

Forskningsöversikt traumatologi

Katastrofmedicinskt centrum Linköping
Kunskapscentrum i traumatologi
på uppdrag av Socialstyrelsen

Bevakningsperiod 2 oktober 2020 - 1 oktober 2021



Sammanställt av Katastrofmedicinskt centrum, Linköping, Region Östergötland
Kunskapscentrum i traumatologi på uppdrag av Socialstyrelsen
Författarna svarar för innehåll och slutsatser

Linköping, 1 november 2021

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Introduktion

Denna rapport utgör en forskningsöversikt över kunskapsområdet traumatologi och är en av tre årliga leveranser inom uppdraget som kunskapscentrum i katastrofmedicin genomför på uppdrag av Socialstyrelsen. I upphandlingsdokument (2.7-31938/2019) beskrivs leveransen som följer: Forskningsöversikten ska omfatta en sammanställning av vetenskaplig litteratur (artiklar i vetenskapliga tidskrifter och doktorsavhandlingar) samt presentationer på vetenskapliga möten och konferenser i urval som publicerats och/eller presenterats under föregående år. Baserat på ovanstående underlag ska Kunskapscentrumet identifiera och kortfattat summera forskningsresultat inom kunskapsområdet som direkt eller indirekt kan stärka den svenska hälso- och sjukvårdens katastrofmedicinska beredskap...Kunskapscentrumet ska även identifiera kunskapsluckor inom kunskapsområdet samt analysera och dra slutsatser gällande behov av framtida forskningsstudier som kan stärka den svenska hälso- och sjukvårdens katastrofmedicinska beredskap.

Metod

Urvalet av artiklar är baserat på det omvärldsbevakningsarbete som pågått under bevakningsperioden: kunskapscentrumet har identifierat ett visst antal källor med instruktion i upphandlingsdokument och på basen av publikationpraxis inom det svenska fältet och kontinuerligt inhämtat publikationer från databasen PubMed. För begränsning i ett brett forskningsfält har sökning i databas koncentrerats på trauma, traumavård och/eller injury och forskning som pågår i eller utgår från Sverige. Bevakning av utvalda tidskrifter inkluderar internationell forskning och riktlinjer från medicinska föreningar och ämnesföreträdare. Manuell bevakning av utvalda tidskrifter och tips från involverat nätverk kompletterade databassökning. Publikationer om akutvård och prehospital vård med inriktning på trauma, kvalitetssäkring och blodprodukter/läkemedel inkluderades. Civilas roll i prehospitala vårdkedjan och uppföljning/rehabilitering har inkluderats, som ett steg i att täcka in publikationer om forskning om "trauma chain of survival". Specifika skadetyper associerade till ortopedi eller sportmedicin exkluderades.

PubMed-sökning

Söktermer : Trauma or trauma care or injury and Sweden
Trauma care and Sweden in Swedish
Trauma/care and Covid-19

Bevakade tidskrifter

Prehospital and Disaster Medicine
European Journal of Trauma and Emergency Care
American Journal of Emergency Care
Journal of Trauma and Acute Care Surgery
Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine
Academic Emergency Medicine
Prehospital Emergency Care
Journal of American College of Surgeons
World Journal of Surgery
JAMA Surgery
Resuscitation
Injury
Burns
Trauma

Resultat

Under bevakningsperioden inkluderades 208 artiklar. Publikationerna delades in i elva kategorier enligt forskningsområde och ämne (bilaga 1). En fjärdedel av publikationerna var inom identifierade kategorin vårdkvalitet och prediktion. Vi lyfter publikationer inom pandemiomställning, prehospital vård (transporter och blodprodukter), tactical medicine, riktlinjer och forskning om skador associerade med elsparkcyklar som aktuellt ämne.

