The Price of Mammography in the United States: Data from the National Survey of Mammography Facilities

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THERE IS WIDESPREAD AGREEMENT IN THE UNITED States that growth in health care expenditures must be contained. To this end, various reform strategies have been proposed that focus on defining which services should be offered in a minimum benefits package. Some of the questions about this approach concern the type and frequency of preventive services to be offered in such a package; the answers will dramatically affect our decisions regarding aggregate expenditures.

Discussion of reform proposals has centered on aggregate expenditures and has neglected both the determinants of unit costs and the prices of various health care services. Nor have ways to lower these costs been examined. Substantial containment of health care expenditures can be achieved by discontinuing medically inappropriate services and by reducing the unit costs of appropriate services through organizing health care resources more efficiently. Direct investigation of these strategies is important to ensure delivery of high-quality health care services at low cost. Otherwise, pressures to contain aggregate expenditures may result in reduction of appropriate services or in deterioration of their quality.

We will examine the determinants of costs and prices (as measured by charges) for the preventive service of screening mammography, using

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data from the National Cancer Institute (NCI) sponsored National Survey of Mammography Facilities (NSMF) in the United States conducted in 1992. Because screening mammography is a proven cancer control strategy (Fletcher et al. 1993) and part of the proposed minimum benefit package for preventive services (Eckholm and Powell 1993), its aggregate cost is of interest to health policy planners engaged in designing the package (Clymer 1993). Questions related to the mammography benefit concern appropriate age at screening, whether screening should occur every one or two years, whether the benefit should be available to high-risk women younger than the universal screening age, and what constitutes high risk. There has been little discussion, however, either of determinants of unit cost and price of mammography or of how innovations in service delivery might lower these figures. Because these concerns apply to preventive services and medical procedures in general, a study of mammography may guide the study of other health care services as well.

Background

Mammography has gained increased acceptance in recent years as a screening modality for early detection of breast cancer. The procedure is conducted on asymptomatic women, who are largely referred by their physicians in accordance with mammography guidelines. In 1990, about a third of American women over the age of 40 reported having had a screening mammogram in the previous year, twice the proportion undergoing it in the year prior to 1987 (Breen and Kessler 1994). Yet 38 percent reported in 1990 that they had never had a mammogram (Breen and Kessler 1994). High charges constitute a barrier to use of screening mammography, especially for women not covered by health insurance (Urban, Anderson, and Peacock 1994).

Low-cost screening mammography has been advocated in the United States by the American Cancer Society (1987). Studies by federal agencies, including the Office of Technology Assessment (OTA), the General Accounting Office (GAO), and the Physician Payment Review Commission (PPRC) have indicated that low-cost screening mammography is feasible and desirable (Physician Payment Review Commission 1989; General Accounting Office 1990, 1993; Wagner 1991). Based on these studies, the Medicare fee schedule for screening mammography was set

at $55 per examination in 1991 (for 1993 the maximum allowed charge was $58.29).[1] A number of radiologists have demonstrated the feasibility of low-price screening mammography in practice and have outlined the steps necessary to make high-quality mammography screening services available at a low charge (Bird and McLelland 1986; Bird 1989, 1992; Sickles et al. 1986a, 1987; Clark 1992).

First, they recommend that screening mammography be performed as a distinct service and that specific resources be dedicated to it. A corollary is that the procedures should be as simple as possible. Screening mammography is usually defined as two views per breast: cranial caudal and mediolateral oblique. A necessary but not sufficient condition of low-price screening mammography is that facilities distinguish between screening and nonscreening services (Bassett et al. 1989).

Second, it has been documented that mammography cost is lower when more examinations are performed per day. In the baseline case of the PPRC study, a facility would have to perform at least 15 examinations per day (per mammography machine) to meet the current Medicare fee ceiling (including a professional fee of $12 per examination).

