Available online at www.sciencedirect.com

Public Health

journal homepage: www.elsevier.com/puhe

Original Research

Exploring disparities in incidence and mortality rates of breast and gynecologic cancers according to the Human Development Index in the Pan-American region

J. Martínez-Mesa [a,b,*], G. Werutsky [b], S. Michiels [c], C.A.S. Pereira Filho [d,b], A. Dueñas-González [e,b], J.J. Zarba [f,b], M. Mano [g,b], C. Villarreal-Garza [h,i,b], H. Gómez [j,b], C.H. Barrios [k,b]

[a] IMED, School of Medicine, Passo Fundo, RS, Brazil
[b] Latin American Cooperative Oncology Group (LACOG), Porto Alegre, RS, Brazil
[c] Service de Biostatistique et d'Epidémiologie, Gustave Roussy, Univ. Paris-Saclay, Univ. Paris-Sud, UVSQ, CESP, INSERM, Villejuif, France
[d] Clínica AMO, Brazil
[e] Instituto de Investigaciones Biomédicas UNAM, Mexico
[f] Hospital Zenon Santillan, Tucuman, Argentina
[g] Intituto do Cancer do Estado de Sao Paulo (ICESP), University of São Paulo (USP), Brazil
[h] Instituto Nacional de Cancerología, Mexico
[i] Centro de Mama, Tecnológico de Monterrey, Mexico
[j] Instituto Nacional de Enfermedades Neoplásicas, Peru
[k] Department of Medicine, PUCRS School of Medicine, Brazil

ARTICLE INFO

Article history:
Received 7 February 2017
Received in revised form
29 March 2017
Accepted 19 April 2017
Available online 1 June 2017

Keywords:
Breast neoplasms
Genital neoplasm
Female
Epidemiology
Gynecology
Incidence
Mortality
Human Development Index

ABSTRACT

Objective: To evaluate whether a country's Human Development Index (HDI) can help explain the differences in the country's breast cancer and gynecological cancer incidence and mortality rates in the Pan-American region.
Study design: Ecological analysis.
Methods: Pan-American region countries with publicly available data both in GLOBOCAN 2012 and the United Nations Development Report 2012 were included ($n = 28$). Incidence and mortality rates age-standardized per 100,000 were natural log-transformed for breast cancer, ovarian cancer, corpus uteri cancer, and cervical cancer. The mortality-to-incidence ratio (MIR) was calculated for each site. Pearson's correlation test and a simple linear regression were performed.
Results: The HDI showed a positive correlation with breast cancer and ovarian cancer incidence and mortality rates, respectively, and a negative correlation with cervical cancer incidence and mortality rates. The HDI and corpus uteri cancer showed no association. MIR and the HDI showed a negative correlation for all tumor types except ovarian cancer. An increment in 1 HDI unit leads to changes in cancer rates: in breast cancer incidence $\beta = 4.03$ (95% confidence interval [CI] 2.61; 5.45) $P < 0.001$, breast cancer mortality $\beta = 1.76$ (95% CI

* *Corresponding author*. IMED School of Medicine, Rua Senador Pinheiro, 304, Passo Fundo, RS CEP: 99070-220, Brazil.
E-mail address: jeovanymm@gmail.com (J. Martínez-Mesa).
http://dx.doi.org/10.1016/j.puhe.2017.04.017

0.32; 3.21) $P = 0.019$, and breast cancer-MIR $\beta = -0.705$ (95% CI 0.704; 0.706) $P < 0.001$; in cervical cancer incidence $\beta = -3.28$ (95% CI −4.78; −1.78) $P < 0.001$, cervical cancer mortality $\beta = -4.63$ (95% CI −6.10; −3.17) $P < 0.001$, and cervical cancer-MIR $\beta = -1.35$ (95% CI −1.83; −0.87) $P < 0.001$; in ovarian cancer incidence $\beta = 3.26$ (95% CI 1.78; 4.75) $P < 0.001$, ovarian cancer mortality $\beta = 1.82$ (95% CI 0.44; 3.20) $P = 0.012$, and ovarian cancer-MIR $\beta = 5.10$ (95% CI 3.22; 6.97) $P < 0.001$; in corpus uteri cancer incidence $\beta = 2.37$ (95% CI −0.33; 5.06) $P = 0.83$, corpus uteri cancer mortality $\beta = 0.68$ (95% CI −2.68; 2.82) $P = 0.96$, and corpus uteri cancer-MIR $\beta = -2.30$ (95% CI −3.19; −1.40) $P < 0.001$.