Covid-19

Covid-19-pandemin och omställning av vården har dominerat även inom traumaforskningen och publikation. Vi inkluderar en bråkdel artiklar som behandlar bland annat pandemins påverkan på traumaförekomst och typer av trauma, omställning av vården, risker för vårdpersonal och effekt av lockdowns. Studier och beskrivningar om omställning av akutvården och vårdens processer återfinns från olika delar av världen, där italienska erfarenheter publicerades brett efter den första vågen. Tillämpning av studieresultat från liknande studier genomförda i USA begränsas delvis av uppdelningen av det amerikanska traumasystemet i olika nivåer. I svensk kontext beskrivs och utvärderas omställning av akutflöden i en studie från Huddinge sjukhus.

En omfattande studie från Israel kartlägger förekomsten av trauma och sjukhusinläggningar under mars och april 2016-2020. Data om kliniska och demografiska parametrar samt om omständigheter hämtades från nationellt traumaregister omfattande 21 sjukhus. Pandemin och lockdown i Israel påverkade förekomst av trauma och sjukhusintag; färre traumapatienter inkom men med allvarligare skador. Ändringen i allvarlighetsgrad förekom i grupperna moderat (ISS-9-14) och allvarligt skadad (16-24), inte i kritiskt skadade (över 25).

Rozenfeld, Met al. COVID-19 Changed the Injury Patterns of Hospitalized Patients. *Prehospital and Disaster Medicine*, 36(3), 251-259.

Chieragato A, et al. Emergently planned exclusive hub-and-spoke system in the epicenter of the first wave of COVID-19 pandemic in Italy: the experience of the largest COVID-19-free ICU hub for time-dependent diseases. *Minerva Anestesiol* 2021 Oct;87(10):1091-1099.

Qasim, Zaffer et al. Trauma center activity and surge response during the early phase of the COVID-19 pandemic—the Philadelphia story. *Journal of Trauma and Acute Care Surgery*: October 2020 - Volume 89 - Issue 4 - p 821-828.

Af Ugglas B, Skyttberg N, Wladis A, Djärv T, Holzmann MJ. Emergency department crowding and hospital transformation during COVID-19, a retrospective, descriptive study of a university hospital in Stockholm, Sweden. *Scand J Trauma Resusc Emerg Med*. 2020 Oct 28;28(1):107.

Chiba, H et al. “Safer at home”: The effect of the COVID-19 lockdown on epidemiology, resource utilization, and outcomes at a large urban trauma center. *Journal of Trauma and Acute Care Surgery*: April 2021 - Volume 90 - Issue 4 - p 708-713.

En studie från Mayo Clinic (USA) undersöker pandemins effekt på aggressivitet och hot mot personal på akutmottagning. Studien kombinerade enkät och register över händelser och visade positiv association mellan covid-19-pandemin och incidens av aggressivt beteende och överfall mot akutpersonal, speciellt hade förekomsten av att attacker med någon typ av kroppsvätska ökat. Ett fokus på vårdpersonalens säkerhet i framtida pandemier efterfrågas.

MacGuire, S.S et al. Impact of the COVID-19 pandemic on workplace violence at an academic emergency department. *The American Journal of Emergency Medicine*, available online September 23.

Prehospital vård

I kategorin prehospital vård framkom studier om transportsätt av traumatiskt skadade i USA och Libanon, där det förekommer att polisen transporterar skadade (speciellt skottskadade) till sjukhus. I samband med särskilda händelser med skjutningar och sprängningar i Sverige kan behovet och förekomsten av att annan blåljuspersonal transporterar skadade till sjukhus komma att diskuteras. Vi lyfter en kohortstudie från ett level 1-traumacentrum i USA och två artiklar om transport av skadade med data från nationella traumaregister i Libanon och USA med sistaförfattare Dr Mazen El Sayed.

I artikeln "Police transport of firearm-injured patients—more often and more injured" av Maher, Z et al. från juli 2021 ses en ökande trend av skottskadade patienter som transporterades av polis till ett level 1-traumacentrum i Philadelphia mellan 2012 och 2018; 48, 9 procent av skottskadade anlände till sjukhus med polistransport år 2012, 2018 var siffran 78,5 procent. Studien undersökte mortaliteten för patienterna och visar att skottskadade som anlände med polis var allvarligare skadade men att mortaliteten jämfört med patienter som anlant med ambulanstransport var lika.

