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Cancer mortality rates among US and foreign-born individuals: United States 2005–2014

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Abstract

From 1970 to 2010 the foreign-born population in the United States has rapidly increased from 9.6 to 40.0 million individuals. Historically, differences in cancer rates have been observed between US-born and foreign-born individuals. However, comprehensive and up-to-date data on US cancer rates by birth place is lacking. To compare cancer mortality rates among foreign and US-born individuals, population-based cancer mortality data were obtained from the CDC's National Center for Health Statistics. Utilizing data recorded on death certificates, individuals were categorized as US-born or foreign-born. Annual population estimates were obtained from the American Community Survey. Age-adjusted mortality rates and rate ratios (RRs) for all cancer sites were calculated using SEER*Stat. A total of 5,670,535 deaths from malignant cancers were recorded in the US from 2005 to 2014 and 9% of deaths occurred among foreign-born individuals. Overall, foreign-born individuals had a 31% lower cancer mortality rate when compared to US-born individuals (Rate Ratio (RR): 0.69 (95% CI: 0.68–0.69)), and similar results were observed when stratifying by sex, race/ethnicity, age, and geographic region. However, foreign-born individuals did have significantly elevated cancer mortality rates for seven cancers sites, of which five were infection-related, including: nasopharynx (RR: 2.01), Kaposi Sarcoma (RR: 1.94), stomach (RR: 1.82), gallbladder (RR: 1.47), acute lymphocytic leukemia (RR: 1.27), liver and intrahepatic bile duct (RR: 1.24), and thyroid (RR: 1.22) cancers. Many of these deaths could be avoided through improved access to prevention, screening, and treatment services for immigrant populations in the US or in their country of origin.

Keywords

Cancer; Foreign-born; Immigrant; US-born; Stomach; Cervical; Liver; Malignancy

1. Introduction

Foreign-born individuals in the United States (US) represent a rapidly growing segment of the general population. From 1970 to 2010 the foreign-born population in the US has increased from 9.6 to 40.0 million individuals, and in 2010 foreign-born individuals

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composed 12.9% of the general US population (U.S. Census Bureau, 2010; Singh and Hiatt, 2006). In contrast to 1970 when most immigrants into the US were from Europe, in 2010 most of the foreign-born population had immigrated from Latin America (51%), Asia (30%), or Europe (11%) (U.S. Census Bureau, 2010).

When compared to their US-born counterparts, foreign-born individuals are more likely to be uninsured, below the poverty line, have limited English proficiency, and lower educational attainment (Singh and Hiatt, 2006; Dominguez et al., 2015). Despite these disparities, after controlling for sociodemographic variables, immigrants on average are healthier, live longer, and have lower rates of hypertension, smoking, obesity, asthma, high cholesterol, heart disease, and mental health disorders than US-born individuals (Singh and Hiatt, 2006; Dominguez et al., 2015; Cunningham et al., 2008; Singh and Miller, 2004; Blue and Fenelon, 2011; Singh and Siahpush, 2001). This phenomenon is commonly referred to as the “immigrant paradox,” and there are a number of theories on why immigrants have improved health outcomes, including migration selectivity, higher social support, and a lower prevalence of harmful risk factors (e.g. smoking and obesity) when compared to their native-born counterparts (Singh and Hiatt, 2006; Cunningham et al., 2008; Singh and Miller, 2004; Singh and Siahpush, 2001).

Cancer outcome research reveals the same immigrant health advantage. Overall, immigrants have lower cancer mortality rates when compared to their respective US-born race/ethnicity groups (Singh and Hiatt, 2006; Singh and Miller, 2004; Singh et al., 2013). Due primarily to factors that occur prior to an individual’s immigration to the US (such as vaccine availability or acquisition of specific infections), foreign-born individuals have an elevated risk of developing and dying from a number of infection related cancers, including stomach (Singh and Hiatt, 2006; Cunningham et al., 2008; Singh and Miller, 2004; Singh and Siahpush, 2001; Singh et al., 2013), liver (Singh and Hiatt, 2006; Dominguez et al., 2015; Singh et al., 2013), and cervical (Singh and Hiatt, 2006; Dominguez et al., 2015; Singh and Miller, 2004; Seeff and McKenna, 2003) cancer. While they have lower cancer mortality rates overall, foreign-born individuals have lower access to healthcare, and are significantly less likely to undergo breast (Singh and Hiatt, 2006; Cunningham et al., 2008; Singh and Miller, 2004; Singh and Siahpush, 2001; White et al., 2017), cervical (Singh and Hiatt, 2006; Dominguez et al., 2015; White et al., 2017; Goel et al., 2003; Endeshaw et al., 2018a), and colorectal cancer screening when compared to their US-born counterparts (Singh and Hiatt, 2006; Dominguez et al., 2015; Singh and Miller, 2004; Seeff and McKenna, 2003).

