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Awardee-specific economic costs of providing cancer screening and health promotional services to medically underserved women eligible in the National Breast and Cervical Cancer Early Detection Program

Sujha Subramanian[1], **Donatus U. Ekwueme**[2], **Jacqueline W. Miller**[2], **Jaya S. Khushalani**[2], **Justin G. Trogdon**[3], **Faye L. Wong**[2]

[1]RTI International, 307 Waverley Oaks Road, Waltham, MA 02452, USA

[2]Division of Cancer Prevention and Control, Centers for Disease Control and Prevention, GA, Atlanta, USA

[3]Department of Health Policy and Management, Gillings School of Global Public Health, University of North Carolina at Chapel Hill, Chapel Hill, USA

Abstract

Objectives—To estimate awardee-specific costs of delivering breast and cervical cancer screening services in their jurisdiction and to assess potential variation in the cost of key activities across awardees.

Methods—We developed the cost assessment tool to collect resource use and cost data from the National Breast and Cervical Cancer Early Detection Program awardees for 3 years between 2006 and 2010 and generated activity-based cost estimates. We estimated awardee-specific cost per woman served for all activities, clinical screening delivery services, screening promotion interventions, and overarching program support activities.

Results—The total cost per woman served by the awardees varied greatly from $205 (10th percentile) to $499 (90th percentile). Differences in the average (median) cost per person served for clinical services, health promotion interventions, and overarching support activities ranged from $51 to $125.

Conclusions—The cost per woman served varied across awardee and likely reflected underlying differences across awardees in terms of screening infrastructure, population served, and barriers to screening uptake. Collecting information on contextual factors at the awardee, health system, provider, and individual levels may assist in understanding this variation in cost.

Keywords

Breast cancer screening; Cervical cancer screening; Program cost

Sujha Subramanian, ssubramanian@rti.org.

Conflict of interest No conflicts of interest were reported by the authors of this paper.

Introduction

Screening and early detection of breast and cervical cancer have been shown to reduce cancer-related death rates and improve cancer patients' survival [1–4]. The National Breast and Cervical Cancer Early Detection Program (NBCCEDP) is a nationwide, comprehensive, federally funded public health program that makes cancer screening services available to low-income uninsured and underinsured women [5]. Through the NBCCEDP, eligible women ages 40 to 64 years and 21 to 64 years may receive screening and diagnostic services for breast and cervical cancer, respectively. As the largest organized cancer screening program for low-income women in the United States, the NBCCEDP operates in all 50 states, the District of Columbia, six U.S. territories, and 13 American Indian and Alaska Native tribal organizations.

Since its inception in 1991, the NBCCEDP through its national partners, which include health departments, community leaders, medical care providers, and others, has provided breast and cervical cancer screening services to more than 5.3 million low-income women [6]. Annually, some awardees screen less than a 1,000 women while others screen more than 200,000 women. To date, the NBCCEDP has diagnosed more than 63,000 invasive breast cancers, 20,000 premalignant breast lesions, 4,300 invasive cervical cancers, and 199,000 premalignant cervical lesions [6]. Women diagnosed with cancer through the program may receive treatment through the Medicaid program as authorized by the Breast and Cervical Cancer Prevention and Treatment Act passed by US Congress in 2000 [7].

In the NBCCEDP legislation (Public Law 101–354), the US Congress mandated that (1) the CDC award funds only to awardees capable of carrying out the major program functions as described in the legislation, and (2) each awardee should ensure that funds be used in the most cost-efficient manner [8]. To date in the program, there have been no reports on the awardee-specific economic costs of providing cancer screening and health promotional activities that are implemented to educate and recruit patients to undergo screening. Past economic cost studies on the NBCCEDP have been at the national level [9]. These studies have reported on the economic cost of delivering cancer screening services in the program. Prior studies have also indicated that there could be variation in the cost of providing services across awardees [10, 11]. However, the economic cost of providing screening to women for either breast, cervical, or both cancers by specific awardees has not been previously reported.

This study estimated the average annual awardee-specific costs of delivering breast and cervical cancer screening and diagnostic services and identified variation in cost by key activities. Specifically, we estimated awardee-specific (1) total cost per woman served, (2) cost per woman screened for breast and for cervical cancer, (3) cost per woman served for screening promotion activities, and (4) cost per woman served for core overarching program management and administrative activities. While our goal in this paper is not to explain the differences across awardees, our cost estimates do provide information on the magnitude of variation in the distribution of NBCCEDP resources to specific programmatic activities during the study period. Providing awardee-specific costs of delivering cancer screening and health promotion services in the NBCCEDP could deepen our understanding of how each

awardee allocates resources to meet the needs of their eligible population. The estimates could provide useful baseline information to help gauge future program budget allocations for investments in cancer prevention, early detection, and health promotional services in low-income populations.

