

# Improving Outcomes in Patients at Risk for Venous Thromboembolism Following Total Knee and Total Hip Replacement: Implications for Managed Care

The information presented in this publication is based upon the conclusions and insights derived from a roundtable discussion involving a multidisciplinary group of healthcare professionals. The purpose of the roundtable discussion was to identify barriers—and ways of overcoming those barriers—to improved outcomes for patients who have undergone surgery for total knee replacement (TKR) or total hip replacement (THR), and who are, consequently, at risk for venous thromboembolism (VTE). The diversity of the assembled healthcare professionals allowed for a wide-ranging discussion that included clinical, institutional, and systemic approaches to improving outcomes for VTE in patients after receiving TKR or THR.

This publication will begin by providing a clinical overview of the nature and burden of TKR/THR-related VTE and will then review and summarize the conclusions of the panel. The roundtable discussion, it should be noted, was conducted as part of the *Success in Thrombotic Risk Interventions*, or *ThromboVentions™*, quality improvement initiative. Funding for the roundtable discussion and this publication was provided by Janssen Pharmaceuticals, Inc.

## Clinical Overview

VTE is a disease that comprises both deep vein thrombosis (DVT) and pulmonary embolism (PE). Erythrocytes and thrombocytes bound together by fibrin are the constituent components of venous thrombi that develop when vessel damage is present and where blood flow is stagnant.<sup>1</sup> The most common sites for venous thrombi are valve pockets located in the deep veins of the thigh or calf where they are either broken down through fibrinolysis or otherwise embolize into the pulmonary arteries, resulting in PE.<sup>1</sup> VTE is associated with both long-term complications, such as chronic pulmonary hypertension and the post-thrombotic syndrome as well as death.<sup>1</sup>

While the exact incidence of VTE is unknown, an estimated 1 million Americans suffer from VTE annually, and more than 600,000 experience symptomatic VTE events, a situation that a recent publication from the Centers for Disease Control and Prevention (CDC) described as a public health concern.<sup>2,3</sup> Along with older patients and those who suffer from limited mobility, people undergoing surgery constitute one of the highest risk groups for VTE, and within the larger surgical population, those undergo-

## Abstract

An estimated 1 million Americans suffer from venous thromboembolism (VTE) annually and more than 600,000 experience symptomatic VTE events each year. Patients undergoing total knee replacement (TKR) and total hip replacement (THR) are at high risk for developing VTE (40%-60% risk without prophylaxis). The economic burden of post-TKR/THR VTE is very large, with the average length of stay more than double that of patients without VTE, and risk-adjusted overall costs 4 and 5 times greater among the TKR and THR populations, respectively, compared with non-VTE patients. Efforts are underway, however, in the public and private sectors to increase the rates of appropriate VTE thromboprophylaxis. Payers are experimenting with quality measurement and improvement programs to incentivize clinical behavior toward optimizing outcomes; the role of patient education in VTE prophylaxis is also evolving. There is an excellent opportunity to reshape the current patient education approach and develop appropriate, accessible materials, but, ultimately, a multipronged effort that targets as many variables related to VTE risk as possible is necessary in order to achieve success in lowering the burden of post-TKR/THR VTE.

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For faculty information and disclosures, see end of text.

## Report

ing total knee replacement (TKR), and particularly total hip replacement (THR), are at notably high risk for VTE.<sup>4,5</sup> The estimated risk for DVT among TKR and THR patients who have not received thromboprophylaxis is between 40% and 60%, and among those receiving conventional thromboprophylaxis, the 91-day risk of symptomatic VTE for TKR and THR patients is 1.7% and 2.4%, respectively.<sup>4,5</sup>

