



Saint Paul's Hospital Millennium Medical College

Residency Program

Department of Radiology

**Use and associated factors of American College of Radiology
Thyroid Imaging, Reporting and Data Systems among Surgical and
Internal Medicine residents at Saint Paul's Hospital Millennium
Medical College, Addis Ababa, Ethiopia**

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List of Abbreviations

ACR: American college of radiology

CT: Computed Tomography

FNAC: Fine needle aspiration and cytology

GP: General Practitioner

HMIS: Health management and information systems

MOH: Ministry of Health

RSS: Risk stratification system.

TI-RADS: Thyroid imaging reporting and data systems

MDCT: Multi-detector computed tomography.

MRI: Magnetic resonance imaging

RIS: Radiology Information system

SPHMMC: Saint Paul's Hospital Millennium Medical College

SPSS: Statistical Packages for the Social Sciences

U/S: Ultrasound

WHO: World Health Organization

Abstract

Background: The American College of Radiology Thyroid Imaging and Reporting and Data Systems is fully utilized by radiology residents and radiologists in Saint Paul Hospital Millennium Medical College, it is still not fully being utilized in other specialties like surgery and internal medicine. there are no local or international studies assessing the knowledge, attitude, and use of the American College of Radiology Thyroid Imaging and Reporting and Data Systems among healthcare professionals.

Objectives: This study is aimed to assess the use and associated factors of American College of Radiology Thyroid Imaging Reporting and Data Systems among surgical and medical residents at Saint Paul Hospital Millennium Medical College, June 2024.

Methods: A cross-sectional study was conducted among all (189) surgical and internal medicine residents currently enrolled and who were willing to participate in the research. A self-administered online questionnaire developed from input from expert radiologists was used as a data collection tool. Statistical Package for Social Sciences, version 26 (SPSS Inc., Chicago, IL) was used for data analysis. Independent variables were analyzed using frequencies, means, and percentages. Mean and median scores were used to measure the level of knowledge, attitude, and use of ACR TI-RADS scores. Bivariate and a multi-variate analysis was done between the independent, intermediate variables against the use of ACR TI-RADS. Variables having P- value <0.05 were considered as significantly associated with the dependent variable. The degree of association between dependent and independent variables was expressed by using an odds ratio with a 95% confidence interval.

Results: out of 111 respondents the level of good Use of ACR TI-RADS among surgical and internal medicine residents was 40.5 %. Knowledge and having ACR TI-RADS interpretation tools in the workplace were found to have a statistically significant association with the use of ACR TI-RADS.

Conclusion: The study showed the level of use of ACR TIRADS was low in surgical and medical residents. Multi-prong interventions are needed to improve knowledge of physicians and also make interpretation tools available in the work place.

1. Introduction

1.1 Background of the study

The thyroid is an endocrine gland located in the anterior neck and is responsible for production for thyroid hormone (T3, & T4). It is in the visceral space of the anterior neck, and it is completely enveloped by the pre-tracheal fascia(1) Goiter refers to the enlargement of the thyroid gland. It can occur from multiple conditions, resulting in the formation and enlargement of thyroid nodules. In severely iodine-deficient areas the prevalence may be as high as 80%. Goiter is more common in women (M: F = 1:4) and incidence declines with age (2).

In addition, Thyroid nodules are also detected in up to 50 to 60% of healthy subjects. Most nodules do not cause clinically significant symptoms, and as a result, the main challenge in their management is to rule out malignancy, with ultrasonography (US) and fine-needle aspiration (FNA) serving as diagnostic cornerstones (3).Ultrasound is still the first-line diagnostic thyroid imaging modality. Despite the ease of access of ultrasound, reporting of findings have been a challenge for sonographers. Inter-observer variation, selecting areas of emphasis, and stratification of malignancy risk of nodules were the major issues (4).

The Thyroid Imaging and Reporting and Data Systems (TI-RADS) was first published in 2017 by the American College of Radiology (ACR) to help Sonographers report nodules based on risk stratification. The American College of Radiology Thyroid imaging reporting and data systems feature five categories—composition, echogenicity, shape, margin, and echogenic foci in which each feature is assigned 0–3 points. The nodule’s point total determines its risk level, which ranges from TR1 (benign) to TR5 (highly suspicious). In conjunction with the nodule’s maximum diameter, the TR level determines whether to recommend a fine-needle aspiration (FNA) biopsy, a follow-up Ultrasound examination, or no further action (4). Since its first publication in 2017, ACR TI-RADS has been widely adopted by many centers worldwide. Studies have shown that ACR-TI-RADS reduces unnecessary biopsies and also improves the consistency of imaging recommendations (5).

The prevalence of goiter in Ethiopia is high. In a stratified ‘goiter survey’ done in 1992 the gross goiter prevalence among schoolchildren and household members was 30.6 and 18.7% respectively. (6). In another study done in northwest Ethiopia in 2022 showed the total prevalence of goiter among adolescent girls was 33.4% (7). This high burden of disease will be having an impact on the Patient, delays in care and treatment. For example, based on the monthly

HMIS report in Sint Paul Millenium Medical College (SPHMMC) about 75 thyroid Fine needle aspiration (FNAC) are done every month and waiting time for the service is about one week. Despite the high burden of disease, the causes of thyroid enlargement in multiple institution-based studies have found them to be benign. For example, retrospective study done in Jimma University Medical Center showed that 91.5% were found to be benign and 0.5% were found to be malignant (8). Thus, it is indicative of the need for a unifying risk stratification system (RSS) to describe and assess thyroid nodules (5).

Even though, ACR TI-RADS is fully adapted and being used as RSS for assessing thyroid nodules by the radiology department in Saint Paul Millennium Medical College (SPHMMC), the ultrasound reports and recommendations given based on this TI-RADS score are not being followed by primary care physicians. Assessing the root cause of this disconnect is crucial to improve patient care.

1.2 Statement of the problem

The primary care physicians managing patients with goiter or thyroid nodules are surgeons and internists, or lower-level physicians (residents, General practitioners, and interns working in those respective departments. After clinical evaluation, initial investigations include ultrasound, Laboratory tests, and Fine needle aspirations. Due to the limitation of clinical evaluation ultrasound should be viewed as an extension of physical examination and all patients being evaluated for goiter should have a thyroid ultrasound scan. (9). Even though Ultrasound is widely available, description and risk assessment of nodules has been a challenge (3).

Multiple guidelines for malignancy risk stratification of nodules based on Thyroid ultrasound were introduced. The ACR TI-RADS risk stratification system is widely adopted in many institutions. And has been shown to improve patient care. An international online survey collected from 52 countries done by Jenny K. Hoang Et al, highlighted the importance of having a unified international system that addresses physicians' concerns and simplifies risk classification of thyroid nodules will be beneficial for the practitioners and patients." (10) Furthermore, unlike other Risk Stratification systems (RSS) the ACR TI-RADS provides a clear management recommendations thus it reduces unnecessary benign biopsies by up to 19.9% to 45.6% compares to other RSSs (11).

The radiology department of SPHMMC has adapted the ACR TI-RADS for reporting on all thyroid nodules. Despite this, it has been observed that many primary care physicians in

SPHMMC still don't use the findings and recommendations of this risk stratification system as a tool for patient management. Moreover, it has been a recurring issue where patients are sent for unnecessary and repeated invasive investigations, despite not indicating ultrasound scans. As a result, patients are subjected to unnecessary costly invasive investigations, referrals, and delays in treatment in the hospital. Consequently, it also puts a financial and temporal strain on the health system. Having a unifying Risk stratification system for thyroid nodule like the ACR TI-RAD will significantly reduce unnecessary invasive procedures and treatment delays, thus providing a significant advantage for the patient (11).

Identifying and understanding the major barriers that prevent the adaption of an RSS in the health care system is crucial in order to design effective interventions that promotes its use (12). But there are no local studies done assessing utilization of any type risk stratification systems as the main tool in assessing and reporting of thyroid nodules by physicians. In addition, to this date There are no international or local studies done to assess the use and associated factors of the ACR TI-RADS among physicians. This research will try to assess physicians' familiarity and attitude towards this RSS and identify potential gaps. It will also explore how physicians practically apply the ACR TI-RADS guidelines in patient management, and the perceived utility and feasibility of integrating this standardized approach into clinical practice.

