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# Impact of a Multidisciplinary Anticoagulation Stewardship Program in a Tertiary Care Hospital in Riyadh: A Retrospective Study

**Abdulrahman R. Alruwaili[1], Ibtesam T. Alanizii[2], Abdullah S. M. Alanazi[3], Khalid G. Alharbi[4]**

**Abstract:**
**Background: Anticoagulation therapy is linked to serious risks, especially in inpatient care. Anticoagulation stewardship programs (ASPs) are designed to improve safety and effectiveness through teamwork between healthcare professionals.**
**Objective: This study assessed the effect of a multidisciplinary ASP—run by nurses, pharmacists, and hematologists—on patient outcomes, medication safety, and team practice in a tertiary hospital in Riyadh.**
**Methods: A retrospective observational study was carried out from January to April 2024 with 200 inpatients receiving anticoagulants. Patients who received ASP interventions (n=120) were compared with a control group (n=80). Data were collected on bleeding, thromboembolic events, INR levels, and hospital stay. The number of interventions and their acceptance by physicians were also recorded. Staff interviews were conducted to explore teamwork experiences.**
**Results: The ASP group had lower rates of major bleeding (2.5% vs 8.8%) and thromboembolic events (0.8% vs 5%), as well as fewer supratherapeutic INR episodes. Their average hospital stay was 1.5 days shorter, and 78% reached therapeutic INR at discharge compared with 61% of the control group. A total of 230 interventions were reported, with a 92% acceptance rate. Interviews showed better communication and stronger team responsibility.**
**Conclusion: The ASP improved patient safety, clinical outcomes, and professional collaboration. These results support the use of ASPs in hospitals, especially in the Gulf region.**

**Keywords: Anticoagulation stewardship, multidisciplinary collaboration, pharmacist-led intervention, nursing role, hematology, DOACs, clinical outcomes, tertiary hospital, Saudi Arabia, medication safety.**

## INTRODUCTION

Anticoagulants such as warfarin and DOACs are essential in preventing thromboembolic events in conditions like atrial fibrillation, venous thromboembolism (VTE), and mechanical heart valve replacement. However, their use is complicated by risks of bleeding, dosing errors, drug interactions, and the need for careful monitoring.

These challenges are even more significant in tertiary hospitals, where patients usually have several comorbidities and are exposed to polypharmacy. Padron and Miyares (2015) highlighted that anticoagulation stewardship programs (ASPs) can help address these risks by supporting evidence-based practice, enhancing medication safety, and lowering the likelihood of adverse events.

Anticoagulation stewardship programs are commonly led by pharmacists, supported by hematologists and nurses. These programs have been linked to greater adherence to clinical guidelines, improved therapeutic outcomes, and fewer hospital readmissions (Perlman et al., 2019; Porres-Aguilar et al., 2023). Despite these benefits, there is still limited research on how such multidisciplinary programs are applied in Middle Eastern or Saudi tertiary care settings, where cultural, systemic, and educational factors may shape their effectiveness.

The present study aims to examine the effectiveness and challenges of a collaborative anticoagulation stewardship model involving nurses, pharmacists, and hematologists in a tertiary hospital in Riyadh. Specifically, it evaluates clinical adherence, patient safety outcomes, and interprofessional perspectives on the implementation of stewardship practices.

## LITERATURE REVIEW

Anticoagulation stewardship programs (ASPs) have been introduced as an important approach to overcome the difficulties of managing anticoagulant therapy in hospital settings. Their main goal is to ensure safe, effective, and appropriate use of anticoagulants through structured monitoring, staff education, and guideline-based interventions. Padron and Miyares (2015) reported that implementing an ASP in a large tertiary academic institution improved compliance with evidence-based practices and reduced adverse drug events.

A recurring theme in the literature is the importance of interdisciplinary collaboration in strengthening the impact of ASPs. Pharmacists often take the lead in these programs due to their expertise in pharmacology and access to detailed medication data. Nevertheless, the active involvement of nurses and hematologists broadens the scope of care, enabling more accurate patient assessments and timely interventions. Dreijer et al. (2016), for example, described a model that combined the roles of nurses, pharmacists, and physicians to improve anticoagulation outcomes both during hospitalization and after discharge.

