Improving TIRADS Reporting with a Novel, Standardized, Automated Points-Based Template

Nikita Consul, MD, Yanqiu Zheng, MD, Andy Cooc, DO, Fanny E. Morón, MD, L. Alexandre Frigini, MD

Baylor College of Medicine, Houston, TX 77030

OVERVIEW

Examining the reliability of radiologist reported TIRADS scores

Purpose

- ACR TIRADS criteria in **May 2017** improved thyroid US reporting.
- Radiologist-reported **TIRADS scores and final recommendations are still subjective** without further standardization.
- **Comparison** of free-form style reporting with standardized automated reporting.

Findings

- Template utilization increases accuracy of the reported **TIRADS scores**, and vice versa.
- **Accuracy of recommendations** for the nodules significantly increases after ACR Criteria adoption, but further increases after template standardization.

Impact

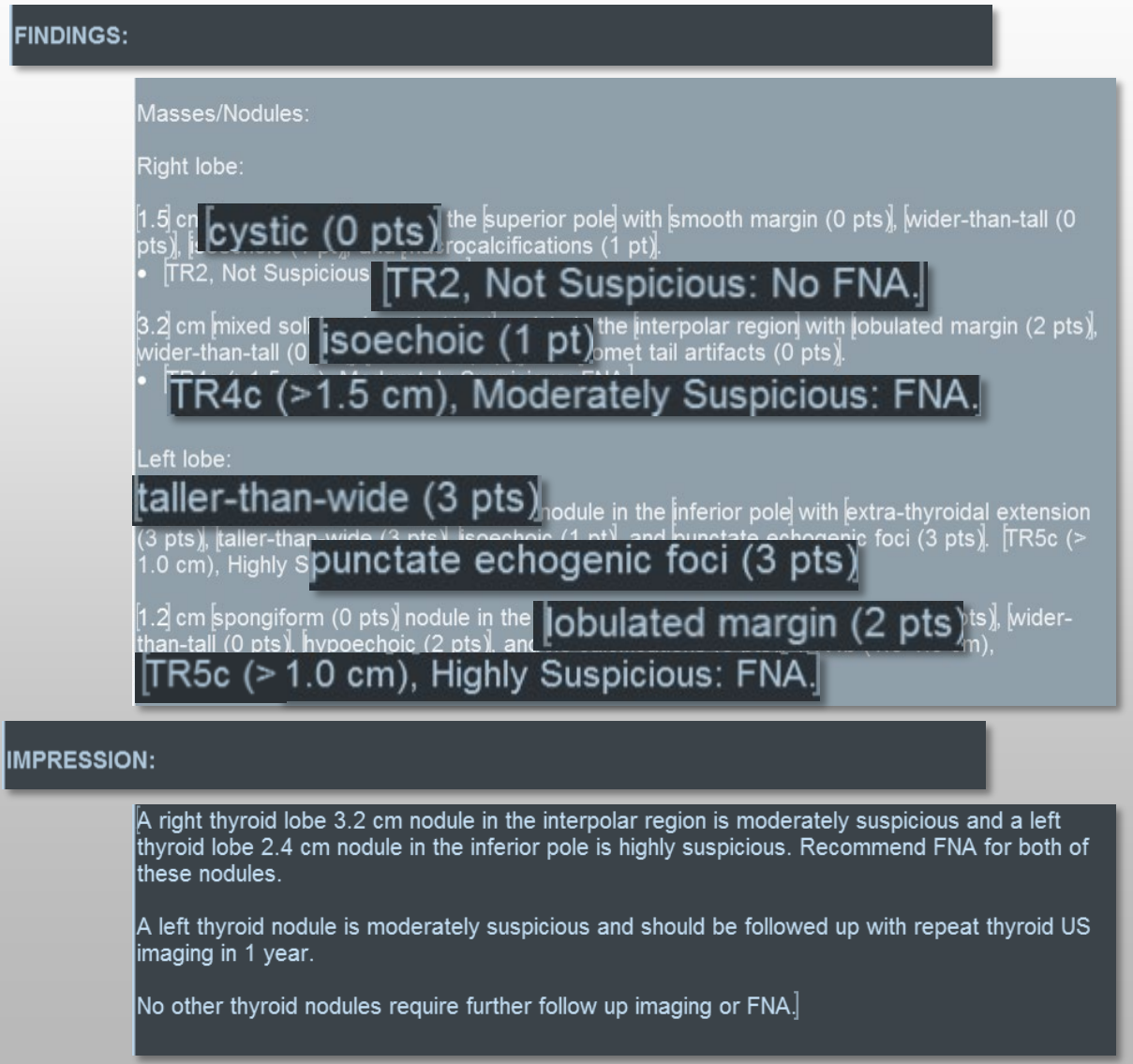
- Template standardization led to a decrease in the number of nodules recommended for **unwarranted workup per ACR Criteria from 65% to 27%.**
- More than just ACR Criteria adoption, the **push for points-based, standardized reporting of thyroid US** can lead to further decrease in unnecessary nodule workup.

