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# Antepartum and postpartum thromboprophylaxis: A survey of current practices in South Africa and comparison with recommendations

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# Antepartum and postpartum thromboprophylaxis: A survey of current practices in South Africa and comparison with recommendations.




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**364302**

A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of

Master of Medicine

Johannesburg, 2025

# Declaration

I Zwidorulwa Rabali declare that this research report in the format of a “submissible” paper is my own, unaided work. It is being submitted for the Degree of Master of Medicine in the branch of Obstetrics and Gynaecology at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.



……

(Signature of candidate)

16th day of April 2025 in Randburg

# Abstract

**Background:**

Thromboprophylaxis guidelines are critical for VTE prevention, yet the optimal implementation of risk-appropriate thromboprophylaxis during pregnancy and postpartum remains uncertain.

**Methods:**

An electronic survey was distributed to 120 medical practitioners at the University of the Witwatersrand to assess thromboprophylaxis practices in pregnancy and postpartum.

**Results:**

Seventy (58%) responses were received, and 64 (53%) complete responses were analysed. Most respondents practiced in the public sector (83%) and followed clinical guidelines, with 50% adhering to the RCOG guideline. Low molecular weight heparin was widely prescribed during both antepartum and postpartum periods (94%), primarily at a fixed dose (53%). Barriers included lack of mechanical prophylaxis (30%), perceived complications of thromboprophylaxis (28%), and cost (22%). Case-based assessments revealed significant variation in practices due to complex risk assessment scoring systems and disparate guideline recommendations.

**Conclusion:**

Despite adherence to guidelines, variation in thromboprophylaxis practices highlights the need for evidence-based consensus recommendations to enhance clinical guidance.

# Acknowledgements

I would like to thank my supervisors Dr Rhemtula and Prof Schapkaitz for their guidance and patience during this research project. Their assistance is invaluable and greatly appreciated.

I would also like to acknowledge Dr Clarence Jah for his assistance with the analysis of results.

Lastly, I would like to thank all my colleagues in the Department of Obstetrics and Gynaecology at the University of Witwatersrand who partook in the survey.


This research project is dedicated to my family. For their never-ending prayers and words of encouragement, I appreciate you all.

To my parents Christopher Tshitangoni Rabali and Julia Tshimangadzo Rabali.

To my siblings Thiofhitshithu, Ndinavhushavhelo, Rofhiwa, Hahangwivhawe, Ridovhusanae, Rendani, Uandwela, Asashanduki and Vhamudivhe.

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# Nomenclature

| | |
|---|---|
| ACOG | American College of Obstetrics and Gynecology |
| APS | Antiphospholipid Syndrome |
| ASH | American Society of Haematology |
| DOACs | Direct oral anticoagulants |
| DVT | Deep vein thrombosis |
| HIV | Human Immunodeficiency Virus |
| LMWH | Lower Molecular Weight Heparin |
| PE | Pulmonary embolism |
| RCOG | Royal College of Obstetricians and Gynaecologists |
| SA | South Africa |
| SASTH | South African Society of Thrombosis and Haematology |
| SASOG | South African Society of Obstetricians and Gynaecologists |
| VTE | Venous Thromboembolism |

# SECTION 1- Protocol

## I. Literature Review and Background

Venous thromboembolism (VTE) is a preventable condition that has the potential to cause significant morbidity and mortality. The incidence of VTE is one to two events per 1000 of the population worldwide [(1)] but is increased in pregnancy due to the physiologic and anatomic changes in pregnancy. A pregnant woman has a fourfold to five-fold increased risk of developing VTE than a non-pregnant woman of the same age group [(2)].

The two main clinical manifestations of VTE are deep vein thrombosis (DVT) pulmonary embolism (PE). The risk of developing DVT is higher in the third trimester with a 75-80% risk in pregnancy. PE is more likely to occur in the postpartum period with an incidence as high as 40-60% and a mortality rate of 2% [(3)]. With such high rates, the prevention of developing VTE in pregnancy should be part of standard obstetric practice [(4)].

It is strongly recommended that all pregnant women should undergo a documented risk assessment for VTE risk factors in early pregnancy to identify women at risk [(5)]. Risk factors differ according to the antepartum and postpartum periods [(6)]. The two risk factors strongly associated with VTE in pregnancy are hereditary thrombophilia and previous unprovoked or pregnancy related VTE. There are several clinical risk factors which are associated with a low to intermediate effect on VTE. These include advanced age and parity, medical conditions, caesarean delivery, postpartum haemorrhage, immobilisation in pregnancy and obesity. Risk factors in combination have been shown to interact and further increase the risk of developing VTE in pregnancy [(4,6,10)]. VTE risk factors are also population specific, the risk of VTE among South African pregnant populations has also been attributed to HIV infection [(5)].

There are various risk assessment guidelines that have been developed to identify pregnant women that warrant thromboprophylaxis [8,15]. International protocols for VTE thromboprophylaxis in pregnancy are those developed by the Royal College of Obstetricians and Gynaecologists (RCOG) guideline 37a [9], the American College of Obstetricians and Gynaecologists (ACOG) bulletin 196 [10] and the American Society of Haematology (ASH) [11].

These protocols are derived from observational studies, expert opinions and case reports on VTE. While these protocols are from developed countries, the efficacy of these protocols has been tested and reviewed in many countries [12,13]. A study by Yan-Qing Cai et.al. applied the RCOG guideline in China and concluded that this risk assessment protocol is effective in predicting the development of VTE.

The RCOG guideline considers a large number of VTE risk factors and employs a weighted risk score that categorizes women into one of three groups: low risk (≥2 points), intermediate risk (3 points), or high risk (≥4 points) for VTE (see Appendix A). Ideally this should be done prenatally or in early pregnancy and should be repeated if the woman is admitted to hospital, during labour and immediately postpartum. Women with a personal history of VTE in pregnancy (except those with a single event related to major surgery) are classified as high risk. The RCOG guideline recommends that high risk women receive thromboprophylaxis from the antepartum period until at least six weeks postpartum. In pregnant women at intermediate risk, postpartum thromboprophylaxis for at least two weeks and/or antepartum thromboprophylaxis from 28 weeks is recommended. In women classified as low risk postpartum thromboprophylaxis for at least ten days is recommended [9].

In contrast, the ACOG only considers a personal history of VTE and inherited thrombophilia (Appendix B) for which antepartum thromboprophylaxis is recommended until six weeks postpartum. The ASH guideline advises thromboprophylaxis only in women at high risk for VTE. The ASH guideline assessed evidence from systemic reviews and formulated recommendations for the prevention of VTE. Owing to the level of evidence, the ASH guideline suggests against thromboprophylaxis in women with only one clinical risk factor, excluding high risk factors (thrombophilia or a personal history of VTE) [11].

The preferred agents in pregnancy for thromboprophylaxis are heparin compounds such as low molecular heparin (LMWH) or unfractionated heparin (UFH) [8,14,15,19]. Heparin compounds do not cross the placenta and do not require regular monitoring. LMWH agents also have an increased half-life, making them safe and easy to use in an outpatient setting.

According to a recent systematic review by Jacobsen et al, enoxaparin thromboprophylaxis was associated with lower risks of bleeding, heparin induced thrombocytopenia, teratogenicity, and pregnancy loss compared to other drugs [16]. Other anticoagulants including warfarin and direct oral anticoagulants are contraindicated in pregnancy due to the teratogenic risk associated with its use.

The RCOG guideline recommends the use of a weight adjusted dose of LMWH (Appendix C) based on the booking weight with adjustment post-delivery. In women with renal dysfunction, doses should be reduced. The recently published High-Low study has provided guidance on the use of the RCOG recommended LMWH dose. The investigators of this randomised controlled trial found no statistical difference in efficacy and safety outcomes between low dose and intermediate dose LMWH (half therapeutic dose) in women with prior VTE [17].

Management during delivery requires a multidisciplinary approach in order to reduce the associated risks of maternal bleeding and VTE. Guidelines recommend a time interval of 12 hours between the last prophylactic LMWH dose and delivery. In view of the risk of spinal or epidural hematomas, the 12-hour time interval is also applicable when neuraxial analgesia and anaesthesia is administered. After delivery, it is recommended that LMWH should be reintroduced four to six hours after removal of the catheter if haemostasis is adequate. LMWH is recommended at least until discharge in women with multiple risk factors, for at least two weeks in women with intermediate risk factors and for at least six weeks in women with high risk factors.

In South Africa adherence to VTE guidelines was found to be suboptimal [18]. Local and international recommendations for antepartum and postpartum thromboprophylaxis are used to guide clinical practice at district, regional and academic hospitals as well as private hospitals. Local clinical guidelines for antepartum and postpartum thromboprophylaxis include the South African Society of Thrombosis and Haemostasis (SASTH) recommendations [19] as well as the BetterObs guidelines from the South African Society of Obstetricians and Gynaecologists (SASOG) [20]. These guidelines (Appendix D, E, F and G) represent a modification of the RCOG guideline.

## II. Study justification

VTE is an important cause of maternal morbidity and mortality, and its prevention should be a priority for health care services globally. To help clinicians identify women who would benefit from thromboprophylaxis, guidelines have been developed by international and local societies. Application of the RCOG guidelines has been associated with a decline in UK maternal mortality rates. It has also been successfully used in different countries with good outcomes. In South Africa, of concern, the maternal mortality statistics from PE noted an increase from 24 to 32 maternal deaths between 2019 and 2020, of which 30 occurred within health care facilities [21].

## III. Aims and Objectives

### 1. Study Aim

The aim of this study is to characterize current attitudes, barriers and practices in thromboprophylaxis use in obstetrics in order to guide future local recommendations for VTE thromboprophylaxis in pregnancy and the postpartum period.

## 2. Study Objectives

1. To evaluate the attitudes of South African obstetricians with regards to VTE risk assessment and management

2. To evaluate current practices of South African obstetricians with regards to VTE risk assessment and thromboprophylaxis in pregnancy and postpartum.

3. To identify barriers among South African obstetricians that prevent adherence to VTE guidelines.

4. To compare surveyed practices with current local and international recommendations.

# IV Research methods

### 1. Study design

This will be a quantitative cross sectional descriptive study in the form of a survey using an online questionnaire.

### 2. Study setting

The study will be conducted online using the redcap link.

### 3. Study population

The study population for this survey will be qualified practising medical doctors in the field of Obstetrics in South Africa. Participants will be identified using the membership registry of the Department of Obstetrics and Gynaecology at the University of Witwatersrand and the membership registry of the South African Society of Obstetrics and Gynaecology. The expected target response rate is 35% based on a previously published response rate to a web-based survey from the Department of Obstetrics at the University of Witwatersrand.

## 4. Study period

Surveys will be distributed electronically via email to the study population as soon as ethical approval is obtained. Reminder emails will be sent on three occasions.

