Finding the needle in the haystack…

Cervical spine imaging & Clinical decision rules in children: The CRIC study

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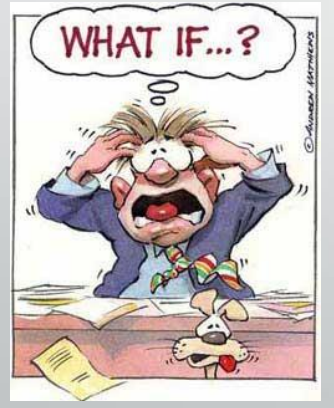
Queensland Government

Lady Cilento Children's Hospital

PREDICT Paediatric Research in Emergency Departments International Collaborative


CAUTION
X-RAY
RADIATION

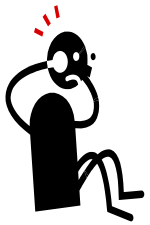

RIP

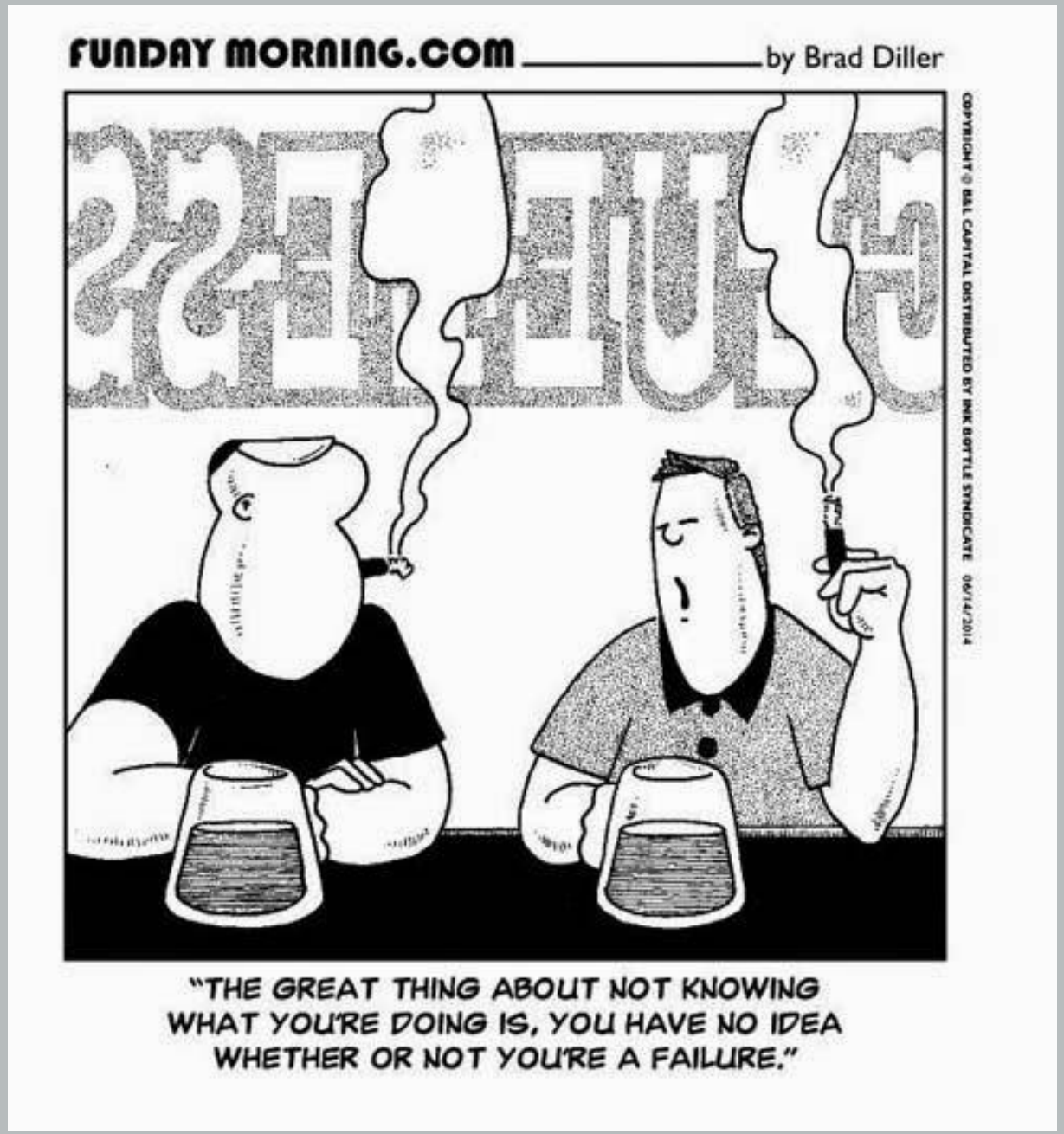

WHAT IF...?

NEXUS

CANADIAN C-SPINE RULE

PECARN




FUNDAY MORNING.COM
by Brad Diller
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"THE GREAT THING ABOUT NOT KNOWING WHAT YOU'RE DOING IS, YOU HAVE NO IDEA WHETHER OR NOT YOU'RE A FAILURE."

CRIC: what we did….

September 2015 – September 2016

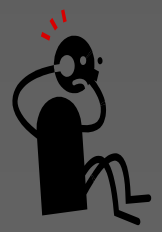
Prospective observational study

All children <16 y presenting with

- Neck pain in the context of trauma
- Immobilised pre arrival for possible CSI
- Otherwise considered at risk by initial treating team for CSI

Exclusion

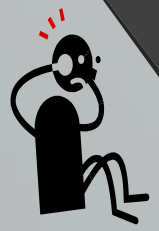
- Penetrating trauma
- Unable to achieve follow up call
- No consent



64647 presentations

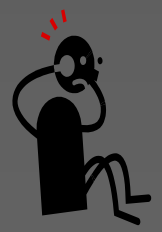
