Use of Statistics to Assess the Global Burden of Breast Cancer

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Abstract: A variety of statistics are used to quantify the burden (occurrence and outcome) of cancer generally and of breast cancer specifically. When undertaking any cancer control program, understanding these statistics, their source, and their quality is important for assessing the current situation, allocating resources to different control strategies, and evaluating progress. Two core statistics are the cancer incidence rate and the cancer mortality rate, which provide estimates of the average risk of acquiring and of dying from the disease, respectively. About 16% of the world’s population is covered by registration systems that produce cancer incidence statistics, while mortality data are available for about 29%. Breast cancer incidence and mortality vary considerably by world region. In general, the incidence is high (greater than 80 per 100,000) in developed regions of the world and low (less than 30 per 100,000), though increasing, in developing regions; the range of mortality rates is much less (approximately 6–23 per 100,000) because of the more favorable survival of breast cancer in (high-incidence) developed regions. The incidence of breast cancer is increasing almost everywhere. This unfavorable trend is due in part to increases in risk factors (decreased childbearing and breast-feeding, increased exogenous hormone exposure, and detrimental dietary and lifestyle changes, including obesity and less physical activity). On the other hand, mortality is now decreasing in many high-risk countries due to a combination of intensified early detection efforts and the introduction of mammographic screening, resulting in the diagnosis of more small, early stage tumors, and advances in treatment.

Key Words: breast cancer, burden of illness, health care evaluation mechanisms, health planning, outcomes assessment, program evaluation, registries, resource allocation, statistics

Several statistics are used to quantify the burden (occurrence and outcome) of cancer generally and of breast cancer specifically. Understanding these statistics, their source, and their quality is important for the planning and evaluation of cancer control programs. In this article we review the core statistics commonly used for planning and assessing the effectiveness of a cancer control program, the strengths and limitations of selected statistics, and the key sources of global cancer statistics. In addition, we discuss regional differences and temporal trends in breast cancer incidence and mortality, as well as possible explanations for the observed patterns.

CORE STATISTICS FOR ESTIMATING CANCER BURDEN

Although the general idea of the burden of a disease such as cancer to a community seems fairly straightforward, there are multiple dimensions in which it may be expressed.

Incidence

Cancer incidence is the number of new cancer cases occurring in a specific population during a period of time. It can be expressed as an absolute number of cases per year (the volume of new patients presenting for treatment) or as a rate per 100,000 persons per year. The latter provides an approximation of the average risk of developing a cancer. Because the risk of cancer is strongly related to age, comparison of the risk of cancer among populations (e.g., countries, ethnic groups, or populations at different time periods within a country) may use age-standardized incidence rates to allow for the effect of differences in their age structure (1). When evaluating the impact of primary prevention strategies, a reduction in incidence (occurrence of new cases) is the appropriate statistic to use.

Mortality

Cancer mortality is the number of deaths occurring due to cancer, and the cancer mortality rate is the number of deaths due to cancer per 100,000 persons per year in a defined population. The number of deaths provides one measure (and a rather unambiguous one) of the outcome...
or impact of cancer. It is the product of the incidence and
the fatality of a given cancer. Fatality, the inverse of
survival, is the proportion of cancer patients that die. The
cancer mortality rate therefore measures the average risk
to the population of dying from a specific cancer, while
fatality (1 − survival) represents the probability that an
individual with cancer will die from it. Mortality rates are
frequently used as a convenient proxy measure of the risk
of acquiring the disease (the incidence rate) when compar-
ing different populations or groups because they may be
more generally available (as described below). However,
such use introduces an assumption of equal survival/
fatality in the populations being compared. This may be
reasonable for cancers with poor survival rates (liver,
lung, esophagus), but for breast cancer, for example, there
are quite large variations in survival between countries
and over time. It is safer therefore to use mortality as a
measure of outcome rather than occurrence.

Prevalence

Prevalence refers to the proportion (or percentage) of
the population that has the disease in question at a given
point in time. For cancer, this sometimes refers to individu-
als who have developed a cancer at some time in their life
(1). However, this definition includes as cancer cases those
who are cured of the disease, and it is not particularly use-
ful for health care planning purposes. Partial prevalence,
which limits the number of patients to those in whom
cancer was diagnosed during a fixed time in the past, is
therefore a more practical measure of cancer burden (2).
The prevalence of cases diagnosed within 1, 3, and 5 years
is likely to be of relevance to the different stages of cancer
therapy, namely, initial treatment (1 year), clinical follow-
up (3 years), and cure (5 years). Patients who are still alive
5 years after diagnosis are usually considered cured, since
for most cancers, the death rates of such patients are similar
to those of the general population. Breast cancer is a notable
exception, however, as the risk of death remains higher
than that of the general population for many more years.

Life-Years Lost

Several other more complex statistics have been used
to measure the impact of cancer, particularly in health
economics. Person-years of life lost (PYLL) quantifies the
years of normal life span that are lost due to deaths from
cancer, and the years of life lost (YLL) may be weighted
according to age, so that, for example, a year saved at age
20 is valued more highly than one at age 60. A further
refinement is to calculate disability-adjusted life-years
(DALYs) or quality-adjusted life-years (QALYs) lost.

These involve a further weighting (between 0 and 1) of
the years of life lived between diagnosis and death, reflect-
ing the quality of these life-years (where 0 = dead and
1 = perfect health). Such estimates require a lot of data on
incidence and duration of disease, as well as a lot of guesswork
about quality of life in different circumstances and cultures.

Survival

The survival time of a patient with cancer is defined as
the time that elapses between diagnosis and death. The
most basic measure of patient survival is the observed
survival. The 5-year observed survival is the probability
for an individual of survival at 5 years from the date of
diagnosis. Not all deaths among cancer patients will, how-
ever, be due to the primary cancer in question. Deaths from
other causes reduce the observed survival and preclude
comparison between groups for which probabilities of
death in the general population vary. This problem is
avoided by the use of relative survival—the observed sur-

vival in a patient group divided by the expected survival
of a comparable group in the general population with
respect to age, sex, and calendar period of investigation.

INTERNATIONAL CANCER STATISTICS

Sources

The sources of information on international cancer
incidence, mortality, and survival have been summarized
by Parkin and Bray (3). Incidence data derive from
population-based cancer registries. Registries cover about
16% of the world population, although the distribution is
very uneven by region (Table 1). Cancer incidence data from

Table 1. Percentage of the Population Covered by
Incidence and Mortality Registration Systems in
Various World Regions

<table>
<thead>
<tr>
<th>Region</th>
<th>Incidence (% covered)</th>
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<tr>
<td></td>
<td>Based on registries</td>
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<tr>
<td></td>
<td>Based on all registries</td>
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<tr>
<td>Africa</td>
<td>1</td>
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<tr>
<td>North America</td>
<td>32</td>
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<td>Latin America</td>
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<tr>
<td>Caribbean</td>
<td>12.7</td>
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<tr>
<td>Japan</td>
<td>19.6</td>
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<tr>
<td>Asia (other)</td>
<td>4.7</td>
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<tr>
<td>Oceania</td>
<td>82</td>
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<td>World total</td>
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CIS vol. VIII, Cancer Incidence in Five Continents, vol. VIII (4).
registries meeting stringent quality criteria (of completeness and validity) are included in the series Cancer Incidence in Five Continents (4). Cancer registries also produce survival statistics, and population-based figures have been published from many developed countries; for example, the Surveillance, Epidemiology, and End Results (SEER) program comprising 14 cancer registries covering 26% of the U.S. population (5) and the EUROCARE-3 project covering 12 countries of Europe (6). Survival data from populations in China, the Philippines, Thailand, India, and Cuba have been published by Sankaranarayanan et al. (7).

Statistics on cancer mortality are derived from the information on death certificates, which are collected by civil registration systems that record vital events (births, marriages, deaths). National-level mortality statistics are collated and made available online by the World Health Organization (WHO) (http://www3.who.int/whosis); this source also provides tables of estimated coverage and completeness of the data from the different countries. Mortality data are available for about 29% of the world’s population (Table 1).

Estimation

Cancer incidence and mortality data are available for only a small number of the world’s countries, and estimation procedures are required to obtain a comprehensive global picture of the cancer profile and its evolution over time. In its GLOBOCAN estimates, the International Agency for Research on Cancer prepares national estimates of incidence, mortality, and prevalence of cancer that uses all available sources of information from the different countries. The level of accuracy depends on the extent and quality of locally available data. The most recent country-level estimates have been provided for 24 different cancers and 5 broad age-groups in GLOBOCAN 2002. These estimates are available on CD-ROM (8) and, in a format allowing rather less flexibility for analysis and presentation, on the Internet (http://www.dep.iarc.fr/globocan/globocan.html).

REGIONAL VARIATIONS IN BREAST CANCER INCIDENCE AND MORTALITY

Breast cancer is by far the most common cancer of women, comprising 23% of all female cancers, and there were an estimated 1.15 million new cases in 2002 (9). It ranks second overall when both sexes are considered. More than half of all cases occur in industrialized countries—about 361,000 in Europe (27.3% of cancers in women) and 230,000 in North America (31.3%). Incidence rates are high in most of the developed areas of the world (except for Japan, where breast cancer is third after colorectal cancer and stomach cancer), with the highest age-standardized incidence in North America (99.4 per 100,000) (Fig. 1). Within the United States, certain populations, such as white women in California and Hawaiian women, have age-adjusted rates of 100 per 100,000 or higher (4). In part, the high incidence in the more affluent world areas is likely due to the presence of screening programs that detect early invasive cancers, some of which would otherwise have been diagnosed later or not at all (10). The incidence is more modest in eastern Europe, South America, southern Africa, and western Asia, but breast cancer is still the most common cancer of women in these regions. In contrast, low rates (less than 30 per

Figure 1. Breast cancer incidence rates worldwide according to GLOBOCAN 2002 (18). Rates are age-standardized (world standard) rates (per 100,000).
100,000) are found in most African and Asian populations, although they are increasing; in some Asian populations, they are already the same as in southern Europe, and in others (e.g., the Philippines), they are even higher. The incidence in the Jewish population of Israel is especially high (87.1 per 100,000). The lowest incidence internationally is in central Africa, where the age-standardized rate is 16.5 per 100,000.

The prognosis of breast cancer is generally rather good, so that this cancer ranks as the fifth cause of death from cancer overall, although it is still the leading cause of cancer mortality in women (the 411,000 annual deaths worldwide represent 14% of female cancer deaths). The very favorable survival of breast cancer cases in western countries—for example, 89% at 5 years in cases registered by the U.S. SEER program in 1995–2000 (5)—is also in part a consequence of the presence of screening programs.

Because of the very favorable survival of breast cancer in the more affluent developed countries and the poor survival in some of the least affluent developing countries, differences in mortality rates worldwide are much less marked than differences in incidence rates (Fig. 2). The estimated mortality rates in Africa and the Pacific (Micronesia and Polynesia), for example, are not greatly inferior to those in Europe.

The combination of its high incidence and relatively good prognosis make breast cancer the most prevalent cancer in the world today; there are an estimated 4.4 million women alive in whom breast cancer was diagnosed within the last 5 years (compared with just 1.4 million survivors—male and female—from lung cancer). It has been estimated that 1.5% of the U.S. female population are survivors of breast cancer (11).

Explaning Regional Variations in Breast Cancer Incidence

Genetic factors, including the major susceptibility genes (BRCA-1, BRCA-2), may account for up to 10% of breast cancer cases in developed countries (12), but their prevalence in the population is too low to explain much of the international or interethnic variation in risk. Most must therefore be a consequence of different environmental exposures. This is clear from studies of migrants, which show quite clearly that incidence changes following migration; for example, an increase in the risk of breast cancer in migrants.

**Figure 2.** Breast cancer incidence and mortality rates per 100,000 by region or country. Reprinted with permission from Parkin et al. (21). Copyright 2002, Lippincott, Williams and Wilkins.
cancer in populations from European countries at relatively low risk (Italy, Poland) occurs after migration to Australia, particularly if they migrate as children (13,14). Furthermore, studies comparing the risks in migrants and their offspring (particularly among Asians migrating to the United States) demonstrate that there are major increases in risk between first, second, and third generations (15).

The major influences on breast cancer risk appear to be certain reproductive factors (low parity, late age at first pregnancy), larger body size/obesity, and less certainly, diet (16). There have, however, been few attempts to quantify the magnitude of risk differentials between populations that might be explained by such factors. Internationally there is some association between national incidence (or mortality) rates of breast cancer and population averages for various variables related to fertility (17) or body weight (18). However, such models can explain only a minor component of the variation in incidence. In the United States, Brinton et al. (19) calculated that the difference in incidence between whites and blacks, at least among women age 40–54 years (20%), was entirely explicable in terms of the different prevalences of certain reproductive and lifestyle variables.

REGIONAL TRENDS IN BREAST CANCER INCIDENCE AND MORTALITY

The changing profile of breast cancer incidence and mortality among populations in each world region, and within populations over time, has been recently reviewed by Bray et al. (20).

Europe

In countries where national screening programs started in the mid- to late 1980s (the Nordic countries, England, Wales, and The Netherlands), incidence rates were increasing at an annual rate of 1–3% before organized screening activity began (Fig. 3) (21). In several countries, such as England and Wales (22) and Sweden (23), a screening-related increase—a short-duration “bump” in the incidence curve—can be seen in the age groups being screened as a result of the detection of prevalent cancers during the first screening round. Quite substantial increases in incidence (greater than 2% per year) up to the mid-1990s were also seen in several countries where there was no national program, or where screening was very limited (e.g., Spain and Slovakia) (Fig. 3). Annual increases of 2–4% per year have been reported for the incidence of breast cancer in the former Soviet Union between 1971 and 1987 (24).

The most recent data indicate some signs of a slowdown or leveling off of the increase in incidence in several countries since the mid-1990s, particularly in The Netherlands, Sweden, and England and Wales (21). This may be a result of a cohort-specific peak in incidence (25), although the observations are also consistent with what would be expected after the initial breast screening round: a decline after the postscreening increase to a level slightly higher than that before screening (26).

Figure 3. Breast cancer incidence rate in selected European and Scandinavian countries. ASR, age-standardized rate (world standard) (per 100,000). CIS, Cancer Incidence in Five Continents.
Mortality in most countries has increased from the 1950s until at least the 1980s, particularly in countries of eastern and southern Europe. A leveling off and subsequent decline in breast cancer mortality from the early 1990s is now evident in several other European countries (21), although the declines are often confined to women younger than 50 years of age (Fig. 4).

Some recent decreases in mortality are also evident in several countries that do not have national screening programs, although these tend to be confined mainly to younger age groups. Mortality is still increasing in several eastern European or former Soviet countries, where rates were relatively low in the past (Russian Federation, Estonia, Romania, and Hungary).

North America

The pattern observed in the United States and Canada is broadly similar to that in Europe, with increases in incidence among both white and black women (Fig. 5) (27). Most of this increase occurred in the period between 1980 and 1987 (5) and is related to increases in mammographically detected incident cases as a result of the intensification of breast screening at this time (28). The overall rate of increase has slowed to 0.6% per year since the late 1980s (29).

The leveling off in mortality and subsequent decline noted in several northern European countries in the 1980s was also observed in both the United States (30) and
Canada (31), and the extent of the decrease in both younger and older women is shown in Figure 4. Since the mid-1980s, the trends in U.S. whites and blacks have diverged, with white women experiencing a leveling off and subsequent decline in mortality from the early 1990s, but black women experiencing a slight increase in mortality throughout the same period (27).

Australia and New Zealand

The incidence of breast cancer in New South Wales (representing about one-third of Australian women) increased steadily from the early to mid-1980s (Fig. 5), and by 1995 was nearly 50% higher than in 1983. The greatest increase was in the target age group for mammography screening (50–69 years), which became available in 1984 on a limited basis and in 1992 was nationwide and accessible to all women at least 40 years of age (32). In New Zealand, there were steady increases in incidence rates among both Maori and non-Maori women from 1978 to 1992 (33).

Breast cancer mortality in Australia rose steadily from the early 1970s to the late 1980s (34). Between 1985 and 1990, breast cancer mortality fell by 3.2% among women 50–69 years of age and by 4.2% among women 25–49 years of age, with little change (−0.2%) among older women (34). The proportion of women screened in all age groups increased substantially between 1988 and 1994, and by 1994 nearly 65% of women in the target age group had had at least one mammogram (34).

