Functional recovery patterns in seriously injured automotive crash victims

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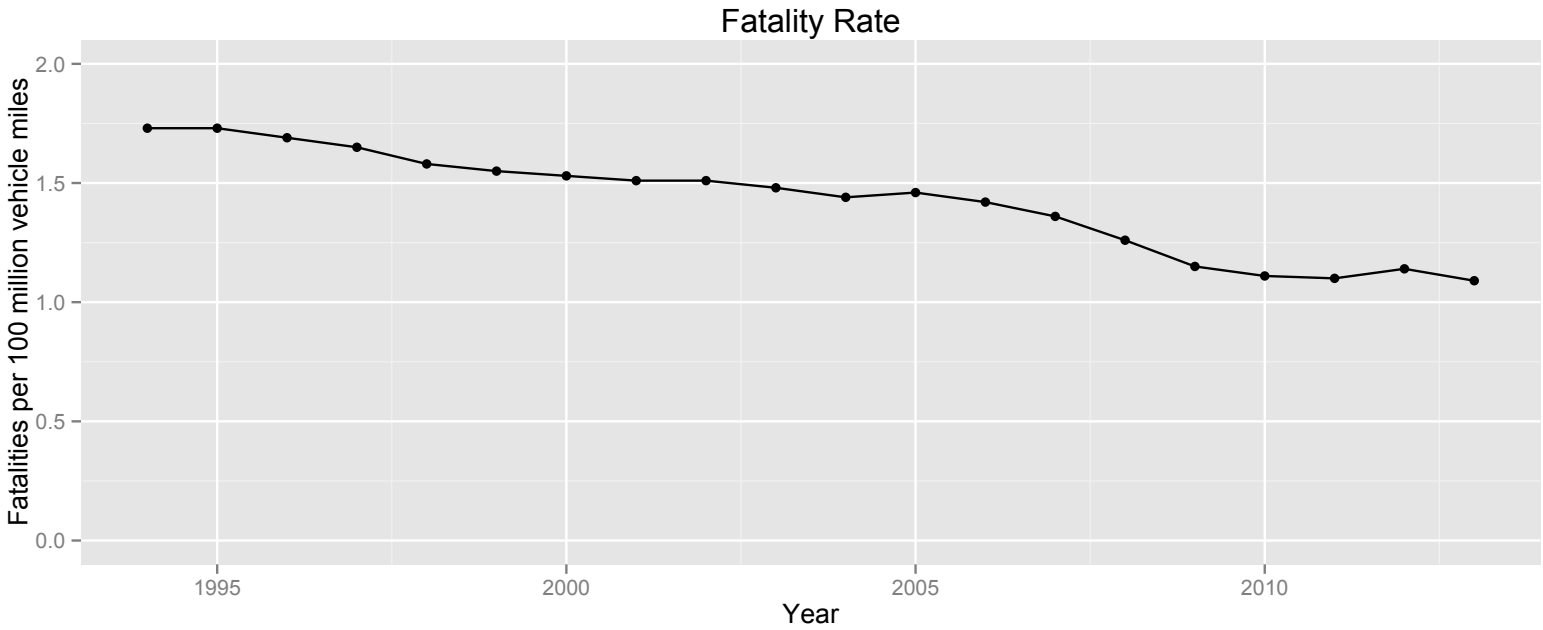
December 16, 2015

Background



- Substantial success in reducing fatality
- Future best return on investment may be a reduction in disabling injuries
- Need to quantify injury burden, tools aren't well validated

UVa/Inova Fairfax CIREN Project

Compare CIREN occupant

- Self-reported 12-month outcomes (Short Form 36)
- Predicted 12-month outcomes (Functional Capacity Index)

Functional Capacity Index

- Predicts functional ability 1 year post injury
- 0 (dead) to 100 (full recovery) scale
- Units are “Percent of Full Life”
- Natural interpretation in life years
- Linked to AIS 2005 (2008 update)
- No validation studies
- Applied in McMurry, et al., *AAAM/Traffic Injury Prevention*, 2015

