National Clinical Guideline on Venous Thromboembolism (NCG-VTE)

Eve Protocol

National Policy ☐ National Procedure ☐ National Protoco ☐ National Guideline ☐

National Clinical Guideline ☒

National Clinical Guideline on Venous Thromboembolism (NCG-VTE): Eve Protocol Phase 1:

Diagnosis & immediate treatment, physical & psychological recovery; awareness of signs & symptoms; general aspects of prevention in non-pregnant adults*

(*For pregnant and postpartum patients, refer to current national guidelines on VTE in pregnancy/postpartum)

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Document Owner	National Clinical Director, Integrated Care; Office of the Chief Clinical Officer (CCO)
Document Owner name	Dr Siobhán Ní Bhriain
Document Owner email contact	lead.integratedcare@hse.ie
Document Commissioner	Dr Colm Henry, HSE Chief Clinical Officer (CCO)
Document Approver	HSE CCO Clinical Forum
Development Group Name	HSE National Clinical Programme in Venous ThromboEmbolism (NCP-VTE)
Development Group Chairperson	Prof. Fionnuala Ní Áinle, Clinical Lead, HSE National Clinical Programme in Venous ThromboEmbolism (NCP-VTE)

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NCG-VTE Phase 1: Guidelines for prevention, early identification, assessment, diagnosis, best treatment strategies and recovery of VTE in nonpregnant adults, including DVT and pulmonary embolism, with a focus on patient safety and education.
Description:
NCG-VTE Phase 1: Comprehensive guidelines for the assessment and diagnosis of VTE (incorporating immediate management strategies), Recovery and awareness & prevention, including deep vein thrombosis (DVT) and pulmonary embolism (PE). This document emphasizes patient safety, education, and the importance of providing information in accessible formats.

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Acknowledgments

The National Clinical Guideline for VTE (NCG-VTE) is dedicated to the families and friends of all those who have lost loved ones due to VTE. We are particularly indebted to the family of Ms Eve Cleary, who have served on and supported the work of the guideline taskforce.

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We wish to specially thank the members of the National Clinical Programme (NCP) VTE working groups in patient education and recovery, led by Ms Sarah Garvey and Ms Annmarie O'Neill respectively, for creating the patient educational materials that accompany the NCG-VTE and for advocating for our work on patient recovery in this guideline. We also sincerely thank Dr Clare Lewis, Chloé Carpenter and Miriam Kennedy.

We greatly appreciate the support and engagement of the membership of the NCP-VTE Clinical Advisory Group (CAG) under the leadership of Professor Karen Murphy, the Irish Haematology Society (IHS) coagulation specialist interest group (SIG), under the leadership of Professor Niamh O'Connell and National Quality and Patient Safety (NQPS), with thanks to Ciara Kirke and Dr Orla Healy.

Finally, we have been privileged to work as a team of multidisciplinary colleagues in shaping the work of this guideline. We thank every member of the guideline taskforce, each one of whom gave so generously of their time and expertise.

Executive summary

VTE comprises deep vein thrombosis (DVT) and pulmonary embolism (PE) and affects millions of individuals worldwide every year [1]. Long-term consequences affect up to 40-50% of all VTE survivors [2-9]. Despite the incidence, mortality and long-term health impact of VTE, awareness of this condition in the general population is poor. Up to 50-60 % of all VTE cases occurs during or after hospitalization, such that VTE is a leading preventable cause of hospital death [6, 10, 11]. Consequently, excellent integrated care of VTE is of paramount importance.

This National Clinical Guideline addresses strategies to improve awareness of VTE and its signs and symptoms amongst patients and healthcare practitioners (HCPs) in the community and in hospitals, so that missed opportunities to diagnose and manage VTE are avoided. Clear pathways for urgent VTE diagnosis & immediate management are outlined, through recommendations and illustrated figures. A central tenet of this guideline is a focus on recovery following a VTE event. To achieve this, a suite of patient educational resources is provided, aimed at improving patients' knowledge of their condition and to explain what they may expect during their journey. Pathways aimed at exploring patients' psychological and physical symptoms following a VTE are provided, reflecting the current state of the art.

The data and information provided in this guideline align with international best practice, as defined by international organizations such as the International Society on Thrombosis and Haemostasis and the European Society of Cardiology.

Our patient and family partners have worked closely with us since the beginning of the planning process. They have advocated for improved educational tools, better communication and pathways to recovery. Not only have they impacted the focus of the guideline, but they have also ignited a collaborative, multidisciplinary research programme by identifying gaps in evidence.

Finally, our sincere hope is that the NCG-VTE will protect patients and their families from tragedy and from life-altering debilitation. We hope that this work will help all those who have been diagnosed with a VTE to recover to the best of their potential and to live well.

1.0 Guideline Purpose

The NCG-VTE provides guidance to assist clinicians in achieving the best possible outcomes for patients through:

- Early identification of patients with suspected VTE,
- Ensuring appropriate diagnostic & immediate management strategies,
- Supporting patient recovery following VTE,
- Implementation of appropriate prevention strategies.

The NCG-VTE emphasizes the importance of educating patients and HCPs on the signs and symptoms of VTE and of ensuring that high risk groups and hospitalized patients receive appropriate thromboprophylaxis with clear pathways for diagnosis & immediate treatment.

The NCG-VTE should be read in conjunction with the Supplementary Appendix. This is published online, along with the accompanying patient educational materials, at: www.hse.ie/eng/about/who/cspd/ncps/vte/

1.2 Scope

- **Hospitalized patients.**
- **Pre-hospital emergency care:** in the recognition of risk factors and signs and symptoms as part of early identification of patients with suspected VTE.
- **Primary Care:** to provide guidance and support for general practitioners in recognizing risk factors for and symptoms of VTE and in early identification & referral.

1.2.1 Out of scope:

- Pregnant & postpartum patients, as this important topic is addressed in detail in current National Recommendations on VTE in pregnancy and postpartum.
- Detailed management, including chronic anticoagulation and decision-making on duration on anticoagulation is out of scope.
- Guidance on VTE prevention in specific subgroups (such as trauma).

1.2.2 Target Users

HCPs providing care in general practice, in acute hospital settings and in the pre-hospital emergency setting.

1.3 Objectives

The objectives of the NCG-VTE are to:

- **Enhance patient safety and outcomes; Increase awareness and educate HCPs.**
- **Standardize care across acute hospital settings in each HSE region.**
- **Guide and support general practitioners:** in the identification of risk factors and recognition of signs and symptoms and in the early identification & referral of patients with suspected VTE.
- **Guide and Support Pre-Hospital Emergency Care Clinicians:** In recognition of risk factors and potential signs and symptoms of VTE.
- **Facilitate recovery:** Supporting patients in physical and psychological recovery following a VTE event, including the provision of dedicated educational materials.

1.4 Desired outcomes

This guideline supports service commissioners and HCPs to increase awareness of VTE signs & symptoms, reduce potentially preventable VTE, improve patient safety for those with suspected VTE, improve quality of care (including recovery) and achieve best patient outcomes.

1.5 Disclaimer

Healthcare staff should use clinical judgement in applying the guidance herein and give due regard to individual circumstances presented by each patient and available resources. Recommendations may not be appropriate in all circumstances and the decision to adopt specific recommendations should be made by the practitioner considering the individual circumstances presented by each patient / resident and available resources. Therapeutic options should be discussed locally and, on a case-by-case basis as necessary.

1.6 Supporting evidence

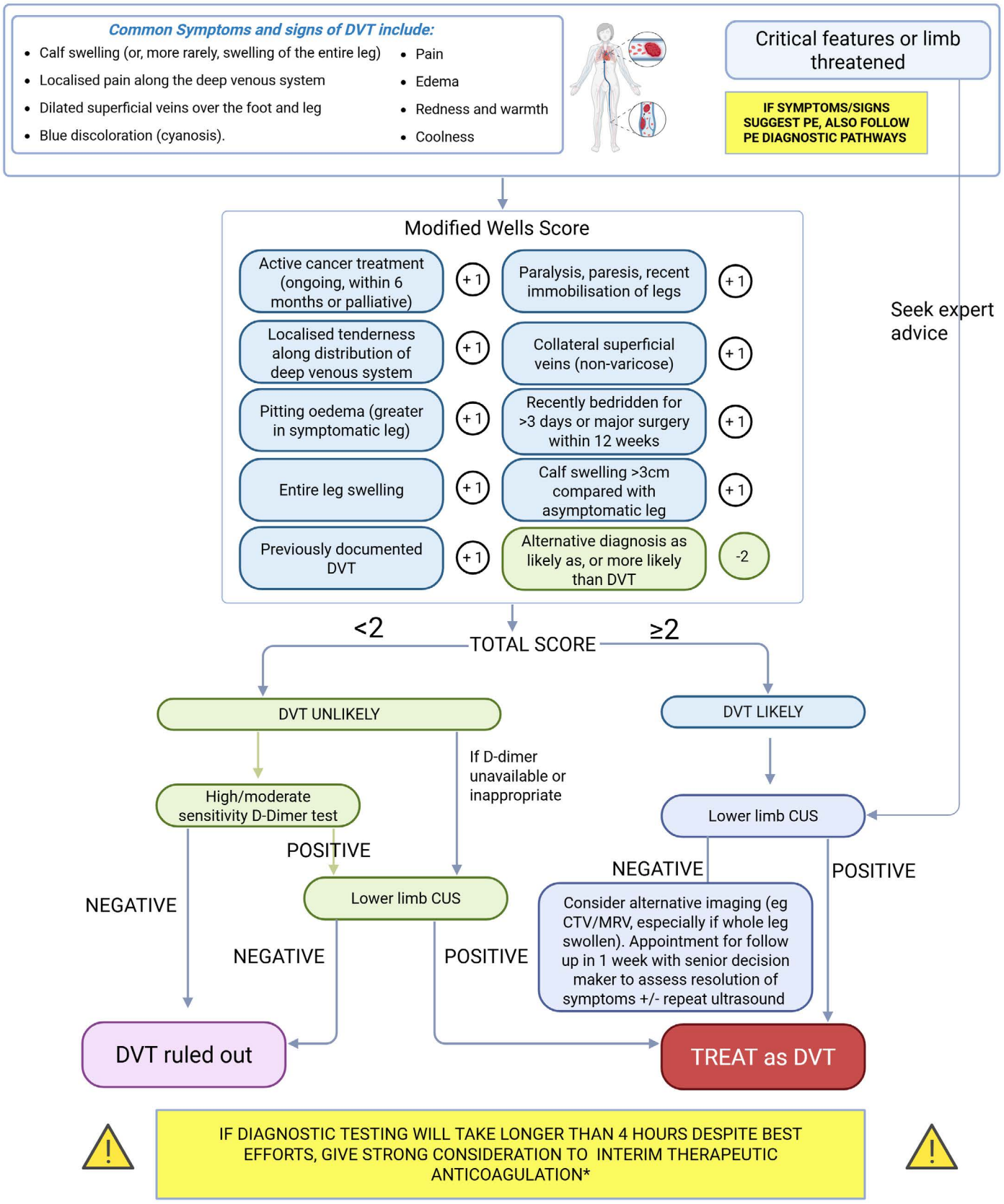
Supporting evidence was informed by the results of an evidence synthesis (including international society guidelines), which are listed in the references and described in the **Supplementary Appendix**. For each recommendation in this guidance document, the certainty level of the evidence and the strength of the evidence are estimated as follows:

Certainty Level	Meaning
Very Low	The true effect is probably markedly different from the estimated effect.
Low	The true effect might be markedly different from the estimated effect.
Moderate	The authors believe that the true effect is probably close to the estimated effect.
High	The authors have a lot of confidence that the true effect is similar to the estimated effect.

For each recommendation, the strength of recommendations (Strong or Weak/Conditional) is also suggested.