- 1109 met inclusion criteria
  - 1010 enrolled in study
    - 973 without prior imaging
      - 5 CSI (0.5%)
    - 37 with prior imaging
      - 9 CSI

- 5 deaths; nil known missed injuries; Telephone follow up rate 93.2%



Population

- **2/3 male**
- **Age**
  - Median 10.9y
  - 16% under 5
- **Mode of arrival**
  - 73% QAS
  - 3% primary retrieval
  - 3% IHT
- **ATS**
  - 90% Cat 1-3
  - 60% Cat 1 or 2



Mechanism

54.5% fall

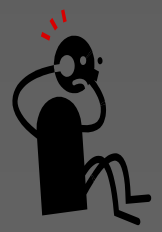
21% MVA related

Specific sports

- 20% "football"
- 4.1% gymnastics and trampolining
- 3.6% cycling, BMX and mountain biking
- 2.9% motorcross
- 2.4% horse riding

High risk mechanisms

- 8.3% Axial load
- 9.1% Neck hyperflexion



Clinical Features

91.9% GCS 15

45.9 % neck pain in ED; 42.9 tenderness

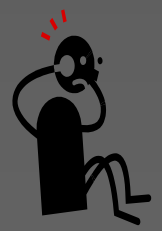
- 27.4% posterior midline tenderness

6% focal neurology

3.7% torticollis

23.9% suspected significant other injuries

16.3% clinician defined distracting injury



Imaging

(n =973)

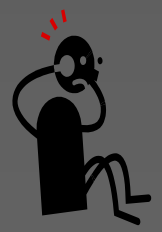
40.7% received imaging

32.4% Plain films

13.4 % CT

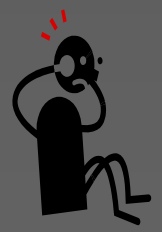
Whole C-spine 81.5%

3% MRI



Imaging

(n =396)



