2-8-2018

Global Survey of Clinical Oncology Workforce

Aju Mathew
University of Kentucky, aju.mathew@uky.edu

Digital Object Identifier (DOI)
https://doi.org/10.1200/JGO.17.00188

original report

Global Survey of Clinical Oncology Workforce

abstract

A lack of well-trained clinical oncologists can result in significant cancer health disparities. The magnitude of this problem around the world is poorly described in the literature. A comprehensive global survey of the clinical oncology workforce was conducted. Data on the number of clinical oncologists in 93 countries were obtained from 30 references. The mortality-to-incidence ratio was estimated by using data on incidence and mortality rates from the GLOBOCAN 2012 database; the ratio was > 70% in 26 countries (28%), which included 21 countries in Africa (66%) and five countries in Asia (26%). Eight countries had no clinical oncologist available to provide care for patients with cancer. In 22 countries (24%), a clinical oncologist would provide care for < 150 patients with a new diagnosis of cancer. In 39 countries (42%), a clinical oncologist would provide care for > 500 patients with cancer. In 27 countries (29%), a clinical oncologist would provide care for > 1,000 incident cancers, of which 25 were in Africa, two were in Asia, and none were in Europe or the Americas. The economic and social development status of a country correlates closely with the burden of cancer and the shortage of human resources. Addressing the shortage of clinical oncologists in regions with a critical need will help these countries meet the sustainable development goals for noncommunicable diseases by 2030.

J Glob Oncol 4. © 2018 by American Society of Clinical Oncology

INTRODUCTION

Globally, cancer is the second leading cause of death.[1] Although we know that cancer mortality rates are dropping in United States, even within the country, glaring cancer health disparities exist.[2] In countries with less advanced health care facilities, cancer incidence and mortality continues to rise.[1] In most of these regions, the mortality-to-incidence ratio is distressingly high, resulting in a profound burden on public health and the economy. Cancer accounts for > 200 million disability-adjusted life years worldwide.[3]

A lack of access to resources to diagnose and treat cancer is a major hindrance to the equitable delivery of cancer care. In several regions of the world, access to cancer prevention and early diagnosis are suboptimal. The poor quality of cancer registries in low and middle-income countries results in a glaring knowledge deficit that adversely impacts cancer health care delivery. Access to affordable cancer treatment using chemotherapy, targeted therapy, or radiotherapy is another major impediment to global cancer control. In addition to these tremendous challenges, inadequate availability of health care professionals contributes to cancer health disparities. A shortage of > 2,300 medical oncologists in the United States is anticipated in 2025.[4] It is an undeniable fact that there is a profound shortage of oncologists in several parts of the world; however, the magnitude of this problem is poorly described in the literature. The aim of this study was to survey and describe the availability of clinical oncologists around the world.

METHODS

Articles that provided data on the number of clinical oncologists that were published after January 1, 2007, and that provided data over any time period during the last 10 years were identified by using searches on PubMed and Google Scholar. In addition, searches were performed on professional society Web sites, documents, and government records that were obtained from the ministry of health Web sites of various countries. Data obtained from professional societies, government or health authority sources, research surveys, and expert opinions were considered to be valid for the purpose of this study. If there are multiple sources of data for a specific country, the most recent data were used if the source was deemed to be more reliable than the previous one. Because a nonsystematic search was conducted, a flow diagram will not be reported.

Aju Mathew

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

Corresponding author: Aju Mathew MD, MPhil, FACP, University of Kentucky, 800 Rose St, CC452, Lexington, KY 40536; e-mail: aju.mathew@uky.edu.

Given the nature of the research question, such a search strategy is not expected to impact the validity of the study findings.

To obtain estimates on cancer incidence and mortality rates at the country level, the GLOBOCAN model—produced by International Agency for Research on Cancer—was used.[5] It provides estimates on cancer incidence and mortality for 2012. The ratio of newly diagnosed patients with cancer per clinical oncologist was ascertained for each country. For the purpose of this study, the mortality-to-incidence ratio was computed from the incidence and mortality estimates for 2012 provided by the GLOBOCAN model. The economic status of countries was classified into low-, lower middle-, upper middle-, and high-income groups on the basis of gross national income by per capita calculated by using the World Bank Atlas method.[6] The social development of a country was defined by the Sociodemographic Index (SDI), which was derived from measures of education, income, and fertility, and classified into low, low-middle, middle, high-middle, and high SDI categories.[3]

RESULTS

Data on the number of clinical oncologists were obtained for 93 countries from 30 unique references[7-36] (Tables 1 and 2). It included 32 countries in Africa, 21 from Asia and Australia, 31 from Europe, and nine from North and South America.

