Published in final edited form as:

J Cancer Educ. 2013 September ; 28(3): 466–473. doi:10.1007/s13187-013-0488-7.

The Effectiveness of a Community-Based Breast Cancer Education Intervention in the New York State Capital Region

Nur Zeinomar¹ and Roxana Moslehi^{1,2}

¹Department of Epidemiology and Biostatistics, School of Public Health, University at Albany, State University of New York, NY

²Cancer Research Center, University at Albany, State University of New York, NY

Abstract

Objectives—We determined the effectiveness of a community-based breast cancer education intervention among understudied populations in the New York State (NYS) Capital Region by assessing and comparing baseline and post-education breast cancer knowledge.

Methods—Participants included 417 students recruited from five colleges/universities and 67 women from four community group organizations. Baseline and post-education knowledge was assessed via self-administered mostly multiple-choice questionnaires. An open-ended question soliciting opinions about public health prevention strategies against breast cancer was included on college/university students' questionnaires. Effectiveness of education intervention was estimated through a paired t-test. Stratified analysis was done using demographic and descriptive variables. Answers to the open-ended questions were analyzed qualitatively.

Results—The mean percentage of correct answers increased from 39.9% at baseline to 80.8% post-education ($P<0.0001$) among college/university students and from 43.5% to 77.8% ($P<0.0001$) among community group members. Effectiveness remained statistically significant in all stratified analyses with similarly high percentage of correct answers achieved post-education irrespective of knowledge level at baseline. Stratified analysis also revealed similar patterns of improvement in overall knowledge and narrowing of the gap in post-education knowledge. Primary prevention emerged as the dominant theme post-education in students' responses to the open-ended question, signifying the effectiveness of our education in raising awareness about modifiable risk factors and inspiring proactive thinking about public health prevention strategies.

Conclusions—This community-based education intervention was effective in increasing breast cancer knowledge among demographically diverse groups with low levels of baseline knowledge in the NYS Capital Region. Our findings provide leads for future public health prevention strategies.

Keywords

Breast cancer; community-based education intervention; public health prevention; cancer knowledge; New York State

INTRODUCTION

Breast cancer is the most common cancer and the second leading cause of cancer death among women in the United States (US). There were an estimated 226,870 new cases of

invasive breast cancer and 39,520 deaths due to breast cancer among US women in 2012[1]. In New York State (NYS), breast cancer rates have been reported to be higher upstate (including the NYS Capital Region) compared to New York City (NYC) [2]. A number of counties in the NYS Capital Region are among areas with highest incidence rates of breast cancer in the state; an example is Rensselaer County where breast cancer rates were 135.6 per 100,000 females during 2005–2009 compared to 112.0 per 100,000 females for NYC during the same period [3]. The five-year relative survival for breast cancer drops from 98.4% for localized (early-stage disease) to 23.8% for metastatic disease[4]. Preventive approaches aimed at reducing risk of breast cancer occurrence and mortality require knowledge of etiologic risk factors and screening guidelines among individuals.

There are no reports of breast cancer education intervention or knowledge assessment among communities in upstate New York in the published literature. Most published national and international studies have reported low levels of awareness and knowledge about breast cancer among women from the general population[5–20] as well as among college/university students[21–26]. Examples include a meta-analysis of 221 studies in the US, which identified lack of knowledge about breast cancer risk factors and screening guidelines as one of the main barriers of adherence to screening recommendations[17]. In a British study, 50% of the 1400 women surveyed did not recognize age as a risk factor for breast cancer[14]. Similarly, studies involving college and university students in the US reported gaps in breast cancer and breast health knowledge among both genders [21–23]. An international study conducted among university students in 23 countries also noted relatively weak knowledge of breast cancer[24].

Higher rates of breast cancer in the NYS Capital Region along with the lack of a readily available breast cancer educational tool in the context of limited knowledge of breast cancer reported for subgroups of the general population [5–26] motivated a community-based breast cancer education intervention in the NYS Capital Region among college/university students and community group members. The main goals of this study were to assess baseline knowledge and determine effectiveness of newly developed educational tools in improving knowledge among these targeted populations.