Methods

Data collection

We developed a cost assessment tool (CAT) to collect cost information from the NBCCEDP awardees [Office of Management and Budget (OMB) approval was obtained for this data collection—OMB Control No. 0920–0776]. The CAT is a standardized web-based instrument created to collect activity-based cost data; it was designed to derive cost estimates from a programmatic perspective based on economics theory and methods that reflect best practice [12]. Therefore, all cost are reported from the NBCCEDP awardee perspective. The CAT was used to collect data on all costs incurred by sites, regardless of the funding source used to pay for those costs. Additionally, the CAT was used to collect information to estimate in-kind or donated contributions. To ensure comparability of total cost across awardees, the CAT collected comprehensive information on labor and non-labor resources and a detailed protocol was used to guide the data collection from each awardee. Additional details on the CAT are provided in previous publications [11, 13].

The CAT was designed to reflect budget categories familiar to management and fiscal staff in order to minimize any ambiguity in the data elements requested. For each of the key data elements, we requested that costs be allocated to the following program activities: management, screening, patient support and case management, public education, recruitment, data management, professional education, coalition and partnership building, quality assurance and improvement, and evaluation. To improve the accuracy of the data, awardees were asked to report the amount of time that each staff member spent on specific program activities each year.

We used the CAT to collect cost data for the 2006–2007, 2008–2009, and 2009–2010 program years. Program activities and costs related to all funding sources, including CDC, state, and other organizations, were collected in the CAT and are reported in this study. We also collected data on the number of women screened and served by NBCCEDP awardees with the use of non-CDC funds. Five awardees (California, Hawaii, Maine, Michigan, and Minnesota) had incomplete data for the years requested and provided cost data for 2007–2008 and 2008–2009 rather than for 2008–2009 and 2009–2010.

Statistical analysis

We calculated the average cost per woman served by the NBCCEDP and the average cost of each activity performed by the awardees. Our final analysis was restricted to the 50 states and the District of Columbia. We excluded tribes and territories because prior analyses indicated that their cost structures were very different from those of the state awardees [11, 14]. Data on funding and resource use were taken from the CAT. Total costs for each activity were calculated by pooling all costs allocated to that activity. We did not include in-kind

contributions as it was not always possible to allocate these to specific activities and there was some variation across awardees in reporting this information. The total number of women served included all women who were screened or who received diagnostic follow-up using either federal or non-federal funds. Data on the number of women served or screened were obtained from CDC's Minimum Data Elements (MDE) and the CAT. The MDE collects data on services that are associated with federal funds, whereas the CAT collected data on services associated with non-federal funds.

All costs in this analysis are presented in 2018 dollars and the objective was to assess variation across the awardees. The average cost estimates for each awardee were calculated by dividing cost totals, or specific activity-based cost, by the number of women served; for clinical cost related to screening, we used the number of women screened by the awardee. Overall costs were divided into breast and cervical cancer-specific costs using the allocation for each activity as reported in the CAT. Clinical costs associated with breast and cervical cancer services were derived using information from the CAT, which included separate fields for various screening- and diagnosis-related procedures. We calculated the cost per woman served or screened for each year separately and then derived average cost by awardee based on the 3 years of data collected.

We report the awardee-specific cost per woman served for all activities combined, screening promotion activities (patient support and case management, patient education, and recruitment), and core overarching program management and administrative activities (program and data management, quality assurance and improvement, partnerships and professional development, evaluation and administrative). We also report cost per woman screened for breast and cervical cancer screening overall and separately for each cancer. For each composite cost estimate, we report the mean and the median cost and the estimated cost at the 10th and 90th percentiles. A percentile is a measure at which that percentage of the total values are the same as or below that measure. For example, 90% of the data values lie below the 90th percentile, whereas 10% of the data values lie below the 10th percentile. We report the variation in cost across awardees using the 10th and 90th percentiles, which provides an estimate of the difference between the low and high cost estimates without including extreme values.