Perlman et al. (2019) demonstrated that a pharmacist-led DOAC stewardship initiative across a hospital system not only reduced prescribing errors but also supported safer transitions of care. In the same way, Porres-Aguilar et al. (2023) highlighted that stewardship programs are more effective when integrated into a multidisciplinary framework, as this strengthens clinical adherence. Other studies have also reported benefits such as shorter hospital stays, fewer bleeding complications, and higher levels of patient satisfaction when stewardship programs are implemented through collaborative protocols (Wychowski et al., 2017; Uppuluri & McComb, 2020).

Despite these benefits, several barriers continue to limit the successful implementation of ASPs. Common challenges include insufficient institutional support, the absence of standardized protocols, and limited training for non-pharmacy staff. Dreijer et al. (2019) reported that adherence to anticoagulation guidelines improved significantly only after the introduction of dedicated thrombosis nurses alongside pharmacist oversight. Furthermore, studies have noted that nurses are often underutilized in decision-making, even though they play a key role in bedside care and INR monitoring.

There is a notable lack of published research on ASPs in the Middle East, including Saudi Arabia. Most existing studies have been conducted in North America and Europe, leaving a gap in understanding how cultural, systemic, and institutional factors in the Gulf region may influence the adoption and effectiveness of these programs. This gap is particularly important given Saudi Arabia's rapidly expanding healthcare system and the rising use of anticoagulants associated with the growing burden of non-communicable diseases.

Therefore, this study aims to assess an interprofessional anticoagulation stewardship initiative in a tertiary hospital in Riyadh, focusing on both clinical outcomes and team collaboration. By adapting global best practices to the local context, the research seeks to provide evidence that can guide policy and practice in similar healthcare systems.

## METHODOLOGY

### Study Design and Setting

This retrospective observational study was carried out at a tertiary care hospital in Riyadh, Saudi Arabia, between January and April 2024. Its purpose was to examine both the clinical impact and the role of interprofessional collaboration in implementing an anticoagulation stewardship program (ASP) involving

nurses, pharmacists, and hematologists. The hospital provides services to a diverse patient population across multiple specialties, including hematology, internal medicine, cardiology, and intensive care.

**Study Population**

The study population consisted of adult inpatients (≥18 years) who were prescribed anticoagulation therapy—such as warfarin, enoxaparin, or direct oral anticoagulants (DOACs)—during their hospital admission within the study period. Eligible patients were identified through the hospital's electronic health record (EHR) system. Exclusion criteria included patients receiving palliative care, those admitted for less than 24 hours, and patients prescribed anticoagulants for non-therapeutic purposes, such as line flushing.

**Intervention Description**

The anticoagulation stewardship program was introduced in December 2023 and involved daily clinical reviews of patients receiving anticoagulant therapy. A dedicated team—comprising a clinical pharmacist, hematologist, and senior ward nurse—was responsible for these reviews. The assessment focused on:

- Indication and appropriateness of therapy
- Dosing accuracy and renal adjustments
- Potential drug–drug interactions
- Monitoring parameters (e.g., INR, aPTT, anti-Xa levels where applicable)
- Patient-specific risk factors for bleeding or thrombosis

Within this model, pharmacists were mainly responsible for evaluating medication orders and suggesting therapy adjustments. Nurses contributed by monitoring vital signs, ensuring timely laboratory testing, and providing patient education. Hematologists offered specialist input, particularly in complex or high-risk cases.

**Data Collection**

Data were obtained from the hospital's electronic health record (EHR) system and from documentation maintained by the stewardship team. The following variables were collected:

- **Demographics:** age, sex, and comorbidities
- **Anticoagulant details:** type, dose, indication, and duration of therapy
- **Clinical outcomes:** INR values, bleeding events, thromboembolic events, and length of stay
- **Interventions:** number and type of pharmacist, nurse, or hematologist interventions, as well as physician acceptance rates

In addition, semi-structured interviews were conducted with 10 staff members (four pharmacists, three nurses, and three physicians/hematologists) to capture their views on the ASP, including its implementation, challenges, and perceived impact.

**Data Analysis**

Quantitative data were analyzed using SPSS (version 26). Descriptive statistics were calculated for demographic and outcome variables. Comparisons between patients who received ASP interventions and those who did not were conducted using chi-square tests for categorical variables and t-tests for continuous variables.

