Global Incidence of Brain and Spinal Tumors by Geographic Region and Income Level

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Introduction

Brain and spinal tumors represent biologically and epidemiologically heterogeneous neoplasms.Technical challenges in identifying, imaging, sampling, and histologically characterizing these tumors have made studying their epidemiology difficult, particularly in resource-limited settings [1-5]. Understanding global disease burden is a critical prerequisite to planning to meet health needs, and the global incidence of brain and spinal tumors has not been reported. Our study aims to determine the global incidence of brain and spinal tumors by geographic region and income level.

Methods

We analyzed data from 207 tumor registries on five continents, and calculated age-standardized rates to compare tumor incidence between World Health Organization regions and World Bank income groups.

Results

The global incidence of malignant brain tumors was 4.25 cases per 100,000 person-years (95% CI [4.21 – 4.29]), and varied by region from 6.76 [6.71 – 6.80] in Europe to 2.81 [2.64 – 2.99] in Africa. Incidence also varied by World Bank income group, ranging from 6.29 [6.26 – 6.32] cases per 100,000 in high income countries (HIC), to 4.81 [4.77 – 4.86] in low and middle income countries (LMIC). Malignant spinal tumors were much less frequent (0.098 [0.093 – 0.104]) and varied similarly by region and income group.

Global burden of malignant brain tumors

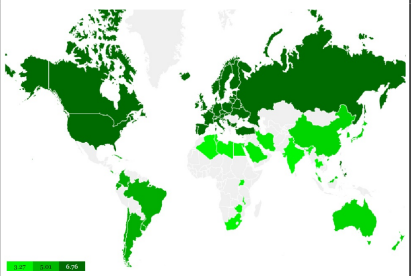

Figure 1. Age-Standardized Rates of malignant brain tumor incidence in World Health Organization regions calculated using data from 207 tumor registries globally. The ASR of brain tumors was higher in the high income group (6.29 per 100,1000 person-years) and lower in the low/middle income group (4.81 per 100,000 person-years).

Estimated global burden of brain and spinal tumors

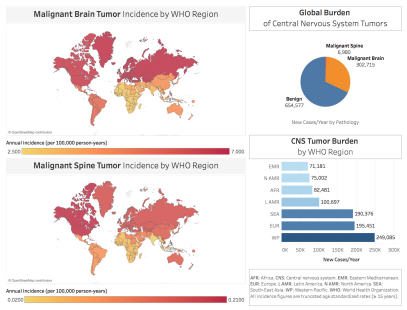

Figure 2. Global disease burden estimates calculated by determining disease burden in over 200 registries and then multiplying the estimated incidences of malignant and benign brain and spinal tumors by the reginonal population.

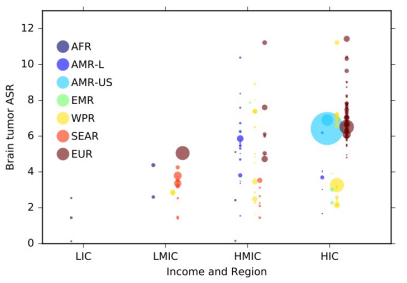

Figure 4. Brain tumor Age Standardized Rate (per 100,1000 person-years) for each registry by income and region . Marker area is porportional to the population size surveilled by the corresponding registry.

Registry Data Validation

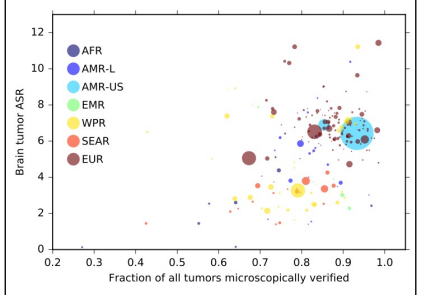

Figure 3. Brain tumor Age Standardized Rate (per 100,1000 person-years) for each registry as a function of the fraction of all tumors in that registry which are microscopically verified. Marker area is porportional to the population size surveilled by the corresponding registry. Color denotes the region of the registry according to the key. Registries in all regions that verify more tumors report higher tumor rates.

Conclusions

The apparent incidence of brain and spinal tumors varies by region and income group, although case ascertainment bias driven by limited resources in low income regions likely plays a large role. These data underscore the magnitude of the need for neurosurgical services in underserved regions, and demonstrate the need for improved diagnosing and reporting infrastructure for guiding the development of surgical capacity.

Learning Objectives

Understand disease burden of brain and spinal tumors in different regions around the world and ascertain a relationship between disease burden, income levels, and clinical need.

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