REWIEW
DOI: 10.4274/tjh.galenos.2025.2025.0365

A Narrative Review on the Approach to Hospital-Acquired Venous Thromboembolism in Pediatric Trauma and Critically Ill Patients

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August 27, 2025
October 5, 2025

ABSTRACT
Pediatric trauma and critical illness are known to confer increased risk for hospital-acquired venous thromboembolism (HA-VTE) in children. They are associated with increased mortality and the development of disabling co-morbidities. In this narrative review we discuss the current literature on HA-VTE in children with severe trauma or those who are critically ill. Pediatric literature in this field continues to grow with randomized trials and guidelines actively being developed. We describe available data related to the frequency of HA-VTE specific to these populations, as well as the pathophysiological concepts and considerations for its development and management. We outline an approach to HA-VTE in these 2 groups by delving into risk assessment and identification of risk factors that accrue in these children, the need to assess for thromboprophylaxis and balance its risks and benefits, the clinical presentation and imaging modalities to confirm diagnosis of HA-VTE, and management principles for developed HA-VTE. We used some of the available guidelines including the Eastern Association for the Surgery of Trauma and Pediatric Trauma Society and the recently updated 2024 American Society of Hematology/International Society for Thrombosis and Haemostasis guidelines on the management of VTE in children, to aid in our discussion.

INTRODUCTION

Venous thromboembolism (VTE), which primarily includes deep venous thrombosis (DVT) and pulmonary embolism (PE), is a common complication with established practices in adults (1). Its frequency in the general pediatric population is considerably less (2-4). Despite this, the incidence of hospital-acquired venous thromboembolism (HA-VTE) in children is not insignificant and is associated with increased morbidity and mortality (5, 6). Although the literature on HA-VTE prevention and management in children is not as robust as in adults, contemporary epidemiology of pediatric HA-VTE has been paralleled by a rise in pediatric literature over the last decade, with efforts to better understand the approach to VTE in hospitalized children (Figure 1) (7, 8).
In hospitalized children, specific cohorts are known to be at high risk of HA-VTE, e.g., those with severe trauma and critically ill (9-12). Severe or major trauma, i.e. children with higher Injury Severity Scores (ISS) or ≥ ISS 25 (12, 13), can also be viewed as a subpopulation of critical illness. The association of HA-VTE in these two populations is related to the number of risk factors afflicted children are exposed to, which is far greater than that of the general population. These include factors such as presence of central venous access devices (CVAD), prolonged hospitalization, mechanical ventilation, and conditions associated with dysregulation of the inflammatory system (14-16). Additionally, underlying complex chronic conditions such as congenital heart disease and malignancy, have their innate risk factors that carry a higher likelihood for both critical illness and HA-VTE (17-20). In this study, we

aimed to (1) review the current pediatric literature on HA-VTE with a focus in children with severe trauma or those who are critically ill and (2) outline a systematic approach to guide its prevention and management based on current pediatric evidence.

METHODS

We thoroughly searched published literature from inception to present in the following databases: MEDLINE (PubMed), EMBASE (Elsevier), SCOPUS, Cochrane Library including CENTRAL and CDSR, for relevant articles related to VTE in pediatric trauma and critical illness (Supplementary material). We searched the concepts of PEDIATRICS, Venous Thromboembolism, TRAUMA, and CRITICAL ILLNESS. The articles were manually reviewed to determine scope and inclusion. The included literature was used to guide the writing of this review article. Reference lists of pertinent studies were also reviewed for additional relevant articles

