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Cost-Effectiveness of a Novel Treatment for Cancer-Associated Thrombosis (CAT): Results from an Early Economic Analysis

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OBJECTIVE

This early economic analysis explored the potential cost-effectiveness of a hypothetical new therapy for the treatment of CAT from a United Kingdom (UK) National Health Services (NHS) perspective.

INTRODUCTION

- Cancer is a strong and independent risk factor for thrombosis, particularly venous thromboembolism (VTE).[1,2] VTE in cancer patients is associated with a higher economic burden and increased health care expenditures compared to cancer patients without VTE.[3]
- Direct oral anticoagulants (DOACs) and low-molecular weight heparins have demonstrated to be effective in preventing or treating cancer-associated thrombosis (CAT), but they also interfere with hemostasis leading to an increased risk of bleeding and decreased adherence.
- As a result, many patients with CAT who would benefit from treatment do not complete the full 3-6 months of treatment that is recommended by most guidelines. These patients do not receive adequate treatment in terms of dose and/or duration, which can lead to less favorable outcomes.

METHODS

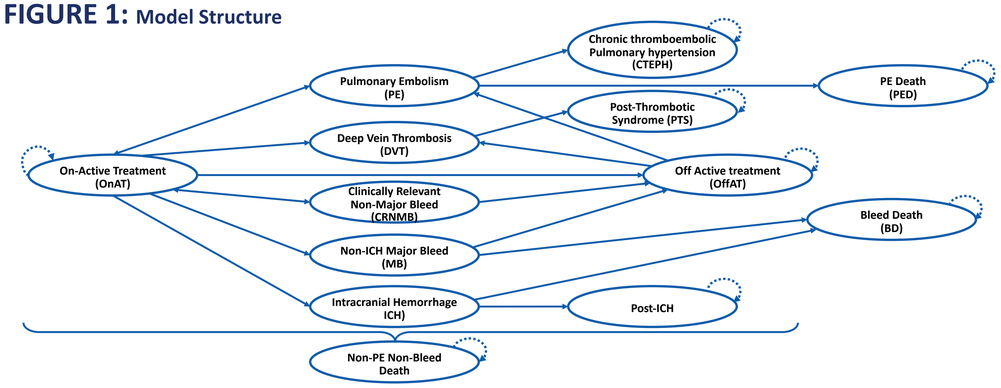
Overview

- A Markov model was developed to reflect the clinical pathways typical of patients with CAT. The model structure was derived from prior cost-effectiveness publications developed by Li et al.[4,5]
- The model used a one-month cycle length and a lifetime horizon.
- All cost-related input values were inflated to 2021 British pound sterling (GBP); costs and outcomes in the model were discounted annually at 3.5%.
- Key model outcomes included clinical events, life years (LYs) and quality-adjusted LYs (QALYs), total costs, incremental outcomes (eg, clinical events, LYs, QALYs, costs), and incremental cost per QALY gained.

Model Structure & Patient Flow

- A hypothetical cohort of adult patients with active cancer and a diagnosis of acute symptomatic VTE for whom long-term treatment with DOACs is indicated received either the hypothetical treatment, apixaban or dalteparin.
- Patients entered the model in the "On Active Treatment (OnAT)" state and flowed through the model as illustrated in **Figure 1**.

FIGURE 1: Model Structure



Assumptions & Inputs

- Clinical efficacy for the apixaban and dalteparin arms were derived from the data presented in Li et al.[4,5]
- Treatment discontinuation for apixaban and dalteparin was informed by real-world discontinuation rates. Initial discontinuation rates were informed by an internal analysis of United States (US) claims-based data, while subsequent discontinuation rates were derived from the Li et al. (2019) model.[4,6]
- Health state costs were derived from UK reference cost tables and health state utilities were derived from the National Institute for Health and Care Excellence (NICE) apixaban appraisal in 2015.[7,8]
- Key modeling assumptions are summarized in **Table 1**. Key model parameters and input values are summarized in **Table 2**.

METHODS

TABLE 1. Key Assumptions

Assumption	Rationale
Patients were assumed to exist in mutually exclusive health states, ie, they could not have VTE and bleed simultaneously.	Markov model standard assumption.
Patients who experienced VTE were assumed to return to the same anticoagulant or switch to another treatment depending on assumed probabilities.	As a placeholder, patients on the hypothetical treatment were assumed to switch to dalteparin (40%) or apixaban (60%). Based on a registry study of CAT patients with breakthrough VTE, one-third of dalteparin patients were assumed to switch to apixaban and one-third were assumed to increase their dose.[9] For apixaban, it was assumed that two-thirds switched to dalteparin.
Patients who experienced MB or ICH were assumed to transition to off-treatment or post-ICH, respectively, after 1 cycle.	Assumption from Li 2019 and Li 2020 models.[4,5]
Patients who experienced CRNMB were assumed to transition to "off treatment" with a 10% probability after 1 cycle.	Assumption.

