

Cancer disparities between mainland and island Puerto Ricans

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ABSTRACT

Objectives. Examination of cancer rates in a single Hispanic subgroup—Puerto Ricans—and comparison of incidence rates among mainland Puerto Ricans living in the United States, island Puerto Ricans in Puerto Rico, and U.S. non-Hispanic whites to reveal ethnic-specific cancer patterns and disparities in Puerto Ricans.

Methods. Incidence data were obtained from the cancer registries of Puerto Rico and three U.S. northeastern states (New York, New Jersey, and Connecticut) with a high density of mainland Puerto Ricans. Age-adjusted rates were compared by standardized rate ratios (SRRs).

Results. Total cancer incidence was the lowest in island Puerto Ricans, intermediate for mainland Puerto Ricans, and highest in U.S. non-Hispanic whites. Compared to mainland Puerto Ricans, islanders had significantly lower rates ($p < 0.05$) for major cancers—lung (SRRs = 0.36 in males and 0.29 in females), prostate (SRR = 0.71), female breast (SRR = 0.73), and colon-rectum (SRRs = 0.74 in males and 0.65 in females)—as well as several less common cancers (urinary bladder; non-Hodgkin lymphoma; liver; kidney and renal pelvis; pancreas; thyroid; leukemia; and skin melanoma). Overall cancer rates in mainland Puerto Ricans were modestly lower than those in U.S. non-Hispanic whites, but mainland Puerto Ricans had the highest rates for stomach, liver, and cervical cancers among the three populations.

Conclusion. Despite socioeconomic disadvantages, island Puerto Ricans have relatively low cancer incidence. Identifying contributing factors would be informative for cancer research, and understanding the reasons for increased cancer risk in their mainland counterparts would facilitate the development of ethnic-specific intervention programs.

Key words Hispanic Americans, neoplasms, incidence, Puerto Rico, United States.

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The Hispanic population is the largest and fastest growing minority group in the United States. The more than 35 million Hispanics make up 13% of the U.S. population now (1), and this proportion

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is projected to increase to 25% by 2050 (2). As a total group, Hispanics are socioeconomically disadvantaged—they are almost three times more likely to be below the poverty level and to have no health care coverage compared to non-Hispanic whites (3). However, Hispanics in the United States have lower cancer incidence rates than non-Hispanic whites for all cancers combined (age-adjusted

incidence ratio = 0.7 for both males and females) as well as for the most common cancers, namely prostate, female breast, colon-rectum, and lung (age-adjusted incidence ratios range from 0.4 to 0.8) (3). Similar trends exist for cancer mortality rates (3).

This apparent health paradox needs to be interpreted with caution, however, due to two characteristics of the Hispanic population. First, Hispanics in the United States are a heterogeneous group comprising five major subgroups: Mexican (59%), Puerto Rican (10%), Cuban (4%), Central or South American (9%), and “other” Hispanics (18%) (1). These ethnic subgroups are diverse in nationality, genetic composition, socioeconomic status, culture, and health outcomes (3–6). Second, Hispanics are migrants; therefore, the effects of diverse migration and acculturation that exist even within ethnic subgroups must be taken into consideration (6, 7). Cancer risk in Hispanics may vary by ethnicity as well as by migration history. Therefore, it is essential to study individual Hispanic subgroups separately in order to reveal differential cancer patterns among the subgroups and compare them with those of non-Hispanic whites. Ethnic-specific cancer disparities could be missed if Hispanics are treated as one homogenous population.

In this study, cancer incidence was examined in one ethnic subgroup—Puerto Ricans—and cancer rates were compared among Puerto Ricans residing in Puerto Rico (island Puerto Ricans), Puerto Ricans living in the continental United States (mainland Puerto Ricans), and U.S. non-Hispanic whites. Given that Puerto Ricans are the second-largest Hispanic subgroup in the United States, information on their cancer burden has important public health implications.

