Back and Neck Pain Treatment in California:
A Close-Up of Geographic Variation

California HealthCare Foundation

Geographic Variation Series. This Close-Up paper is part of a set of reports that examines the different rates at which certain health care procedures are delivered in communities across the state.[1] The first series of reports uses data from 2005 through 2009 and includes heart surgery, childbirth, joint replacement, hysterectomy, mastectomy, carotid endarterectomy, gall bladder removal, and weight loss surgery. The second series uses data from 2005 through 2010 and includes treatments for breast cancer, prostate cancer, and spinal conditions. The data are based on patients' place of residence and show that procedure rates across the state can vary widely, even in contiguous communities.

Unlike earlier studies of such variation, which have relied on Medicare patient data, this project included data not only for Medicare beneficiaries (both fee-for-service and managed care) but also for patients of a broader age range enrolled in commercial plans and Medicaid, and the uninsured. The data account for age, sex, income, education, health insurance status, race, and other factors. Further information about this set of reports can be found in a research summary paper, "All Over the Map: Elective Procedure Rates in California Vary Widely," www.chcf.org/variation.

Most Americans experience back or neck pain at some point in their lives. While back and neck pain is extremely common, it usually clears up on its own. However, some people experience back and neck pain that is long-lasting and debilitating (chronic or episodic). This report covers treatment for three of the most common types of back and neck pain:

- Pain in the neck, or cervical spine, the uppermost region of the spinal column
- Pain in the lower back, or lumbar spine, the lowest mobile region of the spinal column
- Pain due to neck or back vertebra fracture, called vertebral compression fracture (VCF), caused by osteoporosis, a common condition of aging in which bones become less dense and more brittle

Low Back and Neck Pain

Types of Low Back and Neck Pain

Several conditions may be present with back and neck pain, including nerve compression, segmental instability, spinal deformity, and neoplasm (an abnormal growth). Some low back and neck pain is caused by trauma (accident, sport), repetitive motion, or sedentary work. Some of the most common causes of severe, debilitating low back and neck pain include:

- **Herniated discs** occur when the outer membrane of a disc is weakened and the inner gel leaks, irritating and pressing on nerves. Herniated discs can cause radicular pain, which radiates out from the spine; sciatica, which radiates to the lower body and legs; and cervical myelopathy (see below).
- **Cervical myelopathy** is a spinal cord compression commonly associated with cervical disc herniation or spondylosis (see below). Common symptoms include numbness or clumsiness of the hands, arms, or legs, and unsteady walking.
- **Spondylosis** refers to degeneration caused by wear and tear of the cervical spine that involves disc shrinkage and development of vertebrae bone spurs. It can compress and constrict nerves or the spinal cord, leading to both radicular pain and myelopathy.
- **Cervical and lumbar stenosis** describes reduced space for the nerves within the spinal column. It may be congenital or can develop

CLOSE-UP

May 2013

over time. Resulting nerve pressure can cause sciatica, radicular pain, or myelopathy.

- **Degenerative spondylolisthesis** occurs when one vertebra slips forward out of alignment with the rest of the spine, sometimes causing lumbar spinal stenosis and resulting in pain or numbness.

Diagnosis of Low Back and Neck Pain

Most low back and neck pain is acute, meaning it lasts only a few days or weeks, and it often clears up on its own. Pain that develops rapidly, pain that is extremely intense, or pain associated with a history of cancer, fever, significant trauma, or neurological symptoms such as muscle weakness and the loss of bladder control, may indicate a serious condition that requires immediate diagnosis and treatment.

Many diagnostic tests such as computed tomography (CT) scans and magnetic resonance imaging (MRI) for low back and neck pain are better at ruling out serious conditions than they are at identifying the precise cause of symptoms. Most adults — with or without back or neck pain — will show some abnormality on a back or neck MRI or CT scan, so finding an abnormality on a scan does not necessarily mean it is the cause of a patient's back or neck pain.

Treatment Options for Low Back and Neck Pain

Regardless of the patient's specific condition at the time, there is often no clear best treatment for many types of low back and neck pain. As for any elective treatment, a patient's own values and level of comfort with uncertainty in outcome should be considered alongside the clinician's recommendations. Patients suffering from back or neck pain should consider their feelings about the potential benefits and harms involved, and the time, energy, and cost required for each treatment.

Nonsurgical Treatment

The vast majority of patients with low back or neck pain improve without surgical treatment. Nonsurgical approaches to low back and neck pain include:

- **Exercise and self-care.** Staying active and maintaining strength is important in treating all causes of back pain. Specific exercises may be beneficial to patients with certain conditions.
- **Manipulation, massage, and other alternative therapies.** Complementary therapies such as spinal manipulation, massage, and acupuncture may offer some, mostly short-term, benefit to many patients and are generally safe. Spinal manipulation in patients with herniated discs has been controversial because of a perceived risk of further injury, but the evidence strongly suggests that this is extremely rare.
- **Non-narcotic pain medications.** Over-the-counter acetaminophen and non-steroidal anti-inflammatory drugs (NSAID) such as ibuprofen and aspirin may offer some temporary relief from acute back and neck pain. All medications have side effects, however, and there are risks associated with even such commonly used drugs as acetaminophen and NSAIDs.
- **Narcotic pain medications and muscle relaxants.** Narcotics and muscle relaxants are often prescribed for sciatica and other chronic back pain, although evidence that they effectively relieve symptoms is lacking. Muscle relaxants and narcotics can cause fatigue, clouded thinking, and constipation; older patients may also be more prone to falls and cognitive impairment when using narcotics, which also pose significant risks for abuse and dependency.
- **Steroid injections.** Corticosteroids are sometimes injected into the tissues surrounding the spinal column or at the roots of nerves, to reduce swelling and promote healing. However, there is no sound evidence that steroids lead to long-term pain relief.

Surgical Treatment

The effectiveness of elective spine surgery depends upon the underlying condition. It is most effective in cases that involve nerve compression, segmental instability, deformity, tumor, or trauma.

Low back (lumbar) pain procedures. The major types of surgery for lumbar pain are decompression (discectomy and laminectomy) and fusion:

- **Discectomy (for herniated disc).** The surgeon removes parts of the damaged disc that are pressing on a nerve or nerves. The Spine Patient Outcomes Research Trial (SPORT), a major study of spine surgeries, found that after one year, people who had this surgery for radicular pain associated with herniated disc were more likely to feel satisfied with their symptoms than people who had nonsurgical treatment, though all patients felt better. At two years, the patients treated with this surgery had higher function and less pain and disability than patients treated non-surgically. Discectomy carries a 2% to 4% risk of injury to the tissues and nerves of the spine, and 14% to 25% of patients have repeat operations within 10 years.[2]
- **Laminectomy.** This surgery makes more room for the lumbar nerves by cutting away bone near the center of the vertebra, relieving painful pressure on the nerves caused by spinal stenosis. SPORT reported that after four years, people who had this surgery were more likely to feel satisfied with their symptoms than people who had nonsurgical treatment, though the difference grew smaller over time. SPORT also reported a 13% reoperation rate within four years of the initial surgery.[3]
- **Spinal fusion.** Part or all of the disc is removed, and the resulting space left between the vertebrae is filled with the patient's own bone from elsewhere in the body, cadaver bone, or bioengineered material. Metal screws and rods are often used to support the fused segments of bone. Fusion is intended to realign the spine and to reduce painful movement between the vertebrae. Infrequently, spinal fusion causes nerve damage and increased pain. About 10% of patients undergo further surgery for back pain within five years.

Between 2005 and 2010, the number of back surgeries performed each year in California went up. The increase was made up largely of spinal fusions, which rose from 12,000 in 2005 to 16,000 in 2010. Between 2005 and 2010, decompression surgeries declined.[4] There is only limited evidence to support the use of spine fusion for conditions of the spine that do not include instability or deformity.

Neck (cervical) pain procedures. There are several surgical treatments for neck pain, the outcomes of which are most likely to be positive in patients with instability, deformity, or myelopathy. Surgery for nonspecific neck pain without symptoms of nerve compression, such as weakness or loss of sensation, may not lead to improvement. The evidence comparing outcomes of surgery to outcomes of nonsurgical care for spondylosis, with and without nerve compression, has been inconsistent.

- **Discectomy and fusion.** Discectomy is the removal of a herniated disc and is often paired with a fusion. After removing the disc, the surgeon may fuse the vertebrae above and below the space that is left, using the patient's own bone from elsewhere in the body, cadaver bone, or bioengineered material. Additional support may be provided by metal plates and screws.
- **Laminectomy/Laminoplasty.** Laminectomy is a decompression surgery that removes bone (lamina) that may be compressing the spinal cord or nerves. It is usually performed with fusion, using screws and rods for support to prevent a progressive forward curvature. Laminoplasty is a similar procedure that opens up the bone covering the spinal cord but leaves it in place.

- **Foraminotomy.** This decompression procedure, done through a very small incision, removes a small amount of bone that is compressing a pinched nerve. Fusion is not considered necessary with this procedure.

In addition to the general risks of any surgery, neck surgery can also entail nerve damage, loss of movement, damage to parts of the cervical spine above or below the surgery site, and problems swallowing (for anterior surgeries). Complication rates of 1% to 8% have been reported.[5]

Osteoporotic Vertebral Compression Fractures

Osteoporosis is a common condition in which bones become less dense and more brittle as people age. Vertebral compression fracture (VCF) is commonly associated with osteoporosis.

Some osteoporotic VCFs cause no symptoms, and many VCFs heal with time, but for some people these fractures can be very painful and lead to impaired mobility and poor quality of life. They can also cause the spine to become misaligned or misshapen, a condition called kyphosis. Patients with extreme kyphosis (sometimes called Dowager's Hump) may experience restricted movement, pain resulting from constricted spinal nerves, breathing problems, and other symptoms. While these symptoms may lead some patients to seek medical attention, other VCFs may not cause symptoms and are only discovered during imaging studies of the back.

