

# Development of an Expert Based ICD-9-CM and ICD-10-CM Map to AIS 2005 Update 2008

Kathryn L. Loftis, Janet P. Price, Patrick J. Gillich, Kathy J. Cookman,  
Amy L. Brammer, Trish St. Germain, Jo Barnes, Vickie Graymire,  
Donna A. Nayduch, Christine Read-Allsopp, Kathy Baus,  
Patsye A. Stanley, Maureen Brennan



**AAAM**

Association for the Advancement of Automotive Medicine

# Introduction to Injury Coding Schemes

- **International Classification of Diseases (ICD) codes** – hospitals primarily use to list diagnoses and apply standard charges for treatment
- **Abbreviated Injury Scale (AIS) codes** – Researchers and analysts in the trauma community use to record injury, assign severities, and benchmark for treatment
- **Injury Severity Scores (ISS)** - calculated from AIS, provides measure of overall injury severity, used by hospitals and researchers to track outcomes, and to compare populations when evaluating quality of care
- There is a need to bridge the gap between ICD codes and AIS codes, especially when trying to compare data from multiple data sets



# Previous Development of ICD and AIS Maps

- **Schmitt et al., 2014** – mapped between police severities and AIS severities, noted this was difficult and a set of standardized rules were needed
- **Barnard et al., 2013** – mapped AIS08 codes to ICD-9-CM for the most frequent injuries in motor vehicle crashes (MVCs) using Crash Injury Research and Engineering Network cases
- **ICDPIC** - mapped AIS90 to ICD-9-CM and study showed poor agreement with expertly coded cases when analyzing resulting ISS
- **ICDMAP90** – provided map between AIS90 codes and ICD-9-CM, but resulted in many generic codes and prompted user for high or low options, making results inconsistent
- **Garthe et al., 1999** – detailed a list of specifications that would be needed to properly map between ICD and AIS, stating this map was needed but would be a complex and expensive undertaking



# Basis for Map Development

- To properly develop the map, experts in both ICD and AIS were recruited internationally
- This work involved a week of face-to-face interaction and discussions with almost a year of follow-up assignments and teleconferences
- Coding rules and guidelines in ICD-9-CM, ICD-10-CM, and AIS08 had to be reviewed, followed, and matched between the disparate coding systems
- Rules for resolving differences and creating the maps were developed by the entire group to provide consistent mappings



# Guidelines for mapping

- The initial map developed was from ICD-9-CM to AIS08
- Mapping rules were developed and the same rules and guidelines were then applied to the ICD-10-CM map
- AIS rules took precedence over ICD rules
- *Example Rule: For ICD codes for focal brain injuries that also involve LOC, do NOT code LOC based on the AIS rule that LOC is not coded in addition to anatomic brain injury unless that AIS code has an associated coma modifier.*



# Guidelines for mapping

- ICD codes listed as “other specified” received any valid unused AIS codes referring to that specific anatomy
  - *ICD-9-CM 813.42 Other closed fractures of distal end of radius*
- ICD codes listed as “other and unspecified” received the appropriate “not further specified” AIS08 code
  - *ICD-9-CM 813.07 Other and unspecified closed fractures of proximal end of radius*



# Guidelines for mapping

- If multiple AIS08 codes were required to fulfill the map from ICD, 'AND' and 'OR' were used to properly map
  - *ICD-9-CM code 800.11 "Closed fracture of vault of skull with cerebral laceration and contusion; with no loss of consciousness"*
    - In ICD, the "and" in the description may be interpreted as an "or"
  - *AIS08 map: 150402.2 (closed vault skull fracture) AND 140688.2 (cerebral laceration) OR 140602.3 (cerebral contusion)*
    - LOC is not addressed according to AIS rules.



# Guidelines for mapping

- When two or more valid options for AIS08 codes existed, the AIS rule of “code conservatively” was applied
  - *ICD-9-CM 873.8 Other and unspecified open wound of head without mention of complication*
  - *AIS08 116000.3 or 110600.1 OR 110800.1*
  - *AIS08 Severity map selected is 1*
- When two or more valid AIS08 codes were required for an ICD map, the highest severity option was selected
  - *ICD-9-CM 800.11 Closed fracture of vault of skull with cerebral laceration and contusion; with no loss of consciousness*
  - *AIS08 Boolean Map: 150402.2 (closed vault skull fracture) AND 140688.2 (cerebral laceration) OR 140602.3 (cerebral contusion)*
  - *AIS08 Severity map selected is 3*





