

Introduction to Abbreviated Injury Scale (AIS)

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Data Fundamental

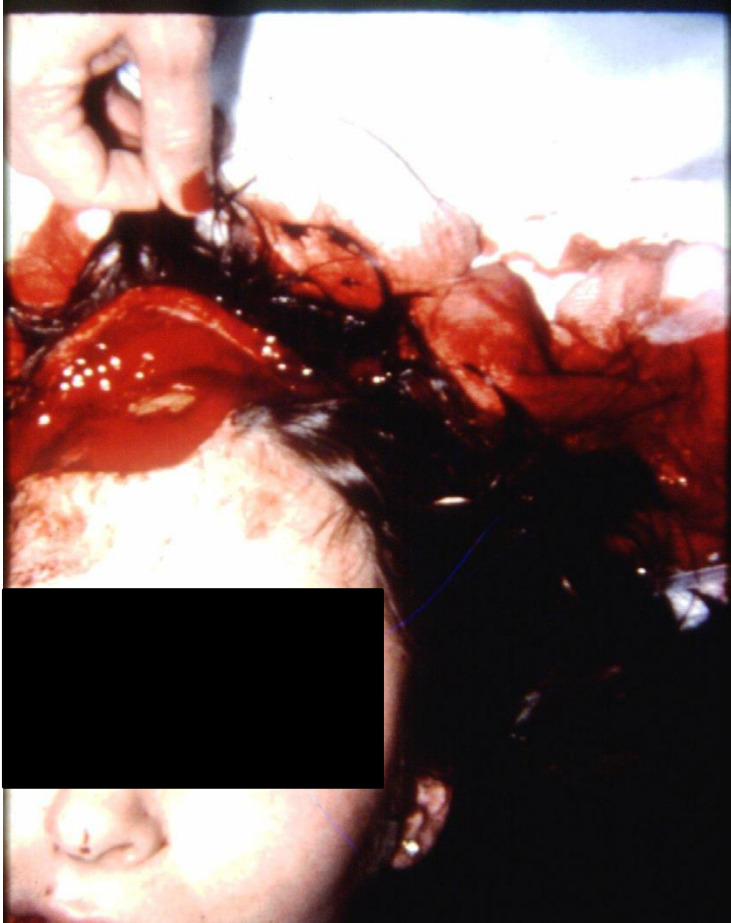
Collection
*Classification**
Interpretation
Analysis

Accident Severity

Collision severity

Injury severity

Injuries



Early Severity Classification

- ▶ Burden of injury – live or dead
- ▶ Live - bleeding or not bleeding
- ▶ Injured – treated or not treated
- ▶ Treated – physician, doctor, emergency room
- ▶ Released or admitted

Injury Severity

- ▶ *Fatal Injury* - injuries which caused death in less than 30 days after the accident.
- ▶ *Serious Injury* - inpatient or fracture, concussion, internal injuries, crushing, severe cuts, severe shock type of injury or death after 30 days.
- ▶ *Slight Injury* - minor sprain, bruise, cut, or requiring only roadside attention

Working Definitions of Fatality

- ▶ Greece, Portugal, Spain - within 24 hours.
- ▶ France - within 6 days.
- ▶ Italy - within 7 days.
- ▶ Most other states - within 30 days.
- ▶ Correction Factors applied to get 30 day equivalent, range from 1.3 (Spain) to 1.078 (Italy).

Serious & Slight

- ▶ Prone to error
 - ▶ severity assessed and assigned by police at the scene
- ▶ Correct in $\approx 60\%$ of cases

**Therefore a better scale is
needed which could be used by
non medics and the scale that is
anatomically based**

AIS Introduction

Abbreviated Injury Scale (AIS)

Probability of threat to life scale based on individual injury

Globally – agreed injury data tool specifically designed to classify injuries

AIS Objectives

- ▶ Anatomically-based scale
 - ▶ organ, bone, tissue
- ▶ Standardisation of terminology
 - ▶ agree a common language
- ▶ Simple method to rank injuries by severity
 - ▶ Use 'abbreviated' – unique numerical digit
 - ▶ Time-independent measure
 - ▶ severity is constant
- ▶ Rank injury (damage to body part)
 - ▶ not outcome