Earlier studies (based on cancer data from 20–30 years ago) showed that the incidence rates for all sites combined and several major types of cancer (prostate, breast, lung, and colon-rectum) were lowest in island Puerto Ricans, followed by mainland Puerto Ricans and then U.S. non-Hispanic whites (8–12). On the other hand, incidence rates for stomach and cervical cancers tended to be similar for island and mainland Puerto Ricans and lower for non-Hispanic whites (8–12). However, the data from these earlier studies may have been skewed by the fact that cancer cases in mainland Puerto Ricans were identified solely by self-

TABLE 1. Number and proportion of Puerto Ricans among Hispanic populations in nine counties in the states of New York, New Jersey, and Connecticut (USA)

County	Hispanics (No.)	Puerto Ricans (No.)	Puerto Ricans (%)
New York State			
Chautauqua	5 901	4 542	77.0
Erie	31 054	21 575	69.5
Monroe	39 065	27 501	70.4
Montgomery	3 433	2 376	69.2
New Jersey State			
Camden	49 166	33 712	68.6
Cumberland	27 823	18 520	66.6
Connecticut State			
Hartford	98 968	73 750	74.5
New Haven	83 131	55 851	67.2
Windham	7 737	5 373	69.4
Total	346 278	243 200	70.2

Source: U.S. Census Bureau, Census 2000 summary file 1 (SF1), Table QT-P9, Hispanic or Latino by type: 2000.

reported ethnicity and place of birth, as recorded in hospital or tumor registry records. As this information is often missing in these types of medical records, the incidence rates in mainland Puerto Ricans might have been biased. To improve the accuracy of reported cancer incidence rates in mainland Puerto Ricans, the current study used incidence rates of Hispanics in geographical areas with a high Puerto Rican density to approximate rates in mainland Puerto Ricans. Analyzing cancer incidence data from 1998–2002, this study examined if differential cancer rates still exist among island Puerto Ricans, mainland Puerto Ricans, and U.S. non-Hispanic whites. Such information could help researchers identify cancer disparities in Puerto Ricans, determine their possible causes, and develop culturally specific intervention programs to reduce them.

MATERIALS AND METHODS

Sources of cancer incidence data

Cancer data for island Puerto Ricans were provided by the Puerto Rico Central Cancer Registry, which has been funded by the National Program of Cancer Registries (NPCR) of the U.S. Centers for Disease Control and Prevention (CDC) since 1997 with a mandate to collect high-quality data. In a 2003 CDC audit, completeness-of-case ascertainment from hospital sources was 95.3%.

In the United States, 50% of mainland Puerto Ricans reside in the states of New York (NY), New Jersey (NJ), and Connecticut (CT) (1). Within these three states, there are nine counties with a

high density of Puerto Ricans, and about 70% of Hispanics in these counties are Puerto Ricans (Table 1). This study used cancer incidence rates in Hispanics from these nine counties to approximate those in mainland Puerto Ricans. Cancer data from the selected counties of the three states were obtained from the New York State Cancer Registry, the New Jersey State Cancer Registry, and the Surveillance, Epidemiology, and End Results (SEER) Program for Connecticut. These three registries are members of the North American Association of Central Cancer Registries (NAACCR), and the Connecticut and New Jersey registries have participated in the SEER program since 1973 and 2001, respectively. The data records from these registries for 1998–2002 that were analyzed in this study were more than 95% complete and met the NAACCR standard for high-quality cancer incidence data (13). All three cancer registries use the NAACCR Hispanic/Latino Identification Algorithm, version 2 (NHIA v2), for identification of Hispanic cases. This hierarchical algorithm of ethnicity assignment is based on self-reported Hispanic origin, race, birthplace, gender, maiden name, and surname (14).

Cancer incidence rates for U.S. non-Hispanic whites in NY, NJ, and CT (statewide data) and in the nine counties with a high Puerto Rican density (countywide data) were obtained from the same sources as those for the Hispanic data described above. When incidence data of U.S. non-Hispanic whites were compared with those of Puerto Ricans, similar rate ratios were obtained regardless of whether the statewide or county-

TABLE 2. Annual age-adjusted incidence rates per 100 000 in males for selected cancer sites in island Puerto Ricans, mainland Puerto Ricans, and U.S. non-Hispanic whites, 1998–2002^a

