Trauma in the Elderly

C M Ursic
St George Hospital
Sydney

I don't want to achieve immortality
through my work...
I want to achieve it through not dying.

Woody Allen

WHO Classification

"Aging is the combination of a set of gradual physiologic, organic, and emotional alterations, or the gradual and irreversible organic deterioration to adapt to environmental alterations."

Middle Age	45-59 yrs
Elderly	60-74 yrs
Aged	75-90 yrs
Very Old	>90 yrs

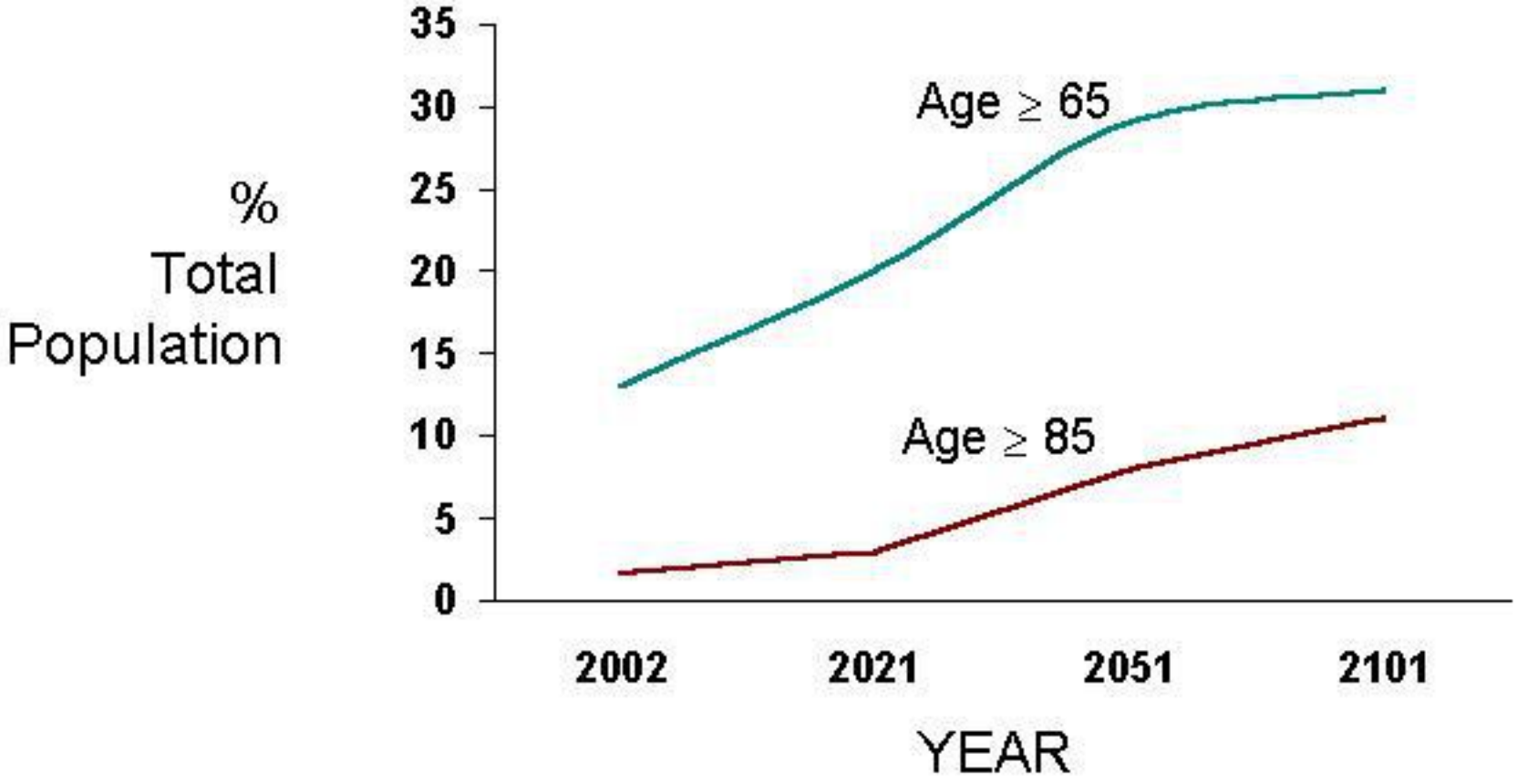
Statistics
Te Tari Tatau

MEDIAN AGE:

2002:	35 yrs
2021:	40 yrs
2051:	45 yrs

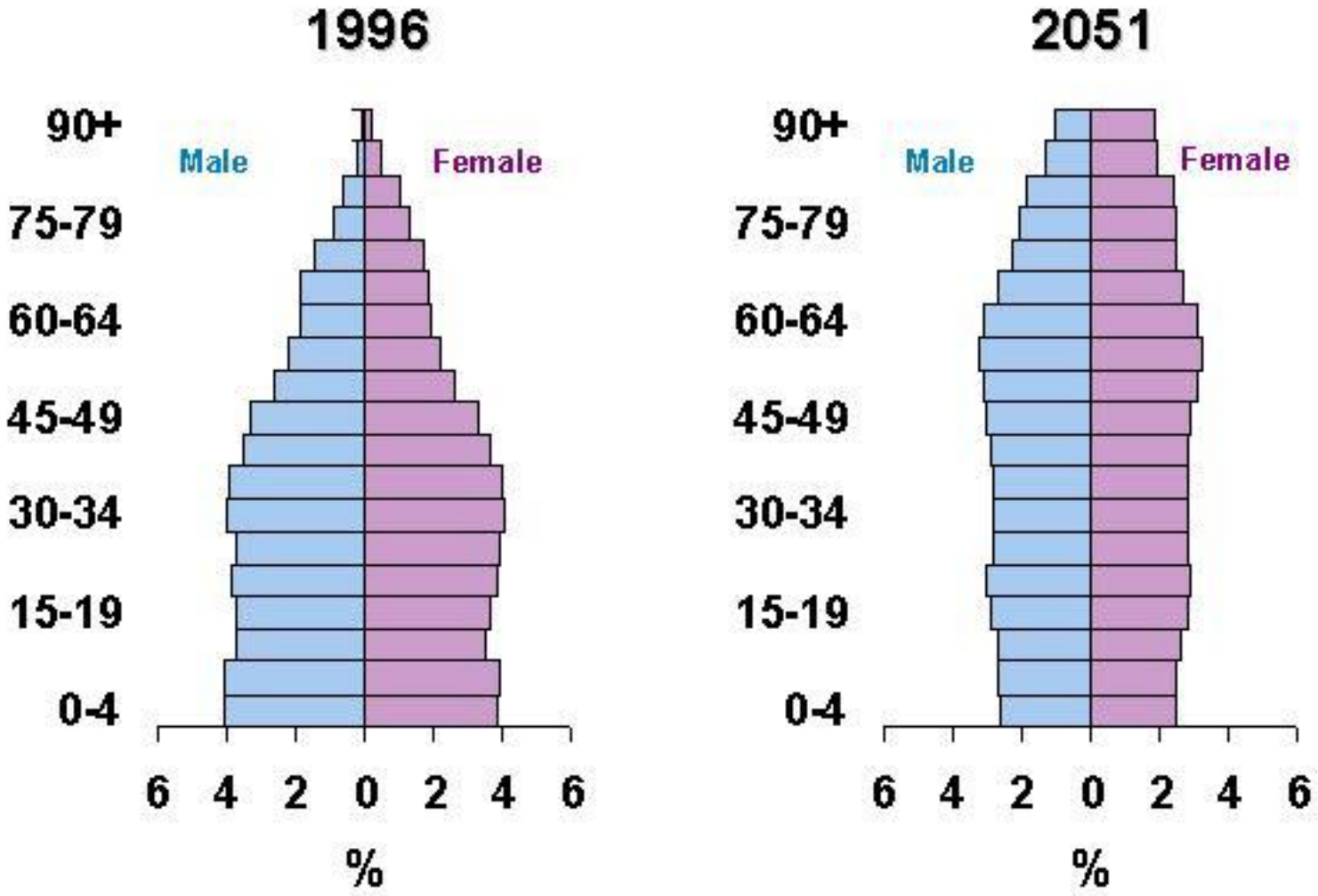
Australian Bureau of Statistics
An agency of the Australian Government

