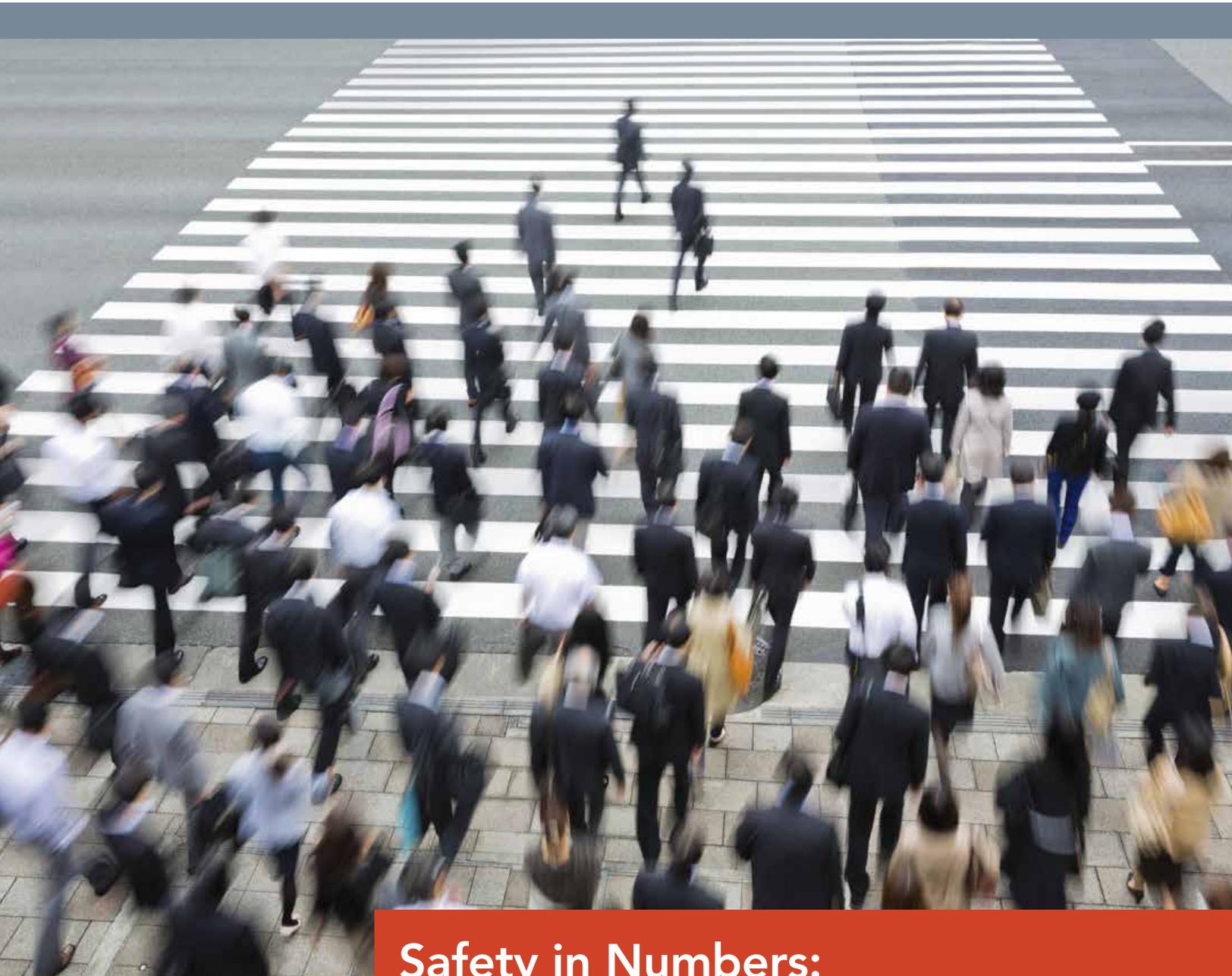




CALIFORNIA HEALTHCARE FOUNDATION



**Safety in Numbers:**  
Cancer Surgeries in California  
Hospitals

NOVEMBER 2015

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## About the Author

Maryann O’Sullivan, JD, is an independent health policy consultant.

## Acknowledgments

The author would like to acknowledge the time and effort spent by this project’s advisory committee, which was made up of experts in the field. The author also wishes to thank others for their significant contributions to this project. (For a list of those people, see Appendices B and C.)

## About the Foundation

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## Introduction

Cancer patients and their providers are faced with many critical decisions, starting with the best treatment approach.<sup>1</sup> When surgery is part of the plan, a decision must be made about where to have it. Information about quality, including how many surgeries a hospital has performed for that particular cancer, should be an important consideration. This is because research shows that hospitals performing a small number of cancer surgeries are more likely to have worse patient outcomes — more complications and deaths—than hospitals where a larger number of cancer surgeries are performed.

Despite the staggering number of Californians who are diagnosed with cancer each year — 155,920 new cases in 2014 — there is very little information available to guide decisionmaking about where to have cancer surgery, not only for patients and providers, but also for payers and policymakers. This report is part of a groundbreaking effort to make cancer surgery volume data about California hospitals readily available to the public for the first time.

This report describes key findings from an analysis of aggregated hospital cancer surgery volume data, and summarizes interviews with leaders at hospitals where

*“I was genuinely surprised the first time I saw some of the very low hospital numbers for these complex surgeries. I thought, how is this possible? It really hit home how important it is that this information is being made available for the first time. Patients may not have been getting the best care without knowing their hospital’s surgical volume numbers. It makes me think what other data could we get from hospitals and surgeons to really help patients make the best decisions.”*

— Joseph P. Parker, PhD, center manager  
Healthcare Outcomes Center, OSHPD

these surgeries were performed infrequently to understand the factors behind the numbers. (A description of the research methods can be found in Appendix A.)

This paper accompanies the public release of California hospital data on the volume of cancer surgeries: People can now readily look up the number of surgeries performed at California hospitals for 11 cancer types at [www.calqualitycare.org](http://www.calqualitycare.org).<sup>2</sup> The goal of sharing these findings is to inform stakeholders, including patients, providers, payers, and policymakers, in their decision-making, and ultimately to improve the quality of cancer care delivered to Californians.

## Findings

Findings for each stage of research are presented below.

