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## Introduction

Cancer of the brain and central nervous system is an abnormal growth of cells within the brain or spinal cord; it can be primary, originating in the nervous system, or secondary, transmitted to it from another organ. These tumors can be benign or malignant and cause serious problems because the skull is hard and there is not enough space for the tumor to grow, which leads to increased pressure on the surrounding tissues and nerves (1, 2). Common symptoms include headache, nausea, vision problems, weakness, and loss of balance. Diagnosis is based on magnetic resonance imaging (MRI) and biopsy, and treatment options include surgery, radiation therapy, and chemotherapy. Tumors of the central nervous system are abnormal growths of cells in the tissue of the brain and spinal cord, a general term that includes more than 120 independent tumor patterns. Tumors can affect the central nervous system of the body, which consists mainly of the brain and spinal cord). Tumors arise when cells in the brain and spinal cord begin to grow

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## A Study of Brain and Central Nervous System Cancer: A Global Perspective Comparison Review

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## Abstract

*Brain and central nervous system cancer is one of the most dangerous* types of tumors affecting the central nervous system, as it arises as a result of abnormal growth of cells inside the brain. Cancer may be primary, that is, it arises directly in the brain, or secondary when cancer moves from another organ in the body to the brain, and the severity of the disease varies depending on the type of tumor, its location, and extent of spread. This review intends to discuss one of the dangerous cancers to human life, accompanied with analyzing its global data, and making the necessary comparisons. Publications from WHO, the International Agency for Research & Cancer, and Cancer Today 2024 on the incidence and mortality of male and female brain and central nervous system cancer in global continents and UN regions were used, with a comparison made to find their indicators, and the survival rates in different regions were discussed, illustrated with charts. The results indicated that the number of incidences is not few, but the mortality rate was very high, which reflected on weak survival rates. The results indicated that the number of incidences and mortality in females was lower than in males. **In conclusion**, a brain tumor is a growth of cells in or near the brain. Brain tumors can occur in the tissues of the brain. They can occur near brain tissue. Such nearby places include nerves, the pituitary gland, the pineal gland, and membranes covering the surface of the brain. The analysis proved that the mortality rate was very high, which directly affected the survival rate, especially for males.

**Keywords:** Brain, Central Nervous System, Cancer



abnormally. Spinal cord tumors are much less common than brain tumors. Brain tumors can start inside the brain. They are called primary brain tumors (3, 4). And sometimes, cancer from other parts of the body reaches the brain. Such tumors are called secondary brain tumors, they are also called metastatic brain tumors. The size of brain tumors ranges from very small to very large tumors. Some brain tumors are detected when they are very small because they cause symptoms that you notice immediately. While other types of brain tumors grow up to a very large size before they are detected. Some parts of the brain are less active than others. If a brain tumor starts in a less active part of the brain, it may not cause symptoms immediately. The tumor may reach a very large size before it is detected. Treatment options for brain tumors vary depending on the type, size and location of the tumor (5, 6). Common treatments include surgery and radiation therapy. This paper is looking for one of the most important malignant cancers that lead to the death of many infections and the death rate sometimes reaches more than 85%, with an analysis of global data issued by the United Nations organization and comparisons by continents, regions and both sexes (7). There are many types of brain tumors. The type of brain tumor depends on the type of cells that make up the tumor. Laboratory tests of tumor cells can provide information about the cells. Types of brain tumors include Gliomas and associated brain tumors, Tumors of the choroid plexus, Fetal tumors, Pineal tumors, Meningiomas, Nerve tumors, and Tumors of the pituitary gland (8, 9). Brain tumors appear when cells in or near the brain undergo DNA changes, and the DNA of the cell carries the instructions that dictate to the cell the commands to be executed. The changes order the cells to grow rapidly and continue their life cycle while healthy cells die as part of their normal life cycle, and this leads to the presence of many excess cells in the brain, and the cells may form a growth called a tumor. The etiological factors of DNA changes leading to brain tumors are not yet clear. For many people who develop brain tumors, the cause is never known. DNA changes are sometimes passed from parents to children. The changes may increase the risk of a brain tumor. But such hereditary brain tumors are rare. The indicators and symptoms of a brain tumor vary depending on the size and location of the brain tumor, and the symptoms may also depend on how fast the brain tumor grows, also called the tumor grade. General signs and symptoms of brain tumors may include headache, nausea or vomiting, blurred vision and eye problems, loss of sensation, movement and imbalance, confusion, difficulty speaking, severe fatigue, memory problems and behavior change, dizziness and epilepsy, and hearing problems (10). Review of literature revealed scarce publication regarding brain cancer and its relations factors. Consequently, this review will focus on brain and central nervous system cancer in regard to the global perspective comparison aspect.