REPORTED FREQUENCIES OF HA-VTE IN PEDIATRIC LITERATURE

The reported frequencies of pediatric HA-VTE are based on registry, database, retrospective and survey studies (21). Its incidence has wide variability largely due to the lack of standardization in VTE screening, diagnosis, and study design. However, it remains clear that the frequency of HA-VTE in children has been steeply and steadily rising since 2001 with a 210% increase until 2019 (5). A bimodal pattern has consistently been observed, with the highest rates occurring during the neonatal period, followed by another peak in adolescence (3, 5, 6). Specific to the trauma and critically ill pediatric populations, multiple studies with wide variability exist with a reported incidence ranging from 0.2% to 1.1 % for trauma and 0.3% to 27.8% for critically ill (21). Majority are based on small to medium single-center studies with some database literature adding perspective from larger cohorts. The incidence of VTE in adult trauma patients remains significantly higher than children. However, adult trends begin during the late adolescent period, with a rise at age 16 years that continues into adulthood (22). Hence, the higher incidence of HA-VTE in children with trauma compared to the general pediatric population is not uniform across all age groups. In critically ill children, after excluding studies that focused on specific subpopulations such as in cardiac disease, CVAD-related thrombosis, and children with bacteremia, the incidence of HA-VTE is only as high as 0.9 % (23). The presence of these risk factors, however, are common in children who are critically ill or have severe trauma.

RELEVANT PATHOPHYSIOLOGY

The pathophysiology for VTE has traditionally been explained by the mechanistic framework first published in 1852 by Rudolph Virchow, which postulated that thrombus formation is caused by changes in blood flow, vessel wall integrity, and/or blood composition (24). Identified risk factors can be classified based on its disruption of one of the components of this triad. Endothelial injury and exposure of blood to foreign material is common in these 2 populations and may be a direct result from trauma, iatrogenic from invasive devices needed for life saving measures, and/or from disease states such as sepsis. Altered hemodynamics result in low flow states especially seen in the acute stages of hospitalization. Additionally, both trauma and critical illness lead to extreme physiologic derangements with alterations in the immune-inflammatory system, ultimately leading to a hypercoagulable milieu. The different mechanisms underlying the activation of the coagulation cascade resulting from specific inflamed states such those seen as in trauma versus sepsis-induced disseminated intravascular coagulation (DIC) exists, but it remains unclear if either predisposes to greater risk of VTE over the other, i.e. hypofibrinolytic and hyperfibrinolytic phenotypes respectively, as seen in trauma versus sepsis-induced DIC (25).

Developmental hemostasis refers to the age-related qualitative differences and changes in the levels of hemostatic proteins throughout the life span (26). Neonates are born with decreased levels of both pro and anticoagulant proteins and reach near adult levels at approximately 6 months of age. This continues to be less than adult mean values until late adolescence, but the overall balance between hemostatic factors does not lead to abnormal hemostasis in the absence of provoking factors. Given a decreased capacity for thrombin generation and increased antithrombotic potential, it can be argued that the hemostatic system of neonates is protective for thrombotic complications compared with adults (27). Knowledge regarding developmental hemostasis is important in the management of anticoagulation therapy and interpretation of laboratory investigations in children. The correlation and effect of developmental hemostasis is complex and continues to be an ongoing area of investigation (27, 28).

APPROACH TO VTE IN PEDIATRIC TRAUMA AND CRITICAL ILLNESS

Risk assessment: HA-VTE risk assessment and consideration of bleeding risk

The approach to HA-VTE in pediatric trauma and critically ill children begins with an assessment of the child's individual risk of HA-VTE on admission to the hospital. Although multiple risk assessment models (RAM) exist for the identification of critically ill children with high risk of developing HA-VTE, no available pediatric RAM is

currently recommended, and none are routinely being used in clinical practice (29). This is largely due to the lack of prospective validation of these RAMs. As a result, the current approach to risk assessment of HA-VTE is based on physician identification of risk factors and their perception on the magnitude of its influence on the development of HA-VTE at any given period. To complicate matters, the assessment of bleeding risk also needs to be considered when dealing with contrasting endpoints between safety and efficacy or determining the net clinical benefit of administering pharmacologic anticoagulation for HA-VTE. However, there are currently no bleeding risk assessment tools available in pediatrics. Additionally, the presence and absence of risk factors is dynamic and may continue to emerge during hospitalization. This must be taken into consideration as this is likely to change the calculated risks throughout a child's course of hospitalization. The Solutions for Patient Safety Network provides an outline of risk assessment for HA-VTE in children based on the presence and number of risk factors (30). This has provided framework for risk stratification, but with important limitations. While it is assumed that increasing number of risk factor is additive and entails higher risk, the relative weight of each risk factor is not well understood and may not be equal.

