Research Article

Cancer Epidemiology, Biomarkers & Prevention

Cancer Mortality in Hispanic Ethnic Groups

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Abstract

Background: Cancer is the leading cause of death among Hispanics. The burden of cancer mortality within Hispanic groups has not been well quantified.

Methods: Cancer mortality rates for 2008–2012 in Florida were computed on the basis of race, ethnicity, and birthplace, specifically focusing on major Hispanic groups—Mexicans, Puerto Ricans, Cubans, Central Americans, South Americans, and Dominicans. Age-adjusted mortality rate ratios derived from negative binomial regression were used to compare Hispanics, aggregated and by group, to nonHispanic whites (NHW).

Results: A total of 205,369 cancer deaths from 2008–2012 were analyzed, of which 22,042 occurred in Hispanics. Overall cancer mortality rates were lower for Hispanics, 159 and 100 per 100,000 in males and females, respectively, compared with 204 and 145 per 100,000 in NHWs, largely driven by relatively low rates of lung and breast cancers among Hispanics. However, Hispanics had a higher risk of death from stomach and liver cancers, both infection-related. Of all Hispanic groups, Mexicans had the lowest mortality, whereas Cubans had the highest, with significantly higher mortality for colorectal, endometrial, and prostate cancers.

Conclusions: Compared with other Hispanic groups, Cubans and Puerto Ricans had significantly higher rates. For these longer-established populations in the United States, increases in diet and obesity-related cancers are evident. Some groups show excesses that clearly fall out of the common Hispanic patterns, with implications for public health: Cubans for colorectal cancer, Puerto Ricans for liver cancer, and Dominicans for prostate cancer.

Impact: Cancer mortality outcomes in Hispanics vary between ethnic groups. Research and public health strategies should consider this heterogeneity. *Cancer Epidemiol Biomarkers Prev; 26(3); 1–7. ©2017 AACR.*

Introduction

Hispanics are the largest minority population in the United States, numbering 55 million in 2014 (1). Cancer is the leading cause of death for Hispanic men and women (2), although the cancer mortality burden borne by Hispanics is less than that of nonHispanic whites (NHW) and nonHispanic blacks (NHB; ref. 3). Hispanics, comprising 17% of the U.S. population in 2014 and projected to increase to 29% by 2060 (4), are heterogeneous, with varying nativity, immigration experiences, language dominance, and socioeconomic circumstances (5), reflected in considerable diversity among Hispanic groups in cancer incidence (6, 7) and mortality rates (2, 8). Aggregating these distinct groups in cancer research limits the ability to detect and address determinants of disparities that arise from differences in the prevalence of risk and prognostic factors. Irrespective of whether these differences are attributable to biologic, cultural, or socioeconomic factors, it is critical to assess and accurately characterize intra-ethnic Hispanic cancer outcomes to maximize effectiveness in meeting the needs of this fast-growing minority population.

Mortality is the most useful indicator of progress against cancer because it is dependent upon both incidence and survival. Unbiased cancer incidence and survival studies of distinct Hispanic groups have been impeded by the incompleteness in cancer surveillance systems of birthplace and specific Hispanic ethnicity information (6). However, these are nearly complete on death certificates, presenting an invaluable opportunity to accurately assess cancer outcomes among different groups of Hispanics in the United States.

We used cancer mortality data from Florida, home to 9% of the total U.S. Hispanic population (1), for 2 main reasons. First, Florida, which is 25% Hispanic (9), is the only U.S. state with numerically meaningful representation from all major Hispanic ethnic groups: Cubans (30%), Puerto Ricans (21%), South Americans (17%), Mexicans (16%), Central Americans (11%), Dominicans (4%), and Spaniards (1%; ref. 9). Second, unlike in other states with large Hispanic populations, the Hispanic cancer experience in Florida is overwhelmingly foreign-born (6), providing a unique circumstance favorable to avoiding confounding by birthplace (U.S.- or foreign-born), a known strong determinant of cancer mortality (10). In this study, we compared cancer mortality across these 6 major Hispanic groups, the aggregate Hispanic population, NHWs, and NHBs.