First line investigations in children imaged

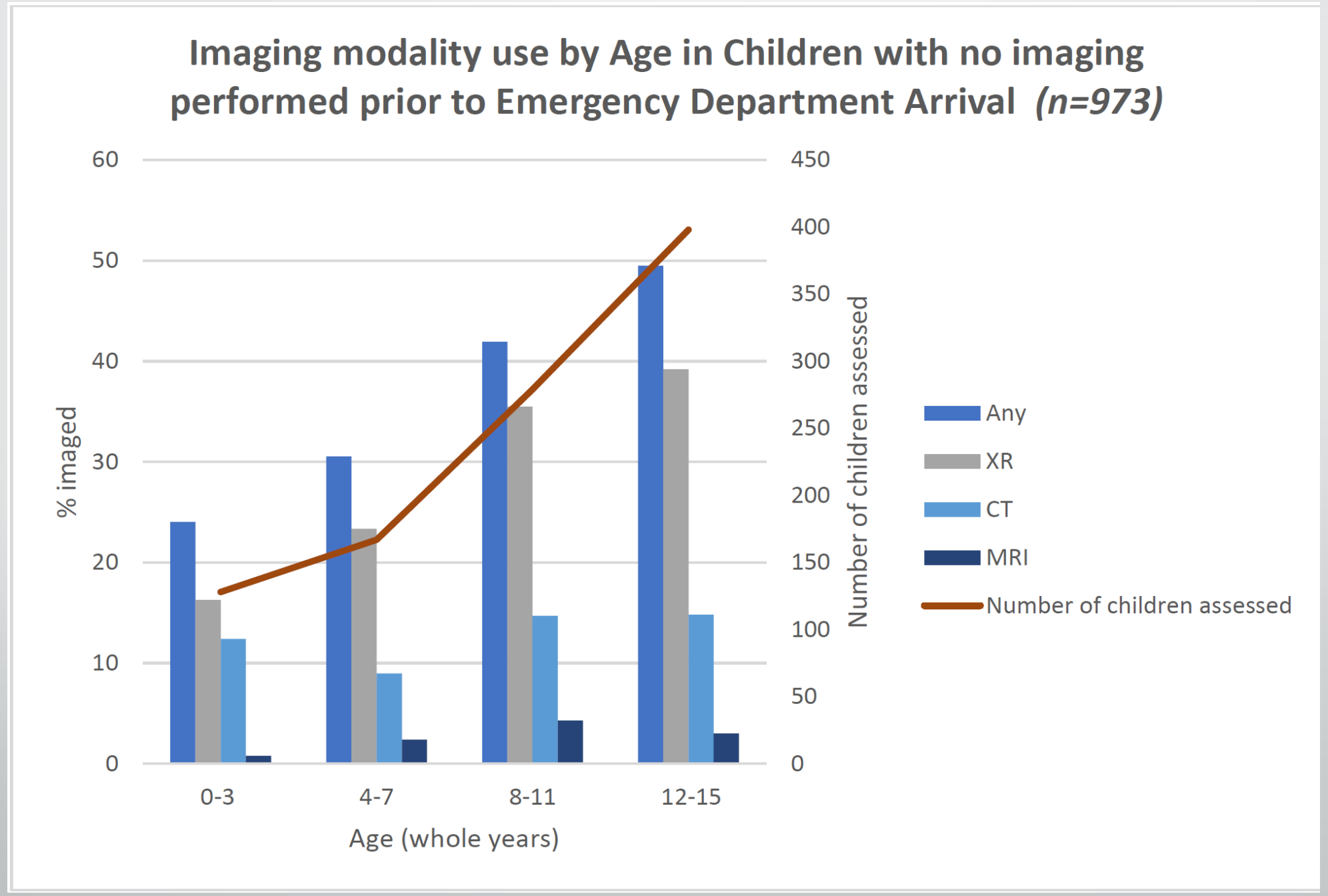
- 77.5% XR
- 22% CT

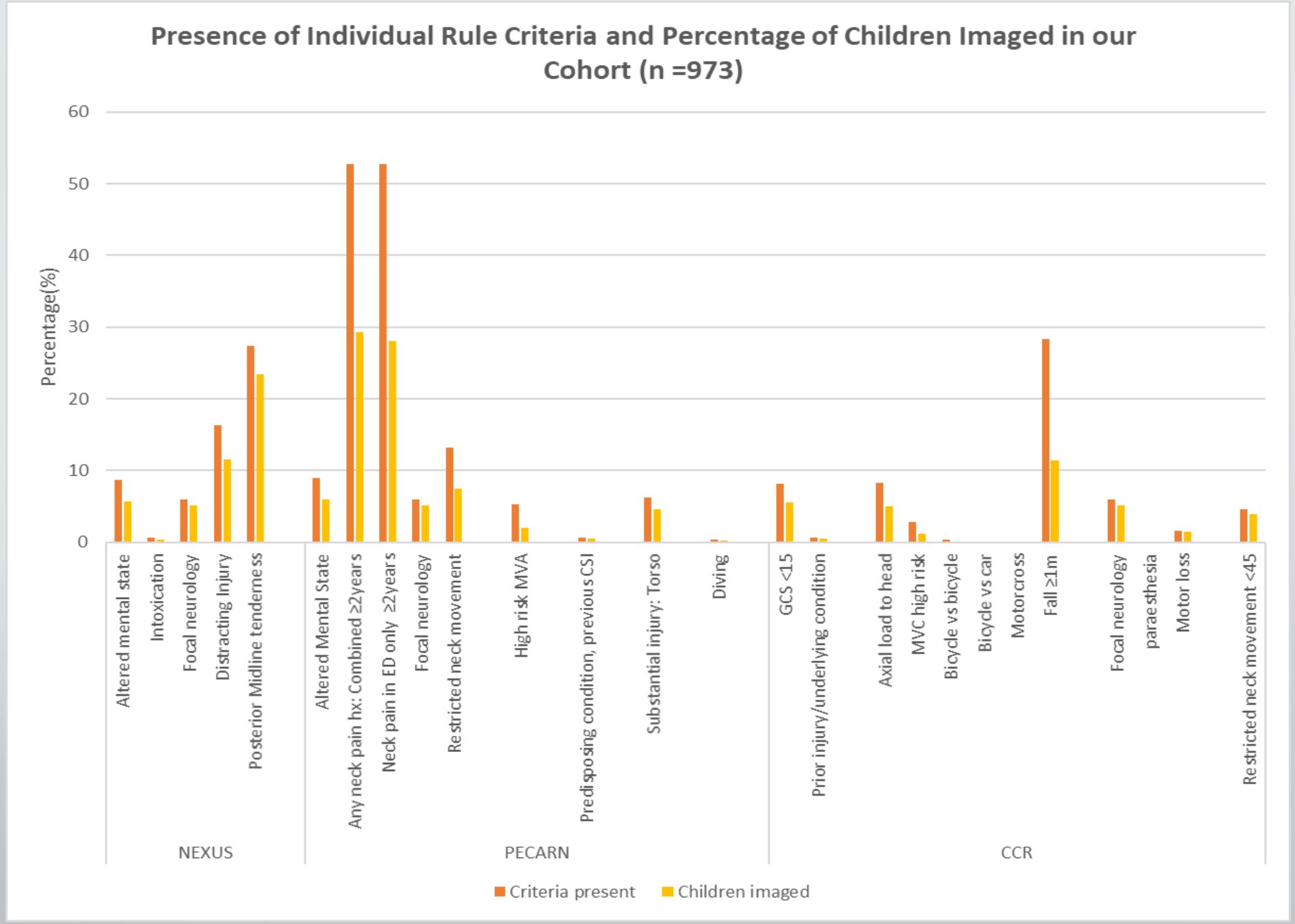
CTs

- 67% were done as first line Ix
- Only 1 done outside ED (SSU)

Multiple Modalities

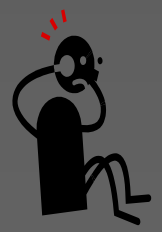
- 16.1% with plain films also received a CT
- 13% of all children receiving a CT also received an MRI
- 7 children received all 3 imaging types


Imaging modality use by Age in Children with no imaging performed prior to Emergency Department Arrival (n=973)
60
50
40
30
20
10
0
% imaged
450
400
350
300
250
200
150
100
50
0
Number of children assessed
0-3
4-7
8-11
12-15
Age (whole years)
Any
XR
CT
MRI
Number of children assessed


