



PREVENTING
VENOUS THROMBOEMBOLISM
IN HOSPITALISED PATIENTS

*Summary of NHMRC Activity
2003–2010*

Working to build a healthy Australia

Printed document

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Contact:

National Health and Medical Research Council
Level 1
16 Marcus Clarke Street
Canberra ACT 2601
GPO Box 1421
Canberra ACT 2601
Ph: 61 2 6217 9000
Fax: 61 2 6217 9100
Email: nhmrc@nhmrc.gov.au

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■ Introduction

The National Health and Medical Research Council (NHMRC) has been working to prevent venous thromboembolism (VTE) in hospitalised patients in Australia since 2003 through national programs in public and private hospitals, and the development of an evidence-based clinical practice guideline.

Along the way, NHMRC, through its National Institute of Clinical Studies (NICS), has worked with over 80 Australian hospitals, as well as peak health care bodies, national and international experts in VTE prevention and quality improvement, and Federal, State and Territory health departments and agencies.

This report summarises these VTE prevention activities and makes recommendations for health professionals, hospitals and health policy makers to consider as part of local and jurisdictional VTE prevention efforts.

What is VTE?

VTE is the formation of a blood clot in a major vein in the legs (deep vein thrombosis – DVT) or lungs (pulmonary embolism – PE). It is a significant and often preventable cause of hospitalisation and death. Approximately half of VTE cases occur soon after a hospitalisation for surgery or medical illness.¹ VTE is 100 times more common in hospital than in the community,² with medical and surgical patients facing similar levels of VTE risk.³

VTE is estimated to result in approximately 2,000 deaths per year in Australia.³ In 2007–08, 35,000 hospital separations were associated with VTE – a rate of 4.5 per 1000 separations. In almost half of these separations (46%), VTE was the principal diagnosis for that hospitalisation.⁴ (Data table available in Appendix A)

VTE has significant short-term and long-term consequences, in terms of morbidity and cost.^{5,6} Patients admitted with a VTE require diagnostic tests, treatment with anticoagulants and a longer hospital stay, and may need more tests and prolonged treatment to manage the complications of VTE following hospital discharge.⁵

Preventive measures such as anti-clotting medication, intermittent pneumatic compression, anti-embolic stockings and early mobilisation have all been shown to reduce the incidence of VTE.^{3,7}

Evidence-practice gap

In 2003, NICS identified a significant gap in Australia between evidence and current practice in VTE prevention,^{3,7} a picture that is mirrored elsewhere.^{8,9}

Despite the fact that VTE is a significant patient safety issue for hospitals and that the effectiveness and safety of preventive measures are well established, Australian hospitals vary widely in their VTE prevention practices, with effective preventive measures often under-used or not used at all for patients at risk of VTE, particularly those at high risk.^{3,7,10}

The under-utilisation of prophylaxis and the high burden of VTE highlighted enormous opportunity for NHMRC–NICS to work with hospitals to ensure the application of effective prevention strategies and measures to improve patient safety. The need to improve patient safety in this area has also been identified internationally with calls for action on VTE prevention in the United Kingdom and United States of America.^{11,12}

Evidence for a solution

NHMRC–NICS undertook a variety of activities to review available evidence in order to demonstrate the need to address VTE prevention in hospitals. These activities informed the development and implementation of the national VTE prevention program and related initiatives and included:

1. A commissioned study of trends and determinants of VTE in Australia to determine the prevalence of use of VTE prophylaxis measures, and to determine the absolute relative risk of VTE in high risk surgical and medical patients with and without prophylaxis.^{3,13}
2. A commissioned systematic literature review in 2003 to assess the comparative effectiveness of different strategies for increasing hospitals' use of VTE prevention measures.^{14,15} The review concluded that VTE prevention in hospitals can be improved by using a combination of 'active' strategies to implement evidence-based guidelines. Simply publishing guidelines is less effective.^{14,15}

The systematic literature review also recommended that these strategies should target whole hospitals as well as individual staff members, so that prevention practices become integrated into routine clinical processes independent of individual managers or clinical leaders.^{14,15}

3. Production and dissemination of the NICS *Evidence-Practice Gaps Report Volume 1* (2003) with a chapter that raises awareness of the importance of "Improving venous thromboembolism in hospitalised patients".⁷
4. A review of Australian health care system evidence-practice gaps first reported in 2003. *Evidence-Practice Gaps Report Volume 1: A review of developments: 2004-2007*.¹⁰ This report highlighted the progress NHMRC-NICS had made in increasing awareness of VTE prevention within the hospitals and several Australian initiatives of State and Territory Health departments and peak quality and safety health care agencies.

■ VTE hospital prevention program

Based on the results of the systematic review, a national VTE prevention program was launched in public hospitals across Australia in 2005. The program was extended to private hospitals in 2008, with funding from the Australian Commission on Safety and Quality in Health Care.

The aim of the VTE prevention program was to improve the use of effective VTE preventive measures for hospitalised patients in Australia. Program objectives are summarised in Table 1.

Table 1: Program and participant objectives

NHMRC objectives	Participating hospital objectives
1. Raise awareness of gaps in VTE prophylaxis and seek hospital executive support and commitment to a systematic approach to VTE prophylaxis.	1. All participating hospitals have a whole-of-hospital VTE prophylaxis policy in place.
2. Develop VTE prophylaxis-specific evidence implementation resources, suitable for use by hospital clinicians and safety and quality managers.	2. All admitted patients are systematically assessed for VTE risk on admission and risk status is documented.
3. Host national workshops for participating hospital clinicians and safety and quality managers to share information on effective strategies for improving VTE prophylaxis in hospitalised patients.	3. All admitted patients at risk of VTE receive appropriate (according to local policy) VTE prophylaxis and VTE prophylaxis measures are documented.
4. Develop and support a network of Australian hospital quality and safety managers and clinicians interested in VTE prophylaxis and evidence implementation.	4. All participating hospitals have sustainable systems in place to support routine VTE risk assessment and management processes in hospitalised patients.