Results

Figure 1 presents the average cost per woman served by awardee based on the 3 years of data collected from the awardees. The mean and median cost per woman served was $337.01 and $314.46, respectively. There was more than a $300 difference between the lowest and highest costs per woman served, with a cost of $204.83 at the 10th percentile and $498.98 at the 90th percentile.

In Fig. 2, we show the cost of clinical services across the NBCCEDP awardees. The clinical cost per woman served was $175.02 and $168.04 for the mean and median, respectively. Awardees at the 10th percentile had a cost per woman served of $112.75 while those at the 90th percentile had a cost of $221.53, a difference of more than $100. As shown in Fig. 3, the proportion of breast versus cervical cancer screens supported by the NCCEDP awardees

varied. The proportion of breast cancer screens ranged from 18 to 72% and this likely impacts the cost per woman as the clinical cost of breast cancer screening is generally higher than cervical cancer screening.

To further assess the clinical cost across the awardees, we present the clinical cost per woman screened for breast and cervical cancer separately in Fig. 4a, b. The median cost was $124.57 for breast cancer screening and $66.69 for cervical cancer screening. Breast cancer screening cost at the 10th percentile was $88.5 while the 90th percentile was $204.81 a difference of $116.29. For cervical cancer screening, these same percentile costs were $44.97 and $97.12, respectively, a difference of $52.15.

Figure 5 presents the average cost per woman served for patient support, recruitment, and education activities, and all other health promotion activities aimed to reach more women and increase breast and cervical cancer screening among vulnerable populations. The mean and median costs of these activities were $65.75 and $50.52, respectively, with a difference of $123.26 between the 10th and 90th percentiles. Patient support activities were the largest cost component among these screening promotion interventions.

Figure 6 provides the awardee-specific average cost per woman for all core overarching activities including program management, data management, quality assurance, partnerships, professional development, evaluation, and administrative costs. The mean and median costs for all of these activities together were $95.02 and $93.14, respectively. The 10th and 90th percentile costs were $41.21 and $166.21, a difference of $125.00. Program and data management were generally the two activities that accounted for the highest proportion of cost for the core overarching support activities.

Discussion

The NBCCEDP awardees perform a variety of activities related to screening delivery, screening promotion, and overarching support. In this study, we showed that across all these activities, awardees reported a wide variation in the average cost per woman served. For each of the three cost categories, the variation between awardees with low versus high cost per woman served was more than $100. For the program years included in this study, the difference in total cost per woman served by the NBCCEDP awardees was more than $300 between the lowest and highest cost awardees. The findings from this study are similar to those previously reported; other studies have also reported substantial variation across NBCCEDP awardees [10, 11, 15].

The current study adds to the existing literature by presenting costs at the awardee level and complements the prior studies that only reported overall variation across all programs.

Screening cost specific to breast and cervical cancer revealed wide variations. These results could be due to differences in the cost of mammograms and Pap tests [11]. There is regional variation in the clinical cost of screening services as NBCCEDP programs are able to negotiate difference levels of provider reimbursement for screening and diagnostic tests related to breast and cervical cancer. The variation in the cost of cervical cancer screening across the awardees was half that of breast cancer screening; therefore, the proportion of

each kind of screening delivered impacted the overall difference in cost per woman. The wide variation in the cost of screening promotion activities could reflect the priorities of each awardee as some awardees did not spend any funds on certain activities, while others spent a large amount. For instance, almost all the grantees conducted patient case management, recruitment, and education, but the proportion of funds spent on these specific promotion activities differed. Overall, the awarders varied both in the amount spent on these specific activities as well as total spent across all promotion activities. The overarching program support activities also indicated differences across awardees both in the overall magnitude and in the relative contribution of each specific activity. These overarching support activities require substantial investment, which are often fixed costs. There is some evidence from prior studies to indicate that these costs are subject to economies of scale; [10, 16] that is, the cost per woman served decreases as the number of women served increases.