	Island Puerto Ricans		Mainland Puerto Ricans ^c		U.S. non-Hispanic whites ^d		Island vs. mainland Puerto Ricans (SRR ^e (95% CI) ^f)	Mainland Puerto Ricans vs. U.S. non-Hispanic whites (SRR (95% CI))
	Rank	Rate (SE) ^b	Rank	Rate (SE)	Rank	Rate (SE)		
All sites		335.8 (2.1)		510.8 (14.5)		604.9 (1.1)	0.66 (0.61–0.70) ^g	0.84 (0.80–0.89) ^g
Prostate	1	116.0 (1.2)	1	159.2 (8.6)	1	173.1 (0.6)	0.73 (0.64–0.82) ^g	0.92 (0.83–1.02)
Colon & rectum	2	45.9 (0.8)	3	62.4 (5.4)	3	74.1 (0.4)	0.74 (0.60–0.90) ^g	0.84 (0.72–0.99) ^g
Lung & bronchus	3	24.9 (0.6)	2	63.9 (5.3)	2	88.8 (0.4)	0.39 (0.30–0.50) ^g	0.72 (0.63–0.83) ^g
Oral cavity & pharynx	4	17.0 (0.5)	8	15.6 (2.5)	10	14.3 (0.2)	1.09 (0.81–1.48)	1.09 (0.78–1.51)
Stomach	5	15.8 (0.5)	6	20.0 (3.3)	11	12.7 (0.2)	0.79 (0.54–1.15)	1.58 (1.05–2.37) ^g
Urinary bladder	6	13.8 (0.4)	4	25.4 (3.9)	4	48.8 (0.3)	0.54 (0.36–0.81) ^g	0.52 (0.42–0.64) ^g
Non-Hodgkin lymphoma	7	11.0 (0.4)	5	21.7 (3.0)	5	25.3 (0.2)	0.51 (0.35–0.74) ^g	0.86 (0.67–1.10)
Esophagus	8	8.8 (0.3)	10	11.9 (2.6)	13	8.4 (0.1)	0.74 (0.44–1.22)	1.43 (0.85–2.39)
Liver & intrahepatic bile duct	8	8.8 (0.3)	7	18.7 (2.9)	15	7.5 (0.1)	0.47 (0.30–0.73) ^g	2.50 (1.57–4.00) ^g
Larynx	9	8.1 (0.3)	13	6.9 (1.6)	14	7.8 (0.1)	1.18 (0.77–1.79)	0.89 (0.58–1.35)
Leukemia	10	7.4 (0.3)	11	11.8 (2.4)	8	18.0 (0.2)	0.63 (0.38–1.04)	0.66 (0.48–0.91) ^g
Kidney & renal pelvis	11	6.6 (0.3)	9	13.5 (2.4)	7	19.8 (0.2)	0.49 (0.30–0.80) ^g	0.68 (0.51–0.91) ^g
Pancreas	12	5.7 (0.3)	12	10.4 (2.3)	9	14.4 (0.2)	0.55 (0.30–0.98) ^g	0.72 (0.50–1.05)
Melanoma of skin	19	2.3 (0.2)	20	3.6 (1.3)	6	22.1 (0.2)	0.63 (0.26–1.52)	0.16 (0.13–0.21) ^g

^a Age standardized to U.S. 2000 population. The selected cancer sites were the top 10 cancer sites in at least one of the three study populations.

^b SE = standard error.

^c Estimated from incidence rates in Hispanics in nine counties with a high Puerto Rican density in the states of New York, New Jersey, and Connecticut (USA).

^d Rates in non-Hispanic whites in the states of New York, New Jersey, and Connecticut (USA).

^e SRR = Standardized rate ratio.

^f CI = confidence interval.

^g *P* value < 0.05.

wide data for U.S. non-Hispanic whites were analyzed. Statewide (vs. county) incidence rates for non-Hispanic whites were used in this study because they have a smaller variance and hence better precision.

Statistical analysis

The cancer incidence rates reported in this study were annual rates based on tumors with malignant behavior per 100 000 persons for the period 1998–2002, age-adjusted by the direct method to the year 2000 U.S. Bureau of the Census estimates using 19 different age groups (<1, 1–4, 5–9 . . . 80–84, 85+ years) (15). For island Puerto Ricans, age-adjusted cancer incidence rates and standard errors were generated using SEER*Stat software version 6.4.4 (National Cancer Institute, Cancer Statistics Branch, Bethesda, Maryland). For mainland Puerto Ricans, the numbers of cases and population at risk over the 5-year period in Hispanics in the selected counties of each of the three states were obtained. The numbers of cases were then summed across the nine counties and divided by the sum of the population estimates to obtain Hispanic incidence rates in the nine counties with a high Puerto Rican density. These rates were first calculated by gender, cancer site, and age (for the

19 age groups). Age-adjusted rates and standard errors were then computed by gender and cancer site (16). Similar procedures were applied to aggregate data from non-Hispanic whites in the three states to calculate age-adjusted rates.