Program design and participation

Between years 2005 and 2009, over 80 public and private hospitals of varying size and location participated in the VTE prevention program. This large-scale quality improvement program was designed to address a national problem with local (hospital) solutions and was based on the Institute for Healthcare Improvement Collaborative model.¹⁶ The principle underpinning this method is collaboration for improvement – whereby multiple teams drive change through the simultaneous implementation of effective improvement strategies and theory.

Each hospital formed a project team, identified local barriers to VTE prevention, and adopted multiple strategies to overcome barriers and drive change. An outline of the VTE prevention program is provided in Appendix B.

Key results

- Barriers to VTE prevention practice reported by hospitals were similar across all participating hospitals and consistent with those identified in the literature.¹⁵
- The strategies and interventions selected by each hospital varied and often depended on organisational factors such as the level of executive support, availability of resources, support for system and process of care changes and the complement of staff available to drive change within the hospital.

A summary of VTE prevention barriers and strategies used to address them can be found in Appendix C.

By the end of the program:

- Most hospitals in public and private hospitals had a whole-of-hospital policy for VTE prevention (83% public; 68% private).
- The majority of high risk patients received appropriate VTE prophylaxis. Improvement was significant in public hospitals between the start and finish of the two year program with an absolute improvement of 21% (55% to 76%). Absolute improvement in the one year private hospital program was 9% (53% to 62%). (Figure 1)
- Documentation of patient VTE risk status (measured in private hospitals only) increased significantly, from about 10% to over 50% of patients. Documentation of risk was associated with improved prophylaxis prescribing; patients with documented risk were significantly more likely to receive appropriate prophylaxis, regardless of risk.
- System-based improvements were adopted by many hospitals; these are more likely to contribute to sustained improvement and depend less on individual drivers for change. (Figure 2). These included the:
 - development or review of VTE prevention policy applicable to the whole hospital
 - incorporation of risk assessment and prophylaxis prescribing reminders/resources into system-based processes of care
 - distribution of education materials for hospital staff and patients, and
 - reporting of VTE prevention and performance indicators to executive and throughout the hospital.

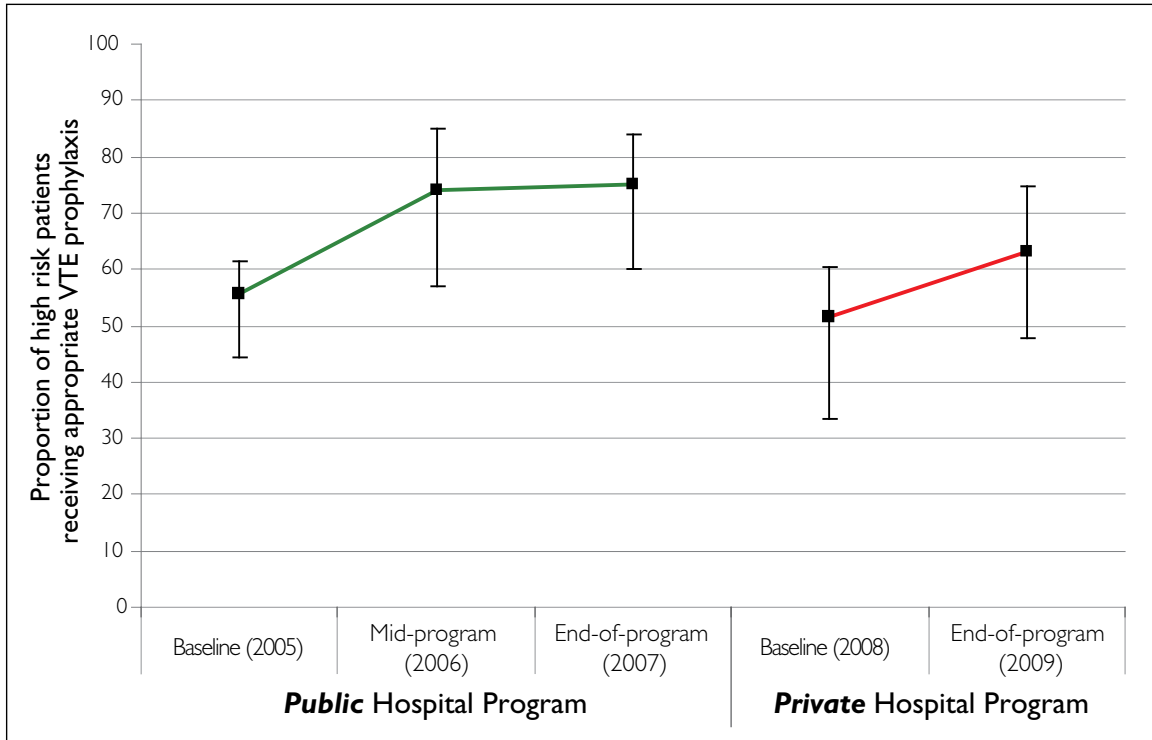


Figure 1: Proportion of patients at high risk of VTE who received appropriate VTE prophylaxis

