Making breast and cervical cancer a reproductive health priority

In calling for the High-level Meeting on Non-communicable Diseases (NCDs), the United Nations (UN) opened an opportunity to assess the world's progress in reducing the burden of a range of illnesses. We should seize this opportunity to make breast and cervical cancer – two of the deadliest NCDs – central to the discussion.

In 1994, visionary leaders in public health decided at the International Conference on Population and Development in Cairo to bring both breast and cervical cancer under the reproductive health umbrella. The conference called on countries to make prevention and treatment of "breast cancer and cancers of the reproductive system" universally accessible by 2015.[1]

Similarly, two years later, 189 countries agreed in the Millennium Declaration to reduce deaths from pregnancy, birth, and postdelivery complications by 2015. The world has since mobilized to combat deaths from maternal causes, resulting in a steady decrease in maternal deaths worldwide, from 471,000 in 1980 to 273,000 in 2011, with the bulk of the deaths concentrated in a handful of countries.[2] Despite the important policy framing in Cairo, the same progress cannot be seen in combating deaths from breast and cervical cancer, which together take more women's lives than maternal causes.

IHME researchers have found that the number of cases and the number of deaths from these cancers continue to rise in most countries, especially in the developing world.[3] We opted to use the set of developing regions determined by the Global Burden of Diseases, Injuries, and Risk Factors Study 2010 (GBD Study 2010), which excludes all European countries, Australasia, and high-income countries in North America and Asia. These areas are now included in developed regions.

As high-income countries enjoy the benefits of early cancer screenings, drug therapies, and vaccines, the burden of breast and cervical cancer is shifting to low-income countries in Africa and Asia. Within those countries, more women are developing breast and cervical cancer during their reproductive years, adding more pressure on families and societies already suffering from high rates of infectious disease and high rates of child mortality.

The number of new breast cancer cases more than doubled around the world in just three decades. Global breast cancer incidence increased from 641,000 cases in 1980 to 1.6 million cases in 2010, an annual rate of increase of 3.1%. This pace exceeds global population growth. Global cervical cancer incidence grew at a slower pace, from 378,000 cases in 1980 to 454,000 in 2010, a growth rate of 0.6% annually. In both types of cancer, developing countries saw a faster pace of increase than the global average. Breast cancer cases grew by 4.4% annually in developing countries, and cervical cancer grew by 1.1%.

Some measure of encouragement can be taken from the fact that while cases are on the rise, deaths are increasing at a slower pace. Breast cancer deaths have risen from 250,000 in 1980 to 425,000 in 2010, a 1.8% annual increase. Cervical cancer deaths grew to 200,000 over the same period, an increase of 0.5% annually. As with the number of cases, the developing world saw a more rapid increase in women dying of cancer, with an annual increase of 2.7% for breast cancer and 0.8% for cervical cancer.

The progress has been very different, however, for women with breast cancer than for women with cervical cancer. Comparing the number of new breast cancer cases annually to the number of deaths from the disease can give breast cancer patients good reason for hope. In developing countries, there were 37 women dying for every 100 new cases of breast cancer in 1980. In 2010, that number was 26 to 100. For cervical cancer patients, despite 30 years of medical advancements and investments in health infrastructure, there are still more than 50 women dying from cervical cancer in some countries for every 100 women who are diagnosed with the disease.

To decrease the number of cases and deaths worldwide from these cancers, policymakers should consider the most troubling trend IHME found: the rising number

of deaths in women of reproductive age. From 1980 to 2010, deaths in reproductive-aged women increased 1.5% per year for breast cancer and 0.5% per year for cervical cancer.

The increase is even faster in developing countries. Based on current trends, breast and cervical cancer are likely to soon approach maternal causes as a critical driver of mortality in women of reproductive age in developing countries. Today, there are 2.3 maternal deaths for every death from either breast or cervical cancer in women between the ages of 15 and 49 in the developing world. By 2025, we expect maternal deaths to fall and deaths from breast and cervical cancers to rise so that they are nearly equal among women of reproductive age.

The populations that have benefited most from screening and treatment are in the developed world, where women are less likely to die from breast or cervical cancer. The shift in the burden of these cancers from high-income countries to developing countries adds to an already full agenda of health challenges faced by developing countries.

This study on breast and cervical cancer grew from the foundational work at IHME to systematically collate the world's data on causes of death from vital registration systems, surveys, and censuses. We were able to take advantage of a growing body of evidence from verbal autopsy studies, which depend on information gathered from household members and relatives to determine causes of death in areas lacking death registration. IHME used this dataset to develop new models for maternal mortality.[2] We will also use this work as a key component of the GBD Study 2010, the results of which are expected to be published in early 2012.

After seeing IHME's maternal mortality work, Susan G. Komen for the Cure® asked if IHME could prioritize work on both breast and cervical cancer in advance of the UN meeting on NCDs. We have taken up that challenge, and the results are in this report. We provide breakdowns of our estimates for breast cancer incidence and mortality, both by region and for each of 187 countries. In addition, we have included detailed data on breast and cervical cancer trends for all countries at the end of the report.

Some of our findings may run counter to other efforts to estimate incidence and mortality for these cancers worldwide. We address several technical reasons for these differences in the "Our approach" section. We hope that disagreements over scientific approaches to breast and cervical cancer will not cloud the discussion about how best to ensure a future in which fewer women develop breast and cervical cancer, and more women who are diagnosed survive.

Our approach

There are five main differences between our results and estimates produced by the International Agency for Research on Cancer (IARC) and released through the GLOBOCAN website. The differences can be traced to several key factors.

- IHME researchers based their estimates on additional sources of data, especially for cancer deaths. For example, in countries that lack vital registration data, we were able to use data from verbal autopsy studies, which gather information from relatives about how a family member died. Even in countries where rich data sources are available, IARC used modeled mortality estimates from the World Health Organization. For cervical cancer deaths in India, for example, the IARC approach yields a much higher number of deaths than the IHME approach.
- Many cancer deaths are inaccurately coded or ill-defined by the agencies collecting the data. IHME has fixed the coding and assigned the deaths to the appropriate categories.
- To generate the mortality-to-incidence (MI) ratio, a key measure for the number of women with cancer who die annually, IHME has attempted to improve on previous methods by factoring in age, country, and year. We have found that our estimates are in sync with data from cancer registries.
- IHME uses one approach for estimating mortality data in every country. GLOBOCAN data are based on 26 different approaches for different groups of countries. The approach used for Saudi Arabia and South Africa, for example, is different from the one used for Vietnam and China.
- Many of the approaches used for estimating mortality in the GLOBOCAN data rely on trends observed in Nordic countries. We believe relying on such a limited number of countries leads to an overestimation of MI ratios in many developing countries, particularly for breast cancer.

Breast cancer cases rise, but deaths increase at a slower pace

Globally, more women are developing breast cancer and more women are dying from it than ever before. Those trends tell only part of the story.

As public policies about early detection and targeted approaches for breast cancer treatment became more widespread over the past three decades, the patterns for breast cancer began to change. We now see that, even as cases rise, the number of women dying is not rising as quickly. This success is not being shared globally, as some countries are far outpacing others. This has led to a shift in the burden of breast cancer cases and deaths. What once was thought of as a problem mainly for high-income countries is now an even larger problem for low- and middle-income countries. Within those developing countries, a troubling trend is emerging: women are being hit by the disease at a younger age. While in high-income countries breast cancer has become less common among women of reproductive age, meaning ages 15 to 49, in developing countries breast cancer cases in younger women now make up 44.1% of the overall number of cases.