Maher, Zoë; Beard, Jessica H.; Dauer, Elizabeth et al. Police transport of firearm-injured patients—more often and more injured. *Journal of Trauma and Acute Care Surgery*: July 2021 - Volume 91 - Issue 1 - p 164-170.

De nationella studierna visar på liknande tendenser: i båda länderna har polistransport av skadade ökat men att vanligaste skadetyper som transporterades av polis var trubbigt trauma, följt av penetrerande trauma. Studierna i båda länderna visar att överlevnad av patienter med trubbigt trauma inte påverkades av transportör eller av att polisen tog patienten till närmaste sjukhus, men också att enklare triagering och införande av protokoll kan stödja polisen i arbetet med traumatiskt skadade.

Sakr, F., Bachir, R., & El Sayed, M. Association between Mode of Transportation and Survival in Adult Trauma Patients with Blunt Injuries: Matched Cohort Study between Police and Ground Ambulance Transport. *Prehospital and Disaster Medicine*, Volume 36 issue 4.

Ghassan Bou Saba, Rana Bachir & Mazen El Sayed.

Impact of Trauma Center Designation Level on the Survival of Trauma Patients Transported by Police in the United States. *Prehospital Emergency Care*, Accepted author version online: 22 Sep 2021.

I samband med omvärldsanalys traumatologi och workshoparbete kring bevakningarna om ämnesområdet identifierades forskningsbehov om vårdkvalitet av skottskadade i Sverige. I dagsläge är inte kvalitetssäkring av vården av skottskadade standardiserad, och om trenden med förekomst av skjutningar fortgår kommer antalet vårdade i skottskador att fortsätta öka. Skjutningsfallen ansågs inte betungande av analysgruppen som i att de kan hanteras, men uppföljning och utvärdering av vård av skottskadade saknas.

Blodprodukter och transfusion

Kategorin med näst flest inkluderade publikationer var kategorin blodprodukter och läkemedelsbehandling vid massiva blödningar. Publikationen "Patterns of blood use in Sweden from 2008 to 2017: A nationwide cohort study" av Auvinen, MA et al. kartlägger transfusioner i Sverige och visar att blodtransfusioner har minskat under den studerade perioden, med undantag för användning av trombocyter. Wikman, A. et al. lyfter frågan om blodförsörjning i katastrofer i Sverige i en artikel i *Läkartidningen* i mars 2021 i en serie om transfusionsstrategier. Huvudbudskapen i arbetet är:

- Det saknas en nationell beredskapsplan för blodförsörjning vid kris- och katastrofhändelser, och regionala/lokala planer är begränsade.

- Blodlager på sjukhusen motsvarar 1–3 veckors normalförbrukning.

- Regionala lager av kritiskt material vad gäller blodpåsar samt blodtypnings- och virusreagens är begränsade.

- Prehospital användning av blodprodukter har introducerats i några regioner.

- Vid en masskadehändelse kan tillgång på pre-hospitalt blod rädda liv.

- En enhet helblod innehåller alla blodfaktorer, är lätt att hantera och kan relativt snabbt mobiliseras – men prehospital tillgänglighet är en logistisk utmaning.

Agneta Wikman, Beatrice Aspevall Diedrich, Rut Norda, Denise Bäckström, Andreas Wladis, Patrik Nimberger Hansson. Blodförsörjning vid katastrofer – en nationell beredskap behövs. *Läkartidningen*. 2021,118:20149.

Prehospitala transfusioner undersöktes av en dansk grupp i en prospektiv, icke-randomiserad klinisk observationsstudie. Enligt författarna lider 25 procent av traumapatienter av koagulopatier när de anländer till sjukhus. Relativt nya strategier för att stävja koagulopati, med inspiration från militärmedicinen, så som damage control resuscitation förespråkar användning av blodkomponenter för tidig transfusion. Tidigare studier kommer främst från akutvård i helikopterambulans. Syftet med studien var att karaktärisera patienterna som erhöll prehospital blodkomponentsbehandling och utvärdera om behandlingsmöjligheten ska finnas tillgänglig. Inkluderade patienter behandlades av prehospitalt team med akutläkare. Resultaten visar att blodkomponentsbehandling är genomförbart frekvensmässigt för akutläkarbil och team i mellanstor skandinavisk stad. Resultat av behandlingen var förbättrad fysiologisk status och mildare grad av chock efter transfusion.