1.3 Significance of the study

This study will aim to identify and highlight significant gaps in medical and surgical residents' knowledge, necessitating targeted educational interventions. It will also assess any perceptions that medical and surgical residents have regarding the utility and relevance that the ACR TI-RADS have in assessing and managing thyroid nodules. Furthermore, it will illuminate the level of utilization of the ACR TI-RADS in their clinical practice. providing a comprehensive understanding of current practices and potential areas for improvement.

The study will help guide the medical and surgical departments in identifying the major gaps and formulating effective strategies to enhance the adoption and implementation of the ACR TI-RADS guidelines in clinical practice. Also helps to elucidate any problems observed by the residents in regards to ultrasound reports coming from the radiology department and offer solutions so to make the ACR TI-RADS a unifying standard thyroid nodule risk stratification system. This in turn is also beneficial to the patients with a decrement in the number of invasive procedures, unnecessary follow-ups, and expedited care. Ultimately, these improvements can

enhance patient outcomes and satisfaction while optimizing resource utilization within the healthcare system.

SPHMMC can use the findings of this study to identify root cause problems and generate quality improvement projects to enhance clinical care for patients. Furthermore, the Ministry of Health and policymakers can leverage the study's insights to evaluate the feasibility and potential challenges of adopting the ACR TI-RADS as a national standard for evaluating thyroid nodules.

2. Literature review

2.1 Overview of TI-RADS

In 2017, the Thyroid Imaging Reporting and Data System (TI-RADS) Committee of the American College of Radiology (ACR) published a white paper that presented a new risk-stratification system for classifying thyroid nodules based on their appearance at ultrasonography (4). It was widely accepted by radiologists and showed the use of this RSS when reporting thyroid nodules. It allowed radiologists to recommend further management to clinicians based on the nodule characteristics.

Numerous studies have explored the effectiveness of the ACR-TI-RAD and have found that it is a valuable tool that reduces unnecessary invasive procedures and costs. For instance, a hospital-based cross-sectional 2023 study done in Uganda by Hamdi Mohamed Isse et al on 132 patients with thyroid nodules, used Spearman's correlation to establish a relationship between TI-RADS and cytology findings of 169 nodules. The study showed that TI-RADS 3 was the most common at 42.9% (n=69). The proportions of malignancy for TI-RADS 4 and TI-RADS 5 were 73.3% and 85.7%, respectively. The correlation between ACR TI-RADS and the Bethesda system of thyroid classification scores was $r=0.577$. The sensitivity, specificity, positive and negative predictive values, and positive and negative likelihood ratios of ACR TI-RADS were 90.9%, 98.5%, 90%, 99.3%, 62.3, and 0.1, respectively. (13)

In addition, a 2018 study in India by Gokulakrishnan P. K Et al did a prospective study including 184 patients studied for 2 years (April 2015-April 2017). Thyroid nodules in B-mode ultrasound get a fine-needle aspiration cytology (FNAC) and, Bethesda classification of these nodules is used. The risk of malignancy for TI-RADS 2, TI-RADS 3, TI-RADS 4, and TI-RADS 5 was 0, 2.2, 38.5, and 77.8%, respectively. The study concluded That the probability of a particular nodule being malignant can be effectively inferred from the ultrasound-based TI-RADS system with a certain level of confidence. Which is similar to other studies. (14)

In contrast, a study done by Tom James Camwood Et al on the cost-effectiveness of ACR TI-RADS in 2020 used secondary data to assess a hypothetical clinical comparator where 1 in 10 nodules are randomly selected for fine needle aspiration (FNA), assuming a pretest probability of clinically important thyroid cancer of 5%. The study suggested that “the ACR TI-RADS has less accuracy than random selection (65% & 85 respectively. and for T1 and T2 nodules it has a sensitivity of 97%”. They concluded that “the performance of ACR TI-RADS was no better than

random selection.”. but the problem with this study is that it used secondary data from a previous study and the source and criteria of the source data selection were not stated. In addition, the percentage of T1 & T2 nodules at 25% which is not consistent with the vast majority of studies which we have discussed that suggest the fact that T1 & T2 nodules make up the vast majority of nodules on the clinical presentation. This is suggestive of the Data source used may not be suitable to make an overall assessment of ACR TI-RADS performance. (15)

A systematic meta-review done by Huang et al in 2020 compared the ACR TI-RADS with other TI_RADS RSSs like the K-TI-RADS, ATA TIRADS, and the EU TI_RADS. In their study, they found that the ACR TI-RADS system is less sensitive and more specific compared to other RSSs. However, the studies failed to include the TI RADS 3 grade which recommends follow-ups. Thus, having a higher cut-off value for recommendations for invasive procedures like FNAC or biopsy it will reduce the number of unnecessary procedures for benign nodules by 46.6 % compared to 19.5% in other RSSs. And the overall percentage of malignant nodules that will be either receive FNAC or follow-up was 89.4%, which means the overall negative outcome is low compared to other RSSs. Nevertheless, interobserver variability still remained the major issue is proper utilization of the ACR TI-RADS. (11)

2.2 Use Of TI-RADS

Despite the importance of using RSS in describing a thyroid nodule there have been a slow adaption by clinicians. Physicians from different specialties and different geographic places have shown variable levels of usage of RSS in their fields. In a study done in 2020 by Giovanni M et al An online questionnaire was administered to all members of the Italian Society of Medical and Interventional Radiology and found that most health professionals use the TI-RADS scoring when reporting thyroid ultrasounds. Adaptation was more in other specialties compared to radiologists. (16)

On the same note, using the same system of reporting among clinicians is very important. It improves patient care by decreasing ambiguity in reporting and reducing over-investigating patients with invasive and costly procedures. This was highlighted in a 2022 study by X Y Hu, where they tried to assess Improvement in thyroid ultrasound report quality with radiologists' adherence to unified RSS. The study reviewed 899 thyroid ultrasound reports of patients who received fine needle aspiration biopsies and were diagnosed with Bethesda III or IV nodules or thyroid cancer. Ultrasounds reported by radiology were divided into pre-2018 (before guideline adherence) or 2018 onwards. The study has found that “Dedicated adherence to published

thyroid ultrasound reporting guidelines can lead to improvements in report quality. This will reduce diagnostic ambiguity and improve clinician's decision-making...". (17)

As discussed above the number of studies have been published assessing the effectiveness and performance of the ACR TI-RADS. Which majority have concluded it to be an essential tool in patient care. However, few tried to address the slow adaptation of the RSS by clinicians and the reasons behind the region is not been thoroughly assessed. In Ethiopia, there are no specific research assessing the utilization of ACR TI-RADS. Even though there are unpublished studies assessing the performance of the RSS by correlating them with Cytology results they don't assess the utilization of the RSS by other Clinicians who primarily treat the patient.

2.3 Associated Factors for Use of RSS and Guidelines

There are no researches done to this date assessing the associated factors on the use of ACR TI-RADS among health care professionals. However, we can review some studies done assessing the use of RSS or guidelines among healthcare professionals. For example, a study done by Joana More et al in 2017 used scoping reviews and structured interviews to assess the key aspects of the implementation of risk stratification in the healthcare system. The study found that effective use of guidelines and risk stratification systems in healthcare requires a multi-pronged approach to address the key associated factors. Health professionals need knowledge, positive attitudes, and supportive training. Organizations must provide leadership, collaboration opportunities, and appropriate resources. Finally, clear system-level policies and infrastructure are crucial for successful implementation (12).

A study done by Qum Seya B et al in 2021 used a single-center, cross-sectional study to assess barriers to the implementation of clinical practice guidelines among physicians. The study found Three factors were identified as major barriers to guideline adherence: the complexity of guideline documents (61%, n=240), a high number of weak or conditional recommendations (62%, n=245), and time constraints due to clinical responsibilities (65%, n=255). Factors that would improve guideline adherence included access to relevant guidelines at the point of care (87%), improved focus on guidelines during training (82%), and transparency on physician commercial affiliation (62%) (18).