The rapid rise observed in the foreign-born population has not been accompanied by an increase in immigrant health research (Singh and Hiatt, 2006). As such, the purpose of the present study is to use the most recent cancer mortality data to: a) describe cancer mortality rates among the foreign-born population; b) determine if any specific subgroups have elevated rates; c) identify specific cancers for which foreign-born individuals may have higher rates; and d) describe mortality rate changes over time.

2. Methods

2.1. Selection criteria, mortality data, and population estimates

Population-based cancer mortality data were obtained from the National Center for Health Statistics (NCHS) for all deaths occurring in the 50 states and the District of Columbia. NCHS collects information on sex, race, ethnicity, birth place, age at death, state of residence, and cause of death from death certificates filed in each state. Birth place is assigned by NCHS as one of the 50 states, the District of Columbia, Puerto Rico, Virgin Islands, Guam, Northern Mariana Islands, American Samoa, Canada, Cuba, Mexico, or the "remainder of the world". Individuals whose death certificates stated they were born in one of the 50 states, the District of Columbia, or the US territories were categorized as US-born. Remaining cases with a recorded place of birth outside of the US and its territories were categorized as foreign-born (Singh et al., 2013). Mortality data for malignant cancers were selected using the Tenth Revision of the International Classification of Diseases (ICD-10) codes C00-C97. A total of 5,725,710 deaths from malignant cancer were recorded between 2005 and 2014. Cases with no recorded place of birth (0.96%) were excluded from all analyses, for a final sample size of 5,670,535 deaths.

Annual population estimates were obtained from the US Census Bureau's American Community Survey (ACS). ACS is a continuous national survey of randomly selected households and collects detailed information on the US population including information on birth place (American Community Survey, 2016). ACS also provides public-use microdata sample (PUMS) files that can be used to estimate the US population using social, housing and demographic characteristics. We obtained the annual ACS PUMS files from 2005 to 2014 and extracted the US-born and foreign-born population (based on place of birth) for age, race/ethnicity, sex, and Census region subgroups using provided person weights (American Community Survey, 2016).

2.2. Statistical analysis

Mortality data from NCHS and population estimates from ACS for 2005–2014 were formatted using the Surveillance Epidemiology End Results (SEER) Program SEER*Prep (Surveillance Research Program National Cancer Institute, 2016) software to create a SEER*Stat database (Surveillance Research Program National Cancer Institute, 2017). We calculated age-adjusted mortality rates of malignant cancers by birth place, age-adjusting to the 2000 US standard population. Race/ethnicity was categorized into four mutually exclusive categories including: non-Hispanic white, non-Hispanic black, non-Hispanic Asian/Pacific Islander (API), and Hispanic (henceforth referred to as whites, blacks, APIs and Hispanics). Due to the lack of foreign-born American Indian/Alaskan Natives, this group was excluded from all analyses. SEER*Stat was used to calculate rate ratios by birth place (US-born vs. foreign-born), sex, age, race/ethnicity, and cancer site. When utilizing rate ratios to identify cancers for which foreign-born individuals may have higher rates, the Bonferroni correction was performed to account for multiple comparisons in which $p = 0.05$ is divided by the number of comparisons (i.e. the number of cancer types evaluated). The average annual percent change (AAPC) of cancer death rates from 2005 to 2014 by birth

place, sex, race/ethnicity, and cancer site was calculated using Joinpoint. The Tiwari et al., modification was used to calculate AAPC confidence intervals (Tiwari et al., 2006).

3. Results

From 2005 to 2014, 5,670,535 deaths from malignant cancers occurred in the United States, of which 528,694 (9.3%) occurred among foreign-born individuals. Overall, foreign-born individuals had a lower cancer mortality rate when compared to US-born individuals (RR: 0.69 (95% CI: 0.68, 0.69)). When stratified by sex, this pattern remained significant with foreign-born men and women having a 32% and 30% lower cancer mortality rate when compared to their respective counterparts. When stratifying by sex, age, race/ethnicity, and geographic regions, foreign-born individuals had a significantly lower cancer mortality rates for all stratification groups (Table 1).

Overall, cancer mortality rates significantly decreased among US-born (AAPC: −1.68; 95% CI: −2.26, −1.10) and foreign-born individuals (AAPC: −1.62; 95% CI: −2.25, −0.99) from 2005 to 2014. While cancer mortality rates remained constant over the study period for US-born API and foreign-born Hispanics, cancer mortality rates significantly decreased among all other race/ethnicity stratifications (Fig. 1). Despite significant reductions in cancer mortality from 2005 to 2014 across most race/ethnicity stratifications, the associated rate ratios comparing US and foreign-born by race/ethnicity remained largely unchanged (data not shown).

