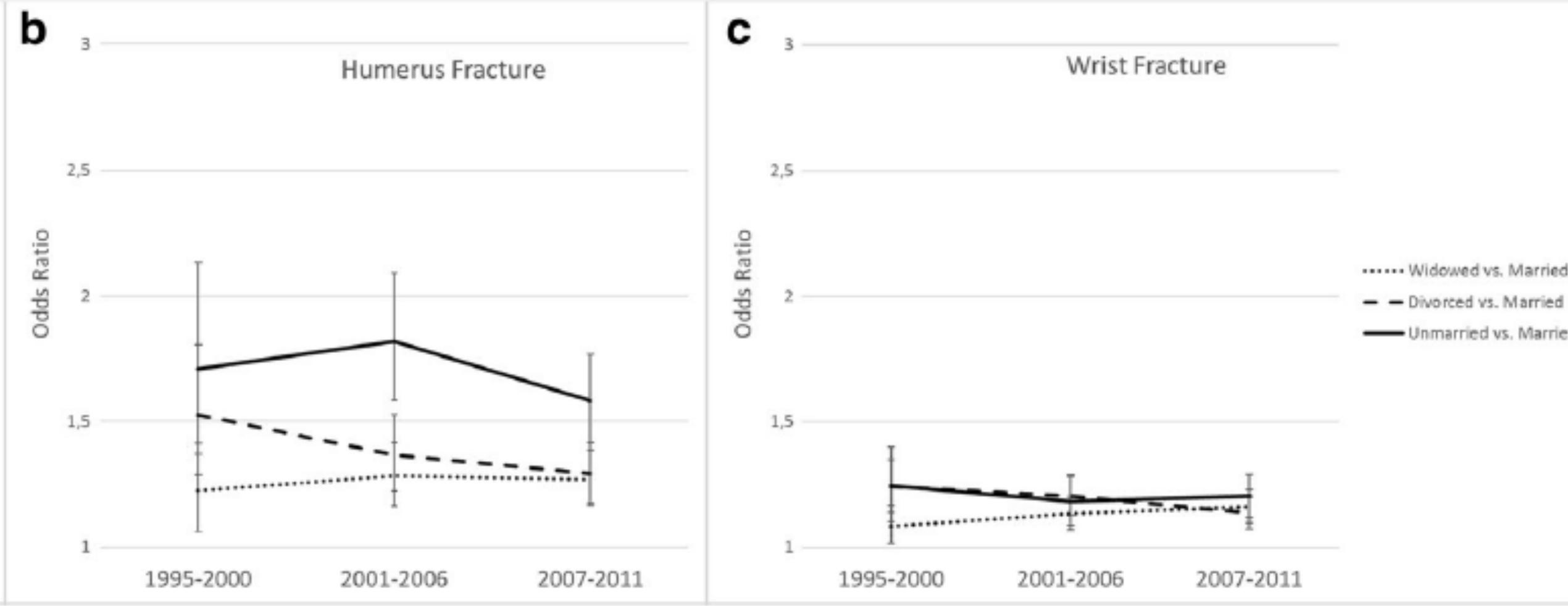
CLINICAL ORTHOPAEDICS AND RELATED RESEARCH
Number 442, pp. 87–92

Update in the Epidemiology of Proximal Humeral Fractures

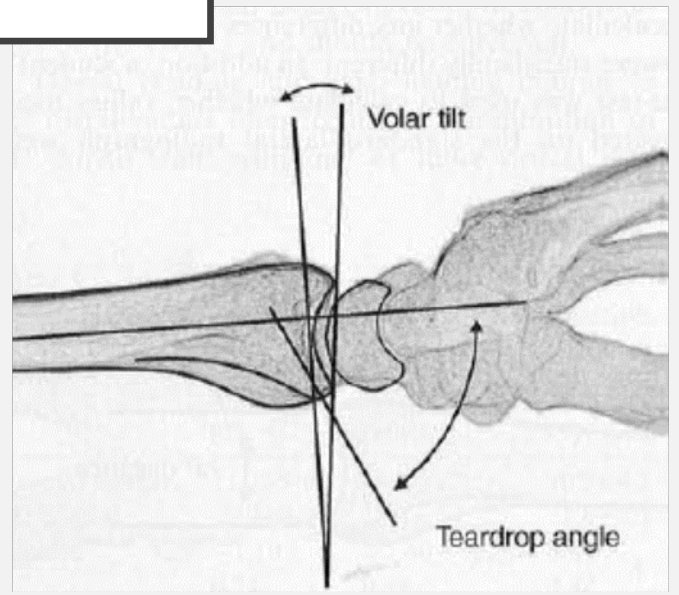
Mika Palvanen, MD, PhD; Pekka Kannus, MD, PhD*†; Seppo Niemi*; and Jari Parkkari, MD, PhD‡*

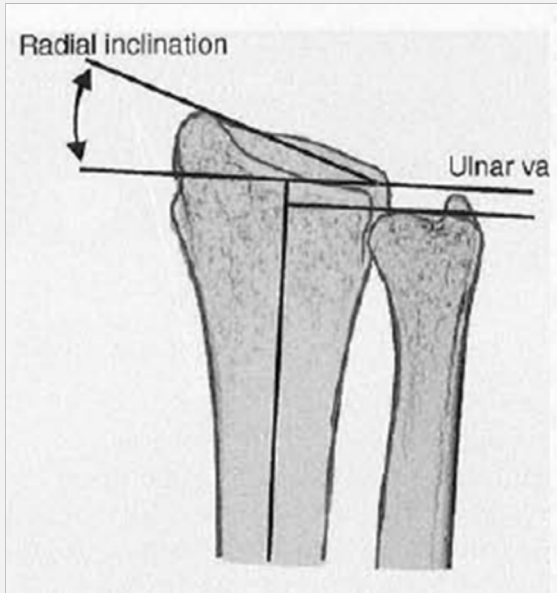
- In Finland Cohort 1960 to 2002
- PHF incidence increased from 32 to 105.
- In women 80 years or older, increased from 90 to 294.
- The mean patient age increased, from 73 to 78 years
- If these trends continue, the number of fractures in elderly Finns will triple during the next three decades.

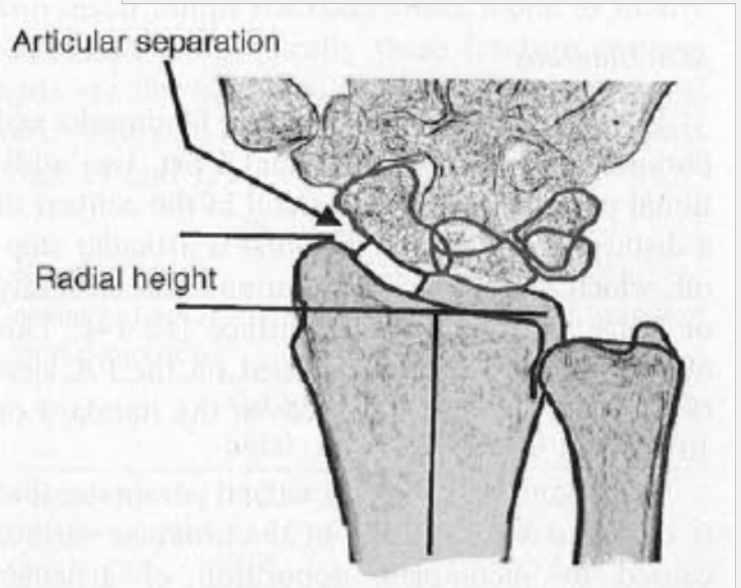
SECULAR TRENDS MARITAL STATUS



DISTAL RADIUS FRACTURES







DISTAL RADIUS # (DRF)

Injury

Volume 35, Issue 5, May 2004, Pages 462-466

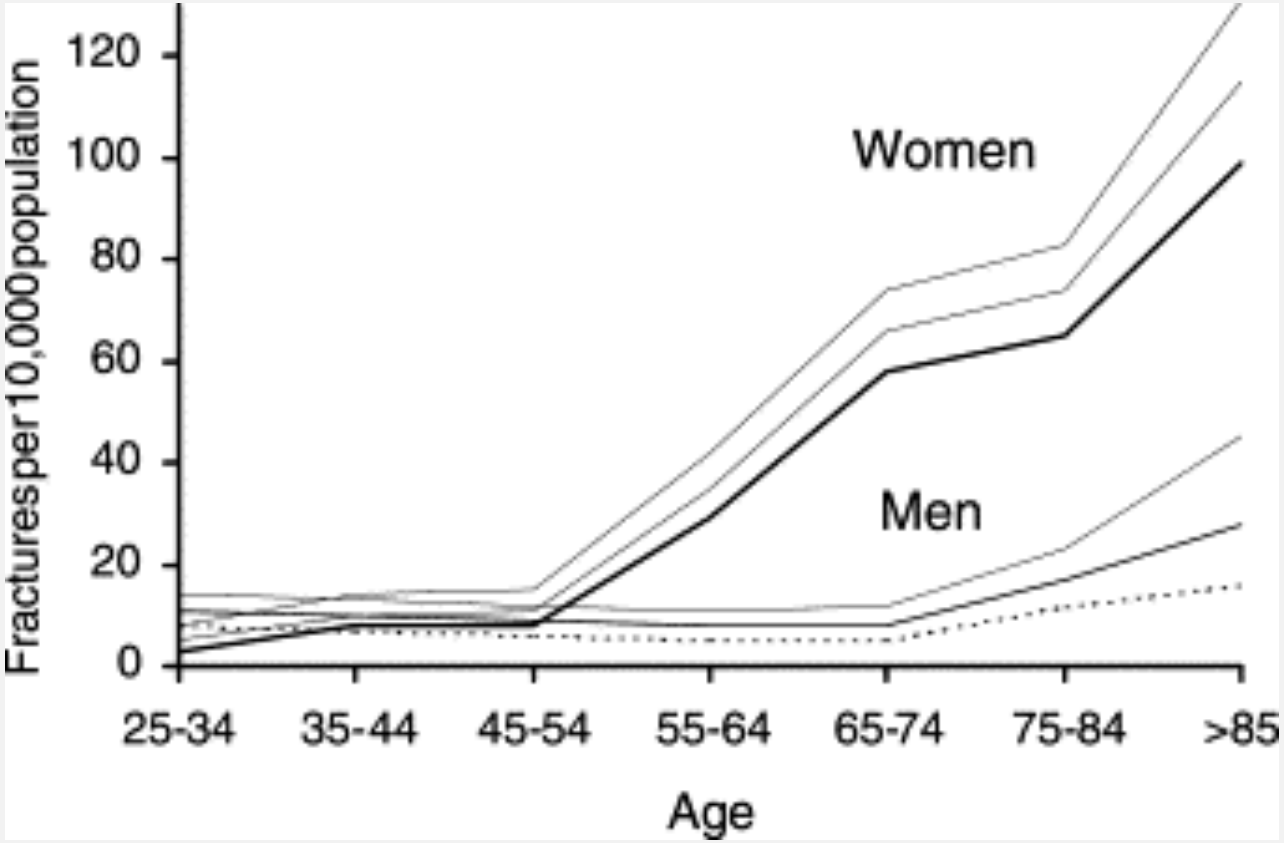
The annual incidence and seasonal variation of fractures of the distal radius in men and women over 25 years in Dorset, UK