Third, it has been asserted that "batch interpretation," the serial reading of mammography films at periodic sessions, rather than one-by-one interpretations after each examination, greatly streamlines the radiologist's professional time, making low professional fees possible. The PPRC study allows for a professional fee of $12, although some radiologists have advocated setting it even lower (Bird and McLelland 1986; Sickles et al. 1986b).

Other suggestions to lower costs include batch processing (developing) of mammography films; establishing dedicated screening mammography facilities away from the high-rent location of a hospital or using mobile facilities; using microcomputers to economize on scheduling, reporting, billing, record keeping, and communications; and conducting prospective studies of local demand to ensure adequate volume prior to establishing a new facility (American Cancer Society 1987).

These recommendations suggest two separate production processes for screening and nonscreening mammography. Mere adoption of any of these procedures does not guarantee that a facility is operating within a low-cost regime. To achieve economic efficiency and maintain quality, screening must be separated from other kinds of mammography, and

[1] Omnibus Reconciliation Act of 1990. P.L.101-58, § 4163.

the process must be redesigned to include the entire range of cost-saving strategies.

A facility delivering mammography at low cost, however, will not necessarily pass savings on to women in the form of low charges. Unless there is price competition among facilities providing mammography, even a low-cost facility may charge the local "usual, customary and reasonable" price that does not reflect its (substantially lower) costs.

Purpose

Although a few low-cost facilities have been documented in the published literature, their prevalence on a national scale is unknown. We will use data from the NSMF to estimate the extent of currently available, low-cost screening mammography in the United States.

We analyze these data not only to test whether mammography is being delivered for a low charge, but also to provide a model for similar analysis of delivery of other medical services. Underlying this analysis is the idea that in order to reduce the aggregate expenditure on services without reducing the quantity or quality of their delivery, unit costs must be reduced to efficient levels.

Data and Methods

The NCI conducted the first NSMF from March to July of 1992. The design and implementation of the survey has been described elsewhere (Houn and Brown 1994). The survey achieved a response rate of 91 percent: 1,057 facilities responded out of 1,162 eligible facilities selected from a national sample frame of about 9,500 facilities.

Questionnaire items included mammography charges and the variables expected to be associated with charges:

1. Is there a distinction between screening and diagnostic mammography?
2. What procedures and services are usually performed as part of the examination?
3. What is the facility volume?

Other items concern batch interpretation, batch processing, wages of radiological technologists, interpretation fees, institutional affiliation, and geographic location.

Economic theory predicts that prices in a competitive market will be lower when more firms serve a given category of buyers. Because the NSMF provides no direct data on the degree of competition faced by each facility, we have added a proxy measure consisting of the number of women older than 45 per mammography machine. This measure was constructed for each health service area—single- or multicounty regions thought to correspond to local markets for health care services—in which a surveyed mammography facility was located (Makuc et al. 1991).

Three types of mammography examinations were defined. Screening mammography was defined separately from diagnostic mammography in facilities that distinguish between the two (even when they actually perform only one type of examination). A third type of "general" examination occurs in facilities that do not distinguish at all.

A multiple regression analysis (ordinary least squares) was performed to test whether the facility characteristics are independently associated with mammography charges. A weighted average of charges for screening and diagnostic examinations was computed for facilities that performed both screening and diagnostic examinations. Differences were ascertained using the *t*-test statistic. The SAS software package was used to analyze the data.

We also separately examined facilities that charge both less and more than $60 for screening mammography to see whether the lower-priced services operated at high volume or used other cost-saving strategies.

The NSMF contains information on possible determinants of mammography cost, but it has no direct data on cost. Instead, it offers data on mammography charges, which are a measure of price. This means that the determinants of costs (economic organization) and price (market structure) cannot be investigated separately, but only as joint propositions. Nevertheless, a reasonable working hypothesis is that lower charges are associated with facilities that distinguish between screening and diagnostic mammography, operate at high volume, and perform batch interpretation. Economic theories of price differentiation suggest that higher charges will be associated with facilities that are accredited by the American College of Radiology (ACR) or that perform breast physical examination (BPE) or other "extra" services as part of the mammography examination.