TIRADS template at our institution

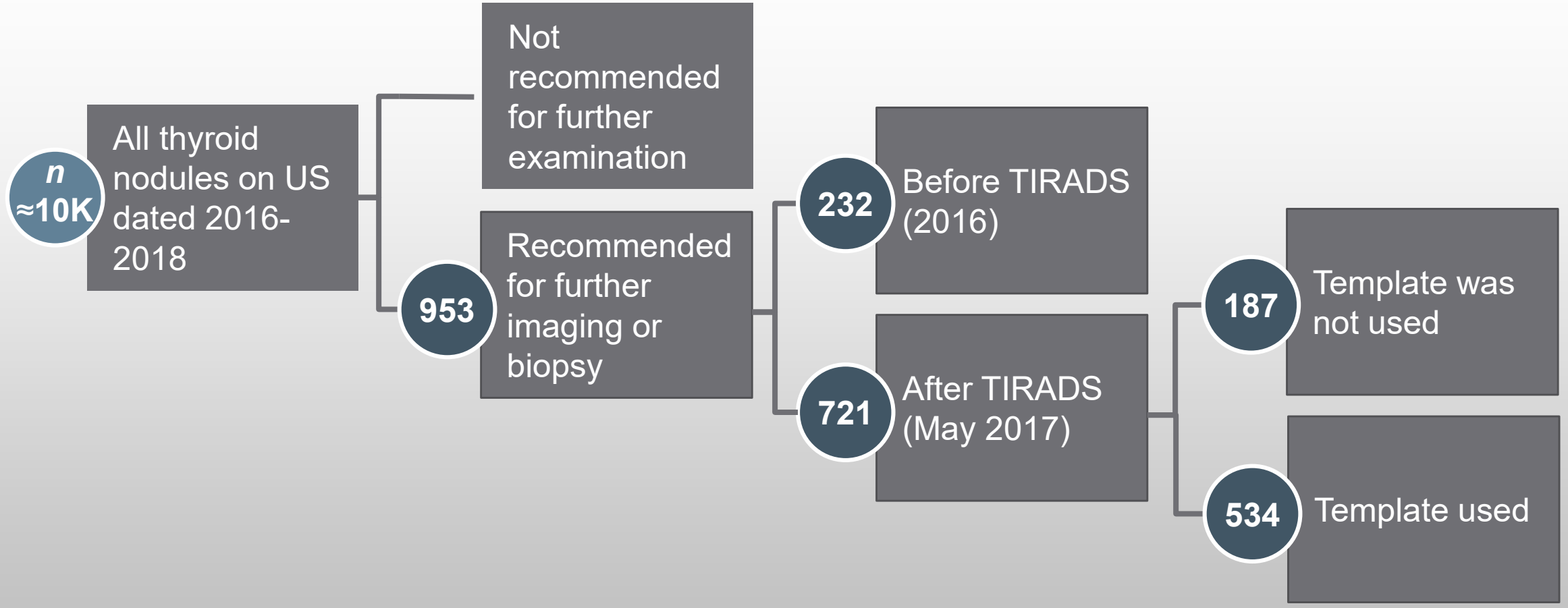
Overview of TIRADS

- A template to directly convert thyroid ultrasound findings into a calculated TIRADS score eliminates the biases of free-form reporting.
- **A points-based template** can increase the accuracy and reduce the bias associated with TIRADS scoring during report dictation.
- The implementation of this template occurred after the ACR 2017 criteria was published.

Example of application



Breakdown of the subsets analyzed



Study recorded the radiologist-reported ultrasound findings, TIRADS score, and final recommendations for each subset out of the 953 thyroid nodules recommended for further imaging or biopsy.

Steps used to calculate reporting accuracy

Data retrieval from thyroid US reports

Findings

FINDINGS:

Nodule 1

Characteristics	1.5 cm [cystic (0 pts)] nodule in the [superior pole] with [smooth margin (0 pts)], [wider-than-tall (0 pts)], [isoechoic (1 pt)], and [macrocalcifications (1 pt)].
TIRADS Score	• [TR2, Not Suspicious: No FNA.]

Nodule 2