Acquired and inherited risk factors related to pediatric trauma and critical illness

Several risk factors are known to contribute to the development of VTE in children afflicted with trauma and who are critically ill (31, 32). Most cases of HA-VTE in children are provoked due to hospital-acquired risk factors. Alternately, severe trauma and ICU admission can be regarded as risk factors instead of study populations. The Eastern Association for the Surgery of Trauma and Pediatric Trauma Society (EAST/PTS) found that in pediatric trauma, increasing age and ISS, particularly age >15 and ISS > 25, confer stronger risk of HA-VTE (9). Although in adults, an ISS ≥ 15 is typically defined as severe trauma, an ISS threshold of ≥ 25 was found to be a more appropriate cut-off for children (13). In subsets of children consisting of both critical illness and trauma, an ISS > 9 confers increased risk for HA-VTE. Irrespective of other risk factors, the presence of a CVAD is the single most important and strongest risk factor for the development of DVT in children (14, 23). Inherited risk factors such as hereditary thrombophilia or innate anticoagulant deficiencies are more common in younger patients than adults and carry higher VTE recurrence rates (33, 34). Based on available single-center studies, registry studies and a meta-analysis, we have summarized risk factors that independently increase the risk of HA-VTE in pediatric trauma and critical illness (Table 1) (14, 15, 35-37). The lack of standardization of the definition of risk factors has limited the understanding of the magnitude of effect they have on the development of HA-VTE.

Thromboprophylaxis: Mechanical, pharmacologic, combination or none

After the identification of individual risk for HA-VTE, the decision needs to be made whether to provide pharmacologic thromboprophylaxis (pTP), mechanical thromboprophylaxis (mTP), both or neither. The net clinical benefit of pTP is established in adults, but not for children. Moreso, it is established in the setting of adult trauma and critically illness (1). Overall, there is a lack of robust data for its use in the general pediatric population. Prospective trials investigating its efficacy in specific subpopulations exist, with only one trial currently in the critically ill pediatric population (38). Guidelines exist for children with trauma, but with considerable paucity of evidence for its recommendations (9). In children hospitalized after trauma, pTP is conditionally recommended for consideration in children older than 15 if the bleeding risk is low or in post- pubertal children younger than 15 years old if they have an ISS greater than 25. This recommendation was conditional because it was based on adult data and the relative safety of enoxaparin in children. Additionally, expert consensus statements suggest strong recommendations for pTP in pediatric trauma with a personal history of VTE and weak recommendations for its consideration if they have a CVAD (39). If pTP is considered, contraindications need to be identified beforehand. Baseline laboratory tests including a complete blood count, coagulation profile, and evaluation of renal function are necessary to identify some of these features. In the situation where bleeding risk increases or bleeding does develop, the decision to continue pTP needs to be reevaluated. The American Society of Hematology and International Society on Thrombosis and Haemostasis recently completed their recommendations for pTP in children. Recommendations for children after trauma and with critical illness are eagerly awaited.

