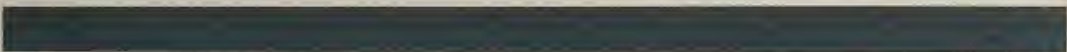




PHYSICIAN

PAYMENT REVIEW

COMMISSION



**THE COSTS OF PROVIDING
SCREENING MAMMOGRAPHY**



JUNE 1989

REPORT TO CONGRESS NO. 89-2

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THE COSTS OF PROVIDING SCREENING MAMMOGRAPHY

Author:

Herschel Goldfield

Submitted to Congress pursuant to
Section 204(f)(1) of the Medicare Catastrophic Coverage
Act of 1988 (Public Law 100-360).

June 30, 1989

Physician Payment Review Commission
2120 L Street, N.W.
Suite 510
Washington, D.C. 20037
(202) 653-7220

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BACKGROUND AND SUMMARY

In section 204 of the Medicare Catastrophic Coverage Act (the Act) of 1988 (P.L. 100-360), Congress expanded Part B coverage to include biennial screening mammography for women aged 65 and over, with screening also available for disabled women between age 35 and 64.¹ This expansion of coverage reflected the consensus that screening mammography can be an effective and efficient method to reduce breast cancer mortality. In the past, Medicare provided coverage only for diagnostic mammography, rather than for both screening and diagnostic mammography. Diagnostic mammography tests are intended only for symptomatic or high-risk patients.

According to the Conference Report (p. 171), standard mammography screening is understood to be a bilateral four-view procedure. It should be distinguished from diagnostic mammography, which may include additional views, magnification, and physical examination and may also be accompanied by an ultrasound examination if indicated. When they are provided, ultrasound or other supplementary diagnostic tests are generally billed separately.

The Catastrophic Coverage Act requires the Secretary to establish standards to assure the accuracy and safety of screening mammographies. These standards are expected to outline precisely the requirements for the conduct of a screening mammogram, and will specify the type of equipment to be used to perform the mammogram, and the qualifications of the persons administering and interpreting the test. The Act also requires that the baseline mammogram will be placed in the beneficiary's permanent medical records.

The Act provides that the Medicare payment for screening mammography will be equal to 80 percent of the lowest of

- (i) the actual charge
- (ii) the fee schedule established under section 1834 (b) of the Social Security Act, or
- (iii) a reasonable charge limit, ^{be} set at \$50 for 1990, and subsequently adjusted by the MEI.²

At the time the legislation was passed, the conferees recognized the concern that the reasonable charge limit of \$50 might "limit the availability of mammography in physicians' offices even though the procedure may be available at clinics, hospital outpatient departments, and outpatient radiology facilities. Accordingly, the conference agreement

¹ The Act provides for a baseline mammogram for beneficiaries between the ages of 35 and 39, annual screening for high risk women between the ages of 40 and 49 (otherwise biennial for low-risk women), and annual screening for women between 50 and 64 years old.

² The Act also establishes a balance billing limit for nonparticipating providers equal to 125 percent of the Medicare reasonable charge for 1990, 120 percent in 1991, and 115 percent after 1991.

require[d] the PPRC to study the cost of providing screening mammography in a variety of settings and at different volume levels," and to report by July 1, 1989. The same agreement called for the General Accounting Office (GAO) to conduct a study of the quality of mammography in different settings and to report by July 1, 1989.

This report presents the results of an analysis of the costs of screening mammography. Data are presented on the current charges for mammography, and estimates of the resource costs of screening mammography. This is followed by a discussion of the quality of screening mammography and patient compliance with screening recommendations. In brief, it was found that:

- o Current charges for screening mammography vary greatly, from \$25 to \$250. When screening and diagnostic mammography are differentiated, screening mammograms cost about one-half as much as diagnostic mammograms.
- o High quality screening mammography can be provided in a variety of settings at a cost of about \$50 per test, if provided at high volumes. Because of large capital costs, the unit costs of screening mammography are sensitive to patient volume. When 30 to 40 tests are performed each day, costs fall below \$50 per test. At volume levels of 5 to 15 tests per day, unit costs are twice as high.
- o At a payment of \$50, screening mammography will not be economically viable for most individual primary care physicians to provide. While primary care physicians can provide good quality service, they cannot do so as efficiently as other providers, such as radiology practices, hospital outpatient departments, large group practices, and freestanding centers.
- o In rural areas of low population density, achieving efficient volume may be more difficult, so that a payment of \$60 may be needed to provide access to screening similar to the access available in more populated areas.
- o The quality of screening mammography must be high in order for the test to be useful. Tests of high quality can feasibly be provided in all of the care settings listed above, provided that qualified personnel, high-quality equipment, and correct procedures are used.
- o Historically, screening mammography has not been used by most women. The new Medicare mammography benefit will result in an increase in the use of screening mammography, and is also likely to substantially increase the number of locations offering screening mammography. However, for a variety of reasons women may be reluctant to obtain the test outside of their own physician's office. Utilization should be monitored in the early years of implementation to determine if additional steps should be taken to increase utilization.

CHARGES FOR SCREENING MAMMOGRAPHY

A starting point for the analysis was to examine data on charges for screening mammography to establish the likely maximum range of costs. Unfortunately, there are few data available on the current charges for screening mammography.³ For most medical services, claims records provide data on the site of a service and the charges associated with it. However, screening mammography has not been covered by Medicare or by most other insurers, so claims data are sparse. Additionally, the CPT coding system that is used by providers to identify services does not distinguish between diagnostic and screening mammography. This precludes efforts to identify and analyze claims for screening mammography, even when claims records are available.

The available data on charges for diagnostic mammography, from surveys and claim forms, provide a likely range for the actual charges for a mixture of screening and diagnostic mammography. Nonetheless, the data are analytically useful because screening mammography has lower costs than diagnostic mammography. Therefore, the range of current charges can be used to establish a maximum upper bound for screening charges.

Claims data for Part B for 1986 indicate that the average allowed charge for mammography⁴ was \$73.07. In the literature, the price of a mammogram is said to range between the extremes of \$25 to \$250, with the average somewhere between \$100 and \$125. This range includes both screening and diagnostic mammograms. (Dodd, 1987; Stelling, 1988; Silberner, 1988)

The current average price for screening mammograms is lower, typically ranging between \$35-\$75, with a reported low of \$27 (McCue, 1987; Stelling, 1988; Moskowitz, 1987; Hess, 1988; Bird, 1989; Sickles, Weber, Galvin, et al., 1986). A survey⁵ of 125 randomly selected sites around the country that offered mammography found that where centers did not differentiate between screening and diagnostic mammography (N=82) the average charge was \$103. At centers where screening and diagnostic mammography were differentiated, the average charge for screening (N=43) was \$53, and the average charge for diagnostic (N=34) was \$113.⁶

In summary, the available information shows a wide variation in charges, and a significant difference between the prices of screening and diagnostic mammography. Screening

³ A soon-to-be completed GAO study is expected to provide data on mammography charges in different sites of service.

⁴ The fee covers both the physician's interpretation and the cost of the nonphysician technical inputs (e.g., equipment, radiologic technician).

⁵ PPRC telephone survey in May 1989.

