MILLIMAN REPORT

Thromboprophylaxis patterns of care following surgery

A claims data analysis of commercially insured members

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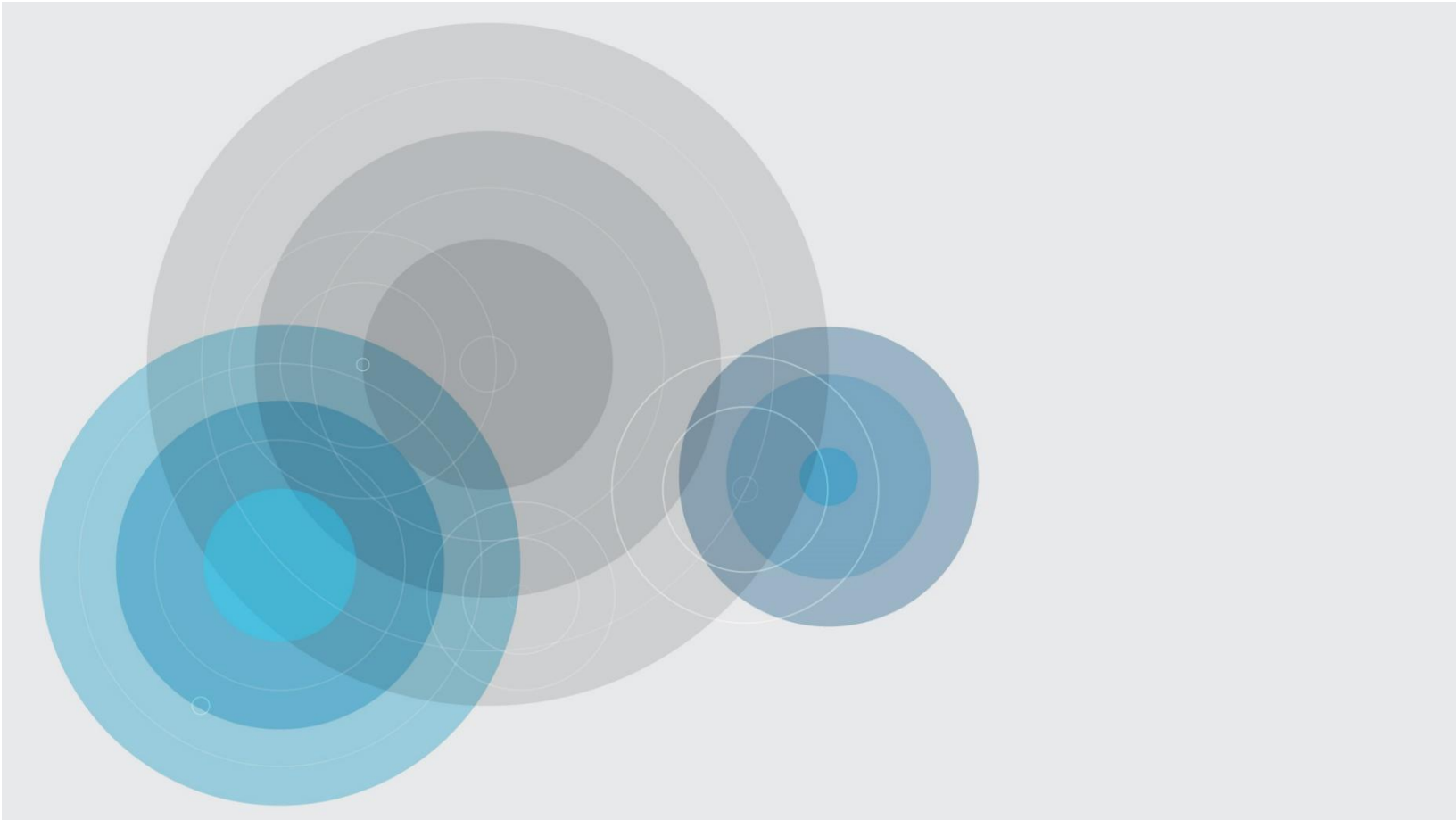

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Executive summary

Individuals are at increased risk of developing venous thromboembolism (VTE) following most major surgical procedures, which can lead to deep vein thrombosis (DVT) and pulmonary embolism (PE) and the serious consequences thereof. VTE risk varies across surgical procedures and by patient characteristics. Antithrombotic drug therapy and/or mechanical VTE prophylaxis (including early ambulation, compression stockings, and intermittent pneumatic devices) have been recommended for several decades by particular specialty societies for patients having major surgical procedures. Specific recommendations for choice of VTE prophylaxis and duration of prophylaxis vary by surgery and by VTE and the bleeding risk of each patient. Despite the evidence supporting thromboprophylaxis following most major surgeries, suboptimal use has been reported with bleeding risk reported to be a concern in some cases.[1,2]

In order to evaluate post-surgery thromboprophylaxis practice patterns, we analyzed 2017-2018 commercial claims data to identify the rate of anticoagulation use in the 30 days after discharge from select inpatient and outpatient orthopedic, podiatry, obstetrics and gynecology (OBGYN), and spine surgeries. From a denominator of 31 million commercially insured members meeting eligibility criteria, we identified 209,181 inpatient and 312,808 outpatient surgery cases of interest and analyzed anticoagulant medical and pharmacy claims as well as medical claims for intermittent pneumatic compression devices (IPCs) in the 30 days following these select surgeries. IPCs are devices worn on the body that automatically compress and decompress to stimulate blood flow. Early ambulation and compression stockings were not analyzed for this analysis. Several key findings were noted including:

- Anticoagulant therapy claims were more frequent in the 30 days following inpatient versus outpatient surgeries.
- For some surgeries, a significantly lower proportion of patients had claims for anticoagulants in the 30 days after surgery compared to clinical guideline recommendations:
  - The American College of Chest Physicians (ACCP) recommends use of pharmacological or mechanical thromboprophylaxis for a minimum of 10 to 14 days following total knee arthroplasty. However, we observed only 35% of inpatient cases and 26% of outpatient cases for total knee arthroplasty with claims for anticoagulants in the 30 days following surgery. Because the claims data does not include over-the-counter (OTC) drug utilization, we are not able to identify use of OTC aspirin therapy.
  - The American Society of Hematology recommends pharmacological prophylaxis following major gynecological procedures. We observed that only 8% of patients undergoing inpatient and 3% undergoing outpatient open abdominal hysterectomy procedures had claims for anticoagulants in the 30 days following surgery.
- Patients utilizing anticoagulants are at increased risk for adverse bleeding events. Statistically significant higher rates of bleeding events occurred among patients with claims for sustained anticoagulant therapy versus patients without claims for anticoagulants or IPCs for particular surgery categories:
  - Outpatient orthopedic (0.29% vs. 0.06%)
  - Outpatient podiatry (0.18% vs. 0.07%)
  - Inpatient OBGYN (1.75% vs. 0.30%)
  - Outpatient OBGYN (3.84% vs. 1.70%)
  - Inpatient spine (1.28% vs. 0.18%)
- Bleeding events were costly when they occurred:
  - Major bleeding events after inpatient surgery among patients with claims for sustained anticoagulant therapy were $11,000 on average.
  - Major bleeding events after outpatient surgery among patients with claims for sustained anticoagulant therapy were $5,000 on average.

With an increased risk of VTEs following surgery, clinical guidelines clearly recommend pharmacological or mechanical VTE prophylaxis including aspirin, traditional anticoagulation, direct oral anticoagulants, and/or mechanical prophylaxis following major surgeries. Yet our data shows a significant variance in use of VTE prophylaxis for some major surgeries compared to clinical guideline recommendations. Low anticoagulation utilization following surgeries may be caused by concerns of increased bleeding risk. Guidelines suggest weighing the bleeding risk associated with anticoagulation with the risk level of patients for VTEs and suggest alternatives to anticoagulation therapy such as IPC devices, either alone or in combination with anticoagulants when bleeding risk is high.

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It is not possible to capture all factors that may be relevant. We present national average data based on approximately 31 million commercially insured members from the 2017-2018 IBM Watson Marketscan commercial and Milliman's own 2017-2018 consolidated data sets. Findings using different data, populations, or time periods will vary. When identifying anticoagulant use, we are unable to identify patients who take over-the-counter aspirin and do not fill a prescription for aspirin. We also are unable to identify patients who were prescribed anticoagulants but did not fill the prescription, or patients whose claims for anticoagulants or IPCs were not covered by the insurer. Some patients may have contraindications for anticoagulants, which could impact their post-surgical care. We looked at patients taking antiplatelet medication within the 90 days prior to surgery and the 30 days after surgery separately but did not analyze other conditions which could have made the prescription of anticoagulants inappropriate.

Background

Venous thromboembolism (VTE) is a condition that affects between 300,000 to 600,000 people annually in the United States and the associated healthcare costs can range between $7,594 and $16,644 per patient.[3,4] Surgery is a known risk factor for VTE, along with other factors such as age, comorbidities, and prior history of VTE. Surgery patients are at risk of developing VTEs in the form of deep vein thrombosis (DVT), which can lead to complications when blood clots break off into the circulation and get lodged in vessels, particularly in the pulmonary artery of the lungs (known as pulmonary embolism or PE). It has been estimated that about 70% of healthcare-associated VTEs can be prevented if hospitals and surgery centers institute an effective post-surgery thromboprophylaxis program typically including low molecular weight heparin, direct oral anticoagulants, and mechanical prophylaxis with IPCs.[5,6,7] One study reported that DVT was detected in 15.5% of posterior spinal surgery patients not receiving thromboprophylaxis.[8] An additional study reported that, without prophylaxis, about half of knee arthroplasties develop VTE but only 5% develop VTE-related symptoms.[9]

There are various options, pharmacologic and mechanical, for thromboprophylaxis following surgery.[10] Anticoagulants are the predominant form of pharmacological intervention, including aspirin, traditional anticoagulation (warfarin and low molecular weight heparin), and direct oral anticoagulants. Antiplatelet agents, particularly acetylsalicylic acid, and a synthetic pentasaccharide, fondaparinux, can also be used for prophylaxis. Mechanical options include walking, compression elastic stockings, and intermittent pneumatic devices (IPCs).

Patients utilizing anticoagulants are at increased risk for adverse bleeding events, such as stroke, anemia, and gastrointestinal bleeds.[15,11] Such events can be costly, from $3,500 to $11,000 per event.[4] Some physicians are hesitant to prescribe anticoagulants for this reason.[12,13] Physicians must weigh the risk of VTE against the risk of anticoagulant related bleeding events and this assessment is reflected in surgery-specific clinical guidelines.

Clinical guidelines on VTE prophylaxis vary based on surgery type and patient risk.[14,15,16,17,18] Risk assessment of patients for VTE is based on a number of factors including age, surgery type, comorbid conditions, and history of VTE (risk factors). Patients over 40 or those who have risk factors are considered moderate to high risk and are recommended for various levels of thromboprophylaxis. Patients undergoing major surgeries including hip and knee arthroplasty, hip fracture surgery, and other major surgeries are unilaterally recommended for thromboprophylaxis, pharmacological prophylaxis (American Society of Hematology), or either pharmacological or IPCs as per the American College of Chest Physicians (ACCP) and the American Academy of Orthopaedic Surgeons (AAOS). For patients undergoing major surgery in general, the American Society of Hematology recommends that mechanical prophylaxis is preferred over no prophylaxis, and that IPCs are preferred over compression stockings.[17] Guidelines for spine surgeries are less prescriptive. Many surgeons have demonstrated a reluctance to prescribe pharmacological or mechanical thromboprophylaxis following spinal surgery other than mobilization (walking).[19] VTE rates vary with region of spinal surgery, length of surgery, and period of immobility.[20] This lack of homogeneity across spinal surgeries leads to reluctance to standardize thromboprophylaxis protocols. See a summary of clinical guidelines recommendations in Figure 1 for all surgeries we analyzed.

