

OptumLabs Grand Rounds

Combining Evidence and Technology to
Drive Quality and Eliminate Low Value Care

Ken Cohen, MD, FACP

Executive Director, Translational Research, OptumLabs
National Senior Medical Director, Optum Care

April 2021

1

At the end of this course, you will be able to:

- Define actions and practices that constitute wasted and harmful care, as well as modalities that can replace these wasteful and harmful care routines
- Describe how to rapidly translate high quality evidence-based medicine (EBM) into daily practice
- Recognize how to leverage technology to utilize clinical algorithms, shared decision-making, and patient-reported outcomes to drive care decisions
- Identify the role of pharmaco-economics in pharmaceutical prescribing
- Define how the use of analytics to measure health care provider (HCP) utilization of EBM and overall cost efficiency drives improved care quality and cost outcomes

Objectives

2

Take one point home...

There is **no relationship** between
cost of care and **quality of care**;
 more care **does not equal** better care!



Confidential property of Optum. Do not distribute or reproduce without express permission from Optum

3

The Cost / Quality Scattergram

One-third of US health care is wasted

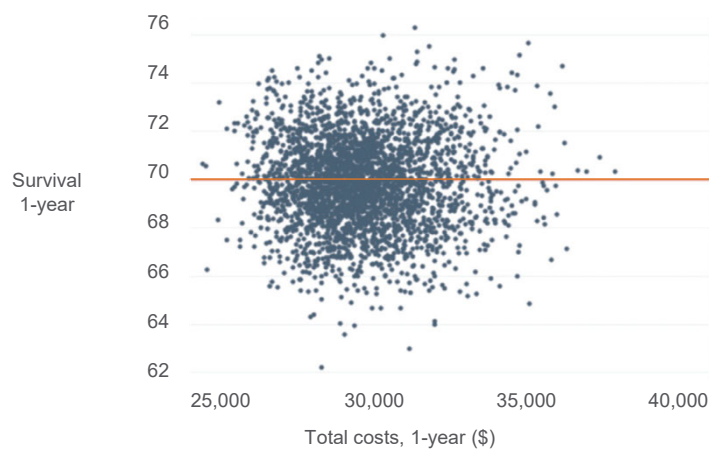


Figure 4. Association between one-year survival and spending at the hospital level for patients with heart attacks, hip fractures, and colorectal cancer – all conditions with limited discretion in diagnosis.

We combined these measures into a single quality dimension and a single cost dimension for the 3,804 hospitals in our sample.

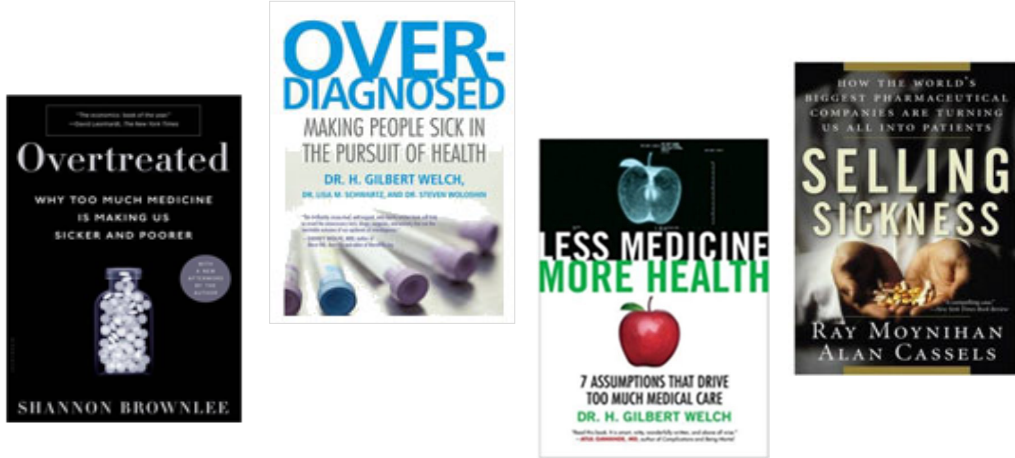
All spending numbers are reported in 2005 dollars and include both hospital spending and physician spending.

—Figure taken from Chandra et al. (2010)

Confidential property of Optum. Do not distribute or reproduce without express permission from Optum

4

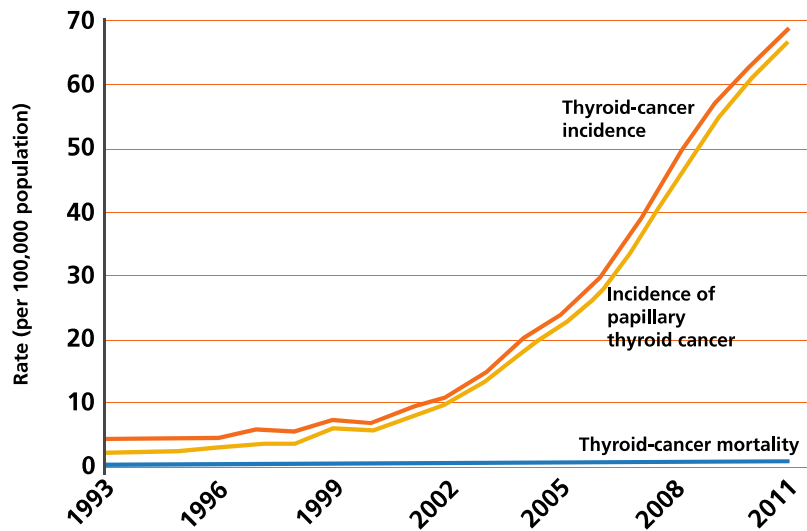
The Press is Spreading the Word



Brownlee, Shannon (2007) *Overtreated: Why too much medicine is making us sicker and poorer*. Bloomsbury Publishing.
 Welch, H. G., Schwartz, L., & Woloshin, S. (2011). *Over diagnosed- Making people sick in the pursuit of health*. Boston, MA, USA: Beacon Press.
 Welch, H. G. (2015). *Less medicine, more health- 7 assumptions that drive too much medical care*. Boston, MA, USA: Beacon Press.
 Moynihan, R., & Cassels, A. (2005). *Selling sickness: How the worlds largest pharmaceutical companies are turning us all into patients*. New South Wales, Australia: Allen & Unwin.
 Confidential property of Optum. Do not distribute or reproduce without express permission from Optum

5

Thyroid-Cancer Incidence and Related Mortality in South Korea, 1993–2011

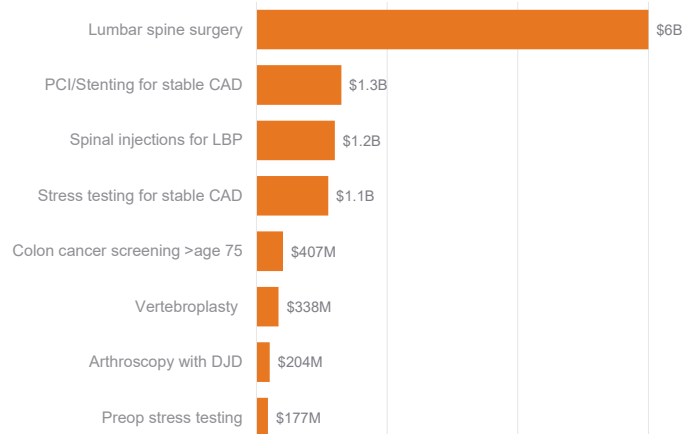


Ahn HS, Kim HJ, Welch HG. Korea's Thyroid-Cancer "Epidemic"—Screening and Overdiagnosis. *New Engl J Med*. 2014;371(19):1765-1767. doi:10.1056/nejmp1409841.

