Errors in adult trauma resuscitation: a systematic review

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Abstract

Introduction Trauma resuscitation at dedicated trauma centers typically consist of ad-hoc teams performing critical tasks in a time-limited manner. This creates a high stakes environment apt or avoidable errors. Reporting of errors in trauma resuscitation is generally center-dependent and lacks common terminology.

Methods We conducted a systematic review by searching Ovid Medline, Scopus and Embase from inception to February 24, 2021 for errors in adult trauma resuscitation. English studies published after 2001 were included. Studies were assessed by two independent reviewers for meeting inclusion/exclusion criteria. Errors were characterized from the included studies and a summary table was developed. Our review was prospectively registered with the International Prospective Register of Systematic Reviews (PROSPERO) (CRD42020152875).

Results The literature search retrieved 4658 articles with 26 meeting eligibility criteria. Errors were identified by morbidity and mortality rounds or other committee in 62%, missed injuries on tertiary assessment or radiology review in 12%, deviations from algorithmic guidelines in 12% or predefined for chest tube complications, critical incident reporting, aspiration or delays in care. In total there were 39 unique error types identified and divided into 9 categories including Emergency Medical Services handover, airway, assessment of injuries, patient monitoring and access, transfusion/blood related, management of injuries, team communication/dynamics, procedure error and disposition.

Conclusions Overall, our systematic review identified 39 unique error types in trauma resuscitation. Identifying these errors is imperative in developing systems for improvement of trauma care.

Keywords Trauma · Medical errors · Resuscitation · Critical Care · Emergency treatment

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Résumé

Introduction La réanimation des traumatisés dans les centres de traumatologie spécialisés consiste généralement en des équipes ad hoc qui effectuent des tâches critiques dans un temps limité. Cela crée un environnement à enjeux élevés susceptible de provoquer des erreurs évitables. Le signalement des erreurs de réanimation traumatologique dépend généralement du centre et manque de terminologie commune

Méthodes Nous avons effectué une revue systématique en recherchant dans Ovid Medline, Scopus et Embase, du début au 24 février 2021, des erreurs de réanimation traumatologique chez l'adulte. Les études anglaises publiées après 2001 ont été incluses. Deux examinateurs indépendants ont évalué les études pour déterminer si elles répondaient aux critères d'inclusion et d'exclusion. Les erreurs ont été caractérisées à partir des études incluses et un tableau récapitulatif a été élaboré. Notre étude a été enregistrée de manière prospective dans l'International Prospective Register of Systematic Reviews (PROSPERO) (CRD42020152875).

Résultats La recherche documentaire a permis d'extraire 4658 articles, dont 26 répondaient aux critères d'admissibilité. Les erreurs ont été identifiées par les rondes de morbidité et de mortalité ou par un autre comité dans 62% des cas, les blessures manquées lors de l'évaluation tertiaire ou de l'examen radiologique dans 12% des cas, les déviations par rapport aux directives algorithmiques dans 12% des cas ou prédéfinies pour les complications du tube thoracique, le signalement des incidents critiques, l'aspiration ou les retards dans les soins. Au total, 39 types d'erreurs uniques ont été identifiés et répartis en 9 catégories : transfert des services médicaux d'urgence, voies respiratoires, évaluation des blessures, surveillance et accès du patient, transfusion/sang, gestion des blessures, communication/dynamique de l'équipe, erreur de procédure et disposition.

Conclusions Dans l'ensemble, notre étude systématique a identifié 39 types d'erreurs uniques dans la réanimation des traumatismes. L'identification de ces erreurs est impérative pour développer des systèmes d'amélioration des soins en traumatologie.

Clinician's capsule

What is known about the topic?

There are a number of studies that identify errors in trauma but without common definitions or taxonomy.

What did this study ask?

What are the errors identified in current trauma resuscitation literature?

What did this study find?

The study found 39 unique error types in trauma resuscitation. These errors can be used to identify areas of improvement for trauma care.

Why does this study matter to clinicians?

This study identifies potential errors in trauma resuscitation which allows clinicians to be aware of errors during their trauma management and develop programs for error reduction for their institutions.