When comparing cancer mortality rates among US and foreign-born individuals for the top 12 causes of cancer mortality among men and women in the United States, foreign-born individuals had significantly lower cancer mortality rates for most cancer sites, with the exception of liver and intrahepatic bile duct among men and women and stomach among men (Table 2) (Ryerson et al., 2016). Of the sixty-five cancer sites evaluated, foreign-born individuals had significantly elevated mortality rates for seven selected cancer sites: nasopharynx (RR: 2.01), Kaposi sarcoma (RR: 1.94), stomach (RR: 1.82), gallbladder (RR: 1.47), acute lymphocytic leukemia (RR: 1.27), liver and intrahepatic bile duct (RR: 1.24), and thyroid (RR: 1.22). Liver and intrahepatic bile duct and stomach cancer mortality rates were not only elevated among the foreign-born population, but accounted for a large number of cancer-related deaths (31,097 and 24,583 respectively). Among the foreign-born population, there were racial/ethnic differences in the mortality rates of specific cancer sites when compared to US-born individuals (Table 3).

Foreign-born individuals did not have elevated cancer mortality rates for cancers that have screening and early detection technologies for which the United States Preventive Service Task Force has a recommendation (*Recommendations for Primary Care Practice*, 2018): breast, cervical, colorectal, or lung and bronchus cancers, both overall, and when stratified by race/ethnicity (data not shown). Overall, similar declines in cancer mortality trends were observed when comparing these cancers between US and foreign-born individuals. While cervical cancer mortality significantly decreased among foreign-born individuals overall, no significant decrease was observed among US-born individuals (data not shown).

4. Discussion

In the present study, foreign-born individuals in the US had lower rates of cancer mortality when compared to the US-born population. When stratifying by age, race/ethnicity, sex, and geographic location, no subgroup of the foreign-born population had higher death rates. Despite overall lower rates of cancer mortality, foreign-born individuals did have significantly elevated cancer mortality rates for seven cancers sites including: nasopharynx (RR: 2.01), Kaposi Sarcoma (RR: 1.94), stomach (RR: 1.82), gallbladder (RR: 1.47), acute lymphocytic leukemia (RR: 1.27), liver and intrahepatic bile duct (RR: 1.24), and thyroid (RR: 1.22) cancers. Despite the high cancer mortality rate observed among US-born blacks when compared to other races/ethnicities in the US-born population, the highest cancer death rates were observed among foreign-born whites. When analyzing trends over time, cancer death rates among foreign and US-born individuals significantly decreased at near identical rates during the study period.

The findings of this study are consistent with other studies that have observed lower cancer mortality rates among foreign-born populations overall, but higher cancer death rates for specific infection-related cancers (stomach and liver and intrahepatic bile duct) (Singh and Hiatt, 2006; Dominguez et al., 2015; Cunningham et al., 2008; Singh and Miller, 2004; Singh and Siahpush, 2001; Singh et al., 2013). These findings also align with previous trends on a widening disparity in cancer mortality when comparing US-and foreign-born individuals, with the foreign-born population experiencing 12% lower cancer death rate in 1979–1981, 21% lower in 1989–1991, 25% lower in 1999–2001, and 31% lower in the present study (Singh and Hiatt, 2006).

Despite an overall elevated rate of liver cancer mortality, when stratified by race/ethnicity foreign-born APIs were the only racial/ethnic group to experience elevated rates of liver and intrahepatic bile duct cancer mortality when compared to their US-born counterparts (Endeshaw et al., 2018b). The higher mortality rates of liver and intrahepatic bile duct cancer observed among APIs can likely be explained by elevated rates of hepatitis B acquired prior to immigrating to the United States (Pollack et al., 2014; Kowdley et al., 2012; El-Serag et al., 2007). As global hepatitis B childhood vaccination programs continue to improve, it is likely that the mortality rates observed among foreign-born APIs will begin to decline (Ryerson et al., 2016).

Foreign-born individuals had higher rates of stomach cancer mortality when compared to US-born individuals (RR: 1.82; 95% CI: 1.80, 1.85), and this remained after stratifying by sex, geographic location, and age. Of note, however, the excess stomach cancer mortality observed among foreign-born individuals was primarily a function of relatively low stomach cancer mortality among US-born whites (2.53 per 100,000) when compared to foreign-born whites (5.18), blacks (US-born: 6.55; foreign-born: 6.05), APIs (US-born: 5.92; foreign-born: 6.31), and Hispanics (US-born: 5.35; foreign-born: 5.49) (Hallowell et al., 2018). As roughly 89% of stomach cancers can be attributed to *H. pylori* infection worldwide (Plummer et al., 2015), the elevated cancer death rates observed among US-born minority groups when compared to US-born whites is likely reflective of elevated *H. pylori* infection rates in these populations, which has previously been documented (Grad et al., 2011).