Although the NBCCEDP awardees operate within a national program framework of legislation and policies, the awardees vary across multiple dimensions including funding level, infrastructure for screening service delivery, population demographics, and barriers related to breast and cervical cancer screening uptake. These differences may explain the reasons for the variation seen in the total cost per woman served by the awardees as well as the specific activities performed. The unique circumstances in each state make it difficult, if not impossible, to perform comparative assessments across the NBCCEDP. Therefore, it is not always possible to generalize the findings from one setting to another. In the data collected through the CAT, only a limited amount of information was gathered on the contextual factors that may better describe the circumstances in each state. For example, understanding the number of providers available to provide services to the NBCCEDP participants in each of the targeted geographic areas may provide useful information on the dynamics that will impact the ability to negotiate favorable agreements with providers. Even though the payment rate for clinical services is capped at the Medicare reimbursement rate, there can be variation in the actual negotiated rate and in payments for other services such as case management. Furthermore, knowledge of the underlying target population will offer additional details to further explore the health promotion interventions selected and implemented by the awardees. Thus, collecting more information on the contextual factors at the awardee, health system, provider, and individual levels may assist in understanding the variation in cost per woman served.

Although we took substantial steps to standardize the cost data collected from each awardee, there could be some variation in the reported data. Cost and resource use information were collected retrospectively and awardee staff did not maintain daily time logs as these are extremely burdensome and time-consuming. To ensure accuracy and consistency, the recall period was within 12 months and each awardee staff reported on their specific program activities using detailed instructions and definitions for each activity.

Under the current five-year funding cycle (DP17–1701, 2017–2022), the NBCCEDP has expanded its scope to support awardees in partnering with health systems and their clinics to implement evidence-based interventions (EBIs) to increase clinic-level breast and cervical cancer screening among disadvantaged populations who have low screening uptake [17]. As

the NBCCEDP expands its focus to provide additional support for screening and health promotion activities, a proportion of the awardee's budget is likely to be allocated to implementation of EBIs; and therefore variation in cost across awardees will depend on the type, intensity, and combination of the interventions implemented. The type of interventions selected will depend on the underlying barriers and needs identified by the awardees in their specific regions. Future analyses need to focus on identifying factors that impact the variation in cost per woman served and assess whether lessons learned at the awardee level can be shared with other awardees to improve efficiencies in intervention implementation.

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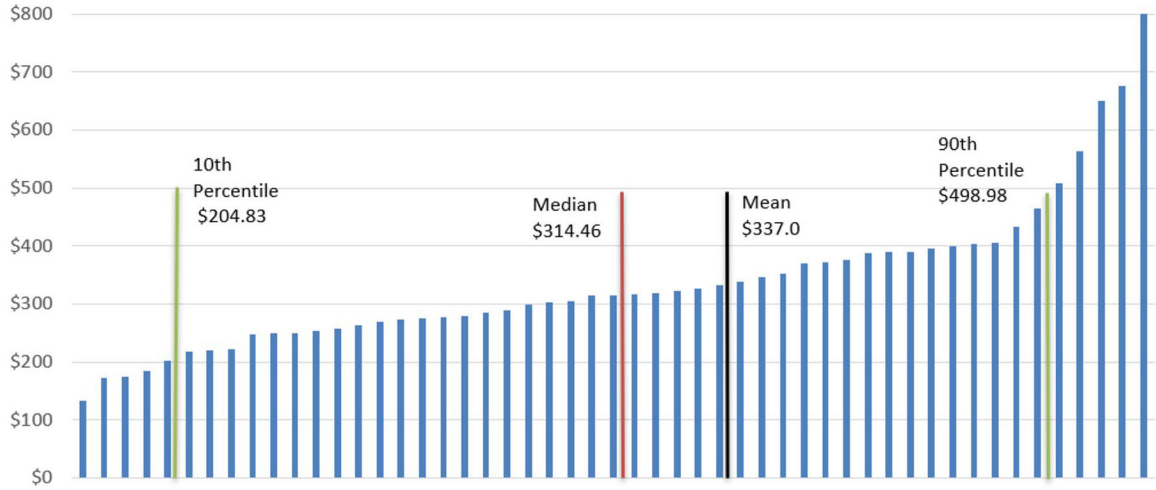

Fig. 1.

Average Cost per Woman Served by Awardees of the National Breast and Cervical Cancer Early Detection Program from 2006 to 2010. The bars represent the 51 awardees of the National Breast and Cervical Cancer Early Detection Program

