

# Physician Confidence in Neck Ultrasonography for Surveillance of Differentiated Thyroid Cancer Recurrence

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**IMPORTANCE** Neck ultrasonography, a mainstay of long-term surveillance for recurrence of differentiated thyroid cancer (DTC), is routinely used by endocrinologists, general surgeons, and otolaryngologists; however, physician confidence in their ability to use ultrasonography to identify lymph nodes suggestive of cancer recurrence remains unknown.

**OBJECTIVE** To evaluate physicians' posttreatment surveillance practices for DTC recurrence, specifically their use of and confidence in ultrasonography.

**DESIGN, SETTING, AND PARTICIPANTS** Cross-sectional study of 448 physicians in private and academic hospitals who completed a survey on DTC posttreatment practices from October 2018 to August 2019 (response rate, 69%) and self-reported involvement in long-term surveillance for thyroid cancer recurrence. Physicians were identified by patients affiliated with the Surveillance, Epidemiology, and End Results Program registries in Georgia State and Los Angeles County. Of the respondents, 320 physicians who reported involvement with DTC surveillance were included in the analysis.

**MAIN OUTCOMES AND MEASURES** Physician-reported long-term surveillance practices for DTC, including frequency of use and level of confidence in ultrasonography for detecting lymph nodes suggestive of cancer recurrence.

**RESULTS** In the cohort of 320 physicians who reported involvement with DTC surveillance, 186 (60%) had been in practice for 10 years to less than 30 years; 209 (68%) were White; and 212 (66%) were men. The physicians included 170 (56%) endocrinologists, 67 (21%) general surgeons, and 75 (23%) otolaryngologists. Just 84 (27%) physicians reported personally performing bedside ultrasonography. Only 57 (20%) had high confidence (rated *quite* or *extremely* confident) in their ability to use bedside ultrasonography to identify lymph nodes suggestive of recurrence; 94 (33%) did not report high confidence in either their ability or a radiologist's ability to use ultrasonography to detect recurrence. Higher confidence in ultrasonography was associated with the general surgery subspecialty (odds ratio [OR], 5.7; 95% CI, 2.2-14.4; reference endocrinology) and with treating a higher number of patients per year (>50 patients: OR, 14.4; 95% CI, 4.4-47.4; 31-50 patients: OR, 8.4; 95% CI, 2.6-26.7; 11-30 patients: OR, 4.3; 95% CI, 1.5-12.1; reference 0-10 patients).

**CONCLUSIONS AND RELEVANCE** Given the importance of neck ultrasonography in long-term surveillance for thyroid cancer, these findings of physicians' low confidence in their own ability and that of radiologists to use ultrasonography to detect recurrence point to a major obstacle to standardizing long-term DTC surveillance practices.

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Differentiated thyroid cancer (DTC) incidence has increased during the past several decades and is diagnosed in more than 50 000 individuals in the US each year.<sup>1,2</sup> Appropriate initial treatment—surgical resection, and for some patients, adjuvant radioactive iodine and thyrotropin suppression—yields excellent prognoses and 5-year survival rates for most patients (>95%).<sup>3</sup> Using the risk categories of the American Thyroid Association (ATA),<sup>4</sup> approximately 3% to 13% of patients at low risk and up to 68% of patients at high risk will have recurrence.<sup>5</sup> Most often, recurrence occurs in the first 10 years after treatment and may be detected by clinical examination using biological markers (eg, rise in thyroglobulin) or postoperative imaging.<sup>6–9</sup> Among imaging practices, neck ultrasonography is a standard part of long-term surveillance and offers high sensitivity in the detection of recurrent or residual thyroid cancer in the cervical lymph nodes and soft tissue.<sup>4,10–12</sup>

Although death from thyroid cancer is uncommon, cancer recurrence remains a concern for patients and physicians and drives the need for long-term surveillance.<sup>4,13</sup> Despite recommendations from a number of professional societies, prior work has found marked variation in surveillance for thyroid cancer recurrence.<sup>4,5,14,15</sup> Long-term surveillance may be performed by different types of specialists, including endocrinologists, general surgeons, and otolaryngologists, and includes neck ultrasonography at variable frequency. Surveillance ultrasonography can be performed in the office setting (bedside) by a treating physician (endocrinologist or surgeon), or more formally, in a radiology suite—the setting for the procedure varies according to resources, comfort level, confidence, and practice patterns.