Economic Status and SDI

The economic status of 20 countries was categorized as low income, and 19 were categorized as low SDI. Two countries were categorized as low economic income but had low-middle SDI (Zimbabwe and Nepal). Two countries that were categorized as low SDI were deemed lower middle–income countries using the World Bank definition (Cote d'Ivoire and Mauritania).

Mortality-to-Incidence Ratio

The mortality-to-incidence ratio was > 70% in 26 countries (28%) and < 50% in 23 (25%). In Africa, the mortality-to-incidence ratio was > 70% in 21 countries (66%) and < 50% in none. In Asia, the mortality-to-incidence ratio was > 70% in five countries (26%) and < 50% in three (16%). The mortality-to-incidence ratio was > 70% in none of the countries in Europe or the Americas. The mortality-to-incidence ratio was > 50% in 13 countries (42%) in Europe and seven countries (100%) in South America.

Ratio of New Diagnosed Patients With Cancer Per Clinical Oncologist

There were eight countries with no clinical oncologist available to provide care for patients with cancer (Fig 1). In 22 countries (24%), a clinical oncologist would provide care for < 150 patients with a new diagnosis of cancer. In 39 countries (42%), a clinical oncologist would provide care for > 500 patients with cancer, of which 26 countries were in Africa (81%), nine were in Asia (47%), two were in Europe (6%), and two were in South America (29%). An extreme shortage of clinical oncologists—> 1,000 incident cancers per clinical oncologist—existed in 25 countries in Africa (78%) and two countries (11%) in Asia. None of the countries in Europe or North or South America faced such an extreme shortage of clinical oncologists.

DISCUSSION

This study identifies significant disparity in the availability of clinical oncologists among the 93 countries surveyed. To my knowledge, this is the most comprehensive survey of the clinical oncology workforce in the world. In addition to highlighting the critical burden of cancer in Africa, the study identifies an extreme shortage of clinical oncologists on the continent as well. The situation was only slightly better in Asia. Compared with the burden of cancer in Africa and Asia, the situation in Europe and the Americas seems to be better; however, there are major disparities among the countries on these continents too. The majority of countries in South America had a mortality-to-incidence ratio of > 50%. Similarly, 42% of countries in Europe had a mortality-to-incidence ratio of > 50%; however, compared with Africa and Asia, the availability of the clinical oncology workforce seems to be better in Europe and North and South America.

This global survey study has several limitations. Although the study is comprehensive and provides data for 93 countries, there are no data on the number of clinical oncologists for several countries; however, previous studies on the

Table 1. Availability of the Clinical Oncology Workforce

Region/Country	Sociodemographic Index	Economic Status	Annual Cancer Incidence, No.	Annual Cancer Mortality, No.	Mortality-to-Incidence Ratio	No. of Clinical Oncologists	Ratio of New Cancer Cases Per Clinical Oncologist
Africa							
Angola	Low-middle	UMI	10,000	7,200	0.72	24	417
Benin	Low	LI	5,000	3,800	0.76	4	1,250
Botswana	Middle	UMI	1,600	1,000	0.63	6	267
Burkina Faso	Low	LI	7,800	6,200	0.79	3	2,600
Burundi	Low	LI	7,000	5,700	0.81	0	No oncologist
Central African Republic	Low	LI	2,800	2,200	0.79	0	No oncologist
Chad	Low	LI	6,000	4,700	0.78	0	No oncologist
Cote d'Ivoire	Low	LMI	12,000	9,300	0.78	4	3,000
Democratic Republic of Congo	Low	LI	37,000	31,000	0.84	4	9,250
Egypt	Middle	LMI	115,000	72,000	0.63	1,500	77
Ethiopia	Low	LI	61,000	45,000	0.74	6	10,167
Gabon	Middle	UMI	1,000	620	0.62	4	250
Ghana	Low-middle	LMI	16,000	11,000	0.69	10	1,600
Kenya	Low-middle	LMI	41,000	28,000	0.68	6	6,833
Malawi	Low	LI	15,000	11,000	0.73	1	15,000
Mali	Low	LI	9,000	7,000	0.78	2	4,500
Mauritania	Low	LMI	1,800	1,300	0.72	1	1,800
Mauritius	High-middle	UMI	2,600	1,500	0.58	11	236
Morocco	Low-middle	LMI	35,000	23,000	0.66	28	1,250
Mozambique	Low	LI	22,000	17,000	0.77	4	5,500
Namibia	Middle	UMI	1,300	800	0.62	4	325
Nigeria	Low-middle	LMI	102,000	72,000	0.71	26	3,923
Rwanda	Low	LI	8,300	6,200	0.75	0	No oncologist
Senegal	Low	LI	6,800	4,900	0.72	12	567
Sierra Leone	Low	LI	2,800	2,200	0.79	0	No oncologist
South Africa	Middle	UMI	77,000	47,000	0.61	40	1,925
South Sudan	Low	LI	8,700	6,600	0.76	0	No oncologist
Tanzania	Low-middle	LI	34,000	24,000	0.71	6	5,667
Togo	Low	LI	3,700	2,800	0.76	0	No oncologist
Uganda	Low	LI	29,000	22,000	0.76	6	4,833
Zambia	Low-middle	LMI	11,000	7,500	0.68	5	2,200
Zimbabwe	Low-middle	LI	16,000	11,000	0.69	4	4,000
Asia							
Afghanistan	Low	LI	20,000	15,000	0.75	0	No oncologist
Bangladesh	Low-middle	LMI	123,000	91,000	0.74	150	820
Bhutan	Low-middle	LMI	500	380	0.76	2	250
China	Middle	UMI	3,065,000	2,206,000	0.72	25,600	120
Georgia	High-middle	UMI	12,000	7,300	0.61	350	34
India	Middle	LMI	1,015,000	683,000	0.67	1,500	677