The age-adjusted incidence rates were compared between two populations (e.g., islanders vs. mainland Puerto Ricans) by calculating a standardized rate ratio (SRR) and its 95% confidence interval (CI) (16, 17). Two populations are significantly different in their standardized rates at the 0.05 level if the 95% CI of the SRR excludes 1. The SRRs for the incidence rates of island Puerto Ricans versus mainland Puerto Ricans as well as the SRRs for mainland Puerto Ricans versus non-Hispanic whites were calculated by gender. SRRs are presented for all sites combined and for the 10 most common cancer sites in each study population. Fourteen different cancers in at least one of the three study populations.

RESULTS

Cancer incidence in males

Table 2 shows the age-adjusted cancer incidence rates in males. For most cancers (9 out of 14 sites), incidence rates

were lowest among island Puerto Ricans, followed by mainland Puerto Ricans and then non-Hispanic whites. The disparity between the two Puerto Rican populations was greater than that between mainland Puerto Ricans and non-Hispanic whites, with overall cancer incidence rates for all sites combined 34% lower in island Puerto Ricans compared to mainland Puerto Ricans and 16% lower in mainland Puerto Ricans compared to non-Hispanic whites (and both *p* values < 0.05). For two cancer sites—liver and intrahepatic bile duct (liver), and stomach—mainland Puerto Ricans had the highest incidence rates among the three populations. Island Puerto Ricans had the highest incidence of cancer of the oral cavity and pharynx (oral cavity). Incidence rates for cancers of the esophagus and larynx were similar across the three populations.

Compared to their mainland counterparts, island Puerto Ricans had lower incidence rates for 12 of the 14 cancers and similar incidence for two cancer sites (oral cavity and larynx). SRRs for eight cancer sites were significantly below 1 (range = 0.39 to 0.74; median = 0.53), including those for the top three cancers, namely prostate (SRR = 0.73), colon-rectum (SRR = 0.74), and lung and bronchus (lung) (SRR = 0.39). The disparity in lung cancer was the most striking

TABLE 3. Annual age-adjusted incidence rates per 100 000 in females for selected cancer sites in island Puerto Ricans, mainland Puerto Ricans, and U.S. non-Hispanic whites, 1998–2002^a

	Island Puerto Ricans		Mainland Puerto Ricans ^c		U.S. non-Hispanic whites ^d		Island vs. mainland Puerto Ricans (SRR ^e (95% CI) ^f)	Mainland Puerto Ricans vs. U.S. non-Hispanic whites (SRR (95% CI))
	Rank	Rate (SE) ^b	Rank	Rate (SE)	Rank	Rate (SE)		
All sites		235.2 (1.6)		368.1 (10.0)		468.6 (0.8)	0.64 (0.60–0.68) ^g	0.79 (0.75–0.82) ^g
Breast	1	77.4 (0.9)	1	97.4 (5.1)	1	144.8 (0.5)	0.79 (0.71–0.89) ^g	0.67 (0.62–0.73) ^g
Colon & rectum	2	33.2 (0.6)	2	51.1 (4.3)	3	53.4 (0.3)	0.65 (0.53–0.80) ^g	0.96 (0.81–1.12)
Corpus & uterus, NOS ^h	3	15.2 (0.4)	4	19.8 (2.3)	4	30.5 (0.2)	0.77 (0.59–1.00)	0.65 (0.54–0.78) ^g
Cervix uteri	4	10.7 (0.3)	6	13.6 (1.7)	13	7.8 (0.1)	0.79 (0.59–1.05)	1.73 (1.25–2.41) ^g
Lung & bronchus	5	9.8 (0.3)	3	32.2 (3.5)	2	60.8 (0.3)	0.30 (0.21–0.44) ^g	0.53 (0.45–0.62) ^g
Non-Hodgkin lymphoma	6	8.3 (0.3)	5	16.0 (2.2)	5	18.3 (0.2)	0.52 (0.36–0.76) ^g	0.87 (0.67–1.13)
Stomach	7	7.8 (0.3)	12	7.5 (1.6)	16	5.5 (0.1)	1.04 (0.69–1.58)	1.36 (0.84–2.20)
Thyroid	8	7.7 (0.3)	7	13.4 (1.7)	8	13.9 (0.2)	0.57 (0.42–0.79) ^g	0.96 (0.76–1.22)
Ovary	9	7.3 (0.3)	10	8.3 (1.7)	6	16.7 (0.2)	0.87 (0.57–1.35)	0.50 (0.38–0.66) ^g
Urinary bladder	10	4.8 (0.2)	13	5.6 (1.3)	9	13.1 (0.1)	0.85 (0.52–1.41)	0.43 (0.32–0.57) ^g
Leukemia	11	4.7 (0.2)	9	8.8 (1.6)	11	10.6 (0.1)	0.54 (0.33–0.87) ^g	0.83 (0.60–1.15)
Pancreas	13	4.1 (0.2)	11	8.1 (1.7)	10	11.3 (0.1)	0.51 (0.29–0.89) ^g	0.72 (0.51–1.02)
Kidney & renal pelvis	16	3.0 (0.2)	8	10.3 (2.0)	12	9.7 (0.1)	0.29 (0.15–0.56) ^g	1.05 (0.72–1.55)
Melanoma of skin	20	1.7 (0.1)	17	3.7 (0.9)	7	14.5 (0.2)	0.45 (0.22–0.94) ^g	0.26 (0.20–0.33) ^g