Sætre Michalsen, K et al. Prehospital Transfusion of Red Blood Cells and Plasma by an Urban Ground-Based Critical Care Team. *Prehospital and Disaster Medicine*, 36(2), 170-174.

Traumainducerad koagulopati diskuteras och definieras i publikationen "Variations and obstacles in the use of coagulation factor concentrates for major trauma bleeding across Europe: outcomes from a European expert meeting." från januari 2021. Riktlinjer för behandling av traumainducerad koagulopati saknas i Europa i dag och konsensusmötet förespråkar standardisering av definition och initiativ till användning av koagulationsfaktorkoncentrat.

Černý, V., Maegele, M., Agostini, V. et al. Variations and obstacles in the use of coagulation factor concentrates for major trauma bleeding across

Europe: outcomes from a European expert meeting. *Eur J Trauma Emerg Surg* (2021).

En översiktsartikel av Tucker, H. et al. pekar på heterogenitet i resultatmått och definitioner i forskning om transfusion med blodkomponenter; fokus läggs på klinisk effektivitet men inte på säkerhet eller skadliga effekter. Konsultering av intressenter och Delphi-process för att avgöra relevanta resultatmått föreslås.

Tucker, Harriet et al. Outcome measures used in clinical research evaluating pre-hospital blood component transfusion in traumatically injured bleeding patients. *Journal of Trauma and Acute Care Surgery*: July 12, 2021.

Tactical medicine och masskadehändelser

Prehospital and Disaster Medicine utgav under sommaren 2021 ett antal publikationer om terrorism, vapen- och skadepanorama och utfall i händelserna, samt uppkomsten av en disciplin som i publikationerna kallas counter-terrorism medicine. I studien "Half-a-Century of Terrorist Attacks: Weapons Selection, Casualty Outcomes, and Implications for Counter-Terrorism Medicine" användes data från The Global Terrorism Database (GTD) för att göra epidemiologisk undersökning av fatala terrorattentat mellan 1970 och 2019. Totalt 160 003 fall inkluderades där 48,78 procent av terrorhandlingarna utfördes med explosiva ämnen och skjutvapen användes i 26,77 procent av fallen. Dödliga skador per händelse under de senaste 50 åren var 2,14 och icke-dödliga 3,22. Hotet som utgörs av bruk av CBRN-vapen speglas i värden för icke-dödliga skador på 49,62 per händelse för kemiska vapen respektive 28,75 för biologiska vapen. Författarna betonar vikten av framtida beredskap på asymmetriska, multimodala attacker fastän dessa historiskt har låg incidens.

Derrick Tin, Colton Margus, Gregory R. Ciottone. Half-a-Century of Terrorist Attacks: Weapons Selection, Casualty Outcomes, and Implications for Counter-Terrorism Medicine. *Prehospital and Disaster Medicine*, 36(5), 526-530.

Tin D, Hart A, Ciottone GR. A Decade of Terrorism in the United States and the Emergence of Counter-Terrorism Medicine. *Prehosp Disaster Med.* 2021 June 17.

Tin D, Granholm F, Hart A, Ciottone GR. Terrorism-Related Chemical, Biological, Radiation, and Nuclear Attacks: A Historical Global Comparison Influencing the Emergence of Counter-Terrorism Medicine. *Prehosp Disaster Med.* 2021 Aug.

the United States. *Trauma*, available online September 25.

Namiri NK, Lui H, Tangney T, Allen IE, Cohen AJ, Breyer BN. Electric Scooter Injuries and Hospital Admissions in the United States, 2014-2018. *JAMA Surg.* 2020;155(4):357–359.

Tendenser, trend - elsparkcyklar

Möjligheten att hyra och använda elsparkcykel har i dagsläget spridit sig till flertalet svenska städer och speciellt i storstäderna är användningen hög; i Stockholm fanns 15 100 elsparkcyklar i bruk i slutet av juli 2021 (Trafikkontoret Stockholms stad).

