A Silent Child's Voice at the Time of Injury: Taking on a Weighted System

Bellal Joseph, MD, FACS
Professor & Chief of Trauma and Acute Care Surgery
The University of Arizona, Tucson, AZ

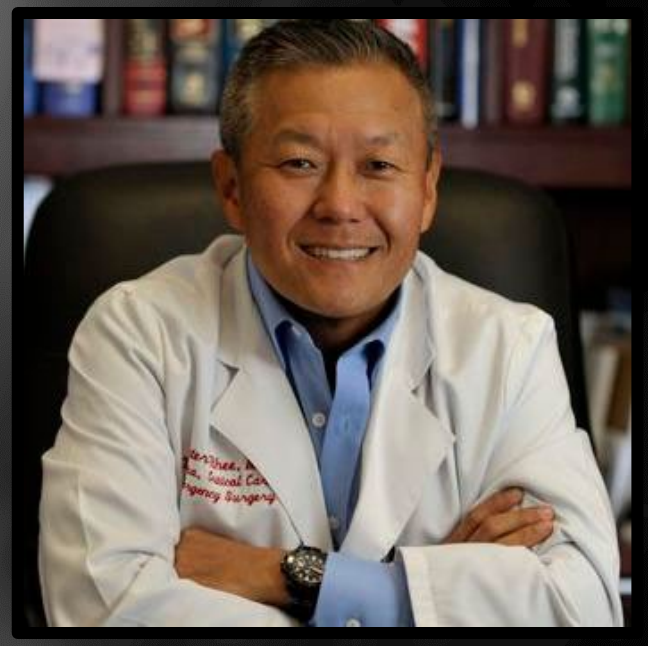
ARIZONA

TRAUMA TEAM

This talk is like illusion;
It alters with perspective


INSPIRE

Inspiration



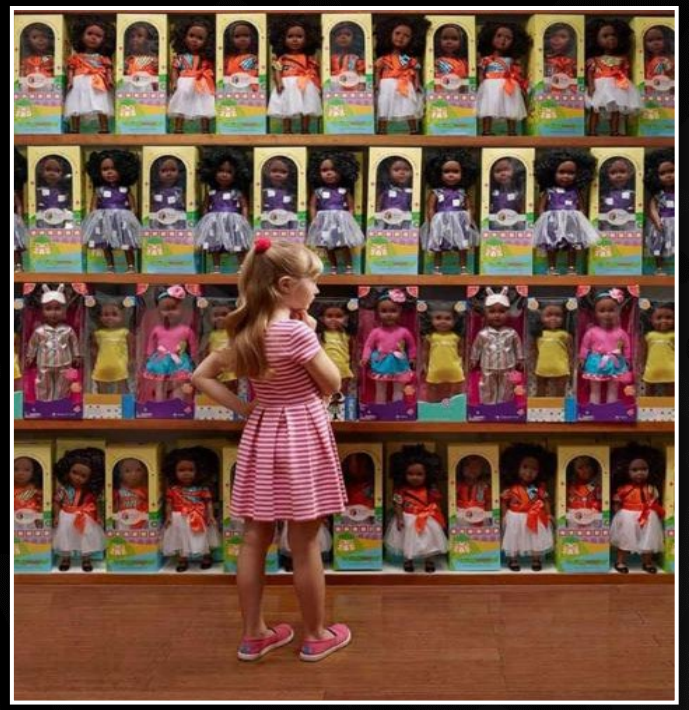

Facing Our Uncomfortable Truths

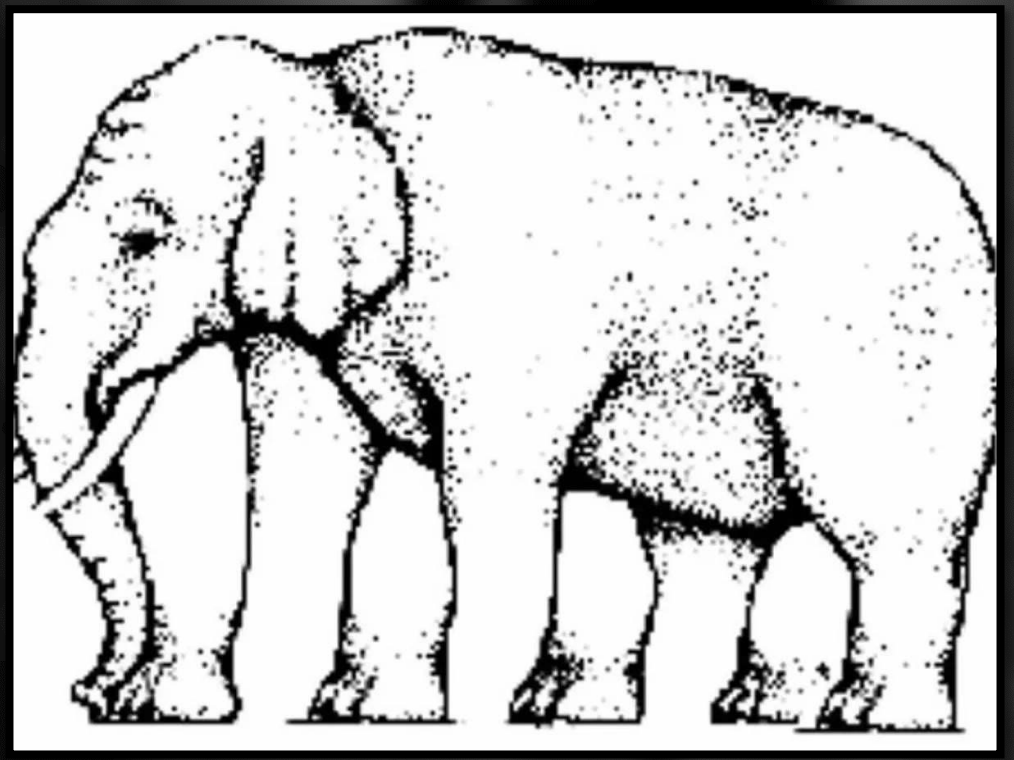
“Of all the forms of inequality,

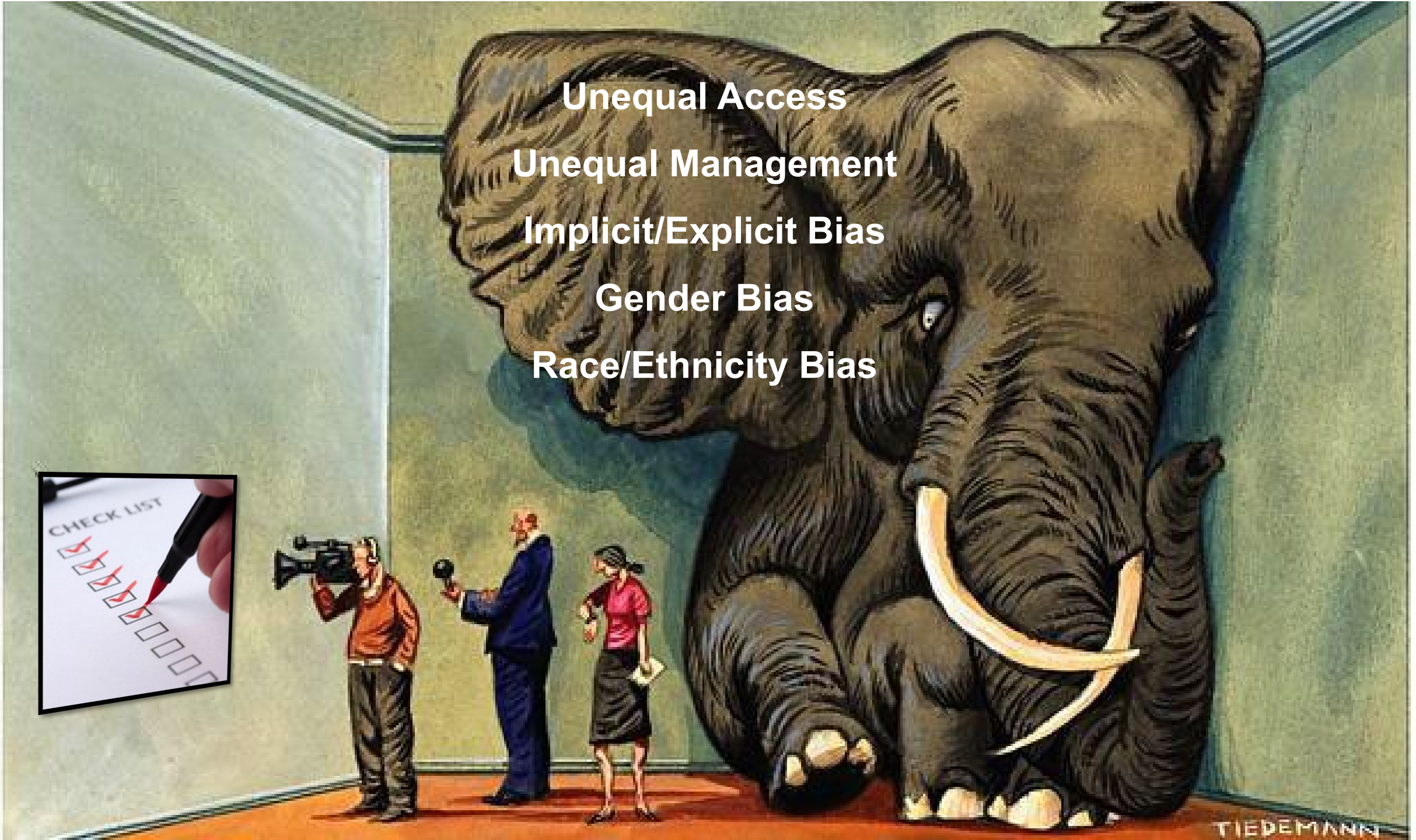
injustice in health is the most shocking and inhumane”

- Martin Luther King Jr.

Let's Pause for a Second






Unequal Access
Unequal Management
Implicit/Explicit Bias
Gender Bias
Race/Ethnicity Bias
CHECK LIST
TIEDEMANN

JUNE 22, 2009

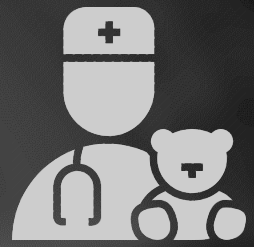
TIME

CODE WHITE

www.time.com


If You Think This Doesn’t Impact You,
Think Again

Pediatric Surgery



- About 75% of APSA are male and white surgeons and
- Only 11% of Pediatric Surgery Fellowship Directors from 1937–2019 were Women
- First Black President of APSA → 2017 only 8 % have ever been women
- APSA DEI Committee → Established in 2018

Morrison, Zachary D., et al. "Diversity, equity, and inclusion: a strategic priority for the American Pediatric Surgical Association." *Journal of Pediatric Surgery* 56.4 (2021): 641-647.

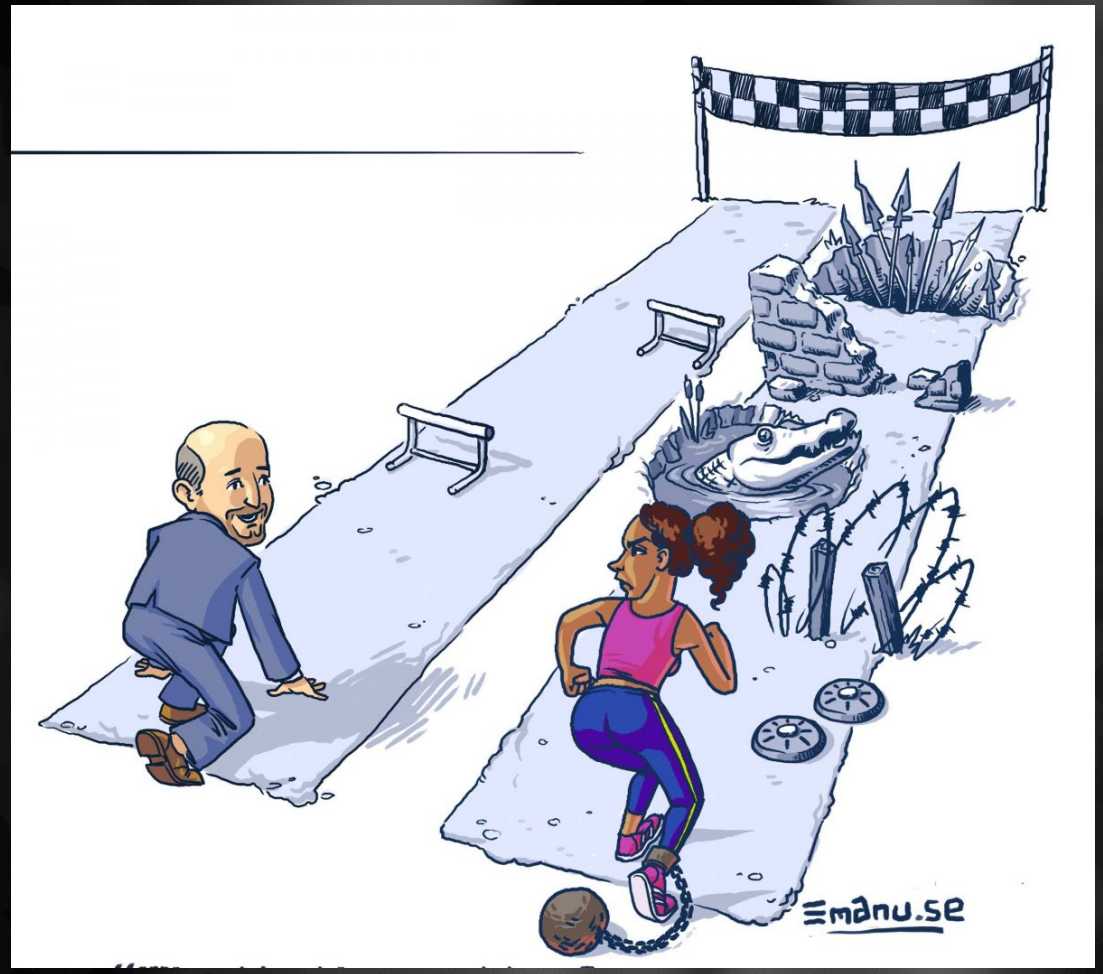
Exploring the gender gap: Letters of recommendation to pediatric surgery fellowship

Arika Hoffman, Rachel Ghoubrial, Melanie McCormick, Praise Matemavi, Robert Cusick

2020

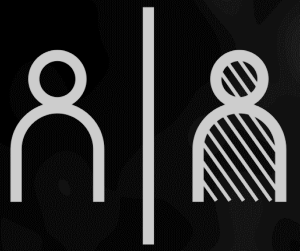
- 364 LoRs for 49 female and 48 male applicants were reviewed
- **Male applicant letters contain agentic terms & active possessive language**
- **Female applicant letters → socio-communal phrases & references to spouse accomplishments**

Is It The Same Distance?



Advancements in Racial Representation

Advancements in Racial Representation



1910

Only 2.5% of U.S. physicians were Black

2008

This fell to 2.2%

Washington, Harriet A. "Apology shines light on racial schism in medicine." *New York Times* 29 (2008): F5.

Advancemen WHY? resentation

2001

2018

Only 14.9% of U.S.

residents were

fell to 12.8%

Haruno, Lee S., et al. "Racial and Sex Disparities in Resident Attrition Among Surgical Subspecialties." JAMA surgery (2023).

Inclusion and representation in the pediatric surgery workforce: Strategies to mitigate bias in the fellowship application process

Loren Berman a, Elizabeth Renaud b, Devon Pace a, Cynthia D. Downard c, Benedict C. Nwomeh d, Eunice Y. Huang e, Ying Z. Weatherall f, Samir K. Gadepalli g, Kevin P. Mollen h, Grace Z. Mak i, Erika Newman g, APSTPD DEI Committee

2022

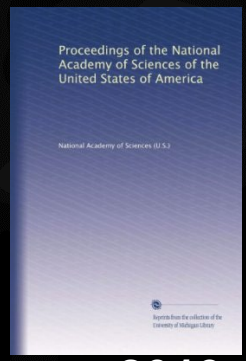
Pediatric surgery workforce is 70% White

Pediatric surgeons at large do not reflect the populations they serve


DOES IT MATTER?

Physician-patient racial concordance and disparities in birthing mortality for newborns

Brad N. Greenwood, Rachel R. Hardeman, Laura Huang, and Aaron Sojourner

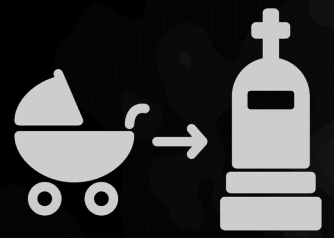


2019

Black newborns cared for by **Black physicians** → **58%** ↓ **mortality** compared to

Black newborns cared for by **White physicians**

Disparities Begin as Early as From the Womb



Infant Mortality

(x3)

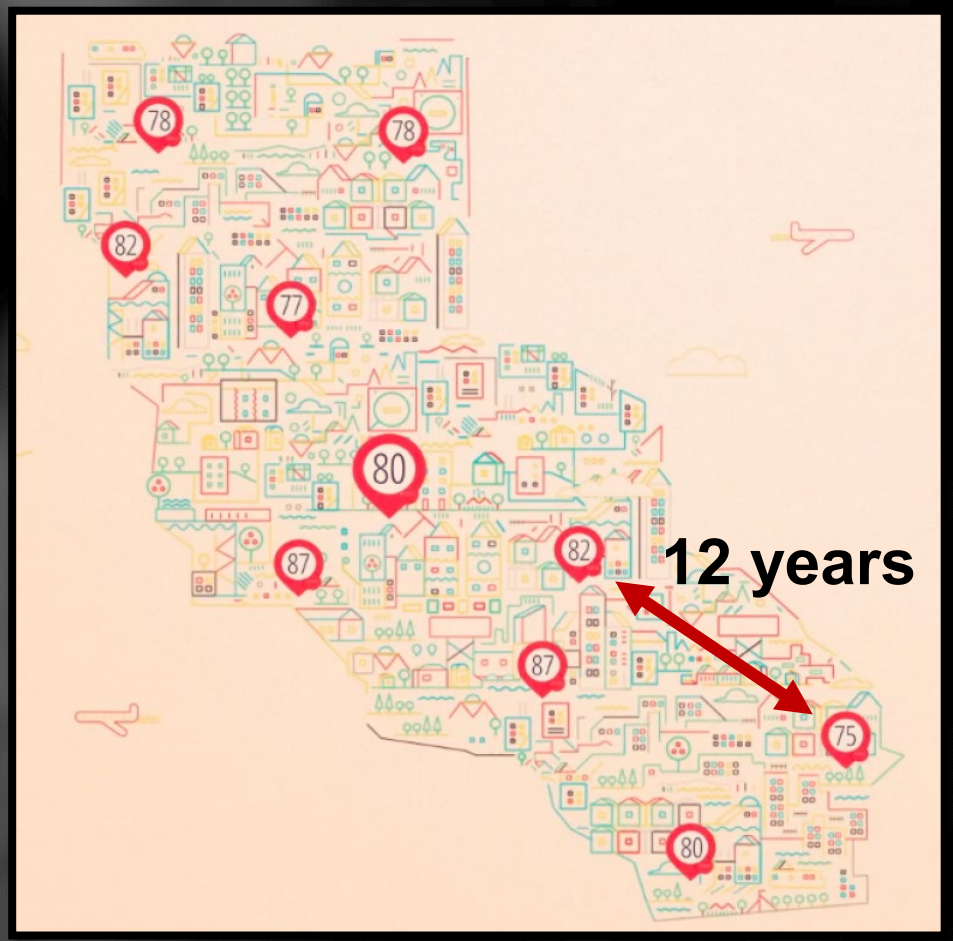
Low Birthweight

(x2)

https://www.chcf.org/publication/2021-edition-health-disparities-race-ethnicity-california/#related-links-and-downloads

The Difference a Mile Can Make -

Life Expectancy by Zip Code



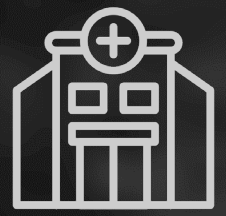
Socioeconomic and Health Disparities Among Pediatric Trauma Patients in the United States

2021

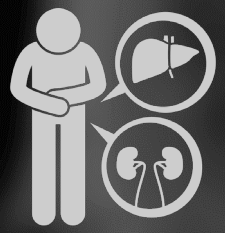
- National Inpatient Sample (2012-2015), **58,810** pediatric trauma patients

Black & Hispanics vs White

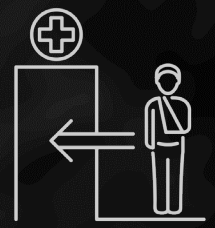
Mortality



LOS



Complications



Non-Routine Discharge

Disparities in Triage?

Care for Black Adolescents?

- Black pts have **higher mortality** in hospitals with **low proportion of black pts**
- **GSW Black adolescent pts** (vs White): more likely **triaged to ATCs** than PTCs

- Andrade, Erin G., et al. "Racial disparities in triage of adolescent patients after bullet injury." Journal of trauma and acute care surgery 92.2 (2022)
- Kishawi, Sami K., et al. "Race and trauma mortality: The effect of hospital-level Black–White patient race distribution." *Journal of Trauma and Acute Care Surgery* 92.6 (2022)

What About In-hospital Care?

Racial/Ethnic Differences in Pediatric Emergency Department Wait Times

Jennifer R. Marin, MD, MSc; Jonathan Rodean, MPP; Matt Hall, PhD; et al

2022

- **Aim:** To determine **racial/ethnic differences** in ED wait times
- Pediatric Emergency Care Applied Research Network Registry - 2016

Compared to Non-Hispanic Whites

ED Wait Times

↑ **Hispanic** **(33%)**

↑ **Non-Hispanic Black** **(27%)**

↑ **Other race** **(12%)**

Racial and Ethnic Differences in Emergency Department Diagnostic Imaging at US Children's Hospitals, 2016-2019

Jennifer R. Marin, MD, MSc; Jonathan Rodean, MPP; Matt Hall, PhD; et al

- Multicenter study of **>13 million pediatric ED visits** to 44 children's hospitals
- Data included from 2016-2019
- **Outcome:** receiving **ED diagnostic imaging** (X-ray, CT, US, & MRI)

Black & Hispanic children less likely to undergo ED imaging

White	Black	Hispanic
(34%)	(24%)	(26%)

<0.001

Racial and Ethnic Disparities in Pain Management of Children With Limb Fractures or Suspected Appendicitis: A Retrospective Cross-Sectional Study

Romain Guedj, Maddalena Marini, Joe Kossowsky, Charles B. Berde, Amir A. Kimia and Eric W. Fleegler

frontiers in Pediatrics
2021

- Children visiting the ED at Boston Children's Hospital (2011-2015)
- **8,347** children with **limb fractures** & **4,780** with suspected **appendicitis**
- **Outcome: analgesic & opioid administration**

Compared to White non-Hispanic Children

Black & Hispanic Children

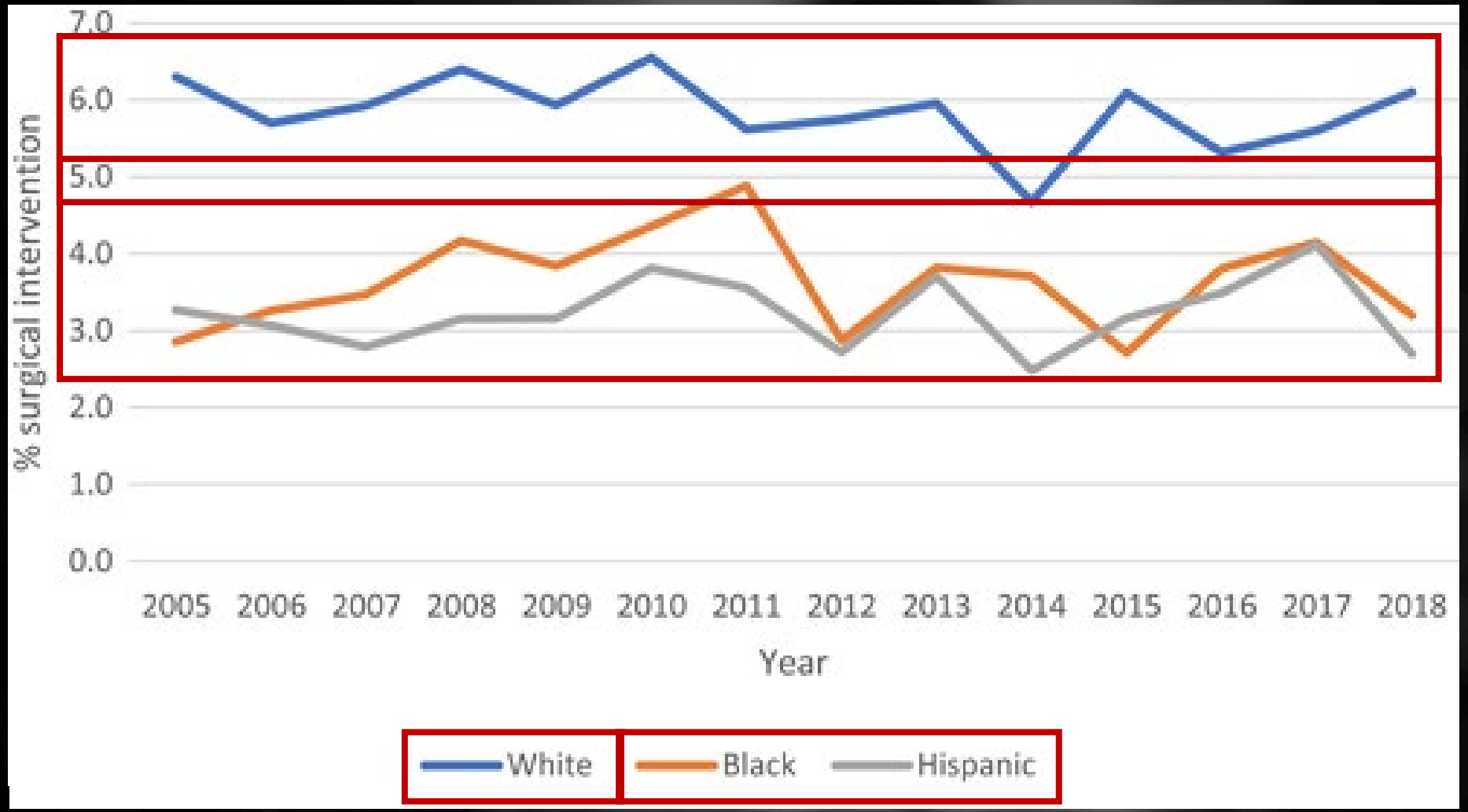
Opioid Analgesia
aOR (0.70)

Surgical Interventions - Quantity & Quality

Epidemiology of Pediatric Surgery in the United States

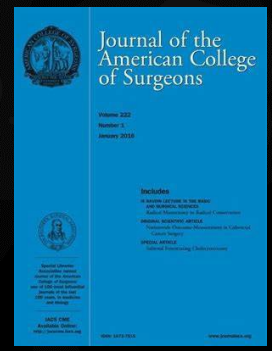
Jennifer A. Rabbitts, Cornelius B. Groenewald

2021



Patterns of Surgical Care and Health Disparities of Treating Pediatric Finger Amputation Injuries in the United States

Lee Squitieri MD, MS, Heidi Reichert MA, H. Myra Kim SCD, Justin Steggerda BA, Kevin C. Chung MD, MS

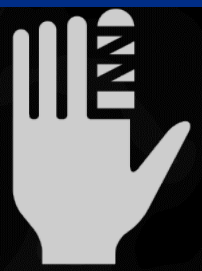


2011

Digit Replantation

Compared to White Patients

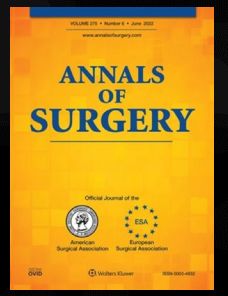
- Black (0.5x)
- Hispanic (0.4x)
- Uninsured (0.4x)



Call For Action: Pediatric Firearm Injuries

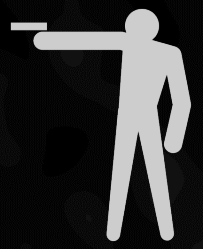
Pediatric Firearm Injuries and Fatalities: Do Racial Disparities Exist?

