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Research Article

Cancer Epidemiology, Biomarkers & Prevention

Cancer Site–Specific Disparities in New York, Including the 1945–1965 Birth Cohort's Impact on Liver Cancer Patterns

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Abstract

Background: Analyses of cancer patterns by detailed racial/ethnic groups in the Northeastern United States are outdated.

Methods: Using 2008–2014 death data from the populous and diverse New York State, mortality rates and regression-derived ratios with corresponding 95% confidence intervals (CIs) were computed to compare Hispanic, non-Hispanic white (NHW), non-Hispanic black (NHB), Asian populations, and specific Hispanic and NHB subgroups: Puerto Rican, Dominican, South American, Central American, U.S.-born black, and Caribbean-born black. Special analyses on liver cancer mortality, given the higher prevalence of hepatitis C infection among the 1945–1965 birth cohort, were performed.

Results: A total of 244,238 cancer-related deaths were analyzed. Mortality rates were highest for U.S.-born blacks and lowest for South Americans and Asians. Minority groups had higher mortality from liver and stomach cancer than NHWs; Hispanics and NHBs also had higher mortality from cervical and prostate cancers. Excess liver cancer mortality among Puerto Rican and U.S.-born black men was observed, particularly for the 1945–1965 birth cohort, with mortality rate ratios of 4.27 (95% CI, 3.82–4.78) and 3.81 (95% CI, 3.45–4.20), respectively.

Conclusions: U.S.-born blacks and Puerto Ricans, who share a common disadvantaged socioeconomic profile, bear a disproportionate burden for many cancers, including liver cancer among baby boomers. The relatively favorable cancer profile for Caribbean-born blacks contrasts with their U.S.-born black counterparts, implying that race per se is not an inevitable determinant of higher mortality among NHBs.

Impact: Disaggregation by detailed Hispanic and black subgroups in U.S. cancer studies enlightens our understanding of the epidemiology of cancer and is fundamental for cancer prevention and control efforts. *Cancer Epidemiol Biomarkers Prev; 27(8); 1–11. ©2018 AACR.*

Introduction

Few states reflect the United States' racial/ethnic diversity as well as New York State (NYS); its 2016 population of 20 million was over 45% minority: 19% Hispanic, 18% black, and 10% Asian/Pacific Islander (API) (1). Yet no comprehensive analysis to date has leveraged this diversity to critically examine on a population level the heterogeneity by race, ethnicity, and birthplace in site-specific cancer mortality patterns, including distinguishing between Afro-Caribbean and U.S.-born black populations as well as detailing the patterns for diverse Hispanic subgroups.

Cancer is the leading cause of death for Hispanics and APIs in the United States; nonetheless, their cancer burden is less than that of non-Hispanic whites (NHWs) and especially non-Hispanic blacks (NHBs), who bear the most disproportionate share of the national cancer burden (2). Hispanic, black, and Asian minorities, projected to increase in both absolute number as well as proportion (3), are heterogeneous, with varying socioeconomic circumstances, nativity and/or immigration experiences, and cultural values and practices. Aggregating these distinct groups in cancer research masks considerable diversity in cancer incidence (4–6) and mortality (7–9) among subgroups. Moreover, it limits the ability to detect and address determinants of differences in cancer incidence, survival, and mortality, and to discern the extent to which biological, cultural, or socioeconomic factors explain revealed cancer disparities.

While comprehensive data on API subgroups are available from the Surveillance Epidemiology and End Results (SEER) cancer surveillance program, that is not the case for non-Mexican Hispanic subgroups and Afro-Caribbeans, who primarily reside in two non-SEER states, New York and Florida. Moreover, unbiased cancer incidence and survival studies for these groups have been impeded by the incompleteness of birthplace and racial/ethnic subgroup information in cancer surveillance systems in general, as well as the incompleteness of follow-up in some registries (10). However, unlike available federal mortality data, some states make specific birthplace information available in their mortality

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data upon request. Because death certificate information on birthplace has been found to be highly accurate for minority populations (11), this allows for the more complete and accurate identification of minority subgroups in cancer data. NYS, with 11.3 million NHWs, 3.5 million Hispanics, 3 million NHBs, and 1.6 million APIs, is ideal for studying race/ethnicity-specific cancer patterns for populations living within the same geography (12).

To fully capture the diversity of cancer patterns, this study aims to compare cancer mortality between Hispanic, black, and Asian decedents, as well as racial/ethnic subgroups, referencing NHWs. In addition, given the rise in liver cancer mortality (13), a cancer that disproportionately impacts minority populations (14), we analyze this cancer site in greater detail. NYS's unique diversity includes a large Caribbean-born black subgroup and large Puerto Rican (PR) and Dominican subgroups. In anticipation of meeting the cancer prevention and control needs of these burgeoning minority populations, public health professionals, clinicians, and policymakers alike will require this accurate characterization of patterns within very diverse racial and ethnic groups.

Materials and Methods

Cancer mortality data for 2008–2014 for NYS residents were obtained from the New York State Department of Health. All-sites-combined cancer as well as the most common cancer-specific causes of death were analyzed. Cancer sites were coded according to the International Classification of Diseases, 10th revision (ICD-10); cancers of unknown primary (CUP) included C79 and C80 as causes of death. Female breast cancer rates were presented in aggregate as well as divided into two age groups, younger than age 50 and 50 or older, to approximate premenopausal and postmenopausal breast cancers.

Major racial/ethnic groups analyzed were NHWs, NHBs (including single race and in combination with one other race, i.e., NHB and NHW were coded as black), Hispanics, and APIs [hereafter referred to as Asians due to proportionally very few (2%) Pacific Islanders in population and only 180 deaths]. A small number of decedents of Native American/Alaskan Native origin ($n = 341$) and those with unknown or more than 2 races ($n = 1003$) were excluded from analyses.

To minimize misclassification, all codes for race and ethnicity were examined, including text fields and birthplace of decedents, to obtain four clearly delineated Hispanic subgroups: PR, Dominican, Central American (CA), and South American (SA). Decedents from Spanish-speaking countries in Central America, as well as those coded Hispanic from Belize, were aggregated into the CA group; likewise, SA was designated for all decedents from Spanish-speaking countries in South America, including any from Guyana, French Guiana, and Suriname who were identified as Hispanic. Included in the All Hispanics category, but not reported as stand-alone subgroups, were Cubans and those born in Spain due to relatively few cancer deaths in NYS, as well as Mexicans, for whom the extremely young population structure and scant number of cancer-related deaths prohibited a stand-alone group. Only 2% of all Hispanic (U.S.-born) decedents ($n = 466$), were of unknown Hispanic subgroup after careful data assembly. For mortality rate calculations, these were proportionally assigned to subgroups based on age, sex, and cancer site combinations, using methodology described elsewhere (4).

Analyzed subgroups among NHB populations were based on race codes and birthplace and included Caribbean-born blacks and U.S.-born blacks. Caribbean-born black decedents were residents of NYS born in the following Caribbean island nations/territories: Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, Cayman Islands, Dominica, Grenada, Guadeloupe, Haiti, Jamaica, Martinique, Montserrat, Saint Kitts and Nevis, Saint Barthelemy, Saint Lucia, Saint Martin, Saint Vincent and the Grenadines, the Netherlands Antilles, the British Virgin Islands, Trinidad and Tobago, Turks and Caicos, and West Indies not-otherwise-specified. NHBs born in other countries (e.g. Guyana, Nigeria, etc.) were included in the All NHB category but not analyzed as stand-alone groups.