## 5. Data collection

A questionnaire survey will be created and distributed using Redcap software (Appendix G). Participants will receive links to the survey by email.

The questionnaire survey is made up of a short introduction to the survey followed by questions about the participant's obstetric practice, awareness of VTE guidelines, application of the VTE risk assessment, and thromboprophylaxis in antepartum and the postpartum period. The last section includes a clinical scenario related to individual patient management in the antepartum period and postpartum period.

Participation in this survey will be voluntary and all data will be kept anonymous. All responses will be saved in Redcap.

The survey instrument will be tested among 5 experts in the field for content and face validity; and adjustments will be made. These responses will be excluded from the main results.

## 6. Data analysis

Data will be analysed on a Microsoft excel spreadsheet. Descriptive statistics will be used to analyse the results of the survey. The quantitative data will be summarised and presented using mean, standard deviation, median and inter-quartile ranges.

| | Strategy | Data collection | Data analysis |
|---|---|---|---|
| 1. To evaluate the attitudes of South African obstetricians with regards to VTE risk assessment and management | Survey questionnaire | Data will be collected from redcap and analysed on a Microsoft excel spreadsheet | Results will be expressed as proportions and frequencies and presented in charts, tables, or figures. |
| 2. To evaluate current practices of South African obstetricians with regards to VTE risk assessment and thromboprophylaxis in pregnancy and postpartum. | Survey questionnaire | Data will be collected from redcap and analysed on a Microsoft excel spreadsheet | Results will be expressed as proportions and frequencies and presented as charts or tables. |
| 3. To identify barriers among South African obstetricians that prevent adherence to VTE guidelines. | Survey questionnaire | Data will be collected from redcap and analysed on a Microsoft excel spreadsheet | Results will be expressed as proportions and frequencies and presented as charts. |
| 4. To compare surveyed practices with current local and international recommendations. | Literature review and survey questionnaire | Data will be collected from surveyed answers and existing guidelines from literature. | Results will be discussed in the final write up as recommendations. |

## V. Ethics

Ethical clearance will be requested from the Witwatersrand University Human Research Ethics Committee. Permission will also be obtained from the University of Witwatersrand Academic Head of the Department of Obstetrics as well as from the SASOG committee. The study will be registered with the National Health Research Database.

## VI. Funding

No external funding for the project is applied for, obtained, or needed. All expenses related to printing, data collection, data analysis, publication, and travel, will be the responsibility of the principal researcher.

| **Item** | **Cost** |
|---|---|
| Internet access | R1500 |
| Stationery | R500 |
| Printing | R500 |
| Publishing costs | R5000 |
| **Total cost** | **R7500** |

## VII. Timeline

| | Nov 22 | Dec 22 | Jan 23 | Feb 23 | Mar 23 | Apr 23 | May 23 | Jun 23 | Jul 23 | Aug 23 | Sep 23 | Oct 23 | Nov 23 | Jan 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Literature review** | | | | | | | | | | | | | | |
| **Protocol write-up** | | | | | | | | | | | | | | |
| **Protocol submission** | | | | | | | | | | | | | | |
| **Corrections Ethics application** | | | | | | | | | | | | | | |
| **Data collection** | | | | | | | | | | | | | | |
| **Data analysis** | | | | | | | | | | | | | | |
| **Write-up** | | | | | | | | | | | | | | |
| **Submission** | | | | | | | | | | | | | | |

## VIII. References


1. Kearon C. Epidemiology of venous thromboembolism. Seminars in Vascular Medicine [Internet]. 2001 [cited 2023 Feb 21]; 01(01):007–26. Available from: http://www.thieme-connect.de/DOI/DOI?10.1055/s-2001-14668.

2. Heit JA, Kobbervig CE, James AH, Petterson TM, Bailey KR, Melton LJ. Trends in the incidence of venous thromboembolism during pregnancy or postpartum: a 30-year population-based study. Ann Intern Med [Internet]. 2005 [cited 2023 Feb 21]; 143(10):697. Available from: http://annals.org/article.aspx?doi=10.7326/0003-4819-143-10-200511150-00006.

3. Bates SM. Pulmonary embolism in pregnancy. Semin Respir Crit Care Med [Internet]. 2021 [cited 2023 Feb 21]; 42(02):284–98. Available from: http://www.thieme-connect.de/DOI/DOI?10.1055/s-0041-1722867.

4. Kolettis D, Craigo S. Thromboprophylaxis in pregnancy. Obstetrics and Gynecology Clinics of North America [Internet]. 2018 [cited 2023 Feb 20]; 45(2):389–402. Available from: https://linkinghub.elsevier.com/retrieve/pii/S088985451830007X.

5. Raia-Barjat T, Edebiri O, Chauleur C. Venous thromboembolism risk score and pregnancy. Front Cardiovasc Med [Internet]. 2022 [cited 2023 Feb 21]; 9:863612. Available from: https://www.frontiersin.org/articles/10.3389/fcvm.2022.863612/full.

6. O'Shaughnessy F, Donnelly JC, Bennett K, Damkier P, Áinle FN, Cleary BJ. Prevalence of postpartum venous thromboembolism risk factors in an Irish urban obstetric population. Journal of Thrombosis and Haemostasis [Internet]. 2019 [cited 2023 Feb 22]; 17(11):1875–85. Available from: https://linkinghub.elsevier.com/retrieve/pii/S153878362202699X.

7. Schapkaitz E, Libhaber E, Rhemtula H, Gerber A, Jacobson BF, Chauke L, et al. Pregnancy-related venous thromboembolism and HIV infection. Intl J Gynecology & Obste [Internet]. 2021 [cited 2023 Feb 21]; 155(1):110–8. Available from: https://onlinelibrary.wiley.com/doi/10.1002/ijgo.13596.

8. Kalaitzopoulos DR, Panagopoulos A, Samant S, Ghalib N, Kadillari J, Daniilidis A, et al. Management of venous thromboembolism in pregnancy. Thrombosis Research [Internet]. 2022 [cited 2023 Feb 21]; 211:106–13. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0049384822000408.

9. Royal College of Obstetricians and Gynaecologists (RCOG) green-top guideline no 37a: Reducing the risk of thrombosis and embolism during pregnancy and the puerperium. London: RCOG [Internet]. 2015 [cited 2023 Feb 21]. Available from: https://www.rcog.org.uk/en/guidelines-research-services/guidelines/gtg37a

10. American College of Obstetricians and Gynecologists (ACOG) practice bulletin no. 196: thromboembolism in pregnancy. Obstetrics & Gynecology [Internet]. 2018 [cited 2023 Feb 21]; 132(1): e1–17. Available from: https://journals.lww.com/00006250-201807000-00054.

11. Bates SM, Rajasekhar A, Middeldorp S, McLintock C, Rodger MA, James AH, et al. American Society of Hematology 2018 guidelines for management of venous thromboembolism: venous thromboembolism in the context of pregnancy. Blood Advances [Internet]. 2018 [cited 2023 Feb 21]; 2(22):3317–59. Available from: https://ashpublications.org/bloodadvances/article/2/22/3317/16094/American-Society-of-Hematology-2018-guidelines-for.

12. Ge Y-Z, Zhang C, Cai Y-Q, Huang H-F. Application of the rcog risk assessment model for evaluating postpartum venous thromboembolism in chinese women: a case-control study. Med Sci Monit [Internet]. 2021 [cited 2023 Feb 20]; 27. Available from: https://www.medscimonit.com/abstract/index/idArt/929904.

13. Zheng J, Chen Q, Fu J, Lu Y, Han T, He P. Critical appraisal of international guidelines for the prevention and treatment of pregnancy-associated venous thromboembolism: a systematic review. BMC Cardiovascular Disorders [Internet]. 2019 [cited 2023 Feb 20]; 19(1):199. Available from: https://doi.org/10.1186/s12872-019-1183-3.

14. Middeldorp S, Ganzevoort W. How I treat venous thromboembolism in pregnancy. Blood [Internet]. 2020 [cited 2023 Feb 21]; 136(19):2133–42. Available from: https://ashpublications.org/blood/article/136/19/2133/463258/How-I-treat-venous-thromboembolism-in-pregnancy.

15. Middeldorp S, Naue C, Köhler C. Thrombophilia, thrombosis and thromboprophylaxis in pregnancy: for what and in whom? Hamostaseologie [Internet]. 2022 [cited 2023 Feb 20]; 42(01):054–64. Available from: http://www.thieme-connect.de/DOI/DOI?10.1055/a-1717-7663.

16. Jacobson B, Rambiritch V, Paek D, Sayre T, Naidoo P, Shan J, et al. Safety and efficacy of enoxaparin in pregnancy: a systematic review and meta-analysis. Adv Ther [Internet]. 2020 [cited 2023 Feb 20]; 37(1):27–40. Available from: https://doi.org/10.1007/s12325-019-01124-z.

17. Bistervels IM, Buchmüller A, Wiegers HMG, Ní Áinle F, Tardy B, Donnelly J, et al. Intermediate-dose versus low-dose low-molecular-weight heparin in pregnant and post-partum women with a history of venous thromboembolism (Highlow study): an open-label, multicentre, randomised, controlled trial. The Lancet [Internet]. 2022 [cited 2023 Feb 20]; 400(10365):1777–87. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0140673622021286.

18. Naidoo P, Mothilal R, Snyman LC. Assessment and management of venous thrombo-embolism risk during pregnancy and the puerperium (Save): The South African cohort. S Afr Med J [Internet]. 2019 [cited 2023 Feb 20]; 109(3):186. Available from: http://www.samj.org.za/index.php/samj/article/view/12556.

19. Schapkaitz E. Recommendations for thrombopropylaxis in obstetrics and gynaecology-a sasog guideline. S Afr J OG [Internet]. 2018 [cited 2023 Feb 21]; 24(1):27. Available from: http://www.sajog.org.za/index.php/sajog/article/view/1312.

20. South African Society of Obstetricians and Gynaecologists (SASOG) BetterObs guideline: thromboprophylaxis in obstetrics 2.0. SASOG [Internet]. 2022 [cited 2023 April 20]. Available from: https://www.sasog.co.za/betterobs/

21. National Committee for the Confidential Enquires into Maternal Deaths (NCCEMD). Saving Mothers Annaul Report 2020 (16). South Africa. DOH Pretoria 2020.

