Early Ambulation Reduces the Risk of Venous Thromboembolism After Total Knee Replacement

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Agenda

Introduction/Background

Methods

Results

Discussion

Introduction/Background

Study Objectives

Although widely recognized as a potentially preventable complication, symptomatic VTE is a frequent complication following TKR.

This case-control study was performed to analyze the association between acute symptomatic VTE and potential risk factors:

- Patient factors
  - Age
  - Gender
  - BMI
  - Type of TKR (unilateral vs. simultaneous bilateral)
- Guideline-based interventions
  - Delivery of pharmacologic prophylaxis
  - Delivery of mechanical prophylaxis
  - Duration of immobility

The Extent of the Problem

Acute VTE is diagnosed after TKR in approximately 2% of patients who receive recommended pharmacologic prophylaxis

- TKR is the principal condition used to study the effectiveness of new anticoagulants

VTE leads to increased LOS and higher costs, and may lead to complications such as fatal PE, post-thrombotic syndrome, and anticoagulant-related bleeding.

Blanchard J, Meuwly JY, Leyvraz PF, et al. Prevention of deep vein thrombosis after total knee replacement: Randomized comparison between a low-molecular-weight heparin (nadroparin) and mechanical prophylaxis with a foot-pump system. *J Bone Joint Surg Br.* 1999;81(4):654-659.

Januel JM, Chen G, Ruffieux C, et al. Symptomatic in-hospital deep vein thrombosis and pulmonary embolism following hip and knee arthroplasty among patients receiving recommended prophylaxis: a systematic review. *JAMA.* 2012; 307(3):294-303.

Evidence-Based Clinical Practice Guidelines

Guideline	Accepted VTE Prophylaxis	Defined Risk
American College of Chest Physicians: Antithrombotic Therapy and Prevention of Thrombosis, 9th ed. Guyatt GH, Akl EA, Crowther M. Executive summary: Evidence-Based Clinical Practice Guidelines. *Chest*. 2012;141(2 suppl):7S-47S. Geerts WH, Bergquist D, Pineo GF, et al. Prevention of venous thromboembolism. *Chest.* 2008;133(6):381S-453S.	• One of the following for 10-14 days – LMWH started ≥ 12 h before or after surgery – Low-dose unfractionated heparin – Factor Xa inhibitor (fondaparinux, apixaban, rivaroxaban) – Warfarin – Dabigatran • Recommends against the use of aspirin alone for any group • In patients with elevated bleeding risk: – Intermittent pneumatic compression device (18 hours daily)	Total knee surgeries are considered high risk for VTE, regardless of age, activity level, or comorbidities
American Academy of Orthopedic Surgeons http://www.aaos.org/research/guidelines/VTE/VTE_guideline.asp	Pharmacologic prophylaxis as above Mechanical prophylaxis for patients with elevated bleeding risk: • Pneumatic compression devices • Foot and leg pumps	Total knee surgeries are considered standard risk for PE. Bleeding risk defined as: • History of a bleeding disorder • History of recent gastrointestinal bleed • History of recent hemorrhagic stroke
Surgical Care Improvement Project	• LMWH • Factor Xa inhibitor (fondaparinux) • Warfarin • Intermittent pneumatic compression devices • Venous foot pump	Orthopedic surgeries with surgical time > 60 min and LOS > 3 days

Research Methods

Case-Control Study

Cases:

- Unilateral or bilateral TKR
- October 2008-March 2010
- > 40 y
- Code for VTE within 90 days of surgery

Controls:

- Unilateral or bilateral TKR
- October 2008-March 2010
- > 40 y
- No code for VTE within 90 days of surgery
- Random selection

- No other TKR or hip replacement within previous 90 days
- No index hospitalization principal diagnosis of VTE
- No index hospitalization VTE with POA = Y
- No pregnancy, childbirth, or puerperium
- Excluded hospital that screened with ultrasound

Data Collection and Analysis

Fifteen volunteer academic medical centers participated.

Up to 20 cases and up to 40 controls in each hospital were abstracted.