2.0 Acute Diagnosis and Immediate Management of DVT and PE

2.1: Recommendations on the Diagnosis and Immediate Management of DVT
The NCP-VTE support the use of targeted educational initiatives, aimed at improving clinical awareness of DVT among all HCPs working in primary, community and prehospital care. *Certainty of evidence: Low; Strength of recommendation: Weak*
A HCP should suspect DVT based on a patient's clinical presentation, symptoms and signs, particularly if risk factors for VTE are also present: **"Think DVT"**. *Certainty of evidence: High; Strength of recommendation: Strong.*
All HCPs involved in the diagnosis of DVT should use a validated diagnostic pathway. *Certainty of evidence: High; Strength of recommendation: Strong.*
A D-dimer measurement is recommended where there is an "unlikely" Wells pretest clinical probability (**Central Figure 1**) as this may exclude DVT in a subset of patients. *Certainty of evidence: High; Strength of recommendation: Strong.*
Venous compression ultrasonography (CUS) is recommended as the first line imaging method for DVT diagnosis. *Certainty of evidence: High; Strength of recommendation: Strong*
If a timely CUS is not available (**Central Figure 1**), people with a high pre-test probability should be considered for therapeutic interim anticoagulation, referring to existing HSE guidelines and anticoagulant product Summary of Product Characteristics (https://www.hpra.ie/). *Certainty of evidence: Moderate; Strength of recommendation: Weak.*
When using interim therapeutic anticoagulation for suspected proximal DVT or PE, a plan for baseline blood tests on an individual basis may include full blood count, renal and hepatic function, prothrombin time (PT) and activated partial thromboplastin time (APTT). *Certainty of evidence: Low; Strength of recommendation: Weak.*
Where bleeding risk factors are present (such as a low platelet count, renal impairment or other conditions), then a personalized risk assessment should be performed before starting therapeutic anticoagulation. *Certainty of evidence: Moderate; Strength of recommendation: Weak.*
Where resources permit, efforts should be made to minimise the time from presentation to CUS (see also: "Recommendations for REOs"- section 5). *Certainty of evidence: High; Strength of recommendation: Strong.*
It is recommended that patients who are diagnosed with DVT are given the relevant NCP-VTE educational material (including information on anticoagulation), discharged home on anticoagulation (for at least 3 months unless there is a clear contra-indication and/or alternative management is indicated eg interval repeat CUS in non-anticoagulated patients with below knee DVT) and with a clear pathway of referral, if needed, to an appropriate specialist for long-term management. *Certainty of evidence: High; Strength of recommendation: Strong.*



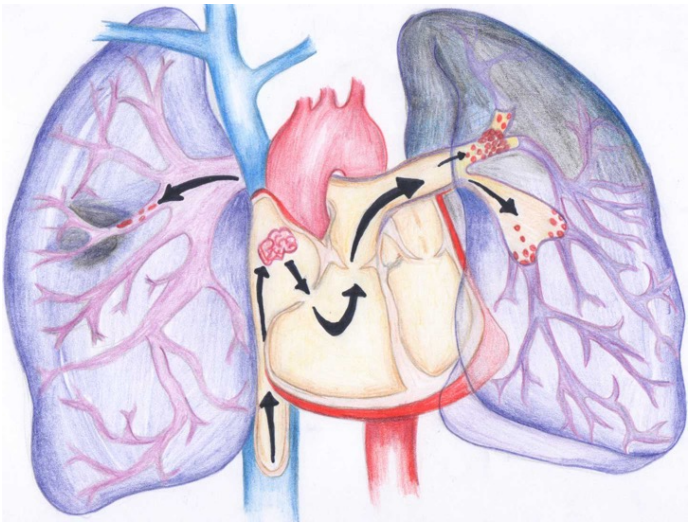
CENTRAL FIGURE 1: Approach to the diagnostic workup of a patient with suspected DVT from the community (not validated for inpatients) [12-16]. In pregnancy/postpartum, please refer to national recommendations for pregnancy. DVT: deep vein thrombosis; PE: pulmonary embolism; CUS: Compression ultrasound; CTV: CT venography; MRV: Magnetic resonance venography. **HSE guidance on anticoagulation is available here and anticoagulant product SPC (https://www.hpra.ie/).*

2.2: Recommendations on the diagnosis and Immediate management of PE
The NCP-VTE support the use of targeted educational initiatives, aimed at improving clinical awareness of PE among all HCPs working in primary, community and prehospital care. *Certainty of evidence: Low; Strength of recommendation: Weak.*
The diagnostic strategy for acute PE should be based on clinical probability, assessed either by clinical judgement or by a validated prediction rule (such as the Wells/Geneva rule (**Central Figure 2**): **"THINK PE"**. *Certainty of evidence: High; Strength of recommendation: Strong.*
In suspected PE without haemodynamic instability (**Central Figure** 2), the use of validated diagnostic algorithms is recommended and anticoagulation should be started without delay in patients with high or intermediate clinical probability of PE while diagnostic workup is in progress. *Certainty of evidence: High; Strength of recommendation: Strong.*
Plasma D-dimer measurement is recommended in outpatients/emergency department patients with low or intermediate clinical probability, or those that are PE-unlikely, to identify patients who can safely avoid imaging. *Certainty of evidence: High; Strength of recommendation: Strong.*
D-dimer measurement is not recommended in patients with high clinical probability, because a negative result does not safely exclude PE, even when using a highly sensitive assay. *Certainty of evidence: High; Strength of recommendation: Strong.*
In suspected **high-risk PE**, (defined by Haemodynamic instability (**Central Figure 2**)), point-of-care echocardiography or emergency CTPA (depending on availability, feasibility and safety) is recommended for diagnosis (**Figure 7**). *Certainty of evidence: Low; Strength of recommendation: Weak.*
In the absence of haemodynamic instability at presentation, further risk stratification of PE is recommended, as it has implications for early discharge vs. hospitalization or monitoring of the patient (**Figures 3 and 6**). *Certainty of evidence: Moderate; Strength of recommendation: Weak.*
The pulmonary embolism severity index (PESI; **Table 3**) is recommended for prognostication in patients with suspected PE. *Certainty of evidence: High; Strength of recommendation: Strong.*
Assessment of the RV by echocardiogram or CTPA is recommended, even in the presence of a low PESI or a negative sPESI, as it has prognostic implications. *Certainty of evidence: Moderate; Strength of recommendation: Weak.*
Systemic (IV) thrombolytic therapy is recommended for **high-risk PE** **(detailed dosing guidance can be found in the current ESC Guidelines on Acute PE [6]: https://www.escardio.org/Guidelines/Clinical-Practice-Guidelines/Acute-Pulmonary-Embolism-Diagnosis-and-Management-of**). *Certainty of evidence: High; Strength of recommendation: Strong.*

In suspected/confirmed **high-risk PE**, I.V. anticoagulation with UFH, including a weight-adjusted bolus injection, should be started as quickly as possible (referring to anticoagulant product Summary of Product Characteristics (https://www.hpra.ie/). *Certainty of evidence: High; Strength of recommendation: Strong.*
Percutaneous catheter-directed therapy/ embolectomy may be considered for patients with **high risk PE** where thrombolysis has failed or is contraindicated, if the appropriate expertise and resources are available. *Certainty of evidence: Low; Strength of recommendation: Weak.*
Routine use of systemic thrombolysis or catheter-directed therapy is not currently recommended for most patients with intermediate or low-risk PE. *Certainty of evidence: High; Strength of recommendation: Strong.*
In patients with intermediate or low-risk PE, if anticoagulation is indicated and not contra-indicated, low molecular weight heparin (LMWH) or a direct oral anticoagulant (DOAC) rather than UFH is recommended for most patients (referring to correct dosing at https://www.hpra.ie/), assuming this is feasible (e.g. based on renal function). *Certainty of evidence: Low; Strength of recommendation: Weak.*
Establishment of a pulmonary embolism response team (PERT) may be considered, if resources and expertise permit. *Certainty of evidence: Low; Strength of recommendation: Weak.*
It is essential that patients who are diagnosed with PE are given the relevant NCP-VTE educational material (including information on anticoagulation) and discharged home on anticoagulation (for at least 3 months in almost all cases). Patients should have a clear plan for suggested length of treatment and a clear pathway of referral to an appropriate specialist for long-term management. *Certainty of evidence: High; Strength of recommendation: Strong.*

High-risk PE is defined by haemodynamic instability. This is an emergency situation requiring immediate action (Central Figure 2)

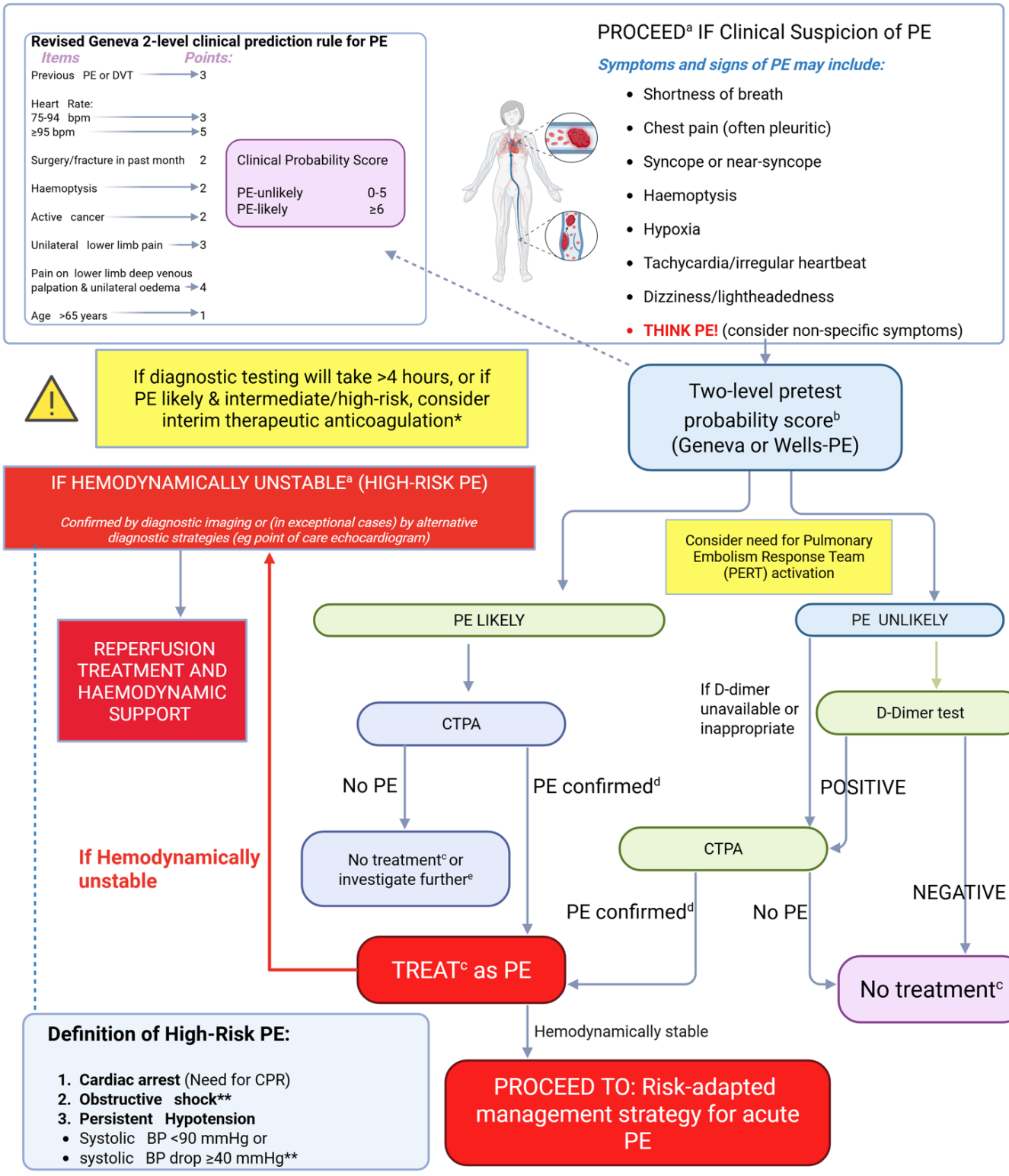
"THINK PE"



Cardiac arrest	Obstructive shock	Persistent Hypotension
Need for CPR	Systolic BP <90 mmHg or Vasopressors needed for BP ≥90 mmHg* *AND* End-organ hypoperfusion$	Systolic BP <90 mmHg or systolic BP drop ≥40 mmHg**

Table 1: Definition of Haemodynamic instability in acute high-risk PE [6]

CPR: cardiopulmonary resuscitation
**Despite adequate filling status*
*** Lasting longer than 15 min and not caused by new-onset arrhythmia, hypovolaemia, or sepsis*
$ altered mental status; cold, clammy skin; oliguria/anuria; increased serum lactate



CENTRAL FIGURE 2: Investigation & acute management of suspected PE. This figure leads into **Figure 3** (Risk-adapted management strategy for PE). CTPA: computed tomography pulmonary angiography; "a": For nonpregnant/ postpartum adults presenting from the community. "b" For simplicity, we show a two-level scheme. When using a moderately sensitive assay, D-dimer measurement should be restricted to patients with a "PE-unlikely" classification. D-dimer measurement is of limited use in suspected PE occurring in hospitalized patients. "c": Anticoagulation. "d": CTPA is considered diagnostic of PE if it shows PE at the segmental or more proximal level. "e": If CTPA is negative. **HSE website [17] and product SPCs (https://www.hpra.ie/),***Defined in Table 1.