”The injury panorama of electric scooter accidents in Gothenburg”, examensarbete av läkarstudenten David Flanking, undersökte statistik från STRADA-registret och utförde en enkätstudie på akuttagningarna på Sahlgrenska och Mölndals sjukhus. Under 2019 sökte 198 elsparkcykelskadade patienter vård. Majoriteten av skadorna skedde nattetid och under helger, 54,4 procent under alkoholpåverkan. Patienterna var unga och skador till huvud- och ansikte, samt skador i armar och ben var vanligast; 9,9 procent hade använt hjälm vid skadetillfället och 15 patienter krävde kirurgisk vård.

Publikationen “Electric Scooter Injuries and Hospital Admissions in the United States, 2014-2018” från januari 2020 visar på kraftig ökning i skador associerade med elsparkcyklar mellan 2017 och 2018. En studie från USA september 2021 baserad på liknande data från The National Electronic Injury Surveillance System (NEISS) visar att runt 28 700 olyckor med elsparkcyklar skedde i USA under 2019 (jämfört med 270 500 cykelolyckor). Nio procent av elsparkcykelolyckorna var associerade med alkohol- eller drogbruk (8 procent respektive 1 procent); 60 procent av alkohol- och drogrelaterade skador var skullskador.

Namiri NK, Lee AW, Amend GM, Vargo J, Breyer BN. Impact of alcohol and drug use on bicycle and electric scooter injuries and hospital admissions in

Riktlinjer

Kategorin riktlinjer innefattar publikationer om behandling, protokoll och beslutsstöd från föreningar och beslutande organ.

Zideman DA, Singletary EM, Borra V, Cassan P, Cimpoesu CD, De Buck E, Djärv T, Handley AJ, Klaassen B, Meyran D, Oliver E, Poole K. European Resuscitation Council Guidelines 2021: First aid. Resuscitation. 2021 Apr.

Peden CJ. et al. Guidelines for Perioperative Care for Emergency Laparotomy Enhanced Recovery After Surgery (ERAS) Society Recommendations: Part 1-Preoperative: Diagnosis, Rapid Assessment and Optimization. *World J Surg.* 2021 Mar 6.

Yli-Hankala A, Chew MS, Olkkola KT, Rehn M, Sverrisson KÖ, Møller MH. Clinical practice guideline on spinal stabilisation of adult trauma patients: Endorsement by the Scandinavian Society of Anaesthesiology and Intensive Care Medicine. *Acta Anaesthesiol Scand.* 2021 May 28.

Sönnerqvist C, Brus O, Olivecrona M. Validation of the scandinavian guidelines for initial management of minor and moderate head trauma in children. *Eur J Trauma Emerg Surg.* 2021 Aug.

Lyng, J. et al. Recommended Essential Equipment for Basic Life Support and Advanced Life Support Ground Ambulances 2020: A Joint Position Statement. *Prehospital Emergency Care*, 25:3, 451-459.

McElroy, L., Robinson, L., Battle, C. et al. On behalf of NaTRIC. Use of a modified Delphi process to develop research priorities in major trauma. *Eur J Trauma Emerg Surg* (2021).

Riktlinjer vid masskadehändelse:

Hughes, A et al. Recommendations for burns care in mass casualty incidents: WHO Emergency Medical Teams Technical Working Group on Burns (WHO TWGB) 2017-2020.

Burns, Volume 47, Issue 2, 2021, Pages 349-370.

Asa M. Margolis, Alison K. Leung, Matt S. Friedman, Sean P. McMullen, Francis X. Guyette & Nathan Woltman (2021) Position Statement: Mass Gathering Medical Care.