POPULATION GROWTH BY AGE AUSTRALIA



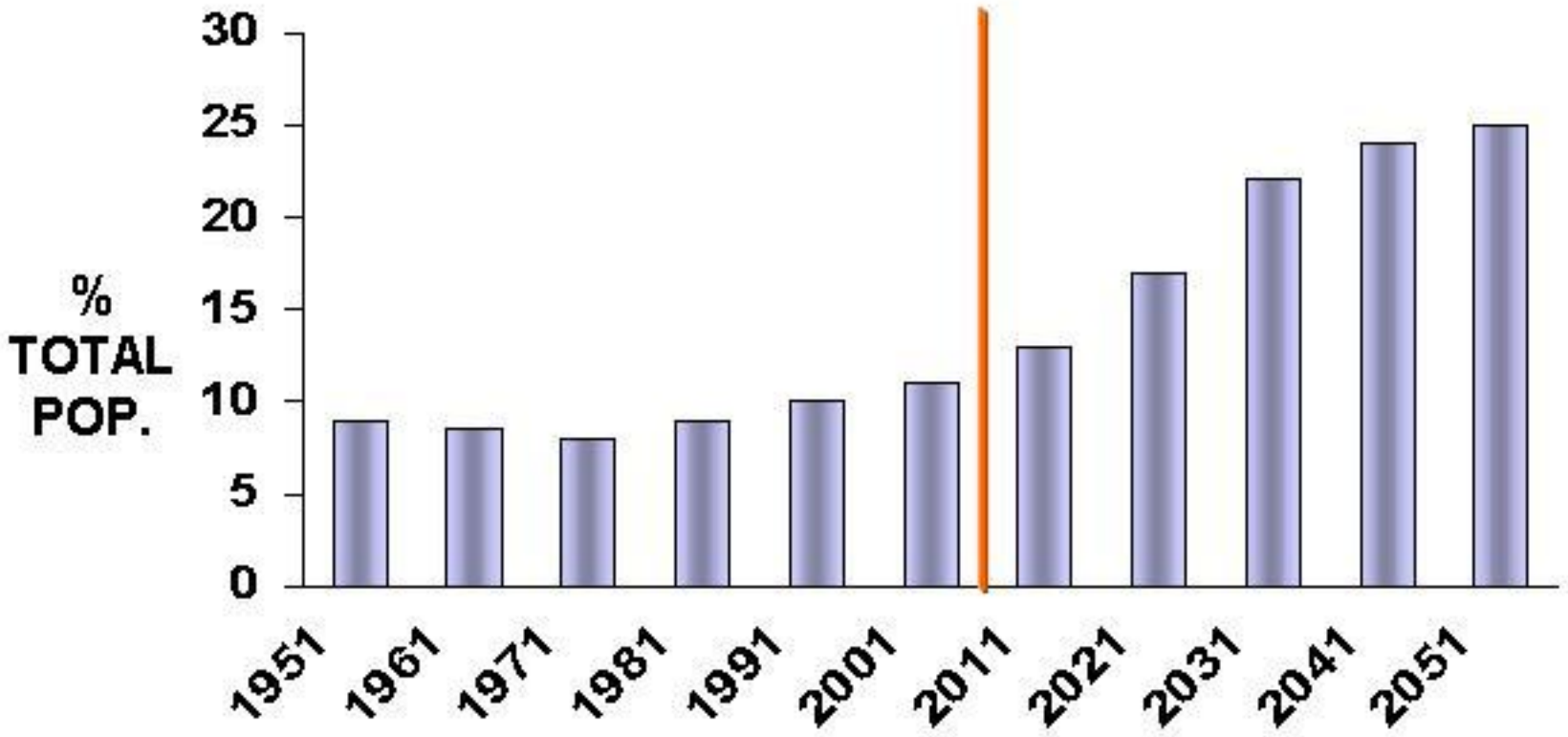
Statistics
Te Tari Tatau

POPULATION, Age and Sex
NEW ZEALAND



Statistics
Te Tari Tatau

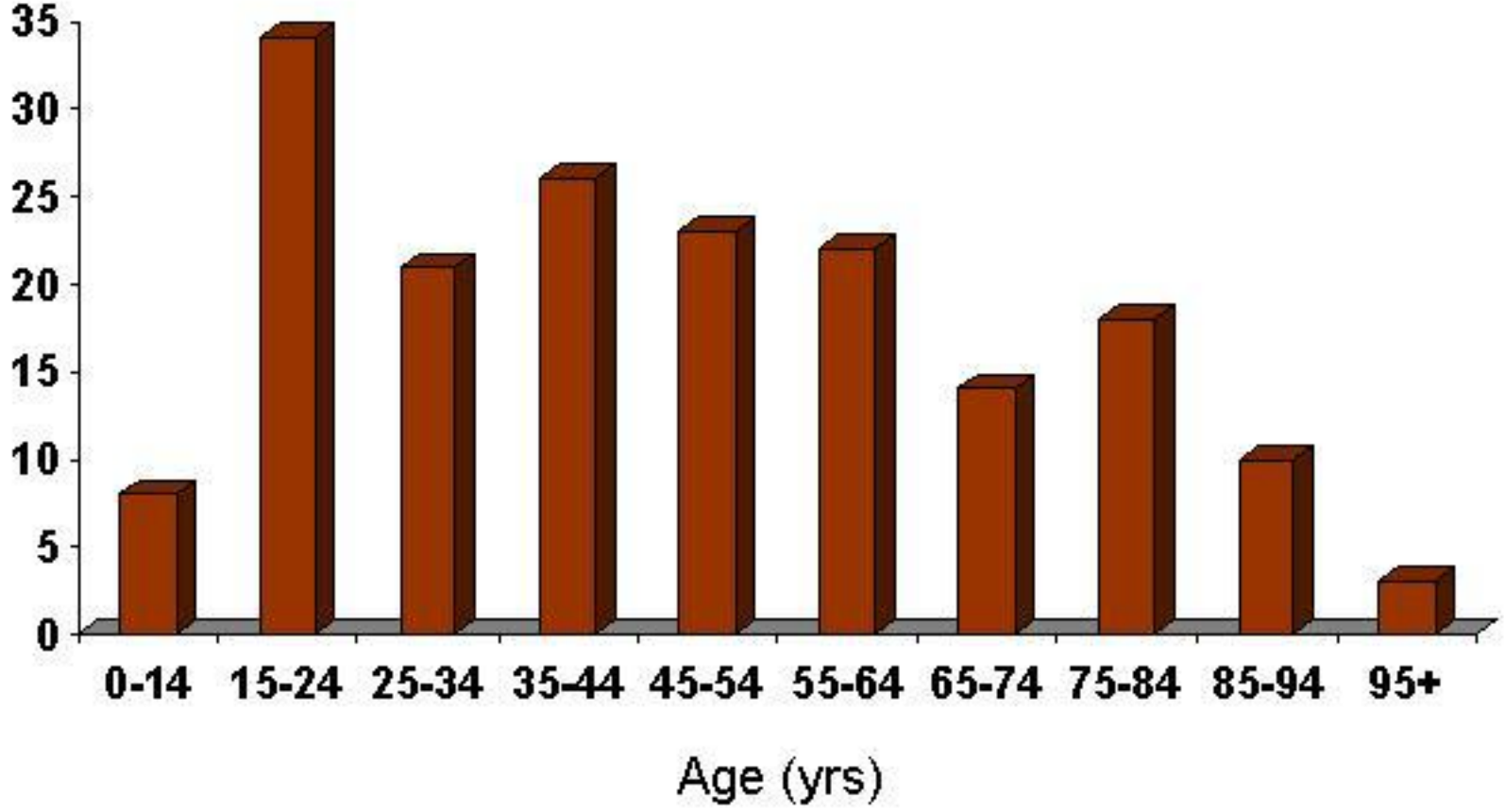
POPULATION > 65
NEW ZEALAND



ST GEORGE HOSPITAL

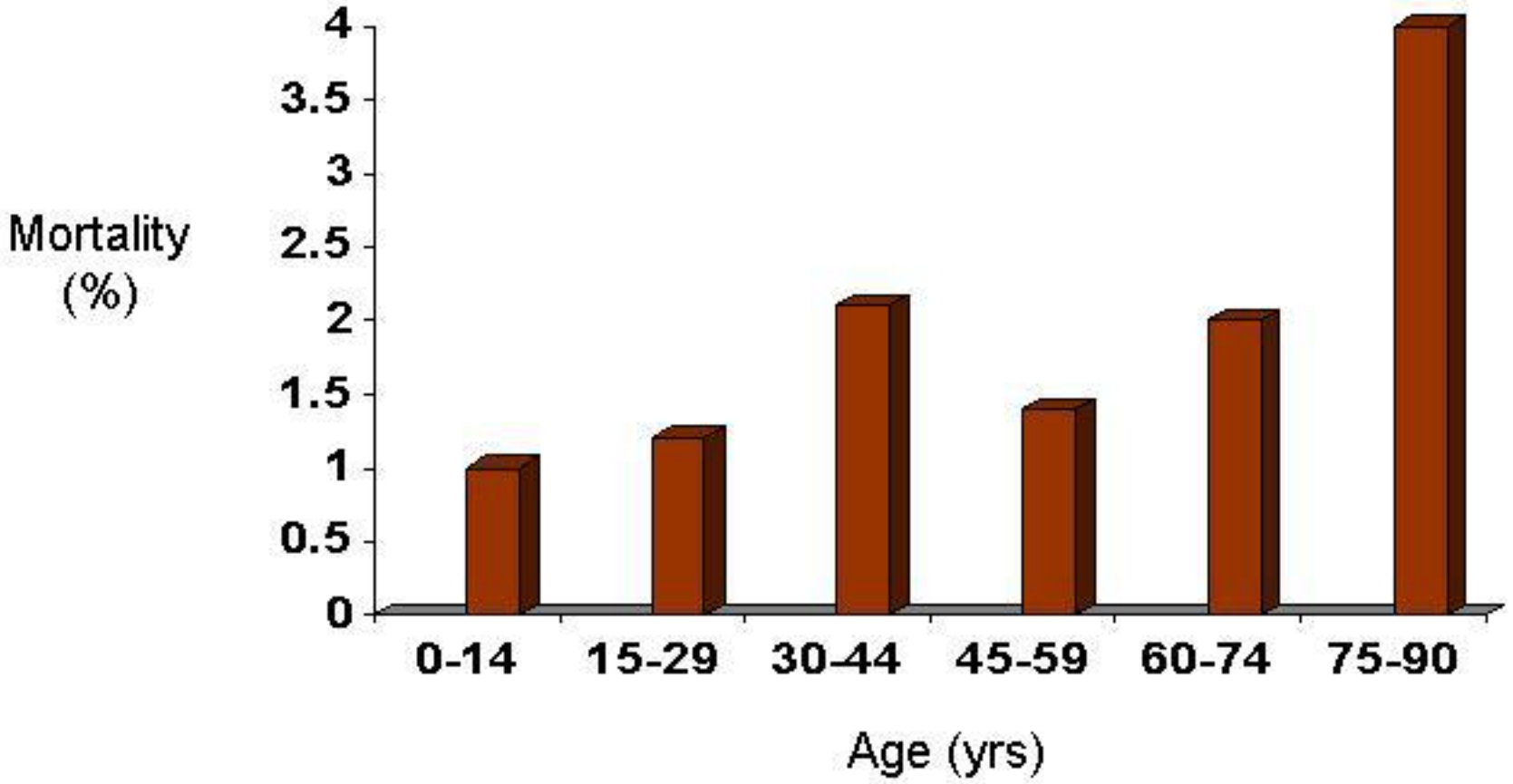
TRAUMA ADMISSIONS: ISS>15

2003



ST GEORGE HOSPITAL
2003

TRAUMA MORTALITY BY AGE



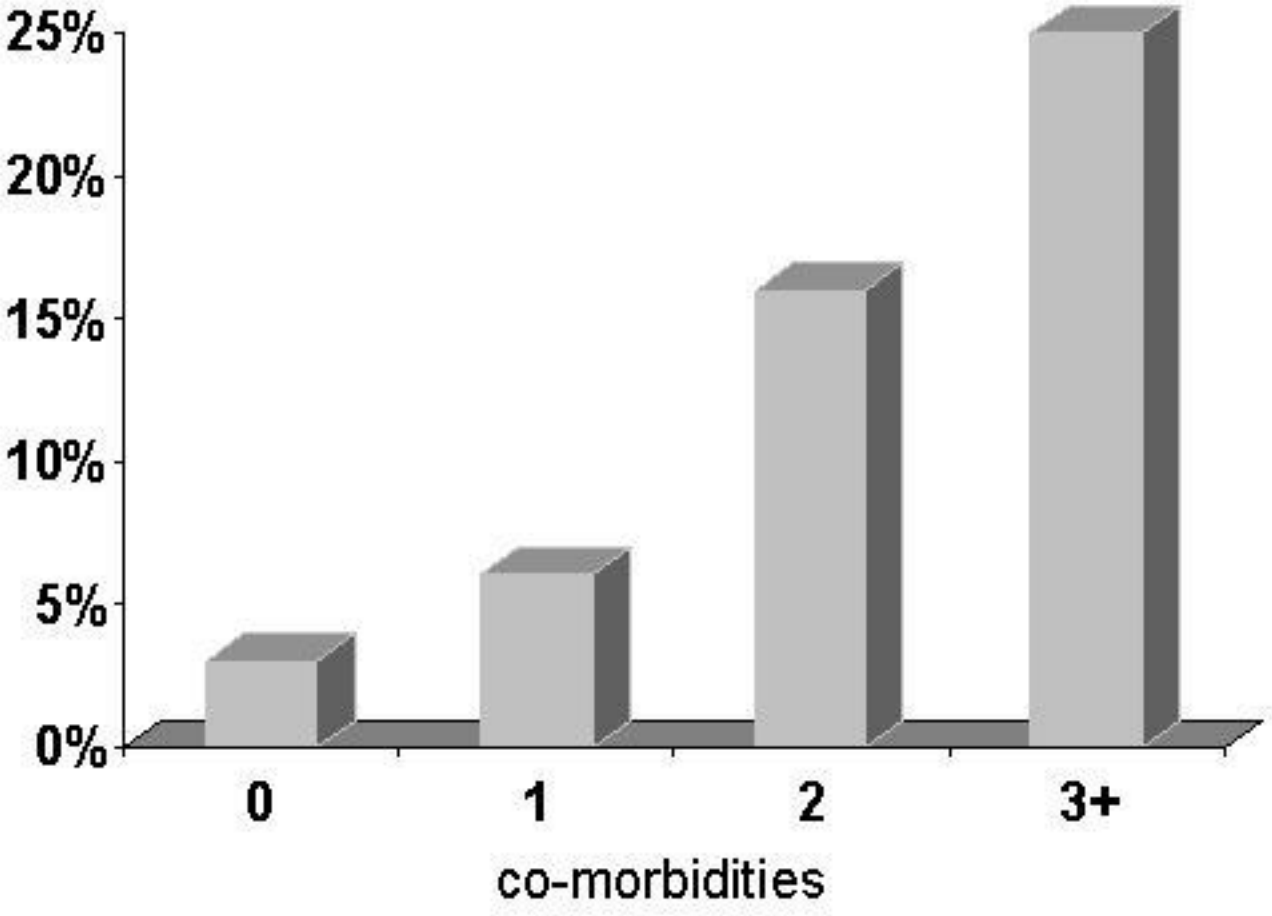
Geriatric Trauma Victims Have:

1. Higher Mortality Rate
2. Higher Complication Rate
3. Longer Hospital Stay

- For Equivalent Injury Severity

Champion, et al, AJPH 1989

Pre-existing Diseases and Mortality



Milzman DP, et al J. Trauma 1992

Increased Relative Risk of Death by Chronic Medical Condition and Injury Severity Score (ISS)

