Increasing Rates of Melanoma Among Nonwhites in Florida Compared With the United States

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Objective: To compare melanoma trends within Florida with national melanoma trends from 1992 through 2004. An analysis of state and national melanoma trends is critical for the identification of high-risk regions of the country.

Design: Data from the Florida Cancer Data System (FCDS) and Surveillance, Epidemiology, and End Results (SEER) were evaluated to determine age-adjusted and race/ethnicity- and sex-specific invasive cutaneous melanoma incidence trends for 1992 through 2004 using jointpoint regression analysis. Standardized incidence rate ratios (SIRRs) were computed to compare Florida with the United States.

Patients: A population of 109,633 patients with invasive melanoma was evaluated: 73,206 (66.8%) from SEER and 36,427 (33.2%) from FCDS.

Main Outcome Measures: Melanoma incidence and change in melanoma rates over time.

Results: The incidence of melanoma among male Hispanic patients residing in Florida was 20% higher than that of their male counterparts in the SEER catchment areas (SIRR, 1.2; 95% confidence interval [CI], 1.1-1.4). Conversely, the incidence of melanoma among female Hispanic patients residing in Florida was significantly lower than that in SEER (SIRR, 0.7; 95% CI, 0.7-0.8). Differences in melanoma incidence were identified in female non-Hispanic black (NHB) patients in Florida who had a 60% significantly higher incidence of melanoma compared with female NHB patients in SEER (SIRR, 1.6; 95% CI, 1.3-2.0).

Conclusion: These findings suggest an emerging public health concern in race/ethnic subgroups that were previously understudied.

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In the past several decades, melanoma incidence has increased more rapidly than that of any other cancer.1 In the United States, it is predicted that 1 in 58 Americans will develop invasive melanoma over their lifetime—1 in 41 men and 1 in 61 women.2 The World Health Organization (WHO) estimates the total global disease burden of melanoma at 690,000 disability-adjusted life-years (DALYs).3 Although the relative risk of UV radiation (UVR) exposure differs by location of residence, season, and individual susceptibility, more than half of these DALYs (50%-90%) are attributed to UVR exposure.4

Variation in melanoma incidence by region of the country exists, likely due in part to UVR exposure.5-8 Geographical regions with increased UVR exposure should be examined for risk differences.9 The descriptive analysis of state and national melanoma incidence rates allow the identification of high-risk regions and populations. These studies are essential for targeting public health interventions.

Much literature has addressed lighter-skinned populations because of their greater risk of developing melanoma. Although the age-adjusted incidence rates for melanoma are lower among Hispanic and non-Hispanic black (NHB) compared with non-Hispanic white (NHW) individuals, melanoma among minority populations is more likely to present at advanced stages, resulting in higher mortality than NHW patients.10-13 Florida offers a unique advantage for studying melanoma incidence rates. Florida has the second highest number of new cases of melanoma per year in the United States (n=4380; 7% of US cases).14 Florida also has the greatest amount of annual UVR exposure in the United States.15 In addition, Florida is a racially and ethnically diverse state, with 20.2% Hispanic and 15.8% NHB individuals, thus providing the opportunity to examine melanoma incidence in nonwhite populations.16

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A comparison of individual state cancer rates with national rates also serves as an important gauge for melanoma prevention efforts, with intensified public health efforts in areas with unequal cancer risk burdens. Cancer statistics for the nation are reported based on the analysis of data from the population-based registries. The Surveillance, Epidemiology, and End Results (SEER) Program has collected data for a number of years and one of its strengths is its longevity. Therefore, SEER incidence rates serve as an important state benchmark for comparison of trends over time. The purpose of this study was to evaluate trends in melanoma incidence rates in Florida (using the Florida Cancer Data System [FCDS]) and in the United States (using SEER data) from 1992 through 2004, with a particular focus on subgroups that have been understudied such as Hispanics and blacks. We compared race/ethnicity–specific incidence rates and trends of invasive melanoma.