FIGURE 1: SUMMARY OF CLINICAL GUIDELINES FOR THROMBOPROPHYLAXIS BY SURGERY TYPE

ORTHOPEDIC SURGERY		
MAJOR SURGERY	ASH, ACCP	Pharmacological or mechanical prophylaxis recommended; combined is better; 10-14 days up to 35 days. Mechanical prophylaxis alone recommended for increased bleeding risk.
HIP AND KNEE ARTHROPLASTY	AAOS, ASH, ACCP	Pharmacological (LMWH, fondaparinux, apixaban, dabigatran, rivaroxaban, LDUH, adjusted-dose VKA, aspirin) or mechanical (IPCD) prophylaxis suggested or recommended; 10-14 days following surgery.
KNEE ARTHROSCOPY	ACCP	No thromboprophylaxis recommended without history of VTE.
HIP FRACTURE SURGERY	ACCP, ASH	Pharmacological (LMWH, fondaparinux, LDUH, adjusted-dose VKA, aspirin) or mechanical (IPCD) prophylaxis recommended; 10-14 days following surgery.
SHOULDER ARTHROPLASTY	DAY, NICE	No established U.S. guidelines. Day et al. recommend either no thromboprophylaxis or mechanical prophylaxis with aspirin unless patient at high risk for VTE. NICE (UK) guidelines recommend no thromboprophylaxis for upper limb surgery unless the patient is under general anesthesia for more than 90 minutes or has other difficulties with mobilization.
LOWER EXTREMITY/PODIATRIC SURGERY		
	ACFAS	Thromboprophylaxis should be considered if the patient has a risk factor for VTE.
GYNECOLOGICAL SURGERY		
MAJOR SURGERY	ASH	Pharmacological prophylaxis suggested.
SPINAL SURGERY		
	NASS	Mechanical prophylaxis (IPCD or compression stockings) suggested for all inpatient surgeries. Pharmacological prophylaxis not recommended for surgeries with posterior approach and low VTE risk; should be considered (LMWH or low-dose warfarin) for longer surgeries or for patients with risk factors.

AAOS: American Academy of Orthopaedic Surgeons
ASH: American Society of Hematology
ACCP: American College of Chest Physicians
NASS: North American Spine Society
ACFAS: American College of Foot and Ankle Surgeons
NICE: National Institute for Health and Care Excellence
Day: Day, 2015.[21]
VTE: Venous thromboembolism
LWMH: Low-molecular-weight heparin
LDUH: Low-dose unfractionated heparin
VKA: Vitamin K antagonist (e.g. warfarin)
IPCD: Intermittent pneumatic compression device

The purpose of this study was to examine practice patterns for thromboprophylaxis use following particular inpatient and outpatient surgeries and the rate of bleeding events for cases with anticoagulation use. We first summarize all surgical cases incurred in November 2017 through October 2018 for key surgeries among inpatient and outpatient orthopedic, podiatry, obstetrics and gynecology, and spine surgery. We then summarize the rate of surgeries reporting thromboprophylaxis utilization in the 30 days following surgery. We additionally report the rate of bleeding events among surgical cases reporting post-surgery anticoagulant use compared to rates for cases without use of anticoagulant therapy and/or IPC. Throughout, we summarize inpatient and outpatient cases separately by body region in total and by unique surgery. Costs of bleeding events reflect average allowed costs: total amounts paid to providers by both patient and payers combined.

Findings

From a denominator of more than 31 million members, we identified 521,989 inpatient and outpatient orthopedic, obstetric and gynecological (OBGYN), podiatry, and spine surgical cases (see Appendix B: Methodology for procedure codes).

Anticoagulants were defined as physician-administered or pharmacy-administered drugs including prescription aspirin, warfarin, enoxaparin, dalteparin, fondaparinux, daltigran, apixaban, edoxaban, rivoraxaban, and heparin. Over-the-counter aspirin is not reported in the data. In order to account for possible explanations as to why we did not identify anticoagulation use after a majority of the surgeries and to differentiate between anticoagulation cases with more than two days of anticoagulant use, we assigned cases into six mutually exclusive cohorts described and summarized in Figure 2.

FIGURE 2: SURGERY COHORT DEFINITIONS

Cohort 1: Sustained Anticoagulant Users	• Surgeries with anticoagulant utilization with more than 2 days supply reported within 30 days following surgery (including where the fill date of the anticoagulant prescription occurred during the inpatient stay); excludes IRF/SNF patients and antiplatelet users. Only 2% of these surgeries had under a week days supply of anticoagulants.
Cohort 2: Brief Anticoagulant Users	• Surgeries with anticoagulant utilization with at most 2 days supply reported within 30 days following surgery (including where the anticoagulant fill was reported during the span of the surgery); excludes IRF/SNF patients and antiplatelet users. • These cases could potentially be considered candidates for IPC.
Cohort 3: IPC Users	• Surgeries with IPC utilization and no anticoagulant utilization reported within 30 days following surgery; excludes IRF/SNF patients and antiplatelet users.
Cohort 4: IRF/SNF Patients	• Surgeries with post-surgery admissions to inpatient rehab or skilled nursing facilities within 30 days of surgery; referred to as IRF/SNF patients. • Anticoagulation use may be masked for this population.
Cohort 5: Antiplatelet Users	• Surgeries with 1+ script for antiplatelets in 90 days preceding or 30 days following surgery. • These patients would not be expected to be placed on prophylactic anticoagulant therapy.
Cohort 6: Surgeries without Anticoagulant or IPC Use	• These surgeries did not report anticoagulant utilization, IPC utilization, post surgery admissions to IRF/SNF, or anti-platelet utilization in the 30 days following surgery. While not discernable in the data, these patients could still have been on over the counter aspirin.

We report the rate of surgical cases, anticoagulant and IPC utilization, and bleeding events. We provide results separately for inpatient and outpatient cases. Bleeding events were stratified by severity (major, moderate, and minor) and by body region. Please refer to Appendix B: Methodology for details on this stratification.

ORTHOPEDIC SURGERIES

We identified 235,774 orthopedic surgeries including elbow ligament repair, hip arthroplasty, hip arthroscopy, hip repair, knee arthroplasty, meniscus, patellar alignment, repair of knee ligament, shoulder arthroplasty, shoulder arthroscopy, and shoulder repair surgeries.

Inpatient

Across the 59,720 orthopedic inpatient surgeries, 19,500 (32.7%) reported claims for sustained anticoagulant use and 36,534 (61.2%) did not have claims for anticoagulants or IPCs (Figure 3). Anticoagulant utilization varied by surgery type. Knee and hip arthroplasty were the most common inpatient orthopedic surgeries reported. Clinical guidelines recommend pharmacological and/or mechanical prophylaxis for these surgeries. However, we observed that only one-third of these cases reported anticoagulant or IPC utilization post-surgery. Less frequent surgeries such as elbow ligament and shoulder repairs, for which there are no established U.S. guidelines, reported the lowest rates of anticoagulant use (7.4% and 8.8%, respectively).

FIGURE 3: ORTHOPEDIC INPATIENT SURGICAL CASES BY COHORT

ORTHOPEDIC SURGERIES	CASE COUNT	**COHORT 1**: SUSTAINED ANTICOAGULANT USERS; WITH OR WITHOUT IPC		**COHORT 2**: BRIEF ANTICOAGULANT USERS; WITH OR WITHOUT IPC		**COHORT 3**: IPC USERS WITH NO ANTICOAGULANT USE		**COHORT 4**: IRF/SNF PATIENTS		**COHORT 5**: ANTIPLATELET USERS		**COHORT 6**: SURGERIES WITHOUT ANTICOAGULANT OR IPC USE	
		N	%	N	%	N	%	N	%	N	%	N	%
ALL	59,720	19,500	32.7%	150	0.3%	377	0.6%	2,313	3.9%	846	1.4%	36,534	61.2%
ELBOW LIGAMENT REPAIR SURGERY	94	7	7.4%	-	-	-	-	6	6.4%	2	2.1%	79	84.0%
HIP ARTHROPLASTY	23,734	7,828	33.0%	65	0.3%	152	0.6%	684	2.9%	314	1.3%	14,691	61.9%
HIP ARTHROSCOPY	46	15	32.6%	1	2.2%	-	-	2	4.3%	1	2.2%	27	58.7%
HIP REPAIR SURGERY	75	29	38.7%	-	-	-	-	1	1.3%	-	-	45	60.0%
KNEE ARTHROPLASTY	31,195	10,871	34.8%	76	0.2%	210	0.7%	1,458	4.7%	455	1.5%	18,125	58.1%
KNEE ARTHROSCOPY	434	71	16.4%	2	0.5%	3	0.7%	22	5.1%	8	1.8%	328	75.6%
MENISCUS SURGERY	287	105	36.6%	-	-	1	0.3%	48	16.7%	4	1.4%	129	44.9%
PATELLAR ALIGNMENT SURGERY	612	208	34.0%	1	0.2%	2	0.3%	29	4.7%	8	1.3%	364	59.5%
REPAIR OF KNEE LIGAMENT	135	38	28.1%	-	-	1	0.7%	13	9.6%	1	0.7%	82	60.7%
SHOULDER ARTHROPLASTY	2,874	306	10.6%	5	0.2%	8	0.3%	31	1.1%	44	1.5%	2,480	86.3%
SHOULDER ARTHROSCOPY	8	2	25.0%	-	-	-	-	-	-	1	12.5%	5	62.5%
SHOULDER REPAIR SURGERY	226	20	8.8%	-	-	-	-	19	8.4%	8	3.5%	179	79.2%

Overall, among the 19,500 orthopedic surgeries with claims for sustained anticoagulant use post-surgery, 0.25% reported one or more bleeding events (Figure 4). The average bleeding event cost for surgeries with claims for sustained anticoagulant therapy was $8,066. The majority (0.22%) of bleeding events reported were of moderate severity; post-hemorrhagic anemia was the most common type (10%).

FIGURE 4: ORTHOPEDIC INPATIENT BLEEDING EVENT RATES

ORTHOPEDIC SURGERIES	**COHORT 1**: SUSTAINED ANTICOAGULANT USERS; WITH OR WITHOUT IPC			**COHORT 2**: BRIEF ANTICOAGULANT USERS; WITH OR WITHOUT IPC			**COHORT 3**: IPC USERS WITH NO ANTICOAGULANT USE			**COHORT 6**: SURGERIES WITHOUT ANTICOAGULANT OR IPC USE		
	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS
ALL	19,500	0.25%	$8,066	150	-	N/A	377	0.53%	$17,123	36,534	0.20%	$10,493
P-VALUE FOR χ^2 TEST OF INDEPENDENCE FOR COHORT 1 VS. COHORT 6 BLEEDING EVENT RATES		0.26										
ELBOW LIGAMENT REPAIR SURGERY	7	-	N/A	-	-	N/A	-	-	N/A	79	1.27%	$380
HIP ARTHROPLASTY	7,828	0.23%	$11,316	65	-	N/A	152	0.66%	$28,577	14,691	0.20%	$10,015
HIP ARTHROSCOPY	15	-	N/A	1	-	N/A	-	-	N/A	27	-	N/A
HIP REPAIR SURGERY	29	-	N/A	-	-	N/A	-	-	N/A	45	-	N/A
KNEE ARTHROPLASTY	10,871	0.24%	$6,156	76	-	N/A	210	0.48%	$5,669	18,125	0.19%	$10,999
KNEE ARTHROSCOPY	71	-	N/A	2	-	N/A	3	-	N/A	328	0.30%	$13,347
MENISCUS SURGERY	105	-	N/A	-	-	N/A	1	-	N/A	129	-	N/A
PATELLAR ALIGNMENT SURGERY	208	0.96%	$806	1	-	N/A	2	-	N/A	364	-	N/A
REPAIR OF KNEE LIGAMENT	38	2.63%	$18,556	-	-	N/A	1	-	N/A	82	-	N/A
SHOULDER ARTHROPLASTY	306	0.33%	$3,242	5	-	N/A	8	-	N/A	2,480	0.20%	$10,591
SHOULDER ARTHROSCOPY	2	-	N/A	-	-	N/A	-	-	N/A	5	-	N/A
SHOULDER REPAIR SURGERY	20	-	N/A	-	-	N/A	-	-	N/A	179	1.12%	$12,443

Outpatient

We identified 176,054 orthopedic outpatient surgeries. Of these, only 10,318 (5.9%) reported claims for sustained anticoagulant use and 160,380 (91.1%) did not have claims for anticoagulants or IPCs (Figure 5). Meniscus and shoulder repair were the most common outpatient orthopedic surgeries reported. Anticoagulant utilization varied by surgery type. One-quarter of hip and knee arthroplasty cases reported sustained anticoagulant utilization post-surgery, where clinical guidelines recommend pharmacological and/or mechanical prophylaxis. By comparison, shoulder repair surgery, with no established guidelines, only reported 2.2% sustained anticoagulant cases.

