CORTICES EPOSNA 2024

CORTICES
ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

EPOSNA

Agenda

3:00 – 3:30 PM: Welcome and Membership Discussion (Beebe and Laine)

3:30 – 3:50 PM: Tibia Nail- Retrospective: Mark Miller

3:50 – 4:10 PM: Necrotizing Fasciitis presentation: Wendy Ramalingam, Lawson Copley, Stephanie Moore & Jon Schoenecker

4:10 – 4:25 PM: NAT presentation: Scott Rosenfeld

4:25 – 4:35 PM: Burst Fracture: Craig Birch

4:35 – 4:45 PM: Femoral Neck Fracture (Virtual): Jill Larson

4:45 – 4:55 PM: Lisfranc study: Megan Johnson & Tony Riccio

5:00 – 5:10 PM: Break Time

5:20 – 5:30 PM: CORTICES Study Development and Launch Overview: Meghana Venkatesh and Fernanda Canizares

5:30 –5:45 PM: MSKI- Prospective Study: Stephanie Moore-Lotridge & Jon Schoenecker

5:45 –6:00 PM: Closing

Welcome and Membership Discussion

Allan Beebe & Jennifer Laine

CORTICES Membership Update

Allan Beebe, MD and Jennifer Laine, MD

CORTICES EPOSNA Meeting

~Washington, DC

May 6, 2024

CORTICES

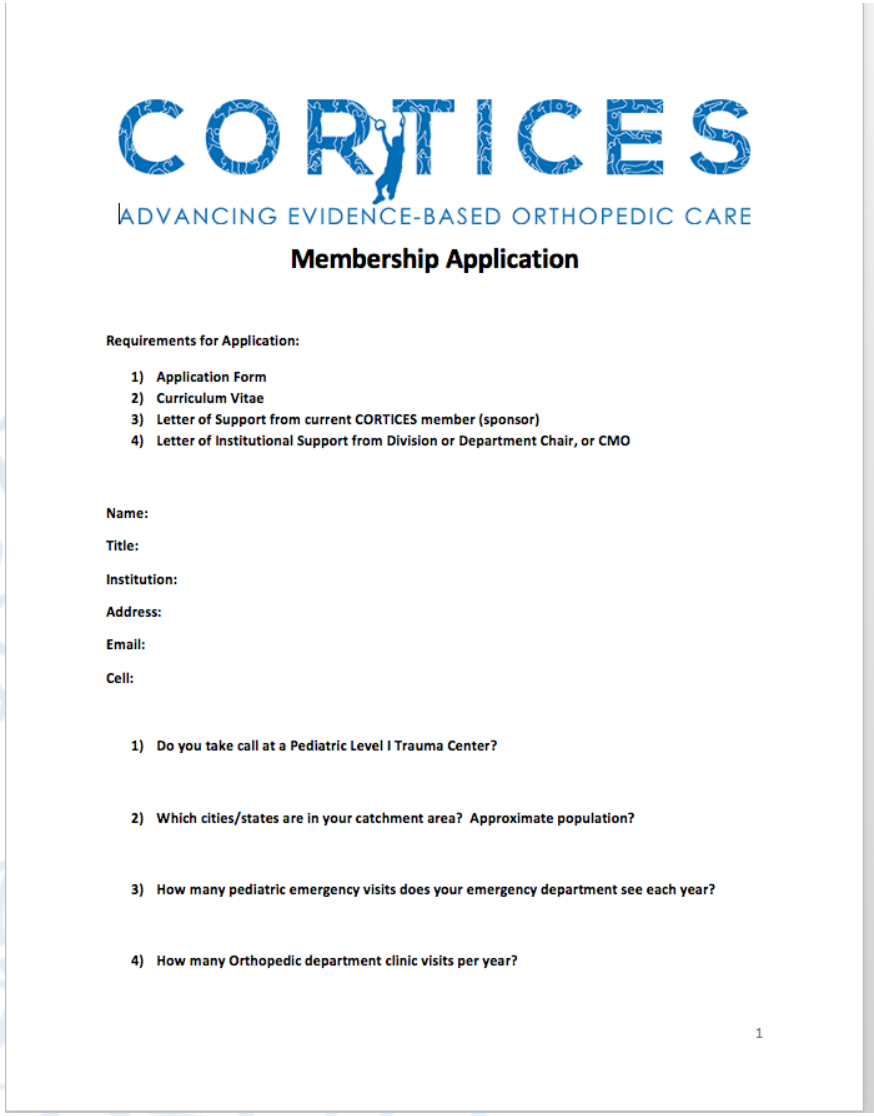
Membership Topics

- Welcome New Members!
  - Process History and Timeline
- What does it mean to be a member?
- Review Points
- Bylaws

Membership Application History

New Institutions:

- Spring 2020: Application for New Institutions
  - Ishaan (UCSF) and Ryan (Omaha)
  - 5 applied



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ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

Membership Application

Requirements for Application:

1) Application Form
2) Curriculum Vitae
3) Letter of Support from current CORTICES member (sponsor)
4) Letter of Institutional Support from Division or Department Chair, or CMO

Name:

Title:

Institution:

Address:

Email:

Cell:

1) Do you take call at a Pediatric Level I Trauma Center?

2) Which cities/states are in your catchment area? Approximate population?

3) How many pediatric emergency visits does your emergency department see each year?

4) How many Orthopedic department clinic visits per year?

1

Membership Application History

Continue to Grow…

- Fall 2022: Admitted Dyad and Scientific Members from Existing Institutions

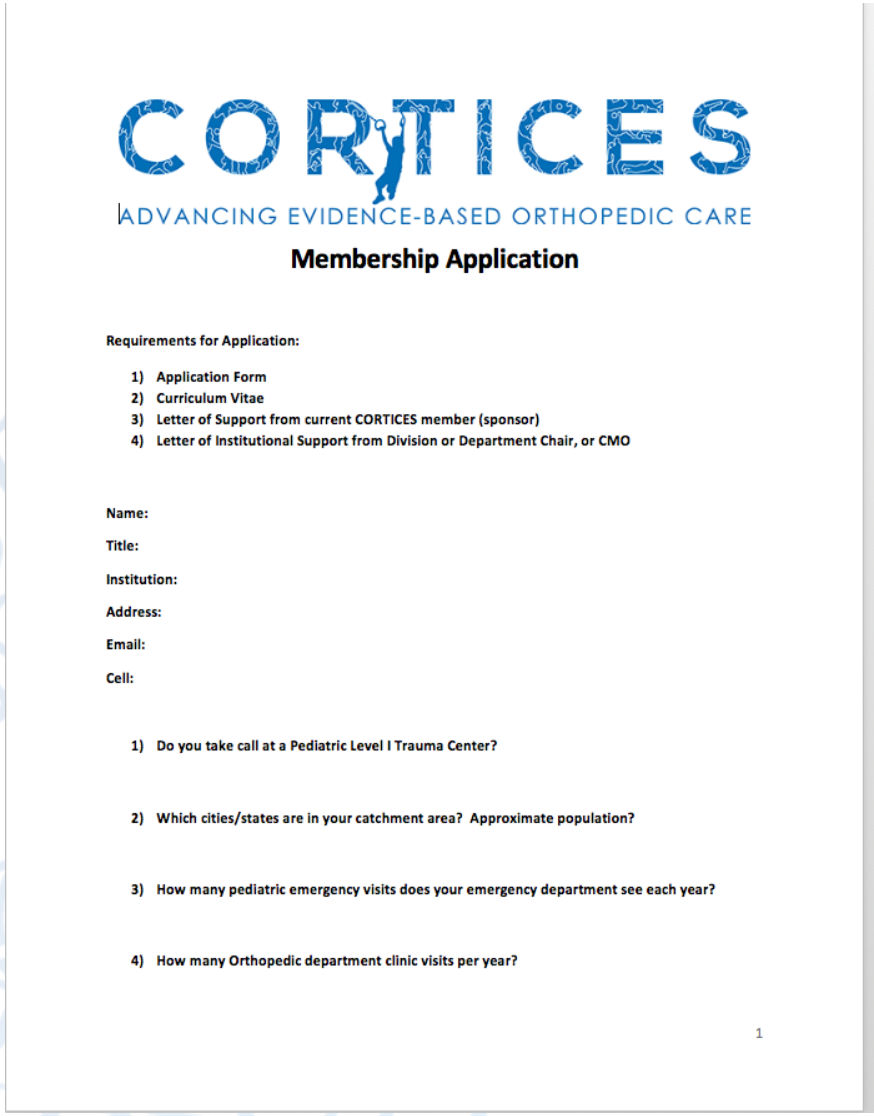
Alex (CHOP)
Sayan (Colorado)
Allen (Nationwide)
Jill (Lurie)
Nate (Vanderbilt)
Dell (CHOA)
Jonas (CHLA)
Zach (WashU)
Stephanie (Vanderbilt)
Ben (Campbell Clinic)
Matt (Michigan)

Membership Application History

Continue to Grow…

- Fall 2023: Admitted New Members (and one Transfer) from Existing Institutions through Application cycle

- When do we open again to new institutions?



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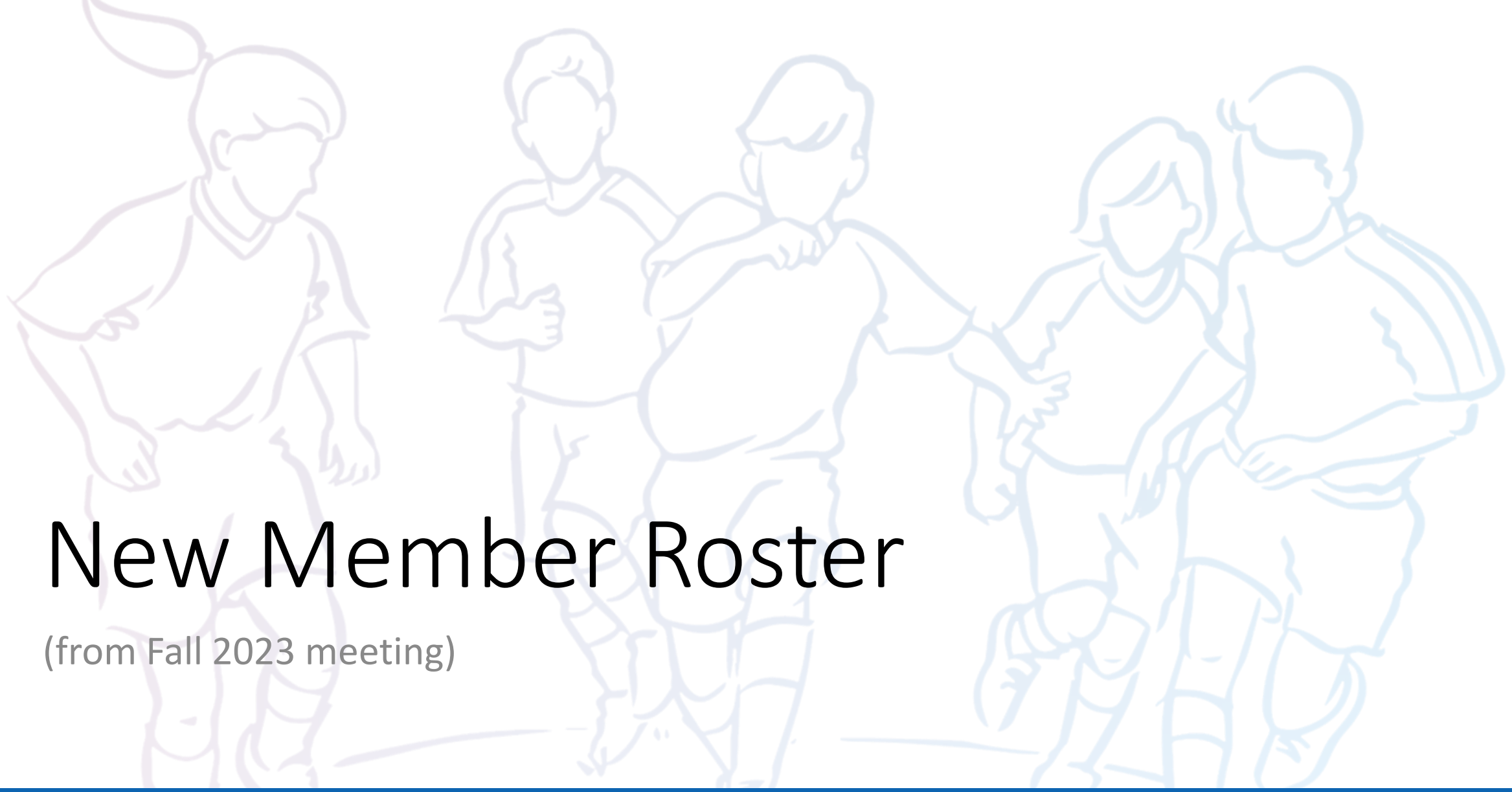

New Member Roster

(from Fall 2023 meeting)

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Familiar CORTICES Face

Jaclyn Hill, MD – transfer membership

Recently located to UCSF

- Joining Ishaan

Previously at Texas Children's

Long-standing CORTICES member

Fellowship: Boston Children's

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New CORTICES Faces

Kristin Livingston

At UCSF for 8 years

Joined Boston Children's recently

- Joined Ben, et al.

Trauma Director

Fellowship: Boston Children's

New CORTICES Faces

Jessica McGraw-Heinrich

Joined Texas Children's in 2023

- Joined Scott

Fellowship: Peds Ortho @ Texas Children's (with Scott)

Trauma Fellowship @ The CORE Institute Phoenix

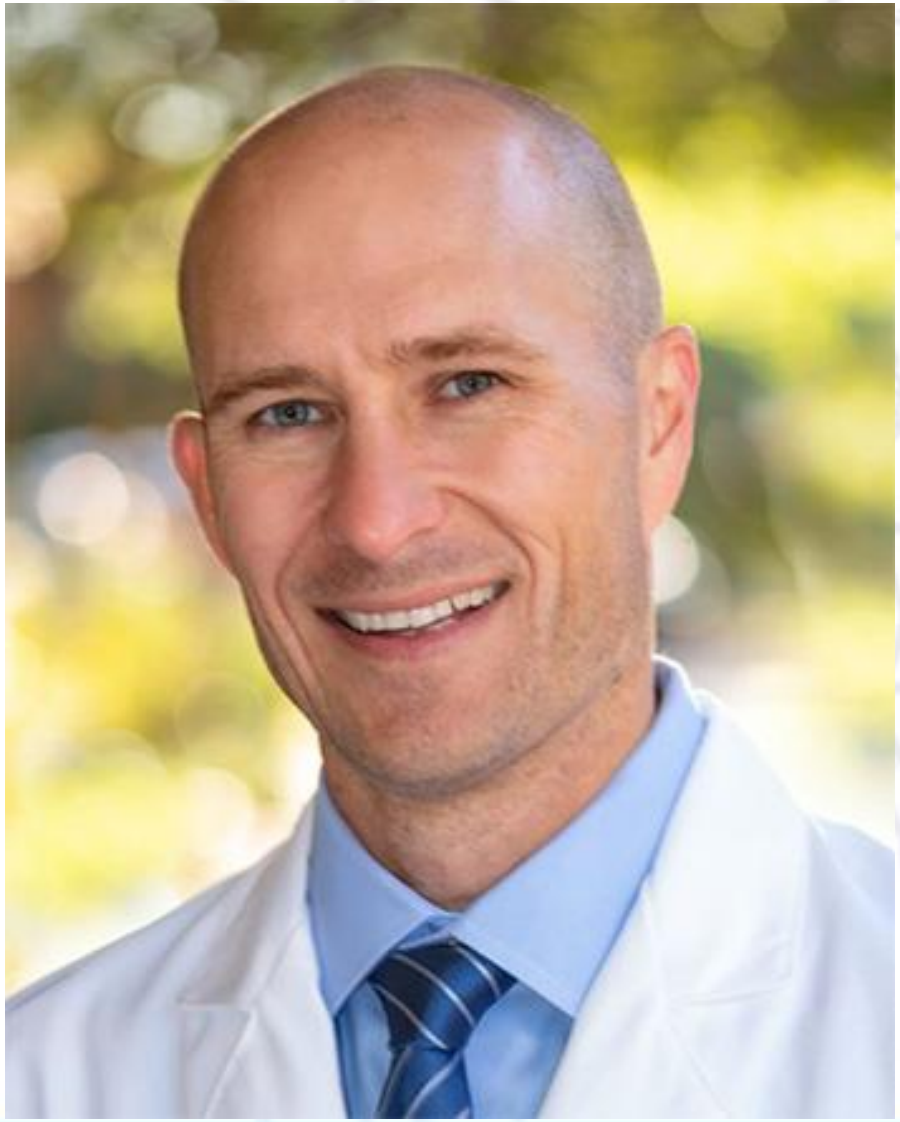
New CORTICES Faces

Emmalynn Sigrist

Joined Gillette Children's in 2021

- Joined Walter and Jennifer

Fellowship: Washington University (with Mark Miller)



New CORTICES Faces

Chris Souder

Baylor Scott & White Health, Texas (2013-8)

Was Trauma Director at Dell Children's (Austin 2018-2023)

Joined Rady Children's in 2003 – building trauma division

- Joined Salil

Fellowship: Rady

Welcome to CORTICES!

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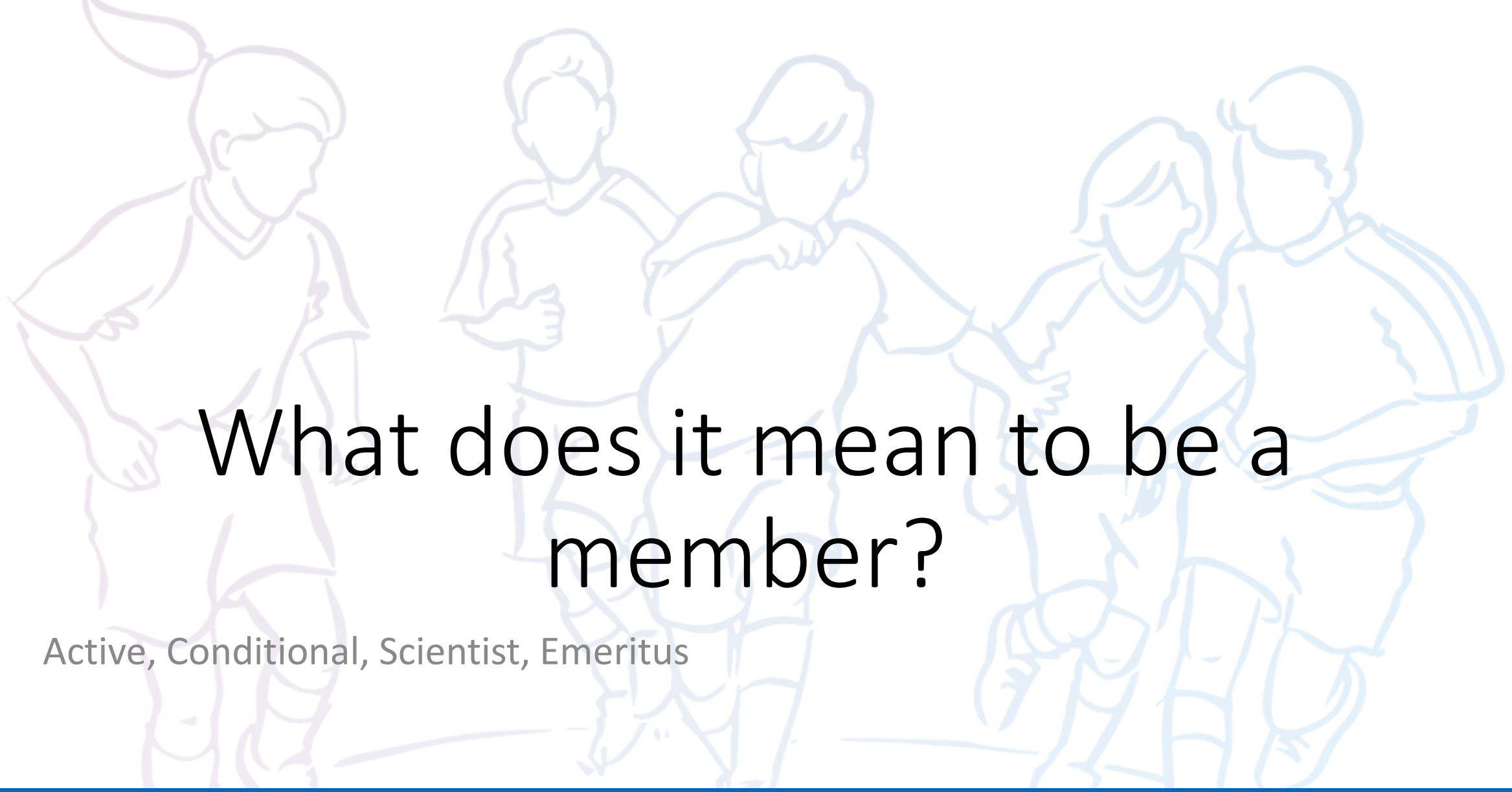

What does it mean to be a member?

Active, Conditional, Scientist, Emeritus

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Membership Status

Active:

- Admitted at time of inception
- Or, met criteria for Active Membership
- May: serve on Board, all committees, has full voting

Conditional:

Membership Status

Active:

Conditional:

- Newly admitted members
- Previous active (did not maintain active)
- 2 year max

Bylaws

Working Copy
Membership Section of CORTICES Bylaws

ARTICLE II. Membership

Section 1 Membership statement

Membership in CORTICES is a privilege and not a right and is contingent on maintaining active participation within the organization. CORTICES will strive to have regional representation of pediatric orthopaedic surgeons from pediatric centers across North America. At each site, there will be at least one lead physician and research representative identified. In addition, once Active Membership is attained, sites may elect to have additional participating members, who may participate when feasible at mid-year and annual meetings. Additional participating members will be approved by the Membership Committee and Board of Directors. Additional participating members from existing sites must apply for membership at regularly identified intervals.

Section 2 Classes of Membership

ACTIVE: An Active member is one who has been admitted at the time of inception of CORTICES or has been admitted through invitation/application process and has met the criteria below for ACTIVE membership. An ACTIVE member may serve on the Board of Directors, all committees, and has full voting privileges.

