

Research Review

EDUCATIONAL SERIES

VTE Prevention in Adult Hospitalised Patients in NZ Release of the NZ National Policy Framework

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VTE continues to be a significant cause of in-hospital morbidity and mortality. Extensive work by the New Zealand VTE Prevention Steering Group and key opinion leaders has culminated in the recent release of the National Policy Framework: VTE Prevention in Adult Hospitalised Patients in NZ, which has been published by the NZ VTE Prevention Programme.

This review summarises the key points of the 77-page framework into an easily digestible format for the busy healthcare worker. The full National Policy Framework, which includes examples of educational, risk assessment and audit tools, can be downloaded from the Health Quality and Safety Commission New Zealand's website (<http://www.hqsc.govt.nz/our-programmes/other-topics/publications-and-resources/publication/654/>).

Hospitalised patients are at a 10-fold increased risk of VTE, most commonly presenting as DVT, but PE, which has a mortality rate of 10%, can also occur.¹⁻³ Extrapolation of data from one NZ hospital indicated that hospital-associated VTE could occur in >1500 patients each year across NZ.⁴ Furthermore, 30–50% of patients with DVT develop PTS, which is characterised by ongoing and debilitating lower limb oedema and pigmentation.^{5,6} However, there is a strong evidence base that the risk of in-hospital VTE can be reduced by >60% with effective thromboprophylaxis.⁷ Internationally, a great deal of progress has been made in the area of in-hospital VTE prevention, including the establishment of the Global VTE Prevention Forum in July 2011. NZ joined a number of other member countries in signing the International Consensus Statement at the Forum, which was established to provide a global platform for shared learning and best practice, exchange of views and information regarding effective VTE prevention and management, and provide leadership to improve patient care and reduce further avoidable mortality through VTE prevention.

The National Policy Framework: VTE Prevention in Adult Hospitalised Patients in NZ has been published by the NZ VTE Prevention Programme and was sponsored with funding from the Health Quality & Safety Commission and supported by the NZ Health and Disability Commissioner, Anthony Hill. The framework, which was compiled in consultation with the multidisciplinary membership of the New Zealand VTE Prevention Steering Group and key opinion leaders, has been published to provide guidance for DHBs and healthcare providers for improving VTE prevention among hospitalised patients.

The framework includes: i) clinical guidance on appropriate thromboprophylaxis for all adult patients; ii) data definitions to facilitate understanding of the extent of in-hospital VTE within DHBs and other healthcare organisations; and iii) resources for facilitation and promotion of preventing in-hospital VTE.

Setting up an in-hospital VTE prevention programme

VTE prevention programmes have been shown to significantly improve the quality of VTE prophylaxis and risk assessment rates among adult hospitalised patients.^{1,8} Therefore, a robust, systems-based VTE prevention programme should be adopted by all hospitals. For an in-hospital VTE prevention programme to be effective, it should: i) incorporate a multifaceted range of processes and measures to enable and support VTE prevention; ii) ensure individualisation of preventative measures for each patient; and iii) balance each patient's clotting and bleeding risks. There are a number of key elements that are necessary for a VTE prevention quality improvement programme to be effective and sustainable (see below). The four steps necessary for setting up a programme that achieves these objectives are outlined as follows.

Abbreviations used in this review

DHB = District Health Board

DVT = deep vein thrombosis

LMWH = low molecular weight heparin

PE = pulmonary embolism

PTS = post-thrombotic syndrome

UFH = unfractionated heparin

VTE = venous thromboembolism

1. Obtain organisational support.
 - Top-level clinical and executive leadership buy-in and support are needed for VTE prevention quality improvement initiatives to be optimally effective.
 - The risk assessment process needs to be embedded as part of routine prescribing processes.
2. Establish a multidisciplinary VTE prevention team.
 - Multidisciplinary teamwork is essential for optimising VTE prevention activities in hospitals, and this needs to be considered to drive the approach in assembling an effective VTE prevention team.
3. Determine the incidence of hospital-associated VTE and current status of VTE prevention activities.
 - It is crucial to identify the current VTE prevention status and any associated problem issues and barriers, since these provide the baseline information needed to evaluate and assess interventions and document their effectiveness.
4. Develop a comprehensive VTE prevention plan using a whole of hospital systems-based approach.
 - Each DHB/health provider must compile a VTE prevention plan that details its goals, strategic priorities, timelines for achievement and quality indicators that will be utilised to improve the structure, processes and outcomes of VTE prevention.