FIGURE 5: ORTHOPEDIC OUTPATIENT SURGICAL CASES BY COHORT

ORTHOPEDIC SURGERIES	CASE COUNT	**COHORT 1**: SUSTAINED ANTICOAGULANT USERS; WITH OR WITHOUT IPC		**COHORT 2**: BRIEF ANTICOAGULANT USERS; WITH OR WITHOUT IPC		**COHORT 3**: IPC USERS WITH NO ANTICOAGULANT USE		**COHORT 4**: IRF/SNF PATIENTS		**COHORT 5**: ANTIPLATELET USERS		**COHORT 6**: SURGERIES WITHOUT ANTICOAGULANT OR IPC USE	
		N	%	N	%	N	%	N	%	N	%	N	%
ALL	176,054	10,318	5.9%	360	0.2%	3,575	2.0%	139	0.1%	1,282	0.7%	160,380	91.1%
ELBOW LIGAMENT REPAIR SURGERY	851	7	0.8%	1	0.1%	9	1.1%	-	-	1	0.1%	833	97.9%
HIP ARTHROPLASTY	2,534	593	23.4%	12	0.5%	159	6.3%	6	0.2%	25	1.0%	1,739	68.6%
HIP ARTHROSCOPY	842	67	8.0%	1	0.1%	27	3.2%	-	-	3	0.4%	744	88.4%
HIP REPAIR SURGERY	3,141	351	11.2%	9	0.3%	117	3.7%	-	-	3	0.1%	2,661	84.7%
KNEE ARTHROPLASTY	9,589	2,534	26.4%	170	1.8%	370	3.9%	95	1.0%	93	1.0%	6,327	66.0%
KNEE ARTHROSCOPY	20,009	1,016	5.1%	23	0.1%	386	1.9%	3	0.0%	81	0.4%	18,500	92.5%
MENISCUS SURGERY	63,345	2,991	4.7%	48	0.1%	921	1.5%	10	0.0%	472	0.7%	58,903	93.0%
PATELLAR ALIGNMENT SURGERY	1,347	111	8.2%	3	0.2%	30	2.2%	3	0.2%	2	0.1%	1,198	88.9%
REPAIR OF KNEE LIGAMENT	20,250	1,411	7.0%	32	0.2%	509	2.5%	9	0.0%	19	0.1%	18,270	90.2%
SHOULDER ARTHROPLASTY	583	39	6.7%	6	1.0%	10	1.7%	2	0.3%	4	0.7%	522	89.5%
SHOULDER ARTHROSCOPY	204	6	2.9%	-	-	4	2.0%	-	-	2	1.0%	192	94.1%
SHOULDER REPAIR SURGERY	53,359	1,192	2.2%	55	0.1%	1,033	1.9%	11	0.0%	577	1.1%	50,491	94.6%

Overall, among the 10,318 surgeries with claims for sustained anticoagulant therapy post-surgery, 0.29% reported one or more bleeding events (Figure 6). Bleeding events occurred more often among the surgeries with claims for sustained anticoagulant therapy than surgeries without claims for IPCs or anticoagulants (0.29% vs. 0.06%; p-value < .001). The average cost of a bleeding event for surgeries with claims for sustained anticoagulant therapy was $5,744. The majority (0.26%) of bleeding events were of moderate severity; ear, nose, and throat was the most common type (0.09%).

FIGURE 6: ORTHOPEDIC OUTPATIENT BLEEDING EVENT RATES

ORTHOPEDIC SURGERIES	**COHORT 1**: SUSTAINED ANTICOAGULANT USERS; WITH OR WITHOUT IPC			**COHORT 2**: BRIEF ANTICOAGULANT USERS; WITH OR WITHOUT IPC			**COHORT 3**: IPC USERS WITH NO ANTICOAGULANT USE			**COHORT 6**: SURGERIES WITHOUT ANTICOAGULANT OR IPC USE		
	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS
ALL	10,318	0.29%	$5,744	360	0.56%	$24,958	3,575	0.06%	$4,378	160,380	0.06%	$6,578
P-VALUE FOR χ^2 TEST OF INDEPENDENCE FOR COHORT 1 VS. COHORT 6 BLEEDING EVENT RATES		<0.001										
ELBOW LIGAMENT REPAIR SURGERY	7	-	N/A	1	-	N/A	9	-	N/A	833	0.12%	$40
HIP ARTHROPLASTY	593	0.17%	$62	12	-	N/A	159	0.63%	$5,978	1,739	-	N/A
HIP ARTHROSCOPY	67	-	N/A	1	-	N/A	27	-	N/A	744	-	N/A
HIP REPAIR SURGERY	351	-	N/A	9	-	N/A	117	-	N/A	2,661	0.11%	$2,145
KNEE ARTHROPLASTY	2,534	0.20%	$2,205	170	0.59%	$49,464	370	0.27%	$2,777	6,327	0.14%	$3,915
KNEE ARTHROSCOPY	1,016	0.49%	$9,494	23	-	N/A	386	-	N/A	18,500	0.05%	$1,855
MENISCUS SURGERY	2,991	0.30%	$3,734	48	-	N/A	921	-	N/A	58,903	0.06%	$3,423
PATELLAR ALIGNMENT SURGERY	111	-	N/A	3	-	N/A	30	-	N/A	1,198	0.08%	$16,707
REPAIR OF KNEE LIGAMENT	1,411	0.21%	$5,273	32	-	N/A	509	-	N/A	18,270	0.03%	$3,452
SHOULDER ARTHROPLASTY	39	-	N/A	6	-	N/A	10	-	N/A	522	0.19%	$2,907
SHOULDER ARTHROSCOPY	6	-	N/A	-	-	N/A	4	-	N/A	192	-	N/A
SHOULDER REPAIR SURGERY	1,192	0.59%	$9,191	55	1.82%	$453	1,033	-	N/A	50,491	0.06%	$13,841

OBGYN SURGERIES

We identified 173,200 OBGYN surgeries including cesarean section, laparoscopic hysterectomy, open abdominal hysterectomy, pelvic floor repair, and vaginal hysterectomy surgeries.

Inpatient

Across the 120,457 OBGYN inpatient surgeries, 2,063 (1.7%) reported claims for sustained anticoagulant use and 118,144 (98.1%) did not have claims for anticoagulants or IPCs (Figure 7). Anticoagulant utilization varied by surgery type. Open abdominal surgery reported the highest rate of sustained anticoagulant utilization (7.9%), an amount lower than might be expected in light of clinical recommendation for pharmacological prophylaxis following major surgeries. Cesarean section, which represented the vast majority of OBGYN inpatient surgeries, reported one of the least frequent use rates of anticoagulants at 1.0%.

FIGURE 7: OBGYN INPATIENT SURGICAL CASES BY COHORT

OBGYN SURGERIES	CASE COUNT	**COHORT 1**: SUSTAINED ANTICOAGULANT USERS; WITH OR WITHOUT IPC		**COHORT 2**: BRIEF ANTICOAGULANT USERS; WITH OR WITHOUT IPC		**COHORT 3**: IPC USERS WITH NO ANTICOAGULANT USE		**COHORT 4**: IRF/SNF PATIENTS		**COHORT 5**: ANTIPLATELET USERS		**COHORT 6**: SURGERIES WITHOUT ANTICOAGULANT OR IPC USE	
		N	%	N	%	N	%	N	%	N	%	N	%
ALL	120,457	2,063	1.7%	97	0.1%	24	0.0%	74	0.1%	55	0.0%	118,144	98.1%
CESAREAN SECTION	105,590	1,005	1.0%	61	0.1%	22	0.0%	28	0.0%	7	0.0%	104,467	98.9%
LAPAROSCOPIC HYSTERECTOMY	2,513	141	5.6%	5	0.2%	2	0.1%	9	0.4%	10	0.4%	2,346	93.4%
OPEN ABDOMINAL HYSTERECTOMY	11,562	908	7.9%	31	0.3%	0	-	36	0.3%	36	0.3%	105,51	91.3%
PELVIC FLOOR REPAIR SURGERY	315	5	1.6%	0	-	0	-	-	-	1	0.3%	309	98.1%
VAGINAL HYSTERECTOMY	477	4	0.8%	0	-	0	-	1	0.2%	1	0.2%	471	98.7%

Overall, among the 2,063 surgeries with claims for sustained anticoagulant therapy post-surgery, 1.75% reported one or more bleeding events (Figure 8). Bleeding event rates were higher among surgeries with claims for sustained anticoagulant therapy than surgeries without claims for anticoagulants or IPCs (1.75% vs. 0.3%; p-value < .001). The average cost of a bleeding event for surgeries with claims for sustained anticoagulant therapy was $10,620. The majority (1.6%) of bleeding events reported were of moderate severity; post-hemorrhagic anemia and reproductive system bleeding were the most common (0.63% each).

FIGURE 8: OBGYN INPATIENT BLEEDING EVENT RATES

OBGYN SURGERIES	**COHORT 1**: SUSTAINED ANTICOAGULANT USERS; WITH OR WITHOUT IPC			**COHORT 2**: BRIEF ANTICOAGULANT USERS; WITH OR WITHOUT IPC			**COHORT 3**: IPC USERS WITH NO ANTICOAGULANT USE			**COHORT 6**: SURGERIES WITHOUT ANTICOAGULANT OR IPC USE		
	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS
ALL	2,063	1.75%	$10,620	97	5.15%	$14,428	24	-	N/A	118,144	0.30%	$8,622
P-VALUE FOR χ^2 TEST OF INDEPENDENCE FOR COHORT 1 VS. COHORT 6 BLEEDING EVENT RATES		<0.001										
CESAREAN SECTION	1,005	1.49%	$10,602	61	3.28%	$31,683	22	-	N/A	104,467	0.24%	$9,394
LAPAROSCOPIC HYSTERECTOMY	141	3.55%	$5,121	5	20.00%	$898	2	-	N/A	2,346	1.41%	$6,846
OPEN ABDOMINAL HYSTERECTOMY	908	1.76%	$12,355	31	6.45%	$3,937	-	-	N/A	10,551	0.64%	$6,936
PELVIC FLOOR REPAIR SURGERY	5	-	N/A	-	-	N/A	-	-	N/A	309	0.32%	$1,458
VAGINAL HYSTERECTOMY	4	-	N/A	-	-	N/A	-	-	N/A	471	0.64%	$3,135

Outpatient

We identified 52,743 OBGYN outpatient surgeries. Of these, only 990 (1.9%) reported claims for sustained anticoagulant use and 49,672 (94.2%) did not have claims for anticoagulants or IPCs (Figure 9). Laparoscopic hysterectomy was the most common outpatient orthopedic surgery. Anticoagulant utilization varied slightly by surgery type between 1% and 3%. ASH suggests pharmacological prophylaxis after major gynecologic surgery, which is more likely to occur in the inpatient setting.

FIGURE 9: OBGYN OUTPATIENT SURGICAL CASES BY COHORT

OBGYN SURGERIES	CASE COUNT	**COHORT 1**: SUSTAINED ANTICOAGULANT USERS; WITH OR WITHOUT IPC		**COHORT 2**: BRIEF ANTICOAGULANT USERS; WITH OR WITHOUT IPC		**COHORT 3**: IPC USERS WITH NO ANTICOAGULANT USE		**COHORT 4**: IRF/SNF PATIENTS		**COHORT 5**: ANTIPLATELET USERS		**COHORT 6**: SURGERIES WITHOUT ANTICOAGULANT OR IPC USE	
		N	%	N	%	N	%	N	%	N	%	N	%
ALL	52,743	990	1.9%	1,802	3.4%	117	0.2%	19	0.0%	143	0.3%	49,672	94.2%
CESAREAN SECTION	303	3	1.0%	1	0.3%	0	-	-	-	-	-	299	98.7%
LAPAROSCOPIC HYSTERECTOMY	41,490	883	2.1%	1,500	3.6%	73	0.2%	19	0.0%	110	0.3%	38,905	93.8%
OPEN ABDOMINAL HYSTERECTOMY	695	20	2.9%	28	4.0%	2	0.3%	-	-	-	-	645	92.8%
PELVIC FLOOR REPAIR SURGERY	5,042	38	0.8%	125	2.5%	31	0.6%	-	-	14	0.3%	4,834	95.9%
VAGINAL HYSTERECTOMY	5,213	46	0.9%	148	2.8%	11	0.2%	-	-	19	0.4%	4,989	95.7%

Overall, among the 990 surgeries with claims for sustained anticoagulant therapy post-surgery, 3.84% reported one or more bleeding events (Figure 10). Bleeding events occurred more often among the surgeries with claims for sustained anticoagulant therapy than surgeries without claims for IPCs or anticoagulants (3.84% vs. 1.7%; p-value < .001). The average cost of a bleeding event for surgeries with claims for sustained anticoagulant therapy was $7,926. The majority (3.54%) of bleeding events reported were of moderate severity and occurred most often in the reproductive system (3.13%).