**METHODS**

**FLORIDA CANCER DATA SYSTEM**

Florida incidence rates were obtained through FCDS. Since 1981, the Florida Department of Health has funded FCDS to collect cancer incidence data. In 1994, the FCDS joined the National Program of Cancer Registries (NPCR) administered by the Centers for Disease Control and Prevention (CDC). Following national standards, nearly 95 000 invasive, reportable incident cases of cancer are annually abstracted from hospitals, freestanding ambulatory surgical centers, radiation therapy facilities, pathology laboratories, and dermatopathologists’ offices. All cancers in the FCDS database are coded using the International Classification of Diseases for Oncology, Third Edition (ICD-O-3). In addition, FCDS has met or exceeded the North American Association of Central Cancer Registries (NAACCR) standards of quality, timeliness, and completeness for all years since 1995, the first year in which certification was sought by this organization. The Florida population increased from 13 551 240 in 1992 to 17 134 935 in 2004.

**SEER PROGRAM**

National incidence rates were obtained from the SEER-13 Program. To obtain incidence rates specifically within Hispanic populations, the 12 SEER registries that collect data on Hispanic ethnicity were included: Atlanta, Georgia; Connecticut; Detroit, Michigan; Hawaii; Iowa; Los Angeles, California; New Mexico; rural Georgia; San Francisco–Oakland, California; Seattle–Puget Sound, Washington; and Utah. Estimates of the underlying populations covered by the SEER registries are based on data from the US Bureau of the Census. The population from which these cases were identified increased in size from 35 796 360 in 1992 to 40 229 493 in 2004. These registries encompass approximately 14% of the US population and 13% of the US cancer cases. This population is representative of the country with regard to socioeconomic status and educational level, although it includes higher proportions of people living in urban areas and those who are foreign born.

**VARIABLES**

For both FCDS and SEER, individual patient medical records are the source of data on patient and tumor characteristics. Melanoma cases were identified by ICD-O-3 codes (8720-8790). Beginning in 2001, SEER switched from using the second edition ICD-O-2 codes to ICD-O-3 codes. Codes for melanoma in both ICD-O editions were matched to ensure consistency in identification of cases.

In both FCDS and SEER, Hispanic ethnicity is not mutually exclusive from race. As a result, race/ethnicity was categorized into 3 groups: NHW, NHB, and Hispanic. Although SEER began collecting data on cancer cases in 1973, it was not until 1992 that the SEER Program expanded to increase coverage of minority populations, especially Hispanics. For this reason, our trend analysis is limited to 1992 through 2004.

**STATISTICAL ANALYSIS**

Age-adjusted melanoma incidence rates with their corresponding 95% confidence intervals (CIs) for FCDS and SEER were generated using SEER*Stat 6.3.6 and SAS software, respectively. The incidence rates are expressed as the number of cases per 100 000 person-years of observation, age-adjusted to the year 2000 US standard population.

Changes in incidence rates over the period of interest were evaluated using joinpoint regression with the Joinpoint regression software developed by the Statistical Research and Applications Branch at the National Cancer Institute. We used a weighted least-squares log-linear approach to identify time points when changes in incidence rates occur, and incidence rate trends by race/ethnicity were allowed up to 3 joinpoints in each regression model. The best-fitting model was chosen based on the Monte Carlo Permutation method that maintained an overall goodness of fit value of < .05. Annual percentage changes (APCs) were calculated for each joined line segment starting in 1992 and then between any identified joinpoints through 2004.

Standardized incidence rate ratios (SIRRs) comparing pooled 1992-2004 age-adjusted melanoma incidence rates by race/ethnicity and sex in Florida vs the SEER-13 were computed along with their corresponding 95% CI using SAS software.

All data used were nonidentifying, and the study was approved by the institutional review board at the University of Miami Miller School of Medicine, Miami, Florida.

