

Cancer Burden in Latin America and the Caribbean

Maria Paula Curado, MD, PhD, and Dyego Leandro Bezerra de Souza, DDS, PhD

ABSTRACT

Background: In Latin America and the Caribbean, the epidemiological transition has been occurring in an unequal manner. Infectious-contagious diseases share space with the increase of chronic nontransmissible diseases, such as cancer, which already represents the second most common cause of death, after cardiovascular illnesses.

Objectives: This study provides a global picture of the burden of cancer in Latin America and the Caribbean, as well as the challenges faced when controlling this disease in these regions.

Findings: Epidemiological information on cancer in Latin America originates mainly from mortality registries and from a limited number of population-based cancer registries. Estimates indicate increases of 72% in the incidence of cancer and 78% in the mortality of men between 2012 and 2030, and for women the rates are 62% and 74%, respectively. These increases in incidence rates, accompanied by disproportionately high mortality rates, when compared with other regions of the world, reveal the magnitude of the challenge of controlling cancer in Latin America and the Caribbean. Although neoplasms are among the main causes of death, the control strategies are faced with issues such as organization and development of the health system, and the public policy formulation mechanism.

Conclusions: Establishing knowledge on the real impact of incidence, mortality, and survival in Latin America and the Caribbean is quite a challenge due to the lack of an updated and dynamic information system on mortality and incidence, although some improvement has been made in the information systems of some countries within the most recent decade. Other obstacles for cancer control are the uneven allocation of resources, lack of investments in equipment and infrastructure, and the concentration of health care professionals in large urban centers, which contribute to the reproduction of socioeconomic inequities in the assistance of populations that suffer from cancer.

Key Words: cancer, incidence, Latin America, mortality

© 2014 Icahn School of Medicine at Mount Sinai. *Annals of Global Health* 2014;80:370-377

INTRODUCTION

In recent decades, Latin America and the Caribbean have been undergoing political, economic, and social transformations that have caused changes in the morbidity and mortality profile of the population. In these countries, the epidemiological transition has been occurring in an unequal manner, which causes infectious-contagious diseases to share space with the increase of nontransmissible chronic diseases, such as cancer, which already represents the second most common cause of death, the first being cardiovascular

illnesses, in many countries.^{1,2} Nontransmissible chronic diseases such as cardiovascular disease, diabetes, and cancer, are responsible for 69% of deaths in Latin America.³ The burden of nontransmissible chronic diseases often is accompanied by a significant economic impact for governments.⁴

The description of the geographic distribution of cancer incidence identifies the profile of the population and, consequently, its quality-of-life standards. The increase in cancer burden in the future can occur due to changes in the population exposed to risk as well as due to an increase in population, and to modifications in the age-group distribution of this population.⁵⁻⁸ Population growth estimates indicate increases in total population and changes in the distribution of age groups in the populations of Latin America and the Caribbean. The aging process, reduction of fertility, and increase in life expectancy has been accelerated in most Latin American countries. Until the 1960s, the demographic characteristics showed young countries, with high fertility rates; however, the 1960s brought a process of demographic

2214-9996/© 2014 Icahn School of Medicine at Mount Sinai

From the International Prevention Research Institute, Lyon, France (MPC); Goiânia Population-Based Cancer Registry, Goiás, Brazil (MPC); Collective Health Department, Federal University of Rio Grande do Norte, Natal, Brazil (DLBDS). Address correspondence to M.P.C.; e-mail: maria-paula.curado@i-pri.org

The authors declare they have no conflicts of interest.

<http://dx.doi.org/10.1016/j.aogh.2014.09.009>

transition and aging, which was not followed by social and economic development to assist the new rising demands for health services.^{9,10}

The epidemiological information on cancer in Latin America originates mainly from mortality registries and from a limited number of population-based cancer registries (PBCRs) that present reliable data. Therefore, incidence data are still limited to specific populations. Only 6% of the Latin American population is covered by PBCRs compared with 96% of the US population and 32% of the European population.¹¹

Within this perspective, the objective of this study was to describe the epidemiological situation of cancer in Latin America, through comparison with international data. Mortality data were obtained from the web page of the World Health Organization (WHO) and from GLOBOCAN, available on the web page of the International Agency for Research on Cancer (IARC). The IARC gathers incidence data from PBCRs of several countries since 1959, through the publication *Cancer Incidence in Five Continents*.¹² This study provides a global picture of the burden of cancer in Latin America and the Caribbean, as well as the challenges faced when controlling this disease in these regions.