McGwin, et al
J Trauma 2004

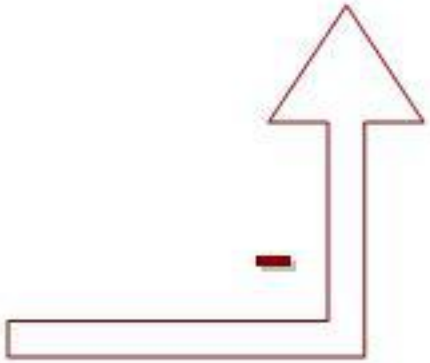
RR DEATH (95% CI)

PREEXISTING CONDITION	ISS		
	1-15	16-25	25+
Renal	4.09	1.88	
Cardiac	3.17	1.35	
Hepatic	3.04	1.82	
Respiratory	1.87	1.30	
Hematologic	1.42		
Imm.-compromised	1.34		
Neurologic	1.29		
Obesity		1.18	1.31
Immunologic			1.19

Source: National Trauma Data Bank

PHYSIOLOGY OF AGING

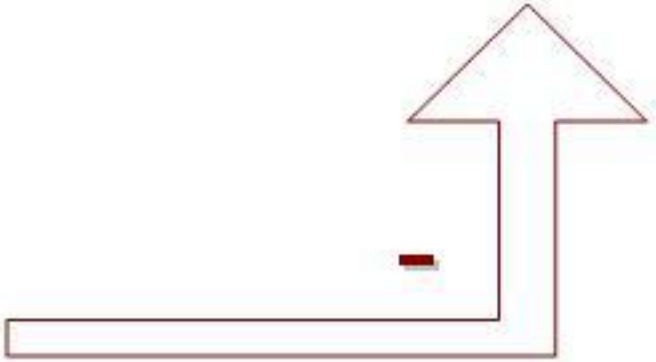
CO = SV x HR



Myocardium
- Degeneration
- Fatty infiltration
- Stiffening, loss of elasticity

PHYSIOLOGY OF AGING

CO = SV x HR



Conduction
⇩ Beta receptors
⇩ Pacing myocytes
AV node atrophy
Bundle branch atrophy