^a Age standardized to U.S. 2000 population. The selected cancer sites were the top 10 cancer sites in at least one of the three study populations.

^b SE = standard error.

^c Estimated from incidence rates in Hispanics in nine counties with a high Puerto Rican density in the states of New York, New Jersey, and Connecticut (USA).

^d Rates in non-Hispanic whites in the states of New York, New Jersey, and Connecticut (USA).

^e SRR = Standardized rate ratio.

^f CI = confidence interval.

^g *P* value < 0.05.

^h NOS = not otherwise specified.

ing, with island Puerto Ricans' incidence 61% lower than that for mainland Puerto Ricans.

When mainland Puerto Ricans were compared with non-Hispanic whites, 10 of 14 SRRs were less than 1, and six were statistically significant (range = 0.16 to 0.84; median = 0.67). The two populations differed the most in incidence of melanoma of the skin, with mainland Puerto Ricans having 84% less risk than non-Hispanic whites. The two mainland populations differed significantly with respect to incidence rates for two of the three cancers with the highest incidence rates (colon-rectum and lung, which had SRRs of 0.84 and 0.72 respectively), but not for the third major site (prostate, which had an SRR of 0.92 but a 95% CI that included 1). Mainland Puerto Ricans had significantly higher incidence rates for liver and stomach cancers (SRRs = 2.50 and 1.58, respectively) compared to non-Hispanic whites.

Cancer incidence in females

A similar trend was evident among women, among whom cancer rates were lowest in island Puerto Ricans, followed by mainland Puerto Ricans and then non-Hispanic whites (Table 3). The total cancer incidence rates were 36% lower

in island Puerto Ricans than in mainland Puerto Ricans and 21% lower in mainland Puerto Ricans than in non-Hispanic whites (with both *p* values < 0.05). However, both Puerto Rican populations had higher incidence rates for cancer of the cervix uteri (cervix) compared to non-Hispanic whites.

When the two Puerto Rican populations were compared, 13 of 14 SRRs were less than 1, and nine were statistically significant (range = 0.29 to 0.79; median = 0.52). The top two cancers in both populations were breast and colon-rectum cancers, and island Puerto Ricans had significantly lower incidence rates for these cancers compared to mainland Puerto Ricans (SRRs = 0.79 for breast and 0.65 for colon-rectum). Lung cancer was the third most common cancer in mainland Puerto Ricans, but it was ranked 5th in Puerto Rico, and its incidence was 70% lower in island Puerto Ricans. The two Puerto Rican populations also differed considerably in the rate for cancer of the kidney and renal pelvis (SRR = 0.29).

