Original Investigation

The Effects of Race and Ethnicity on Thyroid Cancer Incidence

Angelina Magreni, BA; Darrin V. Bann, PhD; Jane R. Schubart, PhD; David Goldenberg, MD

IMPORTANCE  The incidence of thyroid cancer has increased over the past 30 years. Thyroid cancer is less common in blacks than in persons of white descent, and it has been most common in Asians/Pacific Islanders until recently.

OBJECTIVE  To determine whether the incidence of thyroid cancer is increasing at disproportionate rates for different races and ethnicities.

DESIGN, SETTING, AND PARTICIPANTS  Retrospective review. Study participants were individuals with thyroid cancer in the US National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) 13 database from 1992 through 2010. The SEER 13 registry consists of records from Atlanta (Georgia), Connecticut, Detroit (Michigan), Hawaii, Iowa, New Mexico, San Francisco–Oakland (California), Seattle–Puget Sound (Washington), Utah, Los Angeles (California), San Jose–Monterey (California), rural Georgia, and the Alaska Native Tumor Registry.

MAIN OUTCOMES AND MEASURES  The SEER*Stat Joinpoint Regression Program was used to determine the average annual percentage change in thyroid cancer incidence for different races and ethnicities from 1992 through 2010. Trends in thyroid cancer incidence were compared between groups using comparability testing.

RESULTS  During the study period, the average annual percentage change for thyroid cancer was 5.3% (95% CI, 4.8%-5.7%) per year. Stratification of the study population by race revealed that whites experienced the largest increase in age-adjusted thyroid cancer incidence (5.6% per year), followed by blacks (4.8% per year), American Indian/Alaskan natives (3.2% per year), and Asians/Pacific Islanders (2.3% per year). Joinpoint regression comparability testing showed that the increase in disease incidence was not significantly different between whites and blacks ($P = .25$). However, the increase in incidence for Asians/Pacific Islanders was significantly lower than that for whites and blacks ($P < .05$). Stratification of the study population by ethnicity revealed that non-Hispanics experienced a larger increase in incidence (5.5% per year) than Hispanics (3.3% per year).

CONCLUSIONS AND RELEVANCE  The incidence of thyroid cancer continues to increase in all races and ethnicities. No significant difference was observed between the increase in incidence for whites and blacks. However, the increase in incidence for non-Hispanics was significantly larger than that for Hispanics. The increase in incidence of thyroid cancer was greater in whites than in Asians/Pacific Islanders, so whites now have a higher incidence of thyroid cancer than persons of Asian/Pacific Islander descent.
thyroid cancer, with an estimated incidence of 62,980 cases per year in the United States, is the most common endocrine cancer.¹ Per 100,000, thyroid cancer in the United States has increased from an incidence in 1973 of 3.6 cases to an incidence in 2002 of 8.7 cases.² Most of the increase is owing to papillary thyroid cancer, which is associated with a 95% 30-year survival rate.²,³ Despite its favorable long-term survival, thyroid cancer still poses significant clinical and economic burdens.⁴

Racial disparities are recognized in many different types of cancer. The prevalence of most cancers, including colorectal, lung, prostate, gastric, and head and neck, is higher among black populations than among persons of white descent, and blacks are more likely to die of their cancer.⁵,⁶ However, thyroid cancer is half as common in blacks as in whites.⁷ Historically, thyroid cancer incidence is highest in whites, followed by Asians/Pacific Islanders, American Indian/Alaskan natives, and blacks. Thyroid cancer incidence is higher in non-Hispanic men and women than in Hispanic men and women (Table 1).¹

Our aim in this study was to compare the change in thyroid cancer incidence in whites, blacks, Asians/Pacific Islanders, and American Indian/Alaskan natives and in Hispanics and non-Hispanics. The study period was from 1992 through 2010.

Methods

This study was deemed exempt from review by the Penn State College of Medicine institutional review board. The National Cancer Institute's Surveillance, Epidemiology, and End Results (SEER) database (http://seer.cancer.gov/) was used to determine the increase in incidence of thyroid cancer in this retrospective review. The SEER database is a population-based publicly available data set from a government agency that has been gathering data since 1973. Data are contributed by individual registries across the United States. Many existing studies base their assumptions and conclusions on data from 1973 onward.²,⁸,⁹ However, detection of thyroid cancer greatly improved with the introduction of ultrasonography-guided fine-needle aspiration biopsies in the 1980s.¹⁰ Therefore, data after 1992 more closely reflect the current state of thyroid cancer in the United States; for this reason, SEER data from 1992 through 2010 were used for this study. In particular, SEER 13 was selected because it has more racial categories than previous SEER data sets. SEER 13 has 4 different categories for race (white, black, Asian/Pacific Islander, and American Indian/Alaskan native) and 2 categories for ethnicity (Hispanic and non-Hispanic). Therefore, individuals of white race are also either Hispanic or non-Hispanic, individuals of black race are also either Hispanic or non-Hispanic, and so forth. The SEER 13 registry consists of records from Atlanta (Georgia), Connecticut, Detroit (Michigan), Hawaii, Iowa, New Mexico, San Francisco-Oakland (California), Seattle–Puget Sound (Washington), Utah, Los Angeles (California), San Jose–Monterey (California), rural Georgia, and the Alaska Native Tumor Registry.

