

Perceived relative clinical significance of the risks of venous thromboembolism and bleeding from pharmacologic thromboprophylaxis in children: an international survey of pediatric providers: communication from the ISTH SSC Subcommittee on Pediatric and Neonatal Thrombosis and Hemostasis

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Abstract

Background: In the absence of robust data, the decision to provide primary pharmacologic thromboprophylaxis in hospitalized children depends on the perceived risks of hospital-acquired venous thromboembolism (HA-VTE), balanced against the acceptable bleeding risk from thromboprophylaxis.

Objectives: We aimed (1) to determine the perceived relative clinical significance of HA-VTE and bleeding from thromboprophylaxis among pediatric providers, and (2) to determine patient and provider characteristics that modify this perception.

Methods: We conducted a cross-sectional survey among pediatric providers. Using case vignettes and Likert scales, we quantified the likelihood of providing thromboprophylaxis to prevent 4 types of HA-VTE, varying in severity, given equal risks of developing 6 bleeding characteristics, ranging from minor to fatal. We evaluated 9 patient characteristics, including patient age, and 7 provider characteristics that may modify this decision.

Results: A median of 145 (IQR, 139-152) respondents answered each vignette. For all bleeding characteristics other than minor bleeding, respondents were less likely to provide thromboprophylaxis to prevent nonsevere HA-VTE, except for pulmonary embolism with hemodynamic compromise. HA-VTE type, bleeding, and patient characteristics, particularly infant age, were associated with a change in scores in the likelihood of providing thromboprophylaxis. However, changes were minimal, with only infant age associated with a change of ≥ 1 point.

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Conclusion: Among pediatric providers, the acceptable bleeding risk for primary pharmacologic thromboprophylaxis varies with perceived HA-VTE severity. Specific features, particularly infant age, modified the respondents' decisions despite the stated risks. Our findings can provide a robust, semiquantitative approach to address these competing risks clinically and in future research.

KEYWORDS

bleeding, decision making, clinical relevance, venous thromboembolism

1 | INTRODUCTION

Over the last 2 decades, the incidence of venous thromboembolism (VTE), including extremity deep venous thrombosis (DVT) and pulmonary embolism (PE), in hospitalized children has significantly increased by almost 300% [1,2]. Pediatric hospital-acquired VTE (HA-VTE) has a reported incidence of 0.3% to 0.58% [3]. It has become an area of intense investigation, including exploration of risk factors and evaluation of preventive strategies. Primary pharmacologic thromboprophylaxis, which refers to the prescription of anticoagulation in hospitalized children to prevent a first occurrence of HA-VTE, is recommended for most hospitalized adults based on randomized controlled trials (RCTs) that have shown reductions in the risk of HA-VTE without increasing bleeding risk [4–6]. The small number of RCTs that have been performed in children has focused only on unique disease states or physiologic conditions, which limits the generalizability to the broader pediatric population [7–12]. Additionally, adult data extrapolate poorly to children, in part due to age-related differences in hemostasis, pathology, and exposures [13,14].

Despite the paucity of robust data in children, pediatric providers are faced daily with the decision regarding primary pharmacologic thromboprophylaxis. Risk assessment models have been developed to identify children at high risk of HA-VTE [15,16]. However, most models have not been sufficiently validated or recommended for routine clinical use. Additionally, there are no pediatric models for bleeding risk attributable to pharmacologic thromboprophylaxis. Bleeding from pharmacologic thromboprophylaxis in children is reported to have an incidence of approximately 2.5% [17,18]. Ultimately, the decision to provide primary pharmacologic thromboprophylaxis rests on a provider's perception of the risk of HA-VTE, balanced against the anticipated "acceptable" risk of bleeding from anticoagulant exposure. In this study, we aimed (1) to determine the perceived relative clinical significance of HA-VTE and bleeding from primary pharmacologic thromboprophylaxis among pediatric providers, and (2) to determine patient or provider characteristics that modify this perception. We hypothesized that the relative clinical significance depends on the perceived severity of HA-VTE and bleeding, and that specific patient and provider characteristics modify this perception. From here on, we use the term

"thromboprophylaxis" to refer to primary pharmacologic thromboprophylaxis, unless otherwise specified.

2 | MATERIALS AND METHODS

2.1 | Study design

We conducted a cross-sectional, self-administered, web-based survey that was endorsed by the Blood Research Network of the Pediatric Acute Lung Injury and Sepsis Investigators Network and the International Society on Thrombosis and Haemostasis (ISTH). A core group of investigators developed the survey instrument (R.M.T.H., L. R., and E.V.S.F.). The survey underwent multiple revisions and iterations by the Blood Research Network and the ISTH Scientific and Standardization Committee (SSC) Subcommittee on Pediatric and Neonatal Thrombosis and Hemostasis. The final survey was approved and granted exempt status by the Institutional Review Board of the University of Illinois at Peoria (Institutional Review Board number 2154988-5) in May 2024. This report complies with the Checklist for Reporting of Survey Studies guidelines [19].