Results

The Prevalence of Low-Price Mammography

Average charges reported for mammography examinations are shown in table 1. Facilities that explicitly distinguish screening from diagnostic mammography charge on average $91 for screening mammography. This is $30 less than the average charge for diagnostic mammography and $27 less than that for general mammography (among facilities that do not distinguish screening from diagnostic mammography). The higher charge for diagnostic compared with screening mammography is about equally attributable to the technical fee and the interpretation fee.

Figure 1 shows the distribution of average charges reported by mammography facilities. The distribution of screening examinations is left skewed relative to that of diagnostic examinations, which in turn is almost identical to that of general facilities. Even though charges are substantially lower for examinations explicitly classified as screening, less than 16 percent (80/509) of all facilities offering this service report average charges for screening below the Medicare 1993 fee for screening mammography. Among general facilities, only 3.8 percent (16/422) charge this amount or less.

Facilities offer discount prices in particular circumstances. For example, 52 percent of facilities in this study were part of the ACS Low Cost Mammography Screening Projects in the last year, and 43 percent participated in reduced fee or subsidized programs designed to increase mammography

TABLE 1
Mammography Charges in Facilities That Do and Do Not Distinguish Screening from Diagnostic

	Average charges ($)		
	Facilities that distinguish		
	Screening	Diagnostic	General facilities
Interpretation fee	31	41	40
Technical fee	60	80	78
Total charge	91	121	118

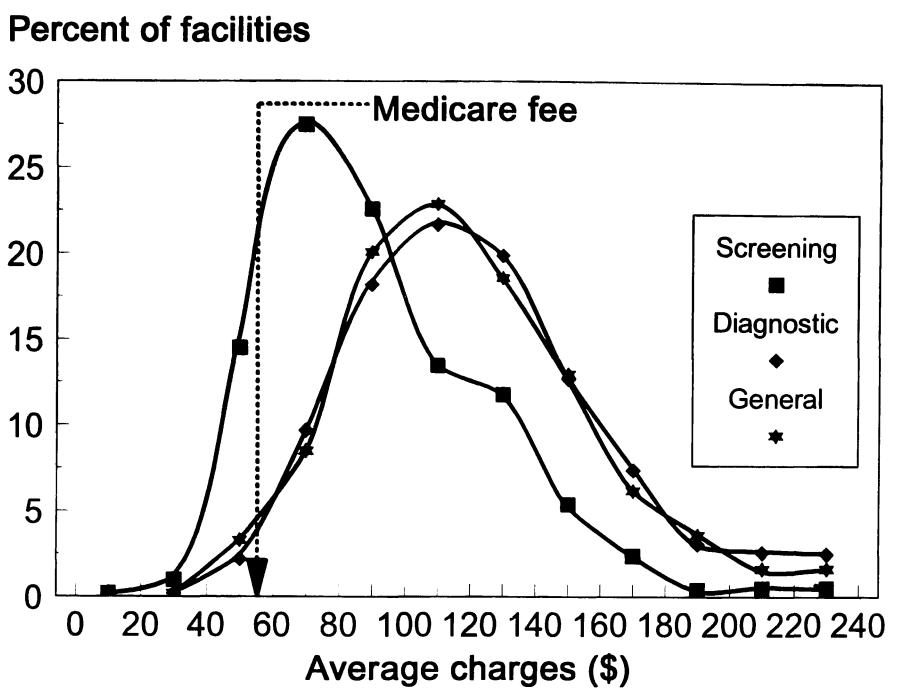

FIG. 1. Percent distribution of average charges.

use by low-income women. Seventy-two percent of the facilities were currently participating in the provision that covers screening mammography for Medicare recipients at the rate of $58. Thus, there is some evidence of price discrimination, which leads to lower charges for some mammograms. However, it appears that the average facility charge for mammography is well above what it could be under efficient conditions of production.