CONDITIONAL: Conditional membership shall include those individuals/Institutions that have applied for membership through either invitation or application and have not yet fulfilled the criteria for full Active membership. This category may also include those previously ACTIVE members who have failed to maintain their ACTIVE criteria requirements during the previous year. No individual or institution may remain in this category longer than 2 years as assessed annually at the Fall Annual Meeting without a

Criteria for Active Membership

Two Categories:

- **Institutional Requirements**
- **Individual Membership Points System**

Criteria for Active Membership

Two Categories:

- **Institutional Requirements**
- **Individual Membership Points System**

- **Membership Dues Current**
- **DUA Active and Signed**
  - **At least 1 ongoing study**
- **Active IRB**
  - **At least 1 active study**

Criteria for Active Membership

Two Categories:

- **Institutional Requirements**
- **Individual Membership Points System**

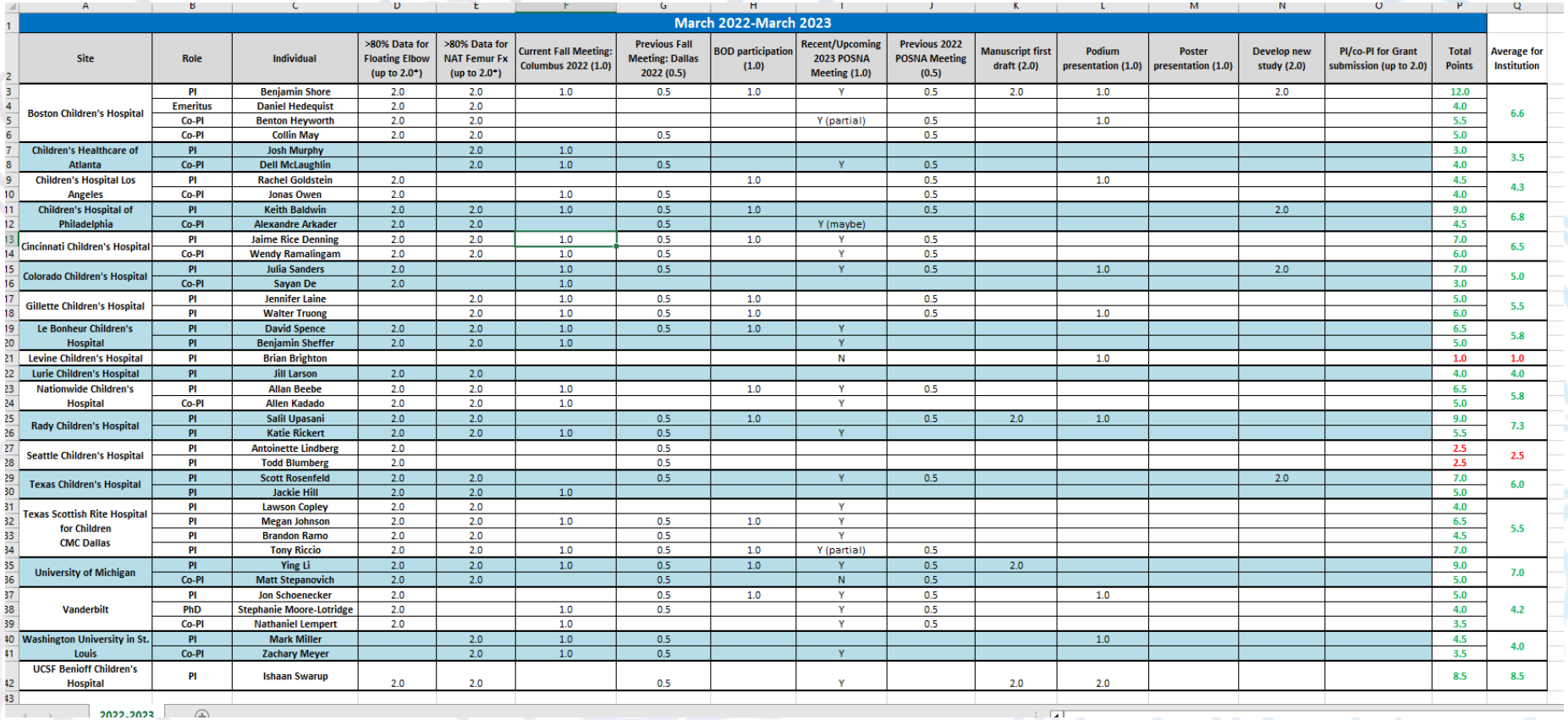
- **3 points over the last year**
- **Points assessed on annual basis**
- **Notified of points status prior to (next) annual meeting**

Points System

- **Attendance**
- **Data**
- **Participation**
- **Productivity/Visibility**

On Hold Since 2020…

Points



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	March 2022-March 2023																
2	Site	Role	Individual	>80% Data for Floating Elbow (up to 2.0*)	>80% Data for NAT Femur Fx (up to 2.0*)	Current Fall Meeting: Columbus 2022 (1.0)	Previous Fall Meeting: Dallas 2022 (0.5)	BOD participation (1.0)	Recent/Upcoming 2023 POSNA Meeting (1.0)	Previous 2022 POSNA Meeting (0.5)	Manuscript first draft (2.0)	Podium presentation (1.0)	Poster presentation (1.0)	Develop new study (2.0)	PI/co-PI for Grant submission (up to 2.0)	Total Points	Average for Institution
3	Boston Children's Hospital	PI	Benjamin Shore	2.0	2.0	1.0	0.5	1.0	Y	0.5	2.0	1.0		2.0		12.0	6.6
4		Emeritus	Daniel Hedequist	2.0	2.0											4.0	
5		Co-PI	Benton Heyworth	2.0	2.0				Y (partial)	0.5		1.0				5.5	
6		Co-PI	Collin May	2.0	2.0		0.5			0.5						5.0	
7	Children's Healthcare of Atlanta	PI	Josh Murphy		2.0	1.0										3.0	3.5
8		Co-PI	Dell McLaughlin		2.0	1.0	0.5		Y	0.5						4.0	
9	Children's Hospital Los Angeles	PI	Rachel Goldstein	2.0				1.0		0.5		1.0				4.5	4.3
10		Co-PI	Jonas Owen	2.0		1.0	0.5			0.5						4.0	
11	Children's Hospital of Philadelphia	PI	Keith Baldwin	2.0	2.0	1.0	0.5	1.0		0.5				2.0		9.0	6.8
12		Co-PI	Alexandre Arkader	2.0	2.0		0.5		Y (maybe)							4.5	
13	Cincinnati Children's Hospital	PI	Jaime Rice Denning	2.0	2.0	1.0	0.5	1.0	Y	0.5						7.0	6.5
14		Co-PI	Wendy Ramalingam	2.0	2.0	1.0	0.5		Y	0.5						6.0	
15	Colorado Children's Hospital	PI	Julia Sanders	2.0		1.0	0.5		Y	0.5		1.0		2.0		7.0	5.0
16		Co-PI	Sayan De	2.0		1.0										3.0	
17	Gillette Children's Hospital	PI	Jennifer Laine		2.0	1.0	0.5	1.0		0.5						5.0	5.5
18		PI	Walter Truong		2.0	1.0	0.5	1.0		0.5		1.0				6.0	
19	Le Bonheur Children's Hospital	PI	David Spence	2.0	2.0	1.0	0.5	1.0	Y							6.5	5.8
20		PI	Benjamin Sheffer	2.0	2.0	1.0			Y							5.0	
21	Levine Children's Hospital	PI	Brian Brighton						N			1.0				1.0	1.0
22	Lurie Children's Hospital	PI	Jill Larson	2.0	2.0											4.0	4.0
23	Nationwide Children's Hospital	PI	Allan Beebe	2.0	2.0	1.0		1.0	Y	0.5						6.5	5.8
24		Co-PI	Allen Kadado	2.0	2.0	1.0			Y							5.0	
25	Rady Children's Hospital	PI	Salil Upasani	2.0	2.0		0.5	1.0		0.5	2.0	1.0				9.0	7.3
26		PI	Katie Rickert	2.0	2.0	1.0	0.5		Y							5.5	
27	Seattle Children's Hospital	PI	Antoinette Lindberg	2.0			0.5									2.5	2.5
28		PI	Todd Blumberg	2.0			0.5									2.5	
29	Texas Children's Hospital	PI	Scott Rosenfeld	2.0	2.0		0.5		Y	0.5				2.0		7.0	6.0
30		PI	Jackie Hill	2.0	2.0	1.0										5.0	
31	Texas Scottish Rite Hospital for Children CMC Dallas	PI	Lawson Copley	2.0	2.0				Y							4.0	5.5
32		PI	Megan Johnson	2.0	2.0	1.0	0.5	1.0	Y							6.5	
33		PI	Brandon Ramo	2.0	2.0		0.5		Y							4.5	
34		PI	Tony Riccio	2.0	2.0	1.0	0.5	1.0	Y (partial)	0.5						7.0	
35	University of Michigan	PI	Ying Li	2.0	2.0	1.0	0.5	1.0	Y	0.5	2.0					9.0	7.0
36		Co-PI	Matt Stepanovich	2.0	2.0		0.5		N	0.5						5.0	
37	Vanderbilt	PI	Jon Schoenecker	2.0			0.5	1.0	Y	0.5		1.0				5.0	4.2
38		PhD	Stephanie Moore-Lotridge	2.0		1.0	0.5		Y	0.5						4.0	
39		Co-PI	Nathaniel Lempert	2.0		1.0			Y	0.5						3.5	
40	Washington University in St. Louis	PI	Mark Miller		2.0	1.0	0.5					1.0				4.5	4.0
41		Co-PI	Zachary Meyer		2.0	1.0	0.5		Y							3.5	
42	UCSF Benioff Children's Hospital	PI	Ishaan Swarup	2.0	2.0		0.5		Y		2.0	2.0				8.5	8.5
43																	

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Bylaws

CORTICES

Questions?

Tibia Nail Retrospective

Mark Miller

Antegrade rigid intramedullary nailing (RIMN) of tibial diaphyseal fractures in adolescents with open proximal tibial physis

May 7, 2024
CORTICES Annual Meeting
National Harbor, MD

Mark L Miller, MD, Julia Sanders MD, Zach I Meyer, MD, and Josh Marino BS

Outline:

1. Recap of retrospective adolescent tibia CORTICES study

2. Review data collection protocol and site participation updates

Primary Aim:
Quantify proximal tibial iatrogenic deformity at skeletal maturity in adolescents with diaphyseal tibial shaft fractures treated with antegrade rigid intramedullary nailing through an open proximal tibial physis

Hypothesis:
Antegrade rigid intramedullary nail fixation through open proximal tibia physis in adolescents nearing skeletal maturity will not cause clinically significant proximal tibial deformity (Mechanic axis deviation > 5mm, Leg length difference > 1 cm).

Primary Outcome:
Deformity Parameters at Skeletal maturity: Mechanical Axis Deviation (MAD), mechanical Medial proximal tibia angle (mMPTA), mechanical posterior proximal tibial angle (mPPTA), Leg length discrepancy (LLD))

REDCAP is built with BCH as host data site

- Data guide and alpha testing at WashU has been completed. Beta testing is set for sites with all necessary DUA's/SSA's and IRB approvals.

- Current approved list:
- BCH, Lurie, Campbell, and Colorado

- Pending approvals:
- Vandy, Rady, and Nationwide

- We will reach out the sites participating in the beta test with instructions/data entry guide in the following weeks

- Inclusion criteria: Age <18, tibial shaft fracture, open physes, treated with rigid tibial IMN, Treated at a CORTICES institution between January 2010 and June 2020
-
- Exclusion criteria: skeletally mature, treatment with other than rigid tibial IMN
-

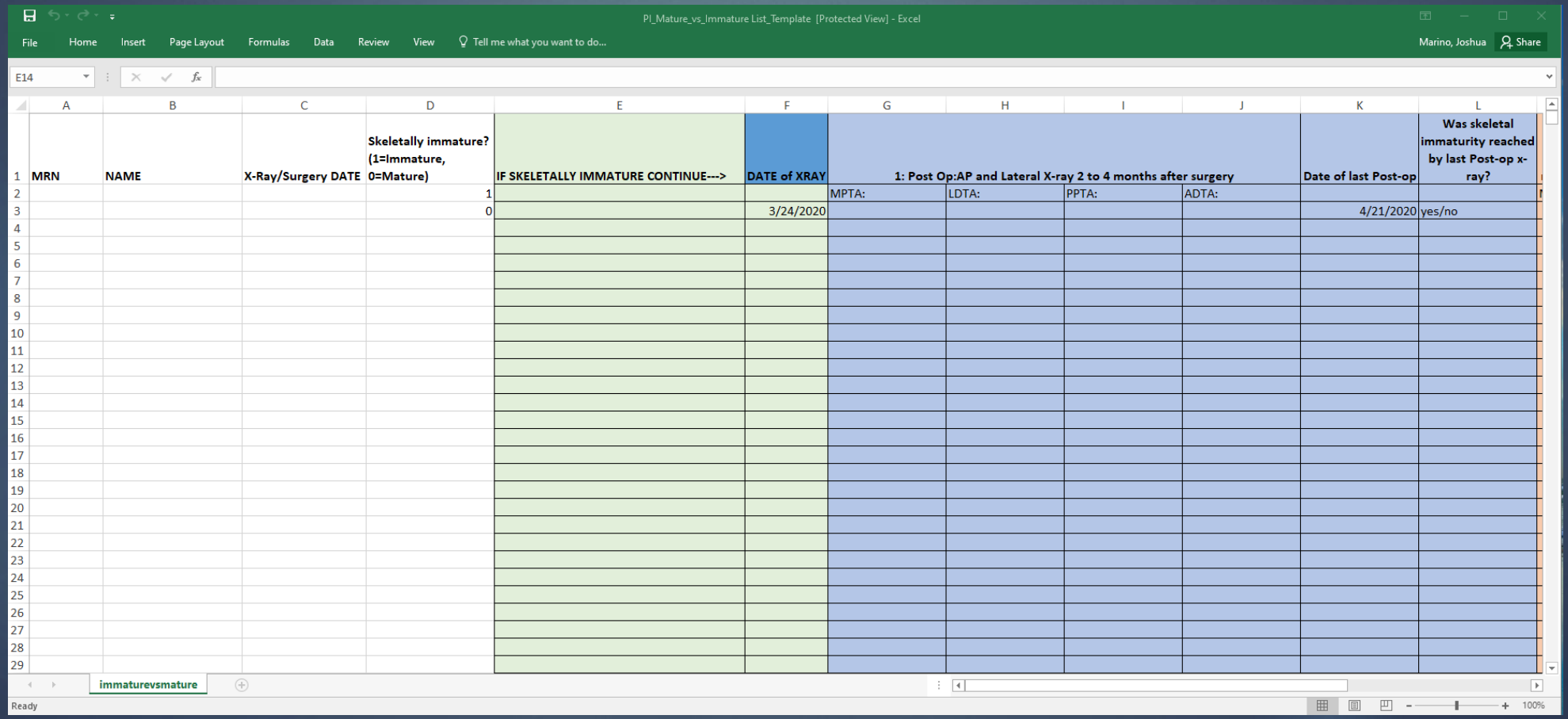
- Record ID
- Sex
  - M
  - F
    - Pre-menarchal
    - Post-menarchal
    - Not recorded
- DOB
- DOI
  - Calculate age at injury
- BMI
- Mechanism of injury (MOI)
  - MVA/MCA/ATV
  - Auto-ped
  - Sports
  - Fall from height
  - Other
- DOS
  - Calculate age at surgery
  - Calculate time from injury

- Bone age
  - Was there a Left hand xray obtained within 3 months of injury? If so then calculate hand bone age using Greulich/Pyle
  - Was there an ipsilateral or contralateral knee radiograph obtained within 3 months of injury? If so then calculate Modified Fels/Liu bone age using Rainbow bone age app

https://apps.apple.com/us/app/whats-the-skeletal-maturity/id1564285837

https://www.jposna.org/index.php/jposna/article/download/692/734/5275

- Due to the subjectivity of skeletal immaturity, we propose that initial patient eligibility should be determined by PI's/attendees once a potential patient list is pulled.
- We will provide an excel document that will make it easier for PI's to determine eligible patients and record the necessary radiographic measurements.



PI_Mature_vs_Immature List_Template [Protected View] - Excel

File Home Insert Page Layout Formulas Data Review View Tell me what you want to do... Marino, Joshua Share

E14

	A	B	C	D	E	F	G	H	I	J	K	L
1	MRN	NAME	X-Ray/Surgery DATE	Skeletally immature? (1=Immature, 0=Mature)	IF SKELETALLY IMMATURE CONTINUE--->	DATE of XRAY	1: Post Op:AP and Lateral X-ray 2 to 4 months after surgery				Date of last Post-op	Was skeletal immaturity reached by last Post-op x-ray?
2				1			MPTA:	LDTA:	PPTA:	ADTA:		
3				0		3/24/2020					4/21/2020	yes/no
4												
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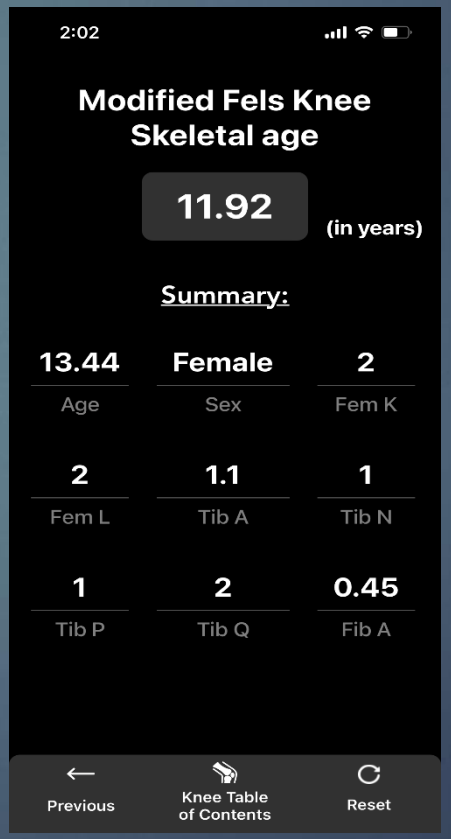
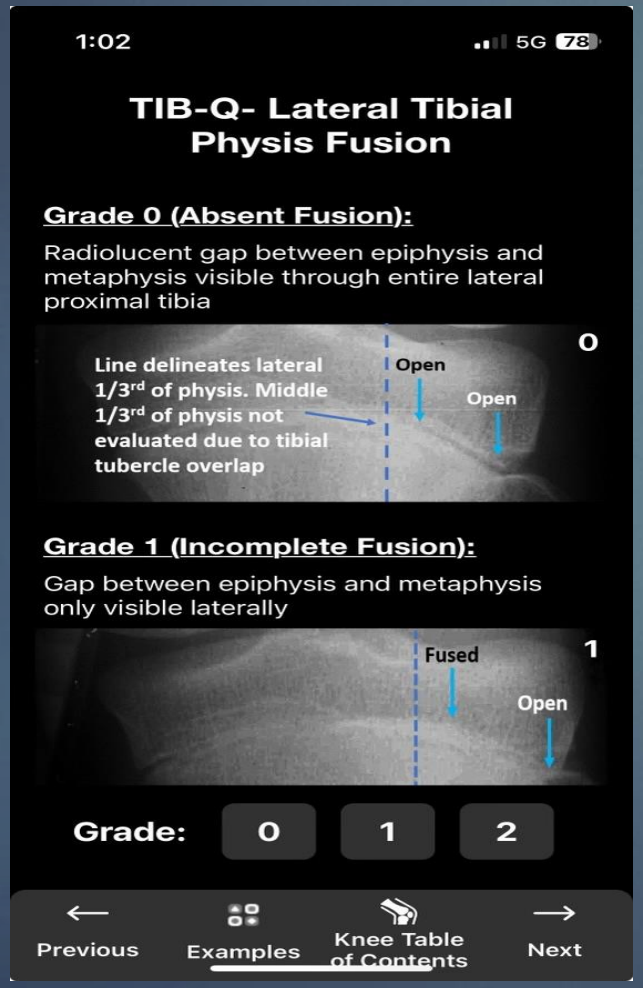
immaturevsmature

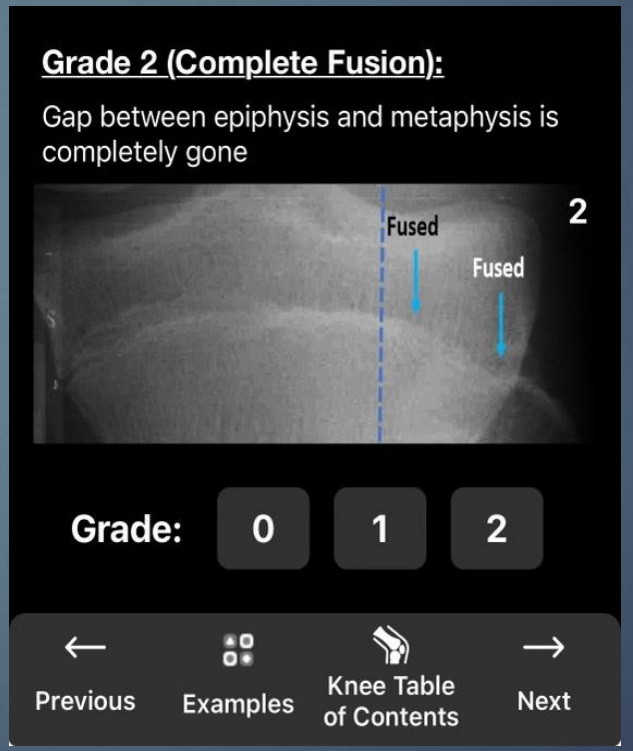
Ready 100%

- Official launch
- After the final revisions have been made to the REDCap following the beta test, we plan to host a presentation meeting over Zoom with all participating coordinators.
- Will include an overview of the data entry guide, Bone Age application training, and all necessary materials to ensure successful data collection.



- What defines a closed tibial physis?
- Need to come to a consensus on this definition to ensure all eligible patients have open physes.





- Surgical technique
  - Reduction
    - Open reduction
    - Closed reduction
  - Nail technique
    - Suprapatellar
    - infrapatellar
    - Extraarticular lateral
- Nail location
  - Above physis
    - Do interlocking screws cross physis?
      - Yes
      - No
  - At physis
  - below physis
- Fracture location
  - Distal 1/3
  - middle 1/3
  - proximal 1/3
- Fracture characteristics
  - Transverse
  - spiral
  - oblique
  - comminuted
- Fracture open
  - Yes
  - No
- Fibula fracture
  - Yes
    - same level
    - distal
    - proximal
  - No
- OTA classification

- Associated injuries
  - Ligamentous knee
  - Fracture
  - Head injury
  - Other
- Time to radiogrpahic healing (weeks)
- Post-op immobilization
  - Cast/splint (weeks)
  - Boot (weeks)
  - Other
- Time to full weight bearing without assistance (weeks)
- Complications
  - Infection
  - VTE
  - Compartment syndrome
  - NV injury
  - Physeal arrest
  - Delayed/nonunion
  - Unplanned return to OR (ie other than HWR)
  - Ipsilateral extremity injury
  - Other
- Return to OR for HWR
  - Yes
    - DOS
  - No
- Full return to activity/sport at same level?
  - Yes
  - No
- Length of follow-up after injury
- Did patient reach skeletal maturity by the last postoperative visit? defined by closure of proximal tibia physis. How many months between injury and skeletal maturity?

