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Estimating the Impact of Increasing Cervical Cancer Screening in the National Breast and Cervical Cancer Early Detection Program among Low-Income Women in the U.S

Lisa M. Pollack, PhD, MPH¹, Donatus U. Ekwueme, PhD², Mei-Chuan Hung, PhD³, Jacqueline W. Miller, MD², Su-Hsin Chang, PhD, SM^{1,*}

¹Division of Public Health Sciences, Department of Surgery, School of Medicine, Washington University in St. Louis, St. Louis, MO 63110;

²Division of Cancer Prevention and Control, CDC, Atlanta, GA 30341;

³Leidos Inc., Atlanta, GA 30345

Abstract

Purpose: The National Breast and Cervical Cancer Early Detection Program (NBCCEDP) provides free cervical cancer screening to low-income women. This study estimated the health benefits gained in terms of life years (LYs) saved and quality-adjusted life expectancy (QALE) gained if cervical cancer screening by the NBCCEDP increased to reach more eligible women.

Methods: Data from Surveillance, Epidemiology, and End Results, NBCCEDP, and Medical Expenditure Panel Surveys were used. LYs saved and QALE gained/100,000 women were estimated and used to predict additional health benefits gained if screening by the NBCCEDP increased from 6.5% up to 10–25% of the eligible women.

Results: Overall, per 100,000 women screened by the NBCCEDP, 1,731 LYs were saved and 1,608 QALE were gained. For white women, 1,926 LYs were saved and 1,780 QALE were gained/ 100,000 women screened by the NBCCEDP. For black women, 1,506 LYs were saved and 1,300 QALE were gained/100,000 women screened. If the proportion of eligible women screened by the NBCCEDP increased to 10–25%, the estimated health benefits would range from 6,626–34,896 LYs saved and 6,153–32,407 QALE gained.

Conclusions: The reported estimates emphasize the value of cervical cancer screening program by extending LE in low-income women. Further, it demonstrates that screening a higher percentage of eligible women in the NBCCEDP would yield more health benefits.

Keywords

cervical cancer; low-income; National Breast and Cervical Cancer Early Detection Program (NBCCEDP); screening

^{*}Corresponding author: Su-Hsin Chang, PhD, SM, Division of Public Health Sciences, Department of Surgery, School of Medicine, Washington University in St. Louis, 660 S. Euclid Avenue, Campus Box 8100, St. Louis, MO 63110. chang.su-hsin@wustl.edu.

1. INTRODUCTION

Since the 1940s, the incidence and mortality of cervical cancer have dropped by more than 75% in the U.S., a decrease that has been attributed in part to increased screening and the use of effective treatments [1, 2]. However, while cervical cancer screening has increased, services do not reach all populations equally [2, 3]. Women living in low-resource, medically underserved areas have higher annual rates of cervical cancer incidence and mortality compared to women in the general population [2, 3].

The National Breast and Cervical Cancer Early Detection Program (NBCCEDP) is a congressionally-mandated (PL 101–354) public health program and the only nationally organized cancer screening program for underserved women in the U.S. [4]. This program provides cervical cancer screening and diagnostic services to low-income uninsured and underinsured women aged 21–64 years who have not had a hysterectomy with removal of the cervix for a non-cancerous condition [5]; women 18–64 years were served prior to update of the U.S. Preventative Services Task Force cervical cancer recommendation in 2012 [6]. Women 250% of the federal poverty level (~11% of U.S. women) are eligible for services [5]. Eligible NBCCEDP participants diagnosed with pre-cancerous lesions or invasive cervical cancer may receive treatment through their state Medicaid program [7].

Since 1991, NBCCEDP-funded programs have diagnosed more than 4,524 invasive cervical cancers and 207,727 premalignant cervical lesions, of which 39% were high-grade [5]. Despite recommendations from the Institute of Medicine – now called the National Academies of Science, Engineering, and Medicine – that the NBCCEDP reach all eligible women [8], Tangka et al., reported that only 6.5% of women aged 18–64 years who were eligible for NBCCEDP-funded Papanicolaou tests (Pap test) received screening between 2010 and 2012 [9]. If more eligible women could be screened by the NBCCEDP, early detection of cervical cancer would extend life expectancy and improve quality of life among underserved women.