Impaired ability to raise heart rate in response to stress

PHYSIOLOGY OF AGING

Atherosclerotic occlusive disease

Valvular thickening & calcification

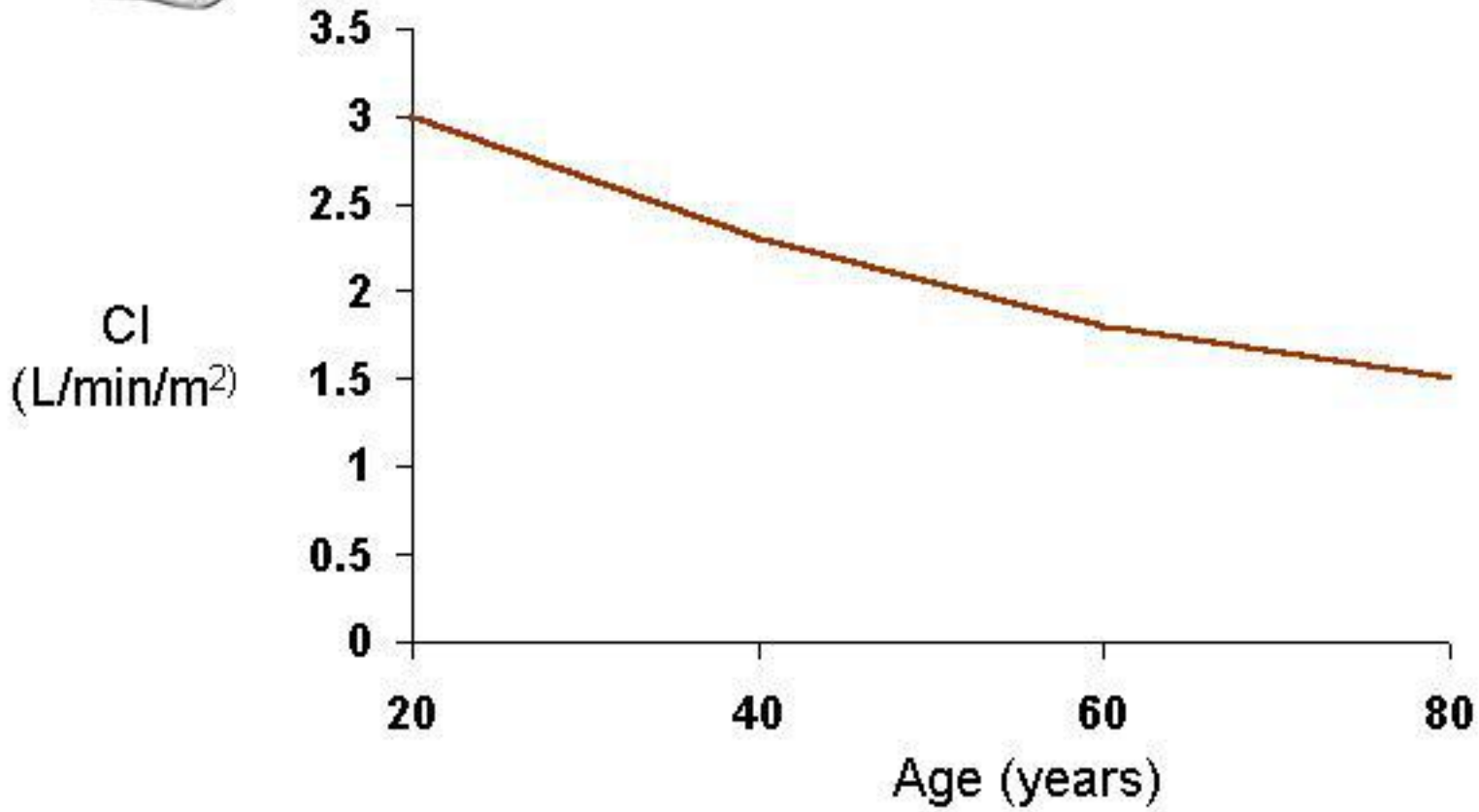
→ Myocardia ischemia

Drugs
- Beta blockers
- Calcium channel blockers
- Afterload reducers

Pacemakers

→ Limited cardiac output

PHYSIOLOGY OF AGING



PHYSIOLOGY OF AGING

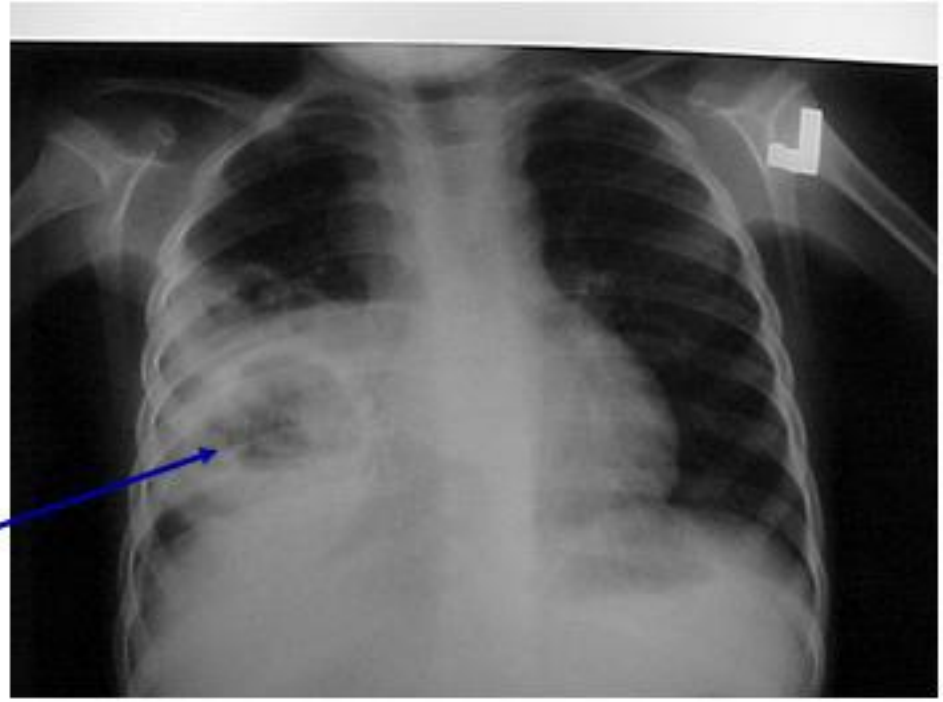
⇩ Alveolar elasticity
⇩ Alveolar size

⇧ Atelectasis
⇧ Air trapping

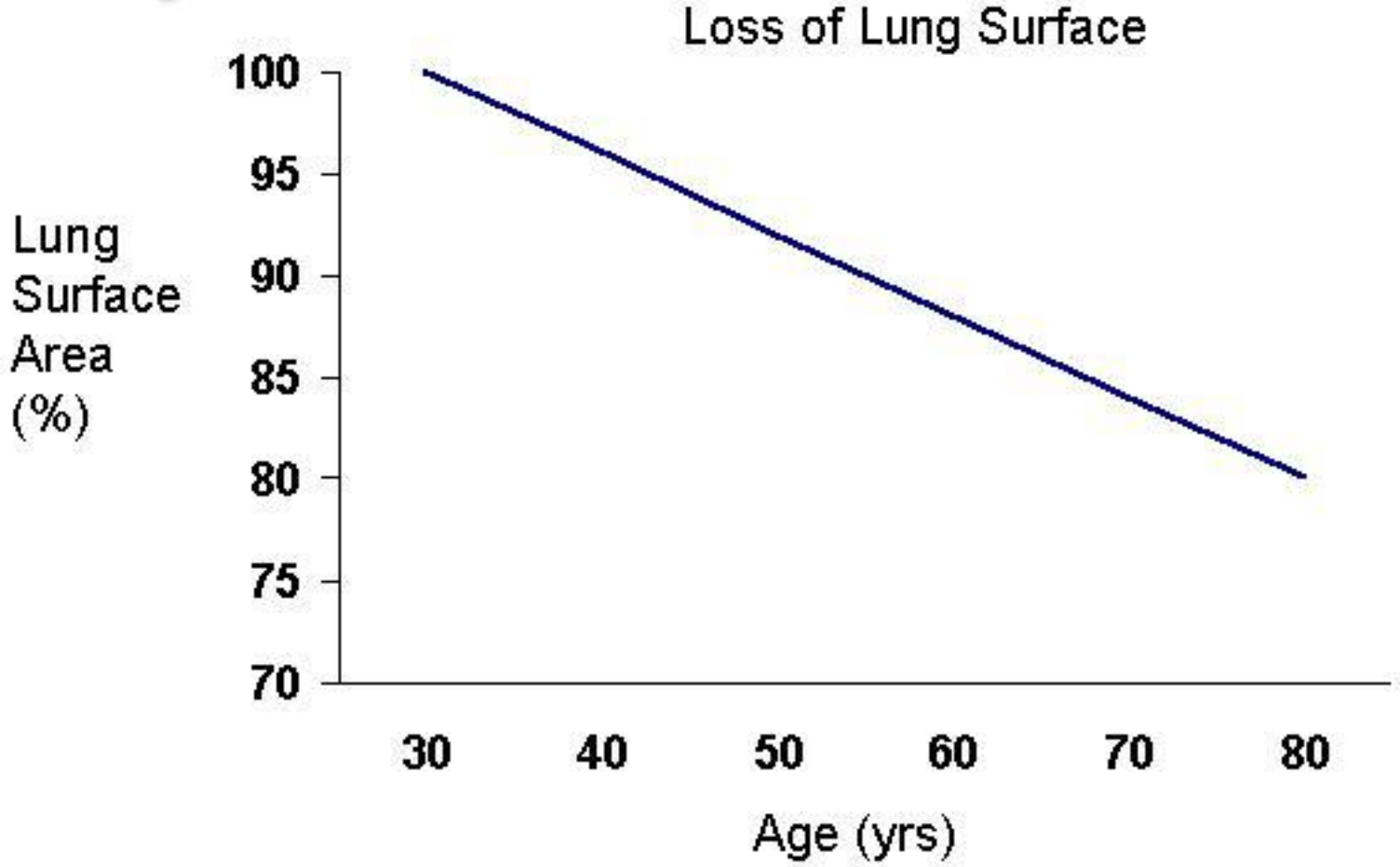
PHYSIOLOGY OF AGING

⇩ Cough & laryngeal reflexes
⇩ Cough strength
⇩ LES tone
⇩ Mucociliary transport

⇧ aspiration risk



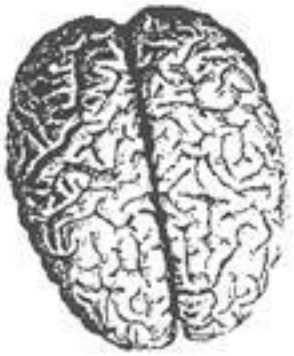
PHYSIOLOGY OF AGING



PHYSIOLOGY OF AGING

PROBLEM	AGE OF ONSET
Chest wall Stiffening	20
Loss of rib density/strength	30

PHYSIOLOGY OF AGING



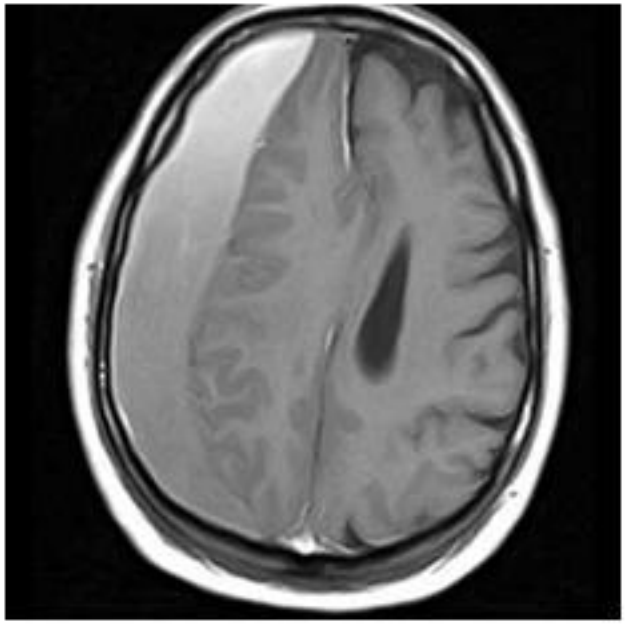
Structural Changes

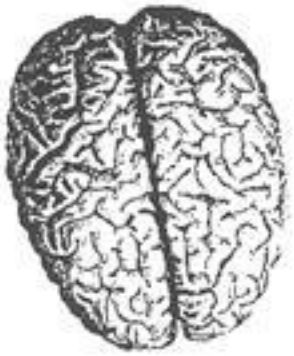
Cerebral atrophy:10% loss of weight

greater movement of brain within skull

•Shearing / rotation

hematomas



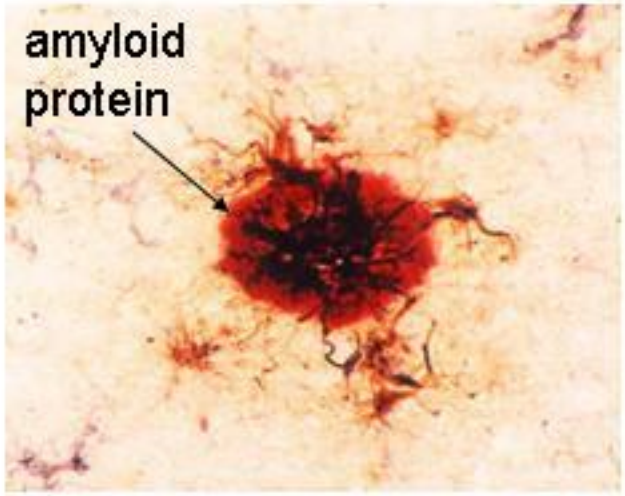


PHYSIOLOGY OF AGING

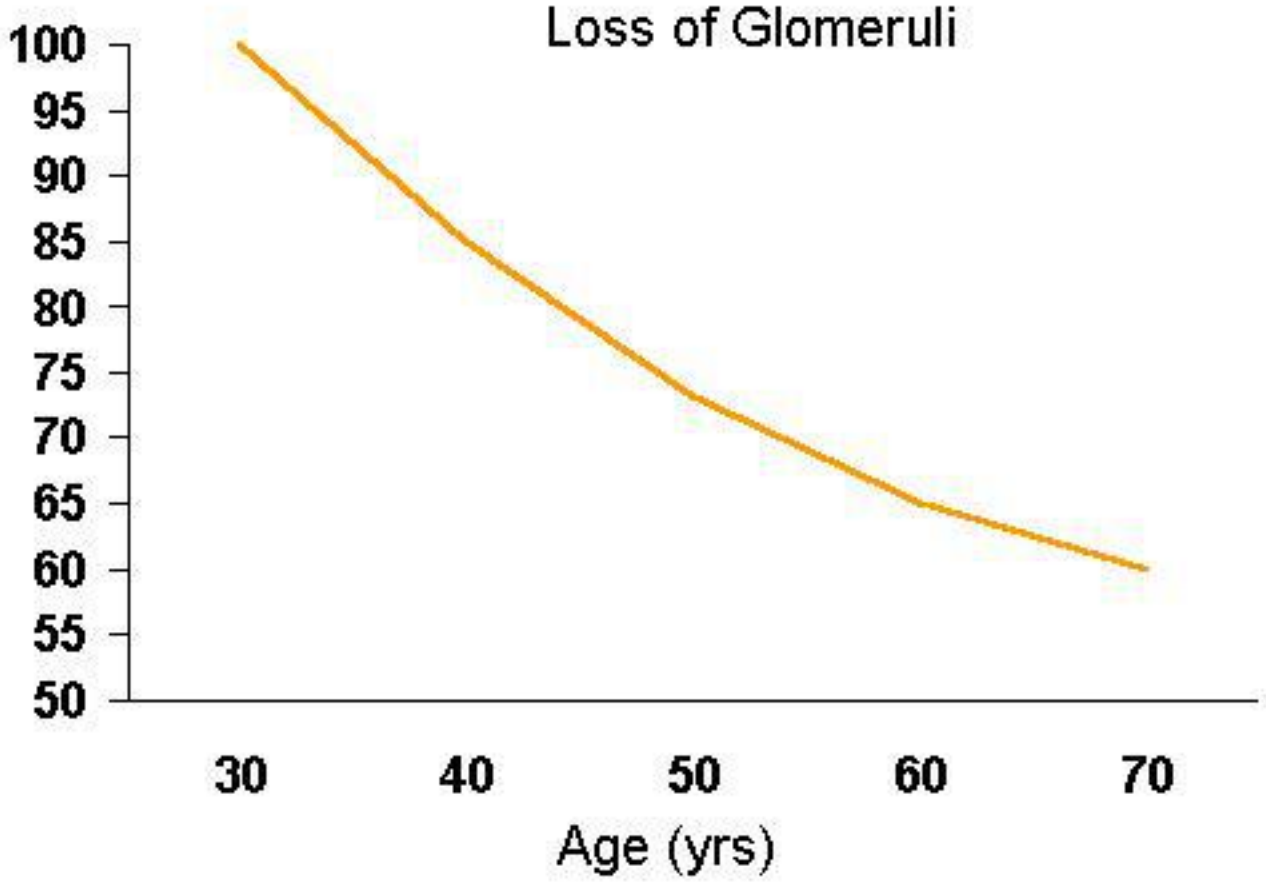
Functional changes

Dendrite deterioration, accumulation of senile plaque, and atherosclerosis

- Memory
- Cognition
- Sensation
  - Vision
  - Hearing
  - Vestibular



PHYSIOLOGY OF AGING



PHYSIOLOGY OF AGING

Progressive fall in creatinine clearance
by 80-90% over lifespan

Impaired thirst &
ADH insensitivity: chronic dehydration

⇩

⇧ Sensitivity to
- •Contrast
- •Aminoglycosides
- •Hypovolemia

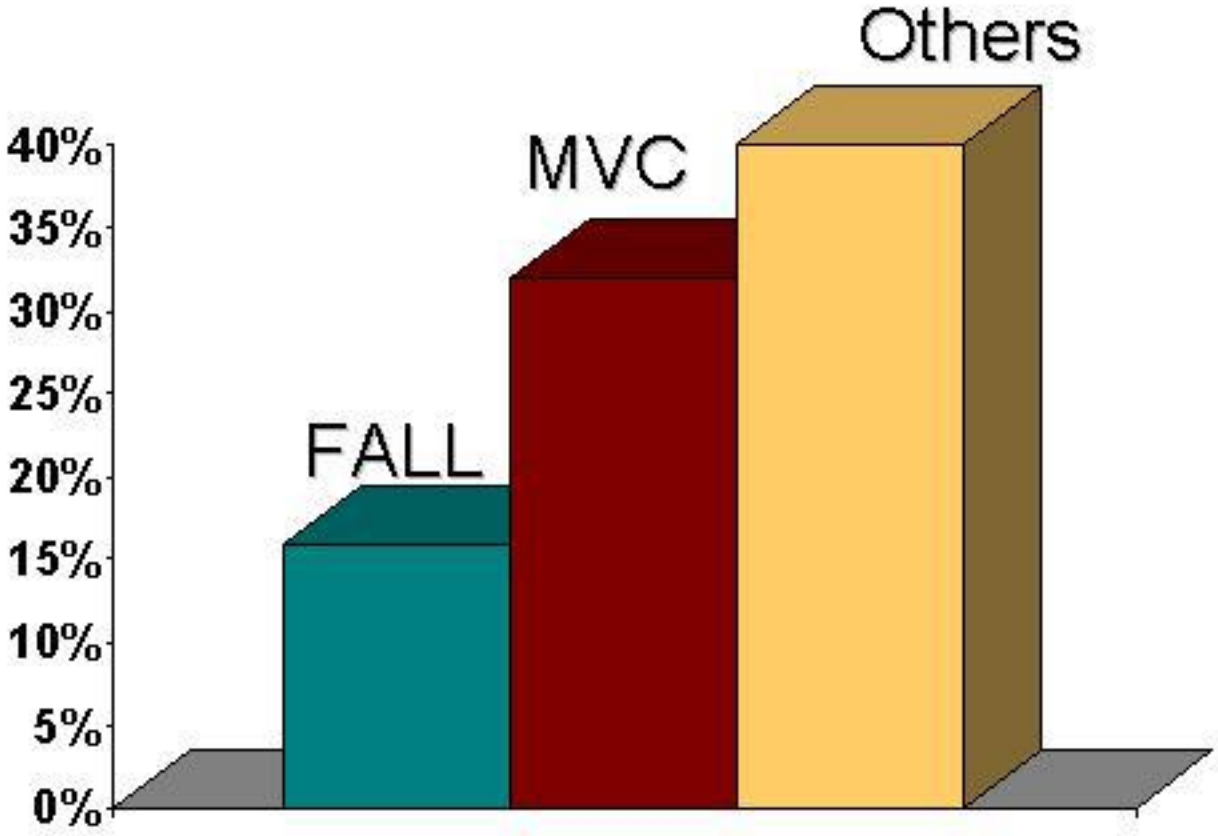
Acute ICU Renal Failure in elderly: 50% mortality