⁶ Further, the appearance of low cost mammography in an area may encourage the introduction of additional low cost mammography in neighboring areas (Bassett, 1989; Sickles, Weber, Galvin et al., 1987), so the recent introduction of such services may lead to continued reductions in charges as the number of screening sites increases.

mammography is often one-half the price of diagnostic mammography and, according to the PPRC survey, is being offered for about \$50 in many areas. However, charge data are not necessarily indicative of the true resource costs of mammographic screening, which are addressed in the next section.

COSTS OF SCREENING MAMMOGRAPHY

The resource costs of screening and diagnostic mammography are different, reflecting differences in the services provided (Dodd, 1987; Strax, 1987). Screening mammography is a bilateral 4-view procedure, intended to screen large numbers of asymptomatic patients and identify those who may need additional diagnostic work. This is different from a diagnostic mammogram, which is ordered to confirm or to locate and characterize an anomaly, and may include additional views, magnification, or physical examination. In typical practice, a radiologist might spend substantial amounts of time evaluating a diagnostic mammogram. However, since its purpose is different, and the probability of detecting an anomaly in any given screening examination is low, it would be inefficient to treat each screening exam in the same way as a diagnostic examination.

This section provides estimates of the costs of screening mammography, and examines the relationship of cost to the volume of mammograms provided in different settings. It begins with a presentation of a baseline cost model for screening mammography, continues with a sensitivity analysis and an analysis of geographic cost variation, and concludes with a qualitative discussion of testing costs in some non-dedicated settings (settings, such as radiology practices that provide services other than screening mammography).

Baseline Cost Model

The cost analysis presented below follows the methodology outlined in "Payment for Diagnostic Services with a Substantial Nonphysician Component," Chapter 11 of the 1988 PPRC Annual Report. Input costs of the resources required to perform screening mammography are estimated, and the unit cost of a screening mammogram is determined for different volume levels and under varying assumptions (e.g., different interest rates and labor costs).

The purpose of the cost analysis is to establish a reasonable range of costs that will include the true cost of providing the service in virtually all cases. In general, the BASELINE assumptions are selected because they lie in the middle of a reported range for a cost item. Because a particular cost value depends on the assumptions that are made for estimating unit costs, a sensitivity analysis was performed to show how the estimated costs depend on those assumptions.

The BASELINE analysis estimates the costs of an efficient, streamlined approach to screening that uses batch processing and interpretation of tests. That is: mammograms are developed and read in a batch process at the end of each day; the primary care

physician receives a standardized report of the findings, particularly if they are normal; mammograms are read primarily to determine if an anomaly is present, with further tests often required to characterize it precisely; and many centers try to schedule appointments so that a constant patient flow is assured and they often require full payment at the time of the test to avoid billing costs. This is thought to be the least expensive way to provide high-quality services. Some screening sites may use less streamlined procedures, with likely reductions in efficiency. Qualitative comparisons are made below to other methods of operating a screening service.

Each of the cost tables presents a breakdown of the input costs of mammography. The costs are split into four categories: Capital Outlays, Fixed Monthly Costs, Semi-Fixed Costs, and Variable Costs. Total capital costs are determined and calculated on a monthly basis. Fixed monthly costs, such as rent, insurance, and accounting costs, are incurred monthly or continuously, and are independent of service volume. Semi-fixed costs (i.e., salaries and benefits) are similar to monthly costs but staffing levels are dependent on volume, so these costs are reported separately. Finally, variable costs such as film, supplies, and the physician's fee are listed last.

The cost components identified in the cost breakdowns (Tables 1-8) are drawn primarily from the examples in the literature.⁷ While the published reports appear to provide an accurate catalog of the inputs needed to provide screening mammography, the published data on the costs of these inputs may not fully express the geographic variation in the costs of some inputs and the uncertainty of some cost estimates. Therefore, additional data have been obtained on the major cost components of the service, such as the cost of purchasing the mammography unit, rent, and technicians' salaries. These costs (for which additional data have been obtained) amount to roughly two-thirds to three-quarters of total costs, and are either fixed (capital cost, rent) or semi-fixed (salary). The costs for other inputs are either relatively small, or are unlikely to vary substantially by setting or geographic location. The strictly variable costs of the examination, such as film and supplies, make up only a small fraction of total costs.

The initial capital outlays documented by Bird (1987) total \$110,000, with \$84,000 allocated to the purchase of a mammography unit and processor and the remainder allocated to furniture, other equipment, and the cost of leasehold improvements. The Bird estimate of the cost of the mammography unit and processor is slightly higher than the list price reported by major suppliers of mammography units⁸ and is also generally higher than that

⁷ Primary sources for needed inputs are Bird and McLelland (1986); Bird (1989); Sickles, Weber, Galvin et al. (1986); Holden, Jackson and Ehrman (1987); and Ware (1989).

⁸ Data obtained from a 1989 PPRC survey of equipment manufacturers and discussions with suppliers of screening services. Additionally, it is reasonable to assume that actual purchase price is from 5 to 10 percent less than list price.

obtained in PPRC's Survey of Physicians.⁹ Since two independent data sources found lower costs, the BASELINE model uses a capital cost estimate of \$80,000 instead of \$84,000. Manufacturers and others report an expected machine lifetime between 5 to 10 years or more.¹⁰ Other capital costs such as leasehold improvements (e.g., constructing partitions, modification of wiring) are assumed to last at least 5 years and may actually last indefinitely. Capital costs are amortized over a 6 year period at an assumed interest rate of 12 percent per year.

Data on the salaries of radiological technologists are limited. Reports in the literature indicate that annual salaries ranged from \$18,000 to \$19,000 (Bird and McLelland (1986); Bird (1989)) to about \$30,000 (Sickles, Weber, Galvin et al. (1986)) in 1987. Survey data on this are imprecise, but imply a salary range from a low of \$14,000 to a high of \$32,000 with a mean between \$18-25,000 (1988 National Survey of Hospital and Medical School Salaries). The BASELINE model assumes a salary of \$25,000 per year and a fringe benefit rate of 15 percent.¹¹ Further, it is assumed that one technician is sufficient for a volume of up to 10 tests per day, two technicians for up to 30 tests per day, and three technicians for up to 60 tests per day.¹² This probably underestimates actual productivity of technicians and also implies higher productivity at higher volume levels.

The radiological technologists will be supported by a clerk/receptionist who will handle billing, appointments, and the forwarding of results to primary care physicians. The salary and benefits of the clerk/receptionist are assumed to be \$18,000 per year.

Office space rental costs are based on the assumption that a mammography screening service will require between 600 and 800 square feet of space (Bird and McLelland, (1988)).¹³ According to a survey by the Building Owners and Managers Association (1988), the national mean cost of office space in medical office buildings in 1987 was approximately \$1.23 per square foot per month. Costs may range as high as \$3.00 per square foot per month (\$36 per square foot per year) in some areas. The BASELINE model assumes 700 square feet (the midpoint of the range cited above) rented at the national mean cost.

⁹ The PPRC physician survey questionnaire and the reports by the manufacturers are not directly comparable since machine specifications and exact date of purchase are unknown. However, the mean reported cost of the unit (\$64,739) in the physician survey appears to be on the order of at least \$5,000 less than the amount used by Bird (1987) to calculate unit costs.

¹⁰ Data from PPRC survey of manufacturers of diagnostic equipment, PPRC Survey of Physicians, and anecdotal reports.

¹¹ The PPRC Survey of Physicians indicates that fringe rates for medical office personnel range between 10 and 20 percent of salary.

¹² In the screening setting, it is assumed that technicians will be responsible for scheduling as well as performing the examination.