- Xray measurements:
- First AP and lateral of tibia obtained post-operatively (within 3 months of injury)
    - MPTA
    - LDTA
    - PPTA
    - ADTA
- AP and lateral of tibia obtained after skeletal maturity (closure of proximal tibial physis).
    - MPTA
    - LDTA
    - PPTA
    - ADTA
    -
- If patient was skeletally immature at last postop visit (minimum of 3 months after injury): latest AP and lateral of tibia
    - MPTA
    - LDTA
    - PPTA
    - ADTA
-
    - Was a standing AP of both lower extremities obtained within three months of injury?
    - Was a standing AP of both lower extremities obtained after skeletal maturity?
- If so, calculate:
    - MTPA, LDTA of both sides
    - AP standing hips to ankles
        - Leg length discrepancy (mm)
        - MAD (mechanical axis deviation) (mm)

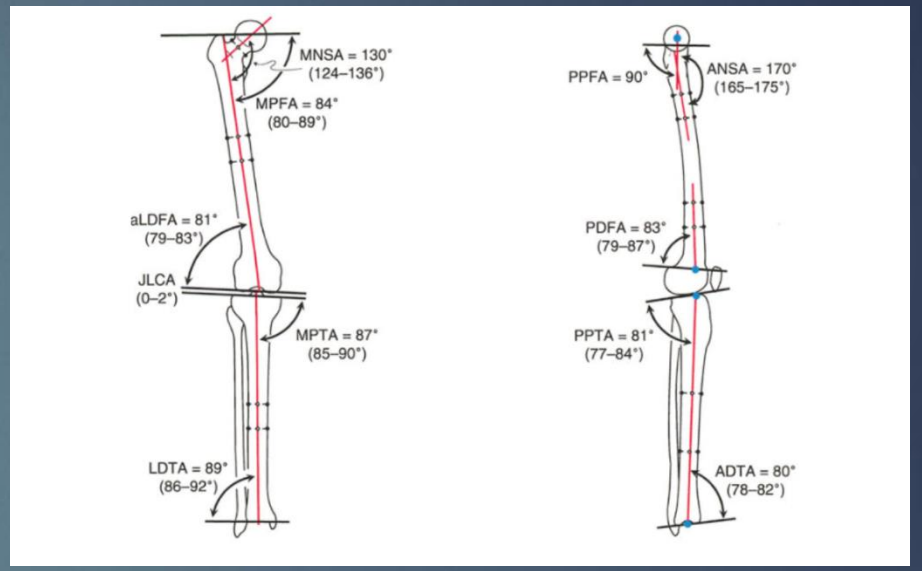
MPTA- Medial Proximal Tibial Angle. Normal 87 deg (85-90)

LDTA- Lateral Distal Tibial Angle. Normal 89 deg (86-92)

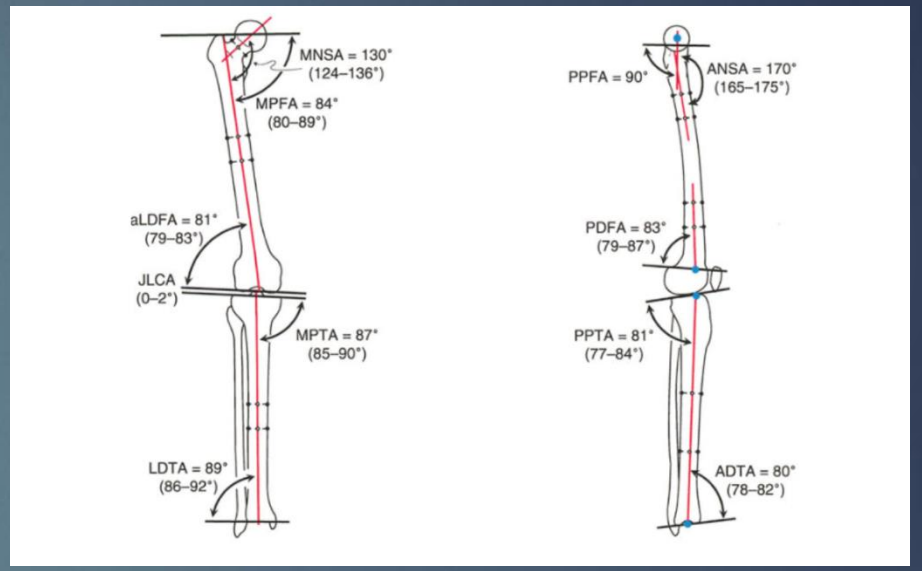
PPTA- Posterior Proximal Tibial Angle. Normal 81 deg (77-84)

ADTA- Anterior Distal Tibial Angle. Normal 80 deg (78-82)

Standing AP of both lower extremities and lateral of tibia of case #7 at 6 weeks postop



Standing AP of both lower extremities and lateral of tibia at skeletal maturity –Case 7 (18 months for this case- age 16



Necrotizing Fasciitis presentation

Wendy Ramalingam, Lawson Copley, Stephanie Moore & Jon Schoenecker

Necrotizing Fasciitis in Children

Fact or Fiction

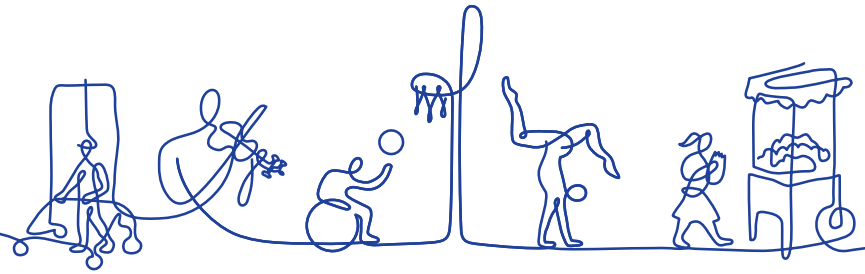
A CORTICES Study

Lawson A. Copley, MD, MBA, FAAOS
Professor of Orthopaedic Surgery and Pediatrics

SCOTTISH RITE FOR CHILDREN

UT Southwestern Medical Center

children's health



12 letter words made by unscrambling letters NECROTIZINGFASCIITIS

accessioning antifriction canonicities citification citizenising

concertinist concertising concertizing concretising concretizing

confiscating consecrating consignifies constricting creationists

fertigations festinations fictionising fictionizing forecastings

fractionises fractionizes graciosities infestations initiatories

initiatrices instigations integrations interactions interfacings

intrinsicate isoantigenic itinerations negationists nonstrategic

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reinitiating reinstations resignations restationing sectionising

sectionizing significance significants significates significator

sinfoniettas transections transfecting transfection

54 words found

20 cases in 20 years

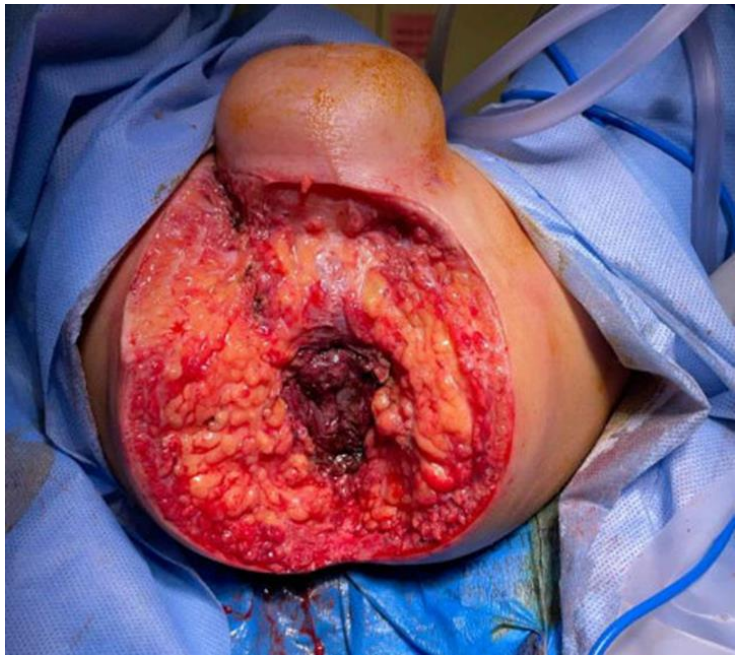
Never Say “Never” or “Always”

1:500,000

Poster Child

7 y.o. m with Pre-B ALL developed rash in peri-anal region

Admitted from Heme/Onc clinic to ICU in septic shock; 7-hour skin progression

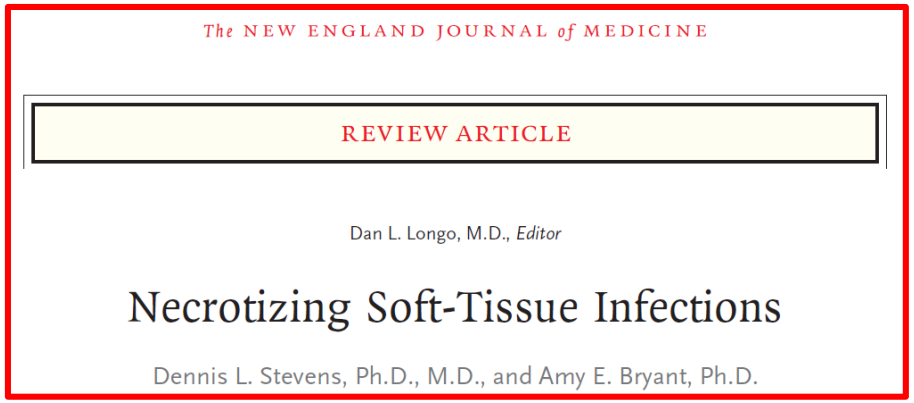


OR 36 minutes later; dusky gray dishwater fluid; no bleeding; excision of all non-viable skin and subQ tissue

Pseudomonas identified, antibiotics targeted, multiple (17) surgical debridements to healthy granulation

Perineal flap (4 wks)

Adult Necrotizing Fasciitis



- Mortality 29% (38% for GABHS Toxic Shock; 45% for Septic Shock; 70% for Cryptogenic Cases – delayed recognition)
- Laboratory Risk Indicator for Necrotizing Fasciitis (LRINEC) Scoring System
  - Positive predictive value for scores $\geq$ 5.8 - 57-92%
  - Negative predictive value (<5.8) - 86-96%
  - In one study, adults admitted to ICU with NF and LRINEC > 6 = mortality 29.3%

Summary of characteristics for assessment/diagnosis of necrotizing fasciitis in adults

POSITIVE CULTURE	TISSUE NECROSIS	SKIN , SQ AND FASCIAL FEATURES	SYSTEMIC INVOLVEMENT	INFLAMMATORY/ IMMUNE RESPONSE	LACK OF IMMUNE RESPONSE	EDEMA
positive culture from blood, connective or fascial tissue	**Widespread tissue destruction**, which may extend from the epidermis to the deep musculature	Late cutaneous findings including **ecchymoses**, **bullae**, and/or **skin sloughing**, foretell a **fatal** outcome.	**organ failure or dysfunction**	over 24 to 72 h, **inflammation becomes extensive**	marked absence of acute inflammatory cells in the tissues	edema of the reticular dermis, subcutaneous fat, and superficial fascia
bacteria spreading along **fascial** planes	**Extensive necrosis**	skin becomes **dusky then purplish**, bullae appear.	**systemic toxicity** (mediated by bacterial exotoxins)	dishwater-gray exudate/inflammatory fluid	noteable absence of pus	
	lack of bleeding of apparently **necrotic** tissue	friability of the **superficial fascia** (gloved finger)	**shock**, **renal** impairment, or acute **respiratory distress** syndrome	polymorphonuclear infiltrate (immune cells)		
	necrosis of **superficial fascia**		severe **multisystemic** disorder			
			hemodynamic collapse/ Perfusion deficits in necrotizing infections			

Dennis L. Stevens, Ph.D., M.D. et al. *Necrotizing Soft-Tissue Infections (2017) N Engl J Med 377:2253-65.*
Necrotizing Soft Tissue Infections (2021) Infect Dis Clin N Am 35, 135-155

What about Children?

Schröder et al. BMC Infectious Diseases (2019) 19:317
https://doi.org/10.1186/s12879-019-3941-3

BMC Infectious Diseases

RESEARCH ARTICLE Open Access

A systematic review of necrotising fasciitis in children from its first description in 1930 to 2018

Arne Schröder[1], Aurélie Gerin[2], Gregory B. Firth[3], Kelly S. Hoffmann[4,5], Andrew Grieve[5] and Christina Oetzmann von Sochaczewski[5,6*]

Although necrotizing fasciitis is often fatal in adults, its case fatality rate seems to be substantially lower in children.

- Systematic Review (393 cases)
  - 5 studies (68 cases) that reported population based on incidence and case-fatality rates
  - 2 case-control studies (27 cases)
  - 298 cases from 195 case series and case reports.
  - Incidence rates varied between 0.022 and 0.843 per 100,000 children per year
    - Case-fatality rate ranging from 0% to 14.3% (1/7 children); 3/68 (4.4%) of aggregated cases.
    - Case-fatality rate was only 2.85% in the only cohort with more than ten patients (1/35)

Necrotizing Fasciitis – HCUPnet KID Data

Healthcare Cost and Utilization Project – Kids Inpatient Database

4100 hospitals with 1,393,186 hospital discharges per year

2012

Region	Cases	LOS* (days)	Mortality	Hospital charges*
Northeast	32	8	1	87,441
Midwest	60	22	1	228,396
South	90	21	4	253,623
West	65	23	3	350,989
Total	**247**			

Case Fatality Rate – 3.6%

2016

Region	Cases	LOS* (days)	Mortality	Hospital charges*
Northeast	23	28	0	502,087
Midwest	52	22	2	200,491
South	101	22	4	280,250
West	62	15	5	252,180
Total	**238**			

Case Fatality Rate – 4.6%

2019

Region	Cases	LOS* (days)	Mortality	Hospital charges*
Northeast	36	15	2	219,162
Midwest	53	14	0	253,393
South	101	22	4	362,441
West	59	20	3	633,357
Total	**249**			

Case Fatality Rate – 3.6%

Incidence approximately 0.0176% (18 per 100,000 discharges)

SCOTTISH RITE FOR CHILDREN | UT Southwestern Medical Center | children's health

What about Children?

Laboratory evaluation for pediatric patients with suspected necrotizing soft tissue infections: A case–control study

Luke R. Putnam [a], Morgan K. Richards [b], Brinkley K. Sandvall [c], Richard A. Hopper [c], John H.T. Waldhausen [b], Matthew T. Harting [a,*]

Journal of Pediatric Surgery 51 (2016) 1022–1025

From 2010 to 2014, 20 cases and 20 controls @ two children's hospitals

Median LRINEC score was 3.5 (1–8) for cases and 2 (1–7) for controls (p=0.03).

P-LRINEC was comprised of serum CRP >20 mg/L (sensitivity=95% (95%CI 79–100%)) and serum sodium <135 (specificity=95% (95%CI 82–100%)).

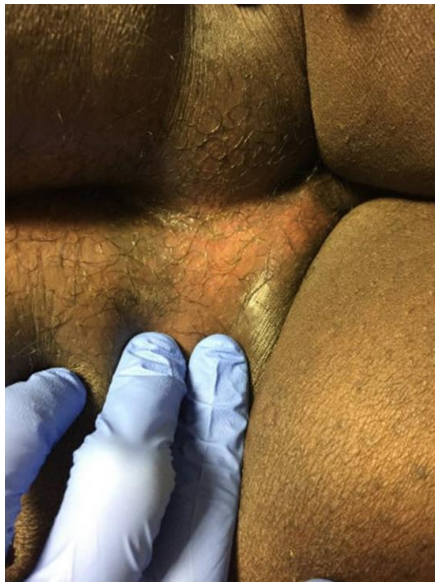
Area under ROC curves were 0.70 (95%CI 0.54–0.87) for the LRINEC score and 0.84 (95%CI 0.72–0.96) for the P-LRINEC score (p=0.06).

There were no deaths in either group.

Children's Medical Center of Dallas

- Epic Slicer/Dicer Data Intelligence Query for ICD 9/10 NF - 2009 to 2023 (14 years)
  - 80 cases identified
    - 40 duplicates
    - 16 irrelevant conditions
  - 26 children with clinical concern documented
    - 16 had necrotizing skin and subcutaneous infections with or without fascial involvement (NSSI-Wifi)
      - Predominantly managed by Pediatric Surgery and Plastic Surgery (minimal orthopaedic consultation)
      - In retrospect, I was involved in 2 cases but I did not consider them Necrotizing Fasciitis at the time.
    - 10 had serious skin and soft tissue infections but not NSSI-Wifi
  - CMC Inpatient Admissions > 24 hours (14 years) – 130,366
    - Incidence: 0.002% (2 per 100,000 admissions or 1/9 the rate of HCUP-KID)
  - Zero deaths; One amputation

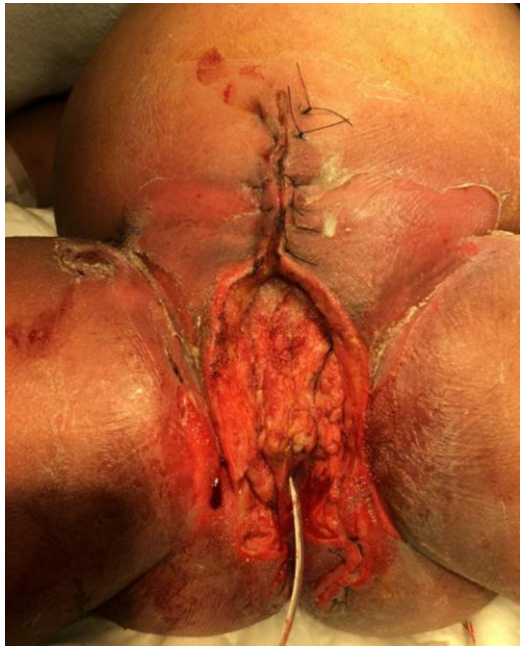





















Empiric antibiotics: 4.6 (range 2 to 10) vs 2.5 (range 1 to 5) for non-NF
Surgeries: 103 (6.4 per child; range 1 to 24) vs 7 (0.7 per child; range 0 to 4) for non-NF
ICU admission: 81.3% vs 30% for non-NF

Clinical Appearance

- Ecchymosis, ulceration, necrosis, rapidly expanding erythema, swelling, fever

Labs

- Elevation of sepsis labs; low sodium; high glucose; coagulopathy; LFTs; Creatinine

Imaging (plain X-ray, CT, MRI, U/S)

- Soft tissue swelling, occasionally gas/subcutaneous emphysema

Surgical Findings

- Absence of bleeding; thrombosed vessels; dishwater gray fluid; ± pus; fasciitis (minimal)

Cultures

- Multiple organisms (aerobic and anaerobic; often preceded by penetrating trauma)
- Single organism (often GABHS)

Pathology

- Necrosis of skin/subQ; Fascia mentioned rarely

Data Collection

	Data Categories																	
	History					Evaluation										Treatments	Outcomes	
Subtype	Demographics	Urgency of Evaluation	Co-morbidities	Penetrating Inoculation (exposure)	Physical Findings	Vital Signs	Consultants	Composite Assessments	Laboratory	Imaging	Image Findings	Surgical Findings	Pathology/Histology findings	Interventions	Outcomes			
Parameters	Sex Race/Ethnicity	Delay from onset to triage	Obesity	Bull (barnyard soil)	Skin/soft tissue appearance	BMI		Cardiovascular system dysfunction	CRP	Plain X-ray	Soft tissue edema	Pus	Evidence of necrosis	ICU Admission	ICU LOS			
	Insurance Class	Seen at OSH	Immunocompromise	Lake (aquamarine)		Pulse		Hepatic dysfunction	ESR	Ultrasound	Foreign matter	Foul Odor		Pressors/Vasoactive medications	Hospital LOS			
	Age at admission	Time from Transfer Request to CMC Triage	Diabetes	Football/soccer (athletic field)		SBP		Acute Kidney Injury	Procalcitonin	CT Scan	Air/Gas in tissues	Ncrotic skin/SQ without bleeding		Steroids	Amputation			
		Delay from triage to surgery consult		Outdoor/bike (soil)		DBP		Acute Respiratory Distress Syndrome (ARDS)	WBC	MRI		Dishwater fluid		Invasive Mechanical Ventilation (IMV)	Death			
						Mean Arterial Presssure		Severe Inflammatory Response Syndrome (SIRS)	ANC			Necrotic fascia/muscle		Surgery	Total number of surgeries			
						Respiratory Rate		Pediatric Sepsis Criteria	Neutrophil Percent			Fascia involved		Antibiotics (empiric)	Coverage Procedure Required			
						Temp (initial)		Phoenix Score	ALC			Subsequent (2nd and/or 3rd) surgery needed for source control		Antibiotics (targeted)				
						Fever/Tmax first 24 hours		LRINEC/P-LRINEC initial and subsequent (adjusted)	Bands					Any Respiratory Support				
						Febrile Days			Hgb									
						SaO2			Platelets									
									Platelent nadir									
									Lactate									
									INR									
									D-Dimer									
									Fibrinogen									
									CK									
									Creatinine									
									Sodium									
									Glucose									
									Total Bilirubin									
									ALT									
									Blood culture									
									Aerobic culture									
									Anaerobic culture									
									Fungal culture									
									AFB culture									
									Monomicrobial (type II)									
									Polymicrobial (type I)									

242 columns of data; History/Evaluation/Defining Criteria/Treatment/Outcome (112 variables studied)

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Pediatric Sepsis

SIRS > Pediatric Sepsis Criteria > Phoenix Score

JAMA | Original Investigation

Development and Validation of the Phoenix Criteria for Pediatric Sepsis and Septic Shock

L. Nelson Sanchez-Pinto, MD, MBI; Tellen D. Bennett, MD, MS; Peter E. DeWitt, PhD; Seth Russell, MS; Margaret N. Rebull, MA; Blake Martin, MD; Samuel Akech, MBChB, MMED; David J. Albers, PhD; Elizabeth R. Alpern, MD, MSCE; Fran Balamuth, MD, PhD, MSCE; Melania Bembea, MD, MPH, PhD; Mohammod Jobayer Chisti, MBBS, MMed, PhD; Idris Evans, MD, MSc; Christopher M. Horvat, MD, MHA; Juan Camilo Jaramillo-Bustamante, MD; Niranjan Kissoon, MD; Kusum Menon, MD, MSc; Halden F. Scott, MD, MSCS; Scott L. Weiss, MD; Matthew O. Wiens, PharmD, PhD; Jerry J. Zimmerman, MD, PhD; Andrew C. Argent, MD, MBBCh, MMed; Lauren R. Sorce, PhD, RN, CPNP-AC/PC; Luregn J. Schlapbach, MD, PhD; R. Scott Watson, MD, MPH; and the Society of Critical Care Medicine Pediatric Sepsis Definition Task Force

JAMA. doi:10.1001/jama.2024.0196
Published online January 21, 2024.