Example

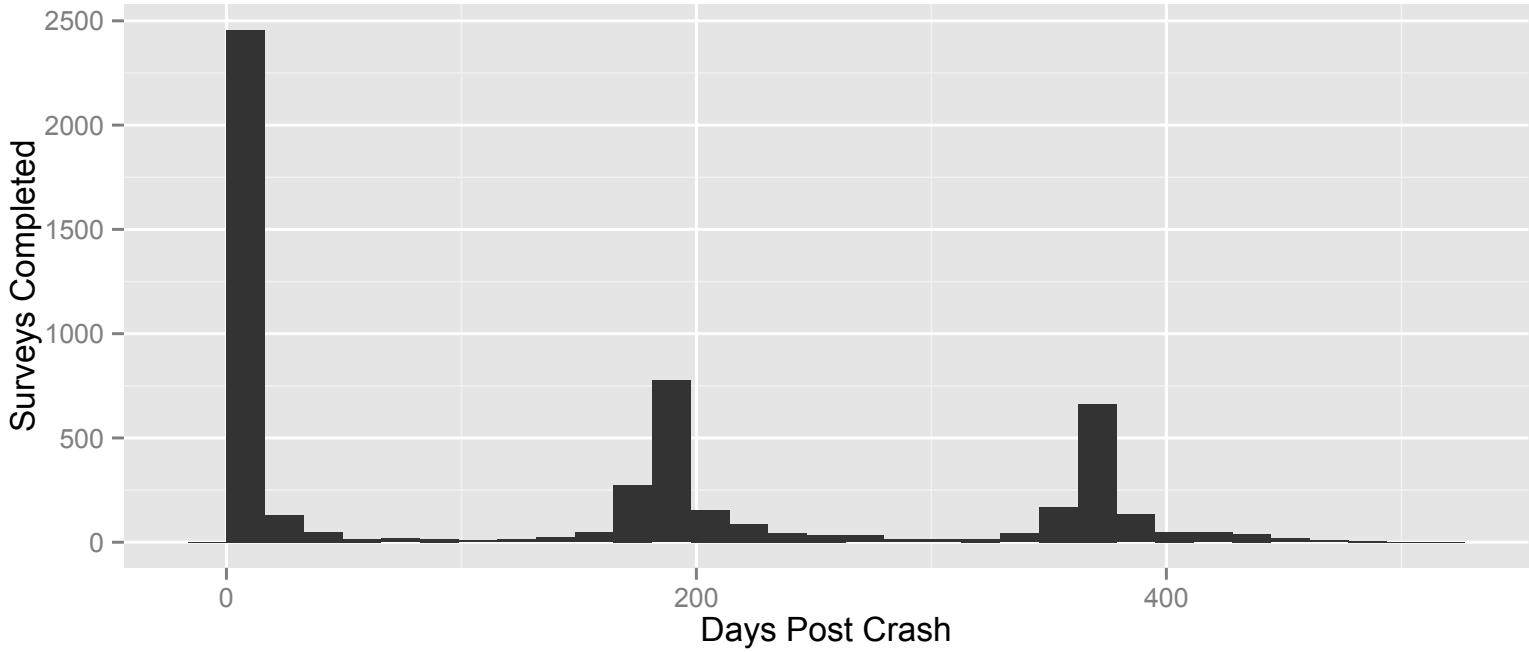
Single injury:

Calcaneus Fracture, $\geq$ 2 Surfaces, Open: FCI of 85.5.