Sakran, Joseph V. MD, MPH, MPA; Nance, Michael MD; Riall, Taylor MD; Asmar, Samer MD; Chehab, Mohamad MD; Joseph, Bellal MD



2020

- Analysis of 2017 ACS-TQIP
- Pediatric (age ≤17 years) patients admitted with firearm injuries
- 3,717 pediatric firearm injuries: Blacks (67.0%) & Whites (33.0%)



Assault
(x2 in Blacks)

Suicide
(x2 in Whites)

Mental Health Care
(x13 in Whites)

Uncovering Gender, Racial, Ethnic, and Socioeconomic Disparities Among Adolescent Survivors of Suicide Attempts in Trauma Centers: Where Can We Do Better?

Racial & Ethnic Minorities

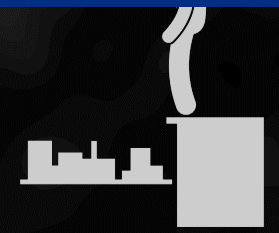
Uninsured Patients

Non-Pediatric Trauma Centers

Mortality

Mental Health Care

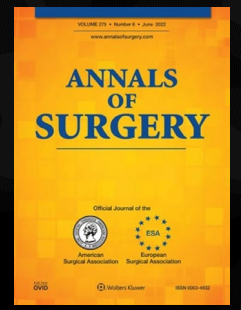
- **Mortality**



Child Abuse

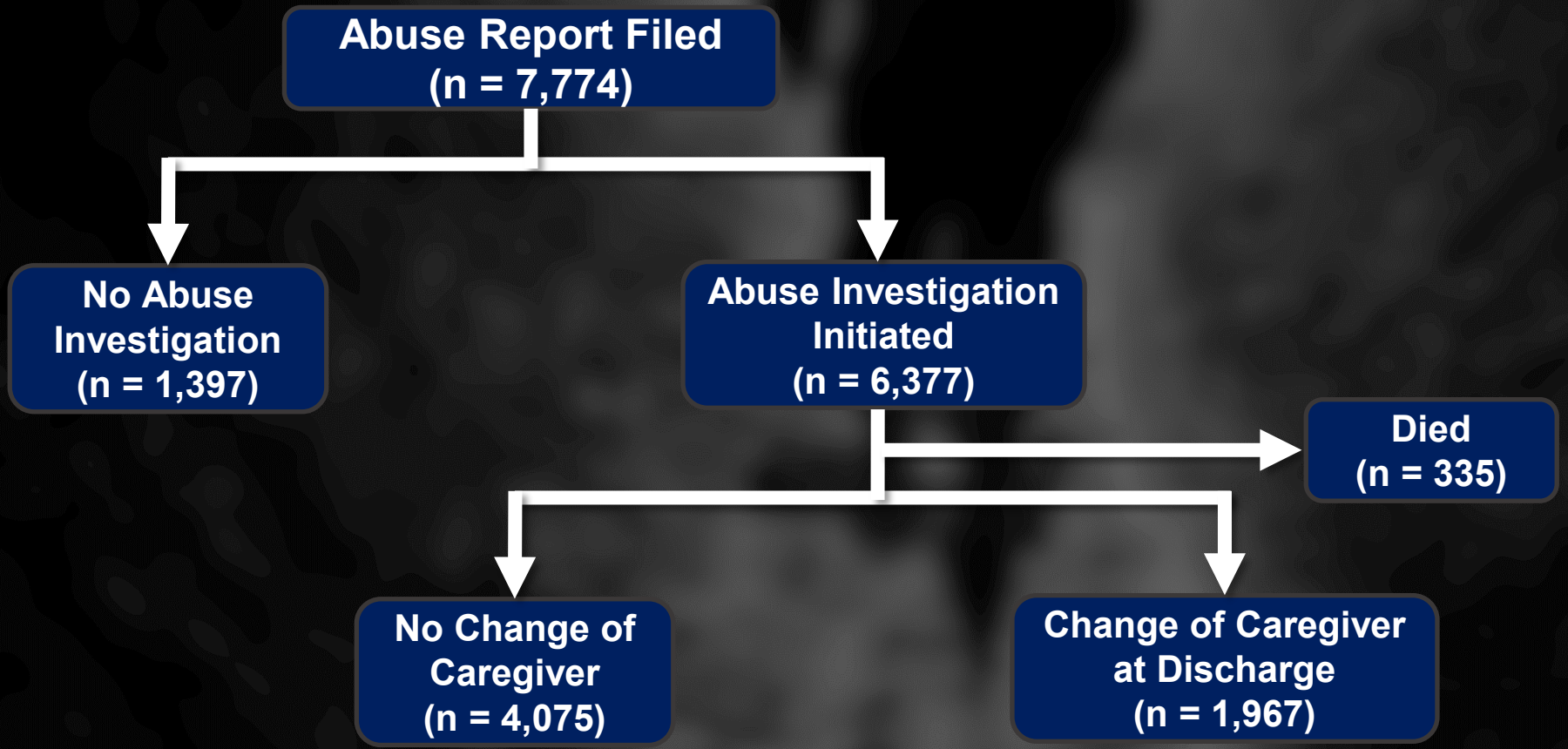
Nationwide Management of Trauma in Child Abuse
Exploring the Racial, Ethnic, & Socioeconomic Disparities

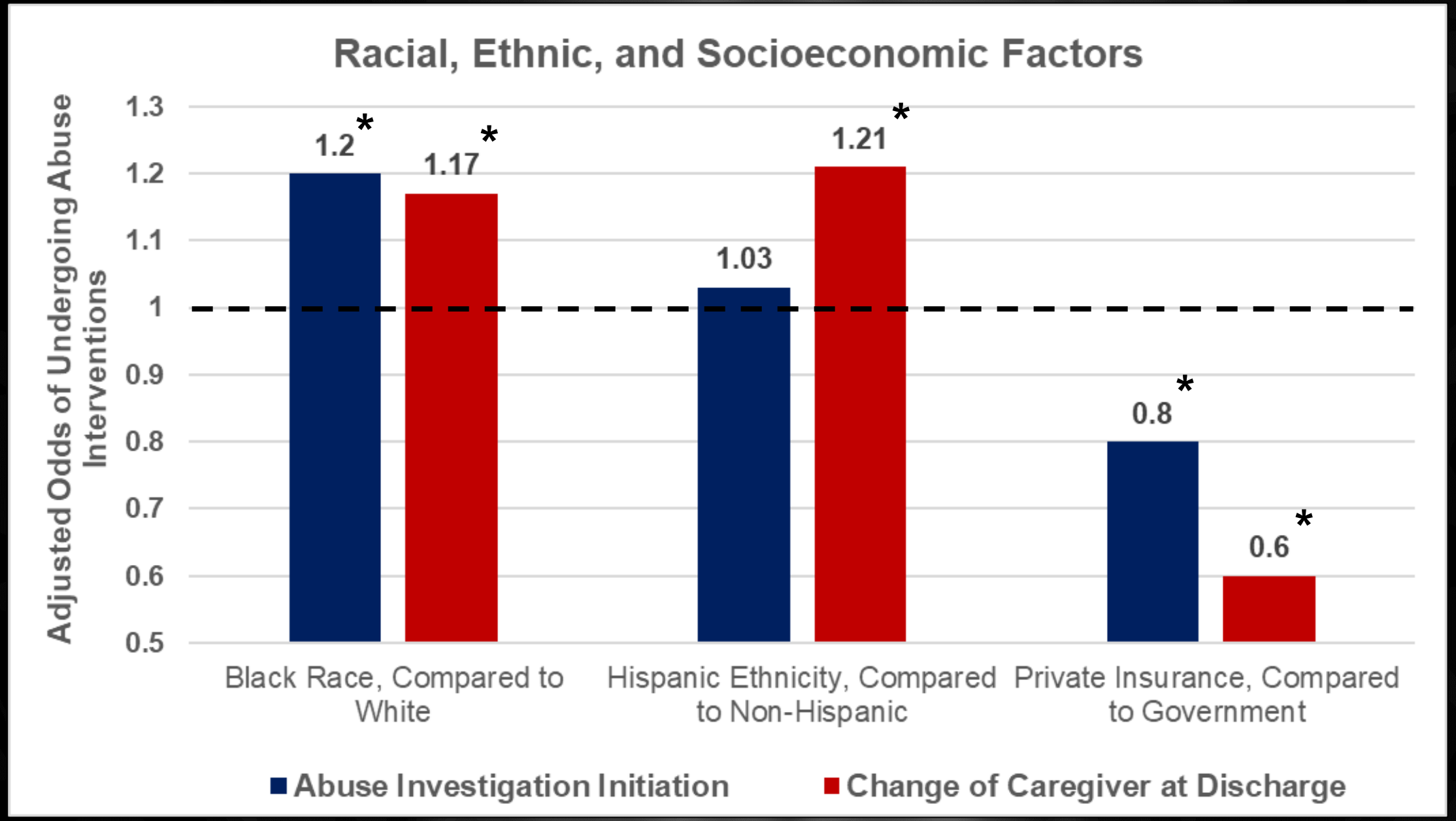
Joseph, Bellal MD, FACS; Sakran, Joseph V. MD, MPH, MPA, FACS; Obaid, Omar MD; Hosseinpour, Hamidreza MD; Ditillo, Michael DO, FACS; Anand, Tanya MD, MPH; Zakrison, Tanya L. MD, MPH

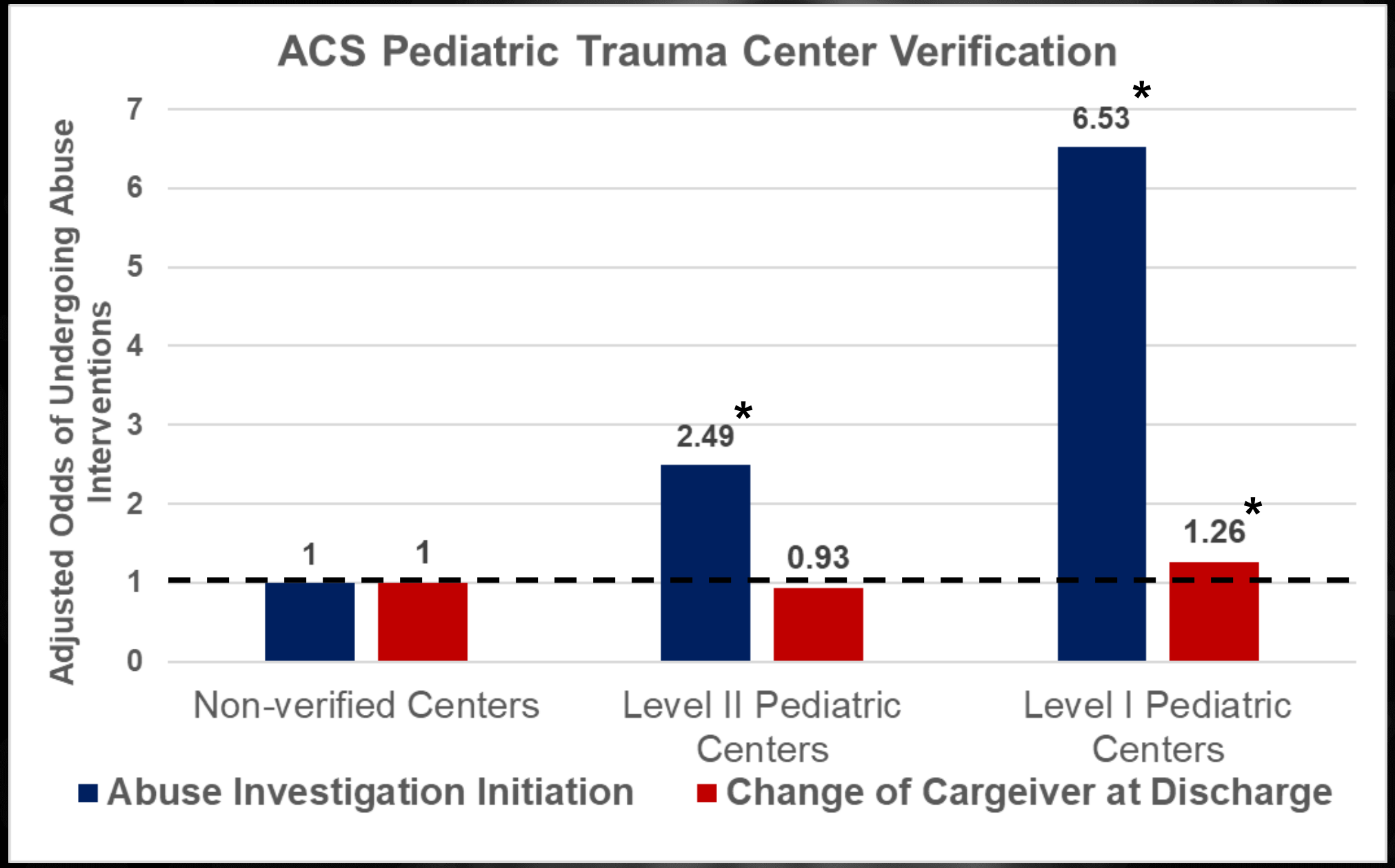


2022

- Analysis of 2017 to 2018 ACS-TQIP, child abuse victims




Racial, Ethnic, and Socioeconomic Factors
Adjusted Odds of Undergoing Abuse Interventions
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
1.2 *
1.17 *
1.03
1.21 *
0.8 *
0.6 *
Black Race, Compared to White
Hispanic Ethnicity, Compared to Non-Hispanic
Private Insurance, Compared to Government
Abuse Investigation Initiation
Change of Caregiver at Discharge


ACS Pediatric Trauma Center Verification
Adjusted Odds of Undergoing Abuse Interventions
7
6
5
4
3
2
1
0
1
1
2.49*
0.93
6.53*
1.26*
Non-verified Centers
Level II Pediatric Centers
Level I Pediatric Centers
Abuse Investigation Initiation
Change of Cargeiver at Discharge

Unequal access, unequal care, & unequal outcomes

Suicide Attempts

Child Abuse

ED Imaging

Life Expectancy

Wait Times

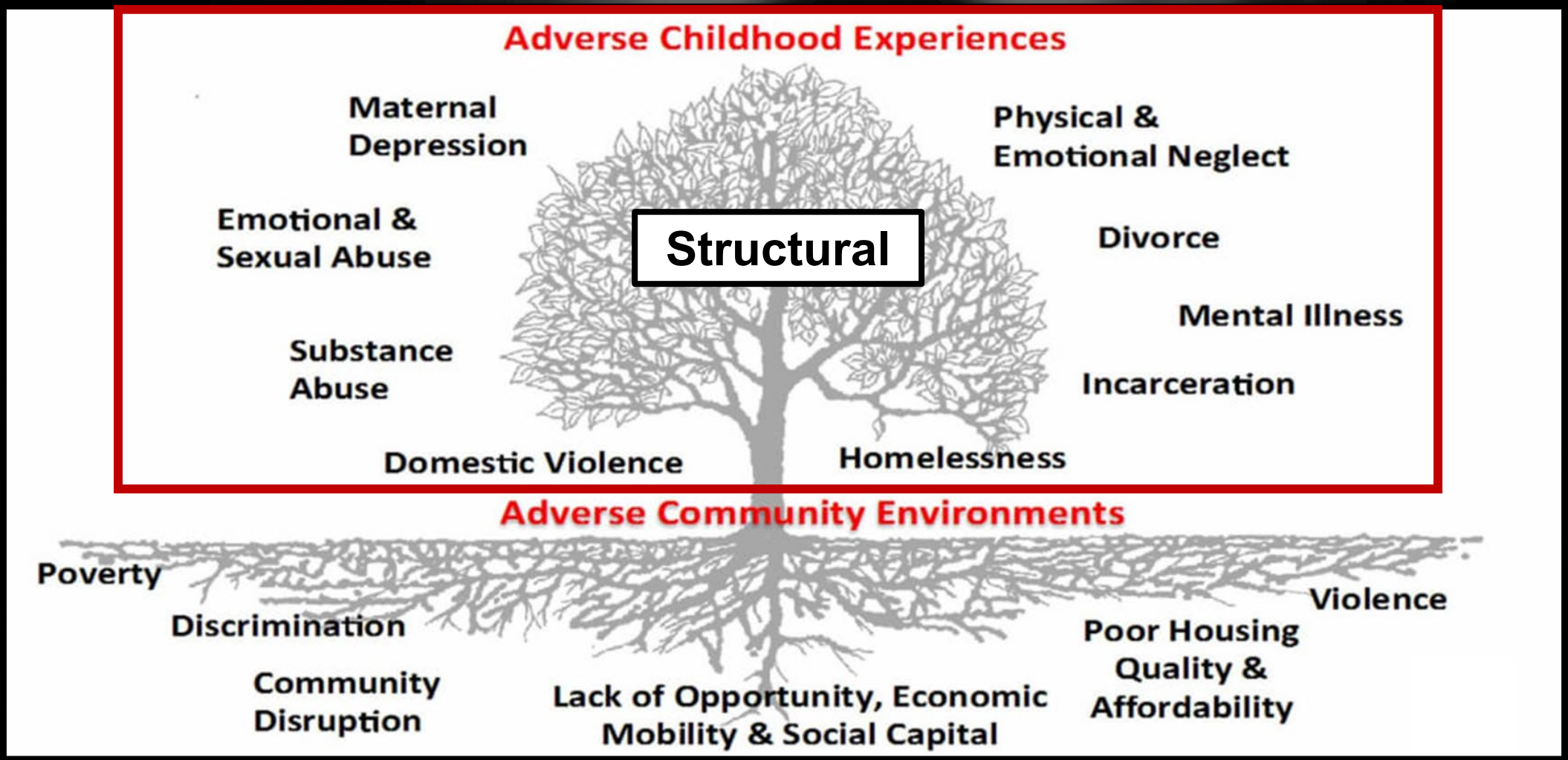
Pain Management

Surgical Outcomes

Gun Violence


WHY?

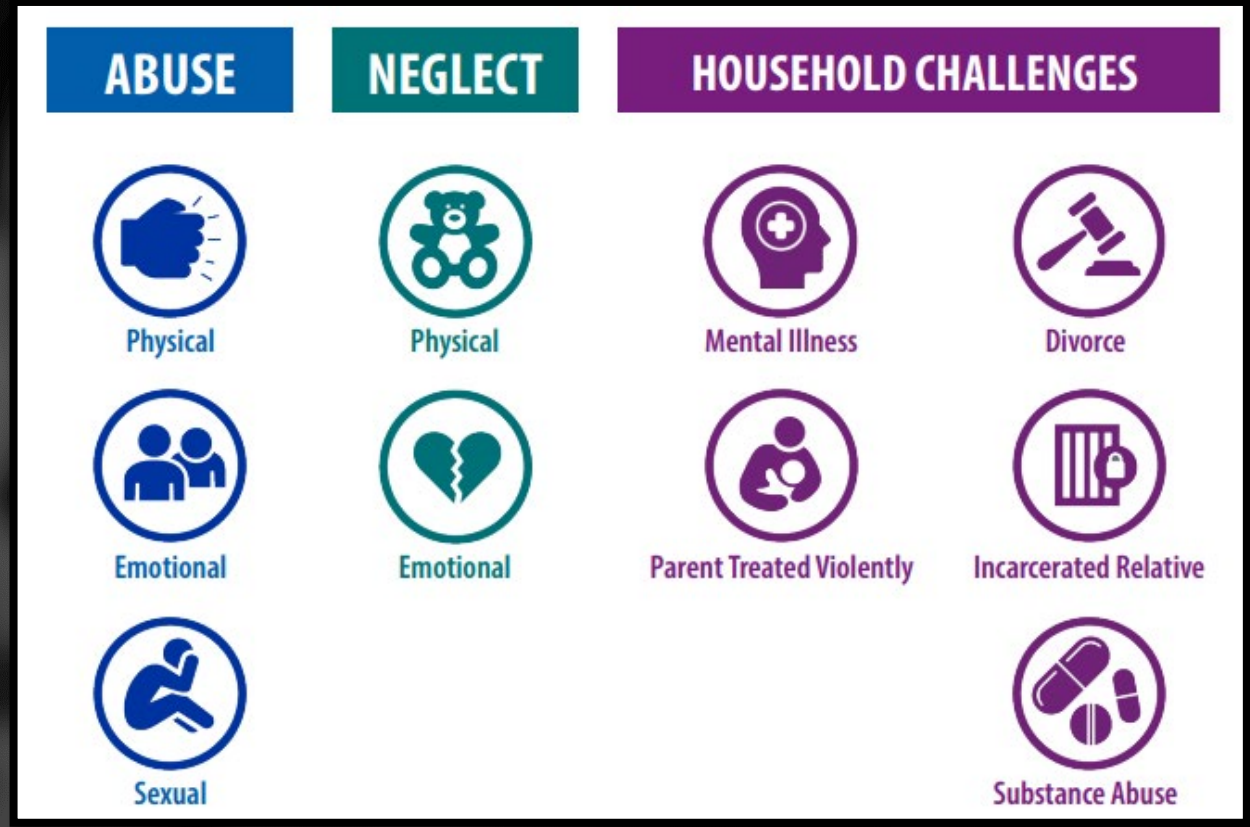
The Duo of Childhood Disparities



Adverse Childhood Experiences (ACEs)

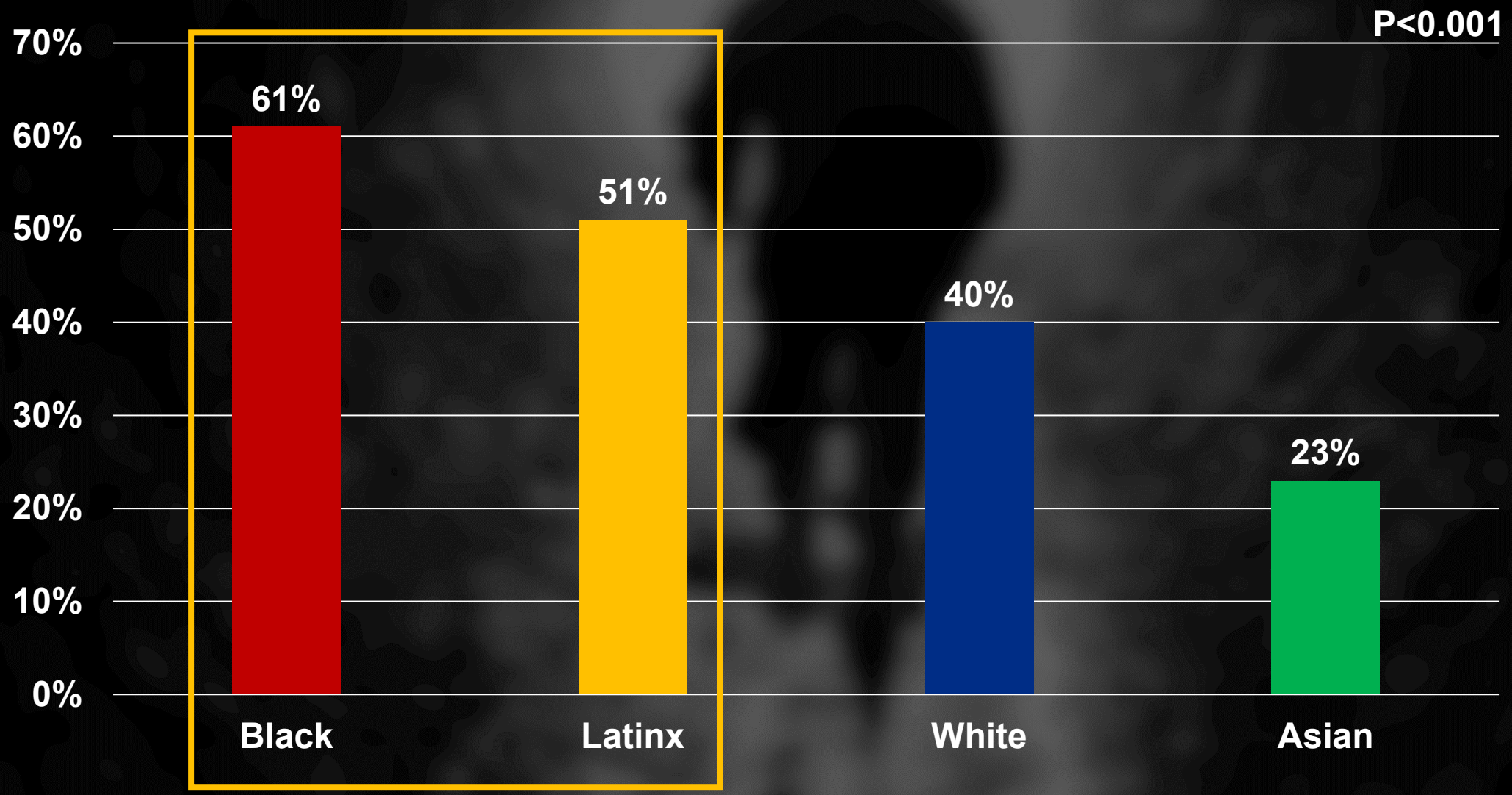
Traumatic Childhood Experiences

- Experiencing or Witnessing
  - Violence, Abuse, or Neglect
- Household Challenges



https://www.cdc.gov/violenceprevention/aces/fastfact.html

Experiencing at least one ACE – United States



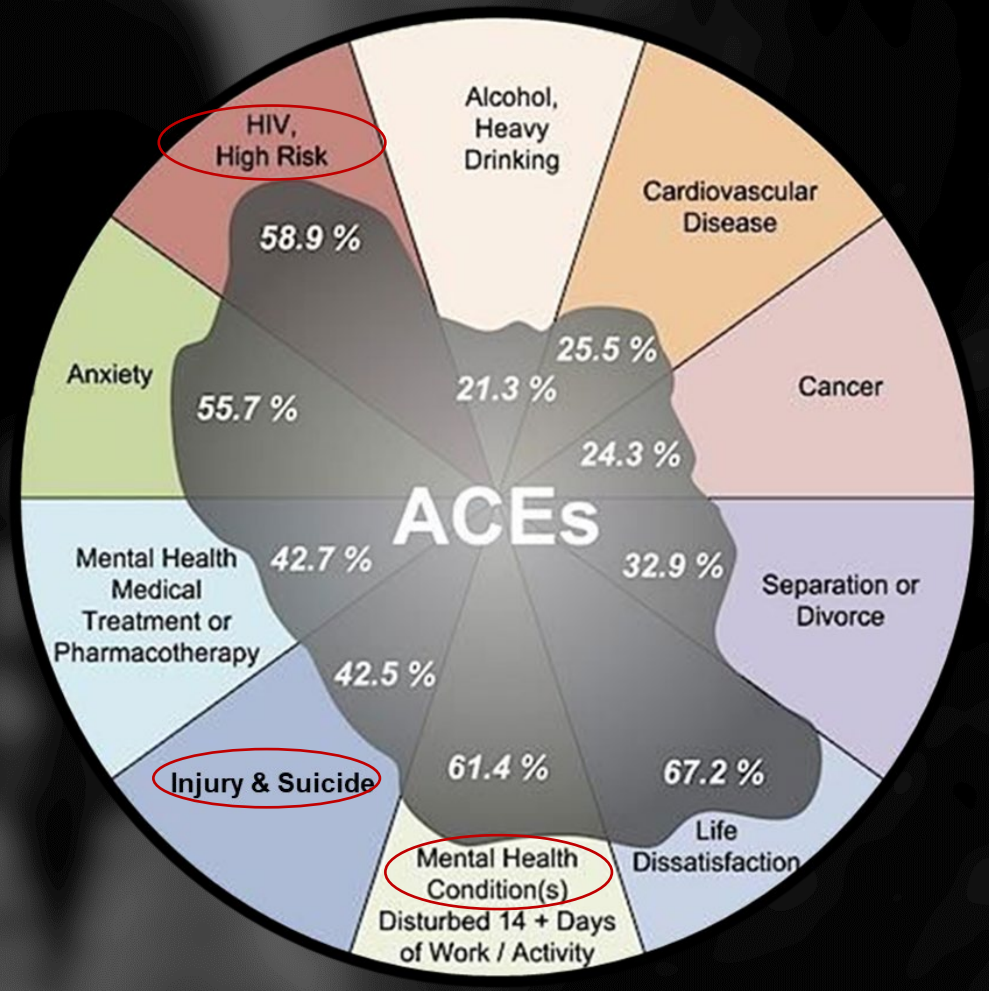
Association of Childhood Trauma Exposure With Adult Psychiatric Disorders and Functional Outcomes