Characteristics	3.2 cm [mixed solid and cystic (1 pt)] nodule in the [interpolar region] with [lobulated margin (2 pts)], [wider-than-tall (0 pts)], [isoechoic (1 pt)], and [comet tail artifacts (0 pts)].
TIRADS Score	• [TR4c (>1.5 cm), Moderately Suspicious: FNA.]

Impression

IMPRESSION:

Nodule 1

Recommendation	A right thyroid lobe 3.2 cm nodule in the interpolar region is moderately suspicious and a left thyroid lobe 2.4 cm nodule in the inferior pole is highly suspicious. Recommend FNA for both of these nodules.

Nodule 2

Recommendation	A left thyroid nodule is moderately suspicious and should be followed up with repeat thyroid US imaging in 1 year.

Chi-squared tests between observed and expected subsets were used to determine statistical significance in each area of discrepancy.

Steps used to calculate reporting accuracy

Example data analysis for Nodule 1

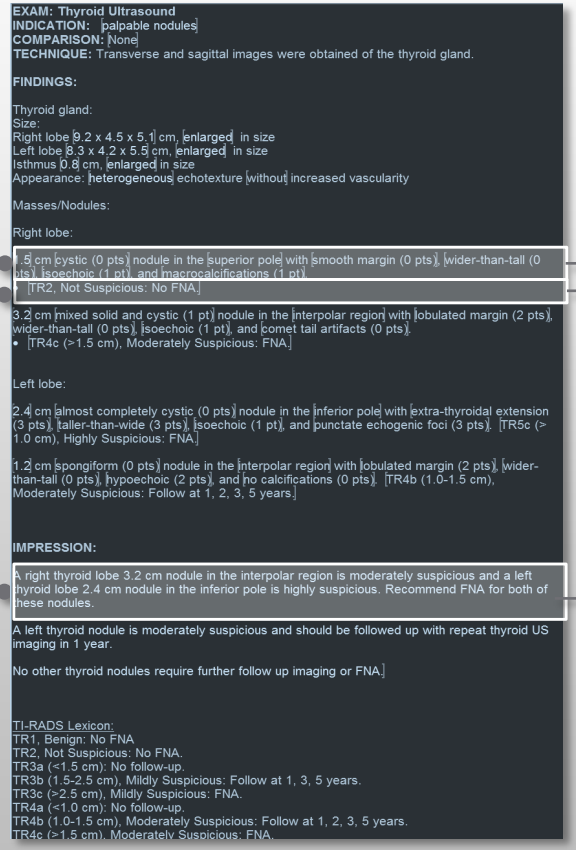
Findings

Characteristics

TIRADS Score

Impression

Recommendation



EXAM: Thyroid Ultrasound
INDICATION: palpable nodules
COMPARISON: None
TECHNIQUE: Transverse and sagittal images were obtained of the thyroid gland.