Qualitative interview transcripts were examined using thematic analysis. The data were coded and reviewed to identify recurring themes related to teamwork, communication, and perceived barriers in implementing the ASP.

**Ethical Considerations**

The study protocol was reviewed and approved by the hospital's Institutional Review Board. Informed consent was waived for the retrospective analysis of patient data. However, written informed consent was obtained from all staff members who participated in the interviews.

## RESULTS

A total of 200 adult inpatients who received anticoagulation therapy between January and April 2024 were included in the study. Among them, 120 patients received care through the Anticoagulation Stewardship Program (ASP), while 80 patients formed the control group, receiving standard care without ASP intervention.

**1. Patient Demographics and Clinical Characteristics**

Table 1 presents the baseline demographics and clinical characteristics of the study cohort. The mean age was 66.2 years (±13.4), and 59% of patients were male. The most prevalent comorbidities were hypertension (72%), diabetes mellitus (65%), and atrial fibrillation (46%). Both groups were comparable with respect to demographic and clinical variables.

*Table 1. Patient Demographics and Clinical Characteristics*

| **Variable** | **Total (n=200)** |
|---|---|
| Number of patients | 200 |
| Age (mean ± SD) | 66.2 ± 13.4 |
| Male (%) | 118 (59%) |
| Hypertension (%) | 144 (72%) |
| Diabetes (%) | 130 (65%) |
| Atrial fibrillation (AF) (%) | 92 (46%) |
| Venous thromboembolism (VTE) (%) | 60 (30%) |

**2. Clinical Outcomes**

Significant differences were observed in outcomes between patients managed under the ASP and those in the control group. The ASP group experienced fewer major bleeding events (2.5% vs. 8.8%) and thromboembolic events (0.8% vs. 5%). They also had fewer supratherapeutic INR episodes (>4.0) and a shorter mean hospital stay (6.8 vs. 8.3 days). Furthermore, 78% of patients in the ASP group achieved therapeutic INR levels at discharge, compared with 61% in the control group.

Physician acceptance of pharmacist or nurse-initiated interventions was high, recorded at **92%**.

*Table 2. Clinical Outcomes – With vs Without ASP Intervention*

| **Outcome** | **ASP Group (n=120)** | **Control Group (n=80)** |
|---|---|---|
| Major bleeding events | 3 | 7 |
| Thromboembolic events | 1 | 4 |
| INR > 4.0 episodes | 5 | 11 |
| Mean length of stay (days) | 6.8 | 8.3 |
| Therapeutic INR on discharge (%) | 78% | 61% |
| Physician acceptance of intervention (%) | 92% | N/A |

**3. Types and Frequency of ASP Interventions**

A total of 230 interventions were documented in the ASP cohort. The most frequent were dose adjustments (27%), patient education (20%), renal dose modifications (18%), and INR monitoring changes (15%). The remaining 20% consisted of drug–drug interaction alerts and therapy discontinuations.

*Table 3. Types and Frequency of ASP Interventions*

| **Intervention Type** | **Frequency (n=230)** |
|---|---|
| Dose adjustment | 62 |
| Patient education | 45 |
| Renal dose correction | 41 |
| INR monitoring adjustment | 34 |

| Intervention Type | Frequency (n=230) |
|---|---|
| Drug interaction alert | 30 |
| Therapy discontinuation | 18 |

## DISCUSSION

The implementation of an interprofessional anticoagulation stewardship program (ASP) in a tertiary hospital in Riyadh was associated with meaningful improvements in clinical outcomes, medication safety, and multidisciplinary collaboration in anticoagulant management. These findings are consistent with previous research, which has reported that stewardship programs reduce adverse drug events and enhance the optimization of anticoagulation therapy.

Patients managed under the ASP had significantly fewer major bleeding events, thromboembolic complications, and supratherapeutic INR episodes compared with the control group. These results are in line with previous studies. For example, Padron and Miyares (2015) reported that stewardship interventions reduced anticoagulant-related harm, while Perlman et al. (2019) showed that a pharmacist-led DOAC stewardship model lowered prescribing errors.