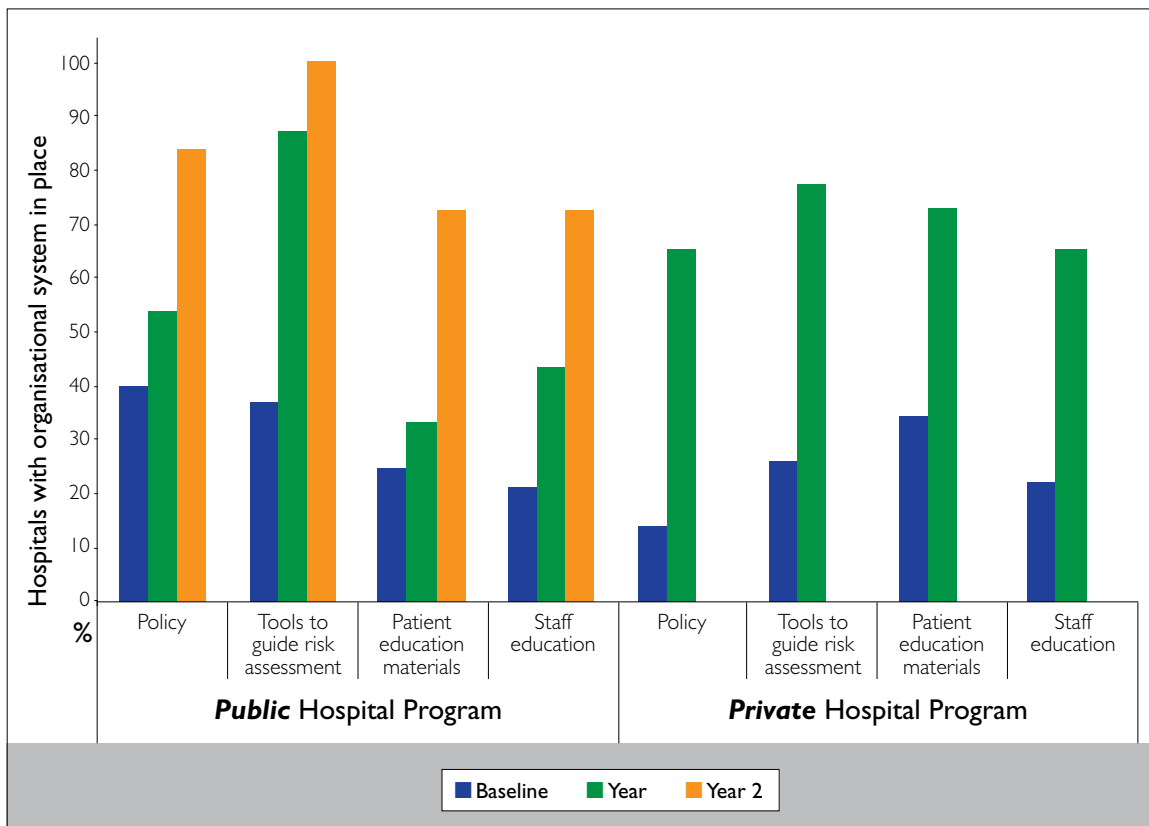


Figure 2: Proportion of hospitals with organisational systems in place to support VTE prevention practice



■ Recommendations

Based on program experience, NHMRC makes the following recommendations to improve VTE prevention in hospitals:

1. All hospitals should develop whole-of-hospital VTE prevention policies, with multidisciplinary involvement, including clinical, nursing, executive and patient groups.
2. Key VTE indicators (including risk assessment and risk management decisions) should be recorded for all admitted patients.
3. All hospitals should adopt consistent risk assessment practices, including the timing of assessment and the manner and place in which each patient's risk level and risk management plan are documented.
4. Hospitals should undertake regular data monitoring to assess performance in the areas of VTE risk assessment and prophylaxis, and feed this data back to clinical units.
5. Training in VTE prevention should be routinely provided in all hospital departments. Training should include awareness raising and education on risk and appropriate prophylaxis.
6. National indicators to measure and monitor VTE risk assessment and prophylaxis should be developed and implemented.

■ Australian VTE prevention guideline

In December 2009, the NHMRC released the *Clinical Practice Guideline for the Prevention of Venous Thromboembolism in Patients Admitted to Australian Hospitals (2009)*.¹⁷ This guideline is the first Australian evidence-based guideline for the prevention of venous thromboembolism and it provides recommendations for preventing VTE in adult surgical and medical patients admitted to Australian hospitals. The guideline was developed in collaboration with a multidisciplinary expert committee that included representation from key clinical disciplines including surgery, haematology, anaesthesia, nursing, pharmacy, public health, and patient experience (Appendix F).

Recommendations for VTE prophylaxis are written according to medical condition and type of surgery (Appendix D). The recommendations are based on the body of evidence, with consideration of the strength of evidence, consistency across studies, likely clinical impact, and generalisability and applicability of study findings in the Australian context. No recommendations were made where the evidence was of poor quality or not relevant to the current Australian healthcare context.

Guideline development and review process

The NHMRC's rigorous guideline development processes¹⁸⁻²¹ were followed throughout guideline development and a draft version of the guideline underwent extensive public consultation in April-May 2009.

A multidisciplinary expert committee was convened in May 2010 to consider any new evidence and other relevant information (e.g. implementation issues) retrieved following a literature search on each of the clinical questions in the original guideline.

The new evidence was reviewed by the committee using a process of considered judgement (based on the NHMRC additional levels of evidence and grades for recommendations for developers of guidelines). The committee found that none of the retrieved studies resulted in any changes to recommendations, or grading of recommendations, therefore the recommendations in the guideline do not need to be altered or updated in 2010. The retrieved evidence and results of the guideline review is available on the NHMRC website.

Further information about the VTE prevention guideline or NHMRC guideline standards and requirements can be obtained from www.nhmrc.gov.au.

Resources to support VTE prevention activities

The NHMRC has developed a range of resources for use by health professionals and patients in hospitals. Table 2 describes resources currently available and under development.

Table 2: NHMRC VTE Prevention Program resources

Resource	Description
<i>Stop the clot: Integrating VTE prevention guideline recommendations into routine hospital care (Stop the clot guide)</i> ²²	<p>Designed for use by hospital clinicians, risk managers, and quality and safety managers</p> <p>Developed in 2006 and updated in 2008 and 2011, in consultation with the program advisory committee and the Australian Commission on Safety and Quality in Health Care</p> <p>Describes important steps and considerations for systematically integrating guideline recommendations into everyday clinical practice, including the following:</p> <ul style="list-style-type: none"> • check existing policies and develop a hospital-wide VTE prevention policy • conduct clinical audits • form a team • raise awareness • understand the barriers • develop and implement an improvement plan • monitor progress • sustain improvements
<i>Stop the clot patient brochure</i>	<p>Designed to inform patients about the risk of VTE in hospital; prompts patients to “ask and act”</p> <p>Available in English and 13 other languages</p> <p><i>Patient information has been updated following release of 2009 VTE Prevention Guideline</i>¹⁷</p> <p>See ‘Plain language guideline summary for patients’ below</p>
<i>Stop the clot poster</i>	<p>Summarises messages in the patient brochure. It prompts patient to “ask and act” – asks information about VTE risk and measures that can be taken to help prevent it</p>
Clinical practice guideline	<i>Clinical practice guideline for the prevention of venous thromboembolism in patients admitted to hospitals 2009</i> ¹⁷
Guideline summary for clinicians	Developed in 2010 to meet the needs of hospital-based clinicians. Based on 2009 VTE Prevention Guideline ²³
Plain language guideline summary for patients	Developed in 2010 to inform patients about the risk of VTE associated with hospitalisation, and measures that can be taken to reduce risk. Based on 2009 VTE Prevention Guideline ²⁴