This study estimated health benefits in terms of life-years (LYs) saved and quality-adjusted life expectancy (QALE) gained if cervical cancer screening by the NBCCEDP increased from 6.5% [9] to 10%, 15%, 20%, and 25% of the eligible women. The estimates reported in this study could provide useful information to help guide cancer control programs to effectively plan and implement evidence-based interventions that expand cervical cancer screening among medically underserved, low-income women.

2. METHODS

Data sources:

2.1. Surveillance, Epidemiology, and End Results 18 (SEER-18)—Data from the National Cancer Institute's SEER-18 registries, 2000–2013, were used to estimate life expectancy (LE) for women with cervical cancer. SEER-18 covers about 28% of the U.S population [10]. Women aged 18–64 years with a primary diagnosis of cervical cancer between 2000 and 2013 were identified using International Classification of Diseases for Oncology, 3rd Edition [11] site codes C530-C539. Patients with histology diagnoses of

mesothelioma (9050–9055), kaposi (9140), and lymphomas and leukemia (9590–9992) were excluded [12]. Women aged 18–64 years were included, because that was the age range for program-eligible women during the time of this study. Data on race/ethnicity, year of diagnosis, age of diagnosis, cancer stage (SEER summary stage: local, regional, distant), survival months, and vital status were used [10]. All patients were followed until death (all-cause) or December 31, 2013, whichever came first.

2.2. Medical Expenditure Panel Survey (MEPS)—Data from MEPS, 2008–2012, Household Component Full-Year Consolidated Data files were used to derive quality-of-life (QoL) utilities in order to estimate quality-adjusted life expectancy (QALE). MEPS is a nationally representative survey of the U.S civilian, noninstitutionalized population [13]. Women aged 18–64 years were included and variables used included race/ethnicity, age at interview, cervical cancer diagnosis (yes/no), age of diagnosis (for those with a cervical cancer diagnosis), Physical Component Summary 12 scores, and Mental Component Summary 12 scores [14, 15]. Using Sullivan's algorithm [16], the physical and mental summary scores were converted to utilities between 0 and 1, where 0 indicates death and 1 indicates perfect health (Online Resource Fig. 1). Cervical cancer duration was defined as time from year of cancer diagnosis to year of survey interview in months.

2.3. NBCCEDP minimum data elements (MDE) database—The NBCCEDP MDE collects data on services provided and outcomes for women who receive screening and diagnostic services through the program [5]. Data from the NBCCEDP MDE, 2010–2013, for women aged 18–64 years were used to obtain cervical cancer stage distribution (no cancer, pre-cancer, local, regional, and distant) from NBCCEDP-funded Pap test results. For this analysis, we refer to these women as screened. Pre-cancerous stage included low-grade squamous intraepithelial lesions and high-grade squamous intraepithelial lesions, all of which can be fully treated to prevent progression to a malignant condition [17].

2.4. LYs saved and QALE gained per woman screened via NBCCEDP

2.4.1. Estimating LE and differences in LEs (LEs) between women with and without a diagnosis of cervical cancer by race/ethnicity and cancer stage: For women with cervical cancer identified in SEER-18, the Kaplan-Meier method was used to estimate a survival function for 168 months following diagnosis (the longest follow-up in the SEER data). The survival function was extrapolated up to 840 months using a semi-parametric method [18]. The technical details for the extrapolation process has been described elsewhere [19–22]. Briefly, the patients in each racial/ethnic group were matched to the corresponding female general population (reference group) by their age of diagnosis. For the reference group, data were obtained from 2000–2013 U.S life tables [23]. For each matched cervical-reference group, a linear regression was fitted to the logit transformed survival ratios (survival probabilities of the cervical cancer group to those of the corresponding reference group) for the last 24 months of the 840 months of follow-up. Assuming a constant excess hazard [19, 24], the logit transformed survival ratios were extrapolated to 840 months. Life expectancy was generated for the cervical cancer group and the corresponding reference group, and the difference in LEs (LEs) between the two groups were derived for

all three cancer stages (local, regional, and distant; Online Resource Fig. 2a). The LEs were used to offset age discrepancies in each group of cancer stage.