Paul W Thompson [a], Julia Taylor [a], Adrian Dawson [b]

Show more

https://doi.org/10.1016/S0020-1383(03)00117-7 Get rights and content

- Most common fracture
- About 40% of the osteoporotic fractures in women 50-60yo occur are DRF[1].
  - Potential for early intervention
- SR- DRF doubles risk of fracture for subsequent fractures[3]
- Bimodal distribution – young men and older women

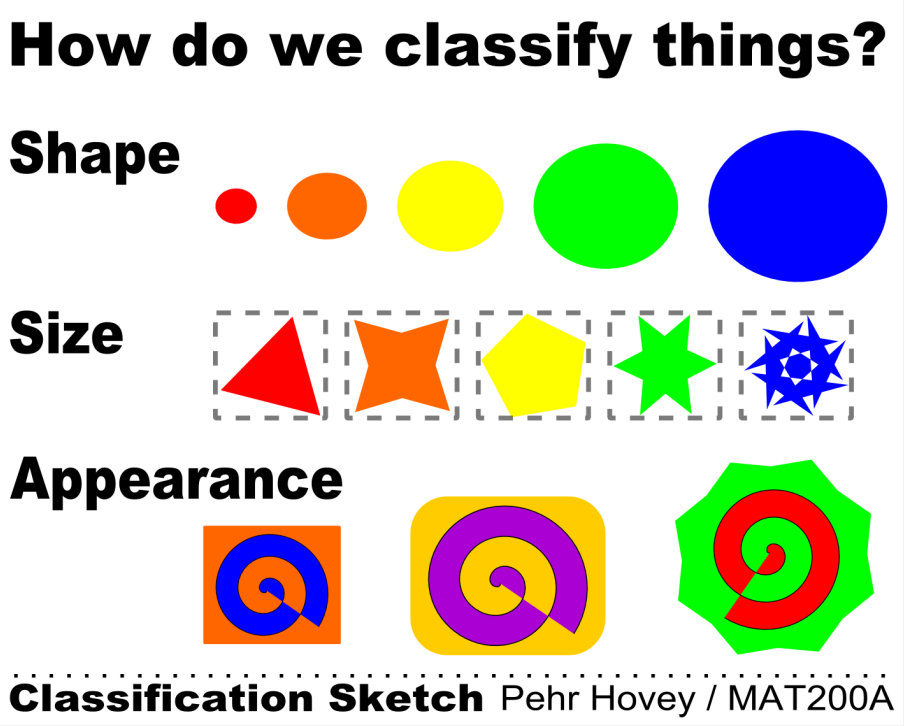


FRACTURE CLASSIFICATION SYSTEMS

Colles' Fracture	1814: earliest classification
Barton's Fracture	1838: Intra-articular shear w/ dislocation
Gartland & Werley	1951: Extra-articular vs. Intra-articular
Older et al	1965: Severity dorsal angulation & shortening
Frykman	1967: Intra-articular & distal ulna Fx patterns
Melone	1984: Intra-articular components
McMurtry & Jupiter	1991: Intra-articular fragment size
Muller/ AO-ASIF	1991: Extra, Partial, Intra-articular; Comminution
Fernandez	1993: Injury mechanism (5 types)

A CLASSIFICATION SYSTEM SHOULD:

- **Separate people into distinct and meaningful groups**
- Classify all
- Be reliable
- Predict treatment needs ± outcomes
- Be easily communicated and adopted by others



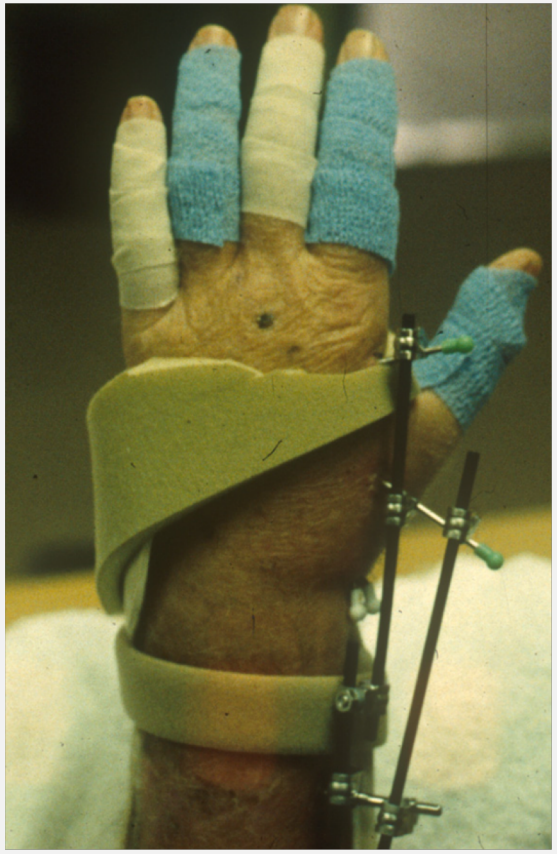
PROPOSED CLASSIFICATION: 1. SIMPLE FRACTURE

- Fracture is not complicated by additional physical or psychosocial problems
- minor associated tissue injury
  - Minimal swelling
  - Fingers moving well
  - Low pain

PROPOSED CLASSIFICATION: 2. DRF WITH PHYSICAL IMPAIRMENT

Moderate to severe associated wrist injuries or impairments

- Instability
- Nerve injury
- Excessive swelling
- Finger stiffness
- Abnormal movement patterns
- Comorbid joint pathology e.g. arthritis



PROPOSED CLASSIFICATION- QUALIFIER: A. ± MALALIGNMENT

- May affect available ROM and motion goals
  - A 5-mm ulnar translation deformity results in a mean 23% loss of pronation range of motion.
  - Radial shortening of 10 mm reduces forearm pronation by 47% and supination by 29%
  - .(Bronstein, 1997; Fraser et al 2009)
- Joint deformity
- Impact on function controversial
  - Depend on demands/expectations

PROPOSED CLASSIFICATION
3. FRACTURE WITH PSYCHOSOCIAL BARRIERS

high pain

≥ 35/50 PRWE 2-10 days (Mehta et al, 2015)

and/or psychosocial risk factors

- Pain catastrophizing
- Low self-efficacy
- Fear of movement
- High anxiety
- Depression
- Poor coping
- Addiction
- Comorbid mental health disorders
- Unresolved/conflicted injury compensation issues
- Previous/Current physical/sexual abuse

PROPOSED CLASSIFICATION
4. FRACTURE WITH PHYSICAL AND PSYCHOSOCIAL BARRIERS

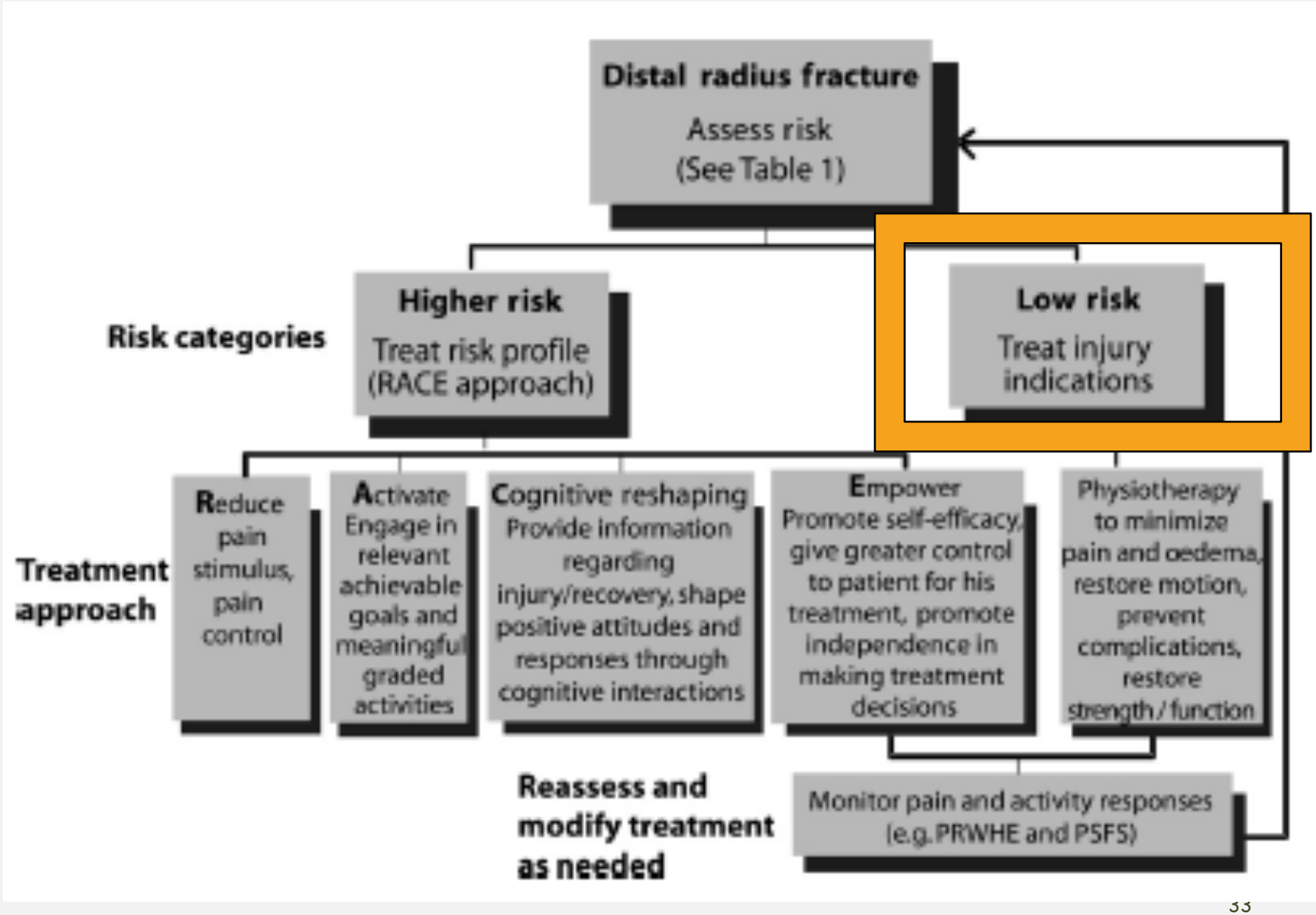
- High pain or Psychosocial risk factors