A systematic review of preventable deaths in trauma found that inconsistent terms were used to describe errors in trauma [9]. Currently, reporting of errors in trauma are generally center-dependent and lack a common terminology [10]. Errors are commonly determined by mortality and morbidity rounds/expert committee [10–15], benchmarking to accepted guidelines [8, 16, 17] or by determining risk using severity scores (Injury Severity Score [ISS] or Trauma and Injury Severity Score [TRISS]) [10, 11]. Amongst the different phases of trauma care, the initial trauma resuscitation phase presents the largest number of avoidable errors [11, 12, 14, 15].

Most recently, papers have been using the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) taxonomy of errors to standardize reporting of preventable errors [18]. This classification system has been used and/or adapted in several studies across multiple medical specialties [10, 11, 15]. Currently, there is no standard model for classifying errors in trauma resuscitation. A better understanding of the types of errors present in the current literature is vital in developing a taxonomy for future studies.

The objective of this systematic review was to describe the errors that occur during trauma resuscitation. The following research question was formulated: “Among injured adults, what are the errors that occur during the acute trauma resuscitation?”

Introduction

Trauma care has seen a number of systems changes with centralizing trauma care into tertiary centers to provide specialized and expedited care [1–5]. Trauma resuscitation in these centers typically consist of ad-hoc teams performing critical tasks in a time limited manner [6, 7]. On average, a critical decision is required every 72 s [8]. This presents a unique high stakes environment that is apt for critical errors to occur in multiple facets of care.

Methods

We performed a systematic review adhering to the standards of the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) (Appendix A) [19]

and registered with the International Prospective Register of Systematic Reviews (PROSPERO) (CRD42020152875). The systematic review was conducted and reported according to PRISMA statements [20]. Research ethics approval and informed consent were not required.

Data sources and search strategy

Ovid Medline, Scopus and Embase were searched from inception to February 24, 2021. Database-specific key index terms and text words related to error, adverse events, trauma, trauma bay, resuscitation and emergency department were used. Our search was limited to studies reported in English. Our detailed search strategy is presented in Appendix B. Reference lists of included studies were reviewed for eligibility. Studies were reviewed by a trauma expert for appropriateness. EndNote X7 (Reuters, New York) was used for reference management.

Eligibility Criteria.

Articles written in English and published between January 2001 and the search date February 24, 2021 were included. We included studies that examined resuscitations conducted by trauma teams, included patients age 16 years or older, and documented errors or adverse events in the ED or trauma bay. Studies were excluded if they focused on mental health trauma, included patients aged less than 16, did not describe trauma care provided by trauma teams or did not specify type or location of errors.

Study selection

Titles were initially screened by one reviewer (AN). Abstract and full-text review were then conducted in duplicate by two independent reviewers (AN, AQ) with disagreements resolved by involvement of a third reviewer (BN). The list of included studies was verified by the third reviewer (BN). Data extraction was done by two authors (AN,AQ) using Excel (Microsoft, WA).

Assessment of bias

Four items from the National Institutes of Health (NIH) Quality Assessment for Observational Cohort and Cross-Sectional Studies were used for the assessment of bias [21]. Studies were scored based on their rate of eligible participants, sampling bias, exposure measure bias and outcome measure bias. The modified method using only four items had been previously used by the authors and found to be adequate [22].

Data synthesis

The primary objective of the systematic review was to identify errors during trauma resuscitation. Errors were distilled

from individual studies into a single list. These were then reviewed by two study investigators. Duplicate errors were combined where appropriate based on consensus and errors not applicable to the acute trauma resuscitation were removed. Themes derived from the initial list of errors were used to derive categories. The remaining errors were then divided into these categories.

Results

Study selection

The literature search retrieved 4658 publications. After duplicates were removed, 4070 articles remained. Five additional articles were identified through reference searches. Of the 4075 articles screened by title, 3933 were excluded. The remaining 142 abstracts were reviewed by two independent reviewers resulting in 93 abstracts being excluded. The remaining 49 publications were assessed in full. In total, 26 studies met the inclusion criteria and were included in the analysis of this systematic review. A flowchart of study selection is illustrated in Fig. 1.