# Completed Maps

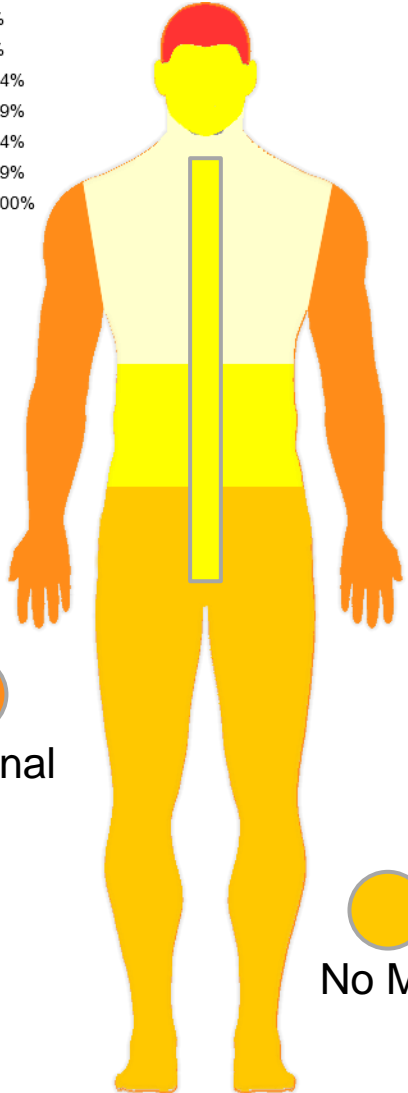
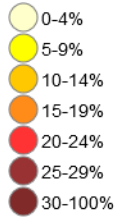
- In total, 19,012 injury related ICD-CM codes were evaluated for mapping to AIS08 and 74% (14,101) were assigned an AIS severity between 1 and 6.

<b>ICD-9-CM to AIS08</b>		<b>ICD-10-CM to AIS08</b>
2,504	codes evaluated for mapping	16,508
2,202	assigned an AIS08 chapter and ISS body region	13,102
2,078	assigned an AIS08 severity between 1-6	12,023

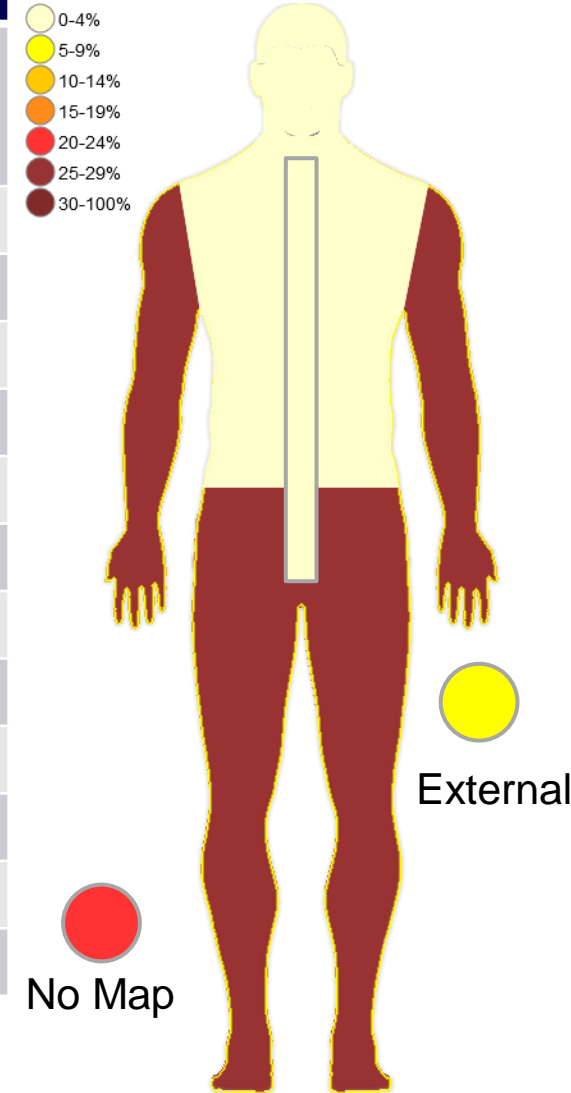
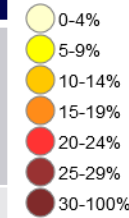
- The maps were also evaluated by a survey of trauma professionals; there was strong agreement between the expert-derived maps and survey results (Zonfrillo et al 2015)