Note: Resources are available from: www.nhmrc.gov.au/nics

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Appendix A: VTE related hospital separation data

Table 3: VTE related hospital separations in Australia (1999-00 to 2007-08)

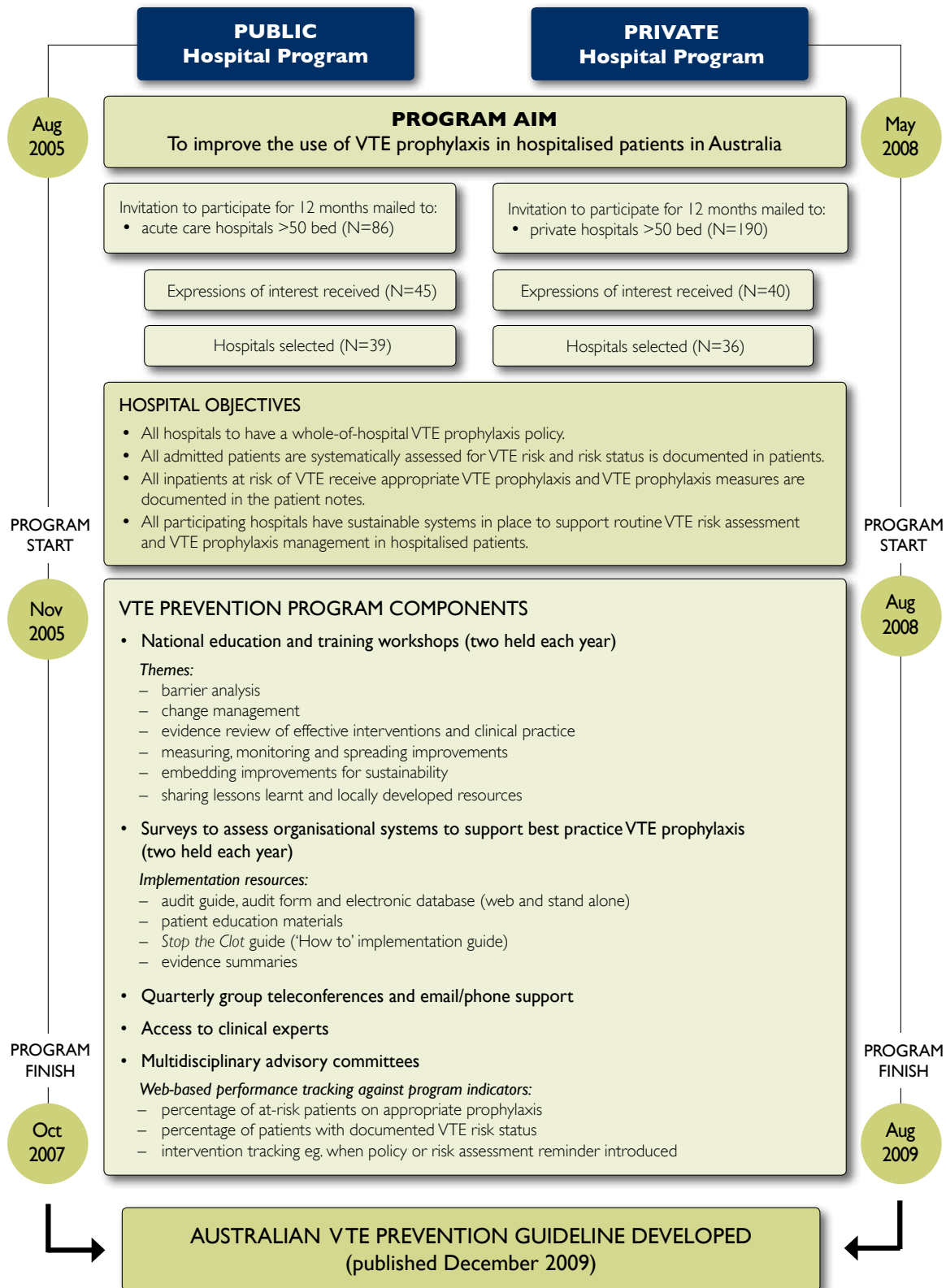
		YEAR									
		1999-00	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	
Recorded Diagnoses*	Rate per 1000 seps										
DVT	Pdx	1.2	1.3	1.2	1.2	1.0	1.0	1.0	0.9	0.9	
	Dx	2.6	2.6	2.6	2.5	2.4	2.4	2.3	2.7	2.3	
PE	Pdx	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.1	1.2	
	Dx	2.0	2.2	2.2	2.1	2.2	2.1	2.1	2.1	2.2	
VTE	Pdx	2.4	2.5	2.4	2.3	2.1	2.1	2.0	2.0	2.1	
	Dx	4.7	4.8	4.7	4.6	4.5	4.5	4.4	4.4	4.5	
Total VTE related separations		27,455	29,366	30,148	30,254	31,026	31,918	32,245	33,514	35,387	
Total hospital separations		5,898,804	6,153,769	6,398,171	6,644,984	6,841,225	7,018,850	7,311,983	7,602,917	7,873,946	

Abbreviations: Pdx – Principal diagnosis; diagnosis chiefly responsible for patient's hospitalisation; Dx – Diagnosis (any); ICD – International Classification of Diseases

Note: *ICD diagnoses codes – DVT I80.2 Phlebitis and thrombophlebitis of other deep vessels of lower extremities; PE I26.0 Pulmonary embolism with mention of acute cor pulmonale and I26.9 Pulmonary embolism without mention of acute cor pulmonale.

