Name: Chloe Ann Bourke Subbi

Essay Title: Critically Appraised Topic in Trauma

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Title: Paramedics cannot accurately estimate burns and total body surface area (TBSA).

Clinical scenario

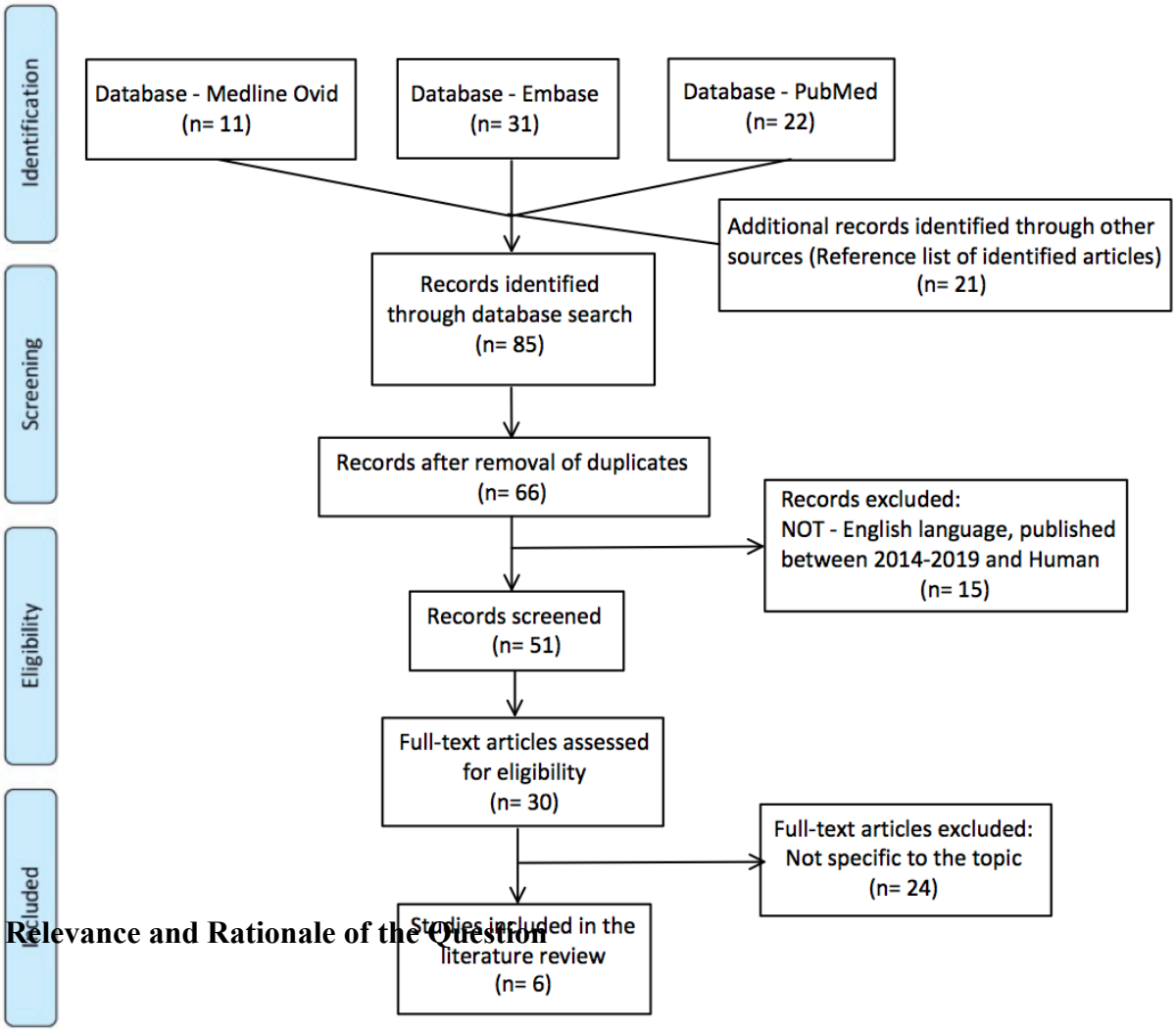
A paramedic is called to a patient entrapped in a house fire where they have sustained extensive burns to their body.

PICO (Population-Intervention-Comparison-Outcome) Question

In prehospital burn patients, can paramedics accurately estimate burns and TBSA compared to a Burns Unit.

Search Strategy

(Paramedic* OR prehospital OR pre-hospital OR out of hospital OR "out-of-hospital" OR ambulance* OR "emergency medical services") AND (estimate* OR calculate OR approximate OR guess) AND (burns OR burn*) AND (body surface area) limit to (English language AND humans AND year="1st January 2014 – 6th September 2019").



Relevance and Rationale of the Question

Burns and TBSA estimation is a crucial component in the management of an acute burn's patient, guiding further interventions, such as fluid resuscitation and resources. Therefore, it is important that this PICO question is explored further as it is widely known that paramedics overestimate burns.