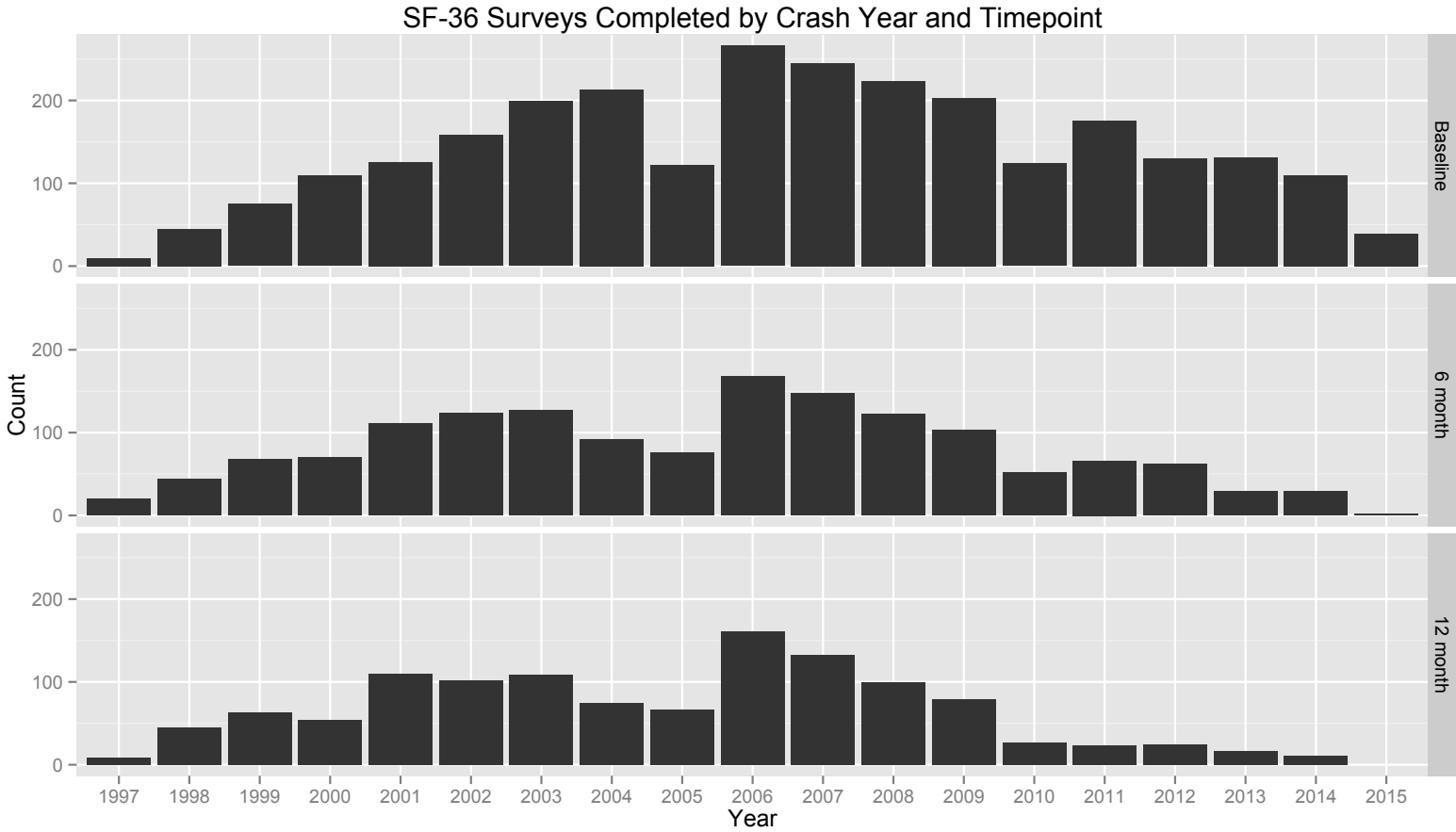
- All functional loss from ambulation
- Interpretation: 14.5% of future life lost

Short Form 36 (SF-36)

- 36 item health status self-assessment
- Subset of items: Physical Component Summary (PCS)
  - Mean 50, SD 10 in the general population
- (CIREN) Administered at baseline, 6, and 12 months