## IX. List of Annexures

Appendix A: RCOG Risk assessment scoring system

| | | Score |
|---|---|---|
| Pre-existing risk factors | -Previous VTE (except a single event related to major surgery) | 4 |
| | -Previous VTE provoked by major surgery | 3 |
| | -Medical comorbidities (cardiac, SLE, DM) | 3 |
| | -BMI > 40 | 2 |
| | -Family history of unprovoked VTE | 1 |
| | -Known low risk of thrombophilia, | 1 |
| | -Age >35 | 1 |
| | -BMI> 30 | 1 |
| | -Parity >3 | 1 |
| | -Smoker | 1 |
| | -Gross varicose veins | 1 |
| Obstetrics risk factors | -Emergency caesarean delivery | 2 |
| | -Pre-eclampsia | 1 |
| | -Assisted reproductive therapy | 1 |
| | -Multiple pregnancy | 1 |
| | -Elective caesarean delivery | 1 |
| | -Prolonged labour | 1 |
| | -Postpartum haemorrhage | 1 |
| | -Preterm birth | 1 |
| | -Stillbirth | 1 |
| Transient risk factors | -Ovarian hyperstimulation syndrome in 1$^{st}$ trimester | 4 |
| | -Surgical procedure in pregnancy | 3 |
| | -Hyperemesis gravidarum | 3 |
| | -Current systemic infection | 1 |
| | -Immobility | 1 |

Appendix B: ACOG risk assessment system

| | Antepartum management | Postpartum management |
|---|---|---|
| -No history of VTE/thrombophilia<br>-Single previous surgery related VTE<br>-Low risk thrombophilia without previous VTE | Surveillance without thromboprophylaxis | Surveillance without thromboprophylaxis |
| -VTE diagnosed in pregnancy.<br>-Previous VTE in pregnancy<br>-Low risk thrombophilia with previous VTE<br>-High risk thrombophilia<br>-Two or more previous VTE | Thromboprophylaxis | Thromboprophylaxis for at least six weeks |
| Low risk thrombophilia with family history of VTE | Surveillance without thromboprophylaxis | Thromboprophylaxis |

Appendix C: RCOG Weight adjusted dose of low molecular weight heparin.

| Weight | Enoxaparin | Dalteparin | Tinzaparin (75 u/kg/day) |
|---|---|---|---|
| <50 kg | 20mg daily | 2500 units daily | 3500 units daily |
| 50-90 kg | 40mg daily | 5000 units daily | 4500 units daily |
| 91-130 kg | 60mg daily | 7500 units daily | 7000 units daily |
| 131-170 kg | 80mg daily | 10 000 units daily | 9000 units daily |
| >170 kg | 0.6mg/kg/day | 75 u/kg/day | 75 u/kg/day |
| High prophylactic dose for 50-90 kg | 40mg 12 hourly Enoxaparin | 5000 units 12 hourly Dalteparin | 4500 units 12 hourly Tinzaparin |

Appendix D: SASTH Antepartum thromboprophylaxis risk assessment

| **Category** | **Risk factors** | **Recommendation** |
|---|---|---|
| High risk | -Previous pregnancy related VTE<br>-High risk hereditary thrombophilia<br>-Antiphospholipid syndrome | Thromboprophylaxis |
| Intermediate risk | -Previous VTE unrelated to pregnancy<br>-Low risk hereditary thrombophilia<br>-Surgery during pregnancy<br>-medical comorbidities<br>-ovarian hyperstimulation syndrome | -surveillance |
| Low risk | Age above 35, BMI more than 30, parity above three, smoker, hyperemesis gravidarum, multiple pregnancy, pre-eclampsia, immobility, assisted reproductive technology, current systemic infection | -Early mobilisation<br>-Avoid dehydration.<br>-Thromboprophylaxis if patient has four or more risk factors. |

Appendix E: SASTH Postpartum thromboprophylaxis risk assessment

| Risk category | Risk factors | Recommendations |
|---|---|---|
| High risk | Anyone requiring antenatal thromboprophylaxis | Thromboprophylaxis for at least six weeks |
| Intermediate risk | Caesarean delivery<br>Readmission or prolonged admission post delivery<br>BMI >40<br>Medical comorbidities (cancer, SLE, cardiac conditions) | Thromboprophylaxis for at least 7-10 days |

| | | |
|---|---|---|
| Low risk | Family history of VTE, low risk thrombophilia<br>Age above 35, BMI >30, parity of more than 3, smoker<br>Elective caesarean delivery, stillbirth, preterm delivery, multiple pregnancy, prolonged labour, postpartum haemorrhage, gross varicose veins, current systemic infection. | Early mobilisation<br>Mechanical prophylaxis<br>Thromboprophylaxis until discharged from hospital if more than 2 risk factors present. |

Appendix F: SASOG Antenatal assessment and management

| Risk category | Risk factors | Recommendations |
|---|---|---|
| High risk | Previous VTE, except if related to major surgery | Antenatal thromboprophylaxis with LMWH |
| Intermediate risk | -Hospital admission<br>-Previous VTE related to major surgery<br>-High risk thrombophilia<br>-Medical comorbidities<br>-Surgical procedure during pregnancy<br>-Ovarian hyperstimulation syndrome | Consider thromboprophylaxis with LMWH |
| Low risk | -Obesity (BMI >30kg/$m^2$)<br>-Age >35<br>Parity >3<br>-Smoker<br>-Gross varicose veins<br>-Current preeclampsia<br>-Immobility<br>-Current systemic infection<br>-Family history of VTE<br>-Low risk thrombophilia<br>-Multiple pregnancy<br>-Hyperemesis gravidarum<br>-Assisted reproduction | Four or more factors: Thromboprophylaxis from 1$^{st}$ trimester<br><br>Three factors: Thromboprophylaxis from 28 weeks<br><br>Two or less factors: Mobilisation and avoid dehydration |

Appendix G: SASOG Postnatal assessment and management

| Risk category | Risk factors | Recommendations |
|---|---|---|
| High risk | -Any previous VTE<br>-Any patient requiring antenatal LMWH<br>-High risk thrombophilia<br>-Low risk thrombophilia with a family history | At least six weeks of thromboprophylaxis with LMWH |
| Intermediate risk | -Caesarean section in labour<br>-BMI > 40kg/$m^2$<br>-Prolonged postdelivery admission or readmission<br>-Non perineal surgery in postpartum period<br>-Medical comorbidities | At least ten days of thromboprophylaxis with LMWH<br>If three or more factors present, consider extending duration |
| Low risk | -Age >35<br>-Parity >3<br>-BMI >30kg/$m^2$<br>-Smoker<br>-Elective caesarean delivery<br>-Family history of VTE<br>-Low risk thrombophilia<br>Gross varicose veins<br>-Immobility<br>-Current pre eclampsia<br>-Current systemic infection<br>-Multiple pregnancy<br>-Preterm delivery<br>-Stillbirth in this pregnancy<br>-Prolonged labour<br>-Postpartum haemorrhage or blood transfusion | Two or more factors present: manage as intermediate risk<br><br>Less than two factors present: Early mobilisation and avoid dehydration |

## X: Survey questionnaire

My name is Dr Zwidorulwa Rabali, I am a registrar in the Department of Obstetrics and Gynaecology at the University of the Witwatersrand. I am doing a research study on thromboprophylaxis in antepartum and postpartum care. The aim of this study is to characterize current attitudes, barriers, and practices in thromboprophylaxis use in obstetrics to guide future local recommendations for VTE thromboprophylaxis in pregnancy and the postpartum period.

As part of the study, I have designed an online survey related to current practices on thromboprophylaxis. Please kindly assist in answering the questions, it will take no more than 10 minutes. Participation is voluntary and answers will be kept anonymous.

If you consent to taking the survey, please tick yes below.

Yes ◯

No ◯

**Part A: Clinical Practice**

1. What best describes the setting of your Obstetric practice?

   A. Private sector service ◯
   B. Public sector service ◯
   C. Both ◯

2. Which province do you practice in?

   A. Eastern Cape ◯
   B. Free State ◯
   C. Gauteng ◯
   D. KwaZulu Natal ◯
   E. Limpopo ◯
   F. Mpumalanga ◯
   G. North West ◯

H. Northern Cape ◯
I. Western Cape ◯

3. What is your rank/ work experience?

A. Specialist: >10 years post speciality training ◯
B. Specialist: 5-10 years post speciality training ◯
C. Specialist: <5 years post speciality training ◯
D. Registrar: >2 years training ◯
E. Registrar: <2 years training ◯
F. Medical officer: >10 years ◯
G. Medical officer: 5-10 years ◯
H. Medical officer: <5 years ◯

4. How many patients do you see in your practice weekly with VTE or a previous history of VTE?

A. 0 to 5 patients in a week ◯
B. 5 to 10 patients in a week ◯
C. >10 patients in a week ◯
D. I don't know ◯

5. Do you follow a clinical practice guideline for prescribing thromboprophylaxis in pregnant and postpartum women?

A. Always ◯
B. Never ◯
C. Sometimes ◯

5.1. Why do you not always follow use a guideline for prescribing thromboprophylaxis in pregnancy?

A. My practice is low risk pregnant women only ◯
B. Thromboprophylaxis has a negative benefit/risk ratio ◯
C. Fear of antepartum or postpartum haemorrhage ◯
D. I do not have easy access to guidelines in my practice ◯
E. Current guidelines are not evidence based ◯
F. The recommendations in current guidelines are weak/conditional ◯
G. Current guideline scores are too complex ◯
H. Time constraints due to clinical responsibilities ◯
I. I am uncertain of which guideline to follow in South Africa ◯

6. Do you perform a VTE risk assessment guideline in the antepartum and/ or postpartum period?

A. Yes ◯

B. No ◯

C. I don't know ◯

6.1. If you do use a guideline, what is it based on?

A. American college of Obstetricians and Gynaecologists (ACOG -196) ◯
B. American Society of Haematology (ASH 2021) ◯
C. Royal College of Obstetricians and Gynaecologists (2015 RCOG -37a) ◯
D. South African Society of Thrombosis and Haematology (SASTH 2018) ◯
E. South African Society of Obstetricians and Gynaecologists (BetterObs 2022 ver. 2) ◯
F. Local institutional guideline ◯
G. Other ◯ Please Name:……..

H. I don't know ◯

6.2. If you do not use a guideline, do you think a clinical practice guideline for thromboprophylaxis risk assessment and management should be implemented in your practice?

A. Yes ◯
B. No ◯
C. I don't know ◯

**Part B: Management**

1. Which thromboprophylaxis agents do you use in the antepartum period?

A. Aspirin ◯
B. Compression stockings ◯
C. Direct oral anticoagulants ◯
D. Low molecular weight heparin ◯
E. Unfractionated heparin ◯
F. Warfarin ◯
G. Other ◯ Please name……..

2. Which thromboprophylaxis agents do you use in the postpartum period?

A. Aspirin ◯
B. Compression stockings ◯
C. Direct oral anticoagulants ◯
D. Low molecular weight heparin ◯
E. Unfractionated heparin ◯
F. Warfarin ◯
G. Other ◯ Please name……

3. When prescribing LMWH thromboprophylaxis for high risk patients, which dosing system do you use?

A. Fixed based dose (e.g., enoxaparin 40mg SC daily for weight< 100kg) ◯
B. Intermediate dose (e.g., enoxaparin 1mg/kg/day) ◯
C. RCOG weight adjusted dose (e.g., <50kg give 20mg SC daily) ◯
D. Anti Xa adjusted prophylactic dose (Anti Xa 0.2-0.4) ◯
E. Other ◯ Please name…….