Factors Associated with Low Charges

Table 2 summarizes the descriptive information on facility characteristics and mammography charges. Table 3 shows the results of total charges regressed on various factors.

Differentiating between Screening and Diagnostic Mammography. The significantly lower average price charged for screening by facilities that explicitly distinguish between screening and diagnostic mammography supports Bassett's contention that differentiating the two

TABLE 2
Descriptive Data or Charges and Related Facility Characteristics

Characteristic	Average charge ($) (SE of mean)
Type of facility	
General	118 (1.86)
Screening/diagnostic	
Diagnostic exam	121 (1.68)
Screening exam	91 (1.47)
Mode of interpretation	
Batch interpret	105 (2.28)
Single interpret	114 (1.38)
Volume	
High (>15/day)	112 (3.28)
Medium (5–14/day)	111 (1.74)
Low (<5/day)	113 (1.89)
Geographic location	
Northeast	140 (2.48)
Midwest	105 (1.96)
South	103 (1.81)
West	107 (2.95)
Urban status	
MSA	116 (1.47)
Non-MSA	101 (1.08)
Affiliation	
Hospital	113 (1.79)
Radiology practice	112 (2.06)
Primary care	111 (3.06)
HMO	114 (10.27)
Other	104 (4.06)
ACR accredited	
Accredited	111 (1.65)
Not accredited	113 (1.71)
Clinical breast examination	
Yes	115 (2.23)
No	111 (1.41)
Radiological consultation	
Yes	123 (5.32)
No	112 (1.22)

Abbreviations: ACR, American College of Radiology; HMO, health maintenance organization; MSA, metropolitan statistical area; SE, standard error.

TABLE 3
Regression Results[a]

Independent variable	Coefficient	Probability
Intercept[b]	77.25	.0001
Distinguish Sx/Dx	−7.93	.0006
Exams/month/machine	−0.01	.2433
Radiologic tech's wages/hour	1.92	.0001
Batch interpretation	−5.41	.0577
Clinical breast exam	4.32	.0904
Radiological consult	−0.66	.8949
Waiting time (in days)	0.09	.5887
ACS low-cost project	−6.98	.0049
Low-income program	−1.55	.5306
Affiliation (compared to radiology practice)		
Hospital	8.96	.0015
HMO	−5.77	.5186
Primary care	−3.26	.4498
Other	−2.70	.5296
Metro status	10.99	.0001
Region (compared with South)		
Midwest	1.91	.5066
Northeast	32.12	.0001
West	0.40	.9053
ACR accreditation	−5.48	.0218

[a] Dependent variable = total charges; adjusted $R^2 = .22$.
[b] The intercept price is the predicted charge for a facility that does not distinguish, produces average volume, has average wage costs, does not batch interpret, does not perform clinical breast exams, does not offer radiological consultation, has average waiting time, does not participate in low-price programs, is affiliated with private radiology practice, is located in a nonurban area in the South, and is not ACR accredited.
Abbreviations: ACR, American College of Radiology; ACS, American Cancer Society; Dx, diagnostic; Sx, screening; HMO, health maintenance organization.

types of services is a prerequisite for achieving low-price screening mammography (Bassett et al. 1989). In the regression analysis, a $7.93 reduction relative to the intercept price for all mammography was associated with differentiation. Fifty-nine percent of the facilities in this study, performing 65 percent of all examinations, reported that they distinguish screening from diagnostic mammography. In a 1988 survey of Los Angeles, Bassett and his colleagues found that only 29 percent of mammography facilities made this distinction.