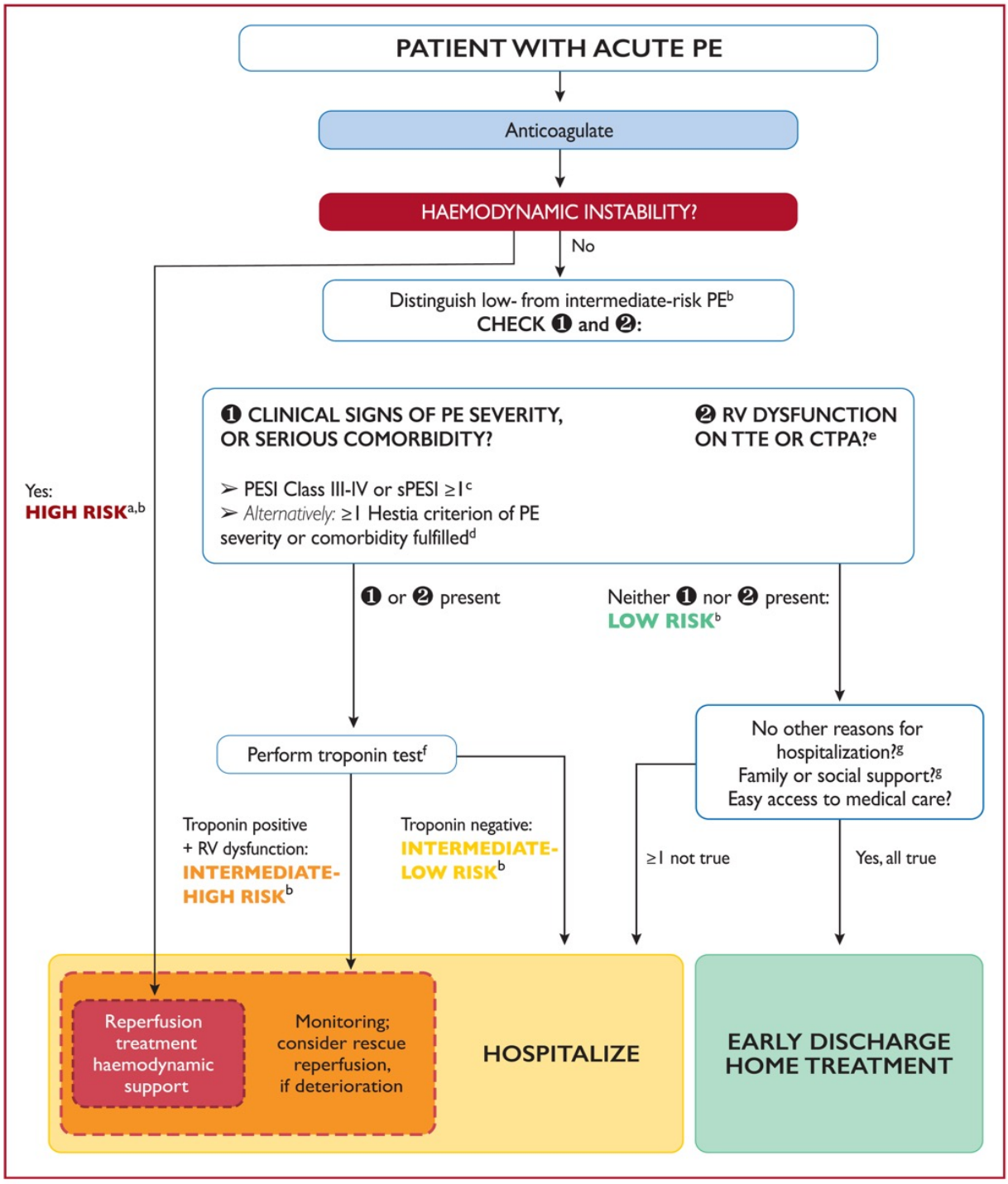


Figure 3: European Society of Cardiology Risk-Adapted Management of confirmed PE (Follows Central Figure 2)

Haemodynamic instability is defined in **CENTRAL FIGURE 2 and Table 1**. "a": Refer to emergency management algorithm (**Figure 7**); "b": Refer to Figure 6 for definition of high, intermediate-high-, intermediate-low-, and low-risk PE; "c" Cancer, heart failure and chronic lung disease are included in the PESI and sPESI (**Table 3**); "d,e" Described in Suppl. Appendix; "f" If not already done. "g" In Hestia Criteria (Suppl. Appendix). Early discharge/home Treatment should only be considered if a pathway has been locally developed and risk assessed, and if appropriate follow up and clinical governance is in place. This will not always be feasible. CTPA: computed tomography pulmonary angiography/ angiogram; PE: pulmonary embolism; (s)PESI: (simplified) Pulmonary Embolism Severity Index; RV: right ventricular; TTE: transthoracic echocardiogram. Konstantinides et al., 2019 ESC Guidelines for the diagnosis and management of acute pulmonary embolism developed in collaboration with the European Respiratory Society (ERS), European Heart Journal, 2019, Figure 6, pg. 573, doi: 10.1093/eurheartj/ehz405, www.escardio.org/Guidelines, Reprinted by permission of Oxford University Press on behalf of the European Society of Cardiology.

2.3 Introduction to the diagnostic and immediate treatment pathway for DVT and PE

Non-specific lower limb swelling and pain is a common primary care and emergency department (ED) presentation, with DVT being one of the possible diagnoses. DVT and PE are collectively referred to as Venous Thromboembolism (VTE).

A missed VTE diagnosis can be fatal or can impose health consequences that may have been avoided by timely diagnosis and treatment. Implementation of validated diagnostic strategies is therefore important for patient quality of care and for efficient resource utilization.

A systematic approach to patients presenting with suspected VTE is needed to safely manage and select the appropriate investigations to provide the correct treatment. This is critical in reducing morbidity and mortality . Current UK National Institutes of Clinical Health and Excellence (NICE) guidelines recommend that ultrasound imaging to be performed within 4 hours for those patients in whom DVT is likely [14]. The NCP-VTE recognizes that most Irish hospitals currently do not have 24-hour Ultrasound Imaging service available, which makes rigorous assessment and robust safety-netting even more important for safe and efficient practice. Resourcing access to these strategies from the community is a crucial priority.

2.4 Deep Vein Thrombosis (DVT) diagnosis and Immediate Treatment (Central Figure 1)

2.4.1 Presentation

DVT is usually (but not always) unilateral and should be suspected based on the patient's clinical presentation, particularly (but not only) if risk factors for VTE are also present [13-16].

Symptoms and signs of DVT are typically (but not always) unilateral, and may include a combination of the features outlined in **Figure 4** [18]. **Differential diagnoses should be considered but are outside the scope of this guideline** . These symptoms and signs are nonspecific and objective testing is required to confirm or exclude a diagnosis of DVT [19]. A patient does not need to have all of these in order for DVT to be suspected.

Symptoms and signs of Deep Vein thrombosis (DVT) include (but are not limited to:)

- Calf swelling (or, more rarely, swelling of the entire leg)
- Pain
- Localised pain along the deep venous system
- Oedema
- Dilated superficial veins over the foot and leg
- Redness and warmth
- Coolness
- Blue discoloration (cyanosis).

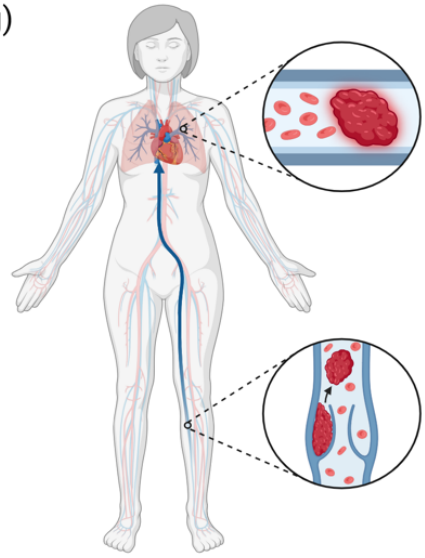


Figure 4: Symptoms and signs of deep vein thrombosis.

2.4.2 Diagnostic Strategies/ Practical Assessment Pathway for DVT [13-15]

A thorough assessment, risk stratification and prompt access to ultrasound scanning is paramount to avoid complications and to initiate appropriate treatment.

(Ultrasound access should be facilitated by REOs and is outside the control of HCPs)

All healthcare professionals involved in the diagnosis of deep vein thrombosis should use a validated diagnostic pathway. Diagnostic strategies for DVT include validated combinations of clinical prediction rules [20], D-dimer assays and compression ultrasonography (CUS). Regional structures, to be implemented by REOs and hospital CEOs/managers, should minimise the duration of time from presentation to CUS.

2.4.2.1 Clinical prediction rules

The NCP-VTE recommends using the two-level modified Wells score [21], given its ease of use, in patients with suspected lower limb DVT (**Central Figure 1, Figure 5**).

2.4.2.2 D-Dimer

D-dimer can be useful for DVT rule-out when its levels are NOT elevated [22]. A D-dimer measurement is recommended in patients with a “DVT unlikely” pretest clinical probability patients as this may exclude DVT in a subset of patients **(Central Figure 1), but only for patients presenting from the community. The D-dimer assay has not been validated for admitted inpatients.**

2.4.2.3: CUS (Compression Ultrasonography)

CUS ***(options and underlying evidence discussed in detail in the supplementary appendix)*** is recommended as the first line imaging method for DVT diagnosis. Alternative imaging should also be considered if CUS is negative (e.g. CTV/MRV, especially if the patient's whole leg is swollen, or if the patient has such a large body mass index that it limits penetration of CUS) or interim repeat ultrasound following discussion with a specialist.

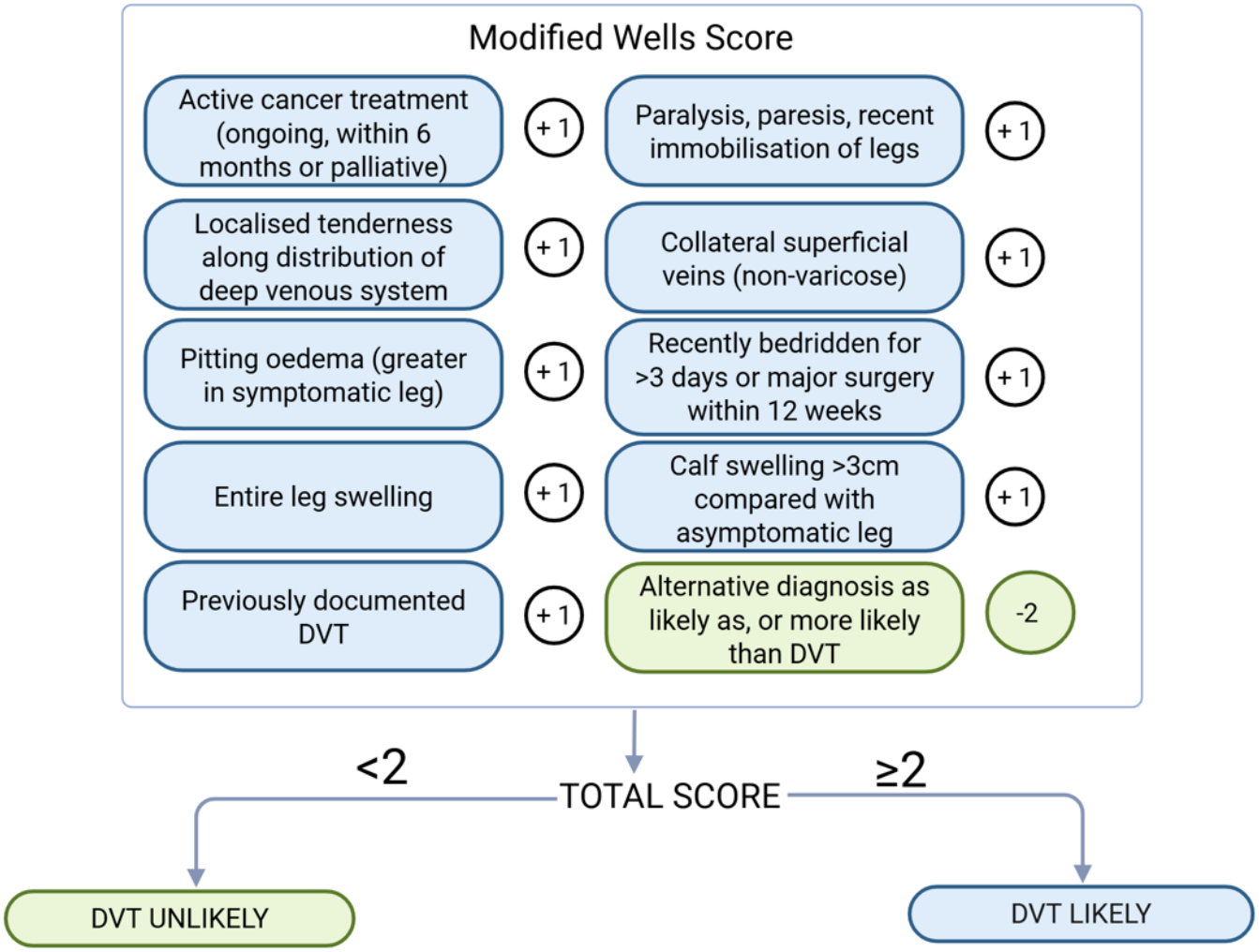


Figure 5: Wells-DVT [20, 21] prediction rule for patients presenting from the community with suspected DVT

