ABSTRACT

Objectives: The US thyroid cancer incidence rates are rising while mortality remains stable. Trends are driven by papillary thyroid cancer (PTC), the predominant cancer subtype which has a very good prognosis. We hypothesised that health insurance and high census tract socioeconomic status (SES) are associated with PTC risk.

Design: Relationships between thyroid cancer incidence, insurance and census tract SES during 2007–2010 were examined in population-based cancer registries. Cases were stratified by tumour histology, size and demography.

Setting: Surveillance, Epidemiology, and End Results (SEER) registries covering 30% of the US population.

Results: PTCs accounted for 88% of incident thyroid cancer cases. Small PTCs (<2 cm) accounted for 60% of cases. Unlike non-PTC cases, the majority of those diagnosed with PTC were <50 years of age and had ≤2 cm tumours. Rate ratios (RR) of PTC diagnoses increased monotonically with SES among fully insured cases. The effect was strongest for small PTCs, high-SES versus low-SES quintile RR=2.7, 95% CI 2.6 to 2.9, two-sided trend test p<0.0001. For small PTC cases with insurance, the monotonic increase in incidence rates with rising SES persisted among cases younger than 50 years of age (RR=3.3, 95% CI 3.0 to 3.5), women (RR=2.6, 95% CI 2.5 to 2.8) and Caucasians (RR=2.5, 95% CI 2.4 to 2.7). Among the less than fully insured, rates generally decreased with increasing SES.

Conclusions: The >2.5-fold increase in risk of PTC diagnosis among insured individuals associated with high SES may be informative with respect to the contemporary issue of PTC overdiagnosis.

INTRODUCTION

In Surveillance, Epidemiology, and End Results (SEER) registry areas of the USA from 1975 to 2011, thyroid cancer incidence rates tripled while US thyroid cancer mortality trends were steady. These discrepant trends are consistent with cancer overdiagnosis. Similar patterns are reported in many but not all industrialised countries. Thyroid cancer incidence rates are higher among women than men and among Caucasians than other major racial groups. Most of the rising incidence results from the increasing diagnosis of small papillary thyroid cancers (PTCs).

Access to health insurance contributes to the overdiagnosis of small PTCs which carries a relatively low risk of death. Incidence rates of small PTCs are elevated in high socioeconomic status (SES) counties and census tracts. Overdiagnosis and overtreatment of PTCs are associated with adverse effects, including postsurgical complications, extended hospitalisation and lifelong hormone replacement therapy. In contrast, several non-PTC types, including follicular, medullary and anaplastic thyroid cancers, carry progressively worse prognoses. The present analysis, based on population-level cancer registry data covering approximately 30% of the USA, demonstrates the magnitude of...
combined effects of neighbourhood SES, and personal insurance status on the overdiagnosis of small PTCs including by age, gender, race and ethnicity.

MATERIALS AND METHODS

Data were obtained from 16 National Cancer Institute (NCI) SEER registries that cover approximately 30% of the US population. The SEER November 2012 data set was used for all analyses. Registries included in analyses were Connecticut, Detroit, Hawaii, San Francisco-Oakland, Atlanta, Iowa, New Mexico, Seattle-Puget Sound, Utah, Los Angeles, San Jose-Monterey, Rural Georgia, Greater California, Greater Georgia, Kentucky and New Jersey. Alaska Native cases were excluded because census tract attributes were not available, and Louisiana cases were excluded because of uncertainty about the population impact of Hurricane Katrina on census tract SES.

Case attributes

Gender and age distributions (<50, 50–64 and ≥65 years of age at diagnosis) were examined. While 98% of cases were 20 years of age and older at time of diagnosis, the analysis included children <20 years of age for purpose of completeness. Race and ethnicity were defined as Hispanic, non-Hispanic Caucasians, non-Hispanic African-Americans, and non-Hispanic Asian/Pacific Islander. Non-Hispanic American Indian/Alaska Natives and other and unknown races were combined as one group. Tumours were classified as ≤2, >2 cm and unknown size. When ≤10 cases were observed, data were suppressed.