FINDINGS:

Thyroid gland:
Size:
Right lobe 9.2 x 4.5 x 5.1 cm, enlarged in size
Left lobe 8.3 x 4.2 x 5.5 cm, enlarged in size
Isthmus 0.8 cm, enlarged in size
Appearance: heterogeneous echotexture without increased vascularity

Masses/Nodules:

Right lobe:

1.5 cm cystic (0 pts) nodule in the superior pole with smooth margin (0 pts), wider-than-tall (0 pts), isoechoic (1 pt), and macrocalcifications (1 pt).
- TR2, Not Suspicious: No FNA.

3.2 cm mixed solid and cystic (1 pt) nodule in the interpolar region with lobulated margin (2 pts), wider-than-tall (0 pts), isoechoic (1 pt), and comet tail artifacts (0 pts).
- TR4c (>1.5 cm), Moderately Suspicious: FNA.

Left lobe:

2.4 cm almost completely cystic (0 pts) nodule in the inferior pole with extra-thyroidal extension (3 pts), taller-than-wide (3 pts), isoechoic (1 pt), and punctate echogenic foci (3 pts). TR5c (> 1.0 cm), Highly Suspicious: FNA.

1.2 cm spongiform (0 pts) nodule in the interpolar region with lobulated margin (2 pts), wider-than-tall (0 pts), hypoechoic (2 pts), and no calcifications (0 pts). TR4b (1.0-1.5 cm), Moderately Suspicious: Follow at 1, 2, 3, 5 years.

IMPRESSION:

A right thyroid lobe 3.2 cm nodule in the interpolar region is moderately suspicious and a left thyroid lobe 2.4 cm nodule in the inferior pole is highly suspicious. Recommend FNA for both of these nodules.

A left thyroid nodule is moderately suspicious and should be followed up with repeat thyroid US imaging in 1 year.

No other thyroid nodules require further follow up imaging or FNA.

TI-RADS Lexicon:
TR1, Benign: No FNA
TR2, Not Suspicious: No FNA.
TR3a (<1.5 cm): No follow-up.
TR3b (1.5-2.5 cm), Mildly Suspicious: Follow at 1, 3, 5 years.
TR3c (>2.5 cm), Mildly Suspicious: FNA.
TR4a (<1.0 cm): No follow-up.
TR4b (1.0-1.5 cm), Moderately Suspicious: Follow at 1, 2, 3, 5 years.
TR4c (>1.5 cm), Moderately Suspicious: FNA.

Methodology

1. Recalculated our own TIRADS Score strictly by the ACR criteria from Characteristics.
2. TIRADS Score "observed" compared against "expected" TIRADS Score for each nodule.
3. Used an algorithm to determine correct Recommendation strictly by ACR Criteria by the expected TIRADS Score
4. Recommendation "observed" compared against the "expected" Recommendation for each nodule.