### Clinical and Economic Burden of VTE (Following TKR/THR)

The mortality rate for people who experience VTE is high. According to recently reported population-based data from the Atherosclerosis Risk in Communities study and the Cardiovascular Health Study, which together comprised nearly 22,000 people followed up over a period of 7.6 years, the 28-day fatality rate among the 366 cases of thrombosis was 10%.<sup>6</sup> Long-term data from Olmsted County, Minnesota, covering the years 1966 to 1990, which included 14,629 person-years of follow-up, showed that mortality rates at 7 days, 30 days, and 1 year were 25.2%, 28.0%, and 36.4%, respectively.<sup>7</sup> The mortality risk associated with PE is particularly high, with a 7-day mortality rate, based on the Olmsted County data, of 40.9%. PE is, in fact, the most common cause of preventable death in hospitals. In the post-surgical setting, death occurring as a result of PE is seen in 0.1% to 1.7% of those undergoing TKR and 0.1% to 2% of patients undergoing THR,<sup>5</sup> and it remains an ongoing problem once patients are discharged. According to a study using data from a US healthcare claims database (1993-1998) that included nearly 12,000 people who had undergone THR, major knee surgery, or hip fracture repair, 10% of patients were readmitted for VTE treatment within 90 days of surgery.<sup>8</sup> The occurrence of VTE postdischarge is, in part, due to the fact that VTE prophylaxis, when given to patients, is often given for an insufficient duration.<sup>9</sup> This is evidenced by data from the Global Orthopedic Registry (2001-2004), which collected data from 100 hospitals in 13 countries and determined that in patients who underwent TKR, 57% (86/152) of thromboembolic events occurred after the median time to hospital discharge (4 days after surgery) (Figure 1). In patients who underwent THR, 75% (65/87) of thromboembolic events occurred after the median time to hospital discharge (5 days after surgery). While nearly all patients received prophylaxis on the first day after surgery, more than 25% were not receiving any form of prophylaxis 7 days after surgery.<sup>9</sup>

The consequent economic burden of post-TKR/THR VTE is also very large, as may be seen in analyses of both private and government healthcare databases. A study of

computerized discharge summaries from 220 US acute care hospitals—comprising 105,562 patients who had undergone TKR, THR, or hip fracture repair—found that those who experienced VTE had more than twice the length of stay (LOS) compared with those with no VTE.<sup>10</sup> For patients with DVT only, the mean LOS was  $11.5 \pm 13.2$  days, compared with  $12.4 \pm 9.8$  days for people with PE, and  $5.4 \pm 4.2$  days for those without VTE at all ( $P < 0.0001$  for both DVT and PE vs no VTE). Figure 2 depicts hospital LOS for those undergoing TKR and THR who experienced a VTE compared with those who did not have an event.

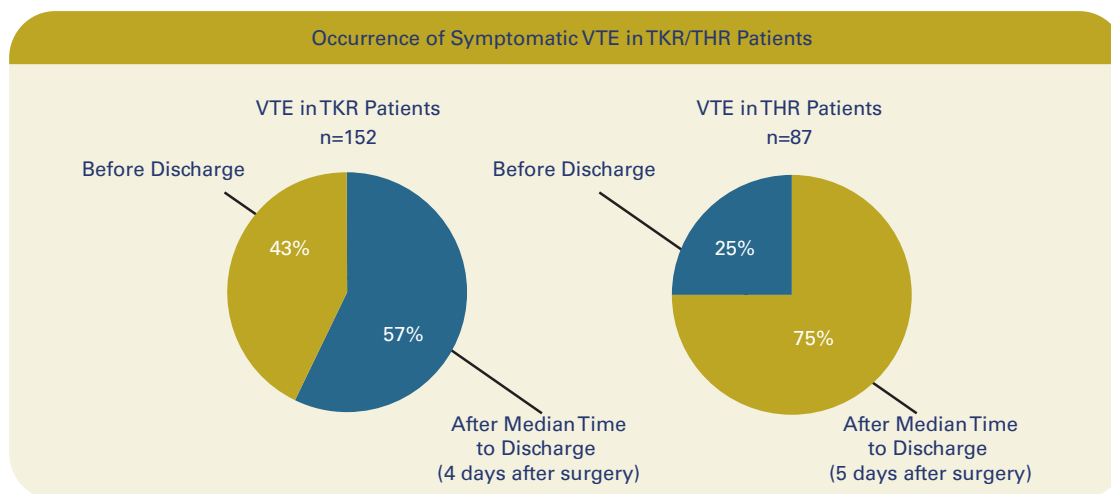
“The statistics relating to the economic burden of DVT following [TKR/THR] surgery are staggering.”

