

# Years of Potential Life Lost Because of Breast and Cervical Cancers in Guatemala

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**PURPOSE** Worldwide cervical and breast cancers are among the most commonly diagnosed cancers and are leading cause of cancer deaths among females in low- and middle-income countries. In Guatemala, breast and cervical cancers are the main cause of cancer-related deaths among women. Therefore, the aim of this study was to determine the years of potential life lost (YPLL) as an indicator of premature deaths as a result of breast and cervical cancers.

**METHODS** Data on the number of deaths as a result of breast and cervical cancers (International Classification of Diseases [10th revision] codes C50 and C53) between 2012 and 2016 and age composition by quinquennials were retrieved from the Health Information System of the Guatemalan Health Ministry. On the basis of each individual's age at death, YPLL was estimated for females between 20 and 70 years of age.

**RESULTS** A total of 1,476 deaths related to breast and cervical cancers was reported over the study period. The trend in breast cancer mortality rate and YPLL did not change from 2012 to 2016. The cervical cancer mortality rate has decreased to 10 deaths per 1 million habitants ( $P = .046$ ). There has been a reduction in YPLL because of cervical cancer, from 50.18 YPLL in 2012 to 29.19 YPLL by 2016, mainly in women between 30 and 34 years of age, in whom YPLL decreased from 600 to 112.50 ( $P = .046$ ).

**CONCLUSION** Cervical cancer screening has significantly reduced the mortality rate of this malignancy, and screening of breast cancer must include creating awareness of the disease and providing access to women at risk.

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## INTRODUCTION

Worldwide, there are more than 2.5 million new cervical and breast cancer cases, and the incidence and mortality of these cancers have increased over the past 30 years. Cervical and breast cancer are the leading cause of cancer-related deaths among females in low- and middle-income countries (LMIC), where women are disproportionately affected because of vulnerabilities related to gender inequality.<sup>1,3</sup> These increases have occurred even though population-based interventions, such as vaccination against human papillomavirus (HPV), screening with cervical cytology, visual inspection of cervix after applying acetic acid, testing for HPV DNA, breast examination, and mammography, are available.<sup>2</sup>

In Latin America, cervical cancer has reduced in incidence and mortality in recent years, but breast cancer has continued increasing and has higher mortality rates than in developed countries because most patients are diagnosed at more advanced stages

of the disease. Both breast and cervical cancers in the region remain the main causes of mortality caused by malignant neoplasms.<sup>3,4</sup> In Guatemala, noncommunicable diseases produce more than one half of deaths in the country, with cancer accounting for approximately 10%. In 2013, the National Commission for the Prevention of Noncommunicable Diseases and Cancer was created by the Health Ministry with the aim of developing policies and actions to decrease the incidence and prevalence of the mortality and disability associated with noncommunicable diseases, which include breast and cervical cancers, with the latter having with its own designated program.<sup>5,6</sup> Cervical and breast cancers are the most common malignancies among females in the country and cause more than 2,000 deaths per year.<sup>5,7,8</sup> Therefore, to assess the burden of breast and cervical cancers among Guatemalan women, we analyzed the years of potential life lost (YPLL) according to the mortality data available from the Guatemalan Health Ministry from 2012 to 2016.

Author affiliations and support information (if applicable) appear at the end of this article.

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## CONTEXT

### Key Objective

Determine years of potential life lost as an indicator of premature deaths as a result of breast and cervical cancers.

### Knowledge Generated

Screening has significantly reduced the mortality rate of cervical cancer, while breast cancer mortality remains unchanged.

### Relevance

Findings show the positive impact of cervical cancer screening and indicate the need to strengthen breast cancer early detection awareness.

## METHODS

This is a study about the YPLL because of cervical and breast cancer in women in Guatemala. Data on mortality were obtained through the database of the Guatemalan Health Ministry, publicly available online in the Health Information System (SIGSA). We used the International Classification of Diseases (10th revision) codes for cervical (C53) and breast (C50) cancers for the data analysis.