Study characteristics

Table 1 demonstrates the study characteristics of the 26 included studies. Studies were primarily published in the USA (1026) but included Australia, Austria, Canada, China, Denmark, France, Germany, Netherlands, Spain, Sweden, Switzerland and the United Kingdom. Studies included were published from 2002 to 2020. Seven (27%) studies were conducted prospectively, eighteen (69%) retrospectively and one (4%) had both prospective and retrospective components. Errors were identified by morbidity and mortality rounds or other committee in 16 studies (62%), missed injuries by computerized tomography (CT) scan/tertiary survey in three studies (12%), deviation from a predefined algorithm based on guidelines in three studies (12%) and the rest were specific to a critical incident reporting system (1), chest tube complications (1), aspiration event (1) or delays in care (1).

Data sources and assessment of bias

Appendix C demonstrates the different data sources and the number of errors that occurred during the resuscitation phase. Nineteen studies used chart review for data collection (73%), five used direct observation (19%) and two used video recording (8%). The captured number of errors varied greatly amongst the studies ranging from 6 to 2689 with only seven studies having greater than 100 events (27%). Overall bias was rated good (4/4) for 20 studies, fair (3/4)

Fig. 1 Prisma flow diagram

for 4 studies and two studies received a poor (1/4) rating for bias (Table 2).

Summary of errors

A full list of all 363 errors identified can be found in Appendix D. Two reviewers (BN, AN) individually removed duplicates and errors not applicable to trauma resuscitation. The two lists were then reviewed together and a total of 305 errors were either removed or amalgamated to create a list of 58 unique errors. Based on recurrent themes in the list, the remaining errors were categorized by stages of the trauma evaluation including Emergency Medical Services (EMS) handover, airway, assessment of injuries, patient monitoring and access, transfusion/blood related, management of injuries, team communication/dynamics, procedure error and disposition (Table 3). Once categorized, errors were further amalgamated upon review by two study investigators and a total of 39 error types were included and divided into 9 categories.

Discussion

Interpretation of findings

The identification of errors varied greatly among studies. Morbidity and mortality rounds have been shown to be limited by recall bias with inaccurate and insufficient details related to timeline, incidence and nature of errors [23]. The assessment by morbidity and mortality committees, although commonplace, is not a standardized practice between institutions and is a possible source of bias for error reporting. Development of standardized systems for identifying errors is imperative for improving trauma care. Sanddal et al. [13] standardized a system for review by presenting a checklist to their review panel including resource utilization, critical time intervals, cause of death and judgments on preventability and care. This system also determined opportunities of improvement regardless of whether the death was preventable or not. Similar systematic approaches would allow for broader and less biased identification of errors. A number of studies provided the distinction between active and latent failures as active failures contributing directly to adverse outcomes and latent failures as conditions predisposing to active failures [11, 12, 24]. The splitting of errors into active

Table 1 Study Characteristics (*n* = 26)

Authors	Year	Country	Tertiary/Rural/ Urban	Study Design	Enrolled patients (n)	Population	Intervention/ Expo- sure	Control	Outcome
Ball et al	2007	Canada	Tertiary	Retrospective obser- vational	761	Adult trauma patient	Chest tube insertion	None	Characterizing com- plications on CT
Benjamin et al	2015	USA	Tertiary	Prospective observa- tional	228	Adult trauma patient intubated	Aspiration event	Non-aspiration events	Incidence and clini- cal significance of aspiration events
Cohen et al	2018	USA	Tertiary	Retrospective obser- vational	65	Trauma Patients	Events Based on HFACS Frame- work	N/A	Reliability of HFACS Framework in Detecting Events
Fitzgerald et al	2011	Australia	Tertiary	Prospective RCT	1171	Adult trauma patients	Computer Decision tool	No Computer	Noncompliance to algorithm
Ghorbani et al	2018	Sweden	Tertiary	Retrospective obser- vational	252	Adult trauma patients with 30d mortality	Peer Review of Deaths	N/A	Number of prevent- able deaths and characterization of errors
Giannakopoulos et al	2012	Netherlands	Tertiary	Retrospective chart Review of prospective RCT Data	1124	Adult trauma activa- tions	Early CT	Typical imaging	Missed injuries on primary and sec- ondary survey
Girard et al	2019	France	Tertiary	Retrospective review	7484	Adult TraumaPa- tients	Preventable deaths	N/A	Errors Classified from Preventable Deaths
Gruen et al	2006	USA	Tertiary	Retrospective review	2594	Adult Trauma deaths	Error identified at morbidity and mortality rounds or <50% prob- ability of mortality with TRISS and HARM Score	None	Characterization of errors
Houshian et al	2002	Denmark	Tertiary	Prospective observa- tional	786	Adult trauma patients	Missed injuries	No missed injuries	Incidence of missed injuries and contrib- uting factors
Ivatury et al	2008	USA	Tertiary	Retrospective Review	805	Adult trauma deaths	Error Identified	N/A	Characterization of errors
Kahol et al	2011	USA	Tertiary	Prospective observa- tional	10	Adult trauma patients	Direct observation	N/A	Characterize devia- tions from ATLS protocol
Kleber et al	2014	Germany	Tertiary	Prospective observa- tional and Retro- spective review	52	Adult traumatic cardiac arrest patients	Direct Observation	N/A	Survival and characteristics of traumatic CPR
LaGrone et al	2020	USA	Tertiary	Retrospective review	2659	Adult trauma patient Deaths	Deaths associ- ated with errors 2005–2014	Trauma Death asso- ciated with Errors 1996–2004	Characterization of errors