PHYSIOLOGY OF AGING

Others

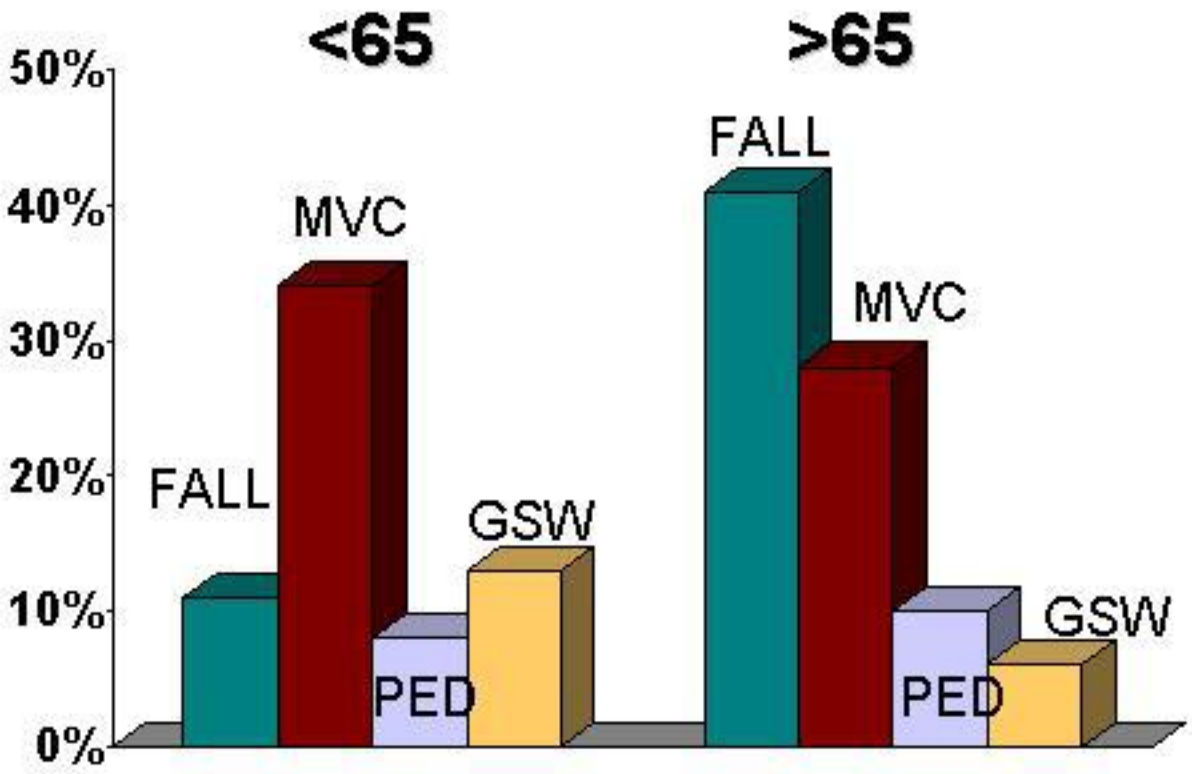
⇩ Bone density and strength	→	susceptibility to fractures
⇩ Muscle mass	→	strength and coordination
Vitamin / mineral deficiencies	→	poor wound healing
T & B cell dysfunction	→	infections

Causes of Death: Age > 65



Zeitlow et al. J. Trauma 1994

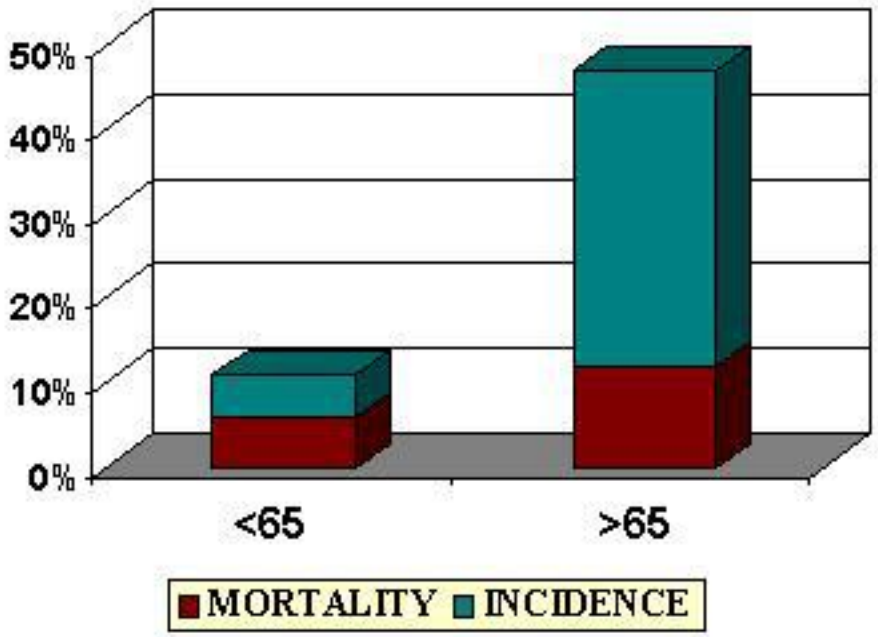
Mechanisms of Injury



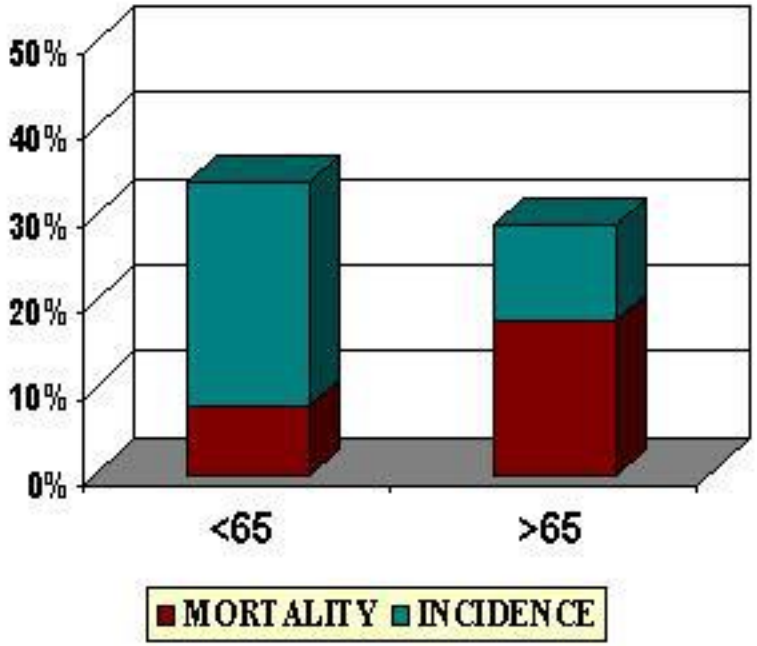
Champion HR, et al 1989

Mechanisms of Injury

FALL



MVC



Finelli et al – J Trauma,1989

The Man-Killing Trees of Kogarah

DANGER

Falls

PREDISPOSING FACTORS

- Visual acuity
- Hearing
- Vestibular / proprioceptive functions
- Memory
- Cerebrovascular disease
- Cardiac dysrrhythmias
- Dehydration
- Medications

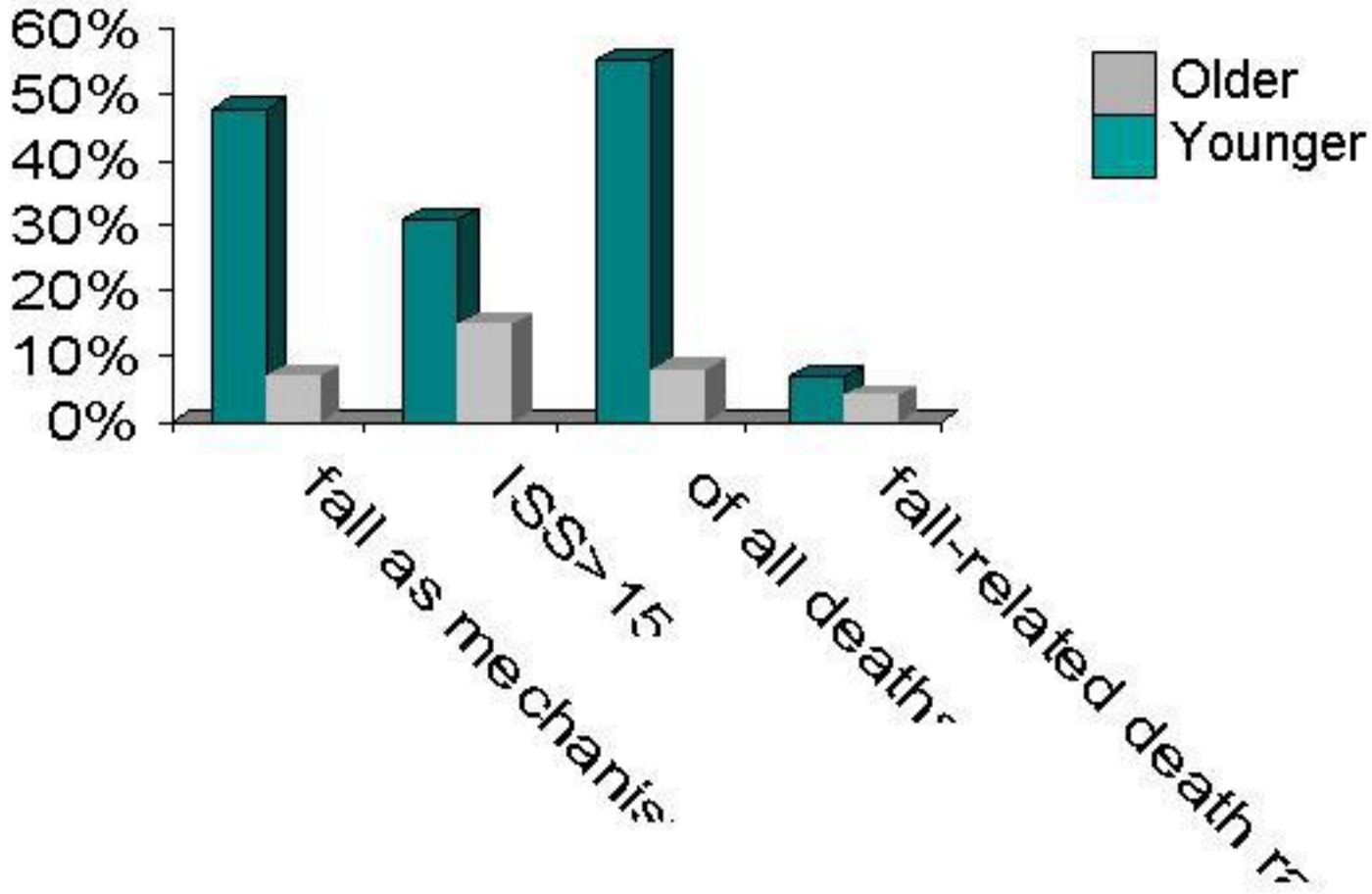
Falls

- 75% of deaths occur in geriatric population

- 50% 1-year mortality if hospitalized for fall

Rubeinstein, et al. West J Med, 1983

Falls



Sterling, et al - 2001

Injury Patterns for all Falls

AIS REGION	Older (n=159) %	Younger (n=83) %	*P*
Head/neck	47	22	<0.001
Chest	23	8	<0.003
Skin & soft tissue	47	60	<0.025
Abdomen	2	12	<0.001
Pelvis / extremity	27	14	<0.021

Sterling, et al - 2001

Crashes

Leading mechanism of injury
bringing elderly to trauma centers

Crashes

Leading cause of trauma death in ages 65-74

Crashes age 75+

- Incidence is second only to < 25 year-olds
- 50% due to driver error

Viano, et al. 1990

Crashes

Elderly more likely to be involved:

- Good weather
- Close to home
- In daylight hours
- At intersections
- Without alcohol use

Crashes

Predisposing factors

Old

- Dementia, memory loss
- Visual acuity
- Auditory acuity
- Arthritis, loss of strength
- Medications