Materials and Methods

Cancer mortality data for 2008–2012 for Florida residents only were obtained from the Florida Department of Health, Bureau of

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Table 1. Study population characteristics, Florida

	Population data 2010		Cancer data (2008–2012)		
	Total population (ref. 11)	Median years of stay in the United States for foreign-born >50 y old (ref. 35)	Cancer deaths	Cancer/All deaths	Foreign-born
NHW	10,884,722	—	160,604	24%	5%
NHB	2,997,371	—	20,207	22%	19%
Hispanic[a]	4,223,806	30	22,042	22%	92%
Mexican	666,536	26	993	18%	56%
Puerto Rican	892,771	41	4,016	21%	84%[b]
Cuban	1,270,300	34	11,862	22%	97%
Central American	454,620	25	1,255	25%	99%
South American	707,062	23	2,875	33%	99%
Dominican	181,381	24	636	25%	98%

[a]Includes 51,136 of origin or birthplace in Spain.
[b]Born on the island of Puerto Rico; here considered foreign-born despite U.S. citizenship status.

Vital Statistics (11). In addition to all-sites-combined, inclusive of all cancers, the 6 most common causes of cancer death—lung and bronchus, breast, prostate, colorectal, pancreas, and unknown primary—were analyzed, as well as cancers of special interest and/or rising incidence in Hispanic populations: cervical, liver, stomach, and endometrial. Cancer sites were coded according to the International Classification of Diseases 10th revision. Cancers of unknown primary included causes of death C79 and C80.

Race and ethnicity, including text fields, and birthplace of decedents were examined to obtain accurate Hispanic group information for each decedent, thereby minimizing misclassification. For example, persons born in Brazil, Italy, Portugal, and individuals of Asian race born in the Philippines, even if labeled Hispanic, were categorized as nonHispanic. Decedents from Spanish-speaking countries in Central America (CA) and South America (SA) were categorized into these 2 groups; a few decedents classified as Hispanic but born in Guyana, French Guyana, Suriname, and Belize were included in the SA or CA groups accordingly. Those born in Spain or with a descriptive in the ethnicity field as "Spaniard" or "Spanish European" were categorized as Spaniard, and included in the overall Hispanic category, although not reported as a standalone group. Decedents identified as 2 or more Hispanic groups (0.1%) in the text fields were placed into the specific group described first: for example, Mexican Cuban was classified as Mexican; Cuban Mexican as Cuban. Ninety Hispanic decedents (0.4%) had vague descriptive ethnicity text indicating CA or SA origins, and 186 U.S.-born Hispanics were of unknown Hispanic group; these were proportionally reassigned by imputation models stratified by age, sex, and cancer site for mortality rate calculations, using methodology described elsewhere (6).

Population denominators for the state of Florida were obtained from the 2010 Census (9), coinciding with the mid-year of this study period. Hispanics who were Not Otherwise Specified (NOS) from the census data were bridged to each of the specific populations proportionately by age group and sex (Table 1). Cancer mortality rates for 2008–2012 for Hispanics in aggregate; 6 Hispanic groups, NHBs, and NHWs were calculated per 100,000 persons, by sex, annualized and age-standardized to the 2000 U.S. Standard Population using 18 age group bands, all 5-year except the last, which was 85 and older. Corresponding 95% confidence intervals (CI) for mortality rates were calculated with gamma intervals modification.

To directly compare rates of Hispanics, in aggregate and by group, to the referent NHW group, we computed age-adjusted site-specific mortality rate ratios using negative binomial regression. Models included decedents ages 40 and over.

SAS 9.3 was used for data analysis. This study was approved by the University of Nevada Las Vegas Institutional Review Board.

Results

In 2008–2012, cancer was the cause of death for 205,369 Florida residents, of which 22,042 (11%) were Hispanic. Ninety-two percent of Hispanic decedents were either foreign-born or born on the island of Puerto Rico (Table 1).

Lung, prostate, and colorectal cancers were the leading causes of cancer mortality among Hispanic males, with the exception of Dominicans and Mexicans for whom liver was third, and Dominicans for whom prostate was first. Among women, lung and breast cancers were either the first or second leading cause of death in all Hispanic groups, with colorectal cancer always third (Table 2).