Histological classification

Only malignant primary thyroid cancers were included in analyses. Thyroid cancer histological classifications were coded using the International Classification of Diseases for Oncology, 3rd edition (ICD-O-3). A total of 283 cases with poorly specified cancer histologies (ICD-O-3 morphologies 8000–8005) were excluded. ICD-O-3 histology codes for PTC were 8050, 8052, 8260, 8340, 8341, 8342, 8343, 8344. Other types were follicular (8290, 8330, 8331, 8332, 8335), medullary (8290, 8330, 8331, 8332, 8335) and anaplastic thyroid cancer (8012, 8020–8021, 8030–8032). Approximately 2% of cases were diagnosed with non-classical thyroid cancer histologies including 284 cases (1%) with other epithelial neoplasms (8010, 8013, 8015, 8022, 8033, 8035, 8041, 8046) and 377 cases (1%) with other rare specified primary thyroid cancer histologies (8070–8072, 8074, 8082–8083, 8130, 8140–8141, 8190, 8200–8201, 8230, 8240, 8246, 8255, 8262–8263, 8310, 8323, 8337, 8347, 8350, 8430, 8450, 8452, 8460, 8480–8481, 8504, 8507, 8560, 8570, 8588–8589, 8800, 8802, 8810, 8830, 8890, 8980, 9040–9041, 9071, 9080, 9120, 9250, 9364). These included adenocarcinomas and squamous cell carcinoma, which are referenced on the SEER thyroid/histology validation list, and other specified histologies that are not found in the SEER validation list but were abstracted from patients’ medical records.

Insurance

SEER data include the six category variable ‘Insurance Recode’ for the diagnosis year 2007 forward, derived from the more detailed ‘Primary Payer at Diagnosis’ variable. For the purpose of the present analysis, categories were collapsed into ‘Fully Insured’ and ‘Other than Fully Insured’. ‘Fully Insured’ is defined by the following seven categories of health insurance: (1) Insured—Private Insurance: Fee-for-Service, (2) Private Insurance: Managed care, (3) Health Maintenance Organisation or Preferred Provider Organisation, (4) TRICARE, (5) Medicare—Administered through a Managed Care plan, (6) Medicare with a private supplement and (7) Medicare with supplement, not otherwise specified and Military. ‘Other than Fully Insured’ included (1) Uninsured cases; (2) Cases with Medicaid, Indian Health Service insurance and (3) Patients reported to be insured without further information available. The 1228 cases with missing data on insurance status were excluded from insurance-related analyses.

Census-tract level SES

SES is typically measured using county-level attributes as a proxy for individual data. However, county-level SES attributes are less precise than smaller area or individual SES attributes. To improve area-based SES estimates, we used a year-dependent census tract SES composite index linked to SEER cases by the census tracts of residence at time of diagnosis. The SES index was derived from seven variables (per cent working class population, per cent adult unemployment, educational attainment, median household income, per cent of population living below 150% of national poverty line, median rent and median home value). Taken together, these variables capture three principal components of SES (income, occupation, education). The weight assigned to each variable was determined on the basis of factor analysis. Specifically, the output from factor analysis that explained more than 90% of the common variance among these variables was used as the ‘SES index’. This index was constructed separately for 2007, 2008, 2009 and 2010 using the 5-year estimates from the 2005, 2006–2010, 2007–2011 and 2008–2012 American Community Surveys, respectively. Census tracts were categorized into SES quintiles according to this index, with equal populations in each quintile. The first quintile (Q1, lowest SES) is the 20th centile or less, and the fifth quintile (Q5, highest SES) corresponds to the 80th centile or higher. The SES index used in the present study has the advantage over specific area level SES measures of protecting against disclosure of case identity through identification of any census tract with a unique permutation of multiple SES attributes. The index is linked to standard SEER data and is available for public
use on request from the authors. A total of 642 cases were missing data on SES and were excluded from SES-related analysis.

