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Return on Investment Analysis of Breast Cancer Screening and Downstaging in Egypt: Implications for Developing Countries

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ABSTRACT

Objective: The aim of this study was to perform a return-on-investment (ROI) analysis of a breast cancer screening program in Egypt by comparing net profit in treatment costs saved to program cost investment. **Methods:** The breast cancer downstaging program targeted women living in an Egyptian slum, where residents have low access to health care. Program costs were estimated by using data from interviews with program administrative staff. Screening and treatment costs were estimated by using Ministry of Health medical reimbursement data. Estimates for expected rates of downstaging were modeled on the basis of data from a previous study. ROI, or relative cost savings, was calculated by comparing treatment cost savings to costs for the screening program. A baseline ROI for facility-based screening was calculated, followed by ROIs for different scenarios. **Results:** Average per-person treatment cost for screened and unscreened patients was estimated to be \$28,632 and \$58,170, respectively, with a cumulative lifetime risk of 6.36%. Total screening

program cost per person was \$112.10. The study estimated an expected decrease in late-stage breast cancer diagnosis by 13.7% as a result of the screening program, saving \$4,049 in treatment costs per individual diagnosed. The analysis resulted in a positive ROI of 133% for facility-based screening. **Conclusions:** Breast cancer represents an increasing burden on health care in Egypt and other developing countries. This study concludes that a community-based downstaging program resulted in a positive ROI, or overall cost-savings. The findings inform that policymakers in low-income and middle-income countries may consider implementing community-based downstaging programs for breast cancer.

Keywords: breast cancer, cancer screening, community, developing countries, downstaging, Egypt, return-on-investment.

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Introduction

Breast cancer is the most common type of cancer and the leading cause of cancer-death among women worldwide [1]. In Egypt, breast cancer is the most common cancer, occurring at a rate of 32% of all cancer types among women [2]. Although incidence levels in Egypt are not as high as in more developed nations [3], breast cancer mortality rates are higher in Egypt than in Western countries (19.1 deaths per 100,000 compared with 14.9 deaths per 100,000 in the United States) [4]. During the last 2 decades, breast cancer rates have been increasing in Egypt and other developing countries because of increases in certain risk factors, such as later age of first pregnancy, decreased number of children, reduced breastfeeding, increased consumption of high-calorie Western diets, urbanization, and changes in the population structure [3,5]. Therefore, breast cancer treatment costs are becoming an increasing burden for Egypt and other developing countries.

Breast cancer treatment costs increase as the severity of the disease increases [6]. Previous studies reported that late-stage cancers have poor outcomes despite extensive and costly treatments [2]. Breast cancer screening can decrease breast cancer mortality as a result of higher treatment successes at early stages and help reduce overall costs of breast cancer treatment in the population [6,7]. Community-based breast cancer screening programs in the United States have been successful in reducing barriers to screening in medically underserved populations, resulting in a long-term reduction of late-stage breast cancer diagnosis [8,9]. Recently established screening programs in the Middle East and Eastern Mediterranean regions have been effective in detecting early-stage cancers [10,11]. Additionally, programs promoting peer education to increase knowledge, awareness, and screening for breast cancer have shown improvements in screening practices in the Eastern Mediterranean region [12].

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In Egypt, several barriers to breast cancer screening, including inadequate knowledge of breast cancer in the population, low access to breast cancer screening facilities, self-care as a low priority in women, fear of breast cancer diagnosis, and other sociodemographic factors, have been identified [13,14]. A downstaging initiative, which aims to decrease late-stage breast cancer diagnosis through a dual method of population education and screening, can be a more effective alternative in populations with limited awareness of breast cancer and the benefits of screening. A downstaging program can be a successful tool to combat the increasing rates of breast cancer in Egypt and other developing countries by reducing the number of women who experience the devastating effects of late-stage breast cancer and ultimately could reduce the burden of high-cost treatment of this cancer [14].