(Continued on following page)

Table 1. Availability of the Clinical Oncology Workforce (Continued)

Region/Country	Sociodemographic Index	Economic Status	Annual Cancer Incidence, No.	Annual Cancer Mortality, No.	Mortality-to-Incidence Ratio	No. of Clinical Oncologists	Ratio of New Cancer Cases Per Clinical Oncologist
Indonesia	Middle	LMI	300,000	195,000	0.65	932	322
Iran	High-middle	UMI	85,000	53,000	0.62	325	262
Iraq	Middle	UMI	26,000	17,000	0.65	60	433
Israel	High	HI	29,000	11,000	0.38	250	116
Japan	High	HI	704,000	379,000	0.54	867	812
Kazakhstan	High-middle	UMI	40,000	24,000	0.6	126	317
Lebanon	High-middle	UMI	9,000	4,800	0.53	100	90
Malaysia	High-middle	UMI	37,000	22,000	0.59	64	578
Nepal	Low-middle	LI	19,000	14,000	0.74	45	422
Oman	High-middle	HI	1,500	900	0.6	30	50
Pakistan	Low-middle	LMI	148,000	101,000	0.68	175	846
Philippines	Middle	LMI	98,000	59,000	0.60	242	612
Sri Lanka	High-middle	LMI	24,000	14,000	0.58	18	1,333
Australia							
Australia	High	HI	122,000	43,000	0.35	448	272
New Zealand	High	HI	21,000	9,000	0.43	40	525
Europe							
Austria	High	HI	41,000	20,000	0.49	426	96
Belgium	High	HI	65,000	30,000	0.46	212	307
Bulgaria	High-middle	UMI	32,000	18,000	0.56	90	356
Czech Republic	High	HI	58,000	27,000	0.47	293	198
Denmark	High	HI	36,000	16,000	0.44	156	231
Estonia	High	HI	6,000	3,600	0.6	52	115
Finland	High	HI	28,000	11,000	0.39	208	135
France	High	HI	349,000	155,000	0.44	813	429
Germany	High	HI	494,000	218,000	0.44	2,899	170
Greece	High-middle	HI	41,000	28,000	0.68	336	122
Hungary	High	HI	50,000	30,000	0.6	586	85
Iceland	High	HI	1,500	530	0.35	15	100
Ireland	High	HI	21,000	8,400	0.4	186	113
Italy	High	HI	354,000	170,000	0.48	2,724	130
Latvia	High	HI	10,000	6,000	0.6	72	139
Lithuania	High	HI	15,000	8,300	0.55	86	174
Malta	High-middle	HI	2,000	820	0.41	7	286
The Netherlands	High	HI	93,000	43,000	0.46	348	267
Norway	High	HI	28,000	11,000	0.39	210	133
Poland	High	HI	152,000	95,000	0.63	1,468	103
Portugal	High-middle	HI	49,000	24,000	0.49	256	191
Romania	High-middle	UMI	79,000	48,000	0.61	270	293
Russia	High	UMI	458,000	296,000	0.65	1,700	269
Serbia	High-middle	UMI	42,000	26,000	0.62	54	778
Slovenia	High	HI	11,000	5,900	0.54	31	355