2.4.2. Estimating QALE and differences in QALEs (QALEs) between women with and without a diagnosis of cervical cancer by race/ethnicity and cancer stage: A kernel-smoothing method was used to estimate a QoL function of time after cervical cancer diagnosis [25]. The utilities beyond the follow-up period were assumed to be the same as the average of the last 10% near the end of follow-up. Quality-adjusted life expectancy per woman was estimated using the following equation:[25]

$$QALE = \int E[QoL(t)]S(t)dt,$$

where E[QoL(t)] denotes the estimated QoL function at time *t*, and S(t) represents the survival function (previously described in Section 2.4.1). Quality-adjusted life expectancy was computed for each cervical cancer group and corresponding reference group [23]. Differences in QALEs were computed by subtracting the QALE for each reference group from the QALE for the corresponding cervical cancer group (Online Resource Fig. 2b).

2.4.3. LE and QALE for program participants and non-participants per 100,000 women: Program participants were defined as program-eligible women who received NBCCEDP-funded Pap tests, whereas non-participants were defined as program-eligible women who did not receive NBCCEDP-funded Pap test (obtained from Tangka et al. [9]).

Per-woman LE and QALE were derived for participants by calculating weighted averages of LEs and QALEs. The weights were defined as the proportions of participants diagnosed with cervical cancer at different stages in the NBCCEDP, 2010–2013 (no cancer, pre-cancer, local, regional, and distant). See Online Resource Table 3a for details. The percentage of women diagnosed with unknown stage was assumed to be equally distributed to the other four cancer stages (Online Resource Table 3a).

Per-woman LE and QALE were derived for non-participants by calculating weighted averages of LEs and QALEs. Cervical cancer stage distribution could not be obtained for non-participants; therefore, data on women aged 18–64 years with no insurance from SEER-18, 2007–2018 (data only available after 2007), [26] were used to proxy eligibility for non-participants for the NBCCEDP program. It was assumed that percentages of non-participant women diagnosed with local, regional, and distant stages resembled those of uninsured women selected in SEER-18 (Online Resource Table 3b). To compute the weights for non-participant women, we made the following assumptions (Online Resource Table 3b): (1) the percentages of women with cervical cancer are the same for participants and non-participants; (2) 2% of participants with pre-cancer would have been diagnosed with a more advanced stage if they had not participated; and (3) the percentage of women with unknown stage was equally distributed across the other three cancer stages (i.e., local, regional, distant).

2.4.4. LYs saved and QALE gained per 100,000 women screened via NBCCEDP: To compute LYs saved per 100,000 women screened within the NBCCEDP, the LEs per 100,000 participants were subtracted from the LEs per 100,000 non-participants. Similarly, QALEs gained per 100,000 women screened were computed in an analogous manner.

2.5. Estimated number of eligible women screened in the NBCCEDP if participation increased from 6.5% to 10%, 15%, 20%, and 25%—The estimated number of eligible women screened in the NBCCEDP if participation increased from 6.5% to 10–25% was obtained by multiplying the number of women eligible for NBCCEDP screening (obtained from Tangka et al.[9]) by the hypothesized target screening percentages (10%, 15%, 20%, 25%).

2.6. Estimated additional number of eligible women screened in the NBCCEDP if participation increased from 6.5% to 10%, 15%, 20%, and 25%— The estimated additional number of women screened in the NBCCEDP if program participation increased from 6.5% to 10–25% was obtained by multiplying the number of women eligible for NBCCEDP screening (obtained from Tangka et al.[9]) by the hypothesized target screening percentages (10%, 15%, 20%, 25%) and then subtracting the estimated number of eligible women screened for cervical cancer in the NBCCEDP at the different screening percentages (obtained from section 2.5).

2.7. Estimated LYs saved and QALE gained if participation in the NBCCEDP were to increase from 6.5% to 10%, 15%, 20%, and 25%—The estimated number of LYs saved and QALE gained for increasing cervical cancer screening in the NBCCEDP from 6.5% to 10–25% was obtained by multiplying the LYs saved and QALE gained per woman screened by the number of additional women screened at the different screening percentages (10%, 15%, 20%, 25%; from section 2.6).