Presence of Individual Rule Criteria and Percentage of Children Imaged in our Cohort (n =973)
Percentage(%)
60
50
40
30
20
10
0
Altered mental state
Intoxication
Focal neurology
Distracting Injury
Posterior Midline tenderness
Altered Mental State
Any neck pain hx: Combined ≥2years
Neck pain in ED only ≥2years
Focal neurology
Restricted neck movement
High risk MVA
Predisposing condition, previous CSI
Substantial injury: Torso
Diving
GCS <15
Prior injury/underlying condition
Axial load to head
MVC high risk
Bicycle vs bicycle
Bicycle vs car
Motorcross
Fall ≥1m
Focal neurology
paraesthesia
Motor loss
Restricted neck movement <45
NEXUS
PECARN
CCR
Criteria present
Children imaged

Strict Rule Application:

Sensitivities, specificities & all that



Missed injuries

Theoretical imaging rates:

- **430 (44.1%) definitely met at least one NEXUS criteria**

  325 (75%) of these children imaged

- **PECARN 60-66%**

  345 -355 (55-59%) imaged

- **Canadian C spine >48%;** likely higher

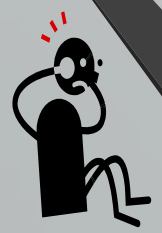
  242 (51%) imaged


FIND THE NEEDLE IN A HAYSTACK
Solving problems like a Pyromaniac

CRIC Quote of the Year

" *It feels like my head is slipping off"*

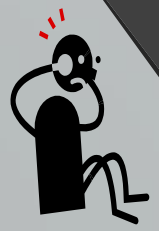
- 8 year old participant with a CSI….



With thanks to patients, caregivers, ED staff and the research team at QCH for their support of this project.

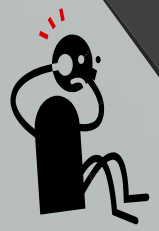
Cervical Spine Imaging in Children

- Problem – it is important
- Present pitfalls – tread with caution
- Possibilities – finding a pathway forward



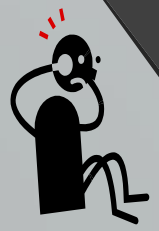
The Grey Zone Continues….

¿Not only WHO to image but HOW?



CRIC: Children's Rules for Imaging the C-spine

- Our Country - who we see & what we do
- Our Context- how the rules perform
- Our Capacity- is a multicentre study feasible?



- Prospective, single centre
- All children presenting for Assessment of possible CSI