METHODS

Capital Region Action Against Breast Cancer (CRAAB!) Education Intervention

The education intervention assessed in our study was initiated by the Capital Region Action Against Breast Cancer (CRAAB!), a non-profit community-based organization in upstate New York. CRAAB! created the newly developed educational tools used in this study in collaboration with us as investigators at the University at Albany based on a thorough review of the most current scientific literature. Educational tools consisted of Microsoft PowerPoint® presentations lasting 35–40 minutes tailored to each of the two target populations of college/university students and community group members. The breast cancer presentation topics covered three general areas of descriptive epidemiology, disease biology, and (established and potential) factors associated with risk. Factors associated with risk included hormonal, genetic, lifestyle and nutrition as well as environmental and occupational. One member of the project team from CRAAB! delivered the presentations to all participating college/university classes and community groups.

Study Population

Participating centers included five colleges/universities and four community groups representing a cross-section of educational and community organizations in the NYS Capital Region. University/college organizations included University at Albany, Siena College,

Fulton Montgomery Community College (FMCC), Maria College, and The College of Saint Rose. These included both public (University at Albany and FMCC) and private (Siena College, Maria College, and The College of Saint Rose) institutions serving from 1,000 students (Maria College) to 17,000 students (University at Albany) and offering a range of degree programs from associate to graduate level. Institutional Review Board (IRB) approvals for the study were obtained from University at Albany, the Principal Investigator (PI) Institute, and from Siena College.

Community group organizations included Zonta Club, Hope in the Boat, Ladies Auxiliary/ West Albany Fire House, and Trinity Alliance. Hope in the Boat is a breast cancer support group whose mission is to empower survivors through physical activity. Trinity Alliance of the Capital Region offers a wide range of social and family services. The Zonta Club of Albany is comprised of female professionals working to improve the status of women. The Ladies Auxiliary of West Albany Fire House supports volunteer members of the West Albany Fire Department.

Assessment Tools and Study Protocol

The assessment tools for the presentation consisted of self-administered mostly multiple-choice pre- and post-education questionnaires targeted to each of the two participating populations of students and community group members. Pre- and pilot testing was conducted on the questionnaires, which led to modifying the questionnaires for use in the study.

Pre- and post-education questionnaires were composed of several demographic and knowledge assessment questions targeted to each of the two participating groups of college/university students (Appendix 1) and community group members (not shown). Race and ethnicity along with other demographic variables were collected to allow for stratified analysis of effectiveness of education intervention. Race and ethnicity were classified in accordance with the system used by the National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) program[27] as well as by other population-based cancer registries in the US such as the NYS Cancer Registry[3]. All multiple-choice knowledge assessment questions on pre- and post-education questionnaires were similar for both groups of participants. An open-ended question soliciting opinions about public health prevention strategies against breast cancer was included on the pre- and post-education questionnaires administered to the college/university students only.

Recruitment scripts were used to inform that participation in the study was voluntary and that all information would remain anonymous. One member of the research team administered and collected nearly all pre- and post-education questionnaires and consent forms. The questionnaires and the consent form for each individual were linked via a unique ID.

Statistical Analysis

Analyses were conducted separately for college/university students and community group members. Only participants who had completed both pre- and post-education questionnaires were included in the analysis. Descriptive statistics were obtained on all demographic variables and on the proportion of correct responses for each of the three main breast cancer presentation topics of descriptive epidemiology, disease biology, and established and potential factors associated with risk, on pre- and post-education questionnaires.

Baseline and post-education breast cancer knowledge was assessed by calculating the mean percentage of correct answers to the 18 questions (5.556% assigned to each correct answer) on each questionnaire. The effectiveness of education on increasing knowledge was assessed

through a paired t-test comparing mean percent correct answers on pre- versus post-education questionnaires while adjusting for dependence of the questionnaires for each individual. Stratified analysis was conducted using demographic and other descriptive variables. Effectiveness was also assessed through a Wilcoxon signed rank sum test, when appropriate; this analysis produced similar results to those obtained from the paired t-test in all cases. All statistical analyses were performed using SAS version 9.1 (SAS Institute, Cary, NC). The open-ended questions were analyzed qualitatively to identify general and common themes from the participants' responses.

