

Health Affairs

At the Intersection of Health, Health Care and Policy

Cite this article as:

Frances Leslie Lucas, Andrea Siewers, David C. Goodman, Dongmei Wang and
David E. Wennberg

New Cardiac Surgery Programs Established From 1993 To 2004 Led To Little
Increased Access, Substantial Duplication Of Services

Health Affairs, , no. (2011):

doi: 10.1377/hlthaff.2010.0210

The online version of this article, along with updated information and services, is
available at:

<http://content.healthaffairs.org/content/early/2011/06/21/hlthaff.2010.0210.full.html>

For Reprints, Links & Permissions:

http://healthaffairs.org/1340_reprints.php

E-mail Alerts : <http://content.healthaffairs.org/subscriptions/etoc.dtl>

To Subscribe: <http://content.healthaffairs.org/subscriptions/online.shtml>

Health Affairs is published monthly by Project HOPE at 7500 Old Georgetown Road, Suite 600, Bethesda, MD 20814-6133. Copyright © 2011 by Project HOPE - The People-to-People Health Foundation. As provided by United States copyright law (Title 17, U.S. Code), no part of *Health Affairs* may be reproduced, displayed, or transmitted in any form or by any means, electronic or mechanical, including photocopying or by information storage or retrieval systems, without prior written permission from the Publisher. All rights reserved.

Advance online articles have been peer reviewed and accepted for publication but have not yet appeared in the paper journal (edited, typeset versions may be posted when available prior to final publication). Advance online articles are citable and establish publication priority; they are indexed by PubMed from initial publication. Citations to Advance online articles must include the digital object identifier (DOIs) and date of initial publication.

Not for commercial use or unauthorized distribution

By Frances Leslie Lucas, Andrea Siewers, David C. Goodman, Dongmei Wang, and David E. Wennberg

New Cardiac Surgery Programs Established From 1993 To 2004 Led To Little Increased Access, Substantial Duplication Of Services

DOI: 10.1377/hlthaff.2010.0210
HEALTH AFFAIRS 30,
NO. 8 (2011): -
©2011 Project HOPE—
The People-to-People Health
Foundation, Inc.

ABSTRACT Despite decreasing demand for bypass surgery, 301 new cardiac surgery programs opened between 1993 and 2004. We used Medicare data to identify where the new programs opened and to assess their impact on access and efficiency. Forty-two percent of the new programs opened in communities that already had access to cardiac surgery, which suggests that their creation has led to a fight for shares of a shrinking market. New programs were much more likely to open in states that did not require them to show a certificate-of-need. Overall, travel time to the nearest cardiac surgery program changed little, which suggests that these programs have done little to improve geographic access. The duplication of services that resulted in many areas may have engendered competition based on quality, price, or both, but it may also have increased surgical rates, with unknown results. We observe that certificate-of-need requirements may help avoid unnecessary duplication of services by preventing new programs from opening in close proximity to existing ones.

Frances Leslie Lucas (lucas@mmc.org) is associate director of the Center for Outcomes Research and Evaluation at the Maine Medical Center, in Portland.

Andrea Siewers is a data analyst at the Center for Outcomes Research and Evaluation.

David C. Goodman is a professor of pediatrics and of community and family medicine at the Dartmouth Medical School, in Lebanon, New Hampshire.

Dongmei Wang is a data analyst at the Dartmouth Institute.

David E. Wennberg is president of Health Dialog Analytic Solutions Inc., in Portland, Maine.

Coronary artery bypass graft surgery—referred to in this paper as bypass surgery or cardiac surgery—is a resource-intensive specialty service that can give patients major relief from angina, increased tolerance of exercise, and improved quality of life. The surgery can even prolong the lives of patients with specific patterns of coronary artery disease.¹

The number of bypass surgeries performed in the United States increased during the mid-1990s, peaked in 1997, and decreased thereafter.² Despite this, the number of new cardiac surgery programs continued to increase between 1993 and 2004.³ Has this expansion served patients and the health care system well?