### Low Volume Linked with Mortality and Complications

The literature review revealed a significant relationship between the volume of some surgeries performed by hospitals and patient outcomes.<sup>3</sup> There is well-established evidence of the relationship between hospital surgical volume and patient outcomes for the following cancer types: bladder, brain, breast, colon, esophagus, liver, lung, pancreas, prostate, rectum, and stomach.<sup>4-14</sup>

On average, patients who undergo surgeries for cancers of the bladder, brain, colon, esophagus, liver, lung, pancreas, rectum, and stomach at hospitals that perform relatively few of these surgeries — compared to hospitals that perform a high volume — are less likely to survive the surgery.<sup>15</sup> This relationship is also seen with surgeries for breast and prostate cancers; however, deaths following these surgeries are uncommon (<1% of all surgeries).<sup>16</sup> Also, patients with bladder, brain, breast, colon, esophagus, lung, pancreas, prostate, rectum, and stomach cancers who have surgery at lower-volume hospitals are more likely to suffer complications after the surgery,<sup>17</sup> and more likely to have longer stays in the hospital.<sup>18</sup>

Based on the literature review findings, researchers for this project analyzed hospital surgery volume data on the 11 cancer types for which there is a strong association between hospitals’ low surgery volume and increased

mortality and complications: bladder, brain, breast, colon, esophagus, liver, lung, pancreas, prostate, rectum, and stomach cancers. See Table 1.

## Most California Hospitals Perform Some Cancer Surgeries at Very Low Volumes

The analysis of California Office of Statewide Health Planning and Development (OSHPD) data identified 341 California hospitals that performed surgeries in 2014 for patients with at least one of the 11 cancers analyzed.

Some hospitals do relatively high volumes of cancer surgeries; 59% of procedures were performed at hospitals that fall within the top quintile in terms of numbers of surgeries in 2014. Many patients, however, are having their cancer surgeries in hospitals that do small numbers of these surgeries in a year, despite the extensive research demonstrating the link between low volume and poor patient outcomes.

### How Low Is Too Low? Cancer Surgery Volume in Hospitals

When it comes to the number of cancer surgeries performed at a hospital, is there a cutoff point below which hospitals should stop performing that particular surgery and refer patients to other facilities? For most of the cancer surgeries for which there is an evidence-based link between low volume and poor outcomes at hospitals, questions still remain regarding the lowest acceptable number of procedures a hospital should perform. The literature only provides evidence that, on average, low hospital surgery volume is associated with worse patient outcomes.<sup>24</sup>

This project took a very conservative approach in defining “low volume”: Low volume was defined as only one or two surgeries at a hospital in a year for at least one of the 11 cancers studied.

In 2014, 674 cancer surgeries were performed in California hospitals that performed only one or two surgeries for that type of cancer that year. Almost 75% of California hospitals (249 out of 341) performed this low volume of cancer surgeries.

**Table 1. Low Hospital Volume for Surgeries and Association with Adverse Outcomes, by Cancer Type**

ADVERSE OUTCOMES (statistically significant association reported by at least one study)	
<b>Bladder</b>	<ul style="list-style-type: none"> <li>▶ Mortality</li> <li>▶ Length of stay</li> <li>▶ Postoperative complications</li> </ul>
<b>Brain</b>	<ul style="list-style-type: none"> <li>▶ Mortality</li> <li>▶ Length of stay</li> <li>▶ Adverse outcome after discharge</li> </ul>
<b>Breast</b>	<ul style="list-style-type: none"> <li>▶ Mortality (rare event)<sup>19</sup></li> <li>▶ Length of stay</li> <li>▶ Postoperative complications</li> <li>▶ Adverse outcome after discharge</li> </ul>
<b>Colon</b>	<ul style="list-style-type: none"> <li>▶ Mortality</li> <li>▶ Postoperative complications</li> </ul>
<b>Esophagus</b>	<ul style="list-style-type: none"> <li>▶ Mortality</li> <li>▶ Length of stay</li> </ul>
<b>Liver</b>	<ul style="list-style-type: none"> <li>▶ Mortality<sup>20</sup></li> </ul>
<b>Lung</b>	<ul style="list-style-type: none"> <li>▶ Mortality</li> <li>▶ Postoperative complications</li> </ul>
<b>Pancreas</b>	<ul style="list-style-type: none"> <li>▶ Mortality</li> <li>▶ Failure to rescue<sup>21</sup></li> </ul>
<b>Prostate</b>	<ul style="list-style-type: none"> <li>▶ Mortality (rare event)<sup>22</sup></li> <li>▶ Length of stay</li> <li>▶ Postoperative complications</li> <li>▶ Readmission rates</li> <li>▶ Need for chemotherapy or radiation following surgery</li> <li>▶ Surgical scarring that affects prostate function</li> <li>▶ Cancer recurrence</li> </ul>
<b>Rectum</b>	<ul style="list-style-type: none"> <li>▶ Mortality</li> <li>▶ Length of stay</li> <li>▶ Postoperative complications</li> <li>▶ Loss of anal sphincter function</li> </ul>
<b>Stomach</b>	<ul style="list-style-type: none"> <li>▶ Mortality</li> <li>▶ Failure to rescue<sup>23</sup></li> <li>▶ Rates of transfer</li> </ul>

Source: Cancer Prevention Institute of California literature review of studies of cancer surgery hospital volumes published in the United States between 2000 and 2014.

*“For the last several years we’ve been working with our surgeons and OR to identify low-volume procedures and to reduce barriers to doing those surgeries elsewhere. We are also looking at what are the high-volume surgeries we are very good at and should do here. People are just starting to understand you can only be good at so many things. . . . We just need to make sure the patients end up in the right place. Making sure they have an uncomplicated surgery is critical to our success.”*

— C. J. Kunnappilly, MD, CMO  
San Mateo Medical Center

As seen in Table 2, less common surgeries — bladder, esophagus, pancreas, stomach — are more likely to occur in hospitals that perform only one or two surgeries for that cancer, while more common surgeries — breast, colon, prostate — are less likely to occur at hospitals that did one or two surgeries in a year for these cancers.