and Moderate to severe associated wrist injuries or impairments

PROPOSED CLASSIFICATION-QUALIFIERS-

- 1. ± malalignment
- 2. ± (risk of) osteoporosis

DRF Rehabilitation Classification			
DRF-Simple	**DRF + Physical Impairments**	**DRF + Psychosocial barriers**	**DRF + Physical Impairment+ Psychosocial barriers**
Low impairment • Minimal swelling • Fingers moving well • Low pain (< 5/10; or 25/50 on PRWE)	**Pain less <35/50 +** **Moderate to severe impairments** • Instability • Nerve injury • Excessive swelling • Finger stiffness • Abnormal movement patterns • Comorbid joint pathology e.g. arthritis	**High pain** ≥ 35/50 PRWE pain in in acute non-emergency care (1st 10 days) or **Psychosocial risk factors** ○ Pain catastrophizing ○ Low self-efficacy ○ Fear of movement ○ High anxiety ○ Depression ○ Poor coping ○ Addiction ○ Comorbid mental health disorders ○ Unresolved/conflicted injury compensation issues ○ Previous/Current physical/sexual abuse	**High pain or Psychosocial risk factors** and **Moderate to severe associated wrist injuries or impairments**
Qualifiers: 1. ± malalignment; 2. ± (risk of) osteoporosis			


Distal radius fracture
Assess risk
(See Table 1)
Risk categories
Higher risk
Treat risk profile
(RACE approach)
Low risk
Treat injury
indications
Treatment approach
Reduce pain stimulus, pain control
Activate
Engage in relevant achievable goals and meaningful graded activities
Cognitive reshaping
Provide information regarding injury/recovery, shape positive attitudes and responses through cognitive interactions
Empower
Promote self-efficacy, give greater control to patient for his treatment, promote independence in making treatment decisions
Physiotherapy
to minimize pain and oedema, restore motion, prevent complications, restore strength / function
Reassess and modify treatment as needed
Monitor pain and activity responses
(e.g. PRWHE and PSFS)

DRF Rehabilitation Classification-based Treatment			
DRF-Simple	DRF + Physical Impairments	DRF + Psychosocial barriers	DRF + Physical Impairment+ Psychosocial barriers
Treatment Approaches			
Home Program with Oversight	Hand Therapist - Impairment Focus	Hand therapist – RACE Approach	Hand therapist – Impairments interventions embedded in RACE
1. **ROM exercises** 2. **Advice on pain management and gradual progression form protection to normal use.**	1. Pain management 2. Edema management 3. Mobility interventions 4. Muscle strength and endurance 5. Motor control 6. Proprioception 7. Dexterity training	1. Reduce Pain Stimulus 2. Activate and engage in achievable goals and graded meaningful activity 3. Cognitive reshaping- cognitive strategies to normalize recovery, promote positive interpretations and expectations 4. Empower self-efficacy	Judicious use of impairment interventions operationalized in RACE

UPPER EXTREMITY FRACTURES
WHAT SHOULD WE MEASURE AS OUTCOMES

Joy C MacDermid PT PhD

Arch Orthop Trauma Surg (2014) 134:197–205
DOI 10.1007/s00402-013-1767-9

TRAUMA SURGERY

Recommendation for measuring clinical outcome in distal radius fractures: a core set of domains for standardized reporting in clinical practice and research

Jörg Goldhahn · Dorcas Beaton · Amy Ladd · Joy Macdermid · Amy Hoang-Kim

DISTAL RADIUS WORKING GROUP OF ISFR AND IOF-ZURICH 2011

SUMMARY - DRF OUTCOMES FOR CLINICAL PRACTICE CONSENSUS

- Pain
  - NRS or PRWE Pain Subscale
- Function
  - QuickDASH or PRWE
- Complications
- Participation- can be one question
- Secondary Impairments
  - Grip strength
  - Motion
  - Radiographic measures

TABLE 4. Summary Checklist Regarding Minimum Outcomes to Capture After DRFs

Outcome Domain		Assessment Parameters	
Performance measures	Hand, wrist, forearm, and elbow range of motion	Bilateral distal interphalangeal, proximal interphalangeal, and metacarpophalangeal joints, wrists, and elbow including passive and active range of motion through flexion and extension; wrist ulnar and radial deviation; forearm pronation and supination	Goniometer measurement at bedside or certified hand therapist assessment
	Bilateral hand grip strength	Bilateral hands	Dynamometer measurement at bedside or certified hand therapist assessment
Patient-reported outcomes	Disability and function	Activities of daily living; work performance; high-performance activities (music, sports, and art)	PRWE, *Quick*DASH, Brief MHQ, PROMIS upper-extremity, function
Pain		Character, intensity, frequency, interference	Visual analog or numeric pain rating scale, PRWE pain subscale, MHQ Pain subscale, PROMIS—Pain Interference
Complications	Occurrence of complications	Malunion, nonunion, tendinopathy, neuropathy, hardware failure, infection	Clinical record
	Reoperation	Unplanned reoperation within 1 y of injury	
	Unplanned readmission	Unplanned readmission to hospital after treatment	
Radiographs	Bony healing, alignment, collapse, and articular congruity as measured on plain radiographs including anteroposterior and lateral images	Radial inclination, ulnar variance, volar tilt, radial height, articular congruency, hardware position and failure, bony union	Clinical record

EVALUATION OF CRPS

Research Paper

PAIN

Recommendations for a first Core Outcome Measurement set for complex regional PAin syndrome Clinical sTudies (COMPACT)

Sharon Grieve[a,b,*], Roberto S.G.M. Perez[c], Frank Birklein[d], Florian Brunner[e], Stephen Bruehl[f], R. Norman Harden[g], Tara Packham[h], Francois Gobeil[i], Richard Haigh[j], Janet Holly[k], Astrid Terkelsen[l], Lindsay Davies[a], Jennifer Lewis[a,b], Ilona Thomassen[m], Robyn Connett[n], Tina Worth[o], Jean-Jacques Vatine[p,q], Candida S. McCabe[a,b]

International Research Consortium
for Complex Regional Pain Syndrome

COMPACT CONSENSUS

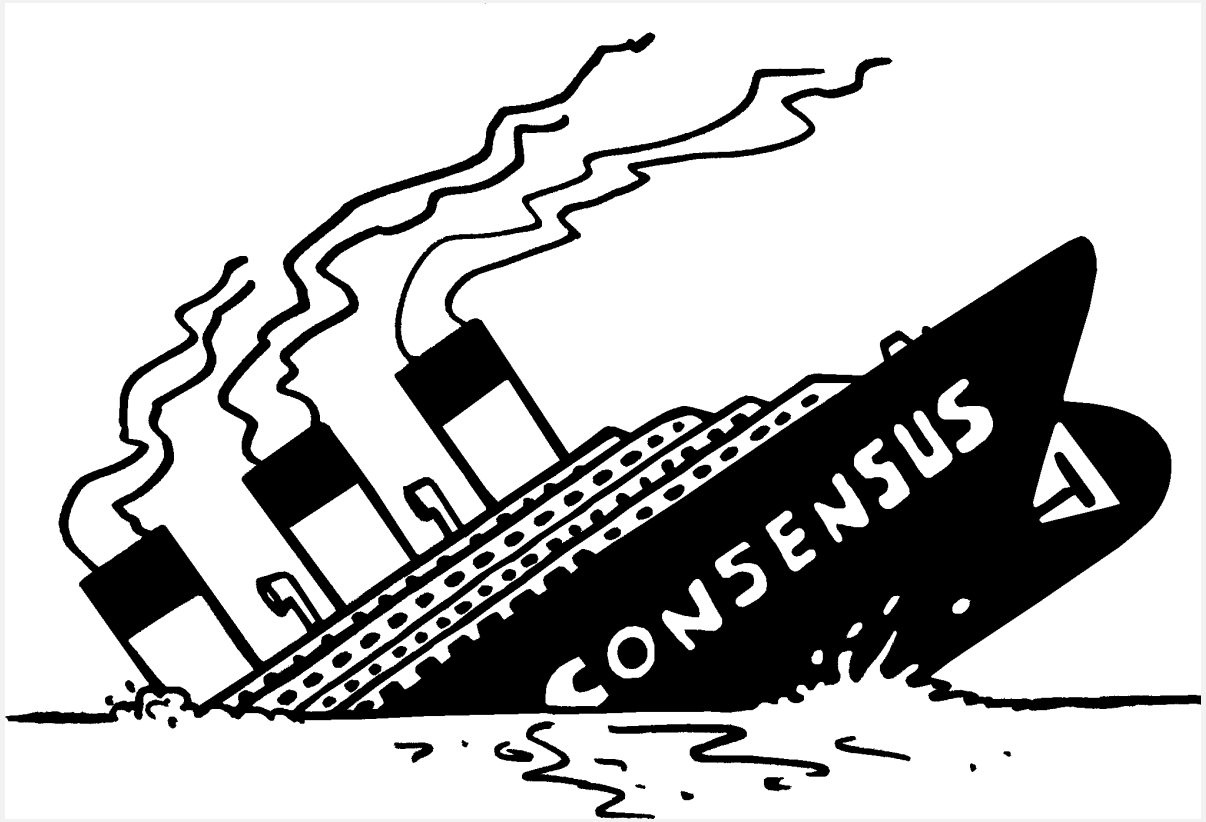
Domains/key concepts:

- pain
- disease severity
- participation
- physical function
- emotional and psychological function
- self efficacy
- catastrophizing
- patient's global impression of change

COMPACT RECOMMENDATIONS

DOMAIN	MEASURE
Pain	SF McGill Neuropathic scale PROMIS 29
Disease severity	CRPS Severity Scale
Participation	PROMIS 29 EQ-5D
Physical function	
Emotional and psychological functioning	PROMIS 29 Single item on suicidal ideation
Self-efficacy	Pain Self-Efficacy Questionnaire
Catastrophizing	Pain Catastrophizing Scale
Self-perception of change	GROC

RESULTS OF CONSENSUS

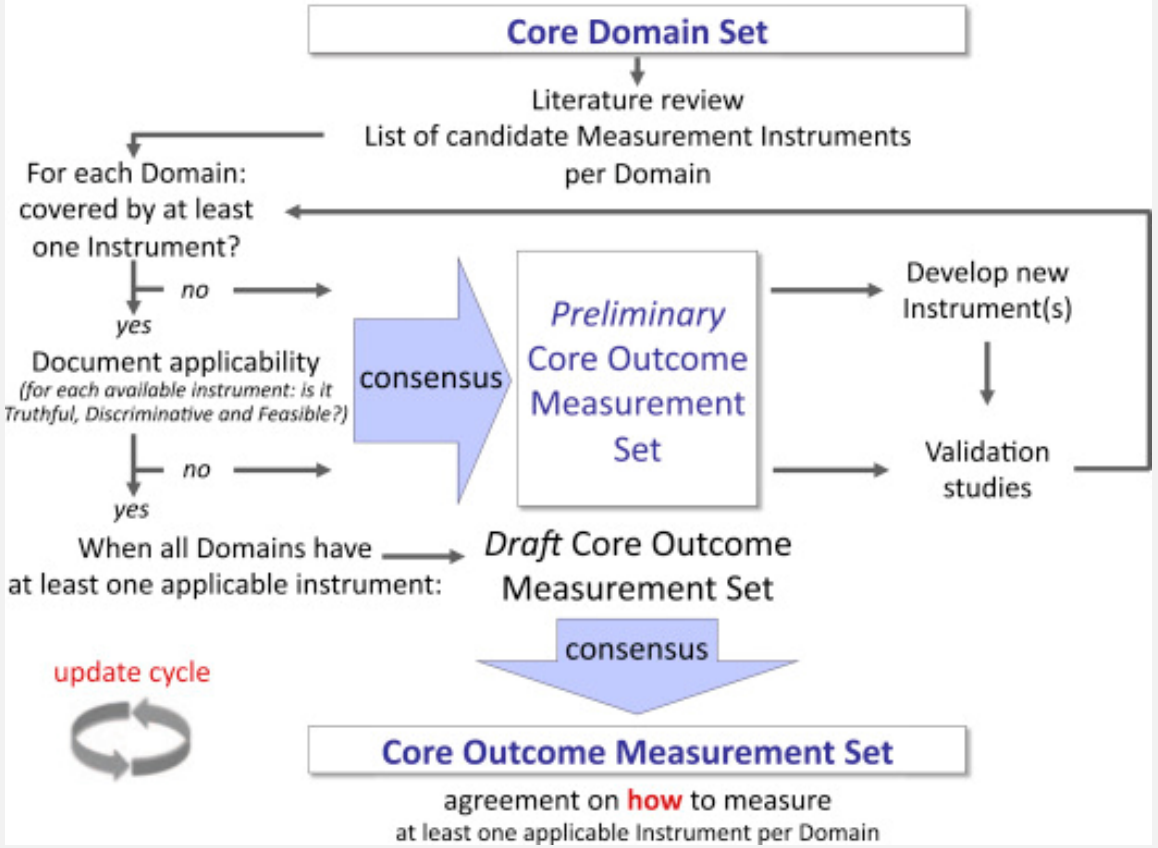


- OTHER Groups

- IMMPACT: Pain
- ICHOM: Thumb, wrist
- Swedish Consensus Panel DRF
- OMERACT: Hand OA

THEMES

- Pain and function patient-reported primary outcomes
  - Should be measured separately
- Radiographs, physical impairments are secondary outcomes



LITERATURE ON PROGNOSIS AFTER UPPER EXTREMITY FALL RELATED FRACTURES

Saurabh Mehta, PT, PhD

ADVERSE HEALTH OUTCOME AFTER UPPER EXTREMITY FRACTURES

Which fractures?

1) Fractures involving proximal and distal humerus

2) Fractures involving mid-forearm, distal forearm/wrist and carpal bones

Which outcomes matter to us?

Region/joint specific

- Chronic pain
- Upper extremity disability
- Return to work/prior level of participation

Overall health

- Fall-related injuries, including fractures
- Overall functional decline
- Frailty

CHRONIC PAIN AND DISABILITY

FRACTURES OF HUMERUS

Purpose: Predictive ability of patient variables on self-reported functions

Participants: Humeral shaft fractures (N = 77; 47 ± 20 years of age)

Predictors assessed: age, mental health, comorbid burden, location of fracture, smoking staus, high vs low energy, BMI, surgical vs non-surgical management, associated fractures

Outcomes assessed: satisfactory outcomes defined as scores of DASH < 21, SST ≥ 10, PCS and MCS of ≥ 40 at an average of 48 months after the injury

Shields E, Sundem L, Childs S, et al. Factors predicting patient-reported functional outcome scores after humeral shaft fractures. *Injury*. 2015;46(4):693-698.

RESULTS - PREDICTORS

	DASH < 21 Odds ratio (p)	SST ≥ 10 Odds ratio (p)	PCS ≥ 40 Odds ratio (p)	MCS ≥ 40 Odds ratio (p)
Age	**0.95 (0.023)**	-	-	-
Mental health problem (yes or no)	-	**6.3 (0.01)**	**12 (0.007)**	**39 (0.003)**
Comorbid burden (comorbid index)	-	-	**0.50 (0.023)**	**0.54 (0.035)**

Shields E, Sundem L, Childs S, et al. Factors predicting patient-reported functional outcome scores after humeral shaft fractures. *Injury.* 2015;46(4):693-698.

In summary

History of mental health issues (e.g. depression) is highly predictive of ongoing upper extremity disability as well as problems with mental and physical health

Age is associated with upper extremity disability; higher the age, the worse the disability

Higher comorbid burden associated with worse perceived mental and physical health

History of smoking, higher BMI, high energy fractures, associated fractures, location of fracture along humerus (e.g. proximal versus distal), type of orthopedic treatment (surgical vs non-surgical) are NOT associated with joint-specific or any other adverse health outcomes

Shields E, Sundem L, Childs S, et al. Factors predicting patient-reported functional outcome scores after humeral shaft fractures. *Injury*. 2015;46(4):693-698.

Purpose: Risk factors for poor functional outcomes after ORIF for shoulder fractures

Participants: Proximal humeral fractures (N = 129; 61.5 ± 13.5 years of age)

Predictors assessed: age, comorbid burden, post-surgical complication, education level, smoking status, BMI

Outcomes assessed: DASH scores on the scale of 0-100 at 12-months after surgery

Christiano A, Pean P, Konda S, Egol ZK. Functional outcome after proximal humerus fracture fixation : understanding the risk factors. *Acta orthopaedica Belgica*. 2017;83(1):1-7..

RESULTS - PREDICTORS

	DASH Scores Beta Coefficient (p)
Age	0.241, 95% CI 0.001, 0.48, p = 0.049
Education level (5 categories: <high school to post graduate)	-6.269, 95% CI -8.82, -3.72, p < 0.0005
Comorbid burden (comorbid index)	6.58, 95% CI 2.91, 10.25, p = 0.001
Post-surgical complication	8.515, 95% CI 0.19, 16.84, p = 0.045

Christiano A, Pean P, Konda S, Egol ZK. Functional outcome after proximal humerus fracture fixation : understanding the risk factors. *Acta orthopaedica Belgica*. 2017;83(1):1-7..

In summary

Lower the education, higher the reported upper extremity disability

Higher the age, the worse the upper extremity disability

Higher comorbid burden associated with worse upper extremity disability

Higher the number of post-surgical complications, worse the upper extremity disability

History of smoking and higher BMI are NOT associated with upper extremity disability

Christiano A, Pean P, Konda S, Egol ZK. Functional outcome after proximal humerus fracture fixation : understanding the risk factors. *Acta orthopaedica Belgica*. 2017;83(1):1-7..

Other important research……

Worse disability (higher DASH scores) in those >65 years of age, females, history of diabetes, osteoporosis (Kruithof et al 2017)

Individuals with mal-union do not necessarily experience poor functional outcomes (Devers et al 2015)

Individuals with Type 2 DM, especially women, experience more severe functional deficits and mortality (Martinez-Huedo 2017)

Those who are treated with shoulder immobilization for shoulder fracture demonstrate poor static and dynamic balance (Coleman and Clifft 2010)

FRACTURES OF WRIST

RISK FACTORS FOR POOR PAIN AND FUNCTION OUTCOMES

- A fairly large body of literature looking at the prognostic indicators of poor outcomes after wrist and forearm fractures
- There were multiple factors which were predictive of poor outcomes after sustaining wrist fractures such as a DRF. Being ≥65 years of age, of female sex, having high school education or less, and a reporting of high baseline pain were the variables consistently reported in the literature to be associated with poor pain and function after DRF.
- The table on the next slide shows the results for the associations between these variables and pain and functional outcomes for short-term (3 months of less) or long term (>3 months) after DRF.