Treatment Options for VCF and Kyphosis

While there are several common treatments for osteoporotic VCF and kyphosis, there is no standard medical or surgical protocol, and there is considerable uncertainty surrounding the efficacy of available treatment options for these conditions.

Nonsurgical Treatment

Nonsurgical treatment for VCF and kyphosis include:

- **Rest and immobilization.** This may include simple bed rest. Back braces designed to restrict movement of the painful area are sometimes recommended, but evidence of their value for VCF is very limited.
- **Osteoporosis medications.** Drugs such as bisphosphonates are employed to prevent and treat osteoporosis. The optimal duration of this therapy has not been established, however, and bisphosphonates can cause a variety of side effects, including rare but serious conditions.
- **Non-narcotic pain medications.** The use of non-narcotic pain medications for VCF is similar in effectiveness, side effects, and risks as for back and neck pain (see above).
- **Narcotic pain medications and muscle relaxants.** The use of narcotic pain medications and muscle relaxants for VCF is similar in effectiveness, side effects, and risks as for back and neck pain (see above).

Surgical Treatment

Surgery to correct VCF and kyphosis is common, though there is conflicting evidence for its effectiveness at restoring function and reducing the risk of more fractures. Two major types of surgery for osteoporotic VCF currently in use are:

- **Vertebroplasty.** This is the injection of synthetic bone cement called polymethylmethacrylate (PMMA) into fractured vertebrae, with the goal of supporting the fractures and relieving pain.
- **Kyphoplasty.** This is a modification of the vertebroplasty procedure that also attempts to correct kyphosis and deformities resulting from a VCF. A small balloon is fed into the space within the vertebrae and inflated to compact fractured bone. Cement is then injected into the space created by the balloon.

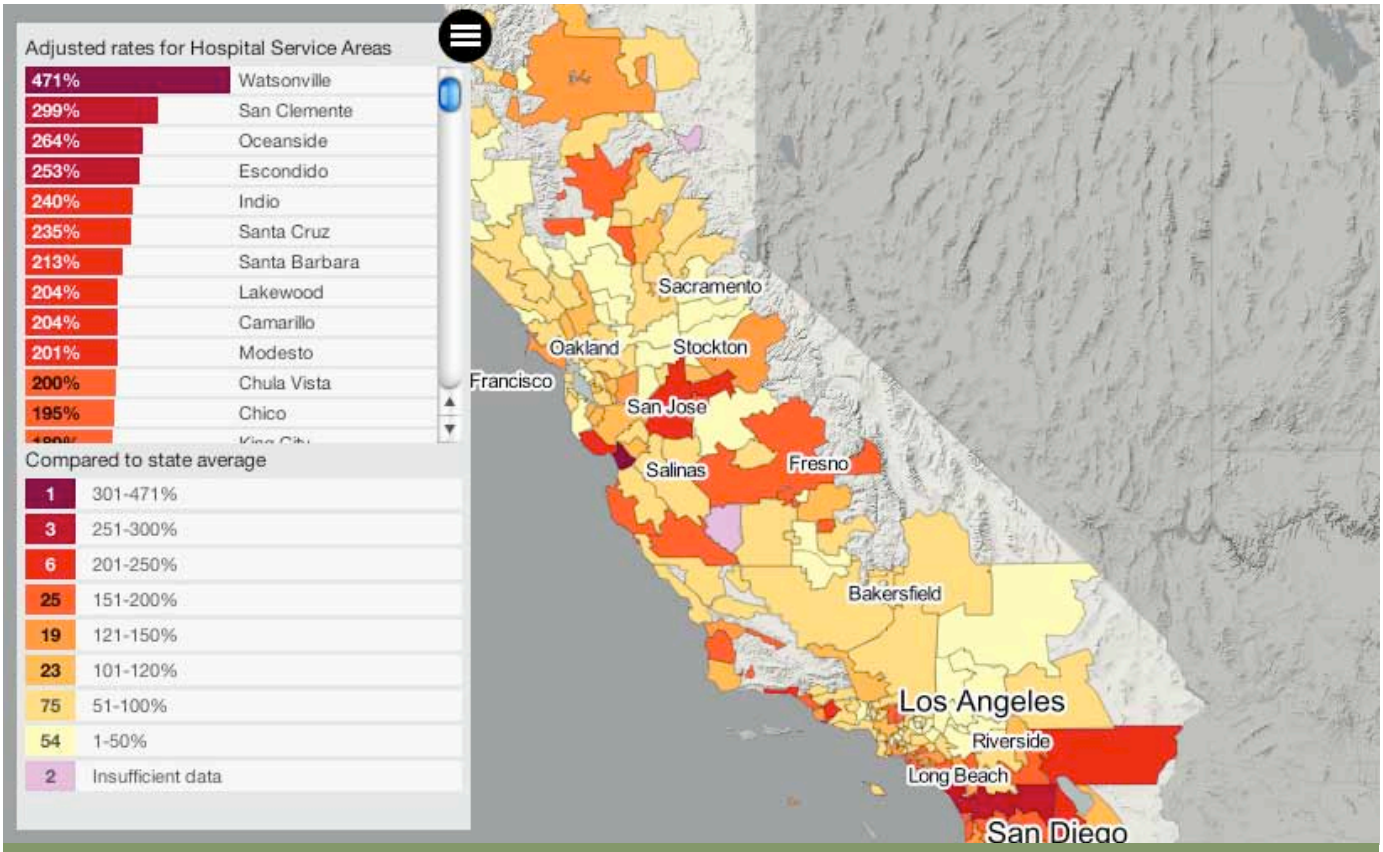
The risk of infection and of damage to soft tissues of surrounding structures of the spine is low for both surgeries. The main risk is that PMMA cement may leak out of the vertebral column and congeal in other parts of the body, but there is no definitive data about how often this potentially serious complication occurs.

Vertebroplasty and kyphoplasty were initially hailed as highly effective surgeries for VCF, with success and "cure" rates in excess of 90%. In the years since the procedures became common, however, studies have reported variable outcomes. In 2009, two randomized clinical trials published in the *New England Journal of Medicine* found that patients treated with vertebroplasty had no better outcomes than subjects treated with a sham procedure.[6] By comparison, a 2012 review found that both surgeries may offer modest benefit compared with nonsurgical treatment.[7] Because of the conflicting results, further study will be necessary to clarify the efficacy of these procedures.

Geographic Variation in Treatment Rates

Patients in several California communities undergo lumbar decompression or fusion, cervical decompression or fusion, vertebroplasty, and kyphoplasty at rates notably higher or lower than the state rate. See Figure 1.

Figure 1. Geographic Variation in Vertebroplasty and Kyphoplasty, California, 2005–2010



DATA VARIATION ANALYSES

Vertebroplasty and Kyphoplasty *(featured in the map above)*

- Residents of Watsonville HSA (Santa Cruz HRR) are at least 12.6 times as likely to undergo vertebroplasty or kyphoplasty as residents of Lodi HSA (Sacramento HRR).
- Residents of Oceanside HSA (San Diego HRR) are at least 7 times as likely to undergo vertebroplasty or kyphoplasty as residents of Fontana HSA (San Bernardino HRR).
- Residents of Modesto HSA (Modesto HRR) are at least 3.8 times as likely to undergo vertebroplasty or kyphoplasty as residents of Merced HSA (Modesto HRR).

DATA VARIATION ANALYSES, *CONTINUED*

Lumbar Fusion

- Residents of Coalinga HSA (Fresno HRR) are at least twice as likely to undergo spinal fusion as residents of Delano HSA (Bakersfield HRR).
- Residents of Lompoc HSA (Santa Barbara HRR) are at least twice as likely to undergo spinal fusion as residents of Sebastopol HSA (Santa Rosa HRR).
- Residents of Escondido HSA (San Diego HRR) are at least twice as likely to undergo spinal fusion as residents of Redwood City HSA (San Mateo HRR).

Lumbar Decompression

- Residents of King City HSA (Salinas HRR) are at least twice as likely to undergo lumbar decompression as residents of Grass Valley HSA (Sacramento HRR).
- Residents of Watsonville HSA (Santa Cruz HRR) are at least twice as likely to undergo lumbar decompression as residents of Eureka HSA (Redding HRR).
- Residents of Santa Cruz HSA (Santa Cruz HRR) are at least twice as likely to undergo lumbar decompression as residents of Corcoran HSA (Fresno HRR).

Cervical Fusion

- Residents of Brawley HSA (San Diego HRR) are at least 3.9 times as likely to undergo cervical fusion as residents of Sebastopol HSA (Santa Rosa HRR).
- Residents of Salinas HSA (Salinas HRR) are at least 3 times as likely to undergo cervical fusion as residents of Berkeley HSA (Alameda HRR).
- Residents of Coalinga HSA (Fresno HRR) are at least 2.8 times as likely to undergo cervical fusion as residents of Oakdale HSA (Modesto HRR).

Cervical Decompression

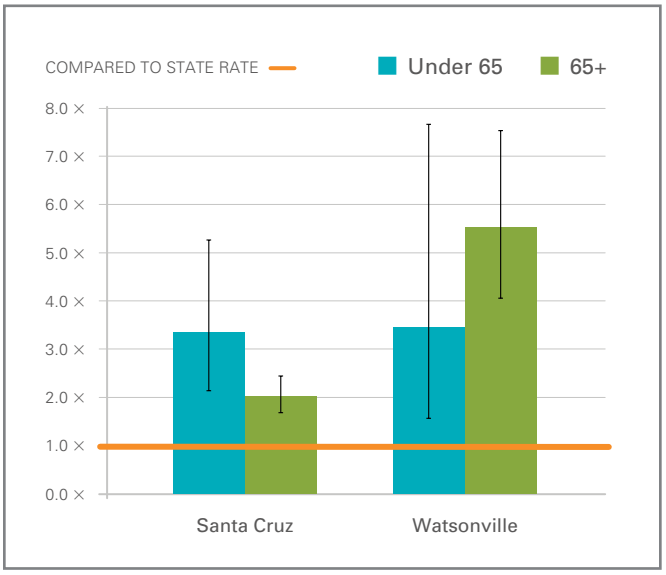
- Residents of Santa Barbara HSA (Santa Barbara HRR) are at least 3.9 times as likely to undergo cervical decompression as residents of Red Bluff HSA (Chico HRR).
- Residents of San Francisco HSA (San Francisco HRR) are at least 3 times as likely to undergo cervical decompression as residents of Lodi HSA (Sacramento HRR).
- Residents of Pittsburg HSA (Contra Costa HRR) are at least twice as likely to undergo cervical decompression as residents of Newport Beach HSA (Orange HRR).