**Table 2. Cancer Surgeries Performed and Hospitals Performing Low Volumes of Cancer Surgeries, by Cancer Type, California, 2014**

	SURGERIES PERFORMED	HOSPITALS THAT PERFORMED...		
		SURGERY	LOW VOLUME OF SURGERIES	
			Number	Percentage
<b>Bladder</b>	897	124	83	9%
<b>Brain</b>	2,858	138	24	0.8%
<b>Breast*</b>	25,290	298	37	0.1%
<b>Colon</b>	7,335	302	35	0.5%
<b>Esophagus</b>	354	84	68	19%
<b>Liver</b>	1,298	106	53	4%
<b>Lung</b>	3,269	193	51	2%
<b>Pancreas</b>	877	110	54	6%
<b>Prostate</b>	5,434	170	54	1%
<b>Rectum</b>	2,239	250	100	4%
<b>Stomach</b>	1,030	189	115	11%
<b>TOTAL</b>	<b>50,881</b>		<b>674</b>	

\*Includes both inpatient and outpatient surgeries.

Note: Low volume is defined as one or two of that type of cancer surgery.

Source: Calculations based on 2014 OSHPD patient discharge data.

### Major US Health Systems Set Volume Minimums for Cancer Surgery

Dartmouth-Hitchcock Medical Center, the Johns Hopkins Hospital and Health System, and the University of Michigan Health System each announced in 2015 that they will require minimum annual standards for cancer surgeries at their hospitals. The minimums are expected to apply to up to 20 hospitals in these health systems.<sup>25</sup>

CANCER TYPE	MINIMUM (PER YEAR)
Esophagus	20
Lung	40
Pancreas	20
Rectum	15

### New York State Sets Hospital Volume Minimums for Medicaid Breast Cancer Patients

In 2009 the New York State Department of Health announced a volume requirement for Medicaid reimbursement for breast cancer surgeries.<sup>26</sup> Specifically, it requires that Medicaid recipients receive mastectomy and lumpectomy procedures only at hospitals that are high volume, defined as “averaging 30 or more all-payer surgeries annually over a three-year period.” The department re-examines volume every year to identify which facilities are disqualified because they are low volume; this review also enables previously restricted providers to qualify for reimbursement if they meet the volume threshold.<sup>27</sup>

### Pattern Persists Over Time

To examine whether volume patterns were similar over time, the project repeated data analysis for each year from 2010 through 2014. Similar patterns of variation were found for each year. For example, the number of hospitals performing one or two surgeries for particular cancer types in 2013 and 2014 is shown in Figure 1.

### California Hospitals of All Types Perform Surgeries in Small Numbers

The research revealed that low volumes of cancer surgeries are a problem among many different types of hospitals. The 249 hospitals that performed only one or two of a particular procedure in 2014 are mostly urban but also rural, in equal numbers small and large, and mostly nonteaching but also teaching hospitals. (See Appendix D for a detailed breakdown.) Hospitals in all these categories perform a low volume of surgeries for each of these cancer types.

### Hospitals Performing More Surgeries Are Nearby

In the past, many patients and providers, perhaps unaware of the link between volume and outcome, may have had surgeries performed locally to avoid sometimes costly, inconvenient travel that may take patients away from the support of family and friends. Of the 674 surgeries in California in 2014 at hospitals that performed only

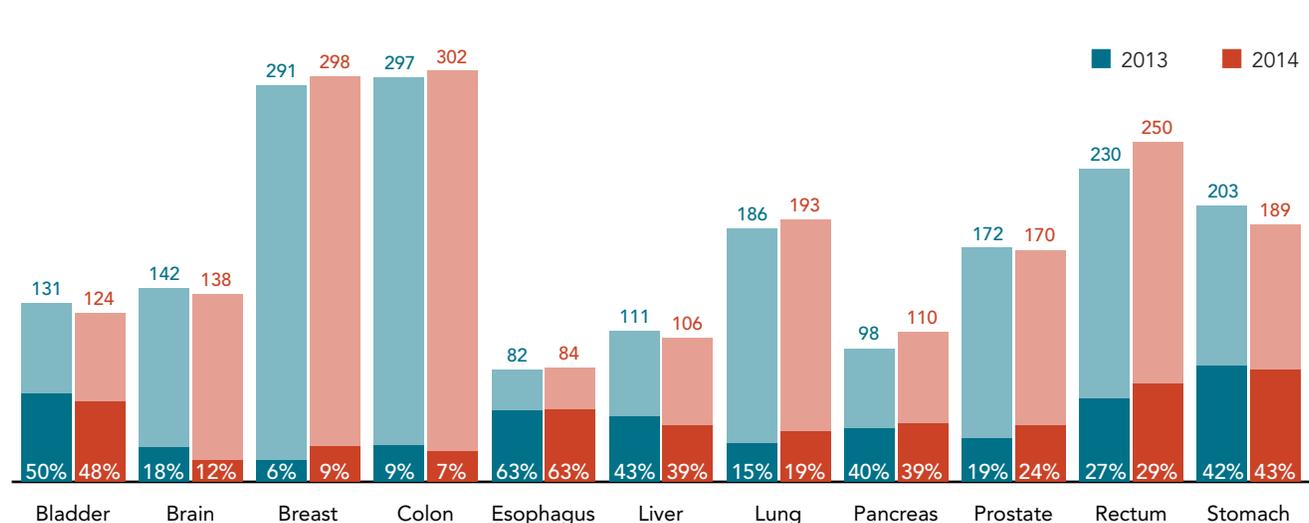
**Table 3. California Cancer Patients Who Had Surgery at Hospitals That Performed Low Volume of Surgeries with a Top 20% Volume Hospital Nearby, by Cancer Type, 2014**

PATIENTS IN PROXIMITY TO HIGH-VOLUME HOSPITAL	
Bladder	69%
Brain	67%
Breast	73%
Colon	60%
Esophagus	70%
Liver	69%
Lung	78%
Pancreas	70%
Prostate	81%
Rectum	68%
Stomach	76%

Notes: Low volume is defined as one or two of that type of cancer surgery. Nearby is 50 miles from the patient's residence, as the crow flies.

Source: Calculations based on 2014 OSHPD patient discharge data.

**Figure 1. Percentage of California Hospitals Performing One or Two Surgeries, by Cancer Type, 2013 and 2014**



Note: Number at the top of each bar is the total number of hospitals performing one or more surgeries.