Reasons for the marked differences in surveillance practices remain unknown. Because neck ultrasonography is known to be a highly operator-dependent examination, the training and comfort level of the clinician performing the examination has strong implications for additional testing and for accurately identifying DTC recurrence. Thus, we questioned whether a major obstacle to standardized practice may be physicians' confidence in their ability to use ultrasonography to detect recurrence.<sup>16</sup> In this study, we evaluated physicians' posttreatment DTC surveillance practices, specifically their use of ultrasonography and their confidence in its ability to detect cancer recurrence.

## Methods

### Study Design and Cohort

This was a population-based, cross-sectional study of surgeons and endocrinologists who treat DTC and who completed a survey on their long-term surveillance practices from October 2018 to August 2019. Physicians involved in thyroid cancer management were identified by patients who had been diagnosed with DTC between January 1, 2014, and December 31, 2015, and had participated in a prior, large population-based study using the Surveillance, Epidemiology, and End Results Program (SEER) registries of Georgia State (Atlanta, Greater Georgia, and Rural Georgia) and

### Key Points

**Question** Are physicians involved in the long-term surveillance of differentiated thyroid cancer (DTC) confident in their own and/or their radiologist's ability to detect recurrence using neck ultrasonography?

**Findings** This cross-sectional study of 320 physicians found that 57 (20%) had high confidence in their ability to use neck ultrasonography to identify lymph nodes suggestive of DTC recurrence, while 94 (33%) reported not being highly confident in either their own ability or a radiologist's.

**Meaning** Given that neck ultrasonography is the cornerstone of long-term thyroid cancer surveillance, physicians' low confidence in their ability and that of radiologists to use ultrasonography to detect DTC recurrence reveals a major obstacle to standardizing surveillance practices.

Los Angeles County.<sup>13,17–19</sup> The survey was sent to all physicians identified by more than 1 patient (n = 482) and to a random sample of physicians identified by only 1 patient (n = 172). A modified Dillman approach<sup>20</sup> was used to recruit survey respondents: we contacted each physician's office to confirm their address; mailed the survey by courier with a cover letter and \$50 financial incentive; followed up with a telephone call; and sent reminders to nonresponders. A double data-entry method was used to ensure less than 1% error.

Figure 1 shows that of 654 response-eligible physicians, 448 responded, yielding a response rate of 69% and a cooperation rate of 93%.<sup>21</sup> Physicians were asked, "After patients are finished with their primary treatment for thyroid cancer, how often are you involved in long-term surveillance for progression or recurrence?" Those physicians who self-identified as being *sometimes*, *often*, or *almost always* involved in long-term surveillance for progression and/or recurrence of DTC in their patients (n = 320) were included in the analytic cohort (Figure 1).

The study followed the Strengthening of Reporting of Observational Studies in Epidemiology (STROBE) guidelines. It was approved by the University of Michigan, the University of Southern California, the Committee for the Protection of Human Subjects of the California State Institutional Review Board, the Georgia Department of Public Health, the Emory University Institutional Review Board, and the California Cancer Registry. Written informed consent was waived for all participants because the research was deemed to be of minimal risk to participants, not adversely affecting their rights or welfare, and could not be carried out practically without a waiver.

### Survey Instrument

We developed a questionnaire (eAppendix in the Supplement) based on past literature,<sup>15,22–24</sup> a conceptual framework,<sup>25</sup> and our team's experience with surveying physicians who care for patients with thyroid cancer. We used standard techniques to evaluate the survey's validity, ie, having it reviewed by clinicians and experts in survey design and piloted by a select group of physicians, prior to being distributed.