William E. Copeland, PhD; Lilly Shanahan, PhD; Jennifer Hinesley, PsyD; et al

JN

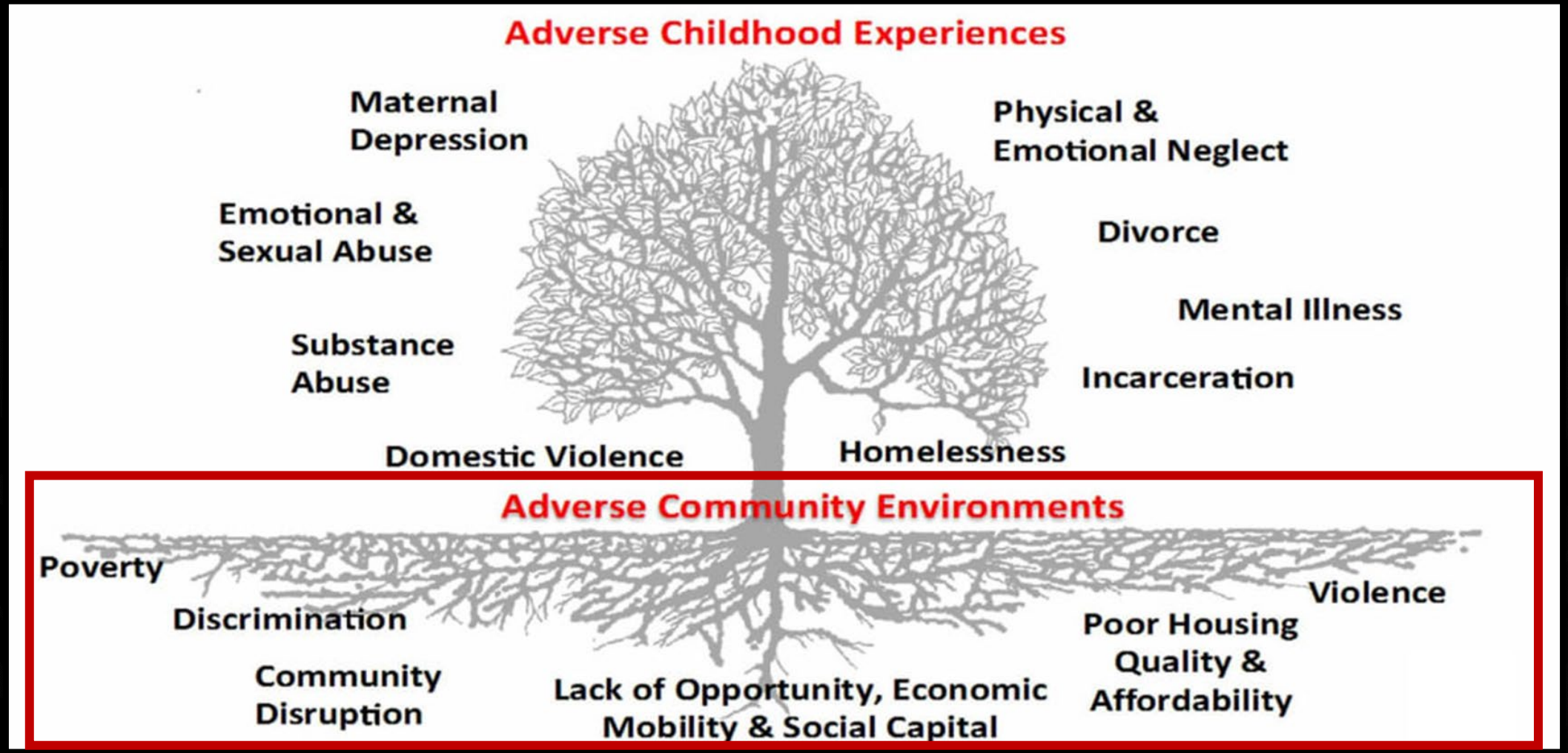
2018

Consequences of ACEs



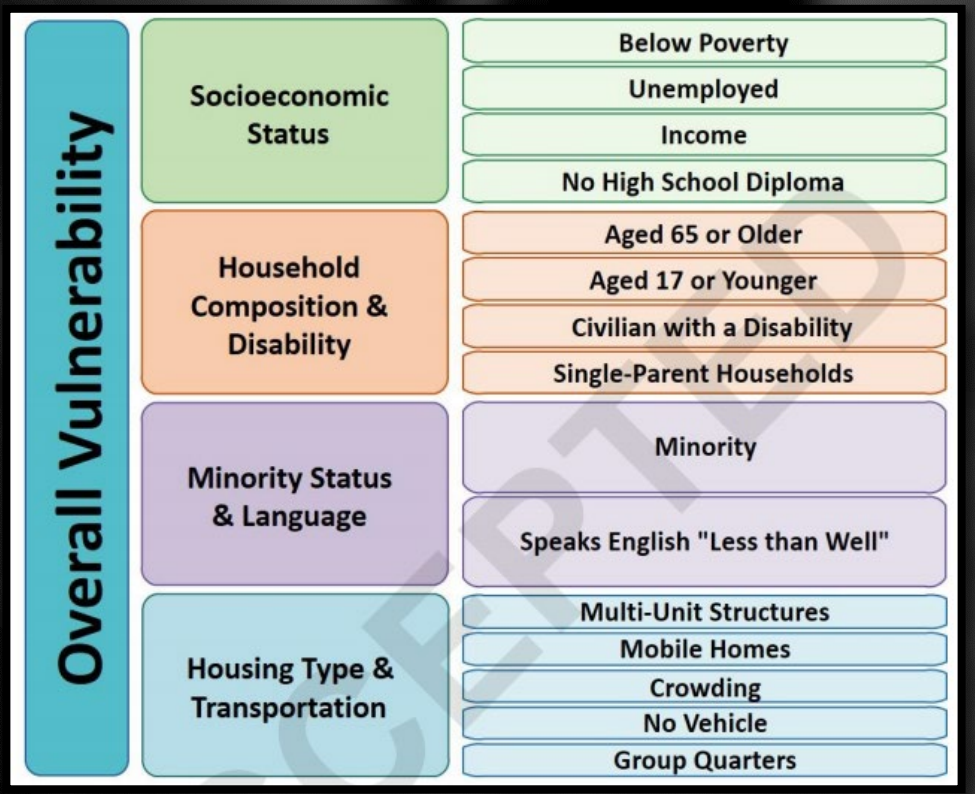
Gelkopf, Marc. "Social injustice and the cycle of traumatic childhood experiences and multiple problems in adulthood." JAMA network open 1.7 (2018)
https://www.cdc.gov/violenceprevention/aces/fastfact.html

The Duo of Pediatric Disparities

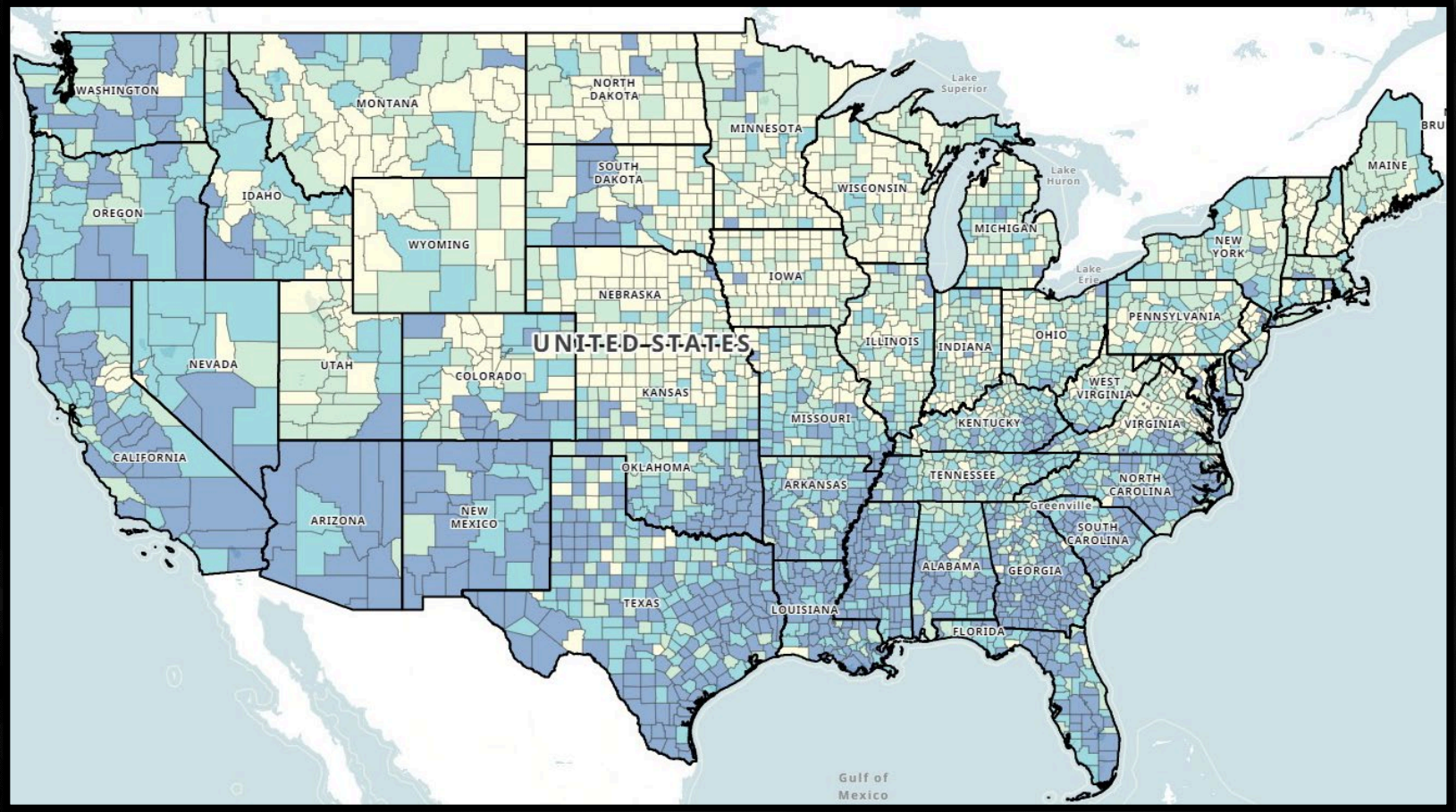


Social vulnerability Index (SVI) – Four Themes

- Identifies communities vulnerable to human/economic loss after disasters
- 0 (low vulnerability) to 1 (high vulnerability) - national SVI percentile rank
- Strongly Associated with worse health outcomes



High-Variability in SVI Across Counties

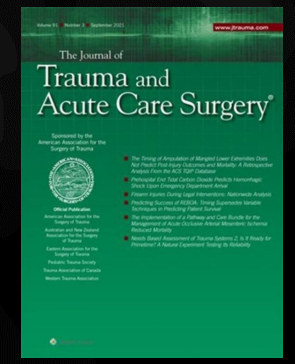


Level of Vulnerability

Low	Low-Medium	Medium-High	High

Social Vulnerability Index is Strongly Associated with Urban Pediatric Firearm Violence: An Analysis of Five Major U.S. Cities

Polcari, Ann M. MD, MPH, MSGH; Hoefer, Lea E. MD; Callier, Kylie MD; Zakrison, Tanya L. MD, MPH; Rogers, Selwyn O. MD, MPH; Henry, Marion MD, MPH; Slidell, Mark B. MD, MPH; Benjamin, Andrew J. MD, MS



2023

- Included 5 Major U.S. Cities: BAL, CHI, LA, NYC, & PHL (2015-2021)
- To assess association between social vulnerability & pediatric firearm injuries

Los Angeles

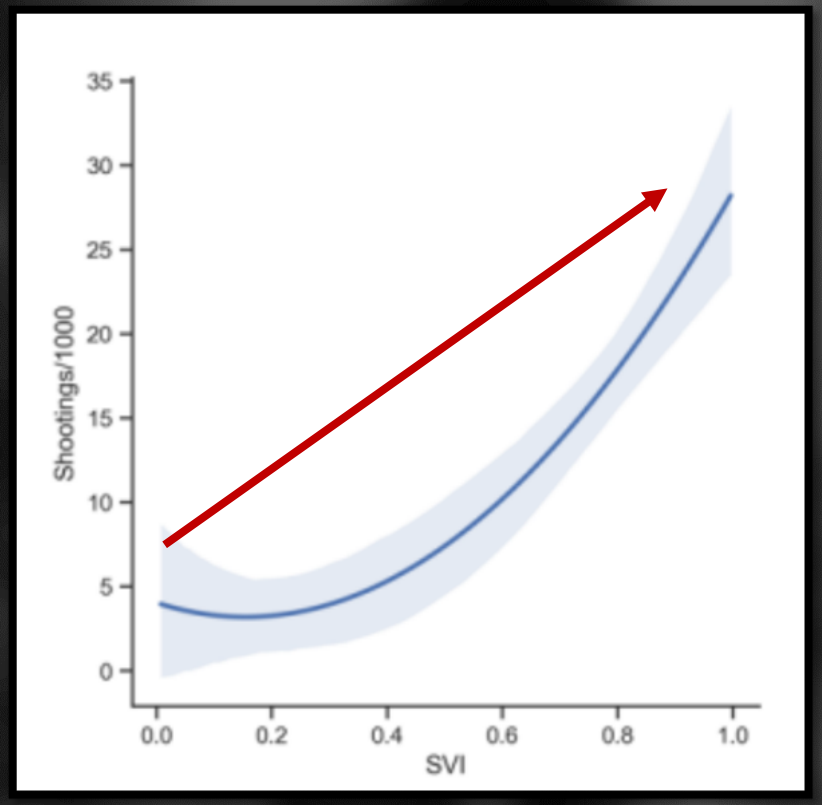
Baltimore

Chicago

NYC

Philadelphia

SVI & Shooting Incidents/1000



Increasing SVI was strongly associated with an increasing incidence of **pediatric shooting incidents/1000**

Does Mon

Bernardino C Branco, Ma

hold

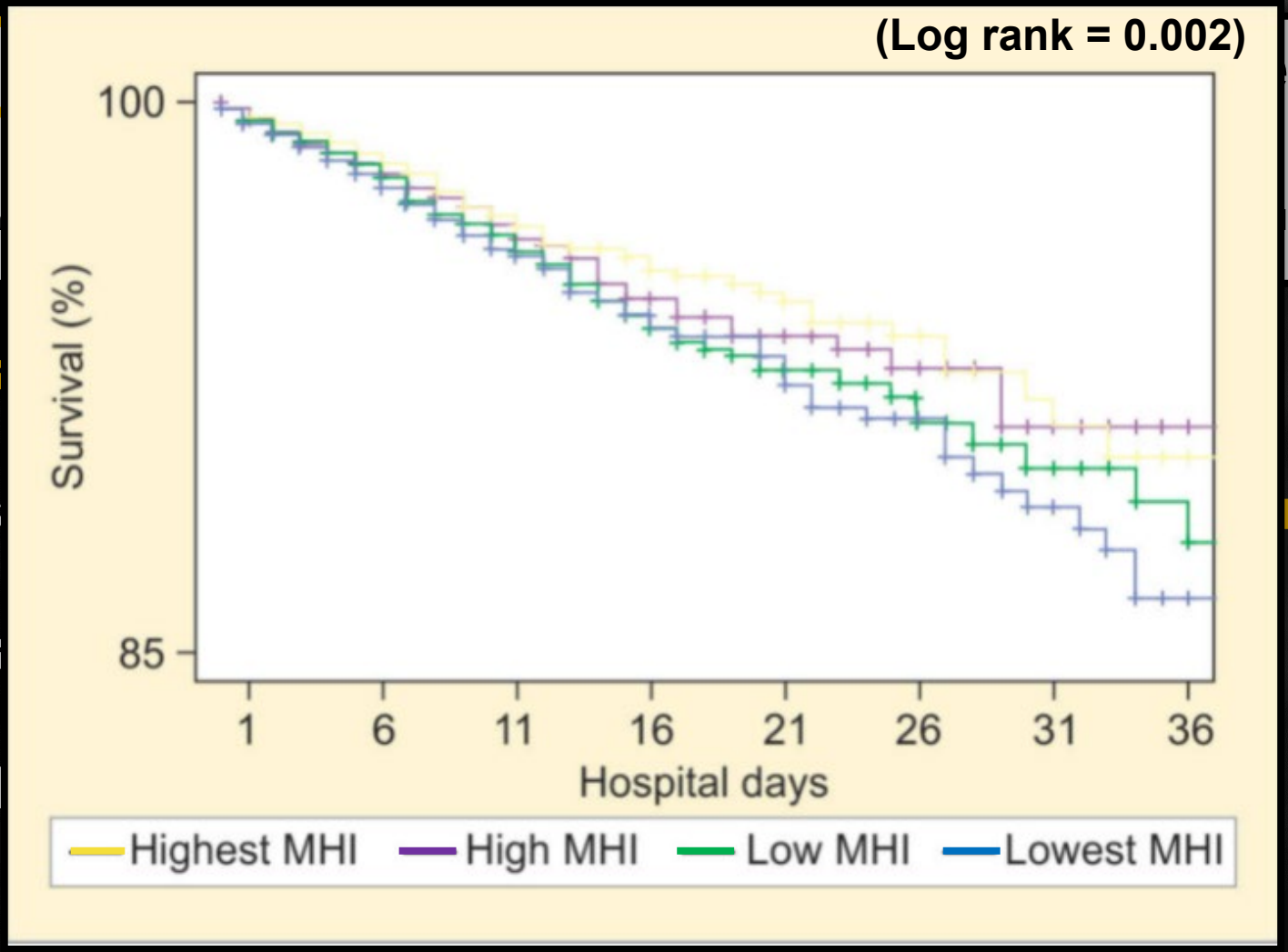
rew L Tang,

2019

- The Arizon
- To investig
- 58,743 pts
- Lowest MH

mortality

ghest MHI: 20.2%



Stepwise decrease in mortality as MHI increased

Persistency of Poverty and its Impact on Surgical Outcomes

Medicare Standard Analytical Files Database

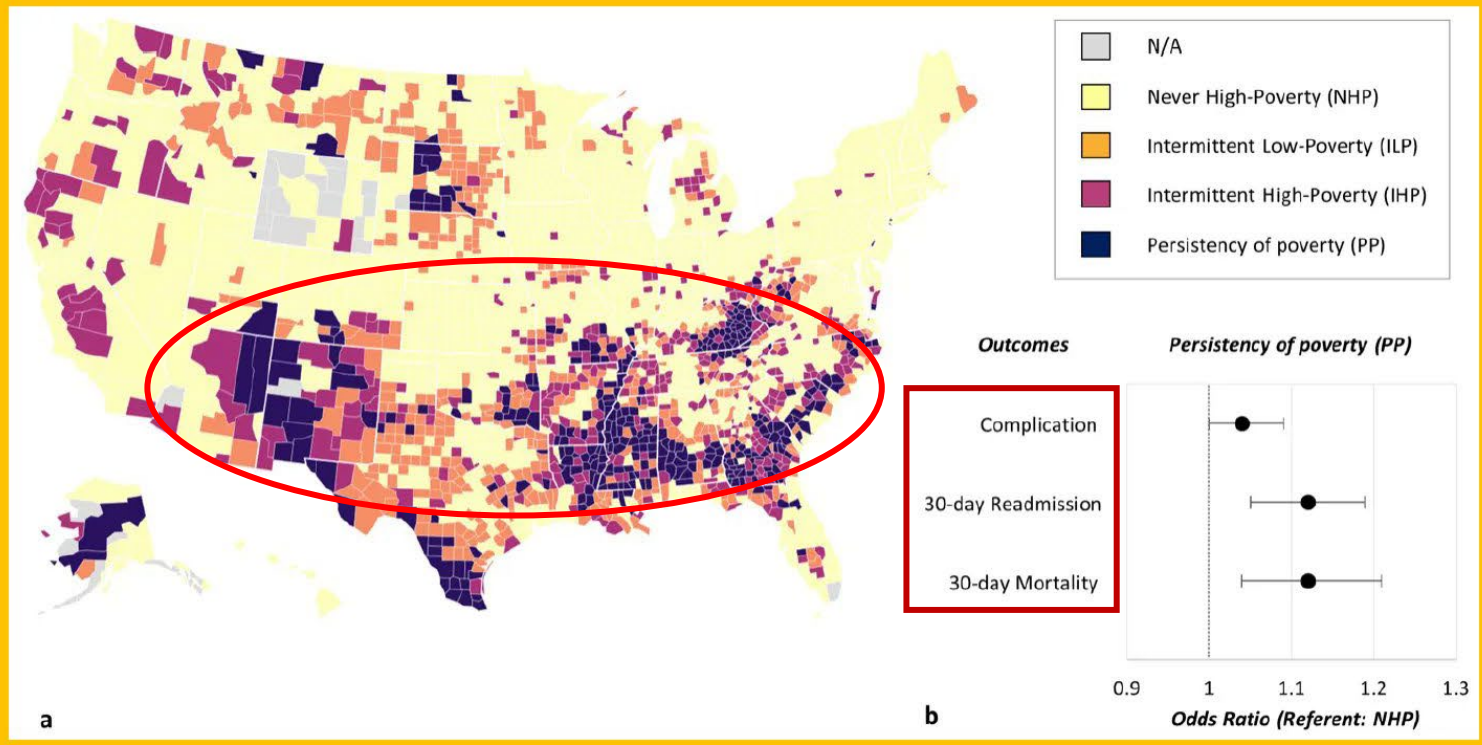
2015-2017

County-Level Poverty Assessed with American Community Survey

336,887 Medical Beneficiaries underwent lung resection, colectomy, CABG or lower extremity joint replacement

PP patients were more likely to present at **younger** median age, be **non-White** and have a **higher cost of care** related to surgical episode

PP patients had higher likelihood of postoperative complications, 30-day mortality, and 30-day readmission



Araujo Lima, Woldensenbet, Moazzam, et al.

THIS IMPACTS YOU


SO WHAT NOW?

Counterefforts

The Patient Protection & Affordable Care Act

- One of the most historic reforms in the US health system
- Signed into law on March 23, 2010
- Expanded access to affordable health insurance coverage to all Americans

Medicare reforms

Expansion of Medicaid eligibility

Prevents insurance from denying owing to pre-existing illnesses

Early and Periodic Screening, Diagnostic, & Treatment (EPSDT)

- Medicaid's EPSDT Child Health Benefit Program

➢ Despite federal EPSDT requirements, states vary greatly in the extent to which they cover services for children

➢ What is the Impact?