Source: Calculations based on 2013 and 2014 OSHPD patient discharge data.

## Lessons from Canada: Improving Patient Outcomes by Addressing Hospital Volume of Cancer Surgeries

In the Canadian province of Ontario, the government agency Cancer Care Ontario (CCO) is responsible for improving the delivery of care to cancer patients.

In response to the literature that confirms a relationship between surgery volume and patient outcome, particularly in highly complex cancers, CCO divided all cancers requiring surgery into two major groups:

1. Those requiring regionalization to a selected number of hospital sites (i.e., designated centers) to maximize volume of care by highly functional and multidisciplinary teams.
2. Those which CCO recognized as benefiting from disseminated surgical services, to allow patients to receive their treatment closer to home. For these, CCO requires that quality performance metrics be reported regularly, ensuring that “quality is moving to the patient.”

Without randomized clinical studies to inform what number of cancer surgeries per year per cancer is adequate to maximize the likelihood of patient survival, CCO engaged cancer surgery experts in panels and, guided by the best evidence available in collaboration with CCO's Program in Evidence Based Care, identified threshold numbers for some cancer surgeries. Hospitals were given a specified period of time to either reach the annual threshold number or cease performing that surgery. Cancer surgery funding was used to increase volumes in the designated centers, while those centers that did not meet the qualitative and quantitative criteria for a designated center were not funded.

In the case of surgery for lung and esophageal cancer, for example, CCO designated 15 centers to provide cancer care, while prior to the implementation of the organizational standards for designated centers, there were 64 hospitals performing some volume of lung and esophageal cancer surgery. Currently, nearly 100% of patients undergo surgeries for lung and esophageal cancer at a designated center.<sup>28</sup>

*“It’s not just the volume of the particular surgeon, it’s also the volume of cancer cases managed by the multidisciplinary team that makes a big difference in outcomes. The literature supports the notion that the more we do, the more likely we are to have better outcomes.”*

— Dr. Khatri, SVP and CMO  
Rideout Regional Medical Center

one or two surgeries for that cancer type, analysis shows that the majority of these patients were within reasonable driving distance of a hospital with a record of higher volumes of surgeries.

Nearly three-quarters of all California cancer patients who had their surgery in a hospital that performed only one or two of that particular cancer surgery lived within 50 miles of a top-quintile hospital (in surgery volume) where they may have been less likely to risk poor outcomes.

## Interviews With Hospital Leaders: Factors Leading to Small Numbers of Surgeries

In an attempt to uncover why some hospitals perform very low volumes of certain surgeries, researchers interviewed leaders from 26 California hospitals randomly selected from those that performed only one or two surgeries for one or more of the 11 cancers studied in 2013. The 59 interviewees included 14 CEOs, 9 CMOs, and 4 chiefs of surgery; 24 were MDs. The interviews were conducted with leaders of hospitals from throughout the state and included rural, urban, teaching, and nonteaching hospitals, and hospitals of varying sizes.

While interviewees were provided with the numbers of surgeries for each of the cancers for which their hospital performed only one or two surgeries, they were not provided with any additional information regarding those surgeries. Thus, most hospital leaders were not aware of the specific circumstances that led to those particular surgeries being performed at their hospital. The interviewees were, however, willing to speculate.

While points of view varied among those interviewed, there seemed to be a general interest in the relationship between volume of surgeries and patient safety. There was also general acknowledgment that because the surgeries of concern are small in number, hospital leaders may have been unaware of the issue in their own hospital. Several key themes emerged from the interviews:

#### **Awareness of research regarding surgery volume and patient safety.**

Most hospital leaders were aware, generally, of the health care literature associating higher volumes of surgeries with better patient outcomes. Most were, however, unaware of the association between low hospital volume and higher mortality and increased complications for most of the 11 cancers studied, with the exception of a few interviewees who knew of the literature linking the volume of surgeries to outcomes for pancreatic and esophageal cancer patients.

Many hospital leaders acknowledged the literature that identifies the importance of highly experienced teams for operating room and postsurgical care. Many, however, expressed the opinion that surgeon volume alone may be an adequate indicator of patient outcome. Several interviewees shared their belief that a surgeon with privileges at multiple hospitals might have performed a cumulative number of surgeries and meet required volume levels.

Some interviewees initially expressed that, since even with low surgery volumes, their hospital had not experienced bad outcomes, they did not feel any pressure to change their practices. When it was suggested that the experience in the literature may be more predictive than any individual hospital's experience, most hospital leaders were open to re-evaluating their point of view.

#### **Role of physicians in volume-related policy decisions**

The division of responsibility for assuring safe surgical practice rested with different parties at different hospitals. Many hospital leaders reported that decisions regarding appropriate volume and competency to perform surgery are a physician-driven clinical matter. Others reported a shared responsibility for these issues between administration and their medical staff.

Hospital leaders indicated that a physician's total surgical volume is a consideration during credentialing or recredentialing. However, most hospital leaders indicated that there was not a specific number of site-specific surgeries that physicians were required to meet to be credentialed.

#### **Difficulty referring uninsured/underinsured patients**

As a possible reason for the performance of low volumes of surgeries at their hospital, some leaders cited the difficulty in making timely referrals in the case of uninsured and Medi-Cal patients. These hospital leaders said that sometimes, facilities to which they wished to refer had genuine capacity issues that prevented them from accepting referrals. However, in the case of Medi-Cal patients, it was administrative hassles, and in the case of uninsured patients, lack of remuneration, that presented barriers to finding appropriate, timely care.

#### **Barriers to travel**

Some hospital leaders said that some patients are reluctant to travel long distances to another facility. This may be especially true for low-income and elderly patients. Other possible barriers for patients to travel include wanting family close-by, lack of financial resources to cover travel costs, and reluctance to travel for follow-up care after the surgery.

*“Patients’ resources for transportation, hotel stays, etc., are sometimes limited. You may have the approval to send the patient to an academic center that is an hour and a half away, but the patient doesn’t have the resources. They will not be treated unless you treat them locally. It’s not insurance, but resources. It’s not an uncommon problem.”*

— Shawn Steen, MD, chief of surgical oncology  
Ventura County Medical Center

### Concerns about losing capacity

Interviewees were asked whether the performance of these small numbers of surgeries was important to the hospital's financial success. Most hospital leaders expressed that, since the number of these surgeries is so small, there would not be a direct serious financial impact to the hospital associated with ceasing to do those surgeries.