(Continued on following page)

Table 1. Availability of the Clinical Oncology Workforce (Continued)

Region/Country	Sociodemographic Index	Economic Status	Annual Cancer Incidence, No.	Annual Cancer Mortality, No.	Mortality-to-Incidence Ratio	No. of Clinical Oncologists	Ratio of New Cancer Cases Per Clinical Oncologist
Spain	High-middle	HI	216,000	103,000	0.48	1,216	178
Sweden	High	HI	50,000	22,000	0.44	415	120
Switzerland	High	HI	42,000	16,000	0.38	299	140
Turkey	High-middle	UMI	148,000	92,000	0.62	400	370
Ukraine	High-middle	LMI	141,000	87,000	0.62	1,935	73
United Kingdom	High	HI	328,000	158,000	0.49	476	689
North America							
Canada	High	HI	182,000	74,000	0.41	517	352
United States	High	HI	1,604,000	617,000	0.38	11,700	137
South America							
Argentina	High-middle	UMI	115,000	66,000	0.57	400	287
Brazil	High-middle	UMI	438,000	225,000	0.51	2,577	170
Chile	High-middle	HI	40,000	25,000	0.63	60	667
Mexico	High-middle	UMI	148,000	79,000	0.53	352	420
Panama	High-middle	UMI	5,400	2,900	0.54	10	540
Peru	High-Middle	UMI	43,000	26,000	0.60	130	331
Uruguay	High-middle	HI	13,000	9,000	0.69	120	108

Abbreviations: HI, high income; LI, low income; LMI, lower middle income; UMI, upper middle income.

oncology workforce shortage have focused on specific countries or regions and do not provide a global overview of the issue as the current study does.[9,23,25,30,31] Data are collated from different types of sources. Some are from professional societies or government sources; however, some are based on the opinion of experts. Most expert opinions are from individuals who collectively provide the estimates within the purview of a symposium or a survey, but some are individual perspectives that are based on personal experience working in a country. Oncology is not a recognized subspecialty in several countries, and, therefore, accurate estimates are hard to obtain; however, the data on the number of clinical oncologists are for individuals who exclusively care for patients with cancer. In some countries, such as India, it is possible that data on clinical oncologists include radiotherapists, who are more qualified in administering radiation than in prescribing chemotherapy. The training program for clinical oncologists and radiotherapists are different in both duration and scope; therefore, it is possible that the data for such countries are an overestimate. Data on the number of oncologists are collated over a 10-year period. With the exception of three countries, data on number of clinical oncologists are collated over a 5-year period (2011 to 2015). Regardless, it is unlikely that the pattern of the oncology workforce shortage will be any different if the time period was restricted to a single year. Finally, the estimates for annual cancer incidence and mortality that were obtained from GLOBOCAN 2012 could be imprecise as the data are obtained from cancer registries with variable quality. Nevertheless, the incidence and mortality data from GLOBOCAN 2012 is recognized universally as the best estimates on cancer burden currently available in a public domain.

There are several ways that we can improve the situation of the shortage of clinical oncologists. International organizations, such as the WHO and Union for International Cancer Control, and professional societies, such as ASCO and the European Society of Medical Oncology, can collaborate to conduct a global study on the availability of human resources for tackling cancer. Such a study should ideally involve a precise estimation of not just the clinical oncology workforce, but also of radiotherapists and surgical oncologists. An accurate estimation of human resources and the strengthening of cancer

Table 2. Details of the Survey

Region/Country	First Author	Year of Reporting	Type of Data Source	Description of the Type of Clinical Oncologist
Africa				
Angola	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
Benin	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
Botswana	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
Burkina Faso	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
Burundi	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
Cameroon	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
Central African Republic	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
Chad	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
Cote d'Ivoire	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
Democratic Republic of Congo	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
Egypt	Stefan[8]	2013	Expert opinion	Clinical oncologists
Ethiopia	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
Gabon	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
Ghana	Parikh[9]	2014	Expert opinion[a]	Oncologists
Kenya	Morgan[10]	2012	Expert opinion	Medical oncologists
Madagascar	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
Malawi	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
Mali	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
Mauritania	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
Mauritius	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
Morocco	Boutayeb[11]	2013	Health authorities from all cancer centers	Medical oncologists
Mozambique	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
Namibia	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
Niger	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
Nigeria	Parikh[9]	2014	Expert opinion[b]	Oncologists
Republic of Congo	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
Rwanda	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
Senegal	Nelson[7]	2011-2013	Survey of pathologists[c]	Oncologists
Sierra Leone	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
South Africa	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
South Sudan	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
Tanzania	The Foundation for Cancer Care in Tanzania[12]	2014	WHO data[d]	Oncologists
Togo	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
Uganda	Parikh[9]	2014	Expert opinion[e]	Oncologists
Zambia	Nelson[7]	2011-2013	Survey of pathologists	Oncologists
Zimbabwe	Parikh[9]	2014	Expert opinion	Oncologists
Asia				
Afghanistan	Are[13]	2015	Expert opinion[f]	Oncologists
Bangladesh	Parikh[9]	2014	Expert opinion	Oncologists
Bhutan	Parikh[9]	2014	Expert opinion	Oncologists