*Kevin Unger, MBA/MSHA, CHE*

A study published in 2011 examined the cost differential between Medicare patients undergoing TKR or THR who experienced VTE and those who did not. The data used in this study were derived from the Medicare Provider Analysis and Review file and the national Medicare database for calendar years 2005 to 2007, and included 187,924 patients who had TKR or THR.<sup>11</sup> The analysis found that compared with those who did not experience VTE, patients who did experience VTE were significantly more likely to be rehospitalized within 1 year ( $P < 0.0001$ ), more likely to experience major bleeding ( $P < 0.0001$ ), and also had significantly higher mortality risk ( $P < 0.001$ ). The authors further found that the risk-adjusted overall cost of VTE compared with non-VTE patients was \$17,997 versus \$4358 in the TKR population, and \$18,930 versus \$3764 in the THR population (both  $P < 0.001$ ).<sup>11</sup>

Thromboprophylaxis of patients at risk for VTE certainly has an ameliorative effect on morbidity and mortality risks as well as economic costs. However, there is a large gap in these benefits between patients whose VTE prophylaxis is appropriately applied compared with those who receive substandard VTE prophylaxis. In a study published in 2010, this difference was demonstrated; the study compared patients who received appropriate prophylaxis per the American College of Chest Physicians (ACCP) guidelines with those who received “partial prophylaxis” (ie, not per ACCP).<sup>12</sup> The study authors used the MarketScan<sup>®</sup> Hospital Drug Database for January 2004 to March 2007 for their analysis, querying for surgical and medical patients age 40 years and older who were at high risk for VTE. A total

■ **Figure 1.** Occurrence of Symptomatic VTE in TKR and THR Patients Before and After Hospital Discharge<sup>9</sup>



Data from the Global Orthopedic Registry from 100 hospitals in 13 countries (2001-2004) were analyzed to determine the time course of VTE events in TKR and THR patients and to ascertain whether these patients received prophylaxis during the time period in which they were at increased risk for VTE. Cumulative incidence rates of DVT and PE, as well as median time to event, starting from the day of surgery, were calculated using the Kaplan-Meier method for patients who had received in-hospital prophylaxis after surgery and who had follow-up data for at least 3 months. PE indicates pulmonary embolism; THR, total hip replacement; TKR, total knee replacement; VTE, venous thromboembolism.

of 21,001 patient records were included, 24.5% of whom had received appropriate VTE prophylaxis and 75.5% of whom had received partial prophylaxis. The authors found that patients receiving appropriate prophylaxis had a significantly lower risk of PE (0.5% vs 0.9%; adjusted odds ratio 0.55,  $P=0.010$ ). Moreover, the total cost per discharge was \$17,386 ( $\pm$ \$12,004) for appropriate prophylaxis versus \$23,823 ( $\pm$ \$19,783) for partial prophylaxis, a difference of \$6437 ( $P<0.001$ ).<sup>12</sup>

#### VTE Prophylaxis Following TKR/THR: Guidelines

The data noted above point to a large gap in the rate of appropriate VTE prophylaxis for the at-risk population, a gap that exists for a number of reasons, despite the availability of evidence-based guidelines. Among the available clinical guidelines, perhaps the most prominent are those published by the ACCP, currently in its 8th edition. The ACCP guidelines are comprehensive in describing the techniques and strategies for VTE prophylaxis.<sup>5</sup> More specifically, in the area of post-TKR/THR risk, the American Academy of Orthopaedic Surgeons (AAOS) has published guidelines focused on symptomatic PE prevention in the TKR and THR patient populations.<sup>13</sup> Both guidelines support the use of VTE prophylaxis, although they differ in their specific recommendations around type, dose, and duration.<sup>5,13</sup>

