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**The Economic Cost of Community-Based Interventions to Improve Breast Cancer Control
among African-American Women**

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Abstract

A number of intervention strategies to improve the rate of early stage breast cancer detection have been proposed and evaluated. Though good effectiveness data exist, policymakers and medical administrators may be reluctant to implement such interventions because of cost considerations. Few cost-effectiveness analyses have been conducted on culturally-sensitive interventions that increase mammography screening rates or reduce barriers to receiving timely diagnostic testing and treatment for African-American women. This paper discusses an innovative cost effectiveness model, funded by the National Cancer Institute, and presents microeconomic estimates the cost of twelve community-based intervention strategies designed to improve early stage breast cancer detection rates and appropriate follow-up after an abnormal mammogram among African-American women. An innovation in the estimates is to include the value of women's time.

Community-based program costs range from \$47 to \$161 per patient on an ongoing basis. Same day scheduling of a mammogram with or without patient transportation, public service announcements, physician education, physician audit with feedback, and same day scheduling of a biopsy cost \$47-\$53 per patient per year on an ongoing basis. Interventions that require full-time personnel to maintain the program, such as patient reminder letters, theory-based education, physician reminders, and telephone counseling, are more expensive and cost approximately \$54-\$57 per patient on an ongoing basis. The three most expensive interventions are the mobile mammography van, lay health workers, and church based navigators, costing approximately \$67-\$161 per patient

In conclusion, the added costs of community-based cancer control programs for vulnerable African-American women are small and have the potential to be offset by the gains in quality-adjusted life years saved as a result of detection at an earlier stage of diagnosis and improved follow-up and treatment, particularly among high-risk communities.

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“We offer many life saving procedures in medicine and yet our society’s priorities make them unavailable. Our discoveries permit longer and longer lives and yet, our quality of life is out of balance. How we solve these problems in our country, and even in our world, will depend on how humane we are in the application of scientific technologies and how scientifically informed we are in making social policy decisions.”

Dr. Alice Huang, Dean of Science, New York University, Convocation, 1994

Introduction

In the United States, approximately 182,000 women develop breast cancer and 46,000 die from it each year.¹ Breast cancer is the second most frequent oncologic diagnosis in women.¹ Though the incidence of breast cancer has increased 55% between 1950 and the present, the mortality rate over that period has declined, perhaps in part because cancers are detected at an earlier stage.²⁻⁴ However, the racial gap in breast cancer mortality is widening. In particular, breast cancer mortality rates have declined for white women since 1990 but not for African-American women.^{5, 6} In 1980, breast cancer mortality was similar in African-American and white women. However, by 1990 it was 16% higher among African-American women than among white women and 29% higher in 1995.⁵ Although breast cancer mortality rates have remained relatively stable for African-American women, they have not experienced the same rate of decline as white women, thus, leading to the widening of this mortality disparity.⁵

Much of the difference in mortality rates between women of differing socioeconomic status or race may be attributable to access to and utilization of preventive services. Routine screening with mammography and clinical breast examination has been shown to decrease mortality rates from breast cancer by 20-30 percent.⁷⁻⁹ Yet African-American women are 2-5 times more likely to have a late stage diagnosis^{10, 11} and prior to diagnosis are 2-4 times less likely to have received preventive mammography or clinical breast exams than white women.¹²⁻¹³

A number of intervention strategies to improve the rate of early stage breast cancer detection have been proposed and evaluated.¹⁴⁻³⁹ Though good effectiveness data exist for many interventions, policymakers and medical administrators may be reluctant to implement such interventions because few cost-effectiveness analyses have been conducted on interventions that increase mammography screening rates or reduce barriers to receiving timely diagnostic testing. The purpose of this paper is to discuss an innovative cost effectiveness model under development, funded by the National Cancer Institute, and to present preliminary data on the cost of twelve intervention strategies with the potential to improve early stage breast cancer detection rates and improved follow-up after an abnormal mammogram among African-American women.