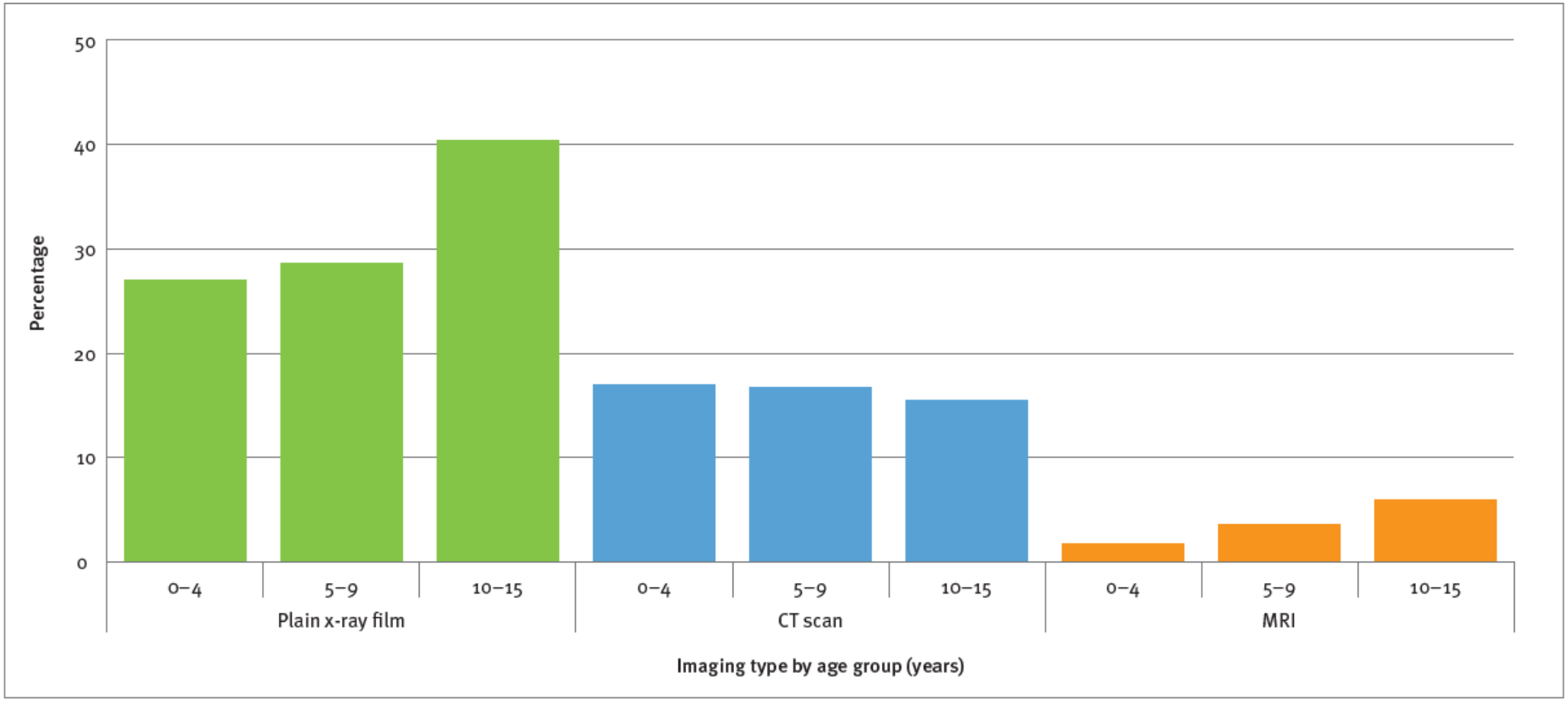
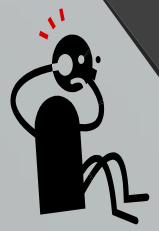
