

Epidemiological analysis of skin cancer in Brazil

Análise epidemiológica do cancro de pele no Brasil

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Abstract

Background: Skin cancer is divided into melanoma or non-melanoma skin cancer. Non-melanoma skin cancer is the most common type of cancer in humans. Melanoma, on the other hand, has a low incidence, but high lethality. In view of the great European miscegenation and great sun exposure in Brazil, it is of great value to study the epidemiology of skin cancers, to determine the magnitude of this disease in society. **Objectives and methods:** This study determines skin cancer indicators in Brazil, by place of residence, in the federal units and regions of Brazil, between 2015 and 2021. **Conclusion:** The values evaluated allow us to conclude that skin cancer is still a disease that causes significant morbidity in Brazil, despite the primary and secondary prevention measures established.

Keywords: Skin neoplasms. Basal cell carcinoma. Squamous cell carcinoma. Melanoma. Epidemiology. Mortality. Incidence.

Resumo

Introdução: O cancro cutâneo pode ser classificado em melanoma e não melanoma. O cancro cutâneo não-melanoma é o cancro mais comum em humanos. Já o melanoma, tem baixa incidência, mas alta letalidade. Tendo em vista a grande miscigenação europeia e a grande exposição solar no Brasil, é de grande valia estudar a epidemiologia dos cânceres de pele, a fim de determinar a magnitude desta doença na sociedade. **Objetivos e métodos:** Este estudo determina os indicadores de câncer de pele no Brasil, por local de residência, nas unidades federativas e regiões do Brasil, entre 2015 e 2021. **Resultados:** Os valores avaliados permitem concluir que o cancro cutâneo ainda é uma doença que causa morbidade no Brasil, apesar das medidas de prevenção primária e secundária estabelecidas.

Palavras-chave: Cancro cutâneo. Carcinoma basocelular. Carcinoma espinocelular. Melanoma. Epidemiologia. Mortalidade. Incidência.

Introduction

In Brazil, cancer is currently the second most frequent cause of death, surpassed only by cardiovascular diseases¹⁻³. Skin cancer can be divided into two types: melanoma or non-melanoma skin cancer (NMSC)^{1,2}.

NMSC is the most common type of cancer in humans^{1,2}. In Brazil, it accounts for about 30% of all registered malignant tumors^{1,3}. But, despite its high incidence, it has high rates of cure, especially if detected and treated early^{2,4}. Skin cancer is more common in people over 40 years of age, and is rare in

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children and black people, except for those who already have some skin diseases, like long-term or severe skin inflammation or injury, xeroderma pigmentosum, albinism, and basal cell nevus syndrome^{1,2}. However, with the constant exposure of young people to sunlight, the average age of patients has been decreasing^{1,2,4}.

Among non-melanoma skin cancers, basal cell carcinoma and squamous cell carcinoma are the main ones. Despite their clinical and histopathological differences, both have a low rate of metastasis and lethality²⁻⁴. People with fair skin, sensitive to the action of the sun, with a personal or family history of skin cancer or with previous skin diseases are the most affected⁴. Among the main risk factors related to non-melanoma subtypes, prolonged and repeated exposure to ultraviolet rays, especially in childhood and adolescence, is one of the most important; other risk factors include having light skin and eyes, with red or blond hair, or being albino; the presence of a family or personal history of skin cancer; individuals with deficient immune system and exposure to artificial radiation^{4,5}.

Melanoma, on the other hand, has a lower incidence and high lethality. According to national epidemiological data, melanoma is estimated to represent only 3% of malignant neoplasms. It affects all age groups and has a high potential for dissemination with a poor prognosis when there are already metastases^{2,5}. Up to one-fifth of patients develop metastatic disease, highlighting the importance of preventive measures and early diagnosis¹.

Melanoma is 20 times more common in Caucasians than in black people. Overall, the risk of melanoma is about 2.6% in whites, 0.1% in blacks, and 0.6% in Hispanics³. This cancer is more common among men, but before the age of 50 rates are higher among women¹. The risk of melanoma increases with age, with the current average diagnosis being 65 years^{1,3,4}.

The main primary prevention of skin cancer is photoprotection. The use of sunscreen prevents the formation of actinic keratoses (precursor lesion of squamous cell carcinoma), squamous cell carcinoma, and melanoma, although data are still somewhat controversial in the latter case. There are insufficient scientific data to prove its efficacy alone in the prevention of basal cell carcinoma, the most common skin cancer⁴. Secondary prevention occurs through early diagnosis and clinical and histopathological examination. Dermoscopy and confocal microscopy are tools that assist in the diagnosis^{2,4,6}.