Compared with NHWs in Florida, Hispanics had lower all-sites-combined cancer mortality rates. In aggregate, Hispanics had significantly higher mortality rates for stomach and prostate cancers than NHWs but significantly lower rates for lung, pancreas, and breast cancers (Table 2). However, there was considerable heterogeneity in rates by Hispanic ethnicity. Mexicans had the lowest cancer mortality rates per 100,000 of all analyzed groups for all-sites-combined, 117 and 82 among males and females, respectively, compared with 236 and 148 among NHBs, who had the highest rates. Among Hispanics, the highest rates per 100,000 were in Cuban males and females, 174 and 104, respectively, followed closely by Puerto Ricans, 158 and 103 for males and females (Table 2).

Compared with NHWs, the overall risk of cancer death in Hispanics was approximately 30% lower for both sexes ($P < 0.05$). Of all cancers analyzed, lung and breast cancers had the greatest mortality risk differentials by race/ethnicity. Compared with NHWs, Hispanic females had a marked 67% lower risk of lung cancer death, whereas Hispanic males had a 42% lower risk (Table 3). For breast cancer, Hispanic women had a 25% lower mortality than NHWs. On the other hand, Hispanics females in Florida had an 86% higher mortality risk for stomach cancer than NHWs, whereas Hispanic men had 85% and 12% higher risk for stomach and prostate cancer mortality, respectively.

Table 2. Annual age-adjusted* mortality rates for selected cancers per 100,000, Florida (2008–2012)