Prehospital Emergency Care, 25:4, 593-595

Pågående registerforskning

SweTraus årsrapport 2020 (publicerad 2021-09-22) listar registeruttag från SweTrau för forskning från 2016 till 2021 (s. 46 i rapporten). Uttag för följande studier har gjorts 2021:

Mortalitet till följd av svåra traumatiska hjärnskador hos patienter som handläggs på traumacenter och icke-traumacenter i Sverige

Tid till sjukhus för traumapatienter i Sverige

Digitala beslutsstöd för rekommendation av transportdestination för traumapatienter

Polytrauma patients – epidemiology and outcome

Radiologisk diagnostik vid penetrerande och trubbigt trauma – en registerstudie med fokus på bukskador (lokalt KS Solna)

Blödning och koagulopati vid traumatisk skada (lokalt uttag KS Solna)

Radiologisk utvärdering av halsryggsskador (lokalt uttag KS Solna)

Radiologisk diagnostik vid penetrerande trauma (lokalt uttag KS Solna)

Extrakorporeal membranoxygenering vid trauma (lokalt uttag KS Solna)

Bilaga 1

Kategoriindelning av totalt 208 inkluderade publikationer. Antal inkluderade publikationer om Covid-19 är kraftigt begränsat.

Identifierad kategori	Antal inkluderade publikationer
Vårdkvalitet & prediktion	55
Prehospitalt & skadepanorama	30
Blodprodukter & läkemedelsbehandling	23
Covid-19	18
Civila & utbildning	18
Riktlinjer	15
Triage	13
Tactical medicin & masskadehändelser	13
Traumaforskning, metodik	8
Vårdpersonal	8
Rehabilitering	7

Bilaga 2

Inkluderade publikationer under bevakningsperioden 2 oktober 2020 – 1 oktober 2021

Kategori Vårdkvalitet och prediktion

Haugland H, Olkinuora A, Rognås L et al.	Mortality and quality of care in Nordic physician-staffed emergency medical services.	Scand J Trauma Resusc Emerg Med. 2020 Oct 14;28(1):100
Ydenius V, Larsen R, Steinvall I, Bäckström D, Chew M, Sjöberg F	Impact of hospital type on risk-adjusted, traffic-related 30-day mortality: a population-based registry study	Burns Trauma. 2021 Mar 6
Hibert-Carius P, McGreevy DT, Abu-Zidan FM et al.	Revised Injury Severity Classification II (RISC II) is a predictor of mortality in REBOA-managed severe trauma patients	PLoS One. 2021 Feb 10
McGreevy DT, Sadeghi M, Nilsson KF, Hörer TM	Low profile REBOA device for increasing systolic blood pressure in hemodynamic instability: single-center 4-year experience of use of ER-REBOA.	Eur J Trauma Emerg Surg. 2021 Jan 30
Magnusson C, Gärskog J, Lökhölm E, et al.	Prediction of a time-sensitive condition among patients with dizziness assessed by the emergency medical services	BMC Emerg Med. 2021 Mar 25
Cao Y, Forssten MP, Mohammad Ismail A, et al.	Predictive Values of Preoperative Characteristics for 30-Day Mortality in Traumatic Hip Fracture Patients.	J Pers Med. 2021 Apr 28
Westman A, Saveman BI, Björnstig U et al.	Mobilisation of emergency services for chemical incidents in Sweden - a multi-agency focus group study.	Scand J Trauma Resusc Emerg Med. 2021 Jul 21;29(1):99
Khaki D, Hietanen V, Corell A et al.	Selection of CT variables and prognostic models for outcome prediction in patients with traumatic brain injury.	Scand J Trauma Resusc Emerg Med. 2021 Jul
Holm S, Engström O, Petäjä I, Huss F.	Does the estimation of burn extent at admission differ from the assessment at discharge?	Scars Burn Heal. 2021 Jun 21
Muhrbeck M, Osman Z, von Schreeb J et al.	Predicting surgical resource consumption and in-hospital mortality in resource-scarce conflict settings: a retrospective study	BMC Emerg Med. 2021 Aug 11
Cancelliere C, Boyle E, Côté P et al.	Predicting nonrecovery in adults with incident traffic injuries including post-traumatic headache.	Accid Anal Prev. 2021 Sep;159:106265
MacKinnon RJ, Slater D, Pukk-Härenstam K et al.	Adaptations to practice and resilience in a paediatric major trauma centre during a mass casualty incident.	Br J Anaesth. 2021 Sep 22
Földesi, M et al.	Fibrinogen level at hospital admission after multiple injury correlates with BMI and is negatively associated with the need for transfusion and early multiple organ failure	Injury, 2021-03-01, Volume 52, Pages S15-S20