## Study Measures

Survey elements included physician-reported demographic characteristics and questions about long-term management of DTC. Questions regarding physician characteristics included medical specialty (endocrinology, general surgery, otolaryngology), years in practice (<10, 10-19, 20-29, ≥30), practice setting (academic medical center, large medical group or staff-model health maintenance organization, private practice), number of patients with cancer treated per year (≤10, 11-30, 31-50, >50), and SEER site (Georgia State or Los Angeles County). Physicians who reported their specialty as endocrine surgery (n = 12) or surgical oncology (n = 12) were included in the general surgery group since these are subspecialties of general surgery. Physicians who could not be categorized in the above-mentioned specialties were excluded from the analytic group (n = 8).

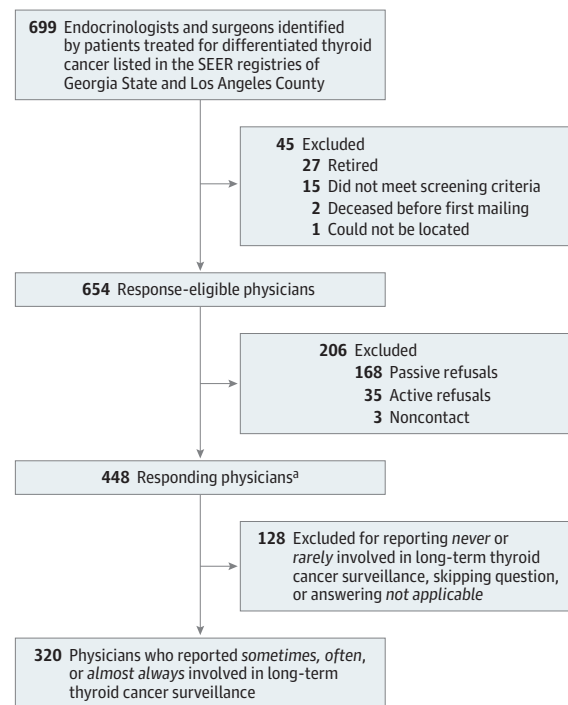
Survey items on DTC long-term follow-up practices were length of surveillance; modalities used for surveillance, ie, stimulated or unstimulated thyroglobulin, neck ultrasonography, radioactive iodine whole-body scan (I-131 scan), neck computed tomography (CT), chest CT, positron emission tomography, bone scan; use of bedside ultrasonography; personal confidence in ultrasonography; and confidence in radiologist-performed ultrasonography (eAppendix in the Supplement). Frequency of surveillance modalities was categorized as being performed at regular intervals (every 6 or 12 months), performed only if recurrence was suspected, or never performed.

Physicians were asked, “How confident are you in your ability to identify lymph nodes that are suspicious for recurrence with bedside ultrasound?” Responses were based on a 5-point Likert scale as follows: not at all confident, a little confident, somewhat confident, quite confident, and extremely confident (eAppendix in the Supplement). Responses were then dichotomized as either *high* confidence (extremely and quite confident) or *low* confidence (somewhat, a little, and not at all confident). Also included was an analogous question regarding the physician’s confidence in the radiologist’s ability to identify lymph nodes suggestive of recurrence on ultrasonography.

## Statistical Analysis

Descriptive statistics were generated for the study sample, and nonweighted frequencies are reported. Multivariable logistic regression analysis was performed; the covariates were physician specialty, practice setting, years in practice, number of patients with thyroid cancer in the past year, and SEER site; and the primary outcome variable was physician confidence in ultrasonography (binary, as described). Odds ratios (ORs) with 95% CIs are reported. Statistical analyses incorporated weights to ensure that statistical inferences were representative of the target population (physicians treating patients with thyroid cancer) to account for potential survey nonresponse bias.<sup>3,26</sup> Percentages and ORs reported are weighted, and number of participants, when provided, are unweighted for clarity. Missing data were less than 5% per survey item. All statistical analyses were conducted using Stata, version 15.1 (StataCorp), and R, version 3.6.1 (The R Foundation).<sup>27,28</sup>

Figure 1. Participant Selection Flow Diagram



SEER indicates Surveillance, Epidemiology, and End Results Program.