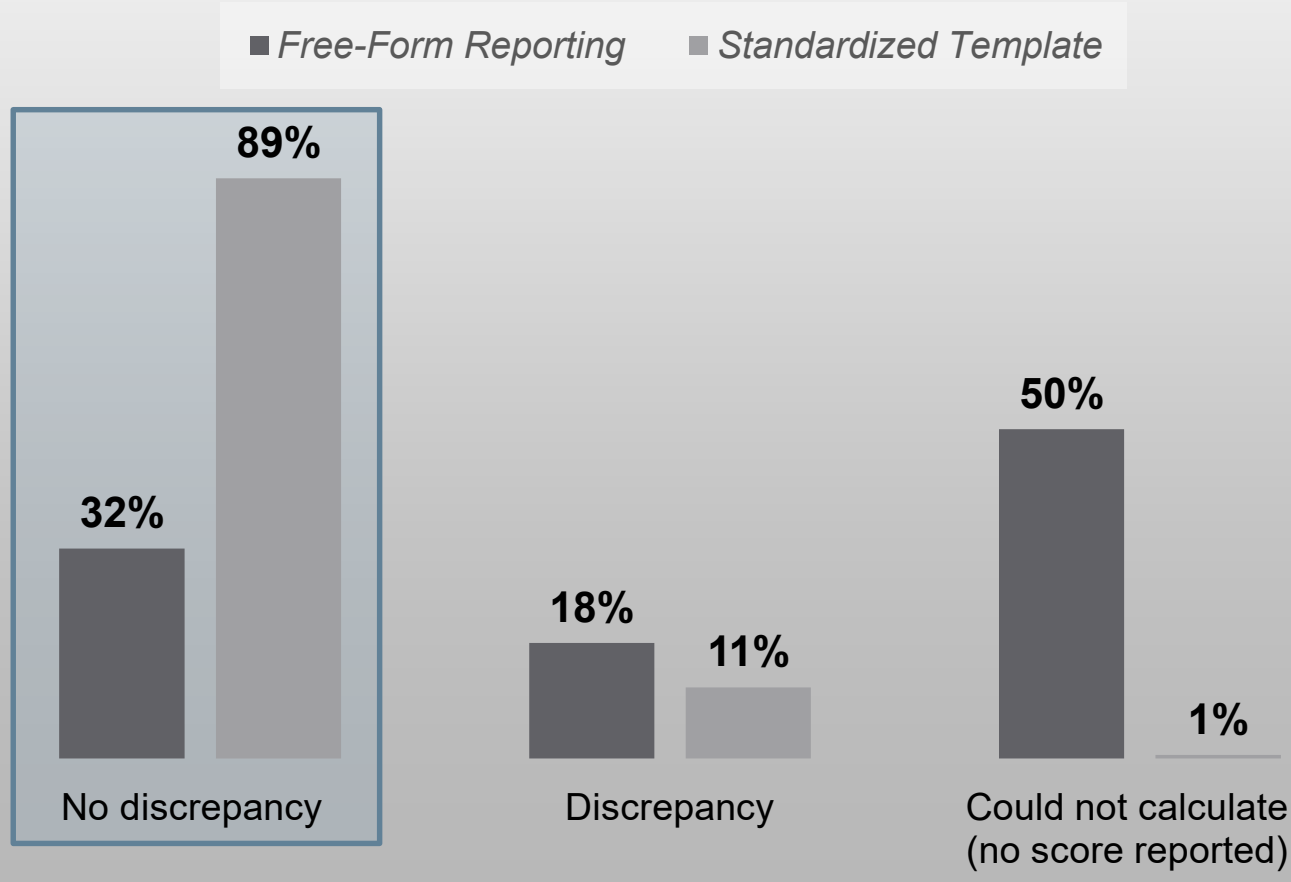
Chi-squared tests between observed and expected scores and recommendations were used to determine statistical significance in each area of discrepancy.

RESULTS

Template utilization leads to increased accuracy of the reported TIRADS scores as compared with the expected scores, and vice versa