Japan

Although breast cancer remains relatively rare in Japan, the incidence (Fig. 5) and mortality (Fig. 4) have been increasing quite rapidly, which is consistent with increasing risk in successive generations of women (35). The overall incidence has been increasing since the mid-1970s (35,36), although the increase has been much larger than that for mortality, demonstrating improving prognosis over time (35).

Developing Countries

There are few data from developing countries, but where they are available, increases in breast cancer incidence and mortality are seen, an observation often more apparent within recent birth cohorts (37), and a probable consequence of the adoption of western lifestyles (38).

Latin America. Most Latin American countries have intermediate rates of breast cancer occurrence. Incidence
and mortality rates have been observed to be increasing in most countries (38); incidence has at least doubled, for instance, in Cali, Colombia (Fig. 6), and in Puerto Rico between the early 1970s and the mid-1990s. In Uruguay, Argentina, and Chile, women are at high or intermediate risk, and mortality rates in younger women have been reported to be more or less constant over time (37).

**Asia.** The age-adjusted incidence is low in most Asian countries, although world-standardized rates are greater than 50 per 100,000 in Manila, Philippines, and in Karachi, Pakistan. Rates in Singapore, particularly among the Chinese population, are also relatively high for the region. Rising incidence has been observed in India (39) and also in Singapore (40) (Fig. 6). In China, breast cancer mortality increased during the period 1987–1999 in both rural and urban areas, with a more marked rise among rural women, although the rates have remained lower than those among urban women (41). Substantial increases are reported also in Taiwan between the 1960s and 1990s (42), and in Hong Kong (43).

**Africa.** In Africa as a whole, breast cancer is less common than cervical cancer (8); however, it is the most common malignancy in North Africa and in urban populations in sub-Saharan Africa (44). Few datasets are available for the study of time trends in Africa, but some increases in incidence are apparent, for example, in Ibadan, Nigeria (44), and in Kampala, Uganda (45), between the 1960s and the late 1990s. Steady increases in breast cancer mortality rates of the same order of magnitude have also been noted from the early 1960s in Mauritius (44).

**EXPLAINING REGIONAL TRENDS IN BREAST CANCER INCIDENCE AND MORTALITY**

In general, the largest increases in breast cancer risk have been seen in populations of women historically at lowest risk, often within developing countries, whereas relatively recent departures from the long-term upward trend have been observed in several, mainly western countries. In contrast, as described above, there have been declines in mortality rates from breast cancer in several developed countries in Europe, North America, and Australia and New Zealand, dating from around 1990 (Fig. 7). A variety of factors are contributing to these trends.

**Changes in Risk Factors**

Changing patterns of childbearing and breast-feeding, of exogenous hormonal exposure, and of lifestyle factors

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**Figure 6.** Breast cancer incidence rates in selected developing countries in Latin America and Asia. ASR, age-standardized rate (world standard) (per 100,000); CI5, Cancer Incidence in Five Continents.
including obesity, alcohol consumption, and reduced physical activity have certainly contributed to trends in incidence and mortality. Earlier menarche and later menopause associated with better nutrition and greater body weight, resulting in an increasing lifetime length of exposure to endogenous estrogen, are consistent with upward trends in the incidence of breast cancer, particularly in developed countries.

**Early Detection and Mammographic Screening**

Mammographic screening for women age 50–69 years is effective in reducing breast cancer mortality, and reductions in mortality have been observed where screening has been introduced (46,47). Evidence that at least part of this decline can be attributed to screening comes from the expected increase in incidence of early stage and in situ breast cancers, followed by a decline in the incidence of advanced cancers and in subsequent mortality in the United Kingdom, northern Europe, and Australia (48–51). It has been estimated that about one-third of the overall 21% reduction in breast cancer mortality in the United Kingdom by 1998 (10 years after screening began) was due directly to screening (52), although the time lag before any benefits from screening can be expected (53), together with the reduction in mortality resulting from notable advances in treatment (discussed below), makes quantification of the contribution of each of these factors problematic. Part of the beneficial effect of screening is probably due to a shift toward earlier diagnosis of breast cancer as a consequence of better awareness of the disease following the extensive publicity surrounding the breast cancer and its prevention.

**Improved Treatment and Management**

Reductions in mortality before the introduction of screening, and in those countries without screening, suggest that improvements in disease treatment and management might be responsible for observed declines in mortality (53,54). In the United Kingdom (55) and Finland (49), the rapid decline in mortality rates was probably due in part to an increased use of tamoxifen among postmenopausal women with node-positive disease. The Early Breast Cancer Trialists’ Collaborative Group (56) reported in a meta-analysis of 55 randomized adjuvant trials that tamoxifen reduced the incidence of contralateral breast cancers by 47% at 5 years. It is likely that the increasing use of this antiestrogen has contributed to decreases in mortality from breast cancer in women with estrogen receptor-positive tumors in developed countries during the 1990s (57). However, it has been suggested that the absolute benefit is more modest (58), because most trials reported on women with estrogen receptor-positive tumors who had early disease, whereas about one-third of women have tumors that are negative for this
receptor, and many women with breast cancer do not present with early disease.

Additional factors that have likely contributed to the decline in mortality, as noted in the United Kingdom, have been the establishment of treatment protocols, improvement in chemotherapeutic options, and development of better therapeutic guidelines (52). Specific structural changes that have embraced the specialization of breast cancer care (such as centralized treatment, adjustments in clinician workload, and use of multidisciplinary teams) have been shown to improve outcome (59).

CONCLUSION

Existing data confirm the magnitude of the problem of breast cancer—the number one cancer of women worldwide. Although the introduction of screening programs has perturbed the preexisting trends in incidence (by bringing forward the date of diagnosis), they do not disguise the steady increase in risk of breast cancer almost everywhere. Combating this will be difficult: primary prevention strategies require changes in lifestyles that run counter to the aspirations of the majority of women worldwide. Fortunately many countries with a high risk of breast cancer have achieved something of a triumph as far as improved outcome (better survival and decreased mortality) is concerned. The data on stage of disease at diagnosis, survival, and mortality suggest that this is the consequence of earlier diagnosis of clinically detectable cancers, detection of nonpalpable lesions by mammography, and improved treatment with hormonal therapy and chemotherapy. How much more improvement is possible with this combination in these countries is unclear, but it clearly offers room to reduce the mortality and morbidity in countries in which the epidemic of breast cancer is still emerging. The intelligence derived from statistical information systems is an important component of breast cancer control programs everywhere.

REFERENCES


Costs and Health Effects of Breast Cancer Interventions in Epidemiologically Different Regions of Africa, North America, and Asia

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Abstract: We estimated the costs and health effects of treating stage I, II, III, and IV breast cancer individually, of treating all stages, and of introducing an extensive cancer control program (treating all stages plus early stage diagnosis) in three epidemiologically different world regions—Africa, North America, and Asia. We developed a mathematical simulation model of breast cancer using the stage distribution and case fatality rates in the presence and absence of treatment as predictors of survival. Outcome measures were life-years adjusted for disability (DALYs), costs (in 2000 U.S. dollars) of treatment and follow-up, and cost-effectiveness ratios (CERs; in dollars per DALY averted). Sensitivity analyses were performed to determine the robustness of the results. Treating patients with stage I breast cancer resulted in 23.41, 12.25, and 19.25 DALYs averted per patient in Africa, North America, and Asia, respectively. The average CERs compared with no intervention were $78, $1960, and $62 per DALY averted. The number of DALYs averted per patient decreased with stage; the value was lowest for stage IV treatment (0.18–0.19), with average CERs of $4986 in Africa, $70,380 in North America, and $3510 per DALY averted in Asia. An extensive breast cancer program resulted in 16.14, 12.91, and 12.58 DALYs averted per patient and average CERs of $75, $915, and $75 per DALY averted. Outcomes were most sensitive to case fatality rates for untreated patients, but varying model assumptions did not change the conclusions. These findings suggest that treating stage I disease and introducing an extensive breast cancer program are the most cost-effective breast cancer interventions.

Key Words: breast cancer, cost-effectiveness, costs, developing countries, economic evaluation, modeling

Each year, breast cancer is newly diagnosed in more than 1 million women worldwide and more than 400,000 women die from it (1,2). Breast cancer as a public health problem is growing throughout the world, but especially in developing regions, where the incidence has increased as much as 5% per year (1,3). The mortality: incidence ratio is much higher in developing countries than in developed countries: only half of global breast cancers are diagnosed in the developing world, but they account for three-fourths of total deaths from the disease (1). The increasing burden of breast cancer is also acknowledged in the resolution on cancer prevention and control, as adopted by the 58th World Health Assembly in May 2005 (4). Therein, member states are urged to develop and reinforce comprehensive cancer control programs to reduce cancer mortality and improve quality of life for patients and their families.

Cost-effectiveness analyses (CEAs) can provide useful information for planning and developing a breast cancer control policy. CEAs can be used to guide budget development, justify allocation of scarce resources to national breast cancer control programs, and identify the most efficient ways of delivering diagnostic and treatment services. Nearly all studies of the costs and health effects of breast cancer control interventions have been performed in developed countries (5), so data to guide resource allocation decisions in developing countries are scarce. Moreover, studies to date have focused on individual interventions, and interactions among interventions have been largely ignored. In addition, existing studies have focused on interventions specific to breast cancer control in situations where breast cancer care was already in place. This limitation precludes comparisons with interventions in settings where care systems have not been established or
with interventions that might be more relevant to other regions of the world.

Our intention was to broadly assess the cost-effectiveness of breast cancer control that covers various interventions in different settings and to enable comparisons with recent CEAs of other health care interventions that follow the same analytic approach (6–9).

**METHODS**

**Study Design**

We used a simplified breast cancer model to simulate the impact of six basic interventions on the course of breast cancer in three regions of the world (10). Each intervention was compared with no intervention (i.e., no active case finding or breast cancer treatment). All interventions were introduced starting in the year 2000 for a period of 10 years, after which no breast cancer interventions were available, and the maximum follow-up was 100 years, which is in line with the World Health Organization (WHO) guidelines on CEA (10). Following this standardized approach, we assumed that interventions were performed optimally. The outcomes of our analysis were life-years adjusted for disability (DALYs) and the total costs of breast cancer treatment and follow-up for each of the six interventions.

We adopted a societal perspective (11) and included all costs and effects in our model. Future costs and effects were discounted at a rate of 3% per year (11). The average cost-effectiveness ratio (CER) compared to the do-nothing scenario was calculated for each intervention by dividing the total intervention costs (the costs are zero in the do-nothing scenario) by the total DALYs averted (i.e., the DALYs lost when no intervention is applied minus the DALYs lost when an intervention is applied for 10 years). The interventions were also compared to arrive at the incremental CER, which we defined as the additional costs of a more effective intervention divided by the size of this additional effect in terms of DALYs averted. To calculate the incremental CERs, the interventions were ordered by increasing effectiveness and the ratio of a scenario with its adjacent, less effective scenario was determined.

**Study Population and Analyzed Regions**

The breast health of adolescent and adult women age 15 years and older was simulated in an open cohort. The costs, effects, and cost-effectiveness of each of the interventions were evaluated for three epidemiologic regions of Africa, North America (including Cuba), and Asia, defined by mortality strata (Appendix A) (10).

**Model Assumptions**

**Interventions** In recent years, many developments in diagnosing and treating breast cancer have occurred, and we could analyze a large number of interventions in our model. However, we confined the model to a small set of basic interventions to allow comparability among the regions. We assessed the following six basic interventions:

- Stage I treatment: Lumpectomy with axillary dissection supplemented with external radiotherapy to the breast. Eligible patients also receive endocrine therapy.
- Stage II treatment: Lumpectomy with axillary dissection supplemented with external radiotherapy to the breast. Eligible patients also receive endocrine therapy.
- Stage III treatment: Neoadjuvant chemotherapy followed by mastectomy with axillary dissection supplemented with adjuvant chemotherapy. External radiotherapy to the breast is also administered and eligible patients receive endocrine therapy.
- Stage IV treatment: Systemic chemotherapy, supplemented with endocrine therapy for eligible patients. In this group of patients, these therapies are palliative.
- Treatment all stages: Treatment of all stages as described above.
- Extensive program: Treatment of all stages as described above, plus a breast awareness program and early case finding through biannual mammographic screening in women age 50–70 years.

**Model Structure** Six mutually exclusive health states were included (Fig. 1): healthy (no breast cancer); American Joint Committee on Cancer (12) stages I, II, III, and IV breast cancer; and deaths from breast cancer.

![Figure 1. Graphical representation of the model showing the relationships between the six different health states through the incidence rates of breast cancer (Rx1–Rx4) and the different mortality rates for the different breast cancer stages (Fx1–4) and the background mortality (M).](image-url)
IV breast cancer; and death from breast cancer. Regional age-adjusted population estimates of breast cancer incidence, breast cancer prevalence, percentage of prevalent cases treated, and background mortality rates were based on the WHO Burden of Disease study estimates for 2000 (13).

Following the WHO guidelines (10), the interventions were aimed at initial disease treatment only, but patients could experience a relapse or progression after initial diagnosis; therefore we filtered out the effect of treating patients whose disease progressed. It was assumed that patients could have a progression only to stage IV breast cancer and that cancer progressed at a constant rate (14).

**Stage Distribution and Case Fatality Rates** The key elements of the model were the stage distribution of both prevalent and incident cases, and the case fatality rate for untreated and treated patients (Table 1). We distinguished between the stage distribution in the developed region (North America) and the two developing regions (Africa and Asia) to reflect the difference in levels of breast cancer care.

Stage distributions for prevalent cases were derived from registry data (Table 1). The stage distribution of prevalent cases in North America was based on the U.S. National Cancer Data Base (NCDB) (15). The stage distribution of prevalent cases in Africa and Asia was based on registry data from Southeast Asia (16).

In the no-intervention scenario, the stage distribution of incident cases and stage-specific case fatality rates were based on registry data from Southeast Asia (16) and applied to all regions. The case fatality rates for treated patients were derived from the NCDB (15). In the extensive breast cancer program scenario, the stage distribution of incident cases and stage-specific case fatality rates were based on data from the NCDB (15) for all regions.

**Quality of Life** The quality of life of patients with breast cancer (Table 1) was based on the WHO Global Burden of Disease study (17). Using NCDB data on stage distribution (15) and quality of life data from several sources (18–20), we arrived at stage-specific quality of life estimates. The quality of life of the susceptible population was also included (17).
Costs

All costs were calculated and are presented in 2000 U.S. dollars. Two types of costs for health services were distinguished: patient-level costs, which were those incurred for individual patients, and program-level costs, which were those incurred at a level above that of the patient (10).

Patient-Level Costs

In all regions patient-level patterns of resource use (i.e., initial evaluation, local treatment, and follow-up) were based on clinical practice guidelines (21,22) (Table 2). These costs included evaluation of women without breast cancer; it was assumed that breast cancer was diagnosed in only 6% of all presenting women (23).

Screening in the extensive cancer program included costs of mammographic screening in women age 50–70 years and further diagnostic tests on referral (Table 2). Detailed lists of all tests and procedures, including housing, personnel, and medical devices, were retrieved from a South African database (24) and were validated for western countries by a team of oncologists.

Unit costs were retrieved from the WHO-CHOICE database on prices of traded and nontraded goods (http://www.who.int/choice). Unit costs of health center visits and hospital inpatient days were based on a report by Adam et al. (25). We combined unit costs with resource

### Table 2. Patient-Level Resource Use Patterns for Breast Cancer Interventions

<table>
<thead>
<tr>
<th>Resourcea</th>
<th>No. of outpatient visits</th>
<th>Length of hospitalization (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Diagnosis</strong></td>
<td>Bilateral mammography</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Complete blood count</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total bilirubin assay</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alkaline phosphatase assay</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fine needle aspiration or core needle biopsy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Liver function tests</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ECG in 50%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bone scan in 25%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ultrasonography of the liver in 25%</td>
<td></td>
</tr>
<tr>
<td><strong>Non-breast cancer examinationb</strong></td>
<td>Bilateral mammography</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Ultrasonography of the liver in 28%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fine needle aspiration or core needle biopsy in 0.27%</td>
<td></td>
</tr>
<tr>
<td><strong>Stage I treatment</strong></td>
<td>Lumpectomy with axillary dissection</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Radiotherapyc</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Endocrine therapy in 50%d</td>
<td></td>
</tr>
<tr>
<td><strong>Stage II treatment</strong></td>
<td>Lumpectomy with axillary dissection</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Radiotherapyc</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Endocrine therapy in 50%d</td>
<td></td>
</tr>
<tr>
<td><strong>Stage III treatment</strong></td>
<td>(Neo)adjuvant chemotherapye</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Mastectomy with axillary dissection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Radiotherapyc</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Endocrine therapy in 50%d</td>
<td></td>
</tr>
<tr>
<td><strong>Stage IV treatment</strong></td>
<td>(Neo)adjuvant chemotherapye</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Endocrine therapy in 50%d</td>
<td></td>
</tr>
<tr>
<td><strong>Follow-up year 1–5 (per year)</strong></td>
<td>2 Bilateral mammographies</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Pelvic examination in 50%</td>
<td></td>
</tr>
<tr>
<td><strong>Follow-up year 6–10 (per year)</strong></td>
<td>Bilateral mammography</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Pelvic examination in 50%</td>
<td></td>
</tr>
<tr>
<td><strong>Screening</strong></td>
<td>Bilateral mammography</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Ultrasonography of the liver in 28%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fine needle aspiration or core needle biopsy in 0.27%</td>
<td></td>
</tr>
</tbody>
</table>

---

*aBased on clinical practice guidelines (21,22).

