

Intermittent pneumatic compression can reduce the burden of venous thromboembolism in India

Dr. Anil Arora
Director & Unit Head,
Dept. of Orthopaedics,
Max Super Speciality Hospital,
Patparganj, New Delhi

Dr. Nitin Gupta
Consultant,
Max Super Speciality Hospital,
Patparganj, New Delhi

Dr. Jason Davis
Health Economist,
Coreva Scientific,
Freiburg, Germany

Abstract

- Introduction: In contrast to earlier studies, recent work has shown that rates of venous thromboembolism (VTE) in India are comparable to those in Western cultures. Orthopaedic procedures increase the risk of VTE. In this study, a computer model is used to estimate the health and economic impact of options for VTE prophylaxis, including heparin, Intermittent Pneumatic Compression (IPC) and no prophylaxis.
- Methods: A published model for VTE prophylaxis was adapted using India-specific incidence and prevalence rates for VTE and bleeding events in the orthopaedic population. Risk factors for VTE were age, gender, smoking status, surgery duration, and body mass index. Results are for 100,000 patients, 35% having total hip and 65% total knee arthroplasty. In 2016, clinical survey determined the cost of prophylaxis and adverse events in Indian Rupees (INR).
- Results: VTE and prophylaxis are estimated to cost healthcare providers INR 2.9 billion per 100,000 surgeries. Switching 1% of patients from low-molecular-weight heparin (LMWH) to IPC saved INR 7.7 million for the 1,000 switched patients. For a switch from no prophylaxis to IPC this saving is INR 18.7 million. Savings were driven by improved patient safety, with fewer anticipated deep vein thromboses and pulmonary embolisms (-111 and -59, respectively) compared to no prophylaxis, and fewer minor (-88) and major (-5) bleeds relative to LMWH, based on current data and literature.
- Conclusions: VTE prophylaxis following arthroplasty in India is likely to be cost saving compared with no prophylaxis. IPC compared to LMWH reduces bleeding events leading to lower costs of care.

Abbreviations: DVT, deep vein thrombosis; INR, Indian Rupees; IPC, intermittent pneumatic compression; LMWH, low molecular weight heparin; NOAC, novel oral anticoagulants; PE, pulmonary embolism; THA, total hip arthroplasty; TKA, total knee arthroplasty

Introduction

The choice of which device or treatment method to use for venous thromboembolism (VTE) prophylaxis in orthopaedic patients can have a great impact on the costs incurred. In the absence of large trials to quantify real-world data, health economics can be used to analyse the clinical and economic impact of different treatment options. Modelling is one means of estimating their impact on budgets, based on citable clinical and economic data. Factors such as the risk of developing adverse events (dependent on patient characteristics), and the costs of those events if they occur are brought together to estimate a total cost of care for a specified patient population.

Orthopaedic surgery is one example of treatment where specific choices made can have a large impact on patient safety and overall costs. Previous studies in the Indian setting had suggested rates of VTE were much lower than in Western cultures¹, thus arguing against prophylaxis, but recent work has shown that rates are comparable in the two settings with appropriate monitoring². Prophylaxis is therefore indicated for the prevention of VTE after orthopaedic procedures².

Objective

To estimate the potential impact on outcomes after total hip or total knee arthroplasty (THA and TKA, respectively) by increasing the proportion of patients receiving intermittent pneumatic compression (IPC).

Methods

- A semi-Markov model for VTE and adverse events was previously developed in the US setting³ and adapted for the Indian setting
- Values were derived from published literature for incidence and prevalence rates for bleeding events in the orthopaedic patient population
- Model includes risk factors for VTE:
 - Age, Gender, Smoking status, Length of surgery, Body Mass Index (BMI)
- Base population profile²: 45.7% male, mean age 57.4, BMI 27.9 kg/m²
- Costs were included from clinician and hospital survey in 2016 (Indian Rupees, ₹)
- Sensitivity analyses were performed (1,000 model runs) varying inputs within uncertainty range (95% confidence intervals) and the results recalculated
- The base case scenario investigates the budget and safety impact of switching 1% of these 100,000 patients from no prophylaxis to IPC and from LMWH to IPC

What is the impact of changing thromboprophylaxis strategy after orthopaedic surgery?