2.5 Immediate and interim anticoagulation (PATIENTS WITH DVT AND/OR PE)

Detailed guidance on anticoagulation is outside the scope of this document. Decisions regarding immediate anticoagulation should be made on a case-by-case basis, weighing the risk of unnecessary anticoagulation against the consequences of delaying treatment, particularly where diagnostic imaging may be delayed. Refer to HSE guidelines [17]; section 2.5.1.1 and anticoagulant product Summary of Product Characteristics (SPC) (https://www.hpra.ie/). Baseline blood tests should be considered on an individual basis, may include full blood count, renal and hepatic function, prothrombin time (PT) and activated partial thromboplastin time (APTT), but should not delay anticoagulation in high-risk scenarios. Where bleeding risk factors are present (discussed below), then a personalized risk assessment should be performed.

2.5.1 Bleeding risk factor assessment (patients diagnosed with DVT AND/OR PE)

All patients requiring interim or ongoing therapeutic anticoagulation should be assessed for risk of bleeding (**Table 2**) . Senior or specialist decision making is recommended if the risk of bleeding is considered moderate to high. Check whether the patient has any of the following risk factors below and individualize management accordingly:

If a significant risk factor is identified (Table 2), senior discussion (e.g. with an ED Consultant or Haematologist) is recommended. Admit if anticoagulation is required.

Risk Factor
Active bleeding
On anticoagulant at therapeutic levels/dose, e.g. warfarin, dabigatran, rivaroxaban, edoxaban, apixaban, heparin, enoxaparin, tinzaparin
Platelets less than 50 x 10^9/L
Planned to undergo procedure, especially one with high bleeding risk, e.g. neurosurgery, spinal or eye surgery
Bleeding disorder, e.g. haemophilia, Von Willebrand disease: Seek specialist advice from Haematology
History of Heparin-Induced Thrombocytopenia (HIT): Seek specialist advice from Haematology
Acquired bleeding disorder, e.g. liver failure with PT > 15 seconds
Acute stroke: Discuss with stroke service
Blood pressure ≥230 mmHg systolic or ≥120 mmHg diastolic
Epidural or spinal or lumbar puncture in last 4 hours or expected in next 12 hours
Other bleeding risk

Table 2: Risk Assessment prior to Commencing Anticoagulation (adapted from National Guidance & Standards published in 2018 and updated in 2022 [23, 24]); Any risk factor above may be a contra-indication to therapeutic anticoagulation. Seek advice from an senior colleague with appropriate expertise (e.g. haematologist).

2.5.1.1: Anticoagulation Quick Reference Summary for VTE (DVT/PE) Treatment (adapted from HSE guidelines [17], 2021 European Heart Rhythm Association Guidance [25] and anticoagulant product Summary of Product Characteristics (SPC) (https://www.hpra.ie/, to which the HCP should refer before prescribing)

Creatinine Clearance (CrCl) should be measured using Cockroft-Gault equation (SI units): CrCl = (140 – Age (yrs)) x Weight (kg) x constant [1.23 for males & 1.04 for females] / Serum Creatinine (µmol/L). Discharge prescription (after first diagnosis) should clearly state intended DURATION OF TREATMENT. If rivaroxaban, state how many further days of twice daily (BD) dosing (i.e. 21 days minus number of days doses have already given in hospital) before reducing to once daily and if apixaban, how many further days of 10mg BD before reducing to 5mg BD.

Apixaban (VTE Treatment)

Dosing	10mg twice daily for 7 days, then 5mg twice daily for at least 3 months.
Renal Impairment	CrCl 15-29 ml/min: No dose adjustment recommended, use with CAUTION. Not recommended if CrCl <15 mL/min or dialysis.
Interactions (This list is not exhaustive; See SmPC for full details)	CONTRAINDICATED with other anticoagulants (unless switching, then refer to SmPC). AVOID CONCURRENT: strong inhibitors (increased bleeding risk) or inducers (reduced efficacy) of CYP3A4 and P-gp. AVOID CONCURRENT USE (risk of reduced efficacy): strong inducers of CYP3A4 and P-gp. CAUTION (increased bleeding risk): NSAIDs, antiplatelet agents including aspirin, SSRIs/SNRIs.
Liver impairment	Contraindicated in hepatic disease associated with coagulopathy and clinically relevant bleeding risk. Not recommended in severe hepatic impairment. Should be used with caution in patients with mild or moderate hepatic impairment (Child Pugh A or B).

Dabigatran (VTE Treatment)

Dosing	Standard Dose: Initial treatment with at least 5 days of parenteral anticoagulant. Then 150mg dabigatran twice daily for at least 3 months. Dose reduction: dabigatran 110mg twice daily is recommended in patients: • ≥ 80 years • patients who receive concomitant verapamil (take verapamil at the same time as dabigatran) Dose reduction for consideration: dabigatran150mg twice daily or 110mg twice daily based on individual assessment of thrombotic risk and bleeding risk should be considered in patients: • Between 75-80 years • with CrCl 30-50 ml/min • with Gastro-oesophageal reflux disease/ Gastritis/ Oesophagitis at increased risk of bleeding: NOTE: For DVT/PE the recommendation for the use of 110mg BD is based on pharmacokinetic and pharmacodynamic analyses and has not been studied in this clinical setting.
Renal impairment	Treatment with dabigatran in patients with CrCl < 30 mL/min is contraindicated. No dose adjustment is necessary in patients with CrCl 50- ≤ 80 mL/min. For patients with CrCL 30-50 mL/min the recommended dose of dabigatran 150 mg twice daily. However, for patients with high risk of bleeding, a dose reduction of dabigatran 110 mg twice daily should be considered. Close clinical surveillance is recommended in patients with renal impairment.
Liver impairment	Not recommended in hepatic impairment and contraindicated in hepatic impairment or liver disease that is expected to have any impact on survival. It should be used with caution in patients with mild or moderate hepatic impairment (Child Pugh A or B).
Interactions (This list is not exhaustive; See SmPC for full details)	CONTRAINDICATED with other anticoagulants CONTRAINDICATED: P-gp inhibitors - ciclosporin, dronedarone, glecaprevir/ pibrentasvir, itraconazole, ketoconazole AVOID CONCURRENT USE: P-gp inhibitor - tacrolimus AVOID CONCURRENT USE (reduced efficacy): P-gp inducers (e.g. carbamazepine, phenytoin, rifampicin, St. John's Wort) CAUTION (increased bleeding risk): P-gp inhibitors - amiodarone, clarithromycin, posaconazole, quinidine, ticagrelor, verapamil CAUTION (increased bleeding risk): NSAIDs, antiplatelet agents including aspirin, SSRIs/SNRIs.
Special Notes	DO NOT OPEN OR CRUSH CAPSULE; Dispense in original packaging due to moisture sensitivity.

Edoxaban (VTE Treatment)

Dosing	Standard dose: Initial treatment with at least 5 days of parenteral anticoagulant. Then 60mg edoxaban once daily for at least 3 months. Dose reduction: edoxaban 30mg once daily in patients with: • CrCl 15-50 ml/min or • Low body weight (≤ 60 kg) or • Concomitant ciclosporin, dronedarone, erythromycin or ketoconazole (P-gp-inhibitors) (based on clinical data)
Renal Impairment	NOT RECOMMENDED in CrCl < 15 ml/min or in patients undergoing dialysis.
Liver impairment	Edoxaban is contraindicated in patients with hepatic disease associated with coagulopathy and clinically relevant bleeding risk. In patients with severe hepatic impairment edoxaban is not recommended. Edoxaban should be used with caution in patients with mild to moderate hepatic impairment (Child Pugh A-B).
Interactions (This list is not exhaustive; See SmPC for full details)	CONTRAINDICATED with other anticoagulants. CAUTION: co-administration of aspirin in elderly patients. The concomitant chronic use of high dose aspirin (>300mg) is not recommended, doses higher than 100mg should only be performed under medical supervision CAUTION (increased bleeding risk): P-gp inhibitors – see dosing guidance above for dose reduction recommendations. CAUTION (risk of reduced efficacy): P-gp inducers (e.g. phenytoin, carbamazepine, phenobarbital, St. John's Wort). CAUTION (increased bleeding risk): NSAIDs, antiplatelet agents, SSRIs/SNRIs Caution in mild to moderate hepatic impairment, not recommended in severe hepatic impairment and contraindicated in hepatic disease associated with coagulopathy and clinically relevant bleeding risk.
Cautions	Edoxaban is predominately absorbed in the upper gastrointestinal tract. Therefore medicines or disease conditions that increase gastric emptying and gut motility may reduce edoxaban dissolution and absorption.

Rivaroxaban (VTE Treatment)

Dosing	Standard Dose: Initial dose of 15mg BD for first 21 days then reduce to 20mg once daily thereafter for at least 3 months. Refer to SmPC for further details.
Renal impairment	CrCl 30-49 ml/min: 15mg BD for first 21 days then reduce to 15mg or 20mg once daily thereafter depending on bleeding risk versus risk of recurrent DVT/PE. Limited evidence for 15mg dose – based on pharmacokinetic modelling. EXTREME CAUTION if CrCl 15-29 ml/min. NOT RECOMMENDED in CrCl < 15 ml/min.
Liver impairment	Rivaroxaban is contraindicated in patients with hepatic disease associated with coagulopathy and clinically relevant bleeding risk including cirrhotic patients with Child Pugh B and C.
Cautions	Take ≥15mg doses with food.
Interactions (This list is not exhaustive; See SmPC for full details)	CONTRAINDICATED with other anticoagulants. AVOID CONCURRENT USE (increased bleeding risk): Strong inhibitors of CYP3A4 and P-gp (e.g. ketoconazole, itraconazole, voriconazole, posaconazole, HIV protease inhibitors). AVOID CONCURRENT USE: dronedarone - limited clinical data. AVOID CONCURRENT USE (risk of reduced efficacy): Strong inducers of CYP3A4 (e.g. carbamazepine, phenytoin, phenobarbital, rifampicin, St. John's Wort) CAUTION: moderate to strong inhibitors of CYP3A4 and/or P-gp (e.g. clarithromycin, erythromycin, fluconazole) in patients with renal impairment CAUTION (increased bleeding risk): NSAIDs, antiplatelet agents including aspirin, SSRIs/SNRIs Contraindicated in hepatic disease associated with coagulopathy and clinically relevant bleeding risk.

Important Prescribing Considerations for DOACs

The following points should be considered when prescribing a DOAC:

1. Initiation and follow-up: Ensure correct dose and frequency of administration of the individual DOAC is chosen at initiation and reviewed at all subsequent appointments based on: licensed indication, age, renal function, weight, concomitant medicines etc.[25] Renal function should be assessed regularly and dose adjusted or therapy reviewed as appropriate (at least 6 monthly and more frequently if renal impairment or risk factors for impaired renal function). Refer to SmPCs for further details.
2. For initiation of treatment for DVT/PE: ensure initial dose and dose adjustment is prescribed clearly. Review the requirement to continue treatment after 3 and/or 6 months.
3. In specific high-risk circumstances (liaise with Haematology colleagues and refer to product SmPC and national guidance https://www.hse.ie/eng/about/who/acute-hospitals-division/drugs-management-programme/protocols/), DOAC reversibility may be considered, using Idaricuzumab (for Dabigatran reversal) and Andexanet Alpha or prothrombin complex concentrate (for Rivaroxaban and Apixaban reversal).