6

Medicare “No Value Care Metrics”

OptimalCare metrics chosen based on cost and harm



PSA >69, carotid artery screening, excess breast imaging – harm from overdiagnosis!

Confidential property of Optum. Do not distribute or reproduce without express permission from Optum

7

Top 10 “Measurable” Wasted Care Areas

Measure Description	Total Cases	Total Cost
Lumbar Fusion Surgery (Inpatient)	2,091	\$ 79,727,718
Hip Replacement Surgery (Inpatient)	2,800	\$ 41,514,347
Knee Replacement Surgery (Inpatient)	3,050	\$ 46,016,275
Cervical Spine Fusion Surgery (Inpatient)	937	\$ 29,201,507
Echocardiograms	119,171	\$ 27,203,018
Carotid Doppler Duplex Scans	37,403	\$ 6,902,696
Nuclear Stress Tests (non-angina cases)	17,532	\$ 11,515,944
Stress Tests (non-nuclear & non-angina cases)	9,716	\$ 1,736,246
Rate of Using Advanced Drugs (not Avastin) to Treat Macular Degeneration	17,886	\$ 36,246,876
Mohs Micrographic Surgery (data unavailable for some CDOs)	25,717	\$ 23,267,635
	236,303	303,332,260

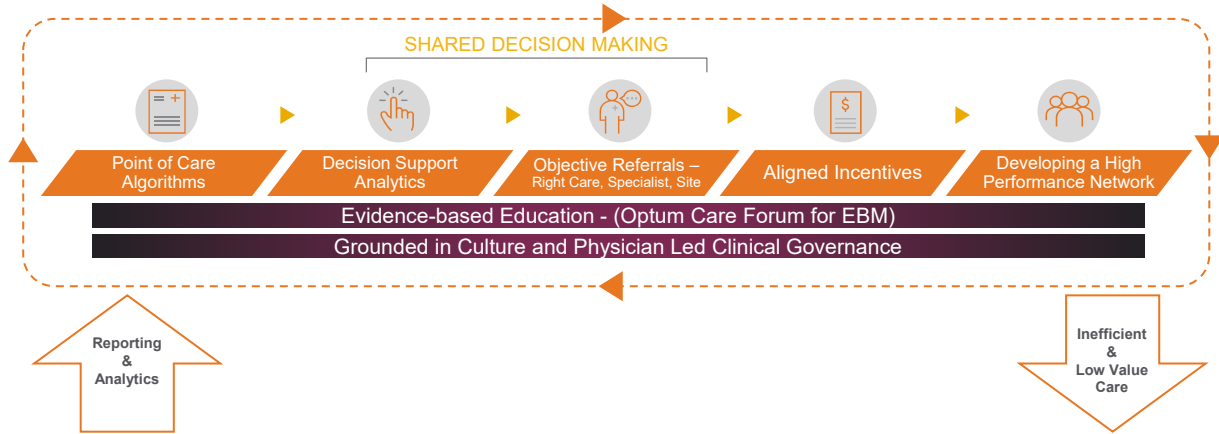
From: Optum Care Healthcare Economics (HCE) division

Confidential property of Optum. Do not distribute or reproduce without express permission from Optum

8

Introduction to Optimal Care Model

The goal is the rigorous elimination of wasted care.



Confidential property of Optum. Do not distribute or reproduce without express permission from Optum

9

Lay the Foundation - Education

“Ted” Talk – Culture Building



Targeted Engagement

Optimal Care for Orthopedics
Evidence driven-Better outcomes Lower cost

REFERRAL RECOMMENDATIONS

- Orthopedic referral typically equals MRI - Early referrals increase imaging utilization/costs and incidental findings can lead to unnecessary surgery.
- In the absence of acute injury requiring immediate attention, a trial of conservative therapy is indicated prior to orthopedic referral.
- In the absence of red flag signs and symptoms, spine referral should be sent to physiatry or pain management prior to consideration of a surgical opinion.

CONSERVATIVE THERAPY: Weight loss, home exercise program, NSAID's, time, corticoid injections when appropriate, physical therapy in person or virtual.

RED FLAGS: Sensory level in the trunk/arms/legs, weakness, acute onset of bilateral sciatica, bowel/bladder incontinence/retention, acute foot drop, fever.

SHARED DECISION-MAKING

- "The Promise of Patient-Centered Care"
- 15 to 30 percent of patients decline surgery.
- Better postoperative outcomes.
- Improved patient satisfaction and loyalty.

Education Modules

Cardiology

Ken Cohen, MD, FACP
January 2021

Optimal Care

- Evidence driven
- Better outcomes
- Lower cost

Forum for EBM

Forum for Evidence-Based Medicine

Listen to Dr. Cohen's Forum for Evidence-Based Medicine podcast [here](#).

Earn up to 1.00 CNE/CME credit per issue.

Active surveillance of papillary thyroid cancer

Analogous to Gleason 6 prostate cancer, the prognosis of small papillary thyroid cancers is remarkably good with very infrequent progression to metastatic disease and late mortality. The 20-year cancer-specific survival for papillary thyroid cancer is 97%.¹ In 2015, guidelines for the management of papillary thyroid cancer recommended the consideration of active surveillance, however this management option is rarely recommended or successfully adopted in the United States.²

Two-thirds of thyroid cancers in this country are small papillary thyroid cancers and the rate of diagnosis of these cancers has increased 280% in the past 25 years. There has not been a similar increase in mortality, suggesting a highly significant degree of overdiagnosis and overtreatment. With this as background, a Japanese study reported their experience in over 2,100 patients with newly diagnosed small papillary thyroid cancer (<1 cm).³ A total of 1,179 patients (55%) chose active surveillance and form the study population for this report. The patients ranged in age from 15-88 and 90% were women. Patients were followed by ultrasound at six-month intervals for the first year and then annually. The median follow-up was six

10

Optimal Care

Algorithms at the Point of Care

11

Preoperative Ischemia Testing

**180
Million**



VA Trial:

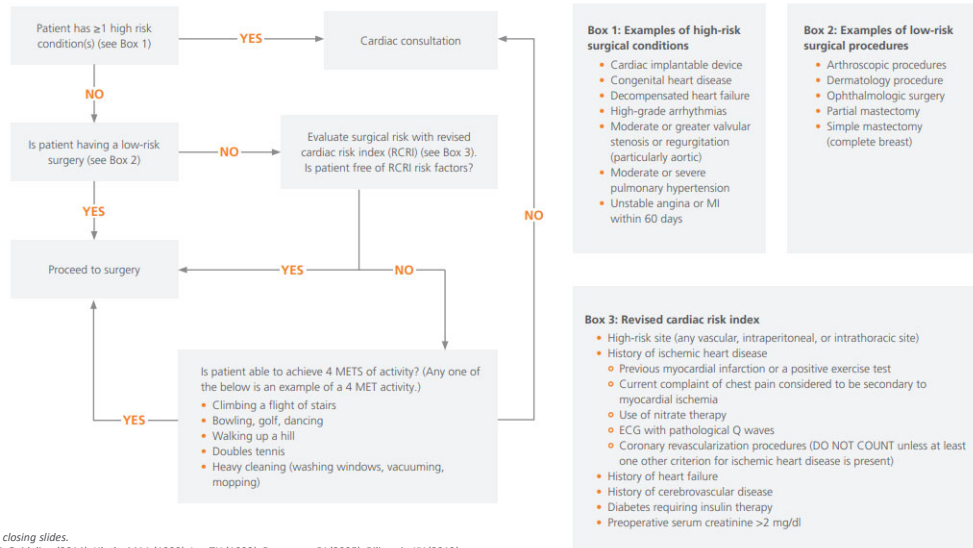
- High risk vascular surgery in patients with known CAD randomized to usual care versus revascularization.
- No change in perioperative MI rate or two-year mortality.

McFalls EO, Ward HB, Moritz TE, et al. Coronary-Artery Revascularization before Elective Major Vascular Surgery. *New England Journal of Medicine*. 2004;351(27):2795-2804. doi:10.1056/nejmoa041905.

12

12

Preoperative Cardiac Surgical Risk Assessment: Non-Cardiac Surgery



Full references provided on closing slides.
 From: Fleisher LA, ACC/AHA Guideline (2014); Hlatky MA1 (1989); Lee TH (1999); Devereaux PJ (2005); Billimoria KY (2013); Wijeyesundara DN (2018); Biccard B (2015); Cohn SL (2019).

13

13

Think CCTA First

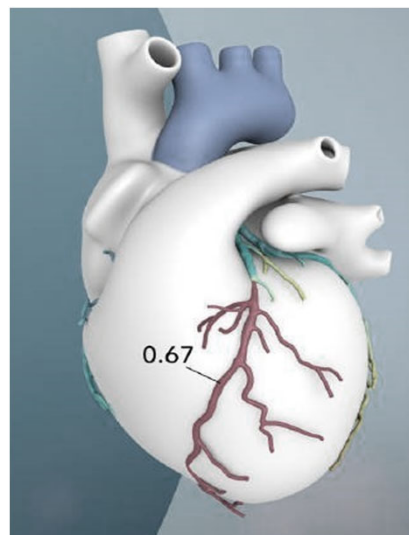
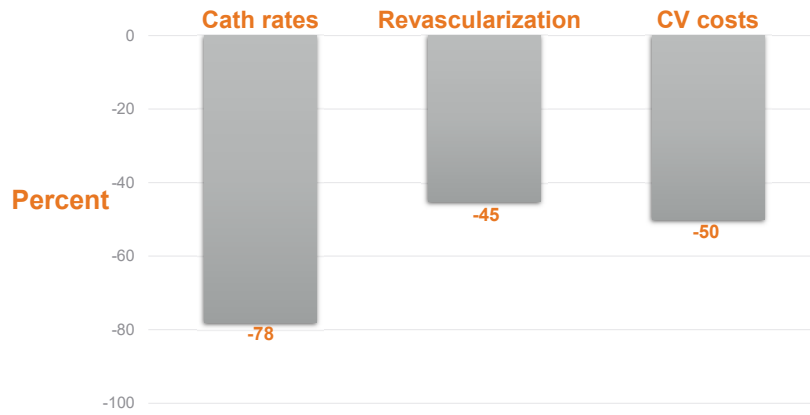


Image courtesy of HeartFlow, Inc.

14

14

CONSERVE Study Results



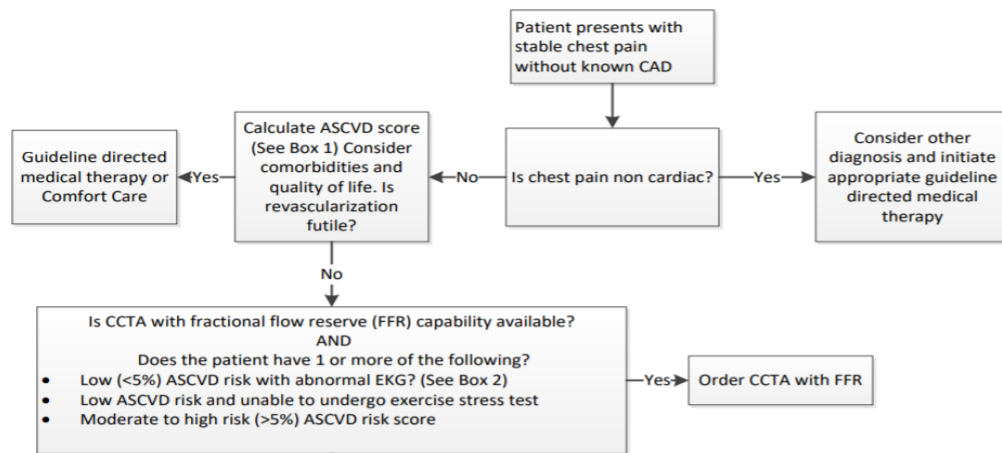
CT reduces nearly 4 of 5 invasive coronary angiograms.

Chang H-J, Lin FY, Lee S-E, et al. Coronary atherosclerosis precursors of acute coronary syndromes. *J Amer Coll Cardiol.* 2018;71(22):2511-2522. doi: 10.1016/j.jacc.2018.02.079

15

15

Stable Chest Pain With No Known Coronary Artery Disease



Fihn S, Gardin J, Abrams J, et al. ACCF/AHA/ACP/AATS/PCNA/SCAI/STS Guideline for the Diagnosis and Management of Patients With Stable Ischemic Heart Disease. *JACC.* 2012; 60:e44-e164.2. Wood D, Ehlsham M, Thourani V, et al. Safe Reintroduction of Cardiovascular Services During the COVID-19 Pandemic: From the North American Society Leadership. *JACC.* 2020; 75:e3177-3183.

16

16

The Right Data at the Point of Care

Advanced, Relevant Data Capability

Objective knowledge around who is performing at the optimal intersection of outcomes and efficiency.