2.8. Statistical analysis—A generalized linear model with a logit link and binomial family was used to estimate the utilities, which take on values between 0 and 1, on the cervical cancer duration for women diagnosed with cervical cancer. Using the estimated model, the utilities were then predicted based on the duration. The complex sampling design in MEPS was adjusted for following the analytic guidelines for MEPS [15]. SAS 9.4 (SAS Institute Inc, Cary, NC) was used for all analyses and the Integration of Survival with Quality of Life (iSQoL) statistical package (http://www.stat.sinica.edu.tw/isqol/)) was used to estimate LE, QALE, LEs, and QALEs. All women were stratified by race/ethnicity (non-Hispanic white (NHW), non-Hispanic black (NHB), and Hispanic) and cancer stage (SEER summary stage: local, regional, and distant). American Indian/Alaska Native and Asians or Native Hawaiian/Pacific Islanders were not included because of small sample sizes.

3. RESULTS

Data from the SEER-18 (2000–2013), MEPS (2008–2012), U.S. life tables (2000–2013), and NBCCEDP MDE (2010–2013) are presented in Online Resource Tables 3 and 4. The results (Table 1) show that overall, NBCCEDP participants versus non-participants had

higher percentages of local (38.6% vs. 36.0%) and regional stage cervical cancer (40.0% vs. 38.9%), whereas non-participants had a higher percentage of distant stage cancer (25.1%) than participants (21.4%). Compared with NHW and Hispanic participants, NHB participants had the lowest percentage of distant stage cancer (20.4%), whereas NHB non-participant had the highest percentage of distant stage cervical cancer (26.3%).

Overall, we estimated 1,731 LYs saved and 1,608 QALE gained/100,000 women screened via NBCCEDP (Table 2). By race/ethnicity, NHW women experienced the most LYs saved and QALE gained/100,000 women screened (LYs=1,926, QALE=1,780), followed by Hispanic women (LYs=1,921, QALE=1,667) and NHB women (LYs=1,506, QALE=1,300).

An estimated 1,088,700 (90% CI: 1,071,400–1,106,100) women would be screened if NBCCEDP participation increased from 6.5% to 10%, and an estimated 2,721,750 (90% CI: 2,678,500–2,765,250) women would be screened if participation increased from 6.5% to 25% (Fig. 1a). Overall, 382,730 (90% CI: 365,430–400,130) additional women would be screened if NBCCEDP screening increased from 6.5% to 10%, and 2,015,780 (90% CI: 1,972,530–2,059,280) additional women would be screened if screening increased to 25% participation level (Fig. 1b).

If participation increased to 10–25%, the overall estimated LYs saved ranged from 6,626 (90% CI: 6,326–6,927) to 34,896 (90% CI: 34,147–35,649) (Fig. 2a). For QALE gained, the estimates ranged from 6,153 (90% CI: 5,875–6,433) to 32,407 (90% CI: 31,711–33,106) (Fig. 2b). The estimated health benefits varied at different levels of participation by race/ ethnicity. For NHW women, the benefits were highest at 20–25% participation, estimated to be 11,196–15,544 LYs saved and 10,347–14,366 QALE gained. For NHB women, the benefits were smallest at all levels of participation ranging from 1,248–5,374 LYs saved and 1,077–4,637 QALE gained. For Hispanic women, the benefits were higher at 10–15% participation, estimated to be 3,624–7,298 LYs saved and 3,144–6,332 QALE gained.

4. DISCUSSION

In this study, we have quantified the health benefits of increasing NBCCEDP-funded cervical cancer screening in low-income women eligible for the program in terms of LYs saved and QALE gained. At current participation of 6.5% among the program-eligible women, we estimated that the program would save 1,731 LYs/100,000 women screened. When adjusted for improvement in quality of life, the estimate was 1,608 QALE/100,000 women screened. Increasing participation to a hypothetical target between 10% and 25%, would increase the total life expectancy for all eligible women screened from 6,626 to 34,896 LYs saved. When the estimated total life expectancy was adjusted to account for quality of life among these women, the estimate ranged from 6,153 to 32,407 QALEs gained.