4. Which of the following do you perceive as barriers to prescribing thromboprophylaxis?

A. Lack of access to pharmacological agents in my practice ◯
B. Lack of mechanical prophylaxis in my practice ◯
C. Lack of patient compliance in my practice ◯
D. The cost of thromboprophylaxis in my practice ◯
E. I am uncertain of which anticoagulant to use in South Africa ◯
F. I am uncertain of which dose to give ◯
G. Perceived complications of thromboprophylaxis ◯
H. Other ◯ Please name…….

**Part C: Clinical Scenarios**

Select the corresponding approach that best describes your management practice for the following antepartum and postpartum scenarios:

1. A 28-year-old woman, P0M3G4 is known with antiphospholipid syndrome on aspirin. She has no personal history of thrombosis. How would you manage her in the antepartum period?

A. No pharmacological antepartum thromboprophylaxis ◯

B. Antepartum pharmacological thromboprophylaxis from presentation at ANC ◯

C. Antepartum pharmacological thromboprophylaxis from 28 weeks gestation ◯

D. Antepartum mechanical thromboprophylaxis ◯

2. A 26-year-old woman, P1G2 is known with homozygous Prothrombin gene mutation. She has no personal history of thrombosis; her mother has a history of postpartum deep vein thrombosis. How would you manage her in the antepartum period?

A. No pharmacological antepartum thromboprophylaxis ◯
B. Antepartum pharmacological thromboprophylaxis from presentation at ANC ◯
C. Antepartum pharmacological thromboprophylaxis from 28 weeks gestation ◯
D. Antepartum mechanical thromboprophylaxis ◯

3. A 35-year-old woman, P0G1 has a previous history of a deep vein thrombosis following a knee arthroscopy two years ago. She has no family history of thrombosis. How would you manage her in the antepartum period?

A. No pharmacological antepartum thromboprophylaxis ◯
B. Antepartum pharmacological thromboprophylaxis from presentation at ANC ◯
C. Antepartum pharmacological thromboprophylaxis from 28 weeks gestation ◯
D. Antepartum mechanical thromboprophylaxis ◯

4. A 28-year-old woman, P1G2 gives a history of postpartum pulmonary embolism two years earlier. She has no family history of thrombosis. How would you manage her in the antepartum period?

A. No pharmacological antepartum thromboprophylaxis ◯
B. Antepartum pharmacological thromboprophylaxis from presentation at ANC ◯
C. Antepartum pharmacological thromboprophylaxis from 28 weeks gestation ◯
D. Antepartum mechanical thromboprophylaxis ◯

5. A 32-year-old woman, P2G3 with a BMI of 28kg/$m^2$ delivers a live baby at 39 weeks gestation by emergency caesarean delivery. How would you manage her in the postpartum period?

A. No pharmacological thromboprophylaxis. Early mobilization and hydration ◯

B. Postpartum mechanical thromboprophylaxis ◯

C. Postpartum pharmacological thromboprophylaxis at least until discharge from hospital ◯

D. Postpartum pharmacological thromboprophylaxis for at least 10-14 days ◯

E. Postpartum pharmacological thromboprophylaxis for at least six weeks ◯

6. A 34-year-old woman, P1G2 with a BMI of 42kg/$m^2$ delivers a live baby at term by normal vaginal delivery. How would you manage her in the postpartum period?

A. No pharmacological thromboprophylaxis. Early mobilization and hydration ◯

B. Postpartum mechanical thromboprophylaxis ◯

C. Postpartum pharmacological thromboprophylaxis at least until discharge from hospital ◯

D. Postpartum pharmacological thromboprophylaxis for at least 10-14 days ◯

E. Postpartum pharmacological thromboprophylaxis for at least six weeks ◯

7. A 30-year-old woman, P3G4 with a BMI 32kg/m2 of delivers a live baby at 39 weeks by elective caesarean section. How would you manage her in the postpartum period?

A. No pharmacological thromboprophylaxis. Early mobilization and hydration ◯
B. Postpartum mechanical thromboprophylaxis ◯
C. Postpartum pharmacological thromboprophylaxis at least until discharge from hospital ◯
D. Postpartum pharmacological thromboprophylaxis for at least 10-14 days ◯
E. Postpartum pharmacological thromboprophylaxis for at least six weeks ◯

# SECTION 2: Journal guidelines

This chapter outlines the authors' guidelines for the Obstetrics Medicine (SAGE Journal) which is the intended journal of publication.

Title- title should be concise, descriptive, unambiguous, accurate, and reflect the precise contents of the manuscript.

Abstract- no more than 150 words between the title and main body of your manuscript that concisely states the purpose of the research, major findings, and conclusions.

Keywords- include a minimum of 5 keywords, listed after the abstract.

Title Page should include:

- Article title
- The full list of authors including names and affiliations of each
- Contact information for the corresponding author: name, institutional address, phone, email
- Acknowledgments section
- Declaration of conflicting interest
- Funding statement
- Ethical approval and informed consent statements
- Data availability statement
- Any other identifying information related to the authors and/or their institutions, funders, approval committees, etc, that might compromise anonymity.

Reference style and citations- The journal follows the Sage Vancouver reference style.

Supplemental material

# SECTION 3: Submissible Article

This section outlines the journal formatted according to the authors' guidelines as described in section 2 above.

**Title**: Antepartum and postpartum thromboprophylaxis: A survey of current practices in South Africa and comparison with recommendations.


**Abstract**

**Background:**

Thromboprophylaxis guidelines are critical for VTE prevention, yet the optimal implementation of risk-appropriate thromboprophylaxis during pregnancy and postpartum remains uncertain.

**Methods:**

An electronic survey was distributed to 120 medical practitioners at the University of the Witwatersrand to assess thromboprophylaxis practices in pregnancy and postpartum.

**Results:**

Seventy (58%) responses were received, and 64 (53%) complete responses were analysed. Most respondents practiced in the public sector (83%) and followed clinical guidelines, with 50% adhering to the RCOG guideline. Low molecular weight heparin was widely prescribed during both antepartum and postpartum periods (94%), primarily at a fixed dose (53%). Barriers included lack of mechanical prophylaxis (30%), perceived complications of thromboprophylaxis (28%), and cost (22%). Case-based assessments revealed significant variation in practices due to complex risk assessment scoring systems and disparate guideline recommendations.

**Conclusion:**

Despite adherence to guidelines, variation in thromboprophylaxis practices highlights the need for evidence-based consensus recommendations to enhance clinical guidance.

**Keywords:**

Low molecular weight heparin, venous thromboembolism, thromboprophylaxis, guidelines, antepartum and postpartum periods.

## 1. INTRODUCTION

Venous thromboembolism (VTE) is a preventable medical condition associated with pregnancy which comprises of deep vein thrombosis (DVT) and its complication pulmonary embolism (PE). The risk of developing DVT is notably higher during the third trimester of pregnancy, whereas PE is more commonly observed in the postpartum period [1-4]. In South Africa (SA), a low-middle income country, PE is one of the top ten causes of maternal deaths. According to the Saving Mothers Report 2023, there has not been a decrease in the rates of PE as a cause of maternal death in SA [5]. Preventing VTE is a global healthcare priority, with current guidelines emphasizing the importance of antepartum and postpartum thromboprophylaxis as a critical component of obstetric management and care.

Several international organisations have published recommendations on VTE prevention and thromboprophylaxis [6-10]. These guidelines stratify women into high, intermediate or low risk based on the risk factors present. Multiple risk factors have been identified, which increase the risk of developing VTE in pregnancy. A previous history of thrombosis and inherited thrombophilia are strong risk factors for VTE [11-14]. Advanced maternal age, anaemia, assisted reproductive conception, certain medical conditions (diabetes, hypertension), human immunodeficiency virus (HIV) infection, immobilisation in pregnancy, caesarean delivery, multiparity, obesity and postpartum haemorrhage are considered low to intermediate risk factors [15-19]. A combination of these risk factors has been shown to further increase the risk of developing VTE in pregnancy.

There is, however, significant variation among guidelines regarding recommendations for risk stratification and the utilisation of antepartum and postpartum thromboprophylaxis. The Royal College of Obstetricians and Gynaecologists (RCOG) guideline categorises women into low, intermediate and high-risk groups according to a weighted risk score of many risk

factors [20]. In contrast, the American College of Obstetricians and Gynaecologists (ACOG) only considers a personal history of VTE and inherited thrombophilia for which antepartum thromboprophylaxis is recommended until six weeks postpartum [21]. More recently, the American Society of Haematology (ASH) assessed evidence from systemic reviews and formulated recommendations for the prevention of VTE [22].

The ASH guideline advises thromboprophylaxis in women considered at high risk (the presence of a high-risk factor such as thrombophilia or a personal history of VTE). The ASH guideline advises no thromboprophylaxis for women without high-risk factors. This disparity between guideline recommendations has led to suboptimal implementation and utilisation of thromboprophylaxis in many countries.

Additionally, there is variation between guidelines with regards to the recommended dose and duration of thromboprophylaxis agent use. Low molecular weight heparin (LMWH) which does not cross the placenta, is readily available, effective and is the preferred agent in pregnancy [23-26]. The optimal LMWH dose in women with prior VTE is however inconclusive with current guidelines suggesting either a fixed low dose or an intermediate dose. The Highlow randomized controlled trial determined that there was no statistically significant difference in the efficacy and safety outcomes between administering fixed low dose and an intermediate dose LMWH in women with prior VTE [27]. In the postpartum period, LMWH, warfarin and fondaparinux are all safe to use. Direct oral anticoagulants (DOACs) may be considered in women who are not breastfeeding according to the ACOG. However, due to more frequent reports of heavy menstrual bleeding with DOACs as compared to warfarin, further study is necessary.

In SA, suboptimal adherence to VTE guidelines and thromboprophylaxis has previously been reported as evidenced by variability in the use of thromboprophylaxis in pregnancy and the postpartum period [28]. The aim of this current study was to describe VTE risk assessment and thromboprophylaxis practices by medical practitioners in Obstetrics in SA as compared to international recommendations. Furthermore, this study aimed to investigate barriers among South African obstetricians that may influence adherence to VTE guidelines.

## 2. METHODS

### 2.1 Study design and population

A quantitative cross sectional descriptive study was performed in the form of a self-administered survey using an online questionnaire. Surveys were distributed electronically via email between March 2024 to June 2024. The study population were qualified practising medical doctors in the field of Obstetrics and Gynaecology in SA identified from the registry of the Department of Obstetrics and Gynaecology in the University of Witwatersrand. In total, 120 medical doctors working in departments Obstetrics and Gynaecology were invited to participate in the study.