Other hospital leaders, however, were concerned that prohibiting certain surgeries because they are not performed in high volumes could leave surgeons at community-based hospitals without an adequate number of surgeries to maintain their skills and interest in serving rural, underserved communities.

### Attempts to increase surgical volume

Some hospital leaders explained that a low volume of surgeries at their hospital might reflect the early stages of a recent surge in their hospital surgeon recruitment or other plans for building higher volumes of cancer surgeries.

### Emergency or unplanned cases

Some hospital leaders were surprised to learn that their surgeons would perform elective cancer surgeries at such low volumes. These interviewees wondered whether these were surgeries in emergent cases or unplanned surgeries on cancers that were identified during the course of a surgery for another purpose, such as during an exploratory surgery without clear advance diagnosis.

## Hospital Leaders Identified Steps to Effect Change

Several hospital leaders discussed approaches they were undertaking or considering to address low volumes of surgeries:

- ▶ Opening up dialogue with their surgeons by sharing hospital volume data as well as research regarding low hospital volume and cancer surgeries
- ▶ Identifying types of surgeries that the hospital will no longer do
- ▶ Maintaining a hospital cancer registry
- ▶ Tracking surgeries monthly by type of surgery and by surgeon

- ▶ Identifying procedures at which the hospital excels and focusing on those
- ▶ Recruiting surgeons to increase volume
- ▶ Cultivating a systems approach with other hospitals to encourage referrals to centers of excellence.

A number of hospital leaders said that while they disfavored legislative or regulatory approaches to addressing volume concerns, they would welcome guidance from specialty societies, such as the American College of Surgeons, regarding optimal volumes for cancer surgeries. Some acknowledged a role for payers in this issue. It was also mentioned that making volume data publicly available, through projects such as this one, could help drive change.

*“What the data will do is open up dialogue with our surgeons. This will be an important discussion point over the next few months. Physicians are data driven. Good data fuels conversation.”*

— Marcia Nelson, MD, vice president of medical affairs  
Enloe Medical Center

## Conclusion

Important hospital surgery volume information is now public and easily accessible to patients, providers, payers, and policymakers. It is unlikely, however, that transparency alone will solve the problem of low volumes of cancer surgeries in hospitals.

To effect change on this front, stakeholders each have an important role:

- ▶ Referring physicians, surgeons, and hospital leaders should be aware of the implications of low volumes of surgeries and consider the data regarding the volumes performed at each hospital when making practice decisions.
- ▶ Payers should exercise their considerable leverage to eliminate low-volume cancer surgeries, including ensuring that needed referral centers are in network and accessible. Payers should cover expenses for patients to travel to those referral centers.
- ▶ Provider organizations and policymakers should consider their responsibility to provide guidance and leadership to providers regarding appropriate volumes of cancer surgeries.
- ▶ When patients, in partnership with their providers, decide that surgery will be part of the treatment plan, patients should be made aware of and should use the data to make decisions about location of their care, and should be provided with resources for travel to those preferred locations, when necessary.

*“Doctors love information that shows that what they are doing is in the best interest of the patient or not. When you have information like this, things change. What really accelerates change is comparative data.”*

— Jerry Kolins, MD, vice president of patient experience  
Palomar Health Downtown Campus

In addition, stakeholders should evaluate other California state databases, including the California Cancer Registry, for their utility in supporting patient decisionmaking regarding cancer treatment at California hospitals and by other healthcare providers.<sup>29</sup> Consideration should be given to the establishment of an all-payer claims database to provide further metrics of cancer care quality with a special emphasis on outcomes.

## Appendix A. Methodology

The findings discussed in this report are based on four distinct data-gathering efforts. An advisory committee of oncologists, health services researchers, hospital representatives, payers, and consumers guided this project throughout, including developing the methodology and selecting cancer types to be analyzed. (See list of advisory committee participants in Appendix C.)

### Literature Review

Researchers from the Cancer Prevention Institute of California (CPIC)<sup>30</sup> gathered and evaluated peer-reviewed scientific research manuscripts describing associations between hospital volume of surgical procedures (with curative intent) and mortality and complications. CPIC researchers identified 181 related manuscripts published in the US since 2000 and, following a rigorous quality evaluation, included 137 high-quality manuscripts in the literature review. The advisory committee used the literature review findings to select the cancer types for this study.

### Identification of Diagnostic and Procedural Codes

Researchers assembled a panel of hospital coding and surgical oncology specialists to choose appropriate cancer diagnostic and procedure codes that correspond to the cancer types selected. The experts reviewed coding manuals and the scientific manuscripts from the literature review to inform their identification of codes. In addition, they analyzed California Office of Statewide Health Planning and Development (OSHPD) data to ensure that relevant ICD-9 and CPT procedure codes were included.

### Hospital Data Analysis

**Individual hospital data.** OSHPD generated the data file for the study using OSHPD patient discharge data (PDD). Patients were included in the analysis if they met the following criteria:

- ▶ Discharged from California hospitals between 2010 and 2014
- ▶ ICD-9 site-specific cancer diagnosis code selected for this analysis
- ▶ ICD-9 procedure code selected for this analysis<sup>31</sup>
- ▶ Adult, 18 years and older

Because of the frequency with which breast cancer surgery is performed as an outpatient procedure, OSHPD used both the PDD and OSHPD ambulatory surgery center data to identify these surgeries that were performed in hospital inpatient and outpatient facilities.

The number of times that each cancer surgery was performed was determined for each hospital for each year (2010 through 2014) and analyzed by a Stanford University consultant.

**Characteristics of hospitals performing low volumes of surgeries.** To examine the characteristics of hospitals performing low volumes of procedures, data were compiled on the number of beds, teaching status, ownership type, and geographic location (urban/rural) of each hospital from OSHPD records. For each cancer, researchers calculated the distribution of these characteristics for hospitals performing one or two surgeries.