- VTE = PE (415.11,415.19); DVT (453.4x)
  plus 451.11, 451.19, 451.2, 451.81, 453.2, 453.8, 453.9

UHC collected and managed the data for data analysis.

UCD team performed data analysis.

VTE Performance Measures

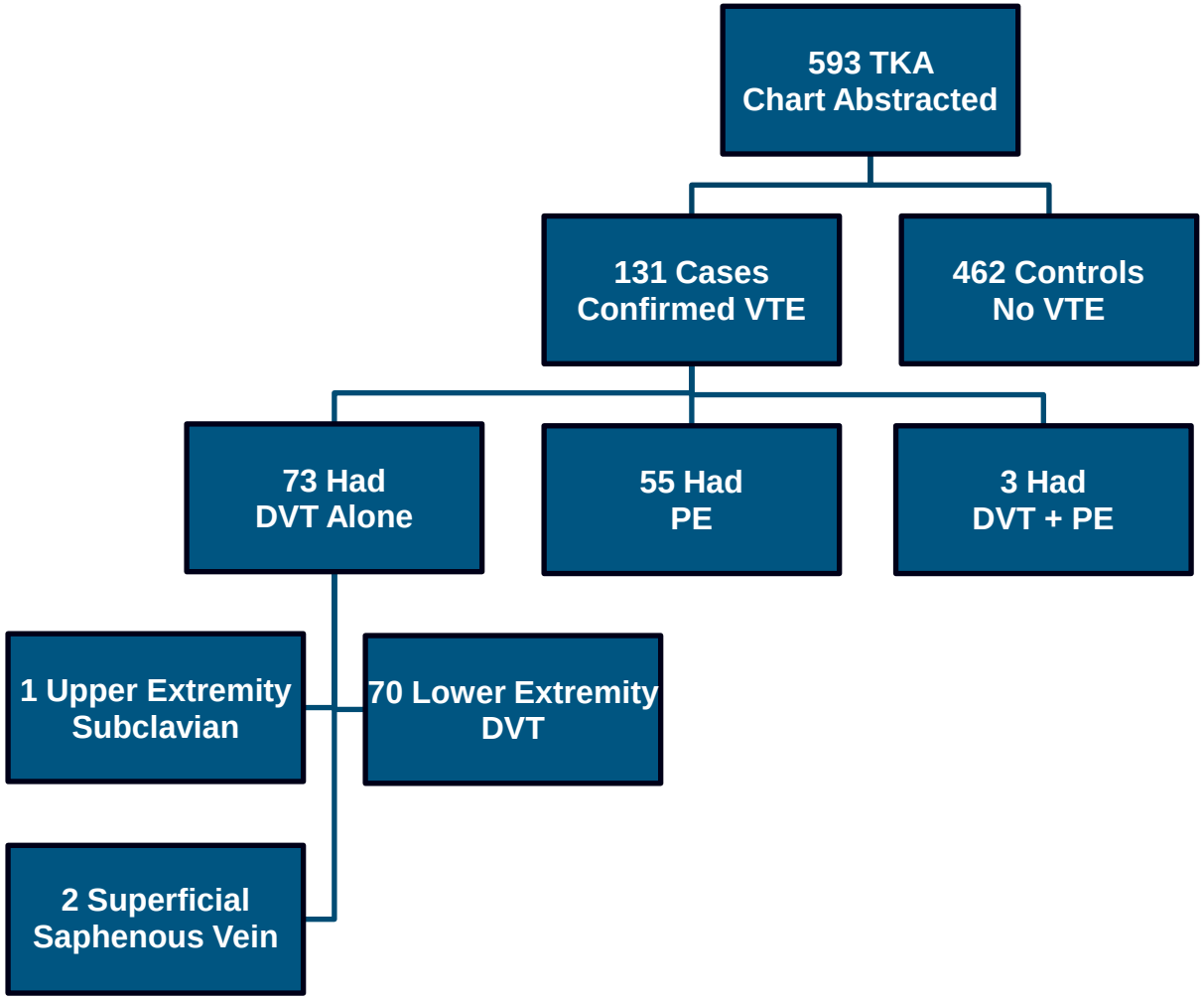
- Percentage of TKR patients who were started on appropriate* prophylaxis before surgery
- Percentage of TKR patients who received appropriate* postop prophylaxis after surgery