Population denominators for NYS, presented in Table 1, were obtained from the U.S. Census Bureau, using 2008 to 2014 single-year American Community Survey data (15).

Cancer mortality rates stratified by sex for the seven-year period of 2008–2014 were calculated per 100,000 persons, 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. Gamma intervals modification was used to calculate

Table 1. Study population characteristics, New York (2008–2014)

	Population data[a]		Cancer decedents data (2008–2014)				
	Total population[b]	Foreign-born[c]	Cancer deaths	Foreign-born[c]	Black race[d]	From New York City	Top country of birth
Non-Hispanic white	11,328,035	10%	182,696	13%	0%	22%	USA, 87%
All Non-Hispanic black	2,968,524	27%	33,499	26%	100%	69%	USA, 74%
U.S.-born black	2,154,932	0%	24,725	0%		65%	USA, 100%
Caribbean-born black	575,260	100%	6,346	100%		81%	Jamaica, 40%
Other foreign-born black	238,332	100%	2,428	100%		85%	Guyana, 30%
Asian[e]	1,600,999	68%	8,516	96%	0%	80%	China, 50%
All Hispanic	3,505,408	50%	19,527	85%	5%	79%	Puerto Rico, 38%
Puerto Rican	1,122,741	28%	9,774	79%	2%	80%	Puerto Rico, 78%
Central American	405,819	64%	1,626	97%	26%	70%	Panama, 24%
South American	608,785	68%	2,746	98%	1%	74%	Ecuador, 29%
Dominican	775,273	61%	3,585	97%	8%	90%	Dominican Republic, 96%
Other Hispanics[f]	592,790	52%	1,796	69%	4%	68%	Cuba, 34%

[a]Single-year American Community Surveys, 2008—2014.
[b]Annualized.
[c]Outside 50 U.S. states.
[d]Includes single race as well as black in combination with one other race.
[e]Includes 2% Pacific Islanders.
[f]Includes Cubans, Mexicans, and Spaniards.

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corresponding 95% confidence intervals (CIs; ref. 16). To directly compare rates for all analyzed populations, we computed age-adjusted site-specific mortality rate ratios (MRRs) using negative binomial regression, which compounds age-specific ratios between populations of remarkably different age structures more effectively than the U.S. Standard Population weights (17). Models included decedents ages 35 and over, except prostate, which included ages 45 and older.

Finally, for liver cancer, common among all minorities, we studied age and cohort-specific patterns, with a focus on the 1945–1965 birth cohort, which is subject to the Centers for Disease Control and Prevention recommendation of one-time HCV testing due to comparatively high HCV prevalence (18). We studied age-specific rates as well as age-adjusted rates, and computed liver cancer MRRs stratified by the 1945–1965 birth cohort (possible ages 43–69 at death during 2008–2014) and all those born outside the cohort, here also called the "normal-risk" cohort, before 1945 or after 1965 (possible ages 40–48 and 64+ at death).

SAS 9.3 was used for data analyses. The University of Nevada, Las Vegas Institutional Review Board determined this research to be Exempt per Common Rule 45 CFR 46.101(a).

Results

Between 2008 and 2014, cancer was the cause of death for 245,582 NYS residents; 244,238 were included in this analysis (Table 1). Among males and females, lung cancer was the leading cause of cancer-related death for all populations except Caribbean-born blacks and Central Americans, for whom lung cancer was second to prostate cancer in males and breast cancer in females. Mortality from liver cancer was second for Asian males, while prostate cancer was second for all other male groups. Among NHW, Asian, and U.S.-born black females, breast cancer rates were second, but much lower than lung cancer, while for the Hispanic subgroups other than CAs, breast cancer and lung cancer were similar as the top two leading causes of death for women. Colorectal cancer was the third leading cause of cancer-related death for most populations (Tables 2 and 3).

SA Hispanics of both sexes in NYS had the lowest all-cancers-combined mortality, 106.9 per 100,000 (95% CI: 100.6–113.4) for males and 75.8 (95% CI: 71.8–80.0) for females, closely followed by Asians and Dominicans. Slightly higher rates were seen for CA and Caribbean-born black groups, but not nearly as high as Puerto Rican or NHWs. U.S.-born blacks were the highest of all groups, with mortality rates per 100,000 for all-cancers-combined of 269.5 (95% CI: 264.5–274.6) for males and 178.2 (95% CI:175.1–181.3) for females. Compared with Caribbean-born blacks, U.S.-born black populations showed considerably higher mortality rates: nearly five times higher for lung cancer, three times higher for male liver cancer, and twice as high for colorectal (in males only) and pancreas, kidney, and bladder cancers. Among Hispanics, the PR group had the highest all-cancers-combined rates, not significantly different than NHW males, with 190.7 per 100,000 (95% CI: 185.2–196.2) among males and 119.7 per 100,000 (95% CI: 116.2–123.2) among females (Tables 2 and 3).

Patterns varied greatly by cancer site. Compared with NHW men, risk of mortality from lung cancer was 56% and 41% lower among Caribbean-born black and Asian men, respectively, and 20% lower among PR men (Table 4). In women, the risk differentials were even greater: 79%, 63%, and 45% lower lung cancer mortality among Caribbean-born black, Asian, and PR women, respectively. Yet U.S.-born black men and women had 49% and 15% higher risk of lung cancer mortality, respectively, than NHWs in NYS. Conversely, Puerto Rican, U.S.-born black and Caribbean-born black populations had significantly higher risk of death from stomach, prostate, premenopausal breast, and cervical cancer compared with NHWs, for whom risk of death from bladder, kidney, leukemia, and ovarian cancers was greater than all other analyzed populations. Notably, both U.S.-born black as well as Caribbean-born black populations had significantly higher mortality from prostate, myeloma (both sexes), premenopausal breast, and endometrial cancers.

Liver cancer mortality risk was between 1.5 and 2 times higher than NHWs for each of the aggregated minority groups: NHBs, Asians, and Hispanics. However, for Puerto Rican and U.S.-born black males born in the 1945–1965 cohort, risk of death from liver cancer was high: MRR: 4.52; 95% CI (4.05–5.04) and MRR: 3.71; 95% CI (3.37–4.08), respectively. Likewise, PR and U.S.-born black women from the 1945–1965 cohort also had significantly higher liver cancer mortality than NHWs: MRR: 3.05; 95% CI (2.45–3.82) and MRR: 2.90; 95% CI (2.38–3.53), respectively (Table 4). Age-group specific rates shown in Fig. 1 for the 1945–1965 cohort (beginning from age group 45–49 through age group 65–69) and for the "normal-risk" cohort (beginning from age group 65–69) visually depict a very discernible "hump and dip" pattern for Puerto Rican males and U.S.-born black males and females for the 1945–1965 birth cohort, reflecting their excess mortality.

Discussion

Presented here is the first comprehensive analysis of recent cancer mortality patterns in the populous state of New York by detailed racial and ethnic subgroup. Novelties include the intra-racial comparison of U.S.-born blacks to Caribbean-born blacks in NYS, unique Hispanic patterns driven by large PR and Dominican populations, and a presentation of East Coast cancer patterns for Asians, more commonly studied on the West Coast, especially California (7).