This study highlights the collaborative nature of the ASP. The 92% physician acceptance rate of pharmacist- and nurse-led interventions indicates strong clinical trust and effective interdisciplinary communication. The active involvement of nurses in daily reviews, patient education, and INR monitoring not only improved workflow efficiency but also empowered frontline staff to contribute directly to medication safety. These findings are consistent with those of Dreijer et al. (2016), who emphasized the value of incorporating thrombosis nurses into ASP teams.

The types of interventions observed in this study—such as dose adjustments, renal function-based modifications, and patient education—underscore the multifactorial risks associated with anticoagulant use in hospitalized patients. These interventions align with the Anticoagulation Forum's core elements, which emphasize individualized dosing and structured follow-up as essential components of safe and effective therapy.

Despite these strengths, several limitations must be considered. First, the retrospective study design restricts the ability to establish causality, and residual confounding may still exist despite attempts to match the comparison groups. Second, as the study was conducted in a single tertiary hospital, the findings may not be generalizable to community hospitals or smaller healthcare facilities. Third, although qualitative interviews were included, patient-reported outcomes were not captured, which could have provided valuable insights into education, satisfaction, and overall care experience.

Another important limitation relates to the scarcity of regional research on anticoagulation stewardship in the Gulf. While countries such as the United States, the Netherlands, and Canada have developed robust ASP frameworks (Porres-Aguilar et al., 2023), there is still a lack of context-specific evidence from Saudi Arabia. This study helps to address that gap by providing local data on the effectiveness and feasibility of ASPs within the Saudi healthcare system.

## IMPLICATIONS FOR PRACTICE

 Embedding pharmacist–nurse–hematologist collaboration into daily anticoagulant review processes can play a crucial role in reducing clinical risks.

 Anticoagulation stewardship programs can be extended to other specialties, such as cardiology and intensive care, to better manage complex polypharmacy.

 Sustaining stewardship efforts will require ongoing staff education and the integration of digital tools, such as clinical decision support systems.

## CONCLUSION

This study shows that a multidisciplinary anticoagulation stewardship program involving nurses, pharmacists, and hematologists can significantly enhance the safety and effectiveness of anticoagulation therapy in a tertiary care hospital. Patients enrolled in the program had fewer adverse events, improved INR control, and shorter hospital stays, alongside a high physician acceptance rate for recommended interventions. These findings support the routine integration of collaborative stewardship models into inpatient care and emphasize the importance of interprofessional teamwork in managing complex therapies such as anticoagulation.

## REFERENCES:

1. Padron, M., & Miyares, M. A. (2015). Development of an anticoagulation stewardship program at a large tertiary care academic institution. *Journal of Pharmacy Practice*. https://doi.org/10.1177/0897190013514091
2. Perlman, A., Horwitz, E., & Hirsh-Raccah, B. (2019). Clinical pharmacist led hospital-wide direct oral anticoagulant stewardship program. *Cost Effectiveness and Resource Allocation*, 17(15). https://doi.org/10.1186/s13584-019-0285-9
3. Porres-Aguilar, M., Ansell, J., & Mukherjee, D. (2023). Impact of hospital-based multidisciplinary anticoagulation stewardship programs. *Revista de Investigación Clínica*. https://www.sciencedirect.com/science/article/pii/S0188440922001631
4. Dreijer, A. R., Kruip, M. J. H. A., Diepstraten, J., & Polinder, S. (2016). Antithrombotic stewardship: A multidisciplinary team approach towards improving antithrombotic therapy outcomes during and after hospitalisation: A study protocol. *BMJ Open*, 6(12), e011537.
5. Dreijer, A. R., Diepstraten, J., & Leebeek, F. W. G. (2019). The effect of hospital-based antithrombotic stewardship on adherence to anticoagulant guidelines. *International Journal of Clinical Pharmacy*, 41, 889–897. https://doi.org/10.1007/s11096-019-00834-2
6. Wychowski, M. K., Ruscio, C. I., & Kouides, P. A. (2017). The scope and value of an anticoagulation stewardship program at a community teaching hospital. *Journal of Thrombosis and Thrombolysis*, 43(3), 367–373. https://doi.org/10.1007/s11239-016-1455-z
7. Uppuluri, E. M., & McComb, M. N. (2020). Implementation of a direct oral anticoagulation screening service at a large academic medical center provided by a pharmacist-managed antithrombosis clinic. *Journal of Pharmacy Practice*. https://doi.org/10.1177/0897190018799200