## **Methods and Indicators**

### **Data resources**

Data for this study were drawn from WHO, the International Agency for Research on Cancer, the Global Cancer Observatory, and Cancer Today, 2024. The International Agency for Research on Cancer produced GLOBOCAN estimates by first generating incidence and mortality rates using cancer registry data-population-based, by continents, regions, and countries. The data were analyzed and graphically illustrated while finding the survival rate (11-29).



### Statistical analyses & Indicators

The data contains the incidence and mortality cases by continents, UN regions, and countries for males and females. The age-specific rate was calculated as;

$$ASR = \frac{\text{Number of cancer cases in specific group}}{\text{Total population in that same age group}} \times 100000 \quad (1)$$

The crude rate of cancer is calculated as

$$CR = \frac{\text{Total numer cases (incidence & mortality) in a specific population}}{\text{Total population at risk}} \times 100000 \quad (2)$$

Estimated Cumulative Risk, which represents the percentage of new cases during a period in which the denominator is the initial number of infected people, is calculated from the following equation:

$$R_{Cumulative} = \frac{N_{d+newcases}}{N_{all\ persons\ at\ risk}} \quad (3)$$

Where;

$N_{d+newcases}$  → The number of new cases of the disease under observation during a given period.

$N_{all\ persons\ at\ risk}$  → The number of all persons at risk for getting ill with the disease under observation at the beginning of.

It should be noted that the survival rate is calculated by dividing the number of people alive after a specific time period by the total number of people diagnosed with that cancer. These processes were repeated for each group to allow for fair comparisons between populations or over time.

### Results and Discussion

The mortality rate was very high, and the survival rates varied by continent and were all close, the highest survival rate was in Asia (25%), followed by North America and Oceania (24%), Europe (20%), Africa (18%), the lowest was in North America and the Caribbean (16%), the global average (22%). The indicators ASR, crude rate, cumulative risk was higher in North America and Europe and lowest in Africa for incidence and mortality, (Table.1) &(Figure.1).

**Table.1:** Incidence & Mortality both sexes by Continent

Continents	Incidence	Mortality	ASR (World)		Crude rate		Cumulative risk		Survival Rate
			Incidence	Mortality	Incidence	Mortality	Incidence	Mortality	
Africa	19289	15877	1.9	1.6	1.4	1.1	0.19	0.17	0.18
Latin America and the Caribbean	26992	22530	3.6	2.9	4.1	3.4	0.35	0.30	0.16
Northern America	28126	21314	5.5	3.3	7.5	5.7	0.51	0.36	0.24
Europe	67559	54001	5.6	3.9	9.0	7.2	0.56	0.43	0.20
Oceania	2626	1979	4.5	3.1	6.0	4.5	0.47	0.35	0.24
Asia	177139	132799	3.2	2.4	3.8	2.9	0.33	0.25	0.25
Total	321731	248500	3.5	2.6	4.1	3.2	0.35	0.28	0.22

Source: WHO, International Agency for Research & Cancer, Cancer Today 2024 (19).