Low Molecular Weight Heparin (LMWH) – VTE Treatment

Dosing (Treatment)	Tinzaparin: 175 units/kg SC once daily Enoxaparin: 1 mg/kg SC twice daily or 1.5 mg/kg SC once daily
Renal Impairment	For Enoxaparin, adjust dose to 1mg/kg once daily when CrCl is 15-30 ml/min (and seek specialist advice). There is no licenced dose adjustment for tinzaparin. Seek specialist input.
Monitoring	Not routinely required; Anti-Xa in special cases
Reversal	Partial reversal with protamine sulfate
Contraindications	Active bleeding, history of HIT

Unfractionated Heparin (UFH) – VTE Treatment

Dosing	IV bolus (80 IU/kg) then continuous infusion (18 IU/kg/hour)
Monitoring	APTT every 6 hours until therapeutic; target APTT ratio 1.5–2.5
Reversal	Fully reversible with protamine sulfate
Use Cases	Preferred in renal impairment or when rapid reversal is needed
Contraindications	Active bleeding, history of HIT

Warfarin (used infrequently for VTE treatment; may be chosen depending on individual patient considerations, such as antiphospholipid syndrome or DOAC failure/recurrent VTE despite therapeutic anticoagulation). Refer also to local guidelines and adhere to local governance pathways for appropriate follow-up.

Initiation	Overlap with LMWH/UFH for at least 5 days AND until INR ≥2 for 2 consecutive days
Monitoring	Regular INR checks; typical target range 2.0–3.0
Interactions	Many drug and food interactions; patient counselling essential. Refer to produce SmPC
Reversal	Vitamin K (oral or IV); consider PCC in severe bleeding
Use Cases	Alternative when DOACs unsuitable or contraindicated

2.6 Pulmonary Embolism Diagnosis and Immediate Treatment (Central Figure 2, Figure 3)

Pulmonary embolism (PE) is a leading cause of death and long-term disability [6]. Therefore, excellent pathways for diagnosis, treatment and long-term management are of crucial importance [5]. European Society of Cardiology (ESC) guidelines provide an evidence-based framework for PE diagnosis and management [6]. This framework has been adapted here for implementation in Ireland.

At the heart of the ESC guideline is a risk-adapted management strategy, outlined in **Figure 3**. The components of this pathway are outlined next.

Pathways differ, depending on whether the patient with suspected PE is categorized into an ESC-defined low, intermediate or high-risk category (**Figures 3 and 6**).

2.6.1 Clinical features of Acute PE

Acute PE can present with non-specific symptoms like dyspnea, chest pain, presyncope or syncope, and hemoptysis. Haemodynamic instability indicates severe PE, often linked to syncope and RV dysfunction [26]. PE can also be asymptomatic, or it can be incidentally discovered. Chest pain often results from pleural irritation [27]. This can result in the classic “pleuritic” type chest pain, in which an intake of breath causes severe sharp pain in the area. Predisposing factors for VTE can help to ensure that PE is suspected, but **40% of PE cases lack identifiable risk factors**. There should also be consideration of other conditions with overlapping symptoms, such as aortic dissection, tension pneumothorax and acute coronary syndrome.

2.6.2 Pre-test probability assessment

The classification of patients with suspected PE into categories of clinical/pre-test probability is essential for diagnosis. Pre-test probability assessment is a process that combines symptoms, clinical findings, and predisposing factors for VTE. This assessment is done either by clinical judgment or using validated prediction rules such as the Wells or revised Geneva rules (Central **Figure 2 and Suppl. Appendix**). This influences the post-test probability of PE after imaging, categorizing patients into low, moderate, or high-probability groups (or simplified categories) [28, 29].

2.6.3 D-dimer testing

As with patients with suspected DVT, D-dimer testing is highly effective in ruling out PE when results are normal, but less useful for confirming PE when they are elevated [6]. Age-adjusted D-dimer cut-offs (discuss with local laboratory first if implementing) improve specificity in older patients, in other words increasing the number of patients in whom PE is excluded without false negatives [30].

2.6.4 PE Imaging (radiological imaging and echocardiography)

Imaging modalities for PE include Computed Tomographic Pulmonary Angiography (CTPA), ventilation/perfusion (V/Q) scanning and Echocardiography (**Suppl. Appendix**).

2.6.5 Risk stratification (in terms of probability of complications) during diagnostic assessment of patients with acute PE

A full evaluation of clinical signs, echocardiographic/radiological findings and biomarkers is essential for risk stratification and initial treatment decisions in acute PE [6] (Figures 3 and 6). Initial risk assessment focuses on clinical signs of **haemodynamic instability (which defines HIGH-RISK PE- Central Figure 2**), which predicts a high risk of early death, therefore **an emergency algorithm including reperfusion (thrombolysis) is indicated (Central Figure 2)**.

For patients without these signs, further risk stratification involves evaluating clinical, imaging, and laboratory indicators of PE severity and identifying comorbidities or other conditions that could worsen the prognosis.

Early mortality risk		Indicators of risk			
		Haemodynamic instability[a]	Clinical parameters of PE severity and/or comorbidity: PESI class III–V or sPESI ≥I	RV dysfunction on TTE or CTPA[b]	Elevated cardiac troponin levels[c]
High		+	(+)[d]	+	(+)
Intermediate	Intermediate–high	-	+[e]	+	+
	Intermediate–low	-	+[e]	One (or none) positive	
Low		-	-	-	Assesment optional; if assessed, negative

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Figure 6: Classification of pulmonary embolism (PE) severity and the risk of early (in-hospital or 30 day) death

CTPA: computed tomography pulmonary angiography; RV: right ventricular; (s)PESI: (simplified) Pulmonary Embolism Severity Index; TTE: transthoracic echocardiogram. “a” Defined in Table 1; “b” Available in [6] beyond the scope of this guideline; “c” Do not use other biomarkers; “d” Haemodynamic instability, combined with PE confirmation on CTPA and/or evidence of RV dysfunction on TTE, is sufficient to classify a patient into the **high-risk** PE category. **In these cases, neither calculation of the PESI nor measurement of troponins or other cardiac biomarkers is necessary**; “e” Signs of RV dysfunction on TTE (or CTPA) or elevated cardiac biomarker levels may be present, despite a calculated PESI of I-II or an sPESI of 0. These patients should be classified into the intermediate-risk category [6]. Konstantinides et al., 2019 ESC Guidelines, Table 8, pg. 563, doi: 10.1093/eurheartj/ehz405, www.escardio.org/Guidelines, Reprinted by permission of Oxford University Press on behalf of the ESC.

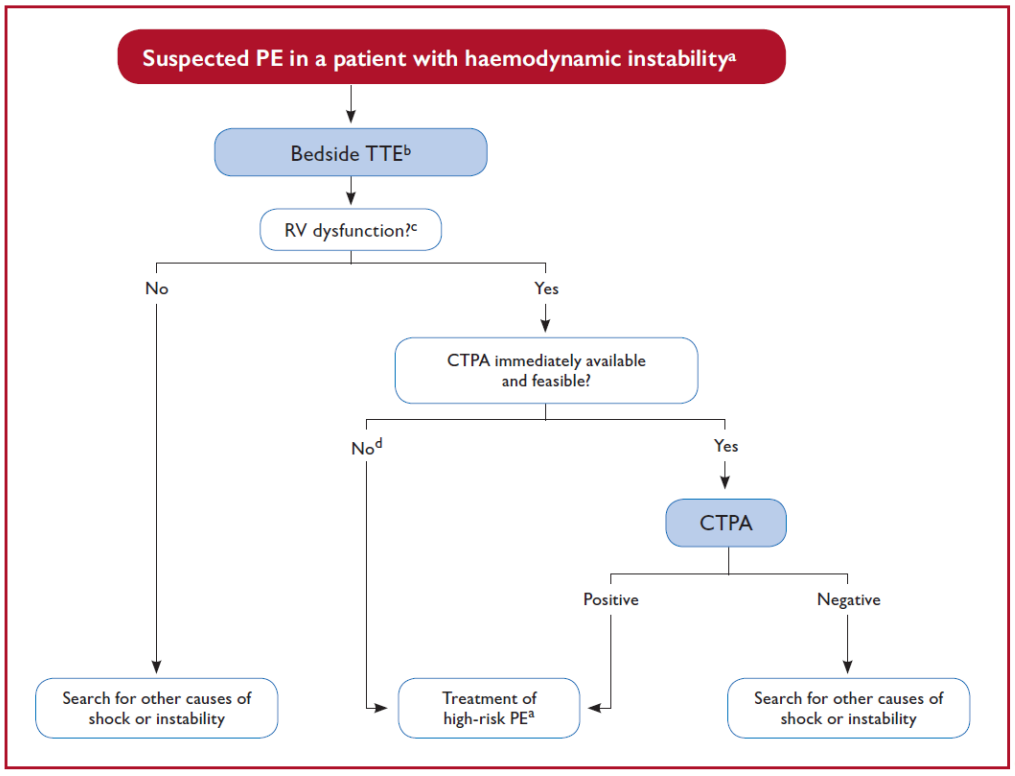


Figure 7: EMERGENCY diagnostic algorithm for patients with suspected high-risk PE presenting with haemodynamic instability (only to be used in exceptional cases, such as cardiac arrest)

CTPA: computed tomography pulmonary angiography; CUS: compression ultrasonography; DVT: deep vein thrombosis; LV: left ventricle; PE: pulmonary embolism; RV: right ventricle; TOE: transoesophageal echocardiography; TTE: transthoracic echocardiogram. "a" In **Table 1**. "b" Ancillary bedside imaging tests could include TOE and bilateral venous CUS."c" In the emergency situation of suspected high-risk PE, this refers mainly to a RV/LV diameter ratio >1.0. "d" Includes cases in which the patient's condition is so critical that it only allows bedside diagnostic tests. In such cases, echocardiographic findings of RV dysfunction confirm high-risk PE and emergency reperfusion therapy is recommended. Konstantinides et al., 2019 ESC Guidelines, Figure 4, pg. 570, doi: 10.1093/eurheartj/ehz405, www.escardio.org/Guidelines, Reprinted by permission of Oxford University Press on behalf of the ESC.

2.6.6 Integration of data during early PE diagnosis

Clinical, imaging and laboratory findings of aggravating conditions/comorbidities should be integrated during PE diagnosis. This allows risk stratification, assessment of early mortality risk and guides early management to improve outcomes. The Pulmonary Embolism Severity Index (PESI) and its simplified version (sPESI) (**Table 3**) are validated tools that combine these to estimate 30-day mortality risk [31-34]. Patients classified as ESC-intermediate risk PE but who have both RV dysfunction and increased cardiac biomarkers are categorized as having intermediate-high risk PE (**Figure 6**). RV dysfunction can be detected using echocardiography or CTPA. Patients with intermediate-high risk PE **should be closely monitored for haemodynamic collapse, usually by admission to high or intensive dependency care [6] (Figure 3)**.

Parameter	Original version [33]			Simplified version [34]	
Age	Age in years			1 point (if age >80 years)	
Male sex	+10 points			-	
Cancer	+30 points			1 point	
Chronic heart failure	+10 points			1 point	
Chronic pulmonary disease	+10 points				
Pulse rate ≥110 bpm	+20 points			1 point	
Systolic BP <100 mmHg	+30 points			1 point	
Respiratory rate >30 breaths/min	+20 points			-	
Temperature <36^{0}C	+20 points			-	
Altered mental status	+60 points			-	
Arterial O_2 Saturations <90%	+20 points			1 point	
	RISK STRATA[a] (CLASS)			**RISK STRATA[a]**	
	Class	**Points**	**Mortality[b]**	**Points**	**Mortality[b]**
	I	≤65	0-1.6%	0	1.0% (CI 0.0-2.1%)
	II	66-85	1.7-3.5%		
	III	86-105	3.2-7.1%	≥1	10.9% (CI 8.5-13.2%)
	IV	106-125	4.0-11.4%		
	V	>125	10-24.5%		

Table 3: Original and simplified Pulmonary Embolism Severity Index [33, 34].
BP: blood pressure; b.p.m.: beats per minute; O2: Oxyhaemoglobin; CI: 95% confidence interval; “a” Based on the sum of points; “b”: “Mortality”= 30 day mortality risk

2.6.7 Immediate management considerations during initial PE assessment

During the diagnostic and prognostic workup of patients with suspected PE, some aspects of treatment have to be delivered in parallel. Therefore, they will be briefly discussed here. Immediate anticoagulation has already been discussed in **section 2.5**. However, we reiterate here the importance of not delaying anticoagulation if the clinical situation is concerning:

For patients with suspected PE, particular those with a high/intermediate clinical probability, anticoagulation should begin while awaiting diagnostic test results (Central Figure 2).