**RESULTS**

**DESCRIPTIVE STATISTICS**

In SEER, 73 206 cases of invasive melanoma were diagnosed between 1992 and 2004: 70 596 (96.4%) among NHWs, 2238 (3.1%) among Hispanics, and 372 (0.5%) among NHBs. In Florida, 36 427 cases of invasive melanoma were diagnosed during 1992 through 2004: 35 022 (96.1%) among NHWs, 1147 (3.2%) among Hispanics, and 258 (0.7%) among NHBs.
TEMPORAL TRENDS AND APCs

The race/ethnicity–specific melanoma incidence rates and jointpoint regression results for SEER and Florida during 1992 through 2004 are presented in Table 1 and Table 2. Since 1992, the incidence of melanoma among NHW patients in the SEER has maintained a significant increase (1992-2004: APC, 3.0%; 95% CI, 2.4 to 3.7) (Table 2). Overall, NHW Floridians had slightly lower melanoma rates than those noted among their SEER counterparts during 1992 through 2004. This Florida group, however, experienced steeper significant increase in rates,
which persisted several years until 2000 (1992-2000: APC 5.6%; 95% CI, 4.5 to 6.6). Thereafter, the incidence rate of melanoma among NHWs residing in Florida decreased from 22.9 per 100 000 person-years in 2000 to 22.4 per 100 000 person-years in 2004.

From 1992 through 1999, the incidence of melanoma among Hispanic patients in SEER significantly increased at a rate of 5.0% (95% CI, 1.9 to 8.2) (Table 2). Beginning in 1999, incidence rates of melanoma among Hispanic patients in SEER decreased from 5.1 per 100 000 person-years in 1999 to 4.1 per 100 000 person-years in 2004. In Florida, the incidence linearly increased through the 1990s, peaking in 2000 with 5.2 per 100 000 person-years. The rates slightly fluctuated from 3.4 per 100 000 person-years in 2001 to 4.0 per 100 000 person-years in 2004.

Incidence rates were consistently low compared with other race/ethnic groups among NHBs in both SEER and FCDS. In SEER, the incidence rate of melanoma among NHBs steeply increased until 1995 and then significantly decreased, with an APC of −6.4% (95% CI, −11.1 to −1.4) from 1995 through 2004. In Florida, the incidence of melanoma among NHBs peaked in 1999, with an incidence of 1.7 per 100 000 person-years. However, NHBs experienced an overall steady and more gradual reduction during 1992 through 2004.

Table 3 presents the sex- and race/ethnicity–specific pooled 1992-2004 age-adjusted incidence rates and the SIRR comparing Florida vs SEER. In the years 1992 through 2004, male and female NHB patients residing in Florida had lower incidence rates of melanoma relative to NHB patients in the 12 SEER catchment areas (SIRRs of 0.9 and 0.8, respectively) (Table 3). Among Hispanic patients, the incidence of melanoma among female patients residing in Florida was significantly lower than those in SEER (SIRR, 0.7; 95% CI, 0.7 to 0.8). The incidence of melanoma among male Hispanic patients residing in Florida, however, was 20% higher than that of their male counterparts in the SEER catchment areas (SIRR, 1.2; 95% CI, 1.1 to 1.4).

The incidence of melanoma among male NHB patients in Florida was not significantly higher than that of SEER (SIRR, 1.1; 95% CI, 0.8 to 1.4). The opposite pattern was evident for female NHB patients residing in Florida. The incidence of melanoma among female NHB patients in Florida was significantly higher than that of those in SEER (SIRR, 1.6; 95% CI, 1.3 to 2.0).

To our knowledge, a systematic comparison of invasive melanoma incidence trends by race/ethnicity of a large individual state with national cancer statistics has not been previously published. We found higher rates of melanoma among female NHB patients and male Hispanic patients in Florida relative to SEER. Male Hispanic patients had a 20% higher incidence rate relative to male Hispanic patients in SEER. In Florida, female NHB patients had 60% higher rates of invasive melanoma than their SEER counterparts. These findings may suggest an emerging public health concern in race/ethnic subgroups residing in Florida, a geographic location with heavy UVR exposure.

We also found the melanoma incidence pattern of Hispanics in Florida resembled the incidence pattern of NHW patients residing in SEER registry areas. Previous research that has studied melanoma incidence by race/ethnicity and sex have found higher incidence rates among male NHW patients relative to female NHW patients and higher incidence rates among female Hispanic patients relative to male Hispanic patients. In contrast, we found that incidence rates were higher among male Hispanic patients in Florida (3.1 per 100 000 person-years) relative to their female counterparts (3.2 per 100 000 person-years), yielding a male to female ratio of 1.6:1. This sex ratio is similar to the male to female ratio of 1.5:1 found among NHW patients in SEER. The sex ratio we report may be related to the assignment of race/ethnicity and/or the ethnic composition of SEER and FCDS. First, Hispanic ethnicity in FCDS data is self-reported and abstracted from the patient’s medical records. Race/ethnicity in SEER, however, is assigned with the use of computer algorithms. The discrepancy between our results and those of previous studies may be owing to the use of commonly applied computer algorithms for identification of race/ethnicity in previous studies. Such algorithms have the potential to misclassify female patients by their married last names. Second, the SEER Hispanic popu-