Young

- High speed
- Alcohol

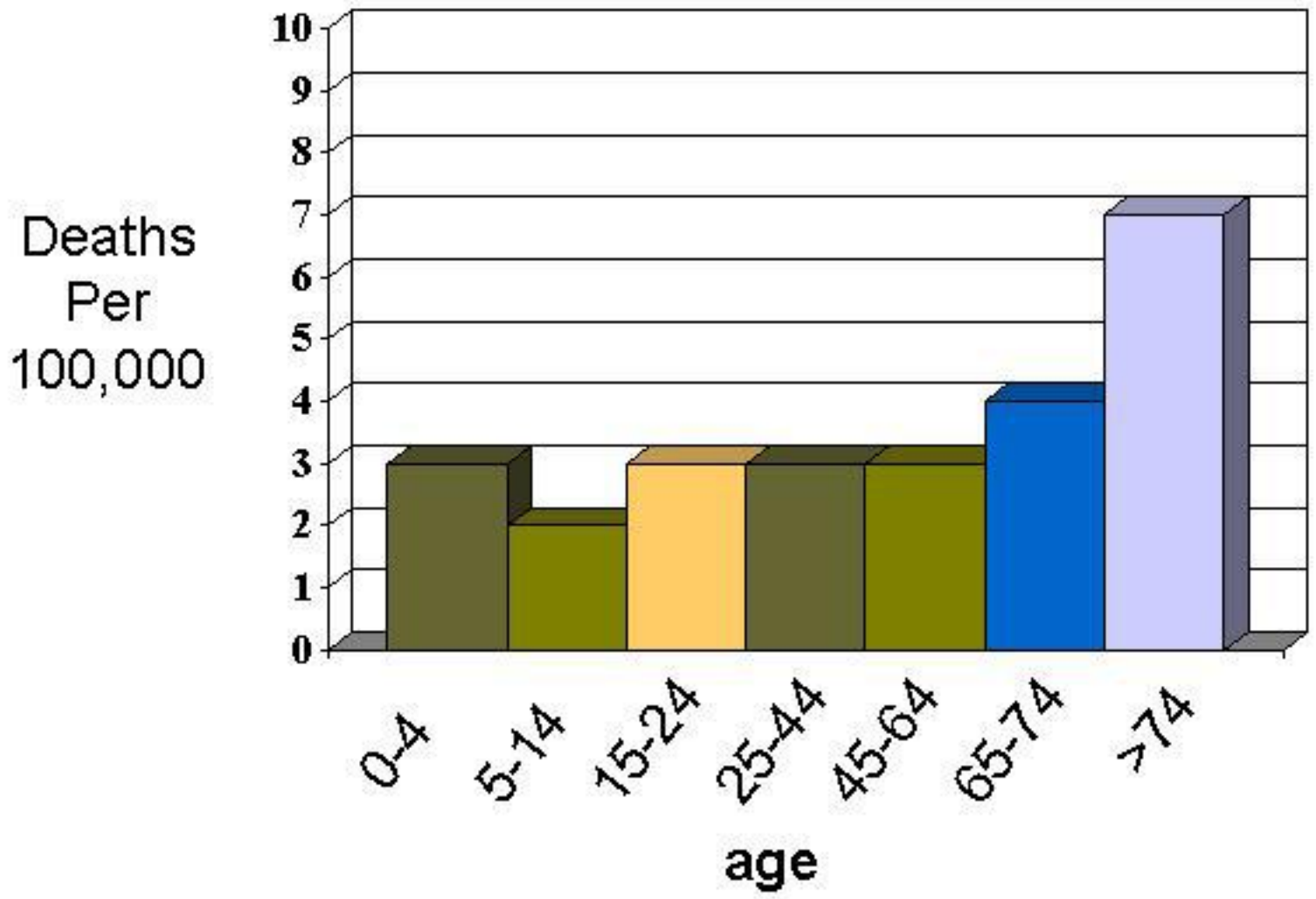
Auto vs. pedestrian: age 65+

64% occur within a crosswalk

20% of all fatalities occur in > 65 yrs age group (highest age group)

Auto vs. pedestrian

incidence



Auto vs. pedestrian

Average U.S. cross-walk

requires pedestrian speed

4 feet / second

Burns

Higher morb./ mort. for lesser burn severity

50% in-hospital mortality

Burns

Predispositions:

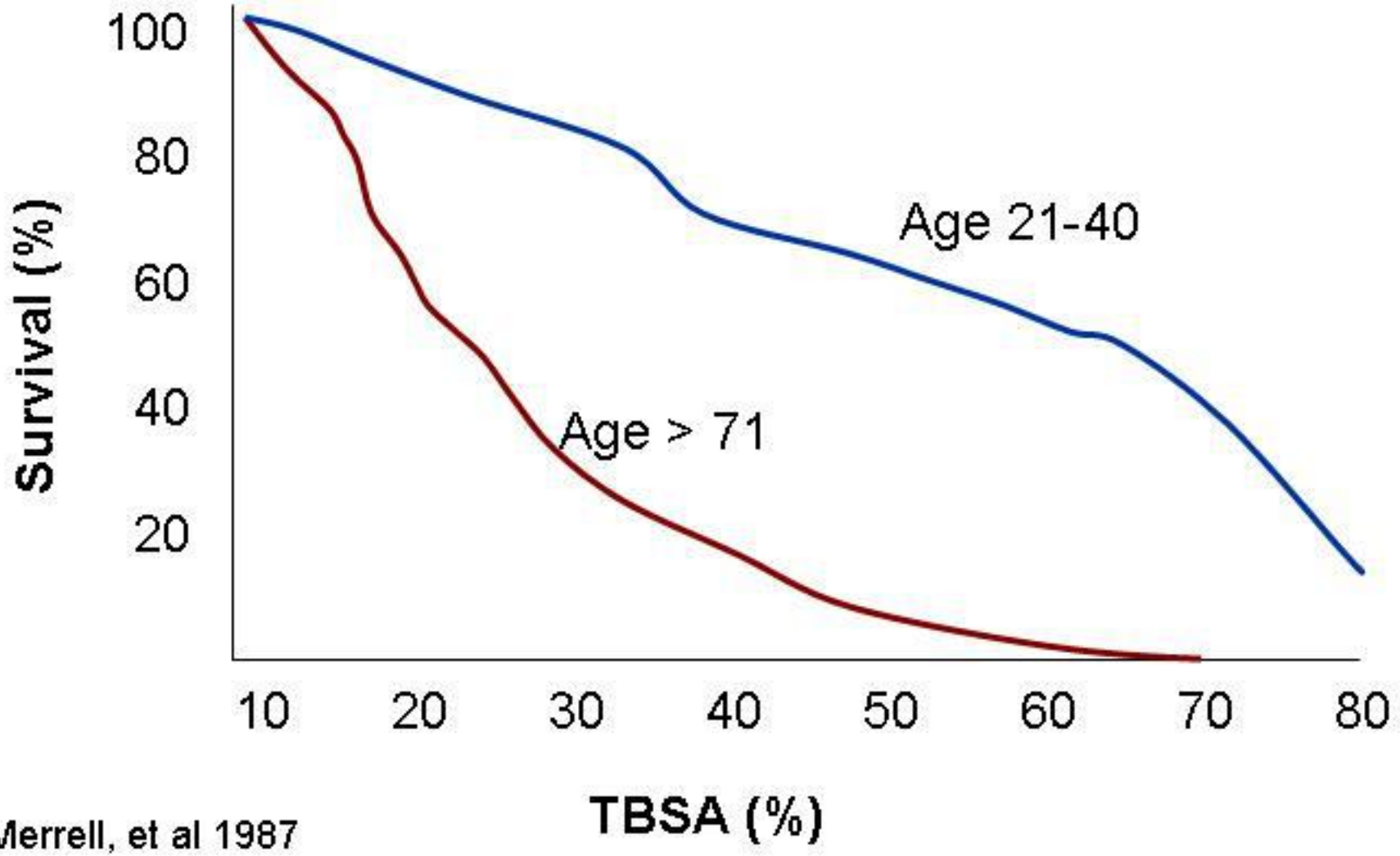
- Impaired sensorium
- Living alone
- Thinner dermis
- ↓ Epidermal proliferation

Poor prognosis:

- Lower extremity burns
- High fluid requirements
- Pneumonia

Anous, et al. 1986

Burns



Merrell, et al 1987

Burns

Early Excision & Grafting

- Improved survival
- Fewer infections
- Shorter hospital stay

- Scott-Conner, et al. 1990
- Deitch, et al. 1983

Neurotrauma

Fall: most common mechanism

Mortality 4 X greater overall

	6-mo. mortality
↑ ICP	90%
Coma > 72 hrs.	100%

Ross. Et al. 1992

Neurotrauma

Chance of meaningful neurologic recovery after coma > 1 week

>51 yrs.	<1%
20-50 yrs.	50%
0-19 yrs.	80-90%

Carlsson, et al. 1968

PRE-INJURY WARFARIN & HEAD INJURY OUTCOME

Year	Author	OUTCOME: Worse	OUTCOME: Same
'04	Lavoie		
'03	Mina		
'03	Reynolds		
'01	Karni		
'01	Li		
'01	Wojcik		
'00	Kennedy		
'99	Garra		
'99	Ferrera		

Spine

Compared to 15-30 year-old age group:

	incidence
Pneumonia	2 X
GI hemorrhage	2 X
PE	7 X
D/C to chronic care	23 X

DeVivo, et al 1990

Spine

Lower survival for equal severity of injury

	15-30 y.o.	>60 y.o.
2-year survival	95%	59%

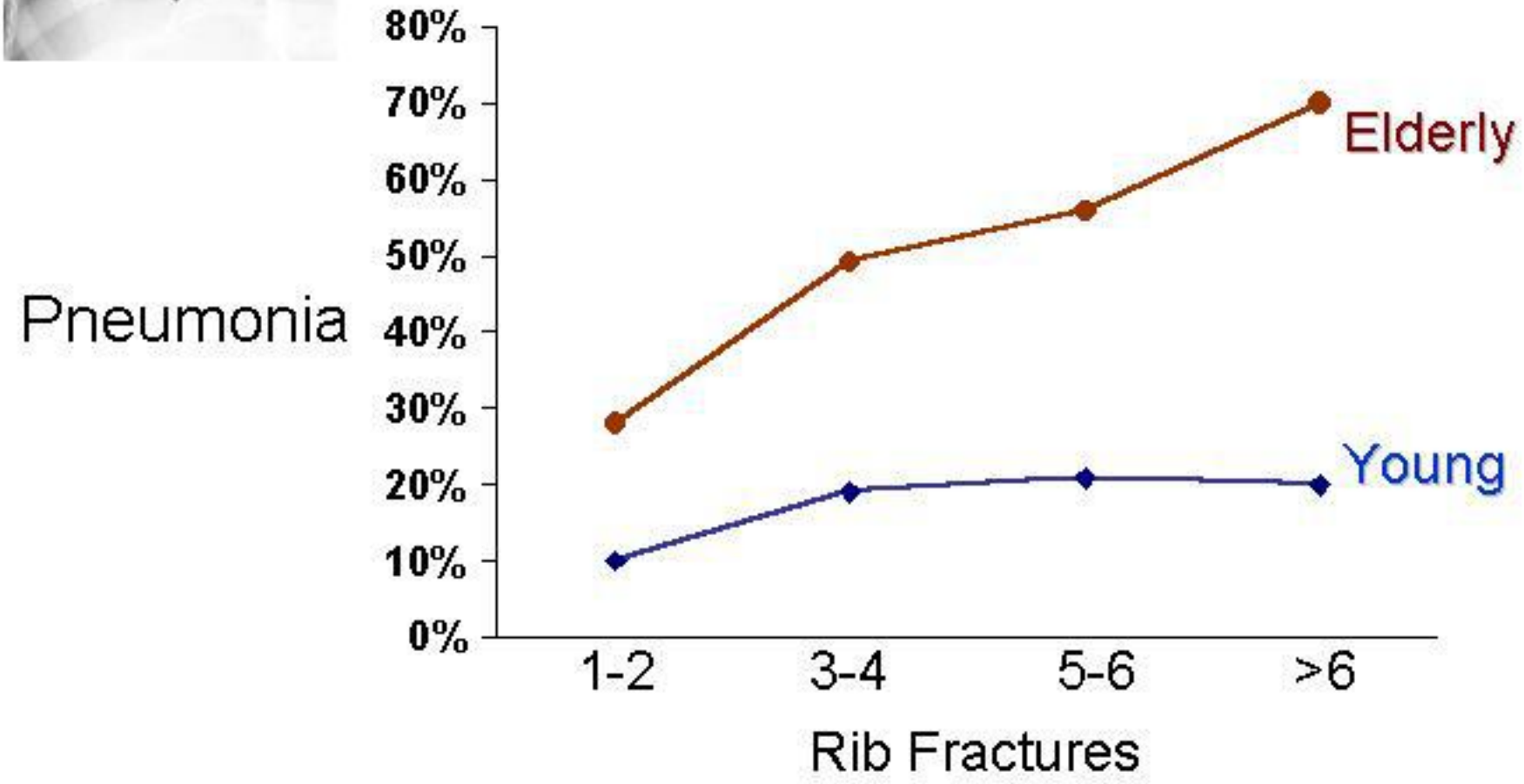
DeVivo, et al 1990

Rib Fractures

	age (yrs)		
	> 65	< 65	*p*
Ventilator days	4.3	3.1	0.16
ICU days	6.1	4.0	<0.05
Hospital days	15.2	11.0	<0.05
Mortality (%)	22	10	<0.001