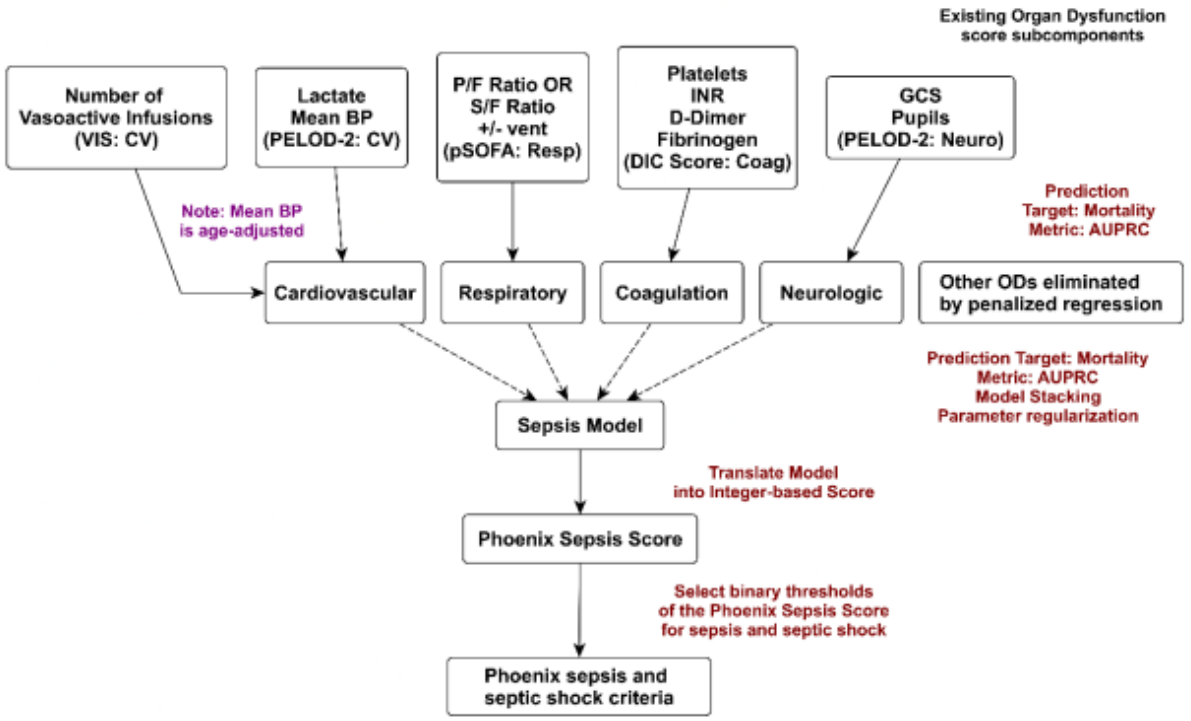
In 2019, the Society of Critical Care Medicine Pediatric Sepsis Definition Task Force updated the pediatric sepsis definition and criteria.

Conceptual definition of pediatric sepsis as suspected infection with life-threatening organ dysfunction with higher risk of mortality.

172,984 children (ED, Inpatient, ICU) had suspected infection in the first 24 h. Of those, 2065 (1.2%) died.

The Phoenix Score supersedes SIRS (Fever, Tachycardia, Tachypnea, WBC>12K) and previous Pediatric Severe Sepsis Criteria (Two or more SIRS criteria plus ARDS, Cardiovascular system dysfunction, OR two or more organ system dysfunctions)

Phoenix Sepsis Score



		Points			
System		0	1	2	3
Respiratory		Normal	Any Resp Support	IMV	IMV + P/F <100
Cardiovascular	Vasoactive Drugs	None	1 Pressor	2 Pressors	
	Hypotension	None	Borderline MAP	Low MAP	
Coagulation			(max 2 points)		
	Platelets	Normal	< 100 K/mL		
	INR	Normal	> 1.3		
	D-Dimer	Normal	> 2 mg/L FEU		
	Fibrinogen	Normal	< 100 mg/dL		
Neurologic	Normal	GCS≤10	Fixed Pupils		
Endocrine	Glucose	50-150 mg/dL	<50 or >150 mg/dL		
Immunologic	ANC	≥ 500	<500		
	ALC	≥ 1000	< 1000		
Renal	Creatinine	Normal	Above age-based		
Hepatic			(max 1 point)		
	Total Bilirubin	< 4 mg/dL	≥ 4 mg/dL		
	ALT	≤ 102 IU/L	> 102 IU/L		

Defining Criteria for Necrotizing Skin/SQ Infections With (or w/o) Fascial Involvement (NSSI-WIFI)

Why NSSI-Wifi?

It’s Abbreviated and Memorable

Parameter Group 3

Skin, SQ, and/or Fascial Defining Criteria

Skin/Soft Tissue Defect
Induration
Discoloration
Friability
Gas / SQ Emphysema
Dishwater fluid
Thrombosed vessels
Odor

Parameter Group 4

Systemic Involvement Defining Criteria

Hepatic
Cardiovascular
Renal
Respiratory
Endocrine
Immunologic
Coagulation
Neurologic
Septic Shock*

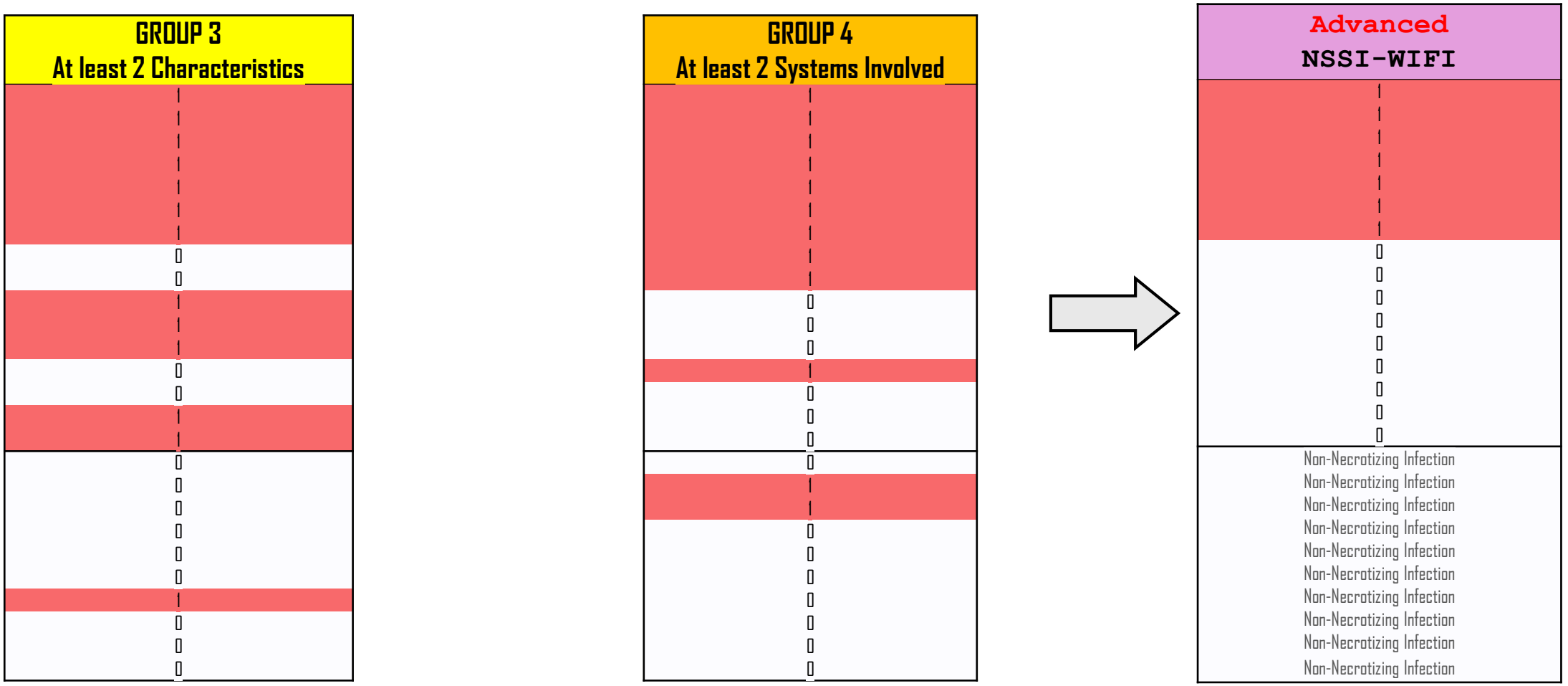
*Resulting in organ or system dysfunction or failure

Application of Defining Criteria to Determine Advanced NSSI-WIFI

AND

Parameter Group 3
Skin, SQ, and/or Fascial Defining Characteristics

Parameter Group 4
Systemic Involvement Defining Characteristics



Breakdown of parameters preliminarily assessed as candidate predictors of NSSI-WIFI

MAJOR CATEGORIES		CATEGORY SUBTYPES	
HISTORY	20		
		Demographics	4
		Urgency of Evaluation	10
		Environmental Exposure	3
		Co-morbidities	3
EVALUATION	65		
		vital signs	16
		laboratory	34
		composite assessment	8
		imaging	4
		imaging findings	2
		surgical findings	1
Treatments/ Interventions	10		10
Outcomes/Late Parameters	2		2
TOTAL:			97

A total of 119 parameter combinations assessed

Value of Collecting Multiple Data Samples

- LRINEC variables were reassessed for 15/16 children w/ NSSI Wifi
  - Only missing 3/90 (3.3%)
- Initial LRINEC average 4.38 (n=16)
- Adjusted LRINEC average 6.75 (n=16)
- Adjustments made for 8/15 (53.3%)
  - Initial LRINEC of 8 children with adjusted scores average 3.83
  - Adjusted LRINEC for 10 children average 8.0

Significant Differences NSSI Wifi vs non-NSSI Wifi

- ICU Admission (p=0.015)
- < Average delay from Triage to ICU + > Average LOS (p=0.023)
- ICU Admit + > Average LOS (p=0.014)
- Adjusted LRINEC > 7 (p=0.037)
- Phoenix Sepsis Criteria > 1 (p=0.046)
- Anaerobic Culture Sent (p=0.005)
- AFB Culture Sent (p=0.01)
- Coverage Procedure Required (p=0.004)
- LOS - Med 26.3 vs 4.1 (p=0.0007)
- Febrile Days – Med 1.5 vs 0 (p=0.19)
- Sodium – Med 135 vs 139.5 (p=0.009)
- Phoenix Score – Med 3 vs 1 (p=0.018)
- Empiric abx – Med 4 vs 2 (p=0.002)
- Surgeries – Med 5 vs 0.5 (p=0.0006)

Significant Differences Adv NW vs NISSI Wifi

- Short time to ICU (p=0.011)
- Short time to ICU + Long Recovery (p=0.009)
- Phoenix Sepsis > 2 (p=0.003)
- Initial Temp – Med 37.9 vs 37.1 (p=0.015)
- Adjusted LRINEC – Med 8 vs 4 (p=0.044)
- Phoenix Score – Med 4 vs 2 (p=0.018)
- Surgeries – Med 8 vs 4 (p=0.022)

Principles Derived

- Necrotizing Fasciitis (as it is commonly understood) does NOT exist in Children but…
  - NSSI-Wifi DOES (we should propose a new ICD-10 diagnosis…not Copley's Disease or Ramalingam Fever)
- Incidence is likely over-reported in National Databases (HCUP KID incidence 9 times CMC rate)
- Be consistent and comprehensive in the assessment
  - Labs - initial and trends over 5-6 days (CBC diff, CRP, PCT, ESR, Blood culture; Chemistry (Na, Creatinine, Lactate); Coagulation (Fibrinogen; D-Dimer); Endocrine (glucose); T. Bili and ALT
  - Imaging (Plain X-ray; Ultrasound; CT scan; +/- MRI) before surgery
  - Antibiotics (appropriate empiric coverage followed by targeted therapy: Type 1 – vanc or linezolid plus zosyn or ceftriaxone plus flagyl; Type 2 – clindamycin with penicillin)
  - Cultures (Aerobic, Anaerobic, Fungal, AFB)
- Calculate the Phoenix Score (> 2) and the Adjusted LRINEC (> 7)
- Establish the cast of characters, roles and responsibilities - Gen Surg (debridement and culture acquisition) >> Plastic Surg (coverage) >> Ortho Surg (amputations, fasciotomies or reconstruction)
- Urgent surgical intervention (acquire cultures; excise all visible necrosis to bleeding margins); Thoughtfully staged debridement (acquire cultures each time; stop frequent returns when they are negative; convert to wound vac management)
- Delayed coverage procedure as indicated
- Calm down – nobody's dying here.
  - On average these children are far less ill than our children with severe and hyper-severe AHO based on rates of bacteremia, pressor use, disseminated disease, and ECMO)

Session 3D: Tiny Humans vs. a Deadly Disease: An Epidemiological Review of Necrotizing Fasciitis in Pediatric Patients

2:00-3:38 PM
Presentation: 2:32-2:36 PM

Stephanie N. Moore-Lotridge, PhD; Samuel Johnson; Wendy Ramalingam, BS, MD; Jonathan G. Schoenecker, MD, PhD

Vanderbilt University Medical Center, Nashville, TN, U.S.

NAT Presentation

Scott Rosenfeld

EPOSNA 2024

Femur Fractures in Children Under 3 Years – Risk Factors for Non-Accidental Trauma: A CORTICES Multi-Center Study

Manya Bali BS; Patricia Miller MS, Benjamin Shore, MD MPH; Scott Rosenfeld MD, CORTICES Study Group

CORTICES
ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

EPOSNA

- Our disclosures are listed in the app
- Project supported by POSNA QSVI grant

Non-Accidental Trauma (NAT) in Children

- Fractures are the 2nd most common presenting injury in NAT
- Diaphyseal femur fractures in children < 3yo

AAOS
American Academy of Orthopaedic Surgeons

Treatment of Pediatric Diaphyseal Femur Fractures

Evidence-Based Clinical Practice Guideline

Adopted by:
The American Academy of Orthopaedic Surgeons Board of Directors
December 5, 2020

CHILD ABUSE
Strong evidence supports that children younger than thirty-six months with a diaphyseal femur fracture be evaluated for child abuse.

Grade of Recommendation: Strong ★★★★

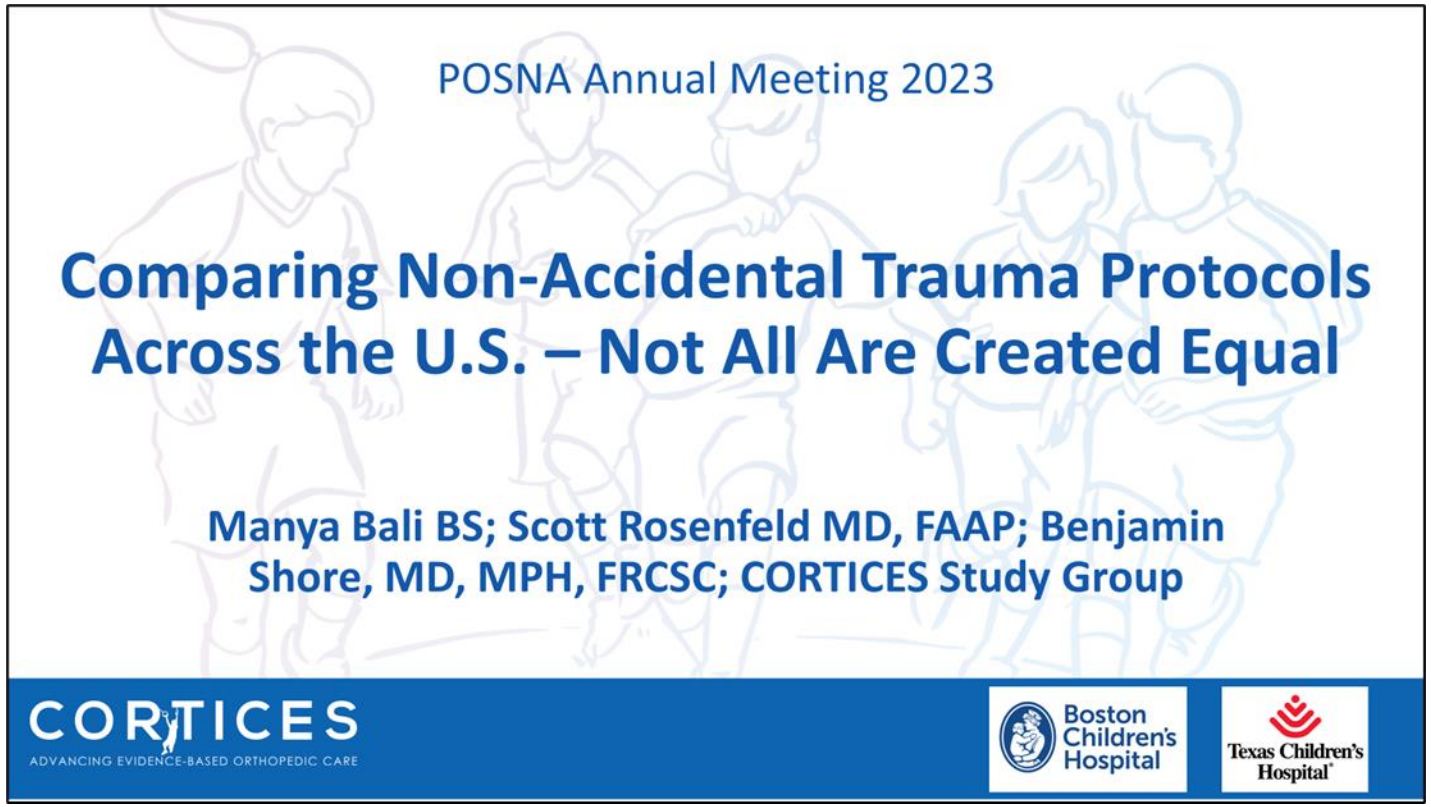
Study	Age Group	Fractures	Fractures Caused by Child Abuse	% of Fractures Caused by Child Abuse
Miettinen	0-15 yrs.	114	2	2%
Rewers	0-3 yrs.	243	28	12%
Miettinen	0-1 yr.	15	Not Reported specific to this age group*	Up to 13%
Hinton	0-1 yr.	73	10	14%

Previous Studies

POSNA 2021

Overall NAT Rate = 25%

Previous Studies



Previous Studies

Independent Risk Factors

- Younger age
- Sex
- Race
- Delayed presentation
- Unknown mechanism

Poor compliance with AAOS CPG for screening

- Subjectivity

Problems

- Small numbers
- Single center
- No consideration of SES
- No consideration of screening bias

Purpose

Utilize CORTICES multicenter database to report:

1. Compliance with screening
2. Factors that influence who gets screened (biases?)
3. Overall rate of NAT
4. Risk Factors for NAT (including socio-economic)
5. Compounding of risk when multiple factors are present

Methods

POSNA QSVI Grant

- Retrospective review

15 CORTICES Institutions

Included:

< 36 months old with diaphyseal femur fracture

2017-2020

Excluded: MVC or birthing injuries, corner fx, pathologic fx, known OI

Methods

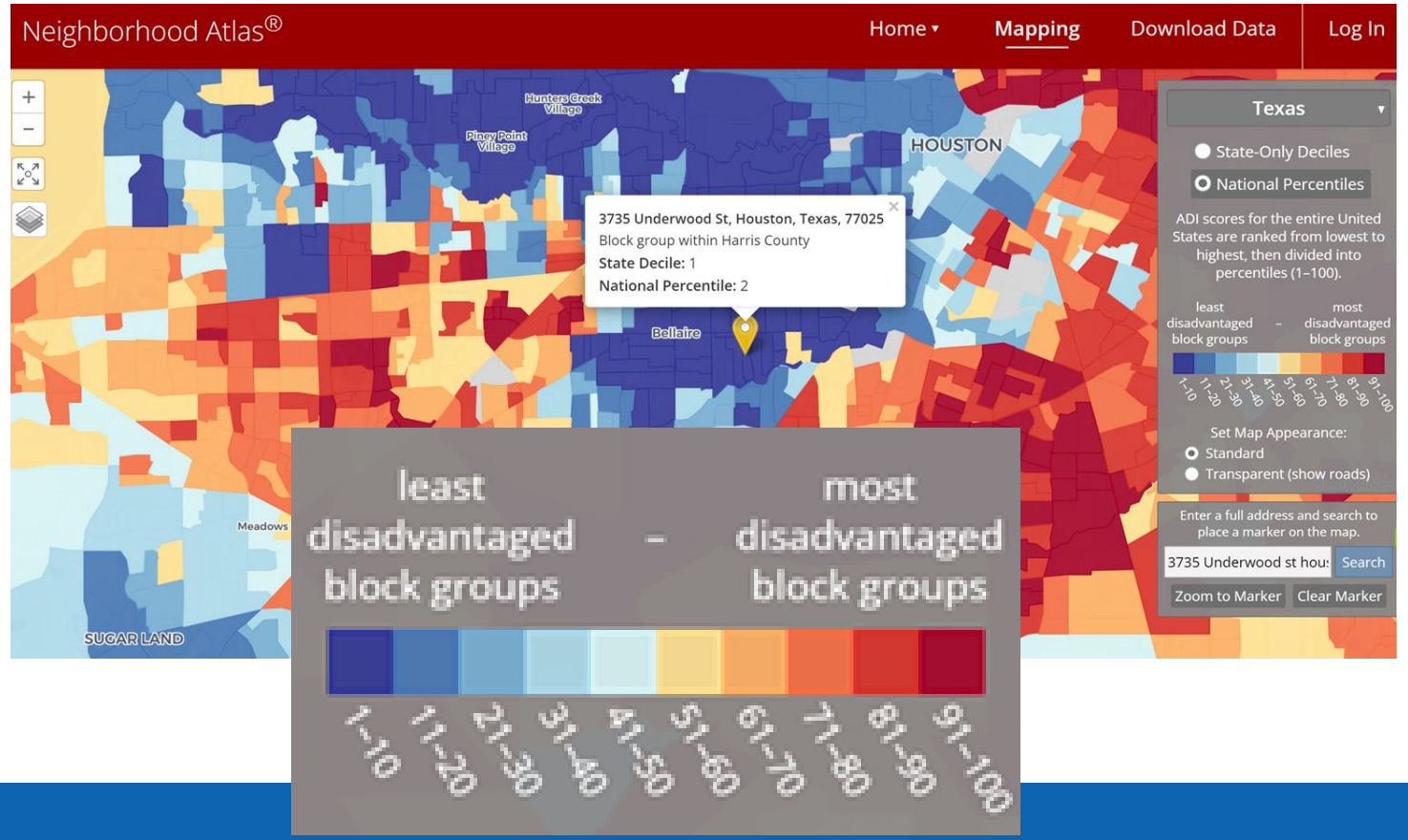
Defined positive NAT as documentation of:

1. Removal from caregiver by CPS
2. Diagnosis code of NAT (T74.12 XA)
3. Referral to a government agency for suspected NAT

Methods

Data collected:

- Demographics
- Injury characteristics
- Socioeconomic data
  - Insurance
  - Area Deprivation Index



Methods

Analysis

- Not only who had NAT, but also who got screened for NAT (biases?)
- Multivariable Generalized Estimating Equations (GEE) clustered on site
- Compounding risks estimated using final GEE models