	All populations		NHW		NHB		Hispanic[a]		Mexican		Puerto Rican		Cuban		Central American		South American		Dominican	
	n	Rate (95% CI)	*n*	Rate (95% CI)	*n*	Rate (95% CI)	*n*	Rate (95% CI)	*n*	Rate (95% CI)	*n*	Rate (95% CI)	*n*	Rate (95% CI)	*n*	Rate (95% CI)	*n*	Rate (95% CI)	*n*	Rate (95% CI)
Male																				
Lung	33,218	58.3 (57.7–59.0)	27,126	62.5 (61.7–63.2)	2,871	61.6 (59.2–64.1)	2,926	39.1 (37.7–40.5)	105	26.2 (20.8–32.3)	454	32.6 (29.5–35.8)	1,907	49.4 (47.2–51.7)	77	23.9 (18.1–30.7)	253	26.1 (22.7–29.8)	56	26.3 (19.3–34.7)
Prostate	10,346	18.8 (18.5–19.2)	7,376	16.8 (16.4–17.2)	1,643	46.7 (44.3–49.1)	1,227	18.8 (17.7–19.9)	38	12.0 (8.2–16.7)	193	17.4 (15.0–20.1)	731	19.3 (17.8–20.7)	50	19.2 (13.7–25.9)	148	20.4 (17.0–24.3)	53	31.3 (23.1–41.1)
Colorectum	9,614	17.2 (16.9–17.6)	7,100	16.8 (16.4–17.2)	1,110	24.1 (22.5–25.6)	1,265	17.0 (16.1–18.0)	53	10.2 (7.1–13.9)	241	17.9 (15.6–20.4)	722	18.9 (17.5–20.3)	59	13.4 (9.5–18.1)	134	12.3 (10.1–14.9)	25	9.6 (6.0–14.3)
Pancreas	6,880	12.1 (11.9–12.4)	5,420	12.5 (12.2–12.9)	606	13.2 (12.1–14.3)	783	10.4 (9.7–11.1)	34	7.1 (4.6–10.3)	124	9.0 (7.4–10.8)	441	11.5 (10.4–12.6)	38	9.7 (6.2–14.1)	115	10.6 (8.6–12.9)	18	6.2 (3.6–10.0)
Liver	4,892	8.6 (8.3–8.8)	3,494	8.3 (8.0–8.6)	561	10.2 (9.3–11.1)	717	9.1 (8.5–9.9)	58	11.3 (8.1–15.2)	213	13.7 (11.8–15.7)	298	7.8 (6.9–8.7)	37	8.3 (5.4–12.2)	77	7.2 (5.5–9.2)	22	9.7 (5.8–15.0)
CUP[b]	6,520	11.6 (11.3–11.9)	5,156	12.2 (11.9–12.5)	629	12.9 (11.9–14.1)	667	8.9 (8.3–9.7)	30	5.1 (3.1–7.7)	127	9.2 (7.6–11.0)	375	9.9 (7.6–11.0)	36	9.4 (6.1–13.7)	73	7.8 (6.0–10.1)	13	7.7 (3.8–13.2)
Stomach	2,166	3.9 (3.8–4.1)	1,281	3.1 (2.9–3.2)	387	8.6 (7.7–9.6)	426	5.6 (5.1–6.2)	24	5.8 (3.4–9.1)	72	5.4 (4.2–6.9)	162	4.3 (3.7–5.0)	49	13.0 (8.8–18.3)	104	10.0 (8.0–12.4)	<10	4.2 (1.8–8.0)
All sites	110,889	197.7 (196.5–198.9)	87,256	204.4 (203.1–205.8)	10,638	236.1 (231.2–241.0)	11,771	158.5 (155.6–161.5)	579	117.2 (105.9–129.2)	2,153	157.5 (150.5–164.6)	6,649	174.1 (169.9–178.3)	520	132.8 (119.0–147.6)	1,354	138.8 (130.6–147.3)	284	136.7 (119.8–155.0)
Female																				
Breast	13,890	21.0 (20.6–21.3)	10,127	21.2 (20.7–21.6)	1,917	28.6 (27.3–29.9)	1,658	15.9 (15.1–16.7)	70	11.4 (8.5–14.9)	329	17.2 (15.3–19.2)	817	17.2 (16.0–18.4)	122	14.0 (11.4–16.9)	223	12.3 (10.6–14.1)	72	16.5 (12.8–20.9)
Lung	26,016	37.3 (36.8–37.8)	22,558	44.1 (43.5–44.7)	1,637	25.6 (24.4–26.9)	1,539	15.0 (14.3–15.8)	44	11.8 (8.4–15.9)	288	16.0 (14.2–18.0)	827	16.3 (15.2–17.5)	87	13.3 (10.5–16.6)	213	13.8 (11.9–15.8)	55	14.8 (11.1–19.3)
Colorectum	8,493	12.0 (11.8–12.3)	6,173	11.7 (11.4–12.0)	1,043	16.3 (15.3–17.3)	1,169	11.4 (10.7–12.0)	32	7.0 (4.5–10.1)	190	10.8 (9.3–12.5)	678	12.9 (11.9–14.0)	73	9.4 (7.2–12.0)	131	8.3 (6.9–10.0)	38	10.2 (7.2–14.1)
Pancreas	6,413	9.0 (8.7–9.2)	4,898	9.1 (8.9–9.4)	661	10.5 (9.7–11.4)	762	7.4 (6.9–8.0)	31	6.8 (4.4–9.9)	112	6.5 (5.3–7.8)	420	7.9 (7.1–8.7)	41	6.5 (4.6–8.9)	118	7.7 (6.3–9.3)	29	8.1 (5.4–11.7)
Ovary	4,796	7.0 (6.8–7.2)	3,741	7.5 (7.3–7.8)	375	5.7 (5.1–6.3)	605	5.8 (5.4–6.3)	24	3.9 (2.4–6.1)	94	5.0 (4.1–6.2)	292	6.2 (5.5–7.0)	58	7.4 (5.4–9.7)	112	6.5 (5.3–7.9)	16	3.8 (2.1–6.2)
CUP[b]	5,171	7.3 (7.1–7.5)	4,001	7.6 (7.3–7.8)	545	8.6 (7.9–9.4)	562	5.5 (5.0–5.9)	22	4.3 (2.5–6.8)	91	5.2 (4.1–6.3)	290	5.5 (4.9–6.2)	48	7.0 (5.0–9.4)	81	5.4 (4.2–6.8)	16	4.4 (5.5–7.2)
Liver	2,221	3.2 (3.0–3.3)	1,496	2.9 (2.8–3.1)	238	3.7 (3.2–4.2)	409	4.0 (3.6–4.4)	23	4.9 (3.0–7.4)	86	4.7 (3.8–5.9)	181	3.5 (3.0–4.0)	40	6.3 (4.4–8.7)	61	4.4 (3.3–5.7)	10	3.0 (1.4–5.4)
Endometrium	2,744	4.0 (3.8–4.1)	1,775	3.6 (3.4–3.7)	524	8.1 (7.4–8.9)	401	3.9 (3.5–4.3)	10	2.1 (0.9–3.9)	76	4.1 (3.2–5.2)	210	4.3 (3.7–5.0)	27	3.5 (2.2–5.1)	58	3.5 (2.6–4.5)	14	4.0 (2.1–6.7)
Stomach	1,508	2.2 (2.1–2.3)	865	1.7 (1.6–1.8)	267	4.3 (3.8–4.8)	325	3.2 (2.8–3.5)	17	3.2 (1.7–5.4)	62	3.4 (2.6–4.4)	118	2.3 (1.9–2.8)	34	4.2 (2.8–6.0)	83	5.5 (4.3–6.8)	<10	1.3 (0.4–3.0)
Cervix	1,545	2.7 (2.6–2.9)	923	2.6 (2.4–2.8)	340	4.9 (4.4–5.5)	242	2.3 (2.0–2.6)	14	1.6 (0.9–2.9)	67	3.4 (2.6–4.3)	84	2.1 (1.7–2.6)	29	3.2 (2.0–4.7)	38	2.1 (1.4–2.9)	<10	2.0 (0.9–3.8)
All sites	94,480	136.9 (136.0–137.8)	73,348	144.8 (143.7–145.9)	9,569	147.8 (144.8–150.8)	10,271	99.6 (97.6–101.5)	414	82.0 (73.2–91.4)	1,863	102.6 (97.9–107.4)	5,213	104.1 (101.2–107.1)	735	99.2 (91.6–107.3)	1,521	95.2 (90.2–100.4)	352	91.1 (81.6–101.5)