¹³ In a physician's office or radiologist's office, space requirements would be reduced, perhaps 300 square feet or less, because office and waiting areas would be part of the overall practice. Thus, if the service is provided in a preexisting office-based practice, costs could be 5-10 percent lower than in a freestanding center (BASELINE case).

Costs for maintenance, promotion, accounting, insurance (includes a portion for liability insurance), film, telephone, and report forms are taken directly from the literature. These costs comprise only 10 percent of total costs.

The physician fee of \$12.00 was selected because there is some disagreement in the literature on the proper level of compensation and only minimal discussion on the amount of time that is required to interpret the screening procedure. Nonetheless, in order to provide a conservative estimate, \$12 was selected because it exceeds the professional fee levels cited by both Bird and Sickles.

This compensation level can also be assessed by comparison to the \$73 allowed by Medicare in 1986 for the diagnostic service, a much more involved procedure. The technical costs of screening mammography (at a volume of 30 tests, BASELINE) are estimated to be \$27. However, since diagnostic mammography requires additional views and magnification, an estimate of technical costs of between \$40 to \$50 is not unreasonable. Subtracting this amount from the \$73 allowed for the procedure leaves an implied professional fee in the \$20-30 range. In comparison, \$12 seems reasonable for the screening service. Another check is to calculate the expected hourly rate of compensation for providing the service. If, for example, 20 mammograms (Sickles, Weber, Galvin et al. (1986); Bird and McLelland (1986)) are interpreted in an hour, the total compensation would be \$240, which is probably adequate payment.

Tables 1 and 2 present the BASELINE analysis of the costs of providing screening mammography in stationary and mobile settings. All calculations assume a 20 day working month, and roughly 8 hours per day available to conduct screening examinations.

According to Table 1, the unit costs of mammography screening range from \$107 at 5 exams per day to \$34 at 50 exams per day. At low volume levels, fixed costs (i.e., equipment, rent) make up a larger portion of the costs of each exam. At higher volumes, the fixed costs are spread over more tests, and are much smaller per exam. Both Table 1 and Table 2 show that at volumes near 20 mammograms per day,¹⁴ providers are able to cover all costs at a \$50 payment level. It is clear from these tables that maintaining sufficient volume is critical to the provision of low cost screening mammography.

Sensitivity Analysis

The purpose of the sensitivity analysis is to test the impact on unit costs if key input cost assumptions are changed. This enables us to determine whether the conclusions of the analysis would be different if the underlying assumptions about costs were different. Therefore, in addition to the BASELINE model above, this section presents a HIGH option that assumes that the BASELINE underestimates input costs and a LOW option

¹⁴ This rate is approximately equal to 3 examinations per hour.

that assumes that the BASELINE option overestimates input costs. By examining all three options for a particular setting, a likely range of actual costs can be established, and the overall sensitivity of the estimates to changes in costs or assumptions can be evaluated. If the LOW and HIGH versions provide very different estimates, then the cost assumptions are shown to have great importance. The larger the difference, the more cautiously the BASELINE should be interpreted. On the other hand, if all three estimates are below a level of \$50 at a particular volume, it can be safely assumed that actual costs will be below \$50.

The assumptions for the HIGH option that differ from the BASELINE are as follows: (1) Capital outlay for the mammography unit is assumed to be \$90,000 instead of \$80,000; (2) Technicians' salaries are assumed to be \$35,000 a year, with a 20 percent fringe benefit rate; (3) Clerk/receptionist salary is assumed to be \$19,000 per year; (4) Office space is assumed to be 800 rather than 700 square feet at a cost of \$3.00 per square foot per month; and, (5) Capital costs are amortized over 5 years at an interest rate of 14 percent.

The assumptions for the LOW option are as follows: (1) Capital outlay for the mammography unit is assumed to be \$78,000; (2) Technicians' salaries are assumed to be \$25,000 per year with a 10 percent fringe benefit rate; (3) One technician is assumed to be sufficient for up to 15 examinations, two technicians for up to 30 examinations, and three for up to 60 examinations; (4) Clerk/receptionist salary is assumed to be \$16,000 per year; (5) Office space is assumed to be 600 square feet at a cost of \$1.00 per square foot per month; and (6) Capital outlays are amortized over 7 years at an interest rate of 10 percent.

Tables 3-6 below present the HIGH and LOW options for mobile and stationary facilities. A comparison of unit cost at identical volume levels shows the significant impact of changing cost assumptions.¹⁵ For example, Tables 3 and 5 show the cost breakdowns for the stationary setting, HIGH and LOW cases. At a volume level of 20 exams per day, the unit cost of a mammogram is \$45.60 under LOW cost assumptions and \$61.51 under HIGH cost assumptions. However, at 40 tests per day, both stationary models have costs below \$50 per test.

The mobile setting is more sensitive to cost assumptions because the estimated capital costs are larger and there is still a wide range of estimates for the cost of purchasing and equipping a mobile mammography van. As the mobile mammography process becomes more widespread, prices and equipment may become more standardized. Comparing Tables 4 and 6, again assuming 20 exams per day, the unit costs are \$64.06 and \$48.05 for mobile and stationary settings, respectively. At a volume level of 40 tests per day, both mobile models have costs below \$50 per test (see BASELINE model).

¹⁵ Volume levels are held constant in this example for analytical purposes. However, it has already been established that volume plays a critical role in the determination of the economic feasibility of low cost screening.

While the range of the costs is fairly large, these scenarios are intended to cover a wide range of reasonable possibilities to ensure that the actual cost is somewhere within the range. All of the models show that at a volume of 40 or more tests per day, unit costs fall below \$50. Some options show costs below \$50 for as few as 10 to 15 tests per day. Additionally, if the test is done at an existing office, in which a part-time technologist is hired, lower rent and salary costs may make the procedure economically feasible in the 5 to 10 tests per day range.

It has been demonstrated that 40 tests per day is a feasible volume level for a dedicated service offered to both mobile and stationary settings (Bird, 1989; Sickles, Weber, Galvin et al., 1986; Hess, 1988). However, it may be more realistic to assume that breakdowns, holidays, etc., will lower the actual average volume somewhat. Even in that case, it appears that a \$50 rate would be sufficient (see Tables 1 and 9).

One issue not directly addressed by the sensitivity analysis is the change in input costs over time. The analysis in this report uses input price data from 1987, 1988, and 1989, but the benefit will be implemented in 1990. In the interim, it is likely that some input prices, such as salaries, will increase. On the other hand, the cost of capital required may decrease if, for example, technology continues to improve or interest rates fall. Since it is impossible to predict future input prices, a prospective adjustment cannot be made, but costs should be assessed after the benefit's first year to determine if an adjustment is warranted.

Geographic Variation in Costs

Some cost components, most notably rent and technicians' salaries, are known to vary by geographic area. It is assumed that other costs such as film, supplies, and the cost of the mammography unit, do not vary by region. Costs such as maintenance, promotion,¹⁶ accounting, insurance, and cost of leasehold improvements are also likely to vary by region, but the extent of their variation is unknown. Finally, the amount allocated to pay for the physician interpretation is assumed to be the same for all areas. This is consistent with the Commission's recommendation concerning paying the same fee for the professional component of a service regardless of local economic conditions.¹⁷

Using the assumptions of the BASELINE model as a starting point, additional prototypical models to show geographic cost differences have been calculated, making relatively high cost assumptions to show the likely extremes of geographic variation in costs. The model for highly "URBAN" areas (Table 7) assumes the following: (1) Rent of \$3.33 per square

¹⁶ Medicare does not generally pay for promotional expenses. However, given current low compliance rates, it may be appropriate to allow for this expense to encourage the use of widespread screening. This may be particularly important in rural areas with dispersed populations which will need advance notification of the day of the visit of a mobile facility.

