

Skin Cancer in Puerto Rico: a Multiannual Incidence Comparative Study

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Background: The incidence of skin cancer continues to increase worldwide. The purpose of this study was to determine the incidence of skin cancer in Puerto Rico in a selected year (2005) and to compare these findings with those previously reported for Puerto Rico in 1974 and 1981 and with other countries.

Methods: The data was collected from the pathology reports corresponding to the period of January to December 2005 of 21 participating Pathology Laboratories throughout Puerto Rico. The rate and distribution of the main types of skin cancer was calculated based on sex, age, anatomic location and laterality.

Results: The incidence of skin cancer in Puerto Rico for 2005 was 6,568 cases, which represent a rate of 167.9 per 100,000 inhabitants. The most common type of skin cancer was basal-cell carcinoma. Skin cancer was more common in males except for melanoma, which was more common in females. The incidence increases with age on all types of skin cancer. The head and neck area was the most frequent location, except for melanoma in women, which was more common on the legs. The incidence rate was 41.5/100,000 in 1974, 52.5/100,000 in 1981 and 167.9/100,000 in 2005, a 305% increase.

Conclusions: We found an increasing incidence of skin cancer in Puerto Rico when compared with previous reported data. This analysis provides a comprehensive evaluation of the epidemiology of skin cancer in Puerto Rico. [*P R Health Sci J* 2010;3:312-316]

Key words: Skin Cancer, Incidence, Puerto Rico

Cancer of the skin refers to those neoplasms that are intrinsic to the skin and which originate from the different components of the epidermis, dermis or adnexal structures. It is the most common of all types of cancer in the United States (1). It is estimated that more than 1 million of skin cancers are diagnosed each year in the United States (1) and that 1 out of 5 Americans will develop skin cancer in the course of a lifetime (2). Most of these (about 800,000 to 900,000) are basal-cell carcinoma (BCC), squamous-cell carcinoma (SCC) occurs less often (about 200,000 to 300,000 per year) (3). Malignant melanoma (MM) is far less frequent than nonmelanoma skin cancer (NMSC) but is responsible for the majority of skin cancer deaths (4).

The incidence of all types of skin cancer is increasing rapidly (1-8). The incidence of skin cancer reported for Puerto Rico in 1974 was 41.5 per 100,000 inhabitants and in 1981 52.5 per 100,000 inhabitants (6). The reported increase of skin cancer, especially keratinocytic and melanocytic, is thought to be from a combination of increased sun exposure (ultraviolet light), increased outdoor activities, infrequent use of sunscreen, indoor tanning, changes in clothing styles, increased longevity

and ozone depletion (8-9). Incidence also increases with age and male sex (8, 10). The incidence of basal-cell carcinoma in individual over 75 years is approximately 5 times higher than that of individuals between 50 and 55 years old and for squamous-cell carcinoma approximately 35 times higher. This means that the association between age and incidence is stronger for squamous than for basal-cell carcinoma. Recent studies have also found an association between the use of psoralen plus ultraviolet (UV) light A phototherapy and biologic therapies with an increase risk of cutaneous malignancies (11-12).

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The authors have no conflict of interest to disclose.

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Results of this study are essential for the evaluation of the disease burden and demand for health care related services, and also for the development of public health prevention and care giving strategies.

Materials and Methods

This study was approved by the Oncology Hospital and Veterans Affairs Caribbean Healthcare System Institutional Review Boards. The study was conducted in accordance with the guidelines for good clinical practice. The data was collected from the pathology reports corresponding to the period of January to December 2005 of 21 participating Pathology Laboratories throughout Puerto Rico. Two pathology laboratories did not participate in the study. The potential percentage of missed cases from these laboratories was estimated to be low. The data of each case included age and gender, type (histopathologic diagnosis), anatomical location and side of the tumor. The data was analyzed in terms of rate and distribution for type of skin cancer, sex, age, anatomic location and laterality.

The inclusion criteria consisted of a complete pathological report with a diagnosis of skin cancer during the year 2005. The following histopathologic diagnoses were included: malignant melanoma, basal-cell carcinoma, squamous-cell carcinoma, keratoacanthoma, Merkel-cell carcinoma, apocrine carcinoma and variants, eccrine carcinoma and variants, sebaceous carcinoma, and trichocarcinoma and variants. Bowen’s disease and squamous-cell carcinoma in-situ were included under the diagnosis of squamous-cell carcinoma. Basosquamous carcinoma was included under the diagnosis of basal-cell carcinoma. The exclusion diagnoses were cutaneous lymphoma, Kaposi’s sarcoma, other sarcomas, metastases to skin and recurrent malignancies. The exclusion criterion was the unavailability of the pathology report and incomplete data. In patients with multiple skin cancers, statistical adjustment was done to count these cases as individual lesions.