AIS Origins

- ▶ The Abbreviated Injury Scale (AIS) – produced AAAM working group
- ▶ Consensus of AIS derived from
 - ▶ Panel of Arbitrators
 - ▶ Diverse viewpoints
 - ▶ Injury expertise
 - ▶ Agreed to agree despite disagreeing
- ▶ 1971- 1st version of AIS produced to aid vehicle crash investigators
- ▶ Extended in 1990 to be more relevant to medical audit and research

Source: Association for the Advancement of Automotive Medicine (AAAM) Official Website

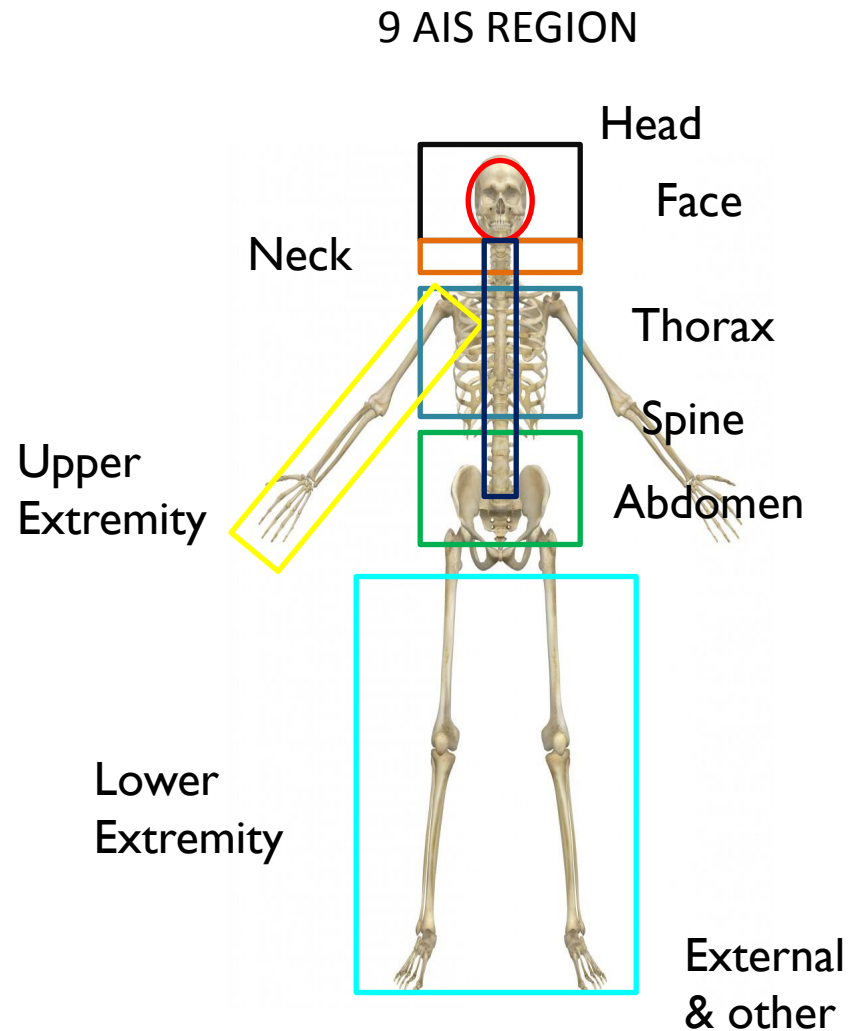
AIS system

▶ Type:

- ▶ Contusion
- ▶ Laceration
- ▶ Hematoma
- ▶ Sprain
- ▶ Dislocation
- ▶ Fracture

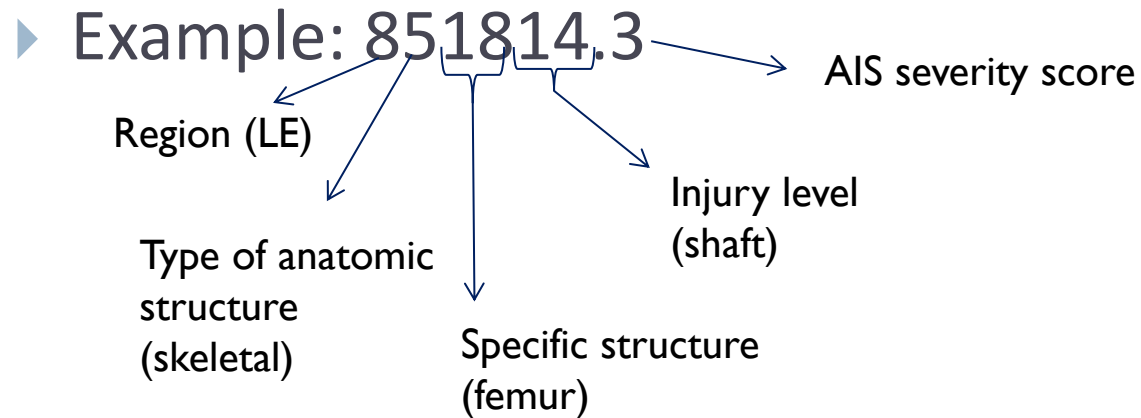
▶ Location:

- ▶ Head
- ▶ Face
- ▶ Neck
- ▶ Thorax
- ▶ Abdomen
- ▶ Spine
- ▶ Upper extremities
- ▶ Lower extremities
- ▶ External (skin)



AIS code

- ▶ Unique Numerical Identifier
- ▶ 7 digit code used to classify an injury



AIS Severity Classification

Ranking	AIS score
1	Minor
2	Moderate
3	Serious
4	Severe
5	Critical
6	Maximal (currently untreatable)

AIS – Threat to life

<u>AIS</u>	<u>% prob. of death</u>
1	0
2	1 – 2
3	8 – 10
4 - 5	50 – 50
6	100

AIS Dictionary

- ▶ ~ 2000 injury descriptors
- ▶ 9 chapters (1 region, 1 chapter)
- ▶ **General Structure**
 - ▶ Whole area
 - ▶ Vessels
 - ▶ Nerves
 - ▶ Internal organs
 - ▶ Skeletal

Formatting guide

AIS 2005	Injury Description
	<p>INTERNAL ORGANS</p> <p>Injuries to Internal Organs (i.e., brain stem, cerebellum or cerebrum) must be verified by CT, MRI, surgery, x-ray, angiography or autopsy. Clinical diagnosis alone is not adequate for substantiating the existence of an anatomic lesion for coding purposes.</p>
<p>140299.5</p> <p>140202.5</p> <p>140204.5</p> <p>140208.5</p> <p>140210.5</p> <p>140212.6</p> <p>140214.6</p> <p>140216.6</p> <p>140218.6</p>	<p>Brain stem [<u>hypothalamus, medulla, midbrain, pons</u>] NFS</p> <p>compression [includes transtentorial (uncal) or cerebellar tonsillar herniation]</p> <p>contusion</p> <p>infarction</p> <p>injury involving hemorrhage</p> <p>laceration</p> <p>massive destruction (crush-type injury)</p> <p>penetrating injury</p> <p>transection</p>
<p>140499.3</p> <p>140402.3</p> <p>140407.2</p> <p>140403.3</p> <p>140404.4</p> <p>140405.5</p>	<p>Use Cerebellum section only if cerebellum, infratentorial or posterior fossa are named. Otherwise, code under Cerebrum.</p> <p>Cerebellum NFS</p> <p>contusion, single or multiple, NFS [include perilesional edema for size]</p> <p>tiny; <1cm diameter^a</p> <p>small; superficial; ≤15cc; 1-3cm diameter</p> <p>large; 15-30cc; >3cm diameter</p> <p>extensive; massive; total volume >30cc</p>

AIS code

Type of anatomic structure

Boxed and bold text - Coding rules

Bold type = anatomical structure

“Not further specified”

Body region

Head

AIS coding rules

AIS only code the actual injuries!

▶ Preliminary diagnoses

- ▶ Probably
- ▶ Possible
- ▶ Rule out
- ▶ Maybe
- ▶ Suspected

▶ Consequences of injury

- ▶ Complications
- ▶ Outcomes



**DO NOT
CODE**

AIS Benefits

▶ Biomechanical Implications

- ▶ opportunities of **vehicle design** changes & interventions
- ▶ Insights into future **injury tolerance** criteria