Overall, a clear contrast is evident between majority immigrant populations in NYS, including Asians, Dominicans, CAs, SAs, and Caribbean-born blacks, and the populations native to the United States and Puerto Rico; the former showed significantly lower overall cancer mortality. Reasons for the advantage of foreign-born populations are complex and undoubtedly have specificities by population group. However, differences on a population basis in three modifiable determinants of many cancers can likely explain much of this advantage: a lower historical prevalence of smoking (19, 20) and obesity (21) among immigrants, as well as reproductive patterns among immigrant women that reduce the risk of breast cancer (22).

NHB populations

Of all analyzed populations and subgroups, U.S.-born blacks stand out as most afflicted by cancer-related death in NYS. Cancer disparities for black populations in the United States have been extensively documented and are usually attributed to higher prevalence of risk factors, especially those associated with lower socioeconomic status (23, 34), as well as racial disparities in health care access and quality (25). Consistent with a recent study in Florida (8), U.S.-born black populations in NYS had

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Table 2. Annual age-adjusted[a] mortality rates per 100,000 for selected cancers by race/ethnicity, New York (2008–2014: male)

				Selected black subgroups			Selected Hispanic subgroups			
	Non-Hispanic white $n = 91,500$	Asian/Pacific Islander $n = 4,709$	Non-Hispanic black all[f] $n = 15,850$	U.S.-born black $n = 11,801$	Caribbean-born black $n = 2,871$	Hispanic all[f] $n = 9,899$	Puerto Rican $n = 5,177$	Dominican $n = 1,644$	Central American $n = 744$	South American $n = 1,322$
	Rate (95% CI)	Rate (95% CI)	Rate (95% CI)	Rate (95% CI)	Rate (95% CI)	Rate (95% CI)	Rate (95% CI)	Rate (95% CI)	Rate (95% CI)	Rate (95% CI)
Oral cavity and pharynx	3.2 (3.0–3.3)	3.2 (2.6–3.8)	4.3 (3.8–4.8)	5.8 (5.1–6.6)	1.4 (0.9–2.3)	2.9 (2.5–3.4)	4.9 (4.1–5.8)	1.8 (1.1–2.6)	1.5 (0.7–2.8)	0.9 (0.4–1.6)
Esophagus	7.8 (7.6–8.1)	3.0 (2.5–3.6)	6.1 (5.5–6.7)	7.7 (6.9–8.6)	3.5 (2.7–4.8)	4.6 (4.1–5.1)	7.2 (6.2–8.3)	4.0 (2.9–5.3)	2.7 (1.4–4.6)	1.8 (1.1–2.8)
Stomach	4.2 (4.0–4.4)	9.5 (8.5–10.6)	9.2 (8.5–10.0)	9.5 (8.5–10.5)	8.3 (7.0–9.9)	7.2 (6.6–8.0)	7.8 (6.7–9.0)	5.2 (4.0–6.6)	11.5 (8.7–14.8)	7.1 (5.7–8.8)
Colorectum	16.9 (16.5–17.3)	12.8 (11.6–14.1)	22.7 (21.5–23.9)	26.7 (25.1–28.3)	14.5 (12.9–16.5)	15.6 (14.6–16.6)	21.7 (19.9–23.6)	11.2 (9.4–13.3)	13.0 (10.0–16.6)	11.7 (9.8–13.9)
Liver[b]	7.2 (6.9–7.4)	13.1 (11.9–14.3)	13.1 (12.3–13.9)	17.7 (16.6–19.0)	5.1 (4.2–6.5)	12.7 (11.9–13.6)	21.3 (19.7–23.1)	7.8 (6.3–9.5)	8.5 (6.0–11.5)	6.6 (5.2–8.2)
1945–1965 birth cohort[c]	2.7 (2.5–2.8)	4.6 (4.0–5.3)	6.8 (6.2–7.4)	10.0 (9.1–11.0)	1.7 (1.2–2.7)	5.8 (5.3–6.4)	11.5 (10.3–12.8)	2.7 (1.9–3.7)	2.5 (1.4–4.3)	2.0 (1.4–2.9)
Outside birth cohort	4.5 (4.3–4.7)	8.4 (7.4–9.7)	6.3 (5.6–7.1)	7.7 (6.7–8.9)	3.4 (2.6–4.9)	6.9 (6.1–7.9)	9.8 (8.3–11.8)	5.1 (3.8–7.3)	5.9 (3.6–10.0)	4.6 (3.4–6.9)
Pancreas	13.7 (13.4–14.0)	8.1 (7.2–9.1)	13.3 (12.4–14.2)	15.8 (14.6–17.0)	8.2 (6.9–9.8)	9.1 (8.4–9.9)	10.4 (9.2–11.7)	8.9 (7.3–10.8)	8.8 (6.3–12.0)	7.8 (6.2–9.6)
Lung[d]	53.1 (52.5–53.8)	32.5 (30.6–34.5)	53.8 (52.0–55.6)	73.3 (70.7–76.0)	22.0 (20.0–24.4)	29.2 (27.9–30.6)	40.0 (37.5–42.5)	24.1 (21.3–27.2)	21.5 (17.2–26.4)	16.7 (14.2–19.3)
Prostate	17.6 (17.2–18.0)	7.7 (6.7–8.8)	43.4 (41.7–45.2)	45.3 (43.1–47.6)	36.8 (33.9–40.0)	19.3 (18.1–20.6)	21.6 (19.6–23.7)	20.0 (17.3–23.0)	29.5 (24.0–35.7)	13.2 (10.9–15.9)
Kidney	5.3 (5.1–5.5)	2.4 (1.9–2.9)	4.1 (3.7–4.7)	5.0 (4.3–5.7)	2.2 (1.6–3.3)	2.8 (2.4–3.2)	3.7 (3.0–4.5)	1.3 (0.7–2.1)	2.8 (1.5–4.6)	2.8 (1.9–4.0)
Bladder	9.1 (8.9–9.4)	2.9 (2.3–3.5)	5.5 (4.9–6.2)	6.6 (5.8–7.5)	3.8 (2.9–5.2)	4.3 (3.8–4.9)	5.3 (4.4–6.4)	3.9 (2.8–5.3)	2.5 (1.1–4.7)	3.0 (2.0–4.4)
Brain	5.4 (5.2–5.6)	2.1 (1.7–2.6)	2.7 (2.3–3.1)	3.1 (2.6–3.6)	2.0 (1.5–3.1)	2.7 (2.4–3.2)	3.1 (2.5–3.8)	2.6 (1.8–3.6)	2.4 (1.3–4.0)	2.5 (1.8–3.5)
CUP	10.1 (9.9–10.4)	4.8 (4.1–5.6)	10.5 (9.7–11.3)	13.1 (12.0–14.2)	5.6 (4.6–7.0)	7.1 (6.5–7.8)	9.6 (8.4–10.9)	5.8 (4.5–7.4)	4.8 (2.9–7.1)	5.0 (3.7–6.6)
NHL	7.8 (7.5–8.0)	4.3 (3.6–5.0)	5.8 (5.2–6.4)	5.9 (5.2–6.7)	5.4 (4.4–6.8)	6.2 (5.6–6.9)	6.8 (5.8–7.8)	6.0 (4.7–7.6)	6.1 (4.1–8.6)	6.5 (5.0–8.2)
Myeloma	3.6 (3.4–3.8)	1.4 (1.0–1.9)	6.5 (5.9–7.2)	6.6 (5.8–7.4)	6.5 (5.5–8.0)	3.4 (3.0–4.0)	3.4 (2.7–4.2)	3.9 (2.8–5.2)	3.6 (2.0–5.7)	3.8 (2.7–5.2)
Leukemia	9.5 (9.2–9.8)	4.1 (3.5–4.8)	7.0 (6.4–7.7)	7.5 (6.6–8.3)	6.1 (5.0–7.5)	5.9 (5.3–6.5)	5.5 (4.7–6.5)	6.2 (4.8–7.7)	5.7 (3.7–8.3)	6.8 (5.3–8.6)
All-sites-combined[e]	193.3 (192.0–194.6)	120.4 (116.7–124.2)	224.3 (220.6–228.0)	269.5 (264.5–274.6)	140.7 (135.3–146.4)	146.3 (143.2–149.4)	190.7 (185.2–196.2)	122.8 (116.4–129.5)	134.0 (123.1–145.5)	106.9 (100.6–113.4)

Abbreviations: CUP, cancers of unknown primary; NHL, non-Hodgkin lymphoma.