Specialist Selection Criteria

Group	Market	Region	Specialty			
Wellmed	El Paso	Texas	Gastroenterology			
Name	Degree	Practice	Address	Distance	Cost Assessment	
Oja, Edwin	MD	TRINITY GASTROENTEROLOGY	125 W CASTELLANO DRIVE EL PASO EL PASO TX 79912 Phone: 915-506-8950 Fax: N/A	5.8 miles	Tier 1	Quality Assessment Quality Care
Cosentino, Mark Languages Spoken: Spanish	MD	BHS PHYSICIANS NETWORK INC	1250 E CLIFF DR STE 1C EL PASO EL PASO TX 79902 Phone: 915-351-7200 Fax: 915-351-7201	6.3 miles	Tier 1	Quality Care

- Patient reported data
 - Satisfaction
 - Outcomes
- Access
 - Average time to schedule
 - Real-time availability
 - Responsiveness
- Clinical data
 - Outcomes data
 - Low value care
 - Values alignment

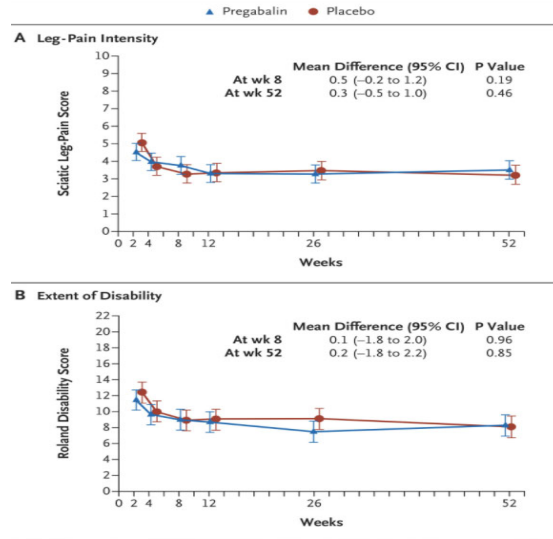
17

17

Optimal Spine Care

18

Trial of Pregabalin for Acute and Chronic Sciatica



Mathieson S, Maher CG, McLachlan AJ, et al. Trial of Pregabalin for Acute and Chronic Sciatica. *New Engl J Med.* 2017;376(12):1111-1120. doi:10.1056/nejmoa1614292.

19

19

Pharmacotherapy for Chronic Low Back Pain

NSAID's and Duloxetine Have Evidence for Use

Opioids

No evidence of improved outcomes – tramadol should be thought of as a narcotic!

Gabapentin

No evidence of improved outcomes, 50% experience dizziness, cognitive difficulty, or malaise

TCA/Benzo's

No evidence of improved outcomes, amitriptyline is on Beer's high-risk medication list

Muscle relaxants

No evidence of improved outcomes - 30 million Rx's in 2016, on the Beer's high risk medication list

Oral glucocorticoids

No evidence of improved outcomes

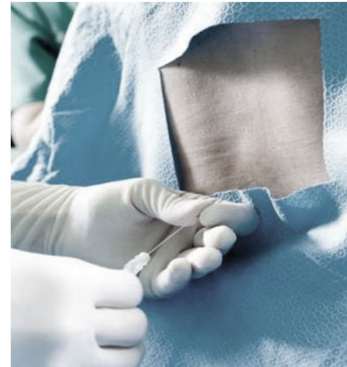
20

20

CMS Assessment for Epidural Corticosteroid Injections (ESI)

Radiculopathy ESI are associated with < 6 weeks pain improvements:

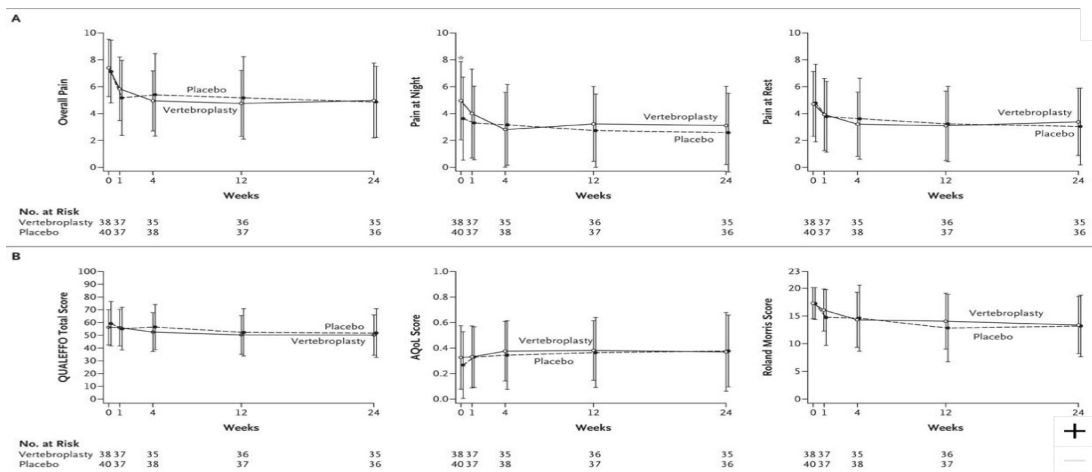
- Benefits are small and not sustained
- No effect on the long-term risk of surgery
- Epidural corticosteroid injections are not effective for spinal stenosis or non-radicular back pain
- Facet joint corticosteroid injections are not effective for presumed facet joint pain



21

21

Randomized Trial of Vertebroplasty for Osteoporotic Vertebral Fractures



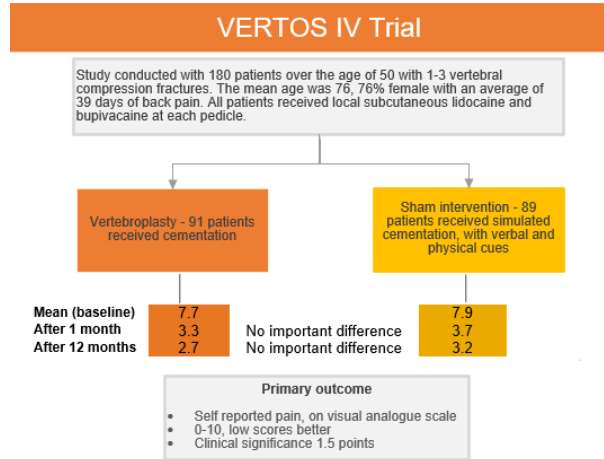
Buchbinder R, Osborne RH, Ebeling PR, et al. A randomized trial of vertebroplasty for painful osteoporotic vertebral fractures. *N Engl J Med.* 2009;361(6):557-568. doi:10.1056/nejmoa0900429.

22

22

Disorders - Vertebroplasty

Based on the BMJ VERTOS IV Trial, vertebroplasty did not result in statistically greater pain relief compared to a sham injection.