Methods

Overview of Cost Effectiveness Models

Cost effectiveness analysis (CEA) has become the leading quantitative tool of the health policy sciences for aiding in the process of making decisions and setting priorities for preventive medical care delivery strategies.⁴⁰ However, many of the factors that crucially affect the results of cost effectiveness analyses vary by age, race, and socio-economic status. Blanket policy statements based on the results of CEA for general populations can result in prevention policies that overlook the particular circumstances of vulnerable subgroups of the population. For instance, most cost effectiveness analyses of recommended protocols for breast cancer screening and treatment assume appropriate utilization. However, without culturally-sensitive follow-up and outreach programs in place for both providers and patients, vulnerable African American women will likely under-utilize appropriate services. While many CEAs of breast cancer control have been developed for general populations, there are no models to date of cost effective breast cancer control strategies designed for African American women.⁴¹⁻⁴⁷

With these considerations in mind, we are undertaking an innovative cost effectiveness analysis of breast cancer control strategies among African American women, that includes an analysis of twelve different provider-targeted and patient-targeted effective interventions to increase appropriate utilization.

Twelve Interventions

The twelve interventions selected for this study are based largely on the work of Mandelblatt⁴⁸ and Yabroff⁴⁹, supplemented by suggestions from community health experts in breast cancer prevention who are members of our National Advisory Committee. In general, the interventions were chosen to represent categories established by Mandelblatt⁴⁸ and Yabroff⁴⁹, where interventions are grouped as patient-targeted or provider-targeted and within these groups are categorized as inreach (reminder letters, same-day screening, theory-based education, physician reminders, audit with feedback, physician education, telephone counseling, same-day biopsy) or outreach (lay health worker, church-based navigator, mobile mammography van, public service announcements) strategies. Eight of the twelve interventions have been proven effective using data from controlled trials. However, to our knowledge, studies of effectiveness are not available for same-day biopsy, lay health worker, church-based navigator, and mobile mammography van. The twelve intervention strategies that will be discussed in this paper are listed in Table 1.

TABLE 1-Twelve Interventions to Improve Breast Cancer Detection, Diagnosis, and Treatment

Interventions to Increase Mammography Use		Interventions to Improve Follow-up After Abnormal Mammogram	
<u>Patient-Targeted</u>	<u>Provider-Targeted</u>	<u>Patient-Targeted</u>	<u>Provider-Targeted</u>
Reminder Letters	Physician Reminders	Telephone Counseling	
Same-day Screening	Audit with Feedback	Same-day Biopsy	
Theory-based Education	Physician Education		
Lay Health Worker Navigator			
Church-based Navigator			
Mobile Mammography Van			
Public Service Announcements			

Interventions to Increase Mammography Use

Patient-targeted intervention strategies. Patient-targeted intervention strategies to increase mammography use include sending reminder letters to patients of the need for a mammogram,¹⁴⁻¹⁹ scheduling of a mammogram on the same day it is ordered by a physician,²⁰ theory-based education delivered by telephone counseling,³⁷ peer recruitment and outreach strategies²¹⁻²⁴ using lay health workers and church-based navigators, operating a mobile mammography unit,^{25, 26} and conducting public communications campaigns.²⁷

Under the reminder letter scenario we examined the costs associated with sending a patient a pre-scheduled appointment reminder letter. For same day scheduling of a mammogram, we estimated the costs associated with providing services on site with and without patient transportation to nearby facilities. Under the theory-based education intervention, we estimated the costs of providing telephone counseling to patients regarding the need for mammography. Peer recruitment strategies include training peer navigators or lay health workers to recruit women residing in a geographically defined community for preventive services. A peer navigator distributes educational materials and makes a follow-up call to ensure that the patient has received her mammogram. Costs were estimated for the lay health worker and the church-based navigator models of peer recruitment. Mobile mammography services allow for the provision of preventive services in underserved neighborhoods and reduce patient travel costs and time. The costs of operating a mobile mammography van are also estimated for this study. Public communications campaigns promote preventive services via radio, television, or printed media using free airtime or space allotted for public services announcements (PSAs) by the media. These may be conducted through a clinic, a community-based organization (CBO), or through a local health department. We examined the cost associated with producing PSAs through a health clinic or CBO.