RESULTS

A total of 417 college/university students (representing both genders) and 67 community group members (all females) participated in this project and received the education intervention as part of 24 educational sessions during a 7-month period. Participation rates (i.e., proportion of individuals present at recruitment who agreed to participate in the study) for college/university students and community group members were 94.3% and 97.1%, respectively. Demographic characteristics of college/university student and community group member participants are summarized in Tables 1 and 2.

Analysis of effectiveness of the education material in increasing knowledge showed that the mean percentage of correct answers among college students increased from 39.8% pre-education (average of 7.2 correct answers out of 18 total) to 80.8% post-education (14.5 correct answers); this signifies ~41% statistically-significant ($P<0.0001$) improvement in knowledge post-education (Table 3). Similarly, the mean percentage of correct answers among community group members increased from 43.4% (7.8 correct answers) pre-education to 77.8% (14.0 correct answers) post-education signifying ~34% statistically-significant ($P<0.0001$) improvement in knowledge post-education (Table 3).

Stratified analyses by each educational organization revealed that effectiveness remained statistically significant for each of the colleges/universities (Table 3). Baseline percentage of correct answers ranged from 32.2%–70.2% signifying a range of 5.8–12.6 correct answers. The range of percent correct answers post-education was 75.0%–88.8% (13.5–16.0 correct answers), signifying both an increase in the overall knowledge for each organization and a narrowing of the gap in post-education knowledge across different organizations (Table 3).

Effectiveness also remained statistically significant for each community group organization. The range of percent correct answers at baseline was 19.7%–65.6% corresponding to 3.5 to 11.8 correct answers out of 18 total. Post-education, the range of percent correct answers was 59.8%–84.8% or 10.8–15.3 correct answers, signifying a similar pattern of improvement in the overall knowledge and narrowing of the gap as mentioned above (Table 3).

When stratified by the three breast cancer education topics, the lowest percent of correct answers at baseline among both groups of college/university students and community members was for the topic of disease biology and the subtopic of “environmental and occupational factors” under the topic of factors associated with risk (Table S1). The highest percent correct answers at baseline among both groups was for “descriptive epidemiology”. Post-education, the percent correct answers increased by an average of 38.3%–51.2% across topics among students and by an average of 28.9%–42.7% across topics among community group members (Table S1).

Stratified analyses were done using several demographic and descriptive variables including gender, race, ethnicity, age group, education level/prior degree, knowing/being a breast cancer survivor, and having attended a breast cancer lecture/seminar in the past (Tables S2

and S3). Analysis by gender among students revealed similar levels of baseline and post-education knowledge among both genders. Stratified analysis by race and ethnicity among college/university students and community group members revealed a gap in knowledge which was narrowed down as the result of education intervention (Table S2 and S3).

Stratified analysis by age revealed that among college/university students, the difference in percent correct answers at baseline between the age group with the highest baseline knowledge (38 years) and the one with the lowest baseline knowledge (18–22 years) was 28.8% or an average of 5.2 correct answers. Post-education, this difference was decreased to 9.9% or an average of 1.8 correct answers (Table S2). Among community group members, the difference between the age group with the highest baseline knowledge (50–59 years) and the group with the lowest baseline knowledge (70–79 years) was 30.3% or an average of 5.4 correct answers. Post-education, the difference was decreased to 22.2% or about 4.0 correct answers (Table S3).

Stratified analysis by highest level of education, prior attendance at a breast cancer lecture/seminar, and being or knowing a breast cancer survivor revealed similar patterns among both participating groups of students and community group members (Tables S2 and S3).

The response rates to the open-ended questions on the surveys administered to the students regarding preventive actions against breast cancer were 71.9% and 62.1%, respectively, for the pre- and post-education questionnaires. Qualitative analysis of students' answers revealed two common overarching themes of screening and primary prevention (which included awareness and avoidance of risk factors at both the individual and the societal levels). On the pre-education questionnaire, the majority of responses (50.7%) fell under the theme of screening, which included breast self-exam (BSE) and mammography. Of responses, 36.9% fell under the theme of primary prevention, which included awareness of lifestyle, family history, genetic, environmental, and hormonal factors. On the post-education questionnaire, primary prevention emerged as the dominant theme with 80.3% of respondents specifying awareness/avoidance of risk factors. Screening was mentioned either as the sole public health message or in addition to primary prevention by 39.8% of students post-education.