¹⁷ In its 1989 report PPRC recommended that "Payments under the Medicare Fee Schedule should vary from one geographic locality to another to reflect variations in physicians' costs of practice. The cost-of-practice index underlying the geographic multiplier should reflect variation only in the prices of nonphysician inputs."

foot per month, for 250 square feet (the space requirements are assumed to be smaller because it seems likely that screening facilities will be affiliated with existing practices in high cost urban areas where space costs often drive siting decisions); (2) Technicians' salaries of \$35,000 per year, and; (3) 10 percent higher than BASELINE costs for insurance and 25 percent higher costs for leasehold improvements. The model for RURAL areas (Table 8) assumes (1) Use of a mobile facility; (2) Technicians' salaries of \$25,000 per year; (3) Clerk/receptionist salary of \$15,000 per year; and (4) Doubled costs for maintenance, promotion, and gasoline.

Costs that vary geographically account for about one-third of monthly costs in the BASELINE model, so geographic differences have the potential to significantly alter unit costs. At 15 tests per day, RURAL costs are estimated at \$65.09 per test, \$1.49 more than URBAN costs. Both URBAN and RURAL results are higher than the stationary BASELINE value of \$57.42. At 40 tests per day, URBAN and RURAL are nearly equal at \$40.99 and \$40.83 respectively. This convergence is due to the amortization of the higher RURAL capital costs over a larger number of tests.

The impact of the geographic variation in costs as measured against the BASELINE model is somewhat less than that seen in the comparison of the HIGH-LOW models in the previous section because capital costs are assumed to be constant, and because rural and urban costs for different inputs do not vary in a consistent direction. That is, some urban costs may be higher than rural costs, but others are lower.

Nonetheless, there is a concern that a uniform payment level may be too low in rural areas because it may be difficult to consistently provide even as many as 20 tests per day, even using a mobile van. This may prevent the extension of the service into isolated areas with low population density. Overall, rural costs are roughly the same as urban costs, but expected volume is an important determinant of economic feasibility. This issue is discussed further below.

Non-Dedicated Settings

The analysis in this report assumes the use of a dedicated, streamlined, screening mammography process. However, mammography could be offered in other settings without reductions in efficiency. One typical setting would be in a radiology practice, where mammography would be one of many tests performed. Nonphysician costs would probably be lower in such a setting because all scheduling, recordkeeping and other administration would be centralized, waiting areas would be shared, and maintenance and other technical costs would be spread over a larger staff and more equipment.

On the other hand, by forgoing batch processing and interpretation, providers will most likely incur slightly higher developing costs, and perhaps significantly higher interpretation costs. When a mammogram is evaluated at the same time it is taken, the interpreting physician is generally called away from another activity, and will probably use more time than is needed for strictly screening for an abnormality. This increases the physician costs

of providing the test, even though nonphysician costs may be lower. According to some sources, a radiologist with mammography experience can read, for screening purposes, up to 1 test per 1 to 2 minutes (Sickles, Weber, Galvin, et al., 1986; Bird and McLelland, 1986). This rate would easily allow for 20 films to be evaluated in one hour.

Mammography might also be offered in primary care settings ranging from large group practices to solo physicians' offices. It would be more economical to offer the service in group practices or shared facilities in medical office complexes than in a solo practitioner's office, since high volume could more easily be maintained. Additionally, a busy practice could more easily distribute costs such as maintenance, accounting, and space, and could probably offer more flexibility in scheduling, since technicians would be available full-time.

Depending on the setting, primary care providers could also offer concurrent evaluation if a radiologist or other qualified physician is available to interpret the x-ray. Concurrent evaluation would reduce patient time and travel costs. If concurrent evaluation is not available, these settings would need to use batch processing and contract with a consulting radiologist for interpretation. If additional tests are indicated, they would almost certainly be performed by a radiologist.

Screening mammography can feasibly be provided in non-dedicated settings. In each setting, the unit cost and quality will depend on the characteristics of the practice, the management ability of the physician, and the resources allocated to the service. In some non-dedicated settings, such as radiology practices, it is likely that high quality services could be offered for about the same amount paid for freestanding screening centers while also offering concurrent evaluation of results. In other settings, high quality could be maintained, but low volumes would result in significantly higher unit costs.

QUALITY AND COMPLIANCE IN A SCREENING MAMMOGRAPHY PROGRAM

The use of mammographic screening to reduce breast cancer morbidity and premature mortality depends on the quality of the exam and followup care, and the likelihood that women will use the service.¹⁸ Without good quality care and widespread compliance, the value of the new mammography screening benefit will fall short of its potential.

Some observers suggest that there may be a strong relationship between the technical quality of the exam, the patient's personal rapport with the provider, convenience, comfort and patient compliance. For example, the more comfortable and convenient the setting,¹⁹ the more likely that patients will have the test performed. Additionally, patients may perceive that dedicated screening centers, which will be somewhat less convenient and

¹⁸ Typically, the percent of eligible patients who use a service is called the compliance rate.

¹⁹ Comfort and convenience are not necessary for technical quality, but are included in the broadest definition of quality.

comfortable than their primary physician's office, will provide lower quality care. This perception may discourage compliance, even though in reality convenience and comfort are not related to technical quality. Because use of screening mammography has been so limited in the past, it is difficult to predict the ultimate impact of these possible perceptions on patients' behavior.

This section will review the issues of quality of care and compliance, and will also discuss the interaction between perceived quality and compliance.

Quality

The quality of the screening mammogram is important for the same reasons that apply to any diagnostic test. Early detection of breast cancer is crucial for successful outcomes, and false negative results may cause tragic situations. Additionally, a false-positive must be followed-up, generating additional costs, discomfort, inconvenience and anxiety on the part of the patient. Access to mammography services, if they are of low quality, does not help the patient, and may instead be counterproductive and costly. GAO will soon issue a comprehensive report on the quality of screening mammography. However, this section will briefly discuss some quality concerns as they relate to volume and setting.

The abilities of the interpreting and supervising physician, the skill of the technician administering the test, the quality and condition of supplies and equipment used to perform the service, and the availability of a baseline mammogram for purposes of comparison with each new test are all factors that contribute to the technical quality of the test. These factors can be compared from setting to setting to make a preliminary assessment of service quality.

The cost analysis above is based on the assumption that screening mammography will be provided in settings that are designed to maximize the efficiency of service delivery to large numbers of patients. Some policymakers have expressed concern that such settings may be of lower quality than low-volume settings, or settings such as the primary care physician's office. This section will compare the characteristics of services offered in these different settings.

There is no indication that technical quality differs between a radiology practice and a screening center. First, successful high-quality screening at streamlined screening centers has been reported in the literature. Second, screening centers can use the same equipment, technicians, and radiologists as radiology practices to perform key functions of the test and are often located near a radiology practice. The test results can then be forwarded to the primary care physician. The result is that quality can easily be maintained even if patient volume is high.