(Continued on following page)

Table 2. Details of the Survey (Continued)

Region/Country	First Author	Year of Reporting	Type of Data Source	Description of the Type of Clinical Oncologist
China	Yang[14]	2012	Health authorities	Oncologists
Georgia	Silbermann[15]	2015	Expert opinion	Oncologists
India	Parikh[9]	2014	Expert opinion	Oncologists
Indonesia	Awofeso[16]	2011	Expert opinion	Oncologists
Iran	Bayat[17]	2015	Survey of government data and hospitals	Medical oncologists
Iraq	Parikh[9]	2014	Expert opinion	Oncologists
Israel	Efrati[18]	2015	Expert opinion	Oncologists
Japan	Takiguchi[19]	2013	Survey of government designated cancer hospitals	Medical oncologists
Kazakhstan	Silbermann[15]	2013	Expert opinion	Oncologists
Lebanon	Piana[20]	2012	Expert opinion	Medical oncologists
Malaysia	Daily Express[21]	2012	Government data	Clinical oncologists
Nepal	Parikh[9]	2014	Expert opinion	Oncologists
Oman	Parikh[9]	2014	Expert opinion	Oncologists
Pakistan	Parikh[9]	2014	Expert opinion	Oncologists
Philippines	Noh[22]	2016	Professional society[g]	Medical oncologists
Sri Lanka	Parikh[9]	2014	Expert opinion	Oncologists
United Arab Emirates	Parikh[9]	2014	Expert opinion	Oncologists
Australia				
Australia	Australian Institute of Health and Welfare[23]	2015	Government data	Medical oncologists
New Zealand	Bidwell[24]	2009	Government data	Medical oncologists
Europe				
Austria	De Azambuja[25]	2015	Survey from professional societies, health authorities and professionals	Medical oncologists
Belgium	De Azambuja[25]	2015	Survey from professional societies, health authorities and professionals	Medical oncologists
Bulgaria	De Azambuja[25]	2015	Survey from professional societies, health authorities and professionals	Medical oncologists
Czech Republic	Eurostat[26]	2014	Health authorities[h]	
Denmark	Eurostat[26]	2014	Health authorities[h]	
Estonia	Eurostat[26]	2014	Health authorities[h]	
Finland	De Azambuja[25]	2015	Survey from professional societies, health authorities and professionals	Medical oncologists
France	De Azambuja[25]	2015	Survey from professional societies, health authorities and professionals	Medical oncologists
Germany	De Azambuja[25]	2015	Survey from professional societies, health authorities and professionals	Medical oncologists
Greece	Eurostat[26]	2014	Health authorities[h]	

(Continued on following page)

Table 2. Details of the Survey (Continued)