2.6.7.1 Thrombolytic therapy

Thrombolytic therapy provides rapid improvement in pulmonary obstruction and right ventricular function in PE [6]. Thrombolysis can reduce mortality and recurrent PE in ESC-defined “high-risk” PE patients [6] but carries risks of severe bleeding and intracranial haemorrhage. Catheter-directed treatments and surgical embolectomy are not currently considered standard of care but in certain circumstances (and where expertise exists), can occasionally provide alternative reperfusion strategies in challenging patient groups [6], for example, if use of systemic thrombolysis is not possible due to extremely high bleeding risk. Randomized trials with clinically-important outcomes evaluating CDT [35, 36] and reduced-dose systemic lysis [37] in ESC-defined intermediate-high risk acute PE respectively are ongoing.

2.6.7.2: Pulmonary Embolism Response Teams (PERT)

The value of multidisciplinary PERTs is gaining growing recognition [6]. PERTs bring together specialists from various fields to enhance decision-making and treatment implementation in real-time, potentially improving outcomes for patients with severe PE [38, 39]. This collaborative approach aligns with modern healthcare needs, providing structured and immediate responses to acute PE cases [40].

2.6.8 Access to an integrated centre for pulmonary embolism care for patients with severe PE

A minority of patients with severe PE require additional care modalities for reasons including:

1. Failure of systemic thrombolysis.
2. Deterioration while on standard therapy.
3. Some patients who have contraindications to anticoagulation (such as those whose VTE was provoked by recent severe trauma or surgery).
4. Patients with complex competing risks factors .

For selected patients, a centre for advanced, integrated pulmonary embolism care could promote optimal patient care (to be scoped), by providing the relevant expertise on one site. This centre should provide access to as many as possible of the following services.

- Extracorporeal Membrane Oxygenation & access to intensive/high dependency beds.
- Specific expertise and training in catheter-directed therapies for PE.
- Cardiothoracic surgery and other relevant multidisciplinary input.
- Dedicated Haematology input in thrombosis and haemostasis.
- Access to expertise in pulmonary hypertension.
- Ability to offer echocardiography as part of the risk stratification and treatment process.
- Resourced to provide 24:7 access to all these aspects of acute PE treatment.
- Helicopter transfer would improve equitable access.

The vast majority of patients with a diagnosis of PE are best managed locally, with care guided by this NCG-VTE. Based on international evidence, the NCP-VTE recommends that a scoping exercise be conducted to explore the establishment of at least one Irish centre of integrated PE care (in a model 4 hospital), where the relevant expertise to care for selected cases of severe PE, particularly where complexity is challenging, is present on one site.

2.7 Primary and prehospital care: considerations for patients with suspected VTE

Integrated care is central to the diagnosis and management of VTE. Patients with VTE frequently present in the community and require a smooth pathway of care towards prompt diagnostic investigations. We focus here on general practice and on pre-hospital emergency care, as these are some of the most common sites of initial patient presentation with suspected VTE. However, all HCPs share responsibility for recognizing patients' VTE symptoms and signs.

2.7.1 General Practice

Patients with symptoms and signs suggestive of VTE should be promptly referred for diagnostic imaging (**Central Figure 1**). Development of an integrated community- based model of care for patients presenting to General Practice or in the community should be a future priority.

2.7.2 Pre-hospital emergency care

Awareness of VTE amongst prehospital staff could result in a working diagnosis of VTE being made. As a condition that can be sometimes overlooked, this may help in having VTE included in the differential diagnosis by ED medical staff.

2.8 Patient education and information at the time of VTE diagnosis

Increasing patients' knowledge of VTE at time of diagnosis is important for engaging in treatment strategies, and for awareness of potential complications whilst on treatment.

- ✓ Patients with newly diagnosed PE and/or DVT should be provided with the relevant NCP-VTE patient educational material (Supplementary Appendices; www.hse.ie/eng/about/who/cspd/ncps/vte/).
- ✓ Education at the time of initial VTE should include information on what to expect regarding post-VTE care and potential complications.
- ✓ Following a VTE event, patients should receive NCP-VTE education material pertaining to exercise, psychological recovery and anticoagulation.

3.0 Physical and psychological recovery following VTE: What is important in addition to anticoagulation?

3.1 Post Thrombotic Syndrome (PTS) following DVT

Post Thrombotic Syndrome (PTS) [41] is characterised by symptoms of pain, fullness and cramping with lower limb swelling, dependent cyanosis, erythema and venous ectasia and occurs due to ongoing venous hypertension after DVT. PTS can affect up to 50% of individuals following proximal DVT. Although PTS is not fatal, it has a detrimental effect on quality of life that is similar to that of other chronic illnesses like diabetes mellitus or heart failure [42, 43]. PTS severity can be assessed using the Villalta Score (**Suppl. Appendix**). Symptomatic and lifestyle measures can be helpful (**Suppl. Appendix; Recommendations**).

3.2 Post-Pulmonary Embolism syndrome

Long-term disability following PE includes a spectrum of symptoms, functional limitation and diminished quality of life that can occur following an acute PE despite appropriate treatment.

Features of this “post-PE syndrome” are common, ranging from 20-75% [3-9]. The PPES is formally defined as “new or progressive dyspnoea, exercise intolerance, and/or impaired functional or mental status after at least 3 months of adequate anticoagulation following acute PE, which cannot be explained by other (pre-existing) comorbidities” [5].

In addition to persistent physical symptoms, many patients experience emotional distress, depression, anxiety and post thrombotic panic syndrome [2, 44-48]. Measuring all relevant aspects of physical and mental health in VTE patients will lead to earlier detection of the whole range of complications described above and timely referral to relevant healthcare professionals, where appropriate.

3.3 Assessment of patient outcome measures during recovery following VTE

Quality of life patient-reported outcome measures have been informed by patient stakeholder engagement and by reference to the recommendations of the International Consortium for Health Outcomes Measurement (ICHOM)-VTE [4].

3.3.1 What data should be recorded?

Implementation of PROM measurement may be considered in centres with the required expertise and personnel resources for feasibility. The suggestions herein are provided to assist care providers who wish to evaluate PROM as part of capturing post-PE impact. If a centre wishes to do so, then the 7 PROM suggested by ICHOM-VTE are measurable at a minimum with a core set of 4 tools and 2 questions [4] (**Appendix 2; Figure 8**).

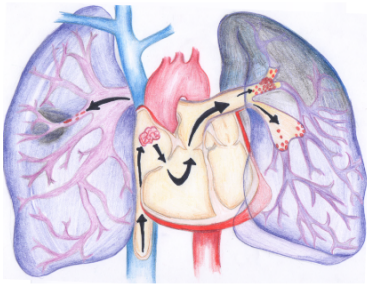
3.4 Suggested ideal post-PE care pathway (Figure 8)

The NCP-VTE-suggested post-PE care pathway has been informed by recommendations of the ESC guidelines on acute PE 2019 [6] and of ICHOM-VTE [4]. Following diagnosis of acute PE and

initial anticoagulation, patients should be counselled, given relevant patient educational materials (**Supplementary Material**) and advised on what to expect in terms of follow-up. This follow up may require initial visits before 3-6 months, depending on individual circumstances. However, it is important that a specific appointment is scheduled at 3-6 months to screen for post-PE complications. Each hospital should determine the best location and speciality for this clinic visit, depending on local resources and pathways. This clinic visit is an opportunity to screen for CTEPD, psychological symptoms and to evaluate satisfaction with treatment, life expectations and quality of life (**Suppl. Appendix; Figure 8**).

3.5 Co-design of a model for a VTE Recovery Programme

Thrombosis Ireland and the NCP-VTE propose a patient-centred recovery programme algorithm, to be supported through future funding initiatives (**Suppl. Appendix**).



Diagnosis of acute PE

Anticoagulate

Interim visits may be considered on an individual basis between diagnosis and 3-6 month appointment

Post-PE follow up appointment (between 3-6 months after PE $)

Screen for psychological symptoms[a]

Ask: "Are you satisfied with your VTE treatment?" (yes/no)

Ask: "Have you experienced a change in your expectations, aspirations, values, or perspectives on life opportunities since the diagnosis of VTE?"

Determine QoL[a]

Dyspnea, functional limitation (PVFS scale) or risk factors for CTEPH[b]?

No

Focus on anticoagulation, secondary prophylaxis and recovery

Yes

Refer to centre with advanced PE expertise (consideration of further testing, incl. echocardiogram, VQ scan, RH catheterization if indicated)

Post VTE Functional Status (PVFS) Scale Grade

0: No functional limitations
All usual duties/activities at home/at work can be carried out at same level of intensity. Symptoms, pain, and anxiety absent.

1: Negligible functional limitations
Usual duties/activities at home/at work can be carried out at same level of intensity, despite some symptoms, pain, or anxiety.

2: Slight functional limitations
Some usual duties/activities carried out at lower level of intensity/ are occasionally avoided due to symptoms, pain, or anxiety.

3: Moderate functional limitations
Usual duties/activities at home or at work have been structurally modified (reduced) due to symptoms, pain or anxiety.

4: Severe functional limitations
Assistance needed in activities of daily living due to symptoms, pain, or anxiety: nursing care and attention are required.

Figure 8: Ideal follow-up strategy & diagnostic workup for long-term sequelae of acute PE $ Can be done by any VTE-experienced physician; *While all patients should ideally be functionally assessed a full formal review of the PVFS scale may only be possible where relevant resourced expertise and WTE are available . Please ensure all patients are given the Relevant Patient Educational Materials* a: Can be done using the PeMB-QOL questionnaire [49] +/- PROMIS short form GH questionnaire [50]; appendix 2*; b: Summarized in ESC guidelines on Acute PE 2019 [51], and should be reviewed in the tertiary centre.*Together, the PeMB-QOL questionnaire, the PROMIS short form GH questionnaire, the PVFS scale (and the two questions) encompass PE-relevant PROMs recommended by ICHOM-VTE [4]. CTEPD: chronic thromboembolic pulmonary disease; PVFS: post-VTE functional status; CTEPH: chronic thromboembolic pulmonary hypertension; PeMB-QOL: Pulmonary Embolism Quality of Life; PROMIS-GH: Patient-Reported Outcomes Measurement Information System Global Health; PROM: patient-reported outcome measure; ICHOM: international consortium for health outcomes measurement; VQ: ventilation/perfusion; RH: right heart.

3.6: Recommendations: Physical and psychological recovery following VTE: What is important in addition to anticoagulation?
Following a VTE event, patients should be assessed at 3-6 months (especially if the VTE event was a PE), to assess for long term sequelae (Figure 8). Earlier and later visits should also be scheduled as appropriate. *Certainty of evidence: low; Strength of recommendation: weak.*
Post Thrombotic Syndrome (PTS) after DVT should be assessed using a validated scoring tool. The NCP-VTE endorses the Villalta scale (**Suppl. Appendix**). *Certainty of evidence: Moderate; Strength of recommendation: Weak.*
Graduated compression stockings (GCS) may be considered after DVT for PTS prevention but patients should be counselled that evidence is lacking on their impact on the risk of PTS. *Certainty of evidence: High; Strength of recommendation: Strong.*
When practical and safe, early mobilisation and exercise (including provision of the NCP-VTE patient educational material on exercise (www.hse.ie/eng/about/who/cspd/ncps/vte/)) should be considered in patients following DVT. Leg elevation, weight loss, and exercise as examples of lifestyle modifications in patients with PTS may be considered. *Certainty of evidence: Very low; Strength of recommendation: Weak.*
Patients with persistent symptoms after 3-6 months of appropriate anticoagulation for PE should be evaluated for the post-PE syndrome (PPES). *Certainty of evidence: Moderate; Strength of recommendation: Strong.*
Following a VTE event, patients should receive NCP-VTE patient educational material pertaining to exercise, psychological recovery and anticoagulation (www.hse.ie/eng/about/who/cspd/ncps/vte/). *Certainty of evidence: Very low; Strength of recommendation: Strong.*
Following a VTE event, an patient's plan for anticoagulation should ensure that the appropriate drug and dose is chosen in line with all of the factors listed in section 2.5.1.1, the patient is fully informed and monitoring/review is planned *Certainty of evidence: High; Strength of recommendation: Strong.*

4.0 Awareness of VTE of signs and symptoms; basics of VTE prevention

4.1 VTE awareness

Despite the impact of VTE, awareness of this condition in the general population is poor. A 2015 survey by the World Thrombosis Day (WTD) Campaign, under the auspices of the International Society on Thrombosis and Haemostasis (ISTH), reported that the proportion of respondents who demonstrated awareness of the terms "thrombosis", DVT and PE (68%, 44% and 54%, respectively) was lower than for other thrombotic disorders, such as heart attack and stroke [52]. More recently, a 2022 US survey reported that 75% had never heard of DVT and fewer than 1 in 10 had an awareness of DVT symptoms [53].