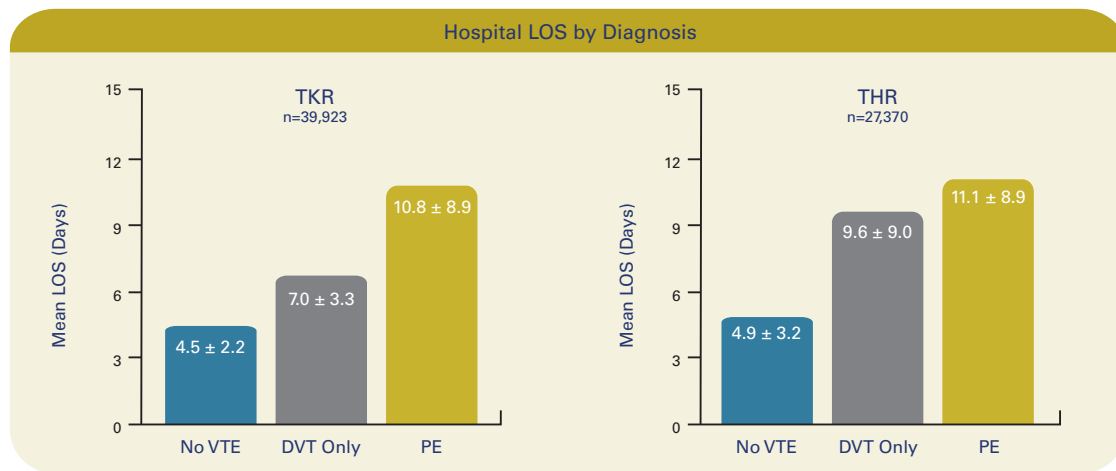
The approaches to patient risk stratification vary somewhat between the two guidelines. The AAOS guidelines suggest individual risk-benefit analyses for postsurgical

patients regarding the likelihood of their experiencing PE or major bleeding complications.<sup>13</sup> The ACCP guidelines provide a larger discussion on the subject of risk stratification, and ultimately posit two approaches. The first approach involves the use of formal risk assessment models (RAMs), which the ACCP guideline authors ultimately reject. The reasoning for this rejection of RAMs is that they lack proper validation, they are cumbersome to use, and they are undermined by a general lack of understanding regarding the ways in which different risk factors interact in a given patient.<sup>5</sup> The second approach, which the ACCP guidelines do endorse, involves targeting at-risk patient

“We’ve found in our organization that in order to be successful and get physician buy-in, we have to have them at the table when we’re making those protocols and guidelines, because if they’re not brought into the loop until after the guidelines are developed, they are less willing to adopt them. If physicians are at the table helping you develop the guidelines and they’re reading the literature, creating it and tweaking it to the needs of the organization, I think the application and practice of those guidelines is going to be pretty successful.”

*Aman D. Sabharwal, MD, CPHM*

■ **Figure 2.** Length of Stay in Hospital for Patients Receiving TKR or THR Surgery Who Experienced PE, DVT, or Neither<sup>10</sup>



DVT indicates deep vein thrombosis; LOS, length of stay; PE, pulmonary embolism; THR, total hip replacement; TKR, total knee replacement; VTE, venous thromboembolism.

groups—particularly any patients undergoing TKR/THR—and routinely providing them with VTE prophylaxis.<sup>5</sup>

### Improving Quality of Care for VTE Prophylaxis Following Orthopedic Surgery

The CDC's description of VTE as a public health concern, previously noted, is echoed in a publication by the US Department of Health and Human Services' (DHHS) Agency for Healthcare Research and Quality (AHRQ) titled: "Preventing Hospital-Acquired Venous Thromboembolism: A Guide for Effective Quality Improvement."<sup>14</sup> The fact that VTE is now understood and defined as a hospital-acquired condition, and has warranted significant governmental intervention, speaks to the seriousness of the situation. The implications of this situation extend to the managed care community.

To encourage hospitals to prevent adverse events, CMS has identified 10 categories of hospital-acquired conditions for which Medicare will no longer pay the additional costs of hospitalization. These are conditions—including DVT and/or PE following TKR or THR—that:

- Are not present upon hospital admission,
- Are acquired during the hospital stay, and
- Can reasonably be prevented by applying evidence-based guidelines.<sup>15-17</sup>

These statements very recently took on a greater sense of urgency and purpose with the announcement in 2011 by the DHHS of the launch of a program called *Partnership for Patients*, which will invest \$1 billion to improve the quality, safety, and affordability of healthcare in the United States.<sup>18,19</sup> The two primary goals of the programs are prevention of ill-