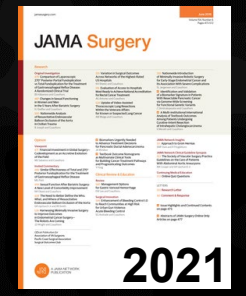
Counterefforts

- In **2011**, the US Department of Health and Human Services (HHS) launched the **largest US federal action plan** for reducing healthcare disparities:

    1. Streamlined **policy & government efforts** to reduce disparities
    2. Assessed **resource allocation**
    3. Increased **data availability** to improve minority population health
    4. **Provided incentives** for quality care of minority populations

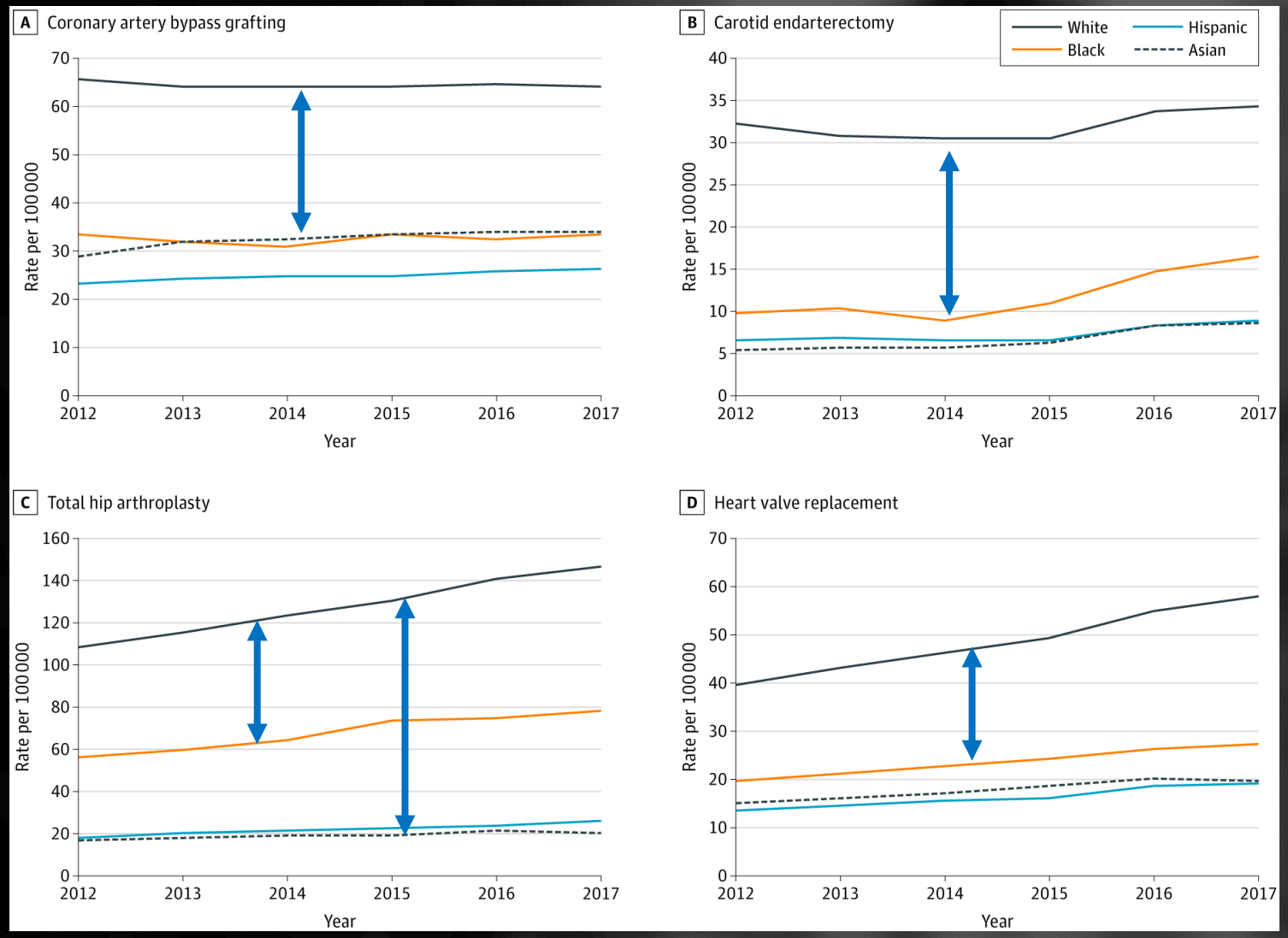
Racial Disparities in the Use of Surgical Procedures in the US

Matthew J. Best, MD; Edward G. McFarland, MD; Savyasachi C. Thakkar, MD; Uma Srikumaran, MD, MBA, MPH



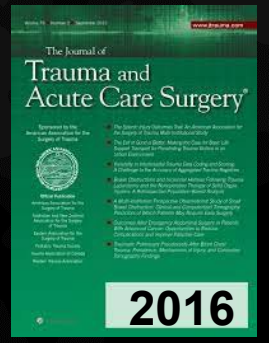
- National case-control study (**2012-2017**)
- To analyze **whether HHS national initiatives improved**:
  - **Racial disparities** in the use of **9 surgical procedures** in the US
  - Procedures that are previously shown to have racial disparities

By 2017, racial disparities persisted for all 9 procedures



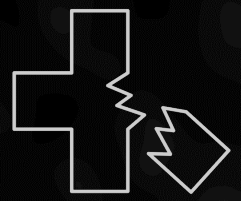
The impact of patient protection and Affordable Care Act on trauma care: A step in the right direction

Joseph, Bellal MD; Haider, Ansab A. MD; Azim, Asad MD; Kulvatunyou, Narong MD; Tang, Andrew MD; O'Keeffe, Terence MD; Latifi, Rifat MD; Green, Donald J. MD; Friese, Randall S. MD; Rhee, Peter MD, MPH

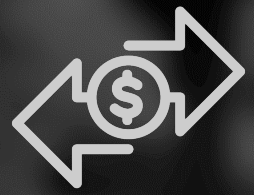


- Analysis of Level I TC registry (2012-2014), 9,892 patients
- To assess impact of **ACA on insurance, reimbursements, & outcomes**

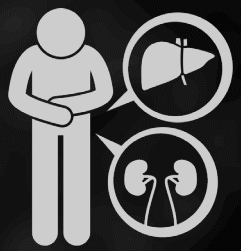
Affordable Care Act



Uninsured (50%)



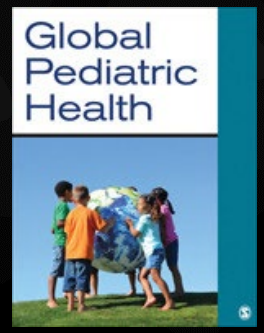
Hospital Reimbursements (20%)



Hospital Outcomes

Does Medicaid Insurance Provide Sufficient Access to Pediatric Orthopedic Care Under the Affordable Care Act?

Jenny Nguyen, BS, Nidharshan S. Anandasivam, MD, Daniel Cooperman, MD, Richard Pelker, MD, PhD, and Daniel H. Wiznia, MD



2019

- **Aim:** Assess access to pediatric orthopedic urgent care for a child's likely operative distal radius fracture
- Phone call to 180 pediatric orthopedic surgeons in 8 states requesting appointments for caller's fictitious 11-year-old child with distal radius fracture

Ability to Schedule Appointments

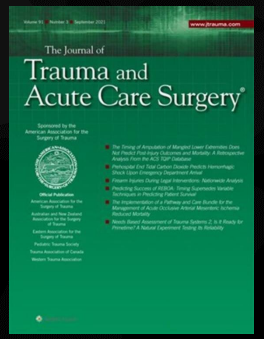
Privately insured (83%)

Medicaid (38%)

INJURY PREVENTION

The Impact of Disparities in Pediatric Trauma on Injury-Prevention Initiatives

Fallat, Mary E. MD; Costich, Julia PhD, JD; Pollack, Susan MD



2006

- Injury prevention initiatives have had little impact
- Interactions of race, ethnicity, language, culture, environment, socioeconomic status, and access to health care must be analyzed and understood
- Interventions should be targeted towards most vulnerable children

Failures Everywhere

Triage

In-hospital Care

Interventions

Outcomes

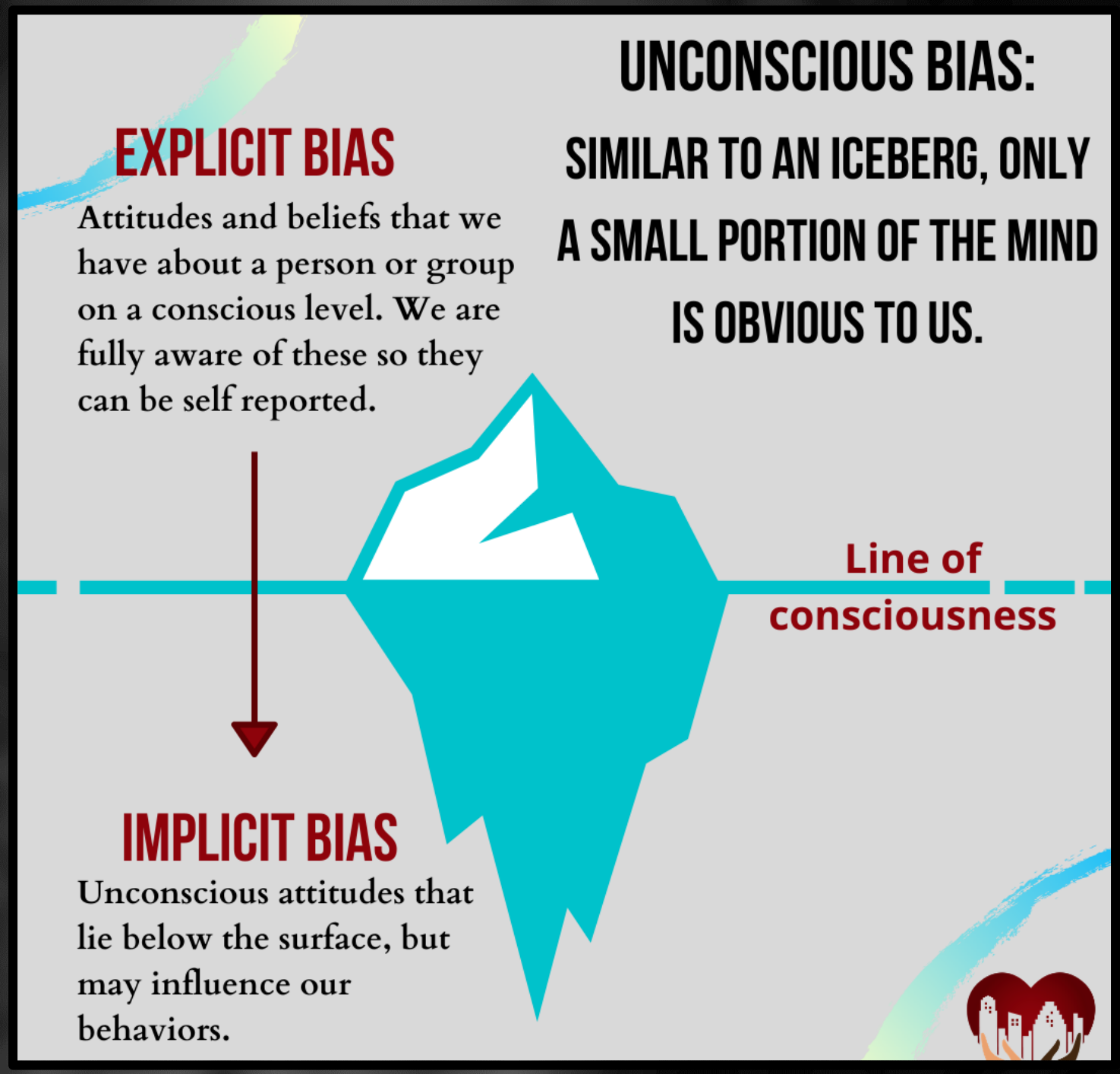
Injury Prevention

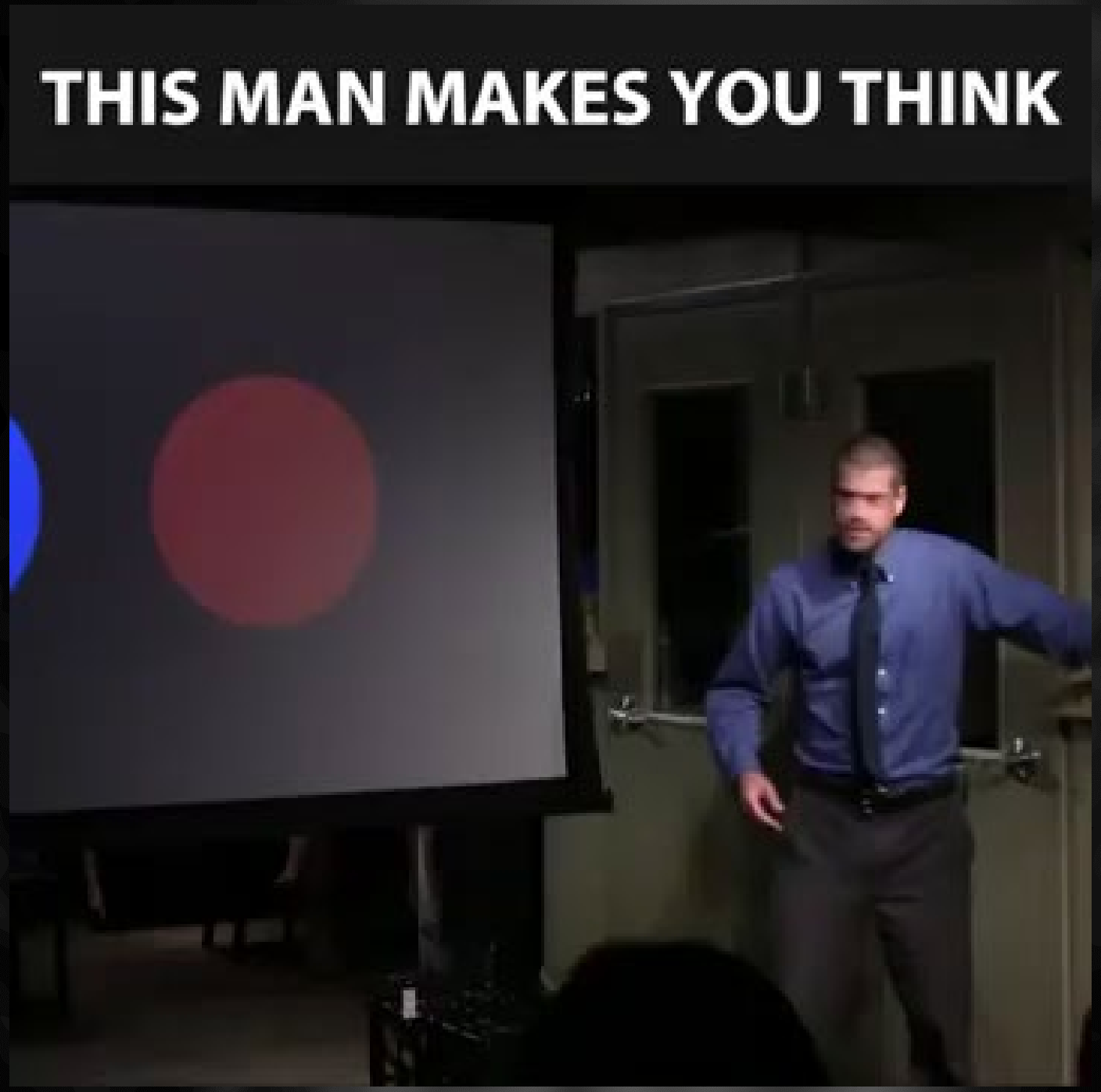
National Initiatives


WHY?
INSPIRE


Race Bias
Religious Bias
Macroaggressions
Country of Origin Bias
Comes in Many Shapes & Forms
Microaggressions
Gender Bias
Implicit & Explicit Bias
Ethnicity Bias

Conscious & Unconscious Bias



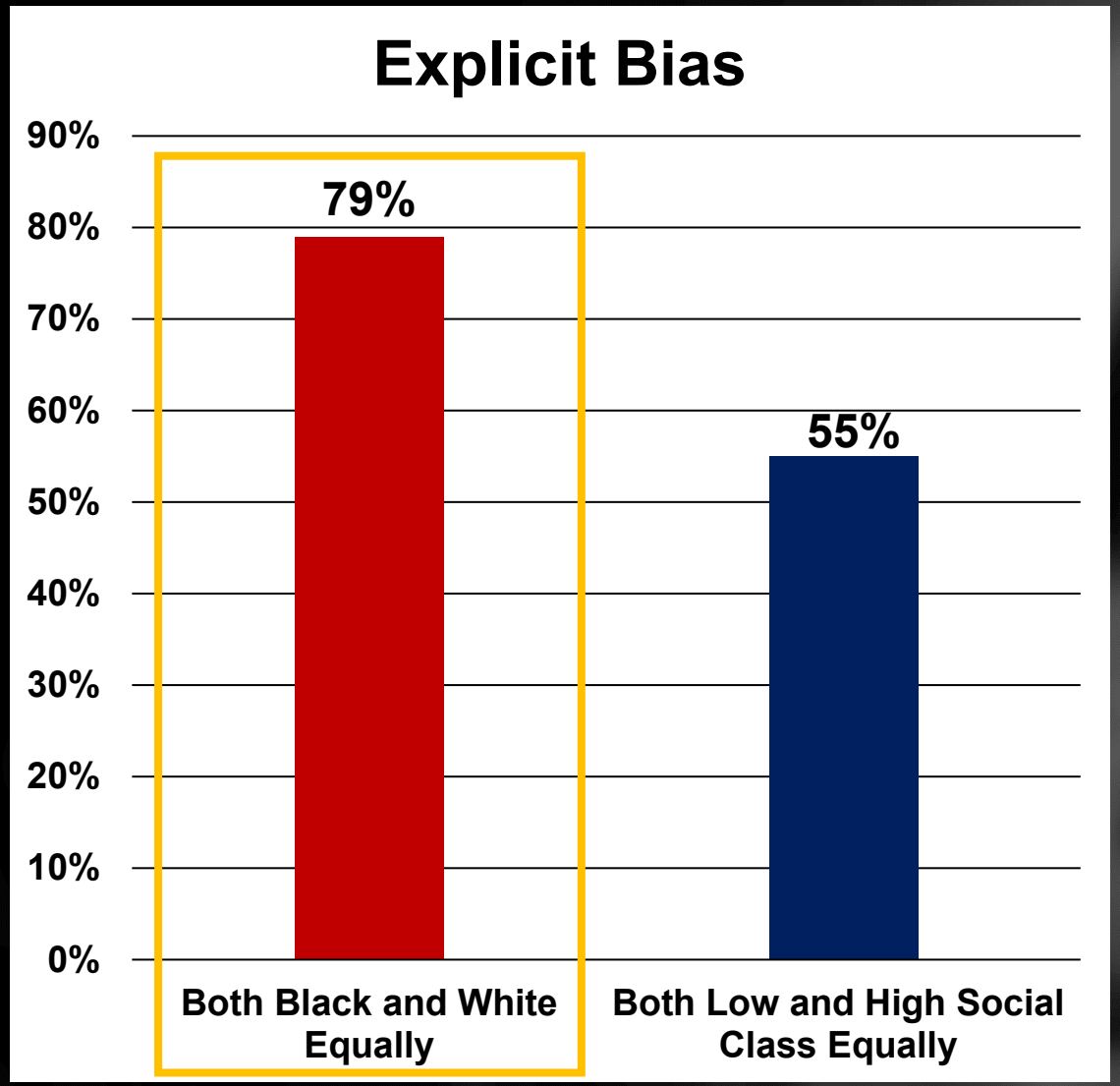

THIS MAN MAKES YOU THINK

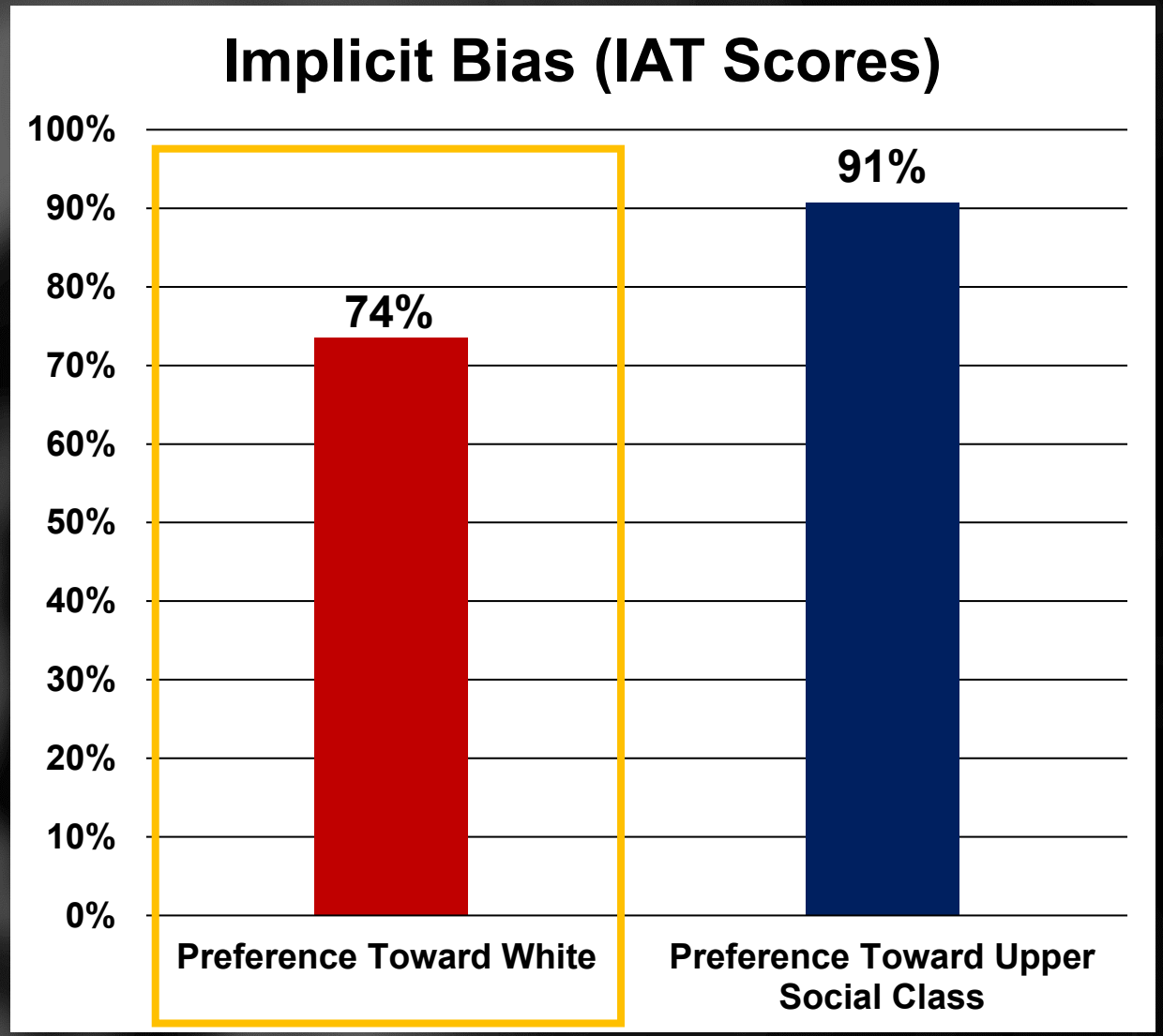
Unconscious race and class bias

Its association with decision-making by trauma and acute care surgeons

Haider, Adil H. MD, MPH; Schneider, Eric B. PhD; Sriram, N PhD; Dossick, Deborah S. MD; Scott, Valerie K. MSPH; Swoboda, Sandra M. RN; Losonczy, Lia MD, MPH; Haut, Elliott R. MD; Efron, David T. MD; Pronovost, Peter J. MD, PhD; Freischlag, Julie A. MD; Lipsett, Pamela A. MD; Cornwell, Edward E. III MD; MacKenzie, Ellen J. PhD; Cooper, Lisa A. MD, MPH

- Survey of 248 EAST members
- **Nine clinical vignettes** (trauma/ACS management questions)
- **Race & Social Class** Implicit Association Tests (IAT) completed





Clinical decisions associated with implicit bias

Understanding & Countering Implicit Bias

Bias We All Share

Implicit bias is the automatic or involuntary attitudes we have about members of distinct social groups that **unconsciously** affect our beliefs or actions

Find Your Blind Spots

Implicit Association Testing can help identify where you might be most biased, but self-reflection to assess if your automatic reactions may be biased is also warranted

Transparent Criteria

You can't eradicate automatic thoughts, but you can develop systems around hiring, promotion, and evaluation to avoid formally codifying these implicit biases

EAST Equity, Quality and Inclusion in Trauma Surgery Practice Ad Hoc Task Force

Visual abstract by @CAHarrisMD

#EAST4ALL http://bit.ly/EAST4ALL

Eastern Association for the Surgery of Trauma
Advancing Science, Fostering Relationships, and Building Careers

Harvard Implicit Association Test

Bias Can Only Explain so Much

What Can be Done About This?

The Role of Professional Societies

We are Evolving

COMMITTEES

Committee on Diversity Issues

STATEMENTS

Statement on Diversity

PTS
pediatric trauma society
A Voice for the Injured Child

DEI Taskforce

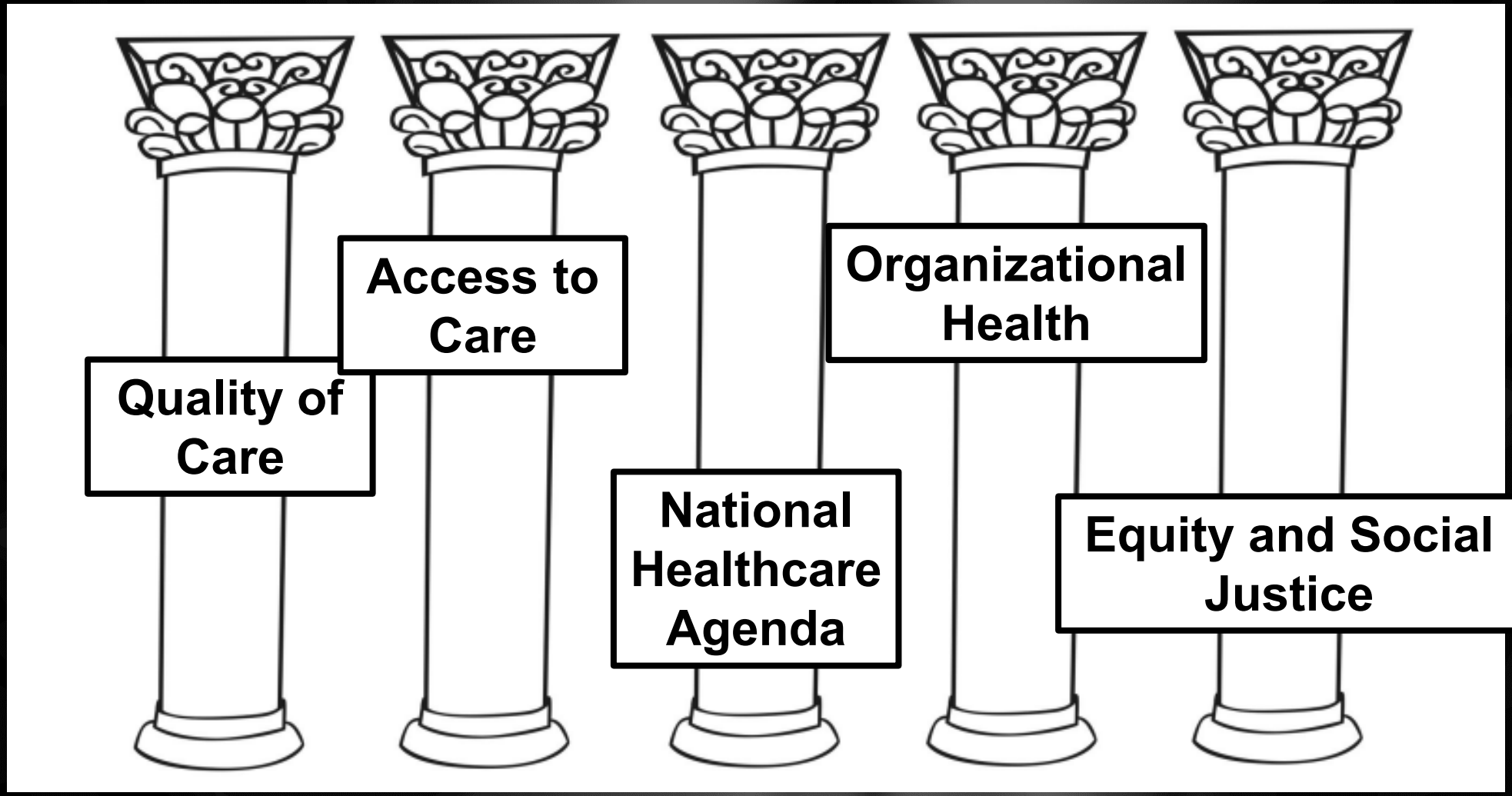
Coming Soon

Diversity, Equity, and Inclusion Committee

Diversity, Equity and Inclusion Committee

APSA
American Pediatric Surgical Association
Saving Lifetimes™

The Five Pillars of APSA



Best Practices To Mitigate Bias & Support Diverse Pediatric Surgery Applicants

Association of Pediatric Surgery Training Program Directors

DEI subcommittee

Strategies

Application screening

- All applications should be reviewed by a diverse team.
- Remove candidate photos from ERAS (Electronic Residency Application Service) applications before screening.
- Read personal statements first.
- Selection criteria should center on life experiences (e.g., challenges and obstacles overcome) and attributes as well as academic performance.
- Widen the lens through which you select residents to interview (identify experiences, attributes, competencies, and metrics that would add value to your program).

Preparing for interviews

- Consider how your program presents itself to applicants. Review all online content (hospital website, ERAS, etc.) to ensure that message of inclusivity and valuing diversity is projected.
- All faculty should undergo implicit bias training.
- All faculty should take at least two implicit association tests.

Conducting interviews

- Conduct CV-blinded interviews: faculty have access only to the applicant's personal statement.
- Interviews should be structured, using a consistent list of questions for all applicants, and include attribute-based questions.
- Be aware that virtual interview platforms introduce additional bias against underrepresented in medicine learners and low socioeconomic applicants.
- Implement bias mitigation strategies including common identity formation, perspective taking, consider the opposite, and counter stereotypical exemplars.
- Utilize an interview scoring form that encourages consideration of non-traditional metrics.