*bIncludes resource use of initial evaluation of women without breast cancer who were initially suspected of having breast cancer (23).

*cRadiotherapy includes a standard dose of 50 Gy given in 25 fractions of 2 Gy on an outpatient basis in all stages of breast cancer (33).

*dEndocrine therapy consists of 20 mg tamoxifen per day for 5 years (21,22).

*eThe (neo)adjuvant chemotherapy combination regimen consists of four, 21-day cycles of doxorubicin (60 mg/m²) and cyclophosphamide (830 mg/m²) supplemented with 4 mg dexamethasone, given on an outpatient basis (21,22).

ECG, electrocardiography; NA, not applicable.
use patterns to estimate the total costs per patient treated. All unit costs are presented for the regions of Africa, North America, and Asia in Appendix B.

**Program-Level Costs** We based estimated quantities of resources required to start up and maintain each intervention for 10 years (e.g., personnel, materials and supplies, media, transport, maintenance, utilities, and capital) at national, provincial, and district levels on a series of evaluations made by regional costing teams in the different WHO regions and validated against the literature (26). We obtained unit cost estimates of program-level resources (e.g., the salaries of central administrators, capital costs of vehicles, storage, offices, and furniture) from a review of the literature, which was supplemented by primary data from several countries (the full list of unit cost estimates is available at http://www.who.int/choice). The process and methodology for estimating program costs are described in detail elsewhere (26,27).

**Sensitivity Analyses**
To address uncertainty and determine the robustness of the model, we conducted both univariate and multivariate sensitivity analyses on key parameters. Specifically we assessed the effects of varying the stage distribution of prevalent cases, the stage distribution of incident cases, and the case fatality rate of treated patients, individually and then collectively.

**RESULTS**

**Intervention Effectiveness**
In Africa, the smallest group treated in the 10-year period was women who had stage I breast cancer (Table 3); of these 37,277 cases, 9604 were previously untreated prevalent cases and 27,673 were new cases of breast cancer. Most of the treated women were those with stage III breast cancer (228,914; 58,978 prevalent and 169,936 incident cases). In North America and Asia, the trends were the same, although the absolute numbers of treated patients were higher. The female population in North America was four times smaller than the female population in Asia, but the number of treated patients was one-third higher in North America. The population sizes in North America and Africa were similar, but the number of treated patients was four times larger in North America.

Because of these differences between regions, the number of DALYs averted for the total population or per treated patient in the 10-year period also varied considerably (Table 3). For example, in Africa, treatment of stage I patients resulted in a total of 873,000 DALYs averted for the total population and 23.41 DALYs averted per treated patient. Despite the greater number of treated patients with stage II, III, or IV breast cancer, the total number of DALYs averted was considerably less for each of these stages. When all diagnosed cases were treated, 1,490,000 DALYs were averted for the total population (3.77 per treated patient). When an extensive breast cancer program was assumed to exist in Africa, 6,374,000 DALYs were averted for the total population (16.14 per treated patient).

**Costs and Cost-Effectiveness**
The range in total costs per intervention over the 10-year period was considerable. For example, the total costs for introducing stage I treatment was $68 million in Africa, $3879 million in North America, and $143 million in Asia (Table 3).

The costs of diagnosis were a fixed component in all intervention scenarios because cases must be diagnosed correctly before treatment can be initiated. This category also accounted for the exclusion of women presenting without breast cancer. As a result, costs per treated patient were lowest when all diagnosed cases were treated (Table 3). In all three regions, the diagnostic costs for patients with stage I breast cancer constituted 62–68% of the total costs, whereas the diagnostic costs for all patients made up 17–20% of the total costs.

The costs per treated patient with stage I disease were $1829 in Africa, $24,008 in North America, and $1188 in Asia (Table 3). The costs of treatment represented 16–27% of the total costs in each region.

In the extensive program, different cost items accounted for widely varying proportions of the total costs (Table 3). In Africa, the patient-level costs of screening and associated diagnostic examination of false-positive screens ($180 million) were 38% of the total costs; in North America, these costs ($5299 million) constituted only 26% of the total costs; and in Asia, these costs ($703 million) made up 58% of the total costs.

In each of the six intervention scenarios, the total program costs accounted for 8–24% of the total costs in Africa and Asia, but only 1–4% of the total costs in North America (Table 3).

When we compared the intervention scenarios with the no-intervention scenario, treatment of stage I patients and the extensive breast cancer program were the most cost-effective interventions, with average CERs for stage I treatment and extensive programs, respectively, of $78 and $75 per DALY averted in Africa, $1960 and $915 per
Table 3. Number of Patients Treated, DALYs Averted, Costs, and CERs at an 80% Coverage Level, Over a 10-Year Period (2000–2010) by WHO Region

<table>
<thead>
<tr>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Diagnosis</td>
<td>Non-breast cancer examination</td>
<td>Treatment</td>
<td>Follow-up</td>
<td>Screening</td>
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<td>Africa</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Stage I treatment</td>
<td>37,277</td>
<td>873</td>
<td>23.41</td>
<td>11</td>
<td>31</td>
<td>13</td>
</tr>
<tr>
<td>Stage II treatment</td>
<td>55,955</td>
<td>231</td>
<td>4.13</td>
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<td>Stage III treatment</td>
<td>228,914</td>
<td>399</td>
<td>1.74</td>
<td>11</td>
<td>31</td>
<td>93</td>
</tr>
<tr>
<td>Stage IV treatment</td>
<td>72,738</td>
<td>14</td>
<td>0.19</td>
<td>11</td>
<td>31</td>
<td>14</td>
</tr>
<tr>
<td>Treatment all stages</td>
<td>394,884</td>
<td>1490</td>
<td>3.77</td>
<td>11</td>
<td>31</td>
<td>138</td>
</tr>
<tr>
<td>Extensive program</td>
<td>394,884</td>
<td>6374</td>
<td>16.14</td>
<td>11</td>
<td>20</td>
<td>134</td>
</tr>
<tr>
<td>North America</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage I treatment</td>
<td>161,558</td>
<td>1979</td>
<td>12.25</td>
<td>500</td>
<td>2171</td>
<td>1040</td>
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<tr>
<td>Stage II treatment</td>
<td>242,507</td>
<td>542</td>
<td>2.24</td>
<td>500</td>
<td>2171</td>
<td>1562</td>
</tr>
<tr>
<td>Stage III treatment</td>
<td>952,107</td>
<td>1587</td>
<td>1.60</td>
<td>500</td>
<td>2171</td>
<td>7136</td>
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<tr>
<td>Stage IV treatment</td>
<td>315,214</td>
<td>56</td>
<td>0.18</td>
<td>500</td>
<td>2171</td>
<td>1074</td>
</tr>
<tr>
<td>Treatment all stages</td>
<td>1,711,414</td>
<td>4282</td>
<td>2.50</td>
<td>500</td>
<td>2171</td>
<td>10,812</td>
</tr>
<tr>
<td>Extensive program</td>
<td>1,711,414</td>
<td>22,098</td>
<td>12.91</td>
<td>500</td>
<td>1626</td>
<td>10,874</td>
</tr>
<tr>
<td>Asia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage I treatment</td>
<td>120,738</td>
<td>2325</td>
<td>19.25</td>
<td>27</td>
<td>64</td>
<td>23</td>
</tr>
<tr>
<td>Stage II treatment</td>
<td>181,235</td>
<td>663</td>
<td>3.66</td>
<td>27</td>
<td>64</td>
<td>34</td>
</tr>
<tr>
<td>Stage III treatment</td>
<td>741,439</td>
<td>1205</td>
<td>1.63</td>
<td>27</td>
<td>64</td>
<td>178</td>
</tr>
<tr>
<td>Stage IV treatment</td>
<td>235,993</td>
<td>42</td>
<td>0.18</td>
<td>27</td>
<td>64</td>
<td>29</td>
</tr>
<tr>
<td>Treatment all stages</td>
<td>1,279,005</td>
<td>4155</td>
<td>3.25</td>
<td>27</td>
<td>64</td>
<td>264</td>
</tr>
<tr>
<td>Extensive program</td>
<td>1,279,005</td>
<td>16,086</td>
<td>12.58</td>
<td>27</td>
<td>38</td>
<td>251</td>
</tr>
</tbody>
</table>

aIncremental CER versus less effective alternative. To calculate the incremental CER, the interventions were ordered by increasing effectiveness and the ratio of a scenario with its adjacent, less effective scenario was determined.

bAverage CER compared to the do-nothing scenario. In the do-nothing scenario costs were zero.

CER, cost-effectiveness ratio; DALY, disability-adjusted life-year; WHO, World Health Organization; NA, not applicable, because the intervention is less cost-effective than others.
DALY averted in North America, and $62 and $75 per DALY averted in Asia (Table 3). The least cost-effective option was stage IV treatment (average CERs of $4986, $70,380, and $3510 per DALY averted in Africa, North America, and Asia, respectively).

Incremental CERs revealed that in Africa and North America, the optimal breast cancer program was the most cost-effective intervention scenario ($75 and $915 per DALY averted, respectively) (Table 3). In Asia, the most cost-effective options were stage I treatment ($62 per DALY averted) and then the optimal breast cancer program ($77 per DALY averted).

The order in which interventions should be introduced according to the cost-effectiveness results (i.e., the “expansion path,” for more details on expansion paths, see Tan-Torres Edejer et al. (10)) is illustrated for Asia in Figure 2. Stage I treatment would be introduced first. With more resources, an optimal breast cancer program would be established.

**Sensitivity Analyses**

In the first two univariate sensitivity analyses, it was assumed that cancers were diagnosed earlier compared with the base case analysis (i.e., more stage I and II cancers and fewer stage III and IV cancers). This assumption produces a more favorable distribution, with the sole exception of the prevalent cases in North America, where the distribution becomes less favorable. Applying these alternative stage distributions for prevalent and incident breast cancer cases resulted in lower average CERs for stage I treatment and for treatment of all stages in Africa, North America, and Asia because more stage I patients received treatment, which was associated with lower case fatality rates (Table 4 shows results for Asia as an example). For stage III and IV treatment, the average CERs increased because fewer cases were diagnosed at these stages. Because the shift in distribution of incident cases of stage II breast cancer decreased the overall mortality in the no-intervention scenario, the average CERs for stage II treatment and the extensive program also increased.

In a third univariate analysis, the assumption of a 50% reduction in treatment effect on case fatality rates (i.e., higher case fatality rates of treated cases than those used in the base case analysis) increased the average CERs of each of the six interventions in Africa, North America, and Asia (Table 4 shows results for Asia as an example).

Combining all three univariate sensitivity analyses in a multivariate analysis resulted in a further increase in the average CERs for stage II, III, and IV treatment and the extensive program (Table 4). The average CERs for stage I treatment and treatment of all stages were between the CERs calculated in the individual sensitivity analyses.

![Figure 2. Expansion path for the Asian region.](image)

**Table 4. Results of Univariate and Multivariate Sensitivity Analyses for Asia**

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Univariate analyses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Alternative stage distribution of prevalent cases b</td>
</tr>
<tr>
<td></td>
<td>Alternative stage distribution of incident cases b,c</td>
</tr>
<tr>
<td></td>
<td>Alternative case fatality rates d</td>
</tr>
<tr>
<td></td>
<td>Multivariate analysis e</td>
</tr>
<tr>
<td>Stage I treatment</td>
<td>Average 45 Incremental 45</td>
</tr>
<tr>
<td>Stage II treatment</td>
<td>Average 48 Incremental 48</td>
</tr>
<tr>
<td>Stage III treatment</td>
<td>Average 261 NA 48</td>
</tr>
<tr>
<td>Stage IV treatment</td>
<td>Average 283 NA 390 NA 162 NA 609 NA 642 NA 5175 NA 255 NA 1186 NA 8875 NA 73 NA 82</td>
</tr>
<tr>
<td>Treatment all stages</td>
<td>127 182 113 216 274</td>
</tr>
</tbody>
</table>

*Data are presented as cost-effectiveness ratios, calculated as cost (in 2000 U.S.$) per DALY (disability-adjusted life-year) averted.

*Stage distribution: stage I, 29%; stage II, 26%; stage III, 33%; and stage IV, 12%.

*In the absence of an extensive breast cancer program.

*Case fatality rates of treated patients: stage I, 0.013; stage II, 0.053; stage III, 0.122; and stage IV, 0.288.

*All adjustments in the three univariate sensitivity analyses were implemented simultaneously.

*Incremental cost-effectiveness ratio versus lesser effective alternative.

NA, not applicable, because the intervention is less cost-effective than others.
DISCUSSION

Our analyses showed that treating early stage breast cancer is more cost-effective than treating late-stage disease. In Africa and Asia, treatment of stage I, II, or III disease costs less than $390 per DALY averted, whereas treatment of stage IV disease costs more than $3500 per DALY averted; in North America, the respective values were $6550 and $70,400. For comparison, we can use benchmarks suggested by other researchers to assess whether a health intervention is cost-effective: cost per DALY averted or life-year gained equal to the per capita income (28), twice per capita income (29), or three times per capita income (30) (low-income countries are defined as having per capita incomes of $765 or less per year, and high-income countries are defined as having per capita incomes of more than $9386 per year). According to these benchmarks, all interventions except treatment of stage IV disease were cost effective in all three regions.

The incremental CERs indicated that priorities in national breast cancer control programs would be treatment of stage I disease or implementation of an extensive cancer control program (including breast cancer awareness campaigns and active mammographic screening).

Although the extensive cancer control program reflects the economic attractiveness of diagnosing breast cancer at an earlier stage, many developing countries may not be able to meet the total costs of such a program (including the required infrastructure, logistics, and expertise). Given the limited available resources, priorities are probably best directed at treatment of early stage disease and at developing a less expensive means of early diagnosis. We did not evaluate clinical breast examination or breast self-examination because currently there is no consensus on their value alone or in addition to mammography. Nevertheless, together with other ways of raising awareness, clinical breast examination and breast self-examination could be a cost-effective means by which to diagnose breast cancer earlier in resource-poor settings.

A number of our study limitations have to be addressed. We used data on stage distribution and case fatality rates from a sample of developing countries to reflect the absence of breast cancer control interventions. For the same variables, we used data from U.S. cancer registries to reflect intervention effectiveness. Whether these data are accurate can be assessed only when studies on the effectiveness of breast cancer interventions in developing countries become available.

We did not include stage 0 disease (i.e., ductal carcinoma in situ) in our model because very little information is available on this type of breast cancer in developing regions. Furthermore, the WHO Global Burden of Disease study provides information only on the prevalence and incidence of palpable breast cancer. From the NCDB, it is clear that through screening, the proportion of disease diagnosed at stage 0 increased substantially in the United States (15). Although not all stage 0 breast cancer will result in breast cancer-related death if not treated, and overtreatment (with its associated costs) will likely be introduced, including stage 0 disease in the model will probably reinforce our conclusion that treating earlier stages of breast cancer is the most cost-effective intervention.

We estimated program costs for breast cancer interventions that are not yet in place on this scale in developing countries and therefore cannot be validated. However, an extensive cancer control program was estimated to cost $50 million for 95% geographic coverage in The Netherlands; this value compares well with the costs of breast cancer screening in that country, which were $49 million in 2003 (31).