An important difference between a screening center and a regular radiology practice is that the center is geared to perform only one function, while the radiology practice must perform many. The process of mass screening is different than the process required for

diagnosis and characterization. In a typical lower volume setting,²⁰ exams are often read as they are performed. If the exam is being provided in a radiologist's office, additional tests might be performed at the same time if the exam revealed an anomaly, reducing the need for patient travel and delay in obtaining a definitive diagnosis. In this setting, a certified technician and trained radiologist will generally be available, and presumably, quality in such settings would be high. Radiology practices can support a high volume screening program together with a diagnostic mammography program.

There may be differences in technical quality between a screening center and a primary care physician's office. The provision of screening mammography in primary care settings creates unique problems for physicians offering the test. For example, if the physician has hired a certified radiologic technician, the technician will either sit idle for much of the time, or will be required to perform other tasks, which would be an inefficient use of the technician's time. Additionally, if performing x-ray mammograms is not the primary function of the technician, quality may be affected (Homer, 1985).²¹ Unless regulations require the use of certified technicians, some physicians could employ less-skilled personnel to perform the test.

Additionally, most primary care physicians are not qualified to read mammographies without additional training. Therefore, it will be necessary to develop quality guidelines that will ensure that only physicians with demonstrated ability will interpret screening mammograms. However, qualifications should be determined by competency-based criteria that are developed by the medical profession, rather than by any specific regulatory requirements that are externally imposed.

On the other hand, it is possible that "nontechnical" quality (convenience, comfort) may be higher at the primary care office, which is familiar to the patient. However, the physicians in charge of screening centers have strong incentives to provide high quality service, and to employ skilled and considerate technicians. These incentives include professional ethics, liability risks and competitive pressures. Additionally, referring physicians would be more likely to send their patients to centers whose quality is known or that are managed by radiologists to whom they normally refer patients.

The language of the Catastrophic Coverage Act is written in a way that will allow regulations that place the responsibility for quality determination with the medical profession. The Act requires that "mammography must be performed by an individual who--(i) is licensed by a state to perform radiological procedures, or (ii) is certified as qualified to perform radiological procedures by such an appropriate organization as the

²⁰ A typical lower volume setting might be either a radiology practice or a medical group. The distinguishing feature of these settings is that they may not streamline the testing process as is done in a screening center and as is assumed in the cost analysis above.

²¹ This does not preclude the use of part-time radiologic technicians, which would reduce salary costs, but would also complicate office visit scheduling.

Secretary specifies in regulations; [and] the results of mammography must be interpreted by a physician--(i) who is certified as qualified to interpret radiological procedures by such an appropriate board as the Secretary specifies in regulations, or (ii) who is certified as qualified to interpret screening mammography procedures by such a program as the Secretary recognizes in regulation as assuring the qualifications of the individual with respect to such interpretation."²² HCFA has not yet issued the proposed regulations that define the exact requirements.

By their nature, these requirements may de facto restrict mammography to a limited number of higher-volume settings, radiology practices, and to very few primary care physicians, regardless of payment levels. It should be pointed out that the Act does not preclude qualified primary care physicians from providing screening mammography. If the test is performed on high-quality, well-maintained equipment, administered by a certified radiological technologist, and interpreted by a qualified physician, quality can be as high as in other settings. Some primary care physicians may even be able to cover the costs of the service at fairly low volumes, depending on the specifics of the practice setting, and will be able to maximize patients' convenience and comfort. However, it will probably be more difficult for the primary care physician to provide a high quality, low-cost exam than for either radiology practices or screening centers.

Compliance

The main advantage to providing mammography in primary care physician offices is that access would be made easier and more comfortable. It has been asserted that many women will be reluctant to travel to the locations where high-volume screening is available, both because of the burden of traveling and general reluctance to have a mammogram done by someone other than the primary care physician. While both of these points may be true to some extent, the historically cited reasons for low compliance with screening recommendations are high cost (Sickles, Weber, Galvin et al., 1986; Stelling, 1988; Dodd, Fink, and Bertram, 1987), and the failure of primary care physicians to encourage their patients to obtain mammograms (Fox, et al., 1985; Dodd, 1987).²³ If patients are not educated by their physicians and encouraged to take the test, they cannot even make the choice of whether or not to be tested.

There is no empirical evidence to suggest that convenience must be the critical controlling variable. Once the cost barrier is reduced, if physicians recommend having a screening examination, their patients may no longer be reluctant to travel a reasonable distance to obtain it. Additionally, with the creation of the Medicare benefit, screening mammography will probably become available in more locations, making travel somewhat less of a barrier to access (McLelland, 1987; Sickles, Weber, Galvin et al., 1987).

²² In short, the legislative language implies that either board-certified radiologists or physicians who are accredited by a special certification program will be eligible to receive payment for screening mammograms.

²³ Some physicians have pointed out that the expense of the test made them reluctant to recommend it to their patients.

An example of the success of the screening center approach has been reported by Sickles, et al., in San Francisco. Their mobile screening service encouraged new patients to obtain a mammogram, rather than simply drawing patients from other sites. Ninety-three percent of their clients had not had a mammogram before (Sickles, 1988), and the average age was 50, with many women over 65 using the service (Sickles, personal communication, 1988). Thus, reduced prices²⁴ and mobile services increased access to the exam.

Still, even with reduced cost and greater convenience, some women may continue to be reluctant to travel even a short distance to obtain a test. For beneficiaries with a primary care physician, this should not be a significant problem since the physician is likely to have an established relationship with a local radiology practice, and will be able to encourage compliance. As with many other services, the greatest danger is to the uninformed beneficiary lacking a primary care physician to encourage the use of preventive services (Makuc, 1989). Efforts should be made to bring such patients into the mainstream of the health care system, to reach them with mobile services, or at least to inform them of the current recommendations on screening mammography.

After the mammography benefit takes effect, it will probably take several years for the system to respond and develop the needed capacity to provide all necessary screening for beneficiaries and others. In this interim period, it should be possible (particularly if CPT adopts the recommendation to add a new code for screening mammography) to monitor access to screening to determine if compliance has reached high levels. If it has not, steps can be taken to encourage physicians and patients to use the service and, if necessary, to increase the accessibility of the service.

Summary

Both quality and compliance are important in enhancing the role of mammography in the reduction of breast cancer morbidity and mortality. Whether or not the screening examination is offered by the primary care physician, the primary care physician will play an important role in reducing breast cancer mortality by encouraging screening and by educating patients. However, the primary care physician may not be in the best position to offer high quality exams at reasonable cost. Efficiently-run screening centers should be able to fill this need without greatly inconveniencing patients.

On the other hand, the best provider of patient education and instruction is the primary care physician, where the doctor-patient relationship will lend strength to the physician's recommendations. The catastrophic legislation recognizes the importance of continuity of care by requiring that the results of the baseline mammogram be "placed in permanent medical records maintained with respect to the woman." (Section 204 (b) (3) (D)) The

²⁴ Sickles' mobile screening van charged \$40, which was paid by patients at the time of service. The coinsurance for a \$50 mammogram would be \$10.

primary care physician is also most familiar with the patient, and will be more likely to detect gross physical changes if they occur.

Screening mammography need not be offered by primary care physicians in order to be an effective tool. Of course, if qualified primary care physicians offer screening mammography in their own offices, continuity of care is ensured and convenience is maximized. However, greater convenience without ensured quality will not benefit Medicare patients.