mTP, e.g., intermittent pneumatic compression devices or sequential compression devices, are medical devices commonly used in adults due to its ability to aid in the prevention of HA-VTE and spare exposure to anticoagulants (40, 41). It presumably works by reducing venous stasis and stimulating the release of antithrombotic mediators, such as tissue plasminogen activator from the endothelium. Overall, its use in pediatric thromboprophylaxis is low with large variation in its prescription (42). This might represent its lack of availability in younger patients. However, one study performed in children suggests that mTP alone is not efficacious in preventing HA-VTE versus its combination with pTP or pTP alone (43). There are no randomized trials testing its efficacy in any pediatric

population. Due to its low usage and the difficulties in studying its efficacy, there is a lack of consensus for its use in children. While we await evidence detailing its use and efficacy in children, mTP should be considered when available given its safety profile, but caution must be taken regarding the perception of its benefits and when counselling parents and caregivers regarding its efficacy to prevent HA-VTE in children. As with pTP, the EAST/PTS guidelines made a conditional recommendation for the use of mTP alone or in combination with pTP in both hospitalized children 15 years and older or post-pubertal children younger than 15 years with an ISS greater than 25. Consensus agreement state that mTP is appropriate in children with significant bleeding risk or contraindication to pTP.

In the absence of robust data and availability of mTP for younger age groups, a provider may still choose to avoid any form of thromboprophylaxis. In these instances, the risk of HA-VTE is accepted and no iatrogenic bleeding risk from anticoagulant exposure is employed to the child. While this may sound reasonable, question lies in how much risk is acceptable without causing harm. Recent prospective data has shown that in high-risk pediatric trauma patients, delay of initiation of pTP was associated with development of HA-VTE and that early initiation may be beneficial (44).

Confirming the Diagnosis of HA-VTE in Children

The decision to confirm the diagnosis of HA-VTE is based on risk assessment and the development of clinical signs and symptoms. Physical examination alone has poor accuracy in diagnosing DVT in children (45). The clinical manifestations of DVT are related to pain, swelling and discoloration from venous congestion of affected limbs. In those with an indwelling CVAD, line dysfunction in the presence of other exam findings should also raise clinical suspicion of HA-VTE (45). PE presents with cough, shortness of breath, tachycardia, tachypnea, and hypoxemia. Signs and symptoms of non-extremity DVT may be subtle and are typically related to underlying organ dysfunction. There are no laboratory tests to confirm the diagnosis of HA-VTE. This includes biomarkers such as C-reactive protein, d-dimer, and factor VIII activity, which are currently being investigated for use in risk assessment, but not for diagnosis (46). Additionally, radiographic screening for clinically unsuspected VTE is not recommended routinely (47-49). The diagnosis of HA-VTE therefore requires a high index of suspicion. Imaging modality primarily depends on anatomic location. Historically, venography was considered the gold standard for diagnosis of DVT, but it has now been replaced by minimally invasive techniques. For extremity DVT, compression limb ultrasonography is inexpensive, non-invasive and specific, therefore is the most common imaging technique used (50). For HA-VTE suspected within the central vessels (e.g. femoral vein extension into inferior vena cava), contrast MRV is recommended over CT due to radiation exposure and its ability to clearly define the venous system and thrombus (50). However, the use of MRI has limitations. CT venography is more readily accessible and can be considered if MRV is unavailable. Echocardiography and ultrasound of involved central vessels might still be a useful modality depending on anatomic location and in the setting of contraindications to either CT or MRI. Despite the absence of data on its diagnostic utility in children, for suspected PE, CT pulmonary angiography is often the initial imaging modality of choice given the feasibility of its use (50, 51). In the presence of contraindications to the administration of intravenous contrast, a ventilation/perfusion (V/Q) scan can be performed as the initial imaging modality for PE, but this will likely depend on availability and experience of centers, with potential limitations in its interpretation.