Similarly, a systemic meta-review done by Franke et al in 2008, assessed the factors that influence the implementation of clinical guidelines for health professionals. the study reviewed 5

literature and one website. It found that “effective strategies often have multiple components and that the use of one single strategy, such as reminders only or an educational intervention, is less effective. Besides, the characteristics of the guidelines themselves affect actual use. In addition, characteristics of professionals – e.g., awareness of the existence of the guideline and familiarity with its content – likewise affect implementation. Furthermore, patient characteristics appear to exert influence: for instance, co-morbidity reduces the chance that guidelines are followed. Finally, environmental characteristics may influence guideline implementation. For example, a lack of support from peers or superiors, as well as insufficient staff and time, appear to be the main impediments” (19).

As discussed above a number of studies have been published assessing the effectiveness and performance of the ACR TIRAD. Which majority have concluded it to be an essential tool in patient care. However, few tried to address the slow adaptation of the RSS by clinicians and the reasons behind the reason are not been thoroughly assessed. And in Ethiopia, there are no specific researches assessing the utilization of ACR TI-RADS. Even though there are unpublished studies assessing the performance of the RSS by correlating them with Cytology results they don't assess the utilization of the RSS by other Clinicians who primarily treat the patient

2.4 Conceptual Framework

The conceptual framework for our study on Use and Associated Factors of American College of Radiology Thyroid Imaging, Reporting, and Data Systems (ACR TI-RADS) Among Surgical and Medical Residents at Saint Paul Hospital Millennium Medical College (SPHMMC), Addis Ababa, Ethiopia is designed to visually represent the relationships between the independent and dependent variables and further correlation among the dependent variables. Since there is no similar study done, the associated factors are synthesized based on other literature done on assessment of the use of RSS and guidelines among physicians. (18,19) This framework helps in understanding how various factors interact to influence knowledge and attitude, and also in turn affect the use of ACR TI-RADS among the residents (20). Furthermore, how knowledge and attitude affect the use of ACR TI-RADS among surgical and medical residents.

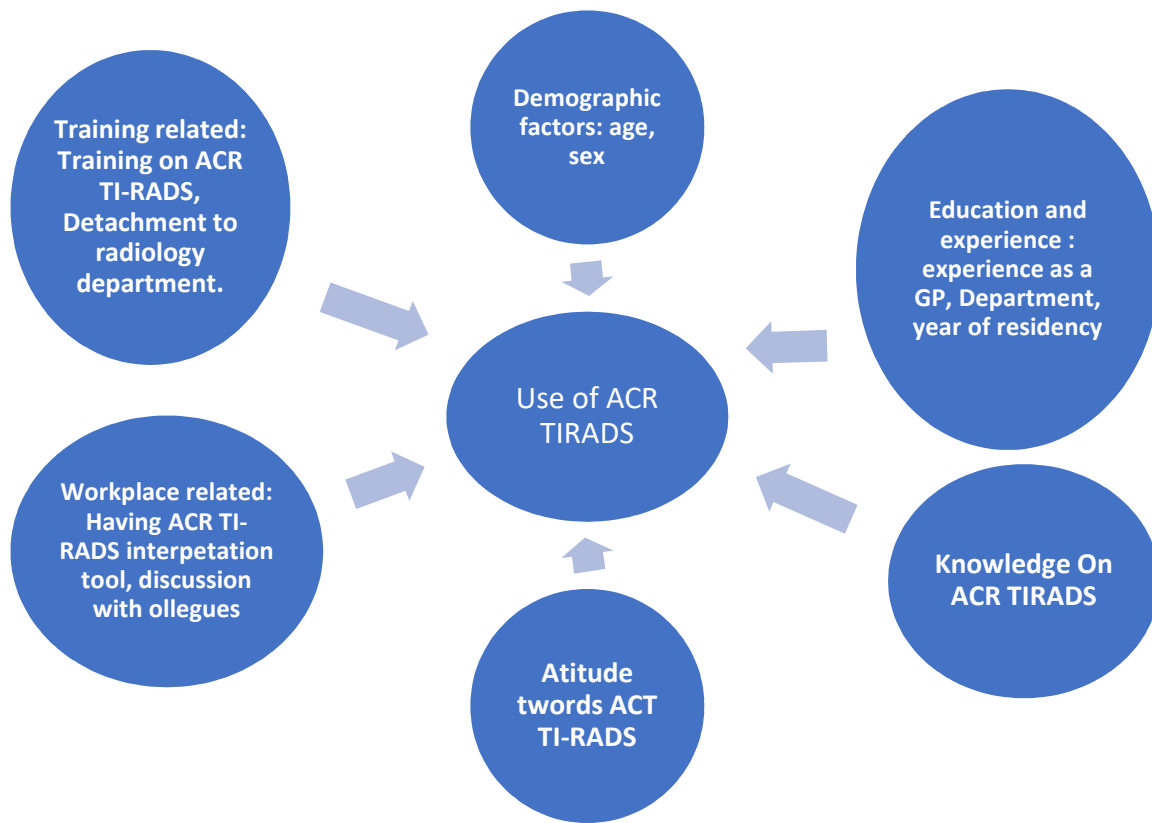


Figure 1. Conceptual framework showing possible associated factors affecting the Use of ACR TI-RAD among surgical and internal medicine residents at SPHMMC June 2024 (adapted and modified from other literature) (18,19) .

3. Objectives of the study

3.1 General Objectives

- This study aimed to assess the use and associated factors of American College of Radiology Thyroid Imaging Reporting and Data Systems among Surgical and Medical Residents at Saint Paul's Hospital Millennium Medical College, in 2024.

3.2 Specific objectives

- To determine the Use of American College of Radiology thyroid imaging reporting and imaging data systems among surgical and medical residents at Saint Paul's Hospital Millennium Medical College.
- To identify any associated factors that affect utilization of the American College of Radiology Thyroid imaging reporting and imaging data systems Risk stratification system in Saint Paul's Hospital Millennium Medical College

4. Methods and Materials

4.1 Study setting and period

This research will be conducted at St. Paul's Hospital Millennium Medical College (SPHMMC) in Addis Ababa, Ethiopia. SPHMMC is a tertiary-level care teaching hospital with a vast variety of specialty and sub-specialty programs. In its 10 years of specialization residency program, it has produced many specialized physicians. Currently over 1072 resident doctors are enrolled in the institution in various fields of specialty. The institution currently has so far produced 219 internists and 106 surgeons since 2006. The study will take place over one month, from June 03 to July 06, 2024.

4.2 Study design

This research will employ a cross-sectional study design to assess the Use and associated factors of the American College of Radiology Thyroid Imaging Reporting and Data System among surgical and internal medicine residents of Saint Paul Hospital Millennium Medical College (SPHMMC).

4.3 Population

4.3.1. Target population

All surgical and internal medicine residents are enrolled in residency training programs at different institutions in Ethiopia.

4.3.2. Source population

All surgical and internal medicine residents who are enrolled in residency training programs during the month of June 2024, at SPHMMC and are willing to participate in this research. Residents from all levels of training (e.g., first-year to final-year residents.)

4.3.3. Study population

Study unit: The individual resident will be the study unit.

4.4 Eligibility criteria

4.4.1. Inclusion Criteria

Internal medicine and General surgery residents that are enrolled in St. Paul's Hospital

Millennium Medical College during June 2024.

4.4.2. Exclusion criteria

Residents who are on leave or absent from the institution during the data collection period will be excluded from the study.