For mortality and YPLL calculations, we used population data from SIGSA<sup>9</sup> for each year. We divided the population into quinquennial age groups from 15 to > 70 years. A maximum age of 70 years was chosen because of the projected life expectancy of Guatemala's population between 2000 and 2020.<sup>10</sup>

For YPLL, the calculations were made according to the formula:

$$PYLL = \sum_{i=1}^{70} d_i(70 - i)$$

where 70 years is the cutoff age before death occurrence;  $i$  is the average number of YPLL because of death registered at the given age group; and  $d_i$  is the number of deaths in the  $i$  age group.

The YPLL rate was calculated as the quotient of the YPLL number and the number of inhabitants in Guatemala in the

age group 20-70 years. The YPLL rate was calculated per 100,000 population.

The proportion mortality ratio was calculated according to the formula:

$$PMR = \frac{\text{No. of deaths as a result of a given cause in a specified time period}}{\text{Total deaths in same time period}} \text{ per } 100,000.$$

The mortality rate was calculated according to the formula:

$$MR = \frac{\text{No. of deaths among women } 20 - 70 \text{ years of age during a given interval}}{\text{Total population } 20 - 70 \text{ years of age living during the same interval.}} \text{ per } 100,000.$$

A variable comparison was carried out using trend test analysis, analysis of variance, the Shapiro-Wilk test, and the 2-sample  $t$  test. All statistical tests were 2-sided and conducted at the 5% statistical significance level using R Studio and STATA version 12.

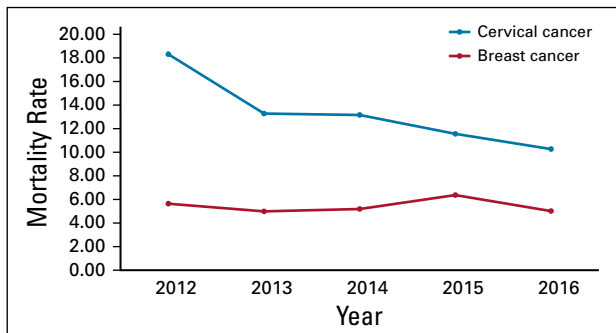
## RESULTS

Cancer is a leading cause of death in Guatemala; there are between 21 and 23 cancer-related deaths per 100,000 inhabitants in the country (Table 1). During the study period from 2012 to 2016, 1,476 deaths resulting from breast and

**TABLE 1.** Mortality of Cervical and Breast Cancers from 2012 to 2016

Year	Mortality per 1,000,000		Total Deaths		Total Deaths	Total Population	Proportion (mortality/all cancers)		Cancer Mortality per 100,000
	Breast Cancer	Cervical Cancer	Breast Cancer	Cervical Cancer			Breast Cancer	Cervical Cancer	
2012	5.64	18.31	85	276	42,778	15,073,374	2.45	7.96	22.99
2013	4.99	13.28	77	205	44,510	15,438,385	2.31	6.15	21.61
2014	5.19	13.16	82	208	44,896	15,806,674	2.35	5.96	22.09
2015	6.37	11.56	103	187	47,084	16,176,133	2.99	5.42	21.33
2016	5.01	10.27	83	170	46,847	16,555,557	2.38	4.87	21.10
<i>P</i> trend	1.0	.046 <sup>a</sup>	.689	.072			.689	.046 <sup>a</sup>	.072

<sup>a</sup>Statistically significant at  $P < .05$ .



**FIG 1.** Mortality of cervical and breast cancers per 1,000,000 from 2012 to 2016.

cervical cancers were reported in the population. From the total number of deaths as a result of these malignancies, 70.87% were associated with cervical cancer, even though the mortality for this disease had decreased from 18 to 10 deaths per 1 million habitants over a period of 5 years (Table 1; Fig 1), with the highest mortality among patients older than 65 years of age (Table 2; Data Supplement). Conversely, the breast cancer mortality rate has kept steady, causing approximately 5 deaths per 1 million habitants in 2016 (Table 1; Fig 1), with approximately 34% of breast cancer deaths reported among the patient group from 50 to 59 years of age (Table 1; Data Supplement).