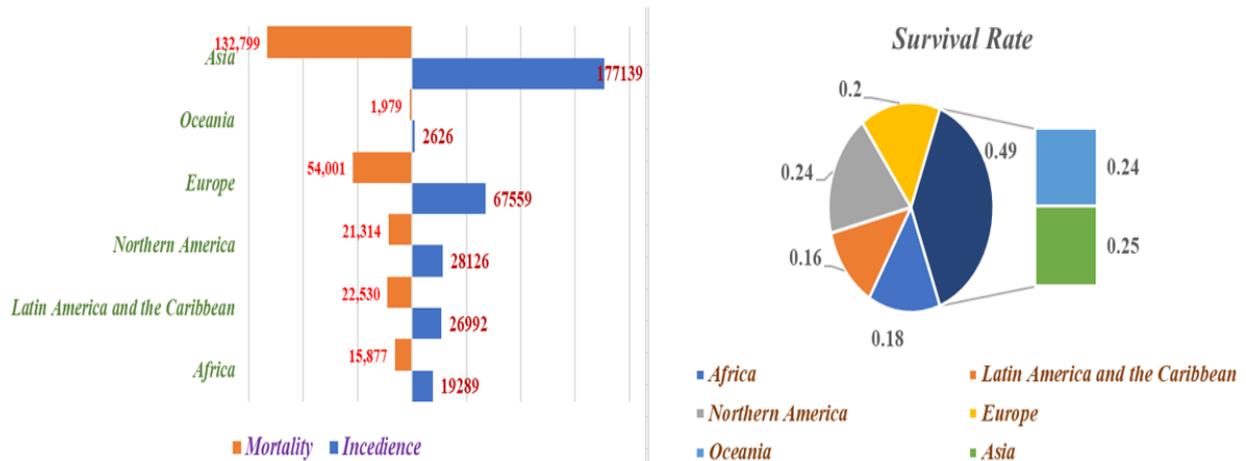


Figure. 1: Incidence, mortality, survival rate by continents

The percentage of female to male was so high in incidence and mortality; the highest female percentage incidence was in Africa (91%), Latin America and the Caribbean (88%), Asia (86%), Europe (82%), Northern America (77%), and Oceania (70%). In mortality, Africa and Latin America and the Caribbean were the highest, while other continents were lower than the incidence percentage globally was (85%, & 78%), (Table .2) & (Figure.2).

Table. 2: Percentage of Incidence & Mortality of Males to Females by Continent

Continents	Incidence			Mortality			Survival Rate	
	Male	Female	%	Male	Female	%	Male	Female
Africa	10079	9210	0.91	8285	7592	0.92	0.18	0.18
Latin America and the Caribbean	14319	12673	0.88	11920	10610	0.89	0.17	0.16
Northern America	15854	12272	0.77	12211	9103	0.74	0.23	0.26
Europe	36944	30615	0.82	29867	24134	0.81	0.19	0.21
Oceania	1543	1083	0.70	1194	785	0.65	0.23	0.27
Asia	94960	82179	0.86	76346	56453	0.74	0.19	0.31
Total	173699	148032	0.85	139823	108677	0.78	0.20	0.26

Source: WHO, International Agency for Research & Cancer, Cancer Today 2024 (19)