4.5 Sample Size and Sampling Procedure

The sample size was estimated using the sample size determination formula for a single population proportion for an infinite population. Since there was no similar study done assessing knowledge, attitude, and utilization of ACR TI-RADS among surgical and medical residents, the estimated population was taken as 50% to ensure the maximum population size to account for maximum variability. We have considered the confidence interval to be with 95 % certainty, and considering the margin of error to be 0.05. we calculated the total sample size of 384 which is calculated using the formula indicated below:

$$n = (Z \alpha/2)^2 \frac{P(1 - P)}{d^2}$$

Were

n = the desired sample sizes

P = Proportion of internal and surgical residents

$Z \alpha/2$ = Critical value at 95% confidence level of certainty (1.96) and

d = 0.05

$$n = (1.96)^2 \frac{0.5(1-0.5)}{0.05^2} = 384.16 \sim 385$$

Since our source population is internal medicine and surgical residents enrolled at SPHMMC during June 2024, and based on current data from the SPHMMC registrar's office there are 134 internal medicine residents and 55 surgical residents. Therefore, the total number of source population will be 189 active residents. Our source population is lower than our calculated sample size. Therefore, all of the source population who are willing to participate in the study will be included in the study. No adjustments are needed for the non-response rate. Our total sample size will be 230. Since all of the study units in the source population, who are willing to participate in the study, are going to be included in the study no sampling procedure will be needed.

Sample size = **189**

4.6 Study Variables:

Dependent variables

- Utilization of ACR TI-RADS among surgical and internal medicine residents at SPHMMC

Independent Variables

- Demographics: Age, sex,
- Education and experience: year of experience as a General Practitioner, Field of specialization and year of residency
- Training and work place: Formal training received on TI-RADS interpretation and utilization, detachment to radiology department
- Work place related: availability of ACR TI-RADS interpretation tool, Colleagues using and discussing ACR TI-RADS

Intermediate variables

- **Knowledge** of ACR TI-RADS: among surgical and internal medicine residents at St. Paul's Hospital Millennium Medical College
- **Attitude** towards ACR TI-RADS among surgical and internal medicine residents at St. Paul's Hospital Millennium Medical College

4.7 Operational definition

Knowledge of ACR TI-RADS: This refers to the ability to correctly identify, explain and interpret the key components of the Thyroid Imaging Reporting and Data System (TI-RADS).(21–23)

Adequate knowledge on ACR TI-RADS: Respondents who score > mean in the knowledge question on the questionnaire will be labeled to have adequate knowledge.(22,24,25)

Inadequate knowledge on ACR TI-RADS: Respondents who score < the mean in the knowledge question on the questionnaire will be labeled to have adequate knowledge.(22,24,25)

Attitude towards ACR TI-RADS: The perception of residents towards the importance and utility of the ACR TI-RADS.

Positive attitude: refers to respondents whose scores $\geq$ equal to the mean on the questions on attitude on the questionnaire with positive responses.

Negative attitude: refers to respondents whose scores $<$ equal to the mean on the questions on attitude on the questionnaire with positive responses. (22,25)

Utilization of the ACR TI-RADS: The frequency and extent to which surgical and internal medicine residents incorporate TI-RADS into their clinical practice for evaluating patients with goiter.

Good Use: Refers to respondents who score $>$ mean on the use and practice questions on the questionnaire (22,25).

Poor Use: Refers to respondents who score $>$ mean on the use and practice questions on the questionnaire.(24,25)

4.8 Data Collection tool, method, and Procedure

Data collection which Likert scale was conducted by using a self-administered questionnaire. Since there is no previous research done assessing the use of ACR TI-RADS, the questions on the questionnaire were prepared based on a review of the 2017 ACR TI-RADS publication (4) to identify the key components of the risk stratification system. Input from 5 senior clinical radiologists as experts and comments from advisors were used (25) to generate the questions assessing for the knowledge, attitude, and utilization of the ACR TI-RADS 1.

The questionnaires overall consisted of 5 sections. The first section had questions assessing the demographic data and educational background of the respondent. The second section had 8 questions that were designed to assess familiarity or any previous training the respondent may have had in regards to ACR TI-RADS and also other workplace factors. The third section has 14 different questions designed to assess the knowledge and attitude of the respondents to the ACR TI-RADS. The first 9 questions assess knowledge, and the first 3 questions have multiple answers and were designed to assess the respondent's ability to identify key components. It was scored 1 if the respondents could identify all of the components or 0 if they failed to do so. The next 6 questions were close-ended and were scored 1 if answered correctly or 0 if incorrectly. All the questions are considered as the same difficulty and have the same score. The last 5 questions from the third section assess attitude. It was scored based on a 4-point Likert Scale.

The fourth part had 5 questions that assessed the use of ACR TI-RADS in clinical practice. The

respondent must answer correctly based on predetermined answers. IT was scored out of 5, based on the respondents' answers. The last section is an open-ended question designed to incite a response on any factors recognized by the respondent regarding the use of ACR TI-RADS in clinical practice

The questionnaire was uploaded into Google Forms and the link to the questionnaire was shared with the surgical and internal medicine residents by their respective chief residents. The respondents were able to access the Google Form from the link and fill out the self-administered questionnaires. Encouragements to fill out the form were done repeatedly after morning sessions and by posts on telegram chat groups to improve the response rate. As respondents fill out the form, their responses were automatically collected and stored in a Google Sheets spreadsheet linked to the form. The response rate was monitored by the principal investigator regularly.

4.9 Data Quality Assurance

The questionnaire was pre-tested on a printed-out form in a group of five residents from each department, and it was reviewed by the principal investigator and no amendments to the questionnaire were necessary. The principal investigator monitored the data collection frequently. Data completeness was automatically ensured since the questionnaire was filled on Google Forms and any missing data prevented respondents from submitting the filled forms.

4.10 Data Processing and Analysis

The data was exported from Google Sheets to Microsoft Excel Office 365 where it was sorted and cleaned. It was then transferred to Statistical Package for Social Sciences, version 26 (SPSS Inc., Chicago, IL) for analysis. The demographic and awareness data were analyzed using frequencies, means, and percentages. Mean and median scores were used to measure the level of knowledge, attitude, and use of ACR TI-RADS scores. Cross cross-tabulation of frequencies and percentages of the independent, intermediate, and dependent variables was presented. Bivariate analysis was done between the independent, intermediate variables against use of ACR TI-RADS was done using Bivariate binary logistic regression. Variables which were found to have an association with the dependent variable (p-value up to 0.2) were then entered into multivariate logistic regression models for further analysis was done. Variables having P- value <0.05 were considered as significantly associated with the dependent variable. The degree of association between dependent and independent variables was expressed by using an odds ratio with a 95% confidence interval. The data was summarized and presented by use of tables and texts.

4.11 Ethical considerations

Ethical clearance and approval were obtained from the Institutional Research Ethics Review Board (IRB) of SPHMMC. The purpose and significance of the study were disclosed to the respondents, and an online written informed consent was obtained before data collection. Privacy of individual respondents' data and confidentiality of information was maintained as no personal information of the respondents was recorded during the data collection. There were no risks or benefits awarded to the individual respondents. for participating in the study.

4.12 Dissemination of Results

The results of this research will be presented orally to the department of radiology. The findings of this study will be shared with all relevant departments in SPHMMC including surgery and internal medicine to be used as input to make ACT TI-RADS institutional standard guidelines. It will also be shared with other medical institutions to spread awareness and encourage broader adoption of ACR TI-RADS. The study will also be prepared for publication in peer-reviewed, reputable medical and radiology journals, targeting those specializing in endocrinology, radiology, and medical education to ensure that the research reaches a wide audience of healthcare professionals and researchers.

5. Results

5.1 Socio-demographic characteristics and educational status, Experience of the respondents.

Out of the total of 186 samples, information was collected from 111 residents making a response rate of 58%. The majority of study participants were male 66.7% (74), and 52.3% (58) of the respondent's age group were 26- 30 with a mean age of 30.8(SD 2.72). Out of 111 respondents, 61.3% (68) were from Internal medicine and 38.7% (43) was from the Surgery department. The majority of the respondents 32.4% (36) were from year 1, 29.7% (33) were from year 3, 27.9% (31) were from year 2 and 9.9% (11) were from year 4 residency. 46.8% (52) respondents had 2 - 4-year work experience as a general practitioner, 10.8% (12) respondents had more than 4 years of experience as a general practitioner.