DEFINITIONS: For purposes of data analysis, a patient's community of residence is identified by a **hospital service area (HSA),** which designates a local health care market for community-based inpatient care. An HSA can include more than one city or town. **Hospital referral region (HRR)** designates a health care market for tertiary medical care, which is based on where patients receive major cardiovascular surgery and neurosurgery. Each HRR includes at least one HSA with a hospital or hospitals that perform major cardiovascular procedures or neurosurgery.

The rate of vertebroplasty and kyphoplasty in Watsonville HSA (Santa Cruz HRR) is at least 3.5 times the state rate, and at least 4 times the state rate for residents 65 years of age and older. See Figure 2.

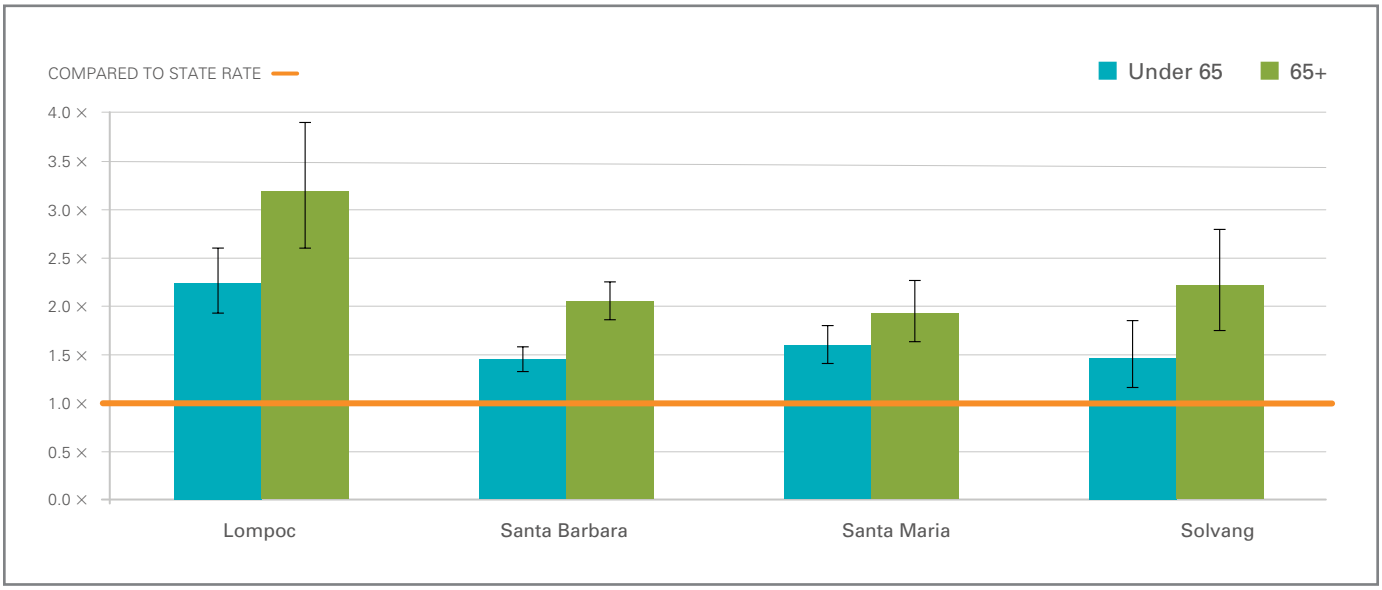
Note regarding Figures 2 through 5:
The black vertical line at the top of each bar displays the range of confidence intervals. This range is used when comparing HSA rates to each other and to the state rate.

Figure 2. Vertebroplasty and Kyphoplasty, HSAs in Santa Cruz HRR Compared to the State Rate by Patient Age Group, 2005–2010



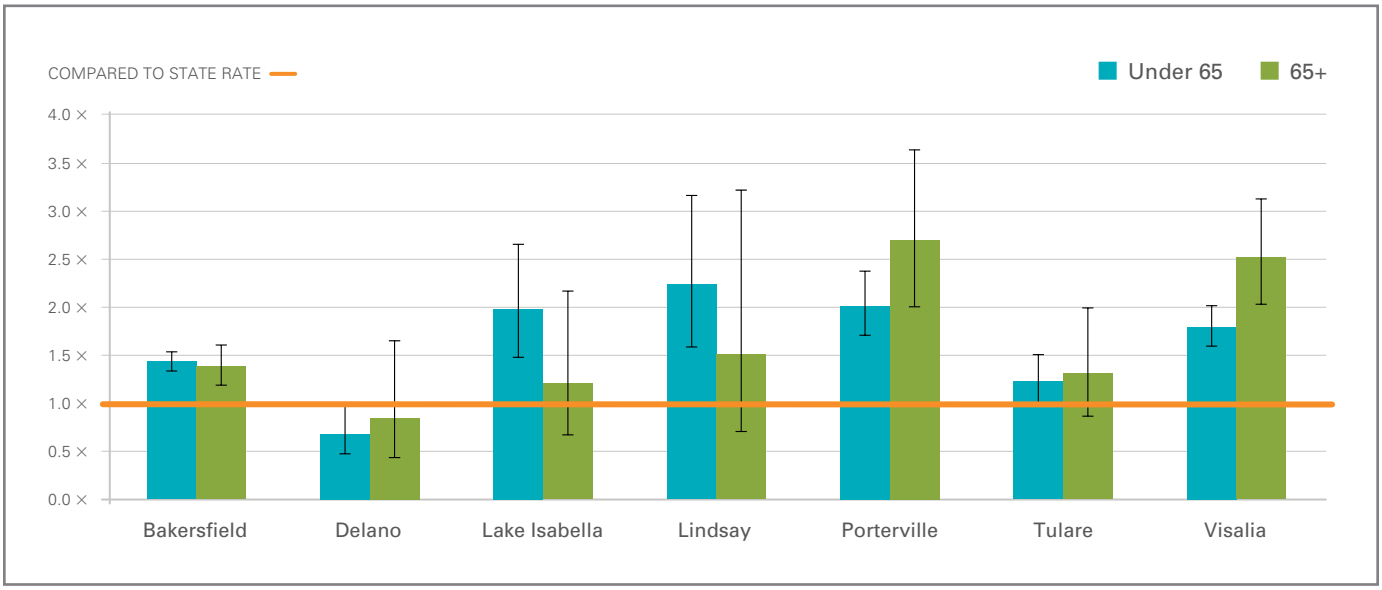
In all HSAs in Santa Barbara HRR, residents age 65 and over are 1.5 times as likely to undergo lumbar decompression compared with the state average, and in Lompoc they are 2.5 times more likely than the state average to undergo the procedure. See Figure 3.

Figure 3. Lumbar Decompression, HSAs in Santa Barbara HRR Compared to the State Rate by Patient Age Group, 2005–2010



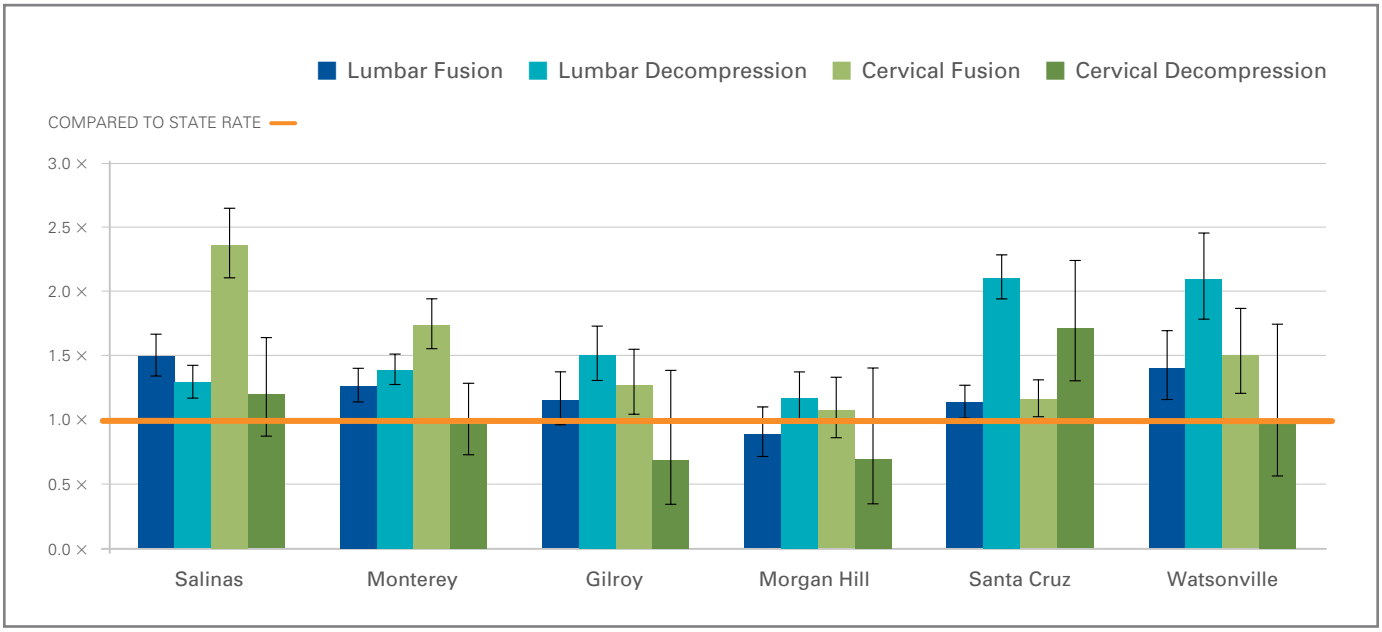
In five of seven HSAs in Bakersfield HRR, residents are at least 20% more likely to undergo cervical fusion compared with the state average. In Visalia and Porterville HSAs, residents are at least 1.5 times as likely to undergo this treatment. See Figure 4.