2.2 | Survey instrument

The survey instrument consisted of instructions on the introductory page, followed by a demographic section that collected respondents' characteristics, and then clinical vignettes. The full survey can be found in the Supplementary Text. There were 4 clinical vignettes, each composed of 2 parts. The order in which respondents received the clinical vignettes was randomized to equalize the response distribution and minimize bias.

Respondents were asked to rate the likelihood that they would provide thromboprophylaxis to a 15-year-old hospitalized female to prevent a specific type of HA-VTE, ie, asymptomatic DVT, symptomatic DVT, PE without hemodynamic compromise, or PE with hemodynamic compromise, in the setting of concurrent risk of developing a specific bleeding characteristic. A 5-point Likert scale was used to quantify the likelihood of providing thromboprophylaxis, ie, definitely

unlikely, probably unlikely, neither unlikely nor likely, probably likely, or definitely likely. The HA-VTE types were chosen to reflect the severity of VTE that may be encountered clinically. The bleeding characteristics were chosen to align with the ISTH definitions of major bleeding, clinically relevant nonmajor bleeding (CRNMB), and minor bleeding in children [20]. For major bleeding, we included fatal bleeding, bleeding at a critical organ site, eg, intracranial, and bleeding that decreases hemoglobin by >2 g/dL in 24 hours. For CRNMB, we included bleeding that requires a blood transfusion and bleeding that requires procedural intervention, eg, epistaxis requiring nasal cautery. Finally, we defined minor bleeding in the survey instrument as bleeding that stops without intervention, eg, epistaxis.

We then asked respondents how their decision to provide thromboprophylaxis would change across 9 different patient characteristics. For example, we asked whether their decision would change if the patient were 3 weeks old or had a hemoglobin of 7 g/dL. For this question, we asked respondents to consider that the risk of HA-VTE in each vignette was equal to the risk of developing bleeding that requires a blood transfusion. We chose this specific bleeding characteristic among others because of its clinical relevance to pediatric inpatient providers. A comparable 5-point Likert scale was used: definitely less likely than my decision above, probably less likely, neither less nor more likely than my decision above, probably more likely, or definitely more likely than my decision above. The patient characteristics chosen included the following: 3 weeks old, 9-year-old male, admitted to an intensive care unit (ICU), diagnosed with sepsis, hemoglobin of 7 g/dL, an international normalized ratio (INR) of 2.0, known to have a patent foramen ovale, platelet count of 50 000 per μ L, and scheduled for elective femoral osteotomy surgery. These characteristics were selected *a priori* for their potential to modify a respondent's baseline decisions, despite the vignette's mention of equal risks of developing HA-VTE and bleeding.

Pretesting of the survey instrument was performed to assess validity and identify areas for improvement. The pretest group consisted of 4 experts who have published in the field of pediatric thromboprophylaxis (3 pediatric critical care physicians and a pediatric hematologist). Direct feedback was sought, and cognitive interviewing was conducted with each pretester using a 5-item questionnaire we created to ensure that survey items were conveyed as intended [21]. We specifically asked about clarity, ease of survey completion, reliability of answers, and suggestions for phrasing the survey items. Prior to survey distribution, a pilot test group of 6 subspecialists (2 pediatric critical care physicians, 2 pediatric hematologists, and 2 pediatric hospitalists) who were not involved in the development of the survey instrument was asked to conduct a dry run of the online survey in its entirety to ensure proper functioning.

2.3 | Sample characteristics

Purposive sampling was employed, targeting inpatient providers involved in the decision to provide thromboprophylaxis to hospitalized children. The survey instrument was distributed to

members of networks and societies in pediatric critical care, pediatric hematology, and pediatric hospital medicine. These included the Pediatric Acute Lung Injury and Sepsis Investigators, the European Society of Paediatric and Neonatal Intensive Care, the ISTH SSC Subcommittee on Pediatric and Neonatal Thrombosis and Hemostasis, the Asian Society for Pediatric Thrombosis and Hemostasis, the Children's Healthcare Advancements in Thrombosis Consortium, and the Section on Hospital Medicine LISTSERV. Pretesters and pilot testers were excluded from participating in the final survey.

2.4 | Survey administration

The survey was administered using the Qualtrics platform (Qualtrics International Inc). A survey link was sent via email between September and December 2024. The link was also posted on the networks' websites and social media platforms when possible. One month after its initial distribution, follow-up emails were sent to all groups.

2.5 | Ethical considerations

Survey participation was voluntary, confidential, anonymous, and implied consent. Identifiable data were not collected.

2.6 | Statistical considerations

Descriptive analysis was used for the demographic questions and Likert scale items, with the number of responses reported as counts (percentages) or medians (IQRs). We interpreted bleeding characteristics with a median response corresponding to the neutral value on the Likert scale, ie, neither unlikely nor likely, as having clinical significance equal to the given type of HA-VTE. Quantile regression modeling was used to evaluate the association between the decision to provide thromboprophylaxis and HA-VTE type, bleeding characteristics, and respondent characteristics. Quantile regression estimated the median Likert scale score in the presence of these variables. We also used quantile regression to evaluate the association between a change in the decision to provide thromboprophylaxis and the specific HA-VTE type, bleeding characteristics, patient characteristics, and respondent characteristics. In the model, quantile regression estimated the median change in the Likert scale score in the presence of these variables. *P* values $< .05$ were considered statistically significant. Statistical tests were performed using Stata version 18 (StataCorp).