The incidence rates were calculated based on the Puerto Rico population estimates for 2005 which was 3,912,054 and multiplied by 100.000 (13). The statistical analysis use for comparing rates between age and sex was the Z test with a 95% confidence intervals and frequency distribution for %. P < 0.05 was considered statistically significant.

Results

A total of 6,568 new skin cancer cases were reported in Puerto Rico for 2005. The most common type of skin cancer was basal-cell carcinoma (BCC) with 4,164 cases (rate 106.4, 63.4%), followed by squamous-cell carcinoma (SCC) 2,042 cases (rate 52.2, 31.1%), keratoacanthoma (KA) 235 cases (rate 6.0, 3.6%) and melanoma 100 cases (rate 2.6, 1.5%) (Table 1).

Other reported skin cancers correspond to 0.7% and included: sebaceous carcinoma, adnexal carcinoma, porocarcinoma, adenoid cystic carcinoma, apocrine carcinoma, Merkel-cell carcinoma, malignant nodular hidradenoma, and malignant proliferating trichilemmal tumor.

Table 1. Incidence rates and mean age for the main types of skin cancer

| Type of skin cancer | # of cases | Rate* | Mean Age |
|---------------------|------------|-------|----------|
| BCC | 4,164 | 106.4 | 69.8 |
| SCC | 2,042 | 52.2 | 73.5 |
| KA | 235 | 6.0 | 73.5 |
| MELANOMA | 100 | 2.6 | 64.1 |

*Rates per 100,000 inhabitants
The incidence of skin cancer in Puerto Rico for 2005 was 6,568 cases (rate 167.9)

Skin cancer was more common in males than in females and was statistically significant (p<0.05) for basal-cell carcinoma 53.9% vs. 46.1%, squamous-cell carcinoma 58.1% vs. 41.9% and keratoacanthoma 55.8% vs. 44.2%. This difference was not observed in melanoma which was found to be more common in females 48.0% vs. 52.0% (Table 2). Mean age for the main types of skin cancer was 69.8 in basal-cell carcinoma, 73.5 in squamous-cell carcinoma and keratoacanthoma and 64.1 in melanoma patients (Table 1). The incidence rates by age and sex were higher for the age group of 85 years and older (rate per 100,000 inhabitants) for both basal-cell carcinoma (860.0) (Table 3) and squamous-cell carcinoma (616.0) (Table 4). The distribution by age for melanoma was different between males and females because in males the majority of the cases reported were between the age group of 64-84 years, but in females the majority of the cases were in the age groups of 35-59 and 60-84 (data not shown).

Table 2. Incidence rates by type of skin cancer and sex

| Type of skin cancer | Male | | Female | | P-value |
|---------------------|--------|-------|---------|------|---------|
| | #cases | Rate | # cases | Rate | |
| BCC | 2,209 | 117.5 | 1,892 | 93.1 | <0.0001 |
| SCC | 1,181 | 62.8 | 851 | 41.9 | <0.0001 |
| KA | 130 | 6.9 | 103 | 5.1 | 0.0185 |
| MELANOMA | 48 | 2.6 | 52 | 2.6 | 0.9941 |

*Rates per 100,000 inhabitants

In both sexes, the most frequent location of basal-cell carcinoma and squamous-cell carcinoma was the head and neck area (data not shown). Melanoma in males was more common also in the head and neck area, but in females the legs was most frequent location (Table 5). The results of this study show a small but generally consistent excess of left-sided skin cancer (data not shown), but no statistically significant difference was

reach because of the high number of reports were the laterality was not specified.

We found an increase in the incidence of skin cancer in Puerto Rico when compared with previous reported data, for 1974 the incidence rate was 41.5/100,000, in 1981 was 52.5/100,000 and in 2005 was 167.9/100,000, a 305% increase in incidence.