### 2.2 Data collection

Following a literature review, a questionnaire was developed with 18 questions. The survey instrument was tested among five experts in the field for content and face validity; minor adjustments were made prior to data collection. These responses were excluded from the results. The survey consisted of three sections about the respondents' clinical practice, prescribing thromboprophylaxis in the antepartum and the postpartum periods and clinical scenarios related to individual patient management in the antepartum (cases 1-4) and postpartum (cases 5-7) periods. The survey used multiple-choice questions, with branch logic employed where relevant. Participants could answer "other," but were then required to elaborate.

### 2.3 Data analysis

Data was captured into REDCap (Research Electronic Data Capture) and analysed using Statistica 18 software (Palo Alto, California, USA). Descriptive statistics were used to present the results of the survey. The quantitative data is summarised and presented using tables, charts and graphs. Univariate logistic regression analysis was conducted to identify factors associated with performance of VTE risk assessment with the correspondent unadjusted odds ratio (OR) and 95% confidence intervals (CI). Significance level was set at $<0.05$.

## 3. RESULTS

Of the 120 surveys sent out we received 70 responses (58%). Six responses were excluded as they were incomplete. The total number of surveys analysed was 64 (53%) (Fig 1).

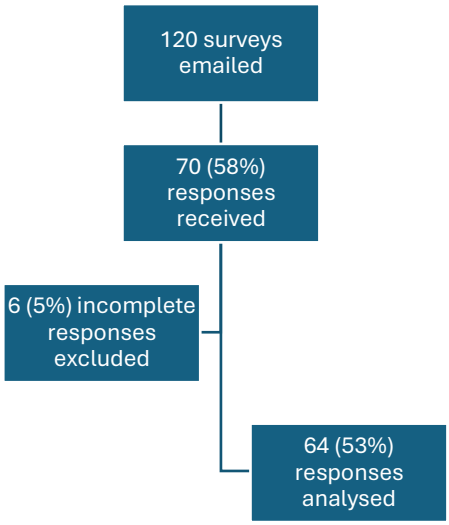



Figure 1: Survey responses

### 3.1 Respondent characteristics

Table 1 summarises the characteristics of the respondents. Most of our respondents practise within the public sector (n=53, 83%). 48% of respondents were specialists (n=31), 45% were registrars within the specialist training program (n=29) and 6% were medical officers (n=4). Most of the respondents reported seeing between 0-5 patients per week with VTE or a previous history of VTE (n=52, 81%).

Table 1. Clinical practice characteristics of the respondents.

| **Clinical Practice** | **Total N=64** (%) |
|---|---|
| **Obstetric practice** | |
| Public | 53 (83) |
| Private | 5 (8) |
| Both | 6 (9) |
| **Profession rank** | |
| Specialist, >10 years | 5 (8) |
| Specialist, 5-10 years | 8 (13) |
| Specialist, < 5 years | 18 (28) |
| Registrar, > 2 years | 16 (25) |
| Registrar, < 2 years | 13 (20) |
| Medical Officer, 5-10 years | 2 (3) |
| Medical Officer, < 5 years | 2 (3) |
| **Number of patients with VTE or history of VTE seen per week** | |
| 0-5 | 52 (81) |
| 5-10 | 4 (6) |
| >10 | 1 (2) |
| Uncertain----Adjust | 7 (11) |
| Key. venous thromboembolism (VTE) | |

### 3.2 VTE Risk assessment

All respondents indicated that they follow a clinical practice guideline when prescribing thromboprophylaxis. However, 27% (n=17) of respondents reported following a clinical practice guideline irregularly (Table 2). Fig 2 illustrates the different guidelines which respondents follow, with 50% (n=32) of respondents following the RCOG guideline. Forty-one (64%) respondents indicated that they perform a VTE risk assessment in the antepartum and postpartum periods. On univariate analysis, clinician experience, rank and the number of VTE patients per practice were not significantly associated with the performance of VTE risk assessment in routine practice (Supplemental Table 1). The most common reasons reported for performing a VTE risk assessment sometimes (n=2, 3%) or never (n=21, 33%) were uncertainty around which guideline to follow in SA (n=8, 35%), current guidelines employing a complex risk score (n=6, 26%) and time constraints due to clinical responsibilities (n=6, 26%) (Table 3).

Table 2. Responses regarding guidelines and VTE risk assessment in clinical practice

| **Response** | **Do you follow a clinical practice guideline for prescribing thromboprophylaxis in pregnant and postpartum women? N=64 (%)** | **Do you perform a VTE risk assessment in the antepartum and/ or postpartum period? N=64 (%)** |
|---|---|---|
| Always | 47 (73) | 41 (64) |
| Never | 0 (0) | 21 (33) |
| Sometimes | 17 (27) | 2 (3) |

Table 3. Reasons for not routinely following a clinical practice guideline for thromboprophylaxis risk assessment (n=23)

| **Reason** | **N (%)** |
|---|---|
| Uncertain which guideline to follow | 8 (35) |
| Time constraints due to clinical responsibilities | 6 (26) |
| Current guideline scores are complex | 6 (26) |
| Low risk patients | 2 (9) |
| Current guideline recommendations are weak/conditional | 1 (4) |

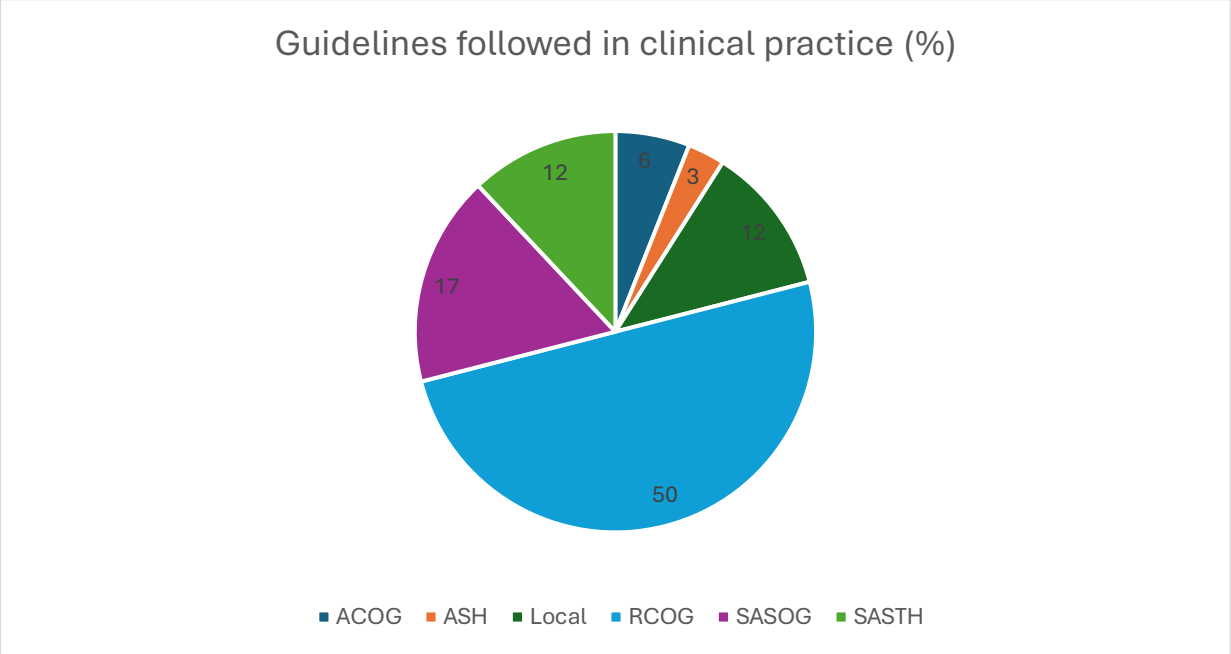



Figure 2. Pie chart of different guidelines followed in clinical practice for thromboprophylaxis for pregnant and postpartum women

Key: American College of Obstetricians and Gynecologists (ACOG), American Society of Hematology (ASH), Royal College of Obstetricians and Gynaecologists (RCOG), South African Society of Obstetricians and Gynaecologists (SASOG), South African Society of Thrombosis and Haematology (SASTH)

### 3.3 Thromboprophylaxis prescribing in pregnancy and postpartum period

According to the respondents, the preferred anticoagulant used in the antepartum and postpartum periods was LMWH (Fig 3.). When prescribing LMWH thromboprophylaxis in pregnancy, the dosing system used the most was a fixed based dose (e.g., enoxaparin 40mg SC daily for weight 50-90kg) (n=34, 53%) followed by an intermediate dose (e.g., enoxaparin 1mg/kg/day) (n=25, 39%) (Fig 4.). The most common barriers to prescribing thromboprophylaxis were unavailability of mechanical prophylaxis (n=19, 30%), the perceived complications of thromboprophylaxis such as bleeding (n=18, 28%) and the cost of thromboprophylaxis (n=14, 22%) (Table 4).

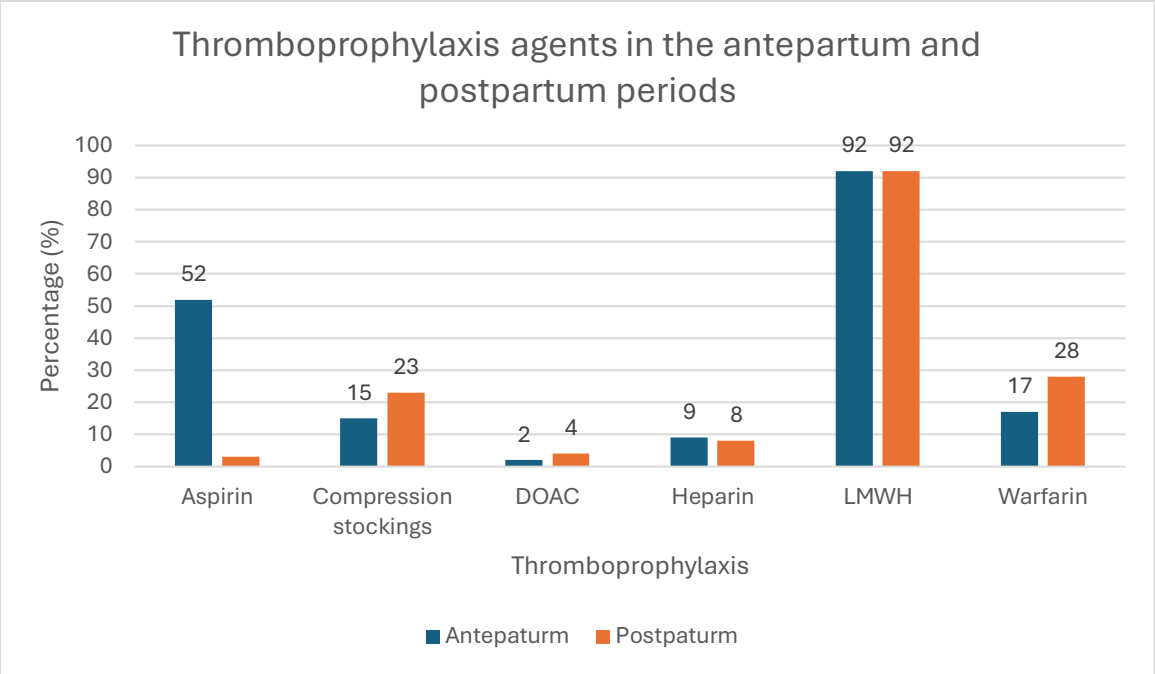



Figure 3: Bar chart depicting the different thromboprophylaxis agents used in the antepartum and postpartum periods.