POLICY DISCUSSION AND RECOMMENDATIONS

PPRC was directed to report on the cost of providing screening mammography in different settings and at different volume levels. The cost analysis was performed to establish the likely range of the resource costs of screening mammography. This section will discuss the adequacy of the proposed payment level, the adequacy of payments for screening by primary care physicians, and the adequacy of payments for rural areas.

Adequacy of Payment Level

The BASELINE cost analysis shows that at a rate between 15 and 20 exams per day, \$50 is sufficient payment. Under HIGH cost assumptions, at least 40 exams per day would have to be done to cover costs. The expectation of this level of volume under both BASELINE and HIGH assumptions implies that mammography screening would be economically feasible primarily at mobile clinics, screening centers, hospital outpatient departments, neighborhood health centers, large group practices, radiology practices and in shared facilities in medical office buildings.

Table 9 summarizes the findings of all of the individual cost analyses. Solo practitioners and small groups would probably not be able to generate sufficient volume to cover costs. Even under the LOW option, where costs may be low enough for the service to be offered in lower-volume settings, it is unlikely that performing one or two exams per day would be economically viable.

As discussed above, the geographic variation in the input costs (see Tables 7 and 8) of mammography screening results in a very small range of unit costs (assuming a level of 30 examinations per day) because of the relatively large capital costs, which are assumed to be constant across areas. Therefore, geographic adjustment for nonphysician costs would be expected to produce only small differences in payment levels. However, given the existence of known differences in input costs, adopting a geographic adjustment for the nonphysician costs of providing screening mammography would be consistent with the PPRC recommendation for geographic multipliers in a Medicare Fee Schedule.

Adequacy of Payment Level for Primary Care Physicians

Screening mammograms in low-volume settings (primary care settings) are likely to be more expensive and less efficiently done than in other settings. Table 1 shows unit costs for screening mammography of \$107 at a volume level of 5 per day, which is actually a higher volume than most primary care physicians would probably perform. At lower volumes, costs would be even higher. However, it should be noted that by using part-time staff and sharing equipment, unit costs could be reduced somewhat below the levels shown in Table 1.

Given that a streamlined high-volume process can provide widespread access to high-quality²⁵ screening mammography, while primary care physicians may not be able to provide equivalent service, the Commission does not recommend payment of higher fees that will provide additional compensation for physicians for providing the service in very low-volume settings.

Adequacy of Payment Level for Rural Areas

Mobile van services have been successful in providing mammography and other diagnostic testing services in rural areas (McCue, 1987; Hess, 1988). Vans often make regular appearances in different localities and appointment schedules are arranged in advance. However, in order to keep volume high enough to pay for screening in rural areas at a \$50 payment rate, local physicians must encourage their patients to schedule screening appointments in advance. This may require additional expenditures on promotional campaigns, as well as taking extra time to ensure that appointments are kept.

Other factors may also contribute to higher input costs in rural areas. As was shown above, the costs of the mobile screening setting are somewhat higher than the costs for stationary centers. Additionally, in areas with very low population density, gasoline costs may be much higher, because of the need to travel longer distances on a daily basis. Other costs, such as equipment maintenance, vehicle maintenance, and technicians' salaries may be higher because of greater wear and tear and the difficulty in recruiting skilled personnel to remote areas.

Finally, the importance of maintaining high volume may restrict access to the service in isolated areas with very low population density. Since it would be difficult or impossible for a rural screening van to maintain a volume in the range of 30 to 40 tests per day, the Commission favors increasing the payment for screening mammography in rural areas of low population density to \$60 per test, in order to ensure that screening will reach those populations.

²⁵ GAO will report comprehensively on quality issues. However, it is certainly feasible and practical to provide high quality service in high volume settings.

TABLES

**Table 1. Monthly and Unit Costs of Providing Screening Mammography Services
Stationary Setting/BASELINE Case**

		TESTS PER DAY						
		5	10	15	20	30	40	50
Capital Outlays								
Mammography Unit and Processor	\$80,000							
Start-up Supplies	2,000							
Leasehold Improvements	15,000							
Furniture	5,000							
Office Equipment	3,500							
Miscellaneous	500							
Subtotal of Capital Costs	\$106,000							
Amortized Monthly Cost 6 years, 12% per year		\$2,072	\$2,072	\$2,072	\$2,072	\$2,072	\$2,072	\$2,072
Fixed Monthly Costs								
Maintenance	425							
Promotion	250							
Accounting	100							
Insurance	100							
Rent	875							
Telephone	100							
Taxes	750							
Subtotal fixed monthly	\$2,600	\$2,600	\$2,600	\$2,600	\$2,600	\$2,600	\$2,600	\$2,600
Semi-Fixed Costs								
Radiological Technologist Salary	2,100	2,100	2,100	4,200	4,200	\$8,300	\$8,300	\$8,300
Benefits	315	315	315	630	630	990	990	990
Clerk/Receptionist Salary	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300
Benefits	200	200	200	200	200	200	200	200
Variable Costs per Exam								
Film	\$3.00	\$300	\$600	\$900	\$1,200	\$1,800	\$2,400	\$3,000
Medical Records	2.00	200	400	800	800	1,200	1,600	2,000
Other Supplies	1.00	100	200	300	400	600	800	1,000
Miscellaneous	1.00	100	200	300	400	600	800	1,000
Postage	1.00	100	200	300	400	600	800	1,000
Forms	0.75	75	150	225	300	450	600	750
Total Monthly Costs		\$9,482	\$10,337	\$13,627	\$14,502	\$18,712	\$20,482	\$22,212
Nonphysician Cost per Exam		94.62	51.69	45.42	36.26	31.19	25.58	22.21
Physician Fee		12.00	12.00	12.00	12.00	12.00	12.00	12.00
Total Unit Cost		\$106.62	\$83.69	\$57.42	\$48.26	\$43.19	\$37.58	\$34.21

**Table 2. Monthly and Unit Costs of Providing Screening Mammography Services
Mobile Setting/BASELINE Case**

		TESTS PER DAY							
		5	10	15	20	30	40	50	
Capital Outlays									
Mammography Unit and Processor	}	\$175,000							
Mobile Unit and Installation									
Furniture									
Office Equipment		3,500							
Miscellaneous		500							
Start-up Supplies		2,000							
Subtotal of Capital Costs		\$181,000							
Amortized Monthly Cost			\$3,538	\$3,538	\$3,538	\$3,538	\$3,538	\$3,538	
6 years, 12% per year									
Fixed Monthly Costs									
Maintenance		\$875							
Promotion		250							
Accounting		100							
Insurance		125							
Gasoline		400							
Telephone		100							
Taxes		750							
Subtotal fixed monthly		\$2,375	\$2,375	\$2,375	\$2,375	\$2,375	\$2,375	\$2,375	
Semi-Fixed Costs									
Radiological Technologist Salary		2,100	2,100	2,100	4,200	4,200	\$8,600	\$8,600	\$8,600
Benefits		315	315	315	630	630	990	990	990
Clerk/Receptionist Salary		1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300
Benefits		200	200	200	200	200	200	200	200
Variable Costs per Exam									
Film		\$3.00	\$300	\$600	\$800	\$1,200	\$1,800	\$2,400	\$3,000
Medical Records		2.00	200	400	600	600	1,200	1,600	2,000
Other Supplies		1.00	100	200	300	400	600	800	1,000
Miscellaneous		1.00	100	200	300	400	600	800	1,000
Postage		1.00	100	200	300	400	800	800	1,000
Forms		0.75	75	150	225	300	450	600	750
Total Monthly Costs		\$10,703	\$11,578	\$14,868	\$15,743	\$20,253	\$22,003	\$23,753	
Nonphysician Cost per Exam		107.03	57.89	49.56	39.38	33.78	27.50	23.75	
Physician Fee		12.00	12.00	12.00	12.00	12.00	12.00	12.00	
Total Unit Cost		\$119.03	\$69.89	\$61.56	\$51.38	\$45.78	\$39.50	\$35.75	