When mainland Puerto Ricans were compared with non-Hispanic whites, 11 of 14 SRRs were less than 1, but only six were statistically significant (range = 0.26 to 0.67; median = 0.52), including SRRs for cancers of the breast (SRR = 0.67) and lung (SRR = 0.53). For colon-rectum

cancer, the two mainland populations had similar incidence rates. Mainland Puerto Ricans had a substantially lower incidence rate of melanoma (SRR = 0.26) but a higher incidence rate of cervical cancer (SRR = 1.73) compared to non-Hispanic whites.

DISCUSSION

Using recent data, differences were found in cancer incidence rates among island Puerto Ricans, mainland Puerto Ricans, and non-Hispanic whites comparable to those observed in previous reports, based upon use of a different method to estimate incidence rates in mainland Puerto Ricans (8–11). The current study showed the following trend: incidence rates for all sites combined and the major cancer sites (prostate, breast, lung, and colon-rectum) increased across the three groups, with the lowest rates in island Puerto Ricans, intermediate rates in mainland Puerto Ricans, and the highest rates in non-Hispanic whites.

A key issue in interpreting these findings is whether the observed cancer patterns could be biased by the quality of the data. Cancer data were obtained from four tumor registries, all of which are members of SEER, the CDC-sponsored NPCR, or the NAACCR, and have

completeness-of-case ascertainment of at least 95%. To approximate incidence rates for mainland Puerto Ricans, incidence rates of Hispanics in selected counties in which the majority (about 70%) of Hispanics are Puerto Ricans were used. Given that non-Puerto Rican Hispanics make up less than 30% of Hispanics in the selected counties, the Hispanic cancer rates in these counties should generally reflect the rates of Puerto Ricans. Nevertheless, there are some uncertainties in identifying Hispanic cancer cases using the NHIA (the NAACCR Hispanic/Latino Identification Algorithm). This method, which is based on self-reported Hispanic origin, race, birthplace, gender, maiden name, and surname (14), has a sensitivity of 84% and specificity of 99% in classifying an individual as Hispanic versus non-Hispanic, so it tends to undercount Hispanic cases (14). As the cancer rates reported for mainland Puerto Ricans were likely to be underestimated, the actual differences in cancer rates between mainland Puerto Ricans and the other two study populations could be even greater (for cancer sites where mainland Puerto Ricans had a higher incidence) or smaller (for cancer sites where mainland Puerto Ricans had a lower incidence) than those reported here.

Given the effect of migration, it is not surprising that the cancer incidence rates in Puerto Ricans living in the United States fall between the rates for their native counterparts and those for the general U.S. population (18–22). However, unlike other migrant populations, divergence from a traditionally healthy diet to a high-fat Western diet, and the resulting weight gain subsequent to migration, are not obvious explanations for the higher cancer rates in mainland Puerto Ricans versus island Puerto Ricans (23, 24), because island Puerto Ricans do not appear to have a noticeably healthier lifestyle than their mainland counterparts. For example, the traditional core diet in Puerto Rico, which consists of rice, milk, starchy vegetables, and beans, has relatively low intake of fruits and leafy vegetables (25–28). According to results reported for the year 2000 by the CDC Behavioral Risk Factor Surveillance System (BRFSS), an annual health survey conducted by telephone, only 7% of island Puerto Ricans met the guideline of consuming five or more servings of fruits and vegetables per day; this group

also appeared to be sedentary, with 55% of islanders reporting no physical activity in the past month (29). Therefore, the lifestyle of mainland Puerto Ricans is not necessarily worse than their counterparts in Puerto Rico. Some studies suggest that although mainland Puerto Ricans have, in general, adopted a typical American diet that is high in fat, those who are acculturated also consume a diversity of cereals, fruits, and vegetables that are not commonly available in Puerto Rico; this non-traditional diet is associated with a decreased prevalence of total and central obesity (25, 27, 28). Indeed, data on Puerto Ricans from the 1982–84 Hispanic Health and Nutrition Examination Survey (HHANES) failed to show a positive correlation between body mass index (BMI) and acculturation, although such an association existed in Mexican Americans (7). Using recent survey data, the current authors' previous study also found that Puerto Ricans living in the mainland United States and those in Puerto Rico had similar age- and sex-adjusted prevalence of obesity (21% vs. 22%, respectively) (30). Therefore, the lower cancer rates in island Puerto Ricans versus mainland Puerto Ricans can not be adequately explained by differential diet and prevalence of obesity.