FIGURE 10: OBGYN OUTPATIENT BLEEDING EVENT RATES

OBGYN SURGERIES	**COHORT 1**: SUSTAINED ANTICOAGULANT USERS; WITH OR WITHOUT IPC			**COHORT 2**: BRIEF ANTICOAGULANT USERS; WITH OR WITHOUT IPC			**COHORT 3**: IPC USERS WITH NO ANTICOAGULANT USE			**COHORT 6**: SURGERIES WITHOUT ANTICOAGULANT OR IPC USE		
	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS
ALL	990	3.84%	$7,926	1,802	2.44%	$1,073	117	0.85%	$584	49,672	1.70%	$2,174
P-VALUE FOR χ^2 TEST OF INDEPENDENCE FOR COHORT 1 VS. COHORT 6 BLEEDING EVENT RATES		<0.001										
CESAREAN SECTION	3	-	N/A	1	-	N/A	-	-	N/A	299	1.34%	$7,079
LAPAROSCOPIC HYSTERECTOMY	883	3.51%	$8,752	1,500	2.67%	$1,129	73	1.37%	$584	38,905	1.82%	$2,225
OPEN ABDOMINAL HYSTERECTOMY	20	-	N/A	28	-	N/A	2	-	N/A	645	2.17%	$2,414
PELVIC FLOOR REPAIR SURGERY	38	2.63%	$3,153	125	0.80%	$1,429	31	-	N/A	4,834	0.41%	$2,120
VAGINAL HYSTERECTOMY	46	13.04%	$4,455	148	2.03%	$210	11	-	N/A	4,989	1.94%	$1,582

PODIATRY SURGERIES

We identified 48,805 podiatry surgeries including ankle arthroscopy, ankle fracture fixation, ankle fusion, ankle/foot tendon repair, foot fracture, foot fusion, and toe surgeries.

Inpatient

Across the 2,081 podiatry inpatient surgeries, 561 (27.0%) reported claims for sustained anticoagulant use and 1,189 (57.1%) did not have claims for anticoagulants or IPCs (Figure 11). Anticoagulant utilization varied by surgery type. Foot fusion reported the highest rate of anticoagulant utilization (31%). Toe surgery reported the least frequent use of anticoagulants at 19%. ACFAS recommends considering thromboprophylaxis for patients with risk factors for VTE. These inpatient cases may be higher risk as most podiatry surgeries occur in the outpatient setting.

FIGURE 11: PODIATRY INPATIENT SURGICAL CASES BY COHORT

PODIATRY SURGERIES	CASE COUNT	**COHORT 1**: SUSTAINED ANTICOAGULANT USERS; WITH OR WITHOUT IPC		**COHORT 2**: BRIEF ANTICOAGULANT USERS; WITH OR WITHOUT IPC		**COHORT 3**: IPC USERS WITH NO ANTICOAGULANT USE		**COHORT 4**: IRF/SNF PATIENTS		**COHORT 5**: ANTIPLATELET USERS		**COHORT 6**: SURGERIES WITHOUT ANTICOAGULANT OR IPC USE	
		N	%	N	%	N	%	N	%	N	%	N	%
ALL	2,081	561	27.0%	8	0.4%	2	0.1%	286	13.7%	35	1.7%	1,189	57.1%
ANKLE ARTHROSCOPY	30	8	26.7%	0	-	1	3.3%	1	3.3%	3	10.0%	17	56.7%
ANKLE FRACTURE FIXATION	1,258	337	26.8%	5	0.4%	0	-	177	14.1%	20	1.6%	719	57.2%
ANKLE FUSION	117	26	22.2%	0	-	0	-	16	13.7%	2	1.7%	73	62.4%
ANKLE/FOOT TENDON REPAIR	35	10	28.6%	0	-	1	2.9%	2	5.7%	-	-	22	62.9%
FOOT FRACTURE FIXATION	325	89	27.4%	2	0.6%	0	-	53	16.3%	7	2.2%	174	53.5%
FOOT FUSION	258	80	31.0%	1	0.4%	0	-	32	12.4%	3	1.2%	142	55.0%
TOE SURGERY	58	11	19.0%	0	-	0	-	5	8.6%	-	-	42	72.4%

Among the 561 cases with claims for sustained anticoagulant therapy post-surgery, no bleeding events were identified (Figure 12).

FIGURE 12: PODIATRY INPATIENT BLEEDING EVENT RATES

PODIATRY SURGERIES	**COHORT 1**: SUSTAINED ANTICOAGULANT USERS; WITH OR WITHOUT IPC			**COHORT 2**: BRIEF ANTICOAGULANT USERS; WITH OR WITHOUT IPC			**COHORT 3**: IPC USERS WITH NO ANTICOAGULANT USE			**COHORT 6**: SURGERIES WITHOUT ANTICOAGULANT OR IPC USE		
	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS
ALL	561	-	N/A	8	12.50%	$818	2	-	N/A	1,189	0.17%	$16,189
P-VALUE FOR FISHER'S EXACT TEST FOR COHORT 1 VS. COHORT 6 BLEEDING EVENT RATES		1.00										
ANKLE ARTHROSCOPY	8	-	N/A	-	-	N/A	1	-	N/A	17	-	N/A
ANKLE FRACTURE FIXATION	337	-	N/A	5	20.00%	$818	-	-	N/A	719	0.14%	$20,798
ANKLE FUSION	26	-	N/A	-	-	N/A	-	-	N/A	73	-	N/A
ANKLE/FOOT TENDON REPAIR	10	-	N/A	-	-	N/A	1	-	N/A	22	-	N/A
FOOT FRACTURE FIXATION	89	-	N/A	2	-	N/A	-	-	N/A	174	-	N/A
FOOT FUSION	80	-	N/A	1	-	N/A	-	-	N/A	142	0.70%	$11,581
TOE SURGERY	11	-	N/A	-	-	N/A	-	-	N/A	42	-	N/A

Outpatient

We identified 46,724 podiatry outpatient surgeries. Of these, 3,306 (7.1%) reported claims for sustained anticoagulant use and 42,068 (90.0%) did not have claims for anticoagulants or IPCs (Figure 13). Toe surgery was the most common surgery reported. Anticoagulant utilization varied by surgery type between 2.9% for toe surgery and 19.3% for ankle fusion. The variation may reflect relative risk factors for VTE that impact the guideline recommendation for thromboprophylaxis.

FIGURE 13: PODIATRY OUTPATIENT SURGICAL CASES BY COHORT

PODIATRY SURGERIES	CASE COUNT	**COHORT 1**: SUSTAINED ANTICOAGULANT USERS; WITH OR WITHOUT IPC		**COHORT 2**: BRIEF ANTICOAGULANT USERS; WITH OR WITHOUT IPC		**COHORT 3**: IPC USERS WITH NO ANTICOAGULANT USE		**COHORT 4**: IRF/SNF PATIENTS		**COHORT 5**: ANTIPLATELET USERS		**COHORT 6**: SURGERIES WITHOUT ANTICOAGULANT OR IPC USE	
		N	%	N	%	N	%	N	%	N	%	N	%
ALL	46,724	3,306	7.1%	153	0.3%	864	1.8%	94	0.2%	239	0.5%	42,068	90.0%
ANKLE ARTHROSCOPY	5,118	453	8.9%	4	0.1%	103	2.0%	2	0.0%	12	0.2%	4,544	88.8%
ANKLE FRACTURE FIXATION	4,365	534	12.2%	46	1.1%	37	0.8%	39	0.9%	21	0.5%	3,688	84.5%
ANKLE FUSION	450	87	19.3%	13	2.9%	1	0.2%	6	1.3%	8	1.8%	335	74.4%
ANKLE/FOOT TENDON REPAIR	6,006	681	11.3%	17	0.3%	101	1.7%	9	0.1%	32	0.5%	5,166	86.0%
FOOT FRACTURE FIXATION	4,835	308	6.4%	8	0.2%	69	1.4%	7	0.1%	22	0.5%	4,421	91.4%
FOOT FUSION	5,694	647	11.4%	37	0.6%	91	1.6%	25	0.4%	47	0.8%	4,847	85.1%
TOE SURGERY	20,256	596	2.9%	28	0.1%	462	2.3%	6	0.0%	97	0.5%	19,067	94.1%

Overall, among the 3,306 surgeries with claims for sustained anticoagulant therapy post-surgery, 0.18% reported one or more bleeding events (Figure 14). Bleeding events occurred more often among the surgeries with claims for sustained anticoagulant use than surgeries without claims for IPCs or anticoagulants (0.18% vs. 0.07%; p-value = .04). The average cost of a bleeding event for surgeries with claims for sustained anticoagulant therapy was $5,353. Almost all (0.18%) bleeding events reported were of moderate severity; and occurred most often in the ear, nose, and throat (0.09%).

FIGURE 14: PODIATRY OUTPATIENT BLEEDING EVENT RATES

PODIATRY SURGERIES	**COHORT 1**: SUSTAINED ANTICOAGULANT USERS; WITH OR WITHOUT IPC			**COHORT 2**: BRIEF ANTICOAGULANT USERS; WITH OR WITHOUT IPC			**COHORT 3**: IPC USERS WITH NO ANTICOAGULANT USE			**COHORT 6**: SURGERIES WITHOUT ANTICOAGULANT OR IPC USE		
	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS
ALL	3,306	0.18%	$5,353	153	-	N/A	864	-	N/A	42,068	0.07%	$3,307
P-VALUE FOR FISHER'S EXACT TEST FOR COHORT 1 VS. COHORT 6 BLEEDING EVENT RATES		0.04										
ANKLE ARTHROSCOPY	453	0.22%	$10,510	4	-	N/A	103	-	N/A	4,544	0.07%	$10,590
ANKLE FRACTURE FIXATION	534	-	N/A	46	-	N/A	37	-	N/A	3,688	0.03%	$458
ANKLE FUSION	87	-	N/A	13	-	N/A	1	-	N/A	335	-	N/A
ANKLE/FOOT TENDON REPAIR	681	0.29%	$6,619	17	-	N/A	101	-	N/A	5,166	0.10%	$2,187
FOOT FRACTURE FIXATION	308	0.65%	$2,107	8	-	N/A	69	-	N/A	4,421	0.05%	$733
FOOT FUSION	647	0.15%	$4,153	37	-	N/A	91	-	N/A	4,847	0.17%	$1,995
TOE SURGERY	596	-	N/A	28	-	N/A	462	-	N/A	19,067	0.06%	$3,511

SURGERIES OF THE SPINE

We identified 64,210 spine surgeries including cervical fusion, disc surgery, laminectomy, lumbar fusion, and other spinal decompression surgeries. Other spinal decompression surgeries are defined as any other spinal surgeries that specify decompression of the spinal cord, cauda equina, or nerve root, including laminotomy, facetectomy, foraminotomy, vertebral corpectomy, laminoplasty, and posterolateral extradural exploration.

Inpatient

NASS recommends mechanical prophylaxis (IPC or compression stockings) for all inpatient surgeries and does not recommend pharmacological prophylaxis for surgeries with posterior approach and low VTE risk. Across the 26,923 inpatient surgeries, only 701 (2.6%) reported claims for sustained anticoagulant use, only 50 (0.2%) reported claims for IPC without anticoagulant claims, and 24,330 (90.4%) did not have claims for anticoagulants or IPCs (Figure 15). Anticoagulant utilization varied slightly by surgery type between 1.5% and 3%.

FIGURE 15: SPINE INPATIENT SURGICAL CASES BY COHORT

SPINE SURGERIES	CASE COUNT	**COHORT 1**: SUSTAINED ANTICOAGULANT USERS; WITH OR WITHOUT IPC		**COHORT 2**: BRIEF ANTICOAGULANT USERS; WITH OR WITHOUT IPC		**COHORT 3**: IPC USERS WITH NO ANTICOAGULANT USE		**COHORT 4**: IRF/SNF PATIENTS		**COHORT 5**: ANTIPLATELET USERS		**COHORT 6**: SURGERIES WITHOUT ANTICOAGULANT OR IPC USE	
		N	%	N	%	N	%	N	%	N	%	N	%
ALL	26,923	701	2.6%	51	0.2%	50	0.2%	1,404	5.2%	387	1.4%	24,330	90.4%
CERVICAL FUSION	4,411	79	1.8%	2	0.0%	3	0.1%	243	5.5%	80	1.8%	4,004	90.8%
DISC SURGERY	1,385	42	3.0%	2	0.1%	4	0.3%	62	4.5%	19	1.4%	1,256	90.7%
LAMINECTOMY	618	9	1.5%	1	0.2%	0	-	58	9.4%	5	0.8%	545	88.2%
LUMBAR FUSION	16,177	482	3.0%	37	0.2%	40	0.2%	815	5.0%	208	1.3%	14,595	90.2%
OTHER SPINAL DECOMPRESSION SURGERY	4,332	89	2.1%	9	0.2%	3	0.1%	226	5.2%	75	1.7%	3,930	90.7%

Overall, among the 701 surgeries with claims for sustained anticoagulant therapy post-surgery, 1.28% reported one or more bleeding events (Figure 16). Bleeding event rates were higher among the surgeries with claims for sustained anticoagulant therapy than cases without claims for IPCs or anticoagulants (1.28% vs. 0.18%; p-value < .001). The average cost of a bleeding event for surgeries with claims for sustained anticoagulant therapy was $10,608. All bleeding events reported were of moderate severity and occurred most often as post-hemorrhagic anemia (0.43%).