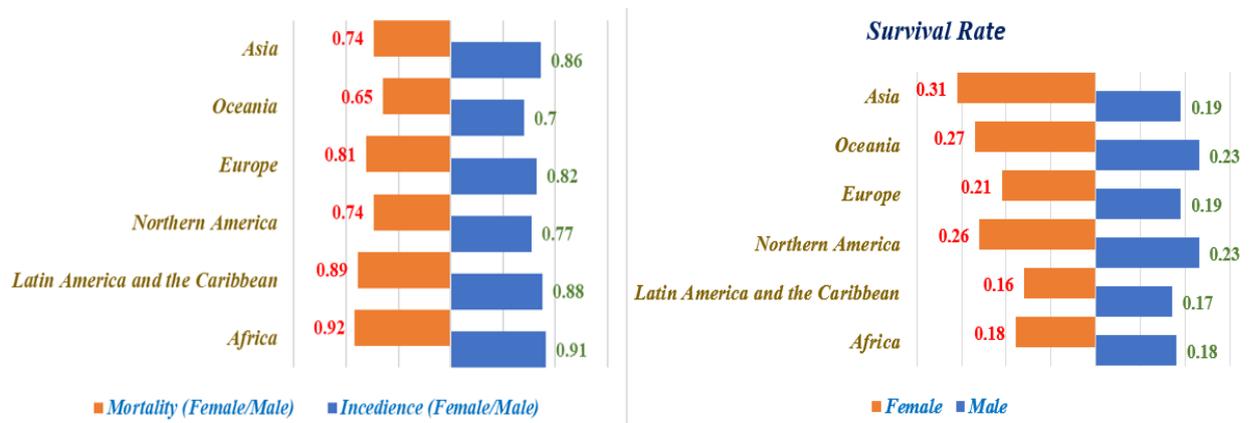


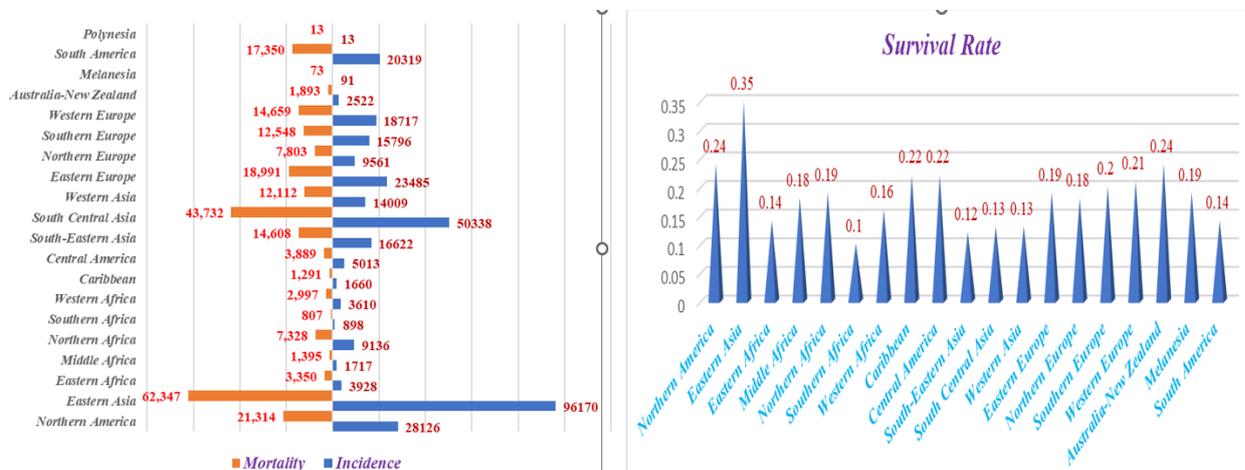
Figure.2: Incidence & mortality (female / male), and male / female survival rate

The compression of incidence, mortality, ASR, crude rate, and cumulative risk for both sexes by UN regions shows that the highest was in East Asia, South Central Asia, and North America with high mortalities; the lowest was in Polynesia; and there were no cases in Micronesia. This analysis reflected on survival rate with the same percentages, (Table .3) & (Figure.3).

**Table.3:** Incidence & Mortality, ASR, crude rate, & cumulative risk both sexes UN regions

UN Regions	Incidence	Mortality	ASR (World)		Crude rate		Cumulative risk		Survival Rate
			Incidence	Mortality	Incidence	Mortality	Incidence	Mortality	
Northern America	28126	21314	5.5	3.3	7.5	5.7	0.51	0.36	0.24
Eastern Asia	96170	62347	4.0	2.4	5.9	3.9	0.40	0.25	0.35
Eastern Africa	3928	3350	1.2	1.1	0.84	0.71	0.13	0.12	0.14
Middle Africa	1717	1395	1.2	1.0	0.90	0.73	0.11	0.10	0.18
Northern Africa	9136	7328	3.8	3.1	3.6	2.9	0.37	0.33	0.19
Southern Africa	898	807	1.4	1.3	1.3	1.2	0.14	0.14	0.10
Western Africa	3610	2997	1.3	1.2	0.85	0.71	0.13	0.12	0.16
Caribbean	1660	1291	3.0	2.2	3.8	2.9	0.31	0.25	0.22
Central America	5013	3889	2.7	2.0	2.7	2.1	0.25	0.21	0.22
South-Eastern Asia	16622	14608	2.3	2.0	2.4	2.1	0.22	0.20	0.12
South Central Asia	50338	43732	2.5	2.2	2.4	2.1	0.24	0.22	0.13
Western Asia	14009	12112	5.0	4.4	4.9	4.2	0.48	0.47	0.13
Eastern Europe	23485	18991	5.4	3.9	8.1	6.5	0.55	0.43	0.19
Northern Europe	9561	7803	5.7	3.9	8.9	7.3	0.56	0.43	0.18
Southern Europe	15796	12548	5.8	3.9	10.4	8.3	0.58	0.44	0.20
Western Europe	18717	14659	5.6	3.9	9.5	7.4	0.56	0.43	0.21
Australia-New Zealand	2522	1893	5.6	3.7	8.1	6.1	0.56	0.41	0.24
Melanesia	91	73	1.0	0.85	0.79	0.63	0.12	0.09	0.19
South America	20319	17350	3.9	3.2	4.6	4.0	0.39	0.34	0.14
Micronesia	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0
Polynesia	13	13	1.7	1.7	1.9	1.9	0.25	0.25	1
<b>Total</b>	<b>321731</b>	<b>248500</b>	<b>3.5</b>	<b>2.6</b>	<b>4.1</b>	<b>3.2</b>	<b>0.35</b>	<b>0.28</b>	<b>0.22</b>