Variable	Outcome - Pain or Function at Short-term (≤3 months) or Long-term (>3 months) after DRF
Radiographic Incongruity (High)	Function: At 3 months after DRF, ≥ 1mm of incongruity was associated with lower MHQ scores (β = -15.06, p=0.04) (Chung, Kotsis, & Kim 2007)
Age	Function: • At 6 months after DRF, individuals >50 years of age reported worse MHQ scores (β = 0.29, p=0.03) (Chung, Kotsis, & Kim 2007) • Similarly, an increase in age by every 10 years was associated with worse grip strength and wrist ROM (both p<0.001) (Cowie et al 2015) • Gliatis et al showed that individuals >30 years of age had worse functional outcomes (p<0.05) (Gilatis, Plessas, & Davis 2000) • Moore et al demonstrated that those ≥65 years of age showed significantly higher wrist/hand disability at 1 year compared to those <65 years (Moore & Leonardi-Bee 2008)

Variable	Outcome - Pain or Function at Short-term (≤3 months) or Long-term (>3 months) after DRF
High Baseline Pain	Pain: • Pain intensity of ≥5/10 scored on numerical rating scale 1 week after wrist fracture was highly associated with development of CRPS I (+ve LR of >15) (Moseley et al 2014) • Similarly, those who ≥35/50 scored on the pain scale of the PRWE 1 week after DRF were 8 times more likely to experience ongoing pain at 1 year after DRF (Sen/Spe: 85/78) (Mehta et al 2015) • Higher pain was also associated with high disability on the DASH as much as 2 years after DRF ($\beta = 3.91$, $p<0.0001$) (Swart et al 2012)

Variable	Outcome - Pain or Function at Short-term (≤3 months) or Long-term (>3 months) after DRF
Being Female	Risk of chronic pain/CRPS • Females were more likely to develop CRPS compared to males once hand therapy was initiated after a DRF (OR of 5.8, p = 0.016) (Jellad et al 2014) • Similarly, Roh et al also showed that females were 2.2 more likely to develop CRPS compared to males after a DRF (OR of 2.2, p = 0.02) (Roh et al 2014)
Others	• Income – patients in lower income strata had more functional impairments on MHQ (β = 2.78, p=0.002) (Chung, Kotsis, & Kim 2007) • Third-party claimants – patients with pending injury claims had higher PRWE scores at 1 year (β = 22.2, p<0.0001) (Grewal et al 2007)

Other relevant research

The following injury-related factors, irrespective of short- or long-term assessment period significantly associated with risk of poor pain & functional outcomes

- ✓ High energy fracture (Roh et al., 2014; Cowie et al, 2015)
- ✓ Pre-reduction or injury ulnar+ variance or radial shortening (MacDermid, et al 2002) (Egol et al, 2014)
- ✓ Greater severity of injury, e.g. comminution (Roh et al., 2014; Wakefield & McQueen, 2000)
- ✓ Mal-union (Grewal & MacDermid, 2007; Wakefield & McQueen, 2000)

In Summary

Patients with presence of one or more demographic, health, or injury-related variables are at risk of poor pain and functional outcomes after wrist fractures.

Patients receiving injury compensation

High energy injury

Mal-union

Age Score of ≥35/50 on PRWE pain scale or ≥5/10 at baseline

Lack of emotional or informational support

High school education or less

Lower socio-economic status

FALLS AND FUNCTIONAL DECLINE

FRACTURES OF HUMERUS

Purpose: The frequency with which individuals with upper extremity fractures receive fall risk assessment and treatment

Participants (humerus fracture cohort): Humeral shaft fractures (N = 98458; 79.66 ± 7.6 years of age)

Predictors assessed: age, sex, comorbid burden, wrist versus humerus fracture, being assessed of treated for fall risk 1 year prior to fracture, nursing home admission 3 months before

Outcomes assessed: required management of fall risk within 6 months after the fracture

McDonough CM, Colla CH, Carmichael D, et al. Falling Down on the Job: Evaluation and Treatment of Fall Risk Among Older Adults With Upper Extremity Fragility Fractures. *Physical therapy*. 2017;97(3):280-289.

RESULTS - PREDICTORS

	Fall risk management (Odds ratio)
Age	3.08
Sex	1.12
Charlson Score (2 versus 0)	1.74
Humerus versus wrist	1.48
Being treated with fall risk	5.35
Nursing home admission	1.89

McDonough CM, Colla CH, Carmichael D, et al. Falling Down on the Job: Evaluation and Treatment of Fall Risk Among Older Adults With Upper Extremity Fragility Fractures. *Physical therapy*. 2017;97(3):280-289.

In summary

Fewer than 20% of individuals with UE fractures had received fall risk assessment - inadequate screening practice

Being older, history of fall or gait assessment/treatment, humerus fracture (vs. wrist fracture), nursing home admission within 1 year - predict health care usage for fall risk management in the next 6 months after incident UE fractures

Shields E, Sundem L, Childs S, et al. Factors predicting patient-reported functional outcome scores after humeral shaft fractures. *Injury*. 2015;46(4):693-698.

FRACTURES OF WRIST

ORIGINAL ARTICLE

JBMR®

Wrist Fracture and Risk of Subsequent Fracture: Findings from the Women's Health Initiative Study

Carolyn J Crandall,[1] Kathleen M Hovey,[2] Jane A Cauley,[3] Christopher A Andrews,[4] Jeffrey R Curtis,[5] Jean Wactawski-Wende,[2] Nicole C Wright,[6] Wenjun Li,[7] and Meryl S LeBoff[8]

15.5% of women sustained non-wrist fragility fractures

Risk for subsequent fracture is greater women who has wrist fracture at younger age

Missed opportunity to intervene and modify the risk

BMJ

RESEARCH

Functional decline after incident wrist fractures—Study of Osteoporotic Fractures: prospective cohort study

Beatrice J Edwards, associate professor of medicine and orthopaedics,[1] Jing Song, biostatistics manager,[2] Dorothy D Dunlop, associate professor,[2] Howard A Fink, clinician investigator/staff physician,[3] Jane A Cauley, professor and vice chair for research[4]

Having wrist fracture increased the odds of functional decline by 48%

Risk factors predicting subsequent falls and osteoporotic fractures at 4 years after distal radius fracture—a prospective cohort study

Neha Dewan [1,2] · Joy C. MacDermid [1,2,3] · Ruby Grewal [2,3] · Karen Beattie [1,4]

Prior falls (≥2) in past year is an independent predictor of falls after wrist fracture

ASSESSMENT OF FALL RISK

JHT READ FOR CREDIT ARTICLE #333.
Scientific/Clinical Article

Reliability and validity of selected measures associated with increased fall risk in females over the age of 45 years with distal radius fracture – A pilot study

Saurabh P. Mehta PT, PhD [a,b,*], Joy C. MacDermid PT, PhD [c,d], Julie Richardson PT, PhD [c], Norma J. MacIntyre PT, PhD [c], Ruby Grewal MD, MSc, FRCSC [d,e]

ICC values > 0.75 for most measures, except those assessing PA

Expected divergent/convergent relationships

TIMED UP AND GO (TUG)

- Purpose: to assess mobility, balance, and fall risk in older adults
- Set-up: Define 3m walking path, place a target on the floor (painter's tape or a cone), place a chair with arm rests at the distance of 3m from the mark, have patient sit in the chair with his/her back against the backrest, patient should wear regular footwear and the usual gait aid (if any used by patient) should be kept close to the chair
- Procedures: The test involves getting up on the command of "Go", walking to the target that is 3 meters (9.8 feet) away, turn around at the target, walking back to the chair, and sit down. The test ends when the patient's buttocks touch the seat. Time in seconds recorded.

https://youtu.be/BA7Y_oLEIGY

TUG INTERPRETATION

Interpretation

<10 sec: Normal

10-14 seconds – moderate fall-risk

10-19 sec: Fairly mobile

>14 sec classified as fallers (prediction accuracy 90%)

20-29 sec: variably mobile

>30 sec: dependent in balance and mobility, significant difficulties in ADLs

87% sensitivity / 87% specificity

(Podsiadlo and Richardson: Am Geriatric Soc, 1991)

FUNCTION REACH (FR)

Purpose- Measures dynamic balance in a functional context of reaching forward

Set up - Patient stands sideways next to (but not touching) a wall, where a ruler is placed horizontally on the wall at his/her shoulder height. Patient will raise the straight arm (one towards the wall) out in front at 90° and make a fist.

Procedures: Therapist will mark this point on the ruler and then ask the patient to reach forward as much he/she can without moving the feet while keeping his/her hands in a fist shape. The location of the head of the 3rd metacarpal is marked and recorded at the start and at end of the reach.

https://youtu.be/_aJqJzt-U2s

FORWARD REACH INTERPRETATION

Interpretation

FR of < 18.5 cm indicates fall risk in frail elderly (75% Sensitivity, 67% Specificity) (Thomas et al. 2005)

FR of <7 inches indicates: Unable to leave neighborhood without help

Limited in mobility skills

Most restricted in ADLs

SIT-TO-STAND TEST - 30 SECONDS VERSION

Purpose: Assess functional strength of lower extremities in adults and older adults

Set up: Patient seated in the middle of a chair (17 inches height of seat from floor), preferably placed against a wall to prevent sliding, with back straight, feet approximately shoulder width apart placed slightly behind the knees, arms crossed and held against chest

Procedure: At the command of “Go”, patient rises to stand (body completely erect) and then returns back to the initial seated position (make sure patient is fully seated). Count number of repetitions completed in 30 seconds

https://youtu.be/Ng-UOHjTejY

SIT-TO-STAND TEST

What to expect??