Results

Table 1 lists the AAPC in age-adjusted thyroid cancer incidence by race, ethnicity, and sex. To simplify the comparison of trends in incidence, the AAPCs were calculated over the following 4 periods: 1992 through 1995, 1996 through 2000, 2001 through 2005, and 2006 through 2010. During the study period (1992–2010), the AAPC for thyroid cancer in all races and ethnicities was 5.3% (95% CI, 4.8%-5.7%) per year. Stratification of the study population by race revealed that whites experienced the largest increase in age-adjusted thyroid cancer incidence during the study period (5.6% per year), followed by blacks (4.8% per year), American Indian/Alaskan natives (3.2% per year), and Asians/Pacific Islanders (2.3% per year) (Figure 1). Stratification of the study population by ethnicity revealed that non-Hispanics experienced a larger increase in incidence (5.5% per year) than Hispanics (3.3% per year) (Figure 2). Whites and blacks experienced statistically similar increases in AAPCs, and trend analysis failed to reject parallelism between the groups (P = .25). The

| Table 1. Thyroid Cancer Incidence per 100,000 From 2007 to 2011* |
|-----------------|-----------------|-----------------|
| Variable        | Male            | Female          |
| Race            |                 |                 |
| White           | 6.3             | 20.4            |
| Black           | 3.3             | 11.3            |
| Asian/Pacific Islander | 5.7     | 18.5            |
| American Indian/Alaskan native | 3.4     | 11.8            |
| Ethnicity       |                 |                 |
| Hispanic        | 4.7             | 17.2            |
| Non-Hispanic    | 6.8             | 19.7            |

* Data are from the National Cancer Institute.¹

The SEER*Stat software version 8.0.4 Joinpoint Regression Program (National Cancer Institute) was used to determine the average annual percentage change (AAPC) in incidence for the thyroid cancer population described by SEER 13 data from 1992 through 2010. The AAPC in thyroid cancer incidence was calculated for each race and ethnicity over the entire study period and over the following 4 specified periods to simplify the comparison: 1992 through 1995, 1996 through 2000, 2001 through 2005, and 2006 through 2010. Joinpoint regression comparability testing for parallelism in annual percentage change in thyroid cancer incidence was conducted to compare trends over the entire study period for each race and ethnicity stratified by sex.

An AAPC can be calculated as a weighted average of the slope of the joinpoint regression curve over a fixed period (an interval with fixed join points). Therefore, the AAPC can be used to compare changes in cancer incidence between groups over specified intervals. Join point enables comparability testing for parallelism to determine whether the annual percentage change regression mean functions are parallel. If the P value is less than .05, then the null hypothesis that the regression mean functions are parallel is rejected.
AAPCs for white and black women were also similar at 6.1% per year for white women and 5.9% per year for black women, with no significant difference in trends \((P = .35)\).

The AAPC for Asians/Pacific Islanders (2.3% per year) was lower than that for whites (5.6% per year) \((P < .05)\). Furthermore, the incidence of thyroid cancer in whites surpassed that of Asians/Pacific Islanders in 2002 (Figure 3). Thyroid cancer incidence is now highest in whites. In addition, the AAPC for Asians/Pacific Islanders (2.3% per year) was lower than that for blacks (4.8% per year) \((P < .05)\).

The AAPC for American Indian/Alaskan natives (3.2% per year) was lower than that for whites (5.6% per year) \((P < .05)\) and blacks (4.8% per year) \((P < .05)\). However, the AAPC for American Indian/Alaskan natives (3.2% per year) was not significantly different from that for Asians/Pacific Islanders (2.3% per year) \((P = .17)\).

Over the entire study period, the AAPCs for non-Hispanics and Hispanics were significantly different \((P < .05)\). The AAPC for non-Hispanics was 5.5% per year, while the AAPC for Hispanics was 3.3% per year. Similarly, the AAPCs for non-Hispanic and Hispanic women were significantly different \((P < .05)\), with an increase of 5.9% per year for non-Hispanic women and an increase of 3.7% per year for Hispanic women. Therefore, thyroid cancer incidence is increasing more quickly in non-Hispanic women than in Hispanic women.