# ICD to AIS Chapters

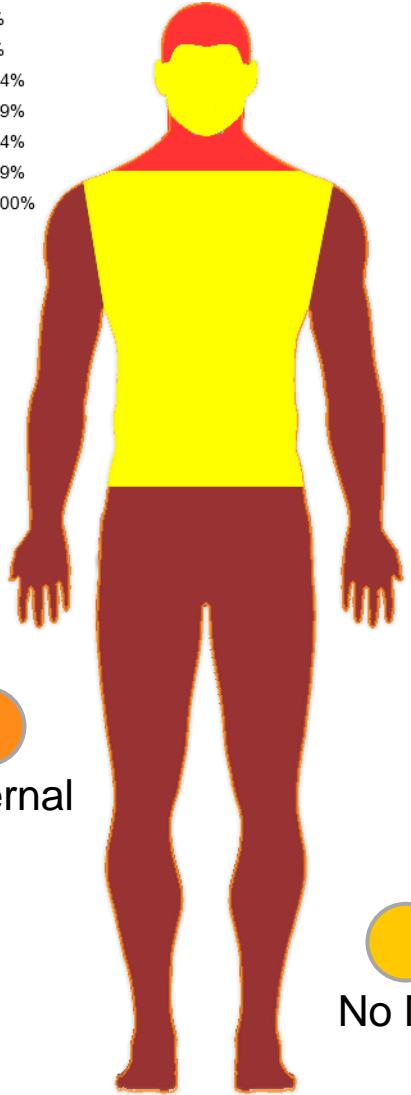


ICD to AIS Chapters	ICD-9-CM to AIS08 Chapters		ICD-10-CM to AIS08 Chapters	
	Count	Percentage	Count	Percentage
<b>AIS08 Chapters and Percentage of Each Within Dictionary</b>				
No Map	302	12.06%	3496	21.18%
Other Trauma (1.10%)	1	0.04%	20	0.12%
Head (14.06%)	504	20.13%	345	2.09%
Face (8.75%)	136	5.43%	408	2.47%
Neck (5.55%)	24	0.96%	168	1.02%
Thorax (9.55%)	98	3.91%	464	2.81%
Abdomen (12.51%)	191	7.63%	574	3.48%
Spine (10.81%)	122	4.87%	716	4.34%
Upper Extremity (16.26%)	398	15.89%	4724	28.62%
Lower Extremity (20.11%)	342	13.66%	4307	26.09%
External (1.30%)	386	15.42%	1286	7.79%
<b>Total</b>	<b>2504</b>		<b>16508</b>	



# ICD to ISS Body Regions

- 0-4%
- 5-9%
- 10-14%
- 15-19%
- 20-24%
- 25-29%
- 30-100%

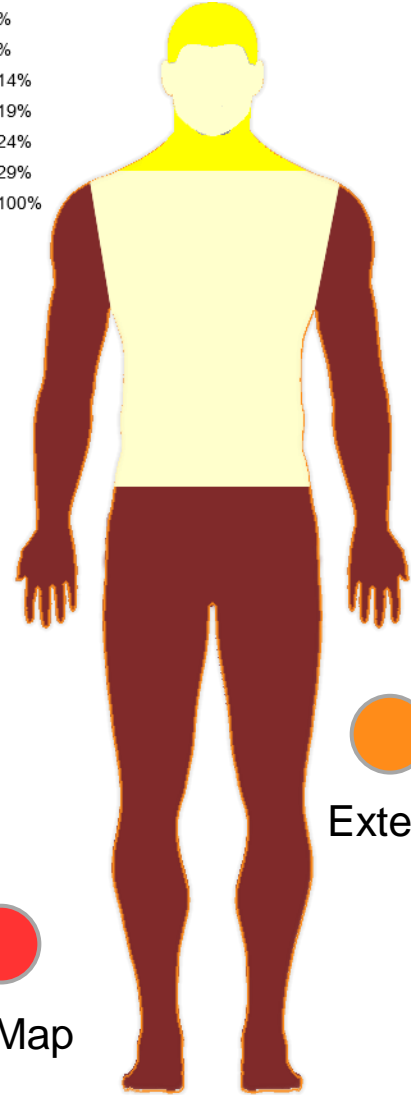


External

No Map

ICD to ISS Body Region	ICD-9-CM to ISS Body Regions		ICD-10-CM to ISS Body Regions	
	Count	Percentage	Count	Percentage
<b>ISS Body Regions</b>				
<b>No Map</b>	302	12.06%	3496	21.18%
<b>Head and Neck</b>	603	24.08%	809	4.90%
<b>Face</b>	136	5.43%	435	2.64%
<b>Chest</b>	131	5.23%	478	2.90%
<b>Abdominal and Pelvic Contents</b>	206	8.23%	687	4.16%
<b>Extremities and Pelvic Girdle</b>	656	26.20%	8063	48.84%
<b>External</b>	470	18.77%	2540	15.39%