Breast cancer cases rising worldwide

Between 1980 and 2010, the number of breast cancer cases steadily increased more than two and a half times from 641,000 to 1.6 million annually. This represents an annual increase of 3.1%. The rise in breast cancer cases is happening in every region and in every country, with the number of cases in some countries increasing much faster than the global trend. The number of women with breast cancer in Malaysia, for example, grew from 1,529 to 8,429, an annual increase of 5.7% between 1980 and 2010. Over the same period, the United States, which has more breast cancer cases than any other country, went from 127,425 cases to 241,249, an annual increase of 2.1%.

The regions with the most growth in breast cancer cases are North Africa and the Middle East, Oceania, Southeast Asia, Western sub-Saharan Africa, and Central Latin America. In the high-income countries of North America, Western Europe, and Southern Latin America, breast cancer cases have grown at a slower pace than the global average. The United Kingdom had one of the lowest annual growth rates at 1%.

To put the number of cases in perspective, for each country we calculated the lifetime risk – the chance that a woman would develop breast cancer during her lifetime. Globally, that risk is 5.5%, meaning about 1 of every 18 women is at risk of developing breast cancer in the course of her life. But clear regional patterns vary greatly from the average. For example, incidence is very high in the high-income countries of North America, Australasia, and Western Europe, where more than 10% of women – or 1 in 10 – risk developing breast cancer. In contrast, some countries in sub-Saharan Africa and South Asia show a risk of less than 3%.

In the countries with the lowest risk for breast cancer, including Niger, Bangladesh, Guatemala, and Gambia, 1 in 58 women will develop breast cancer. Women with the highest risk are in countries such as Luxembourg, Denmark, Belgium, and Israel, where the risk ranges from 1 in 8 to 1 in 7.

If current trends continue, the risk will rise in the developing world. Those countries are experiencing an increase in the breast cancer burden. In 1980, 65% of all breast cancer cases were in developed countries. By 2010, the share of breast cancer cases in the developed world shrank to less than half, at 49%, with the majority of cases now found in the developing world. Some developing countries saw a rise in breast cancer cases of more than 7.5% annually, more than twice the global rate.

Figure 1:
Breast cancer cases by region, 1980 to 2010

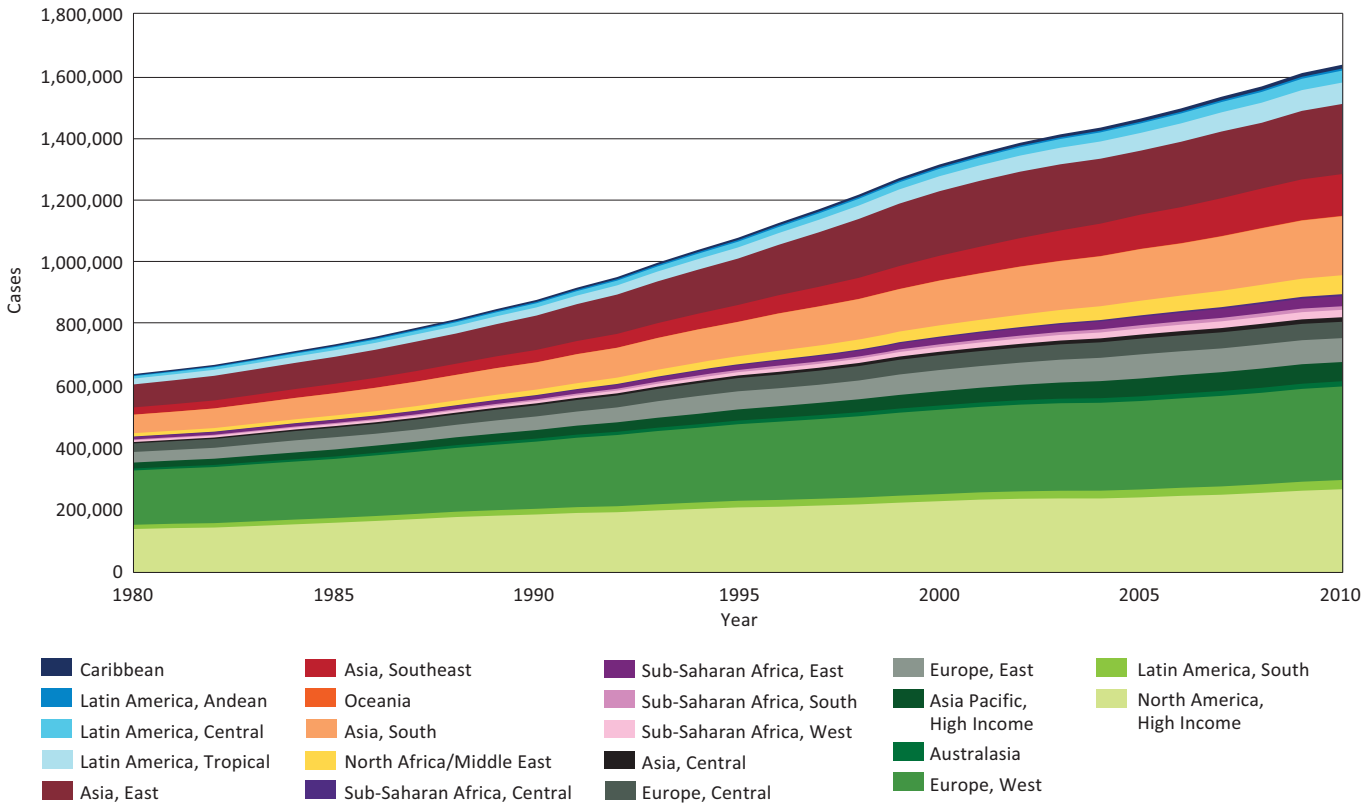
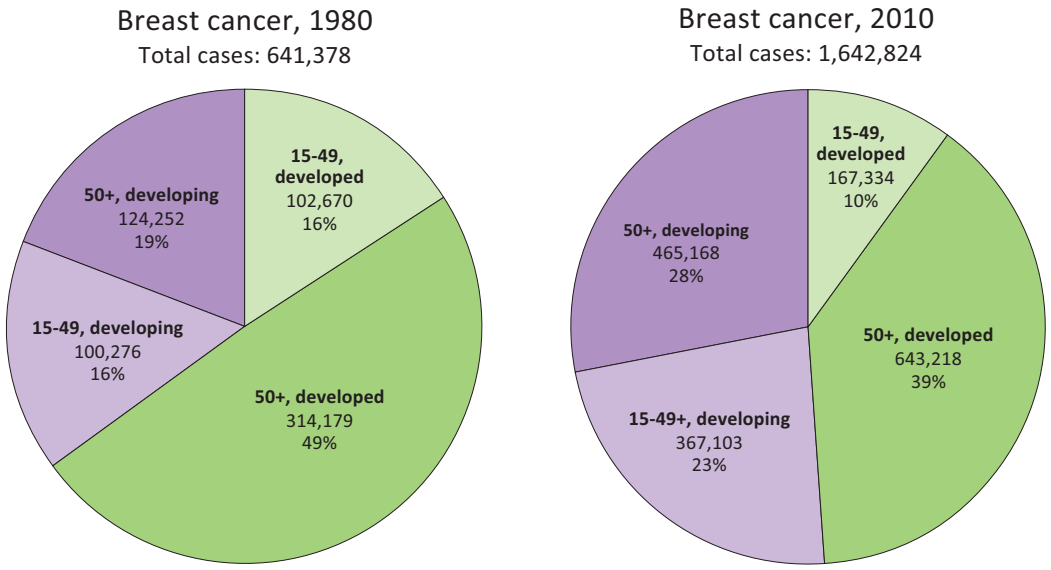


Figure 2:
Breast cancer cases in developed and developing countries by age, 1980 and 2010



*The **number of women developing breast cancer grew 156% since 1980**, but the **number of deaths grew by only 70%**. That difference is significant and promising, but the trend is not equally distributed around the world.*

The shift in the breast cancer burden to the developing world is being felt most acutely in women who traditionally had the lowest risk for the disease: women of reproductive age. In developing countries, the risk of a woman developing breast cancer before age 50 more than doubled between 1980 and 2010.