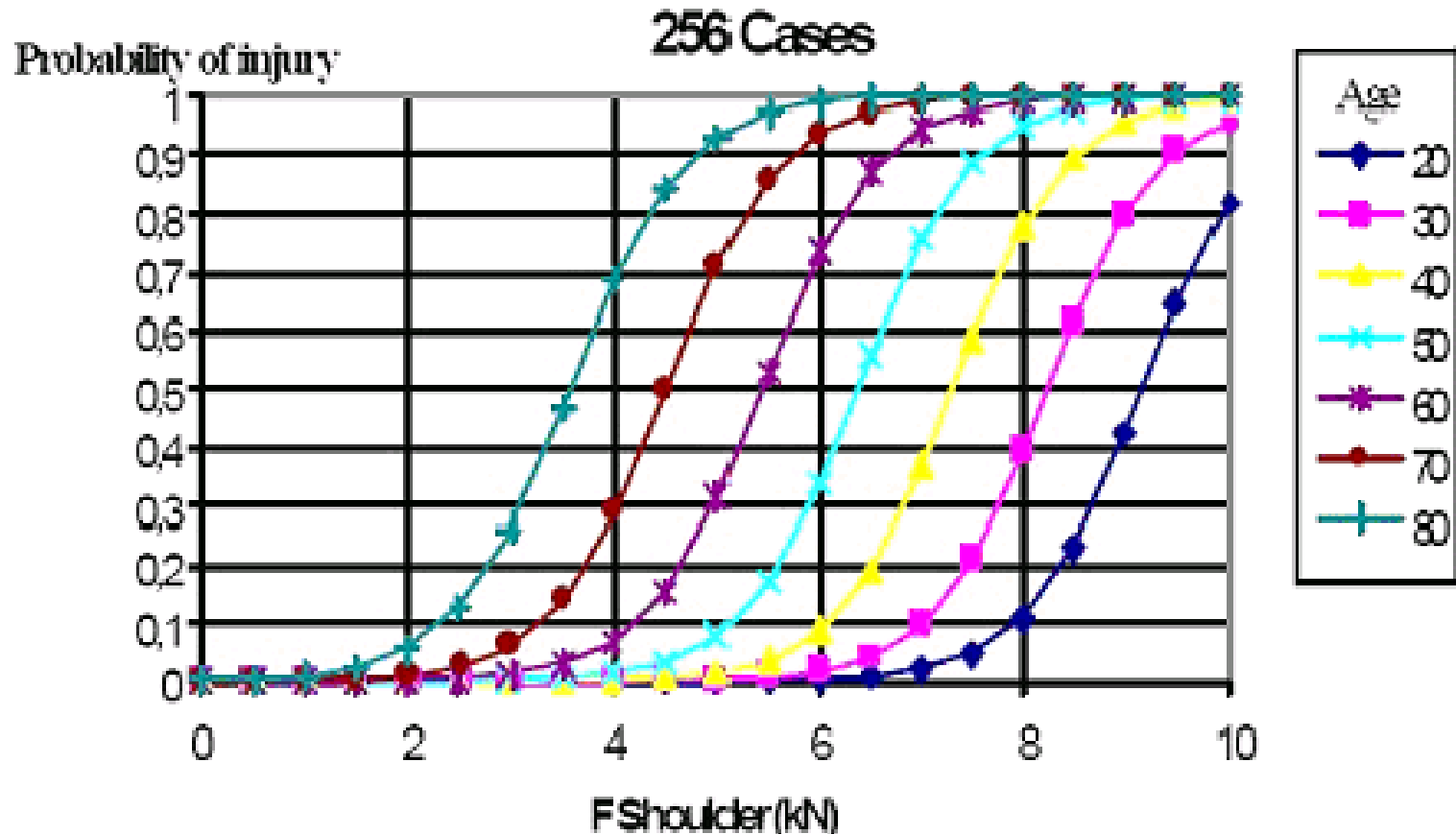
▶ Clinical Implications

- ▶ Helps to predict **treatment measures** & length of hospital stay
- ▶ Better understanding of long term **consequences** (disability, impairment)
- ▶ Can guide **resources** utilization & health care **cost**