[a]2000 U.S. Standard Population.

[b]Includes intrahepatic bile duct.

[c]High HCV prevalence birth cohort; age-adjusted rates for liver cohorts originate from different age groups and thus should only be compared across populations, not within.

[d]Includes bronchus.

[e]All sites-combined includes those listed as well as those not listed here.

[f]"All" includes those who fall in this race/ethnicity category but not specifically studied here.

Table 3. Annual age-adjusted[a] mortality rates per 100,000 for selected cancers by race/ethnicity (New York, 2008–2014; female)

				Selected black subgroups			Selected Hispanic subgroups			
	Non-Hispanic white $n = 91,196$ Rate (95% CI)	Asian/Pacific Islander $n = 3,807$ Rate (95%CI)	Non-Hispanic black all[g] $n = 17,649$ Rate (95% CI)	U.S.-born black $n = 12,924$ Rate (95% CI)	Caribbean-born black 3,475 Rate (95% CI)	Hispanic all[g] $n = 9,628$ Rate (95% CI)	Puerto Rican $n = 4,597$ Rate (95% CI)	Dominican $n = 1,941$ Rate (95% CI)	Central American $n = 882$ Rate (95% CI)	South American $n = 1,424$ Rate (95% CI)
Oral cavity and pharynx	1.1 (1.0–1.2)	1.2 (0.9–1.5)	1.5 (1.3–1.7)	1.9 (1.6–2.3)	0.8 (0.5–1.5)	0.9 (0.7–1.1)	1.1 (0.8–1.5)	0.8 (0.5–1.3)	0.7 (0.3–1.6)	0.7 (0.4–1.2)
Esophagus	1.7 (1.6–1.8)	0.6 (0.4–0.9)	1.9 (1.6–2.2)	2.6 (2.2–3.0)	0.8 (0.5–1.5)	1.1 (0.9–1.3)	1.6 (1.2–2.0)	0.8 (0.5–1.3)	1.0 (0.4–1.9)	0.8 (0.4–1.3)
Stomach	2.1 (2.0–2.2)	4.0 (3.5–4.7)	4.6 (4.2–5.0)	4.5 (4.0–5.0)	4.5 (3.8–5.5)	3.9 (3.5–4.3)	3.8 (3.2–4.4)	2.8 (2.2–3.6)	6.7 (5.0–8.6)	4.5 (3.6–5.6)
Colorectum	12.3 (12.0–12.6)	8.0 (7.2–8.8)	15.2 (14.4–15.9)	17.3 (16.3–18.2)	11.1 (10.0–12.5)	10.0 (9.3–10.6)	13.3 (12.1–14.5)	8.4 (7.2–9.7)	9.4 (7.4–11.8)	6.5 (5.4–7.8)
Liver[b]	2.9 (2.8–3.1)	4.9 (4.3–5.6)	4.0 (3.6–4.4)	4.5 (4.0–5.0)	3.0 (2.4–3.9)	5.2 (4.7–5.7)	6.2 (5.5–7.1)	5.5 (4.5–6.6)	4.7 (3.3–6.4)	4.4 (3.4–5.4)
1945–1965 birth cohort[c]	0.7 (0.7–0.8)	1.0 (0.8–1.4)	1.6 (1.4–1.9)	2.2 (1.8–2.7)	0.6 (0.3–1.4)	1.6 (1.3–1.8)	2.2 (1.8–2.8)	1.2 (0.8–1.9)	1.1 (0.5–2.3)	1.1 (0.7–1.8)
Outside birth cohort	2.2 (2.1–2.3)	3.9 (3.3–4.7)	2.4 (2.1–2.7)	2.3 (1.9–2.8)	2.3 (1.8–3.4)	3.6 (3.2–4.2)	4.0 (3.3–5.0)	4.2 (3.3–5.6)	3.7 (2.4–7.9)	3.3 (2.3–4.6)
Pancreas	10.2 (9.9–10.4)	6.5 (5.7–7.2)	11.3 (10.6–11.9)	13.2 (12.4–14.1)	7.0 (6.1–8.1)	7.1 (6.5–7.6)	8.4 (7.5–9.3)	5.4 (4.5–6.5)	7.3 (5.6–9.4)	6.7 (5.5–8.0)
Lung[d]	39.4 (38.9–39.9)	15.6 (14.5–16.8)	29.3 (28.3–30.3)	41.6 (40.1–43.1)	8.3 (7.4–9.5)	14.4 (13.7–15.2)	20.6 (19.2–22.1)	11.0 (9.6–12.5)	9.3 (7.3–11.6)	9.4 (8.0–11.0)
Female breast	21.0 (20.7–21.4)	9.1 (8.3–9.9)	27.9 (27.0–28.9)	31.2 (30.0–32.6)	20.7 (19.2–22.5)	14.7 (13.9–15.4)	18.1 (16.8–19.5)	13.3 (11.9–14.9)	15.1 (12.6–17.8)	11.2 (9.7–12.8)
Premenopausal[e]	3.0 (2.8–3.1)	1.8 (1.5–2.2)	5.7 (5.2–6.2)	6.0 (5.4–6.7)	5.0 (4.2–6.1)	2.4 (2.1–2.7)	2.9 (2.4–3.5)	2.8 (2.2–3.5)	1.6 (1.0–2.5)	2.2 (1.6–2.9)
Postmenopausal	18.0 (17.8–18.4)	7.2 (6.5–8.0)	22.3 (21.4–23.1)	25.2 (24.1–26.4)	15.7 (14.5–17.2)	12.3 (11.6–13.0)	15.2 (14.0–16.5)	10.6 (9.3–12.0)	13.5 (11.1–16.1)	9.0 (7.7–10.5)
Cervix	1.8 (1.7–1.9)	1.6 (1.2–1.9)	4.4 (4.0–4.8)	4.8 (4.3–5.4)	3.7 (3.1–4.6)	2.9 (2.6–3.2)	3.9 (3.3–4.5)	2.8 (2.2–3.6)	2.5 (1.7–3.7)	2.2 (1.6–2.9)
Endometrium	4.9 (4.7–5.1)	2.1 (1.7–2.5)	10.2 (9.7–10.8)	10.8 (10.0–11.5)	8.5 (7.6–9.7)	4.1 (3.8–4.6)	4.8 (4.1–5.5)	3.8 (3.0–4.7)	7.6 (5.8–9.7)	2.5 (1.8–3.3)
Ovary	8.4 (8.2–8.6)	4.5 (3.9–5.1)	6.6 (6.1–7.1)	7.0 (6.4–7.6)	5.2 (4.5–6.2)	4.8 (4.4–5.3)	5.6 (4.8–6.4)	4.1 (3.3–5.0)	6.4 (4.9–8.3)	4.0 (3.1–5.0)
Kidney	2.2 (2.1–2.3)	1.0 (0.8–1.4)	1.7 (1.4–1.9)	2.1 (1.8–2.5)	0.7 (0.4–1.4)	1.1 (0.9–1.3)	1.4 (1.0–1.8)	0.6 (0.3–1.0)	1.4 (0.7–2.4)	1.0 (0.6–1.6)
Bladder	2.6 (2.5–2.7)	1.2 (0.9–1.5)	2.2 (1.9–2.5)	2.6 (2.3–3.0)	1.4 (1.0–2.2)	1.5 (1.3–1.8)	2.1 (1.7–2.6)	0.9 (0.6–1.4)	1.5 (0.7–2.6)	0.8 (0.4–1.4)
Brain	3.7 (3.5–3.8)	1.5 (1.2–1.9)	1.8 (1.5–2.0)	1.7 (1.4–2.0)	1.9 (1.4–2.7)	2.0 (1.8–2.3)	2.4 (1.9–2.9)	2.1 (1.6–2.8)	1.3 (0.7–2.1)	1.9 (1.3–2.6)
CUP	7.4 (7.2–7.6)	3.2 (2.7–3.8)	7.3 (6.8–7.8)	8.7 (8.0–9.4)	4.9 (4.2–5.9)	4.6 (4.2–5.1)	5.2 (4.5–5.9)	4.4 (3.6–5.4)	5.1 (3.7–6.8)	4.1 (3.2–5.2)
NHL	4.8 (4.6–5.0)	2.5 (2.1–3.0)	3.5 (3.1–3.8)	3.5 (3.1–4.0)	3.0 (2.5–3.9)	3.5 (3.1–3.9)	4.1 (3.5–4.8)	3.2 (2.5–4.0)	3.3 (2.2–4.7)	3.4 (2.6–4.4)
Myeloma	2.3 (2.2–2.5)	0.9 (0.6–1.2)	4.3 (4.0–4.7)	4.6 (4.1–5.2)	3.9 (3.2–4.8)	2.2 (1.9–2.6)	2.4 (1.9–3.0)	3.3 (2.6–4.2)	1.8 (1.0–2.9)	1.5 (1.0–2.2)
Leukemia	5.1 (5.0–5.3)	2.5 (2.0–2.9)	3.6 (3.3–4.0)	3.8 (3.3–4.2)	2.7 (2.2–3.6)	3.9 (3.5–4.3)	4.3 (3.7–5.0)	3.6 (2.9–4.5)	3.9 (2.7–5.3)	3.2 (2.4–4.1)
All-sites-combined[f]	145.4 (144.4–146.3)	76.5 (74.0–79.1)	151.7 (149.5–154.0)	178.2 (175.1–181.3)	99.9 (96.5–103.5)	96.2 (94.3–98.2)	119.7 (116.2–123.2)	83.5 (79.7–87.4)	98.3 (91.7–105.2)	75.8 (71.8–80.0)