From a public policy perspective, the most compelling argument for the development of

new programs is to improve patients' access to health care. From the hospital industry's perspective, cardiac services are important revenue centers, both because of the income they generate directly and because they support interventional cardiology procedures such as cardiac catheterization, angioplasty, and insertion of stents to open clogged arteries, all of which are procedures that also produce income. During the federal 2004 fiscal year, cardiac surgery was the third most profitable surgical service, after neurosurgery and transplant surgery.⁴ In general, cardiac services overall contribute 25–40 percent of a hospital's net revenues.⁵ Specialty heart hospitals can be especially lucrative.^{6,7}

The dilemma for policy makers is how to plan the development of new cardiac surgery programs that legitimately improve access without

increasing demand⁸ and exacerbating the duplication of services in the health care system. Historically, the planning function was performed through the certificate-of-need process, in which an applicant generally must demonstrate both the need for and its capacity to provide high-cost new medical services before the state grants approval for the new program. However, many states repealed their certificate-of-need laws once the federal mandate for their provision was repealed.⁹

Given the overall decrease in the use of bypass surgery in recent years, continuing to expand the number of hospitals offering cardiac surgery may result in unnecessary duplication of services without increasing patients' access to such services. Our multiyear study used Medicare claims data to identify where new cardiac surgery programs were created and to assess their impact on geographic access. We measured patients' access by travel time for Medicare beneficiaries and by duplication of services in small geographic areas.

Study Data And Methods

HOSPITALS PERFORMING BYPASS SURGERY We used Medicare claims data from the Medicare Provider Analysis and Review files to identify all hospitals performing bypass surgery from 1992 to 2004. Each claim includes dates of service; up to six *International Classification of Diseases, Ninth Revision* (ICD-9), procedure codes; and a hospital identification number. We included in our study hospitals whose identification numbers occurred on any claims containing ICD-9 procedure codes 36.10–36.19, which cover coronary artery bypass surgery.

We defined established programs as those billing for bypass surgery in 1992. New programs are those that started billing for the surgery between January 1993 and September 2004.

We excluded hospitals that began billing for bypass surgery in the final quarter of 2004, because they would not provide sufficient information for our analysis. We also excluded hospitals that discontinued billing for the surgery before August 2004, on the assumption that they had closed their cardiac surgery programs. We used a combination of Internet searches and personal telephone contacts to identify specialty heart hospitals because the Medicare data did not include information about them.

We obtained ZIP codes for most of the hospitals from Medicare's Provider of Services file for 2001. For twenty-two hospitals, we conducted web searches to obtain their ZIP codes. Nineteen of these hospitals had opened after Medicare's file had been constructed, and the file had incomplete data for the other three hospitals.

TRAVEL TIME TO HOSPITALS To obtain a measure of geographic access and its change over time, we estimated the travel time to the nearest cardiac surgery hospital from the ZIP code of residence for each beneficiary in the Medicare eligibility files. We included each fee-for-service Medicare beneficiary who was eligible at midyear in 1993 or 2004.

For all of the beneficiaries' ZIP codes in the continental United States, we then measured the distance from the so-called population centroid (an estimate of the geographic center of the population in the ZIP code) as of 1993 and 2004 to the nearest road. We added this distance to the distance by road to the population centroid of the ZIP code of the nearest hospital, weighting by road type to estimate a beneficiary's total travel time to that hospital. When a beneficiary's ZIP code of residence and the nearest hospital's ZIP code were the same, we set the travel time at zero.¹⁰ For a handful of ZIP codes, we could not calculate travel times. We derived these from MapQuest, an online mapping application.

ACCESS TO CARDIAC SURGERY PROGRAMS To investigate changes in access by population characteristics, we also identified age, sex, and race as well as the so-called rurality of residence for each beneficiary—that is, to what degree the location of residence was or was not rural. We defined four levels of rurality—urban, and large, small, and isolated rural ZIP codes. We used Rural-Urban Commuting Area codes to categorize the ZIP codes.¹¹ Then we calculated travel times for each subgroup of beneficiaries.

We used two measures of efficiency, or duplication of services. The first was whether new cardiac surgery programs opened in areas already served by other cardiac surgery programs. For this analysis, we identified each hospital within a *Dartmouth Atlas of Health Care* hospital service area according to the hospital's ZIP code. Hospital service areas represent referral patterns for community-based hospital care, empirically derived by examining travel patterns for health care services in the Medicare population.¹² We identified which new cardiac surgery programs opened in competitive markets—that is, a hospital service area in which a cardiac surgery program was already in existence.