Creating the rank list

- Maximize objective assessment and use of objective scoring systems.
- When the comment is made "I'm not sure if this candidate is a good fit for our program," force the speaker to go deeper.
- Avoid the practice of phone calls within our networks.

Standardized Scoring Forms

Category	SCORING					Max Possible	Relative Weight
Letters of Recommendation - 1	0 Fair Support Problems Noted	1 Average Support	2 Above Average	3 Strong Support	4 Outstanding	4	1
Letters of Recommendation - 2	0 Fair Support Problems Noted	1 Average Support	2 Above Average	3 Strong Support	4 Outstanding	4	1
Letters of Recommendation - 3	0 Fair Support Problems Noted	1 Average Support	2 Above Average	3 Strong Support	4 Outstanding	4	1
Letters of Recommendation - 4	0 Fair Support Problems Noted	1 Average Support	2 Above Average	3 Strong Support	4 Outstanding	4	1
General Surgery Residency	0 Not US or Canadian	1 Community Hospital	2 Non-University Academic	3 Academic Medical Center	4 "Top Tier"	30	7.5
Related Research, Community Work, Innovation, or Global Surgery	0 None	1 <1 year or pre-medical only	2 1 year	3 1 year - exceptional research, community work, or global surgery	4 2 years	6	1.5
Clinical or Basic Research Publications	0 None	1 1-3 papers	2 4 or More: First Authors	3 6 or More with First Authors	4 8 or More with First Authors	12	3
Distance traveled (perserverance, endurance, commitment)	0 None identifiable	1 Minor setbacks	2 Adversity or hurdles	3 Unique journey or non-traditional path	4 Major setback or clear disadvantage	15	3.75
Achievement	1 Other Advance Degree	2 Grant Funding	3 Superior Academic Achievement	4 Athletic Accomplishment	5 Leadership	10	2
Hardiness, Grit & Resilience (self awareness, positive relationships, purpose and passion)	0 None identifiable, problems noted	1 Solid ability to navigate challenges	2 Demonstrated growth and dedication	3 Demonstrated endurance and high perseverance for long-term goals	4 Exceptional vision, courage, purpose or passion	15	3.75
ABSITE Scores	0 <20	1 20-40	2 >40	3 >60	4 >80	12	3
Personal Statement	0 Little Thought/Poorly Organized	1 Not insightful	2 Solid	3 Excellent	4 Exceptional	12	3
					Total	128	

Berman, Loren, et al. "Inclusion and representation in the pediatric surgery workforce: Strategies to mitigate bias in the fellowship application process." *Journal of Pediatric Surgery* (2022)

Best Practices To Mitigate Bias & Support Diverse Pediatric Surgery Applicants

APSTPD

Association of Pediatric Surgery Training Program Directors

#EAST4ALL: An introduction to the EAST equity, quality, and inclusion task force

Bonne, Stephanie MD; Williams, Brian H. MD; Martin, Matthew MD; Kaafarani, Haytham MD; Weaver, William L. MD; Rattan, Rishi MD; Byers, Patricia M. MD; Joseph, D'Andrea K. MD; Ferrada, Paula MD; Joseph, Bellal MD; Santos, Ariel MD; Winfield, Robert D. MD; DiBrito, Sandra MD, PhD; Bernard, Andrew MD; Zakrison, Tanya L. MD

#EAST4ALL

- **First task force of its kind** in the world of trauma & ACS
- Diverse **"radically inclusive"**
- To raise awareness & provide resources to combat inequities
- **Chaired the committee for 4 years**

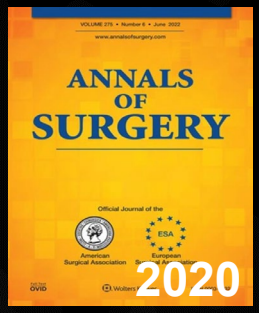
Dr. Bernard

History of Equity, Diversity, & Inclusion in Trauma Surgery for Our Patients, for Our Profession, & for Ourselves

Esther S Tseng, Brian H Williams, Heena P Santry, Matthew J Martin, Andrew C Bernard, Bellal A Joseph

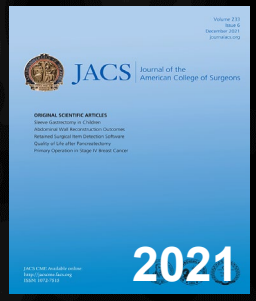
Perceptions of Equity & Inclusion in Acute Care Surgery From the #EAST4ALL Survey

Tseng, Esther S. MD; Zakrison, Tanya L. MD, MPH; Williams, Brian MD; Bernard, Andrew C. MD; Martin, Matthew J. MD; Zebib, Laura MPH; Soklaridis, Sophie PhD; Kaafarani, Haytham M. MD, MPH; Zarzaur, Ben L. MD, MPH; Crandall, Marie MD, MPH; Seamon, Mark J. MD; Winfield, Robert D. MD; Bruns, Brandon MD



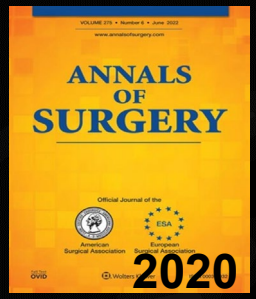
Call to Action on the Categorization of Sex, Gender, Race, and Ethnicity in Surgical Research

Nahmias, Jeffry MD, MHPE, FACSa,*; Zakrison, Tanya L. MD, MPH, MHSc, FACSb; Haut, Elliott R. MD, PhD, FACSd; Gurney, Onaona MD, FACSg; Joseph, Bellal MD, FACSh; Hendershot, Kimberly MD, FACSi; Ghneim, Mira MD, MS, FACSe; Stey, Anne MD, FACSc; Hoofnagle, Mark H. MD, PhD, FACSj; Bailey, Zinzi ScD, MSPHk; Rattan, Rishi MD, FACSl; Richardson, Joseph B. PhDf; Santos, Ariel P. MD, MPH, FACSm; Zarzaur, Ben MD, MPH, FACS



EAST Statement on Structural Racism, and the Deaths of George Floyd, Ahmaud Arbery, and Breonna Taylor

Hoofnagle, Mark H. MD, PhD; Mubang, Ronnie N. MD; Joseph, D'Andrea K. MD, FACS; Joseph, Bellal A. MD, FACS; Christmas, Ashley Britton MD, FACS; Zakrison, Tanya L. MD, MPH, FACS, FRCSC



Social Media & Social Change

MGH Department of Surgery ranked #1 surgical training program nationally for 3 consecutive years!

Mass General Surgery
@MGHSurgery

The #MGHSurgery Residency Program has, for the third consecutive year, ranked 1st in the nation by @doximity! This top ranking is recognition of our amazing residents, faculty & staff. Med students, find us on Doximity's residency navigator: bit.ly/31pMxqU #WhyMGHSurgery

MassGeneral News

6:24 AM · Aug 5, 2020 · Twitter Web App

EQUITY AND SOCIAL JUSTICE

The State of Diversity in American Surgery

A Call to Action

Ellis, Danielle I. MD, MTS*; Kh

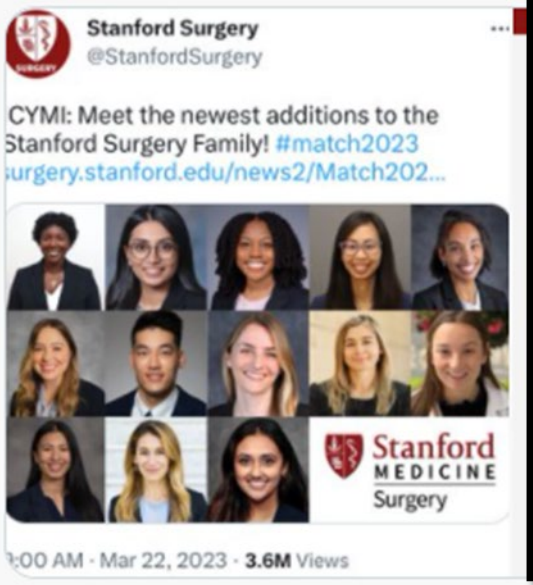
ANNALS OF SURGERY

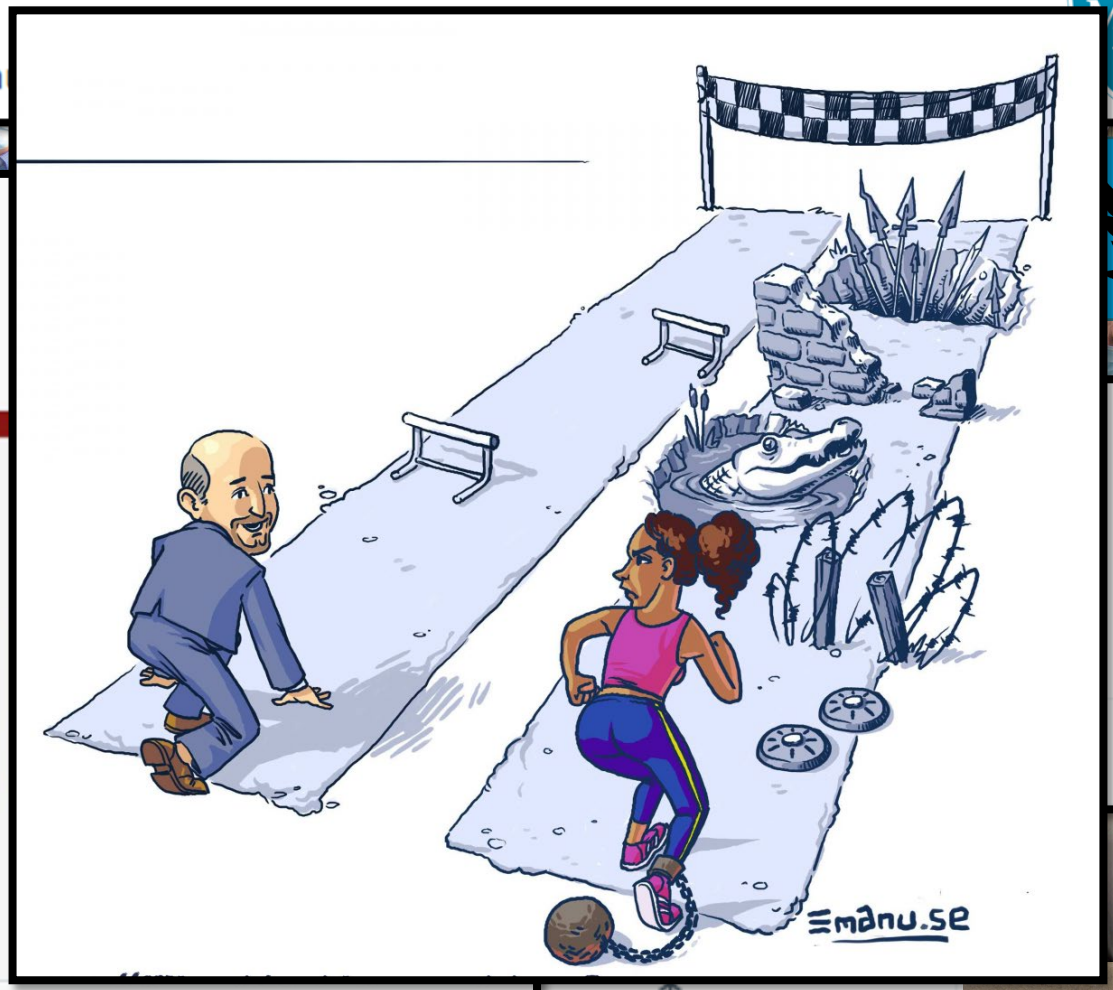
MGH 1811

2021

Stanford's 2023 surgical team:

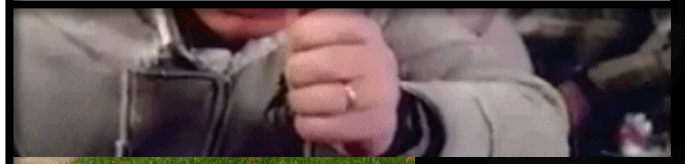
92% women (US: 50% women)
69% nonwhite (US: 38% nonwhite)
0% white men (US: 30% white men)





#MGHSurgerySoWhite

Likes 165 Bookmarks



Prevalence of unprofessional social media content among young vascular surgeons

Hardouin, Scott MDCheng, Thomas W. MSMitchell, Erica L. MDRaulli, Stephen J. MPhilJones, Douglas W. MD, MPHSiracuse, Jeffrey J. MDFarber, Alik MD, MBA

2020

Conclusion

- Images of residents in which they wore bikinis, held glasses of alcohol or expressed social or political views were unprofessional

Diversity, Inclusion, and Equity: Evolution of Race and Ethnicity Considerations for the Cardiology Workforce in the United States of America From 1969 to 2019

Norman C. Wang

American Heart Association®

2020

Conclusion

- "Failures of efforts to increase the number of Blacks and Hispanics have largely been attributable to the limited qualified applicant pool"

- Called for admissions committees to abandon any diversity directives

Retracted Before Issue

JAMA Editor Placed on Leave After Deputy's Comments on Racism

After a staff member dismissed racism as a problem in medicine on a podcast, a petition signed by thousands demanded a review of editorial processes at the journal.

Diversity, Inclusion, and Equity: Evolution of Race and Ethnicity Considerations for the Cardiology Workforce in the United States of America From 1969 to 2019

are posting photos of themselves in bathing suits

Authors apologize after uproar over study calling certain personal social media posts "potentially unprofessional."

The Boston Globe

For Our Patients

Beyond Survival & Physical Healing

Trauma-informed care: recognizing and resisting re-traumatization in health care

Samara Grossman, Zara Cooper, Heather Buxton, Sarah Hendrickson, Annie Lewis-O'Connor, Jane Stevens6, Lye-Yeng Wong, Stephanie Bonne

- Traditional definitions of trauma as a purely physical phenomenon are prevalent

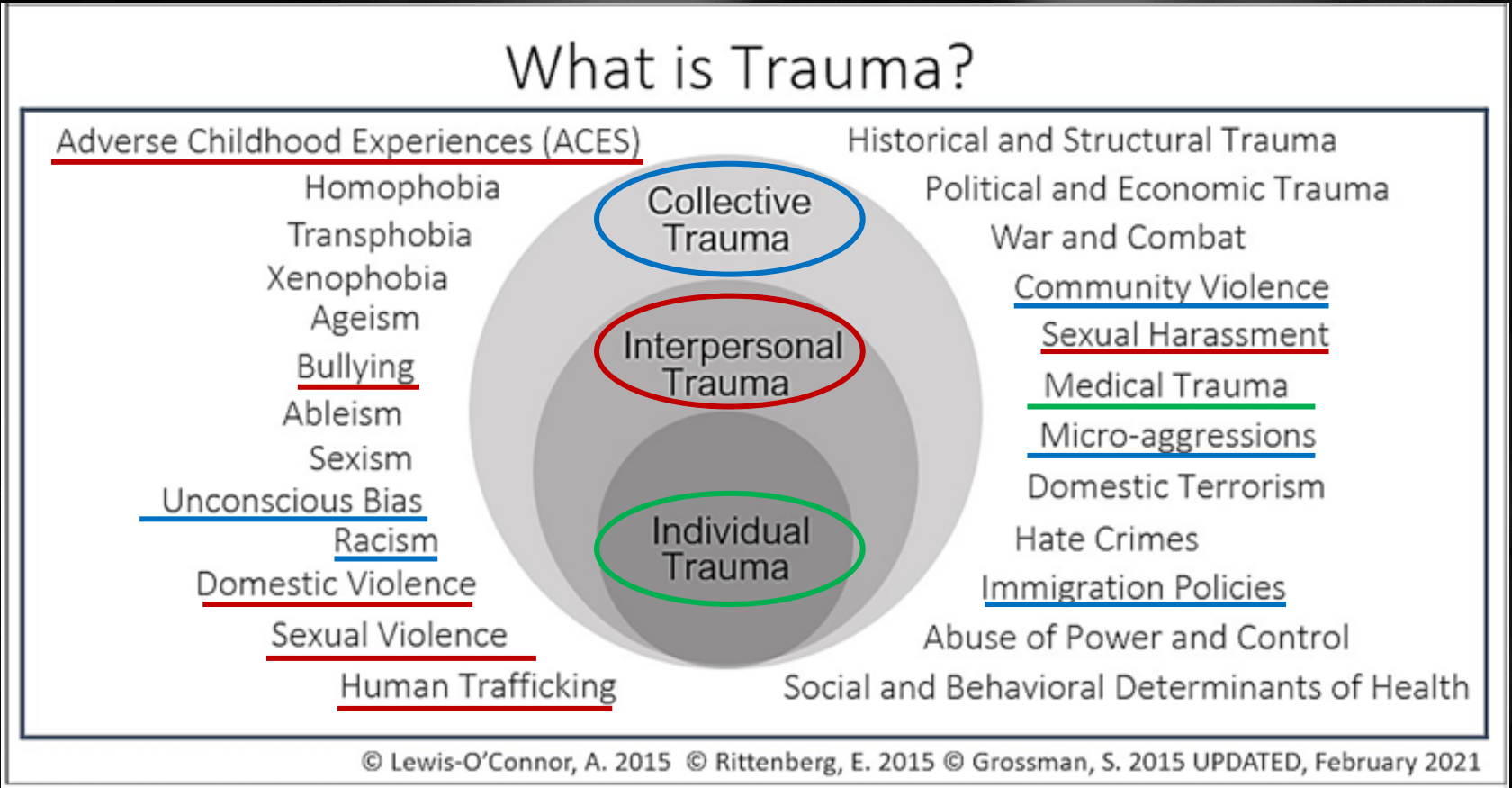
CNTR
COALITION FOR NATIONAL TRAUMA RESEARCH

Trauma: "traumatic injury includes that from vehicular collisions, falls from heights, gunshot wounds & burns…

REALITY

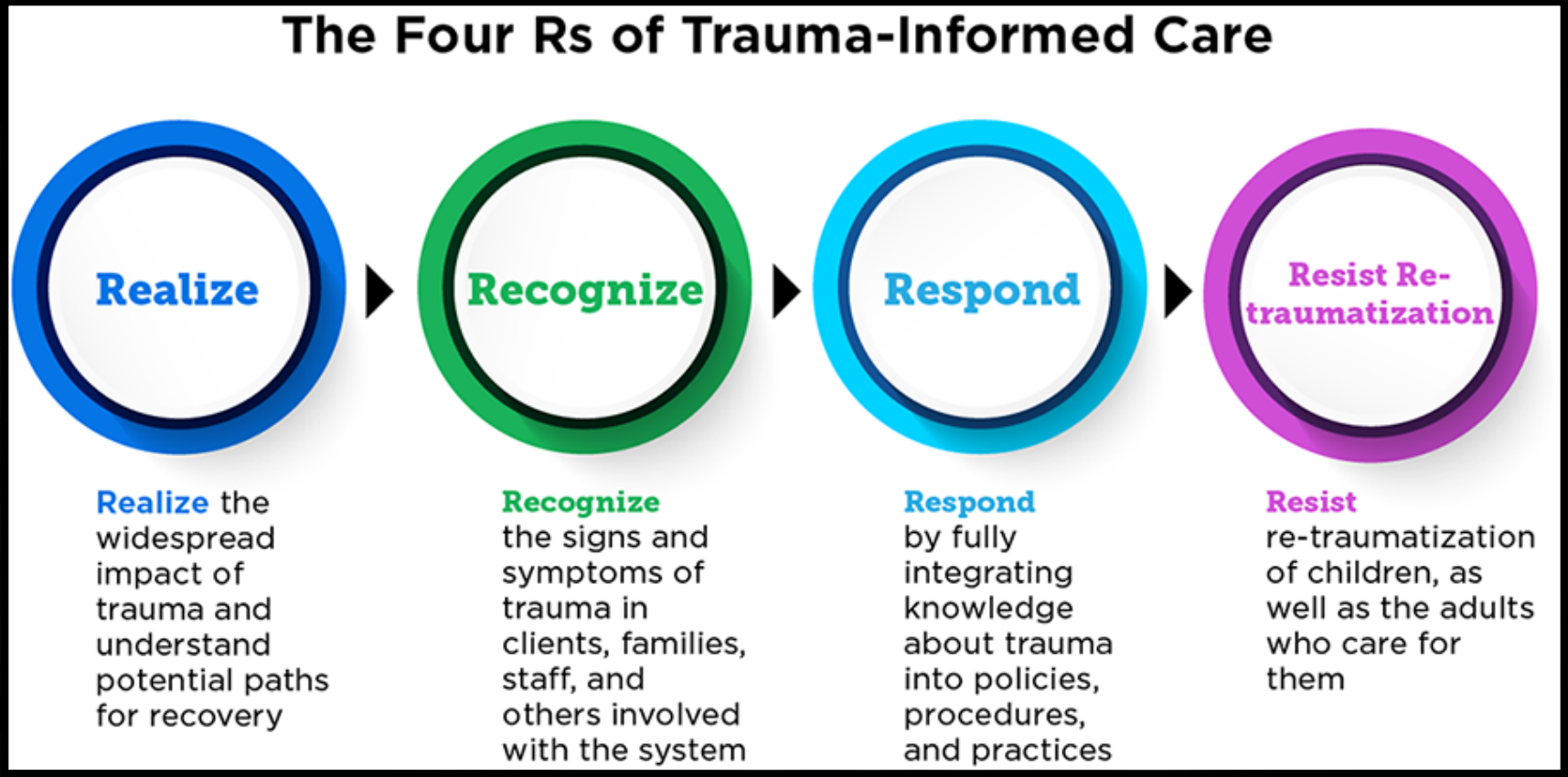
Trauma is defined as both **individual and interpersonal** as well as **collective and structural**

What is Trauma?



Trauma-Informed Approach

- Systematic consideration of past physical & emotional trauma
- Patient- centered, trauma- informed approach to equitable care is key



Building A Trauma-informed Organization -

10 Domains of Trauma-informed Organizational Leadership

Substance Abuse and Mental Health Services Administration

SAMHSA


THIS IS
EVERYONE'S
FIGHT

Don’t Forget the 5 S’s:

- Check your own biases
- Start Open Discussions
- Set Accountability
- Speak Up
- Share The Responsibility

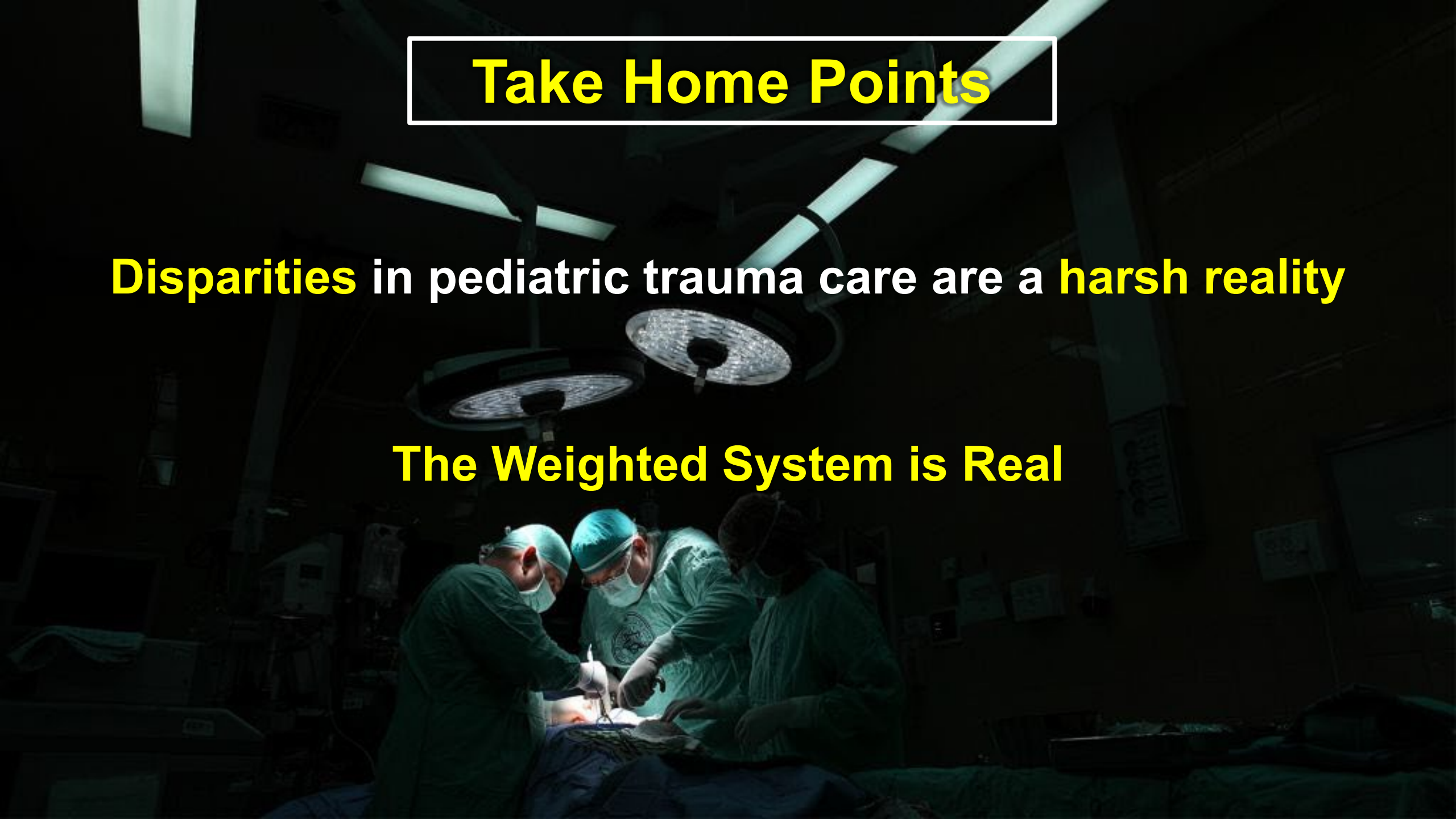
This talk is like illusion;
It alters with perspective

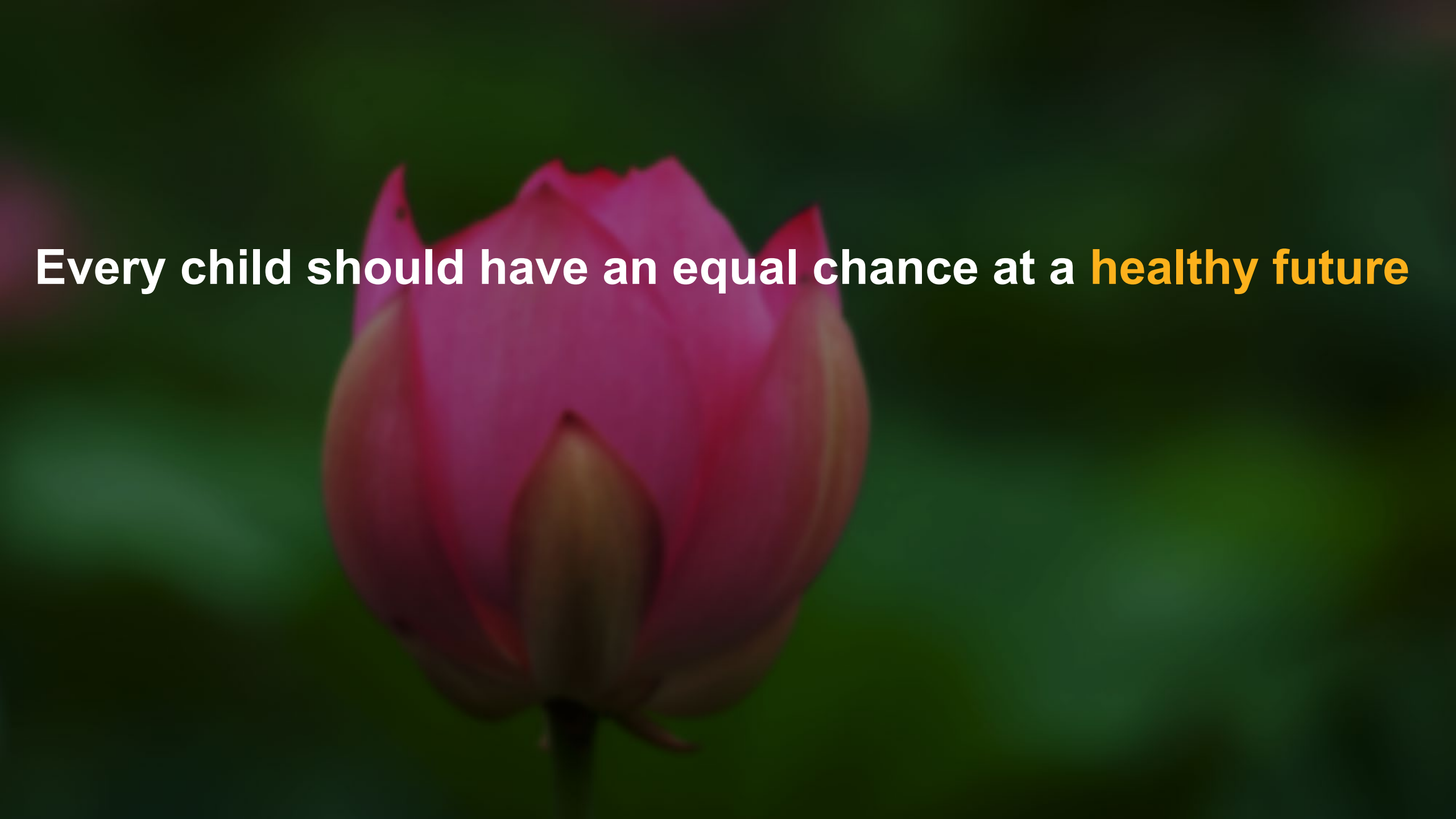

INSPIRE

Take Home Points

Disparities in pediatric trauma care are a **harsh reality**

The Weighted System is Real




Every child should have an equal chance at a healthy future


We need to check our own biases


Who Will Be the Voice of the Future Children?