Two observations, however, undermine what appears at first glance to be a strong trend for facilities that explicitly distinguish between screen-

ing and diagnostic mammography to charge less for screening mammography. First, among those facilities that distinguish and perform both screening and diagnostic mammography, about 60 percent of the examinations were classified as screening. This contrasts with estimates from other sources (Dawson and Thompson 1989; Center for Health Education 1990), and is confirmed by the clinical follow-up phase of this study, that over 80 percent of all mammography should be considered screening. Second, of the 59 percent of facilities that distinguished between screening and diagnostic mammography, many maintained only a minimal price differential between the two procedures. For over 40 percent of these facilities, the difference in price between diagnostic and screening mammography was less than five dollars.

Volume and Capacity Utilization. Figure 2 shows the distribution of volume, measured as examinations per mammography machine per day, reported by facilities. The PPRC analysis indicates that to achieve a cost of less than $60 per examination a facility would need to perform about 15 examinations per day. Only 14 percent of all facilities performed at this volume. The average volume for all facilities was less than 10 (9.2)

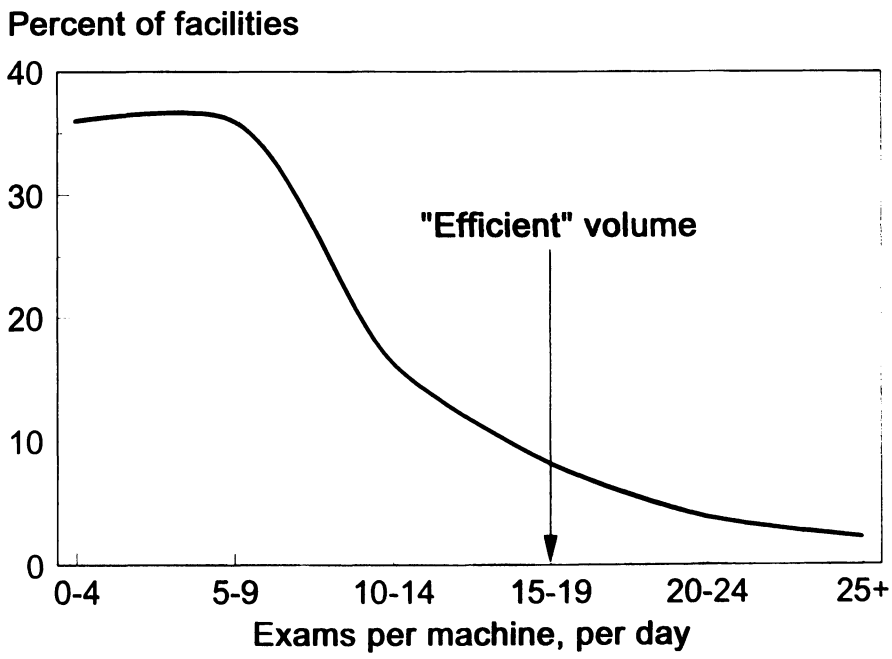

FIG. 2. Percent distribution of facility volume.

examinations per day per machine. Forty-three percent of facilities associated with health maintenance organizations (HMOs) performed 15 or more examinations per day.

In general there was no statistically significant relationship between volume and average mammography charge in the regression, although the relationship is in the expected direction (higher volume is associated with lower charges). The lack of significance is, perhaps, not surprising because few facilities perform mammography at sufficiently high volume to reduce cost. When facilities that distinguish screening from diagnostic mammography were split according to whether they charged on average more or less than $60 for screening mammography, a modest but statistically significant difference was observed in average volume: 10.4 examinations per day per machine for the low-priced facilities, compared with 8.3 examinations per day for the high-priced facilities.

By their own account, most facilities were performing at far below full capacity. The average estimate of full capacity was 20 examinations per day. This was constrained by the number of radiological technologists actually employed. The achievable full capacity, if this constraint were relaxed, would be higher—24 examinations per day per machine—given that the average estimated time per examination was about 20 minutes. Fifty-eight percent of the facilities reported operating at less than 50 percent of their current capacity, and 26 percent reported operating at less than 20 percent.