Table 1 (continued)

Authors	Year	Country	Tertiary/Rural/ Urban	Study Design	Enrolled patients (n)	Population	Intervention/ Ex- posure	Control	Outcome
Leeper et al	2013	Canada	Tertiary	Retrospective cohort	300	Trauma patients	Missed injuries	N/A	Difference in rate and severity of missed injuries depending on TTL specialty
Lubbert et al	2009	Netherlands	Tertiary	Prospective Observational	387	Trauma patients with video recording	Video recording	N/A	Evaluation of team functioning and ATLS deviations
Matsumoto et al	2018	USA	Tertiary	Retrospective Review	874	Trauma patient who died	Preventable deaths	Non-preventable	Establish the preventable and potentially preventable death rates
Montmany, S., et al	2016	Spain	Tertiary	Retrospective review	122	Adult Trauma Patient Deaths	Preventable Deaths	Non-Preventable Deaths	Characterization of Errors
Niemeier et al	2019	Germany/Austria/Switzerland	Tertiary + Rural	Retrospective review	N/A	Critical Incidents reported	Incident reported in Trauma Resuscitation	N/A	Characterization of critical incidents
O'Reilly et al	2013	UK	Tertiary	Retrospective review	150	Trauma patients who died from hemorrhage	Discussed at monthly morbidity and mortality rounds	N/A	Opportunities for performance improvements identified
Pucher et al	2014	UK	Tertiary	Prospective observational	50	Trauma patients under direct observation	Observation	N/A	T-NOTECHS scores and delays
Saltzherr et al	2011	Netherlands	Tertiary	Retrospective Review	62	Patients who died during or after a trauma resuscitation	Preventable deaths	Non-preventable	Identify errors of potentially preventable deaths
Sanddal et al	2011	USA	Tertiary and Rural	Retrospective review	434	Deaths secondary to mechanical trauma	Preventable deaths	N/A	opportunities for improvement (OFT)
Schoeneberg et al	2017	Germany	Tertiary	Retrospective review	193	Adult Trauma Patient Deaths	Preventable Deaths	Non-Preventable Deaths	Characterization of errors
Teixeira et al	2007	USA	Tertiary	Retrospective review	2081	Trauma patients that died	Preventable deaths	N/A	Errors contributing to preventable death
Vioque et al	2014	USA	Tertiary	Retrospective review	1377	Trauma patient deaths as inpatient	Preventable deaths	Nonpreventable deaths	Errors contributing to preventable death
Zhang et al	2020	China	Tertiary	Retrospective review	1913	Adult Trauma Patients	Preventable deaths	N/A	Characterization of errors

N/A Not applicable, TTL Trauma team leader, CPR cardiopulmonary resuscitation, ATLS Advanced Trauma Life Support, CT Computed Tomograph

failures and latent failures is an important distinction when identifying and understanding cause. This distinction can help in developing solutions as active failures are more likely secondary to knowledge gaps and latent failures require more systematic solutions. LaGrone et al. [25] demonstrated the reduction in errors over two 10-year periods after instituting a number of protocols concerning trauma care targeting latent failures. Navarro et al. [26] consequently demonstrated a reduction of active failures through increased ATLS training for practitioners.