FIGURE 16: SPINE INPATIENT BLEEDING EVENT RATES

SPINE SURGERIES	**COHORT 1**: SUSTAINED ANTICOAGULANT USERS; WITH OR WITHOUT IPC			**COHORT 2**: BRIEF ANTICOAGULANT USERS; WITH OR WITHOUT IPC			**COHORT 3**: IPC USERS WITH NO ANTICOAGULANT USE			**COHORT 6**: SURGERIES WITHOUT ANTICOAGULANT OR IPC USE		
	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS
ALL	701	1.28%	$10,608	51	-	N/A	50	4.00%	$14,250	24,330	0.18%	$14,521
P-VALUE FOR FISHER'S EXACT TEST FOR COHORT 1 VS. COHORT 6 BLEEDING EVENT RATES		<0.001										
CERVICAL FUSION	79	1.27%	$25,026	2	-	N/A	3	-	N/A	4,004	0.35%	$9,533
DISC SURGERY	42	-	N/A	2	-	N/A	4	-	N/A	1,256	0.08%	$105,716
LAMINECTOMY	9	11.11%	$10,372	1	-	N/A	-	-	N/A	545	0.37%	$6,006
LUMBAR FUSION	482	1.24%	$9,893	37	-	N/A	40	5.00%	$14,250	14,595	0.14%	$13,273
OTHER SPINAL DECOMPRESSION SURGERY	89	1.12%	$717	9	-	N/A	3	-	N/A	3,930	0.13%	$18,893

Outpatient

We identified 37,287 outpatient surgeries. Of these, only 344 (0.9%) reported claims for sustained anticoagulant use, 410 (1.1%) reported claims for IPC without anticoagulant claims, and 35,779 (96%) did not have claims for anticoagulants or IPCs (Figure 17). Other spinal decompression was the most common surgery reported. NASS guidelines state that pharmacological prophylaxis should be considered for longer surgeries or patients with risk factors. Anticoagulant utilization varied slightly by surgery type and ranged between 0.6% for disc surgery and 2.2% for laminectomy.

FIGURE 17: SPINE OUTPATIENT SURGICAL CASES BY COHORT

SPINE SURGERIES	CASE COUNT	**COHORT 1**: SUSTAINED ANTICOAGULANT USERS; WITH OR WITHOUT IPC		**COHORT 2**: BRIEF ANTICOAGULANT USERS; WITH OR WITHOUT IPC		**COHORT 3**: IPC USERS WITH NO ANTICOAGULANT USE		**COHORT 4**: IRF/SNF PATIENTS		**COHORT 5**: ANTIPLATELET USERS		**COHORT 6**: SURGERIES WITHOUT ANTICOAGULANT OR IPC USE	
		N	%	N	%	N	%	N	%	N	%	N	%
ALL	37,287	344	0.9%	217	0.6%	410	1.1%	101	0.3%	436	1.2%	35,779	96.0%
CERVICAL FUSION	8,428	66	0.8%	60	0.7%	96	1.1%	23	0.3%	110	1.3%	8,073	95.8%
DISC SURGERY	2,052	12	0.6%	12	0.6%	32	1.6%	-	-	12	0.6%	1,984	96.7%
LAMINECTOMY	1,048	23	2.2%	9	0.9%	6	0.6%	6	0.6%	15	1.4%	989	94.4%
LUMBAR FUSION	2,376	40	1.7%	22	0.9%	35	1.5%	24	1.0%	36	1.5%	2,219	93.4%
OTHER SPINAL DECOMPRESSION SURGERY	23,383	203	0.9%	114	0.5%	241	1.0%	48	0.2%	263	1.1%	22,514	96.3%

Among the 344 surgeries with claims for sustained anticoagulant therapy post-surgery, only one bleeding event was reported (0.29%). See Figure 18.

FIGURE 18: SPINE OUTPATIENT BLEEDING EVENT RATES

SPINE SURGERIES	**COHORT 1**: SUSTAINED ANTICOAGULANT USERS; WITH OR WITHOUT IPC			**COHORT 2**: BRIEF ANTICOAGULANT USERS; WITH OR WITHOUT IPC			**COHORT 3**: IPC USERS WITH NO ANTICOAGULANT USE			**COHORT 6**: SURGERIES WITHOUT ANTICOAGULANT OR IPC USE		
	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS	CASES	% WITH 1+ BLEEDING EVENTS	BLEEDING EVENT AVG ALLOWED PER CASE WITH 1+ BLEEDING EVENTS
ALL	344	0.29%	$7,131	217	-	N/A	410	-	N/A	35,779	0.08%	$8,148
P-VALUE FOR FISHER'S EXACT TEST FOR COHORT 1 VS. COHORT 6 BLEEDING EVENT RATES		0.26										
CERVICAL FUSION	66	-	N/A	60	-	N/A	96	-	N/A	8,073	0.07%	$5,761
DISC SURGERY	12	-	N/A	12	-	N/A	32	-	N/A	1,984	0.20%	$4,746
LAMINECTOMY	23	-	N/A	9	-	N/A	6	-	N/A	989	0.20%	$3,516
LUMBAR FUSION	40	-	N/A	22	-	N/A	35	-	N/A	2,219	0.05%	$12,977
OTHER SPINAL DECOMPRESSION SURGERY	203	0.49%	$7,131	114	-	N/A	241	-	N/A	22,514	0.08%	$10,052

Discussion

The risk of VTEs after major surgical procedures is well established as is the recommendation for post-surgery thromboprophylaxis for many surgeries. We identified apparent underutilization when comparing the rate of thromboprophylaxis use to guideline recommendations for several of the surgeries we analyzed. In particular, our analysis of total knee arthroplasty cases reported sustained anticoagulant drug utilization following surgery in only 35% of inpatient and 26% of outpatient cases and IPC utilization without pharmacological therapy for 0.7% and 3.9%, respectively. This is lower than expectations in light of the ACCP recommending universal thromboprophylaxis for a minimum of 10 to 14 days following the procedure. Similarly, ASH recommends pharmacological prophylaxis following all major gynecological procedures. We observed that only 8% of patients undergoing inpatient and 3% undergoing outpatient open abdominal hysterectomy procedures had claims for anticoagulants in the 30 days following surgery. Spinal surgeries had low rates of reported sustained anticoagulant use as expected, but also had low rates of reported IPC use, despite NASS guidelines suggesting mechanical prophylaxis after all inpatient spine surgeries. We observed IPC utilization without pharmacological therapy in only 0.2% of inpatient cases. The low rate of thromboprophylaxis for outpatient podiatry surgeries is more consistent with the ACFAS recommendation to consider thromboprophylaxis only for patients with risk factors for VTE.

Suboptimal utilization of thromboprophylaxis following specific major surgeries has been reported previously and has been associated with concerns regarding bleeding risk associated with anticoagulation therapy. As expected, our analysis found a statistically higher rate of bleeding events among anticoagulant utilizers for some surgeries, and the cost of bleeding events associated with anticoagulant use is high, with major bleeding events costing between $5,000 and $11,000 on average per event.

Given the reluctance of some practitioners to prescribe anticoagulants following surgical procedures, consideration of mechanical thromboprophylaxis is warranted, which is included as a guideline recommendation for most of the surgeries we analyzed.

Limitations

Data limitations inherent in the use of real-world data may have affected these results. They include:

- These results are based on a compilation of IBM Watson's Marketscan commercial and Milliman's own consolidated commercial data for the 2017-2018 period. Different data sets or time periods could produce different results.
- Anticoagulant utilization summarized in this report is based on filled prescriptions. It was not possible to capture medications prescribed but not filled by patients.
- Anticoagulant and IPC utilization in this report is based on claims covered by the insurer. It was not possible to capture denied claims or claims that were not submitted to the insurer.
- Over-the-counter use of products such as aspirin is typically not captured. Surgeries classified as no IPC or anticoagulant use (Cohort 6) could include patients on over-the-counter aspirin.
- Some patients may have contraindications for anticoagulants, which could impact their post-surgical care. We looked at patients taking antiplatelet medication within the 90 days prior to surgery and the 30 days after surgery separately but did not analyze other conditions that could have made the prescription of anticoagulants inappropriate.

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Appendix A: Data sources

IBM MARKETSCAN COMMERCIAL CLAIMS DATABASE

The MarketScan® database represents the inpatient and outpatient healthcare service use of a sample of over 25 million commercially insured individuals nationwide who are covered by the benefit plans of large employers, health plans, and government and public organizations. The MarketScan database links paid claims and encounter data to detailed patient information across sites and types of providers, and over time. Member identification codes are consistent from year to year and allow for multiyear longitudinal studies. The database contains diagnosis codes, procedure codes and diagnosis-related group (DRG) codes, National Drug Codes (NDCs), and site of service information and the amounts allowed and paid by commercial insurers. We used data for calendar years 2017 to 2018. We restricted the members in the database to active employees or dependents under the age of 65 as of December 31, 2018, with at least six continuous months of medical and pharmacy coverage in a non-capitated health plan, resulting in a final sample of around 16 million members per year, about 9% of the full commercially insured population.

MILLIMAN CHSD COMMERCIAL CLAIMS DATABASE

The CHSD database contains proprietary historical claims experience from several of Milliman's Health Cost Guidelines™ (HCG) data contributors. The database contains annual enrollment and paid medical and pharmacy claims for a sample of over 25 million commercially insured individuals covered by the benefit plans of large employers, health plans, and governmental and public organizations nationwide. We used data for calendar years 2017 to 2018. We restricted the members in the database to enrollees under the age of 65 as of December 31, 2018, with at least six continuous months of medical and pharmacy coverage, resulting in a final sample of around 15 million members per year, about 9% of the full commercially insured population.

Appendix B: Methodology

We used commercial medical and pharmacy claims for calendar years 2017 to 2018. Members were eligible to be included in the analysis if they had at least one month of commercial medical and pharmacy coverage from November 1, 2017, through October 31, 2018, with three months of continuous prior coverage and two months of continuous post-coverage and were under the age of 65 as of December 31, 2018.

IDENTIFICATION OF SURGICAL CASES

Surgery cases were identified by either an ICD-10 procedure code or a Healthcare Common Procedure Coding System (HCPCS) code (see Appendix C-1: Surgery Codes) occurring on:

- An inpatient facility claim with a corresponding professional surgical claim occurring within seven days prior to admission and seven days after discharge.
- An outpatient facility claim with a corresponding professional surgical claim occurring within seven days prior and seven days after the date of service.
- A professional surgical claim that could be matched to a facility claim within seven days prior and seven days after the date of service.

Overlapping claims were combined into a single surgical case. If codes for multiple surgery types appeared in the same case, the case was assigned to the surgery type identified by associated professional claim with the highest allowed costs. Allowed costs include both the plan payment and any member cost sharing.

The date of index was assigned as the date of admission on the inpatient facility claim or date of service on the outpatient facility claim associated with the surgery case. The date of discharge from surgery was assigned as the date of discharge on the inpatient facility claim or the date of service on the outpatient facility claim associated with the surgery case. If there were overlapping facility claims, the date of discharge from surgery was assigned to the later date of discharge.

Cases were limited to those with a date of discharge from surgery between November 1, 2017, through October 31, 2018, where the member had continuous qualified medical and pharmacy coverage from the 90 days prior to the date of index through the 60 days after the date of discharge from surgery. Cases were also removed from analysis if the member had another surgery of any type (not restricted to the list of surgeries analyzed) within the 30 days after the date of discharge, or anticoagulant utilization (see Appendix C-2: Anticoagulant NDCs and HCPCS Codes) within the 90 days prior to the date of index with no prior surgery of any type.

IDENTIFICATION OF EVENTS OF INTEREST

Anticoagulant utilization post-surgery

Anticoagulant utilization in the 30 days post-surgery was identified by either:

- An anticoagulant NDC (see Appendix C-2: Anticoagulant NDCs and HCPCS Codes) on a pharmacy claim with date of service occurring between the date of index and within 30 days after the date of discharge from surgery.
- An anticoagulant HCPCS code (see Appendix C-2: Anticoagulant NDCs and HCPCS Codes) on a medical claim with date of service occurring between one and 30 days after the date of discharge from surgery.

For NDCs on pharmacy claims, the days supplied of the drug was taken from the claim itself. For HCPCS codes on medical claims, each unique date of administration was considered to be a one-day supply.

Our analysis did not include over-the-counter aspirin, which is not discernible in the claims data.

Coagulation monitoring claims were identified by HCPCS codes (see Appendix C-3: Coagulation Monitoring HCPCS Codes) on claims occurring between one and 30 days after the date of discharge from surgery.

Intermittent pneumatic compression (IPC) utilization post-surgery

Anticoagulant utilization in the 30 days post-surgery was identified by HCPCS codes for IPC devices (see Appendix C-4: IPC HCPCS Codes) on claims occurring on the date of discharge from surgery or between one and 30 days after the date of discharge from surgery.