Comparing the total YPLL between breast and cervical cancer among all age groups from 2012 to 2016, we found a mean of YPLL for cervical cancer of 2,960 (95% CI, 2,340.43 to 3,579.56) and a mean YPLL for breast cancer of 1,482 (95% CI, 1,193 to 1,770.59;  $P = .0003$ ; Tables 2 and 3). The stratified analysis showed that between 2012 and 2016, YPLL caused by breast cancer has not changed dramatically over the years (Table 2; Fig 2) with a rate of

18.04 YPLL per 100,000 habitants in 2016. In comparison, there has been a constant reduction in YPLL caused by cervical cancer, from 50.18 YPLL in 2012 to 29.19 YPLL by 2016 (Table 3; Fig 3), mainly in women between 30 and 34 years of age in whom YPLL decreased from 600 to 112.50.

**DISCUSSION**

Cancer is one of the leading causes of death worldwide, with more than 17 million new cases and 8.5 million cancer-related deaths per year. By 2030, cancer rates are predicted to increase to 23.6 million and more than 50% of the cases and 65% of the related deaths will occur in LMICs. It is estimated that one third of cancers could be prevented by reducing the main risk factors.<sup>11</sup> Therefore, since 2010, Guatemala has made important efforts towards the reduction of cancer incidence and mortality, and this has resulted in the creation of the Health Ministry of the National Policy Against Cancer, which was followed by the creation of the National Commission for the Prevention of Noncommunicable Diseases and Cancer in 2013.<sup>6,12</sup> Our findings indicate that there is a significant reduction in the YPLL caused by cervical cancer in Guatemalan women, especially among women between 30 and 34 years of age, but this does not seem to be the same case for breast cancer. Some of the reasons for this difference could be a lack of awareness about the disease, inadequate access to medical resources and specialized cancer care, and economic constraints.<sup>13,14</sup>

A 45% reduction in cervical cancer mortality after the implementation of the screening program is similar to the findings of a randomized study in rural India that included 131,746 women, in which the researchers documented a 35% reduction in cervical cancer mortality in patients who had been offered screening.<sup>15</sup> In the process of defining the

**TABLE 2.** Breast Cancer YPLL by Age Group

Age Group (years)	2012	2013	2014	2015	2016	P Trend
20-24	47.50	0.00	47.50	0.00	0.00	.248
25-29	0.00	127.50	85.00	42.50	85.00	.682
30-34	187.50	150.00	225.00	112.50	112.50	.182
35-39	227.50	195.00	260.00	487.50	357.50	.110
40-44	302.50	110.00	275.00	357.50	220.00	1.0
45-49	202.50	225.00	180.00	247.50	135.00	.549
50-54	227.50	140.00	192.50	280.00	245.00	.230
55-59	87.50	187.50	225.00	125.00	250.00	.162
60-64	37.50	52.50	75.00	135.00	75.00	.101
65-69	20.00	7.50	12.50	17.50	12.50	.682
> 70	0.00	0.00	0.00	0.00	0.00	—
Total YPLL	1,340.00	1,195.00	1,577.50	1,805.00	1,492.50	.230
YPLL rate per 100,000 habitants	18.46	15.93	20.35	22.54	18.04	.689

Abbreviation: YPLL, years of potential life lost.

**TABLE 3.** Cervical Cancer YPLL by Age Group

Age Group (years)	2012	2013	2014	2015	2016	P Trend
20-24	0.00	0.00	0.00	0.00	0.00	—
25-29	0.00	0.00	0.00	0.00	0.00	—
30-34	600.00	487.50	375.00	337.50	112.50	.046 <sup>a</sup>
35-39	422.50	617.50	455.00	422.50	455.00	.916
40-44	412.50	440.00	660.00	440.00	467.50	.218
45-49	787.50	382.50	787.50	607.50	495.00	.538
50-54	822.50	332.50	595.00	350.00	437.50	.549
55-59	300.00	337.50	262.50	275.00	225.00	.110
60-64	255.00	187.50	127.50	165.00	150.00	.162
65-69	42.50	45.00	22.50	30.00	72.50	.689
> 70	0.00	0.00	0.00	0.00	0.00	—
Total	3,642.50	2,830.00	3,285.00	2,627.50	2,415.00	.072
YPLL rate per 100,000 habitants	50.18	37.74	42.39	32.82	29.19	.072

Abbreviation: YPLL, years of potential life lost.