AIS Uses

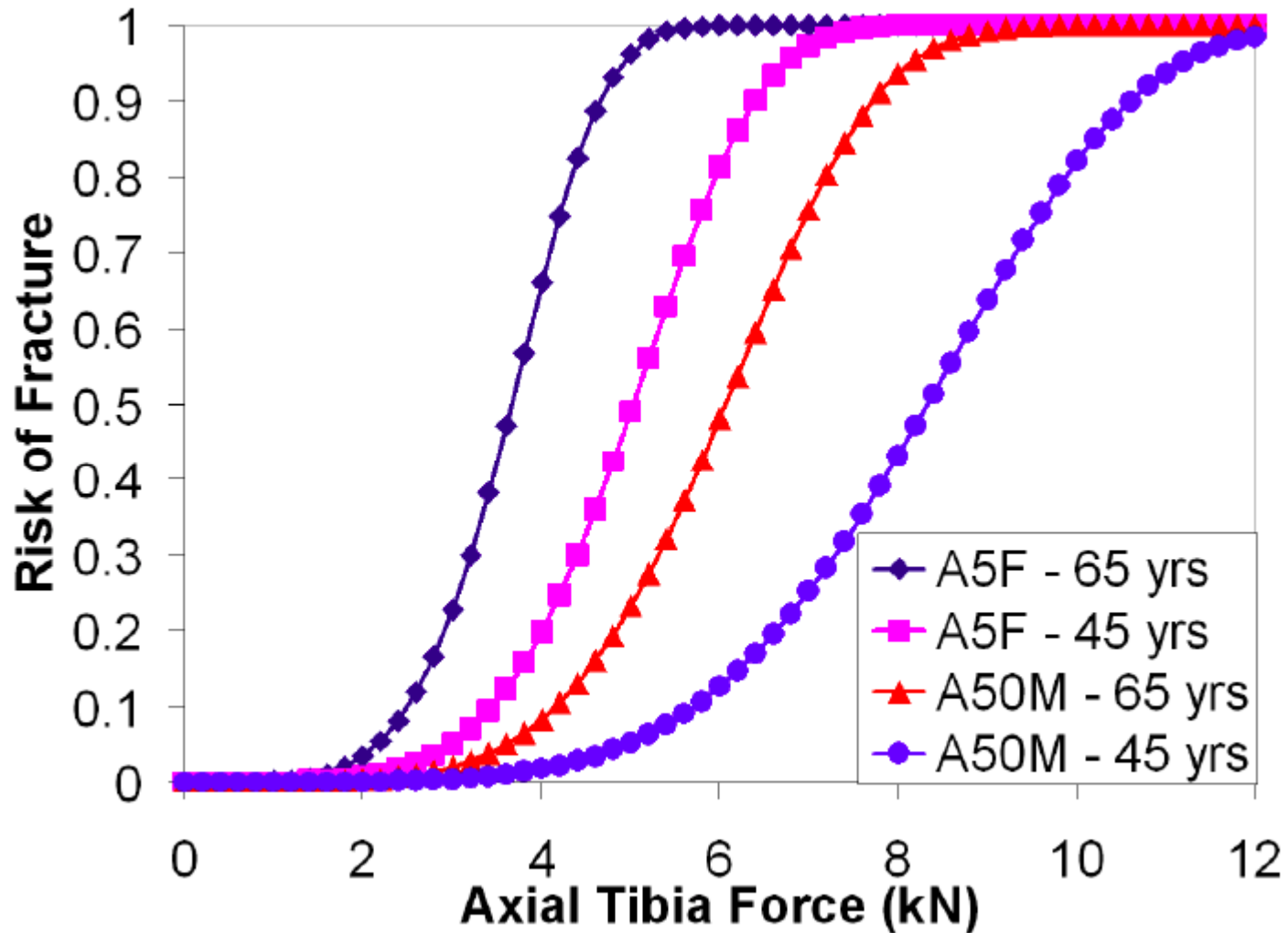
- ▶ Clinical trauma
 - ▶ Outcome evaluation
- ▶ Motor vehicle crash investigation
 - ▶ Vehicle design
 - ▶ Distribution of injuries
- ▶ Health research
 - ▶ Societal cost
 - ▶ Health care system

Example of AIS Uses



! Probability of AIS \geq 3 thoracic injury versus age and shoulder belt load

Example of AIS Uses



Example of AIS Uses

- ▶ **Prevent Death?**
- ▶ **Prevent Permanent Disabilities?**
- ▶ **Prevent AIS 3+ Injuries?**
- ▶ **Prevent AIS 3+ to X% of Population?**
- ▶ **Prevent AIS 2+ to Y% of Population?**

Anatomically-based system to assess *Multiple Injuries*

Maximum AIS (MAIS)

Injury Severity Score (ISS)