INCREASE OF CANCER BURDEN IN LATIN AMERICA AND CARIBBEAN

In 2012, approximately 533,000 new cancer cases and 313,800 deaths from cancer occurred in men in Latin America and the Caribbean, and for the year 2030, estimates indicate an increase of 72% in the incidence and 78% in mortality (917,300 new cases and 557,800 deaths). In women, the incidence increase is estimated at 62% (from 563,000 new cases in 2012 to 914,000 in 2030) and the mortality increase is 74% (from 289,500 deaths in 2012 to 503,700 in 2030).¹³

In the male population, prostate cancer was the most frequently diagnosed cancer, with an adjusted incidence to the world population of 54 cases and 17 deaths per 100,000 inhabitants per year, followed by lung cancer (19 cases and 17 deaths/100,000 inhabitants/year), colorectal cancer (15 cases and 8 deaths/100,000 inhabitants/year), stomach (13 cases and 11 deaths/100,000 inhabitants/year), and liver (7 cases and 6 deaths/100,000 inhabitants/year). In women, the breast is the most common location, with standardized rates of 47 cases and 13 deaths per 100,000 inhabitants per year. Cervical cancer occupies the second position with 22 cases and 9 deaths per 100,000 inhabitants per year. Colorectal cancer follows (13 cases and 7 deaths/100,000 inhabitants/year), then lung (10 cases and 8 deaths/100,000 inhabitants/year), and stomach cancer (7 cases and 6 deaths/100,000 inhabitants/year).¹³

The cancer incidence patterns observed in Latin American and Caribbean countries are directly related to

social and economic inequalities, whereas mortality standards reflect the structure and organization of the health system of each country. Figures 1 and 2 show the spatial distribution of the incidence and mortality rates adjusted to the world standard population. Incidence for all cancers (except nonmelanoma skin cancer: ICD code C44) in men and women is higher in more developed regions such as Uruguay, Brazil, Barbados, and Martinique, whereas the lowest rates are found in less-developed countries such as Haiti and Nicaragua. Regarding mortality, the rates are higher in men than in women and the highest rates are found in countries providing low coverage of the public health system (Paraguay, Uruguay, and Guyana).^{14,15} However, data presented in the figures must be analyzed with caution because they reliability vary depending on the origin country. In Brazil, for example, incidence data are high quality because they are supplied by PBCRs, although with low coverage of population, and therefore it is not possible to establish differences between urban and rural areas. Bolivia does not present with reliable data, and incidence data presented were estimated using data on relative frequency of different cancers (by age and sex), whereas mortality data originated from national incidence estimates using modeled survival.¹³

The high incidence rates of cancers that are typical of less-developed countries, such as cervical and stomach cancers, occur paradoxically at the same time as increases are verified in the incidence of cancers that are most common in developed countries, such as breast and prostate cancers. Additionally, in young adults, tumors associated with infection, such as the HPV, which are common in developed countries, as well as penile, oropharyngeal, and cervical cancers, are frequent in less-developed regions and in those with low socioeconomic conditions.¹⁶

Lung cancer is still the great villain of incidence and mortality for men, with high rates. This neoplasm presents 80% of cancers caused by tobacco. In Brazil, the consumption prevalence of tobacco has decreased from 30% to 15% with reduced mortality rates, mainly in the southern region of the country.¹⁷ Unfortunately, this decrease in consumption occurred only in men and the effect on women should be seen within the next decade.

The ratio between mortality and incidence in Latin America is 0.59, higher than the European Union (0.43) and the United States (0.35), which reflects better support of cancer treatment in developed countries.¹⁴ However, there are differences that must be mentioned when comparing different Latin American and Caribbean countries. Haiti, Guatemala, Nicaragua, and Honduras present the worst indicators, with a ratio higher than 0.60, whereas Puerto Rico, Barbados, Costa Rica, and Martinique present values less than 0.50 (Fig. 3). These differences must be observed with caution: In Latin American countries, especially those with great territorial extensions, internal differences might exist, which are not revealed through these indicators.