- ✓Different age/sex groups and reference values for number of repetitions completed in 30 seconds

Age	60-64	65-69	70-74	75-79	80-84	85-89	90-94
Women	15	15	14	13	12	11	9
Men	17	16	15	14	13	11	9

MCID is 2 repetitions

(Jones, Rikli, Beam 1999)

PHYSICAL THERAPY INTERVENTIONS FOR MANAGING THE RISK OF ADVERSE OUTCOMES

Susan W Stralka PT, DPT, MS

Fractures of the Ulna and Radius

Galeazzi fracture-dislocation
Fracture of the distal third radius associated with dislocation of the inferior RUJ

Monteggia fracture dislocation
Ulnar fracture with associated dislocation of the radial head

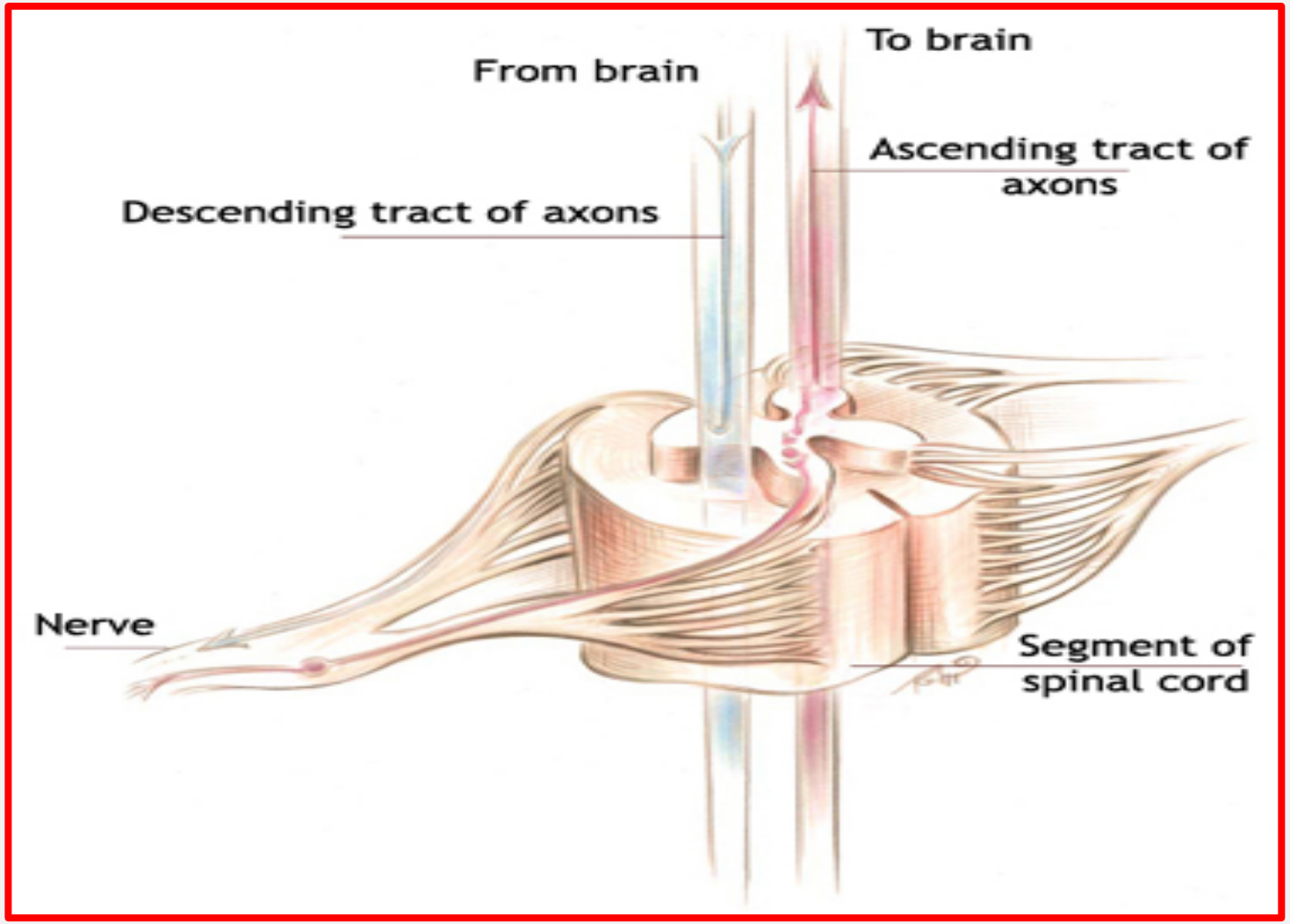
Colle's fracture
Transverse fracture of the radius (distal) with posterior (dorsal) displacement of the distal fragment.

Smith's fracture
Transverse fracture of the distal radius with anterior (volar) displacement of the distal fragment.

Barton's fracture
This is a form of Smith's fracture with volar subluxation of the carpus. Dorsal subluxation of the carpus is also possible ("Dorsal Barton's fracture").

photo credit: >Moff via photopin cc

PERIPHERAL AND CENTRAL NERVOUS SYSTEM



PERSISTENT PAIN

- After the tissue or bone have healed and the patient continues to have persistent pain or abnormal sensations.

PERSISTENT PAIN

- ✓Changes the brain
- ✓Sustained by aberrant process in PNS and CNS
- ✓Disproportionate to stimulation and not helpful

Gray Matter can shrink or thicken which changes the neural connection

PAIN

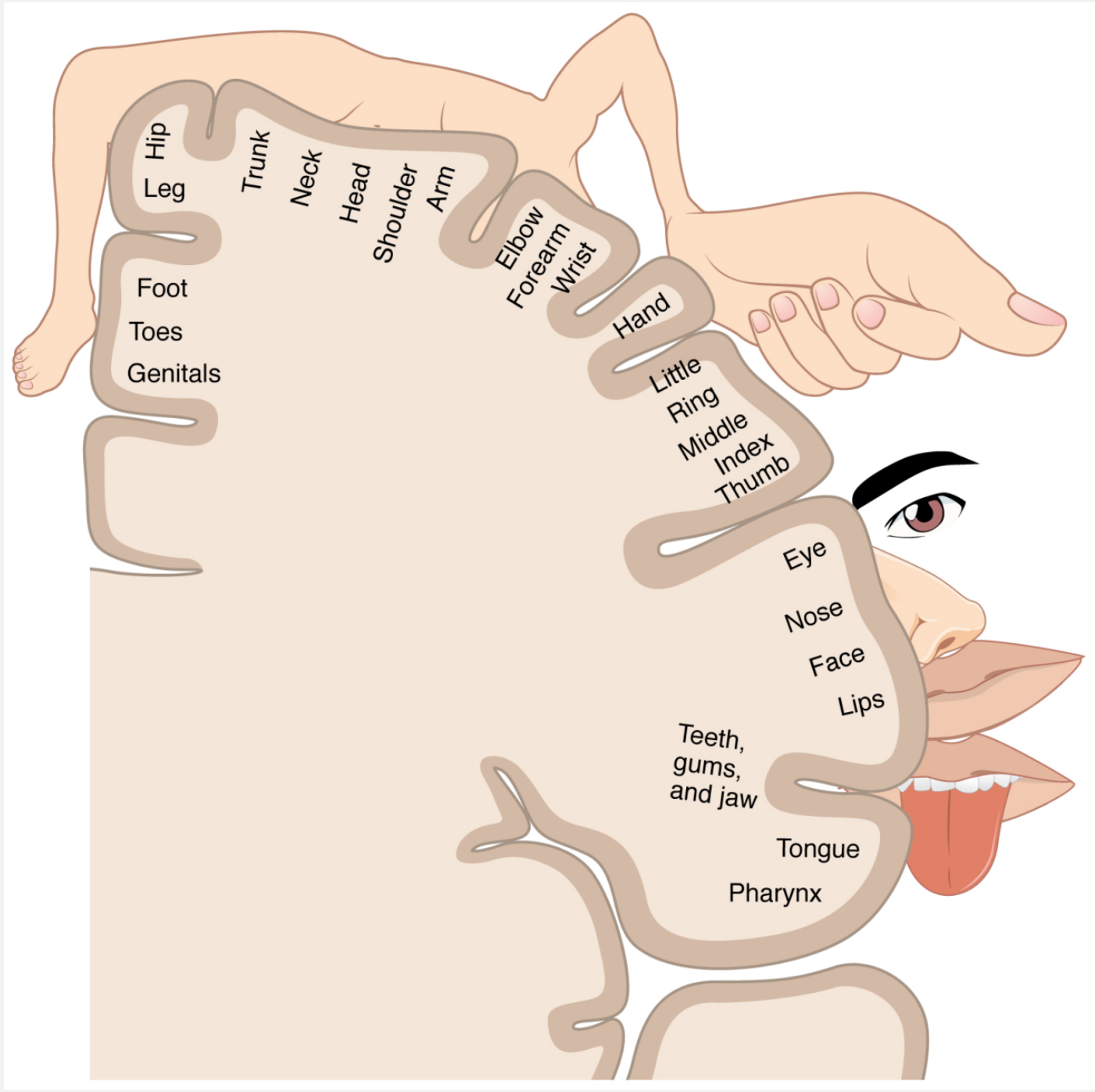
- Pain is one of the major risks factors inhibiting recovery and poor functional outcomes (Dekkers et al 2004; 2003 MacDermid et al 2003)
- Pain pain intensity during the acute stage post-injury determines the the patient's profile for rehabilitation and recovery MacDermid et al 2003
- Clinical Interpretation states pain control at early stages of rehabilitation is considered to be important for reducing long term disability level.

PAIN AFTER TISSUES OR BONES ARE HEALED

- This pain is associated with disruption of a range of body related cortical representation
- Evidence that this disruption maintains pain after the tissue has healed
- This disruption reflects maladaptive neuroplastic change so treatment should be aimed to normalize cortical representation.

POST FRACTURES

- Upper limb immobility with pain
- Edema
- Sensorimotor Changes
- Complex Regional Pain Syndrome - is this preventable
- Identifying predictors that may affect recovery
- Treatment while in cast start rehabilitation program early


Hip
Leg
Trunk
Neck
Head
Shoulder
Arm
Elbow
Forearm
Wrist
Hand
Foot
Toes
Genitals
Little
Ring
Middle
Index
Thumb
Eye
Nose
Face
Lips
Teeth, gums, and jaw
Tongue
Pharynx

PAIN TREATMENT

- Neuromatrix theory- multiple brain areas involved
- Pain is an output-start early
- Address Biopsychosocial – cognitive, emotional biolological, and social
- Neuroplasticity for cortical changes
- Don’t set off Neurotags

CORTICAL CHANGES

- Mis-localization tactile stimuli
- Changes in somatosensory map
- Changes in Motor Cortex representation
- Body perception disturbances
- Distortion
- Referred Sensations
- McCabe, C et al 2003

HEIGHTENED PAIN STATE: CENTRAL SENSITIZATION

- Clinical signs :
  - Allodynia (Wolfe 2006; Bashbaum 2009; Nijs 2013)
  - Primary and Secondary Hyperalgesia (O'Neil 2007; Wolfe 2001)
  - Thermal Sensitivity (Chien 2009)
  - Abnormal Movement and Symptoms Spreading (Smart 2011)
  - Positive Neural Provocation tests (Elvey 2008)