Source: WHO, International Agency for Research & Cancer, Cancer Today 2024 (19)



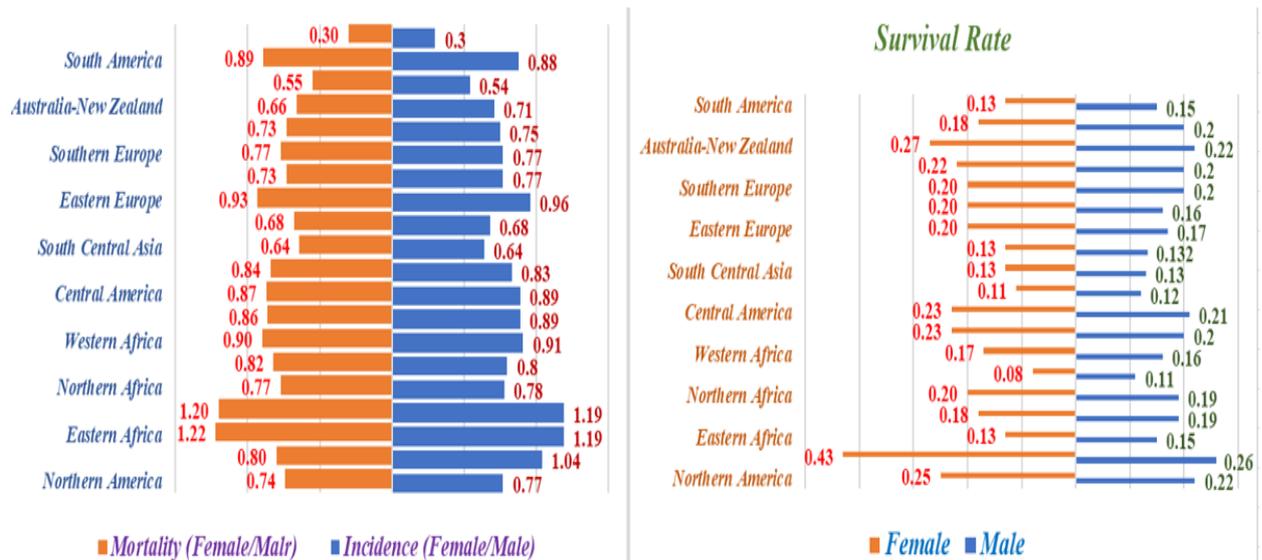
**Figure .3:** UN Regions Indicators

The percentages of females/males show that it was very high in all regions except Eastern and Middle Africa; mortality was higher than incidence. The lowest was in Melanesia. Also, survival rate was very weak, especially in southern Africa, (Table .4) & (Figure.4).

**Table. 4:** Percentage of Incidence, Mortality & survival rates of Males and Females by UN Regions

UN Regions	Incidence			Mortality			Survival Rate	
	Male	Female	%	Male	Female	%	Male	Female
Northern America	15854	12272	0.77	12211	9103	0.74	0.22	0.25
Eastern Asia	46986	49184	1.04	34613	27734	0.80	0.26	0.43
Eastern Africa	1791	2137	1.19	1507	1843	1.22	0.15	0.13
Middle Africa	781	936	1.19	632	763	1.20	0.19	0.18
Northern Africa	5128	4008	0.78	4134	3194	0.77	0.19	0.20
Southern Africa	498	400	0.80	441	366	0.82	0.11	0.08
Western Africa	1881	1729	0.91	1571	1426	0.90	0.16	0.17
Caribbean	876	784	0.89	693	598	0.86	0.20	0.23
Central America	2650	2363	0.89	2071	1818	0.87	0.21	0.23
South-Eastern Asia	9037	7585	0.83	7907	6701	0.84	0.12	0.11
South Central Asia	30605	19733	0.64	26621	17111	0.64	0.13	0.13
Western Asia	8332	5677	0.68	7205	4907	0.68	0.132	0.13
Eastern Europe	11968	11517	0.96	9826	9165	0.93	0.17	0.20
Northern Europe	5392	4169	0.77	4494	3309	0.73	0.16	0.20
Southern Europe	8900	6896	0.77	7080	5468	0.77	0.20	0.20
Western Europe	10684	8033	0.75	8467	6192	0.73	0.20	0.22
Australia-New Zealand	1474	1048	0.71	1137	756	0.66	0.22	0.27
Melanesia	59	32	0.54	47	26	0.55	0.20	0.18
South America	10793	9526	0.88	9156	8194	0.89	0.15	0.13
Micronesia	0	0	0	0	0	0	0	0
Polynesia	10	3	0.3	10	3	0.3	0	1
<b>Total</b>	<b>173699</b>	<b>148032</b>	<b>0.85</b>	<b>139823</b>	<b>108677</b>	<b>0.77</b>	<b>0.19</b>	<b>0.26</b>