Worldwide, over half of the world's population is infected with *H. pylori*, with the prevalence of *H. pylori* varying widely by geographic region (Africa (79.1%), Latin America (63.4%), Asia (54.7%), Europe (34.3–62.8%), North America (37.1%)) (Hooi et al., 2017). Subsequently, individuals born in these areas have a high risk of *H. pylori* infection and the subsequent development of stomach cancer, despite moving to lower risk countries such as the United States after birth (El-Serag et al., 2018). To help address this issue, *H. pylori* screening is beginning to be recommended for first generation immigrants who migrate from high burden countries (El-Serag et al., 2018).

In addition to stomach and liver and intrahepatic bile duct cancers, foreign-born individuals in this study had higher cancer mortality rates for a number of other rare infection-related cancers when compared to their US-counterparts, including: nasopharynx (Epstein-Barr virus), Kaposi Sarcoma (human herpesvirus type 8), and gallbladder (liver fluke) cancers (Plummer et al., 2016). This closely aligns with global trends as only 4.0% of new cancer cases in North America can be attributed to infections, in contrast to 15.4% world-wide and up to 40% in some sub-Saharan regions (Plummer et al., 2016). Unfortunately, the limited information available in this data set with regards to place of birth did not allow us to identify specific subgroups of the foreign-born population that may have higher cancer death rates from these infection-related cancers. Other work, however, has found these infection-related cancers to be elevated based on geographic location, with elevated rates of Kaposi Sarcoma observed among individuals of Mediterranean or Eastern European descent (Iscovich et al., 2000), elevated gallbladder cancer rates among individuals from Chile, Korea, Japan, Czech Republic, Hungary, and Poland (Torre et al., 2017), and higher nasopharynx cancer rates among individuals from East and Southeast Asia (Wei and Sham, 2005). In contrast to previous work, foreign-born individuals did not have higher rates of cervical cancer mortality (RR: 0.95 (95% CI: 0.92, 0.97)) (Singh and Hiatt, 2006; Singh and Miller, 2004; Seeff and McKenna, 2003; Hallowell et al., 2019) overall or when stratified by race/ethnic group (data not shown). However, when stratified by age, older (65+) foreign-born women did have significantly higher mortality rates when compared to their respective US-born counterparts (age 65–79 years (rate ratio = 1.15, 95% CI = 1.09, 1.22); ≥80 years (rate ratio = 1.43, 95% CI = 1.32, 1.55)) (Hallowell et al., 2019).

Other cancers which foreign-born individuals experienced higher mortality, including acute lymphocytic leukemia and thyroid cancer, have relatively high survival rates (Inaba et al., 2013; Davies and Welch, 2010). As such, the mortality differentials observed for these cancers could reflect known disparities in access to healthcare and health insurance among the foreign-born population (Singh and Hiatt, 2006; Dominguez et al., 2015). With improved access to healthcare services among the foreign-born population, observed mortality differences may disappear.

Despite facing numerous sociodemographic disadvantages (Singh and Hiatt, 2006; Dominguez et al., 2015) the overall lower cancer death rate observed among the foreign-born population is expected. Smoking is one of the leading causes of cancer and cancer related mortality in the US, and overall foreign-born individuals are 50% less likely to report smoking cigarettes when compared to their US-born counterparts, even when controlling for socioeconomic and demographic variables (Singh and Hiatt, 2006; Dominguez et al., 2015;

Bosdriesz et al., 2013). While other work has documented the higher life expectancy observed among the foreign-born population, most of the improved life expectancy for both men and women can be attributed to differences in smoking prevalence when compared to their US-born counterparts (Blue and Fenelon, 2011). The lower prevalence of obesity, alcohol consumption, and unhealthy diets observed among the foreign-born population are likely further reducing their cancer risk (Singh and Hiatt, 2006; Dominguez et al., 2015; Cunningham et al., 2008; Singh and Miller, 2004; Blue and Fenelon, 2011; Singh and Siahpush, 2001). Finally, the health advantage observed in the foreign-born population could be due to migration selectivity (i.e. individuals who migrate to the US are healthier and have better health outcomes than those who remain behind) or the salmon bias (i.e. the return of less healthy immigrants to their country of origin prior to death) (Singh and Hiatt, 2006; Cunningham et al., 2008; Singh and Miller, 2004; Singh and Siahpush, 2001).