Our second measure of efficiency assessed the distance between a new cardiac surgery program and the closest program to it at the time the new program opened. We measured this distance in miles between ZIP code centroids, using straight line distances (corrected for the curvature of the earth) rather than distances by road. Because ZIP code population centroids can change over time, we used only 1992 centroids for established programs and 2004 centroids for new programs.

For each new program, we determined whether its state required a certificate-of-need for open-heart facilities when the program opened.⁹ The Medicare hospital identification number indicates the state in which the hospital is located. Six states dropped their certificate-of-need requirements during the study period: Pennsylvania in 1996; Delaware, Nebraska, Nevada, and North Dakota in 1997; and Ohio in 1998.

We hypothesized that new programs would provide little improvement in access.

Study Results

In the continental United States, there were 883 cardiac surgery programs in existence as of December 1992, and 301 new programs opened between January 1993 and September 2004. Of these new programs, 276 were in general hospitals; 25 were in specialty hospitals.

The majority of new programs opened in the East and Midwest (see the map in the online Appendix),¹³ with a very high concentration of new programs in the mid-Atlantic region. Of the 276 new general programs, 53 percent opened in states without certificate-of-need regulations; all new specialty programs opened in states without such regulations. In states whose certificate-of-need status changed during the study period, 78 percent of all new programs, regardless of their type of hospital, opened after the requirement for a certificate was repealed. For example, Ohio repealed its requirement in 1998. Five new programs opened in Ohio before the repeal, and eighteen opened after it.

ACCESS The median travel time for Medicare beneficiaries declined from seventeen minutes in 1993 to fourteen minutes in 2004 (Exhibit 1). In 1993, 36 percent of beneficiaries lived more than thirty minutes from the nearest cardiac surgery program (Exhibit 2). By 2004 that portion had dropped to 28 percent.

We found similar travel times for all of the beneficiary subgroups, with two exceptions (Exhibit 1). First, blacks lived much closer than others to cardiac surgery programs, and there was little change during the study's time period for blacks.

Second, travel times were much longer for residents of all types of rural areas than for urban residents. There was virtually no reduction in median travel time for urban residents (72 percent of the total Medicare population; data not shown) over the course of the study, but median travel times for rural residents decreased by a little more than ten minutes, on average. The largest decreases in percentages living more than thirty minutes from the nearest bypass surgery hospital occurred among rural residents

(Exhibit 2). However, the majority still had to travel more than thirty minutes. This group included more than 90 percent of the residents of isolated rural areas.

DUPLICATION OF SERVICES Overall, 42 percent of new cardiac surgery programs (37 percent of new general programs and 100 percent of new specialty programs) opened in competitive markets (data not shown). Eighteen general programs (6.5 percent) and seven specialty programs (28 percent) opened in the same ZIP code where another cardiac surgery program already existed (data not shown). New specialty programs opened much closer to established programs than new general programs did. For example, 31.9 percent of new general programs and 80 percent of new specialty programs opened within five miles of an existing program (Exhibit 3).

Discussion And Policy Implications

Between 1993 and 2004 there was an increase of about 30 percent in the number of cardiac surgery programs in the United States. This dramatic increase is in spite of the decline in the number of bypass surgeries during this period (Exhibit 4).

The disconnect between growth and volume is even more striking when one considers the

EXHIBIT 1

Medicare Beneficiaries' Travel Time To Nearest Cardiac Surgery Program, 1993 And 2004

	Median travel time, minutes	
	1993	2004
All beneficiaries	17 (7-44)	14 (7-33)
AGE, YEARS		
65-69	17 (8-44)	15 (7-34)
70-74	17 (7-43)	14 (7-34)
75-79	17 (7-44)	14 (6-33)
80-84	17 (7-45)	13 (6-32)
85+	16 (7-45)	13 (6-33)
SEX		
Male	18 (8-45)	15 (7-34)
Female	17 (7-43)	14 (6-33)
RACE		
Black	9 (5-31)	8 (4-19)
Other	18 (8-45)	15 (7-34)
RURALITY OF RESIDENCE ZIP CODE		
Urban	11 (6-21)	10 (5-18)
Large rural	55 (40-77)	42 (28-63)
Small rural	61 (45-81)	50 (35-68)
Isolated rural	69 (52-93)	58 (43-79)

SOURCE Authors' analysis. **NOTES** "All beneficiaries" are Medicare beneficiaries who filed claims for cardiac surgery, as explained in the text. The ranges, shown in parentheses, represent the top of the first quartile of beneficiaries (those with the shortest travel time) and the bottom of the fourth quartile (those with the longest travel time).