Results from the current authors' previous study, which examined health disparities among the two Puerto Rican populations and U.S. non-Hispanic whites, may provide some insight into why island Puerto Ricans had the lowest cancer incidence for many cancer sites. In the previous study, the authors compared the age- and sex-standardized weighted prevalence of various health parameters among Puerto Ricans living in Puerto Rico and New York City (NYC) as well as U.S. non-Hispanic whites, using data from the 1999 BRFSS and a population-based survey conducted in NYC (30). The results indicated that utilization of preventive health care (e.g., routine checkup and vaccination) was the lowest in island Puerto Ricans compared to NYC Puerto Ricans and non-Hispanic whites. If the frequency of cancer screening is also relatively low in island Puerto Ricans, many latent prostate cancers would be undetected, and this may contribute to the relatively low incidence of prostate cancer in island Puerto Ricans. The previous study also found a low prevalence of smoking in island Puerto Ricans (14% vs. 28%

in NYC Puerto Ricans and 23% in non-Hispanic whites), and this may explain the substantially lower incidence rate of lung cancer and the decreased incidence rates of other smoking-related cancers (e.g., bladder, pancreas, and kidney) in Puerto Rico. Another study showed that the prevalence of oral contraceptive pill use was 19% among mainland-born Puerto Rican women, 13% in U.S. women, and 8% in island Puerto Ricans, whereas the prevalence of female sterilization was 19% in both mainland-born Puerto Ricans and U.S. women, but 41% in island Puerto Ricans (31). The reduced breast cancer incidence rate in Puerto Rico could be partly due to the traditional preference of island Puerto Rican women for sterilization over oral contraceptive pills for birth control as well as their tendency to have their first live birth at a relatively early age (32, 33).

The authors' earlier study also raised some unanswered questions about cancer patterns in mainland Puerto Ricans. For example, as reported in the earlier study, although mainland Puerto Ricans as compared to non-Hispanic whites had a significantly higher proportion of obesity (21% vs. 16%), a similar prevalence of smoking and other health indicators (e.g., high cholesterol and hypertension), and similar access to the health care system, they have modestly reduced cancer rates for all sites and some smoking- or obesity-related cancers (e.g., lung, bladder, breast, and colon-rectum). One possible explanation for this counterintuitive result is that cancer rates in mainland Puerto Ricans could be underestimated, as mentioned above. In addition, the largest wave of Puerto Ricans moved to the mainland United States in the 1950s and 1960s (34, 35), so mainland Puerto Ricans within the ages at risk for adult cancers are mostly first-generation Puerto Ricans. The adverse effects of acculturation on cancer risk could be more apparent in the near future as the subsequent generations of mainland-born Puerto Ricans age.

The current study found that the two Puerto Rican populations had significantly higher incidence rates of cancers associated with infectious agents—stomach cancer (*Helicobacter pylori*) and liver cancer (hepatitis B (HBV) and hepatitis C (HCV)) in men, and cervical cancer (human papillomavirus (HPV)) in women—compared to non-Hispanic whites. For these cancers, mainland Puerto Ricans had the highest

rates among the three populations. This is unusual, because immigrants to the United States tend to have reduced risk for infection-related cancers that are common in their native countries (e.g., liver cancer in Chinese and stomach cancer in Japanese) (22, 36). High prevalence of risk behaviors associated with sexual and parenteral transmission of the infectious etiological agents (HPV, HBV, and HCV) (31, 37–39) and low HBV immunization coverage (40) would contribute to their relatively high rates of these cancers. Other speculated attributable factors include low frequency of Pap smear screening and inadequate follow-up of women with an abnormal Pap smear.