### Incidence by insurance and SES

Age-adjusted incidence rates were calculated by tumour size, insurance status, SES and histology for cases diagnosed during 2007–2010, years during which insurance data were available (SEER Stat V.8.1.5, IMS, Inc, Calverton, Maryland, USA). Thyroid cancer incidence rates per 100 000 persons were directly age-adjusted to the 2000 US population. Rate ratios (RR) and 95% CIs were calculated using the SES lowest quintile as the reference. Regression models were used to estimate the percentage change in rate by SES for PTC and non-PTC histologies using the SAS PROC REG procedure (SAS 9.3, Cary, North Carolina, USA). The regression line slope was considered to be statistically different from zero at a cut-off of p≤0.05 based on a two-sided test.

#### RESULTS

**Demographics**

Characteristics of patients diagnosed with thyroid cancer during 2007–2010 are shown in table 1. The 41 072 cases were diagnosed with the following subtypes: 36 020 papillary (88%), 3288 follicular (8%), 722 medullary (2%), 381 anaplastic (1%), 284 other epithelial (1%) and 377 other histologies (1%). Half of the cases (49%) were <50 years of age, including 51% of PTC cases. Most cases in other histological groups were 50 years of age or older. Women accounted for 76% of cases and 77% of

| Diagnosis age (years) | Papillary | Follicular | Medullary | Anaplastic | Other epithelial | Other specified | Total |
|-----------------------|-----------|-----------|-----------|------------|----------------|---------------|-------|
| <50                   | 18 358    | 1333      | 279       | 20         | 65             | 136           | 20 191 |
| 50–64                 | 11 603    | 1266      | 340       | 20         | 67             | 137           | 13 141 |
| 65+                   | 6059      | 929       | 205       | 71         | 152            | 124           | 7740  |

| Sex | Papillary | Follicular | Medullary | Anaplastic | Other epithelial | Other specified | Total |
|-----|-----------|-----------|-----------|------------|----------------|---------------|-------|
| Female | 27 906    | 2304      | 445       | 233        | 168           | 257           | 31 331 |
| Male   | 8114      | 984       | 277       | 148        | 98            | 120           | 9741  |

| Race/ethnicity† | Papillary | Follicular | Medullary | Anaplastic | Other epithelial | Other specified | Total |
|-----------------|-----------|-----------|-----------|------------|----------------|---------------|-------|
| Caucasian†      | 24 285    | 2241      | 494       | 264        | 182           | 251           | 27 717 |
| Hispanic        | 5540      | 1426      | 315       | 153        | 34            | 47            | 6186  |
| API†            | 3684      | 264       | 35        | 51         | 32            | 34            | 4100  |
| African-American† | 1930     | 312       | 68        | 18         | 28            | 34            | 2390  |
| Other           | 581       | 59        | 17        | *          | *             | *             | 679   |

| Tumour size (cm) | Papillary | Follicular | Medullary | Anaplastic | Other epithelial | Other specified | Total |
|-----------------|-----------|-----------|-----------|------------|----------------|---------------|-------|
| ≤2              | 24 745    | 784       | 347       | *          | *             | *             | 154   |
| >2              | 9907      | 2271      | 326       | 289        | 106           | 172           | 13 071 |
| Unknown         | 1368      | 233       | 49        | 83         | 134           | 51            | 1918  |

| Insurance status | Papillary | Follicular | Medullary | Anaplastic | Other epithelial | Other specified | Total |
|------------------|-----------|-----------|-----------|------------|----------------|---------------|-------|
| Fully insured    | 26 800    | 2366      | 497       | 227        | 169           | 265           | 30 324 |
| Uninsured        | 847       | 83        | 27        | 4          | *             | *             | 985   |
| Any Medicaid     | 2621      | 289       | 80        | 47         | 40            | 35            | 3112  |
| Insured, NOS     | 4683      | 466       | 104       | 74         | 43            | 53            | 5423  |
| Unknown          | 1069      | 84        | 14        | 23         | 24            | 14            | 1228  |