Our simplified cost-effectiveness model is appropriate to use for broadly assessing the relative economic attractiveness of breast cancer interventions and for comparing interventions among regions. Our analysis shows that there is a broad variation in epidemiology between regions and that there are large differences in cost structure as well. In contrast to North America, where personnel is the major cost component, the costs of personnel are only a small part of the total costs in developing regions (Africa and Asia). Therefore, while the pattern of most cost-effective interventions is the same, there are substantial differences between interventions across regions and likely within a region. A more detailed country-level analysis, using local cost and resource estimates and epidemiologic information, could be useful for testing whether our model assumptions hold and for obtaining more specific information on the impact of interventions on budgets, especially when there is competition for scarce resources with interventions that are more intensive with respect to either personnel time or resource use. We developed the cost-effectiveness model in such a way that these country-specific adaptations can be performed easily.

For reasons of comparability, we were unable to include many of the elements of breast cancer care that are considered standard in developed countries. A few examples are sentinel lymph node biopsy, breast reconstruction after surgery, and variations in surgical treatment of breast cancer within the same stage. Furthermore, we assumed the use of only one type of chemotherapy and one type of hormonal therapy. These issues can be addressed in a
more tailor-made country-level analysis using the model’s framework.

Finally, we are aware of the current debate surrounding the relative effect of breast cancer screening on reducing mortality rates. This debate focuses on the overtreatment and overdiagnosis that are said to be underappreciated harms of screening (32). In our analysis, we assumed that the introduction of an extensive breast cancer program would cause a shift in stage distribution that would result in reduced mortality rates for all patients, and this assumption probably led to an overestimation of the impact of such a program. Sensitivity analyses showed that varying model assumptions did affect the cost-effectiveness of the interventions, but not our principal study conclusion.

We conclude that both treatment of early stage breast cancer and interventions for down-staging disease at diagnosis are among the most valuable interventions in breast cancer control.

Acknowledgments

The authors gratefully acknowledge the advice of Dr. Sharon Giordano and the editorial assistance of Elizabeth L. Hess and Susan London. This study was supported in part by a grant from the World Health Organization, which had no involvement in the study, and was presented in part at the second biennial Global Summit Consensus Conference on International Breast Health Care, Bethesda, MD, January 12–15, 2005.

REFERENCES


**Appendix A. Epidemiologic Regions as Applied in WHO Generalized CEA (10)**

<table>
<thead>
<tr>
<th>WHO region</th>
<th>Mortality stratum</th>
<th>WHO member states</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>E</td>
<td>Botswana, Burundi, Central African Republic, Congo, Côte d’Ivoire, Democratic Republic Congo, Eritrea, Ethiopia, Kenya, Lesotho, Malawi, Mozambique, Namibia, Rwanda, South Africa, Swaziland, Uganda, United Republic of Tanzania, Zambia, Zimbabwe</td>
</tr>
<tr>
<td>North America</td>
<td>A</td>
<td>Canada, Cuba, United States of America</td>
</tr>
<tr>
<td>Asia</td>
<td>D</td>
<td>Bangladesh, Bhutan, Democratic People’s Republic of Korea, India, Maldives, Myanmar, Nepal</td>
</tr>
</tbody>
</table>

*a, have very low rates of adult and child mortality; D, have high adult and child mortality; E, have very high adult and high child mortality.
WHO, World Health Organization; CEA, cost-effectiveness analysis.

**Appendix B. Unit Costs and Total Costs per Patient (in 2000 U.S. Dollars) by WHO Region**

<table>
<thead>
<tr>
<th>Resource or intervention</th>
<th>Africa</th>
<th>North America</th>
<th>Asia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outpatient visit</td>
<td>0.82</td>
<td>24.05</td>
<td>0.53</td>
</tr>
<tr>
<td>Hospitalization</td>
<td>4.65</td>
<td>203.35</td>
<td>3.75</td>
</tr>
<tr>
<td>Lumpectomy</td>
<td>34.00</td>
<td>414.72</td>
<td>23.54</td>
</tr>
<tr>
<td>Mastectomy</td>
<td>34.56</td>
<td>417.01</td>
<td>24.01</td>
</tr>
<tr>
<td>Radiotherapy</td>
<td>323.43</td>
<td>6465.55</td>
<td>173.20</td>
</tr>
<tr>
<td>(Neo)adjuvant chemotherapy</td>
<td>75.96</td>
<td>852.72</td>
<td>54.87</td>
</tr>
<tr>
<td>Endocrine therapy</td>
<td>0.01</td>
<td>0.04</td>
<td>0.01</td>
</tr>
<tr>
<td>Bilateral mammography</td>
<td>3.57</td>
<td>48.36</td>
<td>2.60</td>
</tr>
<tr>
<td>Fine needle aspiration biopsy</td>
<td>8.22</td>
<td>51.42</td>
<td>6.47</td>
</tr>
<tr>
<td>Chest radiograph</td>
<td>3.05</td>
<td>31.76</td>
<td>2.26</td>
</tr>
<tr>
<td>Bone scan</td>
<td>15.96</td>
<td>107.79</td>
<td>13.06</td>
</tr>
<tr>
<td>Electrocardiography</td>
<td>1.58</td>
<td>28.47</td>
<td>0.91</td>
</tr>
<tr>
<td>Pelvic examination</td>
<td>1.22</td>
<td>20.44</td>
<td>0.70</td>
</tr>
<tr>
<td>Ultrasonography of the liver</td>
<td>3.61</td>
<td>66.10</td>
<td>2.12</td>
</tr>
<tr>
<td>Complete blood count</td>
<td>2.68</td>
<td>35.10</td>
<td>1.97</td>
</tr>
<tr>
<td>Total bilirubin assay</td>
<td>2.23</td>
<td>36.83</td>
<td>1.51</td>
</tr>
<tr>
<td>Alkaline phosphatase assay</td>
<td>4.70</td>
<td>46.76</td>
<td>3.59</td>
</tr>
<tr>
<td>Total costs per patient</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diagnosis</td>
<td>30.96</td>
<td>300.23</td>
<td>17.32</td>
</tr>
<tr>
<td>Non-breast cancer examination</td>
<td>5.57</td>
<td>91.94</td>
<td>3.85</td>
</tr>
<tr>
<td>Stage I treatment</td>
<td>367.54</td>
<td>7311.01</td>
<td>204.77</td>
</tr>
<tr>
<td>Stage II treatment</td>
<td>367.54</td>
<td>7311.01</td>
<td>204.77</td>
</tr>
<tr>
<td>Stage III treatment</td>
<td>444.06</td>
<td>8166.03</td>
<td>260.11</td>
</tr>
<tr>
<td>Stage IV treatment</td>
<td>86.08</td>
<td>1293.47</td>
<td>62.89</td>
</tr>
<tr>
<td>Follow-up year 1–5</td>
<td>31.95</td>
<td>547.31</td>
<td>22.75</td>
</tr>
<tr>
<td>Follow-up year 6–10</td>
<td>24.26</td>
<td>378.69</td>
<td>17.51</td>
</tr>
<tr>
<td>Screening</td>
<td>4.46</td>
<td>62.60</td>
<td>3.15</td>
</tr>
</tbody>
</table>

*a All unit costs are derived from a South African database (24).
WHO, World Health Organization.
Tumor Size and Breast Cancer Detection: What Might Be the Effect of a Less Sensitive Screening Tool Than Mammography?

Stephen W. Duffy, MSc, CStat,* Laszlo Tabar, MD,† Bedrich Vitak, MD,‡ and Jane Warwick, PhD*

*Cancer Research UK Center for Epidemiology, Mathematics, and Statistics, Wolfson Institute of Preventive Medicine, London, United Kingdom; †Mammography Department, Central Hospital, Falun, Sweden; and ‡Department of Medical Radiology, University Hospital, Linköping, Sweden

Abstract: In some limited-resource areas, a state-of-the-art mammography program is not affordable. In such circumstances, one might consider a less resource-intensive, but also less sensitive screening tool such as clinical breast examination (CBE). We used data from the Swedish Two-County Trial to estimate the shift in tumor size resulting from invitation to mammographic screening. By postulating a lesser benefit of a less sensitive screening tool (CBE), particularly in terms of detecting very small tumors, we predicted its likely effect on tumor size distribution. In addition, using the observed association between tumor size and nodal status, and between tumor size and fatality, we predicted the likely benefit in terms of reductions in node-positive disease and in breast cancer mortality. An invitation to mammographic screening was associated with a 27% reduction in the number of node-positive tumors and a 31% reduction in the number of breast cancer deaths. We estimate that in the trial population, screening with CBE alone would have led to an 11% reduction in node-positive tumors and an 11% reduction in breast cancer deaths (approximately 42 deaths prevented per 1000 cases). Assuming instead a tumor size distribution typical of a limited-resource setting (70% of tumors are 30 mm at presentation), we estimate that screening with CBE alone would lead to a 13% reduction in node-positive tumors and a 12% reduction in breast cancer deaths (approximately 72 deaths prevented per 1000 cases). Thus, although the relative benefit of CBE is only slightly greater in the limited-resource setting, the absolute reduction in deaths per case is about 70% higher. Our findings suggest that a less sensitive tool might be expected to confer a breast cancer mortality reduction about half of that observed with mammography.

Key Words: breast cancer, clinical breast examination, early detection, mammography, mortality, screening, tumor size

Randomized trials show that breast cancer mortality reductions on the order of 20–30% are observed in association with invitation to breast cancer screening with mammography, and that greater reductions may be expected in association with actually being screened (1,2). More recent research on service screening programs suggests that participation in modern, organized service screening may well reduce the risk of dying from breast cancer by 40% or more (3).

Mammography is the only single screening modality with a strong evidence base for its efficacy in reducing breast cancer mortality, and as such it is the first recommendation for advancing the diagnosis of breast cancer and thus preventing death from the disease. In a developed country with a high level of awareness about the importance of early detection, and thus prompt seeking of health care services when new symptoms develop, stage at clinical presentation is such that one could not reasonably expect a substantial improvement in stage by any less sensitive screening modality than mammography. There is, however, interest in considering the use of less resource-intensive methods for countries that cannot afford a mass mammography program. It should be noted, however, that in countries with very limited resources, where there is not even general access to surgical treatment for cancer, early detection is not worth considering at this time, and the main objective for such countries must be the delivery of basic treatment.

Possible less sensitive and less resource-intensive methods for earlier diagnosis of breast cancer include education in
breast awareness, training in breast self-examination (BSE), and regular clinical breast examination (CBE) by experienced personnel (4). Breast awareness is a difficult concept to measure, but it is clear that increased awareness has contributed to a downshift in stage at diagnosis in the absence of, or in addition to, that contributed by formal screening (5). Although it seems reasonable that physical examination could be a pathway to earlier diagnosis in limited-resource settings, at the moment, there are no randomized trial results establishing a mortality-reducing benefit of BSE or CBE (6,7), so these approaches cannot be recommended outside of the research/evaluation setting. However, it would be useful to those planning such research studies to have some prior idea of the likely benefit of such less sensitive screening tools.

In this article we examine the effect of mammographic screening, within a randomized controlled trial, on the size distribution of tumors diagnosed and the consequences for risk of node-positive disease and subsequent death from breast cancer. We postulate lesser effects on the size distribution of CBE, a screening test of lower sensitivity, and estimate the likely consequences of these effects for node-positive disease and breast cancer mortality. We provide estimates both for the trial population with its observed tumor size distribution and for the same population after applying a tumor size distribution typical of a limited-resource setting.

METHODS

Our data are from the Swedish Two-County Trial of mammographic screening for breast cancer (1). In this study, 77,080 women age 40–74 years were randomized to regular invitation to mammographic screening (active study population [ASP]) and 55,985 were randomized to no invitation (passive study population [PSP]). In the ASP, women age 40–49 years at randomization were invited every 2 years, and women age 50–74 years were invited every 33 months. After 7 years, the first mortality results were published, showing a significant 30% reduction in breast cancer mortality with an invitation to screening (8), the control group was invited for screening, and the trial was closed. During the trial, 2468 breast cancers were diagnosed, of which 2299 were invasive. Of the invasive cases, we had tumor size data on 2294 (99.8%) and nodal status data on 2147 (93.4%). At the time of our most recent publication of trial results, we had more than 20-years maximum follow-up (1). Our analyses in this article are based only on the invasive cases, as very few deaths arise from ductal carcinoma in situ (DCIS) and because an alternative screening tool such as CBE is unlikely to detect large numbers of in situ cases.

We first tabulated the tumor size distributions in the ASP and PSP. We then tabulated the proportions of node-positive cases and the 20-year fatality rates from breast cancer by tumor size. From these, we derived the shifts in tumor size and the consequent changes in proportions of node-positive cases and fatal cases resulting from the mammographic screening. By applying hypothesized lesser shifts in tumor size from a screening test of lesser sensitivity (CBE), we predicted the likely reductions in node-positive disease and breast cancer deaths from such a test. The methodology is as described in our article on detection of early stage invasive disease and DCIS (9), but it is best explained by demonstration, as in the “Results” section below. Finally, to predict possible reductions in node-positive disease and breast cancer deaths in the limited-resource setting with the use of a less sensitive test, we repeated the calculations assuming that the majority of cancers were of a late stage at presentation.

RESULTS

Table 1 shows the observed distribution of sizes of invasive tumors in the ASP and PSP. Clearly there was a considerable shift toward smaller tumors in the ASP. More than 40% of tumors in the ASP were smaller than 15 mm, whereas less than 30% of PSP tumors were of this size.

If we assume that any shift in tumor size as a result of screening in the ASP is no greater than one size category, we can derive the numbers and percentages shifted to and from each category. For example, on the basis of the rate of tumors of size 50 mm or more in the PSP, the number of cancers one would expect in this category in the ASP is $E_{50} = 77,080 \times 76/55,985 = 105$.

![Table 1. Size Distribution of Invasive Tumors by Trial Arm]

<table>
<thead>
<tr>
<th>Size (mm)</th>
<th>ASP, no. (%)</th>
<th>PSP, no. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1–9</td>
<td>249 (19)</td>
<td>105 (11)</td>
</tr>
<tr>
<td>10–14</td>
<td>319 (24)</td>
<td>179 (18)</td>
</tr>
<tr>
<td>15–19</td>
<td>259 (20)</td>
<td>202 (20)</td>
</tr>
<tr>
<td>20–29</td>
<td>270 (21)</td>
<td>264 (26)</td>
</tr>
<tr>
<td>30–49</td>
<td>128 (10)</td>
<td>167 (17)</td>
</tr>
<tr>
<td>50+</td>
<td>76 (6)</td>
<td>76 (8)</td>
</tr>
<tr>
<td>Total</td>
<td>1301 (100)</td>
<td>993 (100)</td>
</tr>
</tbody>
</table>

*The trial randomized 77,280 women to the ASP (active study population: invitation to mammographic screening) and 55,985 women to the PSP (passive study population: no invitation).
In fact, we observed 76 such tumors in the ASP, so we derive a shift of 29 tumors (29/105 = 28%) from size 50 mm or more to 30–49 mm. The same procedure gives the expected number of tumors in the 30–49 mm category in the ASP as 230. Removing the 29 tumors downshifted from the 50 mm or more group, we have 99 tumors observed in this category in the ASP. Thus we calculated that 230 – 99 = 131 tumors have been shifted from size category 30–49 mm to 20–29 mm (131/230 = 57%). Carrying on with this procedure gives the derived size-shifted percentages in Table 2. These percentages correspond to 798 tumors size-shifted in the ASP, which is 86% of the screen-detected tumors. These shifts resulted in an observed 27% reduction in the number of node-positive tumors and a 31% reduction in the number of breast cancer deaths (Table 3).

Figure 1 shows the observed 21-year survival by tumor size (regardless of trial arm). The corresponding observed proportions of node-positive tumors and 20-year fatality rates are shown in Table 4. Clearly there are very strong gradients of increasing fatality and increasing node positivity with increasing tumor size. By applying these rates to the actual number of invasive tumors by size and trial arm, given in Table 1, one can derive the expected number of node-positive cases in each trial arm (407 in the ASP and 380 in the PSP)—note that greater numbers of cases (and not a higher rate) are expected in the ASP because the size of the ASP was 38% larger than that of the PSP. The expected incidence of node-positive disease in the ASP and PSP is therefore 5.28 and 6.78 per 1000 women, respectively. This represents an expected 22% reduction in the incidence of node-positive disease with an invitation to screening. The actual reduction achieved was 27% (Table 3). Similarly we would expect 419 breast cancer deaths in the ASP and 383 in the PSP and respective fatality rates of 5.43 and 6.83 per 1000 women. The expected reduction in fatality is therefore 21%, considerably less than the actual reduction of 31% (Table 3). Thus this methodology gives a conservative estimate of the mortality-reducing benefit of screening.