Figure 4. Cervical Fusion, HSAs in Bakersfield HRR Compared to the State Rate, by Patient Age Group, 2005–2010



Several spine procedures, including lumbar fusion, lumbar decompression, cervical fusion, and cervical decompression, are performed at higher rates than the state average in several contiguous HSAs along the central coast of Northern California. These HSAs are Salinas and Monterey (Salinas HRR), Gilroy (San Jose HRR), and Santa Cruz and Watsonville (Santa Cruz HRR). In Santa Cruz and Watsonville HSAs, lumbar decompression is performed at least 50% above the state rate, while in nearby Salinas, cervical fusion is at least twice the state rate. Residents of nearby Morgan Hill, on the other hand, undergo these procedures at or below the state rate. See Figure 5.

Figure 5. Lumbar Fusion and Decompression, Cervical Fusion and Decompression, in Six Contiguous HSAs Compared to the State Rate, 2005–2010



Note regarding Figures 6 through 10: Each dot represents the rate for a procedure in a single California HSA. Dots at the top and bottom of the graphs represent the extremes in rates. The narrower the graph, the greater the variation in rates across HSAs.

Figure 6. Vertebroplasty and Kyphoplasty, Age 68+, by HSA, 2005–2010

Highest Rates	PER 100,000
Watsonville (Santa Cruz HRR)	77
San Clemente (Orange HRR)	49
Oceanside (San Diego HRR)	43
Escondido (San Diego HRR)	41
Santa Cruz (Santa Cruz HRR)	39
Indio (San Diego HRR)	39
Santa Barbara (Santa Barbara HRR)	35
Modesto (Modesto HRR)	33
Chula Vista (San Diego HRR)	33
Camarillo (Ventura HRR)	33
State Rate	**16**

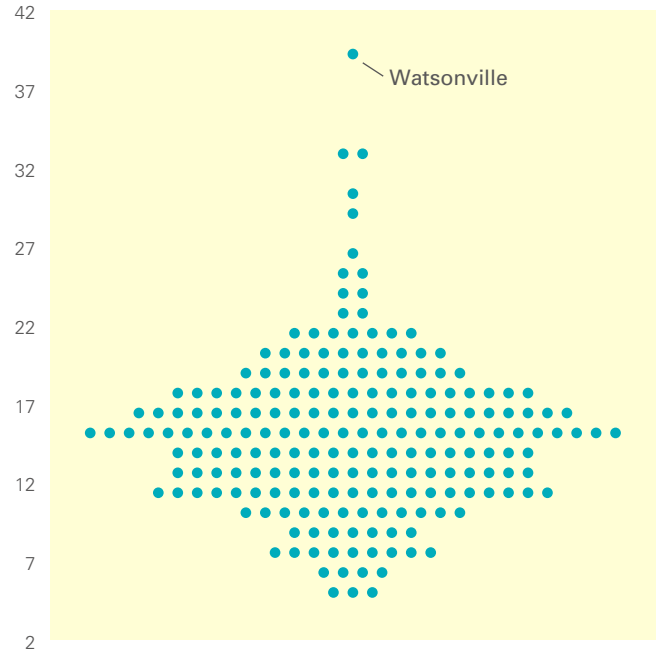


Figure 7. Lumbar Decompression, All Ages, by HSA, 2005–2010

Highest Rates	PER 100,000
Lompoc (Santa Barbara HRR)	175
King City (Salinas HRR)	152
Santa Paula (Ventura HRR)	149
Santa Cruz (Santa Cruz HRR)	148
Watsonville (Santa Cruz HRR)	147
Ventura (Ventura HRR)	142
Fall River Mills (Redding HRR)	135
Oxnard (Ventura HRR)	135
Ojai (Ventura HRR)	134
Lindsay (Bakersfield HRR)	131
State Rate	**70**

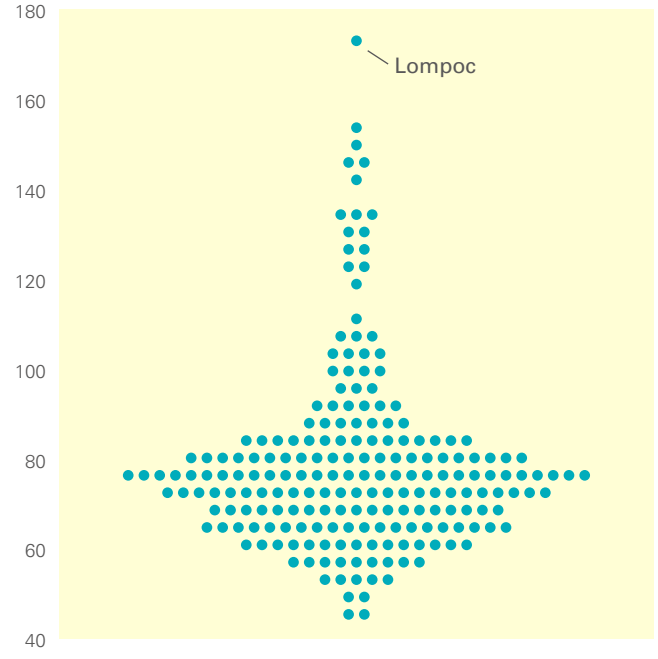


Figure 8. Lumbar Fusion, All Ages, by HSA, 2005–2010

Highest Rates	PER 100,000
Coalinga (Fresno HRR)	118
Lompoc (Santa Barbara HRR)	102
King City (Salinas HRR)	99
Brawley (San Diego HRR)	97
Escondido (San Diego HRR)	96
Fullerton (Orange HRR)	93
Fallbrook (San Diego HRR)	93
Huntington Beach (Orange HRR)	89
La Mesa (San Diego HRR)	88
Pasadena (Los Angeles HRR)	88
State Rate	**53**

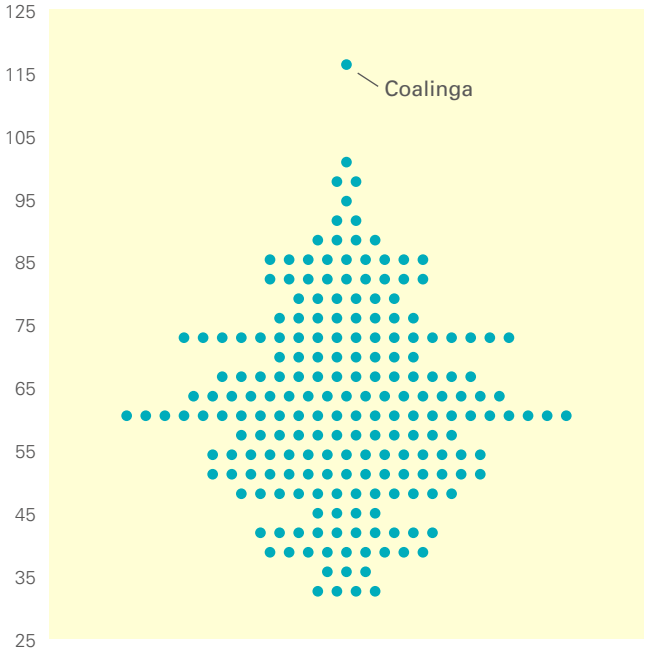


Figure 9. Cervical Decompression, All Ages, by HSA, 2005–2010

Highest Rates	PER 100,000
Avalon (Los Angeles HRR)	34
Santa Barbara (Santa Barbara HRR)	21
Solvang (Santa Barbara HRR)	20
Pittsburg (Contra Costa HRR)	18
San Francisco (San Francisco HRR)	17
Lompoc (Santa Barbara HRR)	17
Willits (Napa HRR)	17
Martinez (Contra Costa HRR)	16
Concord (Contra Costa HRR)	15
Castro Valley (Alameda HRR)	15
State Rate	**7**

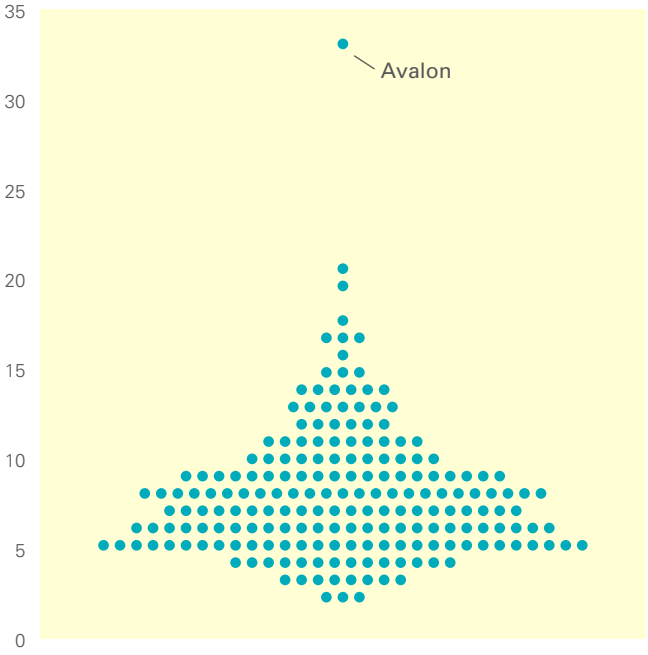


Figure 10. Cervical Fusion, All Ages, by HSA, 2005–2010

Highest Rates	PER 100,000
Brawley (San Diego HRR)	125
Coalinga (Fresno HRR)	109
King City (Salinas HRR)	102
Salinas (Salinas HRR)	100
El Centro (San Diego HRR)	98
Santa Paula (Ventura HRR)	97
Oxnard (Ventura HRR)	93
Porterville (Bakersfield HRR)	90
Ventura (Ventura HRR)	89
Camarillo (Ventura HRR)	87
State Rate	**42**