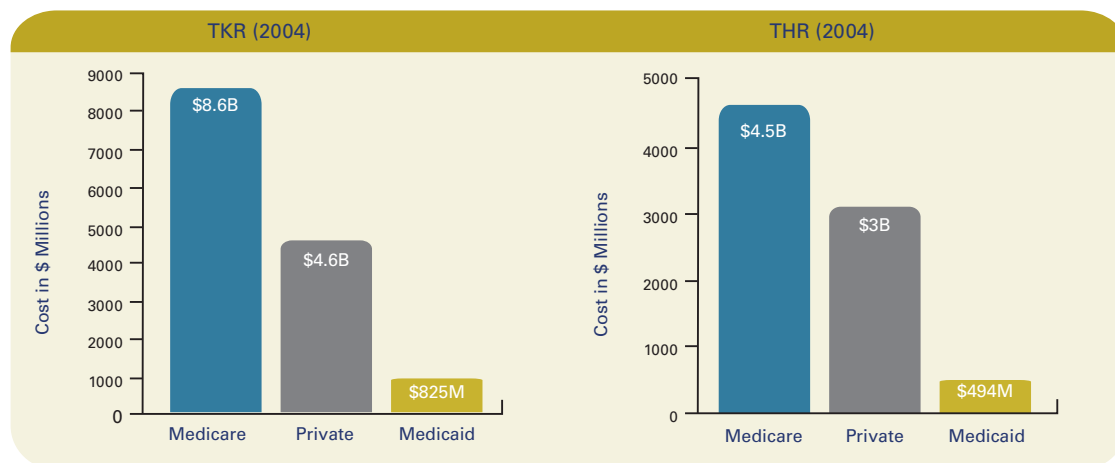
ness and injury and avoiding preventable complications. Nine initial areas of specific initial focus in the area of prevention have been identified, one of which is VTE.<sup>18</sup> The *Partnership for Patients* program is designed to be a joint public-private effort, encompassing hospitals, medical organizations, patient and consumer groups, employers (including pharmaceutical manufacturers), as well as state governments.<sup>19</sup> At present, more than 600 hospitals, 300 professional organizations, and 250 patient/consumer groups have signed pledges to participate in the *Partnership for Patients* program.<sup>18</sup>

While governmental efforts to prevent VTE would be of interest to private payer organizations in any case, the changing landscape of payment for TKR/THR surgeries makes the matter even more pressing. At present, Medicare pays for a majority of TKR and THR surgeries, but the trend has been moving toward a greater burden for private payers (**Figure 3**). In 1997, private insurance paid for 25.5% of TKRs; by 2004, private insurance paid for 32.0% of TKRs. In 1997, Medicare paid for 62.8% of THRs and private insurance systems paid for 30.4%. By 2004, the balance had shifted to 55.4% and 36.2%, respectively.<sup>20</sup> The predicted trends are that there will be a significant increase in both TKRs and THRs in the near future, and that private insurers will continue to bear a growing proportion of these costs.<sup>20</sup>

### Adherence to Guidelines is Suboptimal

The activities of governmental bodies in attempting to call attention to, and reduce the rate of, VTE must be seen in the context of: a) the needlessness of much of the VTE prevalence considering the availability of clinical guidelines

■ **Figure 3.** Proportion of TKR or THR Surgeries Paid by Medicare, Medicaid, and Private Insurers in 2004<sup>20</sup>



THR indicates total hip replacement; TKR, total knee replacement.

and effective VTE prophylaxis, b) the enormous burden in terms of mortality, morbidity, and financial costs associated with VTE, and c) the low rate at which VTE prophylaxis is provided to those patients who require it. With regard to this latter point, the low rate of VTE prophylaxis has been reported in the literature.

A study published in 2010, analyzing discharge and billing records for 16 acute-care hospitals for the calendar years 2005 and 2006, identified 68,278 hospitalized patients at risk for VTE without contraindications for thromboprophylaxis.<sup>21</sup> The analysis categorized patients as critical care, medical, or surgical patients, and ACCP guideline–recommended thromboprophylaxis was compared with the actual regimens patients received. The authors observed that the appropriate dose, type, and duration of prophylaxis was

provided for 10.5% of patients in critical care, 9.8% of medical patients, and 17.9% of surgical patients.<sup>21</sup> Of at-risk patients, 36.8% received no prophylaxis at all while 50.2% received inappropriate prophylaxis; appropriate prophylaxis was provided to 40.2% of patients who underwent TKR and 37.5% of patients who underwent THR.<sup>20</sup>

Slightly better rates of VTE prophylaxis were observed by the Global Orthopaedic Registry Investigators, who evaluated the adherence to ACCP guidelines among physicians in 100 hospitals in 13 countries around the world.<sup>22</sup> Data from the United States showed that 61% of patients who underwent TKR and 47% of patients who underwent THR received “some form of ACCP-recommended prophylaxis in accordance with the recommended timing, duration, and dose/intensity of treatment.”