Table 1 Socio-demographic characteristics, educational status, and Experience of the surgery and internal medicine residents at SPHMMC who participated in the study in June 2024

Variable	Number	Percent
Age		
26 - 30	58	52.3
31 - 35	47	42.3
36 – 40	6	5.4
Sex		
Male	74	33.3
Female	37	66.7
Department		
Internal Medicine	68	61.3
Surgical	43	38.7
Year of residency		
1 year	36	32.4
2 years	31	27.9
3 years	33	29.7
4 years	11	9.9
Year of experience as a general practitioner		
0 -1 year	15	13.5
1 -2 years	32	28.8
2 - 4 years	52	46.8
>4 year	12	10.8

5.2 Familiarity and training related to ACR TI-RAD among surgical and internal medicine residents at SPHMMC June 2024

The majority of the participants, 91.1% (102) heard about the American College of Radiology Thyroid Imaging Reporting and Data System (TI-RADS). Out of 102 participants majority 64 (62.7%) were somewhat familiar with TI-RADS, 21(20.6%) were not familiar and 17 (16.7%) were very familiar. 45.9% (51) of participants have stated that they are not confident in interpreting TI-RADS classification. Whereas 45% (50) of respondents stated some level of confidence in interpreting ACR TI-RADS. Most the of respondents 73.9% (82) did not receive formal training on ACR TI-RADS and 26.1 % (29) received formal training. Out of 29 respondents who received ACR TI-RADS training majority 21(72.4%) of participants got training from seminars. The majority of the respondents 86.5% (96) have encountered a thyroid Ultrasound report containing an ACR TI-RADS score. 22.5% (25) have interpretation tools for the ACR TI-RADS available in their workplace. And 40.5% (45) have had discussions with a colleague or a supervisor regarding the components or the use of ACR TI-RADS. The majority of respondents 73% (81) had detachment to Radiology department during their residency and out of those 81 residents, 39(35.1%) of respondents observed thyroid ultrasound scanning and reporting during their detachment to radiology.

Table 2 Awareness and training related to ACR TI-RAD among surgical and internal medicine residents at SPHMMC June 2024

Variable	Number	Percent
Heard about ACRTI-RADS		
Yes	102	91.9
No	9	8.1
Familiarity with TI-RADS		
Somewhat Familiar	64	62.7
Not Familiar	21	20.6
Very Familiar	17	16.7
Confidence in interpreting TI-RADS classifications		
	51	45.9

Very confident	50	45
Somewhat confident	10	9
Not confident		
Received formal training on ACR TI-RADS		
Yes	29	26.1
No	82	73.9
Type of training		
Seminars	23	79.3
Guest lectures	2	6.8
Others	4	13.8
Know about ACR TI-RADS score		
Yes	96	86.5
No	15	13.5
Interpretation tool at the workplace		
Yes	25	22.5
No	51	45.9
I don't know	35	31.5
Discussion with colleague or supervisor		
Yes	45	40.5
No	48	43.2
I don't remember	18	16.2
Detachment to Radiology		
Yes	81	73
No	30	27
Observe thyroid ultrasound scanning and reporting during their detachment		
Yes	39	48.1
No	42	51.9

5.3 Knowledge of ACR TIRAD among surgical and medical residents at SPHMMC June 2024

The majority of the participants 54.1% (60) correctly identified which departments should use ACR TI-RADS in their clinical practice. 32.4 % (36) and 84.7% (94) correctly identified the purpose of ACR TI-RADS in the assessment of thyroid nodules and components of the ACR TI-RADS thyroid nodule risk stratification system respectively. The majority of the respondents 78.4 % (87) correctly answered ACR TI-RADS risk stratification for patient classification and assessment and 31.5% (35) correctly answered ACR TI-RAD can assess the grade of neoplastic change of a nodule. 81.1% (90) and 43.2% (48) respondents correctly answered if the ACR TI-RAD score affects the follow-up time and whether or not the descriptions used in ACR TI-RAD should matter the same amount as the size of the nodule respectively.

Table 3: the percent and frequency of the answers on Knowledge of ACR TIRAD by surgical and medical residents at SPHMMC June 2024

Variable	Incorrect	Correct
Which department should use ACR TI-RADS clinical practice?	51(45.9%)	60(54.1%)
The purpose of ACR TI-RADS in the assessment of thyroid nodules	75(67.6%)	36(32.4%)
Components of ACR TI-RADS thyroid nodule risk stratification system	17(15.3%)	94(84.7%)
The advantage of ACR TI-RADS risk stratification for patient classification and assessment	24(21.6%)	87(78.4%)
ACR TI-RADs can assess the grade of neoplastic change of a nodule	76 (68.5%)	35(31.5%)
TI-RADs score affects the follow-up timeline	21(18.9%)	90(81.1%)
The components of the ACR	63(56.8%)	48(43.2)

TIRADs should matter the same amount as the size of the nodule

ACR TI-RADs have a maximum score of 5 68(61.3%) 43(38.7%)

ACR TI-RADS risk stratification for patient classification and assessment 35(31.5%) 76(68.5%)

Based on the operational definition respondents who scored greater or equal to the mean value (Mean= 0.56) were considered knowledgeable about ACR TI-RADS. More than half of the respondents 62.2 % (69) have adequate knowledge and 37.8% (42) have inadequate knowledge about ACR TI-RADS. Out of 45 participants who discussed with a colleague or supervisor about ACR TI_RADS 86.7% (39) participants have adequate knowledge about ACR TIRAD. The majority of male participants 67.6% (50) have adequate knowledge. 86% (37) and 48.8% (40) of participants from the surgical department and those who received training respectively have adequate knowledge. 43.3% (13) of respondents those have Detachment to Radiology have adequate knowledge about ACR TIRAD.

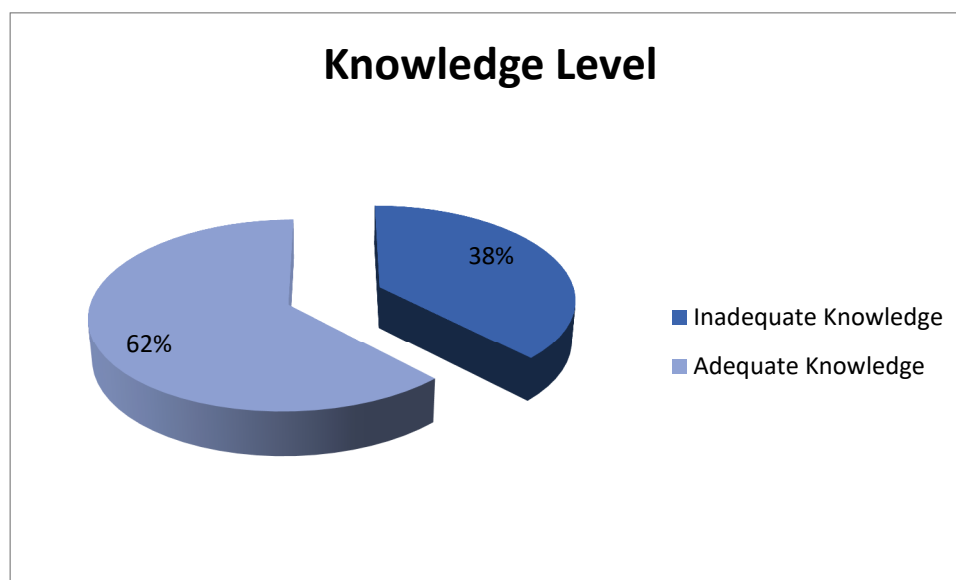


Figure 2:Level of Knowledge on ACR TI-RADS among surgical and internal medicine residents at SPHMMC June 2024

Table 4: Level of Knowledge on ACR TI-RADS among surgical and internal medicine residents based on some independent variables. at SPHMMC June 2024

Variables	Knowledge of the respondents	
	Inadequate	Adequate
Sex		
Female	18(48.6%)	19(51.4%)
Male	24(32.4%)	50(67.6%)
Department		
Internal Medicine	36(52.9)	32(47.1%)
Surgical	6(14%)	37(86%)
Received Training		
Yes	0	29(100%)
No	42(51.2%)	40(48.8%)
Discussion with a colleague or supervisor		
Yes	6(13.3%)	39(86.7%)
No	25(52.1%)	23(47.9%)
I don't remember	11(61.1%)	7(38.9%)
Detachment to Radiology		
Yes	25(30.9%)	56(69.1%)
No	17(56.7%)	13(43.3%)

5.4 Attitude toward ACR TI-RADS among surgical and internal medicine residents at SPHMMC June 2024

The majority of study participants 75.7% (84) believe the ACR TI-RADS is a reliable risk stratification system for assessing thyroid nodules and the majority of respondents 49.5% (55) also believe thyroid ultrasound reports by radiologists using ACR TI-RADS can be dependable to base your clinical decision. 65.8% (73) of respondents agree that ACR TI-RADS can reduce unnecessary invasive investigations without increasing malignancy risk and 52.3% (58) of respondents agree using the ACR TI-RADS for assessing thyroid nodules has an advantage for patients. The majority of study participants 59.5% (66) agree the ACR TI-RADS risk stratification system for thyroid nodules be used as a standard guideline in clinical practice. According to the operational definition, respondents who scored greater or equal to the mean value (Mean= 2.06) were considered to have a positive attitude. The majority 62.2% (69) of the

respondents had a positive attitude. Out of those 66 respondent's majorities 56.5% (39) had good knowledge about ACR TI-RADS.