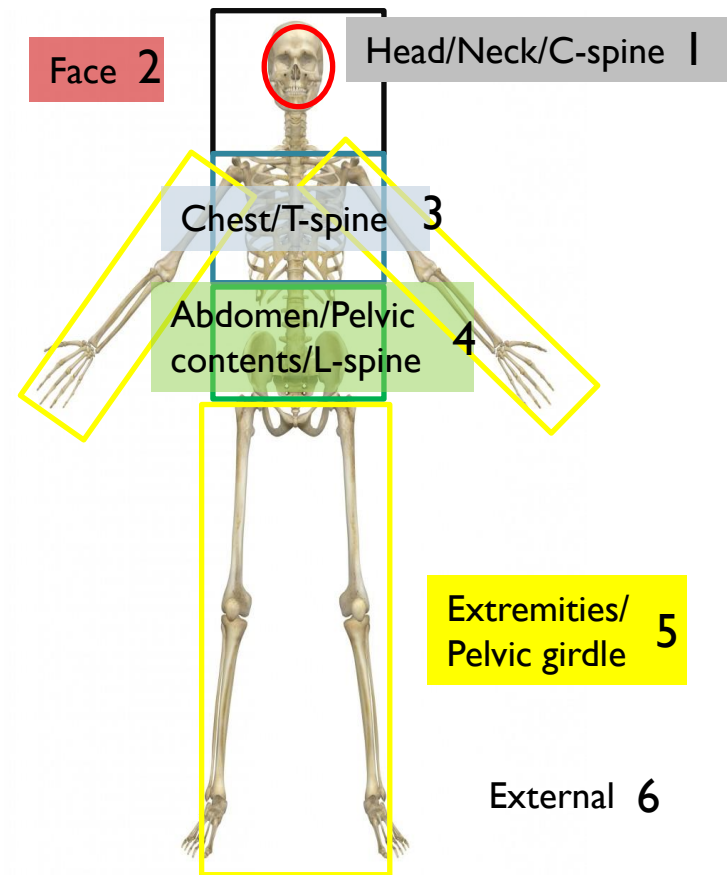
What is MAIS

- ▶ MAIS – highest AIS score in each body region
- ▶ In every region will only have one MAIS

Region	Injury	AIS score	MAIS
Head	Cerebral contusion	3	3
Abdomen	Liver laceration Kidney hilum avulsion	4 5	5
Upper extremity	Fracture metacarpal bone Abrasion at upper limb	2 1	2

What is ISS

- ▶ ISS = sum of squares of 3 most highest AIS score of injuries in 3 different ISS body regions
- ▶ ISS body regions (6 regions):



ISS Calculation

▶ Example:

Region	Injury Description	AIS	Square Top Three
Head & Neck	Cerebral Contusion	3	9
Face	No Injury	0	
Chest	Flail Chest	4	16
Abdomen	Minor Contusion of Liver	2	
	Complex Rupture Spleen	5	25
Extremity	Fractured femur	3	
External	No Injury	0	
Injury Severity Score:			50

▶ Calculation:

$$A^2 + B^2 + C^2 = ISS$$

$$3^2 + 4^2 + 5^2 = \underline{50}$$

AIS Strengths & Limitation

Strengths

- ▶ Agreed scale – accepted globally & by multi disciplines
- ▶ Allows researchers to plot distributions of specific injuries by body region and by severity and then prioritise trauma care, public health policies, vehicle design improvements
- ▶ Provides scientific basis for determining burden of injury

‘Alleged’ Limitation

- ▶ Uses only most severe injury in body region to assess multiple injuries in that body region
- ▶ Not a linear scale (i.e., AIS 4 is not twice as severe as AIS 2)
- ▶ Injuries within each severity code may not be strictly comparable.

Abbreviated Injury Scale (AIS)

The AIS continues to be the bedrock for injury classification and severity assessment.