Region/Country	First Author	Year of Reporting	Type of Data Source	Description of the Type of Clinical Oncologist
Hungary	De Azambuja[25]	2015	Survey from professional societies, health authorities and professionals	Medical oncologists
Iceland	Eurostat[26]	2014	Health authorities[h]	
Ireland	Eurostat[26]	2014	Health authorities[h]	
Italy	De Azambuja[25]	2015	Survey from professional societies, health authorities and professionals	Medical oncologists
Latvia	Eurostat[26]	2014	Health authorities[h]	
Lithuania	Eurostat[26]	2014	Health authorities[h]	
Malta	Eurostat[26]	2014	Health authorities[h]	
The Netherlands	De Azambuja[25]	2015	Survey from professional societies, health authorities and professionals	Medical oncologists
Norway	Eurostat[26]	2014	Health authorities[h]	
Poland	Eurostat[26]	2014	Health authorities[h]	
Portugal	De Azambuja[25]	2015	Survey from professional societies, health authorities and professionals	Medical oncologists
Romania	Silbermann[15]	2015	Expert opinion	Medical oncologists
Russia	Russian Society of Clinical Oncology[27]	2011	Professional society[g]	Clinical oncology
Serbia	Eurostat[26]	2014	Health authorities[h]	
Slovenia	Eurostat[26]	2014	Health authorities[h]	
Spain	Rivera[28]	2014	Health authorities	Medical oncologists
Sweden	De Azambuja[25]	2015	Survey from professional societies, health authorities and professionals	Medical oncologists
Switzerland	Eurostat[26]	2014	Health authorities[h]	
Turkey	Artac[36]	2015	Expert opinion	Medical oncologists
Ukraine	Chekhun[29]	2013	Expert opinion based on governmental statistics	Medical oncologists
United Kingdom	De Azambuja[25]	2015	Survey from professional societies, health authorities and professionals	Medical oncologists
North America				
Canada	Canadian Medical Association[30]	2015	Professional society using data from the Canadian Medical Association Masterfile	Medical oncologists
United States	Vose[31]	2015	Professional society using data from American Medical Association Masterfile	Hematology/medical oncologists
South America				
Argentina	Costanzo[32]	2007	Professional society	Medical oncologists
Brazil	Strasser-Weippl[33]	2013	Census	Medical oncologists
Chile	Jimenez de la Jara[34]	2015	Professional society	Medical oncologists
Mexico	Strasser-Weippl[33]	2014	Professional society	Clinical oncologists

(Continued on following page)

Table 2. Details of the Survey (Continued)

Region/Country	First Author	Year of Reporting	Type of Data Source	Description of the Type of Clinical Oncologist
Panama	Strasser-Weippl[33]	2015	Expert opinion	Clinical oncologists
Peru	Goss[35]	2012	Government data	Medical oncologists
Uruguay	Strasser-Weippl[33]	2015	Expert opinion	Oncologists

[a]Nelson[7] provide the number of clinical oncologists as seven.
[b]Nelson[7] provide the number of clinical oncologists as 20.
[c]Data include medical and surgical oncologists.
[d]Nelson[7] provide the number of clinical oncologists as ≥ 10.
[e]Nelson[7] provides the same estimate.
[f]Data are extrapolated from neighboring countries.
[g]Membership in society.
[h]Data on the number of oncologists were obtained from a comprehensive European Union survey. Oncologists include clinical oncologists, pediatric oncologists, medical oncologists, and hemato-oncologists.

registries will be an important step toward reaching the sustainable development goal of reducing noncommunicable disease by one third by 2030. Training programs must be instituted in regions with an extreme shortage of clinical oncologists. Governments in countries with a shortage of clinical oncologists will need to urgently design measures to address challenges within their regions. Nontraditional approaches, such as training and equipping primary care providers and nurses, can be considered in these countries. Countries such as Egypt and India that have a well-established oncology workforce can be tapped to train the health care professionals in their region. Instead of utilizing scholarship programs to train doctors and nurses from low-income countries by sending them to high-income countries, the funds could be used to enhance regional collaborations. Similarly, oncology workforce development can be significantly aided by collaborations between institutions and universities in high- and low-income countries.

The economic status of a country and its social development status correlate closely with the mortality-to-incidence ratio and the availability of clinical oncologists. Of these three, improving the human resource capacity of a country would be a low-hanging fruit for the global oncology community. Increasing the availability of clinical oncologists may not improve the quality of cancer care. Nevertheless, easier access to a trained health care professional will positively influence the society. Patients will likely be diagnosed at an earlier stage. Various precancerous conditions can be diagnosed and managed effectively. Curable cancers will be treated with