**Proximity of hospitals performing high volumes of surgeries.** Researchers computed the distance that a cancer patient at a hospital with low surgical volume would have had to travel to reach the nearest “high-volume” facility. For the purposes of this analysis, a high-volume facility was defined as one in the top 20% of the volume distribution statewide for the given cancer. This distance was calculated for all patients having a cancer surgery at a hospital with low volumes of surgeries (one or two surgeries for one or more of the 11 cancers studied) in 2014.

### Hospital Interviews

Following the data analysis, interviews were conducted from June to August 2015 with leaders at 26 California hospitals to understand why their hospitals perform some cancer surgeries infrequently. Interviewees were randomly selected from among 249 California hospitals that performed only one or two surgeries for one or more of the 11 cancers studied in 2013. Interviews were about 30 minutes long and were guided by a standard set of interview questions.

## Appendix B. Project Contributors

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## Appendix C. Advisory Committee

A multidisciplinary advisory committee consisting of oncologists, health services researchers, and hospital, payer, and consumer representatives was convened to provide guidance for this project. No individual member of the advisory committee should be considered as endorsing all of the project approaches or all the conclusions contained in this report.

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## Appendix D. Characteristics of Hospitals Performing One or Two Cancer Surgeries, California, 2014

HOSPITAL CHARACTERISTIC	NUMBER OF HOSPITALS	PERCENTAGE OF HOSPITALS
<b>Number of beds</b>		
200+ beds	125	50%
< 200 beds	124	50%
<b>Location</b>		
Urban	204	82%
Rural/Frontier	45	18%
<b>Type</b>		
Teaching	14	6%
Nonteaching	235	94%

Notes: These hospitals performed one or two surgeries for at least one of the 11 cancer types studied. Only 8% of all California hospitals are teaching hospitals; the majority are nonteaching.

Source: Calculations based on 2014 OSHPD patient discharge data.

## Endnotes

1. Choosing Wisely is an initiative of the American Board of Internal Medicine Foundation. Participating organizations have created lists of "Things Providers and Patients Should Question" which include evidence-based recommendations that should be discussed to help make wise decisions about the most appropriate care based on a patients' individual situation. Consumer Reports is developing and disseminating materials for patients. Links to cancer-related materials can be found here: [www.choosingwisely.org/doctor-patient-lists](http://www.choosingwisely.org/doctor-patient-lists).
2. While little other cancer-specific quality data is available, when considering surgery at a California hospital, patients should inform themselves, whenever possible, about other hospital-specific quality or patient safety-related information, including rates for deaths, complications, infection prevention, readmissions, and patient experience/satisfaction. CalQualityCare.org, managed by the California HealthCare Foundation, in partnership with California Hospitals Assessment and Reporting Taskforce (CHART), features information to inform patients' choice of California hospitals: [www.calqualitycare.org](http://www.calqualitycare.org).
3. N. T. Nguyen et al., "The Relationship Between Hospital Volume and Outcome in Bariatric Surgery at Academic Medical Centers," *Annals of Surgery* 240, no. 4 (2004): 586-94; D. R. Urbach and N. N. Baxter, "Does It Matter What a Hospital Is 'High Volume' For? Specificity of Hospital Volume-Outcome Associations for Surgical Procedures: Analysis of Administrative Data," *Quality and Safety in Health Care* 13, no. 5 (October 2004): 379-83; E. L. Hannan et al., "Coronary Angioplasty Volume-Outcome Relationships for Hospitals and Cardiologists," *JAMA* 277, no. 11 (March 1997): 892-8.
4. L. S. Elting et al., "Correlation Between Annual Volume of Cystectomy, Professional Staffing, and Outcomes: A Statewide, Population-Based Study," *Cancer* 104, no. 5 (September 1, 2005): 975-84, doi:10.1002/cncr.21273; J. D. Birkmeyer et al., "Hospital Volume and Surgical Mortality in the United States," *New England Journal of Medicine* 346 (2002): 1128-37, doi:10.1056/NEJMsa012337; B. Hollenbeck et al., "Misclassification of Hospital Volume with Surveillance, Epidemiology, and End Results—Medicare Data," *Surgical Innovation* 14, no. 3 (2007): 192-8; B. R. Konety et al., "Impact of Hospital and Surgeon Volume on In-Hospital Mortality from Radical Cystectomy: Data from the Health Care Utilization Project," *Journal of Urology* 173, no. 5 (2005): 1695-1700.
5. F. G. Barker, "Craniotomy for the Resection of Metastatic Brain Tumors in the US, 1988-2000: Decreasing Mortality and the Effect of Provider Caseload," *Cancer* 100 (2004): 999-1007; F. G. Barker, W. T. Curry, and B. S. Carter, "Surgery for Primary Supratentorial Brain Tumors in the United States, 1988 to 2000: The Effect of Provider Caseload and Centralization of Care," *Neuro-Oncology* 7, no. 1 (January 2005): 49-63; J. A. Cowan and J. Dimick, "The Impact of Provider Volume on Mortality After Intracranial Tumor Resection," *Neurosurgery* 52, no. 1 (January 2003): 48-54.
6. G. Gooiker et al., "A Systematic Review and Meta-Analysis of the Volume-Outcome Relationship in the Surgical Treatment of Breast Cancer. Are Breast Cancer Patients Better Off with a High Volume Provider?" *European Journal of Surgical Oncology* 36 Suppl. 1 (2010): S27-S35, doi:10.1016/j.ejso.2010.06.024.
7. J. D. Birkmeyer et al., "Hospital Volume and Surgical Mortality in the United States," *New England Journal of Medicine* 346 (2002): 1128-37, doi:10.1056/NEJMsa012337; J. D. Birkmeyer et al., "Hospital Volume and Late Survival After Cancer Surgery," *Annals of Surgery* 245, no. 5 (2007): 777-83, doi:10.1097/01.sla.0000252402.33814.dd; E. V. Finlayson and J. D. Birkmeyer, "Effects of Hospital Volume on Life Expectancy After Selected Cancer Operations in Older Adults: A Decision Analysis," *Journal of the American College of Surgeons* 196, no. 3 (March 2003): 410-17; D. Schrag et al., "Surgeon Volume Compared to Hospital Volume as a Predictor of Outcome Following Primary Colon Cancer Resection," *Journal of Surgical Oncology* 83, no. 2 (June 2003): 68-79; K. G. Billingsley et al., "Surgeon and Hospital Characteristics as Predictors of Major Adverse Outcomes Following Colon Cancer Surgery," *Archives of Surgery* 142, no. 1 (January 2007): 23-31, doi:10.1001/archsurg.142.1.23; J. Sammon et al., "Health Care-Associated Infections After Major Cancer Surgery: Temporal Trends, Patterns of Care, and Effect on Mortality," *Cancer* 119, no. 12 (June 2013): 2317-24, doi: 10.1002/cncr.28027; C. Y. Ko et al., "Are High-Volume Surgeons and Hospitals the Most Important Predictors of Inhospital Outcome for Colon Cancer Resection?" *Surgery* 132, no. 2 (2002): 268-73.
8. Gooiker et al., "A Systematic Review"; B. E. Hillner, T. J. Smith, and C. E. Desch, "Hospital and Physician Volume or Specialization and Outcomes in Cancer Treatment: Importance in Quality of Cancer Care," *Journal of Clinical Oncology* 18, no. 11 (June 2000): 2327-40; D. Petitti and M. Hewitt, *Interpreting the Volume-Outcome Relationship in the Context of Cancer Care* (Washington, DC: National Academy Press, 2001), [www.nap.edu](http://www.nap.edu).
9. Hillner, Smith, and Desch, "Hospital and Physician Volume."
10. Hillner, Smith, and Desch, "Hospital and Physician Volume"; E. M. Von Meyenfeldt et al., "The Relationship Between Volume or Surgeon Specialty and Outcome in the Surgical Treatment of Lung Cancer," *Journal of Thoracic Oncology* 7, no. 7 (July 2012): 1170-8, doi:10.1097/JTO.0b013e318257cc45.
11. Hillner, Smith, and Desch, "Hospital and Physician Volume"; Petitti and Hewitt, *Interpreting*.
12. D. Barocas and R. Mitchell, "Impact of Surgeon and Hospital Volume on Outcomes of Radical Prostatectomy," *Urologic Oncology* 28, no. 3 (May/June 2010): 243-50, doi: 10.1016/j.urolonc.2009.03.001.