Relevant Papers

Author and Year	Study Design (LOE)	Population: Sample and characteristics	Aim	Results	Strengths and Limitations
Face & Dalton, 2017	Retrospective record review LOE 2	123 Paediatrics under 16 years between January 2009 and January 2011.	Do estimates of the TBSA of burns differ between NSW NETS and the BU.	- 40% of cases received an initial overestimation of TBSA. - 60% of the burn's estimated with a TBSA >10% were similarly assessed as >10% by the BU. - Children with burns >10% TBSA require fluids. Therefore, if the burn is overestimate, it	Strengths - Compared the estimations of TBSA of burns between NETS and the BU. Limitations - Limited age group and sample size. - NETS only transport patients from a hospital to a BU hospital. - Only included patients with a burn size of 10% or greater.

				changes patient management. - Only two of the 18 cases with >20% TBSA burns, was acutely estimated.	
Fussell, Blackbrun, & Ross, 2014	Observational study LOE 3	82 HCPs took part in the experiment. The experiment comprised of a paediatric mannequin with a burn on its torso. HCPs estimated the TBSA of this burn, and stated how they come to this answer.	Assess the accuracy of estimations between pre-hospital clinicians, a paediatric ED and a specialist paediatric BU.	- 98% of participants overestimated the TBSA with 16% estimating ≥10% TBSA. - Overestimation was far more pronounced in ambulance staff and GPs, and the most accurate by the BU.	Strengths - It was a controlled study as the mannequin had a pre-determined burn size of 3%, according to both the Palmar method and the Lund & Browder Chart. - They used a template of the hand of the paediatric mannequin and copied it three times to design the burn, limiting bias in the burn size.

					Limitations - A vast range of methods were used to estimate the TBSA. This can cause inconsistencies in the data as HCP were not further broken down into the category of method used. Instead they were only separated into health professions. - Only 24 paramedics participated in the study.
McCulloh, et al., 2018	Retrospective review LOE 2	139 patients ≤18 years of age with TBSA ≥10% who presented to hospital within 24 hours of	To determine how accurate prehospital, nonburn center, and ED providers are at estimating	- Sixty-seven of the 139 patients studied were transported by EMS and had transport documentation available with a	Strengths - Compared prehospital EMS providers, nonburn centre, and physicians to BU physicians.

		injury between 2007–2015.	large pediatric burns.	prehospital determination of TBSA. - Overestimate of TBSA was highest by prehospital EMS providers at 40%.	- Consistent with other study findings on the same topic. Limitations - Does not allow for determination of causes of estimation variance. - Each group used different methods to calculate the TBSA which could have caused discrepancies in the findings. - Only included patients with burns greater than 10%, that were less than 18 years. - Providers did not include in their estimates the specific body areas, or if confounding areas such as

					erythema were included.
Kallinen, Koljonen, Tukiainen, Randell, & Kirves, 2016	Observational cohort study LOE 3	67 patients ≥18 years with a TBSA of 20% or greater, treated at Töölö Hospital between 1st January 2006 and 31st December 2010.	To identify factors associated with the prognosis and survival of burn patients by analysing data related to the prehospital treatment of burn patients transferred directly to the BU from the accident site.	- The assessment of prehospital burn injury was reasonably accurate in both physicians and paramedics. - Variables found to be independently associated with 30-day mortality were age, female gender, and final TBSA. - The median difference between prehospital and final TBSA was 3%.	Strengths - Assessed the effects of incorrect burn estimation and its relation to mortality rates. Limitations - Prehospital estimates were completed by the person with the highest level of training therefore most estimations were done by prehospital physicians and not paramedics. - Only 18 out of the 67 patients were treated by paramedics. These 18 patients had less severe burn injuries

					compared to the other 49 patients. - Relatively small number of patients, which poses its own limitations in the statistical analysis. - The assignment of patient groups was not random. - Only included adult burn patients with severe burns. - The prehospital TBSA estimate was assessed in 54% of cases.
Hall & Burns, 2017	Retrospective review LOE 2	490 patients of all ages between January 2010 and August 2015.	To describe patient demographics, injuries, physiology and interventions performed by retrieval physicians in	- Retrieval physicians' overestimate TBSA, compared to the BU. - 25.9% of pre-hospital burn estimations of TBSA were	Strengths - Documentation of cases were entered into an electronic database and checked daily for completeness and accuracy by a senior clinician.

			the care of burns patients in both a pre-hospital and inter-hospital setting.	accurately estimated and 55.5% overestimated. - Overestimation exceeding under-estimation by a ratio of 3:1.	Limitations - Flash and flame burns were the predominant aetiology of burns associated in this cohort, which could have had an influence on burn overestimation due to increased amounts of erythema, which can confuse pre-hospital physicians on its inclusion or exclusion. - Only 105 out of the 490 were prehospital estimations. 27 from ambulance and 76 by helicopter physicians plus an extra two seen by both clinicians.