Analysis of sample data

Figure 1. Frequency of TIRADS score discrepancy between observed and expected



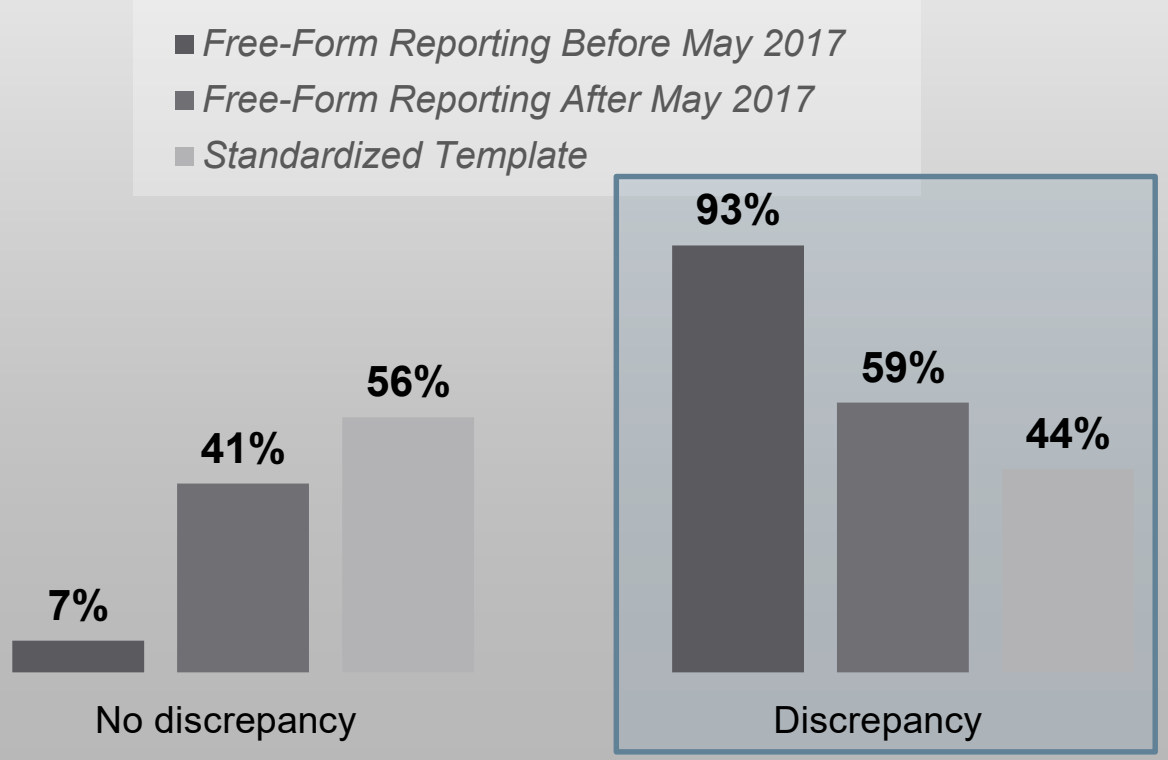
Key takeaways:

- 473 of 534 nodules assessed with the standardized template had an expected TIRADS score that matched the observed TIRADS score.
- 60 of 187 nodules assessed with free-form reporting after May 2017 had matching scores (89% versus 32%, statistically significant).

Accuracy of recommendation based on the characteristics of the nodule is significantly increased after ACR Criteria adoption, but further increased after template standardization

Analysis of sample data

Figure 2. Frequency of recommendation discrepancy between observed and expected



Key takeaways:

- Only 7% (16 of 232 thyroid nodules) prior to TIRADS adoption[1] had observations matching expected recommendations.
- Metric improved to 41% (77 of 187 thyroid nodules) after TIRADS adoption among all free-form radiologist reports.
- Further improved to 56% (297 of 534) with use of TIRADS standardized template (statistically significant).