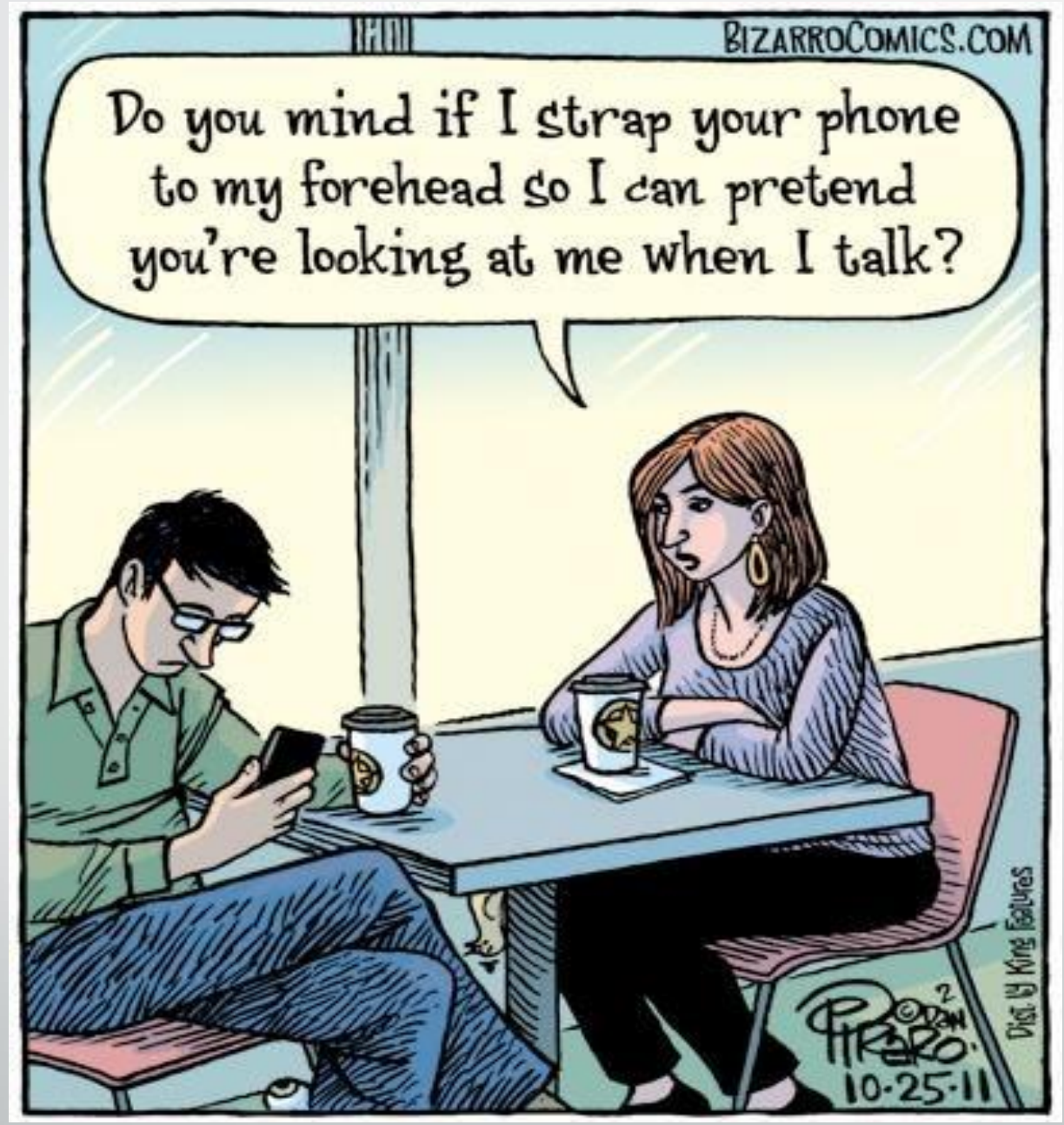