DISCUSSION

To our knowledge, ours is the first reported community-based breast cancer education intervention among understudied populations in the NYS Capital Region. Our results revealed low levels of baseline knowledge of breast cancer among both participating groups of college/university students and female members of the community in the NYS Capital Region. Our assessment revealed that the targeted education intervention was effective in improving knowledge of breast cancer immediately post-education among these subpopulations across a range of demographic and descriptive variables such as race/ethnicity, age group, prior attendance at a lecture/seminar, and being/knowing a survivor.

The rationale for selection of the target populations in our study was based on maximizing the benefits of educational intervention with respect to breast cancer prevention and/or detection. College/university students constitute a newly-independent population who are developing and establishing their individual lifestyle practices with respect to dietary/nutritional habits, oral contraceptive and other exogenous hormone uses, physical activity, and alcohol consumption, factors which influence the risk of breast cancer. Peri- and post-menopausal women in the general population are at the highest risk for developing breast cancer. Therefore, an educational intervention targeting these subpopulations has the

potential to increase knowledge and motivation for making informed decisions with respect to primary prevention and risk reduction options.

Our study revealed an overall less-than-optimal level (i.e., correct answers to less than half of the questions) of baseline knowledge of breast cancer among college/university students and community group members. This finding is consistent with the results of previous studies which surveyed college/university students about their breast cancer knowledge in the US[21–23] and other countries[25, 26] as well as studies which surveyed general population of women[5–20]. Although breast cancer knowledge at baseline was low across breast cancer topics in our study, weaknesses were most prominent for “disease biology” and “factors associated with risk” among both groups of participants. Previous studies among female college students in three US universities[22] and among women aged 40–74 years[14], which reported low baseline knowledge of certain risk factors for breast cancer, concur with our findings.

Our assessment revealed that our education intervention was effective in increasing knowledge about breast cancer among demographically diverse populations with low baseline knowledge in the NYS Capital Region. Our results concur with findings of other educational interventions conducted within the US, including those in Northern[28] and Southern[29] California, Florida[30], Massachusetts and Georgia[19], NYC and Arkansas[9], Texas[6, 31], and North Carolina[32] as well as international studies[5, 10, 12]. Our educational tools consisted of Power Point presentations delivered in lectures catered to each participating group. Previous studies utilized a variety of interventions including presentations, seminars or workshops[5, 6, 9, 10, 28], focused discussion groups[30], video breast health kits[19], and culturally targeted booklets[6, 12, 29, 31, 32].

Stratified analysis revealed similar patterns of significant increase and narrowing of the range with respect to percent correct answers post-education across nearly all demographic and descriptive variables among both participating groups of college/university students and female community members in our study. For example, stratified analysis by prior education revealed that while individuals without a prior college or graduate degree among both groups of participants had lower baseline knowledge, our education was effective in increasing knowledge and narrowing the range of percent correct answers across all educational levels. Interestingly, two international studies, conducted in an urban slum in Egypt[10] and rural Turkey[5], both found that education interventions dramatically improved participants’ breast cancer knowledge even among illiterate women with low levels of baseline information on breast cancer.

Stratified analysis by educational or community group organization revealed that effectiveness remained statistically significant for all organizations. Of note, the highest baseline and post-education level of breast cancer knowledge among all educational organizations in our study was for Maria College, which offers variety of nursing programs with clinical components. The important point is that through our education intervention, we were able to attain post-education knowledge levels close to that achieved by Maria College (i.e., ~89%) among other participating institutions in our study which had much lower baseline knowledge levels, such as the University at Albany. Findings in community group organizations were similar in that we were able to narrow the range of mean percent correct answers post-education (to 4 correct answers from 8 at baseline) across all groups.

Our findings that ~80% of college/university students had never attended a breast cancer lecture/seminar and that >83% of female community group members had not attended a breast cancer lecture/seminar in the past five years underscore the importance of our education intervention on these subpopulations. Other studies had also reported lack of prior

education about breast cancer among university students and general population of women. A large survey of college students in Texas reported that breast cancer was not commonly discussed in classrooms or among family and friends[23]. Deficiency in breast cancer knowledge has also been reported among older women and cited as a barrier to taking preventive and/or risk reducing measures[17].