These estimates indicate that while substantial health benefits have been realized in the program among the eligible women, more improvements in the quality of life as well as gains in the length of life could be realized as more eligible women are screened for cervical cancer. This result supports the findings reported in a previous study that assessed the impact

of the NBCCEDP on cervical cancer mortality [27]. In the previous study, the authors reported that women who received NBCCEDP screening gained 600 LYs/100,000 women screened compared with those who received screening without the program and that women who received NBCCEDP screening gained 5,500 LYs/100,000 women screened compared with those who received no screening [27]. In the current study, we examined the impact of increase in participation on screening in the eligible women and estimated that women who received NBCCEDP screening relative to eligible women who did not receive screening via NBCCEDP saved more than 1,700 LYs/100,000 women. This estimate is between the two estimates reported in a previous study [27]. The differences in the reported estimates may be explained by methodological differences, different years of data used, and different study duration. However, this study and the previous one demonstrate that the NBCCEDP program is in line or has greater health benefits in terms of LYs saved relative to other preventative health services (e.g., smoking-cessation (975 LYs/100,000 people per year of intervention) [28] or colorectal cancer screening (408 LYs/100,000 people per year of intervention) [28]).

In addition to increasing the life expectancy of low-income women, NBCCEDP has also improved quality of life by implementing patient navigation activities to improve patient access to screening and timeliness to diagnosis, reduce their anxieties, and refer those with abnormal diagnostic test results to treatment [29–32]. These activities have helped to increase overall satisfaction among the eligible women who received preventive cancer screening services through NBCCEDP [31, 32].

During the past 27 years, the program has also strived to reduce cancer disparities among racial/ethnic groups by providing access to free preventive cancer screening and diagnostic services [32, 33]. However, the estimates reported in this paper indicate that the health benefits of the program may not be equally distributed. For instance, NHB women had the smallest estimated health benefits, while NHW and Hispanic women had the highest comparable estimated health benefits (NHB: 1,506 LYs versus NHW: 1,926 LYs and Hispanic: 1,921 LYs saved/100,000 women screened via NBCCEDP). The potential explanation for lower health benefits estimated for NHB women may be the fact that they had the largest proportion of non-participants diagnosed with distant stage – a stage that contributes the smallest per-woman LE for non-participants, and thus they have the least number of LYs saved per woman screened.

This explanation notwithstanding, CDC encourages NBCCEDP awardees to reduce cancer disparities in their programs and achieve health equity in the populations they serve.[34] This may be achieved by identifying populations disproportionately burdened by the increased risk of cancer and selecting appropriate evidence-based cultural, structural, and language interventions for implementation. Such interventions could help reduce the continuing disparities in cancer screening reported in this paper and have been found in other studies [35, 36].

As previously reported, since the inception of the NBCCEDP, participation in cervical cancer screening has been estimated to be <10% of the eligible women [9]. In the current study, we have quantified the health benefits of this uptake in screening. In addition, we have

also gone further to project the potential health benefits if NBCCEDP screened up to 10–25% of the eligible women for cervical cancer. However, we realize that it may be challenging to increase participation to the projected level. This implies that women enrolled in NBCCEDP may benefit from patient navigation services that help to navigate through barriers to preventive health services and health promotional activities in the healthcare system. On the other hand, projecting participation up to 25% of the eligible women provides a benchmark for the size of the gain in life expectancy that could be expected in the NBCCEDP. Such expectation may be justified given that, despite coverage gains under the new health insurance expansion, millions of low-income women remain uninsured and continue to face financial barriers to cancer screening [37–39].

Limitations

This study has some limitations. First, this study targeted women aged 18–64 years, rather than 21–64 years, which is the current recommended age range for cervical cancer screening [3, 6]. That is because the age range for NBCCEDP-eligible women prior to 2012 was 18– 64 years, and one major data source used in this study (i.e., Tangka et al.) [9] reported results for women aged 18–64 years, making separation of women aged 21–64 years impossible. Nonetheless, it is expected that the impact of including women aged 18-20 years in this analysis was small, because cervical cancer is rare in young women in the U.S.[40] For example, using data from the National Program of Cancer Registries and the SEER Program, Benard et al. found an average of only 14 carcinomas per year among those aged 15-19 years, and 125 carcinomas per year among those aged 20-24 years.[40] Second, survival functions were estimated based on existing data. If new treatment regimens improve survival outcomes for women with cervical cancer, the estimated changes in life expectancy for each group may be overestimated. Third, when computing weights for non-participants, it was assumed that 2% of underserved women diagnosed with pre-cancer in the program would have been diagnosed with a more advanced stage if they had not participated. Two percent is a conservative estimate, and while there is no available data to examine this, the estimated health benefits would be larger if screening via NBCCEDP were able to detect a higher proportion of women at the pre-cancerous stage. Finally, we assumed screening to increase based on a fixed number of eligible women across all racial/ethnic groups, which might not be applicable given continuing changes in the program's eligible population. However, this study provides health benefits per additional woman screened, which can be used to compute screening targets for specific programmatic goals.