3 | RESULTS

3.1 | Respondent characteristics

We used the term "respondents" to describe our study population in the survey. A total of 215 respondents answered the demographics section

of the survey (Table and Figure 1). Majority were physicians with a subspecialty in either pediatric critical care ($n = 119$, 55.3%) or pediatric hematology ($n = 58$, 27.0%). Most had residency training in pediatrics ($n = 177$, 82.3%), followed by training that included adult care ($n = 38$, 17.7%). Most practiced in North America, specifically the United States ($n = 162$, 97.6%), followed by Europe ($n = 28$, 13%) and Asia ($n = 13$, 6%). Of the respondents, 118 (55.1%) stated that their hospital has guidelines for thromboprophylaxis. In total, we had a median of 145 (IQR, 139–152) respondents who answered at least 1 of the clinical vignettes.

3.2 | Perceived clinical significance of HA-VTE relative to bleeding characteristics

For all bleeding characteristics other than minor bleeding, respondents were less likely to provide thromboprophylaxis to prevent most types of HA-VTE, except for PE with hemodynamic compromise (Figure 2). In the setting of perceived minor bleeding, respondents were more likely to provide thromboprophylaxis to prevent all types of HA-VTE.

For asymptomatic DVT, there were no bleeding characteristics, with a median response corresponding to the neutral value on the Likert scale (Figure 3A and Supplementary Figure S1). However, the median response for “bleeding that needs procedural intervention, eg, epistaxis that needs nasal cautery” and “minor bleeding that stops without intervention, eg, epistaxis” had Likert scale scores indicating *probably unlikely* and *probably likely* to provide thromboprophylaxis, respectively, and their IQRs were skewed toward the neutral Likert scale value. This suggests equivocal clinical significance for these 2 bleeding characteristics, with a clinical significance that lies between them. Symptomatic DVT had equal clinical significance as bleeding that needs procedural intervention. PE without hemodynamic compromise had equal clinical significance for both bleeding that requires a blood transfusion and bleeding that requires procedural intervention. Lastly, PE with hemodynamic compromise had equal clinical significance as “bleeding that decreases hemoglobin by >2 g/dL in 24 hours.”

After adjusting for the different variables included in the quantile regression model, only HA-VTE type and bleeding characteristics were associated with a change in the likelihood of providing thromboprophylaxis (Figure 3B). Compared with asymptomatic DVT, the other types of HA-VTE increased the likelihood of providing thromboprophylaxis, although only PE with hemodynamic compromise was strong enough to change the median response by 1 Likert scale point. Compared with fatal bleeding, all other bleeding characteristics were associated with a higher likelihood of providing thromboprophylaxis. Minor bleeding, in particular, changed the median response by 2 Likert scale points. Respondent characteristics were not associated with a change in median response.

3.3 | Patient characteristics modify respondents' decision making

Some of the patient characteristics modified the respondents' likelihood of providing thromboprophylaxis (Figure 4A). For all HA-VTE

types, respondents were less likely to provide thromboprophylaxis than they were in their original decision for a 3-week-old patient compared with a 15-year-old patient described in the vignette. They were also less likely to do so when the INR was 2.0, except when the perceived risk involved the prevention of PE with hemodynamic compromise. Respondents were more likely to provide thromboprophylaxis for children admitted to the ICU with a perceived risk of symptomatic DVT or PE with hemodynamic compromise, but not for asymptomatic DVT or PE without hemodynamic compromise. In the presence of a patent foramen ovale, providers were more likely to provide thromboprophylaxis regardless of the HA-VTE involved.

After adjusting for the different variables included in the quantile regression model, the factors associated with a lower likelihood of providing thromboprophylaxis compared with the respondent's original decision included patients aged 3 weeks or 9 years, a hemoglobin count of 7 g/dL, a platelet count of 50 000/ μ L, and an INR of 2.0 (Figure 4B). On the contrary, ICU admission, sepsis, and patent foramen ovale were associated with a higher likelihood of doing so. However, except for patients aged 3 weeks, none of these variables changed the median response by at least 1 Likert scale point. Respondent characteristics were not associated with a change in median response.