The main strength of this study is that it provides the most up-to-date comprehensive examination of cancer death rates by birth place, sex, age, and race/ethnicity for the entire US population over the last decade. Unfortunately, similar analyses for cancer incidence cannot be performed due to the large proportion of individuals with missing birth place information in cancer registry data (Singh and Hiatt, 2006). As the data in this study were based on information obtained from death certificates, one major limitation of this study is the lack of information on immigration variables that play a key role in mortality, such as length of residency (Singh and Hiatt, 2006; Cunningham et al., 2008; Singh and Miller, 2004), English proficiency, and legal and citizenship status (Singh and Hiatt, 2006; Reyes and Miranda, 2015) or specific country of origin. Additionally, we did not have access to other variables of interest such as socioeconomic position, education level, health insurance status, and other risk factor data which would likely impact cancer death rates.

In summary, foreign-born individuals in the US have lower cancer mortality rates when compared to the US-born population, despite numerous sociodemographic disparities. However, foreign-born individuals have higher cancer mortality rates for select infection-related cancers, in particular liver and stomach. Efforts to address the major risk factors for these cancers (hepatitis B and *H. pylori*) are needed to relieve this health disparity, and reduce the burden of these cancers in the US.

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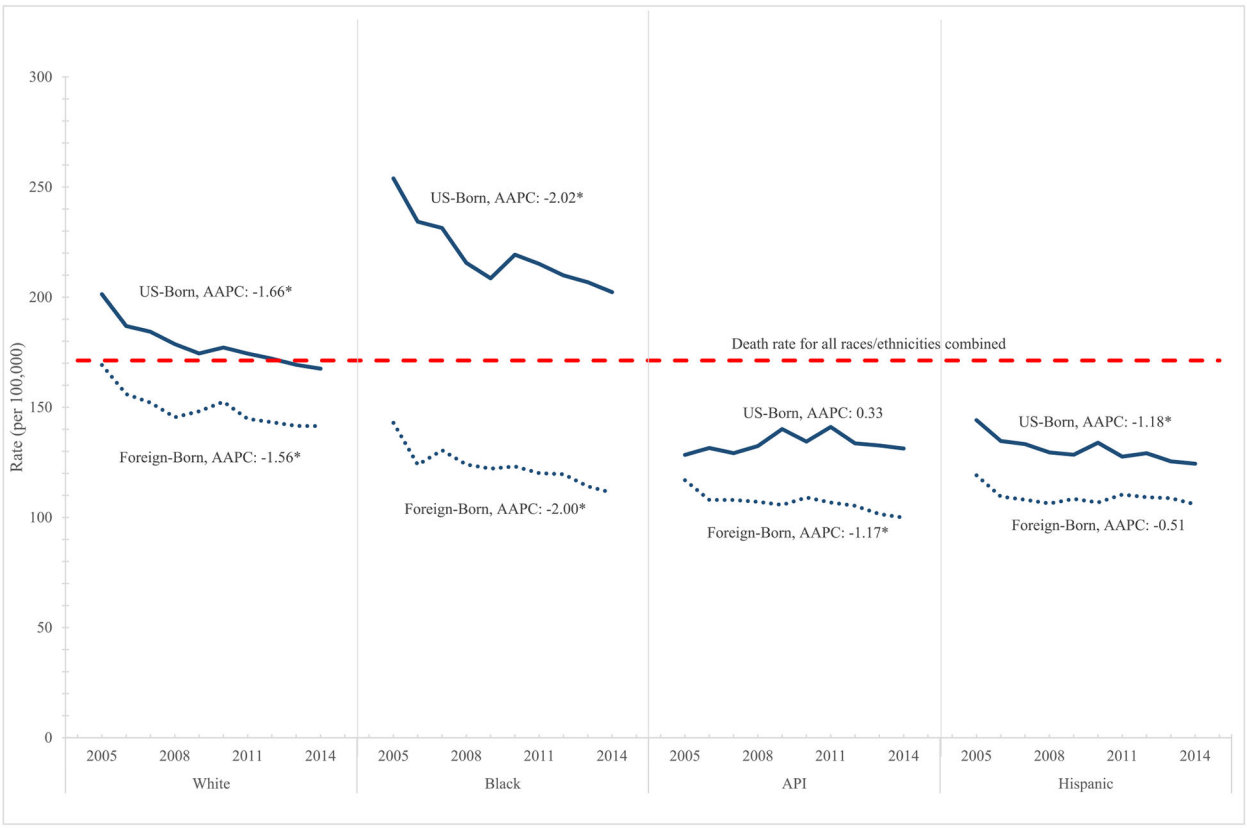

Fig. 1.

Trends in age-adjusted cancer mortality rates by race/ethnicity: United States 2005–2014.