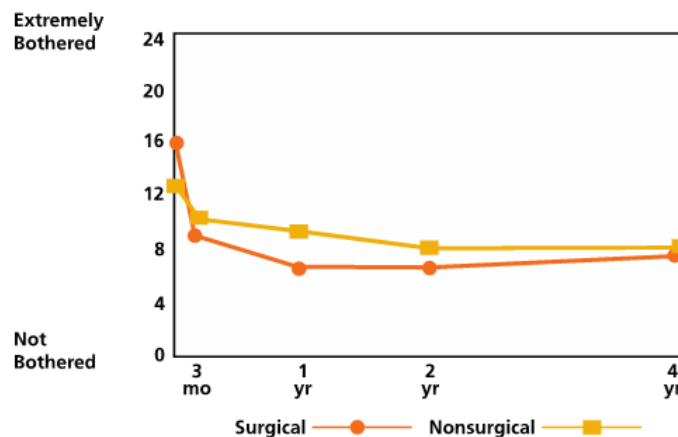
Firanesco CE, Vries JD, Lodder P, et al. Vertebroplasty versus sham procedure for painful acute osteoporotic vertebral compression fractures (VERTOS IV): randomised sham controlled clinical trial. *BMJ*. 2018. doi:10.1136/bmj.k1551.²³

23

Surgery for Spinal Stenosis – Does it Work?

SPORT Trial for Lumbar Spinal Stenosis – Bothersome Score

Surgical versus nonsurgical treatment for spinal stenosis and the bothersome score within four years of treatment.



Lurie JD, Tosteson TD, Tosteson A, et al. Long-term Outcomes of Lumbar Spinal Stenosis. *Spine*. 2015;40(2):63-76. doi:10.1097/brs.0000000000000731.

24

24

Evolution of the Optimal Care Spine Model

Current model of spine care

Reliance on non-evidence-based drugs and procedures

Reliance on surgery with limited benefit – cost of lumbar fusion ~\$95,000

Optimal Care Model

Initial management via PCP, PT, chiropractic

Physiatry/pain management engaged when needed

- Optimal use of rehab, pain psychology, and evidence-based pharmacotherapies
- Limited use of ESI, RF ablation, facet blocks, etc.

Referral to surgery is initiated by physiatry/management

- Shared decision-making using Lumbar Fusion Calculator
- Decision on decompression versus fusion, choice of surgeon, site of service

25

25

Shared Decision Tool for LBP

Benefits/likelihood of cure or resolution of symptoms

- **Up to 52 of 100 people** with chronic back pain and spinal stenosis who pursue physical therapy will have meaningful improvement after 1 year.
- **Up to 77 of 100 people** with chronic back pain and spinal stenosis who undergo surgery will have meaningful recovery after 1 year.

Risks of adverse outcome

- **Serious adverse outcomes from physical therapy are very rare.** Participation with physical therapy can create temporary discomfort and fatigue.
- **Up to 23 of 100 people** who undergo surgery will have an adverse event (e.g., nerve damage, excessive bleeding, cardiovascular event, or infection) that is related to the surgery

Risk of revision

- **Up to 57 of 100 people** who pursue physical therapy for their back pain will not improve sufficiently and choose to be evaluated for back surgery.
- **Up to 22 of 100 patients** who have back surgery will eventually need one or more additional

26

26

Site of Service – Significant Cost Savings

The ASC setting is approximately **60-70% less** than the same procedure performed in a nearby hospital—which represents significant savings to patients, employers and health plans.

Procedure	Hospital	ASC
Anterior cervical discectomy and fusion	\$37,327	\$13,950
Anterior lumbar interbody fusion	\$116,375	\$37,732
Posterior lumbar interbody fusion	\$96,439	\$39,671

Source: South Carolina BCBS Cost Estimator Tool

27

27

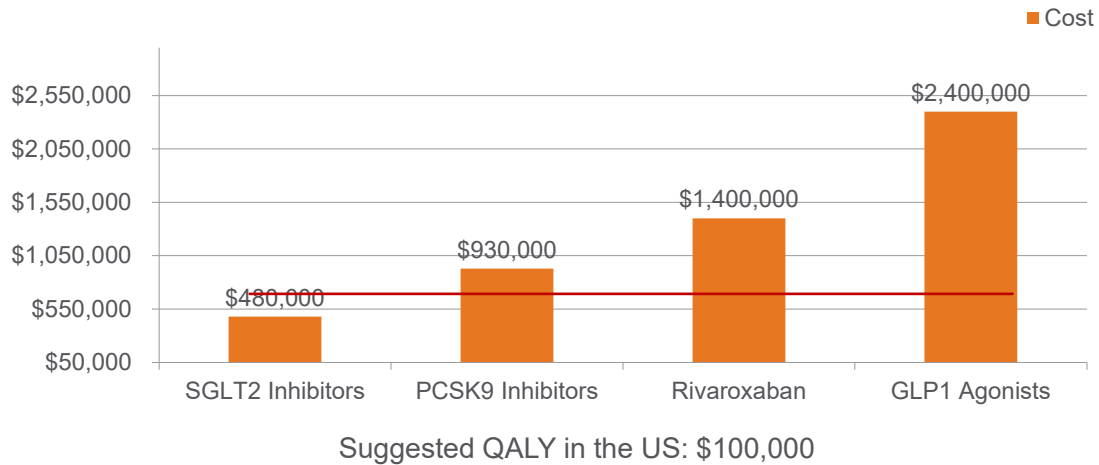
Use of Pharmaco-Economics in Clinical Decision-Making

“We are all faced with a series of
great opportunities brilliantly
disguised as impossible situations.”
Charles Swindoll

28

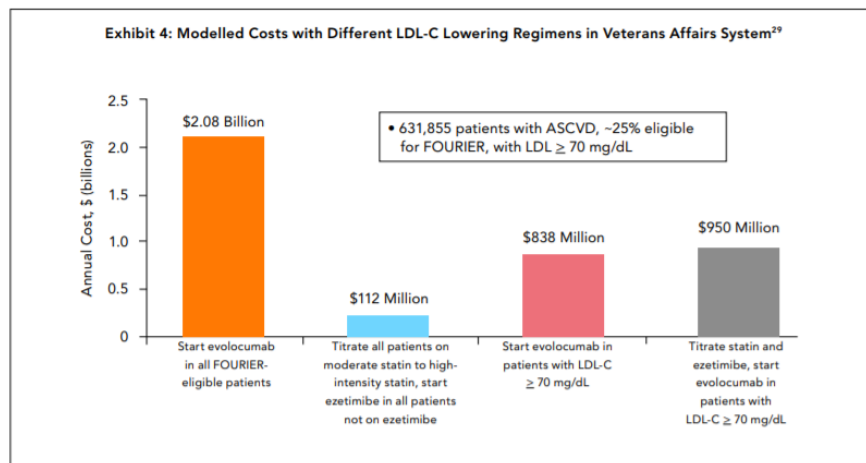
Where is the Value?