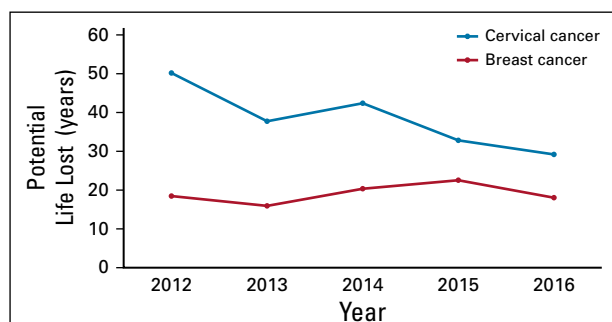
<sup>a</sup>Statistically significant at  $P < .05$ .

impact of a screening program on mortality in England, the estimate of the reduction in mortality was made using an incidence-based case-control study, and results indicated that screening prevented 69.7% of cervical cancer deaths.<sup>16</sup> Similar results were reported in Canada, in which a study there found a 71% reduction in cervical cancer mortality between 1972 and 2006 after the implementation of screening program.<sup>17</sup> Variations in the reduction in mortality have been identified in Latin American and Caribbean countries; limitations and barriers to access to screening services when compared with developed countries might explain these discrepancies.<sup>18</sup>

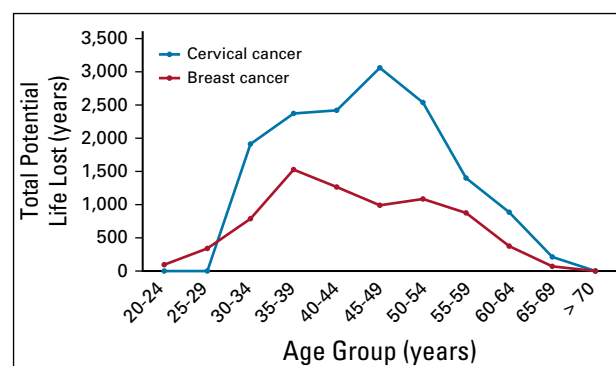
It is important to point out that our study did not analyze the incidence of breast and cervical cancer among the population, and with the data available we cannot

determine the prevalence of these malignancies in Guatemala. In this context, even though breast cancer has a lower mortality rate, many women could be living chronically with the disease because of longer overall survival thanks to available new treatments.<sup>19</sup> In comparison, women with cervical cancer usually have a shorter survival rate at any stage because of complications related to the tumor, such as hemorrhage and renal failure.<sup>19</sup>

The findings in this study indicate that the efforts made in cervical cancer screening are having the appropriate impact among Guatemalan women, significantly reducing the mortality caused by this malignancy, but screening for breast cancer must improve through a greater awareness of the disease and better access to women at risk.



**FIG 2.** Years of potential life lost because of cervical and breast cancers from 2012 to 2016.



**FIG 3.** Breast and cervical cancer years of potential life lost per age group from 2012 to 2016.

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**Manuscript writing:** All authors