These limitations notwithstanding, the benefits of NBCCEDP go beyond the reported health outcomes. The program has helped uninsured women gain access to the healthcare system, leading to better long-term health behavior as reported by Adams et al. [41]. Further the program has helped to increase screening for other chronic diseases. For example, the Well-Integrated Screening and Evaluation for Women Across the Nation (WISEWOMAN) was created to provide heart disease and stroke screening and prevention to the same women who are NBCCEDP-eligible[42].

5. CONCLUSIONS

This study focused on the health benefits (i.e., LYs, and QALE) for cervical cancer screening in the NBCCEDP. Estimating only health benefits of the program helps to clearly demonstrate the value of cervical cancer screening in the NBCCEDP. This approach is similar to other modeling studies used to develop screening policies in the US [43–45]. The results of this study demonstrate that increasing participation from 10–25% would substantially increase life expectancy of the eligible women who receive cervical cancer screening through the program. The reported estimates provide important insights in understanding the value of cervical cancer screening in low-income women, which is essential for public health planning.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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6. DISCLOSURE OF POTENTIAL CONFLICTS OF INTEREST STATEMENT

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a. Estimated number of eligible women screened in the NBCCEDP if participation increased from 6.5% to 10-25%^a



Fig. 1.

(a) Estimated number of eligible women screened in the NBCCEDP if participation increased from 6.5% to 10–25% and (b) Estimated additional number of eligible women screened in the NBCCEDP if participation increased from 6.5% to 10–25%, 2010–2013 National Breast and Cervical Cancer Early Detection program, NBCCEDP; Non-Hispanic White, NHW; NHB, Non-Hispanic Black Frequency (90% confidence interval) reported ^a Estimated number of eligible women screened in the NBCCEDP if participation increased from 6.5% to 10–25% = Women eligible for NBCCEDP screening (obtained from Tangka et al.[9]) × (target screening percentages).

^b Estimated additional number of women screened in the NBCCEDP if participation increased from 6.5% to 10–25% = Women eligible for NBCCEDP screening (obtained from

Tangka et al.[9]) x (target screening percentages) – eligible women screened for cervical cancer in the NBCCEDP at the different screening percentages (from Figure 1a).



Overall 🕺 NHW 🚿 NHB 🗉 Hispanic

Fig. 2.

Estimated numbers of (a) life years (LYs) saved and (b) quality-adjusted life expectancy (QALE) gained from increasing cervical cancer screening in the NBCCEDP from 6.5% to 10–25%, 2010 to 2013

LYs, life years; QALE, quality-adjusted life expectancy; National Breast and Cervical Cancer Early Detection program, NBCCEDP; Non-Hispanic White, NHW; NHB, Non-Hispanic Black Frequency (90% confidence interval) reported ^a Estimated number of LYs saved for increasing cervical cancer screening in the NBCCEDP from 6.5% to 10-25% =LYs saved per woman screened × the number of additional women screened at the different screening percentages

^b Estimated QALE gained for increasing cervical cancer screening in the NBCCEDP from 6.5% to 10–25% = QALE gained per woman screened × the number of additional women screened at the different screening percentages

Cervical cancer stage distribution for program participants^{*a*} and non-participants^{*b*} aged 18–64 years from NBCCEDP MDE (2010–2013) and SEER-18 (2007–2013)

	Pa	articipants (%) ^c	Non	-participants	$(\%)^d$
	Local	Regional	Distant	Local	Regional	Distant
Overall	38.6	40.0	21.4	36.0	38.9	25.1
Race/Ethnicity						
NHW	38.5	40.4	21.1	33.6	41.2	25.3
NHB	34.6	45.0	20.4	30.8	42.9	26.3
Hispanic	41.4	35.5	23.1	40.1	34.5	25.4