Tragically, lack of basic awareness of VTE signs and symptoms amongst the general community, those most at risk and amongst HCPs can result in missed opportunities to save lives and to prevent long-term disability. In addition, sometimes the challenge for clinicians is not just lack of awareness that VTE is a serious condition but also that the initial signs and symptoms can be non-specific and often initially mild, including for example persistent coughing, shortness of breath on exertion, and even just feeling a little dizzy. These are symptoms that could easily be caused by a viral illness. **Therefore, if we remember "THINK THROMBOSIS", we are less likely to miss an opportunity to diagnose and treat VTE. All HCPs share responsibility for recognizing patients' potential VTE symptoms and signs.**

The NCP-VTE, working with the NGO Thrombosis Ireland (Now Irish Heart Foundation) and other HSE colleagues including the National Quality and Patient Safety Directorate, has developed a suite of resources to assist in promoting VTE awareness. These include a "Blood Clot Alert Card", a Blood Clot Information poster (**Figure 9**), a Blood Clot Information Poster and booklet specifically designed for pregnant patients (**Supplementary materials**, **www.hse.ie/eng/about/who/cspd/ncps/vte/**) and simple videos suitable for dissemination on social media, TV or on websites (**www.hse.ie/eng/about/who/cspd/ncps/vte/**). Many make use of QR codes. The WTD campaign also provides a suite of useful resources (https://www.worldthrombosisday.org/).

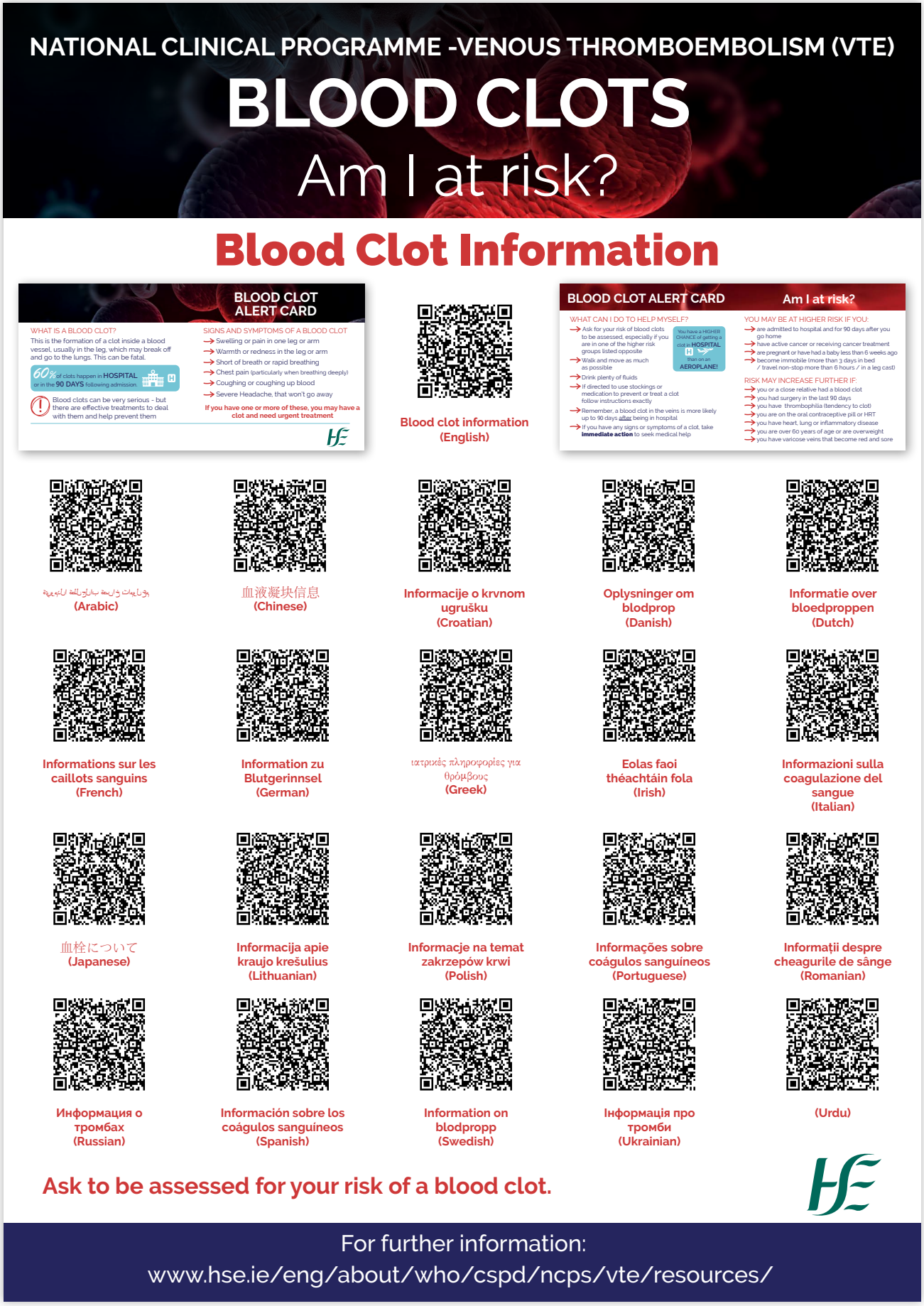


Figure 9: NCP-VTE/Thrombosis Ireland Blood Clot information poster highlighting signs and symptoms of VTE and the risk factors for same, translated into some commonly encountered languages in the Irish health system.

4.2 VTE Risk Factors

VTE risk assessment is required for every in-patient admitted to adult medical and surgical services.

People in the community with VTE risk factors (**Figure 10**) have a higher probability of developing VTE than those without risk factors. This is of relevance when considering referral for investigations. However, rarely is the absolute risk of a patient in the community sufficiently high to warrant outpatient continuous thromboprophylaxis. In contrast, hospitalized patients have a higher risk of VTE than non-hospitalized patients and additional prevention strategies should be considered.

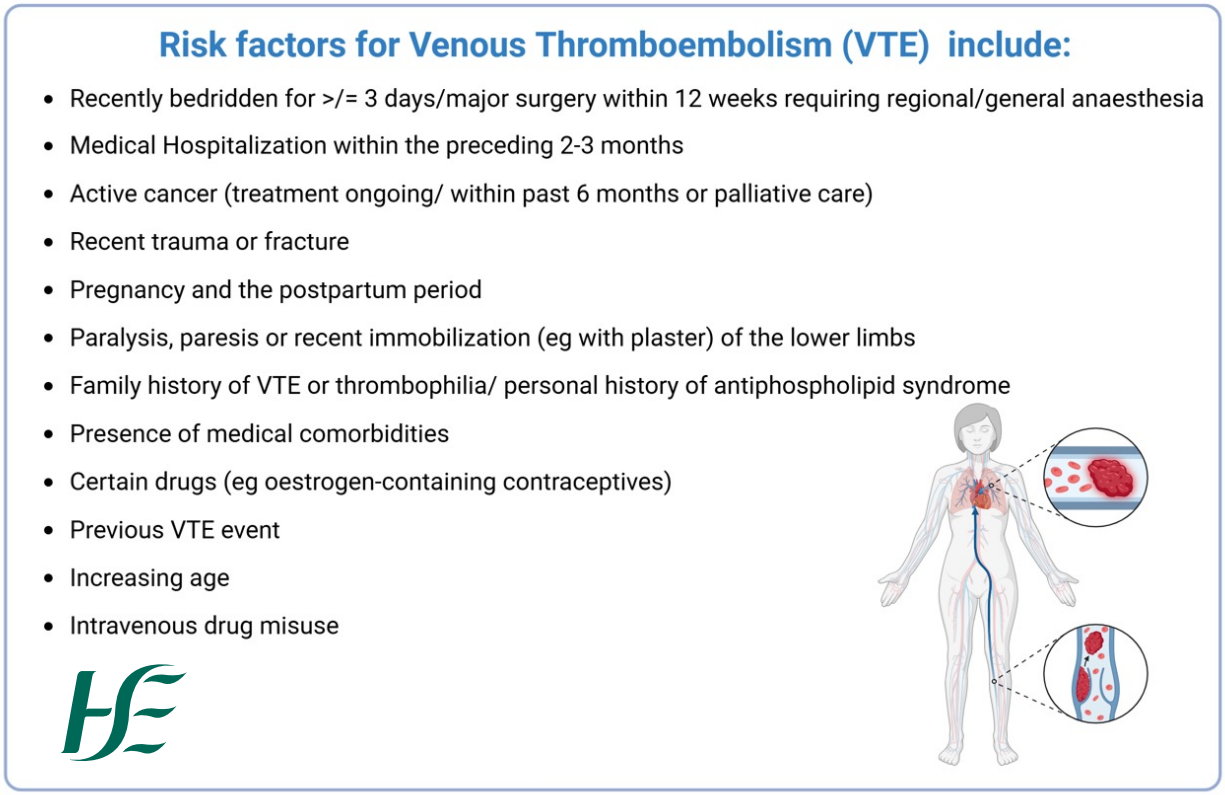


Figure 10: Common risk factors for VTE

Hospital-acquired VTE (HA-VTE, defined as a VTE event occurring either during or up to 90 days following hospitalization) is an important cause of death and disability. Up to **50-60 percent** of all VTE cases occurring during or after hospitalization, **such that VTE a leading preventable cause of hospital death** [1, 10, 11, 54]. In the U.K, HA-VTE has been significantly reduced following the implementation of a National VTE prevention programme. These and other data demonstrate that HA-VTE is a potentially preventable through strategies that may include raised awareness (including awareness of the signs and symptoms of VTE amongst patients), VTE risk assessment and implementation of appropriate thromboprophylaxis [11, 54].

VTE risk factors should be formally assessed in hospitalized patients (according to National Guidance & Standards published in 2018 and updated in 2022 [23, 24]), to identify whether a patient is at risk of VTE and whether pharmacological thromboprophylaxis is required. This includes a bleeding risk assessment, which should be carried out prior to prescription of pharmacological thromboprophylaxis, to ensure that no contraindication exists.

4.3 VTE prevention strategies in Ireland

National guidance on the operationalization of VTE risk assessment and prevention was published in July 2018 by the National Medication Safety Improvement Programme of what was then termed the HSE Quality Improvement Division (now HSE National Quality and Patient Safety). This was the "Preventing Blood Clots in Hospitals Improvement Collaborative Report; National Recommendations and Improvement Toolkit" (**Summary and Audit Standards listed in Suppl. Appendix**).

5.0 Recommendations for REOs for implementation of National Clinical Guideline in Venous Thromboembolism

Implementation of the recommendations in this guideline is the responsibility of REOs.
REOs should ensure that resources are in place to ensure access for patients to all relevant information materials (Suppl. Materials). These include information on the signs and symptoms of VTE (by provision of a VTE alert card (Suppl. Materials) or by ensuring access to similar appropriate information (including poster/ electronic format); particularly relevant for high risk categories, including patients who are admitted to hospital, patients who have active cancer or are receiving cancer treatment, people who are pregnant or have had a birth within the last 6 weeks, patients who undergo lower limb immobilization due to trauma. All efforts should be made to ensure that information is in a language or format that patients can understand
REOs should ensure that the recommendations of the “Preventing Blood Clots in Hospitals Improvement Collaborative Report; National Recommendations and Improvement Toolkit” outlined in the text of this chapter are implemented and operationalized.
The NCP-VTE suggests the development of targeted educational initiatives, aimed at improving clinical awareness of VTE in prehospital care.
It is suggested that REOs develop business cases to deliver an integrated community-based model of care for patients with suspected VTE to support early identification of VTE, provide best practice initiatives, improve patient safety and improve patient outcomes.
REOs should work towards an integrated pathway for DVT diagnosis in the community so that general practitioners can access care for their patients in a timely manner.