This trend has greatly changed the profile of the typical breast cancer patient. In 1980, one could safely assume that most women who had breast cancer were 50 years of age or older, because 68% of all cases were in that age group. The remaining cases were split evenly between women of reproductive age in developed countries and developing countries, both at 16% of the global total.

Since 1980, developed countries drove down the percentage of women age 15 to 49 with breast cancer from 16% to 10%. Developing countries saw the opposite happen. In 2010, women of reproductive age in developing countries made up 23% of the global total of breast cancer cases, meaning there are now twice as many women under 50 with breast cancer in the developing world than in developed countries. There is no sign that the trend is slowing.

Breast cancer deaths increasing more slowly than cases

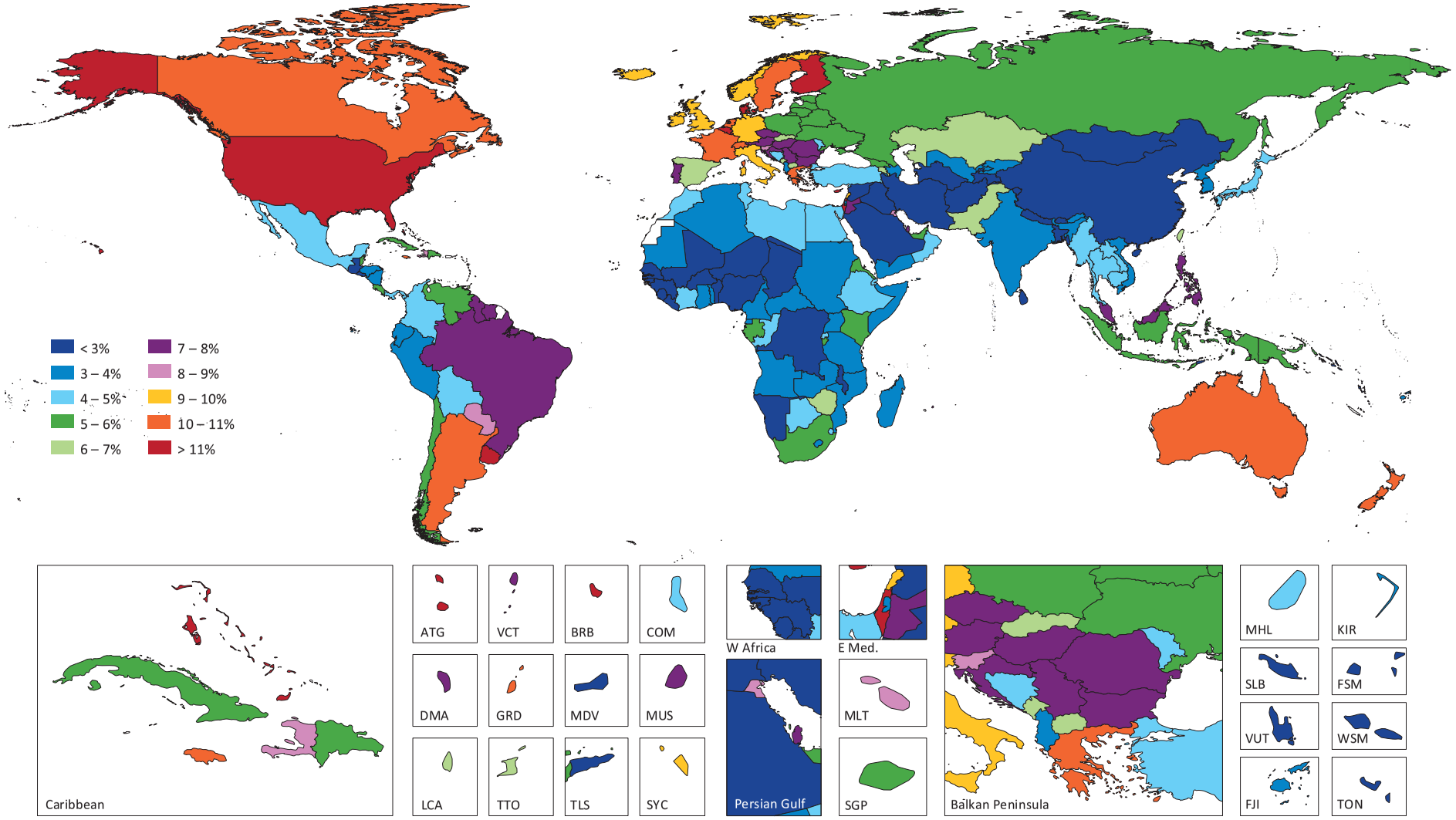
The first glimpses of progress in meeting the breast cancer challenge can be seen in the number of women dying from breast cancer. As we noted previously, breast cancer cases are rising at a rate of 3.1% annually. The global total number of deaths from breast cancer increased from 250,000 in 1980 to 425,000 in 2010, representing an annual increase of 1.8%.

Looked at another way, the number of women developing breast cancer grew 156% since 1980, but the number of deaths grew by only 70%. That difference is significant and promising, but the trend is not equally distributed around the world.

Because deaths are increasing at a slower pace than population growth in many countries, the actual risk of death from breast cancer dropped in some countries while rising in others. Cumulative probability of death increased throughout Central America, parts of Southeast Asia, North Africa, the Middle East, Eastern Europe, and sub-Saharan Africa. In many high-income countries, including the UK, US, and Belgium, the risk of death from breast cancer fell quite rapidly since the 1990s. In calculating cumulative probability of death and incidence, also known as risk, IHME did not take into account the risk of developing other health conditions or dying from other causes. This allowed us to make comparisons between countries more easily.

In 1980, women in Mongolia, Saudi Arabia, Thailand, and Bangladesh all had the lowest risk of dying from breast cancer, at less than 0.5%. By contrast, women in the UK, Uruguay, and Denmark all had a risk of more than 3.9% in 1980. Interestingly, even three decades later, the countries with the lowest risk of death remain the same, while women in Uruguay, Haiti, and the Bahamas now have the highest risk of death.

Figure 3:
Lifetime breast cancer risk, 2010



See the list of country abbreviations within the regional overviews.

The number of deaths in reproductive-aged women in developing countries is rising, along with the number of breast cancer cases. While the number of deaths in younger women in developed countries has remained virtually unchanged for 30 years, breast cancer deaths in the developing world are growing at a rate of 2.2% annually in women under 50.

The fraction of breast cancer deaths in women under 50 varies from 10.3% of the total number of deaths in Western Europe to 41% in Central sub-Saharan Africa. Within countries, the fraction of younger women dying from breast cancer can be even higher. In Bangladesh, 62% of all breast cancer deaths are in women under 50.