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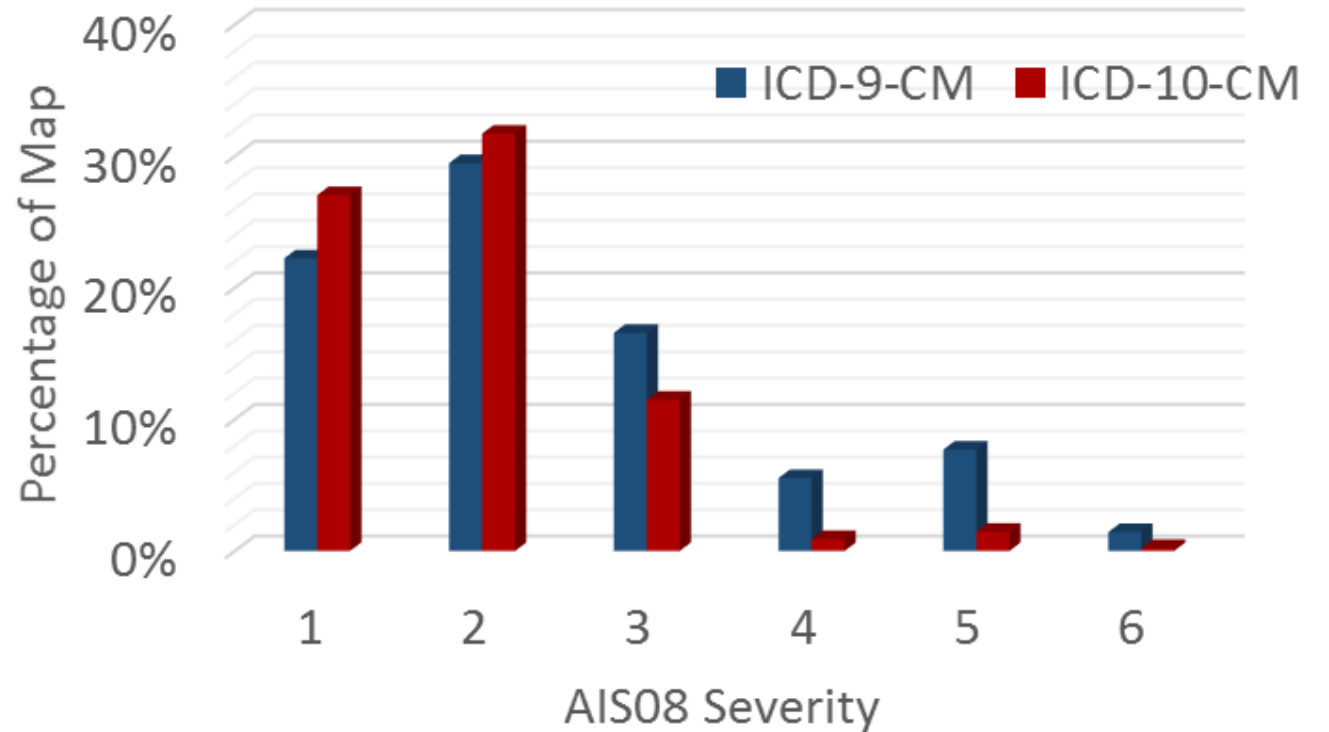


External

No Map

# ICD to AIS08 Severity

ICD to AIS Severity	ICD-9-CM to AIS08 Severity		ICD-10-CM to AIS08 Severity	
	Count	%	Count	%
<b>AIS08 Severity and Percentage of Dictionary</b>				
<b>9 and non-maps</b>	426	17.01%	4485	27.17%
<b>1 - minor (22.36%)</b>	557	22.24%	4466	27.05%
<b>2 - moderate (36.47%)</b>	738	29.47%	5234	31.71%
<b>3 - serious (20.96%)</b>	415	16.57%	1897	11.49%
<b>4 - severe (8.60%)</b>	139	5.55%	148	0.90%
<b>5 - critical (7.75%)</b>	193	7.71%	241	1.46%
<b>6 - maximal (1.65%)</b>	36	1.44%	37	0.22%



# Conclusions

- This paper presents the only map between ICD-9-CM, ICD-10-CM and AIS08 derived by experts in AIS and ICD working together
- This map was designed for use with large ICD data sets where AIS and ISS severities are needed
- The map is now available through AAAM and we encourage researchers and analysts to begin using this and/or the dichotomous map to provide improved consistency in research methodology
- By developing these maps following consistent rules, large data sets coded in ICD can be mapped to AIS 08 and compared with research data sets coded using AIS08 in a standardized manner



# Thank you!

Questions?