**Table 3. Monthly and Unit Costs of Providing Screening Mammography Services
Stationary Setting/HIGH Cost Case**

	TESTS PER DAY							
	5	10	15	20	30	40	50	
Capital Outlays								
Mammography Unit and Processor	\$86,000							
Start-up Supplies	2,000							
Leasehold Improvements	15,000							
Furniture	5,000							
Office Equipment	3,500							
Miscellaneous	500							
Subtotal of Capital Costs	\$112,000							
Amortized Monthly Cost 6 years, 12% per year		\$2,606	\$2,606	\$2,606	\$2,606	\$2,606	\$2,606	
Fixed Monthly Costs								
Maintenance	425							
Promotion	250							
Accounting	100							
Insurance	100							
Rent	2,400							
Telephone	100							
Taxes	750							
Subtotal fixed monthly	\$4,125	\$4,125	\$4,125	\$4,125	\$4,125	\$4,125	\$4,125	
Semi-Fixed Costs								
Radiological Technologist Salary	3,333	3,333	3,333	6,667	6,667	\$10,000	\$10,000	\$10,000
Benefits	667	667	667	1,332	1,332	2,000	2,000	2,000
Clerk/Receptionist Salary	1,375	1,375	1,375	1,375	1,375	1,375	1,375	1,375
Benefits	200	200	200	200	200	200	200	200
Variable Costs per Exam								
Film	\$3.00	\$300	\$600	\$900	\$1,200	\$1,800	\$2,400	\$3,000
Medical Records	2.00	200	400	600	800	1,200	1,600	2,000
Other Supplies	1.00	100	200	300	400	600	800	1,000
Miscellaneous	1.00	100	200	300	400	600	800	1,000
Postage	1.00	100	200	300	400	600	800	1,000
Forms	0.75	75	150	225	300	450	600	750
Total Monthly Costs	\$13,181	\$14,056	\$18,930	\$19,805	\$25,558	\$27,306	\$29,056	
Nonphysician Cost per Exam	131.81	70.28	63.10	49.51	42.59	34.13	29.05	
Physician Fee	12.00	12.00	12.00	12.00	12.00	12.00	12.00	
Total Unit Cost	\$143.81	\$82.28	\$75.10	\$61.51	\$54.59	\$46.13	\$41.05	

**Table 4. Monthly and Unit Costs of Providing Screening Mammography Services
Mobile Setting/HIGH Case**

	TESTS PER DAY							
	5	10	15	20	30	40	50	
Capital Outlays								
Mammography Unit and Processor } Mobile Unit and Installation } Furniture }	\$225,000							
Office Equipment	3,500							
Miscellaneous	500							
Start-up Supplies	2,000							
Subtotal of Capital Costs	\$231,000							
Amortized Monthly Cost 8 years, 12% per year		\$5,374	\$5,374	\$5,374	\$5,374	\$5,374	\$5,374	\$5,374
Fixed Monthly Costs								
Maintenance	\$675							
Promotion	250							
Accounting	100							
Insurance	125							
Gasoline	400							
Telephone	100							
Taxes	750							
Subtotal fixed monthly	\$2,375	\$2,375	\$2,375	\$2,375	\$2,375	\$2,375	\$2,375	\$2,375
Semi-Fixed Costs								
Radiological Technologist Salary	3,333	3,333	3,333	6,667	6,667	\$10,000	\$10,000	\$10,000
Benefits	667	667	667	1,332	1,332	2,000	2,000	2,000
Clerk/Receptionist Salary	1,375	1,375	1,375	1,375	1,375	1,375	1,375	1,375
Benefits	200	200	200	200	200	200	200	200
Variable Costs per Exam								
Film	\$3.00	\$300	\$600	\$900	\$1,200	\$1,800	\$2,400	\$3,000
Medical Records	2.00	200	400	600	800	1,200	1,800	2,000
Other Supplies	1.00	100	200	300	400	600	800	1,000
Miscellaneous	1.00	100	200	300	400	600	800	1,000
Postage	1.00	100	200	300	400	600	800	1,000
Forms	0.75	75	150	225	300	450	600	750
Total Monthly Costs	\$14,189	\$15,074	\$19,948	\$20,823	\$26,574	\$28,324	\$30,074	
Nonphysician Cost per Exam	141.89	75.37	66.49	52.06	44.29	35.41	30.07	
Physician Fee	12.00	12.00	12.00	12.00	12.00	12.00	12.00	
Total Unit Cost	\$153.99	\$87.37	\$78.49	\$64.06	\$56.29	\$47.41	\$42.07	

**Table 5. Monthly and Unit Costs of Providing Screening Mammography Services
Stationary Setting/LOW Cost Case**

		TESTS PER DAY						
		5	10	15	20	30	40	50
Capital Outlays								
Mammography Unit and Processor	\$74,000							
Start-up Supplies	2,000							
Leasehold Improvements	15,000							
Furniture	5,000							
Office Equipment	3,500							
Miscellaneous	500							
Subtotal of Capital Costs	\$100,000							
Amortized Monthly Cost 6 years, 12% per year		\$1,660	\$1,660	\$1,660	\$1,660	\$1,660	\$1,660	\$1,660
Fixed Monthly Costs								
Maintenance	425							
Promotion	250							
Accounting	100							
Insurance	100							
Rent	600							
Telephone	100							
Taxes	750							
Subtotal fixed monthly	\$2,325	\$2,325	\$2,325	\$2,325	\$2,325	\$2,325	\$2,325	\$2,325
Semi-Fixed Costs								
Radiological Technologist Salary	2,100	2,100	2,100	4,200	4,200	\$4,200	\$8,300	\$8,300
Benefits	210	210	210	420	420	420	830	830
Clerk/Receptionist Salary	1,160	1,160	1,160	1,160	1,160	1,160	1,160	1,160
Benefits	175	175	175	175	175	175	175	175
Variable Costs per Exam								
Film	\$3.00	\$300	\$600	\$900	\$1,200	\$1,800	\$2,400	\$3,000
Medical Records	2.00	200	400	600	800	1,200	1,600	2,000
Other Supplies	1.00	100	200	300	400	600	800	1,000
Miscellaneous	1.00	100	200	300	400	600	800	1,000
Postage	1.00	100	200	300	400	600	800	1,000
Forms	0.75	75	150	225	300	450	600	750
Total Monthly Costs		\$8,505	\$9,380	\$12,565	\$13,440	\$15,190	\$19,250	\$21,000
Nonphysician Cost per Exam		85.05	48.90	41.88	33.60	25.32	24.08	21.00
Physician Fee		12.00	12.00	12.00	12.00	12.00	12.00	12.00
Total Unit Cost		\$97.05	\$58.90	\$53.88	\$45.60	\$37.32	\$36.08	\$33.00