Prevention efforts appear to be working

By comparing annual cases to annual deaths in breast cancer, we provide one key measure for the number of women with cancer who die annually: the mortality-to-incidence (MI) ratio. The MI ratio reveals the clearest evidence in our analysis that efforts to diagnose, treat, and control the disease are working. Researchers find the MI ratio by using all data available according to age and dividing the total number of deaths by the total number of cases. For most of the 1980s, the MI ratio for breast cancer remained high for both developed and developing regions. In developed countries, 32 women died for every 100 women diagnosed with breast cancer in 1980. In developing countries, the ratio was 37 to 100.

By 1990, the number of deaths for every 100 new cases fell in both developed and developing countries. The pace of change accelerated over the next two decades. By 2010, the MI ratio fell to 26 deaths for every 100 new cases in developing regions and 21 to 100 in developed regions.

This encouraging decline coincides with broader use of screening over the past three decades, especially mammography, and the introduction of new drugs to treat breast cancer, the most widely used being tamoxifen and raloxifene.

Figure 4:
Growth in breast cancer cases and deaths in developed and developing countries, 1980 and 2010

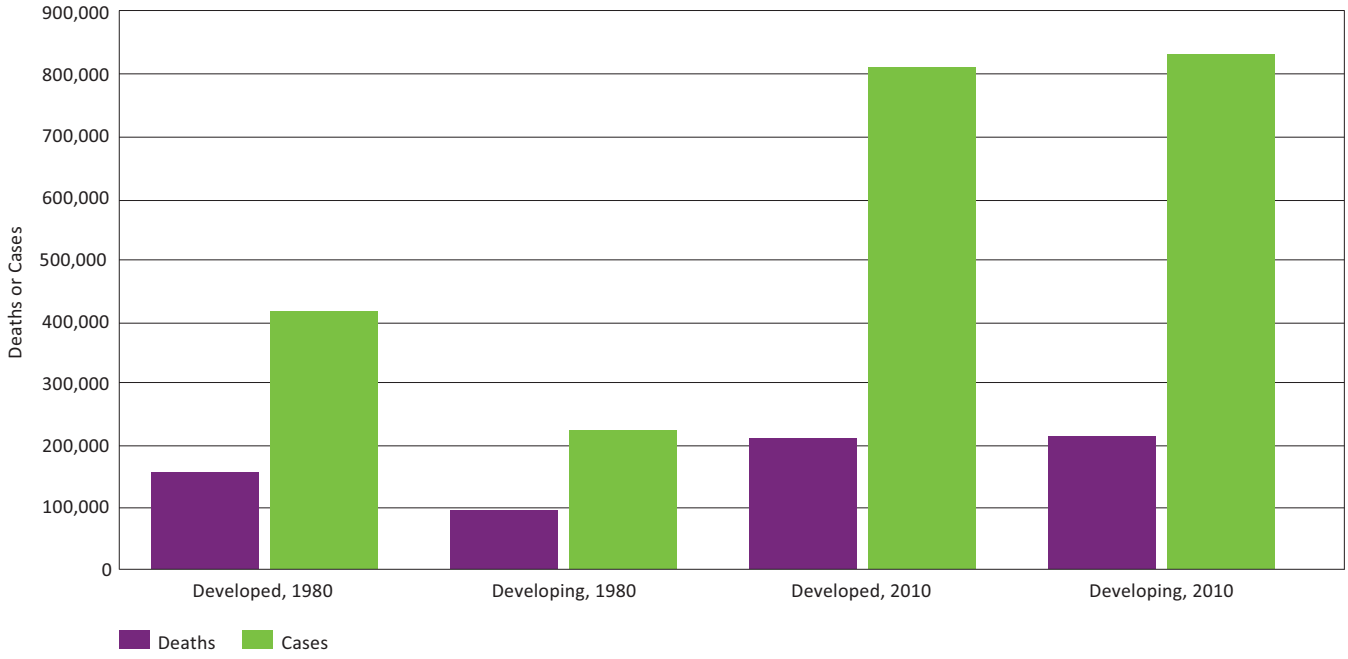


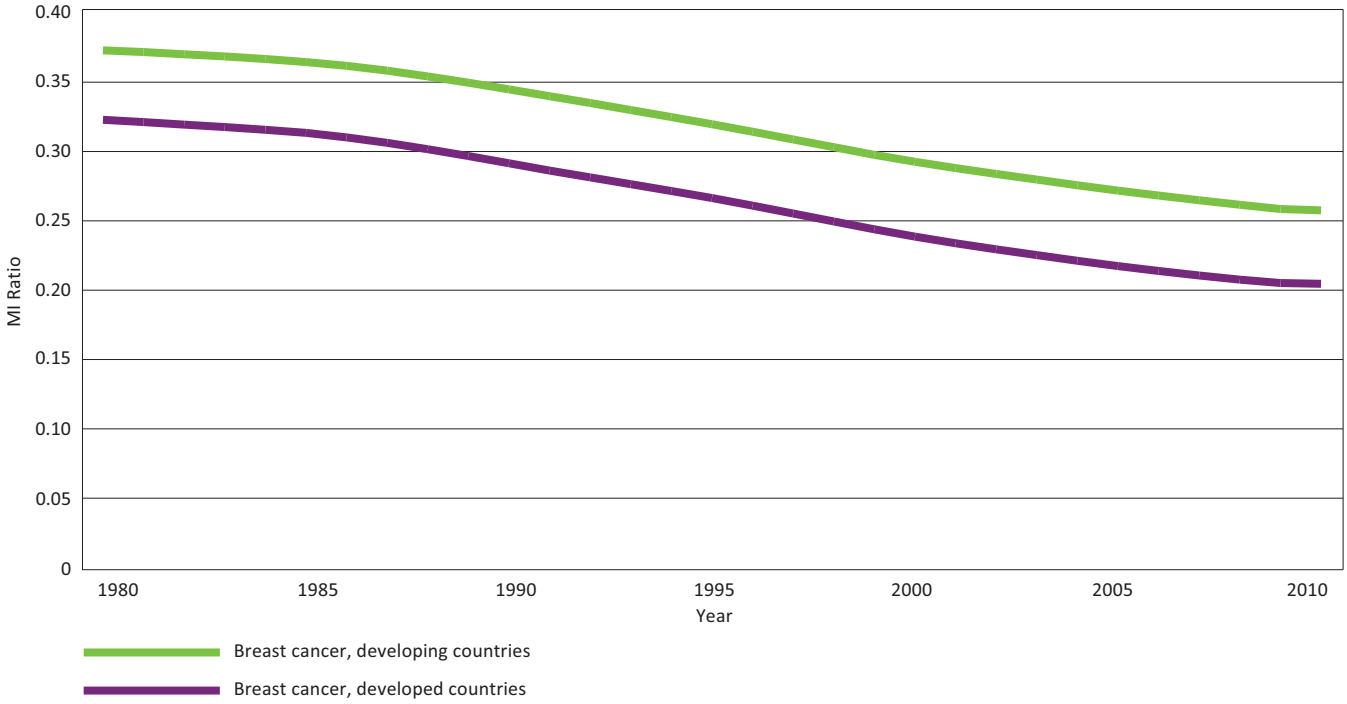
Table 1:

Deaths in thousands from breast cancer by region and age group, 2010

	15-49	50+	Total
Global	**94.0**	**331.2**	**425.2**
Developing	**67.8**	**145.9**	**213.7**
Developed	**26.1**	**185.3**	**211.4**
Asia Pacific, High Income	2.3	11.8	14.1
Asia, Central	1.7	3.2	4.8
Asia, East	13.2	32.1	45.3
Asia, South	20.1	38.8	58.8
Asia, Southeast	9.4	19.8	29.2
Australasia	0.5	3.2	3.8
Caribbean	0.8	3.5	4.4
Europe, Central	2.0	16.7	18.8
Europe, East	5.3	27.3	32.6
Europe, West	8.6	75.2	83.8
Latin America, Andean	0.5	1.3	1.8
Latin America, Central	3.0	7.8	10.7
Latin America, South	1.1	7.5	8.6
Latin America, Tropical	3.5	11.4	14.8
North Africa / Middle East	6.6	10.4	17.0
North America, High Income	6.1	43.7	49.8
Oceania	0.1	0.2	0.3
Sub-Saharan Africa, Central	1.0	1.4	2.3
Sub-Saharan Africa, East	4.0	8.1	12.1
Sub-Saharan Africa, South	0.8	3.0	3.8
Sub-Saharan Africa, West	3.3	4.9	8.2

See the list of countries in each region on pages 26-27.

Figure 5:
Mortality-to-incidence ratio of breast cancer, 1980 to 2010



The use of mammography to detect early breast tumors became widespread in high-income countries in the 1970s. Not until the 1980s did it become a standard of care in other parts of the world,[4-6] although mammograms continue to be out of reach for patients in many developing countries.[7]

Tamoxifen was first approved for use in the US for treating breast cancer in 1977. Over the next two decades, it gradually became the drug of choice throughout much of the world, driven in part by the 1998 Breast Cancer Prevention Trial, which found a 45% reduction in the incidence of breast cancer in women who used the drug.[8] Raloxifene, which became popular much more recently, gives women another treatment option.[9]

The US has experienced a strong reduction in the age-adjusted MI ratio. In 1980, 23 women died from breast cancer for every 100 new cases. In 2010, that dropped to 13 deaths from breast cancer for every 100 new cases, one of the lowest MI ratios globally.

Similar trends emerge in other regions, underscoring how the disease can affect countries – even neighboring countries – in widely diverse ways. It also indicates the possibility for in-depth research into the factors behind these divergent trends and the potential to both replicate success and accelerate progress to ultimately save more women's lives.

Cervical cancer cases increase with little progress in reducing deaths

With breast cancer, the trends in incidence, deaths, and reduction in deaths in proportion to new cases evolved over time, each moving at its own pace. Cervical cancer trends, however, appear to be in lock step and stubbornly impervious to significant change.

Cases are on the rise, and deaths are on the rise at nearly the same pace. As a result, the ratio of women dying compared to new cases of the disease is nearly the same in 2010 as in 1980. The fact that some countries have more than 50 deaths for every 100 new cases is a distressing sign of stagnation in a disease for which we have simple and effective tools for prevention and treatment.

With the recent advent of vaccines for preventing the human papillomavirus (HPV), which causes nearly all cervical cancer,[10] we might be entering a new era of progress in cervical cancer incidence, deaths, and the MI ratio. The vaccines have not been on the market long enough, though, for any measurable benefit to be detected at the global level.

For now, two trends are clear. First, as with breast cancer, the burden of cervical cancer is shifting to the developing world. Second, more women are being diagnosed with the disease during their reproductive years.

Cervical cancer incidence is rising

Worldwide, cervical cancer cases increased from 378,000 in 1980 to 454,000 in 2010. This is an average annual increase of 0.6%. The growth was almost entirely in the developing world.

Even more so than with breast cancer, the burden of new cervical cancer cases began to fall more heavily on the developing countries. High-income countries saw a decrease in cervical cancer cases. The risk of a woman developing cervical cancer in a high-income country is now less than 1%, meaning that in developed countries 1 out of every 100 women risk developing cervical cancer in her lifetime.

In the developing world, by contrast, the risk of cervical cancer is much higher. In fact, the risk is 35% greater than in high-income countries. Overall, 76% of new cervical cancer cases occur in developing regions. Sub-Saharan Africa alone makes up 22% of all cervical cancer cases, or 76,200 in 2010.

As with breast cancer cases, the fraction of women of reproductive age with cervical cancer is increasing in developing countries while decreasing in developed countries. In developing countries, there were 154,000 cases of cervical cancer in 2010 among women ages 15 to 49. That represents 34% of the global total, up from 30% in 1980. In developed countries, by contrast, the fraction of women of reproductive age with cervical cancer shrank slightly from 13% to 10%.

In some countries, younger women now make up the majority of new cases of cervical cancer. More than half the cases of cervical cancer are in women under age 50 in countries such as the Philippines, Indonesia, Uganda, Argentina, Venezuela, and Chile.

Cervical cancer deaths increase at almost the same pace as cases

While the number of cases of cervical cancer rose slowly over the past three decades at 0.6%, the number of deaths increased at a slightly slower pace. The total number of women dying from cervical cancer grew from 174,000 in 1980 to 200,000 in 2010, an annual rate of increase of 0.5%. Both the number of cases and the number of deaths rose more slowly than population growth, which increased at a rate of 1.2% annually.

Women died from cervical cancer at the highest rates in Zimbabwe, Eritrea, and Ethiopia in 1980. The lowest mortality levels that year were in Syria, Egypt, and Sri Lanka, all countries that also had a low risk of women developing cervical cancer. In 2010, the countries with the lowest levels of mortality were Syria, Iran, and Maldives. Guyana and Zambia had some of the highest mortality rates.