4 | DISCUSSION

In this international survey of pediatric providers, we investigated the perceived relative clinical significance of HA-VTE prevention and bleeding from thromboprophylaxis in children. We report that most providers were less likely to provide thromboprophylaxis across all clinical manifestations of HA-VTE, except when the perceived risk involved PE with hemodynamic compromise or when the trade-off was only minor bleeding. This reflects pediatric providers' perception of HA-VTE and the outcomes related to thromboprophylaxis in hospitalized children. Overall, providers were less likely to administer thromboprophylaxis when the bleeding risk was greater than minor bleeding and more likely to do so only when the perceived HA-VTE risk was considered severe (PE with hemodynamic compromise). Among the various bleeding characteristics, minor bleeding was associated with the greatest influence on the decision to provide thromboprophylaxis across all HA-VTE types. We also noted that respondents perceived most types of HA-VTE as clinically equivalent to bleeding characteristics consistent with ISTH definitions of CRNMB [20]. This was true for all types of HA-VTE except for PE with hemodynamic compromise, which was considered clinically equivalent to major bleeding. Among patient characteristics, age at 3 weeks modified a provider's original decision not to provide thromboprophylaxis despite equal risks of developing HA-VTE and bleeding. Provider characteristics had no measurable influence on the likelihood of providing thromboprophylaxis. Our findings suggest that the acceptable bleeding risk of thromboprophylaxis varies with the perceived severity of HA-VTE, and that providers were more likely to avoid bleeding greater than minor bleeding to prevent

TABLE Demographics of survey respondents.

Characteristic	Value
Profession	
Physician	213 (99.1)
Pharmacist	1 (0.5)
Nurse or nurse practitioner	1 (0.5)
Specialty	
Pediatric critical care	119 (55.3)
Pediatric hematologist	58 (27.0)
Pediatric hospitalist	33 (15.3)
Others	5 (2.3)
Residency training	
Pediatrics	177 (82.3)
Anesthesia	17 (7.9)
Medical pediatrics	16 (7.4)
Internal medicine	5 (2.3)
Years in practice since residency training	
<5	60 (27.9)
5-10	44 (20.5)
>10	111 (51.6)
Sex	
Female	120 (55.8)
Male	92 (42.8)
Prefer not to answer	3 (1.4)
Race	
White	155 (72.1)
Asian	38 (17.7)
Black	3 (1.4)
Others/prefer not to answer	19 (8.8)
Ethnicity	
Non-Hispanic	189 (87.9)
Hispanic	13 (6.0)
Others/prefer not to answer	13 (6.0)
Primary continent of practice	
North America ^a	166 (77.2)
United States	162 (97.6)
Mexico	2 (1.2)
Canada	1 (0.6)
Europe	28 (13.0)
Asia	13 (6.0)

(Continues)

TABLE (Continued)

Characteristic	Value
South America	4 (1.9)
Africa	3 (1.4)
Australia or New Zealand	1 (0.5)
Type of hospital ^a	
Free-standing children's hospital	103 (48.1)
Children's hospital within a medical center	94 (43.9)
General hospital	17 (7.9)
Availability of hospital guidelines for primary pharmacologic thromboprophylaxis ^a	
Yes	118 (55.1)
No	82 (38.3)
I do not know	14 (6.5)

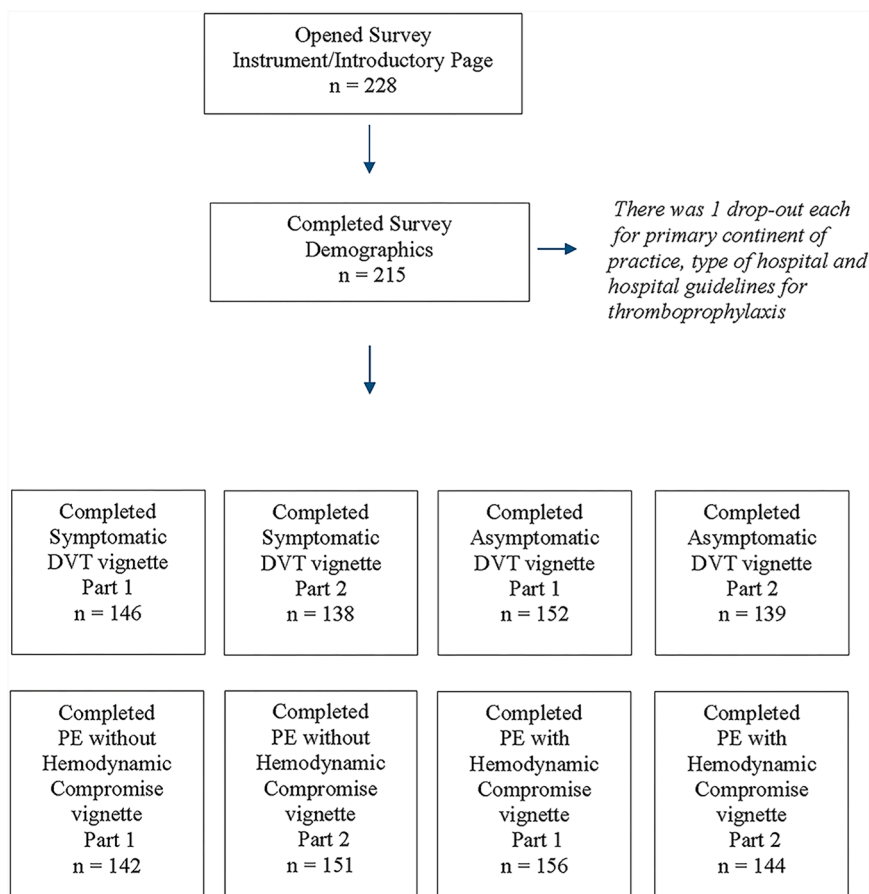
Data are presented as *n* (%).^a There was 1 respondent drop-out.

nonsevere HA-VTE in order to balance these perceived risks. Additionally, patient but not provider characteristics modified respondents' original decision to provide thromboprophylaxis. This suggests that the perceived risk-benefit ratio of thromboprophylaxis is influenced by these clinical features, despite predefined risks.