As described above, because cancer incidence data for U.S. Hispanics are derived from heterogeneous groups, it is difficult to estimate cancer rates in individual ethnic subgroups. The current study used cancer rates of Hispanics from areas with a high density of Puerto Ricans to estimate the incidence rates of this ethnic subgroup. This method can be applied to various Hispanic ethnicities for comparison of their respective cancer patterns. For example, the current study examined the 1998–2002 Hispanic cancer incidence of Los Angeles County, where 72% of Hispanics are Mexican Americans, based on SEER data, and found the incidence rates in Mexican Americans to be lower than those of mainland Puerto Ricans for many cancer sites. Total an-

nual incidence rates for all sites in Mexican Americans were 419.5 per 100 000 in males and 307.3 per 100 000 in females (vs. 535.0 and 394.9 in mainland Puerto Ricans, respectively). This example highlights how examining cancer patterns in individual ethnic subgroups can help reveal cancer disparities that may be masked if Hispanics are analyzed as a homogenous population. Moreover, within an ethnic subgroup, cancer risk can vary considerably by migrant generations, as suggested by data from the current study on Puerto Ricans and other studies of Mexican Americans (23). To minimize cancer disparities among Hispanics, researchers must pinpoint which ethnic populations should be studied, identify the contributing factors, and target public health resources through culturally specific intervention strategies.

Previous studies examining cancer incidence in mainland Puerto Ricans used self-reported ethnicity or place of birth in hospital or tumor registry records to identify Puerto Ricans. As information on ethnicity is often missing in medical records, these incidence rates could have been greatly underestimated. The method used in the current study could help improve accuracy in estimating cancer incidence rates in mainland Puerto Ricans because it does not rely solely on ethnicity information from medical records. Although this method is limited by the fact that it generalizes cancer in-

cidence rates from a few geographical areas to the mainland Puerto Rican population, it should be noted that cancer patterns observed in the current study were consistent with those from previous reports that used a different method to estimate incidence rates in mainland Puerto Ricans (8–12).

Recommendations

Based on the scarce survey data available for Puerto Ricans, the current study suggests some potential attributable factors for the cancer patterns. However, more high-quality comparable data on the prevalence of exposure to environmental risk factors in island and mainland Puerto Ricans is needed to help explain the disparity between cancer rates in Puerto Ricans versus non-Hispanic whites. Identifying the protective factors contributing to the reduced cancer rates in island Puerto Ricans would be informative for cancer research, while understanding the reasons for increased cancer risk in mainland Puerto Ricans would facilitate the development of ethnic-specific intervention programs.

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RESUMEN

Disparidades en la incidencia de cáncer en puertorriqueños residentes en los Estados Unidos y Puerto Rico

Objetivos. Se analizaron las tasas de cáncer en un subgrupo de hispanos residentes en los Estados Unidos de América —los puertorriqueños (PRREUA)— y se compararon sus tasas de incidencia con las de los puertorriqueños que residen en Puerto Rico (PRRPR) y la población estadounidense blanca sin ascendencia hispana (EUBNH) a fin de encontrar patrones de cáncer y disparidades de orden étnico específicos para los puertorriqueños.

Métodos. Se obtuvieron los datos de incidencia de los registros de cáncer de Puerto Rico y tres estados del nordeste de los Estados Unidos (New York, New Jersey y Connecticut) que tienen una elevada densidad de PRREUA. Se compararon las tasas ajustadas por la edad mediante las razones de las tasas estandarizadas (SRR).

Resultados. La incidencia total de cáncer fue menor en los PRRPR, intermedia en los PRREUA y mayor en los EUBNH. Los PRRPR presentaron tasas significativamente menores que los PRREUA ($P < 0,05$) en los principales tipos de cáncer —de pulmón (SRR = 0,36 en hombres; SRR = 0,29 en mujeres), próstata (SRR = 0,71), mama (SRR = 0,73) y colorrectal (SRR = 0,74 en hombres y SRR = 0,65 en mujeres)— así como en algunos tipos de cáncer menos frecuentes (de vejiga, hígado, riñón y pelvis renal, páncreas, tiroides, linfomas no Hodgkin, leucemia y melanoma de piel). En general, las tasas de cáncer en los PRREUA fueron ligeramente menores que las de los EUBNH, aunque de las tres poblaciones los PRREUA tuvieron las mayores tasas de cáncer de estómago, hígado y cervicouterino.

Conclusiones. A pesar de las desventajas socioeconómicas, los PRRPR tienen una menor incidencia relativa de cáncer. La identificación de los factores que contribuyen a ello podría ayudar en las investigaciones sobre cáncer, y comprender las razones del mayor riesgo de cáncer en los PRREUA podría facilitar el desarrollo de programas de intervención específicos para esta población.

Palabras clave

Hispanoamericanos, neoplasias, incidencia, Puerto Rico, Estados Unidos.