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Esophageal cancer incidence rates by histological type and overall: Puerto Rico versus the United States Surveillance, Epidemiology, and End Results population, 1992–2005

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ABSTRACT

Objective: The aim of our study was to compare the age-standardized incidence of esophageal cancer (EC) in Puerto Ricans (PRs) with that for non-Hispanic White (NHW), non-Hispanic Black (NHB), and Hispanic (USH), groups in the United States (US) as reported by the Surveillance, Epidemiology, and End Results program for the 1992–2005 period. *Methods*: We computed the age-standardized and age-specific incidence (per 100,000 individuals) of EC during 1992–2005 using the World Standard Population as reference. The percent changes for age-standardized rates (ASR), from 1992–1996 to 2001–2005, were calculated. The relative risks (RR) and the standardized rate ratios (SRR) were estimated, along with 95% confidence intervals (CIs). *Results*: The ASR of adenocarcinomas (AC) showed increases for most racial/ethnic groups from 1992–1996 to 2001–2005. All racial/ethnic groups showed ASR reductions for squamous cell carcinomas (SCC). For both sexes, PRs had lower AC incidences than NHW and USH but higher than NHB. For those younger than 80 years of age, PR men showed higher SCC incidences than NHW but lower than NHB ($P < 0.05$). The incidence of SCC was about two times higher in PR men than USH men (SRR: 2.16; 95% CI = 1.65–2.88). Among women, the RR for SCC increased with age when comparing PRs to groups in the US. *Conclusion*: Incidence disparities were observed between PRs and other racial/ethnic groups in the US. These differences and trends may reflect lifestyles of each racial/ethnic group. Further studies are warranted to explain these disparities.

1. Introduction

Esophageal cancer (EC) has been ranked as the 8th most common cancer and the 6th most common cause of cancer death in the world [1]. The American Cancer Society estimated a total of 16,980 new cases and 14,710 deaths from EC for the year 2011 in the United States of America (US) [2]. Nonetheless, countries like Iran, India, South Africa, and north China present rates that are 10–100 times higher than the US [2]. Also, relative to the World Standard Population, the Puerto Rican (PR) population has higher age-standardized incidence per 100,000 individuals than the US, in both men (7.3 vs. 5.8) and women (1.9 vs. 1.2) [1].

In the US, different incidence and mortality trends have been seen between racial and ethnic groups. The US Hispanic (USH) population, for example, has lower EC incidence than the non-Hispanic white (NHW) and non-Hispanic black (NHB) populations; the latter group having the highest rates [3,4]. In addition, men clearly present a higher risk of developing EC than women [3,5,6]. Distinct geographic, racial, and sex differences play an important role in EC trends.

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During the past several decades, the sudden increase in EC incidence has become a major concern in healthcare. This increase has been explained by the rise of esophageal adenocarcinoma (AC) [7], which is one of the main histology types of EC along with squamous cell carcinoma (SCC). During the early 1980s, AC accounted for <15% of all EC whereas now it represents >60% [5], displacing SCC and becoming the most common histological type of EC in the US and western Europe [7,8]. Overall, the incidence of SCC has decreased by 3.6% per year between 1998 and 2003 while that of AC increased 2.1% [6]. In the US, most of the increase in AC has occurred in NHW of both sexes [9,10]. Nonetheless, SCC remains 6 times more likely to occur in black men than in white men [11].

The comparison of PR cancer statistics with those of racial/ethnic groups in the US is of interest because of the sociocultural relationship between Puerto Rico and the US [12]. Such a comparison is not only necessary to understand differences and similarities in EC occurrence but could also provide relevant information on the influence of different factors on disease occurrence. We know of no comparison between PRs and US groups for a recent period or for the different histological types of EC. The aim of our study was to compare the age-standardized incidence of EC in PRs with that for USH, NHW, and NHB groups in the US as reported by the Surveillance, Epidemiology, and End Results (SEER) program for the period 1992–2005.