EVIDENCE FOR CORTICAL DISORGANIZATION

- Injury with mobilization early brain changes
- Pain - acute disproportionate pain
- Edema - neurogenic changes
- Type 1 Complex Regional Pain Syndrome - sensory motor incongruence and reorganization of the primary somatosensory cortex
- Evidence with fMRI

CENTRAL SENSITIZATION PAIN CHARACTERISTICS

- Symptoms of pain are generalized not localized
- Often away from primary site of injury
- Spreads throughout body in abnormal pattern
- Allodynia and Hyperalgesia present
- Increased response to multiple stimuli Mechanical, thermal or chemical
- Basic intolerance to both physical and emotional stressors

Nijs. J, It Hurts when you touch me. March 2012

SCREENING AND TESTING

- Pain interview - lanss (leeds assessment of neuropathic signs and symptoms)
- Cold intolerance either warm or cold
- allodynia
- Pressure pain threshold - (2009)
- Sensory discrimination - 2 point discrimination, s-w monofilaments

SCREENING/TESTING

SYMPTOMS

- **Sensory** - allodynia, hyperaglesia, hypoesthesia, abnormal sensations.
- **Autonomic dysfunctions -** temperature, sweating abnormalities changes and changes in skin color
- **Motor -** weakness, tremor, dystonia, myoclonia, difficulty in performing complex movement patterns
- **Trophic** - edema ,hair changes, fat pad atrophy

TREATMENT IDEAS

- Mind - Body Connection
- Pain causes altered motor control which leads to development of dysfunctional movement patterns
- Developing of protective movement and fear of movement causes musculoskeletal impairment
- Kinesophobia
- Cortical reorganization train the brain, uses all senses

Treat the uninvolved side

TARGETED PLASTICITY IN REHAB
ROSEN,LUNDBORG 2007; 2014

- Adaptive, Rapid, Slow and Guided Plasticity
- N=37 ulnar and median nerve repair
- Started 1 week after surgery sensory and motor relearning - mirror visual therapy and observation of touch
- Improvement at 6 months in discriminative touch
- Take away - immediate reeducation sensory and motor incorporate visuo-tactile stimulation with mirrors

COMPLEX REGIONAL PAIN SYNDROME FOLLOWING DRF TREATMENT IDEAS

- Reduce pain so it is manageable
- Reduce edema
- Reduce stiffness and improve ROM
- Restore cortical disorganization
- Calm central nervous system

IDENTIFICATION OF OTHER SYMPTOMS

- Wear sun glasses inside
- Hugs hurt them
- TV or Radio noise
- Turning of pages
- Thinking about moving hurts
- Fatigue, concentration difficulties, insomnia
- Symptoms can’t be reproduced and don’t make sense

PATHOPHYSIOLOGICAL MECHANISMS- NEUROGENIC INFLAMMATION

- Amplification of cytokines, CGRP and substance p
- Inadequate inactivation of inflammatory mediators- so prolonged inflammation
- More receptors available for inflammatory mediators
- Clinical signs- increased temperature, skin reddening, protein extravasation, edema, and nociceptive bombardment

Birklein and Schmelz 2008; Birklein and Kingery 2009

TREATMENT OF CENTRAL SENSITIZATION

- EDUCATION, EDUCATION, EDUCATION- MAJOR ROLE
- BIOPSYCHOSOCIAL APPROACH
- MANAGE TISSUE INJURY
- ESTABLISH ROLE FOR DECREASING STRESS
- PACING OF ACTIVITIES
- EXPECT FLAREUPS
- FEAR AVOIDANCE
- TREAT CNS-RELAXATION,SENSORY DISCRIMINATION, MIRROR THERAPY AND GRADED MOTOR IMAGERY

RESEARCH PRIOR 2018

- Prior to 2018 no studies using Graded Motor Imagery to reduce RISK of preventing CRPS in women following DRF with Immobilization

- Study design: single-blinded RCT, N=36

  weeks traditional therapy for 8

  weeks or traditional therapy and GMI

  measurement Visual analoge, Active ROM,

  dynamometer for grip strength and DASH

STUDY BY DILEK,AYHAN,YAGCI AND YAKUT

- Journal of Hand Therapy 31 (2018)2-9 ,Effectiveness of GMI to improve functions in DRF (n=36)
- DRF complicated prolonged recovery times, discomfort, pain, and decreased mobility
- CC - weakness, pain, stiffness, edema or other soft tissue problems
- Randomized control trial - 8 weeks
- GMI group improvement in pain intensity ROM,DASH and Michigan Hand Questionnaire

GRADED MOTOR IMAGERY (GMI)

- Pain management, increase motion and improve function
- Few studies on effectiveness in reducing pain and improving function
- Theory on GMI - aims to organize cortical activation gradually and reduce cortical disinhibition PREVENTING transition from acute to chronic pain
- Engage the cortical motor networks without triggering the protective pain response
- Optimizes sensory motor processing

GRADED MOTOR IMAGERY

Research randomized comparative trial N=33 while in cast

1 hr 4 times in clinic, home program 3 ten minute sessions daily

Blind assessments -1 week cast is baseline

3 weeks post-cast immobilization ,cast removal and 3 months

Measured wrist hand evaluation, McGill Pain Questionnaire, Budapest Criteria

Grip strength, AROM, Edema, joint position sense

Outcome - GMI should be incorporated into early rehab

GMI REWIRING THE BRAIN

- **Laterality Training or Reconstruction**
  - Restoration of brain's concept of left and right
  - When you look at someone's hand, try to imagine your hand in that position.

- **Imagery**
  - Conscious access to brain which are involved in intention, preparation and then carrying out the movement

- **Mirror Therapy**
  - The brain is tricked into thinking that the limb is better than the brain thinks it is

WHY GMI MIGHT WORK

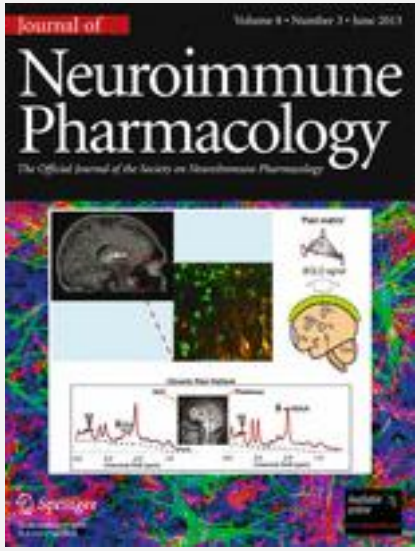
- Earlier work on cancer pain patients by Baider etal and Posadzki etal - visualization approaches help to reduce pain relief at the early stages
- Motor imagery and motor intention related with proprioception and vision share the same neural mechanisms
- Multiple visualization approaches including the 3 components of GMI - lateralization, motor imagery and mirror therapy
- Applying GMI at acute stage may lead to better pain control and functional outcomes.

Dilek, et al 2018 JHT vol 31.

TARGETING THE BRAIN

- Pain emerges from the brain according to the apparent danger of body tissues and the need for concerted response from the individual, not according to activity in nociceptive fibers or actual state of the tissue. (Moseley /Flor)

IMAGING AND CLINICAL EVIDENCE OF SENSORIMOTOR PROBLEMS IN CRPS;USING NOVEL TREATMENT APPROACHES



Bailey J, Nelson S, Lewis J, McCabe C, 2012

STRATEGIES TO NORMALIZE SENSORY REPRESENTATION

- Stimulus and functional context are important: example changes are induced in sensory cortical representation if the characteristics of the stimuli are important. Task MUST be important to cause change.. Reading braille, playing instrument , or unwrapping food.
- Tactile acuity improves when you have to differentiate stimuli during training

TREATMENT INCLUDES GRADED EXPOSURE TO ACTIVITY

- The patient is gradually exposed to feared activities without causing pain and thereby lowering the threat level in the brain.
- The feared activities could be imagined movements, novel movements, movement awareness exercises.
- Individualized to the person and to their pain experience

MANAGEMENT

PERIPHERAL

- Educate first
- Treat symptoms and tissue-physical agents
- Sensory Reeducation
- Manual techniques
- Splints or orthotics
- Exercise
- Neuromuscular retraining

CENTRAL

- Education first
- Mindfulness - be in the moment
- Calm down sympathetic nervous
- Sensory reeducation
- Mirror Therapy
- Graded Motor Imagery
- Cognitive and Behavioral training
- Neuromuscular retraining

- Psychological Assistance
- Pharmacologic Agents

Promote Tissue Healing

Treat Abnormal Pain Inputs and Central Sensitization

WHEN TO START GMI

LATERALITY TRAINING IMAGING → MIRROR THERAPY

Educate, Reactivate, Start GMIP
Edema Control, Nerve & Tendon Gliding Desensitization

↓

Flexibility
Edema Control - ContinuedDiagnosis & Treatment of Secondary Myofascial Pain
Normal Movement Patterns

↓

ROM (gentle), Stress Loading, General Acrobic Conditioning
Postural Normalization & Balanced Use

↓

Ergonomics, Movement Therapies, Normalization of Use
Vocational / Functional Rehabilitation

NORMALIZING MOTOR REPRSENTATION

- Slow, gentle, pain free movement
- Good movement programs - yoga, feldenkrais
- Increased awareness and understanding of how to move efficiently and self awareness

CALMING THE NERVOUS SYSTEM

- Diaphragmatic breathing
- Relaxation, mindfulness
- Threat reduction - mirror therapy and graded motor imagery
- Cognitive behavioral strategies
- Pacing into functional activities

STUDY PROTOCOL
MCGEE,SKYE,VAN HESS ALLIED HEALTH PROGRAMS UNIV MINNESOTA

- Graded Motor Imagery for women at risk for developing CRPS following distal radius fractures with immobilization
- Why - CRPS been shown to have changes in cortical representation
- Why GMI - rehabilitation technique which aims to restore cortical representation
- Why - no studies to date on reducing risk or preventing onset CRPS
- Six week randomized comparative effectiveness trial - modified GMI and standard of care (SOC) group compared to SOC
- Estimated to be completed 2021