Key elements of an effective, sustainable VTE prevention programme in adult hospitalised patients

- Quality improvement framework to plan and guide progress
- An organisation-specific plan that details clear time-specific goals and measurable outcomes
- High-level organisational buy-in, support and infrastructure
- Focussed multidisciplinary steering/working group(s)
- Clear identification of organisational current problem issues, and data quantifying their extent
- Reliable data collection and tracking of key performance indicators and adverse outcome events
- Standardised risk assessment tool, based on current best evidence and best practice, embedded into day-to-day patient care

Training and education for VTE prevention

Research has shown that thromboprophylaxis has often not been provided to at-risk patients in settings where in-hospital VTE prevention strategies have been implemented.^{9,10} This reinforces the need for education of healthcare professionals who understand the rationale, risks and strategies for VTE prevention so sustained improvements can be realised. VTE prevention educational packages should include key information (see below), and are best designed in consultation with the target healthcare professional groups so that the education is 'fit for purpose' and well accepted. VTE prevention education should be included in undergraduate curricula and in clinical induction programmes for junior staff. Multidisciplinary ward rounds, ward handover meetings, grand rounds and leadership walk-rounds also provide important opportunities for communicating the key messages regarding VTE prevention to staff.

Information that should be included in VTE prevention education packages

- VTE pathophysiology
- Organisational VTE prevention guidelines
- When and how to assess patients' VTE risk using the organisation's approved VTE risk assessment tool
- Roles and responsibilities for appropriate patient screening and VTE risk assessment, thromboprophylaxis prescribing, monitoring and management, and clinical judgment
- VTE predictability and preventability by using thromboprophylaxis in specific patient groups (e.g. general medical patients)
- Risks, benefits, appropriate use and application of mechanical prophylaxis
- Risks, benefits and appropriate use of pharmacological prophylaxis
- Patient education
- Key performance indicators and auditing thereof
- Root-cause analyses of VTE events
- Discharge planning

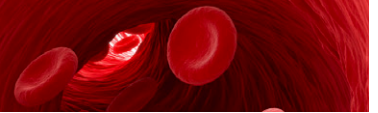
Patient engagement and education

Providing patients with knowledge regarding VTE prevention: i) helps encourage participation in recommended activities (e.g. early ambulation, increasing fluid intake); ii) promotes adherence to pharmacological thromboprophylaxis; and iii) allows patients to self-assess and self-report VTE symptoms. Therefore, relevant information on VTE prevention should be provided both verbally and in prepared written form to all adult patients on admission to hospital and at discharge. Patients identified as being at high-risk at assessment should also receive specific counselling regarding the recommendations, including benefits and risks associated with thromboprophylaxis and what signs and symptoms they should be looking out for, particularly postdischarge. Patients could also complete a self-assessment VTE risk assessment to determine their own risks of VTE and bleeding prior to or on admission, particularly in nonacute care settings.

Clinical Guidance

Clinical guidance regarding VTE prevention is provided in the framework in general terms, as the development of a comprehensive explicit evidence-based clinical guideline for NZ did not fall within the scope of the initiative. Decisions regarding thromboprophylaxis should consider the benefits and risks, particularly those associated with pharmacological prophylactic regimens, with the ultimate decision to provide thromboprophylaxis individualised to each patient. It is important for all VTE prevention team members to have comprehensive knowledge of the current best evidence and best practices so they can: i) inform the scope and direction of VTE prevention quality improvement initiatives; and ii) increase their team's credibility in discussions with clinical staff, hospital leadership and patients. The guidelines recommended for use in NZ are:

- National Health and Medical Research Council (NHMRC) VTE Prevention Guideline¹¹
 - Recommendations for adults for all major types of surgery, acute medical illnesses, trauma, ICU, cancer and obstetrics
- American College of Chest Physicians (ACCP) Antithrombotic Guidelines, 9th edition¹²
 - Emphasis on risk stratification/individualising thromboprophylaxis
- Institute for Health and Clinical Excellence (NICE) Clinical Guideline CG92 2010⁹
 - Guidance for patients at risk of developing hospital-associated DVT, including day-case patients
- American College of Physician (ACP) Guidelines¹³
 - Emphasis on nonsurgical patients
- Reducing the risk of thrombosis and embolism during pregnancy and the puerperium¹⁴



VTE risk assessment

It has been shown that many cases of hospital-associated VTE are preventable with effective risk assessment and appropriate thromboprophylaxis.¹¹ There are a number of identifiable factors that increase the risks of VTE and bleeding in hospitalised patients (see below). In addition, the level of VTE risk for a patient is also influenced by: i) type of surgery; ii) type of anaesthesia; iii) duration of immobility; iv) duration of surgery; and v) surgical complications.

Factors that increase VTE risk	Factors that increase bleeding risk
Older age, particularly >60 years Pregnancy and the puerperium Disseminated or locally advanced cancer or active treatment for malignancy Previous VTE Varicose veins Marked obesity Prolonged severe immobility Use of oestrogen-containing hormone replacement therapy or oral contraceptives in women Inherited/acquired thrombophilia Acute or acute-on-chronic chest infection Heart failure Myocardial infarction Stroke with immobility Some cancer chemotherapies Acute inflammatory bowel disease All surgical procedures, particularly abdominal, pelvic, thoracic or orthopaedic surgical procedures Leg injury that requires surgery or prolonged immobilisation	Significant renal impairment (reduced creatinine clearance for renally excreted anticoagulants) Current active major bleeding (≥ 2 U of blood/blood products transfused in 24h) Current chronic, clinically significant and measurable bleeding over 48h Inherited or acquired bleeding disorders (e.g. haemophilia or other coagulation factor abnormality, coagulopathy, DIC) Severe platelet function disorder or thrombocytopenia (pharmacological prophylaxis not recommended if platelet count $< 50,000$ cells/ μ L) Recent CNS bleeding Intracranial or spinal lesion Recent major surgical procedure of high bleeding risk Active peptic ulcer or ulcerative GI disease Liver failure or prolonged obstructive jaundice Concomitant use of medications that may affect clotting Neuraxial block or recent lumbar puncture

Appendix 3 of the framework provides examples of risk assessment tools that have been developed for use in NZ hospitals to ensure a structured approach to VTE prevention that considers the cumulative risk from the multiple risk factors. In order to achieve such a structured comprehensive approach, a step-wise approach should be utilised (see Fig 1).

Once a patient has been assessed as requiring VTE prophylaxis by the treating physician or appropriate specialist (e.g. midwife for obstetric patients), and the assessment has been recorded, the most appropriate form of VTE prophylaxis must be determined.

The recommended guidelines for NZ (see page 2) along with local organisational guidelines (especially in relation to neuraxial anaesthesia) and clinical judgement guide the choice of appropriate pharmacological antithrombotic agent(s) (see below) for each patient.