Management principles for HA-VTE

When HA-VTE develops during hospitalization, another assessment of the risks associated with treatment options versus the severity and clinical consequences of HA-VTE is necessary. Anticoagulation is the most common management employed. Its goal is to limit propagation of the thrombus, decrease the risk of recurrence, and avoid the potential for downstream complications. In certain cases, systemic or localized thrombolysis and/or thrombectomy may be indicated. The decision to provide thrombolysis for certain types of HA-VTE depends on the presence of life-threatening features such as hemodynamic compromise in PE (47). Thrombolysis and thrombectomy in children have less supporting literature and carry significantly higher risk of bleeding than anticoagulation alone (52). In 2024, the American Society of Hematology (ASH) and International Society for Thrombosis and Haemostasis (ISTH) updated their guidelines on the management of VTE in children (47). Despite the updated guidance, most recommendations are conditional with low quality of evidence. Hence, it is not uncommon that an individualized approach is often taken when managing HA-VTE in children. Decision-making again begins with the identification of contraindications to anticoagulant and/or thrombolytic exposure (Table 2). Previous standard-of-care (SOC) anticoagulants that have historically been utilized are low molecular weight heparin (LMWH), unfractionated heparin (UFH), vitamin K antagonists (VKA) and fondaparinux. Recently, direct oral anticoagulants (DOAC) have been found to have a slightly better efficacy profile without significant increase in

bleeding risk, with recent guidelines suggesting its use over SOC anticoagulants (47). However, specific to the setting of ICU and trauma, the use of oral medications is limited, especially during the acute stages of admission. LMWH enoxaparin is still the most commonly used anticoagulant in pediatrics. UFH, particularly, due to its short half-life, is often used in critically ill children and those with trauma who potentially might have to undergo surgical procedures (53).

In the presence of trauma or critical illness, the incidence of bleeding is typically higher than that of the general population (54). If the severity or risk of bleeding is high enough, multidisciplinary decision making and communication with teams and specialists involved with the acute care of children at high risk for or have concomitantly developed HA-VTE and bleeding should be pursued. This typically includes the pediatric intensivist, pediatric hematologist, pediatric surgeon and interventional radiologist if indicated. These conversations are necessary to be able to decide what to prioritize and manage first. In the pediatric ICU, it is not uncommon for situations to arise where both devastating HA-VTE and hemorrhage present together.

SUMMARY

Pediatric HA-VTE is common in children after trauma or with critical illness due to an accrual of risk factors. Although knowledge gaps exist, research on pediatric HA-VTE is growing. Translation of RAMs into clinical tools that can help guide prescription of pTP and the evaluation of practices such as the use of mTP are urgently needed. Overall, we have outlined an approach to HA-VTE in children based on current literature. However, it must be noted that the difficulty in standardizing HA-VTE practices in children lies largely due to the lack of robust evidence. In the era of precision medicine, individualization of care with considerations to HA-VTE and bleeding risks is an important guiding principle when caring for the children with trauma or critical illness.

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ACKNOWLEDGEMENTS

Emily Johnson-Barlow, MLIS, for performing the full literature search of the articles reviewed to aid in writing this manuscript.

FUNDING

E.V.S.F. was supported by a grant from the Eunice Kennedy Shriver National Institute of Child Health and Human Development (R01HD106326).

AUTHOR CONTRIBUTIONS

R.M.T.H. and E.V.S.F. collected the necessary literature and wrote the manuscript. Both authors revised the manuscript critically for important intellectual content and provided final approval of this version of the manuscript.

Table 1. Some acquired and innate risk factors commonly related to pediatric trauma and critical illness.

Acquired	Presence of CVAD
	Systemic infection
	Mechanical ventilation
	Major vascular injury
	Orthopedic surgery
	Higher ISS *
	Altered mobility from baseline
Innate risk factors	Age < 1 year
	Increasing age in pediatric trauma*
	Obesity
	Congenital heart disease
	Autoimmune disease
	Hereditary thrombophilia
	Cancer

*Cut-off varies with studies. The Eastern Association for the Surgery of Trauma and Pediatric Trauma Society (EAST/PTS) guidelines defined Injury Severity Score ≥ 25 as the cut-off for severe injury. CVAD, central venous access device, ISS, Injury Severity Score.

Table 2. Examples of absolute and relative contraindications to anticoagulant exposure.