Figure 6:
Cervical cancer cases by region, 1980 to 2010

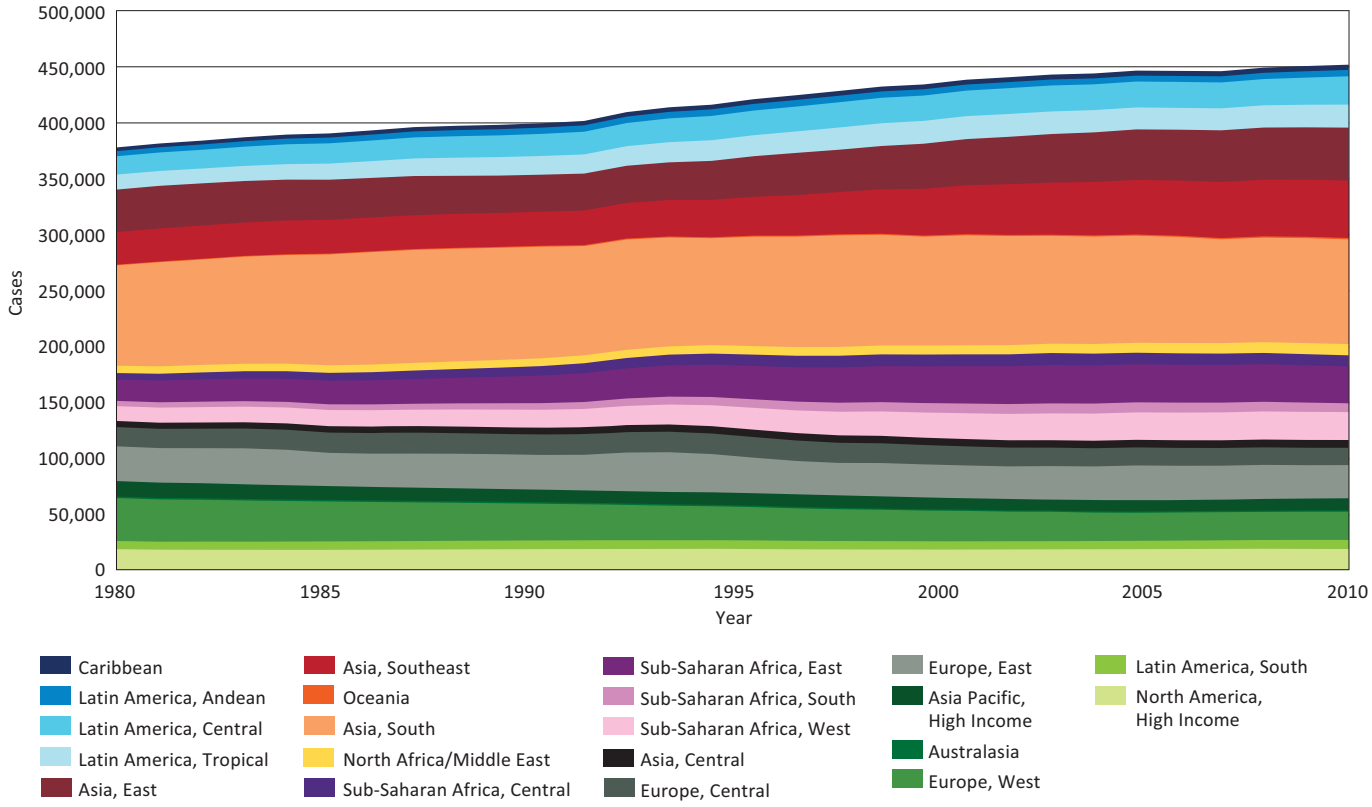
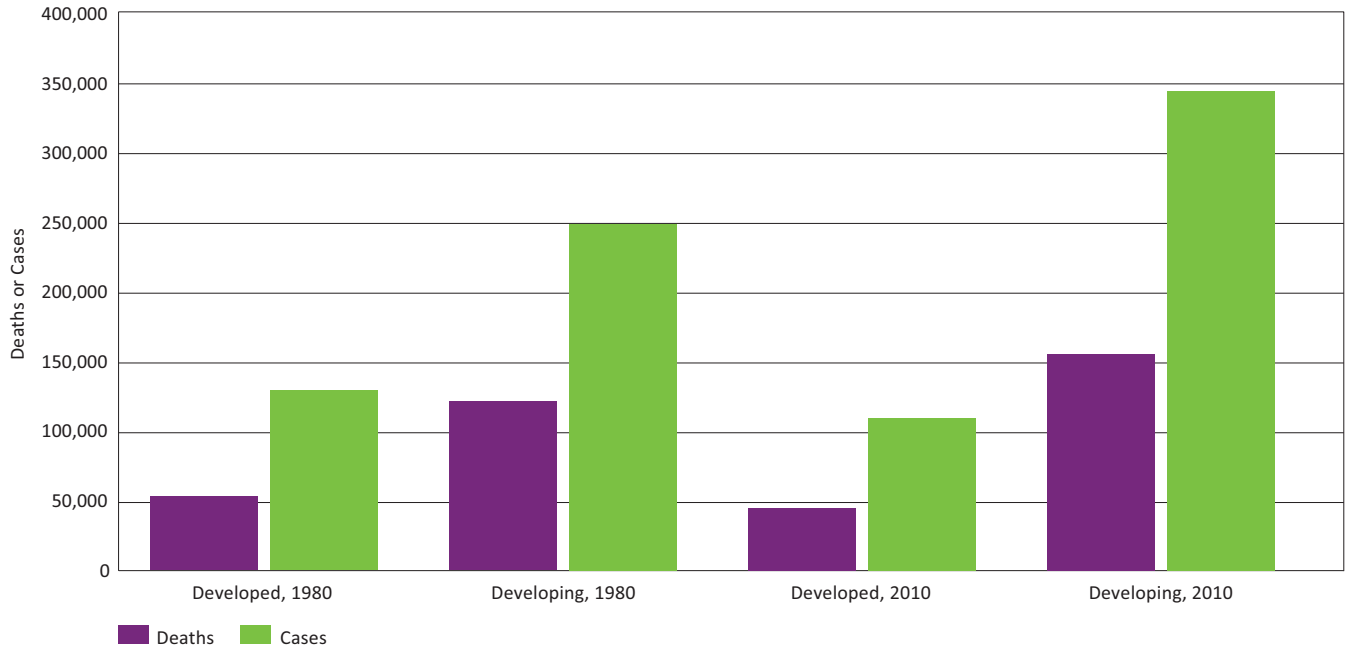


Figure 7:
Growth in cervical cancer cases and deaths in developed and developing countries, 1980 and 2010



In some countries, younger women now make up the majority of new cases of cervical cancer. *More than half the cases of cervical cancer are in women under age 50 in countries such as the Philippines, Indonesia, Uganda, Argentina, Venezuela, and Chile.*

Because deaths from cervical cancer are not increasing as quickly as population growth, the risk of dying from cervical cancer fell in nearly every country from 1980 to 2010. The exceptions are Sri Lanka, Iraq, Thailand, and Zambia, where the risk either stayed the same or increased slightly.

That deaths from cervical cancer are not increasing in step with population growth is an encouraging sign. We see it is possible even for countries with very high mortality rates to change course. Our estimates show that large declines in the risk of dying from cervical cancer occurred in some countries in sub-Saharan Africa and in Latin America. Zimbabwe had a risk of death of 5.7% in 1980, and, by 2010, the risk had fallen to 3.5%, still much higher than the global average but a huge rate of improvement in comparison to its neighbors. In both Peru and Chile, the risk of death from cervical cancer was cut in half between 1980 and 2010.

In three decades, little change in women with cervical cancer dying

Even with positive trends in some countries, the relationship between the number of new cases of cervical cancer and the number of women dying continues to be cause for concern. The age-standardized MI ratio has shown little improvement globally over the past three decades. In 1980, there were 42 deaths from cervical cancer for every 100 new cases of cervical cancer in developing countries. Thirty years later, the death number fell by just two, to 40. Similarly, in developed countries, the ratio changed from 30 deaths for every 100 cases to 28 deaths for every 100 cases.

In many countries, the MI ratio for breast cancer was higher than for cervical cancer in 1980. Because of the lack of progress in decreasing cervical cancer cases and deaths and the relative progress in slowing the growth of breast cancer deaths, the MI ratio for cervical cancer is now higher than the MI ratio for breast cancer in most countries.