Table 5: the percent and frequency of the answers on Attitude of ACR TIRAD by surgical and medical residents at SPHMMC June 2024

Variable	Number	Percent
ACR TI-RADS are reliable risk stratification system for assessing thyroid nodules		
I agree	84	75.7
I don't agree	15	13.5
I strongly agree	12	10.8
ACR TI-RADS can be dependable to base your clinical decision		
I agree	55	49.5
I don't agree	37	33.3
I strongly agree	10	9
I strongly don't agree	9	8.1
ACRTI-RADS can reduce unnecessary invasive		
I agree	73	65.8
I don't agree	20	18
I strongly agree	18	16.2
ACRTI-RADS for assessing thyroid nodules have any advantage for patients		
I agree	58	52.3
I strongly agree	42	37.8
I don't agree	9	8.1
I strongly don't agree	2	1.8
ACR TI-RADS risk stratification system		
I agree	66	59.5
I don't agree	28	25.2
I strongly agree	15	13.5
I strongly don't agree	2	1.8

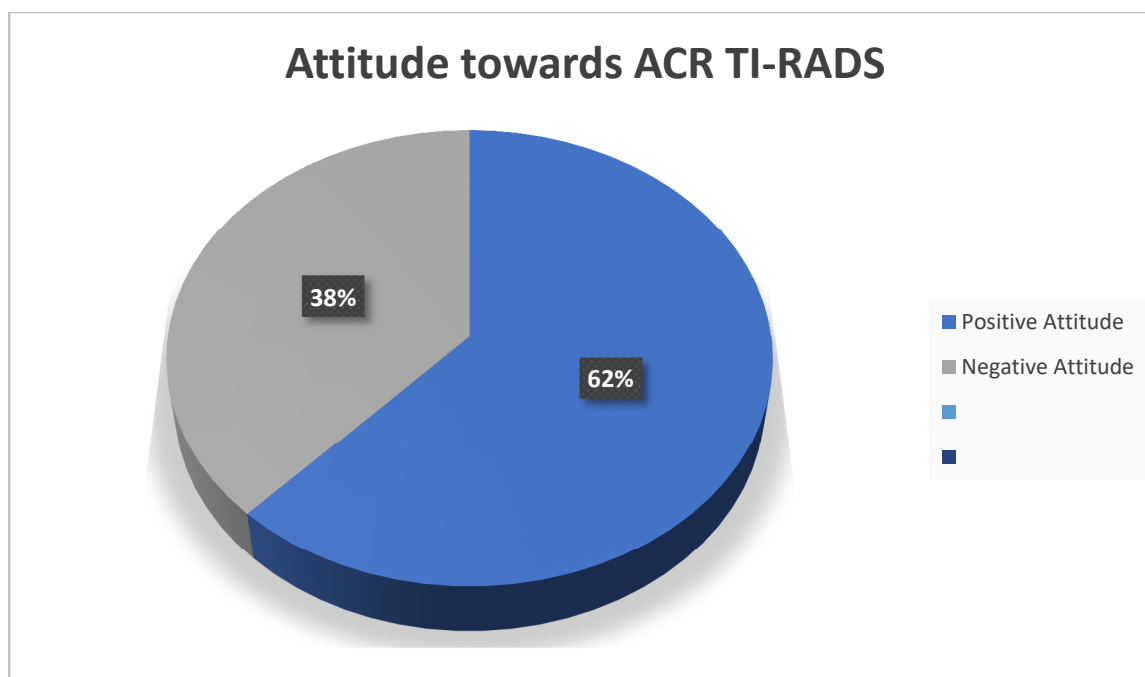


Figure 3: The attitude towards ACR TIRADS among respondent internal medicine and surgery residents at SPHMMC June 2024.

Table 6: The level of knowledge of respondent residents based on the attitude towards ACR TIRADS at SPHMMC June 2024.

Variable	Inadequate Knowledge	Adequate Knowledge
Negative Attitude	12(28.6%)	30(71.4%)
positive Attitude	30(43.5%)	39(56.5%)

5.5 Use of ACR TI-RADS among respondent residents at SPHMMC June 2024

Out of 111 respondents, 31.5% (35) respondents use ACR TI-RADS for assessing thyroid nodules Majority 65.8% (73) of respondents recommend repeated or follow-up imaging in your clinical practice based on sonographic results with ACR TIRAD recommendation and 57.7% (64) use the ACRTI-RADS score to communicate about thyroid nodules with colleagues in the same department when assessing patients with goiter. 76.6% (85) of respondents ordered FNAC for thyroid nodules despite having ultrasound reports with low TIRAD scores & no recommendation for cytologic assessment. Only 38.7% (43) of the respondents selected the correct indication for pathologic assessment.

According to the operational definition, respondents who scored greater or equal to the mean value (Mean= 0.43) were considered to have a good utilization. 45(40.5%) of the respondents have good Use of ACR TI-RADS and 66 (59.5%) have poor Use.

Table 7: Use of ACR TI-RADS among respondent residents at SPHMMC June 2024

Variable	Incorrect	Correct
Use ACR TI-RADS for assessing thyroid nodules	76(68.5%)	35(31.5%)
Recommend for repeated or follow-up imaging in your clinical practice based on their ACR TIRAD recommendation	38(34.2%)	73(65.8%)
Use the ACRTI-RADS score to communicate with colleagues in the same department when assessing patients with goiter	47(42.3%)	64(57.7%)
Order FNAC for thyroid nodules despite having an ultrasound report with a low TIRAD score and no recommendation for cytologic assessment	85(76.6%)	26(23.4%)
When to recommend for Pathologic assessment	68(61.3%)	43(38.7%)