*AAPC significantly different from 0 at the $p = 0.05$ level.

Table 1

Age-adjusted cancer mortality rates in the United States by birth place, sex, age, race/ethnicity, and US Census Region: 2005–2014.[a]
Source: National Center for Health Statistics (NCHS) & American Community Survey.

	US-born		Foreign-born		Rate ratio[c] (95% CI)
	No. of cases	Average annual rate (95% CI)	No. of cases	Average annual rate (95% CI)	
Overall[b]	5,141,841	178.87 (178.72, 179.03)	528,694	122.76 (122.43, 123.10)	0.69* (0.68, 0.69)
Sex					
Men	2,700,236	217.42 (217.15, 217.68)	261,419	148.04 (147.44, 148.63)	0.68* (0.68, 0.68)
Women	2,441,605	151.73 (151.54, 151.93)	267,275	106.88 (106.47, 107.29)	0.70* (0.70, 0.71)
Age (years) – male					
< 35	30,105	4.76 (4.71, 4.82)	4480	4.50 (4.31, 4.69)	0.94* (0.90, 0.99)
35–49	117,152	43.58 (43.33, 43.83)	17,158	26.20 (25.81, 26.60)	0.60* (0.59, 0.61)
50–64	684, 193	278.33 (277.67, 278.99)	64,028	160.99 (159.75, 162.25)	0.58* (0.57, 0.58)
65–79	1,117,658	994.21 (992.35, 996.07)	101,756	649.78 (645.74, 653.83)	0.65* (0.65, 0.66)
80+	751,128	2117.56 (2112.77, 2122.37)	73,997	1651.83 (1639.94, 1663.79)	0.78* (0.77, 0.79)
Age (years) – female					
< 35	26,468	4.36 (4.30, 4.41)	3992	4.00 (3.84, 4.17)	0.92* (0.88, 0.96)
35–49	138,378	50.73 (50.46, 51.00)	22,676	34.95 (34.49, 35.40)	0.69* (0.68, 0.70)
50–64	567,445	218.36 (217.79, 218.94)	62,201	141.68 (140.57, 142.80)	0.65* (0.64, 0.65)
65–79	921,146	683.94 (682.54, 685.34)	94,943	446.38 (443.53, 449.24)	0.65* (0.65, 0.66)
80+	788,168	1238.89 (1236.15, 1241.65)	83,463	1017.85 (1010.95, 1024.79)	0.82* (0.82, 0.83)
Race/ethnicity – male					
Non-Hispanic White	2,274,490	214.79 (214.51, 215.08)	112,397	177.29 (176.24, 178.35)	0.83* (0.82, 0.83)
Non-Hispanic Black	310,684	285.95 (284.88, 287.03)	15,788	149.33 (146.68, 152.02)	0.52* (0.51, 0.53)
Non-Hispanic API[d]	13,930	157.77 (155.07, 160.49)	54,785	128.80 (127.64, 129.97)	0.82* (0.80, 0.83)
Hispanic	83,172	163.36 (162.17, 164.56)	77,785	133.62 (132.59, 134.66)	0.82* (0.81, 0.83)
Race/ethnicity – female					
Non-Hispanic White	2,049,881	151.65 (151.44, 151.86)	120,229	131.58 (130.80, 132.37)	0.87* (0.86, 0.87)

	US-born		Foreign-born		Rate ratio[c] (95% CI)
	No. of cases	Average annual rate (95% CI)	No. of cases	Average annual rate (95% CI)	
Non-Hispanic Black	293,425	178.69 (178.04, 179.35)	17,465	106.33 (104.68, 108.01)	0.60 * (0.59, 0.60)
Non-Hispanic API[d]	11,927	113.71 (111.58, 115.86)	53,813	90.82 (90.02, 91.62)	0.80 * (0.78, 0.82)
Hispanic	70,392	106.60 (105.79, 107.41)	75,153	93.13 (92.44, 93.83)	0.87 * (0.86, 0.88)
Regions of the United States					
Northeast	964,618	179.52 (179.16, 179.89)	132,568	124.33 (123.65, 125.02)	0.69 * (0.69, 0.70)
Midwest	1,227,103	183.33 (183.01, 183.65)	58,821	130.56 (129.49, 131.64)	0.71 * (0.71, 0.72)
South	1,974,091	182.05 (181.79, 182.31)	150,023	120.34 (119.71, 120.96)	0.66 * (0.66, 0.66)
West	926,029	166.18 (165.84, 166.53)	187,282	121.19 (120.63, 121.76)	0.73 * (0.73, 0.73)

[a] Rates are age-adjusted to 2000 standard U.S. population and shown per 100,000.