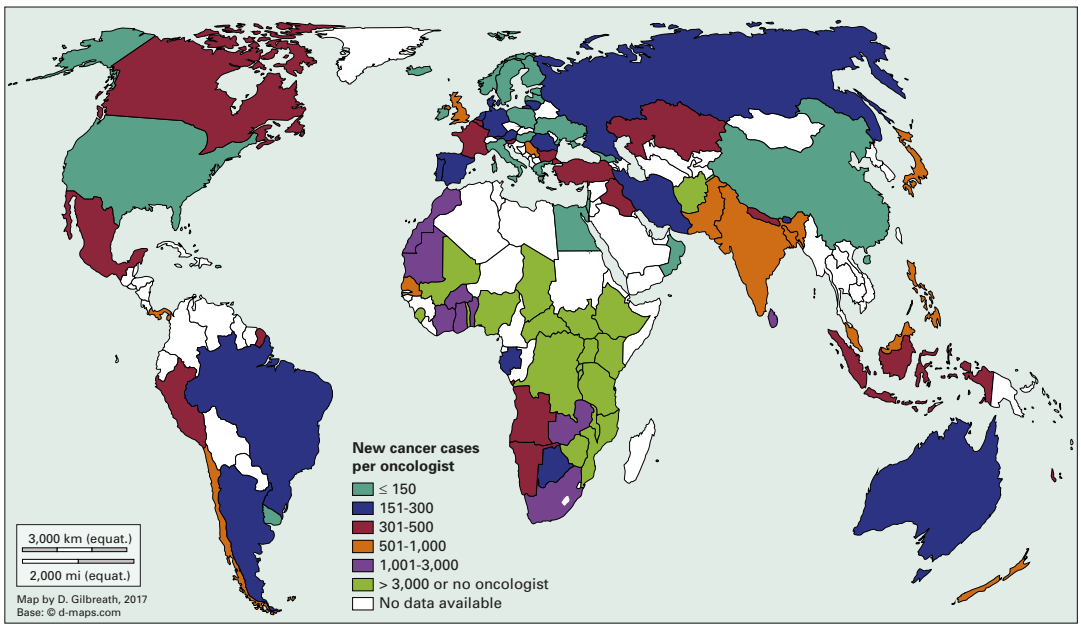

Fig 1. Graphical summary of availability of oncologists.

curative intent. Eventually, more patients with cancer will survive the disease.

DOI: https://doi.org/10.1200/JGO.17.00188
Published online on jgo.org on February 8, 2018.

AUTHOR'S DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

The following represents disclosure information provided by authors of this manuscript. All relationships are considered compensated. Relationships are self-held unless noted. I = Immediate Family Member, Inst = My Institution. Relationships may not relate to the subject matter of this manuscript. For more information about ASCO's conflict of interest policy, please refer to www.asco.org/rwc or ascopubs.org/jco/site/ifc.

Aju Mathew
No relationship to disclose

ACKNOWLEDGMENT

I acknowledge the contribution of Donna Gilbreath of the Markey Cancer Center Research Communications Office, who assisted with preparing the figure in the manuscript, and Brigitte Engelmann, MD, and Lloyd Panjikaran, MD, who provided input during data collection.

Affiliation

University of Kentucky, Lexington, KY; and Kerala Cancer Care, Kochi, India.

REFERENCES

1. GBD 2015 Mortality and Causes of Death Collaborators: Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980-2015: A systematic analysis for the Global Burden of Disease Study 2015. Lancet 388:1459-1544, 2016
2. Siegel RL, Miller KD, Jemal A: Cancer statistics, 2017. CA Cancer J Clin 67:7-30, 2017
3. Fitzmaurice C, Allen C, Barber RM, et al: Global, regional, and national cancer incidence, mortality, years of life lost, years lived with disability, and disability-adjusted life-years for 32 cancer groups, 1990 to 2015: A systematic analysis for the Global Burden of Disease Study. JAMA Oncol 3:524-548, 2017
4. Yang W, Williams JH, Hogan PF, et al: Projected supply of and demand for oncologists and radiation oncologists through 2025: An aging, better-insured population will result in shortage. J Oncol Pract 10:39-45, 2014
5. International Agency for Research on Cancer: GLOBOCAN: 2012. http://globocan.iarc.fr
6. The World Bank: World Bank income classification. http://www.databank.worldbank.org/data/download/site-content/CLASS.xls
7. Nelson AM, Milner DA, Rebbeck TR, et al: Oncologic care and pathology resources in Africa: Survey and recommendations. J Clin Oncol 34:20-26, 2016
8. Stefan DC, Elzawawy AM, Khaled HM, et al: Developing cancer control plans in Africa: Examples from five countries. Lancet Oncol 14:e189-e195, 2013
9. Parikh PM, Raja T, Mula-Hussain L, et al: Afro Middle East Asian symposium on cancer cooperation. South Asian J Cancer 3:128-131, 2014
10. Morgan C, Cira M, Karagu A, et al: The Kenya cancer research and control stakeholder program: Evaluating a bilateral partnership to strengthen national cancer efforts. J Cancer Pol [epub ahead of print on March 24, 2017]
11. Boutayeb S, Taleb A, Belbaraka R, et al: The practice of medical oncology in Morocco: The National Study of the Moroccan Group of Trialist in Medical Oncology (EVA-Onco). ISRN Oncol 2013:341565, 2013
12. The Foundation for Cancer Care in Tanzania: Meeting the challenge of cancer care in northern Tanzania: A program for comprehensive and sustainable care. http://tanzaniacancercare.org/wp-content/uploads/2015/07/FCCT-White-Paper.pdf