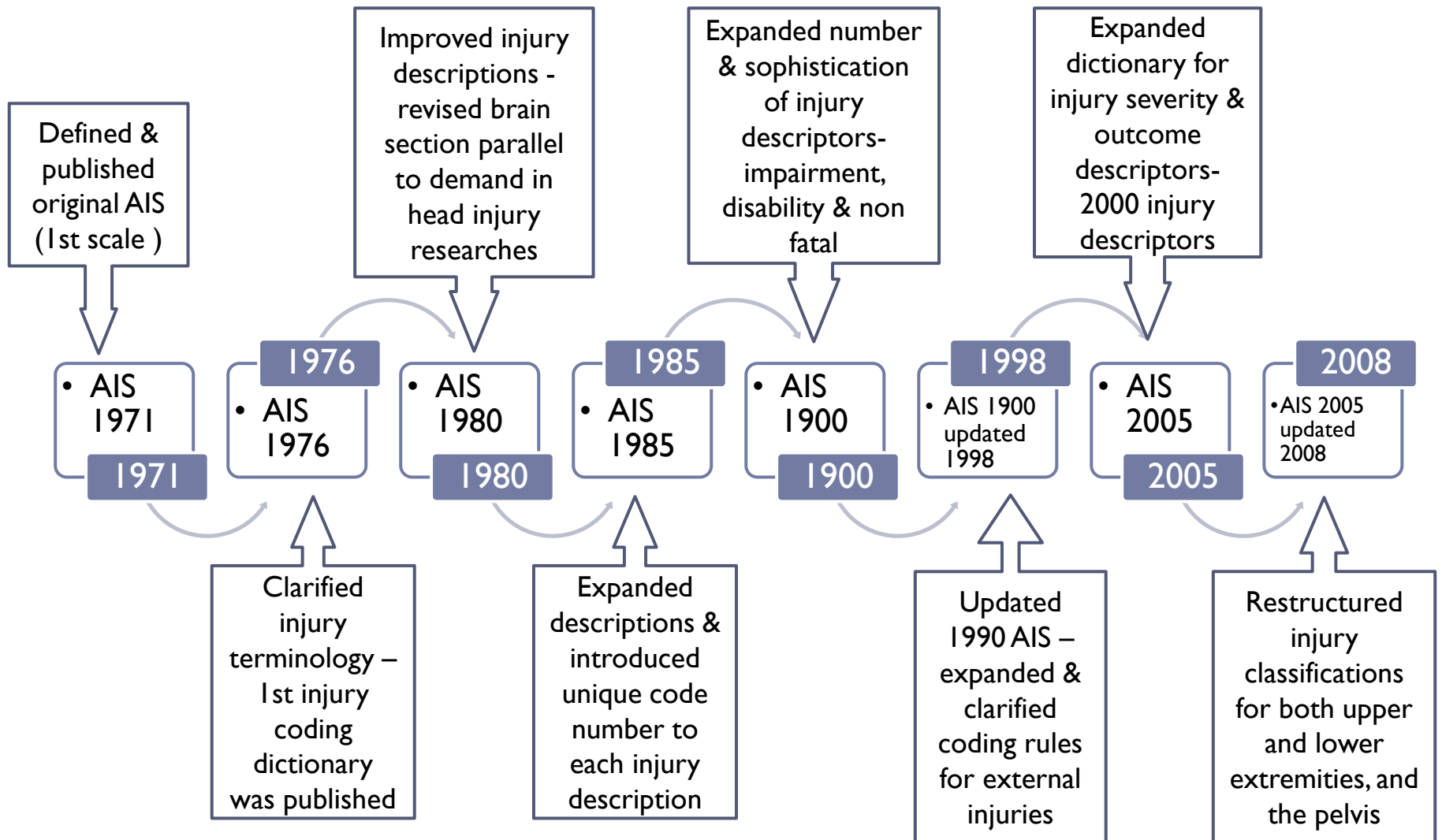
AIS keep growing

Birth: **1969-1971**

Growing Pains: **1971-2005**

Maturity: **2005-Infinity**

AIS Evolution & Revision

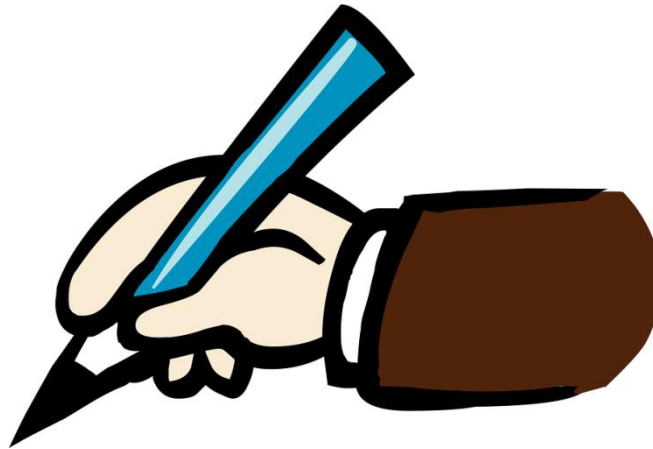


Reference:

- ▶ **More information on AIS code can be obtained from this link:**
 - ▶ <http://aaam.org/about-ais.html>

AIS PRACTICAL SESSION

(refer exercise booklet)





Thank You

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