Key: Direct oral anticoagulant (DOAC), low molecular weight heparin (LMWH).

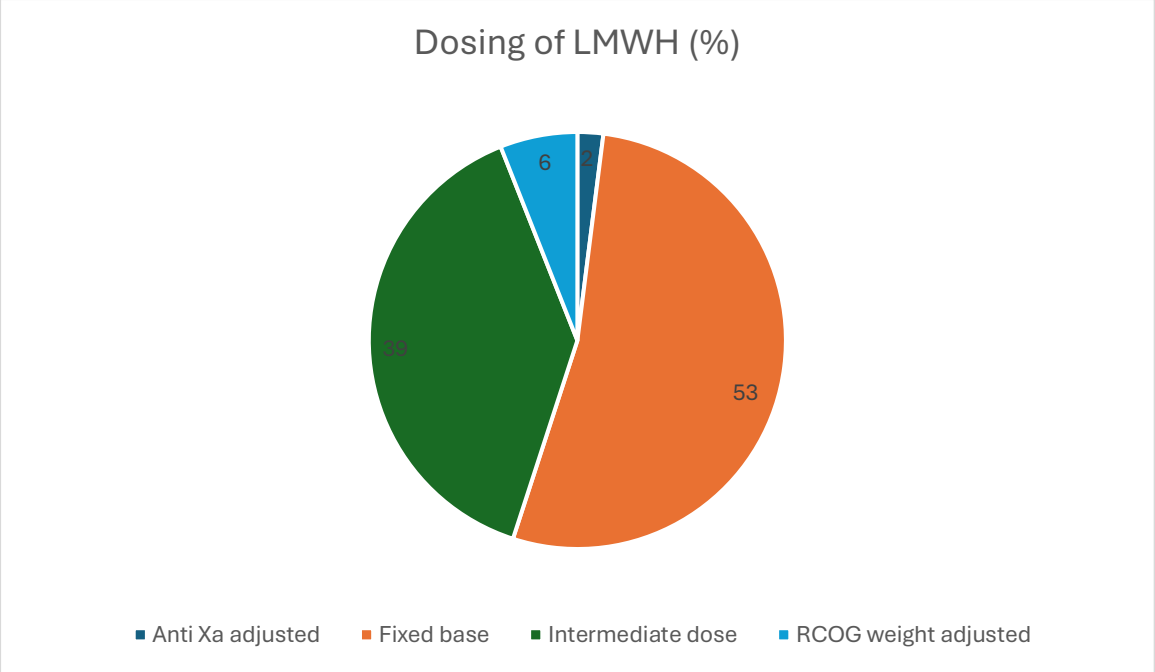



Figure 4: Pie chart depicting LMWH dosing of respondents

Key. Royal College of Obstetricians and Gynaecologists (RCOG)

Table 4. Barriers to the use of thromboprophylaxis agents

| **Barriers** | **N=64 (%)** |
|---|---|
| Unavailability of mechanical prophylaxis | 19 (30) |
| Perceived complications of thromboprophylaxis | 18 (28) |
| Cost of thromboprophylaxis | 14 (22) |
| Patient non-compliance | 10 (16) |
| Unavailability of pharmacological agents | 9 (14) |
| Uncertain which anticoagulant or dose to prescribe | 4 (8) |

### 3.4 Clinical scenarios

The results of case scenarios on antepartum and postpartum management are presented in Table 5 a and b respectively with recommendations from the RCOG guideline.

Table 5a. Responses to antepartum clinical scenarios

| **Responses n (%)** | | | | |
|---|---|---|---|---|
| **No pharmacological thromboprophylaxis** | **Antepartum pharmacological thromboprophylaxis from presentation** | **Antepartum pharmacological thromboprophylaxis from 28 weeks' gestation** | **Antepartum mechanical prophylaxis** | **RCOG recommendations** |
| Case 1: 28-year-old $P_0M_3G_4$ with antiphospholipid syndrome on aspirin with no personal history of thrombosis | | | | |
| 2 (3%) | 60 (94%) | 2 (3%) | 0 (0%) | Consider antepartum pharmacological thromboprophylaxis from presentation |
| Case 2: 26-year-old $P_1G_2$ with homozygous prothrombin gene mutation, with no personal history of thrombosis, but her mother had a history of postpartum deep vein thrombosis | | | | |
| 9 (14%) | 48 (75%) | 5 (8%) | 2 (3%) | Consider antepartum pharmacological thromboprophylaxis from presentation |
| Case 3: 35-year-old $P_0G_1$ with a personal history of a deep vein thrombosis following a knee arthroscopy two years ago and no family history of thrombosis | | | | |
| 18 (28%) | 34 (53%) | 5 (8%) | 7 (11%) | Antepartum pharmacological thromboprophylaxis from 28 weeks 'gestation |

| Case 4: 28-year-old $P_1G_2$ with a postpartum pulmonary embolism two years earlier and no family history of thrombosis | | | | |
|---|---|---|---|---|
| 5 (13%) | 48 (75%) | 7 (11%) | 1 (1%) | Antepartum pharmacological thromboprophylaxis from presentation |

Table 5b. Responses to postpartum clinical scenarios

| **Responses n (%)** | | | | | |
|---|---|---|---|---|---|
| **No pharmacological thromboprophylaxis. Early mobilization and hydration** | **Postpartum mechanical thromboprophylaxis** | **Postpartum pharmacological thromboprophylaxis at least until discharge from hospital** | **Postpartum pharmacological thromboprophylaxis for at least 10-14 days** | **Postpartum pharmacological thromboprophylaxis for at least six weeks** | **RCOG recommendations** |
| Case 5: 32-year-old $P_2G_3$ with a BMI of 28 kg/m$^2$ who delivered a live baby at 39 weeks' gestation by emergency caesarean delivery | | | | | |
| 15 (23%) | 3 (5%) | 38 (59%) | 6 (9%) | 2 (3%) | Postpartum pharmacological thromboprophylaxis for at least 10-14 days |

| | | | | | |
|---|---|---|---|---|---|
| Case 6: 34-year-old $P_1G_2$ with a BMI of 42 kg/m$^2$ who delivered a live baby at term by normal vaginal delivery | | | | | |
| 24 (38%) | 3 (5%) | 6 (9%) | 20 (31%) | 11 (17%) | Postpartum pharmacological thromboprophylaxis for at least 10-14 days |
| Case 7: 30-year-old $P_3G_4$ with a BMI of 32 kg/m$^2$ who delivered a live baby at 39 weeks' gestation by elective caesarean delivery. | | | | | |
| 2 (3%) | 2 (3%) | 35 (55%) | 22 (34%) | 3 (5%) | Postpartum pharmacological thromboprophylaxis for at least 10-14 days |
| Key. body mass index (BMI) | | | | | |

## 4. DISCUSSION

This cross-sectional survey of medical practitioners working in the departments of Obstetrics and Gynaecology, at the University of Witwatersrand, described local practices of thromboprophylaxis. The results of this survey indicated that the majority (64%) of respondents routinely performed a VTE risk assessment according to a clinical practice guideline. Most of the respondents indicated that they followed the RCOG thromboprophylaxis guideline. This was independent of clinician and practice characteristics.

Respondents who reported performing a VTE risk assessment either infrequently or not at all cited several key challenges. These included uncertainty around which guideline to follow owing to many international and local published guidelines. In SA, there are several local guidelines which include the South African Society of Thrombosis and Haemostasis (SASTH) recommendations [29], the South African Society of Obstetricians and Gynaecologists (SASOG) recommendations, (BetterObs guideline) [30] as well as local institutional guidelines. The SASOG recommendations represent a modification of the RCOG guidelines. Respondents also indicated that recommendations, such as those from the RCOG, involve complex VTE risk assessment scoring systems. Lastly, respondents highlighted time constraints, especially in busy clinical settings where healthcare professionals may not have the capacity to thoroughly assess each patient's VTE risk within the time available.

Risk assessment scores should be done prenatally or in early pregnancy and should be repeated postpartum. Applying this scoring assessment in our setting is challenging where there is a ratio of 1 clinician to 40 patients. To improve adherence, there is a need for the development of rapid, user friendly VTE risk assessment tools according to a consensus guideline. One such tool, Thrombocalc, is an electronic, standardised VTE risk assessment system that gives the potential to enhance clinical practice with its use. This system demonstrated a significant increase in the compliance rate for adhering to VTE risk assessment [31].

LMWH is considered the standard of care locally and internationally and was the preferred pharmacological agent in our study for VTE prophylaxis in the antepartum and postpartum periods. LMWH is associated with lower risks of maternal complications such as heparin-induced thrombocytopenia. LMWH also has the advantages of an increased half-life, predictable pharmacokinetics, doesn't cross the placenta and can be administered subcutaneously. It is advised that warfarin be avoided in pregnancy due to its associated risk of central nervous system (CNS) complications, miscarriages and stillbirths [32].

In our study, 17% of respondents indicated that they use warfarin in the antepartum period. In the postpartum period, despite the safety of warfarin during breastfeeding, only 28% of respondents reported prescribing it. Use of DOAC's and compression stockings were also uncommon in this study. The safety and efficacy of DOAC's during lactation have not been established [33]. Compression stockings were used in the minority, as they are not readily available in the public sector. Use of mechanical prophylaxis such as graduated compression stockings or intermittent pneumatic compression in postpartum has limited evidence available [34].

Bleeding which is an important safety concern with anticoagulation use was a barrier to thromboprophylaxis prescribing in 28% of the survey respondents. In the multi-centre, multi-national Highlow study, major bleeding rates of 4.0% were reported in pregnant women with prior VTE randomized to intermediate dose and fixed low dose LMWH respectively. Caution, however, is required when interpreting these studies, because of the use of non-standardised definitions of bleeding.

In our survey, most respondents indicated that they do not use anti-Xa levels to adjust doses of prophylactic LMWH during pregnancy. Rather LMWH thromboprophylaxis was prescribed at a fixed based dose or an intermediate dose. Accordingly, the ACOG advises that anti-Xa monitoring in pregnant women receiving prophylactic LMWH is not required as the optimal anti-Xa reference interval for prophylaxis has not been determined in pregnancy [35]. Similarly, the RCOG guidelines do not recommend routine anti-Xa monitoring except for women at extremes of body weight or with renal dysfunction. Nonetheless, according to surveys from developed countries such as United States, and United Kingdom (UK), anti-Xa level monitoring is commonly performed, in contrast to guideline recommendations as well our survey findings. In a multi-centre study in the UK and Ireland, anti-Xa levels were monitored in 90% of the centres surveyed [36]. There is a need for studies examining the effect of anti-Xa level monitoring in this patient population on safety and efficacy outcomes.