In the absence of robust evidence, a provider's experience, values, and attitudes influence their decision making at the bedside [22]. The relative clinical significance of HA-VTE vs the risk of bleeding from thromboprophylaxis, both important hospital-acquired conditions, is not agreed upon in children compared with adults [23–27]. Qualitative studies on the relative significance of the 2 remain sparse in the adult literature and nearly nonexistent in the pediatric literature [26,27]. While we suspected that respondents who self-identified as having received adult training might differ in their responses to the clinical vignettes compared with those who had only pediatric training, we did not identify such an association. Similarly, specialty-specific respondent characteristics were not associated with the decision to provide thromboprophylaxis.

The bivariate nature of the endpoints related to thromboprophylaxis is a common theme in antithrombotic trials [28–30]. Determining the threshold for clinical benefit in the setting of 2 opposing outcomes relies on knowledge of the risks associated with each outcome and their attributable clinical significance [22,31]. We postulated that the absence of high-quality data on these risks in children reduces the confidence of providers in prescribing thromboprophylaxis and augments their threshold for doing so. Our survey supports these beliefs and the notion that some contextual features may carry more weight than others. For example, a difference in a patient's age of 15 years vs 3 weeks resulted in a lower Likert scale score of 1 point. Despite the high frequency of HA-VTE in infants,

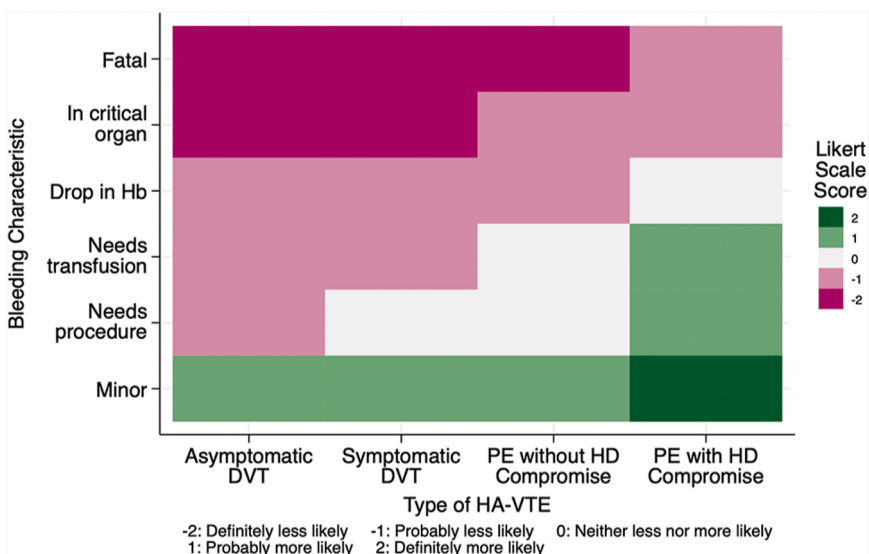
FIGURE 1 Flow chart showing the number of respondents who completed each part of the survey instrument. There were respondent drop-outs along each part. Part 1 involved the likelihood of providing thromboprophylaxis based on the type of hospital-acquired venous thromboembolism and bleeding characteristics. Part 2 involved the likelihood of providing thromboprophylaxis relative to respondents' original decisions, based on various patient characteristics. DVT, deep venous thrombosis; PE, pulmonary embolism.



pediatric providers were less likely to provide thromboprophylaxis for this age group [1,32]. Similarly, a recent survey showed a trend toward decreased comfort in providing thromboprophylaxis in younger age groups, with 19% of respondents expressing discomfort with infants [33]. The reluctance to provide thromboprophylaxis in

infants may be due to a perception that heightened bleeding risk and/or its sequelae, eg, intraventricular hemorrhage and subsequent persistent neurologic morbidity, might be more clinically significant in infants than in older age groups [34]. The reasons behind this reluctance remain unclear and are not supported by the literature,

FIGURE 2 Heat map showing median responses of the likelihood of providing primary pharmacologic thromboprophylaxis by type of hospital-acquired venous thromboembolism (HA-VTE) and bleeding characteristics. DVT, deep venous thrombosis; Hb, hemoglobin; HD, hemodynamic; PE, pulmonary embolism.