  * "Appropriate" subset included percentage of patients who received:
    - Appropriate agent
    - Appropriate agent with recommended dosing
    - Appropriate agent at recommended times
    - Appropriate agent continued postdischarge

- Percentage of TKR patients who were prescribed "continued after discharge" prophylaxis after index admissions (all agents)
- Percentage of TKR patients who ambulated in room ≤ 24 h after surgery (with or without the use of a cane or walker)
- Median time postop until ambulating in room (with or without the use of a cane or walker)
- Percentage of TKR patients w/index or late DVT identified by routine screening (i.e., tests performed in all patients independent of documented clinical concern for PE or VTE in particular patients)

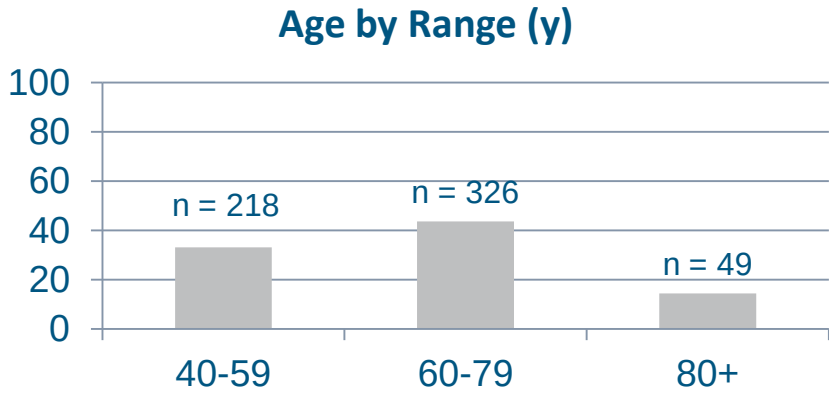
Results

Study Sample



Sample Characteristics

Female 63%
Median age = 63 y



Cases vs Controls:
No differences with regard to gender, race, payer type, or comorbidities

Race/Ethnicity	% (n)
White	72% (428)
Black	18% (105)
Hispanic	6% (35)
Asian	2% (12)
Other	2% (12)
Unknown	1% (6)
Native American/ Eskimo	0.8% (5)

Payer	% (n)
Medicare/Mngd Care	48% (286)
Private	34% (200)
Medicaid/Mngd Care	9% (51)
Other	5% (28)
Unknown	3% (18)
US/State/Local Govt	1% (6)
None/Unins/Self-pay	0.7% (4)

Comorbidities

Top Comorbidities	Cases With VTE, n (%)	Cases Without VTE (%)
Hypertension	92 (70%)	311 (67%)
Diabetes	29 (22%)	100 (22%)
History of malignancy	10 (8%)	53 (12%)
Prior history of DVT or PE	7 (5%)	25 (19%)
Current neoplasm	4 (3%)	9 (7%)
Documented history/risk of bleeding	3 (2%)	7 (5%)

BMI Range	Cases With VTE (131), n (%)	Cases Without VTE (462), n (%)
≤ 30	52 (40%)	191 (41%)
31-34.99	21 (16%)	91 (20%)
35-39.99	23 (18%)	93 (20%)
≥ 40	29 (22%)	74 (16%)
No data	6 (5%)	13 (3%)

Pharmacologic and Mechanical Prophylaxis in Cases and Controls

Pharmacologic Prophylaxis		VTE = Yes n = 129	VTE = No n = 464
LMWH/ heparin	Enoxaparin/dalteparin/fondaparinux, unfractionated heparin subcutaneous	46%	48%
Warfarin alone (no LMWH)		33%	31%
Mechanical Prophylaxis			
Intermittent pneumatic compression device, graduated compression stockings/foot pump		21%	20%
No prophylaxis		0	0

The numbers are mutually exclusive within each stratum.