13. T. Salz and R. Sandler, "The Effect of Hospital and Surgeon Volume on Outcomes for Rectal Cancer Surgery," *Clinical Gastroenterology and Hepatology* 6, no. 11 (2008): 1185-93, doi:10.1016/j.cgh.2008.05.023.
14. J. L. Dikken et al., "Quality of Care Indicators for the Surgical Treatment of Gastric Cancer: A Systematic Review," *Annals of Surgical Oncology* 20, no. 2 (February 2013): 381-98, doi:10.1245/s10434-012-2574-1.
15. Elting et al., "Correlation"; Birkmeyer et al., "Hospital Volume and Surgical Mortality"; Konety et al., "Impact of Hospital"; Barker, "Craniotomy"; Barker, Curry, and Carter, "Surgery"; Cowan and Dimick, "Impact of Provider Volume"; Birkmeyer et al., "Hospital Volume and Late Survival"; Schrag et al., "Surgeon Volume"; Billingsley et al., "Surgeon and Hospital Characteristics"; Hillner, Smith, and Desch, "Hospital and Physician Volume"; Petitti and Hewitt, *Interpreting*; Dikken et al., "Quality of Care Indicators"; E. V. Finlayson, P. P. Goodney, and J. D. Birkmeyer, "Hospital Volume and Operative Mortality in Cancer Surgery," *Archives of Surgery* 138, no. 7 (2003): 721-25, doi:10.1001/archsurg.138.7.721; D. Archampong, D. W. Borowski, and H. O. Dickinson, "Impact of Surgeon Volume on Outcomes of Rectal Cancer Surgery: A Systematic Review and Meta-Analysis," *Surgeon* 8, no. 6 (December 2010): 341-52, doi: 10.1016/j.surge.2010.07.003; D. Hodgson et al., "Relation of Hospital Volume to Colostomy Rates and Survival for Patients with Rectal Cancer," *Journal of the National Cancer Institute* 95, no. 10 (May 21, 2003): 708-16; V. Ho et al., "Trends in Hospital and Surgeon Volume and Operative Mortality for Cancer Surgery," *Annals of Surgical Oncology* 13, no. 6 (June 2006): 851-8; P. Renzulli et al., "The Influence of the Surgeon's and the Hospital's Caseload on Survival and Local Recurrence After Colorectal Cancer Surgery," *Surgery* 139, no. 3 (March 2006): 296-304, doi:10.1016/j.surg.2005.08.023; D. Zingmond et al., "What Predicts Serious Complications in Colorectal Cancer Resection?" *American Surgeon* 69, no. 11 (December 2003): 969-74; J.-H. Baek et al., "The Association of Hospital Volume with Rectal Cancer Surgery Outcomes," *International Journal of Colorectal Disease* 28, no. 2 (February 2013): 191-6, doi:10.1007/s00384-012-1536-1; J. B. Dimick et al., "Hospital Volume Is Related to Clinical and Economic Outcomes of Esophageal Resection in Maryland," *Annals of Thoracic Surgery* 72, no. 2 (August 2001): 334-41; W. J. Gasper et al., "Has Recognition of the Relationship Between Mortality Rates and Hospital Volume for Major Cancer Surgery in California Made a Difference? A Follow-Up Analysis of Another Decade," *Annals of Surgery* 250, no. 3 (September 2009): 472-83, doi:10.1097/SLA.0b013e3181b47c79; J. D. Birkmeyer et al., "Volume and Process of Care in High-Risk Cancer Surgery," *Cancer* 106, no. 11 (June 2006): 2476-81, doi:10.1002/cncr.21888; H. Nathan et al., "The Volume-Outcomes Effect in Hepato-Pancreato-Biliary Surgery: Hospital Versus Surgeon Contributions and Specificity of the Relationship," *Journal of the American College of Surgeons* 208, no. 4 (April 2009): 528-38, doi:10.1016/j.jamcollsurg.2009.01.007; P. Bach et al., "The Influence of Hospital Volume on Survival After Resection for Lung Cancer," *New England Journal of Medicine* 345 (2001): 181-8, doi:10.1056/nejm200107193450306.
16. Barocas and Mitchell, "Impact of Surgeon and Hospital Volume"; M. A. Gilligan et al., "Relationship Between Number of Breast Cancer Operations Performed and 5-Year Survival After Treatment for Early-Stage Breast Cancer," *American Journal of Public Health* 97, no. 3 (March 2007): 539-44, doi:10.2105/AJPH.2005.075663; N. Tanna et al., "The Volume-Outcome Relationship for Immediate Breast Reconstruction," *Plastic and Reconstructive Surgery* 129, no. 1 (January 2012): 19-24, doi:10.1097/PRS.0b013e31821e70ff; L. M. Ellison, J. A. Heaney, and J. D. Birkmeyer, "The Effect of Hospital Volume on Mortality and Resource Use After Radical Prostatectomy," *Journal of Urology* 163, no. 3 (March 2000): 867-9, doi:10.1016/S0022-5347(05)67821-4; B. Konety et al., "Mortality After Major Surgery for Urologic Cancers in Specialized Urology Hospitals: Are They Any Better?" *Journal of Clinical Oncology* 24, no. 13 (May 2006): 2006-12.
17. Elting et al., "Correlation"; Konety et al., "Impact"; Barker, "Craniotomy"; Billingsley et al., "Surgeon and Hospital Characteristics"; Zingmond et al., "What Predicts?"; Bach et al., "Influence"; U. Guller et al., "High Hospital Volume Is Associated with Better Outcomes for Breast Cancer Surgery: Analysis of 233,247 Patients," *World Journal of Surgery* 29, no. 8 (August 2005): 994-1000; A. A. Ghaferi, J. D. Birkmeyer, and J. B. Dimick, "Complications, Failure to Rescue, and Mortality with Major Inpatient Surgery in Medicare Patients," *Annals of Surgery* 250, no. 6 (December 2009): 1029-34, doi:10.1097/SLA.0b013e3181bef697; A. A. Ghaferi, J. D. Birkmeyer, and J. B. Dimick, "Hospital Volume and Failure to Rescue with High-Risk Surgery," *Medical Care* 49, no. 12 (2011): 1076-81; P. P. Goodney et al., "Hospital Volume, Length of Stay, and Readmission Rates in High-Risk Surgery," *Annals of Surgery* 238, no. 2 (August 2003): 161-7.
18. Elting et al., "Correlation"; Konety et al., "Impact"; Barker, "Craniotomy"; Barker, Curry, and Carter, "Surgery"; Baek et al., "Association"; Dimick et al., "Hospital Volume."
19. Studies did show a statistically significant difference in deaths between surgeries for breast cancer performed in high- vs. low-volume hospitals. However, the overall occurrences of deaths following breast cancer surgery is very low (<1%), and the difference between high- and low-volume hospitals is minimal.
20. Studies did not look at other outcomes.
21. Failure to rescue is a measure of a health care facility's ability to "rescue" a patient from a complication of an underlying illness or a complication of medical care. Failure to rescue thus provides a measure of the degree to which providers responded to adverse occurrences that developed on their watch.
22. Studies did show a statistically significant difference in deaths between surgeries for prostate cancer performed in high- vs. low-volume hospitals. However, the overall occurrences of deaths following prostate cancer surgery is very low (<1%), and the difference between high- and low-volume hospitals is minimal.