Abbreviations: CUP, cancers of unknown primary; NHL, non-Hodgkin lymphoma.

[a]2000 U.S. Standard Population.

[b]Includes intrahepatic bile duct.

[c]High HCV prevalence birth cohort; age-adjusted rates for liver cohorts originate from different age groups and thus should only be compared across populations, not within.

[d]Includes bronchus.

[e]Cutoff of age 50 used to approximate pre- and postmenopausal status; age-adjusted breast cohorts originate from different age groups and thus should only be compared across populations, not within.

[f]All-sites-combined includes those listed as well as those not listed here.

[g]"All" includes those who fall in this race/ethnicity category but not specifically studied here.

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Table 4. Mortality rate ratios[a] for selected cancers (New York, 2008–2014)

		Aggregated racial/ethnic groups			Selected racial/ethnic subgroups		
	NHW	Non-Hispanic black MRR (95% CI)	Asian MRR (95% CI)	Hispanic MRR (95% CI)	Puerto Rican MRR (95% CI)	U.S.-born black MRR (95% CI)	Caribbean-born black MRR (95% CI)
Males							
Oral	1	1.42 (1.26–1.59)	0.97 (0.82–1.16)	0.93 (0.81–1.07)	1.48 (1.09–2.02)	1.93 (1.70–2.19)	0.48 (0.34–0.67)
Esophagus	1	0.80 (0.72–0.88)	0.37 (0.31–0.44)	0.58 (0.52–0.65)	0.87 (0.69–1.09)	1.03 (0.92–1.14)	0.42 (0.34–0.53)
Stomach	1	2.20 (2.01–2.41)	2.26 (2.03–2.53)	1.80 (1.63–1.99)	1.85 (1.56–2.18)	2.30 (2.07–2.57)	1.92 (1.64–2.25)
Colorectum	1	1.41 (1.32–1.51)	0.72 (0.65–0.79)	0.94 (0.87–1.01)	1.32 (1.09–1.59)	1.68 (1.52–1.86)	0.90 (0.79–1.03)
Liver[b]	1	2.01 (1.59–2.54)	2.20 (1.71–2.81)	1.72 (1.36–2.16)	2.95 (1.89–4.63)	2.48 (2.02–3.05)	0.73 (0.55–0.96)
1945–1965 birth cohort[c]	1	2.54 (2.31–2.79)	1.67 (1.46–1.90)	2.12 (1.92–2.34)	4.27 (3.82–4.78)	3.81 (3.45–4.20)	0.63 (0.47–0.83)
Outside birth cohort	1	1.51 (1.17–1.95)	2.03 (1.55–2.66)	1.51 (1.19–1.93)	2.22 (1.92–2.56)	1.70 (1.49–1.94)	0.72 (0.55–0.95)
Pancreas	1	1.01 (0.94–1.08)	0.55 (0.49–0.62)	0.68 (0.63–0.74)	0.82 (0.62–1.09)	1.23 (1.09–1.39)	0.57 (0.47–0.68)
Lung[d]	1	1.12 (0.99–1.25)	0.59 (0.52–0.67)	0.55 (0.49–0.62)	0.80 (0.71–0.89)	1.49 (1.35–1.65)	0.44 (0.39–0.50)
Prostate[e]	1	2.74 (2.51–3.00)	0.43 (0.37–0.50)	1.15 (1.04–1.27)	1.29 (1.13–1.48)	3.00 (2.67–3.37)	2.23 (1.97–2.54)
Kidney	1	0.78 (0.69–0.89)	0.44 (0.36–0.54)	0.52 (0.45–0.61)	0.71 (0.58–0.86)	0.96 (0.83–1.10)	0.39 (0.29–0.53)
Bladder	1	0.62 (0.55–0.69)	0.30 (0.24–0.36)	0.47 (0.41–0.53)	0.61 (0.51–0.72)	0.75 (0.67–0.86)	0.38 (0.30–0.49)
NHL	1	0.90 (0.75–1.09)	0.56 (0.45–0.70)	0.90 (0.75–1.09)	1.01 (0.78–1.31)	0.93 (0.73–1.19)	0.78 (0.58–1.03)
Myeloma	1	2.06 (1.73–2.44)	0.43 (0.32–0.58)	1.02 (0.85–1.24)	1.03 (0.79–1.36)	2.10 (1.70–2.59)	2.04 (1.61–2.59)
Leukemia	1	0.82 (0.73–0.93)	0.43 (0.36–0.52)	0.61 (0.54–0.70)	0.59 (0.47–0.75)	0.93 (0.77–1.11)	0.69 (0.54–0.87)
All-sites-combined[f]	1	1.21 (1.18–1.24)	0.61 (0.59–0.63)	0.77 (0.75–0.79)	1.05 (0.96–1.16)	1.49 (1.36–1.63)	0.72 (0.66–0.80)
Females							
Stomach	1	2.15 (1.94–2.39)	1.95 (1.68–2.27)	1.85 (1.65–2.08)	1.85 (1.56–2.20)	2.15 (1.90–2.42)	2.09 (1.76–2.48)
Colorectum	1	1.26 (1.19–1.34)	0.65 (0.58–0.72)	0.81 (0.76–0.88)	1.14 (1.01–1.29)	1.51 (1.36–1.67)	0.93 (0.82–1.07)
Liver[b]	1	1.48 (1.26–1.74)	1.68 (1.39–2.02)	1.82 (1.55–2.12)	2.22 (1.74–2.82)	1.67 (1.32–2.10)	0.96 (0.72–1.28)
1945–1965 birth cohort[c]	1	2.18 (1.83–2.60)	1.38 (1.05–1.81)	2.10 (1.75–2.52)	2.97 (2.28–3.87)	2.94 (2.34–3.69)	0.75 (0.48–1.17)
Outside birth cohort	1	1.09 (0.95–1.26)	1.78 (1.50–2.12)	1.64 (1.44–1.86)	1.80 (1.50–2.17)	1.05 (0.89–1.24)	1.08 (0.84–1.38)
Pancreas	1	1.10 (1.04–1.17)	0.61 (0.54–0.68)	0.69 (0.64–0.75)	0.86 (0.74–0.99)	1.36 (1.22–1.53)	0.67 (0.58–0.79)