EXHIBIT 2

Characteristics Of Medicare Beneficiaries Living Farther Than Thirty Minutes From The Nearest Cardiac Surgery Program, 1993 And 2004

	Percent of beneficiaries	
	1993	2004
All beneficiaries	36	28
AGE, YEARS		
65-69	36	29
70-74	36	28
75-79	36	27
80-84	37	27
85+	36	27
SEX		
Male	37	29
Female	35	27
RACE		
Black	26	18
Other	37	29
RURALITY OF RESIDENCE ZIP CODE		
Urban	15	9
Large rural	88	73
Small rural	94	84
Isolated rural	97	91

SOURCE Authors' analysis. **NOTE** "All beneficiaries" are Medicare beneficiaries who filed claims for cardiac surgery, as explained in the text.

location of most of these new programs. More than 80 percent opened within thirty miles of an existing program, and more than 55 percent opened within ten miles of an existing program. The close proximity of these new programs to existing programs resulted in a negligible decrease in travel time for the 72 percent of Medicare beneficiaries who live in urban areas. Thus, these programs have done little to improve geographic access overall. Instead, their creation has led to a fight for shares of a shrinking market.

Although the overall impact of the new programs on access and efficiency has been mini-

mal, there are interesting findings within certain subgroups of Medicare beneficiaries. Beneficiaries living in rural areas experienced a larger reduction in median, shortest, and longest travel times, compared to beneficiaries in urban areas. These results suggest that careful planning in the future could have a beneficial impact on rural residents and their access to cardiac surgery services.

Interestingly, although questions have been raised about possible inequities in the use of cardiac services, black Medicare beneficiaries had lower median travel times than others throughout the study period. There is a large literature indicating that blacks are much less likely than others to have cardiac surgery.¹⁴ Clearly, geographic access does not explain that difference.

UNINTENDED CONSEQUENCES Our results show the negative impact when the creation of new health care services is not carefully planned. The most rapid increase in cardiac surgery programs has occurred in states that have dropped their requirements for certificates-of-need.

New specialty programs opened in an especially inefficient pattern. All of these programs opened within twenty miles of an existing program, and 80 percent opened within five miles of an existing program. These new specialty programs opened only in states that did not require a certificate-of-need—sometimes almost on the border of states that did require one—and often in close proximity to each other in highly competitive markets.

Although these specialty programs may engender competition based on quality, price, or both, there may be unintended consequences as well. One previous study performed on data from the time period we examined showed that increasing the supply of such specialty services could increase the rates of surgery based on population.⁸ Although the rates of bypass surgery have not increased with increasing supply, the rates of associated procedures such as angioplasties and stents have increased dramatically. In addition, increasing the number of hospitals that perform cardiac surgery when the demand for such surgeries is decreasing results in a higher proportion of procedures being done in hospitals where they are seldom performed,³ potentially adversely affecting the outcomes.¹⁵

We acknowledge that travel distance is not the only measure of access, but geographic accessibility has been shown to strongly predict the use of cardiac services and, sometimes, patient outcomes.^{16,17} Even when a cardiac surgery center is close by, it may be difficult to schedule an elective bypass surgery if its operating rooms are working at capacity. Such circumstances