Antithrombotics available for use in NZ

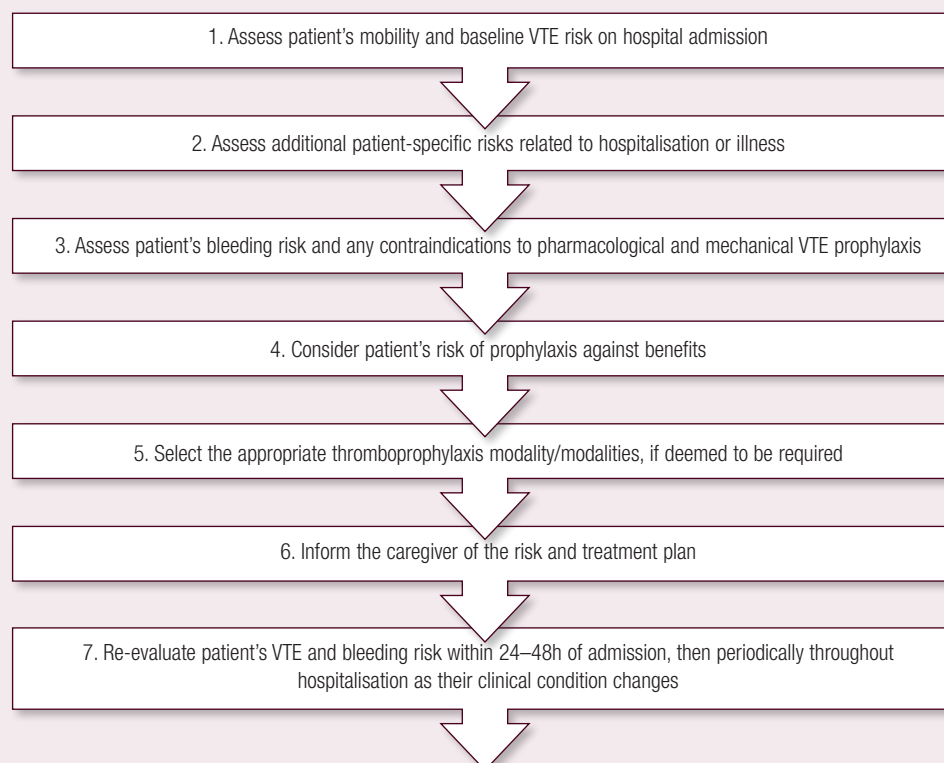
- LMWHs (e.g. enoxaparin, dalteparin)
- UFH
- factor-Xa inhibitors (e.g. rivaroxaban)
- warfarin
- direct thrombin inhibitors (e.g. dabigatran)
- aspirin

For patients in whom pharmacological VTE prophylaxis is indicated, it should be continued until their baseline mobility has recovered, and often needs to be continued postdischarge from hospital. Avoidance or dose reduction is necessary for some pharmacological thromboprophylaxis agents (e.g. enoxaparin, dabigatran) in patients with renal impairment; the benefit-harm assessment may be altered.

The risk of bleeding (the major potential complication of pharmacological thromboprophylaxis) may be exacerbated by surgery (varies according to procedure and anatomical site) and the concomitant use of other drugs that increase bleeding risk (e.g. low-dose aspirin, clopidogrel).

For patients at risk of VTE who also have a high risk of bleeding, mechanical VTE prophylaxis with graduated compression stockings, an intermittent pneumatic compression device or a venous foot pump may be more appropriate; however, consistent use is necessary for efficacy.^{11,13-17}

Fig 1. Steps for developing a structured, comprehensive VTE risk assessment tool



Surgical patients

Surgery, particularly major orthopaedic surgery involving the lower extremity and major surgery for cancer, is a major VTE risk factor. Furthermore, additional risk factors have a cumulative effect on VTE risk among surgical patients,¹² and surgical patients who have a high VTE risk should receive extended prophylaxis.

The postsurgical VTE risk varies with the nature of the procedure, including its duration, and with perioperative care.

An assessment of a patient's VTE and bleeding risks should always be performed and recorded before thromboprophylaxis is prescribed to determine if such intervention is indicated and appropriate.

General and major gynaecological

Patients who have undergone general or major gynaecological surgery should receive an LMWH or UFH for ≤ 9 days or until full mobility has been restored.¹¹ All these patients should also receive mechanical thromboprophylaxis with graduated compression stockings, regardless of whether or not pharmacological thromboprophylaxis is used, until their mobility has fully returned.

Cancer patients

VTE risk is increased in patients with cancer, and this varies by type of cancer, patient demographics, patient history, chemotherapeutic regimen and hospitalisation status.^{15,18} All patients with cancer undergoing surgical procedures (including abdominal, pelvic or neurosurgery) should receive thromboprophylaxis (unless contraindicated).¹¹ The recommended regimen following major general surgery for cancer is an LMWH or UFH for $\geq 7-10$ days, while ≤ 28 days of an LMWH should be considered for patients who have undergone abdominal or pelvic surgery for cancer, particularly if they are obese, slow to mobilise or have a history of VTE.¹¹