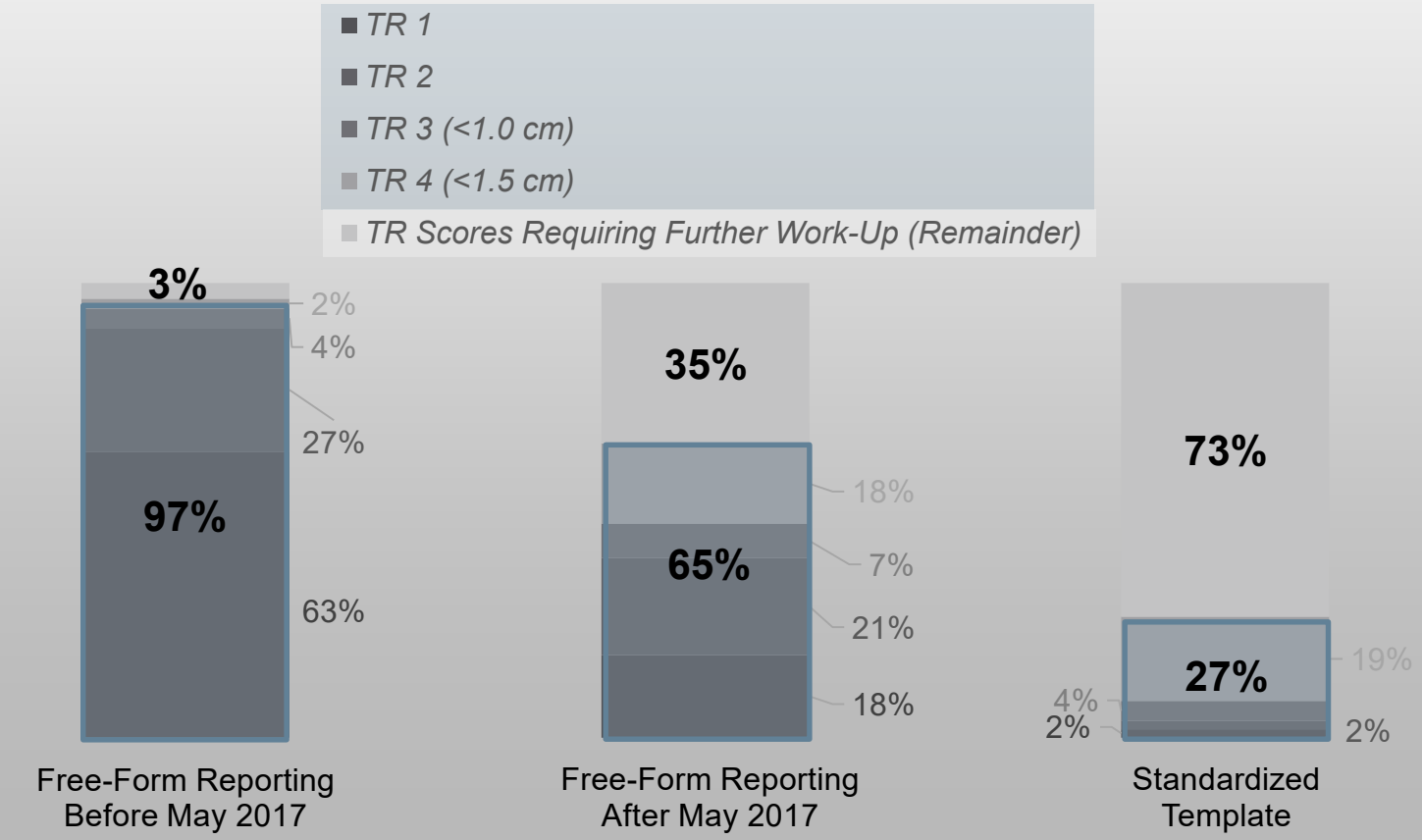
1 Adoption of template occurred in May 2017

RESULTS

Template standardization led to a decrease in the number of nodules recommended for further workup against ACR Criteria from 65% to 27%

Analysis of sample data

Figure 3. Percentage of nodules that actually should have required further workup (based on calculated TIRADS score)



Key takeaways:

- 65% of the thyroid nodules studied (121 of 187) should not have been recommended for further management per ACR criteria based on expected TIRAD scores of TR 1, 2, 3 (<1.5 cm), or 4 (<1.0 cm).
- In comparison, among the 534 nodules reported with our standardized template, only 27% (142 of 534) had these expected TIRADS scores, while 73% had TIRADS scores that require further workup by ACR criteria.

Conclusions

- **Using a standardized template for thyroid ultrasound reports can improve the accuracy of the TIRADS score** and improve the reliability of recommendations for further management communicated to the clinician.

- More than just ACR Criteria adoption, the **push for points-based, standardized reporting of thyroid US** can lead to a further decrease in unnecessary nodule workup.