Bleeding disorder
Hemorrhage
Platelet count unable to be sustained > 50,000/mm3
Intracranial mass
Lumbar puncture or epidural catheter removal in prior 12 hours
Neurosurgical procedure
Pelvic fracture within past 48 hours
Uncontrolled hypertension

FIGURES AND FIGURE LEGENDS

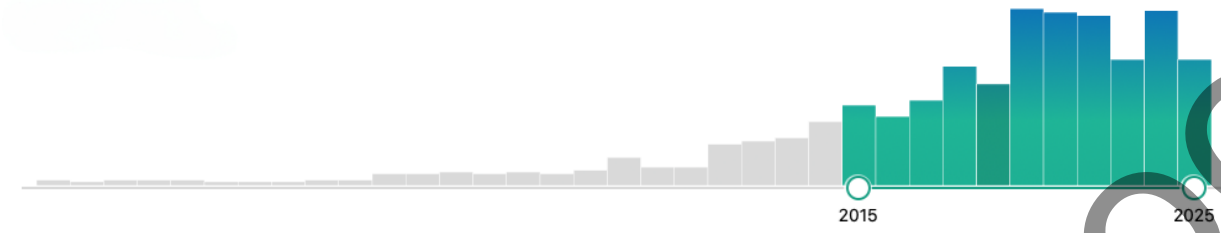

Figure 1. Snapshot of histogram from a PUBMED search on Pediatric VTE in 2025.

Supplementary Material
PubMed Searches
General Search - 1741
(((((("venous thromboembolism"[Title/Abstract]) OR ("VTE"[Title/Abstract])) OR ("deep vein thrombosis"[Title/Abstract] OR "DVT"[Title/Abstract])) OR ("pulmonary embolism"[Title/Abstract] OR "emboli"[Title/Abstract] OR "clot"[Title/Abstract])) OR (("Venous Thromboembolism"[Mesh]))) AND ((("Critical Illness"[Mesh]) OR ("trauma"[Title/Abstract] OR "critical illness"[Title/Abstract] OR "critical condition"[Title/Abstract] OR "intensive care"[Title/Abstract] OR "ICU"[Title/Abstract] OR "high risk"[tiab])) OR (("Intensive Care Units, Pediatric"[Mesh]) OR (("Critical Care"[Mesh]) OR "Intensive Care Units"[Mesh] AND (allchild[Filter])))) AND (allchild[Filter])

Bleeding Risk in Peds Critical Care and Trauma Pt Search - 400
((((((("venous thromboembolism"[Title/Abstract]) OR ("VTE"[Title/Abstract])) OR ("deep vein thrombosis"[Title/Abstract] OR "DVT"[Title/Abstract])) OR ("pulmonary embolism"[Title/Abstract] OR "emboli"[Title/Abstract] OR "clot"[Title/Abstract])) OR (("Venous Thromboembolism"[Mesh]))) AND ((("Critical Illness"[Mesh]) OR ("trauma"[Title/Abstract] OR "critical illness"[Title/Abstract] OR "critical condition"[Title/Abstract] OR "intensive care"[Title/Abstract] OR "ICU"[Title/Abstract] OR "high risk"[tiab])) OR (("Intensive Care Units, Pediatric"[Mesh]) OR (("Critical Care"[Mesh]) OR "Intensive Care Units"[Mesh] AND (allchild[Filter])))) AND (allchild[Filter])) AND ("Hemorrhage"[Mesh] OR "bleeding"[tiab] OR "hemorrhage"[tiab])