Figure 2: Imaging modality rates according to age group (years)



Analysis of the first 300 cases, presented at ACEM, Queenstown, 2016


BIZARROCOMICS.COM
Do you mind if I strap your phone to my forehead so I can pretend you're looking at me when I talk?
PIRRO
10-25-11
Dist. by King Features

278 children were included for analysis. Recruitment occurred from mid September 2015-mid January 2016. Median age was 9.8 years; over 25% were aged under 6 years. 63.4% were male. 61.9% were assessed after falls, 21.2% after motor vehicle related accidents and 32% of presentations were related to specific sports (**Figure 1**). On initial examination, 11% had a GCS less than 15, 2.2% arrived intubated, 3.9% had focal neurology and 6.5%, torticollis (**Figure 2**). Nearly 40% had definite neck pain and tenderness, this was unknown in a further 7.2%. Of those with neck tenderness, this was described as posterior midline in 60%.

Conclusion

This cohort includes a significant proportion of younger children, identifying that while this group is poorly described in the literature, they are regularly assessed in practice for possible CSI. Further research is required to determine if any associations between clinical characteristics and imaging and injury patterns exist, and to assess whether observed patterns persist outside of a spring/summer cohort.

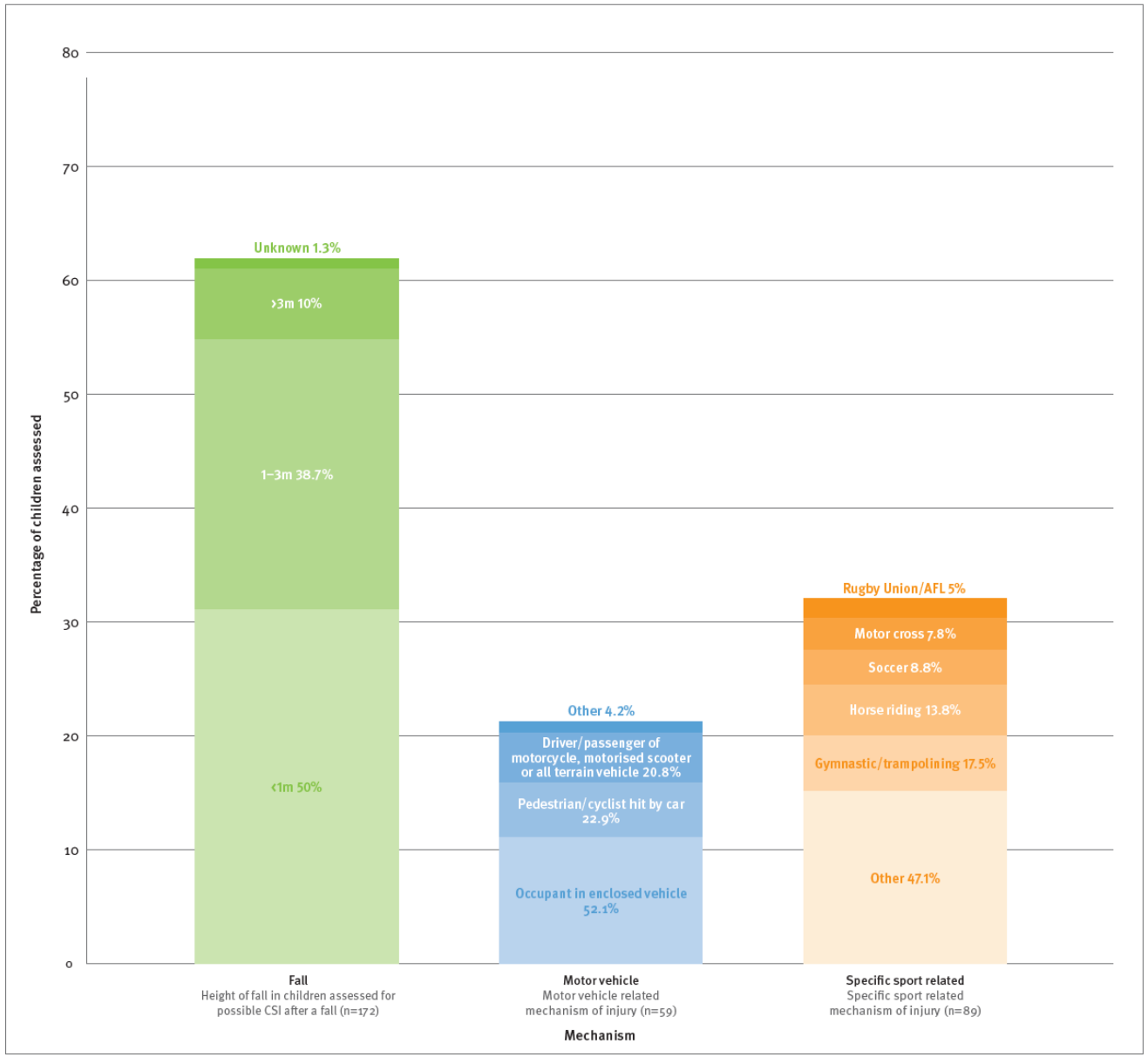


Figure 1: Mechanism of injury in children assessed for possible Cervical Spinal Injury (n=278)

278 children were included for analysis. Median age was 9.8 years. 44% received imaging for possible CSI in the ED; 34.1% had plain x-rays, 15.8% CT scans, and 4.3% MRI scans. A number of children received more than one form of imaging (**Figure 1**). Plain x-rays imaging rates increased with age, whereas CT rates remained relatively constant (15-17%) across all age groups (**Figure 2**). 92.8% of children had their cervical spine "cleared" in ED, of which nearly 60% were cleared without imaging.

Conclusion

A significant number of children are clinically cleared (i.e. without imaging)of cervical spine injury, highlighting the importance of further research into paediatric appropriate clinical decision rules in the assessment and imaging of children with possible CSI. More extensive exploration into patterns of imaging, including multi-centre studies, would also be beneficial.