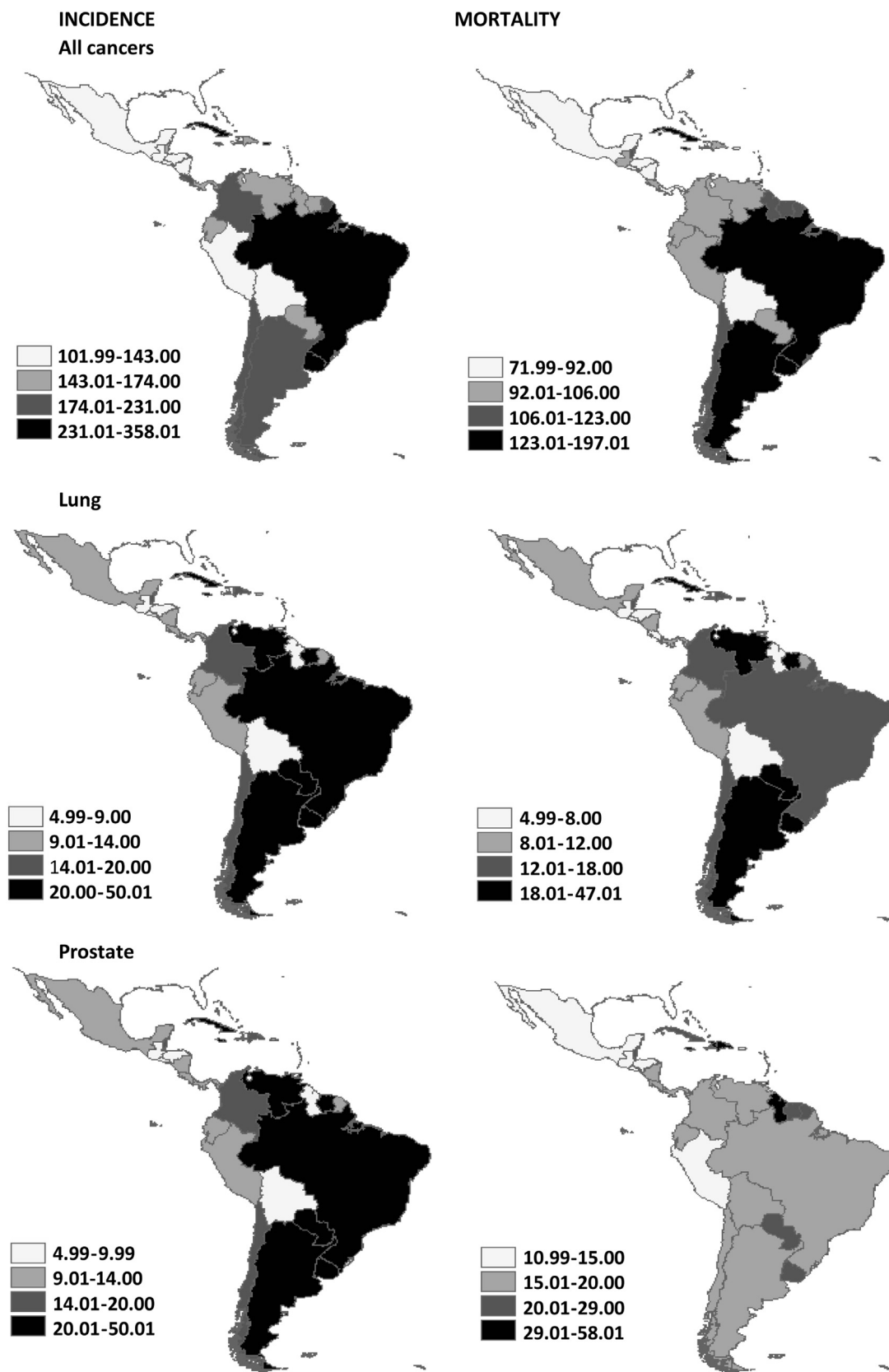


Figure 1. Adjusted rates for cancer incidence and mortality in men for all cancers (except for nonmelanoma skin cancer), lung, and prostate cancers.