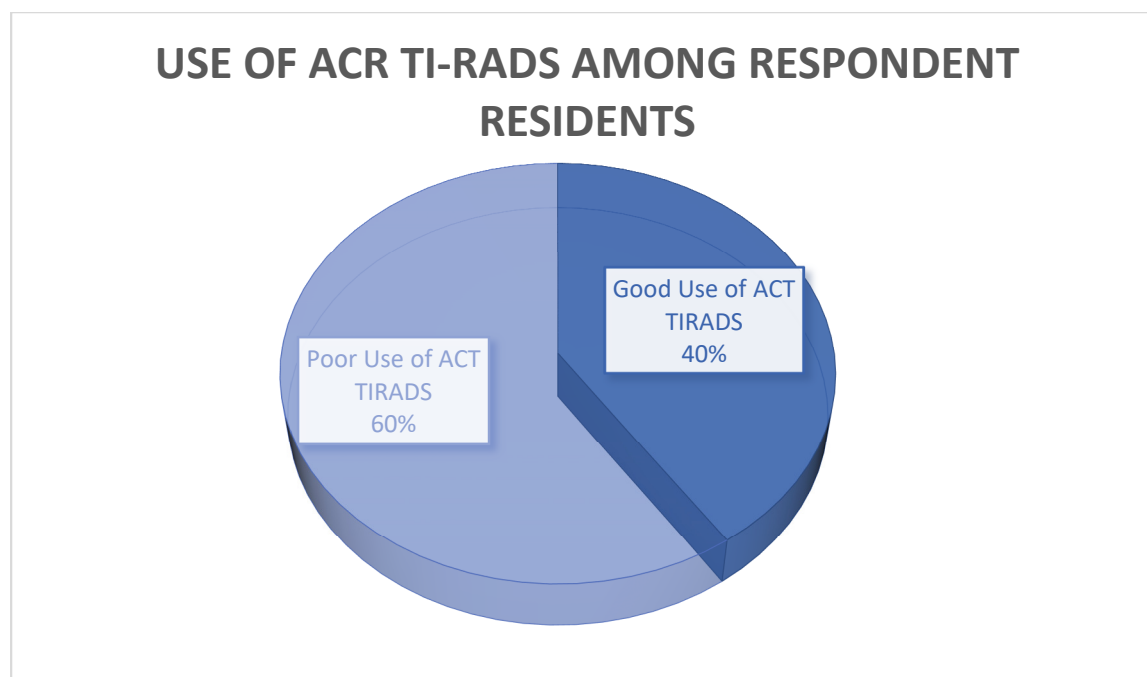


Figure 4: Level of Use of ACR TI-RADS among respondent internal medicine and Surgery residents at SPHMMC June 2024

Out of 35 respondents those have correct utilization of TI-RADS for assessing thyroid nodules majority 82.9% (29) have adequate knowledge. Of those 73 respondents answered correctly recommended repeated or follow-up imaging in your clinical practice based on their ACR TIRAD recommendation 76.6% (56) have good knowledge. The majority of respondents 78.1% (50) use the ACRTI-RADS score to communicate with colleagues in the same department when assessing patients with goiter have a good knowledge. 57.7% (15) of respondents who answered correctly on when to order FNAC for thyroid nodules despite having ultrasound reports with low TIRAD scores have adequate knowledge. And 74.4% (32) of respondents who answered correctly on when to recommend for Pathologic assessment have adequate knowledge. 45(40.5%) of the respondents have good utilization. Out of those 45 respondent's majorities 41(91.1 %) had good knowledge about ACRTI-RADS and 21(46.7%) of respondents had a good attitude about the Use of ACRTI-RADS.

Table 8: percentage and frequency of level of use of ACR TI-RAD from respondent residents based on associated factors

Variable	Utilization	
	Poor (n=66)	Good (n=45)
Department		
Medicine	53 (80.3%)	15 (33.3%)
Surgery	13 (19.7) %	30 (66.7%)

Year of residency		
Year 1		
Year 2	26 (39.4%)	10 (22.2%)
Year 3	17 (25.7%)	14 (31.1%)
Year 4 and above	16 (24.24%)	17 (37.8%)
	7 (10.6%)	4 (8.8%)
Interpretational tool		
I don't know		
No	26 (39.4%)	9 (20%)
Yes	37 (56.06%)	14 (31.1%)
	3	22 (48.9%)
Training		
No	57 (86.4%)	25 (55.6%)
Yes	9 (13.6%)	20 (44.4%)
Discussion		
Yes	14 (21.2%)	31 (68.9%)
No	36 (54.5%)	12 (26.7%)
I don't know	16 (24.24%)	2 (4.4%)
Knowledge		
Inadequate	38 (57.6%)	4 (8.8%)
Adequate	28 (42.4%)	41 (91.2%)

Table 9: Level of Use of ACR TI-RADS based on the level of knowledge and attitude among respondent internal medicine and Surgery residents at SPHMMC June 2024

Variable	Inadequate Knowledge	Adequate Knowledge	Poor Attitude	Good Attitude
Poor Utilization	38(57.6%)	28(42.4%)	18(23.7%)	48(72.7%)
Good Utilization	4(8.9%)	41(91.1%)	24(53.3%)	21(46.7%)

5.6 Factors Associated with the use of ACR TI-RADS among surgical and internal medicine residents at SPHMMC in June 2024

In order to investigate the association of independent variables with the Utilization of TI-RADS both bivariate and multivariate analyses were used. In the Bivariate analysis department, year of residency, presence of Interpretational tool in work workplace, training, discussion with

colleagues, and knowledge significantly associated with good Use of ACR TI-RAD with p-values 0.00, 0.046, 0.00, 0.001, 0.00, and 0.00 respectively. Respondents from the surgery department [COR = 8, 95% CI (3.42, 19.4)] 8 times have good use of ACR TI-RADS than the internal medicine department. Year 2 residency respondents [COR = 2.7, 95% CI (1.0, 7.5) 2.7 times have good use of ACR TI-RADS than year 4 residency respondents and respondents that have Interpretational tool at the workplace [COR = 21, 95% CI (5, 88)] 21 times use ACR TI-RADS than respondents those do not have interpretational tool. Respondents who received training [COR = 5, 95% CI (2.0, 12.6) 5 times have good use of TI-RADS than do not receive training. Respondents who had a discussion with a colleague or supervisor about ACR TI-RADS [COR = 17, 95% CI (3.5, 87)] 17 times had good utilization of TI-RADS than those who didn't have a discussion. Respondents who have adequate Knowledge [COR = 13, 95% CI (4.4, 43.3) 13 times have good utilization of TI-RADS than respondents with Inadequate Knowledge.

In multivariate analysis respondents having ACR TI-RADS interpretational tool at the workplace and respondents having adequate Knowledge were retained as a determinant of the use of TI-RADS with p-values 0.01 and 0.003 respectively. Respondents have Interpretational tool [COR = 38, 95% CI (2.3, 61)] 38 times have good utilization and respondents have adequate Knowledge [COR =39, 95% CI (3.4, 45) 39 times have good utilization of TI-RADS than respondents with Inadequate Knowledge.

Table 10: Factors Associated with the use of ACR TI-RADS among surgical and internal medicine residents at SPHMMC in June 2024.

Variable	Utilization		p-value	COR	p-Value	AOR
	Poor (n=66)	Good (n=45)				
Department Medicine Surgery	53 13	15 30	- 0.00**	1 8.(3.42, 19.4)	- 0.31	1 2.3(0.4, 12)
Year of residency Year 1 Year2 Year 3 Year 4 and above	26 17 16 7	10 14 17 4	0.14 0.04* 0.58 -	2.14(0.7, 5.9) 2.7(1.0, 7.5) 1.4(0.3,6.2) 1	0.19 0.21 0.36 -	3.3(0.5, 20) 3.2(0.5, 20) 3.6(0.3, 79) 1
Interpretational						

tool I don't know No Yes	26 37 3	9 14 22	- 0.85 0.00**	1 1.0(0.4,2.9) 21(5, 88)	- 0.56 0.01*	1 0.6(0.1, 3.3) 38(2.3, 61)
Training No Yes	57 9	25 20	- 0.001**	1 5.0(2.0, 12.6)	- 0.6	1 0.6(0.1, 3.7)
Discussion Yes No I don no	14 36 16	31 12 2	0.00** 0.23 -	17(3.5,87) 2.6(0.5,13.3) 1	0.38 0.97 -	3(0.2, 39) 1(0.12, 8.9) 1
Knowledge Inadequate Adequate	38 28	4 41	- 0.00**	1 13(4.4, 43.3)	- 0.003*	1 39(3.4, 45)

6. Discussion

The aim of this research is to assess the level of Use and associated factors of the ACR TI-RADS among surgical and internal medicine residents in Saint Paul's Hospital Millenium Medical College. The ACR TI-RADS is fully implemented by the Radiology department in SPHMMC as a risk stratification tool to describe thyroid nodules. To this date there is no research done both locally and internationally, assessing the use and associated factors of ACR TI-RADS.

In this study, we have found that the level of good use of ACR TIRAD among surgical and internal medicine residents in Saint Pail's Hospital Millenium Medical College is 40.5%. among those with good use of ACR TI-RADS majority 66.67% are from the surgery department. And 91.1% have shown adequate knowledge. A more positive attitude (72.7 %) was observed in those respondents with poor use of ACR TI-RADS. Even though there are no previous studies done assessing the level of use of ACR TI-RADS among healthcare workers, the level of use of ACR TI-RADS in our study was found to be lower compared to a study done in Italy showing the use of any form of TIRADS among health professionals which was 55.1% (16).