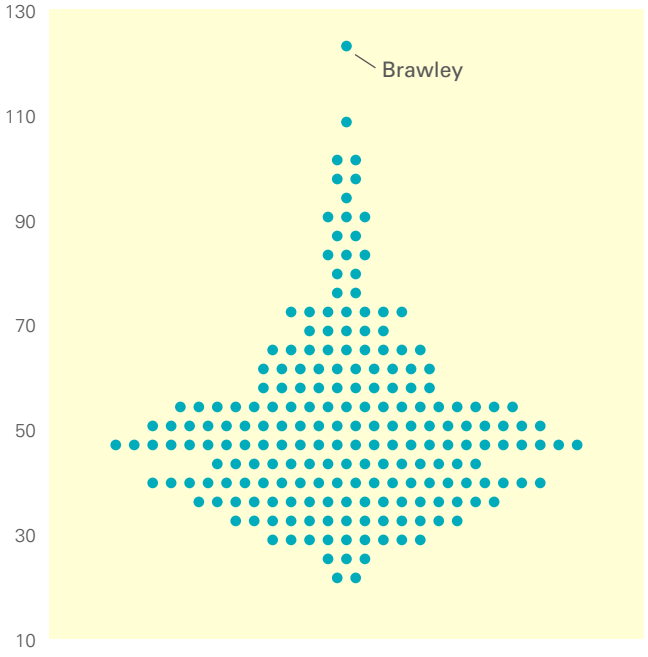


Table 1. Lumbar Decompression and Fusion, Cervical Decompression and Fusion, Vertebroplasty and Kyphoplasty by California Hospital Service Area (HSA), 2005–2010

HOW TO USE THIS TABLE: In Antioch HSA, for example, residents undergo cervical decompression at least at 145% of the state rate (and at most 229%). That means they are at least 45% more likely than the average Californian to undergo the procedure.

Notes: An HSA can include both the city for which it is named as well as surrounding areas. Confidence intervals describe a range and are listed in parentheses. For example, 57%–70% indicates that, with 95% confidence, the range of possible values spans from 57% to 70% of the state rate. Blank cells indicate insufficient data. Color codes are for reader convenience only. Values above the state rate are assigned a color code based on the low end of the confidence range; values below the state rate are assigned a color code based on the high end of the confidence range.

LEGEND*

- Less than 50%
- 120% to 149%
- 150% to 199%
- 200% to 249%
- 250% to 299%
- 300%+

*HSA compared to state rate.

	Lumbar Decompression Compared to state rate of 70 per 100,000	Lumbar Fusion Compared to state rate of 54 per 100,000	Cervical Decompression Compared to state rate of 7 per 100,000	Cervical Fusion Compared to state rate of 42 per 100,000	Vertebroplasty Kyphoplasty Compared to state rate of 16 per 100,000
California	**100%**	**100%**	**100%**	**100%**	**100%**
Alameda	105% (90%–123%)	103% (85%–125%)	164% (110%–243%)	85% (68%–107%)	32% (20%–53%)
Anaheim	117% (110%–125%)	147% (138%–158%)	88% (69%–111%)	150% (139%–161%)	86% (74%–99%)
Antioch	118% (108%–129%)	146% (134%–159%)	182% (145%–229%)	104% (93%–116%)	64% (49%–84%)
Apple Valley	110% (98%–122%)	129% (115%–144%)	77% (51%–115%)	105% (92%–120%)	25% (15%–42%)
Arcadia	87% (79%–95%)	130% (118%–143%)	73% (51%–103%)	110% (98%–124%)	61% (50%–74%)
Arcata	91% (76%–109%)	91% (73%–113%)	72% (39%–133%)	95% (76%–120%)	39% (25%–64%)
Arroyo Grande	104% (92%–118%)	89% (76%–104%)	100% (67%–149%)	129% (110%–151%)	125% (101%–155%)
Auburn	105% (95%–116%)	111% (99%–124%)	103% (73%–144%)	66% (56%–77%)	82% (65%–103%)
Avalon	125% (74%–211%)	153% (86%–270%)	488% (180%–1,327%)	120% (57%–252%)	98% (31%–307%)
Bakersfield	112% (106%–118%)	109% (102%–116%)	71% (58%–87%)	141% (133%–151%)	94% (83%–107%)
Banning	93% (80%–107%)	114% (99%–130%)	42% (21%–81%)	106% (90%–125%)	42% (28%–63%)
Barstow	129% (110%–152%)	152% (129%–178%)	41% (17%–101%)	124% (102%–150%)	40% (24%–68%)
Bellflower	81% (71%–93%)	89% (77%–103%)	73% (46%–116%)	93% (80%–109%)	54% (40%–72%)
Berkeley	100% (89%–111%)	73% (62%–85%)	202% (152%–270%)	57% (47%–69%)	37% (26%–52%)
Big Bear Lake	105% (87%–127%)	117% (96%–142%)	135% (77%–236%)	156% (129%–188%)	40% (20%–80%)
Brawley	145% (119%–175%)	180% (148%–219%)	113% (52%–244%)	296% (243%–361%)	102% (67%–154%)
Burbank	106% (100%–113%)	111% (103%–120%)	101% (82%–125%)	90% (82%–98%)	84% (73%–96%)
Burlingame	120% (108%–133%)	67% (57%–80%)	128% (93%–176%)	74% (61%–88%)	72% (57%–90%)

	Lumbar Decompression Compared to state rate of 70 per 100,000	Lumbar Fusion Compared to state rate of 54 per 100,000	Cervical Decompression Compared to state rate of 7 per 100,000	Cervical Fusion Compared to state rate of 42 per 100,000	Vertebroplasty Kyphoplasty Compared to state rate of 16 per 100,000
Camarillo	184% (169%–202%)	141% (126%–159%)	186% (137%–251%)	205% (182%–231%)	204% (173%–241%)
Canoga Park	98% (91%–106%)	98% (89%–107%)	158% (126%–197%)	91% (82%–101%)	40% (32%–49%)
Carmichael	114% (106%–123%)	104% (95%–113%)	94% (74%–121%)	95% (87%–105%)	114% (98%–134%)
Castro Valley	145% (131%–160%)	94% (82%–108%)	215% (164%–282%)	99% (85%–115%)	87% (68%–111%)
Chester	83% (59%–117%)	90% (62%–129%)		84% (55%–129%)	39% (14%–105%)
Chico	108% (98%–119%)	138% (124%–153%)	100% (73%–137%)	136% (121%–154%)	195% (166%–229%)
Chino	89% (79%–100%)	115% (102%–130%)	112% (77%–162%)	121% (106%–138%)	35% (23%–54%)
Chula Vista	114% (105%–124%)	140% (129%–153%)	108% (81%–144%)	153% (138%–169%)	200% (173%–232%)
Clearlake	91% (75%–112%)	161% (136%–190%)	116% (68%–199%)	160% (132%–193%)	25% (13%–47%)
Coalinga	110% (81%–149%)	220% (173%–280%)		259% (201%–334%)	
Colusa	107% (82%–142%)	136% (103%–179%)	119% (48%–295%)	125% (88%–177%)	34% (14%–82%)
Concord	107% (97%–119%)	135% (122%–151%)	220% (171%–281%)	92% (80%–106%)	107% (86%–132%)
Corcoran	62% (44%–87%)	76% (53%–111%)		150% (111%–203%)	66% (30%–143%)
Corona	98% (89%–107%)	117% (106%–128%)	103% (76%–139%)	106% (95%–118%)	85% (67%–109%)
Coronado	79% (63%–99%)	113% (87%–147%)	50% (18%–137%)	74% (51%–107%)	61% (38%–98%)
Covina	89% (78%–102%)	105% (91%–120%)	79% (49%–128%)	109% (93%–128%)	40% (28%–57%)
Culver City	103% (87%–122%)	113% (92%–137%)	180% (118%–275%)	144% (118%–175%)	48% (31%–75%)
Daly City	103% (92%–115%)	67% (58%–79%)	146% (108%–199%)	81% (69%–96%)	48% (36%–64%)
Davis	120% (105%–137%)	106% (89%–126%)	83% (49%–140%)	73% (59%–91%)	37% (22%–62%)
Deer Park	124% (102%–149%)	118% (94%–147%)	206% (128%–331%)	86% (63%–117%)	52% (29%–91%)
Delano	87% (70%–108%)	58% (43%–78%)	65% (29%–148%)	70% (51%–97%)	36% (18%–72%)
Dinuba	140% (107%–182%)	144% (109%–189%)		172% (126%–235%)	39% (15%–105%)
Downey	87% (78%–96%)	71% (63%–80%)	75% (51%–111%)	100% (88%–114%)	44% (34%–58%)
Duarte	84% (64%–109%)	125% (97%–161%)	55% (17%–171%)	169% (131%–220%)	86% (53%–139%)