Three studies in our systematic review classified errors by injuries missed during the initial trauma resuscitation that were later identified. Giannakopoulos et al. [27] argue that according to Advanced Trauma Life Support (ATLS), more severe injuries should be prioritized and missed injuries aren't errors but rather a calculated risk. Gruen et al. [11] also reported a 2.47% death rate contributed to by error and suggested a 2–3% error-related death rate may be the baseline in complex trauma systems. An acceptable "miss rate" has yet to be determined but more standardized approaches to error identification could potentially lead to a higher error-related death rate or missed injuries.

Three studies in our systematic review detected errors by classifying deviations from an algorithm. Typically, these would be deviations from ATLS protocol, but it is important to note that tertiary trauma care centers may deviate from protocolized practice. Kahol et al. [17] acknowledged this aspect of care and classified deviations from ATLS as errors, innovations or procedural deviations that were either reactive or proactive based on expert review of direct observation cases. They found senior trainees more likely to perform innovations during resuscitation. This sort of acknowledgment of the fluid nature of trauma care also makes error identification difficult as some errors could be seen as innovations depending on the observer. Multiple factors need to be interpreted simultaneously to define errors in trauma resuscitation as the situation and priorities can quickly change but was not within the scope of our study.

Throughout our systematic review, errors were found to be more likely to occur in the trauma bay or emergency department and airway management [28, 29]. This further emphasizes the importance of the proper identification of errors in trauma resuscitation and to target quality improvement towards these areas.

Development of a trauma resuscitation error taxonomy

Through this systematic review, we found that errors in trauma resuscitation were reported using a large array of terms and definitions. We were able to distill the terms down to a list of 39 errors found in trauma resuscitation. We summarized our findings in Table 3. Our categories

were developed based on themes present in errors identified and closely follow ATLS protocol and the chronological approach to trauma resuscitation. We believe that this systematic review is the first step towards the development of a classification system for errors during trauma resuscitation. The JCAHO taxonomy is inadequate for trauma resuscitation due to the high number of errors exclusive to the initial resuscitation, the importance of the first hour in trauma care and the lack of specificity for this critical time period [11, 12, 14, 15]. Adaptation of an agreed upon classification system for errors would allow for improved homogeneity of reporting in future studies and comparison between different centers [10]. A classification system could also be used for assessment of resuscitation by video review or machine-learning assisted algorithms to enhance patient safety in the trauma bay [30].

Strengths and limitations

The studies included in this systematic review were limited by their methodology. Many were retrospective analyses with small numbers of errors that likely limited the ability to determine severity. There was significant heterogeneity in how errors were reported and classified. The determination of many of the errors was based on committee review of mortality, which inherently biases publication of more severe errors and prevents the determination of non-lethal but important errors in trauma resuscitation. This systematic review was also limited to errors stated in literature during the search timeframe and it is likely that there are additional important events that should be included in any final taxonomy.

There was also great heterogeneity amongst studies based on country and trauma systems, where there may be variation of practice, emergency medical services protocols and access to care. This systematic review was limited to English studies. Studies that included direct observation may have been limited by the Hawthorne effect whereby people react differently upon being observed [8, 11].

Clinical implications

The first step to improvement is the recognition of errors. This systematic review presents a list of potential errors found in trauma resuscitation. Clinicians will be able to use this information to better analyze their own trauma management as well as develop quality improvement programs for their institutions. A number of studies have already demonstrated the benefit of simulation, multidisciplinary meetings, ATLS training and protocol development in reducing errors [26, 29, 31, 32].

Table 2 Risk of bias assessment

Authors	Year	Participation > 50% ^a	Sampling bias ^b	Exposure measurement bias ^c	Outcome measurement bias ^d	Overall assessment ^e
Ball et al	2007	Yes	No	No	No	Good
Benjamin et al	2015	Yes	No	No	No	Good
Cohen et al	2018	Yes	Yes	Yes	Yes	Poor
Fitzgerald et al	2011	Yes	Yes	No	No	Fair
Ghorbani et al	2018	Yes	No	Yes	No	Fair
Giannakopoulos et al	2012	Yes	No	No	No	Good
Girard et al	2019	Yes	No	No	No	Good
Gruen et al	2006	Yes	No	No	No	Good
Houshian et al	2002	Yes	No	No	No	Good
Ivatury et al	2008	Yes	No	No	No	Good
Kahol et al	2011	Yes	No	No	No	Good
Kleber et al	2014	Yes	No	No	No	Good
LaGrone et al	2020	Yes	No	No	No	Good
Leeper et al	2013	Yes	No	No	No	Good
Lubbert et al	2009	Yes	No	Yes	No	Fair
Matsumoto et al	2018	Yes	No	No	No	Good
Montmany et al	2016	Yes	No	No	No	Good
Niemeier et al	2019	Yes	No	No	No	Good
O'Reilly et al	2013	Yes	No	No	No	Good
Pucher et al	2014	Yes	Yes	Yes	Yes	Poor
Saltzherr et al	2011	Yes	No	No	No	Good
Sanddal et al	2011	Yes	No	No	No	Good
Schoeneberg et al	2017	Yes	No	No	Yes	Fair
Teixeira et al	2007	Yes	No	No	No	Good
Vioque et al	2014	Yes	No	No	No	Good
Zhang et al	2020	Yes	No	No	No	Good