The percent of cases shifted to a lower size category, assuming a less sensitive screening tool such as CBE instead of mammography, are given in Table 5. The assumed relative benefit of CBE (when compared with mammography) is somewhat arbitrary, due to a lack of available evidence, but we nevertheless believe the predicted estimates to be reasonable. The hypothesized effect of using this screening tool on the distribution of tumor size (assuming for simplicity, equal-size study arms) is shown in Table 6. The predicted number of cases in the size group of 50 mm, for example, is

\[ P_{50} = 76 \times 0.72 = 55. \]

Therefore, for the 30–49 mm category,
\[ P_{30-49} = 167 \times 0.54 + (76 - 55) = 90 + 21 = 111 \]

(i.e., the number of cases not expected to downshift to the 20–29 mm category plus the number of cases downshifted from the 50 mm category). Again applying the observed node-positive and fatality rates from Table 4 to the hypothesized tumor size distribution (Table 6), we obtain respective estimates of 11% for the predicted reduction in node-positive tumors and 11% for the reduction in breast cancer deaths. This corresponds to a total of 42 deaths avoided in 993 cases. We carried out similar calculations using the joint effects of tumor size and nodal status, and found the predicted reductions in the number of node-positive cases and breast cancer deaths to be the same.

Unlike the situation described above, which derives from a northern European population, in many limited-resource countries, stage at presentation is typically more advanced (10). Thus in order to obtain more pragmatic estimates of the effects on nodal status and breast cancer deaths, we reweighted our PSP numbers to ensure that 70% of the tumors were in the 30 mm or more categories, thereafter distributing cases among the categories in the same ratios as before. The numbers in each study arm and size category, after this reallocation, are given in Table 7. Applying the node positivity and fatality rates from Table 4 as before, we predict that screening for breast cancer with CBE alone in a limited-resource country would lead to a 13% reduction in node-positive cases and a 12% reduction in breast cancer deaths. This corresponds to the prevention of 72 deaths in 993 cases. Thus, although the relative benefit is only slightly greater in an environment where late stage at presentation prevails, the absolute reduction in deaths per case is about 70% higher.

### DISCUSSION

The use of a less sensitive screening tool than mammography would be expected to result in a lesser impact on tumor size, lymph node status, and breast cancer mortality than that observed with mammography. Our results, based on plausible assumptions about the relative effect of a less sensitive screening tool in terms of size shifting, suggest that the benefit might approach half of the benefit of invitation to mammography observed in the trials, with an 11–13% reduction in node-positive disease and in breast cancer deaths. Thomas et al. (6) found an 8% reduction in node-positive cases and an 11% reduction in tumors of stage T2 or worse in a trial of BSE in Shanghai. Our predicted percentage size shifts correspond to an absolute number of size-shifted tumors that is about half of the number estimated from mammography. This is consistent with Alexander’s estimates of sensitivity of around 40% for CBE and around 60–80% for mammography (11).

Our predictions are arguably conservative, as the mortality reduction predicted from the observed shift in tumor size distribution with invitation to mammography
underestimated the observed mortality reduction by a factor of one-third. However, the Two-County Trial resulted in a relatively high mortality-reducing benefit compared with the other breast screening trials and had a very high participation rate, 85% on average (12). In a limited-resource country, one would not expect such a high participation rate. However, the effects of the offer of such an intervention would almost certainly include an increase in awareness that would in turn ameliorate stage at presentation, so that the overall benefit might be greater than estimated.

It is therefore unlikely that the benefit of a less sensitive screening method such as CBE would confer a breast cancer mortality reduction substantially greater than the 11–13% predicted here. One would clearly prefer to achieve the substantial benefit of mammographic screening, and indeed mammography is becoming more widespread worldwide, including areas of Africa and eastern Europe that would be considered limited-resource areas (13,14). However, it is not an option for some limited-resource areas, and the lesser benefit might still be worth pursuing, especially if one assumes that some additional improvements could derive from a steady growth in awareness and prompt seeking of health care when a woman first notices a change in her breast. The following caveats should be borne in mind, however:

• Early detection is of no use if treatment facilities are not available. Any early detection or awareness program should be accompanied by efforts to ensure timely delivery of responsive, appropriate treatment of the cases diagnosed.

• In some countries, attitudes are as much a barrier to early detection as limited resources. For example, in a trial of breast cancer screening by CBE in the Philippines, intervention was discontinued due to noncompliance of women recalled for further assessment of suspicious lumps (7). Thus the introduction of screening may also need to be accompanied by behavioral interventions.

• Breast cancer incidence in limited-resource areas is often considerably lower than that in the developed countries of Europe, North America, and Australia. This has implications for cost-effectiveness, even of screening methods requiring minimal resources. However, increasing incidence in some of these settings, and lower average age at onset due to cohort effects, with considerably more potential years of life lost, are also considerations.

Acknowledgments

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REFERENCES


Radiotherapy for Breast Cancer in Countries with Limited Resources: Program Implementation and Evidence-Based Recommendations

Nuran Senel Bese, MD, Krystyna Kiel, MD, Brahim El-Khalil El-Gueddari, MD, Oladapo Babatunde Campbell, MD, Baffour Awuah, MD, and Bhadrasain Vikram, MD, for the International Atomic Energy Agency

Abstract: Radiotherapy is an essential part of the multimodality treatment of breast cancer. Applying safe and effective treatment requires appropriate facilities, staff, and equipment, as well as support systems, initiation of treatment without undue delay, geographic accessibility, and completion of radiotherapy without undue prolongation of the overall treatment time. Radiotherapy can be delivered with a cobalt-60 unit or a linear accelerator (linac). In early stage breast cancer, radiotherapy is an integral part of breast-conserving treatment. Standard treatment includes irradiation of the entire breast for several weeks, followed by a boost to the tumor bed in women age 50 years or younger or those with close surgical margins. Mastectomy is an appropriate treatment for many patients. Postmastectomy irradiation with proper techniques substantially decreases local recurrences and improves survival in patients with positive axillary lymph nodes. It is also considered for patients with negative nodes if they have multiple adverse features such as a primary tumor larger than 2 cm, unsatisfactory surgical margins, and lymphovascular invasion. Many patients present with locally advanced or inoperable breast cancer. Their initial treatment is by systemic therapy; after responding to systemic therapy, most will require a modified radical mastectomy followed by radiotherapy. For those patients in whom mastectomy is still not possible after initial systemic therapy, breast and regional irradiation is given, followed whenever possible by mastectomy. For patients with distant metastases, irradiation may provide relief of symptoms such as pain, bleeding, ulceration, and lymphedema. A single fraction of irradiation can effectively relieve pain from bone metastases. Radiotherapy is also effective in the palliation of symptoms secondary to metastases in the brain, lungs, and other sites. Radiotherapy is important in the treatment of women with breast cancer of all stages. In developing countries, it is required for almost all women with the disease and should therefore be available.

Key Words: breast cancer, developing countries, health resources, radiation oncology, radiation therapy, radiotherapy

Radiotherapy is an essential component of the treatment of breast cancer. Depending on the stage of disease, this therapy can reduce the risk of local recurrence, improve survival, and provide palliation of symptoms. Available data suggest that the incidence of breast cancer is increasing in countries with limited resources (1), which typically have restricted or no access to radiotherapy (2–5). Therefore, implementing and expanding radiotherapy programs will be imperative to ensure the best possible outcomes for women with the disease.

In this article we review the resource requirements for implementing a radiotherapy program in the limited-resource setting, with special reference to treating breast cancer, and we discuss possible strategies for overcoming barriers to a radiotherapy program. In addition, we provide evidence-based recommendations for radiotherapy for breast cancer in such settings.

requirements for safe and effective radiotherapy for breast cancer

In delivering radiotherapy for breast cancer, as for other cancers, a health care system must strive to meet at least basic staff and equipment requirements, each of which plays a role in ensuring that the therapy is both safe and effective (Table 1) (6). A major thrust of the program in human health of the International Atomic Energy
Agency (IAEA) is addressing the need for radiotherapy in countries with limited resources (7). The IAEA has a long track record of providing essential equipment and training staff to safely treat patients with cancer. It has delivered more than $57 million in radiotherapy technology to developing member states since 1981 through the Technical Cooperation program, under which assistance is provided to such states for establishing or upgrading facilities for cancer treatment.

Lack of well-trained staff results in underuse or inappropriate use of even the existing scarce radiotherapy facilities in many countries. Therefore the IAEA provides initial education and training as well as continuing professional development activities for professionals in radiation oncology and allied fields (e.g., physicians, technicians, nurses, maintenance engineers). Another reason for the suboptimal use of existing facilities is the lack of a quality culture in many institutions in developing countries. Many IAEA activities therefore focus on establishing and strengthening quality assurance programs.

The central equipment requirement for radiotherapy for breast cancer is a megavoltage teletherapy unit, either a cobalt-60 unit or a linear accelerator (linac). At present, although the developing world has as many patients with breast cancer as the developed world, it has only about half as many radiotherapy units, with dozens of countries having no radiotherapy at all (8). Either a cobalt unit or a linac can be used for radiotherapy for breast cancer, but experience in countries with limited resources has shown that the downtime of linacs is generally considerably greater. Any interruption to treatment due to equipment breakdown adversely affects patients’ outcomes. The longer or more frequent the interruptions, the worse the impact.

There have been numerous instances where, even after an institution acquired a linac, few patients could be treated because the proper support arrangements were not made. There are many technical differences between cobalt units and linacs, including the build-up region, penumbra, depth dose, dose rate, versatility, beam profile, ease of maintenance, and decommissioning. These are discussed in detail elsewhere (6,9,10). In addition to the teletherapy equipment, high-quality treatment by radiotherapy requires certain quality assurance tools such as an imaging device (a fluoroscopic or computed tomography simulator), immobilization devices, shielding devices, a treatment planning computer system, and tools for dosimetry.

Delivery of safe and effective radiotherapy also requires addressing certain logistical issues. Specifically, in addition to the staff and equipment requirements, the healthcare system must be able to provide the physical facility for radiotherapy, support systems that allow delivery of therapy over a period of weeks, initiation of treatment without long delay, and geographic accessibility to patients.

Although the initial investment in establishing radiotherapy is significant, the long life of radiotherapy equipment (20–30 years) means that the cost per patient treated can be surprisingly modest in an efficiently run facility. Nonetheless, given that substantial initial investment, and in light of the competing needs in countries with limited resources, collaborative and innovative approaches are called for. For example, technical cooperation programs between nations, or with international organizations such as the IAEA (11), can aid in the establishment of radiotherapy in countries with limited resources. Advances in telecommunications may also enable cost-effective approaches by linking radiotherapy facilities with

Table 1. Roles of Staff and Equipment Requirements in Safe and Effective Radiotherapy for Breast Cancer (6)

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Role(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staff</td>
<td></td>
</tr>
<tr>
<td>Radiation oncologist</td>
<td>Clinical evaluation, therapeutic decision, target volume localization, treatment planning, simulation/verification of treatment plan, treatment evaluation during treatment, follow-up examinations</td>
</tr>
<tr>
<td>Medical physicist</td>
<td>Quality control, computerized treatment planning, complex calculations and quality checks</td>
</tr>
<tr>
<td>RTT</td>
<td>Simulation/verification of treatment plan, routine calculations and quality checks, treatment</td>
</tr>
<tr>
<td>Maintenance techniciana</td>
<td>Maintenance of equipment</td>
</tr>
<tr>
<td>Equipment</td>
<td></td>
</tr>
<tr>
<td>Megavoltage teletherapy unitb</td>
<td>Radiation source</td>
</tr>
<tr>
<td>Dosimetry equipment</td>
<td>Physical quality assurance</td>
</tr>
<tr>
<td>Clinical QA equipmentc</td>
<td>Clinical quality assurance</td>
</tr>
<tr>
<td>Immobilization devices</td>
<td>Accuracy of therapy</td>
</tr>
<tr>
<td>Shielding devices</td>
<td>Protection of healthy tissues such as heart, lungs, and spinal cord</td>
</tr>
<tr>
<td>Treatment planning computer system</td>
<td>Calculation of radiation distribution</td>
</tr>
</tbody>
</table>

*aRequired if a linear accelerator (linac) is being used.  
*bA cobalt-60 unit or linac; choice will depend on the factors discussed in the text. Breast brachytherapy is investigational at this time.  
*cIncludes a simulator (fluoroscopic or computed tomography).  
*QA, quality assurance; RTT, radiotherapy technologist/radiographer.
RECOMMENDATIONS FOR RADIOTHERAPY FOR BREAST CANCER

Radiotherapy has an important role in the treatment of breast cancer at every stage. In early stage disease, radiotherapy is an integral part of breast-conserving therapy. For patients with more advanced cancers, adjuvant radiotherapy substantially decreases the risk of local recurrence, and also improves the survival among patients with positive axillary lymph nodes (13–16). In locally advanced disease (often the most common presentation in the limited-resource setting), after neoadjuvant systemic therapy, patients require both radiotherapy and modified radical mastectomy in an effort to achieve local control. In addition, radiotherapy is a valuable tool for the palliation of distant metastasis such as bone and brain metastases, as well as palliation for local recurrences.

Delivery of radiotherapy for breast cancer in the doses needed and according to the schedules supported by current evidence (discussed subsequently and summarized in Table 2) is essential for its effectiveness, as well as its safety. Ongoing studies are exploring the possibility of using lower doses or shorter schedules, which would reduce costs and workloads, but their use should be considered investigational at this time.

Breast cancer requires multimodality treatment that, in addition to radiotherapy, includes surgery and systemic therapy (chemotherapy, hormonal therapy, or both). Approaches for integrating these therapies for safe and effective breast cancer treatment in the limited-resource setting are given in an accompanying guideline (17). Here we elaborate on delivery of radiotherapy in such settings by discussing the evidence base, doses and schedules, and issues such as sequencing with other therapies.

Whole-Breast Radiotherapy

Early stage (stage I or II) breast cancer is surgically treated by either excision of the cancer (lumpectomy) with negative margins or a mastectomy. Disease in the axilla is assessed by either axillary dissection or a sentinel node biopsy followed by axillary dissection if the sentinel node is positive. Radiotherapy is delivered to the breast in the case of breast-conserving surgery, or is delivered to the chest wall after mastectomy if axillary lymph nodes are differing levels of treatment capability and expertise by digital networks or satellite (12). Continued exploration of such strategies will be essential to meet the goal of delivering radiotherapy to all women with breast cancer who need it in limited-resource countries.

<table>
<thead>
<tr>
<th>Stage of breast cancer</th>
<th>Metastatic or recurrent breast cancer</th>
<th>Locally advanced breast cancer</th>
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<td>Whole-breast radiotherapy</td>
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<td>Local- or field radiotherapy with a single 8 Gy fraction in a single fraction</td>
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<td>Patients with multiple symptomatic bone metastases</td>
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<td>Patients with positive axillary lymph nodes</td>
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<td>Patients with negative axillary lymph nodes</td>
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Patients with positive axillary lymph nodes who have multiple adverse features (e.g., primary tumor larger than 2 cm, unsatisfactory surgical margins, lymphovascular invasion) are given 50 Gy in 25 fractions over 5 weeks, administered five times per week. Patients with positive axillary lymph nodes who have lower risk features (e.g., primary tumor smaller than 2 cm, satisfactory surgical margins, absence of lymphovascular invasion) are given 45 Gy in 25 fractions over 5 weeks, administered five times per week.

Patients with positive axillary lymph nodes who have positive lymphovascular invasion are given 50 Gy in 25 fractions over 5 weeks, administered five times per week. Patients with positive axillary lymph nodes who have negative lymphovascular invasion are given 45 Gy in 25 fractions over 5 weeks, administered five times per week.
involved or certain other adverse features are present (discussed in a later section).

Randomized trials have shown that there are no significant differences in disease-free or overall survival between patients treated by mastectomy and those treated by breast-conserving surgery and whole-breast radiotherapy (18–21). The main benefit of breast-conserving surgery and radiotherapy is preservation of body image and a better quality of life. Randomized studies evaluating the use of breast-conserving surgery plus adjuvant systemic treatment have demonstrated higher rates of local recurrence than after breast-conserving surgery plus radiotherapy and adjuvant systemic treatment, but major differences in survival have not been observed (22,23). In view of the higher rates of local recurrence, breast irradiation is currently recommended for most patients who undergo breast-conserving surgery. Breast-conserving surgery requires 1) high-quality breast imaging (mammography and ultrasound) and pathology services to ensure tumor-free margins of excision, 2) surgeons experienced in achieving a good cosmetic result with negative pathologic margins of excision, and 3) radiotherapy facilities.