TRAUMA
RESEARCH
TEAM
ARIZONA
FLOWCODE
PRIVACY.FLOWCODE.COM
@TopKnife_B
bjoseph@arizona.edu
Thank You!

Low Titer Group O Whole Blood for Pediatric Hemostatic Resuscitation

Phil Spinella, MD, FCCM
Professor, Surgery and Critical Care Medicine
University of Pittsburgh
July 2023

University of Pittsburgh | Trauma and Transfusion Medicine Research Center

Disclosures

- Consultant
  - Hemanext, Haima, Cerus, Octapharma
- Co-Founder and Chief Medical Officer
  - Kalocyte

Severe Bleeding Has Poor Outcomes

- Adults 28 day Mortality[2,3]
  - Trauma: 20-24%
- Pediatric 28 day Mortality[1]
  - Operative: 24%
  - Trauma: 37%
  - Medical: 62%

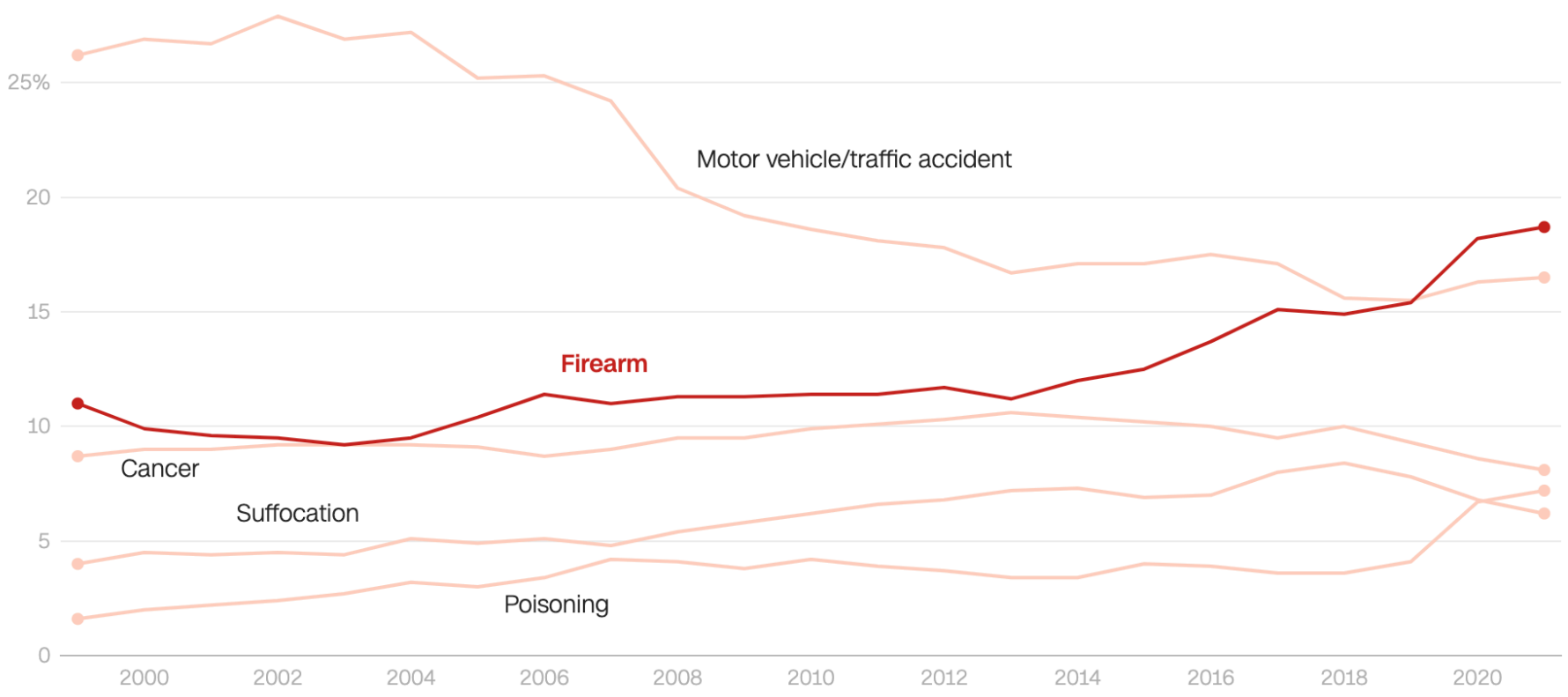
1. Leonard J and Spinella PC
2. Holcomb JB, PROMMT
3. Holcomb JB, PROPPR

Traumatic Injury Outcomes

- Most common cause of mortality 1-46 years of age
- 30,000 preventable deaths per year in US afterinjury from traumatic bleeding
  - 2,000 preventable deaths in children per year in the US
    - Inadequate or untimely care

National Academy Sciences Report: National Trauma System, 2016
Spinella PC, Cap AP, Current opinion in Hematology. 2017

Top five causes of death for children ages 1 to 18, as a percentage of all causes



Damage Control Resuscitation: Directly Addressing the Early Coagulopathy of Trauma

John B. Holcomb, MD, FACS, Don Jenkins, MD, FACS, Peter Rhee, MD, FACS, Jay Johannigman, MD, FS, FACS, Peter Mahoney, FRCA, RAMC, Sumeru Mehta, MD, E. Darrin Cox, MD, FACS, Michael J. Gehrke, MD, Greg J. Beilman, MD, FACS, Martin Schreiber, MD, FACS, Stephen F. Flaherty, MD, FACS, Kurt W. Grathwohl, MD, Phillip C. Spinella, MD, Jeremy G. Perkins, MD, Alec C. Beekley, MD, FACS, Neil R. McMullin, MD, Myung S. Park, MD, FACS, Ernest A. Gonzalez, MD, FACS, Charles E. Wade, PhD, Michael A. Dubick, PhD, C. William Schwab, MD, FACS, Fred A. Moore, MD, FACS, Howard R. Champion, FRCS, David B. Hoyt, MD, FACS, and John R. Hess, MD, MPH, FACP

J Trauma. 2007;62:307–310.

Table 1. Damage control resuscitation principles

- Pre-hospital
  - Rapid recognition of life-threatening hemorrhagic shock
    - Point-of-care devices: near infrared spectroscopy; INR; lactate level may be of value
  - Prevent hypothermia
  - Hemorrhage control with mechanical hemostatic adjuncts:
    - Tourniquet/junctional tourniquet
    - Pressure dressings/thrombin and fibrin-impregnated gauze
    - REBOA
    - Intraabdominal foams (investigational)
  - Hemostatic resuscitation
    - Whole blood is optimal
    - Component therapy with plasma (dried, liquid, or thawed), RBCs, and platelets in 1 : 1 : 1 ratio
  - Permissive hypotension for patients without traumatic brain injury[a]
  - Avoid crystalloid resuscitation
  - Consider TXA administration if less than 3 h from time of injury[b]
  - Consider source of fibrinogen (fibrinogen concentrate or cryoprecipitate)
  - Avoid hypocalcemia
    - In prolonged evacuations, empiric calcium administration for every 4–6 units of RBCs or WB

Every minute counts: Time to delivery of initial massive transfusion cooler and its impact on mortality

J Trauma Acute Care Surg
Volume 83, Number 1

David E. Meyer, MD, Laura E. Vincent, RN, Erin E. Fox, PhD, Terence O'Keeffe, MBChB, Kenji Inaba, MD, Eileen Bulger, MD, John B. Holcomb, MD, *and* **Bryan A. Cotton, MD**, *Houston, Texas*

TABLE 3. Multivariate Regression Predicting 30-d Mortality

	OR	95% CI	*p*
Time to receipt of first cooler, min	1.05	1.01–1.09	0.016
Anatomic injury severity (ISS)	1.05	1.03–1.06	<0.001
Disturbed arrival physiology (w-RTS)	0.61	0.53–0.69	<0.001
Randomization group (1:1:2)	1.46	0.92–2.29	0.102
RI, units	1.03	0.60–1.44	0.184

Median (IQR) time from arrival to MTP activation was 9 (3-20) min
Median (IQR) time from MTP activation to delivery of blood products was 8 (5-11) min

Delay in Recognition/Treatment in Children with Life-Threatening Hemorrhage

Life-Threatening Bleeding in Children: A Prospective Observational Study

Julie C. Leonard, MD, MPH[1]
Cassandra D. Josephson, MD[2]
James F. Luther, MA[3]
Stephen R. Wisniewski, PhD[3]
Christine Allen, MD[4]
Fabrizio Chiusolo, MD[5]
Adrienne L. Davis, MD, MSc[6]
Robert A. Finkelstein, MD[7]
Julie C. Fitzgerald, MD, PhD, MSCE[8]
Barbara A. Gaines, MD[9]
Susan M. Goobie, MD, FRCPC[10]
Sheila J. Hanson, MD, MS[11]
Hilary A. Hewes, MD[12]
Laurie H. Johnson, MD, MS[13]
Mark O. McCollum, MD[14,15]
Jennifer A. Muszynski, MD, MPH[16]
Alison B. Nair, MD[17]
Robert B. Rosenberg, MD, PhD[18]
Thomas M. Rouse, MD[19]
Athina Sikavitsas, DO[20]
Marcy N. Singleton, MSN[21]
Marie E. Steiner MD, MS[22]
Jeffrey S. Upperman, MD[23,24]
Adam M. Vogel, MD[25]
Hale Wills, MD, MS[26,27]
Margaret K. Winkler, MS, MD[28,29]
Philip C. Spinella, MD[30]

OBJECTIVES: The purpose of our study was to describe children with life-threatening bleeding.

DESIGN: We conducted a prospective observational study of children with life-threatening bleeding events.

SETTING: Twenty-four childrens hospitals in the United States, Canada, and Italy participated.

SUBJECTS: Children 0–17 years old who received greater than 40 mL/kg total blood products over 6 hours or were transfused under massive transfusion protocol were included.

INTERVENTIONS: Children were compared according bleeding etiology: trauma, operative, or medical.

MEASUREMENTS AND MAIN RESULTS: Patient characteristics, therapies administered, and clinical outcomes were analyzed. Among 449 enrolled children, 55.0% were male, and the median age was 7.3 years. Bleeding etiology was 46.1% trauma, 34.1% operative, and 19.8% medical. Prior to the life-threatening bleeding event, most had age-adjusted hypotension (61.2%), and 25% were hypothermic. Children with medical bleeding had higher median Pediatric Risk of Mortality scores (18) compared with children with trauma (11) and operative bleeding (12). Median Glasgow Coma Scale scores were lower for children with trauma (3) compared with operative (14) or medical bleeding (10.5). Median time from bleeding onset to first transfusion was 8 minutes for RBCs, 34 minutes for plasma, and 42 minutes for platelets. Postevent acute respiratory distress syndrome (20.3%) and acute kidney injury (18.5%) were common. Twenty-eight–day mortality was 37.5% and higher among children with medical bleeding (65.2%) compared with trauma (36.1%) and operative (23.8%). There were 82 hemorrhage deaths; 65.8% occurred by 6 hours and 86.5% by 24 hours.

CONCLUSIONS: Patient characteristics and outcomes among children with life-threatening bleeding varied by cause of bleeding. Mortality was high, and death from hemorrhage in this population occurred rapidly.

KEY WORDS: critical care; emergency medicine; pediatric; surgery; trauma; transfusion

Critical Care Medicine November 2021 • Volume 49 • Number 11

	Trauma (n=210) 46%	Operative (n=174) 34%	Medical (n=97) 20%
28-day mortality	37%	24%	62%
LTH duration (hrs)	3.06 [1-6]	3.91 [2-7]	3.83 [1-7]
Time to RBC (min)	8.0 [0-42]	6.0 [0-39]	10.0 [0-45]
Time to plasma (min)	33.0 [16-75]	39.5 [12-83]	30.5 [19-65]
Time to PLTs (min)	41.0 [20-71]	42.0 [11-111]	43.0 [15-118]

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Hemostatic Resuscitation Options

- Empiric transfusion
  - RBCs, plasma, platelets in 1:1:1 unit ratio
  - Low Titer Group O Whole Blood
- Goal directed hemostatic resuscitation
  - TEG/ROTEM
    - Blood Products and hemostatic adjuncts
      - Antifibrinolytics and factor concentrates

Types of Whole Blood

- Warm and Fresh
  - Room temp (22C)
  - Transfused within 8 hours
  - Most military data
- Cold and Stored
  - 2-6 C
  - Stored for 14-35 days
  - Civilian data

Types of Whole Blood

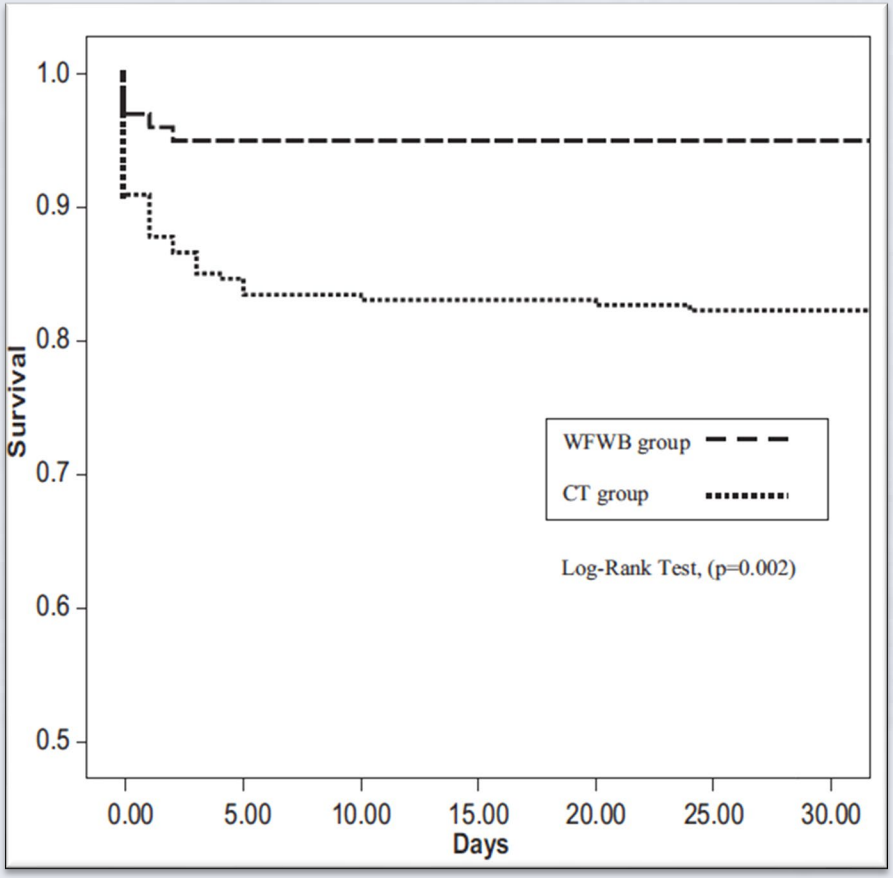
- ABO specific
  - Military data with warm fresh whole blood
- Group O Whole Blood
  - Low titer (Anti A and B < 256)
  - Mostly civilian data with cold whole blood
  - LTOWB

The Journal of **TRAUMA**® *Injury, Infection, and Critical Care*

Warm Fresh Whole Blood Is Independently Associated With Improved Survival for Patients With Combat-Related Traumatic Injuries

J Trauma. 2009;66:S69–S76.

Philip C. Spinella, MD, Jeremy G. Perkins, MD, Kurt W. Grathwohl, MD, Alec C. Beekley, MD, and John B. Holcomb, MD



- 5.15 Selection of Compatible Blood and Blood Components for Transfusion
  - 5.15.1 Recipients shall receive
    - ABO group-compatible Red Blood Cell components
    - ABO group-specific Whole Blood
    - **Low titer group O Whole Blood (for non group O or for recipients whose ABO group is unknown)**

Risk/Benefit Assessment
LTOWB compared to blood components

Advantages of LTOWB	Risks of LTOWB
More potent product Higher Hb, plasma, platelets per volume	Incompatible plasma/immune complexes? Theoretical risk.
Cold platelets – improved hemostasis (RCT data)	Waste? Reduced/eliminated if used in non-trauma massive bleeding
Increased storage duration of platelet product	Ease of over-resuscitation
Less risk of ABO incompatible transfusion reactions than ABO compatible components	
Less bacterial contamination risk	
Logistical advantages Quicker transfusion of balanced product One product vs four products	
Independent association with improved survival	

Volume and Concentrations Between Component Therapy vs. Warm Whole Blood

VS

Component Therapy: *680 mL*
RBC unit + PLT unit + FFP unit + Cryo unit

- *Red blood cell concentration: 29%*
- *Platelets: 80,000*
- *Coagulation factors: 65%*

Whole Blood: 500 mL
A single WB unit

- *Red blood cell concentration: 38-50%*
- *Platelets: 150,000-400,000*
- *Coagulation factor concentration: 90%*

Standard Amounts of Anti-coagulants and Additives in Reconstituted Whole Blood vs Whole Blood

Component Therapy per Unit:

6 x RBC (AS-5)	6 x 120 ml = 720ml
6 x FFP	6 x 50 ml = 300ml
1 x aPLT	1 x 35 ml = 35ml
	Total =1055ml

Whole Blood per Unit:

6 x 63ml = 378ml

Total= 378ml

There is 3 times the volume of anticoagulant and additives with reconstituted whole blood from components compared to whole blood

Spinella PC, J Trauma. 2009;66:S69-76

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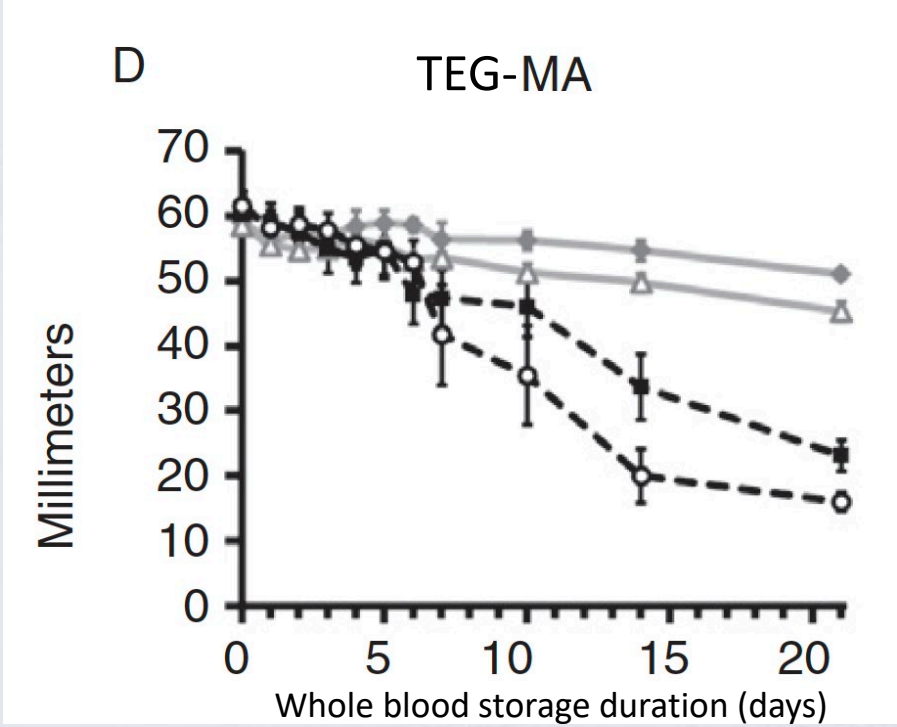
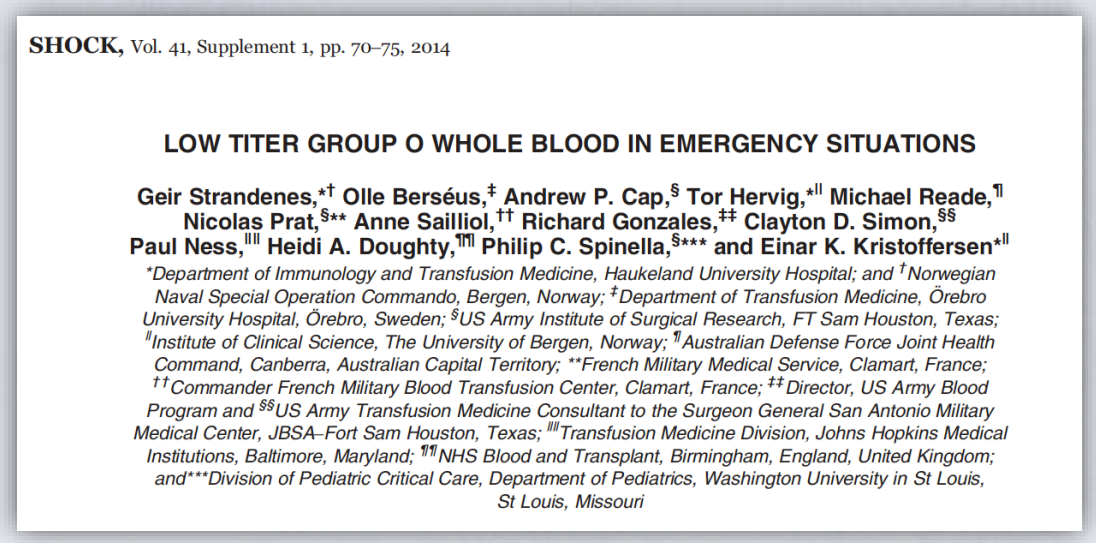
Primary hemostatic capacity of whole blood: a comprehensive analysis of pathogen reduction and refrigeration effects over time

TRANSFUSION 2013;53:137S-149S.

Heather F. Pidcoke, Steve J. McFaul, Anand K. Ramasubramanian, Bijaya K. Parida, Alex G. Mora, Chriselda G. Fedyk, Krystal K. Valdez-Delgado, Robbie K. Montgomery, Kristin M. Reddoch, Armando C. Rodriguez, James K. Aden, John A. Jones, Ron S. Bryant, Michael R. Scherer, Heather L. Reddy, Raymond P. Goodrich, and Andrew P. Cap



Group O WB Less Risk of Severe Hemolytic Reactions vs Component Therapy



SHOCK, Vol. 41, Supplement 1, pp. 70–75, 2014

LOW TITER GROUP O WHOLE BLOOD IN EMERGENCY SITUATIONS

Geir Strandenes,[*†] Olle Berséus,[‡] Andrew P. Cap,[§] Tor Hervig,[*‖] Michael Reade,[¶] Nicolas Prat,[§] Anne Sailliol,[††] Richard Gonzales,[‡‡] Clayton D. Simon,[§§] Paul Ness,[‖‖] Heidi A. Doughty,[¶¶] Philip C. Spinella,[§***] and Einar K. Kristoffersen[*‖]**

[*]Department of Immunology and Transfusion Medicine, Haukeland University Hospital; and [†]Norwegian Naval Special Operation Commando, Bergen, Norway; [‡]Department of Transfusion Medicine, Örebro University Hospital, Örebro, Sweden; [§]US Army Institute of Surgical Research, FT Sam Houston, Texas; [‖]Institute of Clinical Science, The University of Bergen, Norway; [¶]Australian Defense Force Joint Health Command, Canberra, Australian Capital Territory; [**]French Military Medical Service, Clamart, France; [††]Commander French Military Blood Transfusion Center, Clamart, France; [‡‡]Director, US Army Blood Program and [§§]US Army Transfusion Medicine Consultant to the Surgeon General San Antonio Military Medical Center, JBSA–Fort Sam Houston, Texas; [‖‖]Transfusion Medicine Division, Johns Hopkins Medical Institutions, Baltimore, Maryland; [¶¶]NHS Blood and Transplant, Birmingham, England, United Kingdom; and[***]Division of Pediatric Critical Care, Department of Pediatrics, Washington University in St Louis, St Louis, Missouri

- Risk from incompatible plasma (LTOWB)
  - **1: 120,000 risk of mild to moderate reaction**
- Risk of ABO incompatibility (RBCs)
  - **1:80,000 risk of severe (fatal) hemolytic reaction**
  - **Human error**

LTOWB vs CT: Mortality Data-Trauma (2020-2022)

- Williams/Cotton [1]
  - 350 patients, retrospective
  - **2-fold increase in 28-day survival**
    - **Adj OR 2.19, 1.01-4.76, p=0.047).**
- Mihalko/Spinella [2]
  - 384 pts, Prospective/historical control
  - **2 fold reduction in 24 hour mortality**
    - **Adj HR, 0.51, p=0.033**
- Brill/Cotton [3]
  - 1,377 patients, Retrospective
  - **1.5 fold increased 30 day survival**
    - **Adj OR, 1.59, p < 0.001**
- Hanna/Joseph [4]
  - 8,494 patients, Retrospective
  - **1.2 fold increase in 24 hour survival**
    - **Adj OR, 0.78 (0.59-0.89), (p=0,006)**
- Hazelton/Porter [5]
  - 1,623 patients, prospective observational
  - **2 fold reduction for in hospital mortality**
    - **Adj OR 0.52, p< 0.0001**
- Gaines/Leeper [6]
  - 80 children, retrospective/propensity matched
  - **2 fold reduction in 28 day mortality**
    - **Adj OR 0.41, P . 0.02**
- Braverman/Jenkins [7]
  - 214 adults, retrospective/propensity matched
  - **Prehospital study with reduced ED mortality (11 vs 0%), (p=0.04)**
  - 6hr mortality: 22 vs 3% (p=0.08)

1 J Trauma Acute Care Surg. 2020 Jan;88(1):87-93
2 Oral Presentation, ISTH, London 2022
3 J Am Coll Surg. 2022 Apr 1;234(4):408-418
4 J Trauma Acute Care Surg. 2020 Aug;89(2):329-335
5 Ann Surg. 2022 Oct 1;276(4):579-588
6 Ann Surg. 2021 Oct 8. on line
7 Transfusion. 2021;61:S15–S21.