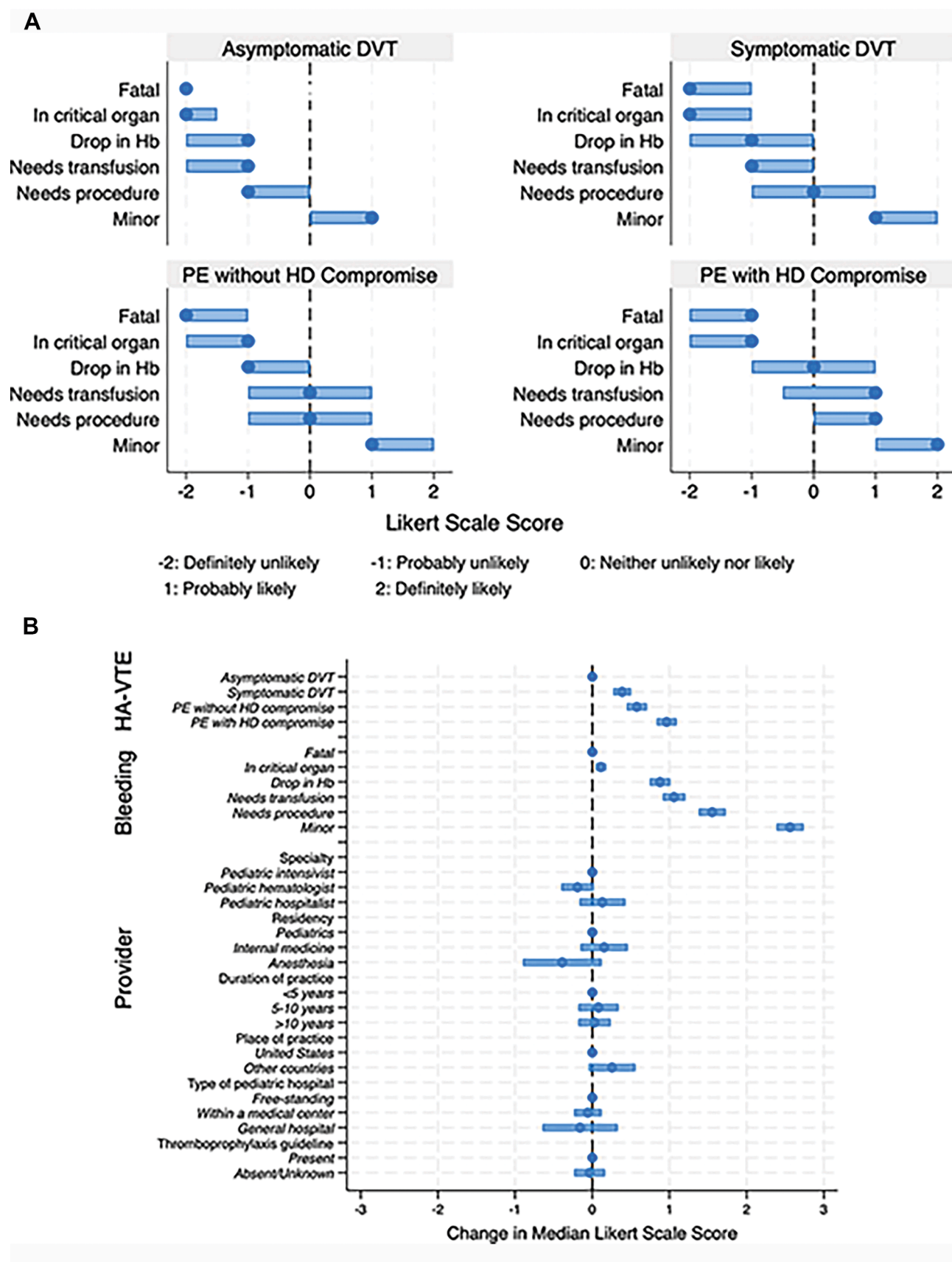
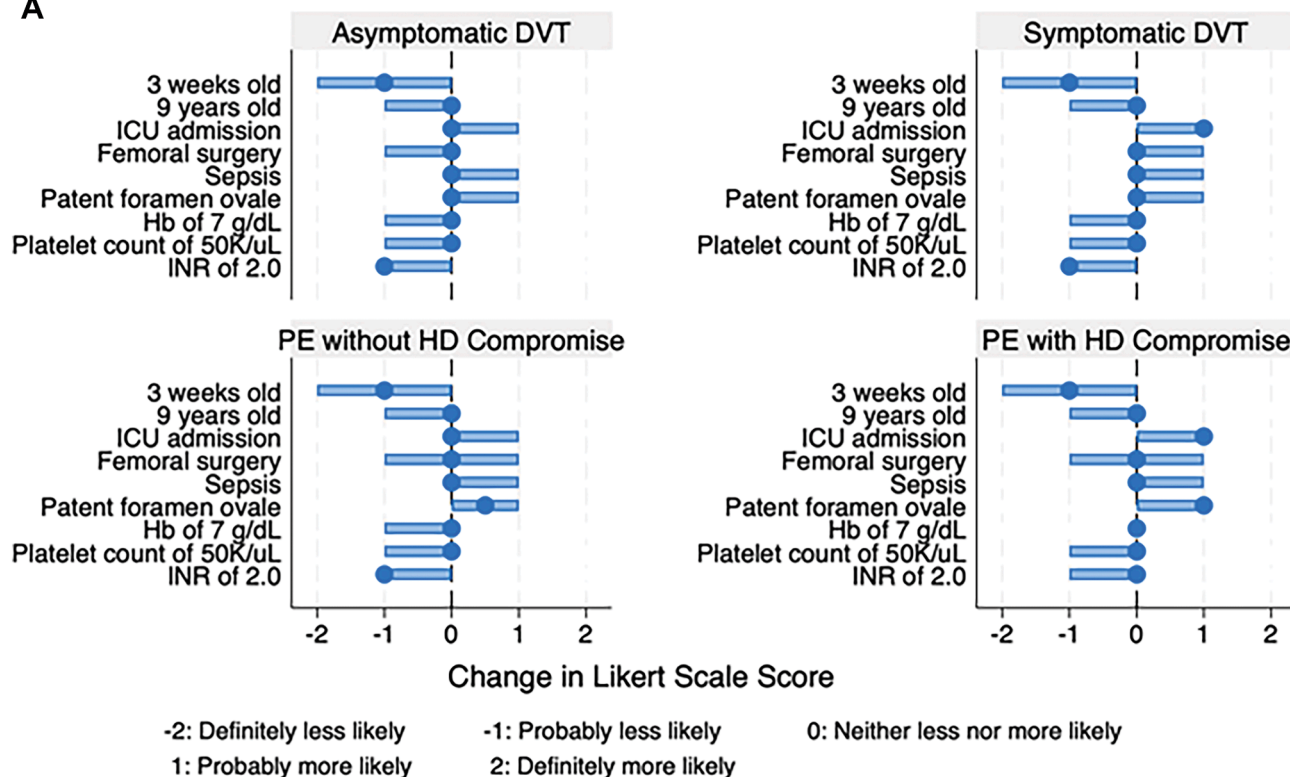