NOTE: *2000 U.S. Standard Population. All sites include all malignant neoplasms, not just those specified above.

[a]Includes origin or birthplace in Spain.

[b]CUP: Cancers of unknown primary.

Table 3. Mortality rate ratios for selected cancers, Florida (2008–2012)

	NHW Referent	All Hispanic RR (95% CI)	Mexican RR (95% CI)	Puerto Rican RR (95% CI)	Cuban RR (95% CI)	Central American RR (95% CI)	South American RR (95% CI)	Dominican RR (95% CI)
Male								
Lung	1.00	0.58 (0.53–0.63)	0.35 (0.29–0.43)	0.52 (0.47–0.57)	0.80 (0.76–0.83)	0.28 (0.22–0.35)	0.37 (0.32–0.41)	0.38 (0.29–0.49)
Prostate	1.00	1.12 (1.05–1.19)	0.75 (0.55–1.04)	1.04 (0.90–1.19)	1.15 (1.07–1.25)	1.10 (0.83–1.46)	1.16 (0.98–1.36)	1.87 (1.43–2.46)
Colon and rectum	1.00	0.96 (0.87–1.07)	0.61 (0.46–0.81)	1.04 (0.90–1.20)	1.12 (1.00–1.26)	0.71 (0.54–0.94)	0.74 (0.61–0.88)	0.65 (0.43–0.96)
Pancreas	1.00	0.82 (0.76–0.88)	0.59 (0.42–0.83)	0.69 (0.57–0.82)	0.92 (0.84–1.02)	0.70 (0.51–0.97)	0.81 (0.67–0.98)	0.62 (0.39–0.98)
Liver	1.00	1.08 (0.93–1.25)	1.26 (0.92–1.74)	1.63 (1.30–2.04)	0.91 (0.74–1.13)	0.86 (0.59–1.26)	0.77 (0.58–1.03)	1.01 (0.64–1.59)
Stomach	1.00	1.84 (1.65–2.06)	1.53 (0.99–2.35)	1.78 (1.40–2.27)	1.42 (1.21–1.68)	3.22 (2.35–4.40)	3.18 (2.59–3.90)	1.33 (0.69–2.56)
All sites	1.00	0.70 (0.65–0.76)	0.54 (0.48–0.62)	0.71 (0.64–0.80)	0.78 (0.71–0.86)	0.54 (0.47–0.62)	0.57 (0.51–0.64)	0.57 (0.49–0.67)
Female								
Breast	1.00	0.75 (0.71–0.79)	0.52 (0.40–0.68)	0.79 (0.71–0.89)	0.83 (0.77–0.89)	0.66 (0.55–0.80)	0.59 (0.52–0.68)	0.76 (0.60–0.97)
Lung	1.00	0.33 (0.30–0.36)	0.20 (0.15–0.28)	0.35 (0.31–0.40)	0.37 (0.34–0.40)	0.27 (0.22–0.33)	0.29 (0.25–0.33)	0.32 (0.24–0.42)
Colon and rectum	1.00	0.98 (0.92–1.04)	0.55 (0.38–0.80)	0.91 (0.79–1.06)	1.13 (1.04–1.23)	0.86 (0.68–1.09)	0.69 (0.57–0.82)	0.85 (0.62–1.18)
Pancreas	1.00	0.81 (0.75–0.88)	0.74 (0.51–1.07)	0.70 (0.58–0.84)	0.88 (0.79–0.97)	0.64 (0.47–0.88)	0.83 (0.69–1.00)	0.85 (0.59–1.22)
Ovary	1.00	0.77 (0.70–0.84)	0.55 (0.35–0.86)	0.66 (0.53–0.81)	0.80 (0.71–0.90)	0.95 (0.73–1.24)	0.84 (0.69–1.02)	0.50 (0.30–0.83)
Liver	1.00	1.39 (1.24–1.55)	1.75 (1.14–2.69)	1.62 (1.28–2.05)	1.20 (1.00–1.44)	1.94 (1.40–2.69)	1.26 (0.96–1.66)	0.90 (0.48–1.68)
Endometrium	1.00	1.11 (0.99–1.23)	0.54 (0.28–1.05)	1.16 (0.92–1.46)	1.22 (1.06–1.41)	0.99 (0.67–1.45)	0.95 (0.73–1.25)	1.01 (0.60–1.72)
Stomach	1.00	1.86 (1.63–2.12)	1.97 (1.16–3.35)	2.16 (1.66–2.80)	1.36 (1.12–1.66)	2.52 (1.72–3.68)	3.19 (2.53–4.03)	0.67 (0.25–1.78)
Cervix	1.00	0.97 (0.84–1.13)	0.80 (0.45–1.42)	1.34 (1.02–1.75)	0.89 (0.70–1.13)	1.24 (0.84–1.84)	0.81 (0.57–1.13)	0.82 (0.41–1.64)
All sites	1.00	0.67 (0.62–0.71)	0.55 (0.49–0.62)	0.68 (0.63–0.72)	0.70 (0.66–0.74)	0.65 (0.60–0.71)	0.62 (0.58–0.67)	0.60 (0.53–0.67)