Source: WHO, International Agency for Research & Cancer, Cancer Today 2024 (19)



**Figure. 4:** UN region indicators

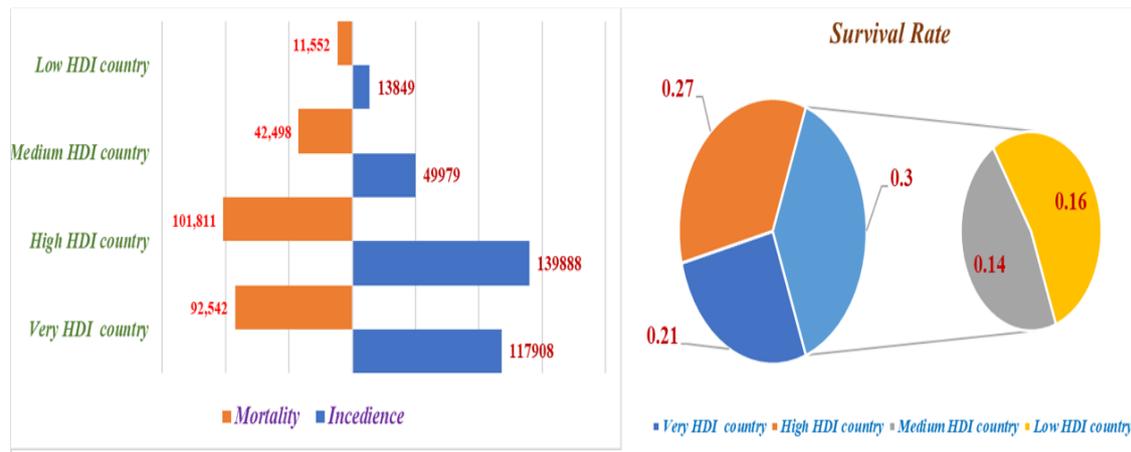
### Human Development Index Both Sexes

High HDI countries ranked the highest in all indicators, followed by very high HDI countries, then medium HDI countries (but with the lowest survival rate), and the lowest were low HDI countries (Table.5)& (Figure.5).

**Table. 5:** Incidence & Mortality, Both Sexes, HDI levels

HDI Levels	Incidence	Mortality	ASR (World)		Crude rate		Cumulative risk		Survival Rate
			Incidence	Mortality	Incidence	Mortality	Incidence	Mortality	
Very HDI country	117908	92542	4.9	3.3	7.2	5.6	0.47	0.36	0.21
High HDI country	139888	101811	4.0	2.7	5.1	3.7	0.40	0.29	0.27
Medium HDI country	49979	42498	2.3	1.9	2.2	1.9	0.22	0.20	0.14
Low HDI country	13849	11552	1.6	1.4	1.1	0.95	0.16	0.14	0.16

Source: WHO, International Agency for Research & Cancer, Cancer Today 2024(19)



**Figure.5:** HDI levels indicators

China ranked the highest in incidence (87498) and mortality (56648), followed by India (32574, 27990), then the USA (24940, 18545), Brazil (12253, 10998), Russia (7955), and Germany (6570). The lowest countries in incidence were, Cape Verde, Sierra Leone, Solomon Islands, Fiji and Guyana. The lowest countries in mortality were Fiji, Sierra Leone, Solomon Islands, French Guyana, and Guyana. No incidence cases in Comoros, Guam, Vanuatu, Saint Lucia, or Sao Tome and Principe. Also, on mortality in Comoros, Guam, Vanuatu, Saint Lucia, and Sao Tome and Principe (Table (6) Figure (6 & 7).