Skilled nursing facility (SNF) or inpatient rehabilitation facility (IRF) utilization post-surgery

SNF and IRF utilization in the 30 days post-surgery were identified by inpatient SNF or IRF claims occurring on the date of discharge from surgery or between one and 30 days after the date of discharge from surgery.

Antiplatelet utilization pre- and post-surgery

Antiplatelet utilization was identified by an antiplatelet NDC (see Appendix C-5: Antiplatelet NDCs) on a pharmacy claim with a date of service occurring within 90 days prior to the date of index, on the date of discharge from surgery, or one to 30 days after the date of discharge from surgery.

Bleeding events post-surgery

Bleeding events in the 30 days post-surgery were identified by ICD-10 diagnosis codes for bleeding events (see Appendix C-6: Bleeding Event Diagnoses) in any of the following:

- Major events: The primary position on a qualified acute inpatient admission (see Appendix C-7: Qualified Claims).
- Moderate events:
  - The primary position on a qualified nonacute inpatient admission.
  - A secondary position on a qualified acute or nonacute inpatient admission.
  - The primary position on a qualified emergency department or observation claim.
- Minor events: The primary position on a qualified outpatient or urgent care claim, including physician office visits.

Inpatient bleeding event allowed costs included all allowed costs associated with the identifying inpatient claim as well as all professional services incurred during the course of the stay. Outpatient bleeding event allowed costs included all allowed costs associated with the identifying claim, including professional services incurred on the same day coded with the same place of service. Allowed costs include both the plan payment and any member cost sharing.

ASSIGNMENT OF PATIENT COHORTS

All identified surgeries were divided into six patient cohorts.

Cohort 1: Sustained anticoagulant users

Cohort 1 included all identified surgery cases with at least three days' supply of anticoagulants in the 30 days post-surgery (including where the fill date of a pharmacy claim occurred during an inpatient surgery stay), excluding those cases with a SNF or IRF stay in the 30 days post-surgery or antiplatelet use pre- or post-surgery. These cases may have also had IPC utilization.

Cohort 2: Brief anticoagulant users

Cohort 2 included all identified surgery cases with at most two days' supply of anticoagulants in the 30 days post-surgery (including where the fill date of a pharmacy claim occurred during an inpatient surgery stay), excluding those cases with a SNF or IRF stay in the 30 days post-surgery or antiplatelet use pre- or post-surgery. These cases may have also had IPC utilization.

Cohort 3: IPC users

Cohort 3 included all identified surgery cases with IPC utilization and no anticoagulant utilization in the 30 days post-surgery, excluding those cases with a SNF or IRF stay in the 30 days post-surgery or antiplatelet use pre- or post-surgery.

Cohort 4: IRF/SNF patients

Cohort 4 included all identified surgery cases with a SNF or IRF stay in the 30 days post-surgery, excluding those cases with antiplatelet use pre- or post-surgery. Anticoagulant use is sometimes not reported for patients in a SNF or IRF.

Cohort 5: Antiplatelet users

Cohort 5 included all identified surgery cases with antiplatelet utilization in the 90 days prior to surgery or the 30 days post-surgery. These patients would not be expected to be placed on prophylactic anticoagulant therapy.

Cohort 6: Surgeries without anticoagulant or IPC use

Cohort 6 included all identified surgery cases with no anticoagulant utilization and no IPC utilization in the 30 days post-surgery, excluding those cases with a SNF or IRF stay in the 30 days post-surgery or antiplatelet use pre- or post-surgery. These patients may have purchased over-the-counter aspirin, which is not discernible in the claims data.

Appendix C: Code sets

TABLE C-1: SURGERY CODES

SURGERY CATEGORY	SURGERY TYPE	HCPCS CODES	ICD-10-PCS CODES
ORTHOPEDIC	ELBOW LIGAMENT REPAIR SURGERY	24343, 24344, 24345, 24346	0RBL0ZZ, 0RBL3ZZ, 0RBL4ZZ, 0RBM0ZZ, 0RBM3ZZ, 0RBM4ZZ, 0RCL0ZZ, 0RCL3ZZ, 0RCL4ZZ, 0RCM0ZZ, 0RCM3ZZ, 0RCM4ZZ, 0RQL0ZZ, 0RQL3ZZ, 0RQL4ZZ, 0RQM0ZZ, 0RQM3ZZ, 0RQM4ZZ, 0RWL07Z, 0RWL37Z, 0RWL47Z, 0RWM07Z, 0RWM37Z, 0RWM47Z
ORTHOPEDIC	HIP ARTHROPLASTY	27125, 27130, 27132, 27134, 27137, 27138	0SR9019, 0SR901A, 0SR901Z, 0SR9029, 0SR902A, 0SR902Z, 0SR9039, 0SR903A, 0SR903Z, 0SR9049, 0SR904A, 0SR904Z, 0SR9069, 0SR906A, 0SR906Z, 0SR907Z, 0SR90EZ, 0SR90J9, 0SR90JA, 0SR90JZ, 0SR90KZ, 0SRA009, 0SRA00A, 0SRA00Z, 0SRA019, 0SRA01A, 0SRA01Z, 0SRA039, 0SRA03A, 0SRA03Z, 0SRA07Z, 0SRA0J9, 0SRA0JA, 0SRA0JZ, 0SRA0KZ, 0SRB019, 0SRB01A, 0SRB01Z, 0SRB029, 0SRB02A, 0SRB02Z, 0SRB039, 0SRB03A, 0SRB03Z, 0SRB049, 0SRB04A, 0SRB04Z, 0SRB069, 0SRB06A, 0SRB06Z, 0SRB07Z, 0SRB0EZ, 0SRB0J9, 0SRB0JA, 0SRB0JZ, 0SRB0KZ, 0SRE009, 0SRE00A, 0SRE00Z, 0SRE019, 0SRE01A, 0SRE01Z, 0SRE039, 0SRE03A, 0SRE03Z, 0SRE07Z, 0SRE0J9, 0SRE0JA, 0SRE0JZ, 0SRE0KZ, 0SRR019, 0SRR01A, 0SRR01Z, 0SRR039, 0SRR03A, 0SRR03Z, 0SRR07Z, 0SRR0J9, 0SRR0JA, 0SRR0JZ, 0SRR0KZ, 0SRS019, 0SRS01A, 0SRS01Z, 0SRS039, 0SRS03A, 0SRS03Z, 0SRS07Z, 0SRS0J9, 0SRS0JA, 0SRS0JZ, 0SRS0KZ
ORTHOPEDIC	HIP ARTHROSCOPY	29860, 29861, 29862, 29863	0SJ94ZZ, 0SJB4ZZ
ORTHOPEDIC	HIP REPAIR SURGERY	29916	
ORTHOPEDIC	KNEE ARTHROPLASTY	27445, 27446, 27447, 27487	0SRC069, 0SRC06A, 0SRC06Z, 0SRC07Z, 0SRC0EZ, 0SRC0J9, 0SRC0JA, 0SRC0JZ, 0SRC0KZ, 0SRC0L9, 0SRC0LA, 0SRC0LZ, 0SRC0M9, 0SRC0MA, 0SRC0MZ, 0SRC0N9, 0SRC0NA, 0SRC0NZ, 0SRD069, 0SRD06A, 0SRD06Z, 0SRD07Z, 0SRD0EZ, 0SRD0J9, 0SRD0JA, 0SRD0JZ, 0SRD0KZ, 0SRD0L9, 0SRD0LA, 0SRD0LZ, 0SRD0M9, 0SRD0MA, 0SRD0MZ, 0SRD0N9, 0SRD0NA, 0SRD0NZ
ORTHOPEDIC	KNEE ARTHROSCOPY	29866, 29867, 29870, 29871, 29873, 29874, 29875, 29876, 29877, 29879, 29884, 29885, 29886, 29887, G0289	0SJC4ZZ, 0SJD4ZZ
ORTHOPEDIC	MENISCUS SURGERY	27332, 27333, 27347, 27403, 29868, 29880, 29881, 29882, 29883	
ORTHOPEDIC	PATELLAR ALIGNMENT SURGERY	27420, 27422, 27424, 27437, 27438, 27440, 27441, 27442, 27443	0SRT07Z, 0SRT0J9, 0SRT0JA, 0SRT0JZ, 0SRT0KZ, 0SRU07Z, 0SRU0J9, 0SRU0JA, 0SRU0JZ, 0SRU0KZ, 0SRV07Z, 0SRV0J9, 0SRV0JA, 0SRV0JZ, 0SRV0KZ, 0SRW07Z, 0SRW0J9, 0SRW0JA, 0SRW0JZ, 0SRW0KZ, 0SUC07Z, 0SUC09C, 0SUC09Z, 0SUC0JZ, 0SUC0KZ, 0SUC37Z, 0SUC3JZ, 0SUC3KZ, 0SUC47Z, 0SUC4JZ, 0SUC4KZ, 0SUD07Z, 0SUD09C, 0SUD09Z, 0SUD0JZ, 0SUD0KZ, 0SUD37Z, 0SUD3JZ, 0SUD3KZ, 0SUD47Z, 0SUD4JZ, 0SUD4KZ, 0SUT09Z, 0SUU09Z, 0SUV09Z, 0SUW09Z

SURGERY CATEGORY	SURGERY TYPE	HCPCS CODES	ICD-10-PCS CODES
ORTHOPEDIC	REPAIR OF KNEE LIGAMENT	27405, 27409, 27427, 27428, 27429, 29888, 29889	
ORTHOPEDIC	SHOULDER ARTHROPLASTY	23472, 23473, 23474	0RRJ00Z, 0RRJ07Z, 0RRJ0J6, 0RRJ0J7, 0RRJ0JZ, 0RRJ0KZ, 0RRK00Z, 0RRK07Z, 0RRK0J6, 0RRK0J7, 0RRK0JZ, 0RRK0KZ
ORTHOPEDIC	SHOULDER ARTHROSCOPY	29805, 29819	0RJJ4ZZ, 0RJK4ZZ
ORTHOPEDIC	SHOULDER REPAIR SURGERY	23410, 23412, 23430, 23455, 29806, 29807, 29826, 29827, 29828	0LQ10ZZ, 0LQ13ZZ, 0LQ14ZZ, 0LQ20ZZ, 0LQ23ZZ, 0LQ24ZZ, 0RCJ0ZZ, 0RCJ3ZZ, 0RCJ4ZZ, 0RCK0ZZ, 0RCK3ZZ, 0RCK4ZZ, 0RUG07Z, 0RUG0JZ, 0RUG0KZ, 0RUG37Z, 0RUG3JZ, 0RUG3KZ, 0RUG47Z, 0RUG4JZ, 0RUG4KZ, 0RUH07Z, 0RUH0JZ, 0RUH0KZ, 0RUH37Z, 0RUH3JZ, 0RUH3KZ, 0RUH47Z, 0RUH4JZ, 0RUH4KZ
OBGYN	CESAREAN SECTION	59510, 59514, 59515, 59618, 59620, 59622	10D00Z0, 10D00Z1, 10D00Z2
OBGYN	LAPAROSCOPIC HYSTERECTOMY	58541, 58542, 58543, 58544, 58548, 58550, 58552, 58553, 58554, 58570, 58571, 58572, 58573, 58575	0UT94ZL, 0UT94ZZ, 0UT98ZL, 0UT98ZZ, 0UT9FZL, 0UT9FZZ
OBGYN	OPEN ABDOMINAL HYSTERECTOMY	51925, 58150, 58152, 58180, 58200, 58210, 58240, 58951, 58953, 58954, 58956, 59525	0UT90ZL, 0UT90ZZ
OBGYN	PELVIC FLOOR REPAIR SURGERY	45560, 57120, 57230, 57240, 57250, 57260, 57265, 57267, 57268, 57270, 57284, 57285, 57289, 57423	
OBGYN	VAGINAL HYSTERECTOMY	58260, 58262, 58263, 58267, 58270, 58275, 58280, 58285, 58290, 58291, 58292, 58293, 58294	0UT97ZL, 0UT97ZZ
PODIATRY	ANKLE ARTHROSCOPY	29891, 29894, 29895, 29897, 29898	0SJF4ZZ, 0SJG4ZZ
PODIATRY	ANKLE FRACTURE FIXATION	27808, 27810, 27814, 27816, 27818, 27822, 27823, 27840, 27842, 27846, 27848	0SSF04Z, 0SSF05Z, 0SSF0ZZ, 0SSF34Z, 0SSF35Z, 0SSF3ZZ, 0SSF44Z, 0SSF45Z, 0SSF4ZZ, 0SSFX4Z, 0SSFX5Z, 0SSFXZZ, 0SSG04Z, 0SSG05Z, 0SSG0ZZ, 0SSG34Z, 0SSG35Z, 0SSG3ZZ, 0SSG44Z, 0SSG45Z, 0SSG4ZZ, 0SSGX4Z, 0SSGX5Z, 0SSGXZZ
PODIATRY	ANKLE FUSION	27870, 27871, 29899	
PODIATRY	ANKLE/FOOT TENDON REPAIR	27650, 27652, 27654, 28760	
PODIATRY	FOOT FRACTURE FIXATION	28322, 28470, 28475, 28476, 28485, 28600, 28605, 28606, 28615, 28630, 28635, 28636, 28645	0QHN04Z, 0QHN05Z, 0QHN34Z, 0QHN35Z, 0QHN44Z, 0QHN45Z, 0QHP04Z, 0QHP05Z, 0QHP34Z, 0QHP35Z, 0QHP44Z, 0QHP45Z, 0QPN04Z, 0QPN34Z, 0QPN44Z, 0QPP04Z, 0QPP34Z, 0QPP44Z, 0QSN04Z, 0QSN05Z, 0QSN0ZZ, 0QSN34Z, 0QSN35Z, 0QSN3ZZ, 0QSN44Z, 0QSN45Z, 0QSN4ZZ, 0QSNXZZ, 0QSP04Z, 0QSP05Z, 0QSP0ZZ, 0QSP34Z, 0QSP35Z, 0QSP3ZZ, 0QSP44Z, 0QSP45Z, 0QSP4ZZ, 0QSPXZZ, 0QWN04Z, 0QWN05Z, 0QWN34Z, 0QWN35Z, 0QWN44Z, 0QWN45Z, 0QWP04Z, 0QWP05Z, 0QWP34Z, 0QWP35Z, 0QWP44Z, 0QWP45Z
PODIATRY	FOOT FUSION	28705, 28715, 28725, 28730, 28735, 28737, 28740, 28750, 28755	