Prevention of VTE/Emboli/Clot in Peds Critical Care and Trauma PT Search - 353
((("Critical Illness"[Mesh]) OR ("trauma"[Title/Abstract] OR "critical illness"[Title/Abstract] OR "critical condition"[Title/Abstract] OR "intensive care"[Title/Abstract] OR "ICU"[Title/Abstract])) OR (("Intensive Care Units, Pediatric"[Mesh]) OR (("Critical Care"[Mesh]) OR "Intensive Care Units"[Mesh] AND (allchild[Filter])))) AND ((("venous thromboembolism"[Title/Abstract] OR "VTE"[Title/Abstract] OR "deep vein thrombosis"[Title/Abstract] OR "DVT"[Title/Abstract] OR "pulmonary embolism"[Title/Abstract] OR "emboli"[Title/Abstract] OR "clot"[Title/Abstract]) AND (prevent*[tiab] OR control[tiab])) OR ("Venous Thromboembolism/prevention and control"[Mesh])) AND (allchild[Filter])

Diagnosis of VTE in Peds Critically Ill and Trauma PT Search - 149
((("Critical Illness"[Mesh]) OR ("trauma"[Title/Abstract] OR "critical illness"[Title/Abstract] OR "critical condition"[Title/Abstract] OR "intensive care"[Title/Abstract] OR "ICU"[Title/Abstract])) OR (("Intensive Care Units, Pediatric"[Mesh]) OR (("Critical Care"[Mesh]) OR "Intensive Care Units"[Mesh] AND (allchild[Filter])))) AND ((("venous thromboembolism"[Title/Abstract] OR "VTE"[Title/Abstract]) AND (diagnos*[tiab])) OR ("Venous Thromboembolism/diagnosis"[Mesh])) AND (allchild[Filter]) AND (allchild[Filter])

Therapy of VTE in Peds Critically Ill and Trauma Pt Search - 269
((("Critical Illness"[Mesh]) OR ("trauma"[Title/Abstract] OR "critical illness"[Title/Abstract] OR "critical condition"[Title/Abstract] OR "intensive care"[Title/Abstract] OR "ICU"[Title/Abstract])) OR (("Intensive Care

Units, Pediatric"[Mesh]) OR (("Critical Care"[Mesh]) OR "Intensive Care Units"[Mesh] AND (allchild[Filter])))) AND ((("venous thromboembolism"[Title/Abstract] OR "VTE"[Title/Abstract]) AND (treat*[tiab] OR "therapy"[tiab] OR "intervention"[tiab] OR "prophyla*"[tiab])) OR ("Venous Thromboembolism/therapy"[Mesh])) AND (allchild[Filter]) AND (allchild[Filter])

Embase Searches
General Search - 1818
((('critical illness'/exp OR ('intensive care'/exp OR 'intensive care unit'/exp) OR ('critical illness':ti,ab OR 'trauma':ti,ab OR 'critical condition':ti,ab OR 'intensive care':ti,ab OR 'icu':ti,ab OR 'high risk':ti,ab)) AND ('venous thromboembolism'/de OR ('venous thromboembolism':ti,ab OR 'vte':ti,ab OR 'deep vein thrombosis':ti,ab OR 'dvt':ti,ab OR 'pulmonary embolism':ti,ab OR 'emboli':ti,ab OR 'clot':ti,ab))) AND ([adolescent]/lim OR [child]/lim OR [infant]/lim OR [newborn]/lim OR [preschool]/lim OR [school]/lim)) AND ('article'/it OR 'article in press'/it OR 'preprint'/it OR 'review'/it)

Bleeding Risk in Peds Critical Care and Trauma Pt Search – 401
((((('critical illness'/exp OR ('intensive care'/exp OR 'intensive care unit'/exp) OR ('critical illness':ti,ab OR 'trauma':ti,ab OR 'critical condition':ti,ab OR 'intensive care':ti,ab OR 'icu':ti,ab OR 'high risk':ti,ab)) AND ('venous thromboembolism'/de OR ('venous thromboembolism':ti,ab OR 'vte':ti,ab OR 'deep vein thrombosis':ti,ab OR 'dvt':ti,ab OR 'pulmonary embolism':ti,ab OR 'emboli':ti,ab OR 'clot':ti,ab))) AND ([adolescent]/lim OR [child]/lim OR [infant]/lim OR [newborn]/lim OR [preschool]/lim OR [school]/lim)) AND ('article'/it OR 'article in press'/it OR 'preprint'/it OR 'review'/it)) AND ('bleeding'/de OR ('bleeding':ti,ab OR 'hemorrhage':ti,ab))