We also assessed the use of thromboprophylaxis by clinical case scenarios relevant to current clinical practice. We identified a strong consensus among respondents for the use of antepartum LMWH in conjunction with low dose aspirin from presentation in antiphospholipid syndrome (APS). The most recent British Society for Haematology guidelines recommend aspirin 150mg from 12 weeks gestation in combination with low molecular weight heparin to reduce the risk of pregnancy complications, including recurrent miscarriage, preeclampsia and fetal growth restriction[37]. APS is also an important risk factor for thrombosis [38]. Similarly, in women with a personal history of thrombosis there was a strong agreement for using antepartum pharmacological thromboprophylaxis from presentation in pregnancy. A prior unprovoked VTE or oestrogen related VTE are associated with a higher risk of recurrence as compared to a previous provoked VTE [39, 40].

Notably, around 50% of respondents indicated they would prescribe antepartum thromboprophylaxis for women with a history of VTE provoked by transient risk factors. This differs from the ASH guideline, which recommends clinical surveillance during pregnancy rather than prophylaxis in such cases. Additionally, there was a strong consensus for using antepartum pharmacological thromboprophylaxis from presentation in high risk inherited thrombophilia with a family history but no personal history of thrombosis.

Lastly, consistent with earlier surveys, our survey revealed significant variability in responses to scenarios involving postpartum clinical risk factors. The differing responses to risk factors with a modest effect on VTE—such as advanced maternal age, parity, obesity, and caesarean delivery—highlight the ongoing lack of consensus among existing guidelines. This underscores the need for further studies to better define the risks of postpartum thrombosis and establish appropriate thromboprophylaxis strategies, including the optimal duration of treatment. It is reported that maternal obesity is associated with an approximately three-fold increased risk of PE [41]. Given the global rise in maternal obesity, this is becoming an increasingly important risk factor. Obesity, especially when combined with other risk factors such as immobilization, has been shown to further elevate the risk of VTE.

Our results must be interpreted considering certain limitations. First, most of our respondents in this survey of South African clinical practice were practicing in the Gauteng province, which limits the generalizability of the results beyond the study area. This study intended to survey the national registry of the South African Society of Obstetricians and Gynaecologists (SASOG); however, permissions were not received. Additionally, most were employed in the public sector, as such the survey findings do not represent a comprehensive view of clinical practice across all sectors, particularly the private healthcare sector. Future research with a more diverse sample, including representation from all provinces and both the public and private healthcare sectors, is recommended. Second actual clinical practices may differ from the responses given in our study's scenarios. Future studies should focus on a retrospective record review to better capture real-world practices.

## 5. CONCLUSION

Despite these limitations, the survey findings indicated that most respondents routinely conducted VTE risk assessments during the antepartum and postpartum periods. However, there was considerable variation in practices. This variation is likely influenced by several factors. One key factor is the uncertainty around which guideline to follow, given the existence of multiple international and local guidelines with divergent recommendations. Another contributing factor is non-adherence to guidelines, which may stem from the complexity of VTE risk assessment scoring systems and busy clinical settings.

This can result in clinicians either modifying or forgoing formal assessments in favour of more simplified approaches, which may not align with recommended best practices. Future efforts should focus on simplifying risk assessment tools, incorporating a VTE clinical assessment in the maternity admissions record, clarifying guideline recommendations, and generating stronger evidence to guide clinical decision-making.

## 6. REFERENCES


1. Kearon C. Epidemiology of venous thromboembolism. Semin Vasc Med [Internet]. 2001 [cited 2023 Feb 21]; 1(1):7–26. Available from: http://www.thieme-connect.de/DOI/DOI?10.1055/s-2001-14668.

2. Heit JA, Kobbervig CE, James AH, Petterson TM, Bailey KR, Melton LJ. Trends in the incidence of venous thromboembolism during pregnancy or postpartum: a 30-year population-based study. Ann Intern Med [Internet]. 2005 [cited 2023 Feb 21]; 143(10):697. Available from: http://annals.org/article.aspx?doi=10.7326/0003-4819-143-10-200511150-00006.

3. Say L, Chou D, Gemmill A, et al. Global causes of maternal death: a WHO systematic analysis. Lancet Glob Health. 2014;2:e323-333. doi: 10.1016/S2214-109X(14)70227-X.

4. Abbasi N, Balayla J, Laporta DP, et al. Trends, risk factors and mortality among women with venous thromboembolism during labour and delivery: a population-based study of 8 million births. Arch Gynecol Obstet. 2014;289:275-284. doi: 10.1007/s00404-013-2923-8.

5. National Committee for the Confidential Enquires into Maternal Deaths (NCCEMD). Saving Mothers Annual Report for 2023 (16). South Africa: DOH Pretoria; 2024.

6. Kalaitzopoulos DR, Panagopoulos A, Samant S, Ghalib N, Kadillari J, Daniilidis A, et al. Management of venous thromboembolism in pregnancy. Thromb Res [Internet]. 2022 [cited 2023 Feb 21]; 211:106–13. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0049384822000408.

7. Middeldorp S, Naue C, Köhler C. Thrombophilia, thrombosis and thromboprophylaxis in pregnancy: for what and in whom? Hamostaseologie [Internet]. 2022 [cited 2023 Feb 20]; 42(1):54–64. Available from: http://www.thieme-connect.de/DOI/DOI?10.1055/a-1717-7663.

8. Kolettis D, Craigo S. Thromboprophylaxis in pregnancy. Obstet Gynecol Clin North Am [Internet]. 2018 [cited 2023 Feb 20]; 45(2):389–402. Available from: https://linkinghub.elsevier.com/retrieve/pii/S088985451830007X.

9. Bates SM, Greer IA, Middeldorp S, et al. VTE, thrombophilia, antithrombotic therapy, and pregnancy: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. Chest. 2012;141:e691S-736S. doi: 10.1378/chest.11-2300.

10. Raia-Barjat T, Edebiri O, Chauleur C. Venous thromboembolism risk score and pregnancy. Front Cardiovasc Med [Internet]. 2022 [cited 2023 Feb 21]; 9:863612. Available from: https://www.frontiersin.org/articles/10.3389/fcvm.2022.863612/full.

11. Pandor A, Daru J, Hunt BJ, Rooney G, Hamilton J, Clowes M, et al. Risk assessment models for venous thromboembolism in pregnancy and in the puerperium: a systematic review. BMJ Open [Internet]. 2022 [cited 2024 Nov 11]; 12(10):e065892. Available from: https://bmjopen.bmj.com/lookup/doi/10.1136/bmjopen-2022-065892.

12. Pabinger I, Grafenhofer H, Kaider A, Kyrle PA, Quehenberger P, Mannhalter C, et al. Risk of pregnancy-associated recurrent venous thromboembolism in women with a history of venous thrombosis. J Thromb Haemost [Internet]. 2005 [cited 2024 Nov 11]; 3(5):949–54. Available from: https://linkinghub.elsevier.com/retrieve/pii/S1538783622159933.

13. Croles FN, Nasserinejad K, Duvekot JJ, Kruip MJ, Meijer K, Leebeek FW. Pregnancy, thrombophilia, and the risk of a first venous thrombosis: systematic review and Bayesian meta-analysis. BMJ [Internet]. 2017 [cited 2024 Nov 11]; j4452. Available from: https://www.bmj.com/lookup/doi/10.1136/bmj.j4452.

14. Gerhardt A, Scharf RE, Greer IA, Zotz RB. Hereditary risk factors for thrombophilia and probability of venous thromboembolism during pregnancy and the puerperium. Blood [Internet]. 2016 [cited 2024 Nov 17]; 128(19):2343–9. Available from: https://ashpublications.org/blood/article/128/19/2343/35507/Hereditary-risk-factors-for-thrombophilia-and.

15. O'Shaughnessy F, Donnelly JC, Bennett K, Damkier P, Áinle FN, Cleary BJ. Prevalence of postpartum venous thromboembolism risk factors in an Irish urban obstetric population. J Thromb Haemost [Internet]. 2019 [cited 2023 Feb 22]; 17(11):1875–85. Available from: https://linkinghub.elsevier.com/retrieve/pii/S153878362202699X.

16. Galambosi PJ, Gissler M, Kaaja RJ, et al. Incidence and risk factors of venous thromboembolism during postpartum period: a population-based cohort-study. Acta Obstet Gynecol Scand. 2017;96:852-861. doi: 10.1111/aogs.13137.

17. Jacobsen AF, Skjeldestad FE, Sandset PM. Ante- and postnatal risk factors of venous thrombosis: a hospital-based case–control study. J Thromb Haemost [Internet]. 2008 [cited 2024 Nov 11]; 6(6):905–12. Available from: https://linkinghub.elsevier.com/retrieve/pii/S1538783622126826.

18. Ezeh E, Katabki A, Khawaja I. Iron deficiency anemia as a rare risk factor for recurrent pulmonary embolism and deep vein thrombosis. Cureus [Internet]. 2021 [cited 2024 Nov 30]. Available from: https://www.cureus.com/articles/53137-iron-deficiency-anemia-as-a-rare-risk-factor-for-recurrent-pulmonary-embolism-and-deep-vein-thrombosis.

19. Schapkaitz E, Libhaber E, Rhemtula H, Gerber A, Jacobson BF, Chauke L, et al. Pregnancy-related venous thromboembolism and HIV infection. Int J Gynecol Obstet [Internet]. 2021 [cited 2023 Feb 21]; 155(1):110–8. Available from: https://onlinelibrary.wiley.com/doi/10.1002/ijgo.13596.

20. Royal College of Obstetricians and Gynaecologists (RCOG) green-top guideline no 37a: Reducing the risk of thrombosis and embolism during pregnancy and the puerperium. London: RCOG [Internet]; 2015 [cited 2023 Feb 21]. Available from: https://www.rcog.org.uk/en/guidelines-research-services/guidelines/gtg37a.

21. American College of Obstetricians and Gynecologists (ACOG) practice bulletin no. 196: thromboembolism in pregnancy. Obstet Gynecol [Internet]. 2018 [cited 2023 Feb 21]; 132(1):e1–17. Available from: https://journals.lww.com/00006250-201807000-00054.

22. Bates SM, Rajasekhar A, Middeldorp S, McLintock C, Rodger MA, James AH, et al. American Society of Hematology 2018 guidelines for management of venous thromboembolism: venous thromboembolism in the context of pregnancy. Blood Adv [Internet]. 2018 [cited 2023 Feb 21]; 2(22):3317–59. Available from: https://ashpublications.org/bloodadvances/article/2/22/3317/16094/American-Society-of-Hematology-2018-guidelines-for.