In view of the great European miscegenation and great sun exposure in Brazil, it is of great value to study

the epidemiology of skin cancers, to determine the magnitude of this disease in society, with a view to implementing primary and secondary prevention policies.

Objectives

To determine skin cancer indicators in Brazil, by place of residence, in the federal units and regions of Brazil, between 2015 and 2021.

Materials and methods

This is an observational, cross-sectional, and descriptive epidemiological study. Incidence estimates data from the José Alencar Gomes da Silva National Cancer Institute (INCA), the Mortality Information Systems (SIM), the Outpatient Information System (SIA), and the Hospital Information System (SIH) were used.

The SUS (Unified Health System) is the model adopted by Brazil for planning and executing actions and services aimed at promoting, protecting, and recovering health. It was created by the Federal Constitution of 1988^{7,8}.

INCA is the auxiliary agency of the Ministry of Health in the development and coordination of integrated actions for the prevention and control of cancer in Brazil. Such actions include medical and hospital care, provided directly and free of charge to cancer patients as part of the services offered by the Unified Health System, and acting in strategic areas, such as prevention and early detection, training of specialized professionals, development of research and generation of epidemiological information⁹.

SIM, developed by the Ministry of Health in 1975, was used to collect data on mortality in the country. It allows, based on the cause of death attested by the physician, to build indicators and process epidemiological analyzes that contribute to the efficiency of health management. Therefore, it is considered an important management tool in the health area that supports decision-making in various areas of health care. It helps in the formulation of epidemiological indicators as strategic instruments to support the planning of actions, activities, and programs aimed at health management¹⁰.

SIH provides information that can be used for the objective subsidiary analysis of the health situation, based on evidence-based decision-making and health program preparation. The data obtained are metrics used in the construction of health indicators, which translate into relevant information for the quantification

Table 1. Number of notified cases of skin cancer in each Brazilian state between 2015 and 2021

Brazilian State	2015	2016	2017	2018	2019	2020	2021	Total
Total	4,202	4,154	4,039	37,064	82,572	63,751	35,918	231,700
Rondônia	50	35	26	71	1,155	654	258	2,249
Acre	4	2	3	11	8	12	6	46
Amazonas	10	14	12	148	371	556	288	1,399
Roraima	2	2	2	2	46	45	10	109
Pará	107	90	81	212	753	768	291	2,302
Amapá	4	3	1	3	4	9	7	31
Tocantins	3	11	15	25	127	128	67	376
Maranhão	38	29	32	596	775	534	222	2,226
Piauí	48	46	52	555	720	202	93	1,716
Ceará	263	260	270	1,238	2,189	1,718	1,021	6,959
Rio Grande do Norte	57	61	64	1,074	2,039	1,488	881	5,664
Paraíba	85	91	86	574	1,093	558	369	2,856
Pernambuco	153	153	126	763	972	772	638	3,577
Alagoas	41	55	46	226	559	448	225	1,600
Sergipe	27	14	23	52	113	209	179	617
Bahia	133	144	133	1,359	2,077	1,281	997	6,124
Minas Gerais	409	426	397	3,719	8,785	7,290	3,964	24,990
Espírito Santo	84	81	107	572	1,642	1,299	1,199	4,984
Rio de Janeiro	146	135	142	317	2,371	1,774	1,280	6,165
São Paulo	846	855	822	11,131	21,152	16,303	8,428	59,537
Paraná	742	696	702	5,743	9,923	7,376	4,141	29,323
Santa Catarina	328	301	297	2,406	7,423	6,227	3,829	20,811
Rio Grande do Sul	389	419	402	3,779	12,303	9,895	5,342	32,529
Mato Grosso do Sul	79	63	49	1,151	2,290	1,313	445	5,390
Mato Grosso	42	58	46	304	1,115	671	403	2,639
Goiás	98	99	90	1,010	2,382	1,977	1,170	6,826
Distrito Federal	14	11	13	23	185	244	165	655

and evaluation of health information. Although the primary function of the SIH is to operationalize the payment of service providers registered in the Unified Health System (SUS) network, this system provides, in addition to other variables, the causes that motivated each of the hospitalizations carried out in the SUS, being one of the few sources of systematic registration of hospital statistics¹¹.