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<td>SEER 18.0 (18.7 to 19.0)</td>
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Table 3. Sex- and Race/Ethnicity–Specific FCDS and SEER Age-Adjusted Incidence Rates With Rate Ratios Comparing Geographic Regions for Invasive Melanoma of the Skin (1992-2004)

Abbreviations: CI, confidence interval; FCDS, Florida Cancer Data System; NHB, non-Hispanic black; NHW, non-Hispanic white; SEER, Surveillance, Epidemiology, and End Results; SIRR, standardized incidence rate ratio.

a Incidence rates per 100 000 person-years are age-adjusted to the 2000 US standard population (19 age groups).

b The SIRR compares pooled FCDS vs SEER incidence rates of melanoma of the skin.
Hispanic subgroups. With the aggregation of all Hispanic ethnicity in public health databases encompass all identification of Hispanic subgroups. At this time, "Hispanic" ethnicity in the SEER Program reside in California, where more than three-fourths (77.1%) of Hispanics are Mexican-American. Conversely, the Hispanic population in Florida is highly heterogeneous, with Cuban Americans as the largest Hispanic subgroup in Florida (31.1%). Hispanic subgroups vary in skin pigmentation, and their skin sun sensitivity may also differ.

The pigmentation and skin sun sensitivity of darker-skinned populations is of particular interest from a biological point of view. The lower incidence of melanoma in Hispanics and NHBs have historically been attributed to the protective effects of darker skin. For this reason, UVR has been postulated to play a smaller role in the pathogenesis of skin cancer among darker-skinned populations. Ethnic disparities in melanoma, however, may be due to biological behavior and/or implications of lower socioeconomic position and health disparities (such as access to health care, more advanced stage at diagnosis, and differences in treatment). This is an area of melanoma and public health research that requires more attention and study.

An inherent limitation of any population-based study is the lack of individual records of exposure. We did not have any individual records of skin sun sensitivity or UVR exposure. In using data from Florida, one issue is net increase in population, ie, migration into Florida, especially among elderly individuals. Given the latency in melanoma development, one cannot assume an individual's UVR exposure based on residency, particularly without dates of residency. Although race has been used as a proxy for skin color and skin sun sensitivity, it does not permit conclusions to be drawn with respect to constitutive skin pigmentation or Fitzpatrick skin type. This is particularly important among Hispanics who do not identify with a racial label. The overall lower incidence of melanoma among darker-skinned populations compared with NHWs limits the sample size presented in this study. Although the potential for underreporting of cancers may exist, funding from the CDC's National Program of Cancer Registrars and the FCDS over recent years have led to active reporting of skin cancers, particularly melanomas, by pathology laboratories and dermatopathologists. Despite these efforts, if underreporting persists, resultant incidence of melanoma among all race/ethnic groups would be greater than reported.

In conclusion, by comparing national melanoma trends with those obtained from individual states, disparities in melanoma prevention and detection may be uncovered. We are hopeful that the analysis of ethnic disparities in melanoma will prompt public health initiatives. The development of educational campaigns on sun safety and skin cancer awareness should be tailored to the unique needs of Florida.

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Author Contributions: Drs Rouhani and Kirsner had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Rouhani, Fleming, and Kirsner. Acquisition of data: Rouhani, Fleming, MacKinnon, and Kirsner. Analysis and interpretation of data: Rouhani, Pinheiro, Sherman, Arheart, Fleming, MacKinnon, and Kirsner. Drafting of the manuscript: Rouhani and MacKinnon. Critical revision of the manuscript for important intellectual content: Rouhani, Pinheiro, Sherman, Arheart, Fleming, and Kirsner. Statistical analysis:

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