Our findings with respect to the open-ended questions about preventive actions against breast cancer are noteworthy. The inclusion of this question allowed us to capture unrestricted opinions impossible to obtain from multiple-choice questions typical of education intervention questionnaires. Qualitative analysis revealed a shift in attitudes brought about by the education intervention in that primary prevention emerged as the dominant theme post-education. This shift in attitudes can be interpreted as effectiveness of our education intervention in empowering the students by giving them the knowledge of modifiable risk factors for breast cancer (such as excessive alcohol consumption, long-term oral contraceptive use, low levels of physical activity, etc.) and by inspiring proactive thinking with respect to public health prevention strategies.

The strengths of our study include the demographic diversity of our study subjects, systematic delivery of education and collection of information, and community-based nature of the intervention. Community-based prevention programs were recently noted as particularly effective with respect to their scope of dissemination, which goes beyond clinical-based prevention programs, hence their independence from access to the health care system[33]. Although, our findings are not generalizable to the entire population of the NYS Capital Region, they are interpretable. Furthermore, our findings with respect to baseline knowledge levels and effectiveness of education intervention are consistent with prior studies conducted in other populations, although, publication bias cannot be ruled out.

Limitations of our study include possibility of self-selection bias, and lack of information on long-term impact of our education intervention. The possibility of self-selection bias influencing our findings is minimized due to high participation rate (95.0%) in both groups. We assessed effectiveness of our intervention immediately post-education. Due to the nature of our study design (i.e., anonymous subjects), we were not able to determine long-term impact of our education intervention through assessing retained knowledge and/or life-style modifications of the participants. Interestingly, prior studies have suggested that effectiveness of breast cancer education may remain significant up to 4–6 weeks[32], several months[6, 9, 28–31], and one year[12] post-intervention.

Besides having long-term assessment plans incorporated in their design, future education intervention studies could benefit from targeting other relevant subpopulations such as health care professionals, who provide counseling regarding appropriate preventive options. Insufficient knowledge among health care professionals has been cited as a barrier to providing breast cancer risk assessment in the primary care setting[34]. Along the same lines, a targeted intervention among nurse practitioners found significant improvement of breast cancer risk assessment knowledge post intervention[34], suggesting potential impact on clinical practice.

In conclusion, our findings revealed low levels of baseline knowledge among subpopulations in the NYS Capital Region, particularly with respect to certain important aspects of breast cancer such as disease biology and associated risk factors. Our study also found a significant improvement in knowledge following the education intervention among these subpopulations. Our findings provide leads for public health prevention strategies in NYS and in other populations by identifying specific areas of knowledge gaps as well as

specific subgroups of the population who could benefit the most from future targeted public health efforts.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

This study was funded through a grant from the New York State Health Research Science Board (HRSB), Patricia S. Brown Breast Cancer Education Community Based Demonstration (RFA 0812160859) to Capital Region Action Against Breast Cancer (CRAAB!) organization and University at Albany (Principal Investigator: Dr. Roxana Moslehi). Our sincere thanks to Ms. Margaret Roberts, the project director for this intervention study at CRAAB!, for preparing and delivering the Powerpoint® presentations and helping with many other aspects of the study. Guidance by and discussions with Dr. David O. Carpenter were invaluable to the success of the overall intervention study. We appreciate all input and contributions by Bonnie Spanier, Ph.D., Emerita Professor at University at Albany, SUNY and a member of CRAAB!. We also thank Ms. Kim Baker, M.S., R.N. at CRAAB! for her help with preparing the educational material and Ms. Joan Sheehan for organizing the community group educational sessions. Finally, we extend our thanks to the professors and students from participating colleges and universities as well as to the organizers and members of participating community groups.