Incidence, hospital morbidity, and mortality are control measures for epidemiological surveillance that allow analyzing the occurrence, distribution, and evolution of diseases. Knowing information about the profile of different types of cancer and characterizing possible changes in the scenario over time are guiding elements for cancer surveillance actions—a strategic component for the efficient and effective planning of cancer prevention and control programs.

Results

Between 2015 and 2021, 231,700 cases of skin cancer were notified in Brazil. 2019 had the highest number of cases (82,572 cases—35.63%), followed by 2020 (63,751 cases—27.51%) and 2018 (37,064 cases—15.99%). In this period, the highest number of notified cases occurred in São Paulo (59,537 cases—25.69%), followed by Rio Grande do Sul (32,529 cases—14.03%) and Paraná (29,323 cases—12.65%). Amapá (31 cases), Acre (46 cases) and Roraima (109 cases), states from the northern region of Brazil, had the lowest number of cases (Table 1).

Of all notified cases, 90.64% (210,032 cases) were NMSC. For melanoma, São Paulo (4,852 cases—22.39%), Rio Grande do Sul (3,642 cases—16.80%) and Paraná (3,103—14.32%) had the highest numbers (Table 2).

Table 2. Number of notified cases of melanoma in each Brazilian state between 2015 and 2021

Brazilian State	2015	2016	2017	2018	2019	2020	2021	Total
Total	1,366	1,350	1,302	3,800	6,258	5,208	2,384	21,668
Rondônia	5	8	6	7	17	23	11	77
Acre	2	1	1	3	1	3	2	13
Amazonas	6	5	6	16	18	36	6	93
Roraima	1	0	1	1	5	1	2	11
Pará	9	15	12	35	48	31	18	168
Amapá	4	3	1	2	1	4	3	18
Tocantins	2	7	7	5	7	6	1	35
Maranhão	19	11	13	26	26	28	8	131
Piauí	15	16	17	19	40	27	11	145
Ceará	55	44	50	76	145	125	54	549
Rio Grande do Norte	26	30	20	39	64	85	45	309
Paraíba	31	22	27	112	112	21	7	332
Pernambuco	42	47	47	126	122	94	73	551
Alagoas	17	26	14	27	70	44	29	227
Sergipe	13	3	12	15	11	22	14	90
Bahia	31	43	40	136	181	133	86	650
Minas Gerais	128	135	130	410	681	563	213	2,260
Espírito Santo	27	25	33	73	177	84	50	469
Rio de Janeiro	62	63	52	68	174	200	89	708
São Paulo	276	269	242	874	1,402	1,194	595	4,852
Paraná	195	189	189	597	776	806	351	3,103
Santa Catarina	120	113	116	348	511	403	219	1,830
Rio Grande do Sul	196	187	201	598	1,182	940	338	3,642
Mato Grosso do Sul	19	24	10	38	66	51	19	227
Mato Grosso	14	21	21	60	65	58	40	279
Goiás	38	34	28	76	346	195	81	798
Distrito Federal	13	9	6	13	10	31	19	101

This data can be explained by the high number of inhabitants in São Paulo—the most populous state in the country. Furthermore, Rio Grande do Sul and Paraná are in the region where most of the population has European ancestry, which is predisposed to the occurrence of this neoplasm due to phenotypic characteristics such as blue eyes, light hair, and skin of phototypes I and II (according to the Fitzpatrick classification)⁵. Clique ou toque aqui para inserir o texto.

About the number of deaths from skin cancer, the year with the highest mortality rate was 2021 (8,88/100,000 inhabitants), with Paraíba as the main contributor to this value (22,64/100,000 inhabitants). The year with the lowest mortality rate was 2015 (6,77/100,000 inhabitants) (Table 3). The region of Brazil with the lowest absolute number of deaths, in this period, was the northern region (114 deaths), the

second least inhabited region of Brazil (18,430,980 inhabitants—which equals 8.77% of the Brazilian population). The southeast region was the one with the highest absolute number of deaths (1,659 deaths), followed by the south (1,201 deaths) and the northeast (556 deaths). The Brazilian state which had the highest number of deaths was São Paulo (882 deaths), followed by Santa Catarina (415 deaths) and Rio Grande do Sul (402 deaths) (Table 4).