2. Methods

2.1. Data sources

As described in other studies [13,14], data sources for this analysis included the SEER program and the Puerto Rico Central Cancer Registry (PRCCR). The PRCCR, part of the National Program of Cancer Registries, is administered by the Centers for Disease Control and Prevention (CDC) and uses the coding standards of the SEER program and of the North American Association of Central Cancer Registries, which makes the registry's data fully comparable to the SEER data. The criteria specified in the third revision of the International Classification of Diseases for Oncology (ICD-O-3) were used to select all cases of EC from 2001 and later (site codes C150–C155 and C158–159) for this analysis [15]. Cases from 1992 to 2000 were originally reported using ICD-O-2 and later converted to ICD-O-3 by the SEER program [16]. Esophageal cancer incidences data from 1992 to 2005 for PRs were obtained from the PRCCR. Esophageal cancer incidences cases for 1992–2005 for each racial/ethnic group (NHW, NHB, and USH) in the US assessed in this study were obtained with the SEER*Stat 6.3.5 software (National Cancer Institute Surveillance Program, Bethesda, MD) and were based on SEER 13 registries database which includes the following cities and states: Atlanta (Georgia), Connecticut, Detroit (Michigan), Hawaii, Iowa, New Mexico, San Francisco-Oakland (California), Seattle-Puget Sound (Washington), Utah, Los Angeles (California), San Jose-Monterey (California), Rural Georgia, and the Alaska Tumor Registry. Hispanic ethnicity was identified by the SEER program using a combination of medical record review and matching surnames against a list of Hispanic surnames [17]. This study does not account for racial differences within the USH population.

2.2. Statistical analysis

For each racial/ethnic group, we applied the direct method to compute EC age-standardized incidence (per 100,000 individuals) during 1992–2005 using the World Standard Population as reference [18]. To assess the trend of EC risk by sex from 1992–1996 to 2001–2005 period, we calculated the annual age-standardized rates [ASR(World)] for each period (1992–1996, 1997–2000, and 2001–2005) as follows:

$$\mathrm{ASR(World)}_i^k = \sum_{j=1}^{4} w_j \frac{d_{ij}^k}{n_{ij}^k}$$

where j represents a given age group, i represents a given ethnic group, k represents a given period, w is the proportion of people in the world population to be evaluated, d is the number of new cases or deaths, and n is the total population. The change in the ASR from the earliest and the latest study period (1992–1995 and 2001–2005) was calculated as a percentage as follows:

$$\%\,\mathrm{change} = \frac{\mathrm{rate}_{2001-2005} - \mathrm{rate}_{1992-1995}}{\mathrm{rate}_{1992-1995}} \times 100$$

The significance of the percentage of change was determined by 95% confidence intervals (CIs) using the formulas from the US Census Bureau [19]. If zero was not included in this interval, significance was set at a P-value less than 5%.

To assess racial/ethnic group differences, we grouped the ASR(World) values during the study period (2001–2005) as follows:

$$\mathrm{ASR(World)}_i = \sum_{j=1}^{4} w_j \frac{\sum_{k=2001}^{2005} d_{ij}^k}{\sum_{k=2001}^{2005} n_{ij}^k}$$

Then, the ratio of two standardized rates [ASR(World) group_i/ ASR(World) group_j] between any two groups (i and j) was estimated with 95% CIs [20] to assess differences in EC incidence between the PR group and USH, NHB, and NHW groups. This ratio is referred to as the standardized rate ratio (SRR).

In addition, age-specific incidence (per 100,000 individuals) for different age groups was computed by sex for 2001–2005. On the basis of these rates, the relative risks (RR) were estimated with 95% CIs to determine relative differences among the study groups by sex and 10-year age group (50–59, 60–69, 70–79, and ≥80) using the Poisson regression model [21]. The interaction between age groups and racial/ethnic groups was also assessed using the likelihood ratio test [22]. The reference groups in the age-specific RR estimation were NHW, NHB, and USH, each stratified by sex. The regression was performed using Stata/SE version 11.0 statistical software (Stata Corp., LP, College Station, TX).

3. Results

3.1. Trends of ASR(World)

3.1.1. All EC

Among men, NHW and USH showed an ASR(World) increase, from 1992–1996 to 2001–2005, but it was only significant for NHW (% change = 18.2; $P < 0.05$). On the other hand, both NHB men and PR men had significant reductions over time ($P < 0.05$; Table 1). Among women, the only observed increase was not statistically significant and occurred in NHW (% change = 1.1; $P > 0.05$). In contrast, PR, USH, and NHB women all had ASR(World) that decreased from 1992–1996 to 2001–2005. Only PR and NHB women had a significant decline (% change in PR = −44.8 and % change in NHB = −20.3; $P < 0.05$ for both).

3.1.2. AC and SCC

Age-standardized rates of AC showed increases for most racial/ethnic groups from 1992–1996 to 2001–2005 (Table 1). Despite the increase of AC in most of the groups, significant changes were only seen in NHW (% change in men = 44.6 and % change in