References

1. Siegel R, Naishadham D, Jemal A. Cancer statistics, 2012. CA: A Cancer Journal for Clinicians. 2012; 62(1):10–29. [PubMed: 22237781]
2. [Accessed October 11, 2012] The Cancer Burden in New York State. http://www.acscan.org/ovc_images/file/action/states/ny/NY_Cancer_Burden_Report_2012.pdf Published July 2012
3. New York State Cancer Registry. [Accessed October 10, 2012.] Cancer Incidence and Mortality in New York State, 1976–2009. <http://www.health.ny.gov/statistics/cancer/registry/>
4. Howlader, NN.; Krapcho, AM.; Neyman, M.; Aminou, N.; Waldron, R.; Altekruse, W.; Kosary, SF.; Ruhl, CL.; Tatalovich, J.; Cho, Z.; Mariotto, H.; Eisner, A.; Lewis, MP.; Chen, DR.; Feuer, HS.; Cronin, EJ.; Edwards, KABK., editors. [Accessed August 20, 2012.] SEER Cancer Statistics Review, 1975–2008. Nov 10. 2011 http://seer.cancer.gov/csr/1975_2008/
5. Budakoglu II, Maral I, Ozdemir A, Bumin MA. The effectiveness of training for breast cancer and breast self-examination in women aged 40 and over. J Cancer Educ. Summer;2007 22(2):108–111. [PubMed: 17605625]
6. Cardarelli K, Jackson R, Martin M, et al. Community-based participatory approach to reduce breast cancer disparities in south Dallas. Prog Community Health Partnersh. Winter;2011 5(4):375–385. [PubMed: 22616205]
7. Dolan NC, Lee AM, McDermott MM. Age-related differences in breast carcinoma knowledge, beliefs, and perceived risk among women visiting an academic general medicine practice. Cancer. 1997; 80(3):413–420. [PubMed: 9241075]
8. Forbes LJL, Atkins L, Thurnham A, Layburn J, Haste F, Ramirez AJ. Breast cancer awareness and barriers to symptomatic presentation among women from different ethnic groups in East London. Br J Cancer. 2011; 105(10):1474–1479. [PubMed: 21989188]
9. Jandorf L, Bursac Z, Pulley L, Trevino M, Castillo A, Erwin DO. Breast and cervical cancer screening among Latinas attending culturally specific educational programs. Prog Community Health Partnersh. Fall;2008 2(3):195–204. [PubMed: 20208198]
10. Kharboush IF, Ismail HM, Kandil AA, et al. Raising the Breast Health Awareness amongst Women in an Urban Slum Area in Alexandria, Egypt. Breast Care (Basel). Oct; 2011 6(5):375–379. [PubMed: 22619648]
11. Linsell L, Burgess CC, Ramirez AJ. Breast cancer awareness among older women. Br J Cancer. 2008; 99(8):1221–1225. [PubMed: 18813307]
12. Linsell L, Forbes LJ, Kapari M, et al. A randomised controlled trial of an intervention to promote early presentation of breast cancer in older women: effect on breast cancer awareness. Br J Cancer. Dec 3; 2009 101 (Suppl 2):S40–48. [PubMed: 19956161]