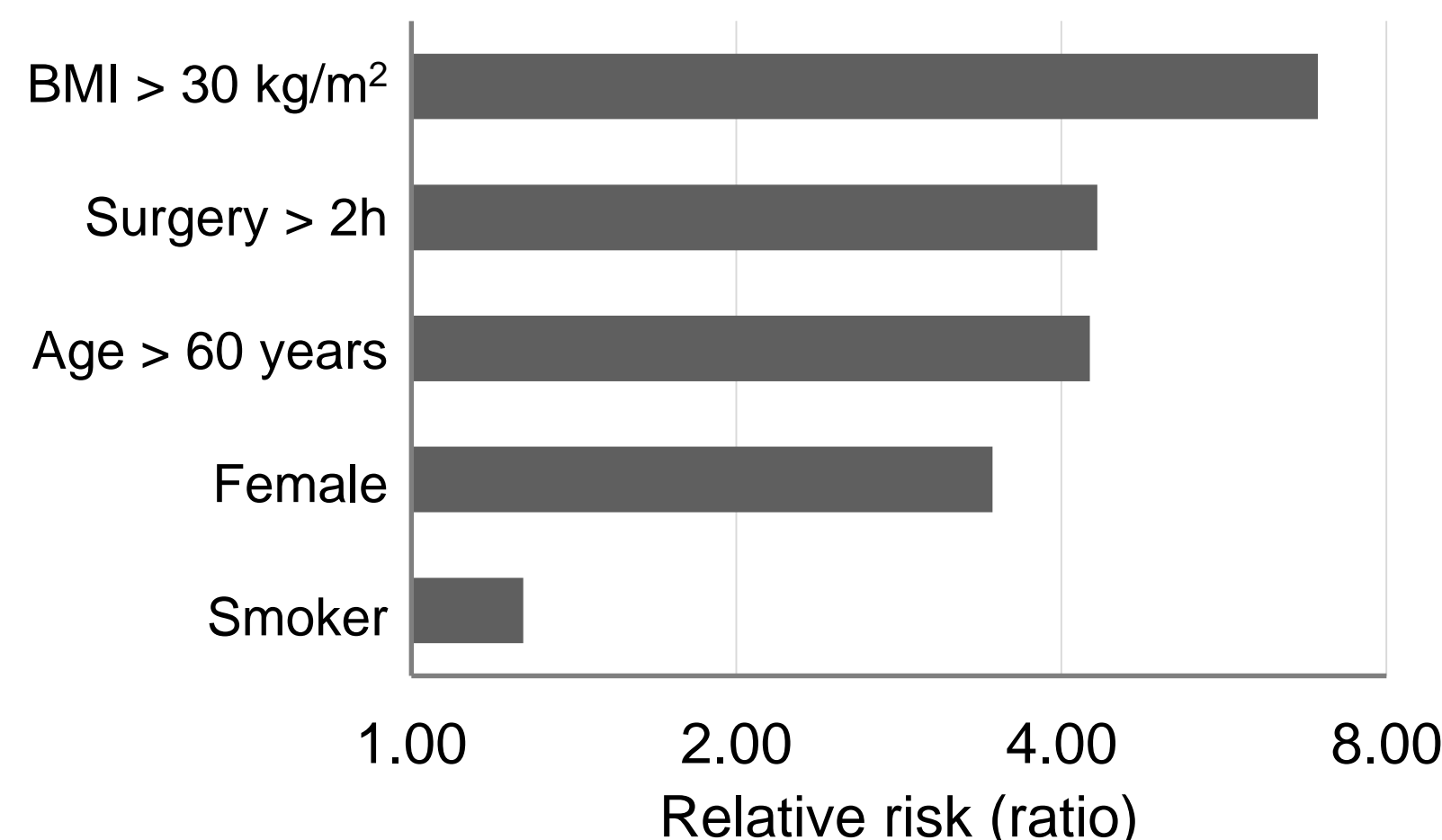
1. In a budget impact model, cost of care for VTE related to orthopaedic surgery is considerable
2. Fewer bleeding events switching from low molecular weight heparin to intermittent pneumatic compression
3. Reduced costs due to venous thromboembolism-related adverse events switching from no prophylaxis to intermittent pneumatic compression

Intermittent pneumatic compression is a safe, potentially cost-saving method of prophylaxis