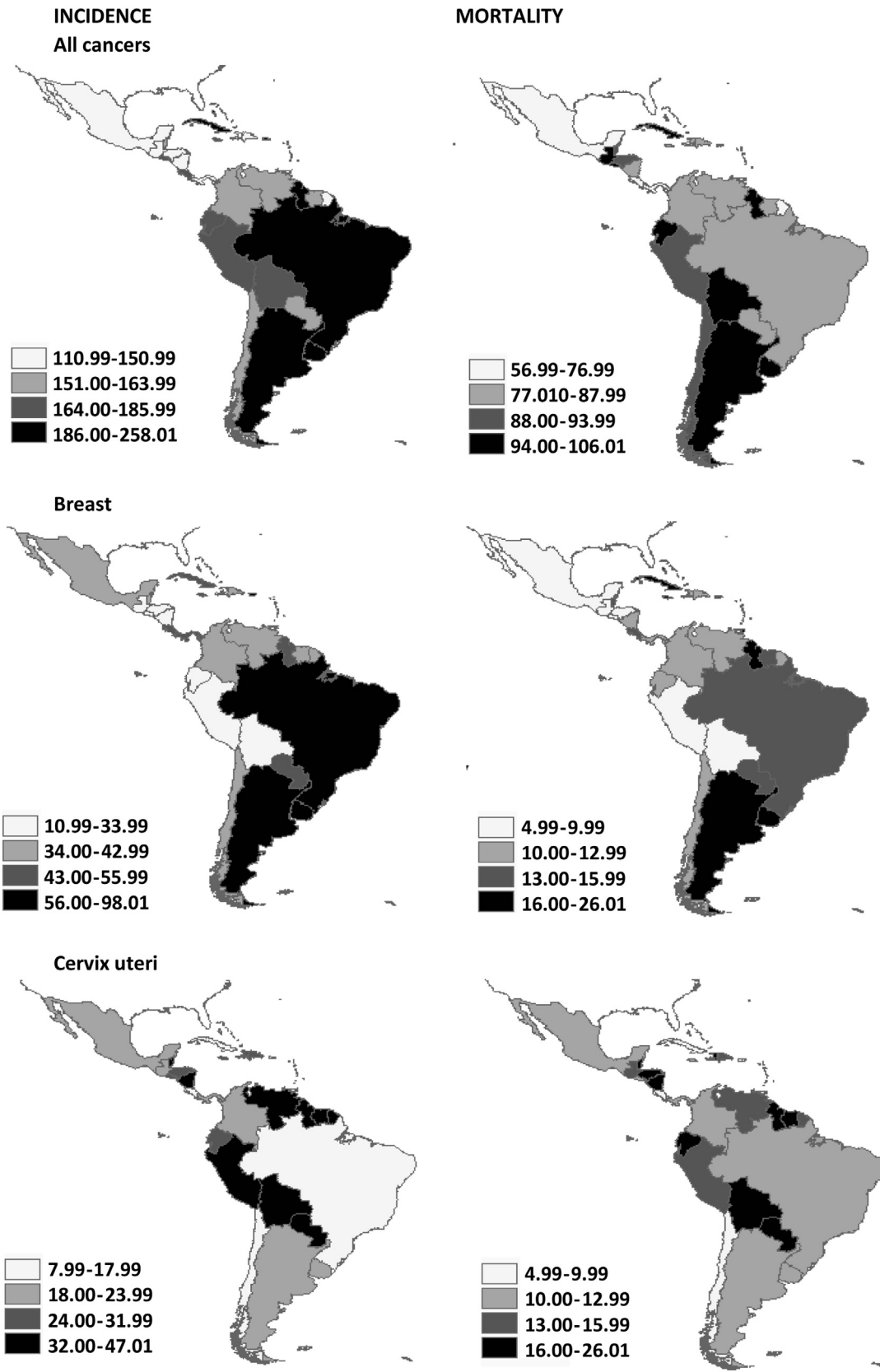


Figure 2. Adjusted rates for cancer incidence and mortality cancer in women for all cancers (except nonmelanoma skin cancers), breast, and cervical cancers.

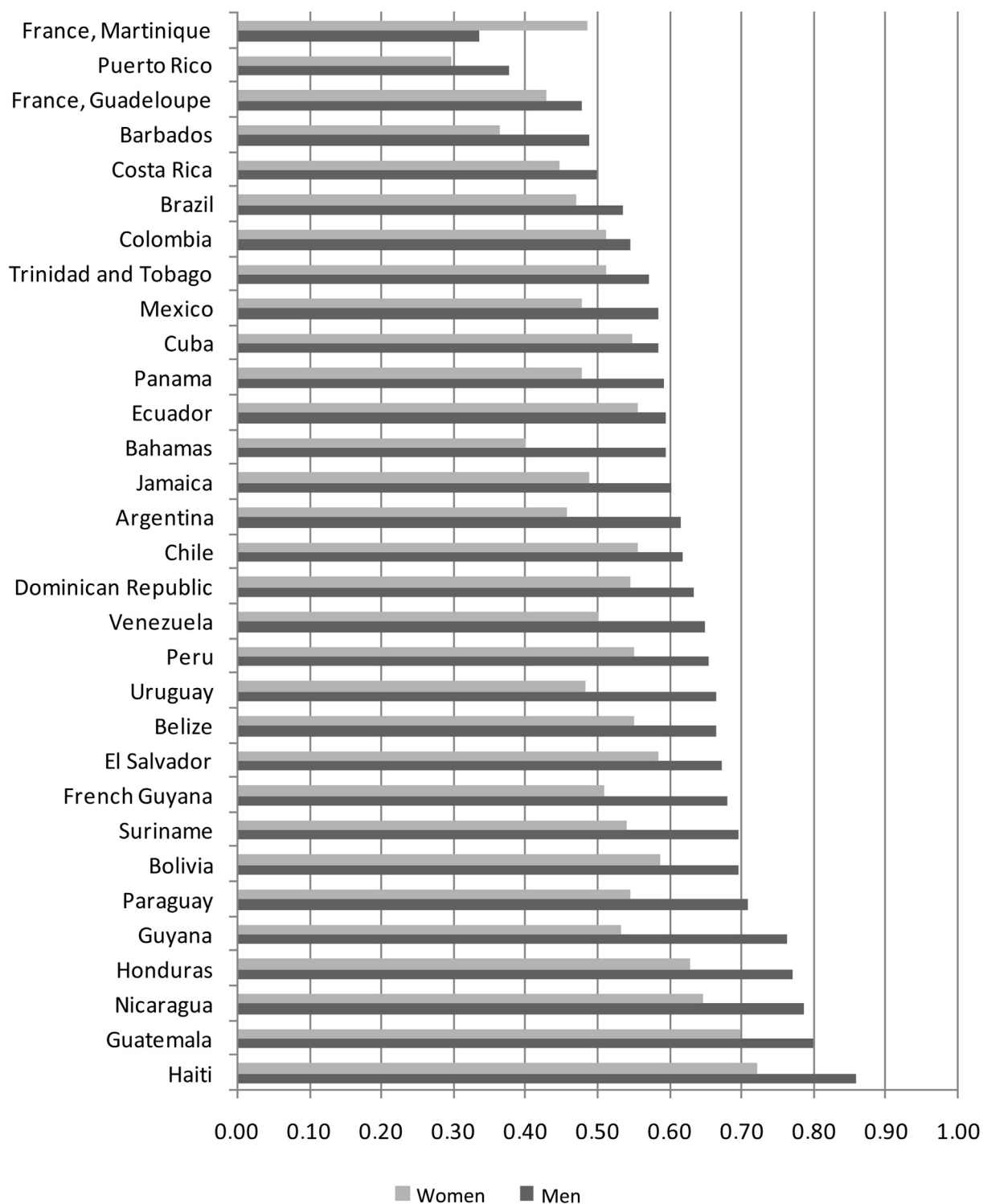


Figure 3. Ratio between overall cancer mortality and incidence in men and women by country.