<sup>a</sup> Response rate, 69%; cooperation rate, 93%.

## Results

Of 448 responding physicians, 320 (72%) reported routine involvement in thyroid cancer surveillance and were included in the analytic cohort (Figure 1). The characteristics of this cohort of 320 physicians are summarized in Table 1. There were 170 endocrinologists (56%), 67 general surgeons (21%), and 75 otolaryngologists (23%). Most reported being in private practice (n = 167, 53%), male (n = 212, 66%), and White (n = 209, 68%). Typical duration of follow-up after DTC treatment was reported as follows: 1 year, 16 (5%); 2 to 5 years, 67 (21%); 6 to 10 years, 78 (25%); 11 to 15 years, 33 (11%); 16 to 20 years, 24 (8%); and more than 20 years, 91 (30%). The response rates from Georgia and Los Angeles were roughly equivalent.

The physicians’ long-term DTC surveillance practices are shown in Figure 2. Of the reported modalities, unstimulated serum thyroglobulin and neck ultrasonography were performed most commonly; both tests were reported as being performed at regular 6-month or 12-month intervals by 244 physicians (82%). Specifically, neck ultrasonography was reported to be used every 6 months by 31 physicians (10%) and every 12 months by 153 (52%) for long-term follow-up, by 58 (19%) at initial follow-up, and by 43 (14%) only when recurrence was suspected; only 14 physicians (4%) reported never using ultrasonography for long-term surveillance. An I-131 scan was

**Table 1. Characteristics of Physicians Involved in Long-term Surveillance for Thyroid Cancer Recurrence (n = 320)**

Characteristic	No. (%) <sup>a</sup>	
	Physicians	High confidence in ultrasonography
Physician specialty		
Endocrinology	170 (56)	33 (21)
General surgery	67 (21)	17 (26)
Otolaryngology	75 (23)	7 (12)
Sex		
Male	212 (66)	36 (19)
Female	105 (34)	20 (21)
Race		
White	209 (68)	38 (21)
Asian	73 (23)	16 (23)
Black or African American/other	29 (9)	2 (7)
Practice setting		
Academic medical center	76 (24)	16 (25)
Large medical group of staff-model HMO	67 (21)	10 (17)
Private practice	167 (53)	30 (20)
Community health clinic/other	7 (2)	1 (13)
Years in practice		
<10	64 (21)	14 (24)
10-19	109 (35)	26 (26)
20-29	77 (25)	8 (12)
≥30	61 (19)	9 (17)
No. of patients with thyroid cancer in past year		
≤10	80 (25)	6 (8)
11-30	107 (33)	16 (17)
31-50	51 (16)	12 (26)
>50	78 (25)	23 (33)
SEER site		
Georgia	148 (50)	26 (19)
Los Angeles County	172 (50)	31 (21)

Abbreviations: HMO, health maintenance organization; SEER, Surveillance, Epidemiology, and End Results Program.

<sup>a</sup> Percentages are weighted for nonresponse. Weights were estimated using SEER registry site, number of SEER patients treated per year, and physician specialty.

reported to be used for routine or scheduled follow-up by approximately one-third of physicians, by 88 (30%) at initial 12-month follow-up, and by 7 (2%) every 12 months. Cross-sectional imaging, ie, CT and positron emission tomography, were more likely to be reserved for suspected recurrence.

Despite nearly ubiquitous use of neck ultrasonography for long-term surveillance of thyroid cancer, only 84 (27%) of these physicians reported personally performing bedside ultrasonography. Furthermore, only 57 (20%) had high confidence (*quite* or *extremely* confident) in their ability to identify lymph nodes suggestive of recurrence using bedside ultrasonography. In comparison, 184 (60%) physicians reported high confidence in their radiologist's ability (independent of their own ability) to identify lymph nodes suggestive for recurrence with a formal ultrasonography. Overall, 94 physicians (33%) did not report high confidence in either their ability or a radiologist's

ability to use ultrasonography to identify lymph nodes suggestive of cancer.