### Highest & lowest countries Incidence

**Table.6:** Highest & lowest incidence & mortality countries

Incidence				Mortality			
Highest		Lowest		Highest		Lowest	
Vietnam	2829	Cape Verde	1	Vietnam	2431	Fiji	1

Canada	3181	Sierra Leone	1	Mexico	2675	Sierra Leone	1
Mexico	3529	Solomon Islands	2	Canada	2765	Solomon Islands	2
Poland	4099	Fiji	2	Japan	3169	French Guyana	2
Spain	4317	Guyana	2	Spain	3364	Guyana	2
Egypt	4452	Belize	3	Poland	3421	Belize	3
Pakistan	5342	Samoa	4	Egypt	3611	Brunei	4
Japan	5361	Barbados	6	Pakistan	4407	Cape Verde	4
Indonesia	5738	Brunei	6	Italy	4824	Samoa	4
Iran	5803	Guyana	6	UK	4840	Eswatini	5
UK	5811	Djibouti	6	France	5049	Barbados	6
Italy	6345	Gambia	6	Indonesia	5259	Djibouti	6
Türkiye	6511	Eswatini	6	Iran	5744	Gambia	6
France	6921	Guinea	8	Türkiye	6016	Equatorial Guinea	7
Germany	7955	French Polynesia	8	Germany	6570	Maldives	7
Russian	10892	Bahamas	9	Russian	8587	Bahamas	8
Brazil	12253	Lesotho	9	Brazil	10998	Congo	8
USA	24940	Maldives	9	USA	18545	French Polynesia	8
India	32574	New Caledonia	13	India	27990	Lesotho	8
China	87498	Timor-Leste	13	China	56648	New Caledonia	11

Source: WHO, International Agency for Research & Cancer, Cancer Today 2024 (19)