Crash Years With SF-36 Data



Project Goals

Use CIREN occupant SF-36 PCS data to

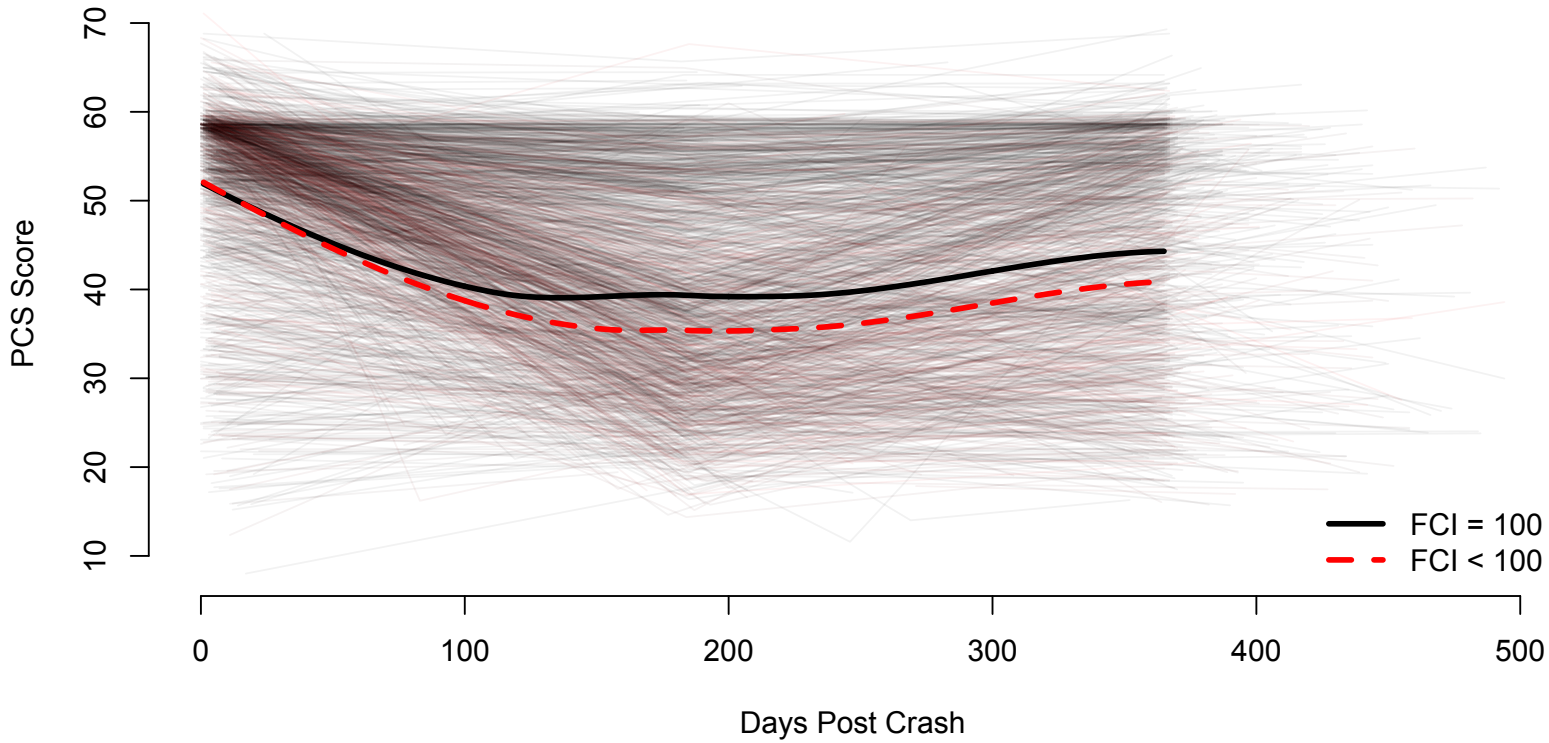
- Describe self-reported recovery patterns
- Evaluate the predictive ability of FCI
- Identify strengths and weaknesses in FCI

CIREN Occupants

$n = 2,668$		
Age: median (IQR)	43	(27,59)
MAIS: median (IQR)	3	(3,4)
BMI: median (IQR)	27	(23,31)
Male	1,215	(45.5%)
Cardiac Disease	696	(26.1%)
Diabetes	255	(9.6%)
Musculoskeletal	305	(11.4%)
Psychiatric Disorders	211	(7.9%)
Pulmonary	244	(9.1%)

Includes comorbidities affecting $>$ 5% of the SF-36 surveyed population.