THE CHALLENGE OF CANCER CONTROL IN LATIN AMERICA AND THE CARIBBEAN: DIFFICULTIES AND ADVANCES

The increase in cancer incidence, accompanied by disproportionately high mortality rates compared with other

regions of the world, reveals the magnitude of the challenge faced by cancer control in Latin America. Although neoplasms are among the main causes of death, the control strategies deal with issues such as the organization and development of health services, public policy formulation mechanisms, and even mobilization of society. One of the consequences of the increases of cancer

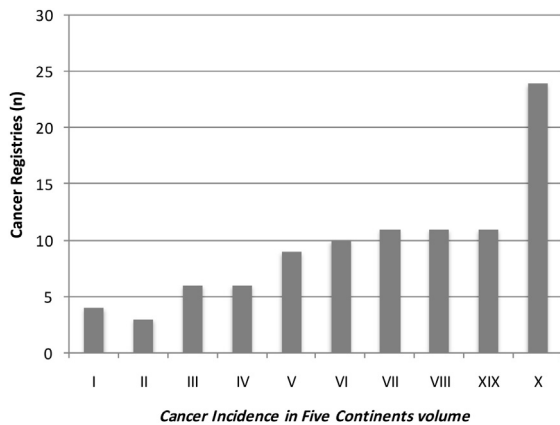


Figure 4. Evolution of the participation of population-based cancer registries of Latin America in the publication *Cancer Incidence in Five Continents*.

incidence and mortality is the increase in economic burden of the disease, which will affect the health systems considerably.^{16,18}

In Latin America, each country has a unique health system, generally with fragmented structures that provide minimal care and sometimes assist only emergencies.^{19,20} Additionally, the current global crisis reverberates on the planning and budget destined to health, and limits the development of health systems. The uneven allocation of resources, the concentration of health care professionals in large urban centers, and the lack of investment in equipment and infrastructure, all lead to the reproduction of the socio-economic inequities in the care of individuals with cancer.¹⁴

The first challenge to Latin American countries that aim to control cancer is the improvement of information systems. The systematic and habitual collection of information, at a national scale, is essential for monitoring, planning, and expanding public policies. Brazil and Mexico have achieved significant improvements in information systems in recent years.²¹ In Brazil, information systems have achieved important levels of detail and amplitude, from administrative and epidemiological points of view. In Chile, there are several regional tumor registries and an established public health delivery program, but data quality could benefit from improvements. The improvements observed in the mortality data within the past 15 years are an example, in addition to the improved quality of information collected by the PBCR. The participation of Latin American cancer registries in this publication is still incipient, as observed in Figure 4. In the most recent volume of *Cancer Incidence in Five Continents*, 25 PBCRs of Latin America and the Caribbean were included, representing 11 of 29 countries of the region, with 6 registries from South America and 5 from the Caribbean. All are regional registries with the exception of Costa Rica, which is national²²—there has been, therefore, an increase in the number of regional registries that for the first time are included as qualified data to measure the effect of incidence on the region, with a limited coverage (38% of the region).

Heterogeneity exists in the health information systems at regional and national levels; Colombia, Argentina, and Venezuela present information systems that are segmented by department, state, or province, with different degrees of disaggregation, which hinders the collection of updated national data.²⁰

Analyses of the trends and projections of incidence and mortality rates is essential to support the planning of public health measures, as well as to control the risk factors that can be modified at short and medium terms, regarding the population's disease burden.²³⁻²⁶ However, discontinuities in the collection of data by the PBCRs in Latin America and the limited coverage of the population has restricted the study of these trends, and consequently, the elaboration of control strategies for the disease.

The absence of survival data and prevalence estimates at population levels is another factor that hinders the establishment of knowledge on the epidemiological reality of cancer in Latin America. Survival data reflect the quality of health services offered for cancer treatment. In Europe, initiatives such as the EURO CARE project, collects data from cancer registries of several countries and allows for a comparison of survival data,²⁷⁻³⁰ which could be followed as an example of collaboration and strengthening of the systematic gathering of information for cancer control. The CONCORD project, which analyzed for the first time cancer survival in the world, included only 2 PBCRs for all of Latin America (1 for Brazil, 1 for Cuba) and highlighted the fragility of the information systems in this region.³¹