Model setup

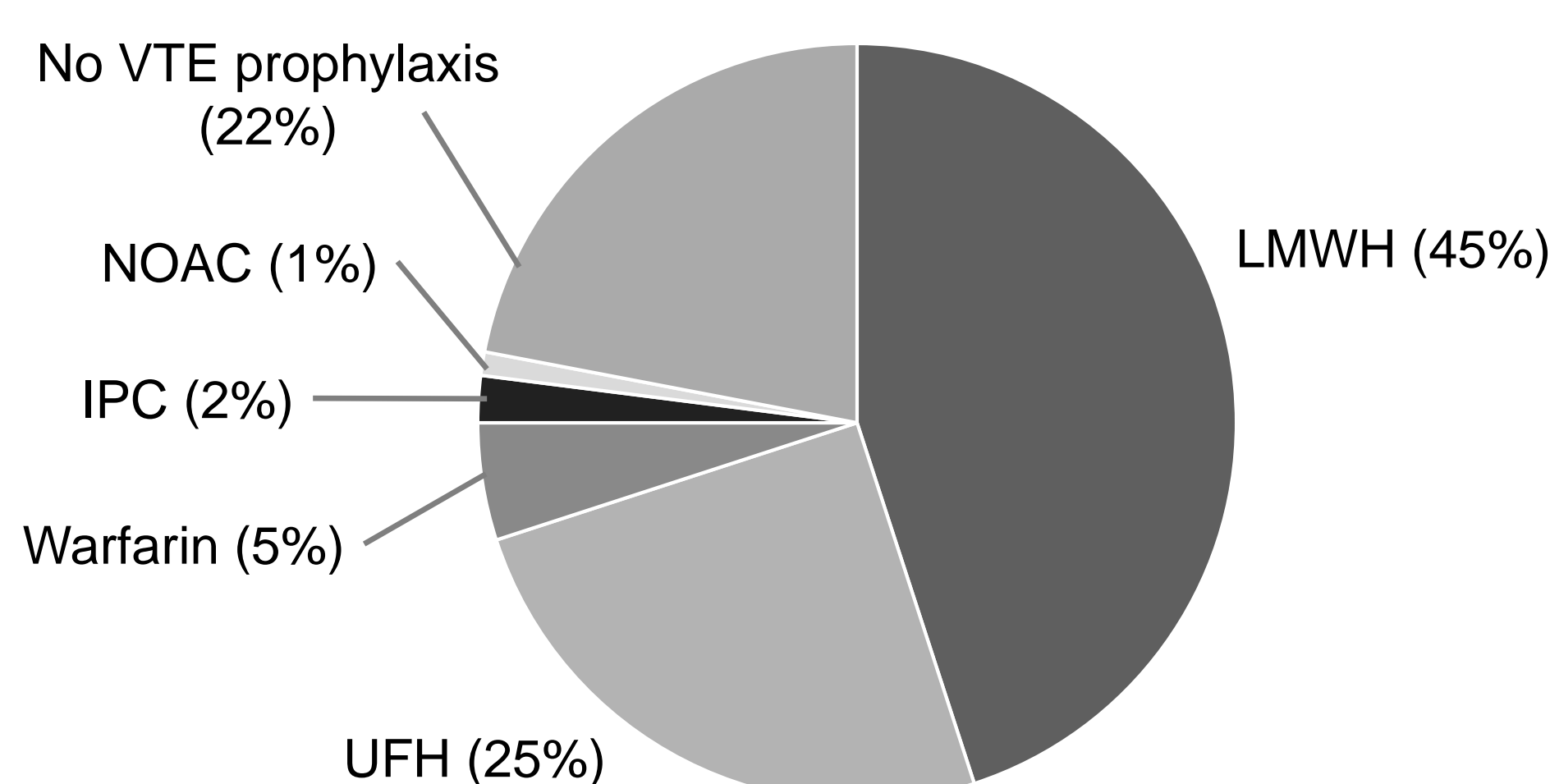
- The risk factors for VTE development in the Indian setting¹ (Figure 1) suggest the risk in the patient population of developing VTE
- A starting market share of treatment patterns (Figure 2) is established from clinician and hospital survey
- A hypothetical population consisting of 100,000 patients (35,000 total hip 65,000 total knee arthroplasty) was considered