NOTE: Mortality rate ratios adjusted for age group; obtained by negative binomial regression. All sites include all malignant neoplasms, not just those specified above.

Discussion

This is the first comprehensive analysis of cancer mortality in all major Hispanic ethnic groups in the United States. Our results reveal both overarching Hispanic patterns and significant differences between Hispanic groups: for most cancers, Cubans have the highest mortality rates, followed closely by Puerto Ricans. The other analyzed groups, Central Americans, Dominicans, South Americans, and especially Mexicans, have overall lower cancer mortality.

Aggregated, Hispanics have lower all-sites-combined mortality compared with NHWs and NHBs in Florida, driven largely by their lower rates of 2 major causes of cancer death: lung and breast cancers. Past smoking trends for all Hispanics (12) and higher fertility in Hispanic women (13) likely account for the diminished risk for these cancers. Lower smoking prevalence among Hispanics may also partially explain relatively low rates in other tobacco-related cancers (2) such as pancreas and bladder (data not shown) compared with NHW. However, Hispanics have higher mortality than NHWs for some cancers, including stomach, prostate, and liver for females.

Cubans and Puerto Ricans

Among all Hispanic populations, Cubans have the highest overall cancer mortality rates for both sexes. Their site-specific mortality pattern is most similar to NHWs: relatively lower liver and stomach cancer risk than other Hispanic groups, but the highest lung cancer mortality rates among Hispanics. Compared with other Hispanic groups, Cubans are historically the heaviest daily smokers (14) and have higher smoking prevalence (15), likely explaining their high lung and overall cancer mortality. Mortality rates among Cubans significantly exceed those of NHWs for colorectal, endometrial, and prostate cancers.