In Latin America, there is a concentration of oncology services in large urban centers, as a consequence of extreme internal migration and development of these areas due to regional and local socioeconomic demands. The population of rural areas must travel to large urban centers to receive treatment as well as for appointments with specialists and for diagnostic services. Such difficulties generate delays in diagnosis and treatment of patients, which results in a worse prognosis compared with patients who already live in urban centers. Data from Colombia, Brazil, Mexico, and Peru show that oncology services are concentrated in large cities. In Mexico, for example, there are 20 linear accelerators, 7 of which are located in the capital. In Peru, there are 25 radiotherapy centers, 18 of which are located in Lima, 3 in Arequipa, and 3 in Trujillo. Such inequity in the distribution of services contributes to the migration of patients to large cities, and increases pressure on the reference centers.^{14,32,33} Even within the urban centers, the accelerated and sometimes disordered spatial occupation often results in inequities that are expressed by mortality rates when comparing populations living in misery with those living in more developed areas.^{34,35}

The necessity of organized and planned services, therefore, is paramount for cancer control in these countries. The decentralization of diagnostic services and reference centers for cancer treatment will reduce the access inequities and will configure itself as an important

strategy to face incidence increases. Adequate planning of services must take into account the identification of reference centers, regionalization of treatment, the distances traveled by patients, and the demand volume per treatment.³⁶

Cancer treatment is based on frequent procedures and the additional difficulties caused by the distance traveled to the treatment center generate problems in the adherence to treatment and also to worse prognosis.¹⁸ Although there has been a certain degree of evolution in sanitary assistance, several obstacles still remain when dealing with cancer treatment necessities such as primary prevention, secondary prevention or early detection, diagnosis, treatment, rehabilitation, monitoring of patients, and palliative care.³⁷ A greater number of oncology specialists is required and the distribution of these specialists also occurs in an unequal manner.³⁸⁻⁴¹ Additionally, Latin American authorities and health care professionals must consider that the necessities of the population with cancer go beyond antineoplastic specialized services, and include socioeconomic and cultural needs.

A common obstacle in the majority of Latin American and Caribbean countries is the lack of national health plans that establish public policies for cancer control. The creation of these national health plans would integrate the existing health systems and better assist the complexity of prevention and treatment required by the disease. Countries such as Bolivia, Brazil, Colombia, Costa Rica, Cuba, Honduras, Mexico, Nicaragua, Panama, and Peru already present a national plan or are in the preparation phase. Other countries such as Argentina and Chile present plans directed toward specific tumors (breast cancer). Some countries also have included in their public health politics the prevention of cancer, particularly as strategies for the control of consumption of tobacco and obesity.^{16,42}

Obtaining adequate financing for cancer control is another challenge faced by Latin American and Caribbean countries. Low- and middle-income countries (LMICs) were responsible for 61.3% of all new cancer cases worldwide in 2008, and it is estimated that this percentage will rise to 63.4% in 2020. However, only 6% of the financial expenses for cancer control originate from these countries, and when comparing mortality and incidence rates, it is verified that LMICs present higher mortality rates. LMICs are responsible for 46.1% of the new cancer cases worldwide.⁴³

The budget percentage spent for health in Latin America is generally lower than that of developed countries. However, disparities exist. Bolivia, Dominican Republic, Peru, and Venezuela, for example, spend only 5% of their Gross Domestic Product (GDP) on health, whereas Cuba, Paraguay, and Costa Rica (respectively, 9.99%, 9.71%, and 10.90% of GDP) spend more than Japan (9.5% of GDP). Argentina spends 8.11% of its GDP on health, whereas Brazil, the most populous

country of the region, spends only 6.3%.⁴⁴ Additionally, these health expenditures, in the majority of cases, were concentrated in the private sector. In Mexico in 2008, of the total spent on health, 52% was for the private sector, which covers only 5% of the entire population.⁴³⁻⁴⁶

In addition to the fact that health expenditures are low in many countries, in Latin America, historically these expenditures were mainly aimed at infectious-contagious diseases, leaving nontransmissible chronic diseases, such as cancer, in a secondary position. However, with the changes in lifestyle and increases in life expectancy, the epidemiological transition, although unequal, has led to an increase in cancer incidence and a consequent increase in the demand for specialized services.^{47,48} Such changes occurred in an unbalanced manner, without a planned strategy from the government or the society.

The distribution of the available resources for the implementation of vigilance and control programs for cancer affects the incidence and mortality rates of the population. The high costs of expansion and improvement of treatment and care highlight the value of prevention and early detection. However, the medical costs of cancer care in Latin America are still lower than those in the United States, the United Kingdom, and Japan.¹⁴ Additionally, these countries do not deal with the triple burden of health deterioration that Latin American countries face, represented by the infectious-contagious diseases, nontransmissible chronic diseases, and external causes, which increase the complexity of planning health expenditures.

CONCLUSIONS

Establishing knowledge on the real impact of incidence, mortality, and survival in Latin America and the Caribbean is quite a challenge as no updated or dynamic information system exists. The strategies adopted by the developing countries of Latin America and the Caribbean are emerging slowly, out of rhythm with the increasing socioeconomic development. Monitoring programs offer opportunities for improvement in cervical cancer control, even before HPV vaccine is routinely adopted in all countries.^{49,50}

There is still much to be done in Latin America and the Caribbean to effectively control cancer. Early diagnosis and prevention initiatives are the necessary activities. However, the organization of such actions still requires evaluation, monitoring of results and re-evaluations, through epidemiological population measures of incidence, mortality, and survival.