^aWas the participation rate of eligible persons at least 50%?

^bWere all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study pre-specified and applied uniformly to all participants?

^cWere the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all participants?

^dWere the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all participants?

^eOverall assessment 4/4 = Good, 2–3/4 = Fair, 0–1/4 = Poor

Research implications

In developing a taxonomy, our list of identified errors would require further input from trauma care experts to assess if there are additional missing or relevant errors that were not found in the literature and would require appropriate validation studies. Further development could be done through expert consensus using techniques such as modified Delphi or RAND appropriateness methods [33]. Assignment of weight and importance to these errors would also be important in developing a taxonomy for real world application. Unfortunately our study was unable to determine severity based on frequency, as other studies, due to the

heterogeneity of errors identified and the variable number of captured events between studies [34]. Currently, the Clavien-Dindo classification system is commonly used to grade severity of surgical complications [35]. Future studies could use a similar system to grade trauma errors with Grade I requiring no intervention, Grade II requiring pharmacological intervention, Grade III requiring procedural intervention, Grade IV causing a life threatening complication and Grade V causing death. This system could be easily applied to trauma but would need further characterization and validation. Ultimately a prospective systematic approach with well-established methodology, such as the Health Care Failure Mode and Effect Analysis™ method,

Table 3 Errors identified and proposed classification system

EMS handover Failure or delay to activate trauma team Inaccurate or incomplete medical history report Delay to arrival of trauma team/team member Airway Hypoxia not addressed Unanticipated loss of airway Delay in intubation Unsuccessful intubation attempt Aspiration event Ventilator malfunction Assessment of injuries Missed/delayed identification of injury/shock Failure to follow cervical spine precautions (if indicated) Imaging not complete or delayed Delay secondary assessment Radiology misinterpreted Inappropriate PPE	Inadequate monitoring Equipment failure Issues with IV access Issues with bloodwork Transfusion/blood related Delay to blood product administration Failure to follow appropriate transfusion protocol Over-resuscitation with crystalloid fluids Inadequate blood therapy Management of injuries Failure or delay to appropriately treat severe injury Incorrect/ineffective treatment of severe injury Complications of an appropriate treatment Medication error Inadequate temperature management	Team communication/dynamics Communication error Team member unavailable Personnel issue Ineffective team leadership Procedure related Technical errors Equipment failure/missing Procedure delayed Procedure inappropriate (e.g., femoral access in setting of intra-abdominal bleeding) Iatrogenic injury Disposition Delay to CT/OR/angiography suite Inappropriate transfer of unstable patient
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IV intravenous, CT computed tomography, OR operating room, PPE personal protective equipment

would be imperative in determining further errors and their impact on patient care [36].

Conclusion

Overall, our systematic review identified 39 unique error types in trauma resuscitation which were categorized by themes. This systematic review provides a first step towards the creation of a common classification system and evaluation of severity for errors during trauma resuscitation. Clinicians can use these identified errors to help recognize errors at their own institution and develop improvements to their trauma care programs.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s43678-021-00118-7>.

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Author contributions AN participated in the literature search, data collection, data analysis, data interpretation, study design and writing of the manuscript, AQ participated in the data collection and data analysis. JJ participated in the study design, data interpretation and

critical revision. BN participated in the study design, data analysis, data interpretation, writing and critical revision.

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Availability of data and material Search strategy available in Appendix B.

Declarations

Conflict of interest None declared.

Ethics approval None required for systematic review.

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