Provider-targeted intervention strategies. Provider-targeted intervention strategies to increase mammography use include strategies to increase the number of times a physician makes an appropriate recommendation for a mammogram utilizing physician reminders and physician

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audit with feedback systems.²⁸⁻³¹ A physician reminder system consists of placing a note in a patient's record or chart alerting the physician when a mammogram is due. Under the physician audit with feedback system, a physician's performance is evaluated and a determination is made as to whether mammograms were ordered on time for eligible patients. For an institution to monitor a physician's performance or to provide preventive service reminders, it must obtain and maintain a record indicating when the patient's mammogram is due and whether or not the physician ordered it on time. Thus, it is necessary to review all of the medical records of at risk patients in a physician's patient panel and to maintain a computerized record of tests due. To review a physician's performance under the audit with feedback intervention, it is also necessary to hold periodic peer meetings. Another strategy involves educating physicians regarding the utility of preventive services.^{32, 33} In this scenario, physicians undergo formal training in a group setting on an annual or semi-annual basis.

Interventions to Improve Follow-up after an Abnormal Mammogram

Patient-targeted intervention strategies. Patient-targeted intervention strategies to improve follow-up after an abnormal mammogram include telephone counseling and same-day breast biopsy for women with positive mammograms. Under telephone counseling, women receive a telephone call that may incorporate a reminder, counseling, and scheduling of an appointment for a mammogram.^{35-37, 39} Another approach to reduce a patient's barriers to diagnostic services involves performing a minimally invasive breast biopsy immediately following a positive mammogram. In this intervention, a radiologist refers patients in need of a biopsy to an on site surgeon who then counsels the patient and performs a biopsy. In addition to removing a barrier to confirmatory tests, we assume that this intervention also saves time and transportation costs for the patient.

Cost Methods

All costs were determined using the micro-costing approach, were adjusted to 2000 dollars, and include patient costs for time in treatment.⁴⁰ Wages were determined from the Bureau of Labor Statistics⁵⁰ and office supply costs were obtained from various commercial dealers.⁵¹⁻⁵⁴ All analyses were conducted using Excel 97 SR-1 (Microsoft Corporation, Redmond WA). We assumed that all providers would be physicians and that the patient volume would be representative of the typical outpatient department of a teaching hospital. Finally, we assumed that patients would be fully compliant with each intervention, so that researchers and managers may more readily use these data for other purposes.

Non-medical costs included patient time spent receiving screening, diagnostic evaluation, and treatment, and travel and waiting time for receiving care. Average travel and waiting times were based on data from the National Health Interview Survey, and time spent receiving services was estimated from prior research and clinical estimates.⁵⁵ Costs were obtained by multiplying these times by median US wage rates for African-American women. Since wages and labor force participation rates are lower for African-American women than for white women, we explored the impact of using average US wages rates in sensitivity analyses. The costs of lost productivity due to breast cancer morbidity and mortality will be accounted for in the cost effectiveness model by decrements in utilities used to "quality-adjust" years of life saved.

In addition to calculating base costs for each intervention, a sensitivity analysis was conducted to calculate the low and high cost estimates for each intervention for a fixed patient caseload. Under each intervention, the cost components that contributed 20 percent or more to the total cost of an intervention were varied by 30 percent of the base cost related item.

Results

Table 2 lists the per patient costs for each of the twelve intervention strategies including base costs and the low and high estimates from the sensitivity analysis. First year start-up costs are presented in addition to ongoing annual costs. The cost of mammography is included in the cost of each intervention.