**Final approval of manuscript:** All authors

**Accountable for all aspects of the work:** All authors

## AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

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## REFERENCES

- Bray F, Ferlay J, Soerjomataram I, et al: Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin* 68:394-424, 2018
- Luciani S, Cabanes A, Prieto-Lara E, et al: Cervical and female breast cancers in the Americas: Current situation and opportunities for action. *Bull World Health Organ* 91:640-649, 2013
- Cazap E: Breast Cancer in Latin America: A Map of the Disease in the Region. *Am Soc Clin Oncol Educ Book* 38:451-456, 2018
- Capote Negrin LG: Epidemiology of cervical cancer in Latin America. *Ecancermedicallscience* 9:577, 2015
- Ministerio de Salud Pública y Asistencia Social Guatemala: Análisis de situación epidemiológica de las enfermedades no transmisibles Guatemala. <http://epidemiologia.mspas.gob.gt/files/Publicaciones%202016/Salas%20Situacionales/An%C3%A1lisis%20de%20Enfermedades%20No%20Transmisibles%202015.pdf>
- Ministerio de Salud Pública y Asistencia Social Guatemala: Plan nacional de prevención, control y manejo de cáncer cervicouterino 2014-2024. [https://www.paho.org/gut/index.php?option=com\\_docman&view=download%7C%20&alias=640-plan-nacional-de-preencion-control-y-manejo-de-cancer-cervicouterino-2014-2024&category\\_slug=sfc-salud-reproductiva-materna-y-neonatal-global-y-regional&Itemid=518](https://www.paho.org/gut/index.php?option=com_docman&view=download%7C%20&alias=640-plan-nacional-de-preencion-control-y-manejo-de-cancer-cervicouterino-2014-2024&category_slug=sfc-salud-reproductiva-materna-y-neonatal-global-y-regional&Itemid=518)
- World Health Organization: Noncommunicable Diseases (NCD) Country Profiles, 2018: Guatemala. [https://www.who.int/nmh/countries/2018/gtm\\_en.pdf?ua=1](https://www.who.int/nmh/countries/2018/gtm_en.pdf?ua=1)
- World Health Organization: Cancer Country Profiles, 2014: Guatemala. [https://www.who.int/cancer/country-profiles/gtm\\_en.pdf](https://www.who.int/cancer/country-profiles/gtm_en.pdf)
- Sistema de Información Gerencial de Salud: Proyecciones de población. <https://sigsa.mspas.gob.gt/datos-de-salud/informacion-demografica/proyecciones-de-poblacion>
- Instituto Nacional de Estadística Guatemala: Indicadores: Esperanza de Vida al Nacer. <https://www.ine.gob.gt/ine/poblacion-menu/>
- Lopez MS, Baker ES, Maza M, et al: Cervical cancer prevention and treatment in Latin America. *J Surg Oncol* 115:615-618, 2017
- Ministerio de Salud Pública y Asistencia Social Consejo Nacional de la Lucha Contra el Cáncer: International Cancer Control Partnership. [https://www.iccp-portal.org/system/files/plans/GTM\\_B5\\_4POLITICAS%20NACIONAL%20CONTRA%20EL%20C%3%81NCER.pdf](https://www.iccp-portal.org/system/files/plans/GTM_B5_4POLITICAS%20NACIONAL%20CONTRA%20EL%20C%3%81NCER.pdf)
- Pinto JA, Pinillos L, Villarreal-Garza C, et al: Barriers in Latin America for the management of locally advanced breast cancer. *Ecancermedicallscience* 13:897, 2019
- Flood D, Chary A, Austad K, et al: Patient navigation and access to cancer care in Guatemala. *J Glob Oncol* 4:1-3, 2018
- Sankaranarayanan R, Nene BM, Shastri SS, et al: HPV screening for cervical cancer in rural India. *N Engl J Med* 360:1385-1394, 2009
- Landy R, Pesola F, Castañón A, et al: Impact of cervical screening on cervical cancer mortality: Estimation using stage-specific results from a nested case-control study. *Br J Cancer* 115:1140-1146, 2016
- Dickinson JA, Stankiewicz A, Popadiuk C, et al: Reduced cervical cancer incidence and mortality in Canada: National data from 1932 to 2006. *BMC Public Health* 12:992, 2012
- Lewis MJ: A Situational Analysis of Cervical Cancer: Latin America & the Caribbean. Washington, DC, Pan American Health Organization, 2004
- Miller JW, Royalty J, Henley J, et al: Breast and cervical cancers diagnosed and stage at diagnosis among women served through the National Breast and Cervical Cancer Early Detection Program. *Cancer Causes Control* 26:741-747, 2015 [Erratum: *Cancer Causes Control*, 2015]