| Census tract SES | Papillary | Follicular | Medullary | Anaplastic | Other epithelial | Other specified | Total |
|------------------|-----------|-----------|-----------|------------|----------------|---------------|-------|
| Q1 (low)         | 4672      | 508       | 124       | 55         | 49            | 58            | 5466  |
| Q2               | 5904      | 579       | 133       | 73         | 61            | 74            | 6824  |
| Q3               | 7063      | 618       | 143       | 75         | 55            | 66            | 8020  |
| Q4               | 8134      | 721       | 151       | 88         | 47            | 79            | 9220  |
| Q5 (high)        | 9685      | 811       | 162       | 82         | 63            | 97            | 10 900 |
| Unknown          | 562       | 51        | 1         | *          | *             | *             | 642   |

| Total | Papillary | Follicular | Medullary | Anaplastic | Other epithelial | Other specified | Total |
|-------|-----------|-----------|-----------|------------|----------------|---------------|-------|
| 36 020| 3288      | 722       | 381       | 284        | 377            | 41 072        | 100   |

*SEER 18 registries excluding Louisiana and Alaska and 232 cases with poorly specified histologies. Case counts suppressed to conceal cells with 10 or fewer cases.

†Caucasian, African-American, and API exclude persons of Hispanic ethnicity.

API, Asian/Pacific Islander; NOS, not otherwise specified; Q, quintile; SEER, Surveillance, Epidemiology, and End Results; SES, socioeconomic status.

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PTC cases. Asians/Pacific Islanders accounted for a high proportion of anaplastic tumours (13%), while African-Americans accounted for a high proportion of follicular, medullary (9% each) and other epithelial tumours (10%). Among Caucasians and Hispanics, subtype distributions were similar to overall thyroid cancer case distributions. Most PTCs (69%) were ≤2 cm (small PTCs). Small PTCs accounted for 24,745 of all 41,072 thyroid cancer cases (60%). Most follicular thyroid (69%) and most anaplastic thyroid cancer (76%) tumours were >2 cm in size. PTC cases had the highest percentage of full insurance coverage (74%). The percentage of full insurance coverage ranged from 60% for anaplastic and other epithelial to 72% for follicular cancer cases. Insurance data were missing for 3% of cases. Analysis of SES was based on 40,430 cases, with missing SES data for 642 cases. Case counts increased with SES for each subtype, doubling for PTC from quintiles 1 to 5, increasing by 60% for follicular, 31% for medullary, 49% for anaplastic, 29% for other epithelial and 67% for other specified cancers.

**DISCUSSION**

In this SEER study among fully insured cases, risk of PTC diagnosis increased monotonically with SES. This association was driven by diagnosis of small PTCs, with a 2.7-fold higher rate in the highest compared to the lowest SES quintile. The effect persisted within several subgroups including persons across all age groups, and white and black populations. Among fully insured individuals, larger increases in SES were shown in red while those of less than half of non-PTCs, among the ‘other than fully insured’ group, including persons <50 years of age, women and white persons. In addition to the overall effect among participants in each SES stratum, the other than fully insured group showed a 4.6-fold increase in PTC diagnosis among persons ≥50 years of age, men, and Asian/Pacific Islanders compared to the lowest SES quintile. Among insured persons, the increase in the lowest SES quintile was less pronounced than among cases with PTCA, with follicular tumours accounting for 60% of PTCs. Among less than fully insured cases, rates did not increase with SES.