Radiotherapy should be started without a long delay after breast-conserving surgery because a prolonged postoperative interval may compromise local control (24,25). When chemotherapy is indicated, radiotherapy may follow chemotherapy, but for patients with close surgical margins, radiotherapy can be given first. In a prospective randomized trial, there were no significant differences in time to any event, distant metastasis, or death, whether radiotherapy or chemotherapy was given first (26). Concomitant chemoradiotherapy can reduce the overall treatment time, but the concomitant administration of anthracyclines should be avoided because of the risk of increased skin and cardiac morbidity (27). Regimens such as cyclophosphamide, methotrexate, fluorouracil (CMF) are cost effective and can be given concomitantly with irradiation (28,29). Radiation therapy should be completed without undue prolongation of the overall treatment time (30).

Most local relapses are observed in the vicinity of the primary tumor bed, and for this reason, partial breast irradiation is currently under investigation. The target volume is smaller; therefore the radiation can be accelerated and completed in only 1 week. However, robust long-term results and toxicity evaluations are not yet available. At present, after breast-conserving surgery, the target volume for irradiation should include the whole breast.

The most common schedule for irradiation used in clinical practice is 50 Gy in 25 fractions to the whole breast, administered daily, five times per week. In a large randomized trial, however, a shorter fractionation schedule (42.5 Gy in 16 fractions over 22 days) proved to be just as safe and effective (31). Other schedules (e.g., 40 Gy in 3 weeks) are currently under investigation (32). The shorter schedules permit more efficient use of resources, and thus more women can be treated with the existing equipment and personnel in countries with limited resources.

Evidence suggests that boost radiation to the lumpectomy site significantly improves the local control rate for women 50 years of age or younger (33). Therefore a 16 Gy additional radiation dose to the tumor bed is recommended for younger women, as well as for women with close surgical margins. The boost dose can be delivered by photons, electrons, or brachytherapy (34).

**Postmastectomy Radiotherapy**

**Early Stage Breast Cancer** Total mastectomy remains an appropriate treatment for many patients with breast cancer in the developing world. Radiotherapy following mastectomy substantially improves local control (35,36). Local recurrence after mastectomy usually occurs within the first 12–24 months, even after adjuvant systemic therapy, most commonly in the chest wall, followed by the supraclavicular fossa. The major risk factor is positive axillary lymph nodes (37). Other risk factors are large tumor size, positive margins of resection, and lymphovascular invasion (38).

Studies have demonstrated that the use of postmastectomy irradiation improves overall survival in women with axillary lymph node-positive breast cancer (13–16). Postoperative radiotherapy to the chest wall and supraclavicular area is therefore recommended for all patients with four or more positive lymph nodes and should be considered for patients with one to three positive lymph nodes. Axillary irradiation is given only to those patients who did not undergo an adequate axillary dissection. Irradiation of the axilla is, in general, not recommended (37,39). The axillary and internal mammary regions are relatively uncommon sites of local recurrence (in comparison with the chest wall), while the morbidity from axillary irradiation (e.g., arm edema) or internal mammary irradiation (e.g., cardiac toxicity) is of concern (40,41). If sophisticated techniques of modern treatment planning and delivery are available, internal mammary irradiation is recommended for patients with clinically or pathologically positive internal mammary lymph nodes, and is considered for patients if the primary tumor is located at the inner quadrant with the other adverse risk factors. On the basis of a recent retrospective review, postoperative chest wall irradiation should also...
considered for patients with negative axillary lymph nodes who have multiple adverse features (e.g., a primary tumor larger than 2 cm, unsatisfactory surgical margins, or lymphovascular invasion) (38).

A regimen of 50 Gy in 5 weeks is widely used for postoperative irradiation, but more rapid fractionation regimens (e.g., 40 Gy in 3 weeks) are under investigation in randomized trials, some already completed (32,42). Such approaches, with appropriate quality control, may be particularly beneficial in countries with limited resources by reducing the radiotherapy workload and costs.

Information on the impact of the sequencing of postmastectomy radiotherapy and systemic chemotherapy on survival is limited. At present, radiotherapy is most commonly delivered after the completion of chemotherapy in patients with node-positive disease.

**Locally Advanced Breast Cancer** In developing countries, a considerable proportion of the patients present with locally advanced breast cancer (LABC) that is inoperable due to direct extension to the ribs, intercostal muscles, or skin; edema (including peau d’orange) or ulceration of the skin of the breast; satellite skin nodules confined to the same breast; inflammatory carcinoma; metastases to the ipsilateral internal mammary lymph nodes; or metastases to the ipsilateral supraclavicular lymph nodes. Patients with LABC have a high probability of distant metastasis as well as a high probability of local recurrence. Initial treatment of LABC is systemic therapy. Approximately 80% of inoperable tumors treated with chemotherapy may regress sufficiently to become operable (43,44). Neoadjuvant hormonal therapy is beneficial in patients with hormone receptor-positive tumors (45). Following systemic therapy, most patients require a radical or modified radical mastectomy, followed by radiotherapy (selected noninflammatory breast cancers exhibiting a complete or partial clinical response to initial chemotherapy can be considered for breast-conserving surgery followed by radiotherapy). Unresectable tumors that remain unresectable even after two regimens of non–cross-resistant chemotherapy should be irradiated. This should be followed, whenever feasible, by mastectomy. If mastectomy is still not possible, then definitive radiotherapy can be applied, with a further boost to the gross tumor using shrinking fields.

**Palliative Radiotherapy**

In patients with metastatic breast cancer, radiotherapy is an effective tool for palliation of the symptoms. The goal is to prevent or relieve symptoms or loss of function for as long as possible. Patients with bone metastases comprise the largest group receiving palliative radiotherapy. Radiotherapy can prevent pathologic fractures in patients with lytic lesions in weight-bearing bones. Traditionally, local-field radiotherapy has been used for patients with symptomatic bone metastases. Evidence suggests that significant symptomatic relief can be obtained with a single 8 Gy fraction, a very cost-effective strategy (46–49). Wide-field radiotherapy (e.g., hemibody irradiation) can be used for patients with multiple bone metastases. The IAEA conducted a multinational, prospective, randomized trial that showed that hemibody radiation of 12 Gy in four fractions delivered over 2 days was a suitable treatment regimen (50). Others have suggested that hemibody irradiation of 6–8 Gy in a single dose is also safe and effective, if preceded by intravenous ondansetron and dexamethasone (51).

Patients with brain metastases can survive for many months after radiotherapy. Whole-brain irradiation and steroids are recommended for alleviating symptoms from brain metastases. Selected patients with no extracranial disease who have one or few metastases and a good performance status can be treated with craniotomy or radiosurgery if available (52).

Palliative radiotherapy is also useful for patients with soft tissue metastases causing pain, discharge, or bleeding. Locally recurrent breast cancer after mastectomy can occasionally be cured with radiotherapy to the chest wall and regional nodes. The likelihood of tumor control increases with a longer disease-free duration since the initial therapy and resection of the recurrent disease, and also depends on the number of sites involved.

**CONCLUSION**

Delivery of safe and effective radiotherapy for breast cancer requires a substantial investment of resources. However, this therapy is important in the treatment of women with breast cancer of all stages. With appropriate treatment, many women are cured of breast cancer, while many others live longer with the disease and have a better quality of life. Use of evidence-based doses and techniques is essential for ensuring the best possible clinical outcomes and avoiding complications. In developing countries, radiotherapy is required for almost all women with breast cancer and should therefore be available.

**REFERENCES**


The Challenge of Early Breast Cancer Detection among Immigrant and Minority Women in Multicultural Societies

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Abstract: A sociological view of the barriers experienced by women from traditional cultures, both in their native countries and as immigrants and minorities in multicultural western societies, in preventive health care generally and in breast screening specifically, is essential not only to understand patterns of late-stage diagnosis, but also to design successful interventions and programs. Breast cancer is a unique disease, as its name ties together a multisymbolic organ of the female anatomy and a potentially fatal affliction, the treatment of which commonly is a body-mutilating procedure (mastectomy). Because of its special nature, breast cancer is shrouded in fears, myths, and connotations reaching far beyond the objective clinical understanding of the disease. Many women do not use available breast-screening services and present with advanced symptoms. To help women detect and treat breast cancer early, health care providers and policymakers should try to understand their predicaments and the factors influencing their decisions. Structural barriers include such socioeconomic factors as poor health insurance, distance to medical facilities, and inability to take time off from work, while organizational barriers include difficulty in navigating complex health care systems and interacting with medical staff. Psychological and sociocultural barriers include poor health motivation, denial of personal risk, fatalism, mistrust of cancer treatments, and the fear of becoming a burden on family members. These barriers can often preclude proactive breast screening or rapid response to symptoms, even when breast cancer awareness is rather high. Moreover, in many traditional societies, especially Muslim ones, women's decisions and actions are controlled by men, and men may be unaware of or disapprove of breast screening. This article discusses several approaches to lowering the described barriers, including specially tailoring educational programs that dispel cancer myths, involving men in breast cancer detection efforts, implementing cultural competence training for mainstream health care providers, and recruiting minority health care professionals to enable better outreach to their coethnics.

Key Words: attitudes, barriers, beliefs, breast cancer, cancer fears, cultural diversity, customs, fatalism, gender roles, health motivation, immigrant and minority women, screening

Breast cancer is a unique disease, as its name ties together a symbolic and erotically charged organ of the female anatomy and a potentially fatal affliction, the treatment of which is based on a body-mutilating procedure (mastectomy). Because of its special nature, breast cancer is shrouded in fears, myths, and connotations reaching far beyond the objective clinical understanding of the disease. A gap is often found between knowledge and practice: many women who are aware of breast cancer risk do not use available breast-screening services (1–4). To help women detect and treat breast cancer early, health care providers and policymakers must attempt to understand their predicaments and the factors influencing their decisions about breast screening.

This article offers a sociological view of the barriers experienced by women from traditional cultures (both in their native countries and as immigrants and minorities in multicultural western societies) in preventive health care generally and in breast care specifically. The empirical data for this overview derive from the literature, as well as research among Russian women who have immigrated to Israel—a multicultural society that includes Jews originating from more than 100 countries and Arabs (predominantly Muslims, but also Christians and Druze). The research included a survey among a national sample of women age 35 years and older as well a series of personal in-depth interviews with these women about their perceptions of breast cancer. The methodological details of these studies have been previously described (1,2). In addition, this analysis draws on the Israeli and international literature on the social and behavioral aspects of breast cancer (3–7).

CONTEXT OF WOMEN’S LIVES

It is impossible to understand women’s health decisions and actions outside of the general context of their lives.
Many societies with low per capita income and limited medical resources are at the same time male-dominated societies in which women have lower social status and fewer personal resources (8). Both globally and in every country individually, women comprise a majority among the poor, uneducated, and unemployed (8). Minority women in western countries are often marginalized, isolated from the mainstream culture, and have limited command of the dominant language. Most of these women both work for wages (usually in low-skilled and poorly paying positions) and serve a second shift at home, where they care for their husbands, children, and elderly parents. As a result of these multiple roles, women’s personal agendas are overburdened and have little room left for health concerns, especially preventive ones, which are perceived as less pressing. Because of low health motivation generally and the traditional emphasis on curative care (i.e., seeking help when the problem is already acute and needs treatment), such women give a low priority to preventive activities such as breast self-examination (BSE), well-woman checkups with clinical breast examination (CBE), Papanicolaou tests, and mammography (9,10). This self-neglect does not necessarily reflect ignorance, as many women are aware of breast cancer risk; rather it reflects social and economic disadvantage augmented by negative emotional reactions to cancer.

An example of differing behavioral patterns that likely reflect the economic and psychosocial differentials between specific groups of women is provided by Israeli data collected in the mid-1990s on compliance with recommended biannual mammography (which is accessible for all citizens of Israel) among women age 50–75 years. The rate of actual screening varied from 60% for Israeli-born Jewish women to 40% for Russian immigrant women to 20% for both Ethiopian immigrant and Israeli Arab women (11). Of note, however, after a targeted intervention among Israeli Arab women that entailed both a media campaign and deployment of mobile mammography units in their communities, the rate of screening among those younger than 60 years of age increased between the mid-1990s and 2003–2004 from about 25% to 60%—a rate now almost equal to that among Israeli-born Jewish women (12). This marked improvement suggests that culturally tailored interventions can overcome barriers to breast screening among minority groups. Similar cases of a rapid increase in women’s participation in breast-screening activities after culturally sensitive educational and clinical interventions have been reported for several minority groups in the United States, such as Cambodian immigrants in the Midwest (13). To ensure the success of such programs, it is important to identify the factors shaping help-seeking behavior among disadvantaged and minority women (14).

### BARRIERS TO EARLY DETECTION OF BREAST CANCER

A variety of structural, organizational, psychological, and sociocultural barriers preclude many women in multicultural societies from using breast-screening services (Table 1). Let us look at each of these more closely.

#### Structural Barriers

Structural refers to the social factors related to women’s place in the social system, with the ensuing personal resources and opportunities. To begin with, many women in developing countries, as well as minority women in the West, do not have health insurance that includes access to preventive services. In the United States alone, more than 25 million women have no access to health care except for emergency care; another 40 million have basic insurance plans with prohibitive deductibles and copayments that de facto preclude women from using preventive services. Among those uninsured and underinsured, more than two-thirds are members of racial and ethnic minorities (15). When they do have formal access to preventive services, many poor women cannot use them because of long travel distances and the lack of transportation, and an

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<th>Table 1. Barriers to Breast Cancer Screening among Immigrant and Minority Women in Multicultural Societies</th>
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inability to take time off from work or pay for child care during their absence (14).

Organizational Barriers

The next tier of barriers, organizational barriers, reflect difficulties that are built into the medical encounters between minority women and the mainstream medical institutions: understanding the complex referral system and the nexus between diagnostics and treatment; communicating in their inadequate English or other host language; and facing arrogance and brusqueness from physicians, nurses, and administrative staff. Gender-related barriers are also at work: the need to expose one’s breasts for examinations performed by often male physicians, surgeons, or radiology technologists. The last factor makes breast examinations especially difficult among religious Muslim women, for example, because rules of Islam strictly prohibit nudity and self-exposure in front of any man other than one’s husband. For many such women, shame is worse than disease and death, and they will not visit women’s health clinics unless they are staffed by women (16,17).

Psychological Barriers

However salient the organizational issues are precluding women from using breast-screening services, the psychological barriers are even more common and pervasive. They all ensue from a deeply entrenched fear of cancer, which is perceived as a universally fatal disease, and hence any thought of cancer triggers multiple psychological defense mechanisms. One such mechanism is denial of one’s own susceptibility, a belief that “this cannot happen to me.” This denial is especially common among women from societies that have a low or moderate risk of breast cancer, who have no personal experience of having a relative or a friend with this disease, but it is also found among women in high-risk populations (1,2,16,18). The extension of this outlook is avoiding any early testing or other preventive activities before trouble strikes in full. In the words of one of my immigrant informants in the Israeli study (2): “I have no time for potential troubles, having enough actual ones; I am also not going to see my body as a foe and test it endlessly for signs of disease. This in itself is morbid.” Another woman expressed a similar view: “If I discover a lump, I will go to a doctor of course, but I am not going to look for it on purpose.” Similar attitudes toward one’s body and the breasts as potential foe have also been found among women in North America in studies trying to elucidate causes for low adherence to BSE (6,19).

Another typical mode of psychological defense is fatalism, that is, the belief that one’s destiny is determined by some higher power and one has no control over disease, life, and death. Specifically, a woman may believe that if she is destined to get breast cancer, she will get it, and then her survival or death is all a matter of luck, fate, or providence, whichever she believes in. This outlook is, of course, common among devout women of any religion, for example, being shared by both ultraorthodox Jews and Muslims in Israel (16), but it also is not uncommon among secular women. Moreover, in many traditional cultures, disease is interpreted as punishment for sins (one’s own or those of the family, clan, or others), and medical intervention in the intentions of the deity makes it even more sinful (16).

The fatalist view of cancer is often augmented by the frightening prospect of mutilation of the body (mastectomy) as its treatment; a woman without a breast or breasts is a castrate, and her femininity and body self-image are greatly diminished (16). In many low-resource countries, breast-conserving therapy may not be available, and in settings where it might be an option, less educated women may know little about recent advances in the surgical treatment of breast cancer that allow breast preservation, provided diagnosis is timely. In addition, some religions prohibit amputation of any body parts because a deceased person must be buried whole.