Cost to prevent one MI with new drug classes



29

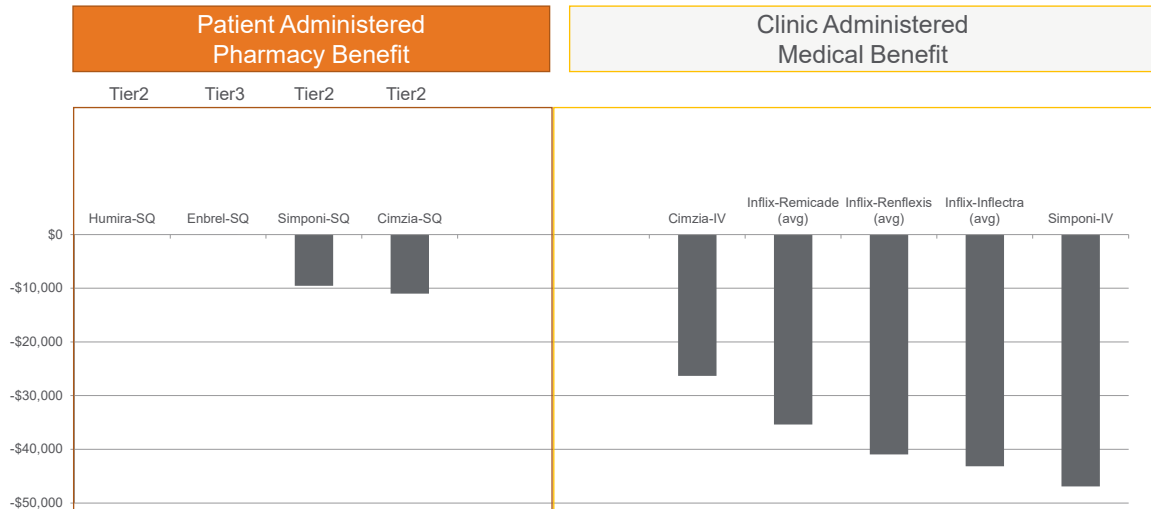
Cost Effectiveness of Ezetimibe vs. PCSK-9 Inhibitor Therapy



The Role of PCSK9 Inhibitors in Lowering LDL-C in Patients with Dyslipidemia
Journal of Managed Care Medicine 2018

30

Commercial Net Cost Comparison for RA Biologic Drugs (WAC & ASP)



31

Does the Expedited Approval Process Work?

Data through 2018

93 drugs initially approved with FDA requirement for follow up studies –
 FDA claimed success of the process as only one approval was withdrawn

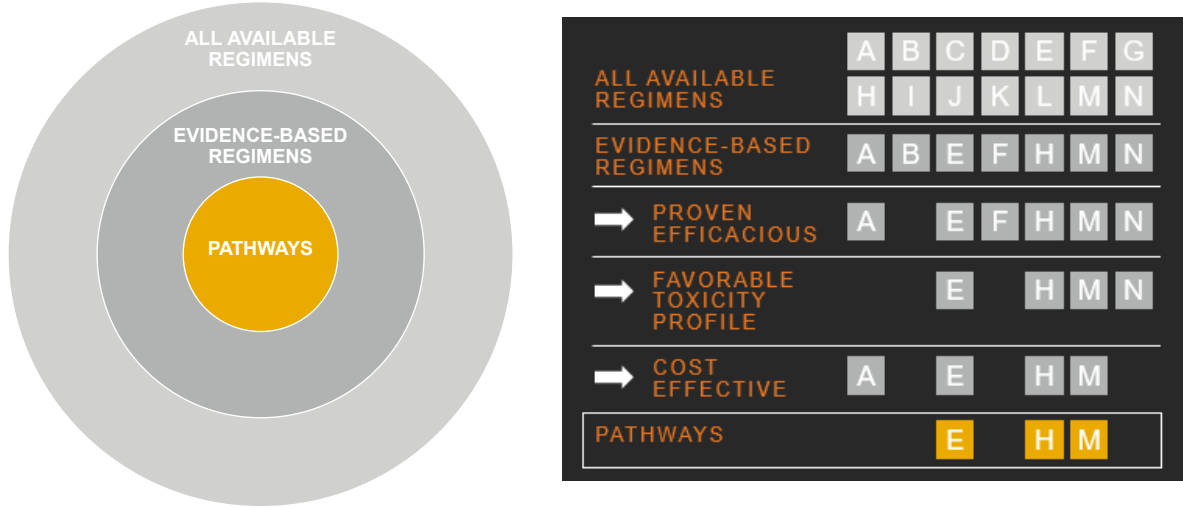
Closer look: Only 20% documented improved overall survival

- 41% “FDA confirmed” successes based on surrogate outcomes that do not predict overall survival or quality of life
- 39% of follow up studies delayed, pending, or ongoing
- Most expensive drug - \$170,000 – did not improve overall survival and worsened QOL

Gwawali B. *JAMA IM*. July 2019.

32

Cancer Treatment Pathways



33

33

Use of Analytics to Drive Optimal Care

All data transparently shared

34

PCP Optimal Care Performance Report

All data transparently shared

Year Selection 2018 (thru October)		PCP/Group						
Measure ID	Measure Description	Year-to-date-2018				Benchmarks		
		Total Cases	Total Cost	Cases per 1,000 (annual)	Cost PMPM	Compared to... Last year 2017	25th Percentile Lowest Utilization Amongst PCPs	Corporate Average 2018 YTD
A01	Lumbar Fusion Surgery	13	\$400,288	0.7	\$1.74	2.5 ↓	1.0 ↓	1.3 ↓
A02	Hip Replacement Surgery	67	\$1,196,359	3.5	\$5.21	5.2 ↓	2.2 ↑	3.0 ↑
A03	Knee Replacement Surgery	98	\$1,510,531	5.1	\$6.58	7.0 ↓	5.2 ↓	5.8 ↓
A04	Cervical Spine Fusion Surgery	8	\$234,050	0.4	\$1.02	0.7 ↓	0.6 ↓	0.8 ↓
M01	Diagnostic Colonoscopies age over 74	209	\$326,837	10.9	\$1.42	13.0 ↓	7.8 ↑	7.8 ↑
M02	Knee Arthroscopies age over 50	41	\$92,419	2.1	\$0.40	4.2 ↓	0.8 ↑	1.5 ↑
M03	Echocardiograms	3,533	\$616,750	184.6	\$2.69	180.5 ↑	145.0 ↑	220.2 ↓
M04	Viscosupplementation Injections	117	\$154,849	6.1	\$0.67	7.8 ↓	5.3 ↑	24.6 ↓
M05	Carotid Doppler Duplex Scans	1,144	\$221,685	59.8	\$0.97	62.4 ↓	25.0 ↑	56.4 ↑
M06	Sleep Studies at facility/not at home	272	\$82,690	14.2	\$0.36	15.5 ↓	0.5 ↑	23.7 ↓
M07	Nuclear Stress Tests (non-angina cases)	436	\$253,140	22.8	\$1.10	24.9 ↓	11.0 ↑	30.6 ↓
M08	PSAs over age 69	4,831	\$160,545	252.4	\$0.70	231.8 ↑	29.0 ↑	153.9 ↑

