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Changing Trends in the Incidence of Thyroid Cancer in the United States

Luc G. T. Morris, MD, MSc, **R. Michael Tuttle, MD**, and **Louise Davies, MD, MS**

Head and Neck Service, Department of Surgery, Memorial Sloan Kettering Cancer Center, New York, New York (Morris); Endocrinology Service, Department of Medicine, Memorial Sloan Kettering Cancer Center, New York, New York (Tuttle); VA Outcomes Group, White River Junction, Vermont (Davies); Dartmouth Institute for Health Policy and Clinical Practice, Hanover, New Hampshire (Davies)

The incidence of thyroid cancer in the United States has tripled in 30 years, rising rapidly since the 1990s. This substantial increase, chiefly comprising small papillary cancers, has been attributed to widespread diagnosis of subclinical disease.[1] Autopsy studies show a sizeable prevalence (5%–30%) of clinically occult thyroid cancer in asymptomatic persons. The rising diagnosis of thyroid cancer has been linked to increasing health care utilization and imaging practices,[2–4] which have led to the increased discovery of small papillary thyroid cancers, which generally exhibit indolent behavior.

Physicians and the public have become more aware of challenges associated with the increased detection of thyroid cancer,[4] and this awareness is beginning to be reflected in clinical practice guidelines. For example, the 2009 American Thyroid Association guidelines provided more nuanced direction about biopsies, suggesting that the size and ultrasonographic appearance of a tumor be considered in deciding whether to biopsy it and discouraging the biopsy of smaller and more benign-appearing nodules.[5] Similar recommendations were provided in 2010 by the American Association of Clinical Endocrinology and National Comprehensive Cancer Network. Here, we examine recent national trends in thyroid cancer incidence.

Corresponding Author: Luc G. T. Morris, MD, MSc, Head and Neck Service, Department of Surgery, Memorial Sloan Kettering Cancer Center, 1275 York Ave, New York, NY 10065 (morrisl@mskcc.org).

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Study concept and design: Morris, Tuttle.
Acquisition, analysis, or interpretation of data: Morris, Davies.
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Methods

We analyzed the incidence of thyroid carcinoma, age-adjusted to the population of the United States in 2000, in the Surveillance, Epidemiology, and End Results registry of the National Cancer Institute, a population-based registry that provides estimates of cancer incidence. Analyses were conducted for the period from1983 to 2012 in SEER Stat, version 8.2.1.[6] Segmented log-linear regression was performed with Joinpoint software version 4.2.0.2 from the National Cancer Institute (http://surveillance.cancer.gov/joinpoint/). Multiple permutation testing was used to identify inflection points in trends. To confirm that delayed reporting did not influence joinpoints, we also examined delay-adjusted incidence rates.[6] The institutional review board of the Memorial Sloan Kettering Cancer Center considers research conducted with SEER data to be exempt from review. A signed data-use agreement was made with the SEER program. All data were deidentified.

Results

From1988 to 1998, the incidence of thyroid cancer had an annual percentage increase of 3.0%. The trend accelerated to 6.7% from 1998 to 2009 and then stabilized from 2010 to 2012 at 1.75%(95%CI, —1.90 to 5.54; $P = .01$ for the change in trend) (Figure). These trends were unchanged when rates of thyroid cancer were adjusted for delayed reporting. The stabilization in incidence rates from2010 to 2012 remained when tumors were stratified by size and was most pronounced for tumors of subcentimeter size (Table).

Discussion

The rapidly rising incidence of thyroid cancer in the United States has been recognized as an “epidemic of diagnosis” more than an epidemic of disease. Acknowledging this, practice guidelines are becoming increasingly nuanced in recommendations about which nodules to biopsy. The data reported here suggest that clinical practices are also changing, as reflected by the beginning of stabilization of the previously rapidly rising incidence of thyroid cancer in the United States. Notably, rates of detection of subcentimeter cancers, previously increasing at more than 9% per year, have stabilized.

These data cannot provide causal evidence of a link between trends in the incidence of thyroid cancer and specific clinical practice guidelines. Nevertheless, the data suggest that changing clinical practices are responsible for the slowing increase in the reported incidence of thyroid cancer. Statistical testing showed positive inflection points (an accelerating incidence of thyroid cancer) in the 1990s and a negative inflection point (a decelerating incidence) after 2009. During the 1990s and 2000s, no known biological risk factors for thyroid cancer have increased and then decreased. More likely, the trends in the incidence of thyroid cancer are due to shifts in medical practices. Some might argue that the incidence of thyroid cancer is now reaching a plateau near that of the prevalence of subclinical thyroid cancers in the US population, but this theory requires further investigation because the reservoir of subclinical thyroid cancers has been estimated as being much larger than the current incidence.[3]

The next few years will determine if this stabilization is durable. The 2015 American Thyroid Association guidelines further refine indications for the biopsy of thyroid nodules. This refinement may lead to a decline in the reported incidence of thyroid cancer, resembling the reversal observed in South Korea as the result of public awareness of the overdiagnosis of thyroid cancer.[4] These trends will have substantial public health ramifications with determination of the appropriate level of aggressiveness in detecting and treating low-risk thyroid cancers.