Physician characteristics associated with high confidence in their ability to use neck ultrasonography to identify lymph nodes suggestive of cancer recurrence are summarized in **Table 2**. In multivariable analysis, general surgeons were more likely (OR, 5.7; 95% CI, 2.2-14.4) than endocrinologists to report high confidence; no significant difference was observed between otolaryngologists and endocrinologists. As a secondary analysis, the general surgeons who reported being endocrine surgeons or surgical oncologists were excluded from analysis. The significance and direction of the findings did not change. Still, among the specialist group showing highest confidence (general surgery), only 17 (26%) reported high confidence in their bedside ultrasonography ability.

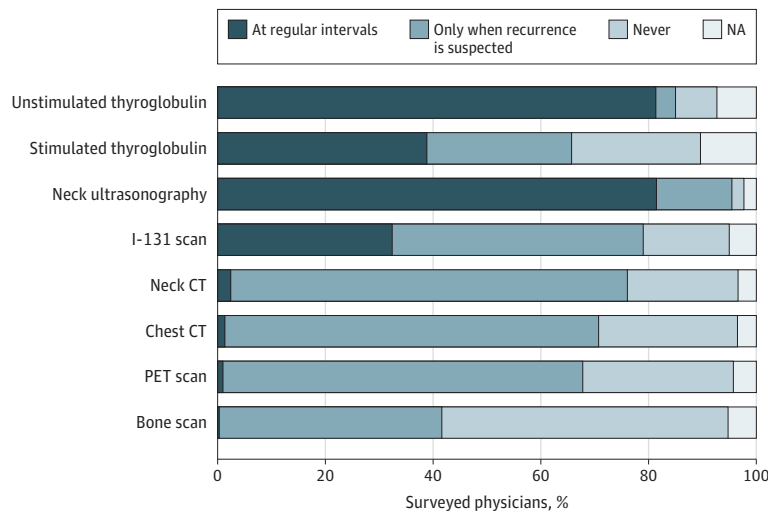
Treating a greater number of patients with cancer per year was associated with the physician having higher confidence in their ability to use bedside ultrasonography to identify lymph nodes suspicious for recurrence of cancer. The group of physicians with the most patients (greatest volume, >50 thyroid cancer cases managed per year) showed the highest confidence, independent of specialty (OR, 14.4; 95% CI, 4.4-47.4; comparison group, ≤10). This trend was seen incrementally, as shown in **Figure 3**. Still, among this group of physicians, only 23 (33%) reported high confidence in identifying lymph nodes suggestive of DTC recurrence using bedside ultrasonography. Practice setting, years in practice, and SEER registry (Georgia or Los Angeles) did not show associations with ultrasonography confidence in multivariable analysis. When the analysis was repeated with years in practice dichotomized as less than 10 vs 10 or greater, there was still no significant association found between number of years in practice and ultrasonography confidence.

## Discussion

In this diverse sample of physician-specialists treating a population-based cohort of patients with DTC and reporting involvement in long-term surveillance, we found low confidence in their own and the radiologist's ability to identify lymph nodes suggestive of recurrence using ultrasonography. While neck ultrasonography is almost invariably part of posttreatment surveillance regimens, few physicians routinely perform bedside ultrasonography examinations. We found that physician specialty (general surgery) and number of patients with thyroid cancer treated per year were associated with higher confidence in ultrasonography ability.

Neck ultrasonography is supported by the ATA guidelines as a highly sensitive method for detecting recurrent or residual disease.<sup>4,10-12,16</sup> Despite being the preferred, initial imaging modality, neck ultrasonography has limitations: results can produce false-positive rates of greater than 50%, and identification of true recurrent disease may be tempered by findings that suggest more treatment does not necessarily improve survival.<sup>23,29,30</sup> Although neck ultrasonography itself has not been shown to improve disease-specific survival at a popu-

**Figure 2. Modalities Used in Long-term Surveillance of Thyroid Cancer Progression or Recurrence, by Surveyed Physicians (n = 320), Georgia State and Los Angeles County**



CT indicates computed tomography; I-131 scan, radioactive iodine whole-body scan; NA, not applicable; PET, positron emission tomography.