Table 3. Incidence rates of BCC by age and sex

| Age group | Male cases | Rate* | Female cases | Rate* | Total cases | Rate* |
|--------------------|-------------|--------------|--------------|-------------|-------------|--------------|
| 0-19 | 4 | 0.7 | 1 | 0.2 | 5 | 0.4 |
| 20-34 | 19 | 4.6 | 34 | 7.9 | 53 | 6.3 |
| 35-59 | 402 | 69.5 | 388 | 58.5 | 790 | 63.6 |
| 60-84 | 1367 | 496.9 | 1124 | 327.3 | 2491 | 402.8 |
| 85+ | 280 | 1259.6 | 217 | 610.2 | 497 | 860.0 |
| Age, not specified | 137 | | 128 | | 265 | |
| Total | 2209 | 117.5 | 1892 | 93.1 | 4101 | 104.8 |

*Rates per 100,000 inhabitants

Table 4. Incidence rates of SCC by age and sex

| Age group | Male cases | Rate* | Female cases | Rate* | Total cases | Rate* |
|--------------------|-------------|-------------|--------------|-------------|-------------|-------------|
| 0-19 | 1 | 0.2 | 0 | 0.0 | 1 | 0.1 |
| 20-34 | 14 | 3.4 | 2 | 0.5 | 16 | 1.9 |
| 35-59 | 155 | 26.8 | 82 | 12.4 | 237 | 19.1 |
| 60-84 | 657 | 238.8 | 425 | 123.8 | 1082 | 174.9 |
| 85+ | 170 | 764.8 | 186 | 523.0 | 356 | 616.0 |
| Age, not specified | 184 | | 156 | | 340 | |
| Total | 1181 | 62.8 | 851 | 41.9 | 2032 | 51.9 |

*Rates per 100,000 inhabitants

Table 5. Anatomic distribution for melanoma

| Site | Male | Female | Total | % |
|--------------|-----------|-----------|-----------|------------|
| back | 7 | 7 | 14 | 15.6 |
| foot | 7 | 7 | 14 | 15.6 |
| leg | 0 | 12 | 12 | 13.3 |
| arm | 1 | 8 | 9 | 10.0 |
| abdomen | 6 | 0 | 6 | 6.7 |
| ear | 5 | 1 | 6 | 6.7 |
| chest | 3 | 2 | 5 | 5.6 |
| neck | 4 | 0 | 4 | 4.4 |
| buttock | 2 | 1 | 3 | 3.3 |
| cheek | 1 | 2 | 3 | 3.3 |
| eyelid | 1 | 2 | 3 | 3.3 |
| others | 7 | 4 | 11 | 12.2 |
| Total | 44 | 46 | 90 | 100 |

Comment

The incidence of skin cancer in Puerto Rico has substantially increased from 1941 to 2005, and it is estimated that will continue to increase (6).

The age-adjusted incidence rates per 100,000 persons were as follow: BCC (males) 117.5, BCC (females) 93.1, SCC (males) 62.8, SCC (females) 41.9 (Table 2). These are lower when compared to the estimated (lowest and highest) age-adjusted incidence rates per 100,000 whites for the year 1994 in the United States (14): BCC (males) 407-485, BCC (females) 212-253, SCC (males) 81-136, SCC (females) 26-59. Although the incidence rates of the US are higher than those of Puerto Rico, they do not approach the rates described from Australia where the incidence is 1000-2000 per 100,000 per year (14). The age-standardized incidence rates in Townsville, Australia between December 1996 and December 1997 were: BCC (males) 2058.3, BCC (females) 1194.5, SCC (males) 1332.3, SCC (females) 754.8 (15). In Scotland, the incidence of SCC between 1995-1997 was 34.7/100,000 which is lower than in Puerto Rico (16). In Canada, the age-standardized rate of NMSC per 100,000 persons was 36 in 1960 and 99 in 2000, lower than the rates in Puerto Rico (17). In Sweden, SCC rates increase in men from 4.4/100,000 in 1961 to 23.1/100,000 in 1995 and among women from 4.1 to 10.1 respectively, but still are lower when compare with the rates of SCC in Puerto Rico (18).

The incidence of skin cancer depends on the geographical region, those living at latitudes closer to the equator have higher incidence rates (8, 10). The highest increases in the incidence of BCC has been reported in Australia with incidence rates between 1 and 2% per year, followed by the US and Europe (10). There is an increased risk of NMSC in white populations, especially those with blue eyes, skin types I and II (sunburn easily, suntan poorly, freckle with sun exposure) and red or blond hair (8). The protective role of skin pigmentation is underlined by the fact of low incidence rates of BCCs in individuals of African descent (10). Malignant melanoma occurs among all racial and ethnic groups, but the frequency of its occurrence is closely associated with the color of the skin, and depends on the geographical zone (8). The risk factors for melanoma occurring in an individual include a combination of constitutional predisposition (skin color, tendency to freckle, family history of melanoma, presence of a large number of nevi, increasing age) and exposure to environmental factors (UV light). Sun exposure in childhood and intense intermittent sun exposures are suggested to be the major environmental risk factors (19).