23. Failure to rescue is a measure of a health care facilities ability to “rescue” a patient from a complication of an underlying illness or a complication of medical care. Failure to rescue thus provides a measure of the degree to which providers responded to adverse occurrences that developed on their watch.
24. While the impact of low volume on mortality and other patient outcomes is measurable and reliable, there are a number of underlying factors that may contribute to the association of hospital volume and patient outcome. For example, a surgeon’s years of experience, credentials, or caseload may be an important driver of the association of hospital volume and patient outcome. Relatedly, a hospital’s processes of care (e.g., standardized checklists used prior to surgery) and teamwork likely contribute to the relationship between hospital volume and patient outcome.
- Billingsley et al., “Surgeon and Hospital Characteristics”; Hillner, Smith, and Desch, “Hospital and Physician Volume”; Kevin G. Billingsley et al. “Does Surgeon Case Volume Influence Nonfatal Adverse Outcomes After Rectal Cancer Resection?” *Journal of the American College of Surgeons* 206, no. 3 (2008): 1167-77.
- B. K. Hollenbeck et al., “Misclassification of Hospital Volume With Surveillance, Epidemiology, and End Results—Medicare Data,” *Surgical Innovation* 13, no. 3 (September 2007): 192-8; J. D. Birkmeyer et al., “Volume and Process of Care in High-Risk Cancer Surgery,” *Cancer* 106, no. 11 (June 2006): 2476-81.
25. “Hospitals Move to Limit Low-Volume Surgeries,” *U.S. News & World Report*, May 19, 2015; e-mail correspondence between John D. Birkmeyer, MD, of Dartmouth-Hitchcock Medical Center and Maryann O’Sullivan, May 31, 2015.
26. “State Health Commissioner Daines Announces Selective Medicaid Contracting for Breast Cancer Surgery,” New York State Department of Health, March 3, 2009, [www.health.ny.gov](http://www.health.ny.gov).
27. “New York State Medicaid Update - March 2015 Volume 31 - Number 3,” New York State Department of Health, March 2015, [www.health.ny.gov](http://www.health.ny.gov).
28. Phone conversation with Jonathan C. Irish, MD, MSc, FRCSC, FACS, Provincial Head, Surgical Oncology Program, Cancer Care Ontario, [www.cancercare.on.ca](http://www.cancercare.on.ca); Lance Lang, MD, physician adviser to CHCF California volume project; and Maryann O’Sullivan, independent health policy consultant, October 31, 2013; email correspondence with Dr. Irish, August 20, 2014.
29. In 2014, CHCF convened a workgroup of experts to come up with recommendations to leverage the California Cancer Registry to produce quality of cancer care metrics. An issue brief, “Fighting Cancer with Data: Enabling the California Cancer Registry to Measure and Improve Care” is available online: [www.chcf.org](http://www.chcf.org).
30. The nonprofit Cancer Prevention Institute of California operates the Greater Bay Area Cancer Registry, is affiliated with the Stanford Cancer Institute, and is dedicated to population-based research.
31. The ICD-9 and CPT codes used for this analysis are available at [www.chcf.org](http://www.chcf.org).