Source: AIHW National Hospital Morbidity Database

Appendix B: Outline of VTE prevention program



Appendix C: Barriers to VTE prevention and strategies to address them

Table 4: Barriers to VTE prevention and strategies to overcome them in Australian hospitals

Barriers	Suggested strategies	Strategies used by participating hospitals to improve VTE prevention
Lack of VTE awareness Knowledge and education deficits Disagreement with evidence	Raise awareness of VTE risk in hospitalised patients and educate clinicians and patients about appropriate risk assessment and management measures	Clinicians: Large scale education and awareness-raising via grand rounds, dedicated VTE days/weeks, VTE newsletters, policy launches, poster and resource displays, targeted education sessions, competitions in compliance and knowledge, availability of clinical champions and experts to impart knowledge, describe and provide the evidence underpinning VTE prevention practice and support improvement. Patients: Education on applying anti-embolic stockings correctly, self-administration of chemical prophylaxis on discharge, distribution of patient information brochures on VTE risk and preventive measures.
Lack of system support Unclear lines of responsibility	Remind clinicians to assess and manage patients' VTE risk	Use of pre-printed or sticker reminders on the medication chart*, patient notes, clinic specific documentation. Use of VTE nurse or pharmacist to initiate or follow-up prescribing of appropriate preventive measures. Use of computer-based reminders and reporting to clinicians for all hospitalised patients. (e.g. integrated into existing highly accessed electronic systems, such as pathology reporting systems) Integration of risk assessment forms into: medication chart, patient notes or other risk screening forms used on admission (e.g. falls, pressure ulcers, etc).
	Develop a whole-of-hospital VTE prophylaxis policy, protocol or guideline	Adaptation of national guidelines into a locally agreed whole-of-hospital VTE prophylaxis policy via engagement and consultation with heads of departments, clinical specialties, hospital pharmacy, and relevant hospital committee, such as Drugs and Therapeutics Committee.
Disputed current practice Variability in practice within the hospital No systematic audits or data collection	Conduct regular local audit and feedback cycles to provide data on: <ul style="list-style-type: none"> • Current practice (by hospital/ward/unit/clinician) • Areas where care processes need improvement • Complications and adverse events (e.g. bleeding, falls) 	Delivery of feedback via: clinical unit meetings, in-services, via departmental heads, Quality and Safety Committee meetings, newsletters. Format of feedback provided: tailored clinician reports (grouped or de-identified), whole-of-hospital reports and ward/unit specific reports. Frequency of audits: varied from weekly to monthly to quarterly to bi-annually.

Source: Based on *Stop the Clot: Integrating VTE prevention guideline recommendations into routine hospital care*²² Available from www.nhmrc.gov.au/nics

Note:* VTE risk and prophylaxis is not currently a standard item on the national inpatient medication chart (NIMC). The Australian Commission on Safety and Quality in Health Care is considering the inclusion of a VTE risk and prophylaxis section on the NIMC. Local modifications require prior permission from jurisdictions.

Appendix D: Summary of VTE prevention guideline recommendations

The complete clinical practice guideline¹⁷ and supporting evidence are available from:
<http://www.nhmrc.gov.au/nics>

Surgical patients

RECOMMENDATIONS BY CLINICAL PROCEDURE	GRADE	EVIDENCE IN SECTION
Total hip replacement		
1. Use thromboprophylaxis for all patients admitted to hospital for total hip replacement.	GPP	5.1.1
2. In the absence of contraindications, use pharmacological thromboprophylaxis and continue for up to 35 days following total hip replacement surgery. Use one of the following: <ul style="list-style-type: none"> • low molecular weight heparin • fondaparinux • rivaroxaban • dabigatran etexilate. <i>Note: Refer to Section 5.1.1 for further information on use of these agents.</i>	A B B B	5.1.1 5.1.1 5.1.1 5.1.1
3. Use graduated compression stockings, intermittent pneumatic compression or a foot pump following total hip replacement until the patient is fully mobile, whether or not pharmacological thromboprophylaxis is used. If possible, use graduated compression stockings with a foot pump where pharmacological thromboprophylaxis is not used.	B B	5.1.1 5.1.1
4. Unfractionated heparin is not recommended for thromboprophylaxis following total hip replacement. Only use unfractionated heparin if recommended thromboprophylactic options are not available.	B	5.1.1
5. Aspirin is not recommended as the sole pharmacological agent for thromboprophylaxis following total hip replacement.	C	5.1.1
6. Warfarin is not recommended for thromboprophylaxis following total hip replacement except where used for therapeutic reasons. In these cases, use adjusted therapeutic doses.	C C	5.1.1 5.1.1
Hip fracture surgery		
1. Use thromboprophylaxis for all patients admitted to hospital for hip fracture surgery.	GPP	5.1.2
2. In the absence of contraindications, use pharmacological thromboprophylaxis and continue for up to 35 days for hip fracture surgery. Use one of the following: <ul style="list-style-type: none"> • fondaparinux • low molecular weight heparin. <i>Note: Refer to Section 5.1.2 for further information on use of these agents.</i>	B B	5.1.2 5.1.2