13. Are C: Cancer on the global stage: Incidence and cancer-related mortality in Afghanistan. http://www.ascopost.com/issues/january-25-2016/cancer-on-the-global-stage-incidence-and-cancer-related-mortality-in-afghanistan/
14. Yang LL, Zhang XC, Yang XN, et al: Lung cancer treatment disparities in China: A question in need of an answer. Oncologist 19:1084-1090, 2014
15. Silbermann M (ed): Cancer Care in Countries and Societies in Transition: Individualized Care in Focus. New York, NY, Springer, 2016
16. Awofeso N, Rammohan A, Asmaripa A.: Exploring Indonesia's "low hospital bed utilization-low bed occupancy-high disease burden" paradox. J Hosp Adm 1:49-58, 2013
17. Bayat M, Harirchi I, Zalani GS, et al: Estimation of oncologists' active supply in Iran: Three sources capture-recapture method. Iranian Red Crescent Med J 19:e56126, 2017
18. Efrati I: As number of cancer patients in Israel grows, oncology experts on decline. https://www.haaretz.com/israel-news/culture/health/1.660449
19. Takiguchi Y, Sekine I, Iwasawa S, et al: Current status of medical oncology in Japan: Reality gleaned from a questionnaire sent to designated cancer care hospitals. Jpn J Clin Oncol 44:632-640, 2014
20. Piana R: Initiatives bring gradual improvements to cancer care in Lebanon. http://www.ascopost.com/issues/september-1-2012/despite-challenges-initiatives-bring-gradual-improvements-to-cancer-care-in-lebanon/
21. Daily Express: 64 oncologists and nearly half women. http://www.dailyexpress.com.my/read.cfm?NewsID=868
22. Noh D-Y, Roh JK, Kim YH, et al: Symposium: "Oncology Leadership in Asia". Cancer Res Treat 49:283-291, 2017
23. Australian Institute of Health and Welfare: Medical practitioners workforce 2015. https://www.aihw.gov.au/reports/workforce/medical-practitioners-workforce-2015/contents/what-types-of-medical-practitioners-are-there
24. Bidwell S, Simpson A, Sullivan R, et al: A workforce survey of New Zealand medical oncologists. N Z Med J 126:45-53, 2013
25. de Azambuja E, Ameye L, Paesmans M, et al: The landscape of medical oncology in Europe by 2020. Ann Oncol 25:525-528, 2014
26. Eurostat: Cancer statistics. http://ec.europa.eu/eurostat/statistics-explained/index.php/Cancer_statistics
27. Russian Society of Clinical Oncology: Home. http://www.rosoncoweb.ru/en/society/
28. Rivera F, Andres R, Felip E, et al: Medical oncology future plan of the Spanish Society of Medical Oncology: Challenges and future needs of the Spanish oncologists. Clin Transl Oncol 19:508-518, 2017
29. Chekhun VF, Shepelenko IV: Cancer education in Ukraine. Ecancermedicalscience 7:369, 2013
30. Canadian Medical Association: Medical oncology profile. https://www.cma.ca/Assets/assets-library/document/en/advocacy/Medical-Oncology-e.pdf
31. Vose J: The state of cancer care in America 2016. https://www.asco.org/research-progress/reports-studies/cancer-care-america-2016#/executive-summary-0
32. Costanzo MV, Nervo A, Lopez C, et al: Adjuvant breast cancer treatment in Argentina: Disparities between prescriptions and funding requirements—A survey. J Clin Oncol 26:17571, 2008 (suppl)
33. Strasser-Weippl K, Chavarri-Guerra Y, Villarreal-Garza C, et al: Progress and remaining challenges for cancer control in Latin America and the Caribbean. Lancet Oncol 16:1405-1438, 2015

34. Jimenez de la Jara J, Bastias G, Ferreccio C, et al: A snapshot of cancer in Chile: Analytical frameworks for developing a cancer policy. Biol Res 48:10, 2015

35. Goss PE, Lee BL, Badovinac-Crnjevic T, et al: Planning cancer control in Latin America and the Caribbean. Lancet Oncol 14:391-436, 2013

36. Artac M: The state of cancer care in Turkey. https://gicasym.org/state-cancer-care-turkey