Percentage of Patients Receiving Appropriate* Postoperative Prophylaxis

45.9% (272/593) of TKR patients received appropriate postop prophylaxis

Hospital Performance:

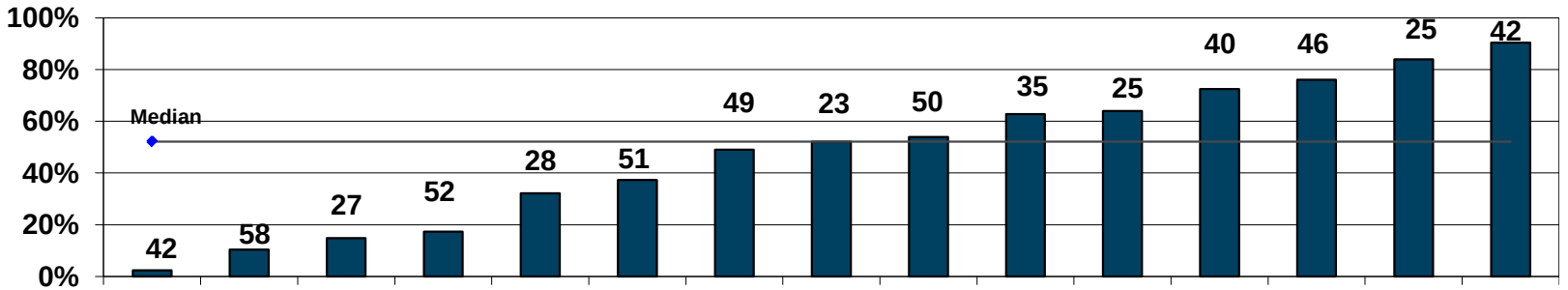
Mean: 48% SD: 27.9%

Median: 52% Range: 2.4%-90.5%

As defined by ACCP guidelines for postop prophylaxis: Cases with documentation that enoxaparin was given 30 mg q12 SC started within 12-24 h post surgery; fondaparinux 2.5 mg SC started within 8 h post surgery; and/or warfarin 2-10 mg PO started within12 h post surgery, prescribed postdischarge.

*For postoperative appropriateness, agent, dose, timing, and "prescribed post discharge" were considered.

Percentage of Patients Receiving Appropriate Prophylaxis After Surgery



Numbers above bars indicate the number of cases with available time data.

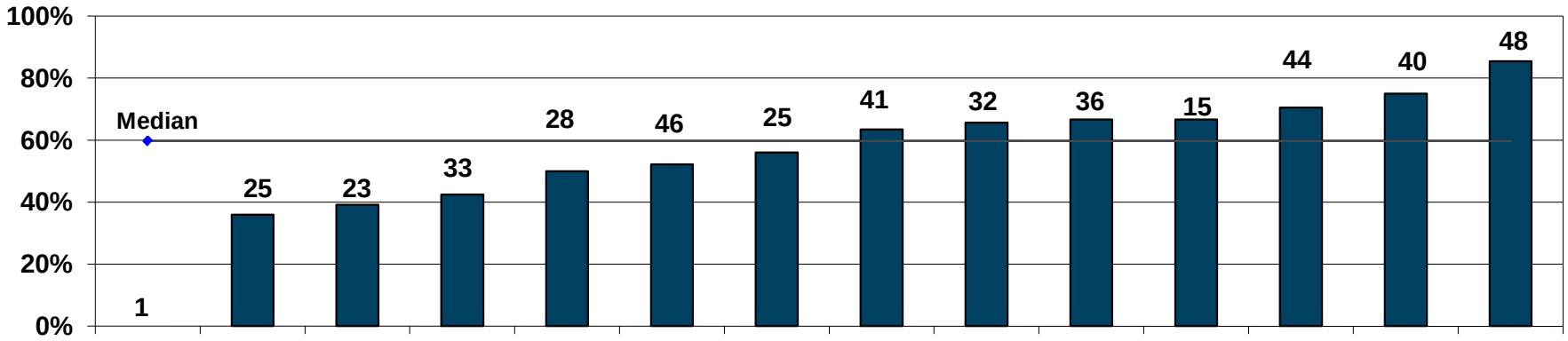
Percentage of Patients Who Ambulated in Room ≤ 24 h After Surgery (With or Without Cane or Walker)