SURGERY CATEGORY	SURGERY TYPE	HCPCS CODES	ICD-10-PCS CODES
PODIATRY	TOE SURGERY	28285, 28290, 28292, 28293, 28294, 28295, 28296, 28297, 28298, 28299	
SPINAL	CERVICAL FUSION	22548, 22551, 22552, 22554, 22590, 22595, 22600	0RG0070, 0RG0071, 0RG007J, 0RG00A0, 0RG00A1, 0RG00AJ, 0RG00J0, 0RG00J1, 0RG00JJ, 0RG00K0, 0RG00K1, 0RG00KJ, 0RG00Z0, 0RG00Z1, 0RG00ZJ, 0RG0370, 0RG0371, 0RG037J, 0RG03A0, 0RG03A1, 0RG03AJ, 0RG03J0, 0RG03J1, 0RG03JJ, 0RG03K0, 0RG03K1, 0RG03KJ, 0RG03Z0, 0RG03Z1, 0RG03ZJ, 0RG0470, 0RG0471, 0RG047J, 0RG04A0, 0RG04A1, 0RG04AJ, 0RG04J0, 0RG04J1, 0RG04JJ, 0RG04K0, 0RG04K1, 0RG04KJ, 0RG04Z0, 0RG04Z1, 0RG04ZJ, 0RG1070, 0RG1071, 0RG107J, 0RG10A0, 0RG10A1, 0RG10AJ, 0RG10J0, 0RG10J1, 0RG10JJ, 0RG10K0, 0RG10K1, 0RG10KJ, 0RG10Z0, 0RG10Z1, 0RG10ZJ, 0RG1370, 0RG1371, 0RG137J, 0RG13A0, 0RG13A1, 0RG13AJ, 0RG13J0, 0RG13J1, 0RG13JJ, 0RG13K0, 0RG13K1, 0RG13KJ, 0RG13Z0, 0RG13Z1, 0RG13ZJ, 0RG1470, 0RG1471, 0RG147J, 0RG14A0, 0RG14A1, 0RG14AJ, 0RG14J0, 0RG14J1, 0RG14JJ, 0RG14K0, 0RG14K1, 0RG14KJ, 0RG14Z0, 0RG14Z1, 0RG14ZJ, 0RG2070, 0RG2071, 0RG207J, 0RG20A0, 0RG20A1, 0RG20AJ, 0RG20J0, 0RG20J1, 0RG20JJ, 0RG20K0, 0RG20K1, 0RG20KJ, 0RG20Z0, 0RG20Z1, 0RG20ZJ, 0RG2370, 0RG2371, 0RG237J, 0RG23A0, 0RG23A1, 0RG23AJ, 0RG23J0, 0RG23J1, 0RG23JJ, 0RG23K0, 0RG23K1, 0RG23KJ, 0RG23Z0, 0RG23Z1, 0RG23ZJ, 0RG2470, 0RG2471, 0RG247J, 0RG24A0, 0RG24A1, 0RG24AJ, 0RG24J0, 0RG24J1, 0RG24JJ, 0RG24K0, 0RG24K1, 0RG24KJ, 0RG24Z0, 0RG24Z1, 0RG24ZJ, 0RG4070, 0RG4071, 0RG407J, 0RG40A0, 0RG40A1, 0RG40AJ, 0RG40J0, 0RG40J1, 0RG40JJ, 0RG40K0, 0RG40K1, 0RG40KJ, 0RG40Z0, 0RG40Z1, 0RG40ZJ, 0RG4370, 0RG4371, 0RG437J, 0RG43A0, 0RG43A1, 0RG43AJ, 0RG43J0, 0RG43J1, 0RG43JJ, 0RG43K0, 0RG43K1, 0RG43KJ, 0RG43Z0, 0RG43Z1, 0RG43ZJ, 0RG4470, 0RG4471, 0RG447J, 0RG44A0, 0RG44A1, 0RG44AJ, 0RG44J0, 0RG44J1, 0RG44JJ, 0RG44K0, 0RG44K1, 0RG44KJ, 0RG44Z0, 0RG44Z1, 0RG44ZJ, XRG0092, XRG00F3, XRG1092, XRG10F3, XRG2092, XRG20F3, XRG4092, XRG40F3
SPINAL	DISC SURGERY	22856, 22857, 22858, 22861, 22862, 22864, 22865, 63075, 63076, 63077, 63078, 0163T, 0164T, 0165T, S2350, S2351	0R530ZZ, 0R533ZZ, 0R534ZZ, 0R550ZZ, 0R553ZZ, 0R554ZZ, 0R590ZZ, 0R593ZZ, 0R594ZZ, 0R5B0ZZ, 0R5B3ZZ, 0R5B4ZZ, 0RB30ZZ, 0RB33ZZ, 0RB34ZZ, 0RB50ZZ, 0RB53ZZ, 0RB54ZZ, 0RB90ZZ, 0RB93ZZ, 0RB94ZZ, 0RBB0ZZ, 0RBB3ZZ, 0RBB4ZZ, 0RT30ZZ, 0RT50ZZ, 0RT90ZZ, 0RTB0ZZ, 0S520ZZ, 0S523ZZ, 0S524ZZ, 0S540ZZ, 0S543ZZ, 0S544ZZ, 0SB20ZZ, 0SB23ZZ, 0SB24ZZ, 0SB40ZZ, 0SB43ZZ, 0SB44ZZ, 0ST20ZZ, 0ST40ZZ

SURGERY CATEGORY	SURGERY TYPE	HCPCS CODES	ICD-10-PCS CODES
SPINAL	LAMINECTOMY	63001, 63003, 63005, 63011, 63012, 63015, 63016, 63017, 63170, 63172, 63173, 63180, 63182, 63185, 63190, 63191, 63194, 63195, 63196, 63197, 63198, 63199, 63200, 63250, 63251, 63252, 63655	
SPINAL	LUMBAR FUSION	22533, 22534, 22558, 22586, 22612, 22630, 22633, 22634, 22800, 22802, 22804, 22808, 22810, 22812, 22840, 22841, 22842, 22843, 22844, 22845, 22846, 22847, 22848, 22849, 22850, 22851, 22852, 22853, 22854, 22855, 0195T, 0196T, 0309T	0RGA070, 0RGA071, 0RGA07J, 0RGA0A0, 0RGA0A1, 0RGA0AJ, 0RGA0J0, 0RGA0J1, 0RGA0JJ, 0RGA0K0, 0RGA0K1, 0RGA0KJ, 0RGA0Z0, 0RGA0Z1, 0RGA0ZJ, 0RGA370, 0RGA371, 0RGA37J, 0RGA3A0, 0RGA3A1, 0RGA3AJ, 0RGA3J0, 0RGA3J1, 0RGA3JJ, 0RGA3K0, 0RGA3K1, 0RGA3KJ, 0RGA3Z0, 0RGA3Z1, 0RGA3ZJ, 0RGA470, 0RGA471, 0RGA47J, 0RGA4A0, 0RGA4A1, 0RGA4AJ, 0RGA4J0, 0RGA4J1, 0RGA4JJ, 0RGA4K0, 0RGA4K1, 0RGA4KJ, 0RGA4Z0, 0RGA4Z1, 0RGA4ZJ, 0SG0070, 0SG0071, 0SG007J, 0SG00A0, 0SG00A1, 0SG00AJ, 0SG00J0, 0SG00J1, 0SG00JJ, 0SG00K0, 0SG00K1, 0SG00KJ, 0SG00Z0, 0SG00Z1, 0SG00ZJ, 0SG0370, 0SG0371, 0SG037J, 0SG03A0, 0SG03A1, 0SG03AJ, 0SG03J0, 0SG03J1, 0SG03JJ, 0SG03K0, 0SG03K1, 0SG03KJ, 0SG03Z0, 0SG03Z1, 0SG03ZJ, 0SG0470, 0SG0471, 0SG047J, 0SG04A0, 0SG04A1, 0SG04AJ, 0SG04J0, 0SG04J1, 0SG04JJ, 0SG04K0, 0SG04K1, 0SG04KJ, 0SG04Z0, 0SG04Z1, 0SG04ZJ, 0SG1070, 0SG1071, 0SG107J, 0SG10A0, 0SG10A1, 0SG10AJ, 0SG10J0, 0SG10J1, 0SG10JJ, 0SG10K0, 0SG10K1, 0SG10KJ, 0SG10Z0, 0SG10Z1, 0SG10ZJ, 0SG1370, 0SG1371, 0SG137J, 0SG13A0, 0SG13A1, 0SG13AJ, 0SG13J0, 0SG13J1, 0SG13JJ, 0SG13K0, 0SG13K1, 0SG13KJ, 0SG13Z0, 0SG13Z1, 0SG13ZJ, 0SG1470, 0SG1471, 0SG147J, 0SG14A0, 0SG14A1, 0SG14AJ, 0SG14J0, 0SG14J1, 0SG14JJ, 0SG14K0, 0SG14K1, 0SG14KJ, 0SG14Z0, 0SG14Z1, 0SG14ZJ, 0SG3070, 0SG3071, 0SG307J, 0SG30A0, 0SG30A1, 0SG30AJ, 0SG30J0, 0SG30J1, 0SG30JJ, 0SG30K0, 0SG30K1, 0SG30KJ, 0SG30Z0, 0SG30Z1, 0SG30ZJ, 0SG3370, 0SG3371, 0SG337J, 0SG33A0, 0SG33A1, 0SG33AJ, 0SG33J0, 0SG33J1, 0SG33JJ, 0SG33K0, 0SG33K1, 0SG33KJ, 0SG33Z0, 0SG33Z1, 0SG33ZJ, 0SG3470, 0SG3471, 0SG347J, 0SG34A0, 0SG34A1, 0SG34AJ, 0SG34J0, 0SG34J1, 0SG34JJ, 0SG34K0, 0SG34K1, 0SG34KJ, 0SG34Z0, 0SG34Z1, 0SG34ZJ, XRGA092, XRGA0F3, XRGB092, XRGB0F3, XRGC092, XRGC0F3, XRGD092, XRGD0F3
SPINAL	OTHER SPINAL DECOMPRESSION SURGERY	62287, 62380, 63020, 63030, 63035, 63040, 63042, 63043, 63044, 63045, 63046, 63047, 63048, 63050, 63051, 63055, 63056, 63057, 63064, 63066, 63081, 63082, 63085, 63086, 63087, 63088, 63090, 63091, 63101, 63102, 63103, 0274T, 0275T, G0276, S2348	

TABLE C-2: ANTICOAGULANTS

GENERIC PRODUCT NAME
APIXABAN
ASPIRIN
BETRIXABAN
DABIGATRAN
DALTEPARIN
DESIRUDIN
EDOXABAN
ENOXAPARIN
FONDAPARINUX
HEPARIN
RIVAROXABAN
WARFARIN