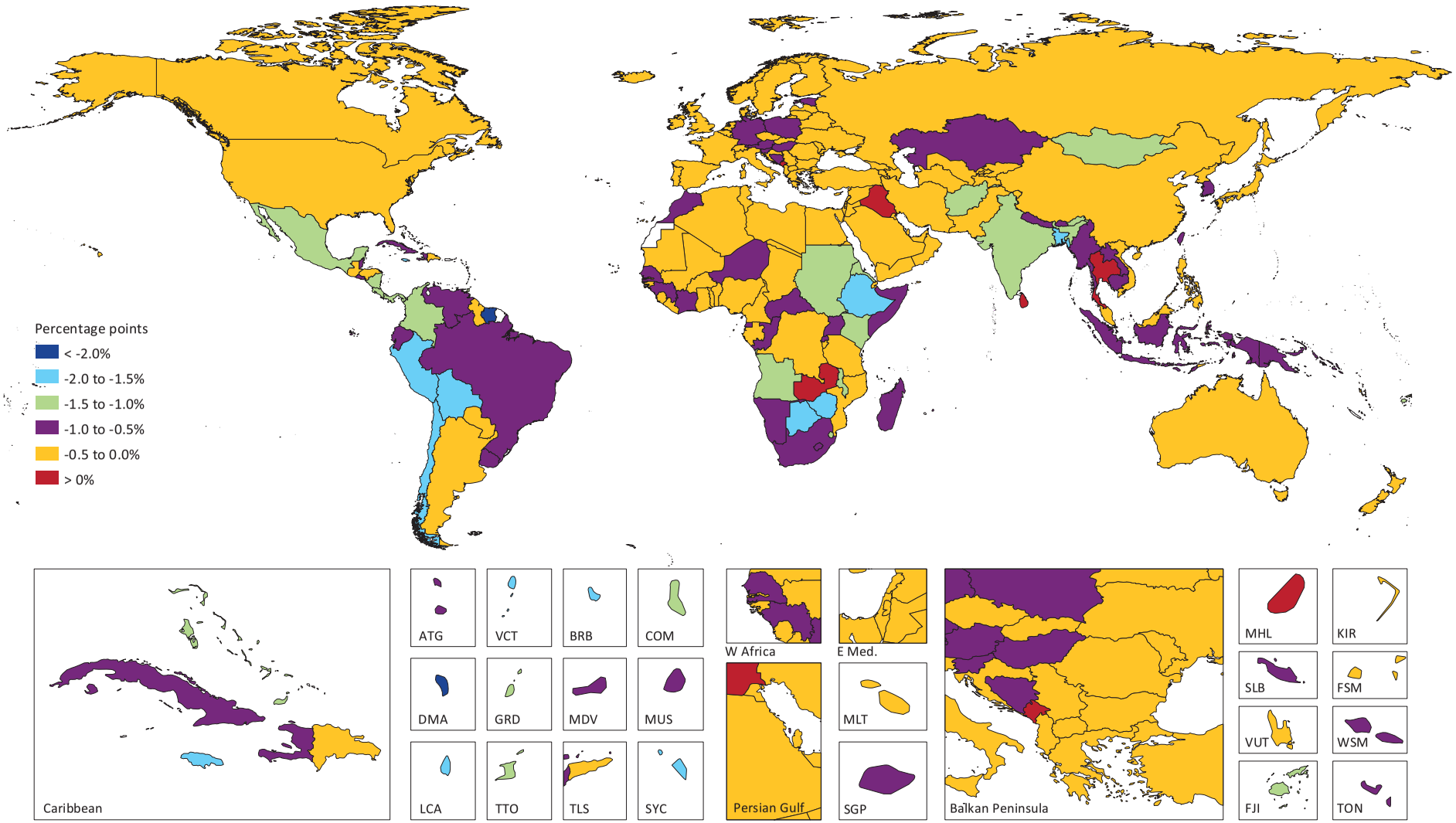
In Australia, the MI ratio for breast cancer was 26 deaths for every 100 new cases in 1980, and for cervical cancer it was 25 to 100. After three decades, Australia lowered its breast cancer MI ratio to 15 deaths for every 100 cases, one of the best ratios in the world. The situation for women with cervical cancer in Australia, though, remained unchanged for 30 years. Germany, similarly, saw its breast cancer MI ratio improve from 28 deaths to 17 deaths for every 100 new cases, while for cervical cancer, the ratio stayed at 27 to 100 over the three-decade period.

In developing countries, the patterns are the same. Malawi had 56 deaths for every 100 new cases of cervical cancer in 1980, and 55 for every 100 in 2010. Over the same period, though, the country greatly lowered its MI ratio for breast cancer from 47 deaths for every 100 new cases to 36. South Africa's MI ratio for cervical cancer barely moved from 45 deaths to 43 deaths for every 100 new cases between 1980 and 2010. The MI ratio for breast cancer – already lower than in most sub-Saharan African countries – dramatically improved, falling from 36 deaths to 25 deaths for every 100 new cases.

Previous research tells us the lack of progress in cervical cancer can be traced in part to weak or nonexistent screening programs in many countries. It has been

Figure 8:

Change in the lifetime risk of death from cervical cancer, 1980 to 2010



See the list of country abbreviations within the regional overviews.

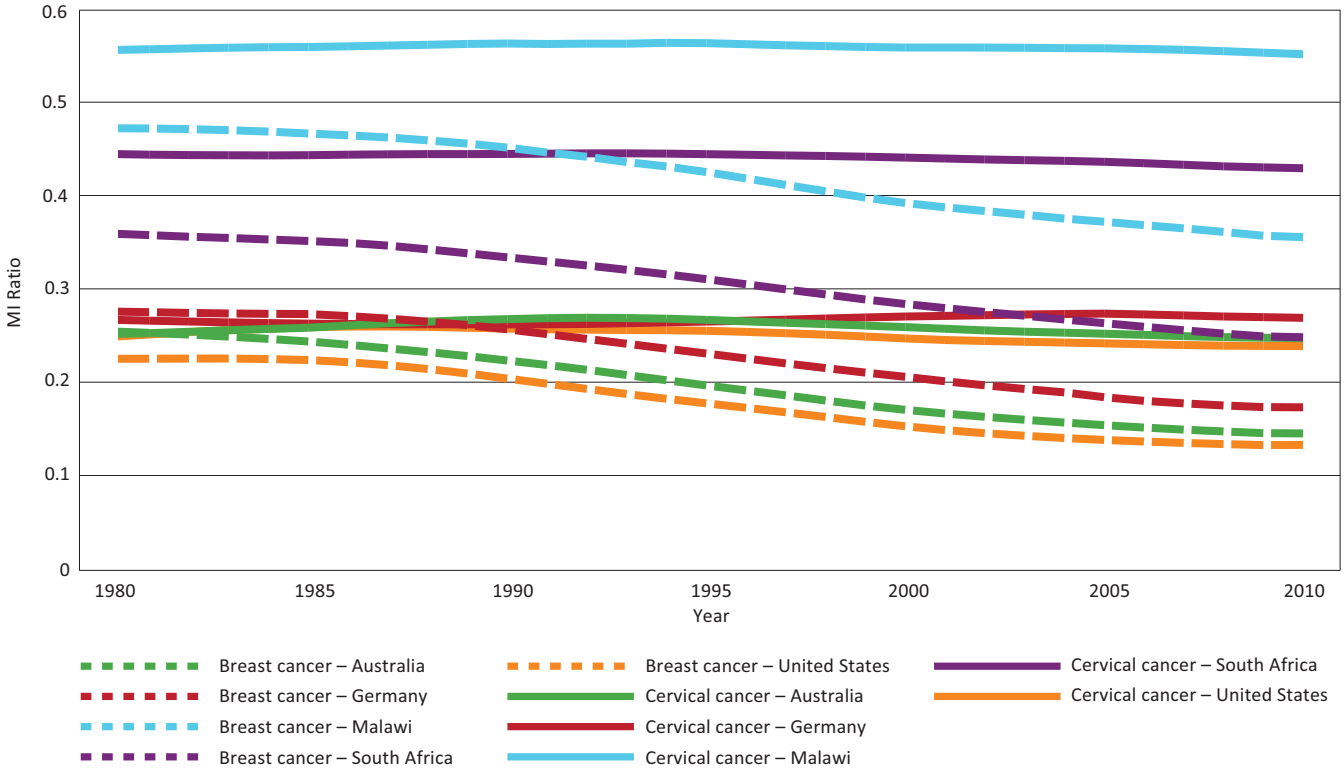
Table 2:

Deaths in thousands from cervical cancer by region and age group, 2010

	15-49	50+	Total
Global	**55.9**	**144.1**	**200.1**
Developing	**46.2**	**109.2**	**155.4**
Developed	**9.7**	**35.0**	**44.7**
Asia Pacific, High Income	0.9	4.3	5.2
Asia, Central	1.0	1.5	2.6
Asia, East	4.5	14.2	18.7
Asia, South	9.8	30.2	40.1
Asia, Southeast	6.1	14.3	20.3
Australasia	0.1	0.3	0.4
Caribbean	0.6	1.7	2.3
Europe, Central	1.4	5.1	6.5
Europe, East	3.1	9.8	12.8
Europe, West	1.9	8.5	10.3
Latin America, Andean	0.8	2.0	2.8
Latin America, Central	3.5	7.9	11.4
Latin America, South	0.9	2.2	3.1
Latin America, Tropical	2.8	6.6	9.5
North Africa / Middle East	1.0	2.8	3.8
North America, High Income	1.5	4.8	6.3
Oceania	0.2	0.3	0.5
Sub-Saharan Africa, Central	2.6	3.2	5.7
Sub-Saharan Africa, East	6.5	13.4	19.9
Sub-Saharan Africa, South	1.1	3.2	4.3
Sub-Saharan Africa, West	5.8	7.7	13.5

See the list of countries in each region on pages 26-27.

Figure 9:
Mortality-to-incidence ratio for breast cancer and cervical cancer in selected countries, 1980 to 2010



estimated that more than 80% of all new cervical cancers are found in countries that lack organized Pap screening, a common test to detect cancer or abnormalities that may lead to cancer of the cervix.[11] When women with cervical cancer are surveyed, research has shown that about 60% of them did not regularly see a physician for a Pap screening.[12] We know that national strategies can work. In the UK, a national screening program begun in 1988 appears to have reversed an alarming trend in women younger than 35 developing cervical cancer.[13] That country has seen one of the strongest annual declines in both cervical cancer cases and deaths. The trends in the MI ratio should be interpreted with caution, though, because of methodological difficulties. For example, some studies have reported that screening programs lead to identification and treatment of premalignant lesions. Therefore, data on incidence and deaths reflect only aggressive cancers.[14]

It is too soon to tell how the trends in cervical cancer will change following the recent advent of vaccines that promise to lower the incidence of HPV, a sexually transmitted infection. The HPV vaccines Cervarix and Gardasil were introduced in 2008 after clinical trials showed they were effective in preventing infection from two strains of HPV, HPV 16 and HPV 18.[15] These two strains of the virus alone cause 70% of cervical cancer cases.[16]

The scale-up of the vaccines globally remains in its infancy, but as observed with other interventions, such as insecticide-treated bed nets, countries can rapidly scale up distribution of interventions with the right policy approach and adequate funding.[17] Given the change seen in breast cancer since the introduction of new drugs that are effective in women with certain risk profiles, there is good reason to believe it is possible to significantly drive down cervical cancer cases and save more women's lives.

Changing cancer's course globally

This study is the first global assessment of country-specific trends in breast and cervical cancer for all countries and by age. The results show that deaths for breast and cervical cancer are increasing annually by 1.8% and 0.5%, respectively.

There are now more deaths from breast cancer than maternal causes, with cervical cancer deaths getting closer every year. In women of reproductive age, complications from pregnancy and birth still cause more deaths in the developing world, but breast and cervical cancer are quickly catching up. If nothing is done to change course, within the next two decades, women under 50 in developing countries will die as often from breast and cervical cancer as from maternal causes.

The challenge ahead cannot be ignored. In a world that has committed significant sums of health funding to combat deaths from maternal causes, our research shows that an increasing fraction of funding should be focused on breast and cervical cancer. Given the incredible groundswell around fighting maternal mortality – a fight that can point to real victories over the past three decades – it would be a wasted opportunity not to leverage the talent and momentum that could make similar progress in breast and cervical cancer. How societies respond to this challenge will determine the course of the two leading causes of cancer mortality in women for many years to come.

Based on our findings, we can make several key recommendations.

Increase country-level health data. Finding the necessary data to accurately measure trends in breast and cervical cancer is fraught with difficulties. For 47 countries, we could not find any data about these cancers. In another 66 countries, data were limited. This means that to capture the global burden from cancer, researchers have to rely more heavily on statistical modeling than they do for other diseases. One step to increase country-level health data is to add more cancer registries in countries. Currently, cancer registries are predominately found in high-income countries. Another step is to create an integrated system to gather data for states, districts, or counties within a country. In doing so, the necessary evidence base will be built to document trends over time and to target strategies that will have the maximum impact.

Expand verbal autopsy in low-resource settings. Most countries have incomplete vital registration systems, meaning that births, deaths, and other health trends cannot be completely captured. The work IHME and others around the world have done to improve verbal autopsy methods provides new options for filling in gaps in national health data. Verbal autopsy is a relatively low-cost way of surveying populations to find trends in cancer deaths and a wide range of other diseases. Recently published work in the scientific journal *Population Health Metrics* shows that verbal autopsy methods using low-cost software to identify causes of death rival physician assessments for accuracy.[18, 19]

Pinpoint the drivers behind divergent trends. Our detailed analysis by country reveals a marked diversity of trends, particularly for breast cancer mortality, by region and within regions. Venezuela and Colombia, for example, have very different trends, despite sharing many of the same lifestyle and demographic characteristics. This tells us that major known risk factors, such as obesity and consumption of animal fat, do not account for all observed patterns. Explanation of these divergent trends may lie in the interaction between genes and known individual risk factors. The next step would be for researchers within the country to study health policies that may be driving these trends as well as underlying interactions between genes and the environment.

Implement national cancer control strategies. We have seen what can happen when screening protocols are followed for breast cancer. Countries such as the US that have promoted screening at the appropriate age levels for breast cancer and have continued to research the efficacy of screening also have the biggest improvements in the mortality-to-incidence ratio for breast cancer. With cervical cancer, national campaigns and programs to encourage screening have not been as successful. By learning from what is working in breast cancer strategies and replicating those efforts for cervical cancer, countries may be able to take advantage of the hope promised by HPV vaccines and make a significant change in cervical cancer trends. Developing national control strategies for both cancers that reflect local epidemiological patterns and trends would be of great benefit.

Efforts to improve maternal and child health include diverse initiatives such as the UN Commission on Women's and Children's Health, the US Global Health Initiative, and the Bill & Melinda Gates Foundation's appeal to countries to make a concerted effort to reduce maternal and child mortality.[20-22] These initiatives are increasing policy attention for women's health issues, particularly for reproductive-age women. Our findings suggest that breast and cervical cancer in low-income countries are major causes of death for women at these ages, and that the situation is getting worse. As the UN High-level Meeting on NCDs raises policy awareness of the importance of controlling breast and cervical cancer, we can make this moment matter. We know there are effective health system responses. We now need the targeted policy approaches to build on the noted success in reducing the burden of maternal causes of death. Four years away from the deadline set at the Cairo conference, breast and cervical cancer can become global health priorities, and the setbacks can be reversed.