Puerto Ricans also have high rates of colorectal and endometrial cancers. Both of these cancers are strongly linked to obesity and diabetes (16) and are often considered "Western" cancers, with risk commonly increasing among first-generation immigrants (6). National surveys show that Mexicans have the highest rates of these risk factors, not Cubans or Puerto Ricans (17). Nonetheless, Cubans and Puerto Ricans have longer average time spent in the United States (continental United States for Puerto Ricans), than other Hispanic immigrants (Table 1); hence, there is a possibility of more persistent acculturation and sustained prevalence of risk factors among these Hispanic groups. Heavy smoking and drinking, more common in Puerto Ricans and Cubans (17, 18), are also risk factors for colorectal cancer (16). Cubans have the lowest colorectal cancer screening rates among all Hispanics (2) and the highest mortality rates, so potential reductions in colorectal cancer mortality could be achieved by increased colorectal cancer screening. Consistent with a more "Western" pattern of cancer occurrence, Cubans and Puerto Ricans had the highest mortality rates of all Hispanic groups for breast cancer, typical of populations with lower parity (2), as well as high prostate cancer mortality. Prostate cancer risk increases have been observed in populations transitioning to a high-calorie, fatty diet (19, 20).

Puerto Ricans are second to Cubans in overall cancer mortality rates. Yet their specific patterns are distinct from Cuban outcomes, with high mortality for the infection-related cancers (i.e., stomach, liver, and cervix). Puerto Rican men in Florida have the highest liver cancer mortality of any Hispanic group, 63% higher than NHWs. In addition, Puerto Rican women not only have the highest cervical cancer mortality rate among Hispanic women but also they are the only group for whom mortality significantly exceeds that of NHW women, despite evidence of high uptake of cervical cancer screening (2), and higher rates of insurance coverage due to U.S. citizenship status (5). Our findings are consistent with a previous study that showed higher infection-related mortality for island Puerto Ricans than NHWs (21).

Mexicans, Central Americans, South Americans, Dominicans

The remaining four Hispanic groups have lower overall cancer mortality rates as well as lower rates for the two most common causes of cancer deaths, lung and breast, likely partially explained by lower rates of smoking (14) and higher parity (5) than their Cuban and Puerto Rican counterparts. Our findings are similar for colorectal cancer: lower rates compared with Cubans and Puerto Ricans. These lower breast and colorectal cancer mortality rates in the more recent immigrant populations, despite less health insurance coverage (5) and lower use of screening tests (2), likely indicate lower disease incidence, as confirmed in other studies (6). Lower risk for CA, SA, and Dominican populations may be a result of lower prevalence of many cancer risk factors concomitant with shorter periods of time living in the United States.

Of all Hispanic groups in Florida, Mexicans of both sexes consistently have the lowest cancer mortality rates, except for stomach and liver. Stomach cancer mortality rates, higher than NHWs for all Hispanics, are especially high among both CAs and SAs. This mirrors the high burden of stomach cancer, associated with *Helicobacter pylori* infection, in Central and South America (22). Given that the more than 99% of CA and SA populations are foreign-born (Table 1), it is natural that the country of origin risk persists after emigration to Florida. Liver cancer mortality is high among Mexican men and particularly high for CA women, although reasons for this are unclear.

Prostate cancer mortality among Dominicans is nearly double that of NHWs. Notably, of all Hispanic groups, Dominicans had the highest proportion of black race in our dataset. Men of African ancestry are known to have high prostate cancer incidence and mortality rates (16, 23), particularly for aggressive forms that present in late stages (24). Dominicans, with the highest prostate cancer mortality among Hispanic groups in Florida, also have the lowest documented rates of prostate cancer screening (25). As such, the debate surrounding targeted PSA screening recommendations for blacks (26), in light of differences in incidence and mortality, could possibly be expanded to include Dominican populations.

Liver cancer is a paramount problem for the overall U.S. population due to rapidly increasing incidence and mortality rates, in contrast to most other cancers (3, 16). Complicating prevention and treatment efforts is the fact that there are multiple causes of liver cancer, including viral infection, obesity/diabetes, and alcoholism, and prevalence of these causes is not evenly distributed among NHWs, NHBs, and Hispanic groups (27). Hispanic group differences in infection with the hepatitis B virus (HBV) and the hepatitis C virus (HCV) likely play an important role in the patterns observed in liver cancer mortality in our study. Among the foreign-born, HBV infection is more prevalent, whereas HCV is less prevalent (2). However, for U.S.-born populations, including Puerto Ricans irrespective of birthplace, chronic HCV infection likely plays a larger role (28). Studies show substantially higher HCV prevalence in Puerto Ricans than other Hispanics (28, 29), and our study revealed that Puerto Ricans had a 62% higher risk of liver cancer death than NHWs in both sexes, higher than all other Hispanic groups for males. In light of this, Puerto Ricans might be considered a priority population for targeted HCV testing, as effective HCV antiviral treatment that reduces liver cancer risk is now available (3).