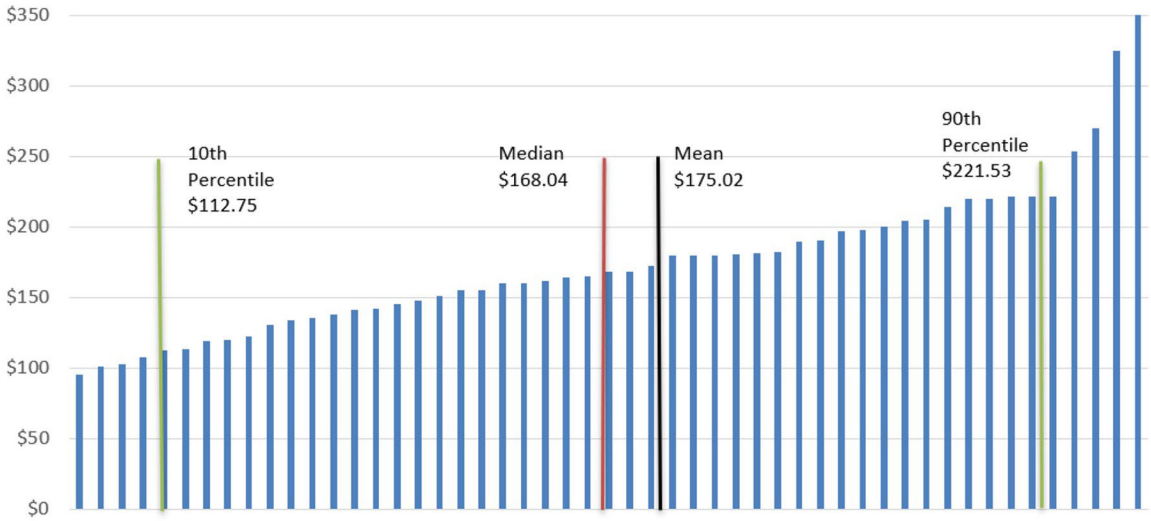

Fig. 2.

Average Clinical Cost of Providing Screening Services per Woman Served by Awardees of the National Breast and Cervical Cancer Early Detection Program from 2006 to 2010. The bars represent the 51 awardees of the National Breast and Cervical Cancer Early Detection Program

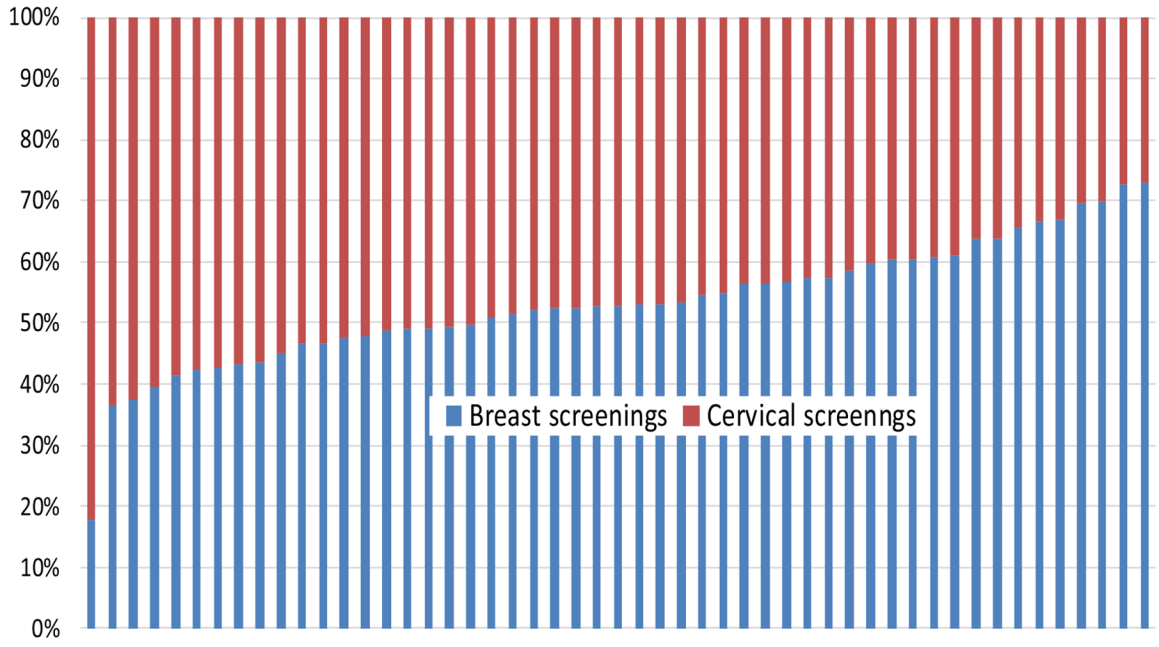

Fig. 3.