Figure 1: Risk factors associated with VTE in the Indian setting



Relative risk of development of VTE for various factors are shown¹

Figure 2: Market share of orthopaedic surgery thromboprophylaxis strategy

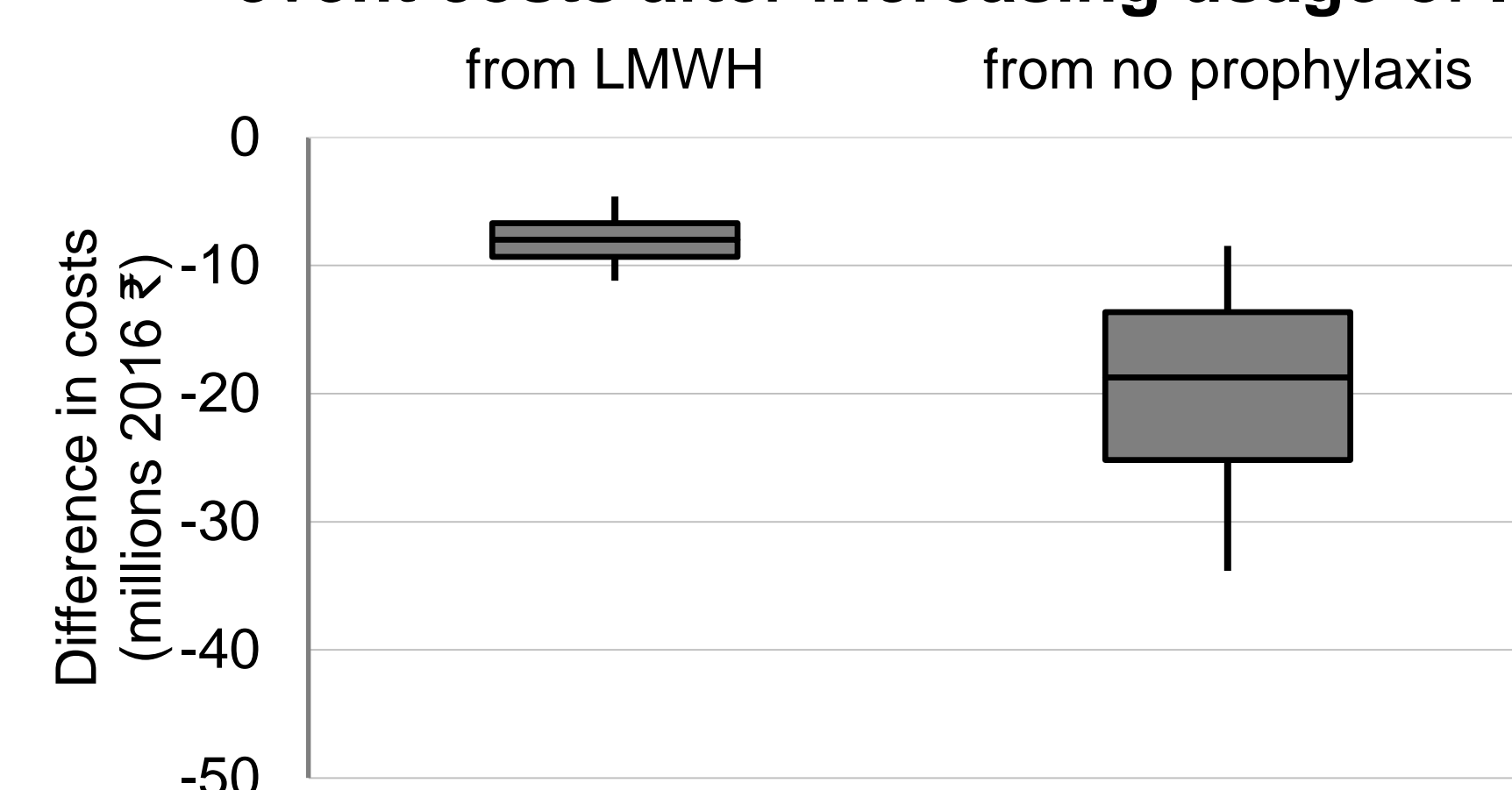


Prophylaxis patterns (including "none") for VTE prevention in patients undergoing orthopaedic procedures. IPC, intermittent pneumatic compression; NOAC, novel oral anticoagulants (rivaroxaban, apixaban); UFH, unfractionated heparin

Results

- Switching 1% of patients in the test population impacts adverse event rates and costs due to adverse events
- Changing from no prophylaxis or LMWH to IPC results in cost savings (Figure 3)