Amos, T et al.	ECMO (extra corporeal membrane oxygenation) in major trauma: A 10 year single centre experience	Injury, 2021-09-01, Volume 52, Issue 9, Pages 2515-2521,
Djuric, O et al.	Genetic variants in TNFA, LTA, TLR2 and TLR4 genes and risk of sepsis in patients with severe trauma: nested case-control study in a level-1 trauma centre in SERBIA	Injury, 2021-03-01, Volume 52, Issue 3, Pages 419-425
Chun-Sing Huang, Travis Miles, Brice Thomas et al.	A CALL FOR STANDARDIZATION: PRACTICE PATTERNS AND MANAGEMENT OF CRITICAL ILLNESS-RELATED CORTICOSTEROID INSUFFICIENCY IN SURGICAL INTENSIVE CARE UNITS	Injury Volume 52, Issue 9, September 2021, Pages 2522-2525
Daniel Jin Keat Lee, Min Li Kang et al.	Improving trauma care in exsanguinating patients with CHOP (Critical Hemorrhage to Operating-room Patient) resuscitation protocol – A cumulative summation (CUSUM) analysis,	Injury Volume 52, Issue 9, September 2021, Pages 2508-2514
Kirsten Vallmuur, Cate M Cameron, Angela Watson, Jacelle Warren	Comparing the accuracy of ICD-based severity estimates to trauma registry-based injury severity estimates for predicting mortality outcomes	Volume 52, Issue 7, July 2021, Pages 1732-1739
Emily C. Alberto, Elise McKenna, Michael J. Amberson et al.	Metrics of Shock in Pediatric Trauma Patients: A Systematic Search and Review	Injury VOLUME 52, ISSUE 10, P3166-3172, OCTOBER 01, 2021
Grant et al	Improved documentation following the implementation of a trauma registry: A means of sustainability for trauma registries in low- and middle-income countries	Injury VOLUME 52, ISSUE 9, P2672-2676, SEPTEMBER 01, 2021
Stroop et al	Efficacy of an Infrared Radiator for Hypothermia Prevention in a Simulated Setup of Entrapped Vehicle Accident Victims	Injury VOLUME 52, ISSUE 9, P2491-2501, SEPTEMBER 01, 2021
Baeikgaard et al	A high fraction of inspired oxygen may increase mortality in intubated trauma patients – A retrospective cohort study	Injury online September 17.
Luu et al	Outcomes following Traumatic Inhalational Airway Injury – Predictors of Mortality and Effect of Procedural Intervention	Injury online September 17.
Kay, A et al.	Trauma patients at risk for venous thromboembolism who undergo routine duplex ultrasound screening experience fewer pulmonary emboli: A prospective randomized trial	Journal of Trauma and Acute Care Surgery: May 2021 - Volume 90 - Issue 5 - p 787-796
Tran, A et al.	Current practices and challenges in assessing traumatic hemorrhage: An international survey of trauma care providers	Journal of Trauma and Acute Care Surgery: May 2021 - Volume 90 - Issue 5 - p e95-e100
Bunn, Corinne MD; Ringhouse, Brendan MD; Patel, Purvi MD et al.	Trends in utilization of whole-body computed tomography in blunt trauma after MVC: Analysis of the Trauma Quality Improvement Program database	Journal of Trauma and Acute Care Surgery: June 2021 - Volume 90 - Issue 6 - p 951-958
Helen Träff, Lars Hagander, and Martin Salö	Association of transport time with adverse outcome in paediatric trauma	BJS Open. 2021 May; 5(3): zrab036.

Tillmann, Bourke W. et al	The timing of amputation of mangled lower extremities does not predict post-injury outcomes and mortality: A retrospective analysis from the ACS TQIP database	Journal of Trauma and Acute Care Surgery: September 2021 - Volume 91 - Issue 3 - p 447-456
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