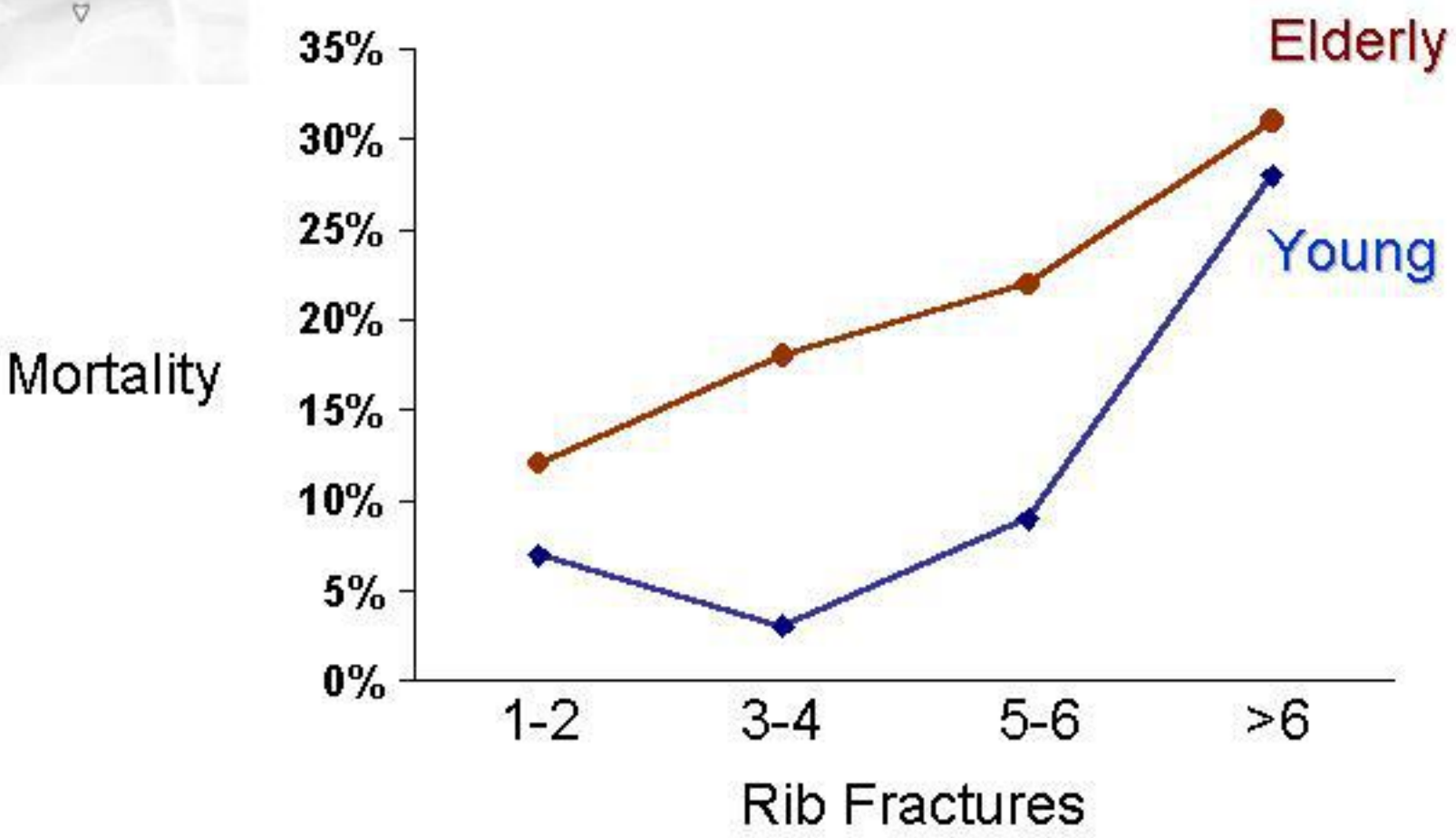
Bulger, et al. J Trauma 2000

Rib Fractures



Bulger, et al. J Trauma 2000

Rib Fractures



Bulger, et al. J Trauma 2000

Penetrating Injuries

Cook County Hospital 1983 – 1998
Age 64 – 90 N = 85

Compared to same-age blunt trauma:

- Lower mortality rate (20%)
- Lower complication (22%)

Nagy, et al. J Trauma 2000

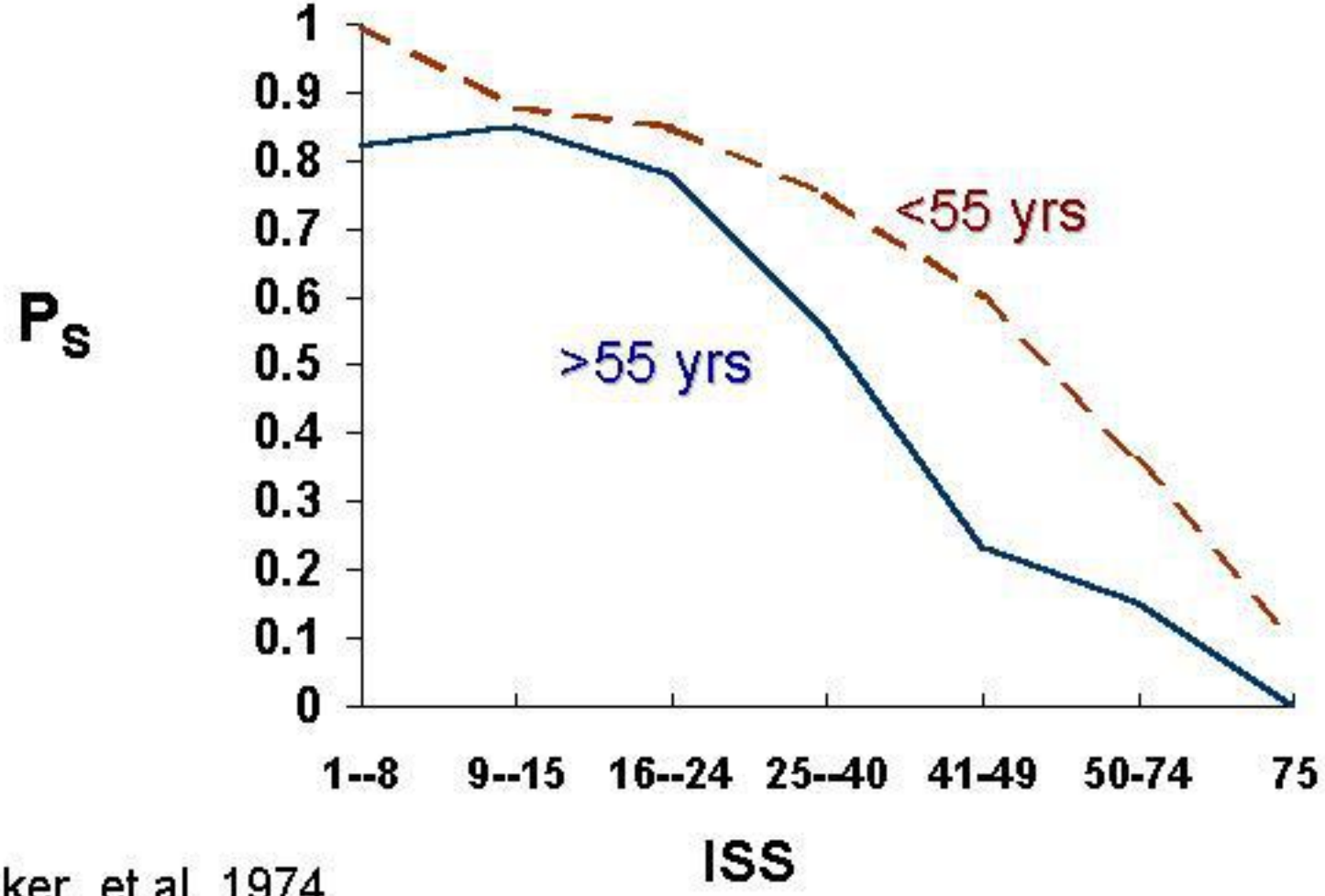
Penetrating Injuries

Cook County Hospital 1983 – 1998

	Young	Old	*p*
complication	17.6%	22.3%	NS
mortality	10%	10%	NS
ICU care	22%	32%	NS
ICU L.O.S.	3.4 d	7.4 d	0.047
D/C home independently	98.8%	79%	0.006