**Table 6. Monthly and Unit Costs of Providing Screening Mammography Services
Mobile Setting/LOW Case**

	TESTS PER DAY							
	5	10	15	20	30	40	50	
Capital Outlays								
Mammography Unit and Processor } Mobile Unit and Installation } Furniture }	\$150,000							
Office Equipment	3,500							
Miscellaneous	500							
Start-up Supplies	2,000							
Subtotal of Capital Costs	\$156,000							
Amortized Monthly Cost 6 years, 12% per year		\$2,590	\$2,590	\$2,590	\$2,590	\$2,590	\$2,590	
Fixed Monthly Costs								
Maintenance	\$675							
Promotion	250							
Accounting	100							
Insurance	125							
Gasoline	400							
Telephone	100							
Taxes	750							
Subtotal fixed monthly	\$2,375	\$2,375	\$2,375	\$2,375	\$2,375	\$2,375	\$2,375	
Semi-Fixed Costs								
Radiological Technologist Salary	2,100	2,100	2,100	2,100	4,200	\$4,200	\$6,300	\$6,300
Benefits	210	210	210	210	420	420	630	630
Clerk/Receptionist Salary	1,180	1,180	1,180	1,180	1,180	1,180	1,180	1,180
Benefits	175	175	175	175	175	175	175	175
Variable Costs per Exam								
Film	\$3.00	\$300	\$600	\$900	\$1,200	\$1,800	\$2,400	\$3,000
Medical Records	2.00	200	400	600	800	1,200	1,600	2,000
Other Supplies	1.00	100	200	300	400	600	800	1,000
Miscellaneous	1.00	100	200	300	400	600	800	1,000
Postage	1.00	100	200	300	400	600	800	1,000
Forms	0.75	75	150	225	300	450	600	750
Total Monthly Costs		\$9,485	\$10,360	\$11,235	\$14,420	\$18,170	\$20,230	\$21,980
Nonphysician Cost per Exam		94.85	51.80	37.45	36.05	26.95	25.29	21.98
Physician Fee		12.00	12.00	12.00	12.00	12.00	12.00	12.00
Total Unit Cost		\$108.85	\$63.80	\$49.45	\$48.05	\$38.95	\$37.29	\$33.98

**Table 7. Monthly and Unit Costs of Providing Screening Mammography Services
Stationary Setting/URBAN Case**

	TESTS PER DAY							
	5	10	15	20	30	40	50	
Capital Outlays								
Mammography Unit and Processor	\$80,000							
Start-up Supplies	2,000							
Leasehold Improvements	16,500							
Furniture	5,000							
Office Equipment	3,500							
Miscellaneous	500							
Subtotal of Capital Costs	\$107,500							
Amortized Monthly Cost 6 years, 12% per year		\$2,102	\$2,102	\$2,102	\$2,102	\$2,102	\$2,102	
Fixed Monthly Costs								
Maintenance	425							
Promotion	250							
Accounting	100							
Insurance	125							
Rent	833							
Telephone	100							
Taxes	750							
Subtotal fixed monthly	\$2,583	\$2,583	\$2,583	\$2,583	\$2,583	\$2,583	\$2,583	
Semi-Fixed Costs								
Radiological Technologist Salary	2,900	2,900	2,900	5,800	5,800	\$8,700	\$8,700	\$8,700
Benefits	435	435	435	870	870	1,305	1,305	1,305
Clerk/Receptionist Salary	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300
Benefits	200	200	200	200	200	200	200	200
Variable Costs per Exam								
Film	\$3.00	\$300	\$600	\$900	\$1,200	\$1,800	\$2,400	\$3,000
Medical Records	2.00	200	400	600	800	1,200	1,600	2,000
Other Supplies	1.00	100	200	300	400	600	800	1,000
Miscellaneous	1.00	100	200	300	400	600	800	1,000
Postage	1.00	100	200	300	400	600	800	1,000
Forms	0.75	75	150	225	300	450	600	750
Total Monthly Costs		\$10,385	\$11,270	\$15,480	\$16,355	\$21,440	\$23,190	\$24,940
Nonphysician Cost per Exam		103.85	58.35	51.60	40.89	35.73	28.99	24.94
Physician Fee		12.00	12.00	12.00	12.00	12.00	12.00	12.00
Total Unit Cost		\$115.95	\$68.35	\$63.60	\$52.89	\$47.73	\$40.99	\$36.94

**Table 8. Monthly and Unit Costs of Providing Screening Mammography Services
Mobile Setting/RURAL Area**

	TESTS PER DAY							
	5	10	15	20	30	40	50	
Capital Outlays								
Mammography Unit and Processor } Mobile Unit and Installation } Furniture }	\$175,000							
Office Equipment	3,500							
Miscellaneous	500							
Start-up Supplies	2,000							
Subtotal of Capital Costs	\$181,000							
Amortized Monthly Cost 8 years, 12% per year		\$3,538	\$3,538	\$3,538	\$3,538	\$3,538	\$3,538	
Fixed Monthly Costs								
Maintenance	\$1,350							
Promotion	500							
Accounting	100							
Insurance	100							
Gasoline	800							
Telephone	100							
Taxes	750							
Subtotal fixed monthly	\$3,700	\$3,700	\$3,700	\$3,700	\$3,700	\$3,700	\$3,700	
Semi-Fixed Costs								
Radiological Technologist Salary	2,100	2,100	2,100	4,200	4,200	6,600	\$6,600	\$6,600
Benefits	315	315	315	630	630	990	990	990
Clerk/Receptionist Salary	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100
Benefits	135	135	135	135	135	135	135	135
Variable Costs per Exam								
Film	\$3.00	\$300	\$600	\$900	\$1,200	\$1,800	\$2,400	\$3,000
Medical Records	2.00	200	400	600	800	1,200	1,600	2,000
Other Supplies	1.00	100	200	300	400	600	800	1,000
Miscellaneous	1.00	100	200	300	400	600	800	1,000
Postage	1.00	100	200	300	400	600	800	1,000
Forms	0.75	75	150	225	300	450	600	750
Total Monthly Costs	\$11,783	\$12,638	\$15,928	\$16,803	\$21,313	\$23,063	\$24,813	
Nonphysician Cost per Exam	117.63	63.19	53.09	42.01	35.52	28.83	24.81	
Physician Fee	12.00	12.00	12.00	12.00	12.00	12.00	12.00	
Total Unit Cost	\$129.63	\$75.19	\$65.09	\$54.01	\$47.52	\$40.83	\$38.81	

Table 9. Summary Table: Costs Per Test at Selected Volumes

		TESTS PER DAY						
		5	10	15	20	30	40	50
Setting	High/Low							
Stationary	Baseline	\$106.62	\$63.69	\$57.42	\$48.26	\$43.19	\$37.58	\$34.21
Mobile	Baseline	119.03	69.89	61.58	51.38	45.78	39.50	35.75
Stationary	High	143.81	82.28	75.10	61.51	54.59	46.13	41.05
Mobile	High	153.99	87.37	78.49	64.06	58.29	47.41	42.07
Stationary	Low	97.05	58.90	53.88	45.60	37.32	36.08	33.00
Mobile	Low	106.85	63.80	49.45	48.05	38.95	37.29	33.98
Stationary	Urban	115.95	68.35	63.60	52.89	47.73	40.99	36.94
Mobile	Rural	129.63	75.19	65.09	54.01	47.52	40.83	36.81

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