**Table 2. Physician Characteristics Associated With High Confidence in Ultrasonography for Surveillance of Thyroid Cancer Recurrence**

Characteristic	High confidence <sup>a</sup> in ultrasonography	
	No. (%) <sup>b</sup>	OR (95% CI)
<b>Physician specialty</b>		
Endocrinology	33 (21)	1 [Reference]
General surgery	17 (26)	5.66 (2.23-14.40)
Otolaryngology	7 (12)	1.17 (0.42-3.28)
<b>Practice setting</b>		
Academic medical center	16 (25)	1 [Reference]
Large medical group or staff-model HMO	10 (17)	0.89 (0.32-2.45)
Private practice	30 (20)	1.44 (0.62-3.34)
<b>Years in practice</b>		
<10	14 (24)	1 [Reference]
10-19	26 (26)	1.21 (0.53-2.76)
20-29	8 (12)	0.52 (0.19-1.43)
≥30	9 (17)	0.94 (0.32-2.79)
<b>No. of patients with thyroid cancer treated in past year</b>		
≤10	6 (8)	1 [Reference]
11-30	16 (17)	4.32 (1.54-12.09)
31-50	12 (26)	8.39 (2.63-26.69)
>50	23 (33)	14.42 (4.39-47.41)
<b>SEER site</b>		
Georgia	26 (19)	1 [Reference]
Los Angeles County	31 (21)	1.04 (0.53-2.02)

Abbreviations: HMO, health maintenance organization; OR, odds ratio; SEER, Surveillance, Epidemiology, and End Results Program.

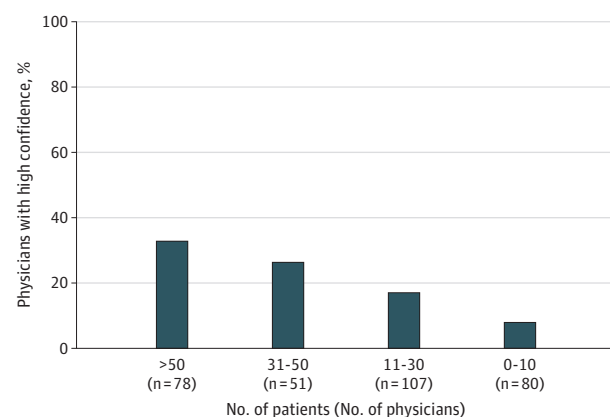
<sup>a</sup> High confidence denotes answers of *quite* or *extremely* confident.

<sup>b</sup> Percentages are weighted for nonresponse.

lation-level, for specific individuals, early identification of recurrent or residual disease may affect life expectancy.<sup>4,23,31</sup>

Previous work has demonstrated marked variation in all aspects of long-term thyroid cancer management, including

**Figure 3. Physicians Reporting High Confidence in Ability to Use Ultrasonography to Detect Thyroid Cancer Recurrence, by Number of Patients Treated per Year**



thyroglobulin testing, neck ultrasonography, and I-131 scan.<sup>15</sup> Overall, use of postoperative neck ultrasonography has increased during the past several decades.<sup>24</sup> The present study found that serum thyroglobulin and neck ultrasonography are used routinely at similarly high rates (about 80% at regular intervals, >90% when recurrence was suspected) as part of DTC surveillance. These study findings are consistent with the 2015 ATA guideline recommendations that support liberal indications of serum thyroglobulin and neck ultrasonography as the primary modalities for postoperative surveillance.<sup>4</sup>

Appropriately, this study found that cross-sectional imaging was not used frequently at regular intervals, but rather when cancer recurrence was suspected. Interestingly, use of I-131 scanning was reported by approximately one-third of physicians as a routinely scheduled test in the first year after treatment. Although used to assess treatment response in high-risk patients undergoing postoperative thyroid remnant ablation, I-131 scan use may also reflect low confidence in the

physician's own or the radiologist's ability to identify lymph nodes suggestive of recurrence using ultrasonography.