Conclusions: A country's HDI should be considered to understand disparities in breast cancer and gynecological cancer in the Pan-American region.

Introduction

Breast cancer and gynecological cancer are considered global public health problems. Breast cancer is the first and cervical cancer the fourth most common cancer in women. A large majority (85%) of the global cancer burden occurs in less developed regions and the vast majority of cancer deaths occur in low- and middle-income countries where screening, prevention, and treatment are almost non-existent and where vaccination against human papillomavirus (HPV) needs to take hold.[1]

According to GLOBOCAN 2012,[2,3] age-standardized incidence and mortality rates per 100,000 women worldwide are 43.3 and 12.9 for breast cancer; 14.0 and 6.8 for cervical cancer; 8.3 and 1.8 for corpus uteri cancer; and 6.1 and 3.8 for ovarian cancer. These rates are higher among women in the Pan-American region countries: breast cancer 67.6 and 14.0; cervical cancer 14.9 and 5.8; corpus uteri cancer 12.3 and 2.0; and ovarian cancer 6.8 and 4.3, respectively.[2,3]

Early detection of breast cancer and cervical cancer increases the chances of a cure and enhance quality of life. Further, recognition of cancer risk factors such as infection with HPV for cervical cancer[4] and BRCA1/BRCA2 mutation carriers for breast cancer and ovarian cancer[5] is extremely important to implement preventive measures and risk-reducing therapeutic strategies.

However, macro-level factors may influence cancer estimates such as access, coverage, and utilization of screening programs, accurate and timeless diagnosis, and optimal treatments. From an economic perspective, Ades et al. showed that European countries with the highest health expenditures have the lowest mortality-to-incidence ratios (MIRs).[6] Some studies suggest that MIRs could be considered as a surrogate measure of health system effectiveness.[7] MIR has been proposed as an indirect cancer lethality measure due to true biological differences in disease phenotype or health system–related attributes, including screening, diagnostic modalities, treatment, and follow-up,[7–10] and to evaluate survival and racial disparities.[8,11] It can serve as a tool to measure the proficiency of diagnosing and effectively treating cancer in each country.

On the other hand, the Human Development Index (HDI) was developed and implemented by the United Nations to rank countries according to levels of social and economic development. The United Nation constructs this complex score by considering the following criteria: life expectancy at birth, mean years of schooling, expected years of schooling, and gross national income per capita.[12]

Using ecological design, we aim to evaluate the association between breast cancer and gynecological cancer rates and a country's HDI to try to understand the inequalities in cancer care in the Pan-American region.

Methods

The Pan-American region includes countries from North, South, and Central America and the Caribbean. A total of 48 countries are members of the Pan-American region.[13] In this context, the Pan-American region has major socio-economic and health care differences between countries. For instance, in terms of the HDI 2012 global rank, the United States and Canada occupy the 3rd and 11th places, whereas Nicaragua, Guatemala, and Haiti are in positions 129, 133, and 161, respectively.[12]

This study is an ecological analysis. Pan-American countries with publicly available data in both GLOBOCAN 2012[2] and the United Nations Development Report 2012[12] were included ($n = 28$): Argentina (ARG), Bahamas (BHS), Barbados (BRB), Belize (BLZ), Bolivia (BOL), Brazil (BRA), Canada (CAN), Chile (CHL), Colombia (COL), Costa Rica (CRI), Cuba (CUB), Dominican Republic (DOM), Ecuador (ECU), El Salvador (SLV), Guatemala (GTM), Guyana (GUY), Haiti (HTI), Honduras (HND), Jamaica (JAM), Mexico (MEX), Nicaragua (NIC), Panama (PAN), Paraguay (PRY), Peru (PER), Trinidad and Tobago (TTO), the United States of America (USA), Uruguay (URY), and Venezuela (VEN). We used three letter abbreviations reflecting the country codes of the International Organization for Standardization 3166.[14]

Outcomes were age-standardized per 100,000 incidences and mortality rates for breast cancer, ovarian cancer, corpus uteri cancer, and cervical cancer and were extracted from GLOBOCAN 2012.[2] MIRs were calculated using age-standardized mortality and incidence rates for each tumor. Because of strong skewness of the outcomes, all statistical analyses included a natural logarithmic data transformation. All outcomes were evaluated as continuous variables.