National Breast and Cervical Cancer Early Detection Program minimum data elements, NBCCEDP

MDE; Surveillance, Epidemiology, and End Results 18, SEER-18; NHW, Non-Hispanic White; NHB, Non-Hispanic Black

^aParticipants = NBCCEDP program-eligible women who received NBCCEDP-funded Pap tests

 b Non-participants = NBCCEDP program-eligible women who did not receive NBCCEDP-funded Pap test

^CRecomputed from the cervical cancer stage distribution obtained for program participants aged 18–64 years from NBCCEDP MDE, 2010–2013 (Online Resource Table 3a demonstrates how cervical cancer stage for participants were recomputed). [5]

^dTo proxy eligibility for non-participants for the NBCCEDP MDE program, cervical cancer stage distribution was estimated from non-insured women 18–64 years from SEER-18 (data were only available after 2007; Online Resource Table 3b demonstrates how cervical cancer stage for non-participants was estimated). [26]

		LYs saved			QALE gained	
	LE^a per 100,000 participants ^b	LE per 100,000 non- participants ^c	LYs saved per 100,000 women screened via NBCCEDP ^d	QALE per 100,000 participants ^{e}	QALE per 100,000 non- participants ^f	QALEs gained per 100,000 women screened via NBCCEDP ^g
Overall	1,674	3,405	1,731	1,577	3,185	1,608
Race/Ethnicity						
MHM	2,234	4,160	1,926	2,111	3,891	1,780
NHB	1,375	2,881	1,506		1,200	2,500 1,300
Hispanic	1,268	3,189	1,921	1,103	2,770	1,667
$b ext{ LE per 100,000 part in local stage imes local st$	ticipants = $100,000 \times [(I tage % in the NBCCEDP)$	LE per woman in no cancer () + (LE per woman in regio	0) × no cancer % in the NBCCED nal stage × regional stage % in the	P) + (LE per woman in pr NBCCEDP) + (LE per w	e-cancer (0) × pre-cancer % oman in distant stage × dist	in the NBCCEDP) + (LE per woman ant stage % in the NBCCEDP)].
Amphant	1,400	10160	14/1	L) 1 V 1	41.14	1,001
<i>c</i> LE per 100,000 non participants) + (LE p 98% of women with a	h-participants = $100,000 \times$ er woman in distant stage pre-cancerous diagnosis in	 [(LE per woman in local si × estimated distant stage % n the NBCCEDP) × stage di 	tage × estimated local stage % for for non-participants)]. Estimated s stribution from the women aged 18	non-participants) + (LE p tage % for non-participants 5-64 with no insurance in S	er woman in regional stage $i = (1 - \% \text{ of women with a})$ LER-18.	× estimated regional stage % for non- no cancer diagnosis in the NBCCEDP –
$^d\mathrm{LYs}$ saved per 100,00	0 women screened via NF	BCCEDP = weighted LEs f	or per 100,000 non-participants -	weighted LE for per 100,	000 participants.	
<i>e</i> QALE per 100,000 (QALE per woman ii in the NBCCEDP)].	participants = 100,000 × [n local stage × local stage	 QALE per woman in no c in the NBCCEDP) + (Q 	ancer (0) × no cancer % in the NB ALE per woman in regional stage	CCEDP) + (QALE per w × regional stage % in the N	oman in pre-cancer (0) × pr (BCCEDP) + (QALE per v	s-cancer % in the NBCCEDP) + voman in distant stage \times
f QALE per 100,000 . for non-participants) + NBCCEDP – 98% of v	non-participants = 100,00 · (QALE per woman in d women with a pre-cancero	0 × [(QALE per woman in listant stage × estimated dist ous diagnosis in the NBCCEJ	local stage × estimated local stage ant stage % for non-participants)]. DP) × stage distribution from the w	% for non-participants) +	(QALE per woman in regi- participants = (1 – % of wo insurance in SEER-18.	anal stage \times estimated regional stage % men with a no cancer diagnosis in the
^g QALEs gained/100,0	00 women screened via N	BCCEDP = weighted QAI	LEs for per 100,000 non-participan	ts - weighted QALEs for	per/participants.	

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Table 2.