**Table 2** Papillary thyroid cancer incidence rates and RR by SES and tumour size among fully insured cases, SEER registries, 2007–2010*

| SES   | All cases | <2 cm tumours | >2 cm tumors |
|-------|-----------|---------------|--------------|
|         | N  | Rate‡ | RR  | 95% CI | N  | Rate | RR  | 95% CI | N  | Rate | RR  | 95% CI |
| Q1 (low) | 26,392 | 4.6 | 1.0 | (Referent) | 18,539 | 3.1 | 1.0 | (Referent) | 6,774 | 1.0 | (Referent) |
| Q2     | 40,451 | 6.5 | 1.4 | (1.4 to 1.5) | 27,222 | 4.4 | 1.4 | (1.3 to 1.5) | 12,051 | 1.9 | 1.5 | (1.3 to 1.6) |
| Q3     | 52,484 | 8.1 | 1.8 | (1.7 to 1.9) | 36,433 | 5.6 | 1.8 | (1.7 to 1.9) | 14,571 | 2.3 | 1.7 | (1.6 to 1.9) |
| Q4     | 64,256 | 9.6 | 2.1 | (2.0 to 2.2) | 45,738 | 6.8 | 2.2 | (2.1 to 2.3) | 16,713 | 2.5 | 1.9 | (1.7 to 2.1) |
| Q5 (high) | 80,110 | 11.6 | 2.6 | (2.4 to 2.7) | 52,832 | 8.4 | 2.7 | (2.6 to 2.9) | 19,254 | 2.9 | 2.2 | (2.0 to 2.4) |

Trend for SES <0.0001 <0.0001 0.002

*SEER 18 excluding Alaska and Louisiana and cases with unknown SES.
†Fully insured: private insurance; Fee-for-Service; Private Insurance: Managed care, Health Maintenance Organisation, or Preferred Provider Organisation; TRICARE; Medicare Administered through a Managed Care plan; Medicare with private supplement; Medicare with supplement, not otherwise specified; and Military; Other: Uninsured; Any Medicaid; Insured, No Specifics; and Insurance status unknown (SEER Nov 2012 Submission).
‡Age-adjusted rates adjusted to the 2000 US standard population.22
Q, quintile; RR, rate ratio; SEER, Surveillance, Epidemiology, and End Results; SES, socioeconomic status.
Table 3  Papillary thyroid cancer incidence rates and rate ratios by SES, age, race and gender among fully insured cases with ≤2 cm tumours, SEER registries, 2007–2010*