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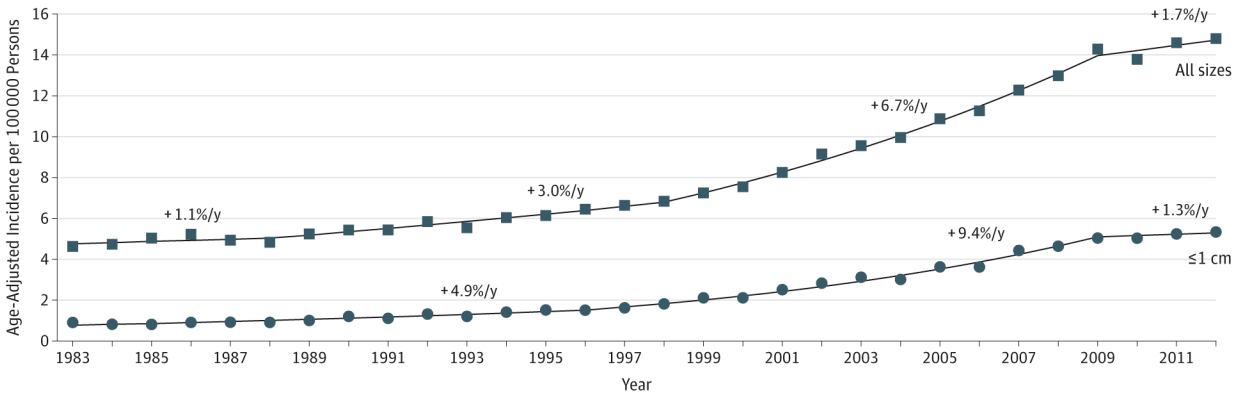

Figure.

Time Trends in Incidence of Thyroid Cancer for All Sizes and Those of 1 cmor Less

Data are expressed per 100 000 persons and age-adjusted to the 2000 US population. Data markers represent observed incidence rates; lines, the joinpoint-modeled regression lines; and percentages, the annual percentage change (Table).

Table

Trends in Thyroid Cancer Incidence in the United States[a]

Tumor Size	APC (95% CI)	*P* Value for APC[b]	ΔAPC	*P* Value for ΔAPC[c]
All sizes				
1983–1988	1.09 (−0.55 to 2.76)	.18		
1988–1998	2.99 (2.30 to 3.68)	1.9×10^{-8}		
1998–2009	6.71 (6.10 to 7.32)	$<1 \times 10^{-10}$		
2009–2012	1.75 (−1.90 to 5.54)	.33	−4.76	.01
All sizes, delay-adjusted incidence rates[d]				
1983–1988	−0.48 (−4.03 to 3.21)	.78		
1988–1998	3.42 (2.74 to 4.11)	5.7×10^{-9}		
1998–2009	7.06 (6.46 to 7.67)	$<1 \times 10^{-10}$		
2009–2012	1.54 (−2.08 to 5.30)	.39	−5.30	.01
Thyroid cancers ≤1 cm				
1983–1996	4.85 (3.90 to 5.82)	3×10^{-10}		
1996–2009	9.41 (8.29 to 10.55)	$<1 \times 10^{-10}$		
2009–2012	1.25 (−7.22 to 10.50)	.77	−7.75	.08
Thyroid cancers 1–2 cm				
1983–1989	3.80 (0.86 to 6.81)	.01		
1989–1994	−1.14 (−6.31 to 4.30)	.66		
1994–2009	7.18 (6.33 to 8.03)	$<1 \times 10^{-10}$		
2009–2012	3.41 (−5.00 to 12.56)	.42	−3.57	.39
Thyroid cancers 2–4 cm				
1983–1995	1.29 (0.36 to 2.23)	.01		
1995–2009	5.41 (4.55 to 6.27)	$<1 \times 10^{-10}$		
2009–2012	2.47 (−5.23 to 10.79)	.52	−2.82	.46
Thyroid cancers >4 cm				
1983–1987	9.90 (0.04 to 20.72)	.05		
1987–1990	−4.02 (−28.68 to 29.18)	.78		
1990–2010	6.93 (5.99 to 7.88)	$<1 \times 10^{-10}$		
2010–2012	−3.75 (−28.48 to 29.54)	0.79	−10.52	.47

Abbreviation: APC, annual percentage change.

[a] Time intervals are bounded by inflection points in the trend line, as determined by multiple permutation testing.

[b] The *P* value for APC reflects testing of the null hypothesis of an APC of zero.

[c] The *P* value for ΔAPC reflects testing of the change in APC in the corresponding time period.

[d] Delay-adjusted incidence rates are included to exclude the possibility of altered joinpoints from potential delays in reporting.[6]