TABLE 2: Key Model Parameters

Characteristic	Value	
Age (years)[10]	69 years	
Gender (% female)[10]	51%	
Weight	70 kg	
Cancer type (%)[10]	**Males**	**Females**
	Lung (23%) Colon (21%) Hematological (17%) Bladder (8%) Pancreatic (7%) Stomach (6%) Brain (4%) Prostate (14%)	Lung (21%) Colon (19%) Hematological (15%) Bladder (7%) Pancreatic (6%) Stomach (5%) Brain (4%) Breast (12%) Ovarian (9.5%) Uterine (3%)

Health State	Monthly Cost, £	Utility or Disutility
On Treatment, Off Treatment[11-14]		Age, gender and cancer-specific
Off Treatment	0	
PE[7,15]	1,302	-0.32
DTV[7,15]	343	-0.11
CRNMB[7,13]	212	-0.0054
MB[7,15]	1,260	-0.30
ICH[7,15]	3,128	-0.495
CEPTH[7,16]	2,871 (first cycle) 1,619 (long-term)	-0.175
PTS[7,17]	72	-0.07
Post-ICH[7,18]	6,518 (first cycle) 267 (long-term)	-0.215

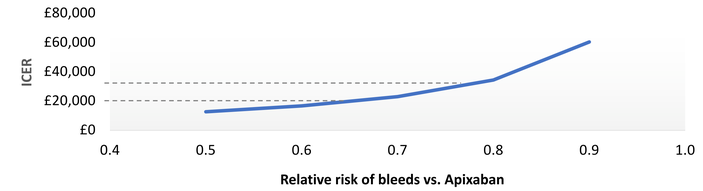
Treatment	Monthly Cost, £
Apixaban[19]*	70.30 (1st cycle) 57.00 (2nd cycle onwards)
Dalteparin[19]**	237.10 (1st cycle) 197.62 (2nd cycle onwards)
Treatment Administration	**Monthly Cost, £**
Dalteparin[19]**	40.00 (1st cycle) 22.00 (2nd cycle on)
Hypothetical Treatment***	9.82

*Apixaban treatment was 10 mg (2 x 5 mg tablets) twice a day for 7 days then 5 mg twice a day onwards.
**Dalteparin treatment consists of 200 IU/kg once a day for the first cycle followed by 150 IU/kg once a day for the remaining cycles. It was assumed that all patients would require training for the first injection and 8% of patients would require professional administration the remaining days.
***The hypothetical treatment was assumed to be administered intravenously for the first dose, followed by monthly subcutaneous injections. The administration cost was assumed equal to one professional injection of dalteparin.

RESULTS

Figure 2. Potential Bleeds Risk Reduction for a Hypothetical New Treatment

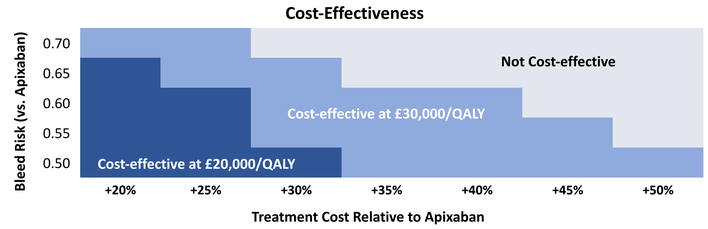
Compared to apixaban, a new treatment that reduced the risk of bleeding by at least 23% was cost-effective at a £30k/QALY threshold assuming a monthly cost that is 20% higher than apixaban, the same risk for venous thromboembolisms, and a 30% lower discontinuation rate (**Figure 2**).



Note: Dotted lines indicate £20,000/QALY and £30,000/QALY, respectively.

Figure 3. Price Threshold Analysis for a Hypothetical New Treatment

Considering a range between 0.5-0.7 for the relative risk of bleeding versus apixaban, the new treatment remained cost-effective with a monthly cost up to 28-53% higher than apixaban (**Figure 3**). The new treatment dominated dalteparin in all scenarios explored.



SUMMARY & CONCLUSION

- An effective treatment that reduces the risk of bleeding and offers improved adherence is a potentially cost-effective treatment option for patients with CAT.
- The model results suggest that a treatment with these characteristics could both improve outcomes in patients with CAT while also demonstrating economic value.

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DISCLOSURES & CONFLICTS OF INTEREST

- This study was conducted by Stratevi, LLC with financial support provided by Anthos Therapeutics, Inc.
- AE: Stratevi, LLC (current employment)
- DB: Anthos Therapeutics (current employment)
- NM: Anthos Therapeutics (current employment)
- AY: Anthos Therapeutics (former employment)
- YK: MYRA Life Science Services (current employment, consultant to Anthos)

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