While thromboprophylaxis with a heparin product in cancer patients receiving chemotherapy has been shown to significantly reduce the risk of thromboembolic events without increasing bleeding,¹¹ routine VTE prophylaxis (pharmacological or mechanical) should not be offered to ambulant cancer patients receiving chemotherapy, unless deemed clinically indicated and appropriate by a VTE risk assessment.¹⁵

Pregnancy

Pregnancy increases VTE risk. While most VTE events occur during the antepartum period, the daily VTE risk is greatest postpartum. UK guidelines recommend that all women in early pregnancy or planning a pregnancy should receive a VTE risk assessment, with a plan regarding thromboprophylaxis discussed and implemented.¹⁹ Risk factors should be reviewed in women admitted to hospital during pregnancy and in the postpartum period. Women with a history of VTE have the highest risk of (recurrent) VTE during pregnancy. Other risk factors include BMI, immobility, family history and pregnancy-specific factors such as preeclampsia, postpartum haemorrhage and caesarean section.¹³

While the Australian and NZ consensus recommendations regarding VTE prophylaxis in pregnancy have recently been published, it has been stressed by the authors that the pragmatic recommendations were developed with low-level evidence due to the paucity of clinical trial data in this area. LMWH thromboprophylaxis is recommended for all women who deliver by emergency caesarean section, while those who deliver by elective caesarean section should only receive pharmacological thromboprophylaxis if they have other risk factors.¹⁴ For at-risk women where pharmacological thromboprophylaxis is contraindicated, mechanical alternatives include intermittent pneumatic compression during the caesarean section and ≤ 24 hours postpartum, or graduated compression stockings.¹¹

Medical patients

For general medical patients, VTE prophylaxis should be based on each patient's risk assessment for clotting and bleeding (see also ACP's recommendations on right)

Although most in-hospital VTE events ($\leq 50-75\%$) occur in medical patients, routine extended thromboprophylaxis cannot be recommended for acutely ill medical patients, with the added bleeding risk outweighing benefits in two large randomised controlled trials.^{20,21} There is also no standard accepted risk-assessment formula for identifying medical patients who are likely to

benefit from thromboprophylaxis. While several scoring systems have been described, the prescriber's clinical judgement remains the key factor for assessing whether thromboprophylaxis should be administered.¹³ With respect to graduated compression stocking, the current evidence suggests only modest efficacy in patients with stroke and immobility, which raises the question of effectiveness in other medical patient groups.

The following are specific recommendations for patients with stroke.

1. **Ischaemic stroke**, particularly those with lower limb paresis: the use of an LMWH should be considered for selected patients following a bleeding risk assessment.
2. **Haemorrhagic stroke**: pharmacological prophylaxis is contraindicated due to increased risk of intracranial haemorrhage.
3. Graduated compression stockings are not recommended due to skin breakdown in 5% of patients.
4. The role of intermittent pneumatic compression is unknown.

The ACP's VTE prevention recommendations for medical patients

- Assess the risk for VTE and bleeding in medical (including stroke) patients prior to initiation of VTE prophylaxis
- Use heparin or a related drug for pharmacological VTE prophylaxis, unless the assessed risk for bleeding outweighs the likely benefits
- Do not use graduated compression stockings as mechanical prophylaxis

Current antiplatelet/anticoagulant therapy

For patients already receiving antiplatelet therapy for another indication, additional VTE prophylaxis (pharmacological or mechanical) can be considered, according to the reason for admission, after a risk assessment has been performed and the benefit for VTE prevention has been found to outweigh the bleeding risk.¹¹ Additional VTE prophylaxis should not be given to patients receiving warfarin who are within their target therapeutic range, or to those receiving full anticoagulant therapy (e.g. LMWH or UFH).

For surgical patients receiving warfarin, the agent should be temporarily withheld ~ 5 days presurgery, and bridging anticoagulation with LMWH or UFH considered, taking into account the patient's VTE risk, and after discussion with the relevant specialities. Warfarin therapy should be resumed $\sim 12-24$ hours postsurgery, provided adequate haemostasis has been achieved and there is no evidence of ongoing bleeding.²²

Metrics (audits/measuring)

Key metrics applied to adults with a length of stay in hospital of ≥ 24 hours are important to assess and understand the scope of hospital-associated VTE and assess and track performance of VTE prevention initiatives. The framework provides detailed information on three types of measures.