Proportion of Breast and Cervical Cancer Screenings provided by Awardees of the National Breast and Cervical Cancer Early Detection Program from 2006 to 2010. The bars represent the 51 awardees of the National Breast and Cervical Cancer Early Detection Program

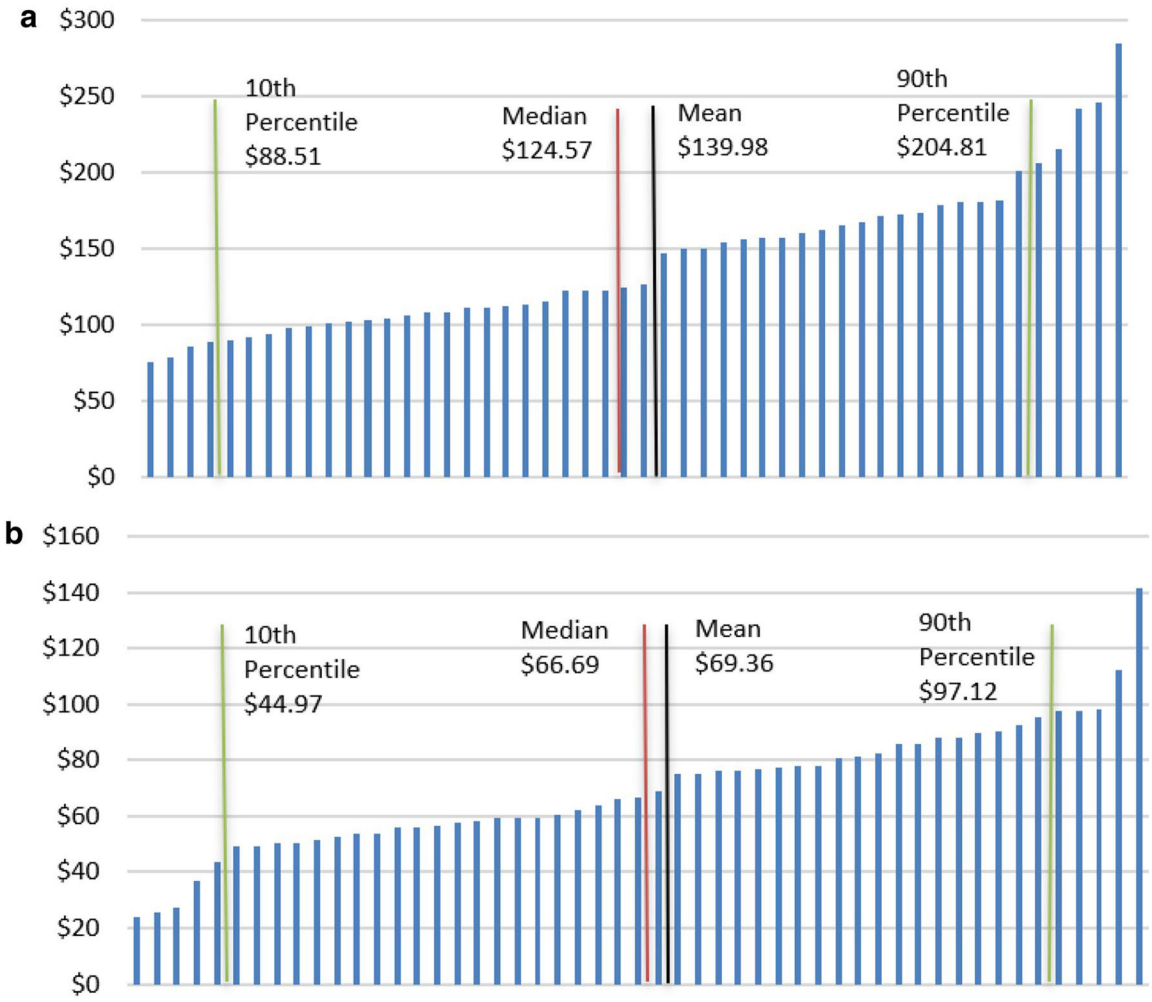

Fig. 4.

a Average Breast Cancer Screening Cost Per Woman Screened by Awardees of the National Breast and Cervical Cancer Early Detection Program from 2006 to 2010. The bars represent the 51 awardees of the National Breast and Cervical Cancer Early Detection Program. **b** Average Cervical Cancer Screening Cost Per Woman Screened by Awardees of the National Breast and Cervical Cancer Early Detection Program from 2006 to 2010. The bars represent the 51 awardees of the National Breast and Cervical Cancer Early Detection Program