Results

15 sites

1263 patients

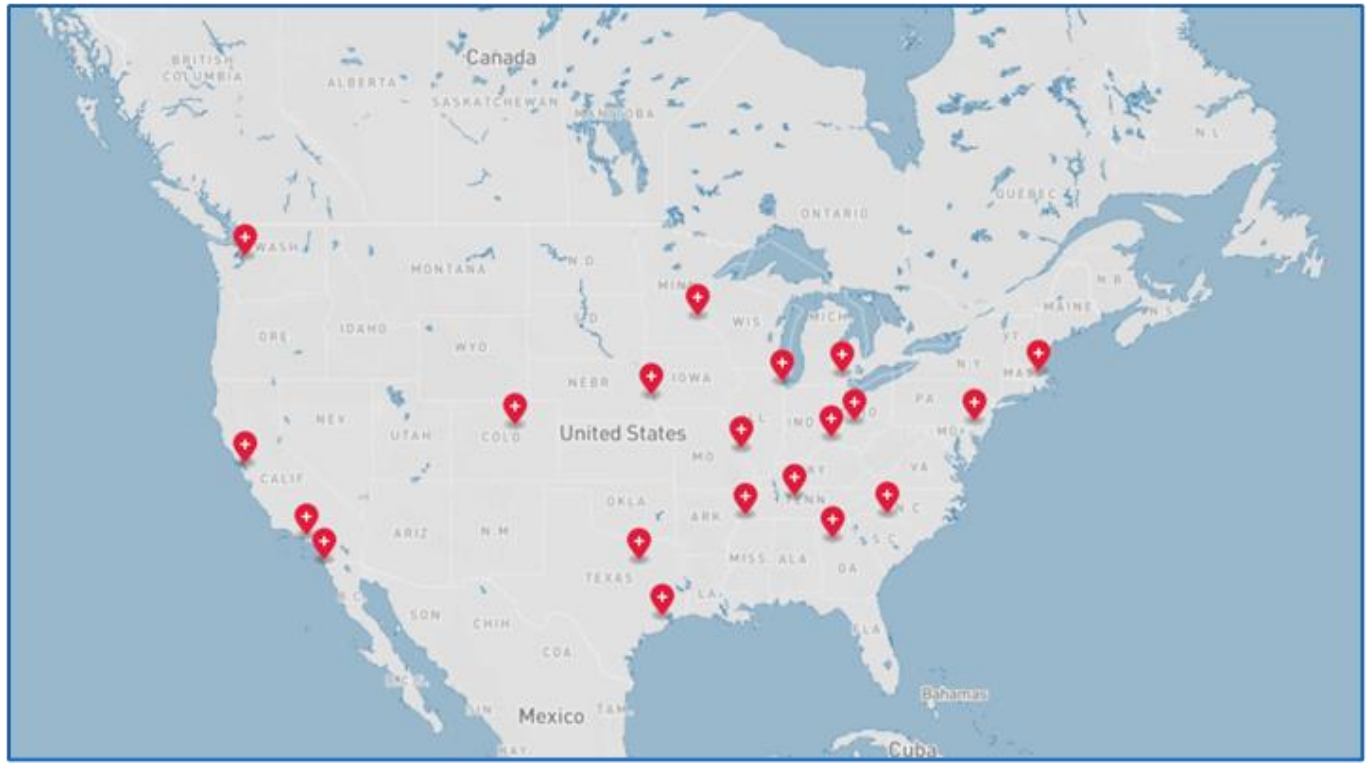
Median age = 23 months

71% male

65% white

44% private insurance

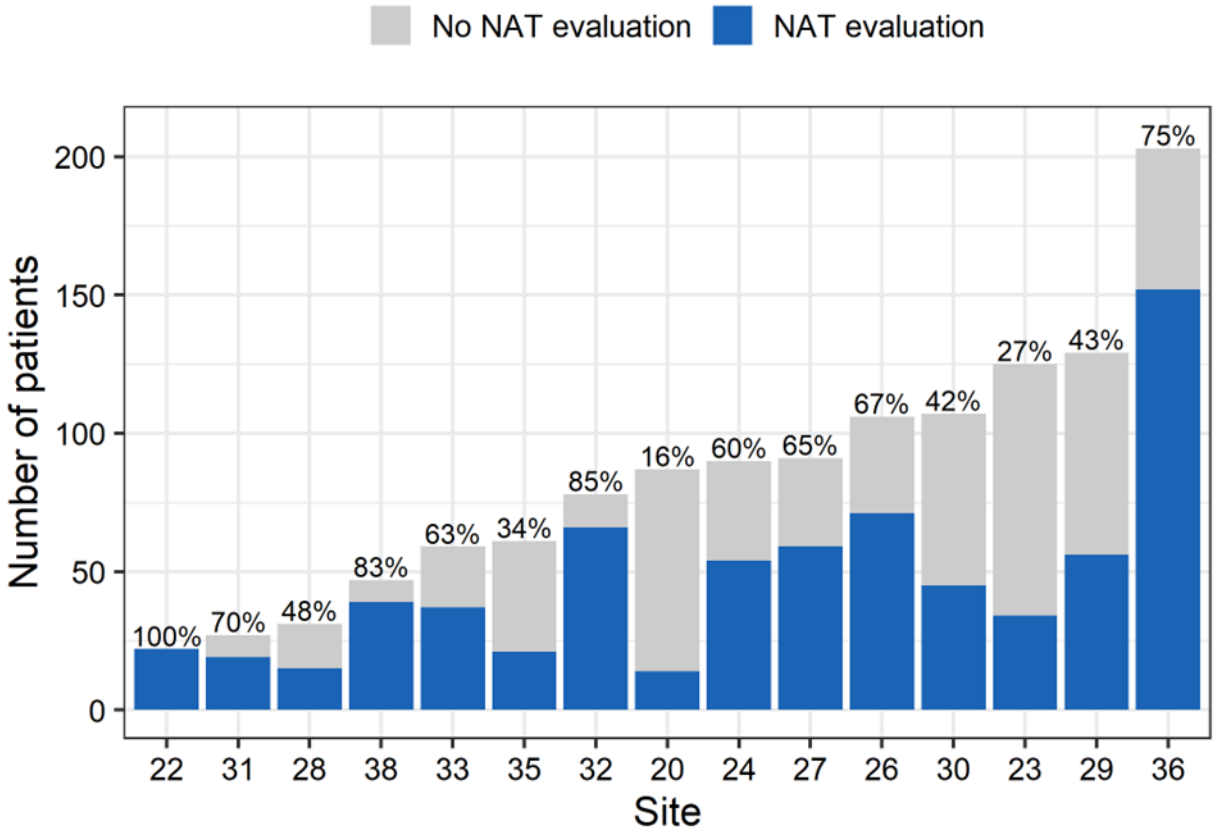
Mean ADI = 46 (1-100)



Results

Screening Compliance: **56%**

- Range by institution: 16%-100%



Results – Factors for NAT *Screening*

Age (per 6 months) (OR=0.65; p<0.001)

Unknown Mechanism of Injury (OR=1.84; p=0.009)

Government Insurance (OR=1.38; p=0.002)

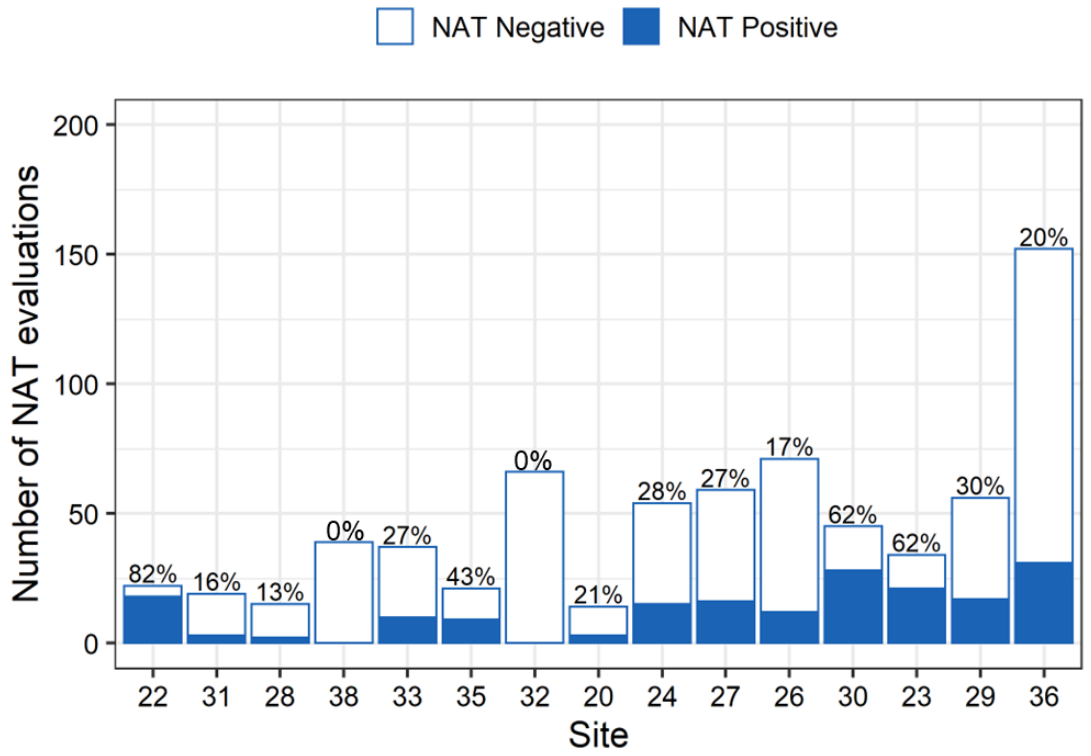
ADI > 50 (OR=1.41; p=0.04)

Black Race (OR=1.41; p=0.04)

Model C statistic, 0.89 (95% CI = 0.86-0.92)

Results – *Positive NAT*

Rate of NAT in patients screened = **26%**
(185/704; 95% CI=23.1-29.7)



Results – Factors for *Positive NAT*

In patients screened for NAT

- Age (per 6 months) (OR=0.60; p<0.001)
- Unknown Mechanism of Injury (OR=3.86; p<0.001)
- Black Race (OR=2.27; p<0.001)
- ADI > 50 (OR=1.81; p=0.01)

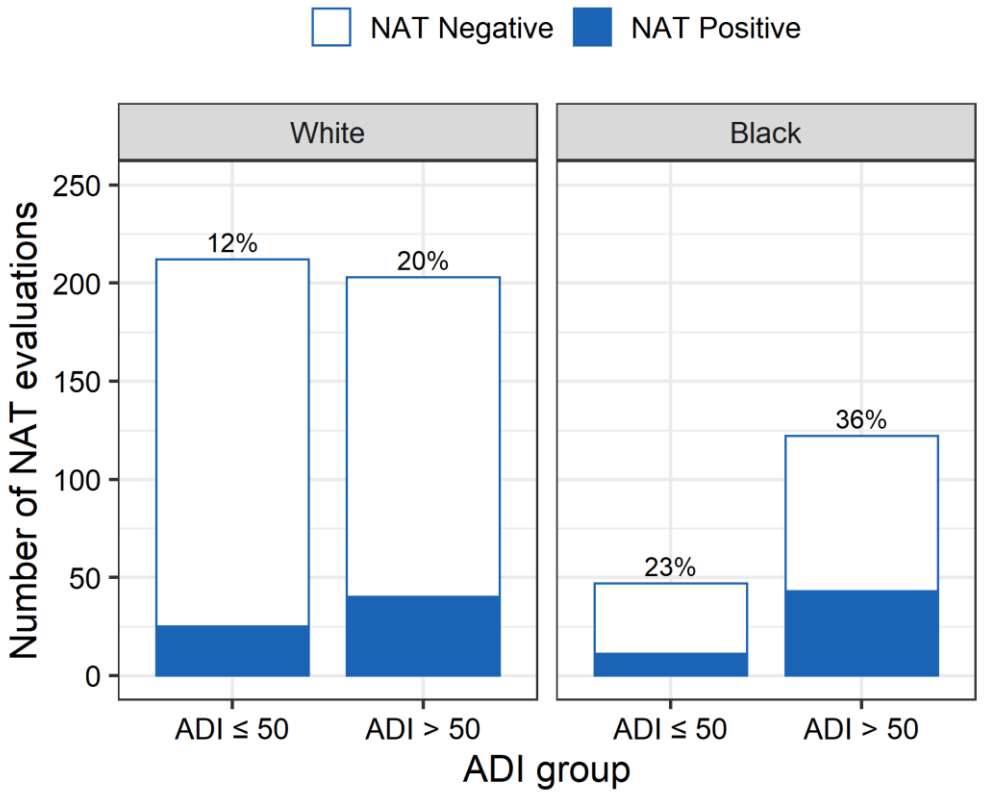
Model C statistic, 0.86 (95% CI = 0.83-0.89)

Results – Race vs ADI

Both variables significant

Black patients more likely to have NAT at all levels of ADI

Higher ADI more likely to have NAT regardless of race



Results – Compounding Risk

Effect of Additional Risk Factors on Risk of NAT				
Age	Baseline Risk of NAT	+ Unknown Mechanism of Injury	+ ADI > 50	+ Black Race
0 months	26.2%	57.8%	75.6%	84.9%
6 months	17.6%	45.3%	65.2%	77.2%
12 months	11.4%	33.3%	53.1%	67.2%
18 months	7.2%	23.1%	40.6%	55.2%
24 months	4.5%	15.4%	29.2%	42.7%
30 months	2.8%	9.9%	19.9%	31.0%
36 months	1.7%	6.2%	13.0%	21.3%

Limitations

1. Large retrospective database
2. Unknown what influences providers to initiate screening (implicit biases)
3. Definitive diagnosis of NAT is difficult
   - No pathognomonic finding
   - Final determination often made outside of the hospital

Conclusions

Largest study, first multicenter, multiregional study

- NAT = 26% of those screened

Nationwide compliance with AAOS CPG remains low (56%)

What factors make kids more likely to be screened?

Socioeconomic disadvantage is a factor for NAT

ADI & Race are independent risk factors for NAT

Risk factors do compound

- Presence of multiple risk factors should prompt official NAT evaluation

Children's Hospital Colorado

Thank You!

Burst Fracture

Craig Birch

Thoracolumbar Fracture Treatment

Craig M Birch, MD

Boston Children's Hospital
Orthopedic Center

HARVARD MEDICAL SCHOOL

TL Trauma:

- **Pediatric spine trauma is rare**
- **Leads to variations in treatment based on either:**
  - Adult literature
    - Example – classic treatment of 2 up, 2 down
  - Anecdotal information

TL Trauma:

- **Overarching goals:**
  - 1. Assess current trends
    - Who takes call
    - Who performs surgery
    - What surgeries are performed
      - Demographic and surgery characteristics
  - 2. Assess outcomes with current practice
    - Future
    - Requires multiple centers with surgical and radiographic data
    - Outcomes?

Step 1 – current practice:

- **Step 1**
  - Survey of current practice
    - Still 2 primary goals:
    - First – assess who takes call and who performs operative intervention
    - Second – how are common TL trauma injuries treated
  - Discussion:
    - Draft survey
    - 1 project or 2 projects?

Survey:

1. **Who takes spine call for thoracic or lumbar injuries at your hospital?**
    1. Orthopedics only
    2. Neurosurgery only
    3. Orthopedics and neurosurgery alternating (by week or day)
    4. Orthopedics and neurosurgery with both teams always available
    5. Other -

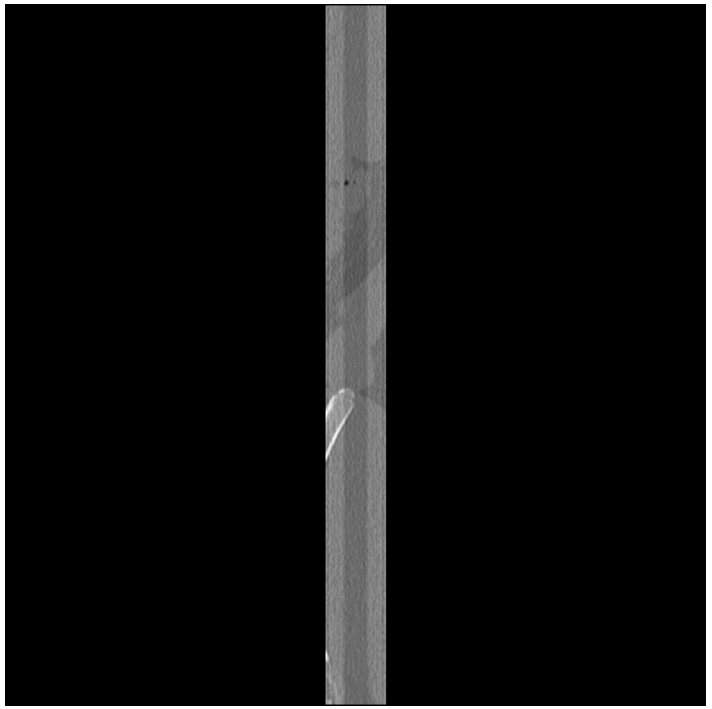
Survey:

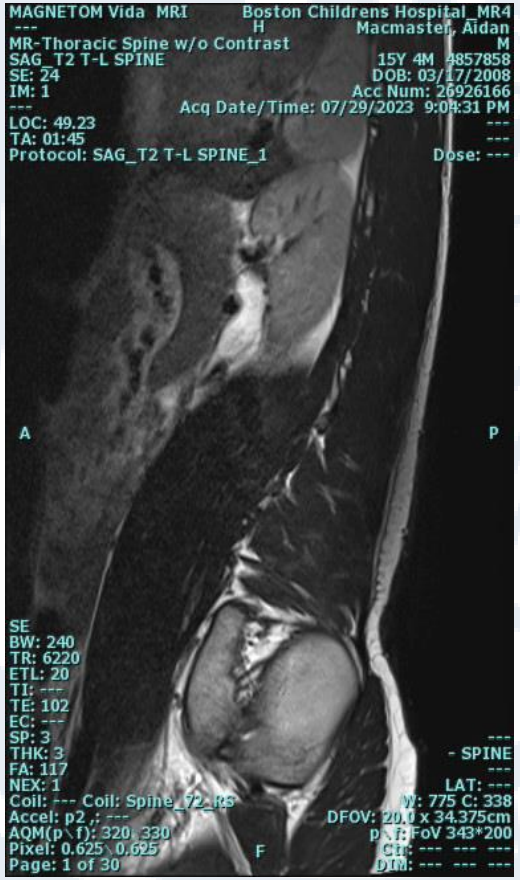
1. **Who performs surgical intervention for operative thoracic or lumbar spine trauma?**
    1. Orthopedics only
    2. Neurosurgery only
    3. Orthopedics or neurosurgery depending on who was on call
    4. Orthopedics or neurosurgery depending on the injury
    5. Orthopedics and neurosurgery combined
    6. Other -

Survey:

Case 1:

16 year old male checked into the boards during a hockey game who presents with the injury shown below in addition to an incomplete spinal cord injury affecting bilateral lower extremities.





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Survey:

Case 1:

How would the injury be treated at your institution?

1. **Posterior spinal fusion**
2. **Posterior spinal decompression and fusion**
3. **Posterior spinal instrumentation without fusion**
4. **Posterior spinal decompression and instrumentation without fusion**
5. **Other**

Survey:

Case 1:

What service(s) would be involved in the care?

1. **Only orthopedics**
2. **Only neurosurgery**
3. **Either only ortho or only neurosurgery depending on call schedule**
4. **Orthopedics and neurosurgery**
5. **Other**

Survey:

Case 1:

What would be the upper instrumented level (injury at L1)?

1. **T12**
2. **T11**
3. **T10**
4. **T9**
5. **Other**

Survey:

Case 1:

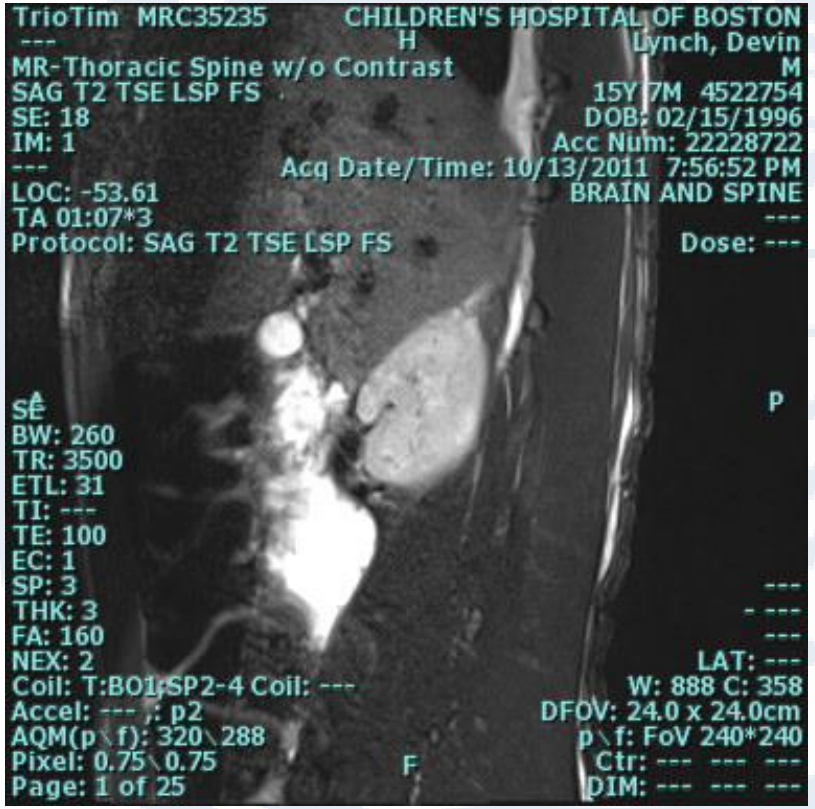
What would be the lower instrumented level (injury at L1)?

1. **L2**
2. **L3**
3. **L4**
4. **Other**

Survey:

Case 2:

15 year old male crashed attempting BMX jump with focal back pain, neurologically intact. L1 burst with injury to PLC.



Discussion:

- **Survey**
  - Any additional information to gather on the call situation?
  - Any additional information to gather on treatment algorithm?
    - Assess differences in neuro intact v neurologic injury
    - Similar fracture patterns
    - Any additional injuries to include?
    - More case examples?

Part II: Retrospective

- **Step 2**
  - Collaborative retrospective review of TL trauma from willing centers with data
- **Objectives:**
  - Type of injuries that occur
  - Type of treatment used
  - Does this vary compared to the adult literature

Part II: Retrospective

- **Primary Aim**
  - Describe the TL injury patterns seen at pediatric institutions that are treated with surgical intervention
  - Hypothesis – most common injury pattern is thoracolumbar junction burst
  - Outcomes
    - AO classification
    - TLICS

Part II: Retrospective

- **Primary Aim**
  - Common surgical treatment of TL injuries at pediatric hospitals
  - Hypothesis – treated in the adult manner with posterior spinal fusion from 2 levels above to 2 levels below
  - Outcomes
    - Surgical data
      - Fusion v instrumentation
      - With or without decompression
      - UIV
      - LIV

Part II: Retrospective

- **Secondary Aims**
  - Surgical complications
    - Infection
    - Hardware failure
    - Return to OR
      - Planned (instrumentation without fusion) v unplanned
  - Neurological status
    - If available

Part II: Retrospective

- **Discussion**
  - What additional information would be helpful?
  - Sites interested in participating?
    - Both survey and retrospective
  - How many years to get information?
    - Do centers have individual registries or data collection for trauma cases?