61.1% (267/437) of TKR patients
ambulated in room ≤ 24 h after surgery

Hospital Performance:

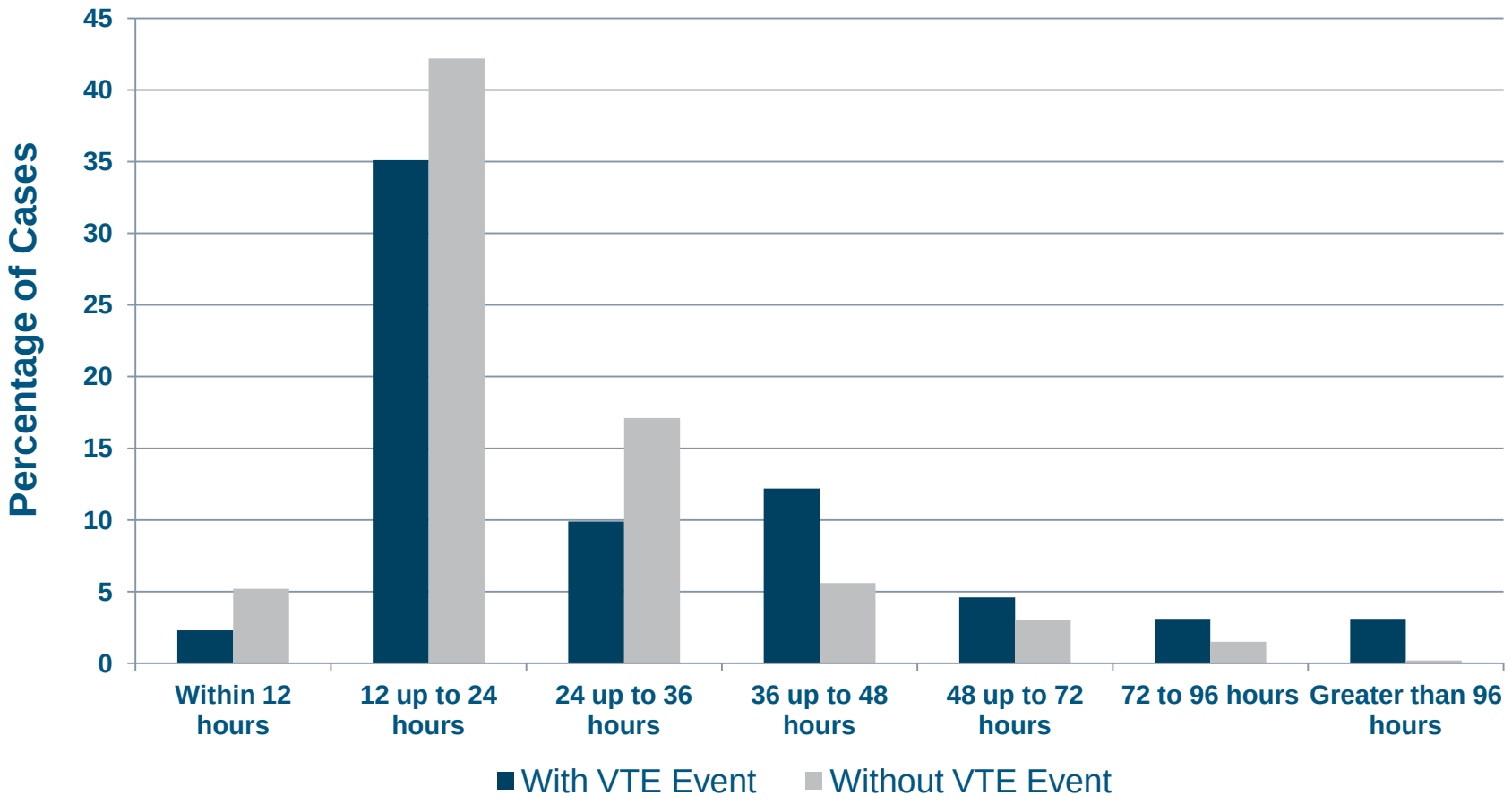
Mean: 54.9% SD: 21.2%
Median: 59.7% Range: 0.0%-85.4%

Percentage Who Ambulated in Room ≤ 24 h After Surgery (With or Without the Use of a Cane or Walker)



Numbers above bars indicate the number of cases with data available.