FIGURE 3 Median responses and IQRs of the likelihood of providing primary pharmacologic thromboprophylaxis for the type of hospital-acquired venous thromboembolism (HA-VTE) relative to bleeding characteristics. (A) The median decision is represented by the blue dots and the IQR by the bars. The y-axis consists of the bleeding characteristics used in the survey. (B) Forest plot for the quantile regression model showing the type of HA-VTE, bleeding characteristics, provider characteristics, and their associations with a change in the decision to provide primary pharmacologic thromboprophylaxis. DVT, deep venous thrombosis; Hb, hemoglobin; HD, hemodynamic; PE, pulmonary embolism.

A



B

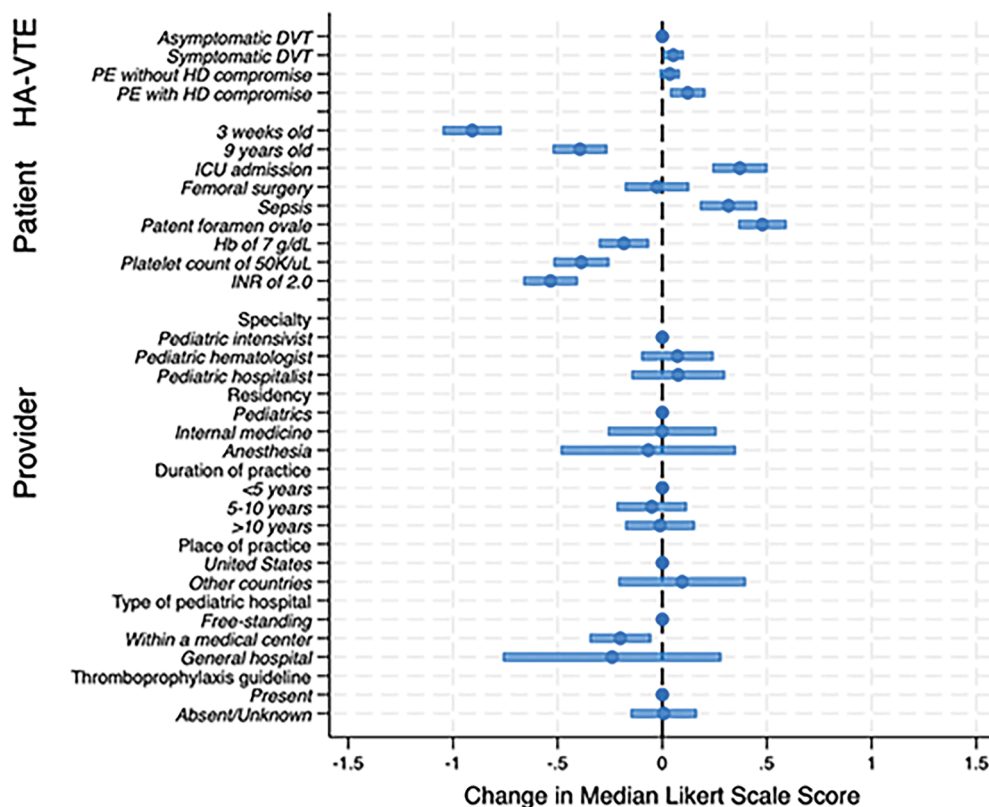


FIGURE 4 Median responses and IQRs for patient characteristics that may modify the respondent's baseline decision to provide primary pharmacologic thromboprophylaxis. The median decision is represented by the blue dots and the IQR by the bars. (A) The y-axis consists of the patient characteristics included in the survey. (B) Forest plot for the quantile regression model according to the type of hospital-acquired venous thromboembolism (HA-VTE), bleeding characteristics, provider characteristics, and their associations with a change in the respondent's baseline decision to provide primary pharmacologic thromboprophylaxis. DVT, deep venous thrombosis; Hb, hemoglobin; HD, hemodynamic; ICU, intensive care unit; INR, international normalized ratio; PE, pulmonary embolism.

which indicates that the incidence of intraventricular hemorrhage is uncommon outside the very premature gestational age group and the first several days of neonatal life [35]. Alternatively, providers may believe that thromboprophylaxis is less effective in this age group. Consistent with this belief, recent data from a phase 2 trial on the efficacy of enoxaparin for thromboprophylaxis showed that it may not be efficacious in infants <1 year old [36].

A recent RCT by Walker et al. examined whether the use of an automated pediatric HA-VTE risk calculator embedded in a patient's electronic health record, along with referral to a hematologist to help guide the decision to provide thromboprophylaxis, decreases the incidence of HA-VTE. Their results were limited by reluctance from the clinical team to follow recommendations provided by hematologists, with almost 75% nonadherence [15,16]. The most common reason reported for refusal was physician preference [15,16]. This finding underscores the importance of provider perception in the decision to provide thromboprophylaxis vs actual calculated risks or expert opinion. Our survey attempted to quantify the relative clinical significance of preventing HA-VTE and bleeding from thromboprophylaxis in children. Current recommendations, clinical studies, and management strategies typically address these competing risks qualitatively or separately [36]. Our results can provide a robust, semiquantitative approach for clinical use and future research. Future RCTs, for example, can use hierarchical composite outcomes or win-ratio methods, based on our findings [37,38].