### Discussion

The increasing incidence of thyroid cancer across all racial and ethnic groups is an urgent public health concern, and various explanations have been suggested as the underlying cause. Some studies\(^\text{5,8,11-13}\) have concluded that this increase in incidence is owing to an increase in the diagnosis of subclinical thyroid cancers, as opposed to an increase in the occurrence of thyroid cancer, because of an increased use of ultrasonography-guided fine-needle aspiration biopsies. These advanced diagnostic techniques enable detection of

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**Table 2. Average Annual Percentage Change in Age-Adjusted Thyroid Cancer Incidence**

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<td>4.7 (4.1 to 5.4)</td>
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<td>6.6 (6.0 to 7.1)</td>
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<td>4.2 (3.0 to 5.4)</td>
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<td>5.5 (4.9 to 6.1)</td>
<td>5.5 (4.9 to 6.1)</td>
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<td>Female</td>
<td>6.1 (5.5 to 6.6)</td>
<td>4.7 (3.3 to 6.2)</td>
<td>5.7 (5.0 to 6.4)</td>
<td>6.7 (6.2 to 7.3)</td>
<td>6.7 (6.2 to 7.3)</td>
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<td>Black</td>
<td>4.8 (3.6 to 6.0)</td>
<td>-4.2 (-10.5 to 2.6)</td>
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<td>6.7 (6.1 to 7.3)</td>
<td>6.7 (6.1 to 7.3)</td>
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<tr>
<td>Male</td>
<td>2.8 (-0.4 to 6.1)</td>
<td>-11.5 (-26.9 to 7.1)</td>
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<td>Asian/Pacific Islander</td>
<td>2.3 (0.3 to 4.3)</td>
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<tr>
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<td>2.3 (0.1 to 4.5)</td>
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<td>American Indian/Alaskan native</td>
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<td>2.2 (1.1 to 3.3)</td>
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<td>-12.5 (-30.8 to 10.6)</td>
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<td>5.1 (3.5 to 6.6)</td>
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<tr>
<td>Female</td>
<td>3.7 (2.6 to 4.8)</td>
<td>-3.6 (-9.6 to 2.9)</td>
<td>5.2 (4.6 to 5.8)</td>
<td>5.2 (4.6 to 5.8)</td>
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<tr>
<td>Non-Hispanic</td>
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<td>3.7 (2.4 to 5.0)</td>
<td>5.0 (4.4 to 5.7)</td>
<td>6.4 (5.9 to 6.9)</td>
<td>6.4 (5.9 to 6.9)</td>
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<tr>
<td>Male</td>
<td>4.2 (3.2 to 5.2)</td>
<td>-0.4 (-4.5 to 3.7)</td>
<td>5.5 (4.9 to 6.2)</td>
<td>5.5 (4.9 to 6.2)</td>
<td>5.5 (4.9 to 6.2)</td>
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<tr>
<td>Female</td>
<td>5.9 (5.4 to 6.4)</td>
<td>4.4 (3.0 to 5.8)</td>
<td>5.5 (4.8 to 6.2)</td>
<td>6.6 (6.1 to 7.1)</td>
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</tr>
</tbody>
</table>

**Figure 1. 1992-2010 Thyroid Cancer Average Annual Percentage Change by Race**

The thyroid cancer average annual percentage change is higher in whites than in blacks and Asians/Pacific Islanders for both men and women. Limit lines indicate 95% CIs.
the assumption that Asians/Pacific Islanders have more
in thyroid cancer incidence than blacks. In addition, under
diagnosis of subclinical thyroid cancer and a greater increase
true increase in thyroid cancer because of an increase in risk
increase in the diagnosis of subclinical thyroid cancers and a
studies3,14-16 suggest that the increase is owing to both an
increase in thyroid cancer incidence by race and ethnicity. Risk factors for the development of thyroid cancer
include female sex,22 exposure to ionizing radiation,23 and io-
daine deficiency or excess.24,25 Less understood risk factors
include female hormones26 and obesity.27,28
Differential exposure to risk factors may also cause differ-
ces in the increase in thyroid cancer incidence by race and
cancer in whites surpassed that in Asians/Pacific Islanders.
Historically, thyroid cancer incidence has been highest
in Asians/Pacific Islanders. According to our study, the
increase in thyroid cancer incidence was lowest in Asians/
Pacific Islanders. Therefore, in 2002 the incidence of thyroid
cancer in whites surpassed that in Asians/Pacific Islanders.
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increase in thyroid cancer incidence was lowest in Asians/
Pacific Islanders. Therefore, in 2002 the incidence of thyroid
cancer in whites surpassed that in Asians/Pacific Islanders.
(Figure 3). Thyroid cancer incidence is now highest in
whites.
Differential exposure to risk factors may also cause differ-
ces in the increase in thyroid cancer incidence by race and
Hispanic black women (75%).21 If differences in incidence
the SEER registry does not provide us with important adju-
vant information such as mode of diagnosis of thyroid nod-
ules (examination vs sonography), body mass index (BMI) or
body fat percentage, or previous thyroid surgery, so we
could not comment on those differences by race and ethnic-
ity. This information would help us explain the shift in race
and ethnicity that we are seeing in this study. For example,
mode of diagnosis may vary by different racial and ethnic
groups because those with greater access to care would have
a greater increase in the diagnosis of thyroid nodules by
sonography. In addition, BMI and body fat percentage have a
large role in the incidence of diagnosis of thyroid nodules by
racial and ethnic groups. Populations with statistically lower
BMI may have thyroid nodules diagnosed more readily by
physical examination, so the incidence of thyroid cancer
may not increase to as great an extent in those populations.
Also, populations with less access to care may have greater
BMI and a higher incidence of thyroid cancer. Finally, racial
and ethnic groups who prophylactically have their thyroid
glands removed after diagnosis of thyroid nodules would
have a lower incidence of thyroid cancer. Therefore, we were