Strengths and limitations

Florida is the only U.S. state with significant representation from each of the major Hispanic groups. Thus, this study is able to circumvent biases from ethnoregional differences arising from disparate baseline risks. While a few studies reported cancer mortality rates for Mexicans, Cubans, and Puerto Ricans (2, 8), none have included Dominicans, CAs, and SAs. Accurate direct comparison between all major Hispanic groups as well as NHWs and NHBs was possible for the first time. Moreover, our study benefits from very high completeness (>99%) of birthplace information for all Florida deaths, which, combined with ethnicity and text descriptives, allowed for unprecedented reliable classification of Hispanic groups, not possible with cancer incidence data.

Our study has the usual limitations of descriptive epidemiology. Risk factor data specific to Hispanic groups in Florida are lacking. Hispanic populations in Florida may not be entirely representative of the same Hispanic groups in the United States. Theoretically, our mortality numbers could be affected by out-migration of Mexicans, Dominicans, CAs, and SAs who return to their home countries of origin to die. However, the magnitude of this phenomenon, known as the Salmon Bias, was found to be small for Hispanics (30). Central American and South American rates are themselves aggregates of diverse populations, although in Florida predominantly Nicaraguan and Colombian, respectively (5). Finally, individual-level data for length of stay in the United States among cancer decedents was not available.

Mortality is a function of cancer incidence and survival. While our results are consistent with previous reports on cancer incidence rates for Hispanic groups (6, 7), it is possible that limited health care access and/or low health care quality for Hispanics result in poor cancer survival, thus impacting the mortality burden. However, analyzing any differential survival by Hispanic group is currently problematic. The accuracy of survival data among the foreign-born in the United States, especially for Hispanics, is prone to biases arising from passive follow-up methods in registries (31, 32) and missing information on specific Hispanic group (33). The SEER cancer surveillance program greatly reduces the problem of passive follow-up by systematically collecting dates of last alive contact for all cancer cases, but its coverage does not include a meaningful representation of Caribbean and SA populations, together comprising 23% of the Hispanic population (9). Nonetheless, prior studies using SEER registries, albeit overwhelmingly represented by Mexican Hispanics, have not shown large differences in survival between Hispanics and NHWs (34). Thus, differences in incidence, rather than survival, likely drive most of the mortality differences seen in our study. Even so, future accurate survival studies in Florida could explain some of our unexpected findings, such as the high ovarian and prostate cancer mortality rates among CAs, given that they are more recent immigrant arrivals (35) from countries at low risk for these cancers (19).

In conclusion, considerable heterogeneity in cancer mortality is observed between Hispanic groups. Two distinct group patterns emerge among Hispanics: low cancer mortality for Mexicans, CAs, SAs, and Dominicans and intermediate mortality for Cubans and Puerto Ricans, higher than the aggregate Hispanic population although still mostly lower than NHWs. The significantly higher mortality rates for colorectal, endometrial, and prostate cancers among the longer-established Cuban immigrant population in comparison to NHWs suggest that "Western" risk factors such as obesity may be an important focus for intervention, especially in the context of acculturation. Our study also shows that for certain populations, public health interventions may be warranted, including those that increase colorectal screening among Cubans, HCV testing and treatment for Puerto Ricans, and awareness of the likely elevated prostate cancer risk for Dominicans.

Hispanics, the largest racial/ethnic minority group in the United States, have diverse cultural, socioeconomic, racial, and geographic backgrounds. Aggregated, this population of 55 million is relatively "low risk" for most cancers, although certain groups, especially Puerto Ricans and Cubans, bear a disproportionate mortality burden. It is important to monitor these trends, identifying protective factors that can be preserved or even replicated in other populations, as well as opportunities to resist the acquisition of major risk factors for cancer. Future studies should attempt to elucidate selective acculturation mechanisms among Hispanic immigrants that would potentially counteract unfavorable trends toward worsening cancer outcomes.

Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

Disclaimer

Any conclusions are the authors' own and do not necessarily reflect the opinion of the data source, the Florida Department of Health, Bureau of Vital Statistics.

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