During this 7-year period, there was a total of 3,755 skin cancer deaths in the whole country of Brazil, mostly male (58.72%). Regarding ethnicity, 62.84% of deaths occurred in Caucasians, followed by mixed ethnicities (23.35%), blacks (2.34%), and Asians (0.69%). Only 1 case was reported in Indians. In 403 cases there was no information on the ethnicity. About the age, the highest percentage of

Table 3. Skin cancer mortality rate in each region and Brazilian state between 2015 and 2021

Region/Brazilian State	2015	2016	2017	2018	2019	2020	2021	Total
Total	6.77	7.04	6.9	6.91	7.62	8.43	8.88	7.45
North	10.53	11.31	11.18	9.59	12.99	13.24	11.02	11.43
Rondônia	13.04	11.76	16.67	13.33	3.03	14.81	12.5	11.86
Acre	–	10	12.5	–	–	–	8.33	5.77
Amazonas	9.52	18.18	9.09	21.43	25	26.67	11.11	17.59
Roraima	20	20	15.38	16.67	27.27	–	20	17.65
Pará	12	5.41	12.5	8.06	19.61	22.86	13.33	13.24
Amapá	16.67	44.44	28.57	–	33.33	–	–	18.18
Tocantins	6.67	5.88	3.92	7.69	2.86	4.88	7.14	5.36
Northeast	4.37	5.21	4.44	4.08	6.07	7.97	9.85	5.57
Maranhão	24.39	30	8.33	15.38	9.09	17.02	22	17.31
Piauí	17.95	10.26	5	2.5	3.03	12.5	19.35	9.66
Ceará	3.23	4.21	5.95	6.82	5.56	7.92	7.83	5.76
Rio Grande do Norte	1.27	4.9	5	7.55	5.97	3.92	8.33	4.69
Paraíba	5.43	6.19	8.27	1.33	4.46	16.22	22.64	6.89
Pernambuco	2.18	2.56	1.45	2.52	4.18	4.12	6.56	2.78
Alagoas	5.36	13.33	10.81	6.33	11.97	9.46	3.08	8.95
Sergipe	12.5	5.56	10.53	20	33.33	8.33	18.18	15.2
Bahia	10.37	13.68	15.53	6.91	6.93	12.44	9.83	10.09
Southeast	6.9	7.42	8.44	8.71	8.69	9.77	9.53	8.44
Minas Gerais	5.46	5.09	6.77	6.91	7.09	7.11	7.21	6.48
Espírito Santo	1.11	6.71	5.17	10.29	6.15	8.9	17.65	6.75
Rio de Janeiro	12.4	12.84	15.67	13.67	14.63	20	14.19	14.61
São Paulo	6.84	7.5	7.94	8.1	8.03	8.89	8.91	7.99
South	8.12	7.11	6.62	6.54	6.75	7.31	7.36	7.08
Paraná	6.63	6.89	5.82	6.51	4.17	5.82	6.13	6
Santa Catarina	11.49	10.77	9.13	7.46	10.56	11.17	8.01	9.72
Rio Grande do Sul	7.56	5.02	5.82	5.89	6.42	6.32	8.26	6.39
West-Center	6.87	8.94	7.05	9.19	8.07	5.92	9.77	8.04
Mato Grosso do Sul	10.34	17.86	5.13	12	8.33	8.96	5.41	8.93
Mato Grosso	4.57	5.45	1.61	6.5	9.78	1.52	11.96	5.75
Goiás	7.32	6.12	12.61	6.82	4.03	5.59	9.18	6.95
Distrito Federal	10.81	14.29	10.71	18.52	22.03	9.3	15.28	14.85

deaths occurred in patients between 60 and 79 years old (43.22%), followed by those between 40 and 59 years old (33.02%) and those over 80 years of age (14.22%).

During this period, there was a 145.01% increase in the notification of skin cancer cases per year in the whole country of Brazil, with no state reporting a decrease in the number of cases. There was also a rise in mortality from skin cancer, with an increase of 4.72% in the mortality rate. Unfortunately, SIM does not differentiate deaths from NMSC from melanoma, making a more adequate analysis of deaths impossible.

Discussion

In a tropical country, such as Brazil, cultural changes regarding tanned skin, outdoor recreational activities, and exposure to occupational solar radiation have been responsible for an excessive exposure to ultraviolet solar radiation in recent decades, especially among the young population^{1,3}.