ACKNOWLEDGMENTS

The authors acknowledge Isabelle Ribeiro Barbosa for support in the preparation of maps.

References

- Comisión Económica para América Latina y el Caribe. América Latina y el Caribe: Envejecimiento de la Población 1950–2050. Boletín Demográfico 2003;72:39–74.
- Bloom DE, Cafiero ET, Jané-Llopis E, et al. The Global Economic Burden of Noncommunicable Diseases. Geneva, Switzerland: World Economic Forum; 2011.
- PAHO. Non-communicable diseases (NCDs) in the Americas: quick facts and figures. Available at: http://new.paho.org/hq/index.php?option=com_docman&task=doc_view&gid=14462&Itemid. Accessed October 2, 2014.
- Bloom D. Breakaway: The Global Burden of Cancer Challenges and Opportunities. A Report from the Economist Intelligence Unit Limited 2009. London: The Economist; 2009.
- Bray F, Moller B. Predicting the future burden of cancer. Nat Rev Cancer 2006;6:63–74.
- Moller B, Fekjaer H, Hakulinen T, et al. Prediction of cancer incidence in the Nordic countries up to the year 2020. Eur J Cancer Prev 2002;11(Suppl 1):S1–96.
- Moller B, Fekjaer H, Hakulinen T, et al. Prediction of cancer incidence in the Nordic countries: empirical comparison of different approaches. Stat Med 2003;17:2751–66.
- de Souza DL, Perez MM, Curado MP. Predicted incidence of oral cavity, oropharyngeal, laryngeal, and hypopharyngeal cancer in Spain and implications for cancer control. Cancer Epidemiol 2011;35:510–4.
- Saad PM, Miller T, Martínez. Impacto de los cambios demográficos en las demandas sectoriales en América Latina. Rev Bras Est Pop 2009;26:237–61.
- Balducci L, Ershler WB. Cancer and aging: a nexus at several levels. Nat Rev Cancer 2005;5:655–62.
- Centers for Disease Control and Prevention. National program of cancer registries. <http://www.cdc.gov/cancer/npcr/about.htm>.
- International Agency for Research on Cancer. Cancer statistics. <http://www.iarc.fr>.
- Ferlay J, Bray F, Pisani P, et al. in GLOBOCAN 2002: Cancer Incidence, Mortality and Prevalence Worldwide. IARC Cancer Base No. 5. version 2.0. Lyon, France: IARC Press; 2004.
- Goss PE, Lee BL, Badovinac-Crnjevic T, et al. Planning cancer control in Latin America and the Caribbean. Lancet Oncol 2013;14:391–436.
- Pan American Health Organization. Health Systems and Social Protection in Health. In: Health in the Americas, 2012 Edition: Regional Volume. Washington DC: Pan American Health Organization; 2012: 205–251.
- Gonzalez-Robledo MC, Gonzalez-Robledo LM, Nigenda G. Formulación de políticas públicas sobre el cáncer de mama en América Latina. Rev Panam Salud Publica 2013;33:183–9.
- Brasil - Ministério da Saúde 2012. VIGITEL BRASIL 2011-Vigilância de fatores de risco e proteção para doenças crônicas por inquérito telefônico. Available at: <http://www.dive.sc.gov.br/conteudos/agrivos/Dant/VIGITEL-2011.pdf>. Accessed October 2, 2014.
- Oliveira EXG, Melo ECP, Pinheiro RS, et al. Acesso à assistência oncológica: mapeamento dos fluxos origem-destino das internações e dos atendimentos ambulatoriais. O caso do câncer de mama. Cad Saúde Pública 2011;27:317–26.
- Londoño JL, Frenk J. Structured pluralism: towards an innovative model for health system reform in Latin America. Health Policy 1997;41:1–36.
- World Health Organization. Health Systems. Available at: http://www.who.int/topics/health_systems/en/. Accessed October 2, 2014.
- Frenk J, Gonzalez-Pier E, Gomez-Dantes O, et al. Comprehensive reform to improve health system performance in Mexico. Lancet 2006;368:1524–34.
- Forman D, Bray F, Brewster DH, et al. Cancer Incidence in Five Continents, Vol. X. Lyon, France: IARC; 2013.
- Jensen OM, Parkin DM, MacLennan R, et al. in Cancer Registration: Principles and Methods. 294. IARC Scientific Publications No. 95. Lyon, France: IARC; 1991.
- Parkin DM. The role of cancer registries in cancer control. Int J Clin Oncol 2008;13:102–11.
- Parkin DM. The evolution of the population-based cancer registry. Nat Rev Cancer 2006;6:603–12.
- Parkin DM, Bray F, Ferlay J, et al. Global cancer statistics, 2002. CA Cancer J Clin 2005;55:74–108.
- EUROCARE. European Cancer Registry Based Study on Survival and Care of Cancer Patients. Available at: <http://www.eurocare.it>. Accessed October 2, 2014.