And, finally, a study from the Brigham and Women’s Hospital involving 183 US sites examined the experience of 5451 patients with ultrasound-confirmed VTE, 38% of whom had undergone surgery within the previous 3 months. The study authors found that of 2726 patients who had their DVT diagnosed while they were in hospital, just 1147 (42%) received DVT prophylaxis within 30 days prior to the diagnosis.<sup>23</sup>

“The key thing is having the different components of the healthcare system sit down at the table and work together in order to consider how best to avoid complications, deliver the most efficient care possible, and get the best outcome. Not just the best clinical outcome or the best cost outcome, but also the best patient experience. Because with Medicare, their goal now, with the triple aim, is to have the entire healthcare system pursuing best cost, best quality, and also best experience.”

*James E. Barr, MD*

### Opportunities for Change

Efforts to increase the rates of appropriate VTE thromboprophylaxis in the United States have prompted a variety of public and private health organizations to undertake initiatives aimed at improving the quality of VTE-related care. These organizations include the AHRQ, the American Public Health Association, the American Society of Hematology, CMS, the National Alliance for



Thrombosis and Thrombophilia, and the National Quality Forum (NQF), among others.<sup>24</sup> It should be noted that the newly introduced *Partnership for Patients* program will work in cooperation with at least some of these organizations in their quality improvement efforts, and as much as half of the \$1 billion funding *Partnership for Patients* will be given over to the CMS in order to test different models for quality improvement.<sup>18</sup> The CMS has already initiated a variety of programs aimed at improving the quality of VTE-related care, including the Surgical Care Improvement Project (SCIP), which employs financially incentivized quality care measures for hospitals.<sup>25</sup> The large-scale Physician Quality Reporting System (PQRS) is a related program incentivizing healthcare professionals to improve care and report quality data across a spectrum of quality measures, including measures related to VTE care.<sup>26,27</sup> At the same time, the NQF convened a group of experts on VTE prevention and published, in 2006, a consensus document describing 2 quality improvement measures and 17 key characteristics for the prevention and care of VTE, a project that was extended with the 2008 publication of 6 additional quality measures.<sup>28</sup>

### *Episodes-of-Care*

In addition to quality measurement and improvement programs, a number of technological and organizational options are applicable to addressing the unnecessarily high rate of VTE observed in clinical care. One such option that has been gaining momentum in the past few years is the use of episode-of-care (EOC)-based reimbursement. EOC analyses are founded on the premise that reimbursement based on the activities of a single clinician for a single patient at a specified time point does not ideally incentivize the clinical behavior and efforts of a provider toward optimizing outcomes.<sup>29</sup> Rather, reimbursement should take into consideration the larger context of the way a provider manages a given patient for a defined clinical purpose, which may include multiple interactions and may involve more than a single intervention.

It is worth pointing out that while the EOC model looks at the larger context of a patient's care, the development of a particular model for EOC reimbursement is still an area of experimentation. One proposed model involves retrospective adjustment in which payment for resources and quality of care is partially withheld and ultimately paid at a set time point when an evaluation of the complete episode is plausible. The prospective payment approach provides for a set payment to the provider that would later be adjusted depending on the quality of care, applying

a pay-for-performance standard.<sup>29</sup> By creating an incentive for adherence to clinical guidelines and improved outcomes for patients at risk for VTE, the EOC approach could overcome some of the existing obstacles to VTE prophylaxis.