[b] Columns may not sum to total because of missing values.

[c] US-born were used as a reference group to generate rate ratios.

[d] Asian and Pacific Islander (API).

* $p < 0.05$.

Table 2

Age-adjusted cancer mortality rates in the United States 2005–2014 for the most common cancers, by sex and birth place.[a]
Source: National Center for Health Statistics (NCHS) & American Community Survey.

Cancer site	Overall		US-born		Foreign-born		Rate ratio[b]
	No. of cases	Average annual rate (95% CI)	No. of cases	Average annual rate (95% CI)	No. of cases	Average annual rate (95% CI)	Rate ratio (95% CI)
Top 12 cancer sites among men							
Lung and bronchus	865,639	60.04 (59.91, 60.17)	806,077	63.88 (63.74, 64.03)	59,562	33.91 (33.63, 34.19)	0.53* (0.53, 0.54)
Prostate	279,970	21.74 (21.66, 21.82)	254,407	22.40 (22.31, 22.49)	25,563	16.85 (16.64, 17.06)	0.75* (0.74, 0.76)
Colon and rectum	266,503	18.74 (18.67, 18.82)	240,268	19.39 (19.31, 19.47)	26,235	14.59 (14.41, 14.78)	0.75* (0.74, 0.76)
Pancreas	181,499	12.50 (12.44, 12.56)	163,609	12.90 (12.83, 12.96)	17,890	9.95 (9.79, 10.10)	0.77* (0.76, 0.78)
Leukemia	128,641	9.34 (9.29, 9.39)	116,566	9.68 (9.63, 9.74)	12,075	6.96 (6.83, 7.10)	0.72* (0.70, 0.73)
Liver and intrahepatic bile duct	132,978	8.66 (8.61, 8.71)	113,666	8.49 (8.44, 8.54)	19,312	9.92 (9.78, 10.07)	1.17* (1.15, 1.19)
Non-Hodgkin lymphoma	110,353	7.95 (7.90, 8.00)	99,337	8.20 (8.15, 8.25)	11,016	6.22 (6.10, 6.35)	0.76* (0.74, 0.77)
Urinary bladder	101,622	7.65 (7.60, 7.69)	93,367	7.98 (7.93, 8.03)	8255	5.30 (5.19, 5.42)	0.66* (0.65, 0.68)
Esophagus	111,207	7.46 (7.42, 7.51)	104,539	8.05 (8.00, 8.10)	6668	3.60 (3.51, 3.69)	0.45* (0.44, 0.46)
Kidney and renal pelvis	83,287	5.72 (5.68, 5.76)	76,254	6.00 (5.96, 6.05)	7033	3.83 (3.74, 3.93)	0.64* (0.62, 0.65)
Brain and other nervous system	78,987	5.24 (5.20, 5.27)	71,277	5.48 (5.44, 5.52)	7710	3.84 (3.75, 3.93)	0.70* (0.68, 0.72)
Stomach	66,218	4.64 (4.60, 4.68)	52,527	4.23 (4.20, 4.27)	13,691	7.39 (7.26, 7.52)	1.75* (1.71, 1.78)
Top 12 cancer sites among women							
Lung and bronchus	695,744	37.64 (37.55, 37.73)	650,829	40.76 (40.66, 40.87)	44,915	18.22 (18.06, 18.40)	0.45* (0.44, 0.45)
Breast	405,140	21.93 (21.86, 22.00)	363,520	22.91 (22.84, 22.99)	41,620	16.02 (15.86, 16.17)	0.70* (0.69, 0.71)
Colon and rectum	251,251	13.19 (13.13, 13.24)	224,969	13.63 (13.57, 13.68)	26,282	10.49 (10.36, 10.62)	0.77* (0.76, 0.78)
Pancreas	179,126	9.49 (9.45, 9.54)	159,150	9.73 (9.68, 9.77)	19,976	8.13 (8.01, 8.24)	0.84* (0.82, 0.85)
Ovary	143,599	7.74 (7.70, 7.78)	128,022	8.00 (7.96, 8.05)	15,577	6.13 (6.03, 6.23)	0.77* (0.75, 0.78)
Leukemia	96,631	5.19 (5.16, 5.23)	86,250	5.33 (5.29, 5.36)	10,381	4.31 (4.22, 4.40)	0.81* (0.79, 0.83)
Non-Hodgkin lymphoma	92,289	4.88 (4.85, 4.91)	82,190	4.99 (4.96, 5.03)	10,099	4.11 (4.02, 4.19)	0.82* (0.81, 0.84)
Corpus and uterus, NOS	81,607	4.36 (4.33, 4.39)	72,297	4.47 (4.44, 4.50)	9310	3.66 (3.58, 3.73)	0.82* (0.80, 0.84)