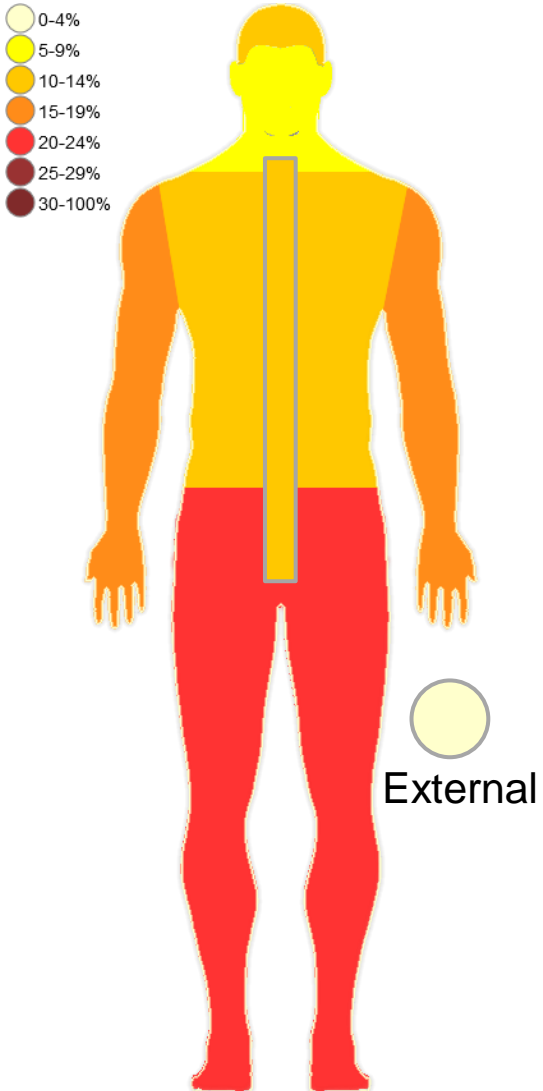


We would like to acknowledge the AAAM Board for the support and sponsorship in developing these maps.



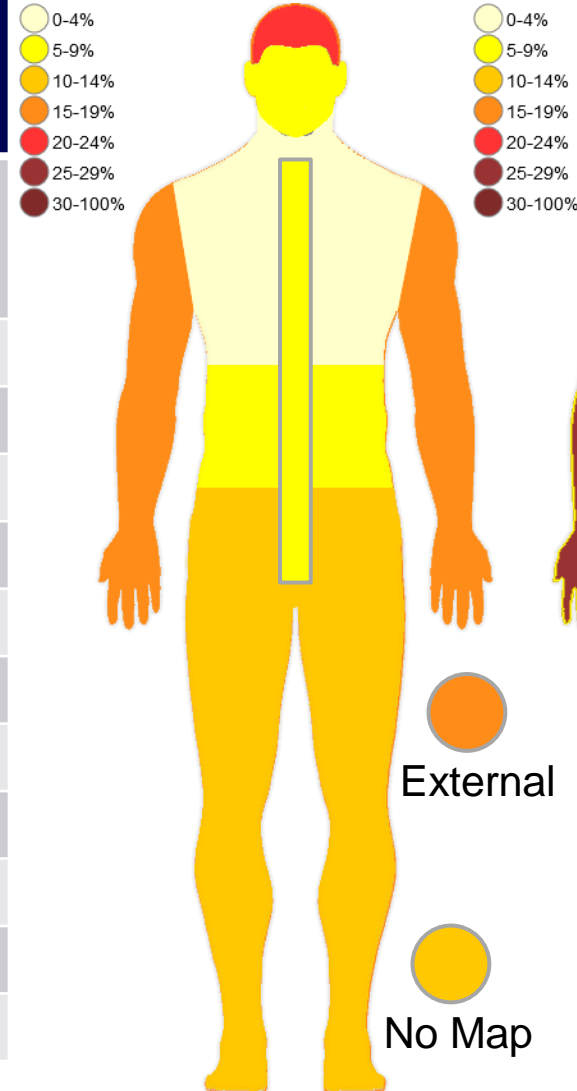
# ICD to AIS Chapters

Dictionary  
AIS08 Chapters



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ICD-9-CM to  
AIS08 Chapters



ICD-10-CM to  
AIS08 Chapters