- Sant M, Aareleid T, Berrino F, et al. EURO CARE-3: survival of cancer patients diagnosed 1990–94: results and commentary. Ann Oncol 2003;14:v61–118.
- Sant M, Allemani C, Santaquilani M, et al. EURO CARE-4. Survival of cancer patients diagnosed in 1995–1999. Results and commentary. Eur J Cancer 2009;45:931–91.
- Verdecchia A, Guzzinati S, Francisci S, et al. Survival trends in European cancer patients diagnosed from 1988 to 1999. Eur J Cancer 2009;45:1042–66.
- Coleman MP, Quaresma M, Berrino F, et al. CONCORD Working Group. Cancer survival in five continents: a worldwide population-based study (CONCORD). Lancet Oncol 2008;9:730–56.
- PAHO. Exclusion in health in Latin America and the Caribbean. Available at: <http://iris.paho.org/xmlui/bitstream/handle/123456789/814/9275124760.pdf?sequence=1>. Accessed October 2, 2014.
- WHO. Why urban health matters. Available at: <http://www.who.int/world-health-day/2010/media/whd2010background.pdf>. Accessed October 2, 2014.
- Kligerman JO. câncer como um indicador de saúde no Brasil. Rev Bras Cancerol 1999;45:5–6.
- Ferreira MA, Gomes MN, Michels FA, et al. Social inequality in morbidity and mortality from oral and oropharyngeal cancer in the city of Sao Paulo, Brazil: 1997-2008. Cad Saude Publica 2012;28:1663–73.
- Knocke D, Kuklinski JH. Network analysis: basic concepts. In: Thompson G, Frances J, Levacic R, Mitchell J, eds. Markets, Hierarchies and Networks: The Coordination of Social Life. London: Sage Publications; 1991:173–82.
- Knaul FM, Alleyne G, Piot P, et al. Health system strengthening and cancer: a diagonal response to the challenge of chronicity. In: Knaul FM, Gralow JR, Atun R, Bhadelia A, eds. Closing the Cancer Divide: An Equity Imperative. Cambridge, MA: Harvard Global Equity Initiative; 2012:79–95.
- Bingham A, Bishop A, Coffey P, et al. Factors affecting utilization of cervical cancer prevention services in low-resource settings. Salud Publica Mex 2003;45(Suppl 3):408–16.
- Cardona JGL. Una propuesta indecente a los posgrados médicos y quirúrgicos en Colombia. Available at: http://www.udea.edu.co/portal/page/portal/bibliotecaSedesDependencias/unidadesAcademicas/FacultadMedicina/BibliotecaDiseno/Archivos/actualidad/Tab/una_propuest_indecete_a_los_posgrados.pdf. Accessed October 2, 2014.
- Rosselli D, Otero A, Heller D, et al. Estimación de la oferta de médicos especialistas en Colombia con el método de captura-recaptura. Rev Panam Salud Publica 2001;9:393–8.
- Dirección General de Gestión del Desarrollo de Recursos Humanos. Necesidades de médicos especialistas para los establecimientos del sector salud. Observatorio Nacional de Recursos Humanos en Salud-Lima: Ministerio de Salud; 2011.
- WHO. World health statistics 2011. Available at: <http://www.who.int/whosis/whostat/2011/en/index.html>. Accessed October 2, 2014.
- Economist Intelligence Unit. Breakaway: the global burden of cancer—challenges and opportunities, 2009. Available at: <http://www.livestrong.org/pdfs/GlobalEconomicImpact>.
- The World Bank. World Bank health nutrition and population statistics database. Available at: <http://data.worldbank.org/data-catalog/health-nutrition-and-population-statistics>. Accessed October 2, 2014.
- Knaul F, Wong R, Arreola-Ornelas H, et al. Household catastrophic health expenditures: a comparative analysis of twelve Latin American and Caribbean Countries. Salud Publica Mex 2011;53(Suppl 2): 85–95.
- Knaul FM, Wong R, Arreola-Ornelas H, eds. Financing health in Latin America: Household Spending and Impoverishment, vol 1. Cambridge, MA: Harvard Global Equity Initiative, Mexican Health Foundation, International Development Research Centre; 2013.
- Paim J, Travassos C, Almeida C, et al. The Brazilian health system: history, advances, and challenges. Lancet 2011;377:1778–97.
- Stuckler D, King L, Robinson H, McKee M. WHO's budgetary allocations and burden of disease: a comparative analysis. Lancet 2008;372:1563–9.
- Almonte M, Murillo R, Inéz Sanchez G, et al. Nuevos paradigmas y desafíos en la prevención y control del cáncer de cuello uterino en América Latina. Salud Publica Mex 2010;52: 544–59.
- Ditzian LR, David-West G, Maza M, et al. Cervical cancer screening in low- and middle-income countries. Mt Sinai J Med 2011;78:319–26.