Time to Ambulation



Process Effects on Outcomes

Pharmacologic Prophylaxis	n	% VTE (n = 131)	% No VTE (n = 462)
Patients receiving appropriate pharmacologic prophylaxis	272	56 (42.7%)	216 (46.8%)
Patients not receiving appropriate pharmacologic prophylaxis	321	75 (57.3%)	246 (53.2%)
Ambulation	**n**	**% VTE (n = 131)**	**% No VTE (n = 462)**
Patients ambulating ≤ 24 h	267	48 (36.6%)	219 (47.4%)
Patients ambulating > 24 h	170	43 (32.8%)	127 (27.5%)
Patients w/no date/time of ambulation documented	156	40 (30.5%)	116 (25.1%)
First Postop Prophylaxis Timing	**n**	**% VTE (n = 131)**	**% No VTE (n = 462)**
Patients receiving 1st postop dose within ≤ 24 h	408	82 (62.6%)	326 (70.6%)
Patients receiving 1st postop dose 24-36 h	41	12 (9.2%)	29 (6.3%)
Patients receiving 1st postop dose > 36 h	14	10 (7.6%)	4 (0.9%)
Insufficient date/time data or no postop prophylaxis	130	27 (20.6%)	103 (22.3%)

Multivariate Analysis Findings

Multivariate adjusted odds ratios and 95% confidence intervals

- Outcome: Any VTE event diagnosed day 2 after surgery or later
- Excluded 1 hospital that screened TKR patients routinely for VTE

Predictive Factor	Odds Ratio (95% CI)	*P* Value
Age	1.02 (0.99-1.05)	.12
Gender (ref: male)	1.40 (0.80-2.38)	.25
Ambulation (ref: no ambulation)		
• Taking steps day 1 or 2	0.30 (0.10-0.88)	< .01
• Taking steps after day 2	0.67 (0.22-2.07)	.56
Type of TKR (ref: unilateral TKR)		
• Bilateral TKR	3.30 (1.40-7.50)	< .01
Pharmacological prophylaxis (ref: only mechanical prophylaxis)	0.50 (0.20-1.09)	.07
BMI ≥ 35 (ref: BMI < 35)	0.94 (0.54-1.62)	.82

Prophylaxis Rates by Surgical Case Load

86 surgeons performed the 593 total knee surgeries in this study.

No. of Cases per Surgeon	No. of Surgeons in This Category	No. of Patients Who Received Appropriate Postop Prophylaxis	No. of Cases in This Category	Rate of Appropriate Prophylaxis in This Category
1-2	30	14	42	33.3%
3-4	20	18	69	26.1%
5-10	19	71	144	49.3%
11-19	9	64	116	55.2%
20 or more	8	105	222	47.3%

Discussion

Discussion

Expected finding:

- Not developing VTE was associated with receiving pharmacologic thromboprophylaxis. (OR = 0.5, P = 0.07)

Interesting but not unexpected findings:

- Bilateral TKR was associated with higher odds of VTE. (OR = 3.3, P = <0.01)
- Early mobilization was associated with lower odds of VTE. (OR = 0.3, P = <0.01)

Unexpected finding:

- Prophylaxis was as effective in morbidly obese as in less obese patients.

Key Take-Aways

- Ambulation within 48 hours was associated with a 70% reduction in the risk of VTE. Although prophylaxis is typically the focus of VTE prevention strategies, this finding demonstrates that early ambulation, a nursing and physical therapy function, directly affects this important health care outcome.

- Prophylactic regimens vary widely across physician practices and organizations.

- Organizations are not following guideline-driven prophylaxis for TKR surgery patients.

Drivers to Improve Outcomes

- Institute a protocol for early ambulation of TKR patients (within 24 hours postop)
- Focus on timing of first postop dose of pharmacologic prophylaxis
- Reduce organizational variation
  - Standardize guidelines within your organization
  - Integrate standardization into order sets

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