Batch Interpretation. A modest proportion of facilities—20 percent—reported that they usually batch interpret mammography films. Batch interpretation was associated with lower charges. In the regression analysis it was associated with a $5.41 lower charge than for all mammography. Among facilities charging less than $60 per examination for a screening mammogram, 33 percent used batch interpretation, compared with 24 percent for those charging more than $60.

Quality Differentials. Economic theory suggests that "quality" factors might increase the price of mammography (Scherer 1980). These might include accreditation by the ACR and various "extra" procedures built into the screening mammography examination. The average charge for ACR facilities was slightly less than for non-ACR facilities, and for screening mammography it was significantly less: $87 versus $94. In the regression analysis, ACR accreditation is associated with a fee reduction of $5.48 for all mammography. Some facilities reported performing clinical breast examination or a consultation with a radiologist who provides

results directly to a woman immediately after her mammogram. Average charges at facilities that performed a clinical breast examination or a radiological consultation as a routine part of the mammography examination were somewhat higher ($5 and $9, respectively).

No relationship was observed between average mammography charges and average reported waiting time for a mammography appointment.

Other Factors

Batch Processing. Only 1.5 percent of facilities reported using batch processing. Because of its low level of use, this variable was not explored further, except in connection with mobile units, which are discussed below.

Participation in "Low-Cost" Mammography Screening Programs. Participation in the ACS Low Cost Mammography Screening Projects within the last 12 months was associated with a $6.98 decrease in charges for all mammography in the regression analysis.

Various programs sponsored by state or local governments to subsidize low-priced or free mammography for low-income women did not significantly affect the average charge.

Region. Region had a strong effect on price, independent of other factors. The average charge for mammography in facilities in the Northeast was $140, compared with average charges ranging from $103 to $107 for the other regions of the country. In the regression analysis, location in the Northeast was associated with a charge $32.12 higher than the South, $31.72 higher than the West, and $30.21 higher than the Midwest. The higher average charge in the Northeast was significantly different from the others.

It is difficult to know whether the higher average charge for mammography associated with location in the Northeast is explained by cost factors or is a function of higher customary fees in that region. They are not explained by higher salaries for radiological technologists. Other studies have observed relatively high fees in the Northeast, but these are usually accompanied by elevated fees in the West as well (Levy et al. 1990; Burney et al. 1978). The different pattern for mammography may be attributable to several facts. Potentially higher prices on the West Coast may be offset by the presence of several influential radiology practices providing low-price screening mammography and by the relatively greater penetration of HMOs in the West than in the Northeast (Sickles 1988; Taplin et al. 1990).

Location in a metropolitan statistical area (MSA) compared with being in a non-MSA was independently associated with an additional $10.99 increase in mammography charges. The metro/nonmetro differentials observed here are consistent with other studies of medical fee variations.

Local Market Conditions. This variable did not prove to be statistically significant in the regression analysis. By this admittedly crude test, pricing of mammography by facilities in the NSMF does not seem sensitive to variations in local conditions of supply and demand.

Affiliation. Average charges did not differ by the institutional affiliation of facilities, as shown in table 2. In the regression analysis in table 3, however, higher charges were associated with hospital-affiliated facilities ($8.96 higher average charge for hospital affiliation than for private radiology practice affiliation). Although observed average charges for hospitals in table 2 were not significantly different, more detailed analysis of the data shows that hospital-affiliated facilities were a third less likely to be located in the Northeast or in urban areas than other facilities. Therefore, for comparable market locations, hospital-affiliated facilities did tend to be more expensive.

Mobile facilities, whatever their institutional affiliation, average $74 for screening mammography, which is less than what stationary facilities charge. Mobile facilities had an average higher volume than stationary facilities: 12 examinations per machine per day. Mobile facilities also made use of batch film processing much more frequently than all facilities: 24 versus 1.5 percent.

Discussion

A considerable literature advocates the desirability and feasibility of low-cost/low-price screening mammography. A key theme of this literature is that low-price screening mammography is attainable if facilities are organized to exploit intrinsic economies of specialization and scale.