According to data, in the most populated and developed areas from the cultural, social, and economic point of view, there is a higher number of doctors per inhabitant and this leads to a higher number of diagnosis and,

Table 4. Number of deaths by skin cancer in each region and Brazilian state between 2015 and 2021

Region/Brazilian State	2015	2016	2017	2018	2019	2020	2021	Total
Total	485	523	543	534	574	537	559	3,755
North	12	19	17	14	20	18	14	114
Rondônia	3	4	5	2	1	4	4	23
Acre	–	1	1	–	–	–	1	3
Amazonas	2	4	1	3	4	4	1	19
Roraima	1	1	2	1	3	–	1	9
Pará	3	2	4	5	10	8	6	38
Amapá	1	4	2	–	1	–	–	8
Tocantins	2	3	2	3	1	2	1	14
Northeast	68	78	80	76	81	76	97	556
Maranhão	10	9	4	8	4	8	11	54
Piauí	7	4	2	1	1	2	6	23
Ceará	5	4	5	6	7	8	9	44
Rio Grande do Norte	2	7	7	4	4	4	7	35
Paraíba	7	6	11	2	5	6	12	49
Pernambuco	18	23	16	28	23	15	21	144
Alagoas	3	8	8	5	14	7	2	47
Sergipe	2	1	2	3	4	1	6	19
Bahia	14	16	25	19	19	25	23	141
Southeast	204	217	245	242	263	245	243	1,659
Minas Gerais	38	40	46	49	50	45	47	315
Espírito Santo	2	11	9	21	12	13	6	74
Rio de Janeiro	48	43	55	51	67	60	64	388
São Paulo	116	123	135	121	134	127	126	882
South	174	176	175	169	171	177	159	1,201
Paraná	54	65	59	63	37	54	52	384
Santa Catarina	57	64	58	51	72	66	47	415
Rio Grande do Sul	63	47	58	55	62	57	60	402
West-Center	27	33	26	33	39	21	46	225
Mato Grosso do Sul	6	10	4	6	7	6	6	45
Mato Grosso	8	6	2	8	9	1	11	45
Goiás	9	9	14	9	10	10	18	79
Distrito Federal	4	8	6	10	13	4	11	56

consequently, more official notifications. This fact may not occur in less developed areas with a fewer number of doctors per inhabitant, justifying the increase in the number of deaths in more populated regions.

In Brazil, most people who die because of skin cancer are elderly individuals who very probably were observed only with advanced disease³. Other patients more likely to die from skin cancer are those with immunosuppression, although these cases are not evaluated separately in our study. However, the exact number of people who develop or die either from basal cell or squamous cell skin cancer annually is unknown^{1,4}.

The southeastern state with the highest number of deaths was São Paulo, which may be associated with being the most populous state in Brazil. It was noted that populated areas have a higher mortality compared to less populated areas. This occurs probably due to the subdiagnosis and subnotified cases in remote areas. Brazil, as already mentioned, is a country with vast social, cultural, and economic differences and this interferes in the concentration of doctors per inhabitants.

The increase in the number of deaths probably occurs because of the late diagnosis and late treatment of the disease, justified by the difficulty in accessing

adequate health care and the poor distribution of specialists in dermatology throughout the Brazilian territory^{5,12}, increasing the rate of disability and lethality. According to data from the Medical Demography of 2018, there are 8,317 specialists in the country, the vast majority concentrated in the South and Southeast regions (74.5%), with no experience in performing dermatological surgical procedures, and working predominantly in an urban setting and private care¹².

From 1999, the Brazilian Society of Dermatology (SBD) started the National Campaign for the Prevention of Skin Cancer in the main Brazilian cities. This form of secondary prevention has resulted in an increase in the early detection of skin cancer and implies a reduction in mortality from this cause⁸.

Conclusion

The values evaluated above allow us to conclude that skin cancer is still a disease that causes significant morbidity in Brazil, despite the primary and secondary prevention measures established. In addition, the inequality observed in its control is notorious. In the same period, while some regions showed a reduction in the number of deaths, other regions an increasing trend remained, as observed in the southeast region.

Due to the vast territorial extension and the remarkable sociodemographic, epidemiological and cultural diversity, significant differences are noted in the incidence and mortality rates in the different Brazilian macro-regions, thus inferring great complexity in dealing with this disease by the responsible healthcare agents and sectors.

These data demonstrate how late diagnosis of skin cancer can impact population morbidity and mortality.

The increase in the number of deaths from skin cancer reflects the need to improve primary and secondary prevention practices.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that no patient data appear in this article.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

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