Available online at www.sciencedirect.com

ScienceDirect

EJSO 44 (2018) 43–52

EJSO the Journal of Cancer Surgery

www.ejso.com

Global variations in the level of cancer-related research activity and correlation to cancer-specific mortality: Proposal for a global curriculum☆

C. Are [a,*], A. Caniglia [b], Mohammed Malik [b], L. Smith [c], Charmaine Cummings [d], Carine Lecoq [e], R. Berman [f], R. Audisio [g], L. Wyld [h]

[a] *Division of Surgical Oncology, Department of Surgery, University of Nebraska Medical Center, Omaha, NE, USA*

[b] *University of Nebraska Medical Center, College of Medicine, Omaha, NE, USA*

[c] *Department of Biostatistics, College of Public Health, University of Nebraska Medical Center, Omaha, NE, USA*

[d] *Society of Surgical Oncology, USA*

[e] *European Society of Surgical Oncology, Belgium*

[f] *Division of Surgical Oncology, Department of Surgery, New York University School of Medicine, New York, NY, USA*

[g] *University of Liverpool, St Helens Teaching Hospital, St Helens, United Kingdom*

[h] *University of Sheffield, Jasmine Centre, Doncaster Royal Infirmary, United Kingdom*

Accepted 30 July 2017

Available online 11 December 2017

Abstract

Introduction: The aim of this study was to analyze global variations in the level of cancer-related research activity and correlate this with cancer-specific mortality.

Methods: The SCOPUS database was explored to obtain data relating to the number of cancer-related publications per country. Cancer-specific mortality rates were obtained from the World Health Organization. Global variations in the level of scholarly activity were analyzed and correlated with variations in cancer-specific mortality.

Results: Data for 142 countries were obtained and significant variations in the level of research activity was noted. The level of research activity increased with rising socio-economic status. The United States was the most prolific country with 222,300 publications followed by Japan and Germany. Several countries in different regions of the world had a low level of research activity. An inverse relationship between the level of research activity and cancer-specific mortality was noted. This relationship persisted even in countries with a low level of research activity. The socioeconomic status of a nation and geographic location (continent) had a mixed influence with an overall apparent correlation with cancer-related research activity.

Conclusion: This study demonstrates significant global variation in the level of cancer-related research activity and a correlation with cancer-specific mortality. The presence of a minimum set of standards for research literacy, as proposed by the European Society of Surgical Oncology and the Society of Surgical Oncology may contribute to enhanced research activity and improve outcomes for cancer patients worldwide.

Keywords: Global cancer research; Variations; Cancer-specific mortality; Cancer research curriculum

☆ The manuscript was approved by the Executive Council of the Society of Surgical Oncology and the European Society of Surgical Oncology in March 2017 for simultaneous publication in the Annals of Surgical Oncology and the European Journal of Surgical Oncology.

* Corresponding author. University of Nebraska Medical Center, Omaha, 68198, NE USA.
E-mail address: care@unmc.edu (C. Are).

http://dx.doi.org/10.1016/j.ejso.2017.07.018

Introduction

The global cancer burden is rising and is the second leading cause of death worldwide. In 2012 there were 14.1 million newly diagnosed cancer cases (excluding non-melanoma skin cancer) worldwide with 8.2 million cancer-related deaths [1]. By 2035, it is predicted that the incidence of newly diagnosed cancer cases will reach 24 million cases annually [2]. Providing the necessary cancer care requires knowledge and familiarity with the most current, evidence-based guidelines and the primary research which underpins them. In addition, improving cancer-specific survival rates requires research across a wide range of disciplines including basic science, translational and outcomes based research. Although much of this research activity is disease specific and transcends geographic issues, national variation in epidemiology, disease patterns and biology, health economic constraints and population variance mean that locally relevant research is essential to optimize care within different countries. With the global cancer burden increasing, delivering evidence-based care that relies upon current research may help to improve cancer-specific outcomes.

Efforts in cancer research have yielded innovative treatment strategies that have led to improved cancer outcomes. Although there are data [3–5] that have highlighted variations in the level of cancer research, there are no data that have assessed variations in the level of cancer-related research activity and its correlation to global cancer-specific mortality. The aim of this study was to determine global variation in the level of cancer-related research activity and correlate this with the rate of cancer-specific mortality at a global level by analyzing data for each individual country. It must be noted that the intent of this paper was not to attribute causality between research activity and cancer-specific outcomes, which are likely to be complex with many confounding factors such as the size of the health economy, variations in academic environment and general health, access to screening and numerous other socio-cultural variables that vary according to the wealth of a nation.

Methods

Information about publications were obtained from the Scopus Database accessed via the University of Nebraska Medical Center [6]. From the Scopus homepage; “cancer” was entered into the search field to identify publications only related to cancer. The search covered the period between 2000 and 2012. The “Life Sciences” and “Health Sciences” boxes were selected (leaving the Physical Sciences and Social Sciences boxes unmarked). The years 2000–2012 were chosen to synchronize with the same time period for which cancer-specific mortality data was available in the World Health Organization (WHO) database. Selecting “Medicine” under the Subject area, as well as “Article” and “Review” under the Document type further refined the search. From the “analyze search results” tab and subsequent “Document type” tab the total number of publications and the percentages of articles and reviews was obtained. The “Country/Territory” tab held data for the number of documents published per country. There were a total of 53,069 documents published under “cancer” that were not linked to a country and these were excluded from analysis.

Cancer mortality information was obtained from the WHO: Global Health Observatory data repository [7]. These data are presented as age-standardized mortality rate for malignant neoplasms per 100,000 population. Gender specific data was also available for the years 2000–2012 and was included in the study. The age standardized mortality rates for the years 2000–2012 were compared to detect any positive or negative trends over this period. This difference in mortality (negative or positive) for each country was documented and correlated with the data relating to the number of publications. Countries for which data on mortality did not exist in the WHO database were excluded from analysis.

Cancer-specific mortality and cancer-related publication volume per individual country were analyzed to determine any correlation by using the Spearman correlation coefficient [8]. The Spearman correlation coefficient is a non-parametric statistical measure of the monotonic relationship between paired data that does not follow a normalized distribution. The differences in cancer-related mortality for each country were ranked in descending order, with the most positive value being assigned a rank value of “1”. Likewise, the number of cancer publications were ranked in descending order, with highest number of publications being assigned a rank value of “1”. The rank values for the data sets were then correlated using Microsoft Excel, and a Spearman coefficient was obtained. Coefficients ranged between −1 and +1, with 0.00–0.19 representing “very weak” correlation, 0.20–0.39 representing “weak” correlation, 0.40–0.59 representing “moderate” correlation, 0.60–0.79 representing “strong” correlation, and 0.80–1.00 representing “very strong” correlation [8].

Subset analysis corrected for socioeconomic status (based on the Human Development Index- HDI) and geography (continents and WHO regions) [9,10] was also performed. The HDI information was obtained from the United Nations Development Programme: Human Development Reports [11]. The HDI is the geometric mean of normalized indices for three dimensions: life expectancy at birth, mean years of schooling, and gross national income per capita. Based on these dimensions, countries are divided into four categories: Very High Human Development Index (VHHDI), High Human Development Index (HHDI), Medium Human Development Index (MHDI) and Low Human Development Index (LHDI) [12]. The WHO divides the world into six regions: Africa (AFRO), the Americas (PAHO), South-East Asia (SEARO), Europe