Thanks

craig.birch@childrens.harvard.edu

Boston Children's Hospital
Orthopedic Center

HARVARD MEDICAL SCHOOL

Femoral Neck Fracture: Virtual Presentation

Jill Larson & Soroush Baghdadi

Ann & Robert H. Lurie Children's Hospital of Chicago®

CORTICES Project Update

Femoral Neck Fractures

Soroush Baghdadi, MD

PIs: Jill Larson, MD
Joseph Janicki, MD

BEST CHILDREN'S HOSPITALS U.S.News & WORLD REPORT RANKED IN 10 SPECIALTIES 2021-22

MAGNET RECOGNIZED AMERICAN NURSES CREDENTIALING CENTER

EPOSNA

Background

- Femoral neck fractures are not uncommon
- A large number will need surgery
- Adverse outcomes common

Current evidence

- 70 patients
- 29% AVN
  - Delbet I & II
  - Displaced

Osteonecrosis After Femoral Neck Fractures in Children and Adolescents: Analysis of Risk Factors

David Spence, MD, Jon-Paul DiMauro, MD, Patricia E. Miller, MS, Michael P. Glotzbecker, MD, Daniel J. Hedequist, MD, and Benjamin J. Shore, MD, MPH, FRCSC

Current evidence

- Extremely limited
- Retrospective, small series

- 30 papers in the English literature 1962 – 2022
- Total of 1185 patients
- Majority of studies 25-50 patients
- Largest study: 239 patients, retro, 8 centers in China

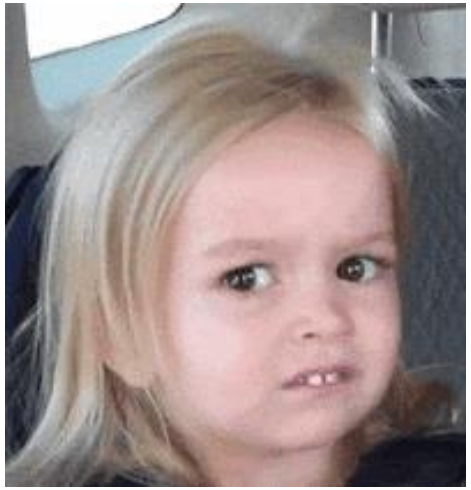
RESEARCH ARTICLE Open Access

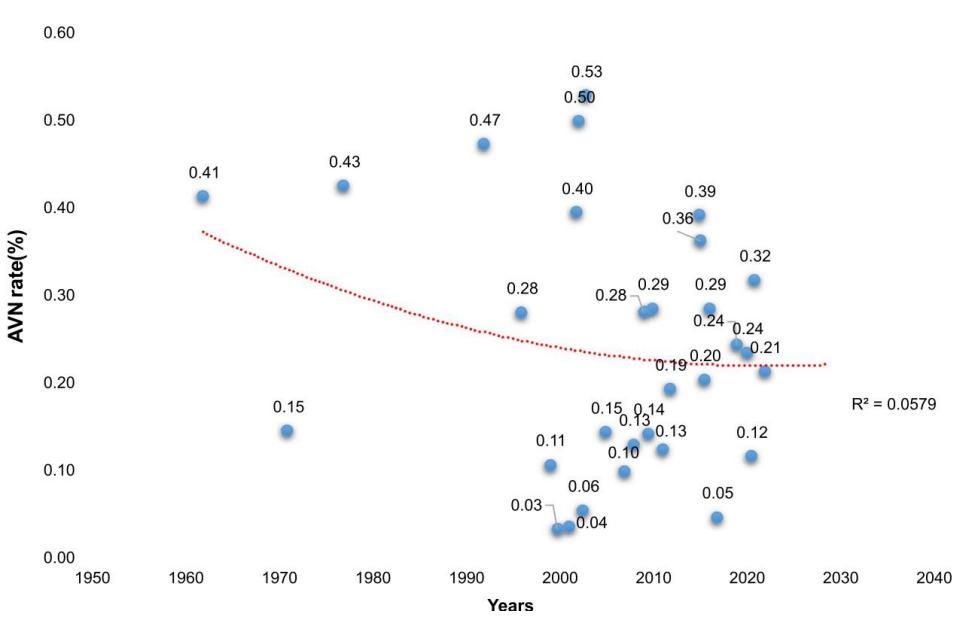
The incidence and risk factors for femoral head necrosis after femoral neck fracture in pediatric patients: a systematic review and meta-analysis

Pengfei Xin[1†], Ziqi Li[2†], Shaoqiang Pei[1], Qi Shi[1,3*] and Lianbo Xiao[3,4*]

Current evidence

- AVN rate: 0-53%





RESEARCH ARTICLE Open Access

The incidence and risk factors for femoral head necrosis after femoral neck fracture in pediatric patients: a systematic review and meta-analysis

Pengfei Xin[1†], Ziqi Li[2†], Shaoqiang Pei[1], Qi Shi[1,3*] and Lianbo Xiao[3,4*]

Primary Aim

- To determine the **incidence** and **risk factors** of adverse outcomes (AVN, non-union, repeat surgery, etc.) after femoral neck fractures

- Primary Hypothesis
  - To determine the incidence and identify the risk factors associated with adverse outcomes following femoral neck fractures in children treated at CORTICES institutions

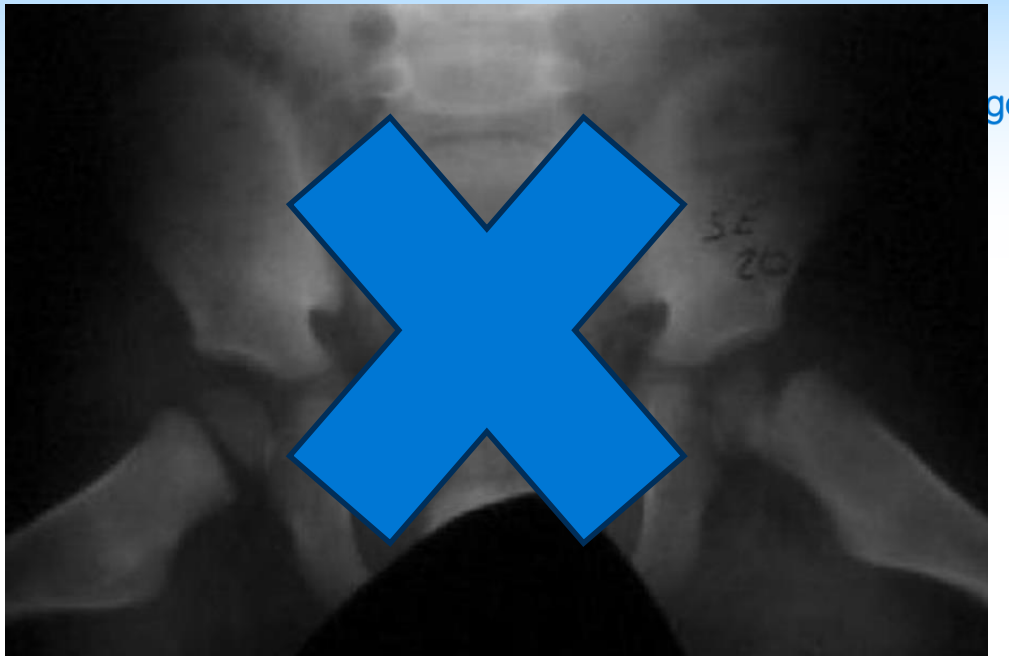
- Primary Outcome
  - Incidence of adverse outcomes (AVN, non-union, repeat surgery, etc.), risk factors for adverse outcomes (imaging and clinical measures)

Secondary Aim

- To identify the demographic and clinical factors associated with a higher incidence of femoral neck fractures in children treated at CORTICES institutions

- To develop a multicenter retrospective database of femoral neck fractures treated by CORTICES members

Design



- Retrospective, multicenter cohort

- **Inclusion**:
  - Ambulatory patients
  - Ages 2-25 years
  - January 2010 – June 2023
  - Femoral neck fracture (distal to physis, proximal to LT)

- **Exclusion**:
  - SCFE, Salter-Harris
  - Incomplete records

CORTICES
ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

Design

- ICD10:
  - S72.0 (Fracture of head and neck of femur)
  - S72.1 (Pertrochanteric fracture)
  - S72.2 (Subtrochanteric fracture of femur)
  - S72.8 (Other fracture of femur)
  - S72.9 (Unspecified fracture of femur)

- ICD9:
  - 73314 (Pathologic fracture of neck of femur)
  - 73315 (Pathologic fracture of other specified part of femur)
  - 73396 (Stress fracture of femoral neck)
  - All 820xx subcodes (Fracture of neck of femur)

Instrument name
General
Imaging

Ann & Robert H. Lurie Children's Hospital of Chicago

Patient Characteristics

Date of Birth

* must provide value

Today M-D-Y

Sex

Male
Female
Unknown

Height in centimeters

Weight in kg

BMI Percentile

Address

History of long bone fractures

Osteogenesis Imperfecta

CORTICES
ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

REDCap

Ann & Robert H. Lurie Children's Hospital of Chicago

Patient Characteristics

Date of Birth

* must provide value

Today M-D-Y

Sex

* must provide value

- Male
- Female
- Unknown

Height in centimeters

Weight in kg

* must provide value

BMI Percentile

* must provide value

Address

History of long bone fractures

* must provide value

Osteogenesis Imperfecta

CORTICES

ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

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Patient Characteristics

Date of Birth
* must provide value
Today M-D-Y

Sex
* must provide value
- Male
- Female
- Unknown

Height in centimeters

Weight in kg
* must provide value

BMI Percentile
* must provide value

Address

History of long bone fractures
* must provide value

CORTICES
ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

Osteogenesis Imperfecta

REDCap

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Patient Characteristics

Date of Birth
* must provide value
Today M-D-Y

Sex
* must provide value
- Male
- Female
- Unknown

Height in centimeters

Weight in kg
* must provide value

BMI Percentile
* must provide value

Address

CORTICES
ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

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Patient Characteristics

Date of Birth
* must provide value
Today M-D-Y

Sex
* must provide value
- Male
- Female
- Unknown

Height in centimeters

Weight in kg
* must provide value

BMI Percentile
* must provide value

Address

History of long bone fractures
* must provide value
- Yes
- No

ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

REDCap

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Patient Characteristics

Date of Birth * must provide value	Today M-D-Y
Sex * must provide value	○ Male ○ Female ○ Unknown
Height in centimeters	
Weight in kg * must provide value	
BMI Percentile * must provide value	
Address	
History of long bone fractures * must provide value	○ Yes ○ No
Medical conditions associated with abnormal bone quality? * must provide value	○ None ○ Osteogenesis Imperfecta ○ Rickets ○ Cerebral Palsy ○ Autism ○ Other
Medications	☐ Epilepsy medications ☐ Bisphosphonates ☐ Steroids ☐ Other

TICES

ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

REDCap

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Patient Characteristics

Injury Characteristics

Date of injury

* must provide value

Today M-D-Y

Time of injury

Mechanism of injury

Polytrauma status (ISS>15, PICU admission, multiple fractures, need for intubation in the ED)

Open fracture?

Prodromal symptoms prior to fracture?

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Patient Characteristics

Injury Characteristics

Date of injury

* must provide value

Today M-D-Y

Time of injury

* must provide value

Now H:M

Mechanism of injury

* must provide value

Low-energy: including falls from < 4 feet (ground level, chair, bed, etc.); sports injuries

High-energy: including motor vehicle accidents and falls >4 feet, gunshot injuries

reset

Polytrauma status (ISS>15, PICU admission, multiple fractures, need for intubation in the ED)

* must provide value

Yes

No

reset

Open fracture?

Yes

No

reset

Prodromal symptoms prior to fracture?

* must provide value

Yes

No

reset

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ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

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Patient Characteristics

Injury Characteristics

Date of injury
* must provide value
Today M-D-Y

Time of injury
* must provide value
Now H:M

Mechanism of Injury
* must provide value
- ○ Low-energy: Including falls from < 4 feet (ground level, chair, bed, etc.), sports injuries
- ○ High-energy: Including motor vehicle accidents and falls >4 feet, gunshot injuries

reset

[illegible]

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Patient Characteristics

Injury Characteristics

Date of injury
* must provide value
Today M-D-Y

Time of injury
* must provide value
Now H:M

Mechanism of Injury
* must provide value
- ○ Low-energy: Including falls from < 4 feet (ground level, chair, bed, etc.), sports injuries
- ○ High-energy: Including motor vehicle accidents and falls >4 feet, gunshot injuries

reset

Polytrauma status (ISS>15, PICU admission, multiple fractures, need for intubation in the ED)
* must provide value
- ○ Yes
- ○ No

reset

[illegible]

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ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

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Patient Characteristics

Injury Characteristics

Date of injury
* must provide value
Today M-D-Y

Time of injury
* must provide value
Now H:M

Mechanism of Injury
* must provide value
- ○ Low-energy: Including falls from < 4 feet (ground level, chair, bed, etc.), sports injuries
- ○ High-energy: Including motor vehicle accidents and falls >4 feet, gunshot injuries

reset

Polytrauma status (ISS>15, PICU admission, multiple fractures, need for intubation in the ED)
* must provide value
- ○ Yes
- ○ No

reset

Open fracture?
- ○ Yes
- ○ No

reset

[redacted]

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Patient Characteristics

Injury Characteristics	
Date of injury * must provide value	Today M-D-Y
Time of injury * must provide value	Now H:M
Mechanism of Injury * must provide value	○ Low-energy: Including falls from < 4 feet (ground level, chair, bed, etc.), sports injuries ○ High-energy: Including motor vehicle accidents and falls >4 feet, gunshot injuries reset
Polytrauma status (ISS>15, PICU admission, multiple fractures, need for intubation in the ED) * must provide value	○ Yes ○ No reset
Open fracture?	○ Yes ○ No reset
Prodromal symptoms prior to fracture? * must provide value	○ Yes ○ No reset

ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

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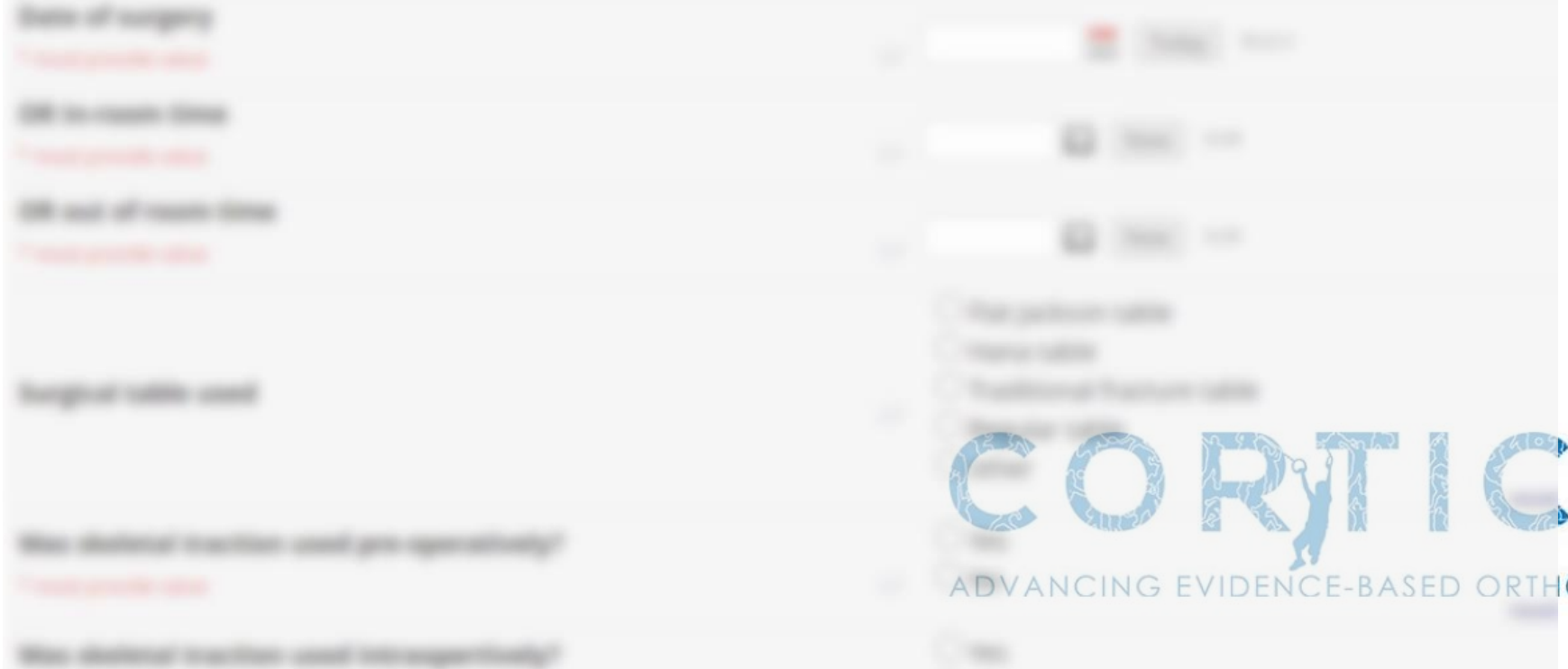
Patient Characteristics

Injury Characteristics

Treatment Characteristics

Date of admission Today M-D-Y

Time of admission
* must provide value
Now H:M



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Patient Characteristics

Injury Characteristics

Treatment Characteristics

Date of admission	Today M-D-Y
Time of admission * must provide value	Now H:M
Date of surgery * must provide value	Today M-D-Y
OR In-room time * must provide value	Now H:M
OR out of room time * must provide value	Now H:M

[blurred]

CORTICES
ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

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Patient Characteristics

Injury Characteristics

Treatment Characteristics

Surgical table used

- ○ Flat Jackson table
- ○ Hana table
- ○ Traditional fracture table
- ○ Regular table
- ○ other

reset

[blurred]

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ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

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Patient Characteristics

Injury Characteristics

Treatment Characteristics

Surgical table used

- ○ Flat Jackson table
- ○ Hana table
- ○ Traditional fracture table
- ○ Regular table
- ○ other

reset

Was skeletal traction used pre-operatively?

* must provide value

- ○ Yes
- ○ No

reset

Was skeletal traction used intraopertively?

* must provide value

- ○ Yes
- ○ No

reset

[blurred]

CORTICES
ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

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Patient Characteristics

Injury Characteristics

Treatment Characteristics

Surgical table used	○ Flat Jackson table ○ Hana table ○ Traditional fracture table ○ Regular table ○ other reset
Was skeletal traction used pre-operatively? * must provide value	○ Yes ○ No reset
Was skeletal traction used intraopertively? * must provide value	○ Yes ○ No reset
Fracture reduction technique	○ Closed ○ Percutaneous assisted ○ Open reset
[illegible]	[illegible]

CORTICES
ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

REDCap

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Patient Characteristics

Injury Characteristics

Treatment Characteristics

Fracture reduction technique	○ Closed ○ Percutaneous assisted ○ Open reset
Surgical approach * must provide value	☐ Anterior (Smith-Peterson) ☐ Anterolateral (Watson-Jones) ☐ Direct lateral ☐ Surgical Dislocation approach
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

CORTICES
ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

REDCap

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Patient Characteristics

Injury Characteristics

Treatment Characteristics

Fracture reduction technique	○ Closed ○ Percutaneous assisted ○ Open reset
Surgical approach * must provide value	☐ Anterior (Smith-Peterson) ☐ Anterolateral (Watson-Jones) ☐ Direct lateral ☐ Surgical Dislocation approach
Instrumentation technique * must provide value	☐ Percutaneous instrumentation ☐ Instrumentation through the same surgical approach ☐ Separate approach for instrumentation
Final hardware construct * must provide value	☐ K-wires ☐ Solid screws ☐ Cannulated screws ☐ Locking plate ☐ Fixed angle device (e.g., Angled blade plate, DHS, FNS) ☐ Intramedullary nail

OPEDIC CARE

REDCap

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Patient Characteristics

Injury Characteristics

Treatment Characteristics

Was capsulotomy done?