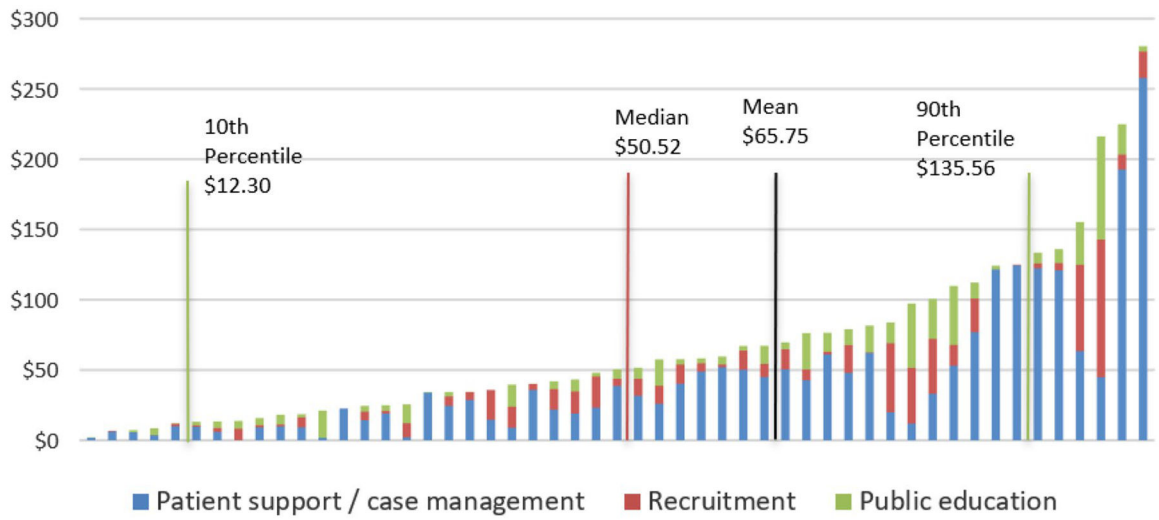

Fig. 5.

Average Cost of Patient Support, Recruitment, and Education among Awardees of the National Breast and Cervical Cancer Early Detection Program from 2006 to 2010. The bars represent the 51 awardees of the National Breast and Cervical Cancer Early Detection Program

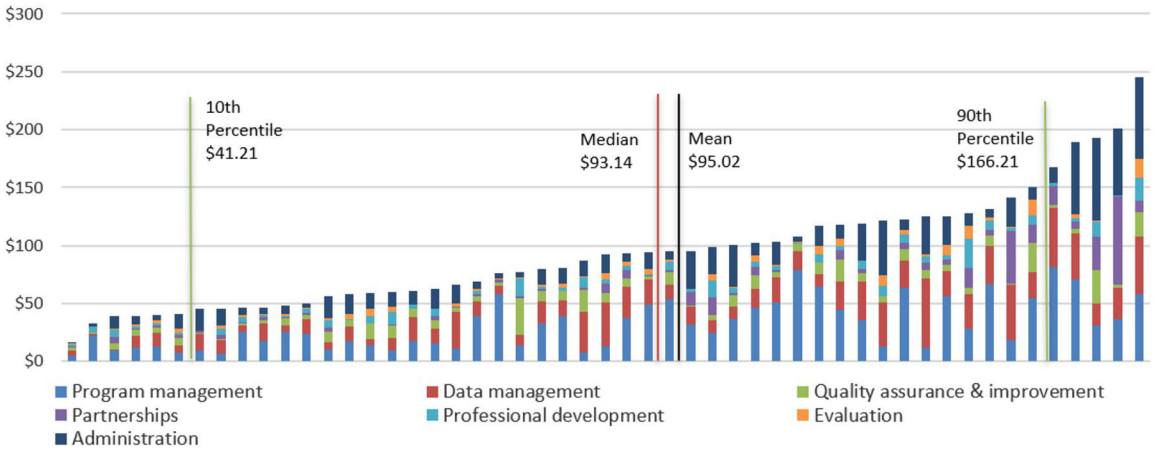

Fig. 6.

Average Cost of Core Program Management and Administrative Activities among Awardees of the National Breast and Cervical Cancer Early Detection Program from 2006 to 2010. The bars represent the 51 awardees of the National Breast and Cervical Cancer Early Detection Program