	Lumbar Decompression Compared to state rate of 70 per 100,000	Lumbar Fusion Compared to state rate of 54 per 100,000	Cervical Decompression Compared to state rate of 7 per 100,000	Cervical Fusion Compared to state rate of 42 per 100,000	Vertebroplasty Kyphoplasty Compared to state rate of 16 per 100,000
El Centro	109% (95%–125%)	136% (118%–157%)	99% (59%–168%)	232% (200%–270%)	60% (42%–84%)
Encinitas	112% (103%–123%)	130% (117%–145%)	86% (63%–119%)	110% (97%–125%)	177% (150%–208%)
Encino	128% (107%–153%)	120% (93%–153%)	131% (78%–221%)	107% (78%–147%)	80% (53%–122%)
Escondido	153% (142%–164%)	178% (165%–193%)	151% (119%–193%)	173% (158%–190%)	253% (225%–286%)
Eureka	72% (62%–84%)	78% (66%–94%)	47% (26%–83%)	123% (105%–144%)	56% (40%–77%)
Fairfield	112% (100%–127%)	109% (95%–124%)	121% (85%–172%)	69% (59%–82%)	51% (34%–75%)
Fall River Mills	192% (155%–239%)	128% (96%–171%)		176% (133%–233%)	80% (44%–147%)
Fallbrook	132% (115%–152%)	173% (150%–199%)	170% (110%–262%)	138% (115%–167%)	148% (115%–190%)
Folsom	123% (109%–140%)	105% (89%–125%)	67% (39%–117%)	93% (77%–113%)	118% (85%–164%)
Fontana	85% (75%–96%)	121% (108%–136%)	135% (95%–191%)	76% (65%–90%)	18% (10%–34%)
Fort Bragg	102% (83%–127%)	134% (109%–166%)	107% (56%–204%)	131% (102%–167%)	27% (14%–52%)
Fortuna	78% (63%–96%)	90% (72%–112%)	62% (31%–122%)	113% (91%–142%)	73% (50%–107%)
Fountain Valley	101% (92%–112%)	162% (147%–178%)	76% (52%–109%)	153% (137%–172%)	146% (124%–171%)
Fremont	115% (106%–125%)	94% (84%–105%)	159% (124%–203%)	115% (102%–129%)	67% (55%–83%)
Fresno	86% (81%–92%)	152% (144%–161%)	72% (59%–88%)	139% (131%–149%)	154% (138%–171%)
Fullerton	130% (122%–139%)	173% (162%–185%)	111% (88%–140%)	141% (130%–154%)	85% (73%–99%)
Garberville	73% (51%–105%)	119% (86%–163%)	91% (37%–224%)	94% (65%–138%)	32% (12%–85%)
Garden Grove	116% (101%–134%)	138% (120%–160%)	70% (39%–125%)	152% (129%–178%)	126% (98%–161%)
Gardena	122% (100%–149%)	83% (64%–108%)	209% (128%–340%)	96% (73%–126%)	155% (113%–212%)
Gilroy	150% (131%–173%)	115% (96%–137%)	69% (34%–139%)	127% (104%–155%)	107% (73%–156%)
Glendale	96% (90%–102%)	99% (92%–107%)	118% (98%–142%)	81% (74%–89%)	161% (146%–177%)
Glendora	94% (83%–107%)	125% (111%–142%)	96% (62%–147%)	118% (102%–137%)	29% (19%–44%)
Granada Hills	107% (92%–125%)	112% (94%–134%)	158% (103%–243%)	123% (101%–148%)	62% (43%–89%)
Grass Valley	70% (61%–81%)	73% (63%–85%)	73% (48%–112%)	66% (56%–79%)	67% (52%–87%)

	Lumbar Decompression Compared to state rate of 70 per 100,000	Lumbar Fusion Compared to state rate of 54 per 100,000	Cervical Decompression Compared to state rate of 7 per 100,000	Cervical Fusion Compared to state rate of 42 per 100,000	Vertebroplasty Kyphoplasty Compared to state rate of 16 per 100,000
Greenbrae	107% (99%–115%)	70% (63%–78%)	198% (162%–240%)	63% (55%–72%)	125% (108%–144%)
Greenville	91% (49%–171%)	63% (28%–141%)		93% (44%–196%)	
Gridley	111% (83%–147%)	156% (119%–205%)	145% (64%–329%)	212% (159%–282%)	95% (55%–162%)
Hanford	126% (113%–140%)	119% (105%–135%)	77% (48%–124%)	146% (128%–166%)	90% (69%–118%)
Harbor City	97% (87%–109%)	117% (105%–130%)	95% (66%–136%)	115% (101%–130%)	111% (91%–137%)
Hawthorne	111% (95%–129%)	81% (67%–98%)	85% (50%–142%)	75% (61%–92%)	82% (56%–120%)
Hayward	149% (135%–166%)	75% (64%–88%)	186% (137%–251%)	98% (84%–114%)	102% (80%–130%)
Healdsburg	79% (64%–98%)	98% (79%–122%)	97% (50%–188%)	94% (72%–122%)	57% (34%–94%)
Hemet	93% (85%–102%)	121% (111%–132%)	82% (60%–113%)	112% (100%–124%)	65% (53%–79%)
Hollister	122% (105%–142%)	112% (94%–134%)	128% (76%–214%)	196% (166%–231%)	66% (43%–100%)
Huntington Beach	96% (88%–106%)	166% (152%–182%)	64% (44%–93%)	158% (143%–175%)	163% (139%–191%)
Indio	118% (104%–135%)	137% (120%–157%)	62% (34%–113%)	165% (142%–192%)	240% (197%–294%)
Inglewood	97% (88%–107%)	92% (82%–103%)	96% (71%–130%)	73% (64%–84%)	60% (46%–79%)
Irvine	96% (85%–108%)	145% (127%–166%)	69% (44%–108%)	147% (127%–170%)	124% (99%–155%)
Jackson	95% (83%–109%)	111% (96%–127%)	41% (23%–74%)	97% (81%–115%)	31% (20%–49%)
Joshua Tree	98% (85%–114%)	91% (77%–107%)	90% (55%–149%)	99% (83%–118%)	84% (62%–115%)
King City	217% (171%–275%)	185% (139%–245%)		242% (178%–328%)	189% (109%–328%)
La Jolla	119% (110%–129%)	129% (116%–144%)	133% (103%–172%)	113% (99%–129%)	153% (131%–179%)
La Mesa	130% (123%–138%)	165% (155%–175%)	127% (106%–154%)	151% (141%–161%)	121% (107%–137%)
Laguna Hills	99% (91%–108%)	127% (115%–140%)	56% (39%–81%)	144% (130%–160%)	131% (112%–154%)
Lake Isabella	111% (84%–145%)	119% (91%–156%)	149% (76%–293%)	169% (130%–219%)	79% (46%–135%)
Lakeport	88% (74%–104%)	137% (117%–161%)	76% (44%–132%)	124% (102%–150%)	43% (28%–66%)
Lakewood	112% (92%–135%)	111% (90%–137%)	66% (29%–148%)	108% (85%–137%)	204% (149%–279%)
Lancaster	127% (119%–136%)	134% (125%–144%)	148% (122%–179%)	144% (134%–155%)	85% (71%–102%)

	Lumbar Decompression Compared to state rate of 70 per 100,000	Lumbar Fusion Compared to state rate of 54 per 100,000	Cervical Decompression Compared to state rate of 7 per 100,000	Cervical Fusion Compared to state rate of 42 per 100,000	Vertebroplasty Kyphoplasty Compared to state rate of 16 per 100,000
Lindsay	187% (144%–242%)	121% (86%–169%)	122% (45%–331%)	209% (153%–286%)	155% (89%–271%)
Livermore	136% (122%–151%)	145% (128%–164%)	136% (97%–190%)	116% (100%–134%)	122% (94%–157%)
Lodi	124% (114%–136%)	122% (110%–135%)	44% (28%–70%)	116% (104%–131%)	17% (11%–28%)
Loma Linda	91% (78%–106%)	115% (98%–135%)	133% (83%–212%)	107% (88%–128%)	46% (30%–71%)
Lompoc	249% (221%–281%)	190% (165%–219%)	248% (170%–362%)	194% (165%–228%)	117% (84%–164%)
Long Beach	86% (81%–92%)	109% (102%–117%)	78% (63%–97%)	92% (85%–100%)	133% (119%–148%)
Los Alamitos	95% (85%–107%)	118% (105%–134%)	78% (51%–119%)	121% (105%–139%)	91% (75%–110%)
Los Angeles	108% (104%–113%)	98% (94%–104%)	121% (106%–138%)	92% (87%–98%)	112% (103%–122%)
Los Banos	108% (88%–133%)	88% (68%–114%)	82% (36%–186%)	118% (90%–154%)	60% (34%–104%)
Lynwood	84% (75%–94%)	94% (84%–105%)	68% (46%–100%)	86% (76%–98%)	27% (18%–41%)
Madera	86% (73%–102%)	160% (139%–185%)	95% (54%–168%)	171% (145%–201%)	76% (53%–108%)
Manteca	103% (91%–117%)	107% (93%–122%)	114% (77%–169%)	87% (74%–103%)	63% (44%–92%)
Martinez	109% (93%–126%)	112% (95%–133%)	226% (158%–323%)	111% (92%–133%)	108% (76%–154%)
Marysville	102% (88%–118%)	152% (133%–174%)	103% (66%–160%)	134% (114%–157%)	101% (75%–135%)
Merced	120% (110%–132%)	112% (100%–125%)	95% (69%–132%)	127% (112%–143%)	36% (27%–48%)
Mission Hills	100% (87%–114%)	111% (97%–127%)	130% (84%–202%)	114% (97%–135%)	76% (56%–103%)
Mission Viejo	105% (97%–113%)	137% (126%–149%)	69% (52%–92%)	130% (119%–143%)	167% (146%–191%)
Modesto	106% (100%–113%)	79% (73%–85%)	83% (67%–104%)	72% (65%–78%)	201% (183%–222%)
Montebello	87% (75%–100%)	102% (88%–118%)	68% (38%–123%)	136% (115%–160%)	50% (36%–69%)
Monterey	139% (128%–151%)	126% (114%–140%)	97% (73%–129%)	174% (155%–194%)	185% (160%–214%)
Monterey Park	75% (60%–93%)	93% (74%–118%)	118% (66%–213%)	110% (84%–144%)	76% (57%–102%)
Morgan Hill	117% (100%–137%)	89% (71%–110%)	70% (35%–140%)	107% (86%–133%)	67% (40%–111%)
Mount Shasta	86% (68%–107%)	95% (74%–121%)	44% (18%–107%)	129% (102%–164%)	114% (79%–163%)
Mountain View	137% (126%–149%)	79% (70%–90%)	123% (93%–165%)	99% (87%–113%)	101% (83%–122%)