RECOMMENDATIONS BY CLINICAL PROCEDURE	GRADE	EVIDENCE IN SECTION
3. If low molecular weight heparin is used, consider the addition of low dose aspirin.	B	5.1.2
4. Aspirin is not recommended as the sole pharmacological agent for thromboprophylaxis following hip fracture surgery.	B	5.1.2
5. Unfractionated heparin is not recommended for thromboprophylaxis following hip fracture surgery.	B	5.1.2
6. Warfarin is not recommended for thromboprophylaxis following hip fracture surgery.	B	5.1.2
7. If pharmacological thromboprophylaxis is contraindicated or not available, use one of the following mechanical methods of thromboprophylaxis until the patient is fully mobile: <ul style="list-style-type: none"> • foot pump • intermittent pneumatic compression. 	C C	5.1.2 5.1.2
Total knee replacement		
1. Use thromboprophylaxis for all patients admitted to hospital for total knee replacement.	GPP	5.1.3
2. In the absence of contraindications, use pharmacological thromboprophylaxis and continue for up to 14 days following total knee replacement surgery. Use one of the following: <ul style="list-style-type: none"> • low molecular weight heparin • fondaparinux • rivaroxaban • dabigatran etexilate. <i>Note: Refer to Section 5.1.3 for further information on use of these agents.</i>	A B B B	5.1.3 5.1.3 5.1.3 5.1.3
3. Use one of the following whether or not pharmacological thromboprophylaxis is used, until the patient is fully mobile: <ul style="list-style-type: none"> • foot pump • intermittent pneumatic compression. 	C C	5.1.3 5.1.3
4. Aspirin is not recommended as the sole pharmacological agent for thromboprophylaxis following total knee replacement.	C	5.1.3
5. Warfarin is not recommended for thromboprophylaxis following total knee replacement.	B	5.1.3
Knee arthroscopy		
1. Routine thromboprophylaxis is not recommended following knee arthroscopy. Consider thromboprophylaxis for knee arthroscopy patients with additional VTE risk factors, in the absence of contraindications.	C GPP	5.1.4 5.1.4

RECOMMENDATIONS BY CLINICAL PROCEDURE	GRADE	EVIDENCE IN SECTION
Lower leg fractures and injuries with immobilisation		
1. Use low molecular weight heparin for all patients admitted to hospital with a lower leg fracture or injury with immobilisation in a brace or a plaster cast. Pharmacological thromboprophylaxis should be continued for the entire period of immobilisation.	A	5.1.5
General surgery		
1. Use thromboprophylaxis in all patients admitted to hospital for general surgery.	GPP	5.1.7
2. In the absence of contraindications, use pharmacological thromboprophylaxis and continue for up to one week or until the patient is fully mobile following major general surgery. Use one of the following: <ul style="list-style-type: none"> • low molecular weight heparin • unfractionated heparin. 	B B	5.1.7 5.1.7
3. Use graduated compression stockings for all general surgical patients, whether or not pharmacological thromboprophylaxis is used, until the patient is fully mobile.	B	5.1.7
4. If recommended thromboprophylaxis is contraindicated or not available, use a foot pump following general surgery, until the patient is fully mobile.	C	5.1.7
Urological surgery		
1. Consider thromboprophylaxis for patients admitted to hospital for urological surgery based on an assessment of the patient's risk of VTE and bleeding.	GPP	5.1.8
Gynaecological surgery		
1. Use thromboprophylaxis for all patients admitted to hospital for major gynaecological surgery.	GPP	5.1.9
2. In the absence of contraindications, use pharmacological thromboprophylaxis and continue for up to one week or until the patient is fully mobile following major gynaecological surgery. Use one of the following: <ul style="list-style-type: none"> • low molecular weight heparin • unfractionated heparin. 	B B	5.1.9 5.1.9
3. Consider the additional use of graduated compression stockings or other mechanical thromboprophylaxis following major gynaecological surgery, especially if pharmacological thromboprophylaxis is contraindicated.	GPP	5.1.9
4. Warfarin is not recommended for thromboprophylaxis following major gynaecological surgery.	C	5.1.9

RECOMMENDATIONS BY CLINICAL PROCEDURE	GRADE	EVIDENCE IN SECTION
Abdominal surgery		
1. Use thromboprophylaxis for all patients admitted to hospital for major abdominal surgery.	GPP	5.1.10
2. In the absence of contraindications, use pharmacological thromboprophylaxis for major abdominal surgery patients and continue for at least five to nine days with low molecular weight heparin.	B	5.1.10
3. Fondaparinux is not recommended for thromboprophylaxis following major abdominal surgery.	C	5.1.10
4. Use graduated compression stockings for all patients following abdominal surgery, whether or not pharmacological thromboprophylaxis is used, until the patient is fully mobile.	B	5.1.10
Cardiac, thoracic and vascular surgery		
1. Use thromboprophylaxis for all patients following cardiac, thoracic or vascular surgery.	GPP	5.1.11
2. In the absence of contraindications, use pharmacological thromboprophylaxis and continue for up to one week or until the patient is fully mobile following cardiac, thoracic, or vascular surgery. Use one of the following: <ul style="list-style-type: none"> • low molecular weight heparin • unfractionated heparin. 	B B	5.1.11 5.1.11
3. Use one of the following mechanical methods of thromboprophylaxis for all patients following cardiac, thoracic, or vascular surgery, whether or not pharmacological thromboprophylaxis is used, until the patient is fully mobile: <ul style="list-style-type: none"> • graduated compression stockings • intermittent pneumatic compression. 	C C	5.1.11 5.1.11
Neurosurgery		
1. Use intermittent pneumatic compression following neurosurgery, until the patient is fully mobile.	A	5.1.12
2. Use pharmacological thromboprophylaxis with extreme caution in patients following neurosurgery, due to the high risk of bleeding.	GPP	5.1.12
3. Where pharmacological thromboprophylaxis is appropriate and not contraindicated, use low molecular weight heparin or unfractionated heparin.	B	5.1.12
4. Consider the use of graduated compression stockings following neurosurgery (alone or in combination with pharmacological thromboprophylaxis).	C	5.1.12

RECOMMENDATIONS BY CLINICAL PROCEDURE	GRADE	EVIDENCE IN SECTION
Trauma and spinal surgery		
1. Use thromboprophylaxis for all patients admitted to hospital for trauma surgery or spinal surgery. Thromboprophylaxis should not start until primary haemostasis has been established.	GPP	5.1.13
2. In the absence of contraindications, consider the use of a foot pump from hospital admission, with the addition of low molecular weight heparin five days after admission for trauma patients undergoing surgery.	C	5.1.13