EXHIBIT 3

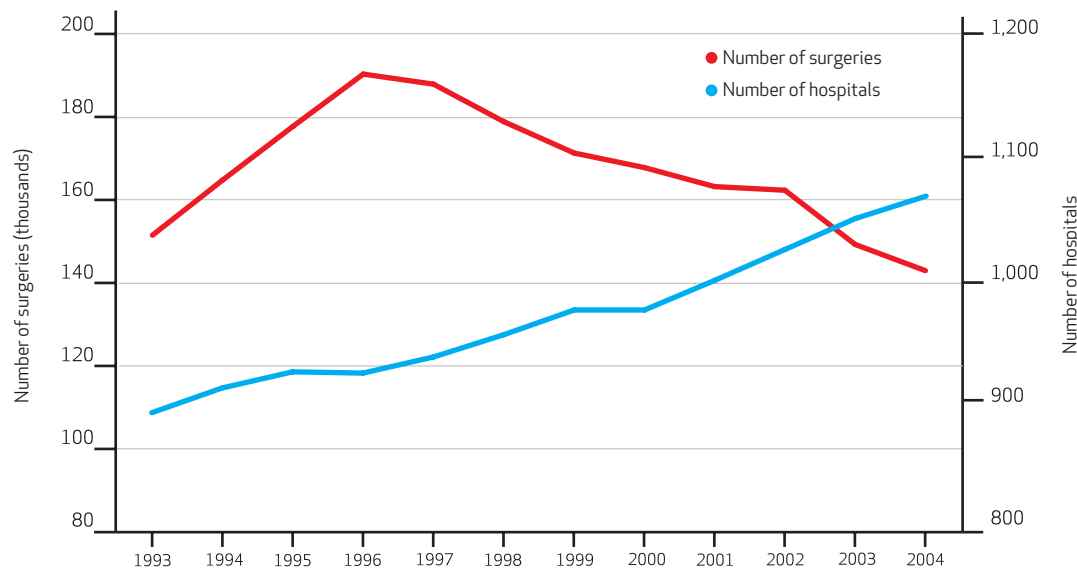
Distance Between New Cardiac Surgery Programs And Nearest Existing Programs

Distance	Percent of programs (N = 301)	
	New general program (n = 276)	New specialty program (n = 25)
Less than 1 mile	7.3	28.0
1-5 miles	24.6	52.0
6-10 miles	19.9	16.0
11-20 miles	12.7	4.0
21-30 miles	10.9	0.0
More than 30 miles	24.6	0.0

SOURCE Authors' analysis.

EXHIBIT 4

Number Of Bypass Surgeries Among Medicare Beneficiaries And Number Of Hospitals Performing Bypass Surgeries, 1993–2004



SOURCE Authors' analysis. **NOTES** Number of surgical procedures is denoted by the red line and relates to the left-hand y axis. Number of hospitals is denoted by the blue line and relates to the right-hand y axis.

might explain the creation of new cardiac surgery programs early in the study period, when demand for cardiac surgery was increasing. But it is highly unlikely to explain the creation of new programs during later years, when the number of such surgeries was declining.

DUPLICATION OF SERVICES It seems clear that the opening of some cardiac surgery programs during the study period, especially in rural areas, improved access without adversely affecting efficiency. In addition, some hospitals probably added cardiac surgery programs so that they could perform primary percutaneous coronary interventions—that is, angioplasty and stents performed during a heart attack. Increasing access to primary coronary interventions might be a positive effect of new cardiac surgery programs. However, most cardiac procedures performed in hospitals—even those with few cardiac procedures—are done for other reasons.¹⁸

Despite potential benefits for some patients, particularly those living in rural areas, we found substantial evidence of duplication of services in highly competitive markets, as well as the pro-

liferation of specialty cardiac hospitals, without improvements in geographic access for the vast majority of patients.

PROVING NEED FOR NEW PROGRAMS The certificate-of-need regulatory process has caused controversy. Proponents believe that it can make health care planning more rational and the use of health care resources more efficient. Opponents believe that the regulatory process actually adds to health care costs by requiring documentation of need and thus delaying the construction of new facilities—resulting in higher construction costs as costs in general rise over time—as well as by being anticompetitive. In addition, the regulatory process can become highly politicized.¹⁹

Flawed though it may be, the certificate-of-need process is one way for society to avoid spending money to needlessly duplicate a service that already exists, in some cases within the same ZIP code. If the nation is serious about restraining the rate of growth of health spending, such programs may need to be reinvigorated or reinstated in states that have dismantled them. ■

Some funding for this manuscript was provided by the National Heart, Lung, and Blood Institute (Grant no. R01HL080437). [Published online June 23, 2011.]