Because it is common that, in the majority of women with breast cancer in low-resource settings, the diagnosis is made relatively late, the prognosis is often poor regardless of the severity and length of treatment, fully supporting the conclusion of those around patients that medical intervention is futile. Apart from the fear of mutilation, many women are terrified by cancer treatments that are perceived to cause endless and futile suffering. This fear is more common among those who have observed others close to them being treated by the fearsome trio of “slash, burn, and poison” (surgery, radiation therapy, and chemotherapy), with ensuing serious adverse effects such as edema, nausea, hair loss, weakness, and weight loss (20). In many less developed countries, effective clinical management of the adverse effects of cancer therapies is precluded by inadequate facilities and staff training, a lack of sufficient and effective medication, and a lack of cultural emphasis on patients’ quality of life. As a result, the amount of suffering corollary to cancer treatment is indeed overwhelming, for both patients and their caregivers. For some women, this image of suffering is a strong additional disincentive for cancer screening (5).

Sociocultural Barriers

A major sociocultural barrier to breast screening in many traditional societies, especially Muslim ones, is that
women’s decisions and actions are controlled by men, and men may be unaware of or disapprove of screening. Furthermore, in many male-dominated societies, women’s social status is totally dependent on their roles as wives, mothers, and housekeepers, as they have no independent income or other sources of identity and self-esteem (16). Women are perceived (and perceive themselves) as subservient to the needs of the family, and their self-worth rests on their ability to provide services to men, children, and elders in their households. Therefore serious disease such as breast cancer completely jeopardizes women’s status in the nuclear and extended family, as they can no longer function in the household and bear children, and, on the contrary, become dependent on others for help and care. Men are often unwilling or unable to cope with this role reversal, and sick wives are eventually sent away or divorced, especially when other wives or lovers are available (e.g., in societies practicing polygamy). Thus in such societies, the diagnosis of breast cancer, with subsequent amputation of the breast(s) and long-term disability, means a de facto social death of a woman. It is no wonder that women will do anything in their power to delay and deny any signs of illness, let alone try to purposely detect the disease by screening (16).

**BREAST SCREENING AMONG OLDER WOMEN**

Breast cancer screening in older women is a particularly useful example of the interplay between the barriers listed above and the late stage of breast cancer diagnosis. Many studies of screening behavior in Israel and the United States (among other countries) have shown that the group least likely to use breast-screening services is women older than 60 years of age (1,6,7,21). Low health motivation is typical for older women in many cultures because of their “relational” view of themselves as secondary and subservient to the needs of those close to them; that is, as givers rather than receivers of care and attention (18). Furthermore, many older women believe that breast cancer strikes younger women and that after menopause the disease is no longer a health concern for them. This belief has been reinforced over the years by the images of younger women in advertisements and promotional campaigns related to mammography and breast cancer treatments (1,6,20,21). Finally, older women who also belong to marginalized or disadvantaged social groups experience higher than usual barriers to health care for all of the aforementioned reasons (9,18). The resulting paradox is that while breast cancer risk increases with increasing age in many countries, the actual use of screening among postmenopausal women declines as they get older.

In the context of immigration, older women may be especially disadvantaged. Such women typically have little (if any) income from public subsidies and depend on the support of their grown children and grandchildren to get around in the new society. As a result of their poor command of the new language and their isolation from the mainstream, these women cannot use the available health services. In our survey among Russian immigrant women age 35 years and older in Israel (1), respondents older than 60 years of age had the lowest frequency of gynecologic visits, CBEs, and mammograms. Low awareness of their rights as patients and flawed communication with providers were common in this group. At the same time, older women often held fatalistic attitudes toward cancer, did not believe that early diagnosis could save their lives, and generally doubted that the whole “fuss” over cancer was worthwhile (2).

An additional finding was that many older immigrant women felt very uncomfortable visiting gynecologic clinics ostensibly meant for women in their reproductive years. In interviews with older Russian immigrant women in Israel, we discovered a cluster of life cycle-related beliefs that may explain these women’s lack of interest in cancer screening (2). These beliefs pertained to the nature of womanhood at different ages and led these older women to believe that they were way past the life stage at which they had to take care of their reproductive system. When asked to specify the types of problems that cause women to visit gynecologists, most informants mentioned menstrual cycle irregularities, fertility problems, prenatal care, sexually transmitted diseases, cervical lesions, pelvic pains, irregular vaginal discharge, and general periodic checkups. None mentioned any cancer-related tests or procedures. At the same time, many informants opined that the whole range of gynecologic conditions, including reproductive cancers, mainly occur in younger women. Hence these older women no longer saw themselves as needing gynecologic care, and visiting obstetrics and gynecology clinics was therefore perceived as irrelevant and even ridiculous. To make matters worse, the need to talk with a Hebrew-speaking male gynecologist was an ordeal for many of these women, and if they visited gynecologists at all, it was only because of complaints and symptoms. When there was no Russian-speaking or female gynecologist in their town or neighborhood, and a female family member could not accompany them to the clinic to help translate, they just canceled visits.

In addition, some older women (especially those in their 70s) felt that their health and illnesses were of minor relevance or interest to anybody and that their advanced
age made any intensive medical care pointless (2). One woman expressed the following: “There is no point in looking for small tumors in my sagging breasts. Even if they find something and I get my breast cut off, how much time do I have left anyway? I prefer to finish my days with both breasts intact—with or without cancer” (Zelda, age 73 years). These women understood their value as human beings mainly in terms of their capacity to be helpful to their children and grandchildren during the remainder of their lives. In addition, they perceived a focus on self-care (including seeking preventive health services) as excessive and selfish. Another woman stated the following: “Thank God, I am still able-bodied and can help my daughter with her two kids, so that she can get herself established as a specialist in Israel. What good would it make if I started rushing between medical offices checking myself for this and that? They would surely find some disease, as nobody of my age is totally healthy. But it is a waste of time, since you cannot live forever, and anyway, who treats old people seriously? The time that I still have to live I want to give to my grandchildren, not to myself” (Ludmila, age 74 years).

In sum, older immigrant women expressed a mixed set of cultural beliefs and communication barriers that merged to produce low health motivation and low use of the available preventive services. Our findings in Israel are in line with those of other studies among older minority women in the United States and Europe (6,9,18,21). Such women could definitely benefit from a proactive and culturally sensitive outreach campaign, one that includes health care workers and is designed to improve their health motivation, reduce cancer-related fears, and increase supportive care among health care workers.

POSSIBLE SOLUTIONS AND POLICY APPROACHES

As described above, in multicultural societies, several types of barriers can preclude women from marginalized and disadvantaged social groups from using breast-screening services. Some of these barriers reflect limited access to preventive health services, whereas others stem from a lack of understanding, interpersonal skills, sensitivity, and motivation among health care providers to accommodate marginalized groups. Even when breast-screening services are accessible and women-friendly, they fail to attract many women because of psychological and sociocultural factors such as fear of a cancer diagnosis and treatment, and subsequent disability and dependence on family members. For other women, breast cancer is a far more remote and unreal concern compared with other, more immediate problems they might have, such as excess weight, aging, musculoskeletal pains, and menopausal symptoms. Women in their 60s and 70s, who may have multiple age-related health problems such as hypertension, heart disease, and diabetes often believe that breast cancer can no longer strike them because it occurs in younger women. Within the system of women’s competing health concerns, breast cancer may have a rather low position, especially in low- to moderate-risk population groups (13,22), in which women seldom have first-hand encounters with this disease in other women. A better understanding of these women’s predicaments and beliefs allows us to suggest some viable approaches to lowering the existing barriers and achieving greater participation of women from minority or other disadvantaged social groups in early detection programs (Table 2).

Macrolevel Approaches

Policymakers and health care providers should consider several macrolevel approaches, which address the problem at the level of the population and the health care system. First, although there are common denominators, no single breast cancer education and early detection program can meet the needs of all social and cultural groups of women. Programs in different countries (and among social groups within countries) should draw on a combination of general and global evidence-based guidelines with careful assessment of the needs of specific communities (23,24). These community needs assessments should collect information on the general roles and social statuses of women vis-à-vis men (i.e., gender relations), the extent of women’s economic independence and the resources they have access to (including health insurance, transportation, and command of the dominant language), and the common epidemiologic and health profiles (to determine which issues predominate on women’s personal health agendas). The most efficient and time-saving method of community needs assessment is conducting focus group discussions with local leaders (both formal and informal), grassroots community and health care workers (e.g., nurses and social workers), and women belonging to the social or ethnic groups one wishes to reach (e.g., recent immigrants, religious minorities, the unemployed) (23,25,26). These discussions will provide more specific information on the barriers to breast health care experienced by these defined groups of women (14).

Second, it is important to ensure actual access to breast-screening services and provision of these services in an
efficient and women-friendly way. Otherwise, nascent interest in the screening services among women “pioneers” will quickly wane and the negative message passed from one woman to the next by the grapevine will quickly kill the initiative. Unfortunately, in countries with limited health care resources, many providers are reluctant to undertake breast screening because an influx of asymptomatic women (often frightened and poorly informed) into the clinics means a sharp increase in their workload, perhaps with no extra remuneration, as the experience of several east European countries suggests (Soldak T, Director of Belarusian Breast Cancer Screening and Early Diagnosis Project, personal communication). In addition, in countries with scarce medical resources, generally the curative paradigm dominates over the preventive one, which is seen as a luxury despite its proven cost-effectiveness; this agenda needs to be gradually shifted in favor of prevention and early detection. Hence organizational measures should be taken to boost the motivation of health care providers to talk with patients about early detection and to conduct screening tests, and to ensure an efficient nexus (referral system) connecting positive findings with subsequent diagnostic and treatment services that will be easy for women to navigate regardless of their education, their language skills, and other potential barriers. Experience shows that a useful approach to coordination between various steps in breast cancer diagnosis and treatment is appointing special staff members (usually nurses) as linkage workers (i.e., “navigators”), whose job it is to be in touch with both women and service providers (27).

Other macrolevel and organizational approaches to delivering an effective screening program include the following:

- Training mainstream health care providers (physicians, nurses, other medical staff) in culturally competent care for minority women with special needs by informing them of the cultural barriers and other issues discussed above.
- Including more health care workers with immigrant or minority backgrounds in breast-screening activities, as these individuals are the best outreach agents for their coethnics, with whom they share a common language and culture.
- Training community outreach workers—laywomen from the same communities—who could spread the message of breast screening and educate other women in its basics. For example, the positive role of “lay helpers,” in this case, women from the same cultural and social network who receive special training in breast-screening outreach, has been shown to boost mammography participation among older black women in the United States (28). Efforts involving lay outreach workers in other health areas, such as AIDS and tuberculosis, have similarly proved to be very successful, both in developing countries and among ethnic minorities in the United States (29).
- Increasing involvement of men in breast cancer detection, because in some societies, without men’s approval, encouragement, and support, their wives, sisters, daughters, lovers, and other female associates will rarely visit clinics. This is especially true in Muslim cultures, in which men largely control women’s options and decisions (30). In other traditional cultures, such as in various Latino minority populations in the United States, men are less controlling but may still exert strong

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<th>Table 2. Approaches to Improving Use of Breast-Screening Services among Immigrant and Minority Women in Multicultural Societies</th>
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<td>Ensure women’s access to breast-screening services</td>
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<td>Motivate health care providers to perform screening and to ensure follow-up</td>
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<td>Train providers in culturally competent care for immigrant and minority women</td>
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<td>Include more immigrant and minority providers in screening activities</td>
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<td>Involve alternative and traditional healers in breast cancer advocacy</td>
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<tr>
<td>Empower women and improve their self-efficacy and self-care</td>
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<td>Educate women about navigating complex health systems</td>
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<td>Dispel popular myths about cancer and breast cancer</td>
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<td>Elevate the ranking of breast health on the list of women’s health concerns</td>
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influence on their female partners’ behaviors. One study has shown a considerable lack of knowledge about female cancers and a lack of concern about early detection of such cancers among Latino men, especially younger ones (31). Special educational programs targeting men can potentially be very effective in changing women’s motivation.

- Educating relevant religious and cultural authorities (whose advice women seek about different lifestyle and moral matters) about breast cancer and the benefits of early detection. These authority figures may include rabbis for ultraorthodox Jewish women, sheiks for Muslim women, and clergy for observant Catholic women. A recent study has shown that a network of church activists can act as facilitators and encourage older women from the same parish in their use of breast screening (32).
- Involving alternative and traditional healers in breast cancer advocacy in societies where women routinely consult these healers for various health problems (22).
- Engaging breast cancer survivor groups in educating women and implementing screening programs, as these women are the living examples of prevailing over cancer and the best advocates for early detection and timely treatment.

**Microlevel Approaches**

Hand in hand with the macrolevel measures, there are several microlevel approaches, which address the problem at the level of the individual woman, for targeting social and psychological barriers to proactive screening behavior. These approaches include the following:

- Empowering minority and other disadvantaged women in their interactions vis-à-vis their male partners and other relatives, and boosting their self-efficacy and self-care in preventive health matters, including breast care.
- Educating women about navigating complex health systems and getting the most out of the available services, including giving practical tips about interacting with doctors and health bureaucracies.
- Dispelling popular myths about cancer generally and breast cancer specifically as incurable and fatal.
- Giving women a better sense of control over their bodies and health, and encouraging them to take a proactive approach in cancer detection.
- Educating women about contemporary cancer therapies, especially breast-conserving surgery, as well as supportive therapies that improve a patient’s quality of life.
- Elevating the place of breast health on the list of women’s health concerns relative to other diseases and conditions they might have and teaching them simple methods of breast awareness and periodic self-examination.

**CONCLUSION**

Most of the suggested interventions (especially at the organizational level) will require some additional resources and efforts, but in the long run they are going to be more cost effective than purchases of expensive equipment or building new medical facilities. These should mainly be directed at training professionals and lay advocates who would together bring more at-risk women to participation in breast screening. When health care resources are limited, the measures described should help to ensure the best possible use of the existing resources for preventive care and women’s health. Indeed, community needs assessment alone can be a money-saving strategy, as it will allow mapping out the services and resources in relation to women’s needs, with subsequent more effective allocation of funds and medical personnel. In addition, educating physicians and other providers of breast care about women’s concerns, lifestyles, and barriers to cancer screening will have multiple positive effects on provider-patient interactions and ameliorate mutual misunderstandings and tensions in cancer care.

**REFERENCES**


**ORIGINAL ARTICLE: SOCIOCULTURAL BARRIERS TO CARE**

**Experiences of Breast Cancer Survivor-Advocates and Advocates in Countries with Limited Resources: A Shared Journey in Breast Cancer Advocacy**

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*University of Washington Breast Health Center and Seattle University, Seattle, Washington; and †Susan G. Komen Breast Cancer Foundation, Dallas, Texas

**Abstract:** The last decade has been marked by rapid growth in the breast cancer advocacy movement around the world. Today such movements are well established in North America and western Europe, and are emerging and gaining momentum in regions of the world with limited resources—Africa, Asia, eastern Europe, and Latin America. Internationally breast cancer advocates have faced the challenges of dealing with many languages, cultures, countries, and health systems. Because of these differences, existing models of breast cancer advocacy are not always appropriate or reproducible across countries. At the second biennial Global Summit Consensus Conference on International Breast Health Care, 12 breast cancer survivor-advocates and advocates from around the world gave statements describing the experiences of women with breast cancer and with advocacy in their countries, and attended a roundtable meeting to discuss breast cancer advocacy from a global perspective. We used the “long table” method to analyze their comments and identify common experiences. Although participants came from diverse settings, the analysis revealed five common experiences that were consistent across cultures: 1) the experiences and fears of breast cancer survivors, 2) beliefs and taboos about breast cancer that hinder awareness programs and treatment, 3) the need for public education and breast cancer awareness programs in countries with limited resources, 4) difficulty in translating the concept and ethos of advocacy into many languages, and 5) the experiences in establishing and maintaining advocacy groups to promote breast cancer awareness and to inform public policy. These themes constitute an action agenda for breast cancer advocacy groups in countries with limited resources. In addition, they provide invaluable insight for policymakers, program planners, and others undertaking efforts to improve breast cancer outcomes in low-resource settings.

**Key Words:** advocacy, breast cancer, international health problems, language, life change events, life experiences, politics, social support, support groups, terminology

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The women’s health advocacy movement began in many countries during the second half of the 20th century. However, organizations by and for patients with breast cancer that provide support and information for patients have been active since the 1950s. In 1952, the American Cancer Society started the Reach to Recovery program. This was a group of women helping women: survivors of breast cancer helping women with newly diagnosed disease. Members of Reach to Recovery, all of whom had had mastectomies, provided a support group for women who had mastectomies. This organization continues today as an international organization supporting women throughout the world (1).