Anaesthesia

RECOMMENDATION	GRADE	EVIDENCE IN SECTION
1. Consider central neural blockade as an alternative to general anaesthesia if feasible.	A	5.2
If central neural blockade is used, there is a risk of developing an epidural haematoma. To minimise this risk, timing of pharmacological thromboprophylaxis should be carefully planned and discussed in advance with the anaesthetist.	GPP	5.2

Medical patients

RECOMMENDATIONS BY MEDICAL CONDITION	GRADE	EVIDENCE IN SECTION
Stroke		
1. Consider the use of thromboprophylaxis for all patients admitted to hospital with ischemic stroke based on an assessment of the patient's degree of immobility and risk of bleeding.	B	5.3.1
2. Pharmacological thromboprophylaxis is not recommended for haemorrhagic stroke patients due to the risk of intracranial bleeding.	GPP	5.3.1
3. Where pharmacological thromboprophylaxis is appropriate and not contraindicated, use low molecular weight heparin for patients with ischemic stroke.	B	5.3.1
If low molecular weight heparin is contraindicated or not available, use unfractionated heparin.	B	5.3.1
Myocardial infarction (MI)		
1. Use thromboprophylaxis for patients admitted to hospital for myocardial infarction, where full anticoagulation is not in use.	C	5.3.2
2. In the absence of contraindications, use unfractionated heparin for thromboprophylaxis following myocardial infarction.	C	5.3.2

RECOMMENDATIONS BY MEDICAL CONDITION	GRADE	EVIDENCE IN SECTION
General medical		
1. Consider the use of thromboprophylaxis for patients admitted to hospital for medical conditions based on an assessment of the patient's risk of VTE and bleeding.	GPP	5.3.3
2. Where pharmacological thromboprophylaxis is appropriate and not contraindicated, use one of the following: <ul style="list-style-type: none"> • low molecular weight heparin • unfractionated heparin. 	B B	5.3.3 5.3.3

Cancer patients

RECOMMENDATIONS FOR CANCER PATIENTS (surgical and non-surgical)	GRADE	EVIDENCE IN SECTION
1. Use thromboprophylaxis for all cancer patients undergoing general surgical procedures including abdominal or pelvic surgery or neurosurgery, provided there are no contraindications. Where pharmacological thromboprophylaxis is appropriate and not contraindicated, use one of the following and continue for at least seven to 10 days following major general surgery for cancer: <ul style="list-style-type: none"> • low molecular weight heparin • unfractionated heparin. 	GPP GPP GPP	5.4 5.4 5.4
2. Consider using extended thromboprophylaxis with low molecular weight heparin for up to 28 days after major abdominal or pelvic surgery for cancer, especially in patients who are obese, slow to mobilise or have a past history of VTE.	GPP	5.4
3. In the absence of other significant risk factors, thromboprophylaxis is not recommended for cancer patients undergoing head and neck surgery.	GPP	5.4
4. In non-surgical cancer patients in the absence of contraindications, commence pharmacological thromboprophylaxis on admission and continue until discharge. Use one of the following: <ul style="list-style-type: none"> • low molecular weight heparin • unfractionated heparin. 	GPP GPP	5.4 5.4
5. For both surgical and non-surgical cancer patients, use graduated compression stockings if pharmacological thromboprophylaxis is contraindicated.	GPP	5.4

Pregnancy and childbirth

RECOMMENDATIONS FOR PREGNANT WOMEN	GRADE	EVIDENCE IN SECTION
1. Minimise immobilisation of women during pregnancy, labour and the puerperium and ensure adequate hydration at all times.	GPP	5.5
2. All women who deliver by caesarean section are at increased risk of VTE and should be mobilised promptly after surgery.	GPP	5.5
3. Where pharmacological thromboprophylaxis is appropriate and not contraindicated, use low molecular weight heparin after caesarean delivery for five to seven days or until the patient is fully mobile.	GPP	5.5
4. Extend pharmacological thromboprophylaxis with low molecular weight heparin or adjusted therapeutic dose warfarin for six weeks for high-risk women, after caesarean or vaginal delivery.	GPP	5.5
5. Consider the use of graduated compression stockings if pharmacological thromboprophylaxis is contraindicated or not used.	GPP	5.5
6. Consider the use of intermittent pneumatic compression during caesarean and in the postoperative period for up to 24 hours.	GPP	5.5

Heparin-induced thrombocytopenia (HIT) patients

RECOMMENDATIONS FOR PATIENTS WITH HEPARIN-INDUCED THROMBOCYTOPENIA	GRADE	EVIDENCE IN SECTION
1. In patients with heparin-induced thrombocytopenia, use heparinoids such as danaparoid as an alternative antithrombotic drug. Specialist advice from a haematologist is recommended in patients with clinically suspected heparin-induced thrombocytopenia.	B	5.6

■ Appendix E: Acknowledgements

Hospital participants

NHMRC would like to acknowledge the hard work, commitment and enthusiasm of participating hospitals in both the public and private hospital prevention programs.

These hospitals contributed not only to improving VTE prevention in hospitals but contributed their knowledge and experience of implementation to bring about practice change in this clinical area and context. Hospitals also helped to raise greater awareness of VTE among the clinician, hospital executive and patient community.

Advisory committees

NHMRC established three multidisciplinary expert committees throughout the program to help plan and implement program activities relating to best practice implementation and guideline development. Members provided advice and guidance to both NHMRC staff and program participants. We thank members for being so generous with their time and sharing their invaluable knowledge and expertise. (See Appendix F for committee membership).

Committees established:

- Public Hospital VTE Prevention Program Advisory Committee (2005–2008)
- Private Hospital VTE Prevention Program Advisory Committee (2007–2009)
- VTE Prevention Guideline Adaptation Committee (2008–2009)
- VTE Prevention Guideline Updating Committee (2010). Further information is available from www.nhmrc.gov.au

NHMRC staff

We acknowledge the work of Dr Sue Phillips, Ms Sonja Hood, Dr Agnes Wilson, Dr Tanyth de Gooyer, Ms Zoe Kelly, Ms Jodie Clydesdale, Ms Maggie Reid and Ms Amy Goodwin, for their significant contributions to NHMRC VTE prevention activities, and the administrative, project and corporate support provided by NHMRC staff.