* must provide value

- ○ Yes
- ○ No

reset

CORTICES

ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

REDCap

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Patient Characteristic

Injury Characteristics

Treatment Characteris

Post-operative course

Post-operative immobiliztion

* must provide value

- ○ None
- ○ Spica cast
- ○ Brace
- ○ Traction
- ○ Other

reset

[redacted]

CORTICES

ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

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Patient Characteristic

Injury Characteristics

Treatment Characteris

Post-operative course

Post-operative immobiliztion

* must provide value

- None
- Spica cast
- Brace
- Traction
- Other

reset

Date full weight-bearing was allowed

Today M-D-Y

[blurred]

CORTICES

ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

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Patient Characteristic	Post-operative course		
Injury Characteristics	Post-operative immobiliztion * must provide value	None / Spica cast / Brace / Traction / Other	reset
Treatment Characteris	Date full weight-bearing was allowed	Today M-D-Y	
	Was the patient referred to bone health? * must provide value	Yes / No	reset
	Vitamin D level		

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ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

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Patient Characteristics

Injury Characteristics

Treatment Characteristic

Post-operative course

Adverse outcomes? * must provide value	◉ Yes ○ No reset
What were the adverse outcomes? * must provide value	☐ superficial infection ☐ deep infection (requiring return to the OR) ☐ AVN ☐ Nonunion ☐ Malunion ☐ Hardware related complications
Treatment of adverse outcome * must provide value	☐ I&D ☐ Hardware removal ☐ Hardware revision ☐ Revascularization procedure (Drilling, BMAC, Core decompression, fibular grafting) ☐ Femoral Osteotomy ☐ Pelvic Osteotomy ☐ Arthroplasty ☐ other
Was hardware removed? * must provide value	◉ Yes ○ No reset
Reason for removal of hardware * must provide value	☐ elective (not related to any adverse outcomes) ☐ symptomatic hardware ☐ infection ☐ joint penetration ☐ other

CES

ORTHOPEDIC CARE

REDCap

Patient Characteristics

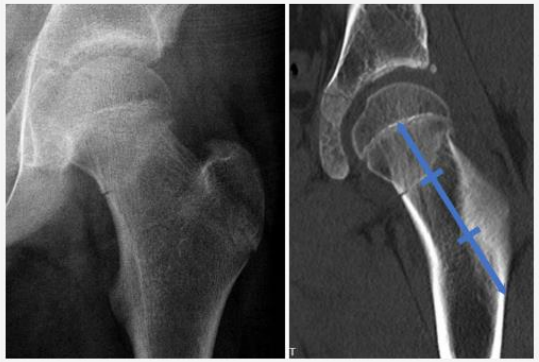
Injury Characteristics

Treatment Characteristics

Post-operative course

Fracture location: A line is drawn from the proximal femoral physis to the lateral cortex, parallel to the neck, and divided in thirds. The most proximal site of fracture line exiting the cortex determines the type. Type I includes the proximal third (Transcervical), Type II middle third (basicervical), and Type III when there is involvement of the trochanters (intertrochanteric). Examples:

Type I:



Type II:

Type III:

* must provide value

- ○ Type I (proximal third)
- ○ Type II (middle third)
- ○ Type III (distal third)

reset

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TICES

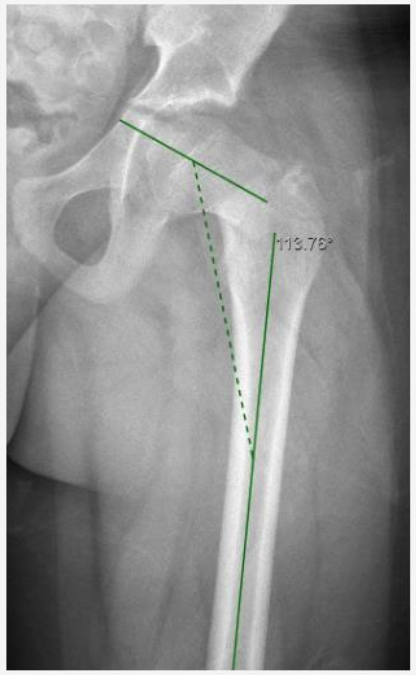
NCE-BASED ORTHOPEDIC CARE

REDCa

Ann & Robert H. Lurie Children's Hospital of Chicago®

- Patient Characteristics
- Injury Characteristics
- Treatment Characteristics
- Post-operative course

Neck-shaft angle on AP



Contralateral NSA

NSA lateral

* must provide value

ICES

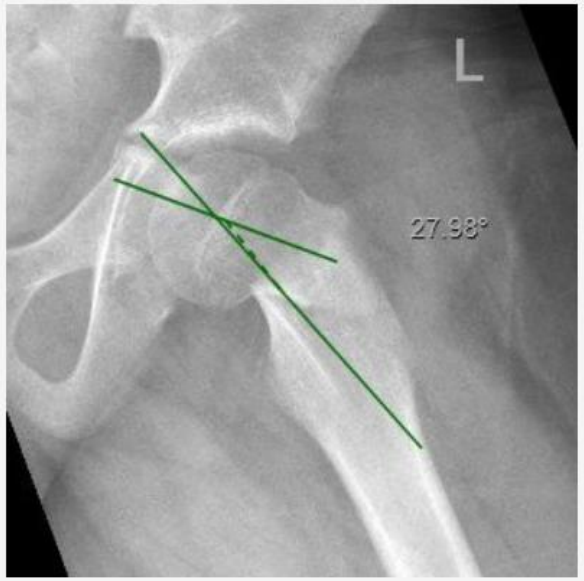
ASED ORTHOPEDIC CARE

REDC

Ann & Robert H. Lurie Children's Hospital of Chicago

- Patient Characteristics
- Injury Characteristics
- Treatment Characteristics
- Post-operative course

Fracture angulation on lateral images



contralateral NSA on lateral view

Largest displacement on AP

* must provide value

CES

ORTHOPEDIC CARE

REDC

- Patient Characteristics
- Injury Characteristics
- Treatment Characteristics
- Post-operative course

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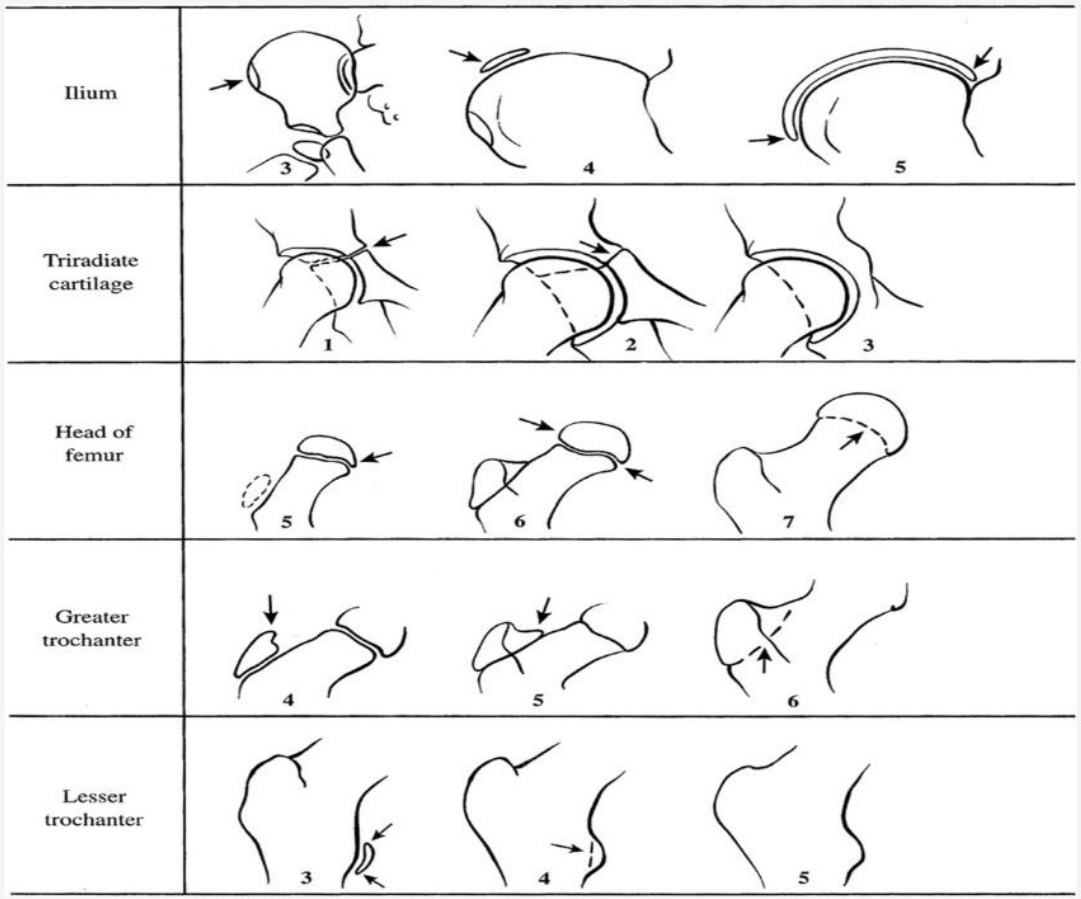
Proximal femoral physis
* must provide value
○ open ○ closed
rese

Triradiate cartilage
* must provide value
○ open ○ closed
rese

Oxford score



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CES
ORTHOPEDIC CARE

REDCap

Ann & Robert H. Lurie Children's Hospital of Chicago

Patient

Injury C

Treatm

Post-op

Injury CT Scan available?
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○ Yes ○ No reset

Injury MRI available?
* must provide value
○ Yes ○ No reset

Intra-operative imaging available?
* must provide value
○ Yes ○ No reset

First post-op imaging available?
* must provide value
○ Yes ○ No reset

Was bone scan done?
* must provide value
○ Yes ○ No reset

Adverse event imaging available?
* must provide value
○ Yes ○ No reset

Final imaging available?
* must provide value
○ Yes ○ No reset

ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

REDCap

Ann & Robert H. Lurie Children's Hospital of Chicago®

General

- Patient Characteristics
- Injury Characteristics
- Treatment Characteristics
- Post-operative course

Imaging

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ADVANCING EVIDENCE-BASED ORTHOPEDIC CARE

Next steps

- Study Protocol
- REDCap
- Data collection

Lis Franc Study Proposal

Megan Johnson, MD
Tony Riccio, MD

TSRH/CMC

Background

- Lack of literature on pediatric Lisfranc injuries
- Little known about mechanism of injury, fracture patterns, threshold for operative vs. nonoperative management, fixation options, subsequent disability/pain
- Not known if the presence of open physes should direct operative vs. nonoperative management, fixation choice, return to activity

Previous Work

- Single institution – 56 peds patients, no PROs (Boston)
- Single institution – 30 peds patients, PROs
- Prelim work by Jaime Denning (unpublished)
- Systematic Review – just published

Specific Aims

- Primary Aim:
  - **Retrospectively characterize pediatric lisfranc injuries with regard to age, mechanism of injury, radiographic injury patterns, treatment, outcomes and compare to historical cohorts of adult Lisfranc injuries**
    - Hypothesis: mechanism of injury, fracture pattern, treatment modalities and outcomes will differ between peds and adult patients
    - Primary outcome: ability to and timing of return to sport, peri-operative complications, postoperative complications, need for supervised therapy services, radiographic outcome (residual displacement, arthritic changes and deformity)

Specific Aims

- Secondary Aims:
  1. **To compare outcomes between operatively and non-operatively managed patients and determine if a threshold of displacement exists beyond which worse outcomes can be expected with non-operative management.**
     - Hypothesis: Surgical and non-surgically managed Lisfranc injuries will have similar outcomes at lower amounts of displacement. However, worse outcomes and less complications will be identified in the non-operative cohort beyond an as of yet undetermined amount of displacement or for certain fracture patterns

Specific Aims

- Secondary Aims:

  2. To determine if the presence of open physes influences the outcome of pediatric Lisfranc injuries by comparing outcomes between pediatric patients with open physes to those less than 18 with closed physes.

  - Hypothesis: Pediatric patients with Lisfranc injuries and open physes have worse outcomes than those with closed physes

Specific Aims

- Secondary Aims:

  3. Develop a classification system of pediatric Lisfranc injuries based on the patterns of injury observed in this population (ex. Patients with open physes have different injury patterns than those with closed physes).

  - Hypothesis: Pediatric patients with Lisfranc injuries, in particular those with open physes, have different injury patterns than adult patients with Lisfranc injuries.

Design/Methods

- Retrospective
- 0-18, Lisfranc injury based on imaging (XR, CT, MRI), can include other foot fractures
- At least 6 month followup
- Exclusion:
  - Neuromuscular, syndromic, metabolic bone disease
  - Polytrauma
  - Open fractures

Design/Methods

- Nonoperative or operative treatment (any fixation method)
- Primary Outcome:
  - Return to sport (chart review)
  - Radiographic outcome (residual displacement, arthritic change, deformity)
  - Complications (chart review)

Participation

- Members that have already expressed interest:
  - Jaime Rice Denning
  - Collin May
  - Keith Baldwin

Update/To Do

- Protocol/Data Dictionary ✓
- IRB
- REDCap – almost done
- Pilot with 10-ish patients to look at inter/intra-rater reliability – could be its own study – have the cases gathered and plan to send out after the meeting
- Survey on practice variation – which would you fix? Could be same XR as above and its own study – same as above

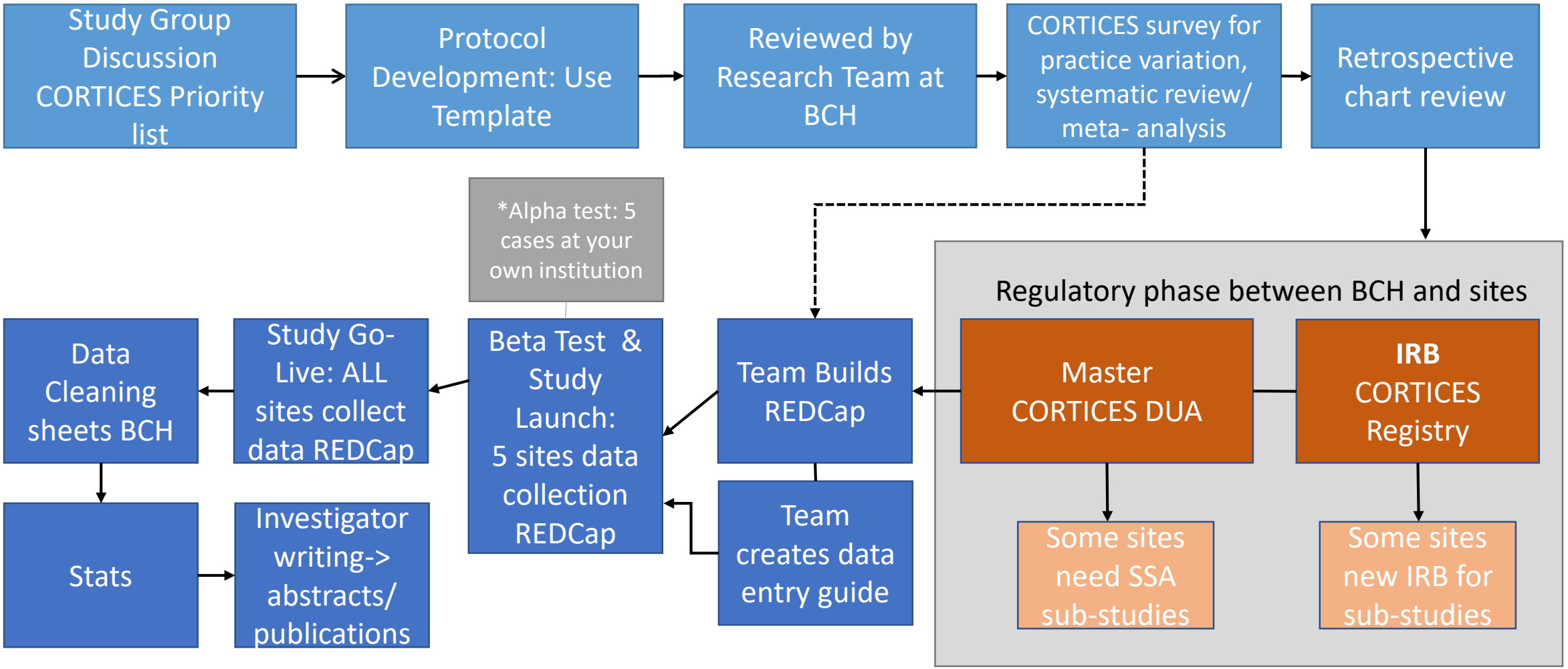
Break Time

Shirts & Group Contacts

CORTICES Study Development and Launch Overview

Meghana Venkatesh & Fernanda Canizares

Process Overview

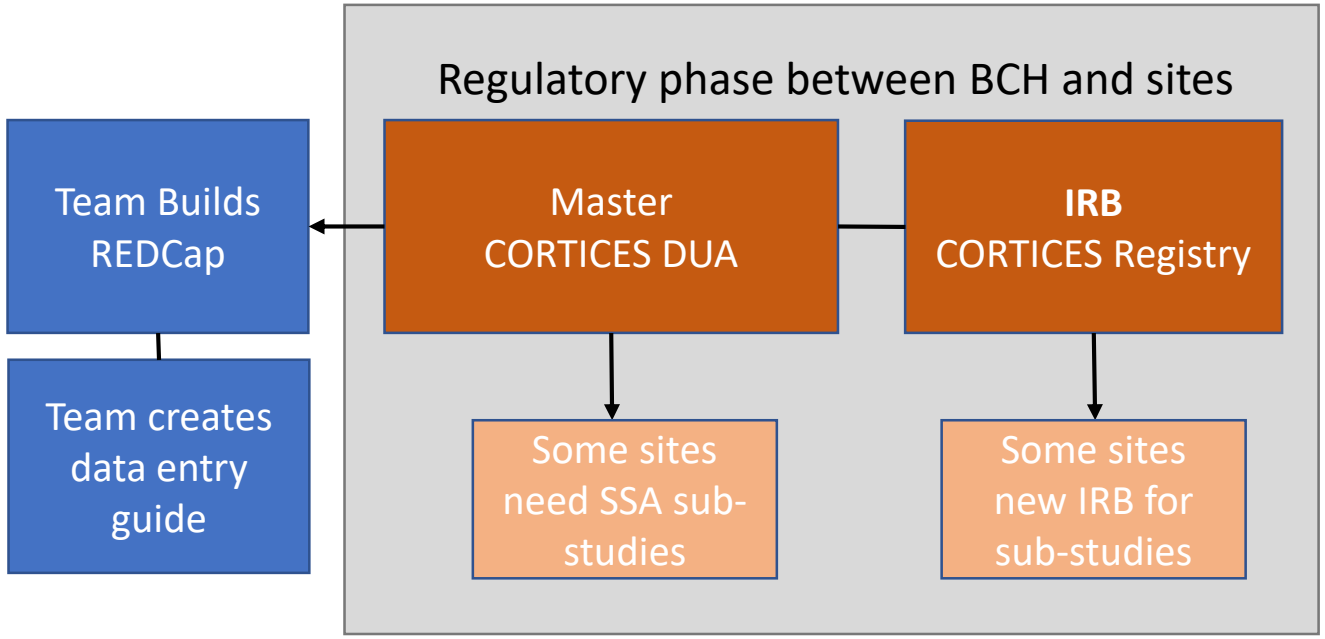


Study Development Steps

- Lead site (LS) will discuss study @ CORTICES meeting and get placed on Priority List for the year
- LS will develop protocol using CORTICES template and submit to BCH for review by the research team
- LS has the ability to conduct surveys and perform systematic reviews/meta-analyses without needing regulatory oversight from BCH

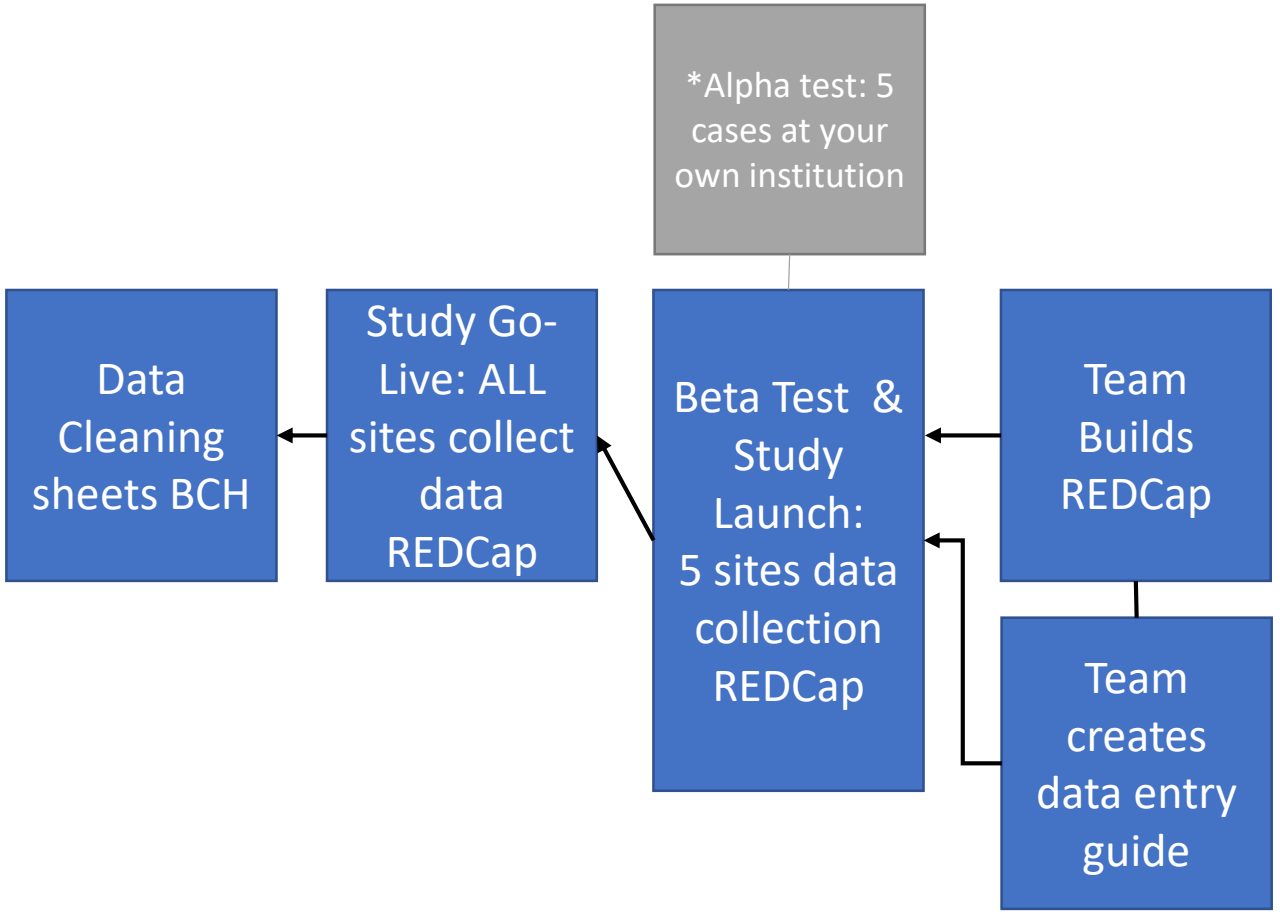
Study Development Steps

- BCH will coordinate with LS to ensure DUA/SSA are in place
- LS creates variable list/data dictionary and sends to BCH who will create/host REDCap to follow the CORTICES DUA



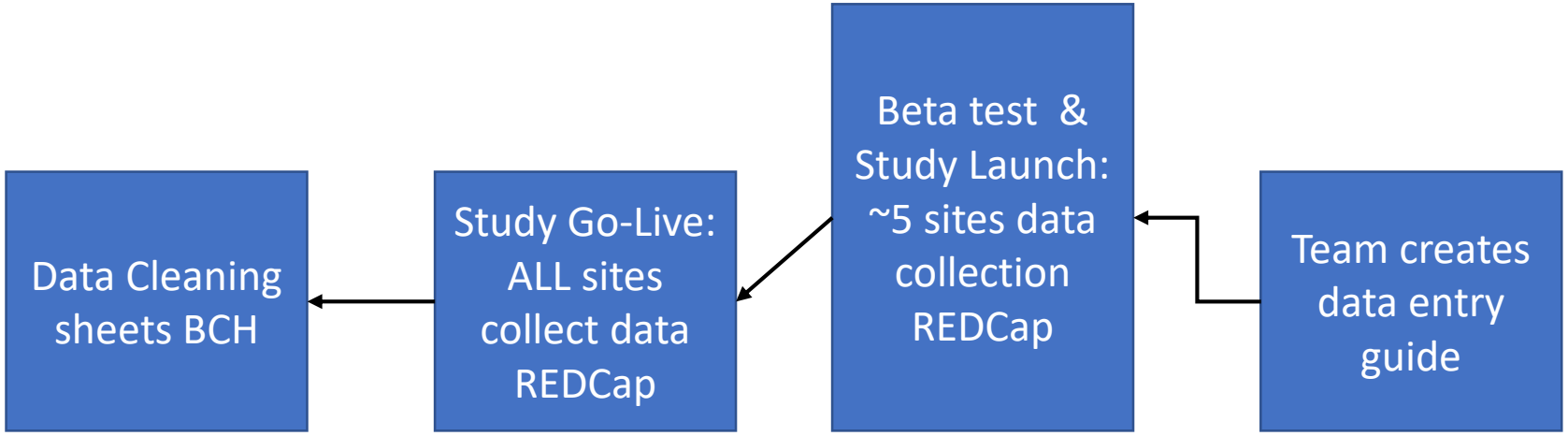
Alpha Testing

- LS needs to conduct testing at their own site to ensure research is sound
- This can occur at any point after REDCap creation and once the site DUA/IRB is in place and verified by BCH
- Alpha testing is done to catch mistakes before the study is given to other sites