The NSMF results indicate that the potential for delivering high-quality screening mammography at low price is largely unfulfilled. Over half the facilities meet prerequisites for exploiting economies of specialization by distinguishing between screening and diagnostic mammography. Even facilities that distinguish, however, seem to be incorrectly classifying mammography screening exams as diagnostic examinations. Only a modest fraction of facilities practices batch interpretation, and even fewer utilize

batch processing. Average volume is far below the level needed to exploit economies of scale.

Facilities that offer reduced charges for screening mammography appear to be following some of the principles recommended to achieve low-cost screening, but they have not institutionalized the full spectrum of organizational factors that make low-cost screening feasible.

Still, some encouraging patterns emerged in pricing of screening mammography. Price differentials were, in general, not found to be associated with measures of quality. Lower charges do not appear to affect quality adversely. To the extent that facilities have made low-price screening mammography available, substantial savings have accrued to the health care system. Projecting the number of examinations reported in this survey to the national sample frame, we estimate that about 23 million mammography examinations were performed in 1992. The national expenditure for mammography would have been $205 million more than it actually was (33 percent of all examinations * $27 * 23 million examinations) had no facility charged the lower price associated with screening mammography.

Far more savings are potentially available from the broader application of low-cost mammography. If the $27 differential had been applied to all of the approximately 80 percent of mammography examinations that are reasonably classified as screening, an additional $292 million could have been saved. If all of these examinations had been delivered at the 1993 Medicare screening mammography fee of $58.29, there would have been an additional savings of $602 million. Situations analogous to screening mammography may exist for other preventive services and medical services in general. For example, a recent study by the U.S. General Accounting Office describes a pattern of resource allocation and payment for magnetic resonance imaging (MRI) services with striking parallels to the screening mammography case (General Accounting Office 1992).

The results of this study suggest three interrelated barriers to the achievement of savings:

1. The persistence of excess capacity of mammography resources and, consequently, high unit costs of production (Brown, Kessler, and Rueter 1990).
2. The persistence of a customary price structure and reimbursement conventions linked to the historical diagnostic fee structure and the

mode of production associated with it. This price structure, in turn, subsidizes persistent excess capacity.

3. The absence of a strong initiative, from government or health care provider organizations, to establish screening mammography as a dedicated and integrated preventive service where resource allocation is consciously planned in accordance with public health needs and economies of scale.

Policy Implications

Various proposals for expenditure containment under health care reform may be considered, using the findings of this study. Would "managed competition," promoted as a reform to enhance price competition between health providers, significantly alter the price of screening mammography? In theory, managed competition would assemble consumers into health care alliances with sufficient market power to force insurers to reduce their premiums. Insurers, in turn, would compel providers to reduce the price of services.

There are two reasons to expect that the kind of competitive pressures anticipated by managed competition would not necessarily reduce the price of screening mammography services. First, our measure of local market competition had no significant effect on reported mammography charges. It could be argued, however, that mammography facilities are currently more shielded from price competition than they would be under managed competition. A second barrier to reducing mammography prices is persistence of excess capacity and an organizational structure inherited from diagnostic mammography. This situation leaves relatively little margin between prices and current (but inefficient) costs. Clearly, there would be resistance to lowering prices below current costs from as blunt an instrument as managed competition, even though the resulting departure of facilities from the market would ultimately result in a lower cost structure.

The "single payer" system, broadly construed, also does not include a specific mechanism for addressing the problem of excess capacity in services like mammography. However, some versions of "single payer" incorporate the prospective pricing of medical services that is found, for example, in the current Medicare system. Prospective prices would be

negotiated between the payer organization and health care providers as a group. By setting a price for screening mammography close to the competitive (efficient) level that exists in the current Medicare fee schedule and preventing "miscoding" of screening mammography as diagnostic, such a system of price negotiation would directly compel facilities either to become efficient, high-volume producers or to leave the market.