	Lumbar Decompression Compared to state rate of 70 per 100,000	Lumbar Fusion Compared to state rate of 54 per 100,000	Cervical Decompression Compared to state rate of 7 per 100,000	Cervical Fusion Compared to state rate of 42 per 100,000	Vertebroplasty Kyphoplasty Compared to state rate of 16 per 100,000
Napa	122% (110%–136%)	104% (92%–118%)	144% (104%–199%)	85% (72%–101%)	107% (87%–131%)
National City	84% (67%–105%)	125% (102%–154%)	121% (62%–235%)	150% (119%–189%)	123% (89%–171%)
Newport Beach	91% (86%–98%)	162% (151%–173%)	57% (44%–74%)	131% (121%–142%)	152% (136%–169%)
Northridge	117% (107%–129%)	115% (103%–129%)	148% (111%–198%)	104% (91%–119%)	53% (42%–68%)
Norwalk	101% (87%–117%)	86% (72%–102%)	124% (77%–198%)	109% (91%–132%)	43% (29%–65%)
Novato	94% (82%–108%)	81% (68%–97%)	164% (113%–236%)	67% (54%–84%)	106% (80%–139%)
Oakdale	109% (92%–129%)	81% (65%–100%)	79% (42%–148%)	55% (41%–73%)	109% (77%–155%)
Oakland	113% (105%–123%)	77% (69%–85%)	207% (169%–253%)	73% (66%–82%)	43% (34%–55%)
Oceanside	103% (97%–110%)	153% (143%–163%)	107% (86%–134%)	128% (118%–139%)	264% (239%–291%)
Ojai	191% (165%–221%)	157% (131%–189%)	161% (96%–271%)	187% (153%–228%)	75% (47%–118%)
Orange	97% (87%–108%)	156% (141%–172%)	90% (61%–132%)	148% (132%–167%)	172% (142%–208%)
Oroville	109% (95%–126%)	133% (115%–153%)	120% (79%–181%)	194% (169%–223%)	57% (42%–78%)
Oxnard	192% (176%–209%)	143% (129%–159%)	186% (137%–254%)	222% (199%–247%)	139% (115%–169%)
Palm Springs	82% (73%–93%)	90% (79%–103%)	83% (55%–124%)	120% (104%–137%)	118% (97%–144%)
Panorama City	90% (80%–103%)	101% (89%–116%)	121% (81%–182%)	59% (48%–72%)	58% (43%–79%)
Paradise	109% (95%–126%)	117% (101%–137%)	93% (59%–146%)	128% (107%–152%)	138% (111%–172%)
Paramount	67% (51%–89%)	85% (65%–111%)	77% (32%–187%)	72% (51%–101%)	90% (53%–152%)
Pasadena	88% (80%–96%)	164% (151%–178%)	85% (64%–113%)	118% (106%–131%)	166% (146%–189%)
Petaluma	103% (91%–116%)	93% (80%–108%)	109% (74%–161%)	75% (63%–90%)	83% (62%–110%)
Pinole	129% (113%–147%)	104% (88%–122%)	192% (135%–272%)	81% (67%–99%)	42% (26%–69%)
Pittsburg	104% (88%–122%)	143% (123%–166%)	256% (183%–358%)	107% (89%–129%)	75% (49%–113%)
Placerville	119% (108%–130%)	123% (111%–137%)	73% (51%–106%)	92% (81%–105%)	40% (29%–54%)
Pleasanton	97% (87%–108%)	125% (111%–142%)	135% (100%–181%)	130% (114%–148%)	105% (83%–134%)
Pomona	94% (86%–102%)	137% (126%–149%)	93% (69%–126%)	128% (116%–141%)	37% (29%–48%)

	Lumbar Decompression Compared to state rate of 70 per 100,000	Lumbar Fusion Compared to state rate of 54 per 100,000	Cervical Decompression Compared to state rate of 7 per 100,000	Cervical Fusion Compared to state rate of 42 per 100,000	Vertebroplasty Kyphoplasty Compared to state rate of 16 per 100,000
Porterville	156% (137%–178%)	151% (131%–174%)	177% (122%–257%)	213% (185%–246%)	97% (71%–132%)
Poway	117% (107%–127%)	153% (140%–167%)	118% (90%–154%)	126% (113%–140%)	162% (140%–188%)
Rancho Mirage	79% (72%–86%)	80% (73%–88%)	54% (40%–74%)	111% (100%–123%)	188% (166%–213%)
Red Bluff	117% (100%–137%)	97% (80%–118%)	26% (11%–65%)	125% (103%–153%)	85% (61%–119%)
Redding	154% (143%–166%)	108% (98%–119%)	73% (55%–97%)	177% (161%–195%)	131% (112%–154%)
Redlands	102% (92%–113%)	134% (121%–148%)	60% (39%–92%)	104% (92%–118%)	38% (28%–52%)
Redwood City	109% (100%–118%)	66% (58%–75%)	169% (136%–211%)	85% (75%–97%)	50% (39%–64%)
Ridgecrest	106% (87%–129%)	95% (76%–119%)	155% (87%–277%)	94% (73%–121%)	51% (31%–83%)
Riverside	92% (86%–98%)	135% (127%–144%)	132% (109%–161%)	119% (110%–128%)	42% (35%–52%)
Roseville	116% (108%–125%)	115% (106%–125%)	91% (69%–118%)	93% (84%–102%)	89% (74%–106%)
Sacramento	122% (115%–128%)	100% (94%–106%)	89% (74%–106%)	90% (84%–96%)	93% (83%–105%)
Salinas	129% (117%–142%)	150% (134%–167%)	120% (87%–164%)	236% (211%–265%)	89% (70%–113%)
San Andreas	98% (85%–113%)	132% (115%–151%)	81% (52%–128%)	114% (96%–134%)	33% (21%–52%)
San Bernardino	96% (88%–104%)	118% (109%–128%)	117% (93%–148%)	105% (96%–115%)	31% (23%–41%)
San Clemente	120% (108%–134%)	125% (110%–142%)	126% (89%–178%)	124% (107%–143%)	299% (255%–352%)
San Diego	110% (104%–115%)	139% (131%–146%)	109% (93%–127%)	124% (117%–132%)	146% (133%–160%)
San Dimas	87% (71%–106%)	119% (98%–146%)	141% (80%–246%)	117% (94%–147%)	41% (24%–71%)
San Francisco	118% (111%–126%)	73% (67%–80%)	250% (211%–296%)	86% (79%–94%)	72% (63%–82%)
San Gabriel	78% (69%–88%)	101% (88%–115%)	73% (48%–110%)	90% (76%–106%)	80% (66%–97%)
San Jose	113% (108%–119%)	77% (72%–82%)	128% (110%–150%)	108% (101%–116%)	101% (91%–112%)
San Leandro	148% (132%–166%)	75% (63%–89%)	192% (140%–265%)	90% (76%–108%)	54% (39%–76%)
San Luis Obispo	102% (92%–114%)	101% (89%–115%)	119% (85%–165%)	119% (104%–137%)	100% (82%–122%)
San Mateo	113% (103%–123%)	71% (62%–82%)	120% (90%–160%)	80% (69%–94%)	74% (60%–91%)
San Pablo	115% (102%–130%)	79% (67%–92%)	151% (109%–211%)	66% (55%–79%)	55% (37%–80%)

	Lumbar Decompression Compared to state rate of 70 per 100,000	Lumbar Fusion Compared to state rate of 54 per 100,000	Cervical Decompression Compared to state rate of 7 per 100,000	Cervical Fusion Compared to state rate of 42 per 100,000	Vertebroplasty Kyphoplasty Compared to state rate of 16 per 100,000
San Pedro	115% (101%–130%)	97% (83%–113%)	128% (86%–189%)	115% (98%–135%)	64% (46%–88%)
San Ramon	143% (125%–164%)	163% (137%–193%)	205% (140%–301%)	167% (140%–200%)	149% (106%–210%)
Santa Ana	94% (86%–102%)	140% (129%–153%)	82% (59%–113%)	134% (121%–149%)	146% (124%–172%)
Santa Barbara	175% (164%–186%)	107% (97%–118%)	301% (254%–356%)	112% (101%–125%)	213% (189%–240%)
Santa Cruz	211% (194%–229%)	113% (101%–127%)	171% (130%–224%)	116% (102%–131%)	235% (198%–279%)
Santa Maria	170% (155%–188%)	129% (115%–145%)	130% (92%–183%)	144% (126%–164%)	176% (145%–213%)
Santa Monica	107% (101%–114%)	99% (92%–108%)	143% (120%–169%)	87% (79%–96%)	77% (67%–88%)
Santa Paula	212% (185%–243%)	160% (135%–190%)	136% (71%–260%)	231% (193%–277%)	84% (53%–132%)
Santa Rosa	100% (93%–107%)	94% (87%–102%)	159% (131%–191%)	84% (77%–93%)	54% (46%–65%)
Sebastopol	78% (65%–94%)	61% (48%–77%)	38% (17%–86%)	47% (35%–63%)	39% (23%–66%)
Selma	91% (74%–113%)	160% (134%–191%)	32% (10%–100%)	129% (102%–163%)	169% (123%–233%)
Simi Valley	116% (106%–128%)	111% (99%–124%)	131% (97%–178%)	116% (102%–131%)	66% (50%–87%)
Solvang	178% (151%–210%)	134% (108%–168%)	288% (192%–432%)	146% (113%–188%)	156% (108%–227%)
Sonoma	95% (80%–112%)	97% (80%–118%)	110% (66%–185%)	70% (54%–91%)	107% (81%–141%)
Sonora	113% (100%–127%)	161% (144%–180%)	72% (47%–111%)	169% (149%–192%)	129% (104%–160%)
South El Monte	90% (66%–122%)	88% (63%–122%)	157% (70%–353%)	100% (68%–147%)	51% (26%–103%)
South Laguna	109% (100%–119%)	123% (111%–137%)	85% (63%–116%)	130% (116%–146%)	161% (137%–190%)
South Lake Tahoe					
South San Francisco	99% (84%–117%)	63% (50%–80%)	126% (78%–205%)	87% (69%–110%)	46% (30%–70%)
Stanford	114% (103%–126%)	113% (99%–129%)	161% (121%–215%)	101% (86%–118%)	112% (90%–138%)
Stockton	120% (111%–129%)	134% (124%–144%)	95% (74%–122%)	122% (111%–133%)	43% (34%–55%)
Sun City	102% (91%–114%)	109% (97%–123%)	63% (39%–101%)	119% (104%–136%)	168% (139%–204%)
Tarzana	115% (102%–129%)	108% (93%–127%)	149% (106%–208%)	93% (77%–112%)	42% (29%–59%)
Templeton	142% (129%–156%)	98% (86%–112%)	69% (46%–103%)	134% (118%–153%)	75% (58%–98%)