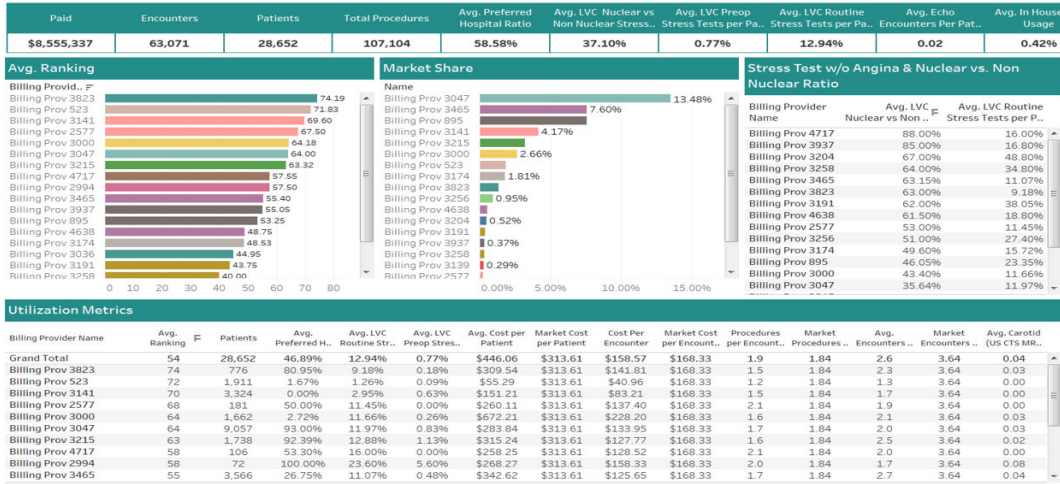
35

Cardiology Efficiency Metrics

Metric Name	Points	Cardio							
		High 100%		Mid High 66%		Mid Low 33%		Low 0%	
		Begin	End	Begin	End	Begin	End	Begin	End
Encounters per Patient	15	0	<= 2.00	> 2.00	<= 2.25	> 2.25	< 2.50	>= 2.50	inf
Procedures Per Encounter	10	0	<= 1.70	> 1.70	<= 1.80	> 1.80	< 2.00	>= 2.00	inf
Preferred Hospital Ratio	10	1	>= 0.90	< 0.90	>= 0.85	< 0.85	>= 0.80	< 0.80	0
LVC Routine Stress Test Ratio	10	0	= 0.000	> 0.000	<= 0.005	> 0.005	<= 0.010	> 0.010	inf
LVC Pre-op Stress Test Ratio	10	0	<= 0.01	> 0.01	<= 0.03	> 0.03	<= 0.05	> 0.05	inf
LVC Nucler vs Non Nuclear Ratio	10	0	<= 0.37	> 0.37	<= 0.61	> 0.61	<= 0.81	> 0.81	1
ASC Steerage Ratio	5	inf	>= 0.90	< 0.90	>= 0.85	< 0.85	>= 0.80	< 0.80	0
In House Lab Usage	10	0	<= 0.01	> 0.01	<= 0.03	> 0.03	<= 0.05	> 0.05	inf
Cost per Patient	10	0	<= 315.00	> 315.00	<= 320.00	> 320.00	<= 330.00	> 330.00	inf
Echo Encounters per Patient	5	0	<= 1.03	> 1.03	<= 1.05	> 1.05	<= 1.15	> 1.15	inf
Carotid US/CTA/MRA Encounters per Patient	5	0	<= 1.06	> 1.06	<= 1.12	> 1.12	<= 1.20	> 1.20	inf

36

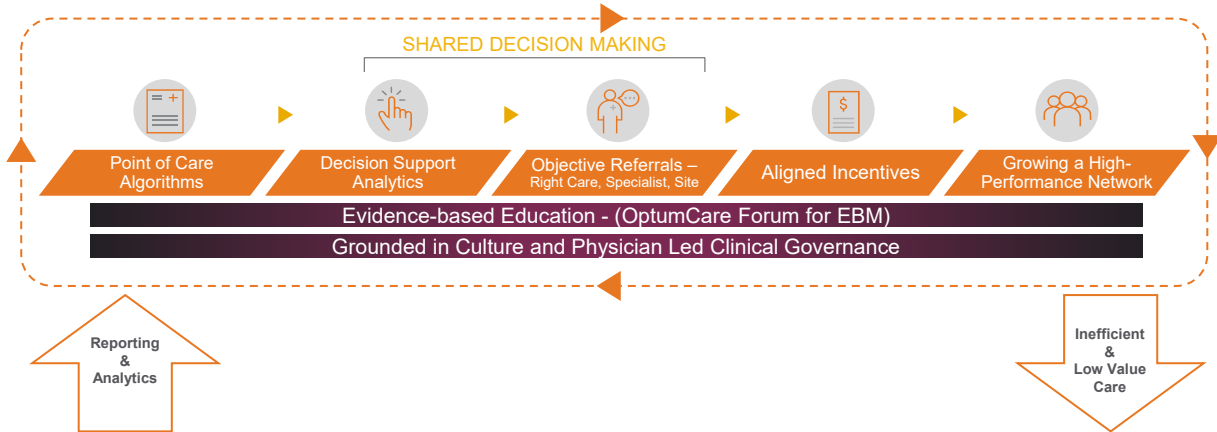
Cardiology Efficiency Report



37

Optimal Care the Solution

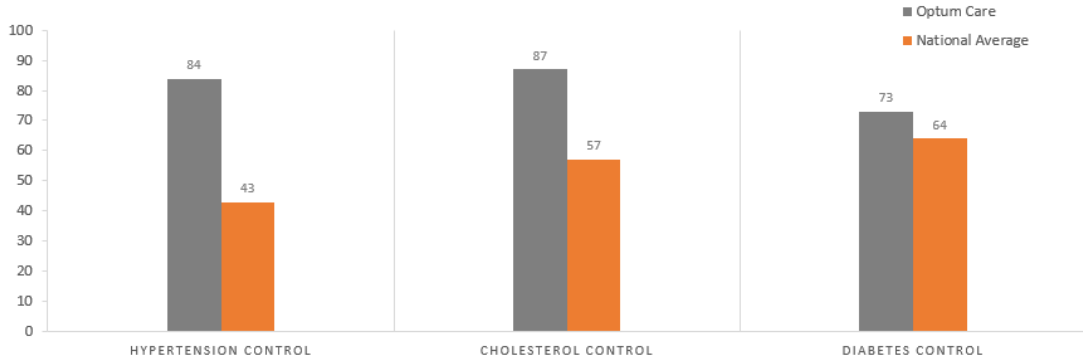
Achieving the goal wasted care elimination.