NOTES

- 1 Eagle KA, Guyton RA, Davidoff R, Edwards FH, Ewy GA, Gardner TJ, et al. ACC/AHA 2004 guideline update for coronary artery bypass surgery: summary article. *Circulation*. 2004;110:1168–76.
- 2 Lucas FL, DeLorenzo MA, Siewers AE, Wennberg DE. Temporal trends in the utilization of diagnostic testing and treatments for cardiovascular disease in the United States, 1993–2001. *Circulation*. 2006;113(3):374–9.
- 3 Wilson CT, Fisher ES, Welch HG, Siewers AE, Lucas FL. US trends in CABG hospital volume: the effect of adding cardiac surgery programs. *Health Aff (Millwood)*. 2007;26(1):162–8.
- 4 Resnick AS, Corrigan D, Mullen JL, Kaiser LR. Surgeon contribution to hospital bottom line—not all are created equal. *Ann Surg*. 2005;242:530–9.
- 5 Mahar M. Money-driven medicine. New York (NY): HarperCollins; 2006.
- 6 Moore K, Coddington D. Specialty hospital rise could add to full-service hospital woes. *Healthc Financ Manage*. 2005;59(7):84–90.
- 7 Kahn CN III. Caveat emptor: joint ventures with specialty hospitals. *Healthc Financ Manage*. 2005;60(6):90–4.
- 8 Nallamothu BK, Rogers MA, Chernew ME, Krumholz HM, Eagle KA, Birkmeyer JD. Opening of specialty cardiac hospitals and use of coronary revascularization in Medicare beneficiaries. *JAMA*. 2007;297(9):962–8.
- 9 National Conference of State Legislatures. Certificate of need: state health laws and programs [Internet]. Washington (DC): NCSL; [last updated 2011 May 11; cited 2011 Jun 3]. Available from: <http://www.ncsl.org/default.aspx?tabid=14373>
- 10 Birkmeyer JD, Siewers AE, Marth N, Goodman DC. Regionalizing high risk surgery and implications for patient travel times. *JAMA*. 2003;290:2703–8.
- 11 WWAMI Rural Health Research Center. RUCA data [Internet]. Seattle (WA): The Center; [cited 2011 May 19]. Available from: <http://www.depts.washington.edu/uwruca/ruca-data.php>
- 12 Dartmouth Institute for Health Policy and Clinical Practice. Dartmouth atlas of health care, data by region [Internet]. Lebanon (NH): The Institute; [cited 2011 May 20]. Available from: <http://www.dartmouthatlas.org/data/region/>
- 13 To access the Appendix, click on the Appendix link in the box to the right of the article online.
- 14 Kressin NR, Petersen LA. Racial differences in the use of invasive cardiovascular procedures: review of the literature and prescription for future research. *Ann Intern Med*. 2001;135:352–66.
- 15 Birkmeyer JD, Siewers AE, Finlayson EVA, Stukel TA, Lucas FL, Batista I, et al. Hospital volume and surgical mortality in the United States. *N Engl J Med*. 2002;346:1128–37.
- 16 Gregory PM, Malka ES, Kostis JB, Wilson AC, Arora JK, Rhoads GG. Impact of geographic accessibility to cardiac revascularization services on service utilization. *Med Care*. 2000;38(1):45–57.
- 17 Moist LM, Bragg-Gresham JL, Pisoni RL, Saran R, Akiba T, Jacobson SH, et al. Travel time to dialysis as a predictor of health-related quality of life, adherence, and mortality: the dialysis outcomes and practice patterns study outcome (DOPPS). *Am J Kidney Dis*. 2008;51(4):641–50.
- 18 Wennberg DE, Lucas FL, Siewers AE, Kellett MA, Malenka DJ. Outcomes of percutaneous coronary interventions performed at centers without and with onsite coronary artery bypass graft surgery. *JAMA*. 2004;292:1961–8.
- 19 Robeznieks A, Becker C, Blesch G, Evans M, Galloro V, Vesely R. Site under construction. *Modern Healthcare*. 2008;38:6–16.