Process measures

The rate of VTE risk assessment (proportion of the total number of patients hospitalised for ≥ 24 hours for a medical or surgical procedure who receive a VTE risk assessment within 24 hours of admission) is one of two process measures included. Each organisation sets its own target rate and timeframe for this measure, but the target recommended in the framework is $\geq 90\%$.

The second process measure described, prevalence of appropriate VTE prophylaxis (proportion of the total number of VTE prophylaxis candidates admitted for ≥ 24 hours who receive thromboprophylaxis according to the organisation's guidelines), is a sensitive indicator of how well the various care delivery steps come together. This measure needs to capture the type of thromboprophylaxis administered for each patient, as well as documentation of a reason for a patient not receiving pharmacological and/or mechanical thromboprophylaxis (so appropriateness can be assessed).

The best method of data collection for these process measures is prospective review of clinical notes and medication charts. Retrospective review of clinical notes of all adults hospitalised during a specific target period is a less than ideal alternative, as it does not provide an opportunity for real-time improvements in VTE prevention.

Outcome measures

The incidence of hospital-associated VTE during hospitalisation or within 90 days of discharge is the outcome measure recommended in the framework. This measure is also an important indicator of how well the care delivery steps come together to prevent hospital-associated VTE. This measure is calculated as the number of adults who develop confirmed DVT originating in the proximal veins of the lower extremities (due to the clinically more serious consequences compared with distal veins) or PE, divided by the total number of patient-days for adults hospitalised for ≥ 24 hours.

Data for this measure are best collected prospectively on a monthly basis with a reporting system involving the organisation's radiology department and anticoagulation service. Accurate clinical coding data can also be used to assist in the identification of readmissions with hospital-associated VTE; note, the ICD-10 coding system does not facilitate easy identification of VTE.

Balancing measures

It is very important to identify unintended consequences that occur after a major system change is implemented. 'Balancing measures' address whether improvements in one part of the system were made at the expense of other processes in other parts of the system. The balancing measure included in the framework is the incidence of bleeding during hospitalisation from pharmacological VTE prophylaxis (the proportion of the total number of hospitalised adults receiving pharmacological VTE prophylaxis who experienced a bleeding event related to the thromboprophylactic agent). The data for this measure are best collected monthly via prospective monitoring of all anticoagulation-related bleeding events.

Data collection

Collecting data for VTE prevention-related quality improvement permits regular monitoring of performance and progress 'plan-do-study-act'/learning cycles, and identifies unintended consequences. Appendix 5 of the framework provides examples of audit tools for this purpose currently used in some NZ hospitals. The framework also provides the following advice/guidance for monitoring and auditing VTE prevention.

- Sufficient information for organisational monthly reports can be obtained from 20 randomly selected patients from each area of care within the organisation.
- Data collection responsibilities are best designated to a specific individual.
- Pilot and refine VTE prevention metrics and data collection tools using short iterative 'plan-do-study-act'/learning cycles.
- Use of independent reviewers assists with developing and refining audit tools – it is valuable to know if they:
 1. arrive at the same VTE risk level
 2. agree on the absence or presence of contraindications to thromboprophylaxis
 3. share the same conclusion about whether the patient was receiving adequate VTE prophylaxis.²³
- Clinical record data can be prospectively collected from current inpatients or retrospectively from discharged patients.
 - Prospectively collected data allow opportunities to immediately address issues of patients safety and quality of VTE prevention as they arise.
- Sequential piloting of the data collection tool helps refine the tool's fields/criteria
 - Collection of ≥ 20 data points preintervention and then as many as required after its introduction enables results to be tracked and trended using run charts.
- Sampling strategies in common use are: i) convenience sampling (selected based on availability); and ii) random sampling (using a selection tool such as a random number generator).
- Cases of hospital-associated VTE are often investigated using a root-cause analysis (Fig 2), the findings of which should be:
 - i) communicated to all stakeholders; and ii) used to inform the organisation's VTE prevention quality improvement initiative.

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Fig 2. Root-cause analysis process



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