23. Jacobson B, Rambiritch V, Paek D, Sayre T, Naidoo P, Shan J, et al. Safety and efficacy of enoxaparin in pregnancy: a systematic review and meta-analysis. Adv Ther [Internet]. 2020 [cited 2023 Feb 20]; 37(1):27–40. Available from: https://doi.org/10.1007/s12325-019-01124-z.

24. Cox S, Eslick R, McLintock C. Effectiveness and safety of thromboprophylaxis with enoxaparin for prevention of pregnancy-associated venous thromboembolism. J Thromb Haemost [Internet]. 2019 [cited 2024 Nov 17]; 17(7):1160–70. Available from: https://linkinghub.elsevier.com/retrieve/pii/S1538783622143564.

25. Lepercq J, Conard J, Borel-Derlon A, Darmon J, Boudignat O, Francoual C, et al. Venous thromboembolism during pregnancy: a retrospective study of enoxaparin safety in 624 pregnancies. BJOG [Internet]. 2001 [cited 2024 Nov 22]; 108(11):1134–40. Available from: https://obgyn.onlinelibrary.wiley.com/doi/10.1111/j.1471-0528.2003.00272.x.

26. Rajaratnam N, Patel JP, Roberts LN, Czuprynska J, Patel RK, Arya R. More on enoxaparin thromboprophylaxis in pregnancy: A review of 10 years' experience from King's College Hospital. J Thromb Haemost [Internet]. 2021 [cited 2024 Nov 22]; 19(1):304–8. Available from: https://linkinghub.elsevier.com/retrieve/pii/S1538783622004391.

27. Bistervels IM, Buchmuller A, Wiegers HMG, et al. Intermediate-dose versus low-dose low-molecular-weight heparin in pregnant and post-partum women with a history of venous thromboembolism (Highlow study): an open-label, multicentre, randomised, controlled trial. Lancet. 2022; doi: 10.1016/S0140-6736(22)02128-6 [published Online First: 20221028].

28. Naidoo P, Mothilal R, Snyman LC. Assessment and management of venous thrombo-embolism risk during pregnancy and the puerperium (Save): The South African cohort. S Afr Med J [Internet]. 2019 [cited 2023 Feb 20]; 109(3):186. Available from: http://www.samj.org.za/index.php/samj/article/view/12556.

29. Schapkaitz E. Recommendations for thromboprophylaxis in obstetrics and gynaecology-a sasog guideline. S Afr J OG [Internet]. 2018 [cited 2023 Feb 21]; 24(1):27. Available from: http://www.sajog.org.za/index.php/sajog/article/view/1312.

30. South African Society of Obstetricians and Gynaecologists (SASOG) BetterObs guideline: thromboprophylaxis in obstetrics 2.0. SASOG [Internet]. 2022 [cited 2023 April 20]. Available from: https://www.sasog.co.za/betterobs/.

31. O'Shaughnessy F, Donnelly JC, Cooley SM, Deering M, Raman A, Gannon G, et al. Thrombocalc: implementation and uptake of personalized postpartum venous thromboembolism risk assessment in a high-throughput obstetric environment. Acta Obstet Gynecol Scand [Internet]. 2017 [cited 2024 Nov 11]; 96(11):1382–90. Available from: https://obgyn.onlinelibrary.wiley.com/doi/10.1111/aogs.13206.

32. Blickstein D, Blickstein I. The risk of fetal loss associated with Warfarin anticoagulation. Int J Gynecol Obstet [Internet]. 2002 [cited 2024 Nov 22]; 78(3):221–5. Available from: http://doi.wiley.com/10.1016/S0020-7292%2802%2900186-8.

33. Wiesen MH, Blaich C, Muller C, et al. The direct factor Xa inhibitor rivaroxaban passes into human breast milk. Chest. 2016; 150(1):e1–4. doi: 10.1016/j.chest.2016.01.021.

34. Ho KM, Tan JA. Stratified meta-analysis of intermittent pneumatic compression of the lower limbs to prevent venous thromboembolism in hospitalized patients. Circulation. 2013; 128(9):1003–20. doi: 10.1161/CIRCULATIONAHA.113.002690.

35. Cohen AJ, Boggio L, Billett HH, DeSancho MT, Gaddh M, Kouides P, et al. North American Physician Practice Patterns in the Management of Anticoagulation in Pregnancy. J Womens Health (Larchmt). 2021 [cited 2024 Nov 23];30(6):829-36. Available from: https://www.liebertpub.com/doi/10.1089/jwh.2020.8385.

36. Voke J, Keidan J, Pavord S, et al. The management of antenatal venous thromboembolism in the UK and Ireland: a prospective multicentre observational survey. Br J Haematol. 2007; 139(4):545–58. doi: 10.1111/j.1365-2141.2007.06826.x.

37. Arachchillage DJ, Platton S, Hickey K, Chu J, Pickering M, Sommerville P, et al. Guidelines on the investigation and management of antiphospholipid syndrome. Br J Haematol. 2024; 205(3): 855-80. Available from: https://onlinelibrary.wiley.com/doi/10.1111/bjh,19635

38. Cervera R, Serrano R, Pons-Estel GJ, et al. Morbidity and mortality in the antiphospholipid syndrome during a 10-year period: a multicentre prospective study of 1000 patients. Ann Rheum Dis. 2015; 74(6):1011–8. doi: 10.1136/annrheumdis-2013-204838.

39. Barillari G, Londero AP, Brenner B, et al. Recurrence of venous thromboembolism in patients with recent gestational deep vein thrombosis or pulmonary embolism: Findings from the RIETE Registry. Eur J Intern Med. 2016; 32:53–9. doi: 10.1016/j.ejim.2016.02.013.

40. Martinelli I, De Stefano V, Taioli E, et al. Inherited thrombophilia and first venous thromboembolism during pregnancy and puerperium. Thromb Haemost. 2002; 87(6):791–5.

41. Navti OB, Pavord S. Venous thromboembolism in pregnant obese individuals. Best Pract Res Clin Obstet Gynaecol [Internet]. 2024 [cited 2024 Nov 23]; 94:102471. Available from: https://linkinghub.elsevier.com/retrieve/pii/S1521693424000178.

**Supplemental table**

Table 1S Univariate logistic regression analysis of performance of VTE risk assessment

| **Variable** | **OR** | **95% CI** | **p value** |
|---|---|---|---|
| Rank-specialist | 2.75 | 0.33 -22.92 | 0.24 |
| Clinical experience->2 years | 2.32 | 0.78-6.93 | 0.133 |
| Number of VTE patients per practice->5 | | | |
| Key: CI, confidence interval, OR, odds ratio | | | |

# Title Page

Article Title: Antepartum and postpartum thromboprophylaxis: A survey of current practices in South Africa and comparison with recommendations.

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Ethical approval: M230647 MED23-04-237

# Appendices

Appendix A: Plagiarism declaration




**PLAGIARISM DECLARATION TO BE SIGNED BY ALL HIGHER DEGREE STUDENTS**

I Zwidorulwa Rabali (Student number: 364302) am a student registered for the degree of

Master of Clinical Medicine in Obstetrics and Hynaecology in the academic year 2024.

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- I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is wrong.
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- I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my own unaided work or that I have failed to acknowledge the source of the ideas or words in my writing.
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R14/49 Dr Zwidorulwa Rabali

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**CLEARANCE CERTIFICATE NO.M230647 MED23-04-237**

| | |
|---|---|
| **NAME (Principal Investigator)** | Dr Zwidorulwa Rabali |
| **DEPARTMENT:** | Faculty of Health Sciences<br>Obstetrics and Gynaecology |
| **DEGREE:** | Master of Medicine in Obstetrics and Gynaecology |
| **PROJECT TITLE:** | *Antepartum and postpartum thromboprophylaxis:A survey of current practices in South Africa and comparison with recommendations* |
| DATE CONSIDERED: | 30/06/2023 |
| **DECISION:** | Approved unconditionally |
| **CONDITIONS :** | If contact information regarding student study participants is required,please contact the Registrar's office - |
| **NOTE:** | Nicoleen.Potgieter@wits.ac.za |
| **SUPERVISOR:** | Dr H.Rhemtula and Prof E.Schapkaitz |
| **APPROVED BY** | Mrs Matty van Niekerk,Chairperson,HREC (Medical) |
| | 02/11/2023 **EXPIRY DATE:** 01/11/2028 |

DATE OF APPROVAL:

This clearance **certificate is valid for 5 years from date of approval.Extension may be applied for.**

**DECLARATION OF INVESTIGATORS**

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authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions.Should any departure be contemplated,from the research protocol as approved. I/we undertake to resubmit the application to the Committee.I **aqree to submit a yearly progress report.** The date for annual re-certification will be one year a**fter the date of convened meeting wh**ere the study was initially reviewed.In this case,the study was initially **reviewed in June and will th**erefore

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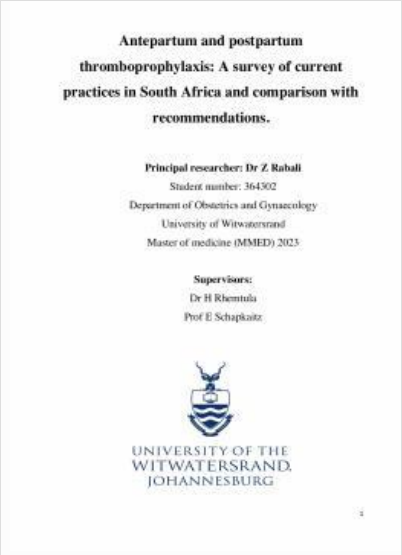
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**Antepartum and postpartum thromboprophylaxis: A survey of current practices in South Africa and comparison with recommendations.**

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University of Witwatersrand
Master of medicine (MMED) 2023

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Abstract

Background:

Thromboprophylaxis guidelines are critical for VTE prevention, yet the optimal implementation of risk-appropriate thromboprophylaxis during pregnancy and postpartum remains uncertain.

Methods:

An electronic survey was distributed to 120 medical practitioners at the University of the Witwatersrand to assess thromboprophylaxis practices in pregnancy and postpartum.

Results:

Seventy (58%) responses were received, and 64 (55%) complete responses were analysed. Most respondents practiced in the public sector (83%) and followed clinical guidelines, with 50% adhering to the RCOG guideline. Low molecular weight heparin was widely prescribed during both antepartum and postpartum periods (94%), primarily at a fixed dose (53%). Barriers included lack of mechanical prophylaxis (30%), perceived complications of thromboprophylaxis (28%), and cost (22%). Case-based assessments revealed significant variation in practices due to complex risk assessment scoring systems and disparate guideline recommendations.

Conclusion:

Despite adherence to guidelines, variation in thromboprophylaxis practices highlights the need for evidence-based consensus recommendations to enhance clinical guidance.

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