Nagy, et al. J Trauma 2000

Survival Probability (blunt trauma) **vs. ISS by Age**



Baker, et al. 1974

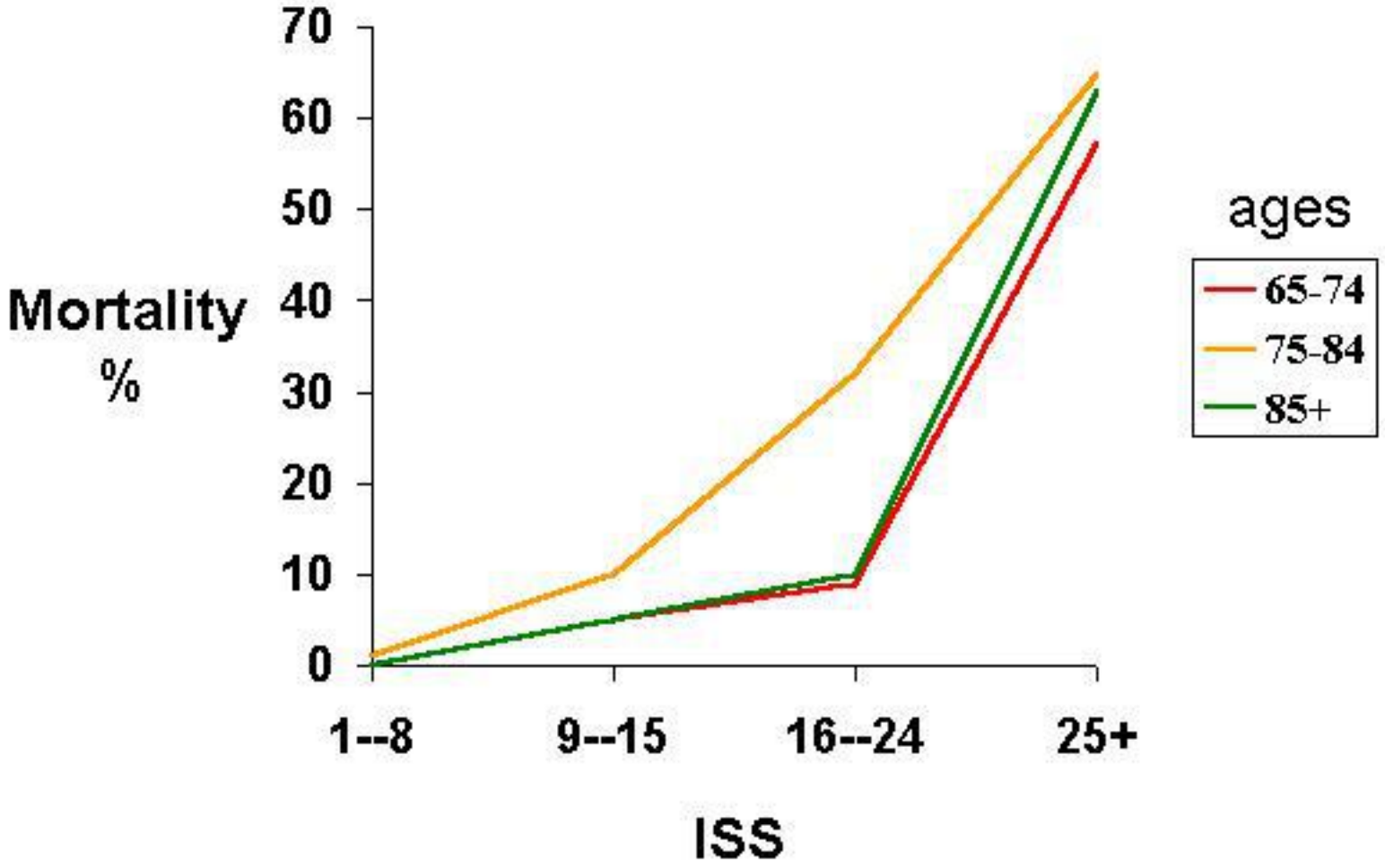
Death Rate (%) v.s. ISS

3,883 patients from the MTOS

	AGE	
ISS	< 65	>65
0-8	0.3	3
9-15	2.7	6.9
16-24	10.5	28.9
25-40	29.3	51.4
41-49	50.0	73.7
50-74	65.2	90.5
75	89.9	94.4

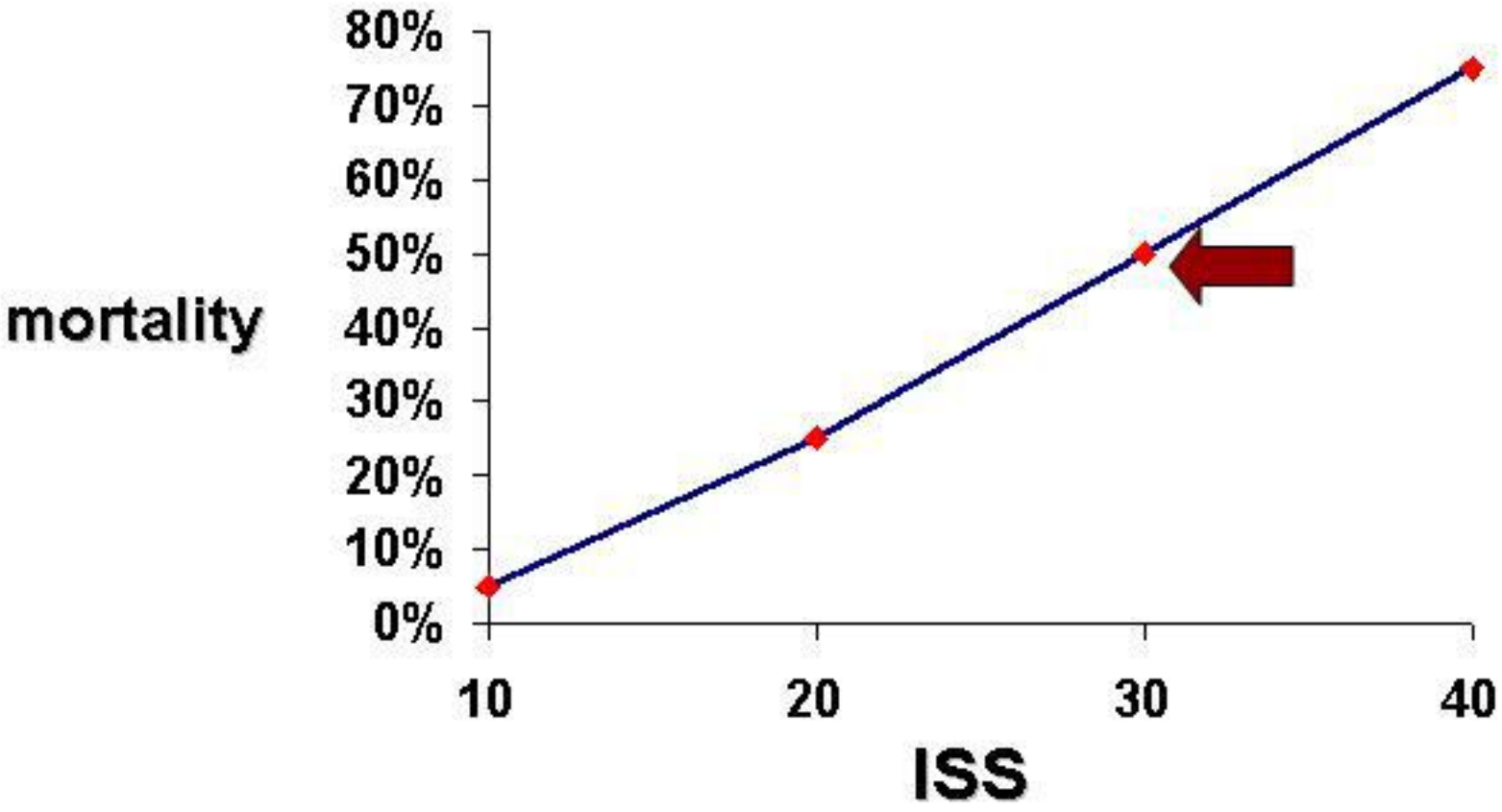
Champion HR, et al. AJPH, 1989

Mortality vs. ISS



Knudson, et al. Arch Surg 1994

LD_{50} after age 65



Grossman, et al. J. Trauma 2002

Predicting Mortality

	Mortality (%)
*GCS < 8	86
SBP < 90	86
Inotropic / vent support	75
*Previous MI	78

* independent risk factor by multivariate logistic regression

Zeitlow et al. J. Trauma 1994

Predicting Mortality

- Shock (SBP < 80)
- Head injury
- Pneumonia

Oreskovich, et al.
J Trauma 1984

- Shock (SBP < 90)
- Head Injury (GCS = 3)
- RR < 10/min

Knudson, et al.
Arch Surg 1994

Aggressive Treatment for Elderly Trauma Victims IS Warranted.

1. **Mosenthal AC -** J Trauma. 2004 May;56(5):1042-8.
2. **Nagy KK** - J Trauma. 2000 Aug;49(2):190-4.
3. **van der Sluis CK , et al -** J Trauma. 1996 Jan;40(1):78-82
4. **Day RJ, et al -** Med J Aust. 1994 Jun 6;160(11):675-8.
5. **Broos PL** – Injury. 1993 Jul;24(6):365-8.

Is Advanced Age a Valid Trauma Team Activation Criterion?

AGE > 70 and ISS > 15		
Trauma Team Activation	NO	YES
N	260	76
Age	NS	NS
Gender	NS	NS
ISS	NS	NS
Mechanism	NS	NS
Mortality (%)	54	34

Demetriades et al. Br J Surg 2002

No Immediate Miracles…

Prevention

- Home safety inspections
- Medication awareness
- Driver education
- Street / pedestrian safety
- Reduction of energy transfer

Prevention

55 ALIVE
MATURE DRIVING PROGRAM

- Vision and hearing changes
- Effects of medication
- Reaction time changes
- Left turns and other right-of-way situations
- New laws and how they affect you
- Hazardous driving situations

Prevention

Queens, N.Y.
Pedestrian safety programs

<u>Outcomes</u>

- ↓43% Fatalities
- ↓ 86% Injuries

Retting, et al. 1989

GENERAL APPROACH TO THE ELDERLY:
All the usual principles apply….

1. Suspect underlying chronic disease

2. Suspect head injury
   - Liberal use of CT scan

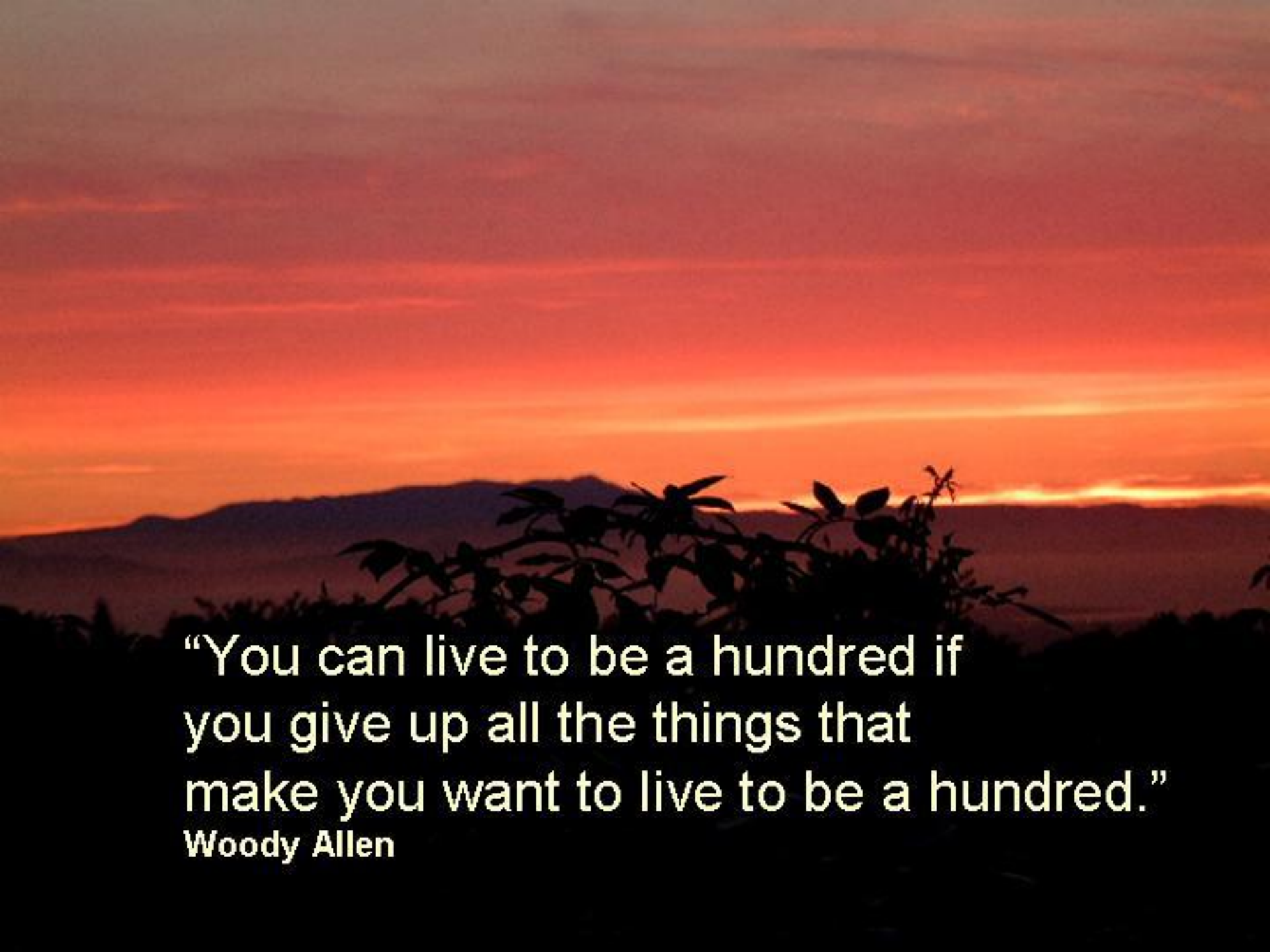
3. Resuscitate quickly
   - Avoid hypoxemia, hypotension

4. Anaemia to 80 g/L is usually well tolerated

5. Rehabilitation is usually mandatory

Summary

1. Different injury patterns (falls # 1)
2. Aging = ↓ physiologic reserve
3. Higher mortality for equal/lesser injury severity
4. Shock & CNS injury = poor prognosis
5. Prevention is the new frontier…


“You can live to be a hundred if
you give up all the things that
make you want to live to be a hundred.”
Woody Allen