13. McMenamin M, Barry H, Lennon AM, et al. A survey of breast cancer awareness and knowledge in a Western population: lots of light but little illumination. *Eur J Cancer*. Feb; 2005 41(3):393–397. [PubMed: 15691638]
14. Moser K, Patnick J, Beral V. Do women know that the risk of breast cancer increases with age? *Br J Gen Pract*. May; 2007 57(538):404–406. [PubMed: 17504593]
15. Osime OC, Okojie O, Aigbekaen ET, Aigbekaen IJ. Knowledge attitude and practice about breast cancer among civil servants in Benin City, Nigeria. *Ann Afr Med*. Dec; 2008 7(4):192–197. [PubMed: 19623922]
16. Pohls UG, Renner SP, Fasching PA, et al. Awareness of breast cancer incidence and risk factors among healthy women. *Eur J Cancer Prev*. Aug; 2004 13(4):249–256. [PubMed: 15554551]
17. Schueler KM, Chu PW, Smith-Bindman R. Factors associated with mammography utilization: a systematic quantitative review of the literature. *J Womens Health (Larchmt)*. Nov; 2008 17(9):1477–1498. [PubMed: 18954237]
18. Sim HL, Seah M, Tan SM. Breast cancer knowledge and screening practices: a survey of 1,000 Asian women. *Singapore Med J*. Feb; 2009 50(2):132–138. [PubMed: 19296027]
19. Wood RY, Duffy ME, Morris SJ, Carnes JE. The effect of an educational intervention on promoting breast self-examination in older African American and Caucasian women. *Oncol Nurs Forum*. Aug; 2002 29(7):1081–1090. [PubMed: 12183756]
20. Wang C, Miller SM, Eggleston BL, Hay JL, Weinberg DS. Beliefs about the causes of breast and colorectal cancer among women in the general population. *Cancer Causes Control*. Jan; 2010 21(1):99–107. [PubMed: 19787437]
21. Daley CM. College students' knowledge of risk and screening recommendations for breast, cervical, and testicular cancers. *J Cancer Educ*. Summer; 2007 22(2):86–90. [PubMed: 17605621]
22. Early J, Armstrong SN, Burke S, Thompson DL. US female college students' breast health knowledge, attitudes, and determinants of screening practices: new implications for health education. *J Am Coll Health*. 2011; 59(7):640–647. [PubMed: 21823959]
23. Estaville L, Trad M, Martinez G. University student understanding of cancer: analysis of ethnic group variances. *J Cancer Educ*. Jun; 2012 27(3):580–584. [PubMed: 22477236]
24. Peacey V, Steptoe A, Davidsdottir S, Baban A, Wardle J. Low levels of breast cancer risk awareness in young women: an international survey. *Eur J Cancer*. Oct; 2006 42(15):2585–2589. [PubMed: 16829071]
25. Sait WA, Al-Amoudi SM, Tawtai DA, Abduljabbar HS. The knowledge of breast cancer among young Saudi females. *Saudi Med J*. Nov; 2010 31(11):1242–1244. [PubMed: 21063656]
26. Sambanje MN, Mafuvadze B. Breast cancer knowledge and awareness among university students in Angola. *Pan Afr Med J*. 2012; 11:70. [PubMed: 22655104]
27. Surveillance, Epidemiology, and End Results (SEER) Program. National Cancer Institute, DCCPS, Surveillance Research Program, Surveillance Systems Branch; (www.seer.cancer.gov) SEER*Stat Database: Incidence - SEER 9 Regs Research Data, Nov 2011 Sub (1973–2009) - Linked To County Attributes - Total U.S., 1969–2010 Counties released April 2012, based on the November 2011 submission
28. Bloom JR, Stewart SL, D'Onofrio CN, Luce J, Banks PJ. Addressing the needs of young breast cancer survivors at the 5 year milestone: can a short-term, low intensity intervention produce change? *J Cancer Surviv*. Sep; 2008 2(3):190–204. [PubMed: 18670888]
29. Mishra SI, Bastani R, Crespi CM, Chang LC, Luce PH, Baquet CR. Results of a randomized trial to increase mammogram usage among Samoan women. *Cancer Epidemiol Biomarkers Prev*. Dec; 2007 16(12):2594–2604. [PubMed: 18086763]
30. Calderon JL, Bazargan M, Sangasubana N, Hays RD, Hardigan P, Baker RS. A comparison of two educational methods on immigrant Latinas breast cancer knowledge and screening behaviors. *J Health Care Poor Underserved*. Aug; 2010 21(3 Suppl):76–90. [PubMed: 20675947]
31. Yi JK, Luong KN. Apartment-based breast cancer education program for low income Vietnamese American women. *J Community Health*. Oct; 2005 30(5):345–353. [PubMed: 16175957]
32. Pavic D, Schell MJ, Dancel RD, et al. Comparison of three methods to increase knowledge about breast cancer and breast cancer screening in screening mammography patients. *Acad Radiol*. May; 2007 14(5):553–560. [PubMed: 17434069]

33. IOM. An integrated framework for assessing the value of community-based prevention. Washington, DC: The National Academies Press; 2012.
34. Edwards QT, Seibert D. Pre- and posttest evaluation of a breast cancer risk assessment program for nurse practitioners. *J Am Acad Nurse Pract.* Jul; 2010 22(7):376–381. [PubMed: 20590960]