The politics of breast cancer accelerated in the United States in the 1970s and 1980s, when well-known women such as Betty Ford, Nancy Reagan, Happy Rockefeller, and Shirley Temple Black began to speak out about their experiences with the disease (2,3). As survivor-advocates, these American women helped raise public awareness about breast cancer and the need for early detection programs. Women increasingly identified themselves publicly as survivors. Breast cancer advocacy further developed as dedicated breast cancer advocacy organizations such as Y-ME, the Susan G. Komen Breast Cancer Foundation, the National Alliance of Breast Cancer Organizations, and the National Breast Cancer Coalition added a political dimension to the provision of breast cancer information and support (3). Today, breast cancer advocacy movements are generally well established in North America and western Europe. The movement in the United States, one of the most successful worldwide, provides a good example of the development of a breast cancer advocacy movement and its power to improve breast health care.

During the 1980s and 1990s, organizations that advocate on behalf of breast cancer championed the Mammography...
Quality Standards Act, the establishment of a special fund in the U.S. Department of the Army for breast cancer research, the establishment and expansion of the Centers for Disease Control and Prevention’s Breast and Cervical Cancer Early Detection Program, and extensive increases in federal funding for the National Cancer Institute. For example, during the 1990s, federal government funding for breast cancer research increased from $81 million to more than $400 million (4,5).

Internationally breast cancer advocates have faced the challenges of dealing with many languages, cultures, countries, and health systems. In particular, in many cultures it is difficult to transcend ethnic and religious differences to break the silence and profound stigma that still surround breast cancer. Because of these many differences, the model of breast cancer advocacy generally endorsed in the United States is not always appropriate or reproducible in other cultures, suggesting the need for alternative models. In addition, the experiences of breast cancer survivor-advocates and advocates in countries with limited resources differ significantly from those in developed countries. Although there is an emerging sense of global breast cancer advocacy, the growth of the advocacy movement in countries with limited resources is somewhat hindered by the difficulty of translating the ethos of advocacy into many languages and cultures. Furthermore, resource-constrained countries have differing financial needs, resource limitations, social barriers, and competing illnesses that frame how breast cancer advocacy can be implemented.

To identify commonalities and differences in the experiences of breast cancer and in the development of breast cancer advocacy movements in limited-resource settings, we undertook a qualitative analysis of statements and comments provided by breast cancer survivor-advocates and advocates at a recent international summit.

**METHODS**

The second biennial Global Summit Consensus Conference on International Breast Health Care (hereafter referred to as the 2005 Global Summit), sponsored by the Fred Hutchinson Cancer Research Center, cosponsored by the Susan G. Komen Breast Cancer Foundation, and hosted by the Office of International Affairs, National Cancer Institute, provided a forum for the voice of breast cancer survivor-advocates and advocates from countries with limited resources. For the purposes of this article, survivor-advocates are defined as breast cancer survivors who work in partnership with a community-based group or organization of survivors.

Each of four sessions of the summit began with a 15-minute introductory statement by a breast cancer survivor-advocate or advocate from a country with limited resources in which she described her own experience or that of women from her country with breast cancer and advocacy. In addition, a 2-hour Advocates Roundtable Meeting provided an opportunity for survivor-advocates and other breast cancer advocates from around the world to discuss breast cancer advocacy from a global perspective. The meeting was facilitated by a representative of the Komen Foundation (D.R.) and was attended by 12 participants, each representing a different country (Belarus, Brazil, Canada, Chile, China, Ghana, Greece, India, Italy, Kenya, Malaysia, and the United States).

In an effort to understand the commonalities and differences in experiences of breast cancer survivor-advocates and advocates from countries with limited resources, we analyzed the introductory statements from the summit sessions and the transcripts from the roundtable discussion for themes. For analysis, we used a low-technology “long table” technique suggested by Krueger (6), which permits analysis of content to identify themes and categorize results.

**RESULTS AND DISCUSSION**

The introductory statements of the breast cancer survivor-advocates and advocates were a powerful addition to the proceedings of the 2005 Global Summit. The stories of these quietly eloquent women illuminated the connectedness of breast cancer survivors and their advocacy efforts around the world. Similarly, although participants in the roundtable meeting noted some differences between their countries in breast cancer experiences and advocacy movements, the commonalities were striking.

Overall, five major themes emerged from the analysis of the statements and the transcript that reflected common experiences of breast cancer survivor-advocates and of advocates worldwide:

- Common experiences and fears of breast cancer survivors
- Beliefs and taboos about breast cancer that hinder awareness programs and treatment
- The universal need for public education and breast cancer awareness programs in countries with limited resources
- The shared problems with language and difficulty translating the concept and ethos of advocacy into many languages
- Common experiences in establishing and maintaining advocacy groups to promote breast cancer awareness and to inform public policy
Experiences and Fears of Survivors

The experiences of breast cancer survivor-advocates from countries with limited resources were reflected in the statements and transcripts. Participants' comments indicated that the commonality of the experience of breast cancer survivors led to the development of support groups. Specifically, survivor-advocates and advocates recognized the need to provide emotional support and education for breast cancer survivors and to provide testimony “to the power of life.” Certain issues are universal for all women with breast cancer, irrespective of age, ethnic group, nationality, or stage of disease, and this universality of the experience of breast cancer was reflected in the comments of survivor-advocates.

I was thinking that breast cancer is the same disease for every woman all over the world, we were survivors. Maybe we felt the same way and we suffer the same, but one of the things I'm taking back home is that we are also different—each country, each culture has a different approach, even when you speak about countries of limited resources.

I'm a breast cancer survivor, five years now, and I am also a breast health advocate. I'm with an organization called the Kenya Breast Health Program. This is basically the only advocacy group for breast health in my country, and I likely got involved with Kenya Breast Health Program at its formation, basically as a result of my experience with breast cancer.

Along with common concerns, experiences, and anxieties, each woman’s journey with breast cancer has a unique set of circumstances. A frequent common experience and expression of survivor-advocates was that of fear. They described the personal fear that a woman experiences after receiving a diagnosis of breast cancer, as well as the societal fear manifested in the response by family members and neighbors:

One of the greatest fears expressed by almost all newly diagnosed breast cancer patients is … am I going to die?

Overcoming fear when alone is not easy … one feels no longer accepted…. The word cancer terrified me.

A woman’s journey in breast cancer in a developing country has a long way to go. For many years, people in developing countries have perceived breast cancer as a frightening disease surrounded by fear and myths.

Avoiding awareness programs and information on this disease as a result of fear has worsened the plight of breast cancer patients in developing countries.

Survivor-advocates and advocates also identified common themes related to the changes in body image associated with mastectomy. In addition, they noted how women with breast cancer must assimilate into their lives the physical scars of treatment, emotional distress, and disruption in family relations. They identified the need for information about prostheses and the need for emotional support for breast cancer patients.

The loss of a breast is a terrifying jolt to one’s body image.

Breast cancer creates an identity crisis with the initial loss of body image. Encouragement, hope, and emotional support from loved ones, family, friends, someone with a common experience, and health care professionals can help prevent social isolation and social discrimination, which can be devastating.

Beliefs and Taboos about Breast Cancer

Several survivor-advocates and advocates identified traditional societal beliefs and cultural taboos that affected women’s access to information, early detection, and treatment. They noted how these beliefs may result in social isolation for women with breast cancer. In addition, their comments suggested that cultural attitudes and taboos, especially beliefs of fatalism, may deter breast cancer advocacy efforts:

Traditional beliefs dominate the Asian lifestyle. Negative attitude of society toward cancer can be a greater killer than the disease itself. The woman is made to feel guilty that she has brought “bad genes” into the family. She keeps her disease under wraps just to avoid social rejection and social isolation. In some cases she is isolated from her family members, whereby her dining utensils are separated, fearing that she will “spread the disease to the rest of the family members.”

I will never give up to those who suggested that when you get close to a disease or have something to do with it, it will follow or it will affect your family.

Cancer, if you talk about cancer, it comes into your house or if you go to the doctor to be examined for breast cancer, you end up with breast cancer. If you don’t go, you won’t get breast cancer.
Need for Public Education and Awareness Programs

Breast cancer survivor-advocates and advocates identified the need for culturally appropriate breast health awareness programs and problems with competing for scarce resources in the face of the burden of communicable diseases in countries with limited resources. Participants from such countries had a heightened awareness of disparities in access to diagnostic and treatment facilities that lead to late presentations of the disease:

Most women in developing countries know very little about breast cancer and its warning signs, and as a result go to hospital for treatment when it is rather too late to get cured.

We have a problem with awareness, we have stigmatization, we have all those and end up leading to late presentations, and we have lack of diagnostic facilities, lack of treatment facilities, financing constraints for the women, competition for resources. HIV/AIDS is a major problem, so you talk about breast cancer and say how many people are dying, and they say HIV, they’re always quoting figures, 700 people per day, and they say, “Wow, this is the problem. Breast cancer, that’s not a problem.

Difficulty in Translating the Concept of Advocacy

Advocacy in the English language is generally interpreted as the art of representing or promoting a cause or purpose on behalf of oneself or others. This may include increasing awareness, influencing policy, affecting legislation, and changing attitudes. Traditionally patient advocacy has involved pleading on behalf of patients’ needs. Yet the word advocacy is not directly translatable in many languages (3,4). This difficulty with translation was a theme that emerged from the analysis of comments. Participants in the advocacy roundtable identified the need to develop an international word or language for advocacy that would reflect the broad range of activities and approaches generally interpreted as breast cancer advocacy. In addition, participants noted that in developing countries, women may not have open access to resources, information, or education that empowers them to implement change and promote advocacy.

I must say that the word advocacy is absolutely new for me.

What I’m trying to do is find what the word advocacy means exactly in Spanish. I know what it means, but I’m trying to find the exact meaning, not the exact word, but the exact meaning.

We still don’t have in Portuguese a word for advocacy, and it’s a big problem because we cannot say “advogados”—or lawyers, it would mean—because we are not. We must find a word for this, outside English word, because we cannot say “advogados” or something like that. I don’t know. We have to think as a group because I’m sure in Spanish and Italian, Latin countries have this problem of the word and we have to make it like an international word.

We don’t have a word for advocacy, it’s exactly the same as what you say it may mean, that you are a lawyer or something like that, and you have to have that qualification to be one. So the word we use is networking and influencing.

There were not rules that could regulate volunteer work, nobody was talking about social responsibility or advocacy was just out of question. It was a bunch of women that were shouting about something, just no credit whatsoever.

Experiences in Establishing and Developing Advocacy Groups

Although there was apparent difficulty with defining advocacy, breast cancer survivor-advocates and advocates identified common bonds, challenges, and steps that propelled their efforts forward. Their comments reflected the incremental nature of breast cancer advocacy and movement along a continuum from support and education, to developing social responsibility, and finally to influencing change. The burdens and hurdles on the road to breast cancer advocacy were reflected in their comments:

So we decided that we have to work towards some other issues, not just giving support to the women themselves, and from there we started doing a little bit of advocacy work.

We started with six people and this was ’93 and things really moved fast, and we start after 2 years we became official Brazilian kind of educational group, volunteer educational group, at that time volunteer work was not accepted in Brazil because we’re intruders in hospitals.

So we came up with the idea that we need some form of guideline so that we make sure that everybody is
trying to do something that is normal, or acceptable, so eventually we lobbied the ministry to set up what they call a breast cancer working group.

The message of breast cancer advocacy has been spreading throughout the world. In the early 1990s, EUROPA DONNA, the European Breast Cancer Coalition, was formed. The emergence of breast cancer advocacy throughout Europe can be traced through the development of EUROPA DONNA, a coalition of affiliated groups for countries across Europe (2). Similarly, Reach to Recovery has grown into an international network of survivor-advocates that includes 84 groups in 50 countries. While some are mature groups, the majority are new groups from Africa, Asia, eastern Europe, and Latin America who need help in establishing support services (1).

In the late 1990s, the Komen Foundation began to develop international affiliates in countries that were interested in implementing Komen activities, such as the Race for the Cure. Today the Komen Foundation has three international affiliates—in Germany, Italy, and Puerto Rico—that fund grants and carry out breast cancer education programs. In addition, the foundation has made grants to nongovernmental organizations (NGOs) in more than 30 countries to support a range of breast cancer education, outreach, and support programs. Representatives from several of these organizations participated in the advocacy roundtable discussion and shared their experiences. They remarked that financial support from foundations and NGOs had been helpful in furthering their activities.

So you need some luck in life, and my lucky occasion came in 1998 when I had the privilege and fortune to cross roads with the Komen Foundation, very, very early when they were starting to become an international organization or at least to start some international efforts.

And we have had really the fortune to look at a wonderful model that in the United States has created, really a switch in the way breast cancer is addressed and see how we could apply at least some part of this model in Italy, through innovation and new strategies, trying not to duplicate efforts that were already there, but creating new opportunities. And in 5 years, we have been able to become self-sufficient, we generate money that allows [us] to fund, we have supported 50 programs of other breast cancer groups in Italy, in small possibly groups that would have good ideas but not have access to funding, so that at the local level, the community level, this is helping women with breast cancer to have something more to face this disease better.

CONCLUSIONS

The last decade has been marked by rapid growth in the breast cancer advocacy movement around the world. There has been a shift in the activities of survivor-advocates and advocates as breast cancer advocacy campaigns have increased in intensity in regions with limited resources including Africa, Asia, eastern Europe, and Latin America. The practice of breast cancer advocacy has increasingly become international, with sustained, effective collaboration among groups. The goals and methods of these campaigns may vary with the social, economic, and cultural circumstances of the countries and women involved. Despite this diversity, survivor-advocates and advocates at the 2005 Global Summit voiced a set of common themes in international breast cancer advocacy that reflected their shared journey with breast cancer.

By virtue of their personal life experiences, breast cancer survivor-advocates possess unique insights regarding the complex sociocultural issues that may hinder the implementation of breast health awareness and early detection programs in countries with limited resources. Survivor-advocates and advocates at the summit expressed common themes pertaining to the experience of breast cancer, including societal fear of the disease, cultural taboos and myths, and a lack of adequate educational resources. Their statements indicated that these factors can be major barriers to breast health awareness and early detection programs in countries with limited resources. Their experiences are consistent with the findings of several studies that have documented that fear, perceptions, and lack of knowledge are obstacles to breast cancer screening (7–9). To successfully recruit women to breast health awareness and early detection programs, such programs must take into consideration women’s perceptions and cultural beliefs about breast cancer. Participants’ comments indicated that these perceptions and beliefs vary among countries and population groups, necessitating a tailored approach to program design. The impact of effective programs is potentially large, as participants’ comments expressed confidence that such programs could contribute to improved survivorship for women with breast cancer.

Although the word *advocacy* is not directly translatable in many languages, the role of breast cancer survivor-advocates and advocates appears to be universal. Participants in the Advocacy Roundtable strongly believed that...
with the assistance of governmental and NGOs, breast cancer advocacy groups can continue to create change. In partnership with organizations such as Reach to Recovery International, the Komen Foundation, and the medical community, survivor-advocates and advocates may be instrumental in establishing effective breast health awareness programs as well as breast cancer research programs that cross social, economic, and cultural boundaries in countries with limited resources (9).

Breast cancer advocacy can have a marked positive influence on societal awareness of and attitudes toward the disease, on breast health care services, and on funding for research (3). However, establishing and expanding advocacy groups in countries with limited resources may be especially challenging. Resource-constrained countries have limitations in financial support, social barriers, and competing illnesses that frame how breast cancer advocacy can be implemented. Comments made by survivor-advocates and advocates at the summit indicated that they have a deep understanding of the barriers to developing breast cancer advocacy in such countries. These individuals are nonetheless motivated to integrate their insights and experiences to support and maintain advocacy groups.

Given the potential of advocacy movements to improve breast health outcomes, the founding and growth of advocacy groups should be fostered in countries with limited resources.

Taken together, the five themes we identified constitute an action agenda for breast cancer advocacy groups in countries with limited resources. In particular, the survivor-advocates’ and advocates’ comments revealed barriers and challenges to breast health care and breast cancer advocacy, but at the same time suggested potential strategies for overcoming them. The themes also provide invaluable insight to policymakers, program planners, and others undertaking efforts to improve breast cancer outcomes in such settings.

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