The Manshiyat Naser Breast Cancer Downstaging Initiative (hereafter, referred to as “downstaging program”), the first national program of the Breast Cancer Centers of Excellence in Egypt, was started in 2015 with the aims to educate the community about breast cancer, offer screening through mammography, provide affordable treatment for identified cases, and facilitate research. In this program, about 150 trained community leaders were assigned to each district for a door-to-door visit to educate the community about breast cancer and encourage adult women to utilize a free mammography screening service provided by the program. A mobile mammography van was available in a central location in the community during the program. However, it is not known whether the costs of the downstaging program (including hiring and training community leaders, developing and printing educational materials, and operating mammography equipment and laboratory tests) offset the costs of treatment saved as a result of early detection of breast cancer in this program. To our knowledge, there have been no studies concerning return-on-investment (ROI) of breast cancer downstaging programs in Egypt. The purpose of this study was to conduct an ROI analysis of the downstaging program to determine the economic benefit of this initiative.

Methods

Study Population

Manshiyat Naser is located outside of Cairo, and its primary industry is the collection and sorting of trash from Cairo. Most individuals live in extreme poverty, few have access to electricity or running water in their homes, and many are exposed to harmful environmental pollutants from the trash filling the streets [15]. The total population of Manshiyat Naser is difficult to assess because of limited resources in the area, and estimates can range from 262,000 to 1 million [16,17]. The United Nations population projection data for Egypt indicate that adult women in the target population, ages 20 to 75 years, comprise 28% of the total population in Egypt [18]. Thus, we estimated that the number of women in our target population in Manshiyat Naser ranges from 73,860 to 281,909. According to incidence data from Globocan in 2012, the cumulative lifetime risk of breast cancer for this age group in Egypt is 6.36% [4]. Estimates of breast cancer cases in the region ranged from 4,698 to 17,929, resulting in a large burden of cancer in a population that has limited access to screening or health care and thus confirming the necessity of a screening program in this area [2]. In the first year of operation, approximately 12,900 adult women living in Manshiyat Naser region participated in the downstaging program and received education, mammography screening, and follow-up treatment.

Estimation of Downstaging

Because the program is still in its early stage, information about the reduction of late-stage cancer as a result of this screening program at Manshiyat Naser was not available at the time of our study. Thus, we used previously published data from a Norwegian study to estimate changes in early-stage and late-stage breast cancer distribution between screened and unscreened patients. The Norwegian study found that among unscreened participants, early-stage breast cancer (stage I) accounted for 46% of diagnoses. After program implementation, the percentage of stage I breast cancer diagnosis increased to 62% of cases (percent change of 35%) [19]. Percent change of early-stage diagnosis versus late-stage diagnosis was calculated in screened and unscreened patients, and these percent change measures were applied to baseline data on stage distribution in Egypt for an estimation of expected change in stage distribution as a result of the downstaging program [3].

ROI Analysis

The Egyptian Ministry of Health (MOH) largely contributes to coverage of medical treatment expenses for low-income patients, such as those in the Manshiyat Naser community, through reimbursement to hospitals and medical practices. Therefore, the ROI analysis examined costs from the perspective of the payer, the Egyptian MOH. Only direct costs, such as community education, screening, and treatment, were included in the analysis. Indirect costs, such as loss of work productivity, and non-direct medical costs, such as patient transportation, were not included. ROI was calculated as the ratio of the program benefit over the total investment cost of the program. All costs were calculated in 2015 Egyptian pounds (EGP) and reported as US dollars (USD) by using the purchasing power parity conversion factor of 2.424 in 2015 [20].

Program cost estimates

Downstaging program cost data were collected from program administration and, for the cost of mammography, MOH treatment cost reimbursement. Program costs included community education (marketing, staff training, community awareness materials, and salaries) and screening (mammogram screening). Data for program administration costs were collected during in-person interviews with the program director, finance officer, program administrator, and nursing staff by using both structured and open-ended questionnaires. Interviews were conducted at the Manshiyat Naser Hospital as well as at the private practice office of a physician (program director), whose nursing staff and finance officer were partially employed at the downstaging initiative. Interviews were conducted in June 2015 and recorded in handwriting by the first author (AS). Most interviews lasted approximately an hour, with the exception of the interview with the program director, who was interviewed several times to clarify questions. No patient interviews were conducted, and the study was determined as not human subject research by the University of Nebraska Medical Center Institutional Review Board. Staff costs included daily salaries for the program administrator, trainers, coordinator, and screening nurses, and wages for community leaders paid according to the number of women they recruited for screening per day.

For screening costs, an estimate was calculated by using MOH treatment cost reimbursement data for mammography administered at a typical health care facility because data were not available for the specific model of mammography van used for the program.

The total number of program participants was estimated to be 12,931 per year. The average number of program participants per week was 267. The total per-person program cost was calculated

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