This approach is based on the premise that it is possible to obtain objective estimates of the cost of preventive services in the absence of competitive market observations. Screening mammography may serve as an instructive case study in this endeavor. Estimates of the determinants of screening mammography cost were obtained both from "demonstration" projects consisting of selected facilities engaged in "best practice" methods and from planned centralized screening programs conducted in other countries. Based on this information, the PPRC conducted analytical studies to estimate the cost of mammography under conditions of efficient production.

The NCI survey makes it possible to assess the validity of the cost estimates conducted by the PPRC. An important component of its estimate is the salary of radiological technologists. In the baseline case, PPRC assumed a radiological technologist salary of $25,200 per year (and additional benefits). The average salary found in this study for a full-time equivalent technologist was $25,680, remarkably close to the PPRC assumption. A substantial proportion of facilities reported relatively high wages: 10.4 percent of the facilities reported average technologist wages of $35,000 or more. However, for high-volume facilities, even a relatively large increase in wages would not increase costs of mammography by much. At a volume of 15 examinations per day, this higher wage would increase the unit cost of mammography examinations from $57.42 to $63.02.

The PPRC model amortized capital costs over a six-year period based on data from diagnostic equipment manufacturers. The amortization period reflects the useful lifetime of mammography equipment. The average age of mammography machines (except machines acquired as net additions to capacity) is 5.1 years in facilities that the NSMF recorded as operating for at least six years, which is close to the PPRC assumption.

There are other indications from our study that an efficiency price for screening mammography in the neighborhood of the Medicare fee is feasible beyond the few "demonstration" low-price facilities that have been

innovators in this area. Although they were in the minority, a significant number of facilities in this survey had charges at or below the Medicare fee level. True screening mammography is a rather homogenous product. If the national equivalent of almost 1,000 facilities (96 in this survey) can operate at this price, other facilities can also replicate the resource and organizational mix necessary to offer mammography at a similarly low charge. The regression results shown in table 3 suggest that, even in the current market, facilities can be identified that will on average charge less than $60 for mammography. The model predicts that an urban facility that distinguishes between screening and diagnostic mammography, pays average radiological technologist wages, uses batch interpretation, participates in ACS Low Cost Mammography Screening Projects, and is ACR accredited will charge $51.45 if located in the South, $51.85 if located in the West, $53.36 if located in the Midwest, and $83.57 if located in the Northeast. With the important exception of the Northeast facilities, it is already possible to identify a descriptive set of facility characteristics associated with mammography charges at or below the Medicare fee.

In summary, data from the NSMF is consistent with assumptions in the PPRC study, suggesting that delivery of high-quality mammography at a low price in the United States is feasible.

In the final analysis, two fundamentally different conceptions of preventive medical services are at stake in health care reform. One views each service as a distinct commodity, not unlike the apples and oranges of elementary economics textbooks. The other sees the array of related services as a public good. When viewed narrowly as the production of radiological films and interpretations, screening mammography fits comfortably within the commodity conception. But when screening mammography is viewed as a public health measure requiring public education and recruitment, multispecialty diagnosis, treatment, follow-up, and periodic evaluation using integrated records from mammography facilities and population-based cancer registries, the public good model is more appropriate. Outside the United States, this latter conception has generally been adopted for screening mammography and seems to function well. For example, the Netherlands and Great Britain currently achieve participation rates of from 70 to 80 percent for biennial screening among women between ages 50 and 69, using regional screening, assessment, and treatment centers (Chamberlain et al. 1993; deKoning 1993). The comparable rate for the United States is about 50

percent. Ironically, we do not know whether the much more expensive U.S. system results in better or worse health outcomes because comprehensive data like rates of suspicious examinations, follow-up diagnostic procedures, cancers detected, and stage at diagnosis, which are routinely monitored in the European programs, are only beginning to be collected systematically in the United States.

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