Recovery Patterns in CIREN Occupants



- Subjects similar to US population at baseline
- FCI $=$ 100 group has not fully recovered 1 year post crash
- FCI $<$ 100 group shows less recovery

Mixed Effects Regression Model

Includes baseline and 12 month PCS. $R^2 = 0.62$.

	Estimate	Std. Error	p-value
FCI	0.2691	0.0317	< 0.0001
BMI (spline, 4 knots)	—	—	< 0.0001
Male	1.5286	0.3583	< 0.0001
12 month indicator	-1.2848	0.7762	0.0980
Max Head Inj	0.6762	0.2069	0.0011
Max Face Inj	-0.0344	0.3930	0.9302
Max Neck Inj	-0.9556	0.4887	0.0506
Max Thorax Inj	-0.4212	0.1820	0.0207
Max Ab Inj	0.3295	0.2288	0.1500
Max Spine Inj	-1.0411	0.2465	< 0.0001
Max UpEx Inj	-0.4741	0.2662	0.0750
Max LowEx Inj	-1.4666	0.2522	< 0.0001

Comorbidities are included in the regression, but not shown.

Common Injuries – Unexpected Functional Loss

Population

- $n = 101$
- FCI $= 100$
- PCS drop of ≥ 5 points at 12 months

Description	Count
Lumbar spine fracture with or without dislocation but no cord involvement, transverse process	21
Cervical spine fracture with or without dislocation but no cord involvement, facet	15
Cerebral concussion, loss of consciousness $<$ 1 hour	14
Lung contusion, unilateral NFS	13
Sternum fracture [OIS II, III]	13
Thoracic spine fracture with or without dislocation but no cord involvement, vertebral body, minor compression	11
Thoracic spine fracture with or without dislocation but no cord involvement, spinous process	10
Lumbar spine fracture with or without dislocation but no cord involvement, vertebral body, minor compression	10
Rib fractures without flail, any location unilateral or bilateral ≥ 3 ribs [OIS II]	9
Rib cage fracture $>$ 3 ribs on one side and ≤ 3 ribs on other side, stable chest or NFS, with hemo-pneumothorax	9

Common Disabling Injuries – Unexpected Full Recovery

Population

- $n = 137$
- FCI < 100
- PCS drop of ≤ 1 point at 12 months

Description	Count	FCI
Fibula fracture, lateral and medial malleoli/trimalleolar, open	12	92.8
Tibial shaft fracture, open	12	92.8
Proximal tibia fracture, complete articular; plateau; bicondylar; Schatzker 4,5,6	11	81.1
Calcaneus fracture, NFS	10	85.5
Fibula fracture, above joint	10	92.8
Proximal tibia fracture, complete articular; plateau; bicondylar; Schatzker 4,5,6, open	9	81.1
Talus fracture, NFS	7	92.8
Cerebrum, diffuse axonal injury, NFS	5	68
Distal femur fracture, extra-articular; supracondylar, NFS	5	87
Fibula fracture, below/through joint, open	4	92.8

Discussion

- FCI correlates significantly with patient reported outcomes
- Subjects continue to improve after 12 months
- FCI may underestimate the burden of spine and lower extremity injuries
- Unclear how to interpret head injury results
- Renewed emphasis on SF-36 collection would be valuable for understanding long term impairment

Limitations

- Conversion from older versions of AIS
- Non-response bias

Special Thanks To

NHTSA CIREN

- Rodney Rudd, PhD
- Mark Scarboro

UVa-Inova Fairfax Team

- Christiane Vo
- Rob Freeth
- Mike Burke
- Nicole Paranich
- Lea Becker
- Jeff Crandall, PhD
- Thomas Hartka, MD
- C. Greg Shaw, PhD
- Christopher Michetti, MD
- Gerald Poplin, PhD