Our study has important limitations to consider. Surveys are prone to response bias and measurement errors. Most of our respondents were pediatric critical care physicians in the United States and may not represent the views of other pediatric providers or those from other countries. We also cannot confirm the reasons behind a respondent's selections and preferences. Due to our distribution method, we were unable to compute the response rates for our survey. However, we know we had only about 145 of 215 respondents per clinical vignette. We anticipated that this would occur, in part, due to survey fatigue, which we preempted by randomizing the order of the clinical vignettes [39]. We also included only 9 patient characteristics and collected a limited number of respondent characteristics to minimize survey length and fatigue. In-depth investigations of other patient and provider characteristics, such as those conducted through qualitative studies, should be pursued. In addition, although we pretested our survey, we cannot refute the complexity inherent in our inquiry, including the inability to predict the type of VTE and bleeding characteristics prior to providing thromboprophylaxis. However, the difficulties faced by respondents reflect those faced by providers at the bedside when deciding on thromboprophylaxis for children. Our survey focused on primary pharmacologic thromboprophylaxis; decisions regarding secondary thromboprophylaxis are also clinically relevant and should be investigated. Our survey did not consider the opinions and values of patients and their caregivers, which may differ from those of their providers [40,41]. Additionally, we did not investigate the relative significance of mechanical thromboprophylaxis and its influence on the decision regarding pharmacologic thromboprophylaxis.

Understanding how this strategy may affect provider practice remains an important area for future studies.

5 | CONCLUSIONS

Our findings suggest that for most pediatric providers, the acceptable bleeding risk attributable to primary pharmacologic thromboprophylaxis varies with perceived HA-VTE severity. Patient-specific characteristics, particularly the infant age group, but not provider characteristics, modified the original decision to provide thromboprophylaxis, even when the risks of HA-VTE and bleeding were stated to be equal. Our findings can provide a robust, semiquantitative approach to address the competing risks of preventing HA-VTE and bleeding from thromboprophylaxis in children clinically and in future research. While we await definitive RCTs of primary pharmacologic thromboprophylaxis in children, we advocate for additional research that incorporates patient and caregiver perceptions and evaluates other contextual scenarios, such as secondary and mechanical thromboprophylaxis.

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AUTHOR CONTRIBUTIONS

R.M.T.H. conceived and developed the survey and figures, collected the data, performed the analysis, and wrote the manuscript. L.R. conceived and developed the survey and wrote the manuscript. A.A.S. wrote the manuscript. S.T. helped with parts of the analysis and pretested the survey. F.C. and F.N. pretested the survey and contributed to important intellectual content. E.V.S.F. conceived and designed the concept for the survey, conceived and developed the survey and figures, designed and performed the analysis, and wrote the manuscript. All authors revised the manuscript critically for important intellectual content and provided final approval of this version of the manuscript.

DECLARATION OF COMPETING INTERESTS

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SUPPLEMENTARY MATERIAL

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