Lung[d]	1	0.80 (0.71–0.90)	0.40 (0.35–0.46)	0.37 (0.33–0.42)	0.55 (0.48–0.63)	1.15 (1.02–1.29)	0.21 (0.18–0.25)
Breast	1	1.33 (1.27–1.39)	0.45 (0.41–0.49)	0.69 (0.65–0.74)	0.86 (0.79–0.93)	1.49 (1.41–1.57)	0.97 (0.89–1.05)
Premenopausal[g]	1	1.88 (1.69–2.09)	0.63 (0.52–0.78)	0.79 (0.69–0.91)	0.97 (0.79–1.20)	2.06 (1.82–2.32)	1.47 (1.22–1.77)
Postmenopausal	1	1.24 (1.18–1.30)	0.42 (0.38–0.46)	0.68 (0.64–0.72)	0.84 (0.77–0.92)	1.40 (1.32–1.48)	0.90 (0.82–0.98)
Cervix	1	2.46 (2.21–2.75)	0.83 (0.66–1.05)	1.60 (1.40–1.82)	2.10 (1.76–2.51)	2.66 (2.35–3.02)	2.01 (1.67–2.41)
Endometrium	1	2.01 (1.80–2.24)	0.42 (0.34–0.52)	0.84 (0.74–0.96)	0.97 (0.83–1.13)	2.15 (1.97–2.36)	1.69 (1.49–1.92)
Ovary	1	0.78 (0.73–0.84)	0.56 (0.49–0.63)	0.57 (0.52–0.62)	0.65 (0.56–0.74)	0.83 (0.76–0.91)	0.62 (0.54–0.72)
Kidney	1	0.75 (0.65–0.87)	0.47 (0.35–0.62)	0.50 (0.41–0.60)	0.61 (0.46–0.81)	0.97 (0.82–1.15)	0.30 (0.20–0.46)
Bladder	1	0.86 (0.75–0.98)	0.45 (0.34–0.59)	0.57 (0.48–0.68)	0.80 (0.64–1.00)	1.01 (0.87–1.17)	0.56 (0.42–0.75)
NHL	1	0.99 (0.77–1.28)	0.55 (0.41–0.74)	0.82 (0.64–1.06)	1.03 (0.74–1.44)	0.96 (0.69–1.32)	0.84 (0.59–1.19)
Myeloma	1	1.84 (1.67–2.04)	0.38 (0.28–0.52)	0.96 (0.83–1.10)	1.05 (0.85–1.29)	1.96 (1.74–2.21)	1.64 (1.38–1.96)
Leukemia	1	0.68 (0.61–0.76)	0.46 (0.38–0.56)	0.70 (0.63–0.79)	0.80 (0.68–0.95)	0.71 (0.62–0.81)	0.52 (0.42–0.64)
All-sites-combined[f]	1	1.14 (1.05–1.23)	0.54 (0.50–0.59)	0.67 (0.62–0.73)	0.86 (0.78–0.95)	1.33 (1.22–1.46)	0.74 (0.67–0.81)

Abbreviations: CUP, cancers of unknown primary; HCV, Hepatitis C virus; NHL, non-Hodgkin lymphoma; NHW, non-Hispanic white.

[a]MRRs derived from negative binomial regression including ages 35+ for all cancers, prostate 45+.

[b]Includes intrahepatic bile duct.

[c]High HCV prevalence birth cohort (1945–1965).

[d]Includes bronchus.

[e]Includes ages 45+.

[f]All sites combined includes those listed as well as those not listed here.

[g]Cutoff of age 50 used to approximate pre- and postmenopausal status.

considerably higher mortality rates than Caribbean-born blacks for nearly all cancers. For cancers typical of the "Western" lifestyle, associated with obesity and smoking (lung, colorectal, postmenopausal breast, pancreas), U.S.-born blacks had higher rates than the NHW referent population; in contrast, Caribbean-born blacks had significantly lower rates (except for colorectal cancer). However, for some cancers, specifically myeloma, prostate, endometrial, and premenopausal breast, both U.S.-born and Caribbean-born blacks sustained significantly higher mortality than any of the other analyzed populations, suggesting a possible racial vulnerability, genetic or other, as seen in the Florida study (8). In NYS, the racial component of these cancers is supported further by the uniquely elevated rates for prostate and endometrial cancers among the Hispanic subgroup with the largest proportion (26%) of reported black race on death certificates (see Table 1) in NYS-Central Americans. Overall, the findings here among disaggregated black populations reinforce the notion that race *per se* is not synonymous with worse cancer patterns, which, as shown here, specifically afflict U.S.-born blacks more so than their Caribbean-born counterparts. The known unique historical context of discrimination for black populations combined with current socioeconomic disadvantage may result in increased prevalence of cancer risk factors by pathways not yet entirely understood, requiring clarification specifically for those U.S.-born. Other striking mortality disparities that were observed uniquely for U.S.-born blacks, in relation to other races, included stomach, cervical, liver, and colorectal cancers, as well as oral cancer among males.