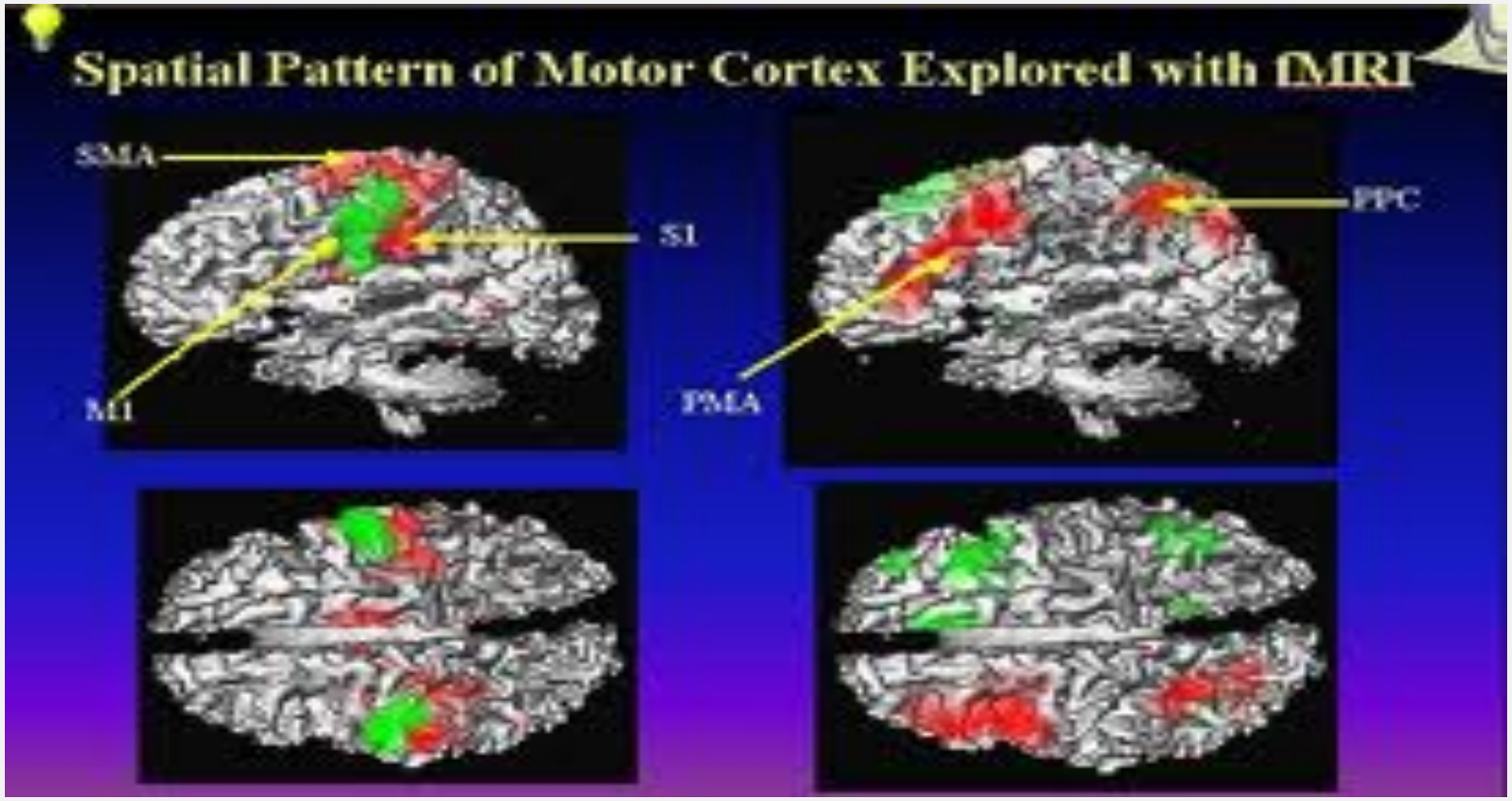
TOP DOWN AND BOTTOM UP MANAGEMENT

- Neuro rehabilitative strategies which target cortical areas and aim to restore impaired sensorimotor function in patients with CRPS have proven to not only restore impaired function, but also pain reduction .
- Functional imaging techniques might be a useful tool to accompany therapy studies to restore the alterations occurring in somatosensory and motor networks. Use good neuroplasticity not maladaptive neuroplasticity.

Schwenkreis,P, Mayer C, American Journal of Neuroradiology, 2009/

NO BRAIN, NO PAIN

- The brain decides whether something hurts, or not, 100 % of the time.
- Pain is an output of the brain not an input.



Questions

CASE STUDY POTENTIAL EARLY INTERVENTION

- 74 yo female immobilized 6 weeks for DRF cast removal twice, extreme pain even before cast put on ,allodynia on dorsum, .temperature change,and stiffness or decreased ROM
- Non-smoker, but history of osteopenia
- High school completed
- Lives alone
- High anxiety, fear of movement, catastrophizing (needs Psychosocial training and therapeutic education)
- Budapest Criteria for CRPS- Allodynia, temperature change, edema, and lack of movement

1. Continuing pain that is disproportionate to any inciting event.

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2. Must report at least one symptom in three of the four categories:

a. **Sensory:** hyperesthesia and/or allodynia

b. **Vasomotor:** temperature asymmetry and/or skin color changes and/or skin color asymmetry

c. **Sudomotor/edema:** reports of edema or sweating changes and/or sweating asymmetry

d. **Motor/trophic:** decreased range of motion and/or motor dysfunction (weakness, tremor, dystonia) and/or trophic changes (hair, nail, skin)

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3. Must display at least one sign in two or more of the following categories:

a. **Sensory:** hyperalgesia to pinprick, allodynia to light touch and/or deep somatic pressure and/or joint movement

b. **Vasomotor:** evidence of temperature asymmetry and/or skin color changes and/or asymmetry

c. **Sudomotor/edema:** evidence of edema and/or sweating changes an/or sweating asymmetry

d. **Motor/trophic:** evidence of decreased range of motion and/or motor dysfunction (weakness, tremor, dystonia) and/or trophic changes (hair, nail, skin)

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4. No other diagnosis that better explains the signs and symptoms.

CENTRAL SENSITIZATION INVENTORY: PART A

Name: _____ Date: _____

Please circle the best response to the right of each statement.

1	I feel tired and unrefreshed when I wake from sleeping.	Never	Rarely	Sometimes	Often	Always
2	My muscles feel stiff and achy.	Never	Rarely	Sometimes	Often	Always
3	I have anxiety attacks.	Never	Rarely	Sometimes	Often	Always
4	I grind or clench my teeth.	Never	Rarely	Sometimes	Often	Always
5	I have problems with diarrhea and/or constipation.	Never	Rarely	Sometimes	Often	Always
6	I need help in performing my daily activities.	Never	Rarely	Sometimes	Often	Always
7	I am sensitive to bright lights.	Never	Rarely	Sometimes	Often	Always
8	I get tired very easily when I am physically active.	Never	Rarely	Sometimes	Often	Always
9	I feel pain all over my body.	Never	Rarely	Sometimes	Often	Always
10	I have headaches.	Never	Rarely	Sometimes	Often	Always
11	I feel discomfort in my bladder and/or burning when I urinate.	Never	Rarely	Sometimes	Often	Always

ASSESSMENTS FALL RISK

- TUG (time up and go) purpose to assess mobility,balance and fall
- walking to a target 9.8/10 feet ,turn around at the target and walk back to chair and sit down. Time recorded when they sit down
- Interpretation (less 10 sec-30 secs) Mrs B had a time 27 sec and was classified in variably mobile .
- < 10 sec –normal
- 10-14 sec- moderate fall risk , 10-19 fairly mobile
- >14 classified as fallers (accuracy 90%)
- 20-29 sec variably mobility,30sec dependent

FORWARD REACH TEST (FR)

- Measures dynamic balance functionally when reaching forward
- Stand sideways to the wall make a fist and raise arm closest to the wall 90 degrees and reach forward. Can not move your feet .Score is measuring the forward distance using the head of the 3rd metacarpal
- FR,18.5 indicates fall risk
- FR of < 7 inches unable to leave house without assistance, needs assistance because of restricted ADL
- Mrs. B- 19.4 inches

SIT TO STAND TEST (30 SECS)

- Not done with Mrs B. at initial evaluation but 3 weeks into the program
- To determine lower extremity strength
- In chair and then stand up and down (30 secs)
- Count repetitions average 13 for 75-79 age group
- Mrs. B- 11

MRS B

Met criteria for CRPS-

Biopsychosocial model

Therapeutic Neuroscience education

Calm central nervous system

Train the brain - graded motor imagery, sensory rehab, normal movement pattern

Treat peripheral mechanisms without setting off pain

- Met criteria for fall risk-
- Home assessment-pictures
- ADL’s made easier
- Balance, gait program
- Tai Chi intervention

EVALUATION FOR CRPS

- Good history and clinical evaluation
- Budapest criteria
- Identify both peripheral and central symptoms
- Neuroscience education –make patient safe
- Calm the nervous systems
- Empower the patient
- Aerobic exercise
- Reevaluate for mechanism changes

DON'T MISS OPPORTUNITY TO INTERVENE AND MODIFY THE RISK

- Identify the mechanisms-Central Sensitivity Index
- Determine the psycho-social barriers-fear of movement, high anxiety and catastrophizing
- Tests to determine fall risk
- Therapeutic neuroscience education -so patients understand about pain and biopsychosocial approach –TREAT THE BRAIN AND PATIENT
- Calm the central nervous system
- **GOAL-FOCUS ON TREATING PAIN TO OPTIMIZE MOVEMENT AND FUNCTION**

PATIENT-RELATED WRIST EVALUATION (PRWE)

1. PAIN											
Rate the **average** amount of pain in your wrist over the past week by circling the number that best describes your pain on a scale from 0-10. A zero **(0)** means that you **did not** have any pain and a **ten (10)** means that you had the **worst pain you have ever experienced** or that **you could not do the activity because of pain.**											
RATE YOUR PAIN: Sample Scale ☞	0 No Pain	1	2	3	4	5	6	7	8	9	10 Worst Ever
At rest	0	1	2	3	4	5	6	7	8	9	10
When doing a task with a repeated wrist movement	0	1	2	3	4	5	6	7	8	9	10
When lifting a heavy object	0	1	2	3	4	5	6	7	8	9	10
When it is at its worst	0	1	2	3	4	5	6	7	8	9	10
How often do you have pain?	0 Never	1	2	3	4	5	6	7	8	9	10 Always

OUR ROLE GOOD NEUROPLASTICITY

Success