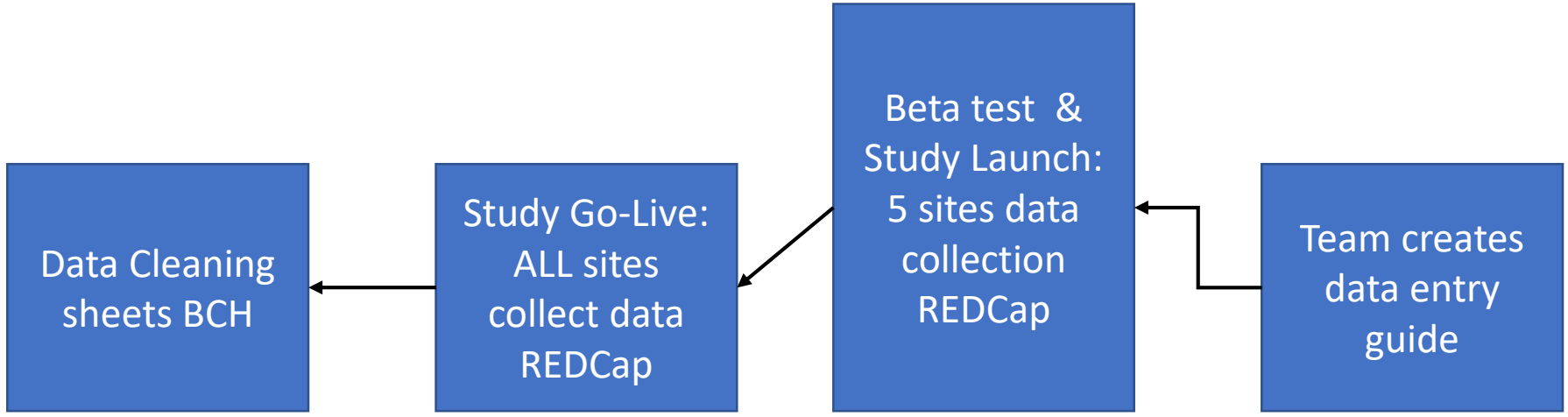
Beta Testing

- LS will need to create a **Data entry guide** which lays out step by step data entry will be done
- Alongside the data entry guide additional materials may need to be made
- Beta testing comprises of the first round of CORTICES sites that have setup DUA/IRBs and REDcaps



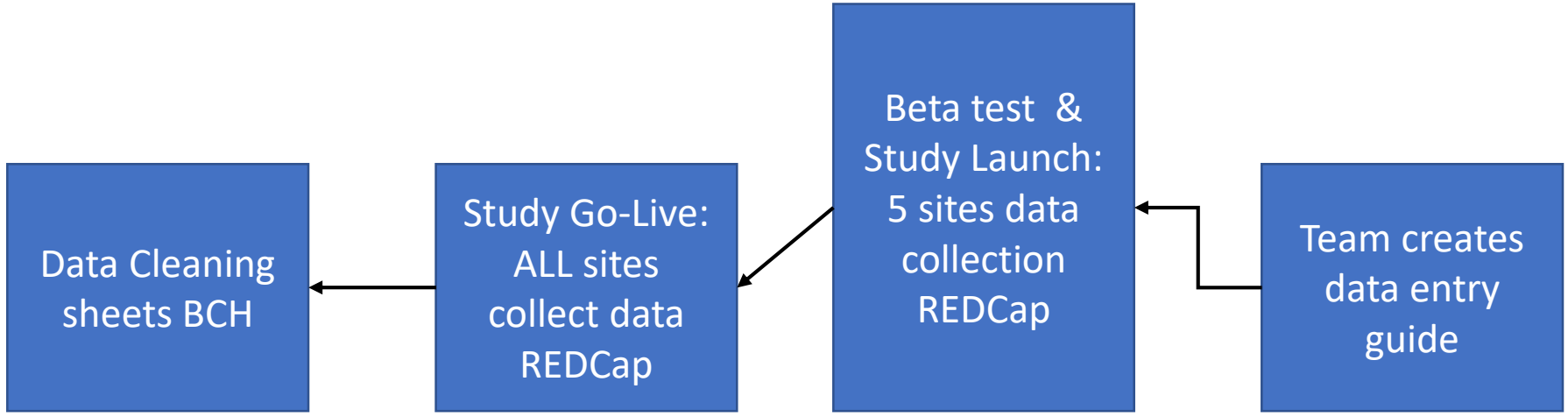
Study Lunch & Study Go-Live

- **Virtual Study Launch** occurs with all Coordinators/PIs of the Beta Sites, the launch will be recorded and disseminated to other sites for the Study Go-Live
- The study launch allows Coordinators to ask questions
- A second study launch zoom session will occur for Study Go-Live if there are changes from Beta testing
- Study Materials will be kept on a DropBox for each study



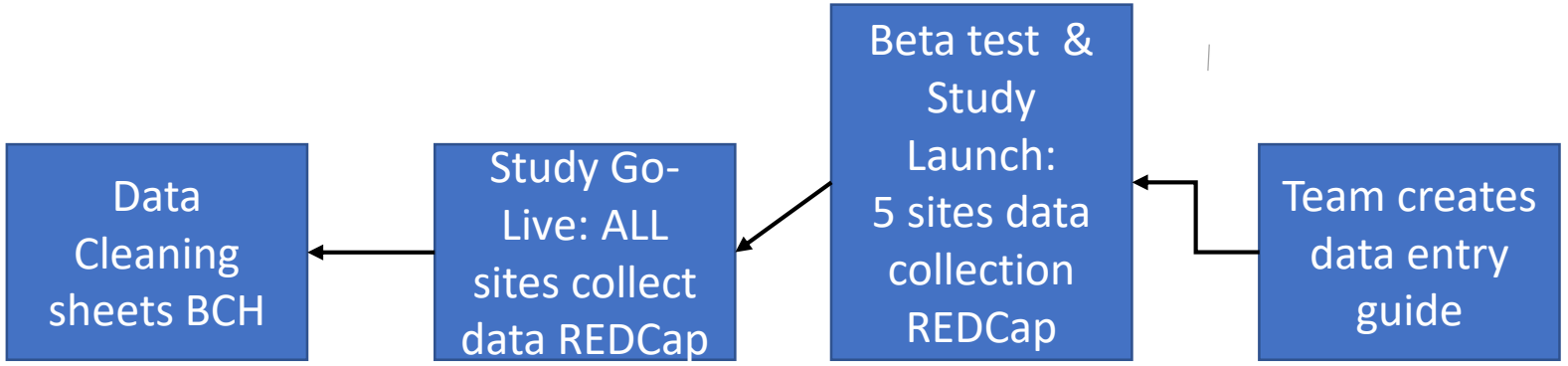
Study Go-Live (SGL)

- SGL is when the REDCap is final & study is launched to all interested sites
- Once DUA/IRB ready, BCH adds coordinators to REDCap & shares training video/DropBox
- Data collection expectation & timeline outlined by the LS with abstract deadlines in mind
- Not all CORTICES sites “have” to participate in each study, but intention is to be communicated to LS



Data Cleaning-BCH

- Once data entry is done the BCH team will generate individual **data cleaning sheets** that will be shared to each institution to address missing data point or questionable entry
- Each site will have **2 weeks** to clean their data queries in order to be added to the final dataset for analysis



Statistical Analysis

- For retrospective chart reviews per DUA only BCH & CHOP can analyze the data
- BCH generates dataset for the statistician/sending the data for analysis to CHOP.
- The turn around time for BCH statistical analysis is up to 6wks.
- For surveys, systematic reviews/meta-analyses each site can perform their own statistical analysis.

Manuscript Creation

- Statistician will share results with LS
- LS is responsible for writing abstracts, manuscripts and publication
- **CORTICES** is to be included in the byline and members included in the footnote
- COI from each author, confirm they are linked via pubmed

Practice Variation in the Surgical Management of Children With Acute Hematogenous Osteomyelitis

Vidyadhar V Upasani [1], Jessica D Burns [2], Tracey P Bastrom [1], Keith D Baldwin [3], Jonathan G Schoenecker [4], Benjamin J Shore [5] CORTICES Study Group

Pediatric Floating Elbows … What Is All the Fuss About? A Multicenter Perspective

Jenny L Zheng [1] CORTICES

Collaborators, Affiliations + expand

PMID: 38098296 DOI: 10.1097/BPO.0000000000002593

Descriptive Epidemiology of Upper Extremity Septic Arthritis in Children–Review of a Retrospective Multicenter Database

Ying Li [1], Ryan M Sanborn [2], Danielle Cook [2], Keith D Baldwin [3], Allan C Beebe [4], Jaime R Denning [5], Rachel Y Goldstein [6], Joseph A Janicki [7], Megan E Johnson [8], Walter H Truong [9], Benjamin J Shore [2];

Children's Orthopaedic Trauma and Infection Consortium for Evidence-Based Studies (CORTICES)

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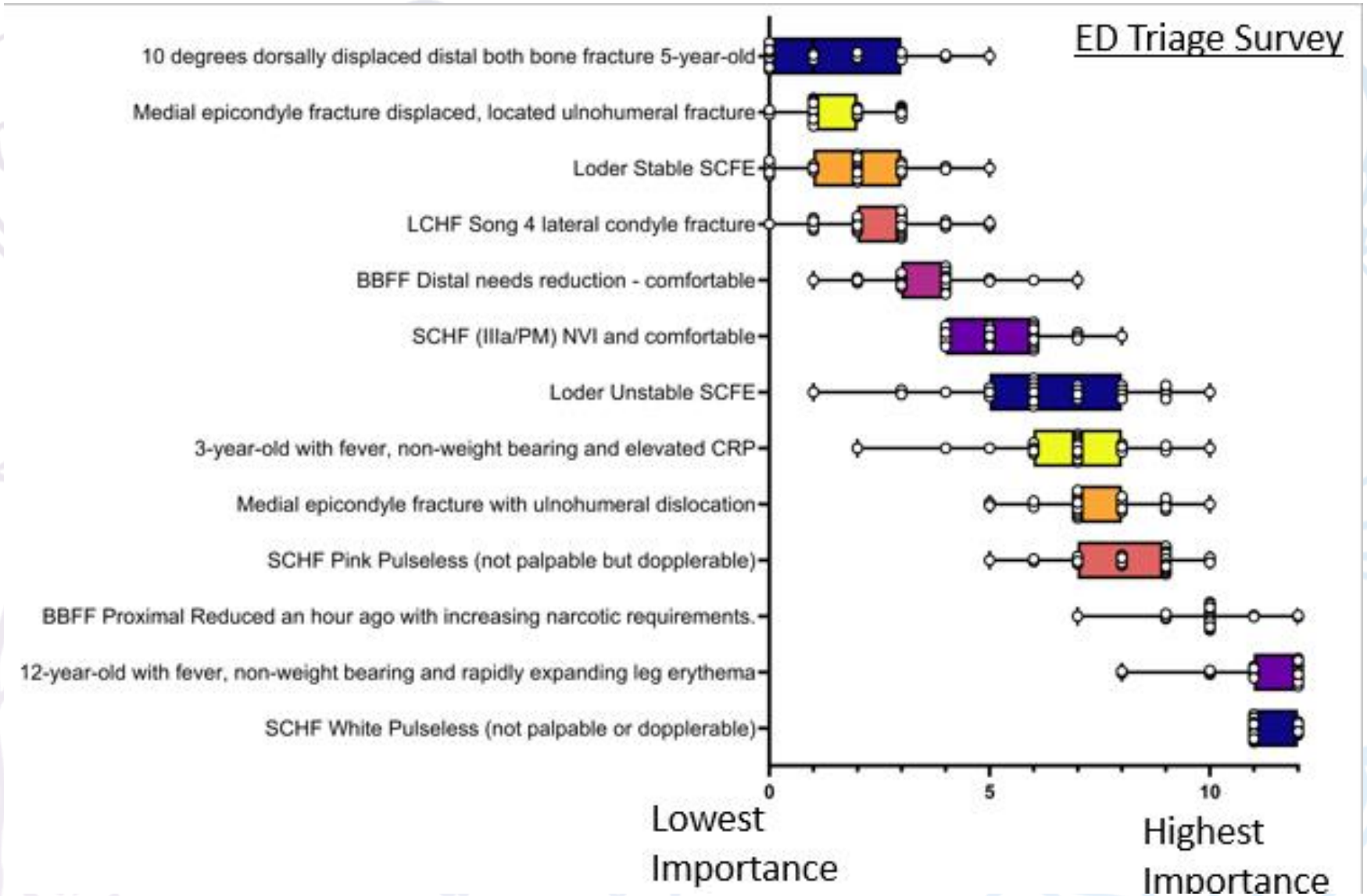
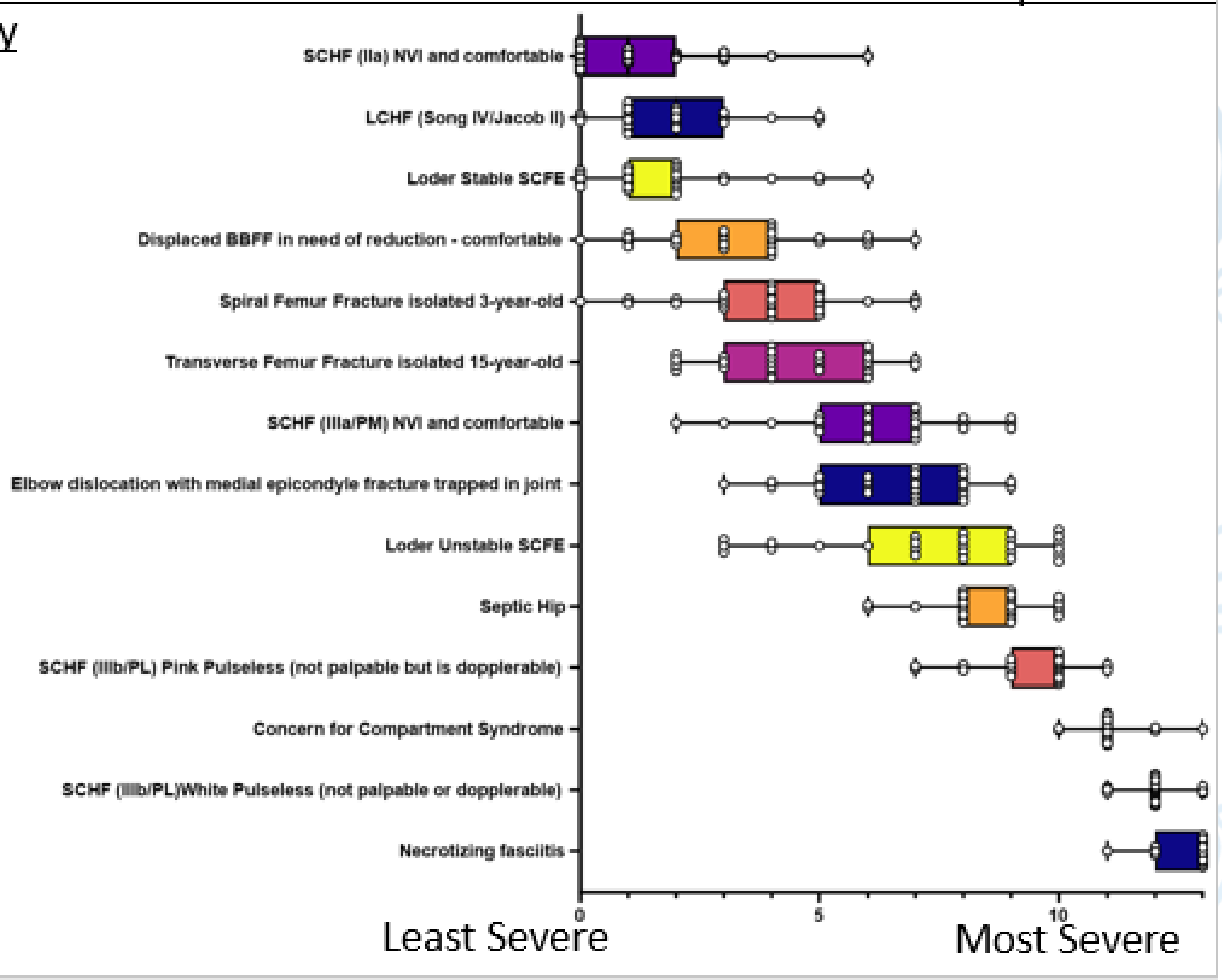
Questions?

MSKI Prospective Study

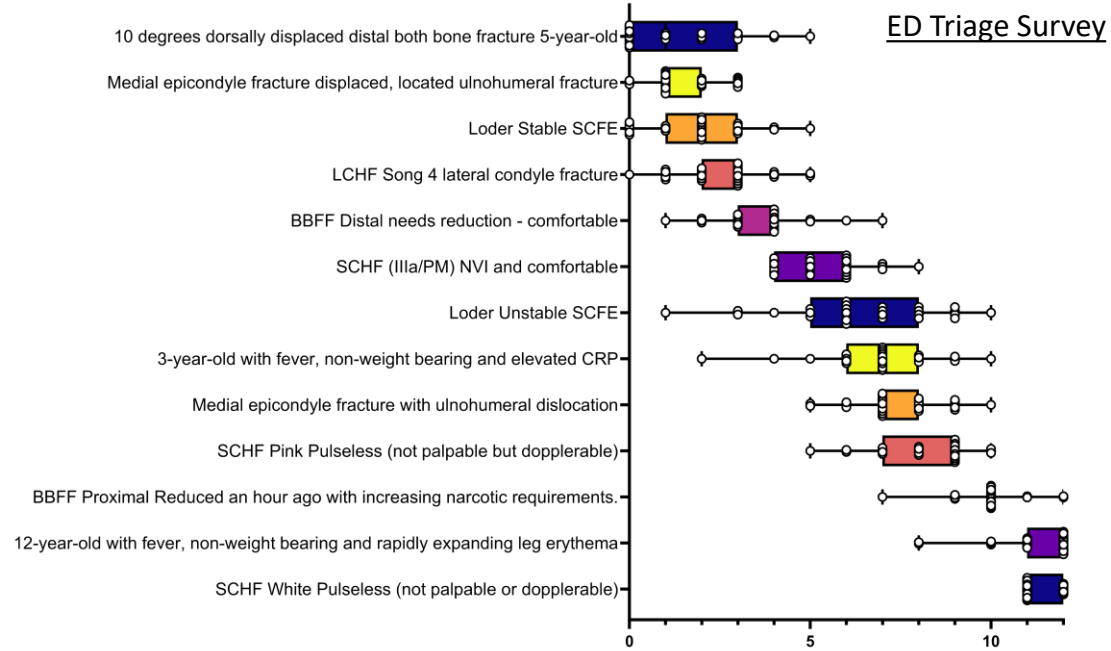
Stephanie Moore-Lotridge & Jon Schoenecker


ED Triage Survey
10 degrees dorsally displaced distal both bone fracture 5-year-old
Medial epicondyle fracture displaced, located ulnohumeral fracture
Loder Stable SCFE
LCHF Song 4 lateral condyle fracture
BBFF Distal needs reduction - comfortable
SCHF (IIIa/PM) NVI and comfortable
Loder Unstable SCFE
3-year-old with fever, non-weight bearing and elevated CRP
Medial epicondyle fracture with ulnohumeral dislocation
SCHF Pink Pulseless (not palpable but dopplerable)
BBFF Proximal Reduced an hour ago with increasing narcotic requirements.
12-year-old with fever, non-weight bearing and rapidly expanding leg erythema
SCHF White Pulseless (not palpable or dopplerable)
0
5
10
Lowest Importance
Highest Importance

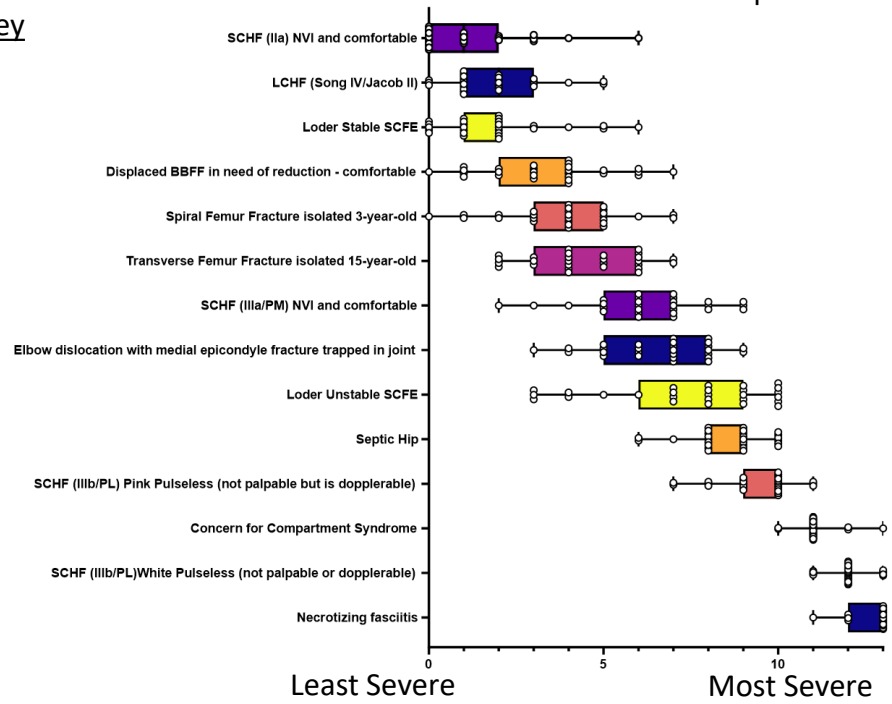
OR Acuity Survey



ED Triage Survey



OR Acuity Survey



CORTICES at EPOSNA 2024

Diaphyseal Femur Fractures in Children Under the Age of 3 – Risk Factors for Non-Accidental Trauma: A CORTICES Multi-Center Study

Manya Bali; Patricia E. Miller, MS; Benjamin J. Shore, MD, MPH, FRCSC; Scott B. Rosenfeld, MD; CORTICES

Wednesday, May 8 @ 8:11-8:15 AM – Session 1 – TRAUMA

E-Poster: Knee Septic Arthritis or Lyme Disease- Can it be Predicted?

Ying Li, MD; Ryan Sanborn; Danielle Cook; Keith D. Baldwin, MD; Benjamin J. Shore, MD, MPH, FRCSC; Children's Orthopaedic Trauma and Infection Consortium for Evidence-Based Studies (CORTICES)

Closing & Final Remarks

Benjamin Shore

Final Remarks

Thank you for attending the 2024 CORTICES Meeting at EPOSNA!

Reminder for Annual Meeting

September 27 2024 to September 28 2024 Friday and Saturday in Seattle

Join us at Succotash if you RSVP'd

186 Waterfront St, National Harbor, MD 20745

Venmo Shore $100 for Dinner!

Benjamin Shore

@Benjamin-Shore-1

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EPOSNA