Figure 2. 1992-2010 Thyroid Cancer Average Annual Percentage Change by Ethnicity

![Figure 2](https://jamaotolaryngology.com/assets/figure2.png)

The thyroid cancer average annual percentage change is higher in non-Hispanics than in Hispanics for both men and women. Limit lines indicate 95% CIs.

Figure 3. Thyroid Cancer Incidence vs Year by Race

![Figure 3](https://jamaotolaryngology.com/assets/figure3.png)

In 2002, the thyroid cancer incidence in whites surpassed that in Asians/Pacific Islanders.

tumors that are 1 cm or smaller and would otherwise lie
dormant and go undetected.10 The findings of other
studies8,14-16 suggest that the increase is owing to both an
increase in the diagnosis of subclinical thyroid cancers and a
type increase in thyroid cancer because of an increase in risk
factors. Studies8,14,17-20 have investigated the possibility that
differences in thyroid cancer incidence between whites and
blacks are owing to variations in socioeconomic status,
resulting in differences in access to health care and detection
and diagnosis of subclinical thyroid cancers. Assuming that
whites have a higher socioeconomic status and more access
to health care,21 they should have enhanced detection and
diagnosis of subclinical thyroid cancer and a greater increase
in thyroid cancer incidence than blacks. In addition, under
the assumption that Asians/Pacific Islanders have more
access to health care,21 they should also have a greater
increase in thyroid cancer incidence than blacks. In the present
study, no significant difference in increased thyroid
cancer incidence was observed between whites and blacks,
but the increased incidence for Asians/Pacific Islanders was
significantly lower than that for blacks. This shift in thyroid
cancer incidence among different races does not support the
theory of access to care as the sole explanation.

In 2012, Hispanic men (48%) were less likely to have
seen a physician in the past 6 months than non-Hispanic
white men (63%) and non-Hispanic black men (58%).21
Hispanic women (68%) were also less likely to have seen a
physician than non-Hispanic white women (76%) and non-
Hispanic black women (75%).21 If differences in incidence
were due to access to care, then non-Hispanics should
have had a greater increase in thyroid cancer incidence
than Hispanics. In fact, joinpoint regression comparability
testing verified that the larger increase in incidence for
non-Hispanics observed in this study was statistically
significant. Therefore, differences in the incidence among
Hispanics and non-Hispanics support the theory of
access to care.

Historically, thyroid cancer incidence has been highest
in Asians/Pacific Islanders. According to our study, the
increase in thyroid cancer incidence was lowest in Asians/
Pacific Islanders. Therefore, in 2002 the incidence of thyroid
cancer in whites surpassed that in Asians/Pacific Islanders.
(Figure 3). Thyroid cancer incidence is now highest in
whites.

In 2002, the thyroid cancer incidence in whites surpassed that in Asians/Pacific Islanders.
unable to conclusively determine whether differences in thyroid cancer incidence by race and ethnicity are due to health care disparities (eg, access to ultrasonography-guided fine-needle aspiration biopsy or propensity for thyroid surgery for benign neoplasms) or other risk factors (eg, exposure to ionizing radiation or BMI and body fat percentage). In addition, our data set only includes information through 2010. The American Thyroid Association29 introduced revised thyroid cancer diagnosis protocols in 2009, so we were unable to evaluate the effects of those protocols on the rise in thyroid cancer incidence.

Conclusions

With the increased thyroid cancer incidence, a shift in incidence has occurred among different races and ethnicities. Differences in access to care among races and ethnicities are not fully understood, but they may have a role in the shift in incidence. Other contributing factors include sex, exposure to environmental risks, lack or excess of dietary risks, and obesity. Further investigation of the various risk factors in different racial and ethnic groups is needed.