| Attribute | Group/trend for SES | SES | Count | Rate | Rate ratio | 95% CI |
|-----------|---------------------|-----|-------|------|------------|-------|
|           |                     |     |       |      |            |       |
| Age group |                     |     |       |      |            |       |
| 00–49 years | p=0.0003           | Q1 (low) | 850  | 2.0  | 1.0 (Ref) |       |
|           |                     | Q2   | 1298  | 3.0  | 1.5 (1.4 to 1.6) |       |
|           |                     | Q3   | 1833  | 4.2  | 2.1 (1.9 to 2.2) |       |
|           |                     | Q4   | 2289  | 5.1  | 2.5 (2.3 to 2.7) |       |
|           |                     | Q5 (high) | 2955 | 6.7  | 3.3 (3.0 to 3.5) |       |
| 50–64 years | p<0.0001          | Q1 (low) | 596  | 6.2  | 1.0 (Ref) |       |
|           |                     | Q2   | 933   | 8.9  | 1.4 (1.3 to 1.6) |       |
|           |                     | Q3   | 1229  | 10.7 | 1.7 (1.6 to 1.9) |       |
|           |                     | Q4   | 1606  | 13.2 | 2.1 (2.0 to 2.4) |       |
|           |                     | Q5 (high) | 2084 | 15.6 | 2.5 (2.3 to 2.8) |       |
| 65+ years | p=0.0008           | Q1 (low) | 332  | 5.2  | 1.0 (Ref) |       |
|           |                     | Q2   | 491   | 6.8  | 1.3 (1.1 to 1.5) |       |
|           |                     | Q3   | 581   | 7.5  | 1.5 (1.3 to 1.7) |       |
|           |                     | Q4   | 678   | 8.6  | 1.7 (1.5 to 1.9) |       |
|           |                     | Q5 (high) | 784  | 9.5  | 1.8 (1.6 to 2.1) |       |
| Race      |                     |     |       |      |            |       |
| Caucasians | p<0.0001          | Q1 (low) | 1416 | 3.5  | 1.0 (Ref) |       |
|           |                     | Q2   | 2245  | 4.7  | 1.3 (1.2 to 1.4) |       |
|           |                     | Q3   | 3096  | 6.0  | 1.7 (1.6 to 1.8) |       |
|           |                     | Q4   | 3883  | 7.2  | 2.1 (1.9 to 2.2) |       |
|           |                     | Q5 (high) | 4891 | 8.8  | 2.5 (2.4 to 2.7) |       |
| African-Americans | p=0.0025 & Q1 (low) | 247  | 1.9  | 1.0 (Ref) |       |
|           |                     | Q2   | 198   | 2.6  | 1.3 (1.1 to 1.6) |       |
|           |                     | Q3   | 181   | 3.0  | 1.5 (1.3 to 1.9) |       |
|           |                     | Q4   | 147   | 3.4  | 1.8 (1.4 to 2.2) |       |
|           |                     | Q5 (high) | 117  | 4.5  | 2.3 (1.8 to 2.9) |       |
| Asian     | p=0.0199           | Q1 (low) | 84   | 2.4  | 1.0 (Ref) |       |
|           |                     | Q2   | 248   | 4.9  | 2.1 (1.6 to 2.7) |       |
|           |                     | Q3   | 312   | 4.8  | 2.0 (1.6 to 2.6) |       |
|           |                     | Q4   | 478   | 5.5  | 2.3 (1.8 to 3.0) |       |
|           |                     | Q5 (high) | 716  | 6.6  | 2.8 (2.2 to 3.5) |       |
| Gender    |                     |     |       |      |            |       |
| Male      | p=0.0014           | Q1 (low) | 318  | 1.1  | 1.0 (Ref) |       |
|           |                     | Q2   | 491   | 1.7  | 1.4 (1.2 to 1.7) |       |
|           |                     | Q3   | 689   | 2.2  | 1.9 (1.7 to 2.2) |       |
|           |                     | Q4   | 888   | 2.7  | 2.4 (2.1 to 2.7) |       |
|           |                     | Q5 (high) | 1266 | 3.7  | 3.2 (2.8 to 3.7) |       |
| Female    | p<0.0001           | Q1 (low) | 1460 | 4.9  | 1.0 (Ref) |       |
|           |                     | Q2   | 2231  | 7.0  | 1.4 (1.3 to 1.5) |       |
|           |                     | Q3   | 2954  | 8.9  | 1.8 (1.7 to 1.9) |       |
|           |                     | Q4   | 3685  | 10.7 | 2.2 (2.1 to 2.3) |       |
|           |                     | Q5 (high) | 4557 | 12.8 | 2.6 (2.5 to 2.8) |       |

*SEER 18 excluding Alaska and Louisiana and cases with unknown SES.
†Fully Insured: Private Insurance; Fee-for-Service; Private Insurance: Managed care, Health Maintenance Organisation, or Preferred Provider Organisation; TRICARE; Medicare Administered through a Managed Care plan; Medicare with private supplement; Medicare with supplement, not otherwise specified; and Military; Other: Uninsured; Any Medicaid; Insured, No Specifics; and Insurance status unknown (SEER Nov 2012 Submission).
‡Age-adjusted rates adjusted to the 2000 US standard population.22
Q, quintile; SEER, Surveillance, Epidemiology, and End Results; SES, socioeconomic status.
Medicaid and uninsured patients, thyroid cancer incidence did not increase with SES. The enumeration of risk among insured cases in high compared to low-SES areas may inform current discussions pertaining to PTC overdiagnosis.