6.0 Guideline Methodology and Copyright

A systematic review of the literature was undertaken to identify relevant literature on venous thromboembolism (VTE) awareness, prevention, diagnosis, immediate treatment and long-term recovery. Systematic searches of EBSCO Medline, Embase, and EBSCO Cinahl, were completed using (MeSH/Emtree terms). **The full NCG-VTE methodology is detailed in the Supplementary Appendix** www.hse.ie/eng/about/who/cspd/ncps/vte/

6.1 Copyright and permissions sought

The following copyright permissions have been sought for reproduction of figures in the main guideline and supplementary appendix (further details are provided in the individual figures).

1. The Lancet (Respiratory Medicine): Age-sex specific pulmonary embolism-related mortality in the USA and Canada, 2000–18: an analysis of the WHO Mortality Database and of the CDC Multiple Cause of Death database 2000–18 [55].
2. European Heart Journal: 2019 ESC Guidelines for the diagnosis and management of acute pulmonary embolism developed in collaboration with the European Respiratory Society (ERS) The Task Force for the diagnosis and management of acute pulmonary embolism of the European Society of Cardiology (ESC) [6].
3. Blood reviews: The post-PE syndrome: a new concept for chronic complications of pulmonary embolism PE [56].
4. European heart journal: Optimal follow-up after acute pulmonary embolism: a position paper of the European Society of Cardiology Working Group on Pulmonary Circulation and Right Ventricular Function, in collaboration with the European Society of Cardiology Working Group on Atherosclerosis and Vascular Biology, endorsed by the European Respiratory Society [5].
5. The Lancet Haematology: Development of an international standard set of outcome measures for patients with venous thromboembolism: an International Consortium for Health Outcomes Measurement consensus recommendation [4].

7.0 Disclosures of Interest, Guideline Commissioning and Alignment with National Priorities

7.1 Disclosures of interest

Listed on www.hse.ie/eng/about/who/cspd/ncps/vte/

7.2 Commissioning of the guideline

The commissioning of this guideline was driven by the need to improve the quality and safety of services provided to patients at risk of and diagnosed with VTE. The guideline was commissioned by Dr Colm Henry, Chief Clinical Officer, overseen by Dr Siobhán Ní Bhriain, National Clinical Director and Lead for Integrated Care and by Dr Mike O'Connor, National Clinical Advisor and Group Lead, Access & Integration, and developed through National Clinical Programme in VTE.

1.7.1 Alignment with HSE National Priorities

The document aligns with several HSE national priorities, including:

Sláintecare Strategy: By promoting best practices in VTE prevention and management, the document supports the Sláintecare strategy's goal of providing safe, high-quality, and accessible healthcare services to all citizens.

National Quality Improvement Programme: The guideline contributes to the National Quality Improvement Programme by standardizing care and reducing the incidence of VTE-related complications, thereby enhancing the overall quality of care.

Corporate or Service Plans: The guideline aligns with HSE corporate and service plans by focusing on patient safety, quality of care, and the efficient use of healthcare resources.

Appendix 1: Supplementary Material (https://www.hse.ie/eng/about/who/cspd/)

1. VTE NCG- SUPPLEMENTARY APPENDIX
2. Blood Clot Alert Card
3. Blood Clot Alert Poster including QR codes in several languages
4. NCP-VTE patient educational material: Oral Anticoagulation
5. NCP-VTE patient educational material: Warfarin
6. NCP-VTE patient educational material: Cancer-associated thrombosis
7. NCP-VTE Patient Educational Poster: Cancer-associated thrombosis
8. NCP-VTE patient educational material: Deep Vein Thrombosis
9. NCP-VTE patient educational material: Pulmonary Embolism
10. NCP-VTE patient educational material: Exercise after a Blood Clot
11. NCP-VTE patient educational material: Living with uncertainty and fear of recurrence
12. NCP-VTE patient educational material: "Look After Your Mind"; Patient Information and Psychological aspects of recovery after a blood clot
13. Videos created by the NQPSD directorate are available at: www.hse.ie/eng/about/who/cspd/ncps/vte/

Appendix 2: Useful Links to Scales and Instruments

14. PROMIS® Scale v1.2 – Global Health https://www.healthmeasures.net/index.php?option=com_instruments&view=measure&id=778
15. Pulmonary Embolism QOL Questionnaire https://pubmed.ncbi.nlm.nih.gov/20025645/
16. Post-VTE Functional Status (PVFS) Scale https://www.thrombosisresearch.com/cms/10.1016/j.thromres.2020.03.020/attachment/89ffc37f-73b5-4afb-941b-121403f351b4/mmc3.pdf
17. VEINES-QOL/Sym questionnaire https://d-nb.info/1117973603/34
18. GAD-7 Anxiety https://www.hse.ie/eng/about/who/cspd/ncps/ncpr/copd/pulmonary-rehabilitation/generalised-anxiety-disorder-assessment-gad7.pdf
19. Patient Health Questionnaire (PHQ-9) https://www.hse.ie/eng/about/who/cspd/ncps/ncpr/copd/pulmonary-rehabilitation/patient-health-questionnaire-9phq9.pdf
20. PROMIS Item Bank v1.0 – Dyspnea Severity – Short Form 10a https://www.facit.org/measures/promis-sf-v1.0-dyspnea-severity-10a
21. PROMIS® Pain Intensity instruments https://www.healthmeasures.net/images/PROMIS/manuals/Scoring_Manuals_/PROMIS_Pain_Intensity_Scoring_Manual.pdf
22. 36-Item Short Form Survey Instrument (SF-36) RAND https://www.rand.org/health-care/surveys_tools/mos/36-item-short-form.html
23. EQ-5D-5L Health Questionnaire https://euroqol.org/information-and-support/euroqol-instruments/eq-5d-5l/
24. Hospital Anxiety and Depression Scale (HADS) https://pubmed.ncbi.nlm.nih.gov/6880820/

Appendix 3: Membership of Development Group (Guideline Taskforce)

Melanie Sheehan	Mother of Eve Cleary who lost her life due to pulmonary embolism
Aine Toher	Pharmacist, The National Maternity Hospital
Anna Cronin	Pharmacist, Tipperary University Hospital
Anne O'Byrne	Librarian, The Rotunda Hospital
Annmarie O'Neill	CEO of Patient Organization Thrombosis Ireland (Irish Heart Foundation)
Audrey Purcell	Pharmacist, St John of God Hospital
Beth Farren	Patient Safety Strategy Manager, Quality & Patient Safety Department HSE midwest
Caoimhe Kenny	Physiotherapist; PhD candidate in VTE Recovery
Carol Guinan	Inclusion Health Midwife, The Rotunda Hospital
Carol Walsh	Advanced Nurse Practitioner in Acute Medicine, Bantry University Hospital
Cathleen Moran	Advanced Nurse Practitioner in Acute Medicine, Galway University Hospital
Catriona O' Leary	Anticoagulation Clinical Nurse Specialist, Cork University Hospital
Chloé Carpenter	Previous NCP-VTE Programme Manager
Ciara Kirke	Clinical Lead, National Medication Safety Programme, NQPSD, HSE
Claire O'Dwyer	Pharmacist, Louth County Hospital
Deborah Bourke	cANP in VTE, University Hospital Limerick
Denise Scott	Venous Thromboembolism Clinical Nurse Specialist, Mater Misericordiae University Hospital
Dr Aine Burke	Consultant Haematologist, Sligo University Hospital
Dr Beatrice Nolan	Consultant Haematologist, Children's Health Ireland, Crumlin
Dr Bibi Bassa	VTE and Trauma Research Registrar, Mater Misericordiae University Hospital
Dr Cian McDermott	Consultant in Emergency Medicine, Mater Misericordiae University Hospital
Dr Colm Cooney	National Clinical Lead, National Programme for Specialist Perinatal Mental Health Services, HSE
Dr Conor Prendergast	Consultant in Emergency Medicine, St Vincent's University Hospital
Dr David Hanlon	National Clinical Advisor in Primary Care, HSE
Dr Denis O'Keeffe	Consultant Haematologist, University Hospital Limerick
Dr Eanna Mac Suibhne	Consultant in Emergency Medicine, Cork University Hospital
Dr Eduard Turcuman	Consultant in Emergency Medicine, University Hospital Galway
Dr Etimbuk Umana	Consultant in Emergency Medicine, Mater Misericordiae University Hospital
Dr Farah Mustafa	Consultant in Emergency Medicine, Our Lady of Lourdes Hospital Drogheda

Dr Gráinne O'Donoghue	Associate Professor of Public Health, Physiotherapy & Sports Science, UCD
Dr Karen Murphy	Consultant Haematologist, St Vincent's University Hospital
Dr Karl Ewins	Consultant Haematologist, Beaumont Hospital
Dr Maeve Crowley	Consultant Haematologist, Cork University Hospital
Dr Rosa McNamara	National Clinical Lead, NCP-Emergency Medicine, HSE
Dr Sinead Lynch	Counselling Psychologist, Mater Misericordiae University Hospital
Dr Tanna Tan	Haematology Registrar, Beaumont Hospital
Eadaoin Maguire	Pharmacist, University Hospital Waterford
Emily Bury	Advanced Nurse Practitioner in VTE, St Vincent's University Hospital
Frances Moore	Pharmacist, St Luke's Hospital Kilkenny
Helen Sheehy	Clinical Nurse Manager, Deep Vein Thrombosis, University Hospital Limerick
Juanita Guidera	Programme Manager, National Quality and Patient Safety Directorate, HSE
Kelly Delaney	Candidate Advanced Midwife Practitioner, Our Lady of Lourdes Hospital Drogheda
Killian Walsh	Library and Information Specialist, RCSI
Lidhy Solomon	ANP in VTE, Mater Misericordiae University Hospital
Liz O'Boyce	VTE Programme Manager, Mater Misericordae University Hospital
Mary Savage	ANP in Acute Medicine, Our Lady of Lourdes Hospital Drogheda
Michelle Neary	ANP in Acute Medicine, Kerry University Hospital
Mick Fitzpatrick	Business Intelligence Analyst, HSE Dublin and South East
Miriam Kennedy	Previous NCP-VTE Programme Manager
Mr Frank Lyons	Consultant Orthopedic Surgeon, Mater Misericordiae University Hospital
Niamh Lucey	Library and Information Services, St. Vincent's University Hospital
Niamh O'Hanlon	Pharmacist, St Vincent's University Hospital
Nóirín Bannon	Programmes Manager, HSE Dublin and South East
Patricia Cunningham	Consultant Radiologist, Our Lady of Lourdes Hospital Drogheda and Our Lady's Hospital Navan
Patricia McKeown	ANP, Injuries Unit, Nenagh Hospital
Prof Andrew Sharp	Professor of Cardiology, Mater Misericordae University Hospital
Prof Fionnuala Ní Áinle	Clinical Lead, National VTE Programme, HSE
Prof Garry Courtney	Clinical Lead, National Acute Medicine Programme, HSE
Prof Gerard O'Sullivan	Interventional Radiologist, University Hospital Galway
Prof Karen Murphy	Consultant Haematologist, St Vincent's University Hospital and Chair, NCP-VTE CAG

Prof Mike Watts	Consultant General Physician, University Hospital Limerick
Prof Niamh O'Connell	Consultant Haematologist; Director, National Coagulation Centre, St James's Hospital
Prof Peter MacMahon	Consultant Radiologist, Mater Misericordiae University Hospital
Sarah Garvey	Advanced Nurse Practitioner in Coagulation, Beaumont Hospital
Sheema Lughmani	Digital Communications Officer, National Quality and Patient Safety Directorate, HSE
Sinead O'Mahony	Pharmacist, St Vincent's University Hospital
Therese O'Brien	Anticoagulation Nurse Manager, Portiuncula University Hospital, Galway
Virginia Silvari	Pharmacist, Cork University Hospital

The NCG-VTE was reviewed by and endorsed by:

Chief Clinical Officer Clinical Forum

RCPI NCP-VTE Clinical Advisory Group

The membership of the Irish Haematology Society Coagulation Specialist Interest Group

Dr Patricia Cunningham, Dean, RCPI Faculty of Radiology

Prof Mick Lee, NCL, NCP-Radiology

Dr David Hanlon, NCAGL for Primary Care

Dr Rosa McNamara, NCL for Emergency Medicine

Prof Cathal O'Donnell, Clinical Director, National Ambulance Service

Dr Orla Healy, National Director, National Quality and Patient Safety Directorate

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