Cancer site	Overall		US-born		Foreign-born		Rate ratio[b]
	No. of cases	Average annual rate (95% CI)	No. of cases	Average annual rate (95% CI)	No. of cases	Average annual rate (95% CI)	Rate ratio (95% CI)
Liver and intrahepatic bile duct	65,579	3.51 (3.48, 3.54)	53,794	3.32 (3.29, 3.35)	11,785	4.80 (4.71, 4.89)	1.44* (1.42, 1.48)
Brain and other nervous system	62,299	3.48 (3.45, 3.51)	55,833	3.63 (3.60, 3.66)	6466	2.66 (2.59, 2.73)	0.73* (0.71, 0.75)
Myeloma	51,199	2.72 (2.69, 2.74)	45,853	2.80 (2.77, 2.83)	5346	2.17 (2.11, 2.23)	0.77* (0.75, 0.80)
Kidney and renal pelvis	47,286	2.51 (2.49, 2.54)	42,910	2.63 (2.61, 2.66)	4376	1.77 (1.72, 1.83)	0.67* (0.65, 0.70)

*$p < 0.05$.

[a]Rates are age-adjusted to 2000 standard U.S. population and shown per 100,000.

[b]US-born were used as a reference group to generate rate ratios.

Table 3

Age-adjusted cancer mortality rates that are elevated among foreign-born individuals, by race/ethnicity: United States 2005–2014.[a]
Source: National Center for Health Statistics (NCHS) & American Community Survey.

Elevated cancers among foreign-born individuals, by race/ethnicity	US-born		Foreign-born		Rate ratio[b] (99.92% CI)
	No. of cases	Average annual rate (99.92% CI)	No. of cases	Average annual rate (99.92% CI)	
Overall					
Nasopharynx	4839	0.17 (0.16, 0.18)	1635	0.34 (0.31, 0.37)	2.01* (1.82, 2.21)
Kaposi sarcoma	360	0.01 (0.01, 0.02)	107	0.03 (0.02, 0.04)	1.94* (1.31, 2.90)
Stomach	87,135	3.05 (3.01, 3.08)	24,583	5.56 (5.44, 5.68)	1.82* (1.78, 1.87)
Gallbladder	16,785	0.58 (0.57, 0.60)	3690	0.86 (0.81, 0.91)	1.47* (1.38, 1.56)
Acute lymphocytic leukemia	11,874	0.43 (0.42, 0.45)	2321	0.55 (0.51, 0.60)	1.27* (1.16, 1.39)
Liver and intrahepatic bile duct	167,460	5.69 (5.64, 5.73)	31,097	7.04 (6.91, 7.18)	1.24* (1.21, 1.27)
Thyroid	14,025	0.49 (0.47, 0.50)	2554	0.60 (0.56, 0.64)	1.22* (1.14, 1.32)
Non-Hispanic White					
Kaposi sarcoma	255	0.01 (0.01, 0.01)	44	0.02 (0.01, 0.05)	2.33* (1.27, 5.26)
Stomach	61,252	2.53 (2.49, 2.56)	8022	5.18 (4.99, 5.39)	2.05* (1.97, 2.14)
Gallbladder	13,151	0.54 (0.52, 0.55)	1110	0.70 (0.63 0.78)	1.30* (1.17, 1.45)
Non-Hispanic Black					
Gallbladder	2336	0.87 (0.81, 0.93)	305	1.13 (0.91, 1.39)	1.30* (1.04, 1.62)
Non-Hispanic API					
Liver and intrahepatic bile duct	1300	6.76 (6.13, 7.44)	11,581	10.84 (10.49, 11.20)	1.60* (1.45, 1.78)
Nasopharynx	121	0.62 (0.44, 0.83)	1101	0.91 (0.82, 1.01)	1.47* (1.07, 2.10)
Gallbladder	99	0.53 (0.36, 0.73)	782	0.78 (0.69, 0.88)	1.48* (1.04, 2.20)
Hispanic					
Gallbladder	965	0.87 (0.78, 0.97)	1485	1.06 (0.97, 1.16)	1.22* (1.06, 1.41)
Melanoma of the skin	826	0.67 (0.59, 0.76)	1290	0.85 (0.77, 0.94)	1.26* (1.08, 1.49)
Acute lymphocytic leukemia	1642	0.65 (0.59, 0.72)	1399	0.77 (0.69, 0.86)	1.19* (1.02, 1.38)

*The Bonferroni adjustment was performed to account for multiple comparisons: $p < 0.0008$.

[a] Rates are age-adjusted to 2000 standard U.S. population and shown per 100,000.

[b] US-born were used as a reference group to generate rate ratios.