Outcomes with LTOWB use in Trauma Patients

- Metanalysis submitted for publication
- **15 civilian trauma studies including 14,424 patients**
  - **3,446 received LTOWB**
- LTOWB was defined as cold-stored RhD-positive or RhD-negative group O whole blood with low titers of anti-A and anti-B antibodies (ranging from 50 to 256).
- Studies were excluded if
  - Modified LTOWB (leukoreduced without platelet-sparing filter plus room temp plts transfused
  - Warm fresh whole blood was used.

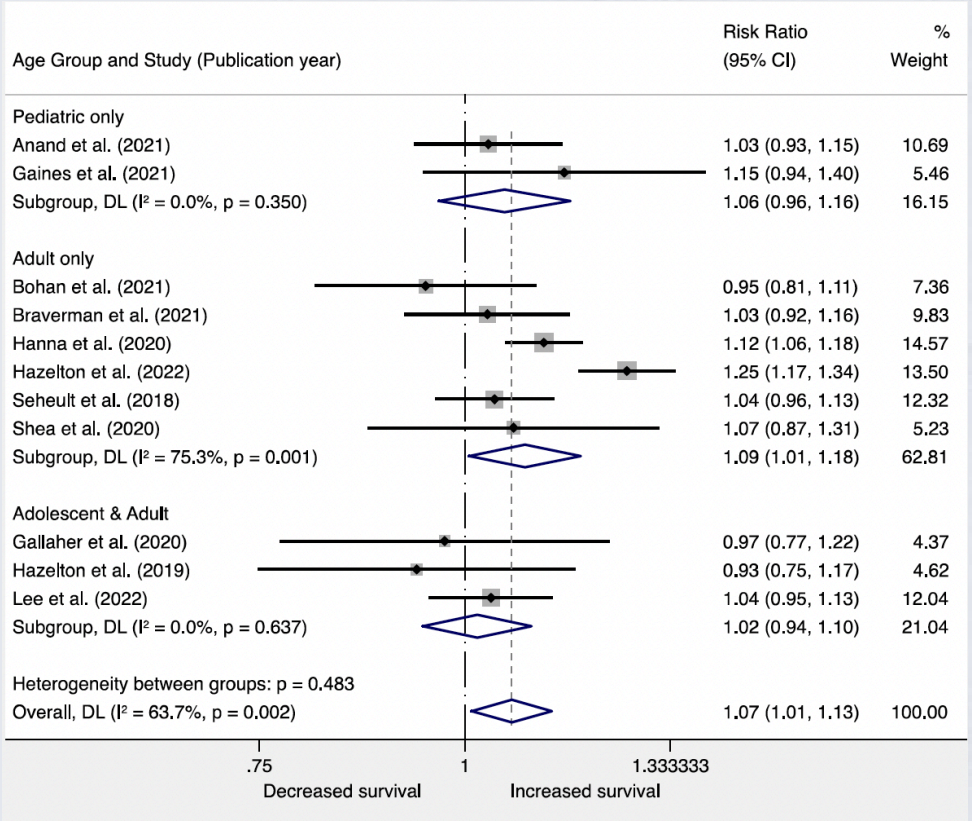
Morgan K, Spinella PC, Leeper CM. Submitted.

Meta-Analysis of LTOWB studies in Trauma Patients

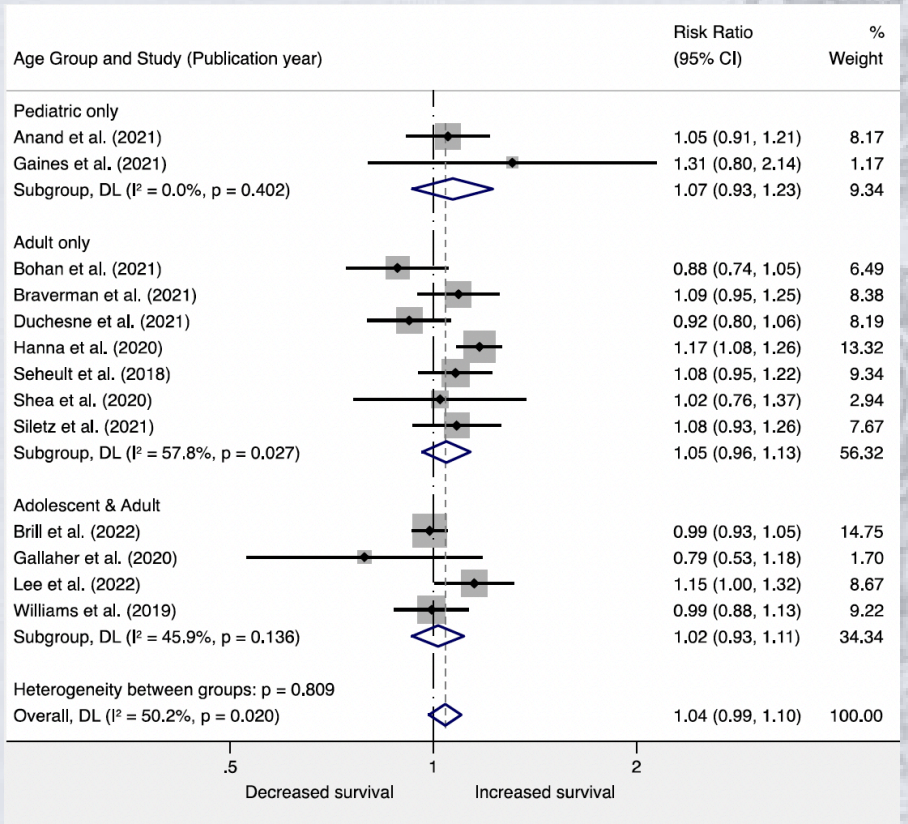
- LTOWB was associated with **improved 24-hour survival** compared to component therapy
  - RR (95% CI) =1.07 (1.01-1.13)
- No significant differences were found for later survival timepoints (28-day, 30-day, in-hospital)
  - RR(95% CI)= 1.04(0.99-1.1)
- No evidence of small study bias and all studies were graded as a moderate level of bias.

Morgan K, Spinella PC, Leeper CM. Submitted.

Meta-Analysis of LTOWB studies in Trauma Patients



24 Hour Survival



28 Day Survival

Submitted for publication

University of Pittsburgh Trauma and Transfusion Medicine Research Center

Whole Blood is Superior to Component Transfusion for Injured Children

A Propensity Matched Analysis

Christine M. Leeper, MD, MS,✉ Mark H. Yazer, MD, Darrell J. Triulzi, MD, Matthew D. Neal, MD, and Barbara A. Gaines, MD

Figure 2 -

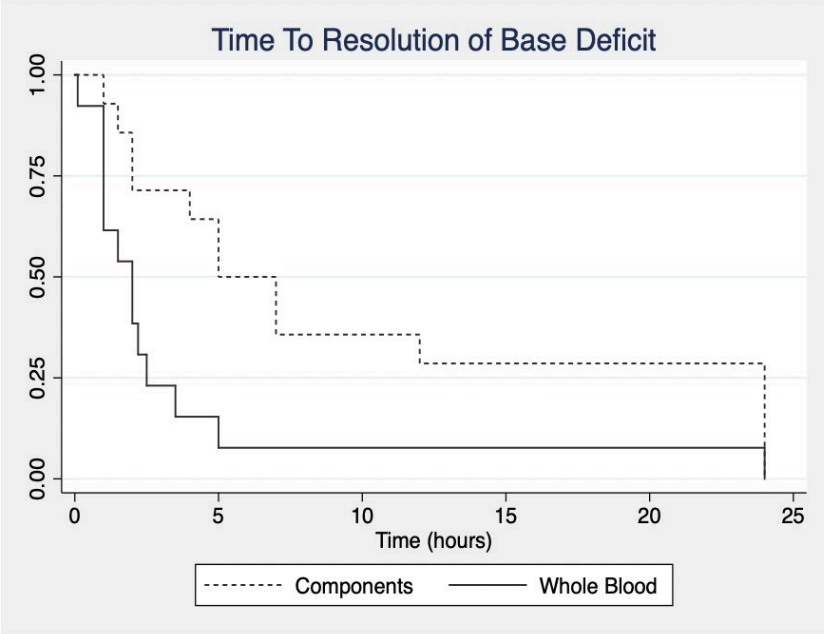
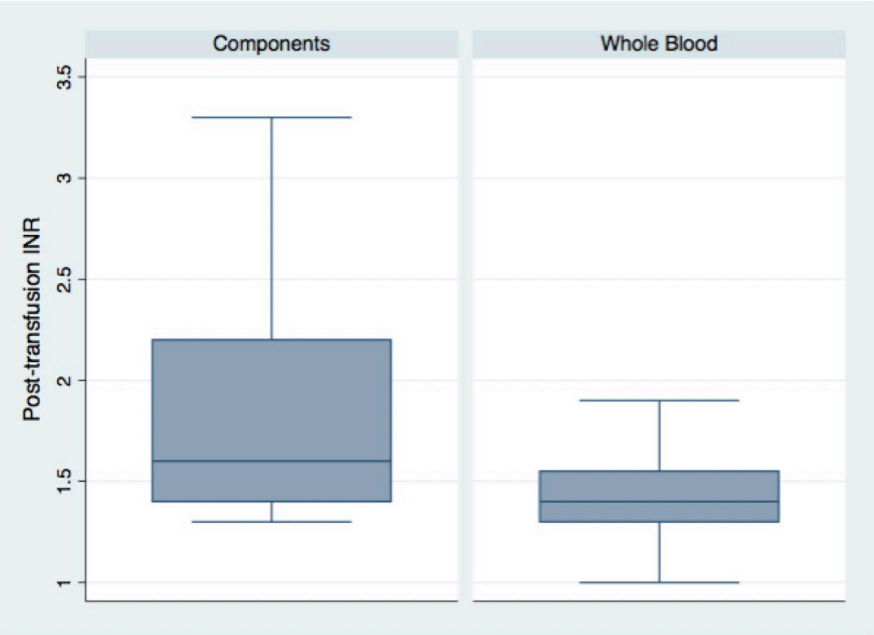


Figure 3



Leeper C. Annals of Surgery. 2020

University of Pittsburgh Trauma and Transfusion Medicine Research Center

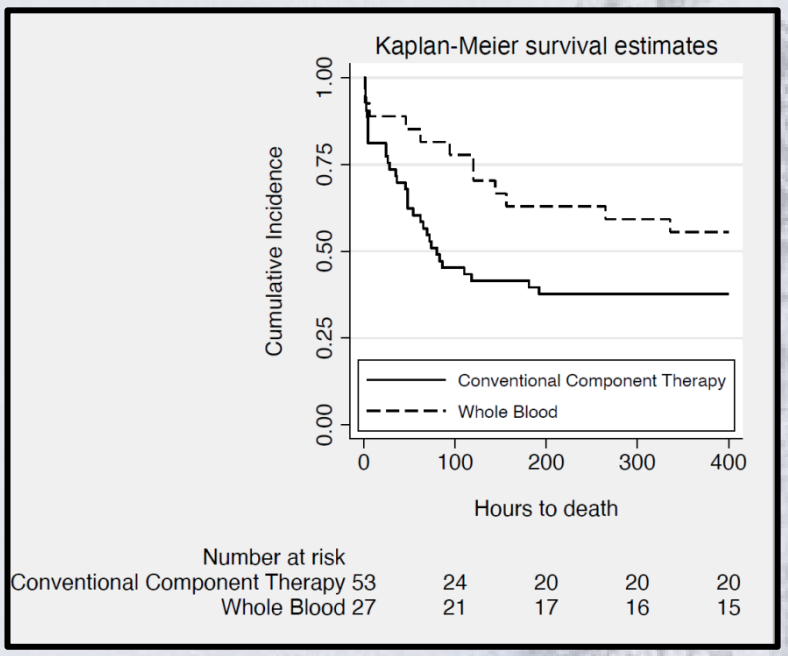
ORIGINAL ARTICLE: PDF ONLY

Low Titer Group O Whole Blood In Injured Children Requiring Massive Transfusion

Gaines, Barbara A. MD*; Yazer, Mark H. MD†; Triulzi, Darrell J. MD†; Sperry, Jason L. MD MPH†; Neal, Matthew D. MD†; Billiar, Timothy R. MD†; Leeper, Christine M. MD MS*

	72 hour mortality			28 day mortality		
	Odds Ratio	95% Confidence Interval	p value	Odds Ratio	95% Confidence Interval	p value
LTOWB	0.23	0.08-0.70	0.009	0.41	0.23-0.98	0.02
Age (years)	1.07	1.00-1.16	0.06	1.02	0.98-1.09	0.13
Total transfusion volume (mL/kg)	1.01	1.01-1.02	<0.001	1.01	1.01-1.02	<0.001
Admission Base Deficit	1.11	1.06-1.17	<0.001	1.12	1.07-1.17	<0.001
Admission INR	1.30	1.06-1.58	<0.001	1.29	1.05-1.58	0.003
Injury Severity Score	1.02	1.00-1.05	0.10	1.02	0.99-1.06	0.06

LTOWB = low titer group O whole blood



Leeper et al, Annals of Surgery, 2021

University of Pittsburgh Trauma and Transfusion Medicine Research Center

Journal of Trauma and Acute Care Surgery, Publish Ahead of Print
DOI: 10.1097/TA.0000000000004035

An assessment of the safety, hemostatic efficacy, and clinical impact of low-titer group O whole blood in children and adolescents

Justin Gerard, Krislynn Mueck, David Lubkin, Gabrielle Hatton, Charles Wade, Bryan Cotton

Inverse Probability Weighted Analysis for 30 day Survival

	Odds Ratio (95% CI)	P value
Whole Blood Group	2.48 (1.16-5.47)	0.02
Age (years)	1.004 (1.0001-1.0006)	0.003
ISS	0.93 (0.89-0.96)	<0.001
Lactate	0.76 (0.67-0.84)	< 0.001

Whole blood hemostatic resuscitation in pediatric trauma: A nationwide propensity-matched analysis

Tanya Anand, MD, Omar Obaid, MD, Adam Nelson, MD, Mohamad Chehab, MD, Michael Ditillo, DO, Ahmad Hammad, MD, Molly Douglas, MD, Letitia Bible, MD, *and* **Bellal Joseph, MD, FACS,** *Tucson, Arizona*

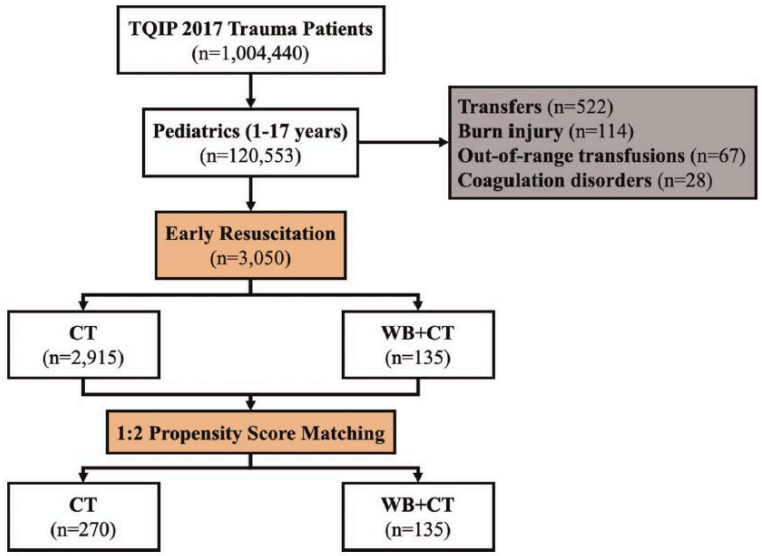


Figure 1. Patient flow diagram.

TABLE 1. Postmatch Patient and Hospital Characteristics

	CT (n = 270)	WB-CT (n = 135)	*p*
Demographics			
Age, mean (SD), y	11.8 (5.3)	12.2 (4.9)	0.401
Male, n (%)	179 (66.3)	87 (64.4)	0.711
Weight, mean (SD), kg	42.1 (18.9)	44.7 (18.4)	0.247
Mechanism of injury, n (%)			0.666
Motor vehicle collision	118 (43.7)	60 (44.4)	
Pedestrian struck	37 (13.7)	19 (14.1)	
Fall	8 (3.0)	3 (2.2)	
Firearm	75 (27.8)	38 (28.2)	
Cut/pierce	17 (6.3)	8 (5.9)	
Other	15 (5.5)	7 (5.2)	
ED vital signs			
Age-adjusted shock, n (%)	136 (50.4)	71 (52.6)	0.673
Temperature, mean (SD), °C	36.1 (2.2)	35.9 (1.5)	0.516
GCS, median (IQR)	5 (3–15)	3 (3–15)	0.080
Injury characteristics, median (IQR)			
Head-AIS	2 (0–3)	2 (1–3)	0.182
Chest-AIS	3 (1–4)	3 (1–4)	0.490
Abdomen-AIS	4 (2–4)	4 (2–5)	0.209
Extremity-AIS	2 (0–3)	2 (0–3)	0.671
ISS	31 (19–41)	34 (22–45)	0.124

LTOWB – A Blood Conservation Strategy?

TABLE 2. Transfusion Requirements

	CT (n = 270)	WB-CT (n = 135)	*p*
4-h Transfusions, median (IQR), mL/kg			
PRBC	31 (22–57)	19 (11–31)	0.008*
Plasma	12 (9–31)	9 (0–21)	<0.001*
Platelets	4 (4–10)	0 (0–6]	<0.001*
WB	—	13 (9–20)	—
Total blood products	48 (33–95)	35 (22–73)	0.013*
24-h Transfusions, median (IQR), mL/kg			
PRBC	36 (25–71)	22 (15–53)	<0.001*
Plasma	17 (11–46)	11 (0–25)	<0.001*
Platelets	6 (4–13)	0 (0–9)	<0.001*
WB	—	14 (10–23)	—
Total blood products	53 (36–119)	39 (24–97)	<0.001*

*Statistically significant.
IQR, interquartile range; PRBC, packed red blood cell.

Anand et al 2020

Special Issue: - SESC Conference

Whole Blood Resuscitation is Safe in Pediatric Trauma Patients: A Multicenter Study

The American Surgeon
2023, Vol. 0(0) 1–6

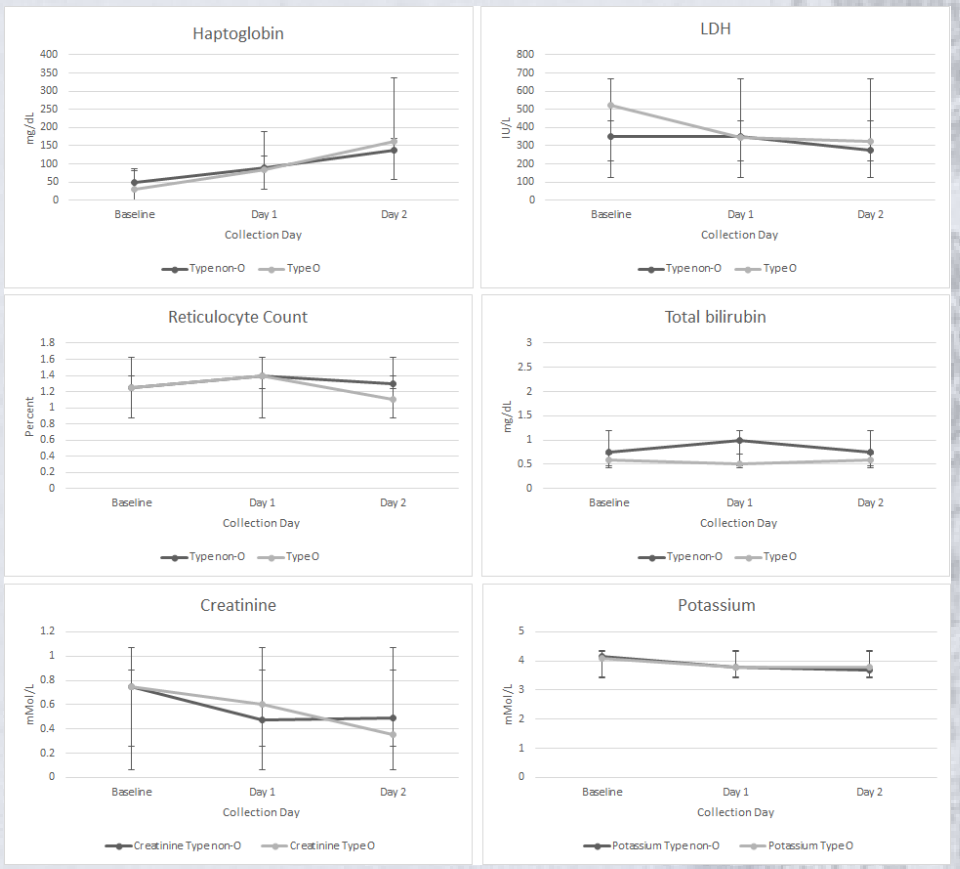
DOI: 10.1177/00031348231157864
journals.sagepub.com/home/asu
SAGE

Lindsey L. Perea, DO[1], Kate Moore, BA[1], Courtney Docherty, DO[2], Uyen Nguyen, BS[3], Mark J. Seamon, MD[4], James P. Byrne, MD[4], Donald H. Jenkins, MD[5], Maxwell A. Braverman, DO[5], John M. Porter, MD[6], Isabella G. Armento, BS[6], Caleb Mentzer, DO[7], Guy C. Leonard, BS[7], Alejandro J. Luis, MD[8], Matthew R. Noorbakhsh, MD[9], James E. Babowice, DO[9], Haytham M. A. Kaafarani, MD[10], Ava Mokhtari, MD[10], Matthew J. Martin, MD[11], Jayraan Badiee, MPH[11], Charles Mains, MD[12], Robert M. Madayag, MD[12], Sarah A. Moore, MD[13], Kathleen Madden, MD[13], and Joshua P. Hazelton, DO[14]

When controlling for age, sex, mechanism of injury, and shock index, there were no differences in mortality or complications between the WB and CT groups

No Increased Risks with LTOWB in Adults or Children

- No increase in transfusion reactions
- No increase in organ failure
- No increase in hospital complications
  - AKI
  - Sepsis
  - ARDS
  - Thromboembolism
- No increase in hemolysis
  - Non Group O patients vs Group O patients who receive LTOWB



Transfusion. 2020 Jun;60 Suppl 3:S24-S30
Transfusion. 2018 Oct;58(10):2280-2288
Transfusion. 2021 Jul;61 Suppl 1:S8-S14

University of Pittsburgh | Trauma and Transfusion Medicine Research Center

Received: 22 October 2020 | Revised: 8 December 2020 | Accepted: 10 December 2020

DOI: 10.1111/trf.16456

SUPPLEMENT ARTICLE

TRANSFUSION

Safety profile of low-titer group O whole blood in pediatric patients with massive hemorrhage

Katrina M. Morgan[1] | Mark H. Yazer[2] | Darrell J. Triulzi[2] | Stephen Strotmeyer[3] | Barbara A. Gaines[3] | Christine M. Leeper[1]

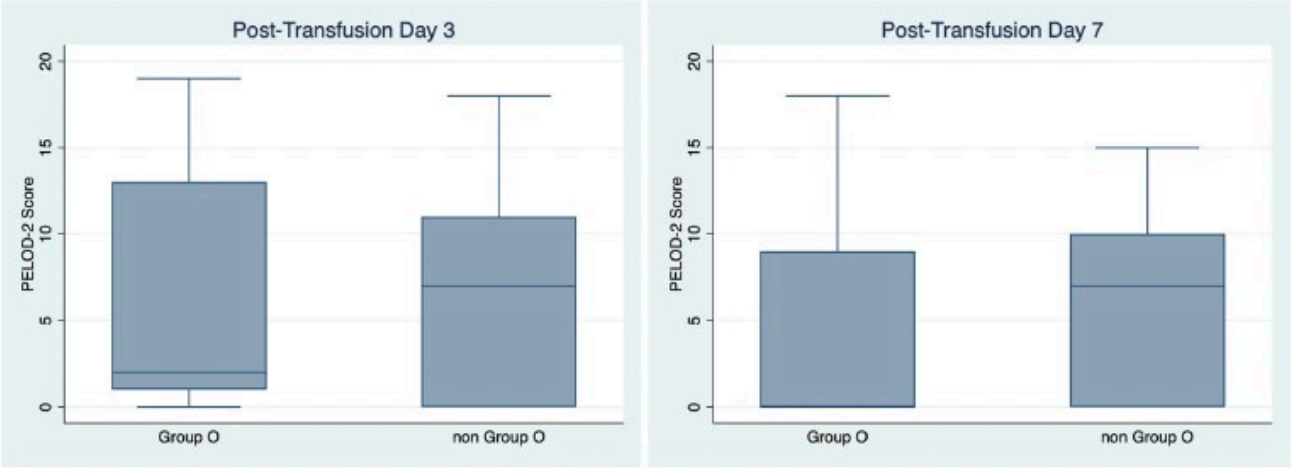


FIGURE 2 PELOD-2 scores did not significantly differ between group O and non-group O LTOWB recipients on post-transfusion days 3 and 7. On day 3, group O PELOD-2 score was 2 (1–13) and non-group O was 7 (0–11) ($p = .82$). On day 7, group O PELOD-2 score was 0 and non-group O was 7 ($p = .48$)

University of Pittsburgh | Trauma and Transfusion Medicine Research Center

blood

Blood, Vol 77, No 5 (March 1), 1991: pp 930-936

Comparison of the hemostatic effects of fresh whole blood, stored whole blood, and components after open heart surgery in children

CS Manno, KW Hedberg, HC Kim, GR Bunin, S Nicolson, D Jobes, E Schwartz and WI Norwood

Table 3. Blood Loss (mL/kg) (mean ± SE) by Age, Surgical Difficulty, and Both

Cold Whole Blood (ABO Matched)	Components in 1:1:1 unit ratio	*P* Value*
44.8 ± 6.0 (n = 57)	74.2 ± 8.9 (n = 52)	.03†
51.7 ± 7.4 (30)	96.2 ± 10.7 (36)	.001‡
37.2 ± 9.7 (27)	24.6 ± 6.0 (16)	NS

24 hr total blood used was 75.5ml/kg and 97.4ml/kg in the WB and CT groups, respectively.
Absolute reduction of 22ml/kg in 16kg child (4yr old) = 352ml of blood
22% relative reduction of total blood use in 24 hrs

40% less blood loss in WB group

THE JOURNAL OF MATERNAL-FETAL & NEONATAL MEDICINE
https://doi.org/10.1080/14767058.2021.1915275

Taylor & Francis
Taylor & Francis Group

ORIGINAL ARTICLE

Check for updates

Whole blood transfusion reduces overall component transfusion in cases of placenta accreta spectrum: a pilot program

Jessian L. Munoz[a,b], Alison M. Kimura[a,b], Elly Xenakis[a,b], Donald H. Jenkins[c], Maxwell A. Braverman[c], Patrick S. Ramsey[a,b] and Kayla E. Ireland[a,b]

- **Prospective observational study of 34 patients 16 received LTOWB and 18 received CT**

Table 1. Demographics of study group.