### *Electronic Health Records/Computerized Provider Order Entry*

The use of electronic health records (EHRs) coupled with the implementation of computerized provider order entry (CPOE) systems is a potentially effective means of "building in" the appropriate use of VTE prophylaxis by creating workflows related to VTE risk that remind or require physicians to ensure at-risk patients receive necessary prophylaxis. The use of these systems has been slow to penetrate the healthcare industry, in part due to the amount of time required to make the transition and the burden of transition.<sup>30</sup> However, a series of 8 focus groups with physicians and staff, conducted at 3 primary care facilities, found that while the learning and adoption curves for these systems were significant, the efficiencies and improvements in terms of safer care more than compensated for the time invested.<sup>30</sup> The fact that safety of care is improved with EHRs and CPOE systems is a promising sign for its applicability to improving clinician practice in the area of VTE prophylaxis.

**"A challenge in new reimbursement models is that they include the entire cost of care, including complications. An organization that has paid a bundled rate and exhibits high rates of complications, such as VTE, will have a difficult time seeing that their financial numbers meet at the end of the year."**

*James E. Barr, MD*

### *Accountable Care Organizations*

An organizational approach to improving care may be seen in the evolution of Accountable Care Organizations (ACOs), healthcare-providing networks comprising primary care physicians, specialists, and hospitals that take responsibility for the costs and standard of care for a given population.<sup>31</sup> The idea behind ACOs is that by achieving a high level of care based on CMS benchmarks, and benefiting from economies of scale and efficiency, along with bonuses earned from the CMS by meeting their benchmarks, these

organizations can provide high quality care while achieving profitability. ACOs employ a variety of models to achieve their goals, including the use of Web technology, hospitalist programs, postdischarge care management, complex case management, and hospice programs. Patient-centered medical homes (PCMHs) are another means of providing affordable quality care afforded by some ACOs. PCMHs provide physician care in a living structure that optimizes patient behavior, in a patient-centric modality, to achieve patient health while at the same time minimizing hospitalization and visits to the emergency department.<sup>31</sup>

“Normally, when I prepare a patient for discharge, I will have initiated their outpatient therapy and spent time explaining it to them before they leave. Unfortunately, by the time they reach the parking lot, they’ve forgotten between 40% and 80% of everything that I have just talked to them about.”

*James E. Barr, MD*

### Patient Education

The notion of patient education to improve outcomes in DVT, and elsewhere, is widely agreed upon but seemingly an unmeetable—or, at least, unmet—goal. The barriers to patient education in VTE prophylaxis have, however, been challenged in the last few years by new information regarding how such efforts might be more effective. A 2006 survey of individuals who have experienced thrombosis and thrombophilia observed a high degree of interest in being educated about prevention and other relevant topics. However, it was also found that there is a dearth of patient-appropriate educational materials about VTE and PE available with which to educate the patient population.<sup>32</sup>

The role of patient education, and the deficit in efforts heretofore, was somewhat clarified by a recent study of patient knowledge regarding anticoagulation at a Veterans Affairs Medical Center. It was found that patient awareness is often disconnected with outcomes, suggesting that patient education, such as it is, may not be optimally designed to achieve the desired ends, and that a different approach to patient education might yield better results.<sup>33</sup> These two surveys point to a large gap in the area of patient education about VTE prophylaxis as well as a large, and identifiable, opportunity to fill that gap with the development of appropriate and accessible patient education materials.

“In our institution, two weeks before a patient is scheduled for an elective hip or knee replacement surgery, they attend a clinic that allows them to meet all the practitioners that are involved in their care. In this particular setting, they also discuss discharge options. If the patient is set up to go to a skilled nursing facility, they will know before they’re even admitted to the facility what the plan is for their total overall care.”

*Electa Stern, PharmD*

### Conclusion

VTE after TKR and THR is a common occurrence associated with enormous burdens in terms of morbidity, mortality, and economic costs, and VTE prophylaxis is an effective means of reducing this burden. Unfortunately, adherence to clinical guidelines is generally quite poor among physicians responsible for the provision of VTE prophylaxis. In response to this poor adherence, a variety of interventions to improve the rate of VTE prophylaxis have been undertaken by both governmental bodies and private organizations. These interventions include systemic, technological, educational, and quality improvement initiatives, including the high-profile *Partnership for Patients* recently introduced by the federal government. Ultimately, a multipronged effort that targets as many variables related to VTE risk as possible is necessary in order to achieve success in lowering the burden of VTE following TKR/THR.

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