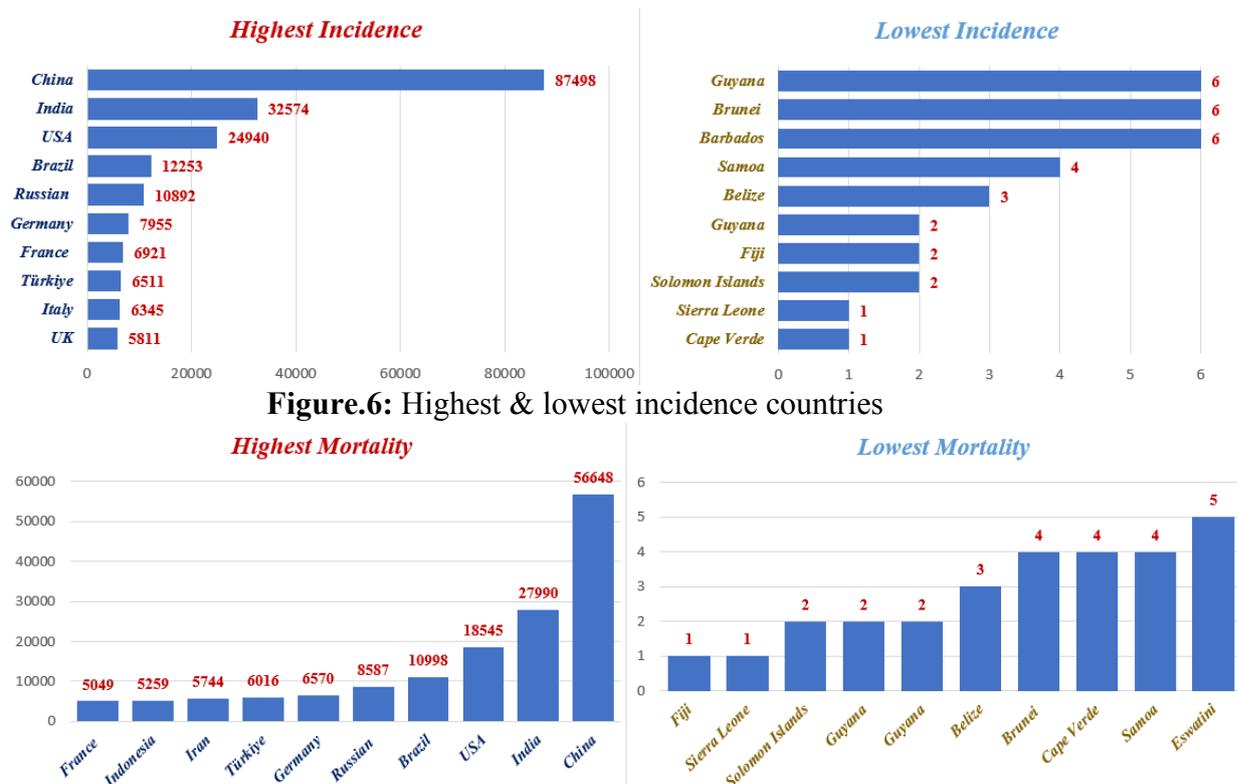


Figure.6: Highest & lowest incidence countries

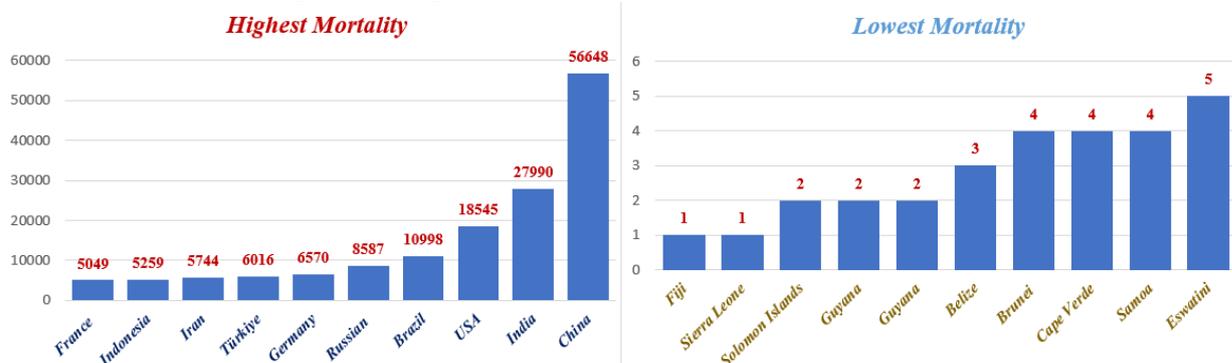


Figure.7: Highest & lowest mortality countries

## Child Indicators

The percentage of children aged (0 – 14), has a percentage of (4%) in incidence and mortality as a total, and it differs between continents. The main thing is that the survival rate was higher than the survival rate of general ages.

**Table.7:** Incidence, mortality, and survival rate for age (0 – 14)

Continents	Incidence			Mortality			Survival Rate		
	Male	Female	Both	Male	Female	Both	Male	Female	Both
Africa	1982	1757	3739	1194	1073	2267	0.39	0.38	0.39
Latin America and the Caribbean	1349	1161	2510	725	608	1333	0.46	0.47	0.46
Northern America	1261	1109	2370	256	223	479	0.79	0.79	0.79
Europe	1391	1176	2567	561	506	1067	0.59	0.56	0.58
Oceania	79	64	143	27	24	51	0.65	0.62	0.64
Asia	7596	5752	13348	4050	3002	7052	0.46	0.47	0.47
<b>Total</b>	13658	11019	24677	6813	5436	12249	0.50	0.50	0.50

Source: WHO, International Agency for Research & Cancer, Cancer Today 2024 (19)

## Conclusion

Primary brain tumors have several different types. Some brain tumors are not cancerous. They are called non-cancerous brain tumors or benign brain tumors. Non-cancerous brain tumors may grow over time and put pressure on brain tissue. Other types of brain tumors are brain cancers, also called malignant brain tumors. Brain cancers can grow rapidly. And cancer cells can invade brain tissue and destroy it. Non-cancerous brain tumors most often cause symptoms that develop slowly. Non-cancerous brain tumors are also called benign brain tumors. It may cause minor symptoms that you don't notice at first. Symptoms may worsen over months or years. The analysis proved that the death rates were very high, reflected in the poor survival rates, especially in developing countries, which require concerted efforts and the search for more effective treatments to alleviate the suffering of a large number of infected.

## Declarations

## Acknowledgment

None

## Ethics statement

The author approved that this research follows the journal's Attach Ethic Approval guidelines as appeared on the journal's author guidelines page.

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## Data availability

Datasets used for this study were publicly available from the Global Cancer Observatory and the Cancer Incidence in Five Continents Plus.

## Competing interests

The author declare no competing interests.

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