Factor	Whole blood ($n = 16$)	Component ($n = 18$)	p Value
Age	32.4 ± 5.9	31.3 ± 5.28	.57[a]
BMI	32.1 ± 7.0	34.5 ± 3.8	.23[a]
Gravity	4 (3.5, 5.8)	5 (3.8, 7)	.54[b]
Parity	3 (2, 3)	3.5 (2, 4.3)	.27[b]
History of CD	16 (100)	16 (89)	.49[c]
Number of prior CD	2 (2, 3)	3 (1.8, 4)	.62[b]
Tertiary referral	14 (88)	13 (72)	.41[c]
Gestational age at delivery	34 (31, 34)	34 (25, 34.8)	.70[b]
PAS by ultrasound			
Previa	2 (13)	5 (28)	.41[c]
Accreta	4 (25)	12 (67)	**.02**[c]
Increta	1 (6)	0	.47[c]
Percreta	9 (56)	1 (6)	**.002**[c]
Diabetes	1 (6)	1 (6)	1.0[c]
Hypertension	2 (13)	2 (11)	1.0[c]
Anemia	5 (31)	8 (45)	.18[d]
Emergent delivery	7 (44)	5 (28)	.33[c]
Public insurance	9 (56)	16 (89)	**.05**[c]

BMI: body mass index; CD: cesarean delivery; PAS: placenta accreta spectrum.
Values presented as mean ± SD, median [P25, P75] or N (column %).
p Values: [a]t-test, [b]Mann–Whitney's test, [c]Fisher's exact test, and [d]chi-squared.
Bold values suggest $p < .05$.

- Total transfusion was less in the LTOWB vs CT group, 2607 ml vs. 4683 ml, (p=0.03)
- 2076 ml less blood transfused
- **44% relative reduction in total blood transfusion**

Study	Outcome	Mean % Less Blood Transfused	Mean Reduced Vol Blood Transfused	Mean Reduced Vol/kg Transfused
Adult Trauma Studies				
Williams, (n=350) Retrospective	2-fold increase 28-day survival	**53%, (post ED) (P=0.033)**		
Brill, (N=1,377) Retrospective	1.5 fold increase 30 day survival	**7%, (post ED) (P<0.001)**		
Hazelton, (N=1,623) Prospective	2-fold reduction In-hosp mortality	**No difference Only Recorded Units**		
Hanna (N=8,494) Retrospective	1.2 fold reduction 24 hr mortality	**No Difference Only Recorded Units**		
Braverman (N=214) Retrospective/Propensity	Reduced death in ED (0 vs 11%)		400ml less in ED	
Mahilko, (N=384) Prospective-Unpublished	2-fold reduction 24-hour mortality	**40%, (72hrs) (P<0.001)**	2.5 Liters	32ml/kg
Obstetric Studies				
Munoz, (N=36) Obstetric, Prospective	44% less blood transfused	**44% (p=0.03)**	2.1 Liter	30ml/kg (70kg)
Pediatric Studies				
Gaines, (N=80) Peds, Retrospective	2-fold reduction 28-day mortality	**18% (p=0.06)**	333 ml	11 ml/kg
Annand, (N=405) Peds, Retrospective	Mortality diff not significant	**26% (P<0.001)**	630 ml	14ml/kg
Manno, (N=109) Ped CT surgery, RCT	40% less blood loss	**40% (No statistics)**	352 ml	22ml/kg

LTOWB – Less Costs

Transfusion-related cost comparison of trauma patients receiving whole blood versus component therapy

Ciaraglia, Angelo MD; Myers, John C. MD; Braverman, Maxwell DO; Barry, John BS; Eastridge, Brian MD; Stewart, Ronald MD; Nicholson, Susannah MD, MS; Jenkins, Donald MD

Author Information

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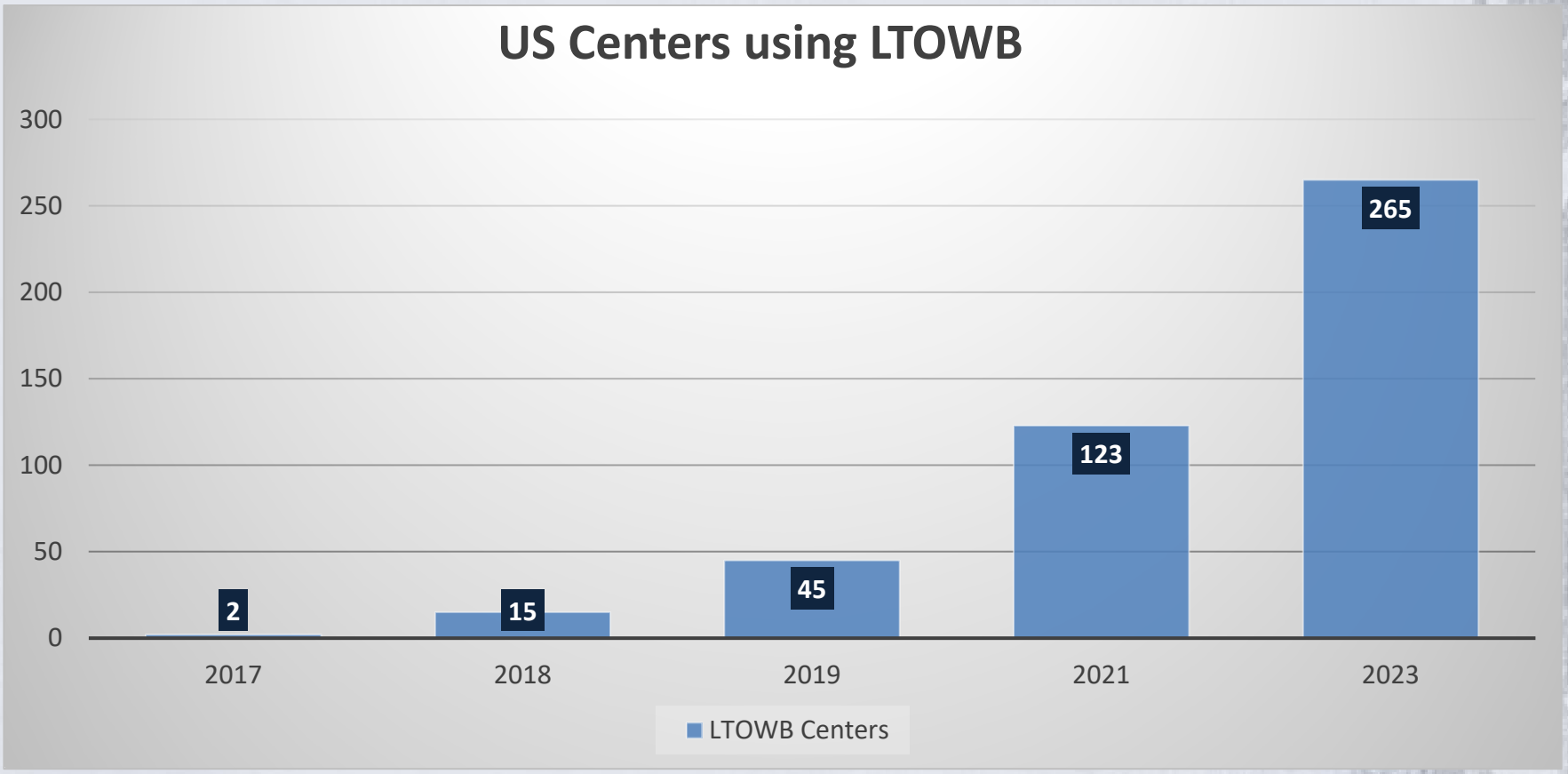
- A retrospective review of adult and pediatric trauma patients who received either LTO+WB or CT from time of injury to within 4 hours of arrival was performed.
- Annual mean cost per unit of blood product used
- Pediatric and adult patients were analyzed separately and were compared on a cost per patient (cost/patient) and cost per patient per milliliter (cost/patient/mL) basis.
- **After the initiation of the WB transfusion, the mean annual cost decreased 17.3% for all blood products**
- **Average net reduction in cost related to blood products was more than $927,000**.

LTOWB in the US



RhD Status of LTOWB

- RhD- preferred for women to prevent hemolytic disease of fetus/newborn (HDFN)
  - RhD- LTOWB very short supply
- If RhD+ LTOWB is only available, do females get it?
  - Estimates of improved survival at very least 5-10% range
- HDFN has 1-6% overall incidence
  - 0.3% risk of fetal demise
- Women and parents of girls strongly prefer to receive RhD+ LTOWB and accept risk of HDFN

RhD+ and HDFN Risk

HEMATOLOGY
2023, VOL. 28, NO. 1, 2161215
https://doi.org/10.1080/16078454.2022.2161215

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Not as "D"eadly as once thought – the risk of D-alloimmunization and hemolytic disease of the fetus and newborn following RhD-positive transfusion in trauma

Mark H. Yazer[a]*, Gleb Panko[b]*, John B. Holcomb[c], Alesia Kaplan[a], Christine Leeper[d], Jansen N. Seheult[e], Darrell J. Triulzi[a] and Philip C. Spinella[f]

RhD PERCEPTIONS

TRANSFUSION

Attitudes of American adult women toward accepting RhD-mismatched transfusions in bleeding emergencies

Gabriel Yu[1] | Jeffrey Siegler[1] | Jane Hayes[2] | Mark H. Yazer[3] | Philip C. Spinella[4]

SUPPLEMENT ARTICLE

TRANSFUSION

Weighing the risk of hemolytic disease of the newborn versus the benefits of using of RhD-positive blood products in trauma

Jennifer Andrews[1,2] | Cassandra D. Josephson[3,4] | Pampee Young[1,5] | Philip C. Spinella[6,7] | Mark H. Yazer[8]

SUPPLEMENT ARTICLE

TRANSFUSION

Parent perceptions of emergent blood transfusion in children

Katrina M. Morgan[1] | Rachel Lobo[2] | Kyle Annen[3,4] | Ricardo I. Villarreal[4] | Stella Chou[5,6] | Stacey Uter[5] | Julie C. Leonard[7,8] | Cameryn Dyer[9] | Mark Yazer[10] | Philip C. Spinella[11] | Christine M. Leeper[11]

ONLINE CLINICAL INVESTIGATION

Use of Antifibrinolytics in Pediatric Life-Threatening Hemorrhage: A Prospective Observational Multicenter Study

OBJECTIVES: To assess the impact of antifibrinolytics in children with life-threatening hemorrhage.

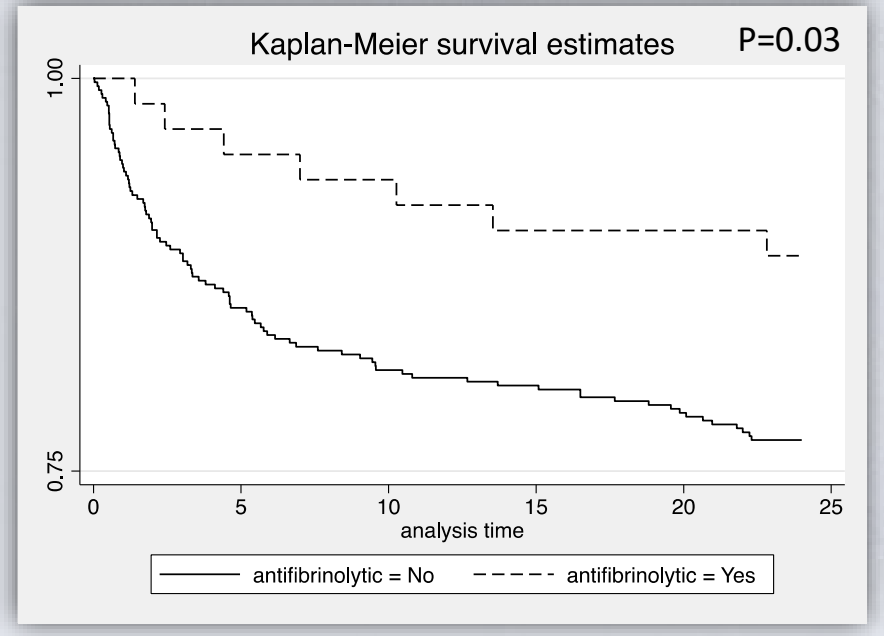
DESIGN: Secondary analysis of the MAssive Transfusion epidemiology and outcomes In Children study dataset, a prospective observational study of children with life-threatening bleeding events.

SETTING: Twenty-four children's hospitals in the United States, Canada, and Italy.

PATIENTS: Children 0–17 years old who received greater than 40 mL/kg of total blood products over 6 hours or were transfused under activation of massive transfusion protocol.

INTERVENTION/EXPOSURE: Children were compared according to receipt of antifibrinolytic medication (tranexamic acid or aminocaproic acid) during the bleeding event.

Philip C. Spinella, MD[1]
Julie C. Leonard, MD, MPH[2]
Barbara A. Gaines, MD[3]
James F. Luther, MA[4]
Stephen R. Wisniewski, PhD[4]
Cassandra D. Josephson, MD[5]
Christine M. Leeper, MD, MS[5]
for the MAssive Transfusion epidemiology and outcomes In Children (MATIC) Investigators and BloodNet



University of Pittsburgh Trauma and Transfusion Medicine Research Center

Antifibrinolytics Independently Associated with Improved Survival

TABLE 3.
Cox Proportional Hazard Models for 6- and 24-Hour Mortalities

	6-hr Mortality		24-hr Mortality	
Measures	**OR (95% CI)**	***p***	**OR (95% CI)**	***p***
Unadjusted analysis				
Antifibrinolytic	0.29 (0.09–0.96)	0.04	0.49 (0.21–1.12)	0.08
Adjusted analysis				
Antifibrinolytic	0.29 (0.09–0.93)	0.04	0.45 (0.21–0.98)	0.04
Pediatric Risk of Mortality score	1.04 (1.02–1.06)	< 0.001	1.05 (1.04–1.07)	< 0.001
Indication operative (ref)				
Trauma	4.18 (1.90–9.17)	0.001	3.08 (1.71–5.56)	< 0.001
Medical	5.45 (2.42–12.26)	< 0.001	3.28 (1.91–6.60)	< 0.001
Age (yr)	0.94 (0.90–0.98)	0.002	0.95 (0.92–0.98)	0.002
Plasma deficit	1.01 (0.99–1.01)	0.17	1.01 (0.99–1.01)	0.12

- A pragmatic, Bayesian, group sequential, combined non-inferiority/superiority, randomized, controlled, multicenter, phase III, platform trial of
  - Low titer group O whole blood vs component therapy
  - Tranexamic acid vs placebo
- Mechanisms of TIC and resuscitation effects will be investigated
  - Multi-OMICS
  - Viscoelastic assays
- Exception from Informed Consent

MATIC-2: General Methods

- 20 US high volume pediatric trauma centers
- 1000 subjects < 18 years of age
- Exception for Informed Consent
- A cross over cluster design
  - Sites randomly assigned to LTOWB or CT and TXA or placebo
    - Cluster stratified by #MTP/year at the 20 sites
  - Cross over for every 250 patients
- Rationale for design
  - Minimizes waste of LTOWB
  - Does not require 24/7 research coordinator coverage

Primary Outcome – 24 Hour Mortality

Evidence-Based and Clinically Relevant Outcomes for Hemorrhage Control Trauma Trials

John B. Holcomb, MD,⊠ *Ernest E. Moore, MD,† Jason L. Sperry, MD, MPH,‡ Jan O. Jansen, MBBS, PhD,§ Martin A. Schreiber, MD,¶ Deborah J. del Junco, PhD,|| Philip C. Spinella, MD,** Angela Sauaia, MD, PhD,†† Karim Brohi, MD,‡‡ Eileen M. Bulger, MD,§§ Andrew P. Cap, MD, PhD,¶¶ John R. Hess, MD, MPH, FACP, FAAAS,|||| Donald Jenkins, MD,*** Roger J. Lewis, MD, PhD,††† Matthew D. Neal, MD,‡‡‡ Craig Newgard, MD, MPH,§§§ Shibani Pati, MD, PhD,¶¶¶ Anthony E. Pusateri, PhD,|||||| Sandro Rizoli, MD, PhD,**** Robert T. Russell, MD, MPH,†††† Stacy A. Shackelford, MD,‡‡‡‡ Deborah M. Stein, MD, MPH,§§§§ Marie E. Steiner, MD, MS,¶¶¶¶ Henry Wang, MD, MS,|||||||| Kevin R. Ward, MD,***** and Pampee Young, MD, PhD†††††*

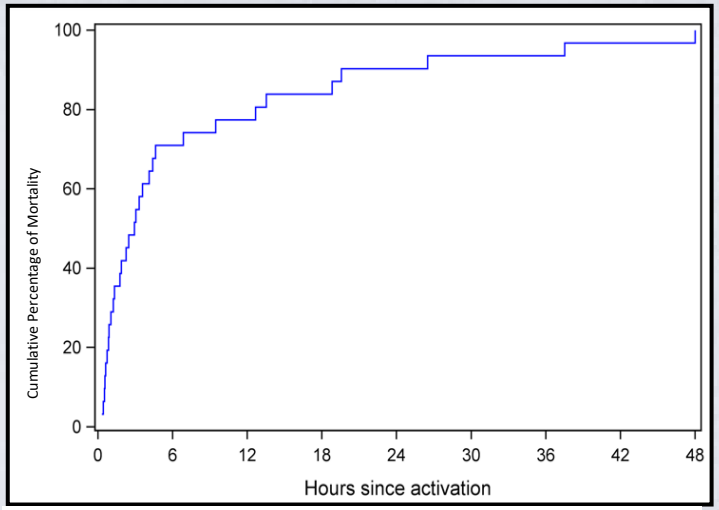


Figure 12: **Mortality due to hemorrhage in children with traumatic injury and life-threatening hemorrhage**

Eligibility Criteria

Inclusion criteria
1. Children, defined as less than 18 years of age with traumatic injury
2. MTP activation for confirmed or suspected active life-threatening traumatic bleeding
AND
Confirmed or suspected active life-threatening traumatic bleeding with at least 2 of 3 of the following criteria
Hypotension for age (< 5% tile)
Tachycardia for age (>95th % tile)
Traumatic injury with exam findings consistent with severe bleeding (e.g., penetrating injury, hemothorax, distended abdomen with bruising, amputation of limb).

Eligibility Criteria

Exclusion Criteria
Unknown time of injury
Greater than 3 hours since time of injury
History of seizure after the injury event
Known allergy or hypersensitivity reaction to TXA
Comatose (Glasgow Coma Score of 3) with fixed and dilated pupils suggesting nonsurvivable brain injury
MTP activated but no blood products given
Patients who required an ED thoracotomy or received more than 5 consecutive minutes of cardiopulmonary resuscitation (prior to receiving randomized blood products)
Patients who are obviously pregnant on clinical examination
Known prisoners as defined in protocol
Known ward of the state
Isolated hanging, drowning or burns
Previous enrollment in MATIC-2
Prior study opt-out with bracelet

Study Intervention

- LTOWB
  - Group O
  - Low titer is anti-A and anti-B < 200 (or supplier standard)
  - Leukocyte reduced/platelet sparing filter
  - Stored in CPD for up to 21 days at 1-6 Celsius
  - Maximum of 8 units
- CT
  - RBC, plasma, platelets in 1:1:1 unit ratio
  - All types of manufacturing methods permitted
- Once MTP is deactivated, standard of care (CT) will be used.

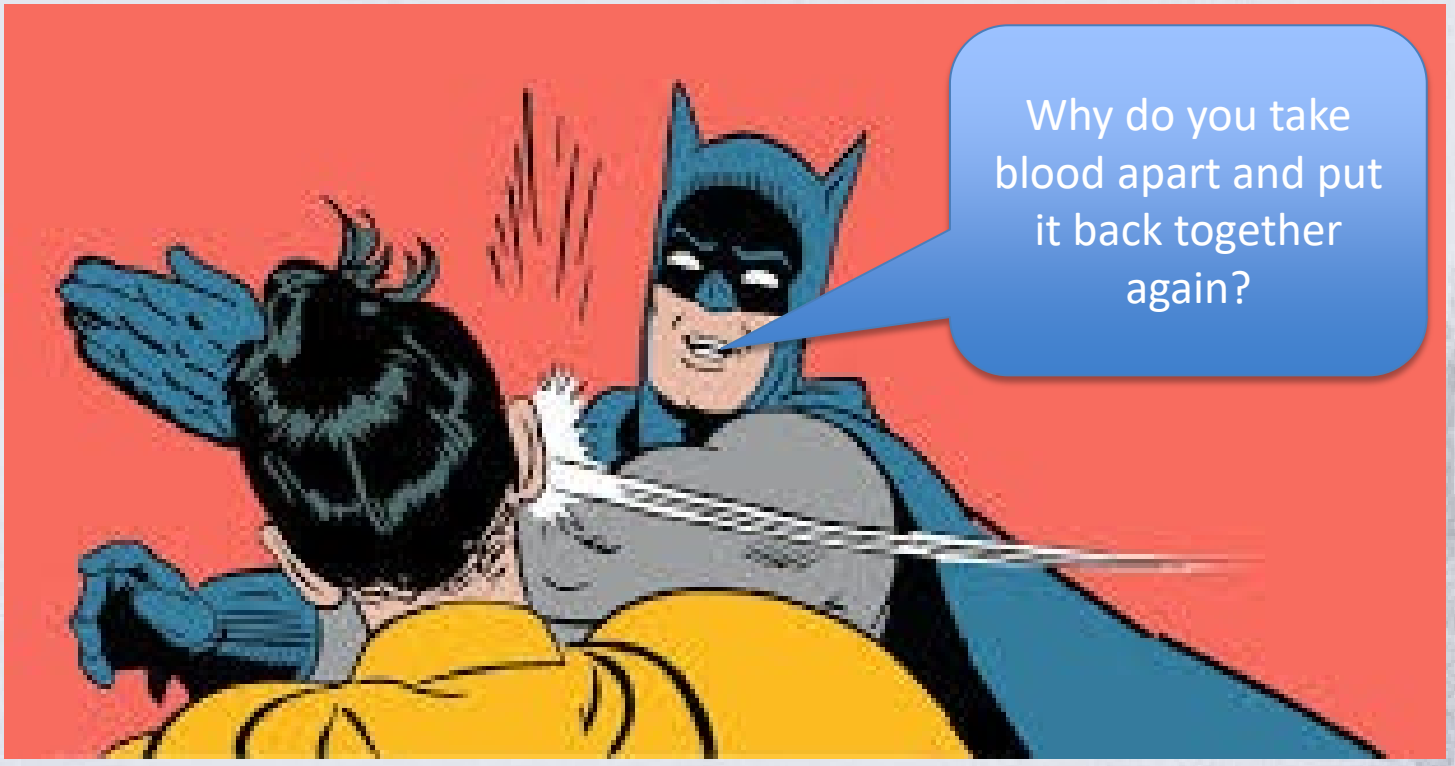
Study Intervention - TXA

- Dose of 25mg/kg (2 max IV dose)
  - No maintenance infusion
- Based on pharmacokinetic data from adult RCTs
  - Modeled for children of different weights

Conclusions

- LTOWB vs Component Therapy
  - Appears safe
  - Less expensive
  - Independently associated with reduced use of blood products and mortality
- RCTs are being performed in adult and pediatric populations

Questions?



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ISBT International Society of Blood Transfusion
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ORIGINAL PAPER

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The risk to future pregnancies of transfusing Rh(D)-negative females of childbearing potential with Rh(D)-positive red blood cells during trauma resuscitation is dependent on their age at transfusion

Jansen N. Seheult,[1,2] Michelle N. Stram,[3] Thomas Pearce,[1] Carolina B. Bub,[4] Stephen P. Emery,[5] Jose Kutner,[4] Naoko Watanabe-Okochi,[6] Jason L. Sperry,[7] Minoko Takanashi,[8] Darrell J. Triulzi[1,2] & Mark H. Yazer[1,2]

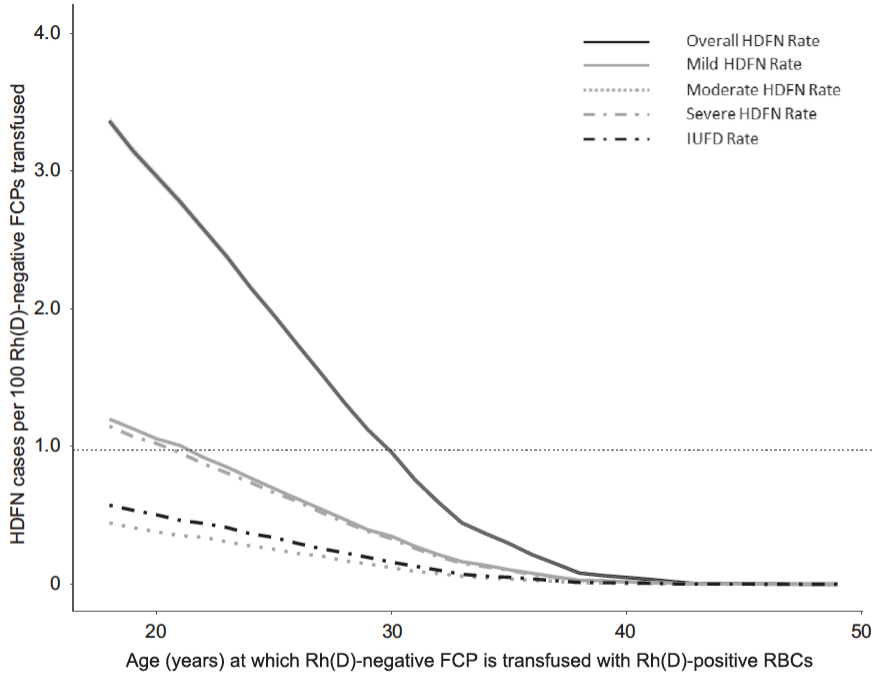

Fig. 3 Estimated rate of haemolytic disease of the fetus and newborn (HDFN), stratified by severity [mild, moderate, severe or intrauterine fetal demise (IUFD)], versus the age at which the Rh(D)-negative female of childbearing potential (FCP) is transfused with an Rh(D)-positive RBC-containing product during trauma resuscitation using assumptions for the United States. The dotted horizontal line represents the average overall HDFN rate of 0·97 HDFN cases per 100 Rh(D)-negative FCPs transfused across all ages from 18 to 49 years, assuming a uniform age distribution.

LETTER TO THE EDITOR

Vox Sanguinis ISBT International Society of Blood Transfusion

Vox Sanguinis. 2021;1–2.

Risk of future haemolytic disease of the fetus and newborn following the transfusion of Rh(D)-positive blood products to Rh(D)-negative children

Figure 1. Locally weighted smooth plot of the future risk of developing HDFN following the transfusion of Rh(D)-positive red blood cells or low titer group O whole blood to Rh(D)-negative FCPs between 0-49 years of age.