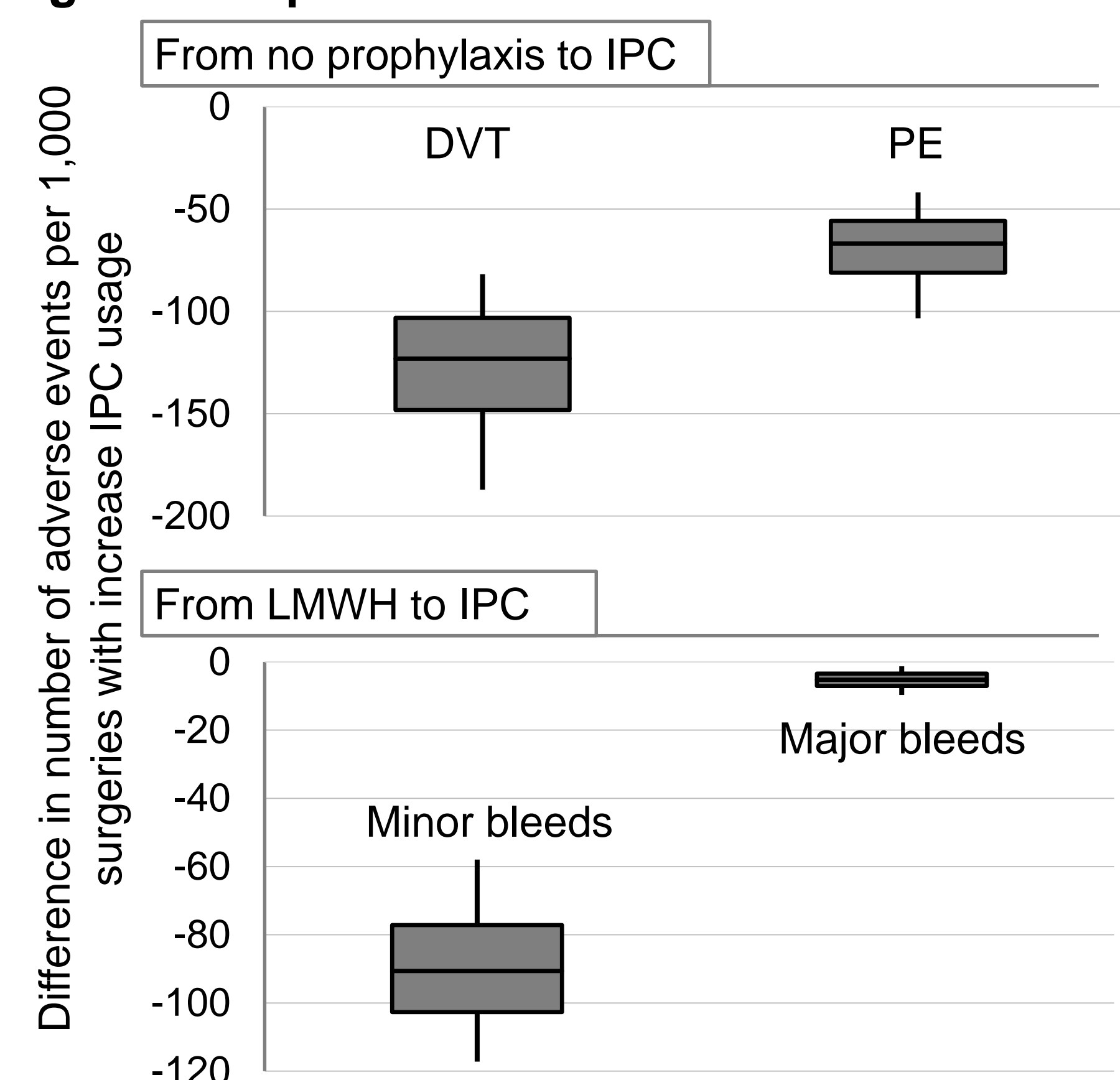
Figure 3: Impact on prophylaxis and adverse event costs after increasing usage of IPC



Sensitivity analysis results show the range (95% credibility interval) of cost savings achieved per 1,000 surgeries changing 1% of patients from LMWH or from no prophylaxis to IPC.

- IPC results in fewer VTE events compared to no prophylaxis while decreasing the number of bleeding events relative to LMWH (Figure 4)

Figure 4: Impact on adverse events after THA/TKA



Sensitivity analysis results of the safety profile reveal fewer VTE events increasing 1% of patients to IPC from no prophylaxis (top) and fewer bleeding events if patients are switched from LMWH (bottom). DVT, deep vein thrombosis; PE, pulmonary embolism

Conclusions

- Patient safety in the Indian setting is improved by fewer VTE events with IPC after surgery
- Increased usage of intermittent pneumatic compression may yield considerable savings by reducing rates of costly adverse events relative to no prophylaxis or LMWH