■ Appendix F: NHMRC Advisory Committees

Public Hospital VTE Prevention Program Advisory Committee (2005–2008)

Chair

Dr Martin Gallagher

Details

Renal Physician and Senior Research Fellow
The George Institute for International Health, NSW

Members

Ms Michele McKinnon

Details

Director, Safety and Quality
SA Department of Health, SA

Ms Karen Oliver

Donor Coordinator
ACT Health, ACT

Ms Bhavini Patel

Director, Pharmacy
Royal Darwin Hospital, NT

Prof David Fletcher

Professor Surgery
University of Western Australia
Head, Surgery
Fremantle Hospital, WA

A/Prof Harry Gibbs

Vascular Physician
Princess Alexandra Hospital, Qld

Dr Luke Bereznicki

Lecturer, Pharmacy
University of Tasmania, Tas

Ms Bernadette Eather

Director, Clinical Governance
St George Hospital, NSW

Dr Sue Phillips

Program Manager
National Institute of Clinical Studies
National Health and Medical Research Council, Vic

Ms Zoe Kelly

Program Officer
National Institute of Clinical Studies
National Health and Medical Research Council, Vic

Private Hospital VTE Prevention Program Advisory Committee (2007–2009)

Chair

Mr Kim Knoblauch

Details

Group Clinical Risk Manager
Ramsay Health, NSW

Members

Mr Graham Bedford

Details

Policy Team Manager
Australian Commission on Safety and Quality in Health Care, NSW

Dr Peter Blombury

Vascular Physician
The Avenue Private Hospital, Vic

Dr Umberto Boffa

Head, Medical Services
Bupa Australia Group
(Australian Health Insurance Association representative)

Prof David Fletcher

Professor Surgery
University of Western Australia
Head, Surgery
Fremantle Hospital, WA

A/Prof Harry Gibbs

Vascular Physician
Princess Alexandra Hospital, Qld

Mr John Jackson

Director, Pharmacy Practice, APhS, Vic

Ms Cathy Jones

Manager, National Quality and Compliance
Healthscope Ltd, Vic

Ms Clare Lumley

National Claims Manager
St Vincent's Health Australia, Vic

Ms Alex McMillan

Clinical Risk Coordinator
St John of God Health Care, WA

Dr Clare Morgan

Haematologist
Mater Private Hospital, Qld

Dr Tanyth de Gooyer

Program Manager
National Institute of Clinical Studies
National Health and Medical Research Council, Vic

Ms Jodie Clydesdale

Program Officer
National Institute of Clinical Studies
National Health and Medical Research Council, Vic

Ms Sonja Hood

Acting Director, Research Implementation Program
National Institute of Clinical Studies
National Health and Medical Research Council, Vic

VTE Prevention Guideline Adaption Committee (2008–2009) and Updating Committee (2010)

Prof Michael Frommer Chair, Sydney Medical Program and Assoc Dean
(Learning and Teaching)
Professor, School of Public Health,
The University of Sydney, Sydney Medical School, NSW

Members

Prof A.B. (Barry) Baker

Details

Emeritus Professor, The University of Sydney, NSW
Director Professional Affairs, Australian and New Zealand
College of Anaesthetists
Nominee of the Australian and New Zealand
College of Anaesthetists

Ms Janette Curtain

Consumer
Nominee of the Consumers Health Forum of Australia
Member of the Updating Committee only

Prof John Fletcher

Professor of Surgery, The University of Sydney,
Westmead Hospital, Sydney, NSW
Rep of the Australia and New Zealand Working
Party on the Management and Prevention of Venous
Thromboembolism (Chairman)

Prof Alexander Gallus

Department of Haematology,
SA Pathology at Flinders Medical Centre, and
Flinders University, Adelaide, SA
Rep of the Australia and New Zealand Working Party
on the Management and Prevention of Venous
Thromboembolism (Member)

Ms Sharon Goldsworthy

Clinical Pharmacy Team Leader
The Queen Elizabeth Hospital, SA
Nominee of the Society for Hospital Pharmacists

Ms Christine Griffiths

Patient Representative
Nominee of Health Issues Centre, Vic
*The Committee was saddened to learn of the death
of Ms Christine Griffiths in March 2009
Ms Griffiths provided input on VTE consumer issues*

Ms Sonja Hood

Acting Director
Research Implementation Program
National Institute of Clinical Studies
National Health and Medical Research Council
Member of the Updating Committee only

Ms Jeannette Kamar

Injury Prevention/No Lift Coordinator
The Northern Hospital, Epping, Vic
Nominee of the Royal College of Nursing, Australia

Members	Details
Ms Philippa Middleton	Research Leader with the Australian Research Centre for Health of Women and Babies (ARCH) in the Discipline of Obstetrics and Gynaecology, The University of Adelaide, SA Contracted Methodologist
Dr Sue Phillips	Interim Executive Director National Institute of Clinical Studies National Health and Medical Research Council, Vic <i>Dr Sue Phillips was represented by Ms Sonja Hood, Acting Director, Research Implementation Program, NICS from August 2008 -June 2010</i>
A/Prof Barry Walters	Clinical Assoc/Prof, Obstetrics and Internal Medicine Royal Perth Hospital and King Edward Memorial Hospital or Women, Perth, WA Nominee of the Royal Australian and New Zealand College of Obstetrics and Gynaecology
A/Prof Christopher Ward	Department of Haematology Transfusion Medicine Royal North Shore Hospital, Sydney, NSW President of the Australasian Society of Thrombosis and Haemostasis Nominee of the Royal Australasian College of Physicians
A/Prof Nicholas Wickham	Consultant Haematologist Adelaide Cancer Centre, SA Nominee of the Medical Oncology Group of Australia
Mr Simon Williams	Orthopaedic Surgeon, VMO Geelong Hospital, St John of God Hospital and Geelong Private Hospital, Vic Nominee of the Royal Australasian College of Surgeons
Dr Agnes Wilson	Research Scientist, Research Implementation Program National Institute of Clinical Studies National Health and Medical Research Council

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