Prevention of VTE/Emboli/Clot in Peds Critical Care and Trauma PT Search - 256
((((('critical illness'/exp OR ('intensive care'/exp OR 'intensive care unit'/exp) OR ('critical illness':ti,ab OR 'trauma':ti,ab OR 'critical condition':ti,ab OR 'intensive care':ti,ab OR 'icu':ti,ab OR 'high risk':ti,ab)) AND ('venous thromboembolism'/de OR ('venous thromboembolism':ti,ab OR 'vte':ti,ab OR 'deep vein thrombosis':ti,ab OR 'dvt':ti,ab OR 'pulmonary embolism':ti,ab OR 'emboli':ti,ab OR 'clot':ti,ab))) AND ([adolescent]/lim OR [child]/lim OR [infant]/lim OR [newborn]/lim OR [preschool]/lim OR [school]/lim)) AND ('article'/it OR 'article in press'/it OR 'preprint'/it OR 'review'/it)) AND ('prevention'/de OR ('prevention':ti,ab OR 'control':ti,ab))

Diagnosis of VTE in Peds Critically Ill and Trauma PT Search - 246
((((('critical illness'/exp OR ('intensive care'/exp OR 'intensive care unit'/exp) OR ('critical illness':ti,ab OR 'trauma':ti,ab OR 'critical condition':ti,ab OR 'intensive care':ti,ab OR 'icu':ti,ab OR 'high risk':ti,ab)) AND ('venous thromboembolism'/de OR ('venous thromboembolism':ti,ab OR 'vte':ti,ab))) AND ([adolescent]/lim OR [child]/lim OR [infant]/lim OR [newborn]/lim OR [preschool]/lim OR [school]/lim)) AND ('article'/it OR 'article in press'/it OR 'preprint'/it OR 'review'/it)) AND 'diagnosis'/exp

Therapy of VTE in Peds Critically Ill and Trauma Pt Search – 551
((((('critical illness'/exp OR ('intensive care'/exp OR 'intensive care unit'/exp) OR ('critical illness':ti,ab OR 'trauma':ti,ab OR 'critical condition':ti,ab OR 'intensive care':ti,ab OR 'icu':ti,ab OR 'high risk':ti,ab)) AND ('venous thromboembolism'/de OR ('venous thromboembolism':ti,ab OR 'vte':ti,ab))) AND ([adolescent]/lim OR [child]/lim OR [infant]/lim OR [newborn]/lim OR [preschool]/lim OR [school]/lim)) AND ('article'/it OR 'article in press'/it OR 'preprint'/it OR 'review'/it)) AND ('therapy'/exp OR 'therapy':ti,ab OR 'intervention':ti,ab OR 'treatement':ti,ab)

Scopus
General Search - 1170
(TITLE-ABS-KEY ("venous thromboembolism" OR "VTE")) AND (TITLE-ABS-KEY ("critical illness" OR "critically ill" OR "trauma" OR "critical condition" OR "ICU" OR "high risk" OR "intensive care unit" OR "Critical care")) AND (TITLE-ABS-KEY ("child*" OR "pediatric*" OR "teen*" OR "adolescen*" OR "infant" OR "baby" OR "babies" OR "toddler")) AND PUBYEAR > 2009 AND PUBYEAR < 2026 AND (LIMIT-TO (DOCTYPE,"ar") OR LIMIT-TO (DOCTYPE,"re")) AND (LIMIT-TO (LANGUAGE,"English"))

Cochrane Library – 12
https://www.cochranelibrary.com/advanced-search/search-manager?search=7796545