Most of the skin cancers in Puerto Rico were basal-cell carcinoma, followed by squamous-cell carcinoma. There was a statistically significant difference between sexes for BCC and SCC, being most common in males. This difference was not held true for melanoma for which the majority of the cases

were reported in women. This finding is very similar to that described by Valentín et al. in 2007 (7). They reported 48.2% of males cases and 51.8% of females cases between 1987 and 2002, with a mean of 98 melanoma cases per year. We found 48% of male cases and 52% of female cases with a total of 100 melanoma cases for the year 2005. Also the distribution by age for melanoma was different between males and females because for males the majority of the cases reported were between the age group of 64-84 years, but for females the majority of the cases were in the age groups of 35-59 and 60-84. In both sexes, the most frequent location of skin cancer was the head and neck area, except for melanoma in women where the most common anatomic area reported was the legs. For women 4.2% of SCC occurred on the genitalia, but the etiology for the cancer in this area is multifactorial and includes the human papillomavirus but not sun exposure (20).

Anatomical asymmetry (laterality) in skin cancer incidence has been observed for malignant melanoma in Australia, England, Finland, Netherlands, Scotland and US from 1998-2003 (21). More recently Butler and Fosko found significantly more skin cancers formed on the left side of the body than the right in men and especially of the exposed areas of the head and neck (22). Our results reflect a small but generally consistent excess of left-sided skin cancers, but not statistically significant due to the high numbers of cases where laterality of skin cancers was not specified in the pathology reports. The suggested explanations to the left-sided skin cancer excess are due to increased exposure to UV rays during driving may lead to the development of more skin cancers on the left side of the body, (22) and asymmetry of melanocyte distribution during embryogenesis (21).

A limitation to our study was the two Pathology Laboratories that did not participated in the study, but potential percentage of missed cases was estimated to be low. Other limitation is the cases not reported due to patients lacking access to physicians, patient not seeking care, patients dying from other causes before diagnosis, and diagnostic accuracy of primary and/or pathologist. The rising in the incidence can be secondary to the increase in life expectancy, earlier detection and higher surveillance.

When compared with previous reported data, the incidence of skin cancer in Puerto Rico has increased from 41.5/100,000 in 1974, to 52.5/100,000 in 1981 and 167.9/100,000 in 2005. These results are valuable for the public health care system to encourage the importance of skin cancer preventive strategies such as: use of sunscreen with sun protection factor of 30 or higher; wearing protective clothing and sunglasses; and avoidance of sunbathing as well as tanning beds which provide an additional source of UV radiation (1). Early detection is essential through regular skin exam by the patient and promptly visiting a physician if new or unusual lesions or a progressive change in a lesion's appearance (size, shape or color, etc) occurs.

For all suspicious lesions removal and microscopic examination is necessary. Although NMSC has a low mortality, its incidence is more common than all other cancers combined (23) and in view of the already mentioned increase in incidence, the cost of care to health insurance is likely to increase. Regulations or legislations that will positively impact the management of skin cancer are needed.

Resumen

Contexto: La incidencia de cáncer de piel continúa aumentando en todo el mundo. El propósito de este estudio fue determinar la incidencia de cáncer de piel en Puerto Rico en un año seleccionado (2005) y comparar nuestros resultados con los reportados para Puerto Rico en 1974 y 1981 y con otros países. **Métodos:** Los datos fueron reunidos de los informes de patología correspondientes al período de enero a diciembre 2005, de 21 Laboratorios del Patología en Puerto Rico. La tasa y la distribución de los principales tipos de cáncer de piel fueron calculadas basadas en el sexo, la edad, la ubicación anatómica y la lateralidad. **Resultados:** La incidencia de cáncer de piel en Puerto Rico para 2005 fue 6,568 casos, que representan una tasa de 167.9 por 100,000 habitantes. El tipo más común de cáncer de piel fue carcinoma baso-celular. El cáncer de piel fue más común en hombres menos melanoma, que fue más común en mujeres. La incidencia aumenta con la edad en toda clase de cáncer de piel. La área de la cabeza y el cuello fue la ubicación más frecuente, menos melanoma en mujeres que fue más común en las piernas. La tasa de la incidencia fue 41.5/100,000 en 1974, 52.5/100,000 en 1981 y 167.9/100,000 en 2005, un aumento de 305%. **Conclusión:** Encontramos una incidencia creciente de cáncer de piel en Puerto Rico cuando comparamos con los datos antes reportados. Este análisis proporciona una evaluación completa de la epidemiología de cáncer de piel en Puerto Rico.

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