Hispanics

Contrary to the narrative for black populations, and despite similar socioeconomic profiles (26, 27), Hispanics have generally

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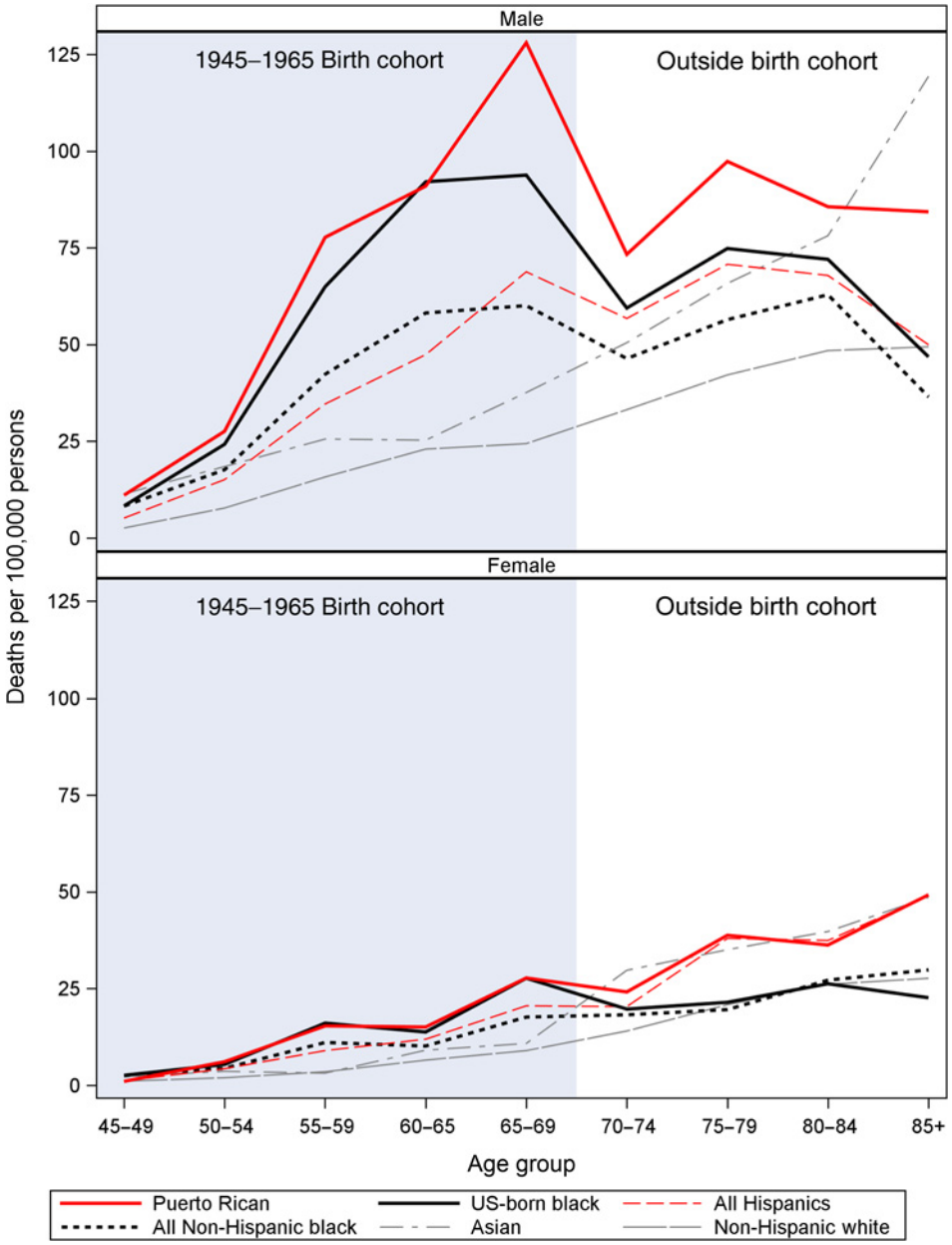

Figure 1.
Increased mortality for liver cancer among PR men and U.S.-born black men and women in the 1945–1965 birth cohort. Age-specific rates by racial/ethnic group (age-specific rates per 100,000 for the age group 65–69 born outside the birth cohort were as follows: males NHW 26.9, NHB 50.9, Asian 41.5, Hispanic 51.5, USB black 67.5, PR 76.8; females NHW 9.4, NHB 10.5, Asian 12.6, Hispanic 21.0, USB blacks 10.8, PR 33.8) New York State, 2008–2014.

been shown to have lower mortality risk from cancer than NHWs (28). However, our study found all-cancer-combined mortality for PR men to be similar to the majority NHW population, albeit with considerable variation by specific cancer sites. Compared with NHWs in NYS, PRs showed higher rates of infection-related cancers (stomach, liver, cervix), as well as prostate and colorectal cancers. Moreover, in comparison with their Dominican, CA, and SA counterparts, PRs distinguished themselves with the highest mortality for almost every cancer, at least partially explained by their higher prevalence of major risk factors for cancer, including obesity, smoking (21, 29, 30), and excessive alcohol use (31, 32) compared with other Hispanic subgroups. In addition, 21% of PRs in the current study were born in the continental United States, which typically translates into earlier adoption of a "Western" lifestyle and greater acculturation, with the cascading effect of increasing prevalence of modifiable cancer risk factors sustained for a longer period of time, indelibly impacting health patterns in later life (21, 33, 34). Conversely, CAs, SAs, and Dominicans likely benefit from healthier diets and more active lifestyles when growing up in their countries of origin and continue to maintain lower rates of obesity (29, 30), alcohol drinking (32), and tobacco use (35) upon migration.

Asians

Understandably, most studies examining the cancer experience of Asian populations in the United States are based in California (7), home to 32% of all Asian Americans (12). Nonetheless, the state of NY has the second largest Asian population, representing 10% of all Asian Americans (12). Largely mimicking their low

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incidence rates for most cancers (5), Asians had some of the lowest mortality rates of all populations in the current study. As in California (7, 36), Asians in NYS showed high rates for only two cancers analyzed—liver and stomach. Liver cancer rates for Asians are largely driven by high prevalence of chronic infection with hepatitis B (14, 37) due to immigration from countries with later implementation of mass hepatitis B (HBV) vaccination campaigns (38). In addition, it is likely that higher prevalence of chronic infection with *Helicobacter pylori* in Asian countries (39, 40) largely explains the high stomach cancer rates. While the leading causes of cancer-related death for Asians (excepting liver) are lung, colorectal, prostate, and breast, similar to all populations, their burden for these lifestyle-related cancers are relatively low, at least partially reflecting their lower prevalence of obesity (41, 42) and smoking compared with NHWs (42, 43). Notably, lung cancer mortality for Asian men and women in NYS was higher than the other majority foreign-born subgroups, consistent with reports showing higher smoking prevalence among Asians in NY than those subgroups (29, 42).

Liver cancer

Considered in aggregate, all major U.S. minority populations suffer from higher liver cancer incidence and mortality (13, 14), which are closely related for this poor prognosis cancer (44), than NHWs. Hepatocellular cancer (HCC) is by far the most common liver cancer histology (45). Prevalence of the major risk factors for HCC, chronic infection with HBV and hepatitis C virus (HCV) (37, 46), obesity (41), diabetes (47), and heavy alcohol consumption (48) are quite unevenly distributed between racial/ethnic groups, by age group and by sex (49, 50). Chronic HCV infection has been at the core of liver cancer increases in the United States in the last decade (14). While hepatitis infection data is not directly collected for new liver cancer cases in the United States, a population-based study from New York City (NYC; ref. 37) and studies from several liver transplantation centers have documented HCV prevalence in HCC cases at approximately 50% (51).

In the current study, all minority populations have high liver cancer mortality rates compared with NHWs, yet we aptly demonstrate how aggregation of heterogenous populations obscures important evidence. Specifically, the liver cancer rates are relatively subdued in the aggregate NHB and Hispanic groups, clearly tempered by the inclusion of foreign-born subgroups with lower liver cancer mortality, specifically Caribbean-born blacks (the lowest of all groups analyzed), Dominicans, CAs, and SAs.