Ultrasonography is known to be highly operator dependent, and the extent of formal or informal training on its use varies.<sup>16</sup> A recent survey of otolaryngology residents found that 44% reported not feeling comfortable performing ultrasonography-guided procedures, and 43% reported not having performed any as part of their residency training.<sup>32</sup> Formal ultrasonography training is offered by the American College of Surgeons, and a study of physician sonographers found that surgeons who had successfully completed training were more likely to correctly identify cervical lymph node status than non-surgeon sonographers.<sup>33</sup>

The present study found differences in levels of confidence in ultrasonography ability by subspecialty, with general surgeons being most likely to report high confidence. This finding suggests that differences in training during residency and fellowship among general surgeons, otolaryngologists, and endocrinologists may contribute to differences in confidence.

Furthermore, studies have demonstrated an association between surgeon volume and patient outcomes after thyroid surgery.<sup>34,35</sup> The current study identified that treating more patients with DTC per year may be associated with ultrasonography confidence. Taken together, it follows that increased patient volume, and thus, increased volume of ultrasonography examinations, indicates being more skilled at operating the ultrasonography and interpreting its results.

### Strengths and Limitations

The strengths of this study were its clinically relevant research question, high survey response rate, large sample size, and representation of multiple specialties involved with thyroid cancer management. Because patients treated for DTC identified their physicians and came from 2 large and diverse SEER areas, it is likely that the study sample is representative of the breadth of practice patterns among specialists in a range of practice settings (eg, private, community, academic), experience levels, and clinical volumes. Because the study questions focused on practice patterns for long-term surveillance for recurrence of DTC, we included only those physicians who self-identified as being routinely involved in long-term DTC follow-up.

Limitations include physician self-report of follow-up practices, including a subjective measure for the outcome of ultrasonography confidence. More work is needed to assess the

association between physician-reported confidence and skill-level since they relate to the objective quality of the examination and ability to identify suggestive lymph nodes. Also, the nuances of ultrasonography and what parts of its operation lead to low confidence may require additional assessment. Furthermore, there is a need to better understand how certain training courses affect confidence and skill in ultrasonography. Nevertheless, this study provides a foundation for future work since the finding of low confidence in ultrasonography points to a previously unrecognized obstacle to long-term surveillance. This survey also may not account for patient-to-patient variation in practice settings at the single physician level; rather, it sought to identify general practice patterns at a population level.

### Conclusions

Neck ultrasonography is supported by the ATA guidelines as a cornerstone of long-term surveillance because, when performed by experienced operators, it offers high sensitivity for detection of recurrent or residual disease.<sup>4,10-12,16</sup> Because most physicians rely on ultrasonography for part of their patients' cancer surveillance regimens, these study findings have implications for physician training, patient care, and health care utilization. Despite routinely using ultrasonography to detect thyroid cancer recurrence, physicians have low confidence in both their own and their radiologists' skills. Although low confidence in a radiologist's ultrasonography may be secondary to examinations being performed by a trained technician and read by a radiologist, it underscores the importance of endocrinologists and surgeons becoming more confident in their own skills.

These study findings highlight a previously unrecognized obstacle to the standardization of long-term thyroid cancer surveillance. Lack of confidence in ultrasonography may lead to variation in its use and that of additional imaging modalities. In addition, if low confidence is associated with a lack of skill, it could have implications for the quality of patient care.

Potential solutions to lack of physician confidence in ultrasonography may be greater availability of and participation in training courses, better communication with radiologists, and opportunities for a team approach to thyroid cancer care, including more involvement of physicians with confidence and skills in ultrasonography.

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**Drafting of the manuscript:** Kovatch, Caoili, Haymart.

**Critical revision of the manuscript for important intellectual content:** All authors.

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