					- All patients had a high TBSA burned.
Caldwell, et al., 2017	Retrospective review LOE 2	73 adults between January 2007 and December 2013	To evaluate the BFS in terms of ongoing utilisation, resuscitation management, and outcomes of patients transported.	- 26% of TBSA was accurate, 41% overestimated, and 33% underestimated. - 6% of patients had an estimation error greater than 20%.	Strengths - Examined accuracy of initial burn size estimations by comparing the BFS TBSA to the TBSA measured during BU admission. - Education was provided throughout the study to improve burn and TBSA estimations. Limitations - Only 61% of documentation was completed which caused gaps in the data. - Only included patients with an estimated burn size of greater than 20%.

					- In 2012 during the study the BFS was changed and modified which could have affected data.

Abbreviations: BFS; Burn Flow Sheet, BU; Burns Unit, HCP; Healthcare Professional, LOE; Level of evidence, ED; Emergency Department, EMS; Emergency Medical Service, GP; General Practitioner, NETS; Newborn and Paediatric Emergency Transport Service, NSW; New South Whales, Total body surface area; TBSA.

Comments

There were some difficulties with this PICO question because very few studies, have been conducted within the last 5 years, that looked at the accuracy of paramedic burn calculation and TBSA compared to a BU. Current literature focuses on comparing the accuracy of 2-dimensional methods used in pre-hospital and inter-hospital care, to 3-dimentional computer and mobile applications. There is older literature related to the PICO question however due to the year of the studies they are not credible. Relevant articles found that paramedics are likely to overestimated burns compare to a BU. Inexperienced paramedics were more likely to overestimate a burn size compared to experienced paramedics (Borhani-Khomani, Partoft, & Holmgaard, 2017). Furthermore, evidence discussed how the methods used to estimate burns and TBSA, such as the Palmar method, Wallace rule of nines and the Lund and Browder Chart, are not reliable (Chan, et al., 2012). Evidence found that the mathematics used some methods confused paramedics causing inaccuracies in estimations.

Consider

Based on the relevant articles a change in practice is not recommended. More education and exposure to burns and TBSA estimation is needed to help improve accuracy. To advance paramedic practice further it is important that more research is conducted on determining the accuracy of the methods used to calculate burns and TBSA. If studies are able to find the most accurate method it will help increase paramedic accuracy in burns and TBSA estimation.

Clinical bottom line

Paramedics are more likely to overestimate burns and total body surface area. This could be due to the methods used in pre-hospital care and the lack of exposure to burns patients.

References

Borhani-Khomani, K., Partoft, S., & Holmgaard, R. (2017). Assessment of burn size in obese adults; a literature review. *Journal of Plastic Surgery and Hand Surgery, 51*(6), 375-380. doi:10.1080/2000656X.2017.1310732

Caldwell, N., Serio-Malvin, M., Chung, K., Salinas, J., Shiels, M., Cancio, L., . . . Mann-Salinas, E. (2017). Follow-Up Evaluation of the U.S. Army Institute of Surgical Research Burn Flow Sheet for En Route Care Documentation of Burned Combat Casualties. *Military Medicine, 182*, 2021-2026. doi:10.7205/MILMED-D-17-00121

Chan, Q., Barzi, F., Cheney, L., Harvey, J., Holland, A., & Cohen, D. (2012). Burn size estimation in children: Still a problem. *Emergency Medicine Australasia, 24*(2), 181–186. doi:10.1111/j.1742-6723.2011.01511.x

Face, S., & Dalton, S. (2017). Consistency of total body surface area assessment in severe burns: Implications for practice. *Paediatric Emergency Medicine, 29*(4), 429-432. doi:10.1111/1742-6723.12806

Fussell, T., Blackbrun, F., & Ross, J. (2014). G14 Are HCPs able to Estimate the Surface Area of a Burn in a Child? *Association of Paediatric Emergency Medicine, 99*(1), 6-7. doi:10.1136/archdischild-2014-306237.14

Hall, K., & Burns, B. (2017). A review of the burns caseload of a physician-based helicopter emergency medical service. *Emergency Medicine Australasia, 29*(4), 438-443. doi:10.1111/1742-6723.12810

Kallinen, O., Koljonen, V., Tukiainen, E., Randell, T., & Kirves, H. (2016). Prehospital Care of Burn Patients and Trajectories on Survival. *Prehospital Emergency Care, 20*(1), 97-105. doi:10.3109/10903127.2015.1056895

McCulloh, C., Nordin, A., Talbot, L., Shi, J., Fabia, R., & Takkar, R. (2018). Accuracy of Prehospital Care Providers in Determining Total Body Surface Area Burned in Severe

Pediatric Thermal Injury. *Journal of Burn Care & Research, 39*(4), 491-496. doi:10.1093/jbcr/irx004

Sadideen, H., D'Asta, F., Moiemen, N., & Yvonne, W. (2017). Does Overestimation of Burn Size in Children Requiring Fluid Resuscitation Cause Any Harm? *Journal of Burn Care & Research, 38*(2), 546-551. doi:10.1097/BCR.0000000000000382