	Lumbar Decompression Compared to state rate of 70 per 100,000	Lumbar Fusion Compared to state rate of 54 per 100,000	Cervical Decompression Compared to state rate of 7 per 100,000	Cervical Fusion Compared to state rate of 42 per 100,000	Vertebroplasty Kyphoplasty Compared to state rate of 16 per 100,000
Thousand Oaks	107% (95%–122%)	114% (99%–131%)	126% (85%–188%)	112% (95%–131%)	97% (75%–125%)
Torrance	110% (104%–116%)	124% (116%–133%)	89% (73%–108%)	115% (106%–124%)	95% (85%–107%)
Tracy	92% (80%–104%)	93% (80%–108%)	109% (74%–160%)	87% (73%–103%)	48% (31%–76%)
Tulare	147% (129%–169%)	101% (85%–120%)	109% (69%–172%)	123% (102%–148%)	38% (23%–64%)
Turlock	108% (96%–121%)	88% (76%–102%)	65% (40%–104%)	75% (62%–90%)	175% (146%–211%)
Ukiah	104% (89%–123%)	137% (117%–162%)	177% (117%–267%)	162% (135%–193%)	66% (46%–95%)
Upland	93% (87%–100%)	126% (117%–136%)	108% (85%–137%)	111% (101%–120%)	43% (33%–54%)
Vacaville	103% (91%–116%)	97% (84%–111%)	78% (51%–120%)	74% (62%–87%)	49% (33%–73%)
Valencia	110% (103%–118%)	124% (115%–135%)	145% (117%–179%)	129% (119%–141%)	110% (92%–130%)
Vallejo	107% (96%–120%)	127% (113%–143%)	182% (136%–244%)	93% (80%–107%)	51% (37%–72%)
Van Nuys	110% (101%–120%)	110% (99%–122%)	100% (74%–136%)	79% (69%–90%)	54% (43%–68%)
Ventura	203% (188%–218%)	157% (143%–173%)	115% (84%–160%)	211% (192%–233%)	188% (160%–220%)
Victorville	92% (85%–100%)	120% (110%–130%)	107% (83%–138%)	93% (84%–103%)	35% (25%–48%)
Visalia	182% (167%–197%)	147% (134%–163%)	116% (86%–156%)	191% (172%–211%)	112% (91%–136%)
Walnut Creek	101% (95%–108%)	107% (99%–116%)	199% (167%–237%)	94% (86%–104%)	95% (83%–108%)
Watsonville	209% (178%–246%)	140% (116%–169%)	99% (56%–175%)	150% (121%–187%)	471% (354%–625%)
Weaverville	122% (85%–175%)	74% (45%–121%)		165% (112%–243%)	33% (11%–104%)
West Covina	94% (85%–104%)	101% (91%–112%)	111% (81%–152%)	114% (101%–129%)	45% (35%–58%)
Whittier	105% (97%–115%)	111% (102%–122%)	102% (76%–136%)	141% (127%–156%)	72% (60%–87%)
Wildomar/Murrieta	110% (102%–119%)	112% (102%–122%)	113% (87%–147%)	128% (116%–140%)	143% (120%–170%)
Willits	102% (81%–129%)	137% (109%–172%)	245% (152%–396%)	126% (97%–163%)	47% (26%–87%)
Woodland	175% (157%–196%)	120% (104%–139%)	83% (48%–144%)	106% (88%–126%)	39% (23%–64%)
Yuba City	87% (76%–100%)	144% (127%–164%)	85% (55%–130%)	154% (134%–178%)	159% (128%–196%)

Study Methodology for Spine Procedures

This analysis incorporates hospital and ambulatory surgery center visits for patients age 20 and over that took place between January 1, 2005, and December 31, 2010, using data on spine surgeries collected by the California Office of Statewide Health Planning and Development (OSHPD). The researchers classified each hospitalization or visit according to the hospital service area (HSA) and hospital referral region (HRR) in which the patient resided, using data on the patient's residence ZIP code recorded in the OSHPD data files and definitions of HSAs and HRRs developed by the Dartmouth Atlas Project.

For each type of surgery, an estimate of the number of procedures performed was obtained by tallying the number of hospitalizations or ambulatory surgery center visits in which the procedure appeared. Annualized rates of use for each area were created by dividing the total number of procedures counted between 2005 and 2010 for the area by the number of person-years between 2005 and 2010 in the over-20 population of the area. Rates for age subgroups were computed as the number of procedures for patients in a given age group, divided by person-years in the given age group.[8]

The rates were adjusted to account for variations in age, sex, race/ethnicity, income, education, and insurance status of people in each area. Statistical techniques were used to "hold constant" these factors across areas, so that the rates reported do not vary across areas because of variations in these characteristics. As a result, differences in the procedure frequencies reported are most plausibly caused by factors other than those for which adjustments were made.

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About the Foundation

The California HealthCare Foundation works as a catalyst to fulfill the promise of better health care for all Californians. We support ideas and innovations that improve quality, increase efficiency, and lower the costs of care. For more information, visit us online at www.chcf.org.

Endnotes

1. Laurence Baker, PhD, Stanford University, developed the research for this report in collaboration with Maryann O'Sullivan, JD, independent health policy consultant, and the California HealthCare Foundation. Sam Wainwright, former research assistant to the New America Health Policy Program, performed analysis and interpretation of the estimates in consultation with Frances Tompkins, consultant at O'Sullivan, Baker and with Shannon Brownlee, MS, of the Lown Institute. Colin Nelson of the Informed Medical Decisions Foundation provided expert assessment of evidence. Lance Lang, MD, chaired an advisory committee of clinicians in various specialties, who were also consulted in the production of this report to review the analysis and to ensure the accuracy of medical content. For a complete list of advisory committee members, see the research summary "All Over the Map: Elective Procedure Rates in California Vary Widely," www.chcf.org/variation. Kristen Bronner, managing editor, Dartmouth Atlas, assisted with illustrations.

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Lumbar and Cervical Pain

- Scott Haldeman et al., "The Bone and Joint Decade, 2000–2010 Task Force of Neck Pain and Its Associated Disorders: Executive Summary," *Spine* 33, no. 4S (2008), S5–S7.
- J. David Cassidy, Gert Bronfort, and Jan Hartvigsen, "Should We Abandon Cervical Spine Manipulation for Mechanical Neck Pain?" *BMJ* 344 (June 7, 2012), e3680.
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- Umile G. Longo et al., "Conservative Management of Patients with an Osteoporotic Vertebral Fracture: A Review of the Literature," *Journal of Bone and Joint Surgery, British Volume* 94-B, no. 2 (February 2012), 152–7.
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- David F. Kallmes et al., "A Randomized Trial of Vertebroplasty for Osteoporotic Spinal Fractures," *New England Journal of Medicine* 361 (August 6, 2009), 569–79.
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2. James N. Weinstein et al., "Surgical Versus Nonoperative Treatment for Lumbar Disc Herniation: Four-Year Results for the Spine Patient Outcomes Research Trial (SPORT)," *Spine* 33, no. 25 (December 1, 2008), 2789–800.

3. James N. Weinstein et al., "Surgical Versus Nonoperative Treatment for Lumbar Spinal Stenosis: Four-Year Results of the Spine Patient Outcomes Research Trial (SPORT)," *Spine* 35, no. 14 (June 15, 2010), 1329–38; James N. Weinstein et al., "Surgical Compared with Nonoperative Treatment for Lumbar Degenerative Spondylolisthesis: Four-Year Results in the Spine Patient Outcomes Research Trial (SPORT) Randomized and Observational Cohorts," *Journal of Bone and Joint Surgery, American Volume* 91, no. 6 (June 2009), 1295–304.

4. This data on the number of spine surgeries over time was generated during this project's research regarding rate variation.

5. See note 1, lumbar and cervical pain.

6. Buchbinder et al., "Randomized Trial of Vertebroplasty, Vertebral Fractures"; Kallmes et al., "Randomized Trial of Vertebroplasty, Spinal Fractures."

7. Papanastassiou et al., "Comparing Effects of Kyphoplasty."

8. Reported rates are usually expressed as the number of events (e.g., procedures) that happens in a given group of people over a given period of time, divided by the total number of members of the group during that period. For example, if there are 100,000 people in a group, and 1,500 of them undergo back surgery in one year, the rate of back surgery is 1,500 per 100,000 for that year. This can also be expressed as a rate of 1.5% (or 1.5 per 100).