Confidential property of Optum. Do not distribute or reproduce without express permission from Optum

38

Optimal Care Quality Measures



-Muntner P, Hardy S, Fine L et al. Trends in Blood Pressure Control Among US Adults With Hypertension, 1999-2000 to 2017-2018. *JAMA*. 2020;324(12):1190. doi:10.1001/jama.2020.14545.
 -Kazemian P, Shebl FM, McCann N, Walensky RP, Wexler DJ. Evaluation of the Cascade of Diabetes Care in the United States, 2005-2016. *JAMA Internal Medicine*. 2019;179(10):1376. doi:10.1001/jamainternmed.2019.2396.

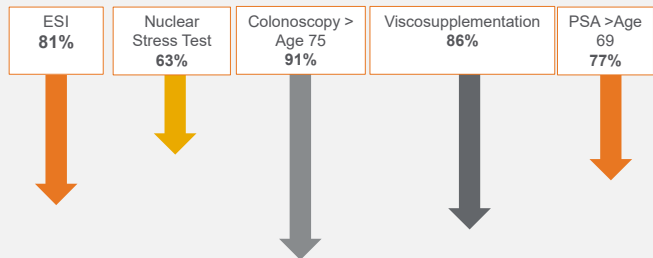
Optimal Care in Practice

Results at New West Physicians (2019 data)

Medicare Metrics: Medical Cost Ratio = 64%
 Star Rating 4.5

Admits/K	153	14 days	SNF ALOS
Acute Bed days/K	557	7.3%	30 day readmission rate

Comparison of Optimal Care Metrics at NWP to CDO Averages:
 Represented as Percent Reduction in Utilization compared to Average



Thank you

Contact information:

Ken.Cohen@nwphysicians.com



41

References

Kazi DS, Penko J, Coxson PG, Guzman D, Wei PC, Bibbins-Domingo K. Cost-Effectiveness of Alirocumab. *Annals of Internal Medicine*. 2019;170(4):221. doi:10.7326/m18-1776.

Ahn HS, Kim HJ, Welch HG. Korea's Thyroid-Cancer "Epidemic"—Screening and Overdiagnosis. *New England Journal of Medicine*. 2014;371(19):1765-1767. doi:10.1056/nejmp1409841.

Mcfalls EO, Ward HB, Moritz TE, et al. Coronary-Artery Revascularization before Elective Major Vascular Surgery. *New England of Journal of Medicine*. 2004;351(27):2795-2804. doi:10.1056/nejmoa041905.

Fleisher LA, Fleischmann KE, Auerbach AD, et al. 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery: executive summary: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. *Circulation*. 2014;130:2215.

Hlatky MA1, Boineau RE, Higginbotham MB, Lee KL, Mark DB, et al. A brief self-administered questionnaire to determine functional capacity (the Duke Activity Status). *Am J Cardiol*. 1989 Sep 15;64(10):651-4.

Lee TH, Marcantonio ER, Mangione CM, Thomas EJ, Polanczyk CA, Cook EF, et al. Derivation and prospective validation of a simple index for prediction of cardiac risk of major noncardiac surgery. *Circulation*. 1999;100(10):1043.

Devereaux PJ, Goldman L, Cook DJ, et al. Perioperative cardiac events in patients undergoing noncardiac surgery: A review of the magnitude of the problem, the pathophysiology of the events, and methods to estimate and communicate risk. *CMAJ*. 2005; 173:627.

Bilimoria KY, Liu Y, Paruch JL, et al. Development and evaluation of the universal ACS NSQIP surgical risk calculator: a decision aid and informed consent tool for patients and surgeons. *J Am Coll Surg*. 2013; 217:8.

42

42

References

- Wijeyesundera DN, Pearse RM, Shulman MA, Abbott TEF, Torres E, Ambosta A, et al. METS study investigators Assessment of functional capacity before major non-cardiac surgery: An international, prospective cohort study. *Lancet*. 2018;391(10140):2631.
- Biccard B. Proposed research plan for the derivation of a new cardiac risk index. *Anesth Analg*. 2015; 120: 543–53.
- Cohn SL, Fleisher LA. Section editor: Pellikka PA. Deputy editors: Givens J, Saperia GM. Evaluation of cardiac risk prior to noncardiac surgery. UpToDate. This topic last updated: Jul 16, 2019.
- Chang H-J, Lin FY, Lee S-E, et al. Coronary Atherosclerosis Precursors of Acute Coronary Syndromes. *Journal of the American College of Cardiology*. 2018;71(22):2511-2522. doi: 10.1016/j.jacc.2018.02.079
- Fihn S, Gardin J, Abrams J, et al. ACCF/AHA/ACP/AATS/PCNA/SCAI/STS Guideline for the Diagnosis and Management of Patients With Stable Ischemic Heart Disease. *JACC*. 2012; 60:e44-e164.2.
- Wood D, Ehtisham M, Thourani V, et al. Safe Reintroduction of Cardiovascular Services During the COVID-19 Pandemic: From the North American Society Leadership. *JACC*. 2020; 75:e3177-3183.
- Mathieson S, Maher CG, McLachlan AJ, et al. Trial of Pregabalin for Acute and Chronic Sciatica. *New England Journal of Medicine*. 2017;376(12):1111-1120. doi:10.1056/nejmoa1614292.
- Hanna FWF, Issa BG, Sim J, Keevil B, Fryer AA. Management of incidental adrenal tumours. *BMJ*. 2018. doi:10.1136/bmj.j5674
- Buchbinder R, Osborne RH, Ebeling PR, et al. A Randomized Trial of Vertebroplasty for Painful Osteoporotic Vertebral Fractures. *New England Journal of Medicine*. 2009;361(6):557-568. doi:10.1056/nejmoa0900429.

43

43

References

- Firanesco CE, Vries JD, Lodder P, et al. Vertebroplasty versus sham procedure for painful acute osteoporotic vertebral compression fractures (VERTOS IV): randomised sham controlled clinical trial. *BMJ*. 2018. doi:10.1136/bmj.k1551.
- Lurie JD, Tosteson TD, Tosteson A, et al. Long-term Outcomes of Lumbar Spinal Stenosis. *Spine*. 2015;40(2):63-76. doi:10.1097/brs.0000000000000731.
- Muntner P, Hardy S, Fine L et al. Trends in Blood Pressure Control Among US Adults With Hypertension, 1999-2000 to 2017-2018. *JAMA*. 2020;324(12):1190. doi:10.1001/jama.2020.14545
- Kazemian P, Shebl FM, McCann N, Walensky RP, Wexler DJ. Evaluation of the Cascade of Diabetes Care in the United States, 2005-2016. *JAMA Internal Medicine*. 2019;179(10):1376. doi:10.1001/jamainternmed.2019.2396.

44

44