Table 1

Descriptive Statistics, College Groups

	N	% <i>a</i>
Participating Colleges and Universities		
University at Albany-SUNY	184	44.12
Siena College	116	27.82
Fulton Montgomery Community College	55	13.19
Maria College	46	11.03
Saint Rose	16	3.84
Gender		
Female	323	77.46
Male	91	21.82
Age		
18–22	331	79.38
23–27	28	6.71
28–32	22	5.28
33–37	13	3.12
38–42	10	2.40
43–47	5	1.20
48 and over	6	1.44
Race		
White	299	71.70
Black	53	12.95
Asian/Pacific Islander	27	6.47
Mixed Race <i>b</i>	11	2.64
Ethnicity		
Non-Hispanic	356	85.61
Hispanic	53	12.71
Undergraduate College Major		
Physical and Biological Sciences	207	49.64
Social and Political Sciences	100	23.98
Arts, Languages, and General Studies	64	15.35
Business and Accounting	28	6.71
Undeclared	11	2.64
Education		
High School or GED	365	87.53
Bachelor's degree or equivalent	45	10.79
Master degree or equivalent	1	0.24
Doctorate or equivalent	3	0.72
Knowing or Being a Breast or Ovarian Cancer Survivor		
No	217	52.04
Yes	200	47.96

	N	% ^a
Self-Assessed Breast Cancer Knowledge		
No Knowledge	7	1.68
Minimal	219	52.52
Moderate	172	41.25
Considerable	19	4.56
Prior Breast Cancer Lecture Attendance		
No	330	79.14
Yes, in college	51	12.23
Yes, in high school	26	6.24
Yes, elsewhere	10	2.40

^a Percentages may not add up to 100% due to missing values

^b Mixed races include individuals who self-identified with more than one race as follows: white and Asian/Pacific Islander (n=3); white, Black, and American Indian (n=2); and white and Black (n=6)

Table 2

Descriptive Statistics, Community Groups

	N	% ^a
Participating Community Groups		
Zonta Club	29	43.28
Hope in the Boat	15	22.39
Trinity Alliance	13	19.40
Ladies Auxiliary/W. Albany Fire House	10	14.93
Age		
18–29	1	1.49
30–39	3	4.48
40–49	6	8.96
50–59	19	28.36
60–69	19	28.36
70–79	14	20.90
80 and over	5	7.46
Race		
White	55	82.10
Black	9	13.43
Asian/Pacific Islander	1	1.49
Mixed Race ^b	1	1.49
Ethnicity		
Non-Hispanic	57	85.07
Hispanic	4	5.97
Education		
High School or GED	18	26.87
Bachelor's degree or equivalent	17	25.37
Master degree or equivalent	22	32.84
Doctorate or equivalent	10	14.93
Knowing or Being a Breast or Ovarian Cancer Survivor		
Yes	47	70.15
No	20	29.85
Self-Assessed Breast Cancer Knowledge		
No Knowledge	1	1.49
Minimal	14	20.90
Moderate	37	55.22
Considerable	14	20.90
Breast Cancer Seminar Attendance in Past 5 Years		
No	56	83.58
Yes	11	16.42

^aPercentages may not add up to 100% due to missing values

^bMixed race includes an individual who self-identified as white and Asian/Pacific Islander

Table 3
Analysis of Effectiveness of Breast Cancer Education Intervention Among College and Community Groups

College or community Group	N	Baseline knowledge (%) ^a	Post-Education knowledge (%) ^a	Mean diff of percentages ^b	95% confidence interval (CI)	p-value ^c
All colleges	416	39.85	80.81	40.92	39.13, 42.71	<0.0001
University at Albany-SUNY	183	32.19	76.96	44.72	42.08, 47.36	<0.0001
Siena College	116	43.06	86.69	43.63	40.47, 46.79	<0.0001
Fulton Montgomery Community College	55	35.05	76.26	41.21	37.39, 45.03	<0.0001
Maria College	46	70.17	88.77	18.6	14.96, 22.23	<0.0001
The College of Saint Rose	16	34.03	75.0	40.97	31.07, 50.87	<0.0001
All community groups	67	43.45	77.78	34.33	29.53, 31.30	<0.0001
Zonta Club	29	48.66	83.91	35.25	29.16, 41.34	<0.0001
Hope in the Boat	15	65.56	84.82	19.26	10.97, 27.55	0.0002
Trinity Alliance	13	19.66	59.83	40.17	24.72, 55.63	0.0001
Ladies Auxiliary/W. Albany Fire House	10	26.11	72.78	46.67	36.04, 57.30	<0.0001

^aRepresents the mean percentage of correct answers.

^bRepresents the mean difference between the percentage of correct answers on the post and pre-education surveys.

^cP-values obtained from paired t-tests.