However, when PR and U.S.-born black subgroups are considered separately, particularly in the context of the 1945–1965 birth cohort with higher prevalence of chronic HCV infection (18), striking patterns emerge. The "hump and dip" pattern seen in Fig. 1 for the PR and U.S.-born black populations portrays an obvious excess mortality in the "hump" representing the 1945–1965 cohort. The "dip" shows age-specific rates that decrease with age, which is not only counterintuitive for liver cancer, but also discordant with the age-specific rate pattern for NHWs and Asians. This pattern is further confirmed by rate ratios showing distinct and substantial cohort differences in mortality for PR men, 4.3 times higher than NHWs in the 1945–1965 cohort, but only 2.2 times higher in the "normal-risk" cohort, with a similar pattern for U.S.-born black men and women, although less clear for PR women. This unusual evidence points to an independent causal factor affecting specific age groups in certain U.S. populations. While both cohorts carry the impact of all risk factors combined (HCV, HBV, obesity, diabetes, alcohol abuse, etc.), the striking differential in mortality rates within the 1945–1965 cohort correlates with known higher levels of chronic HCV infection (46, 52), for which the dominant risk factors in the United States are past intravenous drug use, particularly during the decades when needle-sharing was most common (1960s–1980s; ref. 53), as well as contaminated blood transfusions before 1992 (18). Thus, while HCV may be impacting all populations at some level, we observe that the excess liver cancer mortality likely associated with chronic HCV infection impacts two specific populations most extremely: PR and U.S.-born black subgroups. The results for PR males, in particular, are consonant with results for U.S.-born Hispanic populations (majority Mexican) in Texas and California (54, 55) and other immigrant populations (56); results are also consistent with the high prevalence of chronic HCV infection documented for US-born Hispanics and PRs (46) and high rates of incarceration, linked to HCV transmission (57, 58). Unfortunately, neither Hispanics in aggregate nor Puerto Ricans specifically are recognized as priority populations in the National Viral Hepatitis Action Plan (59), which is especially concerning as effective HCV antiviral treatment that reduces liver cancer risk is now available (59).

Conversely, different risk factors clearly play a more distinctive role in liver cancer etiology for other population groups. For Asians, higher HBV prevalence likely drives their high liver cancer rates (37), especially given the low prevalence of obesity (41), diabetes (except South Asians) (47), and heavy drinking (48). For the majority NHW population in NYS, a more balanced distribution of viral and nonviral risk factors by age group likely drives rates. Generally, liver cancer mortality patterns seem less clear for women. Thus, future research must clarify the risk profile driving the excess liver cancer in minority women, especially foreign-born, whose liver cancer rates consistently surpass NHW women, especially among the "normal-risk" cohort as shown in Fig. 1. Increased awareness of the liver cancer patterns revealed here is critical for clinicians making decisions with their patients about viral hepatitis testing, as well as for public health program planners.

Strengths and limitations

Our state-level population-based study circumvents biases arising from disparate baseline risks across different geographies. While a few studies have reported disaggregated cancer mortality rates for Hispanic subgroups (6, 9, 54), and NHB populations (8), none to date have included them altogether with Asians for the broadest possible portrayal of cancer mortality patterns among distinctive American racial/ethnic populations in the same state. NYS was well-suited for this undertaking. In addition, our study benefitted from very high completeness of the relevant information that allowed for reliable classification of decedents into Hispanic and NHB subgroups (more than 97% complete for all race, ethnicity, and birthplace variables).

The standard limitations of descriptive epidemiology apply to the current cross-sectional study based solely on death data. Cancer mortality reflects primarily incidence, but also survival from a cancer diagnosis. Thus, while our results are consistent with previous studies on cancer incidence for U.S. minority populations (4, 28), it is also possible that racial/ethnic differences in health care access and quality, both extensively documented (60), may have resulted in worse cancer survival, especially for NHBs,

thus impacting the mortality burden. However, neither survival time information nor individual-level indicators of access to quality health care are available from death data. Also lacking are specific risk factor and comorbidity profiles for each decedent, as well as information on individual-level socioeconomic factors, year of immigration, language dominance, or other acculturation measures for immigrants. Theoretically, our mortality numbers could be affected by the Salmon Bias, whereby immigrants return to their home countries of origin to die, although this effect has been shown to be small (61). Asian, CA, and SA rates are themselves aggregates of diverse populations, whose cancer determinants may also differ greatly; sparse numbers prevented a more detailed accounting of these populations. Finally, only 22% of NHWs come from NYC, yet for all minority groups that proportion exceeds 65%. Because adjusted cancer rates are higher in NYS than in NYC (62), our differences, as expressed by MMRs with NHWs as references, are slightly underestimated.

Conclusions

Considerable heterogeneity in cancer mortality is observed between different racial/ethnic populations in NYS. At the extremes are U.S.-born blacks on one side and Asian and SA populations on the other: the former has the highest cancer mortality burden; the latter have very low rates relative to other analyzed groups. Generally, Caribbean-born blacks and the Hispanic populations that are majority immigrant, Dominicans, CAs, and SAs have relatively low mortality. However, overall cancer mortality rates for Puerto Rican men match that of NHWs, a novel finding. Subgroup analyses can facilitate the identification not only of high-risk groups, but also low-risk populations who may have protective factors that can be preserved upon immigration or even replicated in other populations.

For liver cancer, the burden is high for all minority groups. However, the excess mortality among Puerto Ricans and U.S.-born blacks, especially in men, is substantial, the most extreme excess of any cancer, especially in the 1945–1965 birth cohort. By considering NHBs and Hispanics in aggregate, the unique HCV-related burden for these specific groups has previously been masked. Awareness of the severity of this problem is critical to clinicians making decisions with their patients about screenings as well as public health program planners.

In the broader context, disparities for some cancers that are commonly associated with foreign-born populations from developing countries, especially infection-related cancers, are increasingly characteristic of U.S.-born minority populations. These cancers, along with colorectal and oral cancer (in males), consistent with evidence seen for U.S.-born Latinos in California (54, 55, 63), are disproportionately burdening these groups. This commonality among U.S.-born minorities speaks to an undercurrent of entrenched socioeconomic disparities that determine the risk factors for these cancers, including infection with HPV, HCV, *H. pylori*, obesity, diabetes, and alcohol abuse. Contextualizing cancer prevention and control efforts for the burgeoning minority populations in the U.S. will require addressing the social determinants of health.

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 New York State Department of Health, Bureau of Vital Statistics.

Authors' Contributions

Acquisition of data (provided animals, acquired and managed patients, provided facilities, etc.): P.S. Pinheiro, K.E. Callahan, F.P. Boscoe
Analysis and interpretation of data (e.g., statistical analysis, biostatistics, computational analysis): P.S. Pinheiro, K.E. Callahan, F.P. Boscoe, R.R. Balise
Writing, review, and/or revision of the manuscript: P.S. Pinheiro, K.E. Callahan, F.P. Boscoe, T.R. Cobb, D.J. Lee, E. Kobetz
Administrative, technical, or material support (i.e., reporting or organizing data, constructing databases): K.E. Callahan, T.R. Cobb

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Cancer Site–Specific Disparities in New York, Including the 1945–1965 Birth Cohort's Impact on Liver Cancer Patterns

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