This study is a large SEER population-based study, covering 30% of the population, with both census tract SES and individual insurance data. The results are more detailed than previous studies of thyroid cancer incidence and SES. It provides evidence for the association between SES and thyroid cancer incidence, highlighting the need for further research to understand the underlying mechanisms.
coverage,12–15 with findings that differ from early studies that found no association with SES or insurance.25,26 Our study and a New Jersey study spanning 1979–200612 include census tract-level SES. The New Jersey study included county-level insurance data, while this study is based on individual-level insurance data. This is the first report of which we are aware to report a monotonic increase in PTC incidence rates with rising SES among insured cases. Our findings further indicate that this effect is largely driven by the diagnosis of small PTCs.

The rising incidence of small PTCs is described as an epidemic of diagnosis2–4 disproportionately affecting women1,4,5,11,12 and patients under 50 years of age.3 Among insured cases, the effect of SES on risk of small PTC diagnosis was most pronounced among persons <50 years of age. There is a need to determine why people in this age stratum and other at-risk groups including women and Caucasians are more likely to undergo tests that lead to the diagnosis of PTC. Although small PTCs accounted for 60% of thyroid cancer cases in this report, previous studies indicate that PTCs account for <5% of thyroid cancer deaths and that other thyroid cancer types carry far worse prognoses.17 The higher incidence of PTC among insured individuals residing in high-SES areas could be a consequence of higher paid individuals being ‘overinsured’ relative to lower paid ‘underinsured’ workers.27 Overinsurance could increase access to imaging and biopsy for cancer screening and evaluation of benign thyroid conditions. Such technologies may detect small, relatively low-risk thyroid nodules.2–4 In one study, areas with high numbers of young physicians reported increased incidence rates of thyroid cancer compared to areas with high concentrations of older physicians.28 The authors postulated that there is greater use of ultrasound-guided biopsy by young physicians trained in this technology. If these diagnostic resources are more likely to be found in high-SES areas, it could contribute to associations between affluence and PTC incidence. Other potential explanations include that income and insurance are proxy measures for education. To the extent that this is the case, more educated individuals may seek early care and press their physicians for specific thyroid-related tests and treatments.

Unless needed, postdiagnosis thyroidectomy and radiation place patients with small PTCs at risk for avoidable surgical complications, lifetime thyroid replacement therapy and perhaps second malignancies.2–4 The cost of care for US patients diagnosed with well-differentiated thyroid cancer exceeded US$1.6 billion in 2013 alone, including more than US$0.5 billion each for initial treatment and continued follow-up.29 American Thyroid Association (ATA) Management guidelines30 for patients with thyroid nodules encourage non-invasive management unless patients have risk factors such as a family history of thyroid cancer, specific medical or environmental radiation exposures, or rapid tumour growth with hoarseness. One recent study estimated that, in the USA, approximately 82 000 men and women were diagnosed with PTCs during 1981–2011 that would never cause symptoms.31 It has been proposed that some small PTCs be reclassified as non-cancers32,3 5,10 or that the most biologically indolent tumours be managed with watchful waiting.2–4 Reclassifying any PTCs as non-cancerous would affect cancer survival statistics,25 because thyroid cancer survival is known to vary by stage, age, gender and treatment.33 Biomarker research may also help to distinguish thyroid cancers including PTCs that are likely to exhibit aggressive behaviour from other, more indolent types.34

The strengths of this study include the availability of SEER variables for census tract SES and individual insurance status in registries covering 30% of the US population. Most studies of thyroid cancer incidence and SES3,7,11,13–15,24 have measured SES at the county or registry level. Study limitations include potential misclassification of histology and availability of insurance data only for four recent years. In summary, compared to persons with insurance living in low-SES areas, those from high-SES areas had more than a 2.5-fold higher risk of being diagnosed with PTC. The association was driven by small PTCs and persisted among persons younger than 50 years, women and Caucasians. Quantifying the risk of PTC associated with SES and insurance may inform efforts to prevent overdiagnosis.

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