TABLE 2-Per Patient Costs for Each Intervention

	Base Case	Low Estimate	High Estimate
A. Interventions to Increase Mammography Use			
<u>Patient-targeted Strategies</u>			
1. Reminder Letters			
First Year	56.58	55.79	57.38
Ongoing	55.40	54.62	56.18
2. Same-day Screening			
With Patient Transportation			
First Year	49.35	47.64	51.05
Ongoing	49.33	47.63	51.04
Same-day Screening Without Patient Transportation			
First Year	48.12	46.73	49.50
Ongoing	48.10	46.72	49.49
3. Theory-based Education			
First Year	55.05	54.42	55.68
Ongoing	54.96	54.33	55.59
4. Lay Health Worker Navigator			
First Year	69.74	65.48	74.01
Ongoing	69.41	65.14	73.68
5. Church-based Navigator			
First Year	230.59	203.94	261.64
Ongoing	161.40	134.75	188.05
6. Mobile Mammography Van			
First Year	68.65	66.85	69.68
Ongoing	67.41	65.60	68.44
7. Public Service Announcements			
First Year	53.00	52.93	53.06
Ongoing	52.73	52.67	52.79
<u>Provider-targeted Strategies</u>			
8. Physician Reminders			
First Year	55.48	54.99	55.96
Ongoing	54.27	53.79	54.76
9. Physician Education			
First Year	52.55	52.54	52.55
Ongoing	52.54	52.53	52.54
10. Audit with Feedback			
First Year	53.88	53.81	53.89
Ongoing	52.68	52.64	52.72
B. Interventions to Improve Follow-up After Abnormal Mammogram			

<u>Patient-targeted Strategies</u>			
11. Telephone Counseling			
First Year	58.16	56.83	59.49
Ongoing	56.96	55.63	58.29
12. Same-day Biopsy			
First Year	47.08	46.92	49.85
Ongoing	47.06	46.90	49.82
Average of all programs, first year + ongoing costs	66.17	63.15	69.51

Base Costs

Same day scheduling of a mammogram with or without patient transportation, public service announcements, physician education, physician audit with feedback, and same day scheduling of a biopsy cost \$47-\$53 per patient per year on an ongoing basis. This is primarily due to public communications campaigns reaching a large number of patients and the low-intensity nature of the same-day scheduling and physician-targeted interventions. Interventions that require full-time personnel to maintain the program, such as patient reminder letters, theory-based education, physician reminders, and telephone counseling, are more expensive and cost approximately \$54-\$57 per patient on an ongoing basis. The three most expensive interventions are the mobile mammography van, lay health workers, and church based navigators. These intervention strategies are the most intensive requiring the most equipment or personnel and cost approximately \$67-\$161 per patient on an ongoing basis. The two-year average base cost for all programs combined is \$66.17 per patient.

Discussion

Interventions designed to improve early stage breast cancer detection rates and follow-up treatment rates after an abnormal mammogram in African-American women range from \$47 to \$161 per patient on an ongoing basis. Further cost effectiveness analyses will assess optimal intervention strategies that will maximize effectiveness most efficiently. When effectiveness data are lacking, we will perform threshold analyses to inform us of what minimum effectiveness targets would make these interventions comparable to other cost effective interventions.

Conclusion

The added costs of targeted cancer control programs for vulnerable African-American women are small and have the potential to be offset by the gains in quality-adjusted life years saved as a result of detection at an earlier stage of diagnosis and improved follow-up and treatment. These preliminary program cost findings will be integrated into the full CEA model, which is currently still under development. It is hoped that once the full model is completed later this year, the results will be translated from research into practice, through partnerships and collaborations among other researchers, consumers, advocacy groups, providers, insurers and legislators. The challenge to reduce the disparity in breast cancer mortality rates between African American women and white women demands our increased attention.

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