TABLE C-3: COAGULATION MONITORING HCPCS CODES

HCPCS CODE	DESCRIPTION®
36415†	Routine venipuncture
85610	Prothrombin time
85611	Prothrombin time; substitution, plasma fractions, each
93792	Patient/caregiver training for initiation of home international normalized ratio (INR) monitoring under the direction of a physician or other qualified health care professional, face-to-face, including use and care of the INR monitor, obtaining blood sample, instructions for reporting home INR test results, and documentation of patient's/caregiver's ability to perform testing and report results.
93793	Anticoagulant management for a patient taking warfarin, must include review and interpretation of a new home, office, or lab international normalized ratio (INR) test result, patient instructions, dosage adjustment (as needed), and scheduling of additional test(s), when performed.
99201‡	Office or other outpatient visit for the evaluation and management of a new patient, which requires these three key components: a problem focused history, a problem focused examination, straightforward medical decision making. Counseling and/or coordination of care with other physicians, other qualified health care professionals, or agencies are provided consistent with the nature of the problem(s) and the patient's and/or family's needs. Usually, the presenting problem(s) are self limited or minor. Typically, 10 minutes are spent face-to-face with the patient and/or family.
99202‡	Office or other outpatient visit for the evaluation and management of a new patient, which requires these three key components: an expanded problem focused history, an expanded problem focused examination, straightforward medical decision making. Counseling and/or coordination of care with other physicians, other qualified health care professionals, or agencies are provided consistent with the nature of the problem(s) and the patient's and/or family's needs. Usually, the presenting problem(s) are of low to moderate severity. Typically, 20 minutes are spent face-to-face with the patient and/or family.
99203‡	Office or other outpatient visit for the evaluation and management of a new patient, which requires these three key components: a detailed history, a detailed examination, medical decision making of low complexity. Counseling and/or coordination of care with other physicians, other qualified health care professionals, or agencies are provided consistent with the nature of the problem(s) and the patient's and/or family's needs. Usually, the presenting problem(s) are of moderate severity. Typically, 30 minutes are spent face-to-face with the patient and/or family.
99204‡	Office or other outpatient visit for the evaluation and management of a new patient, which requires these three key components: a comprehensive history, a comprehensive examination, medical decision making of moderate complexity. Counseling and/or coordination of care with other physicians, other qualified health care professionals, or agencies are provided consistent with the nature of the problem(s) and the patient's and/or family's needs. Usually, the presenting problem(s) are of moderate to high severity. Typically, 45 minutes are spent face-to-face with the patient and/or family.
99205‡	Office or other outpatient visit for the evaluation and management of a new patient, which requires these three key components: a comprehensive history, a comprehensive examination, medical decision making of high complexity. Counseling and/or coordination of care with other physicians, other qualified health care professionals, or agencies are provided consistent with the nature of the problem(s) and the patient's and/or family's needs. Usually, the presenting problem(s) are of moderate to high severity. Typically, 60 minutes are spent face-to-face with the patient and/or family.

HCPCS CODE	DESCRIPTION®
99211‡	Office or other outpatient visit for the evaluation and management of an established patient, that may not require the presence of a physician or other qualified health care professional. Usually, the presenting problem(s) are minimal. Typically, five minutes are spent performing or supervising these services.
99212‡	Office or other outpatient visit for the evaluation and management of an established patient, which requires at least two of these three key components: a problem-focused history, a problem-focused examination, straightforward medical decision making. Counseling and/or coordination of care with other physicians, other qualified health care professionals, or agencies are provided consistent with the nature of the problem(s) and the patient's and/or family's needs. Usually, the presenting problem(s) are self-limited or minor. Typically, 10 minutes are spent face-to-face with the patient and/or family.
99213‡	Office or other outpatient visit for the evaluation and management of an established patient, which requires at least two of these three key components: an expanded problem focused history, an expanded problem focused examination, medical decision making of low complexity. Counseling and coordination of care with other physicians, other qualified health care professionals, or agencies are provided consistent with the nature of the problem(s) and the patient's and/or family's needs. Usually, the presenting problem(s) are of low to moderate severity. Typically, 15 minutes are spent face-to-face with the patient and/or family.
99214‡	Office or other outpatient visit for the evaluation and management of an established patient, which requires at least two of these three key components: a detailed history, a detailed examination, medical decision making of moderate complexity. Counseling and/or coordination of care with other physicians, other qualified health care professionals, or agencies are provided consistent with the nature of the problem(s) and the patient's and/or family's needs. Usually, the presenting problem(s) are of moderate to high severity. Typically, 25 minutes are spent face-to-face with the patient and/or family.
99215‡	Office or other outpatient visit for the evaluation and management of an established patient, which requires at least two of these three key components: a comprehensive history, a comprehensive examination, medical decision making of high complexity. Counseling and/or coordination of care with other physicians, other qualified health care professionals, or agencies are provided consistent with the nature of the problem(s) and the patient's and/or family's needs. Usually, the presenting problem(s) are of moderate to high severity. Typically, 40 minutes are spent face-to-face with the patient and/or family.
99363	Anticoagulant management for an outpatient taking warfarin, physician review and interpretation of International Normalized Ratio (INR) testing, patient instructions, dosage adjustment (as needed), and ordering of additional tests; initial 90 days of therapy (must include a minimum of eight INR measurements).
99364	Anticoagulant management for an outpatient taking warfarin, physician review and interpretation of International Normalized Ratio (INR) testing, patient instructions, dosage adjustment (as needed), and ordering of additional tests; each subsequent 90 days of therapy (must include a minimum of three INR measurements).
99605‡	Medication therapy management service(s) provided by a pharmacist, individual, face-to-face with patient, with assessment and intervention if provided; initial 15 minutes, new patient.
99606‡	Medication therapy management service(s) provided by a pharmacist, individual, face-to-face with patient, with assessment and intervention if provided; initial 15 minutes, established patient.
99607‡	Medication therapy management service(s) provided by a pharmacist, individual, face-to-face with patient, with assessment and intervention if provided; each additional 15 minutes (List separately in addition to code for primary service).
G0248	Demonstration, prior to initiation of home INR monitoring, for patient with either mechanical heart valve(s), chronic atrial fibrillation, or venous thromboembolism who meets Medicare coverage criteria, under the direction of a physician; includes face-to-face demonstration of use and care of the INR monitor, obtaining at least one blood sample, provision of instructions for reporting home INR test results, and documentation of patient's ability to perform testing and report results.
G0249	Provision of test materials and equipment for home INR monitoring of patient with either mechanical heart valve(s), chronic atrial fibrillation, or venous thromboembolism who meets Medicare coverage criteria; includes provision of materials for use in the home and reporting of test results to physician; testing not occurring more frequently than once a week; testing materials, billing units of service include four tests.
G0250	Physician review, interpretation, and patient management of home INR testing for patient with either mechanical heart valve(s), chronic atrial fibrillation, or venous thromboembolism who meets Medicare coverage criteria; testing not occurring more frequently than once a week; billing units of service include four tests.
G0463‡	Hospital outpatient clinic visit for assessment and management of a patient.
S9336	Home infusion therapy, continuous anticoagulant infusion therapy (e.g., heparin), administrative services, professional pharmacy services, care coordination and all necessary supplies and equipment (drugs and nursing visits coded separately), per diem.
S9372	Home therapy; intermittent anticoagulant injection therapy (e.g., heparin); administrative services, professional pharmacy services, care coordination, and all necessary supplies and equipment (drugs and nursing visits coded separately), per diem (do not use this code for flushing of infusion devices with heparin to maintain patency).

† HCPCS code only included as coagulation monitoring if a claim with HCPCS code 85610 or 85611 occurs on the same day.

‡ HCPCS code only included as coagulation monitoring if the ICD-10-CM Z7901 (long term [current] use of anticoagulants) appears on the claim in any position.

Source: American Medical Association (AMA) https://www.ama-assn.org/

TABLE C-4: IPC HCPCS CODES

HCPCS CODE	DESCRIPTION
A4600	Sleeve for intermittent limb compression device, replacement only, each
E0676	Intermittent limb compression device (includes all accessories), not otherwise specified

TABLE C-5: ANTIPLATELET MEDICATION

GENERIC PRODUCT NAME
CLOPIDOGREL
PRASUGREL
TICAGRELOR

TABLE C-6: BLEEDING EVENT DIAGNOSES

BODY SYSTEM	ICD-10-CM
POST-HEMORRHAGIC ANEMIA	D62
CARDIAC	I312
EAR, NOSE, OR THROAT	R040, R041, R042
GASTROINTESTINAL	I8501, I8511, K250, K252, K254, K256, K260, K262, K264, K266, K270, K272, K274, K276, K280, K282, K284, K286, K2901, K2921, K2931, K2941, K2951, K2961, K2971, K2981, K2991, K625, K661, K762, K920, K921, K922, K9401, K9411, K9421, K9431
GENERAL	R58
INTRACRANIAL	I6000, I6001, I6002, I6010, I6011, I6012, I602, I6020, I6021, I6022, I6030, I6031, I6032, I604, I6050, I6051, I6052, I606, I607, I608, I609, I610, I611, I612, I613, I614, I615, I616, I618, I619, I6200, I6201, I6202, I6203, I621, I629, S064X0A, S064X0D, S064X0S, S064X1A, S064X1D, S064X1S, S064X2A, S064X2D, S064X2S, S064X3A, S064X3D, S064X3S, S064X4A, S064X4D, S064X4S, S064X5A, S064X5D, S064X5S, S064X6A, S064X6D, S064X6S, S064X7A, S064X7D, S064X7S, S064X8A, S064X8D, S064X8S, S064X9A, S064X9D, S064X9S
OPHTHALMIC	H05231, H05232, H05233, H05239, H1130, H1131, H1132, H1133, H2100, H2101, H2102, H2103, H31301, H31302, H31303, H31309, H31311, H31312, H31313, H31319, H3560, H3561, H3562, H3563, H4310, H4311, H4312, H4313, H44811, H44812, H44813, H44819, H47021, H47022, H47023, H47029
REPRODUCTIVE SYSTEM	N920, N921, N922, N923, N924, N930, N938, N939, N950, O031, O036, O046, O071, O081
RESPIRATORY SYSTEM	J942, J9501, R0489, R049
URINARY TRACT	N3001, N3011, N3021, N3031, N3041, N3081, N3091, N421, N99510, N99520, N99530, R310, R311, R312, R3121, R3129, R319, R823

TABLE C-7: QUALIFIED CLAIMS

CLAIM TYPE	HCPCS CODES	REVENUE CODES
OUTPATIENT	99201-99205, 99211-99215, 99241-99245, 99341-99345, 99347-99350, 99381-99387, 99391-99397, 99401-99404, 99411, 99412, 99429, 99455, 99456, G0402, G0438, G0439, G0463, G0466-G0468, T1015	0510-0517, 0519-0523, 0526-0529, 0982, 0983
NONACUTE INPATIENT	99304-99310, 99315, 99316, 99318, 99324-99328, 99334-99337	0118, 0128, 0138, 0148, 0158, 0190-0194, 0199, 0524, 0525, 0550-0552, 0559
ACUTE INPATIENT	99221-99223, 99231-99233, 99238, 99239, 99251-99255, 99291, 99468, 99469, 99471, 99472, 99475-99480	010X, 0110-0115, 0117, 0119-0125, 0127, 0129-0135, 0137, 0139-0145, 0147, 0149-0155, 0157, 0159-0160, 0164, 0166-0175, 0179, 0200-0204, 0206-0214, 0219, 0720-0722
OBSERVATION	99217-99220, 99224-99226, G0378, G0379	
EMERGENCY DEPARTMENT	99281-99285, G0380-G0384	0450-0452, 0456, 0459, 0981

TABLE C-8: THROMBOSIS DIAGNOSIS CODES

TYPE OF VENOUS THROMBOEMBOLISM	ICD-10-CM CODES
DEEP VENOUS THROMBOSIS	I8000, I8001, I8002, I8003, I8010, I8011, I8012, I8013, I80201, I80202, I80203, I80209, I80211, I80212, I80213, I80219, I80221, I80222, I80223, I80229, I80231, I80232, I80233, I80239, I80291, I80292, I80293, I80299, I803, I808, I809, I82401, I82402, I82403, I82409, I82411, I82412, I82413, I82419, I82421, I82422, I82423, I82429, I82431, I82432, I82433, I82439, I82441, I82442, I82443, I82449, I82491, I82492, I82493, I82499, I824Y1, I824Y2, I824Y3, I824Y9, I824Z1, I824Z2, I824Z3, I824Z9, I82601, I82602, I82603, I82609, I82611, I82612, I82613, I82619, I82621, I82622, I82623, I82629, I82811, I82812, I82813, I82819, I82890, I8290, I82A11, I82A12, I82A13, I82A19, I82B11, I82B12, I82B13, I82B19, I82C11, I82C12, I82C13, I82C19
PULMONARY EMBOLISM	I2601, I2602, I2609, I2690, I2692, I2699

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