In our study, the analysis identifies knowledge and having an interpretation tool for ACR TI-RADS in work place as a significantly associated factors for the use of ACR TI-RADS among the respondents. Adequate knowledge was found in 62.2% of the respondents, and a higher percentage of respondents with adequate knowledge was seen from those in the surgery department and those who have had detachment to the radiology department. Where almost all of the respondents who received training showed adequate knowledge. The majority of the respondents have identified either a lack of interpretation toll in the workplace or a lack of awareness if it is present or not. Similar findings were found in a study done by Joana Mora et al have showed that knowledge and training are essential factors for the effective implementation of risk stratification systems. It also outlines that the availability of technologies and interpretation tools determine how readily these RSSs are adopted in clinical practice (12).

Other factors like attitude, training, and detachment to the radiology department, and having discussions with colleagues, were not found to be statistically determinants of the use of the ACR TI-RADS in our study. In contrast, having a positive attitude was shown to significantly influence adherence to the use of RSS, and having a multidisciplinary approach with collaboration among healthcare providers enhances the integration of different RSSs into the

clinical practice. In another study, the complexity of the guideline, personal factors like knowledge and attitude, and environmental factors like the presence of reference tools & discussions with colleagues, are among the determinant factors for the implementation of guidelines among health care professionals (18,19).

Strength of the study

The main strength of the study is that it is the first study both locally and internationally specifically assessing the use of ACR TI-RAD and associated factors among healthcare professionals.

Limitations of the study

The study setting is limited to a single institution and the study population is also limited to surgery and internal medicine residents in training which may have an impact in identifying associated factors.

7. Conclusion and Recommendations

7.1 Conclusion

The Use of ACR TI-RADS among surgical and medical residents in Saint Paul's Hospital Millenium Medical College was found to be 40.5%, which is lower than other studies done on all forms of TI-RADS. Knowledge of respondents and the presence of ACR TI-RAD interpreting tool was found to be statistically significantly associated with good use of ACR TI-RADS.

7.2 Recommendations

For Surgery and internal medicine departments

A multiprong approach and action are needed to improve the knowledge of the residents on ACR TI-RADS. Incorporation of this RSS into the course outline, and active engagement through case studies, seminars, lectures, and workshops, can significantly improve residents' understanding and application of ACR TI-RADS. In addition, posting a printed-out version of the ACR TI-RADS interpretation tool at the work place and also sharing it online so that it could be easily accessed via smart phones should be given emphasis.

For Saint Paul Hospital

An institution-based actions are needed like Encouraging multi-disciplinary communication to set a unifying Risk stratification system. And by setting policies that direct clinician into using specific RSS. And continuous monitoring to assess adherence of health care professionals to using the ACR TI-RADS is needed.

For Fellow researchers.

Further multi centered cross sectional study involving all levels of health care workers is needed to get a full understanding of the use and associated factors of ACTR TI-RADS among health care workers.

For the Federal minister of health

Policies and standard treatment and management guidelines revisions should include this Risk Stratification System a standard for describing thyroid nodules.

8. References

1. Weerakkody Y, Knipe H. Goiter. In: Radiopaedia.org. Radiopaedia.org; 2014.
2. Vander pump MPJ. The epidemiology of thyroid disease. Br Med Bull. 2011 Sep 1;99(1):39–51.
3. Gharib H, Papini E, Garber JR, Dueck DS, Harrell RM, Hegedus L, et al. American Association of Clinical Endocrinologists, American College of Endocrinology, and Association Medici Endocrinology Medical Guidelines for Clinical Practice for the Diagnosis and Management of Thyroid Nodules - 2016 Update Appendix. Endocrine Practice. 2016 May; 22:1–60.
4. Tessler FN, Middleton WD, Grant EG. Thyroid imaging reporting and data system (TI-RADS): A user's guide. Radiology. 2018 Apr 1;287(1):29–36.
5. Ha EJ, Na DG, Baek JH, Sung JY, Kim J Hoon, Kang SY. US Fine-Needle Aspiration Biopsy for Thyroid Malignancy: Diagnostic Performance of Seven Society Guidelines Applied to 2000 Thyroid Nodules. Radiology. 2018 Jun;287(3):893–900.
6. Wolde-Gebriel A N D T E S H O M E D E M E K E Hoon. Goiter in Ethiopia. Vol. 69, British Journal of Nutrition. 1993.
7. Teshome AA, Asagiri BK, Agmas AA, Magnesite MA, Molla YM, Baye ND, et al. Prevalence of goiter and associated factors among adolescent girls in the highland area of Northwest Ethiopia. SAGE Open Med. 2024 Jan 12;12.
8. Mulatu B, Michael Y, Alemu S, Demissie WR. Pattern of Thyroid Cancer and Its Associated Factors Among Thyroid Patients Underwent Thyroidectomy at Jimma Medical Center, Southwest Ethiopia; A Four Years Retrospective Review. 2020; Available from: <https://doi.org/10.21203/rs.3.rs-73562/v1>
9. Hughes K, Eastman C. Thyroid Goiter Causes, investigation and management. Vol. 41, Australian Family Physician. 2012.
10. Hoang JK, Asadollahi S, Durante C, Hegedüs L, Papini E, Tessler FN. An International Survey on Utilization of Five Thyroid Nodule Risk Stratification Systems: A Needs Assessment with Future Implications. Thyroid. 2022 Jun 1;32(6):675–81.

11. Hoang JK, Middleton WD, Tessler FN. Update on ACR TI-RADS: Successes, challenges, and future directions, from the AJR special series on radiology reporting and data systems. *American Journal of Roentgenology*. 2020;216(3):570–8.
12. Mora J, Iturralde MD, Prieto L, Domingo C, Gagnon MP, Martínez-Carazo C, et al. Key aspects related to implementation of risk stratification in health care systems-the ASSEHS study. *BMC Health Serv Res*. 2017 May 5;17(1).
13. Isse HM, Luanda R, Seree SG, Oduber FJ, Nassanga R, Bugeja S. Correlation of the ultrasound thyroid imaging reporting and data system with cytology findings among patients in Uganda. *Thyroid Res*. 2023 Dec 1;16(1).
14. Peri Karuppan G, Seshadri K, Vignesh Krishna G, Mandava R, Venkata Sai P, Rajendiran S. Correlation between ultrasound-based TIRADS and Bethesda system for reporting thyroid-cytopathology: 2-year experience at a tertiary care center in India. *Indian J Endocrinol Meta*. 2018;22(5):651.
15. Camwood TJ, Mackay GR, Hunt PJ, O'Shea D, Skehan S, Ma Y. TIRADS Management Guidelines in the Investigation of Thyroid Nodules; Illustrating the Concerns, Costs, and Performance. *J Endor Soc*. 2020 Apr 1;4(4).
16. Mauri G, Gitto S, Antisana V, Vallone G, Schiavone C, Papini E, et al. Use of the Thyroid Imaging Reporting and Data System (TIRADS) in clinical practice: an Italian survey. *Endocrine*. 2020 May 25;68(2):329–35.
17. Hu XY, Wu J, Seal P, Ghaznavi SA, Symonds C, Kinnear S, et al. Improvement in thyroid ultrasound report quality with radiologists' adherence to 2015 ATA or 2017 TIRADS: a population study. Vol. 11, *European Thyroid Journal*. Bioscientific Ltd.; 2022.
18. Qum Seya B, Goddard A, Qum Seya A, Estores D, Draganov P V., Forsmark C. Barriers to clinical practice guideline implementation among physicians: A physician survey. *Int J Gen Med*. 2021; 14:7591–8.
19. Francke AL, Smit MC, De Veer AJE, Messiaen P. Factors influencing the implementation of clinical guidelines for health care professionals: A systematic meta-review. *BMC Med Inform Deci's Mak*. 2008;8.

20. Wakee M, Holstein LM, Nilsen T. Multivariable analysis. *Journal of Investigative Dermatology*. 2014;134(5): e20.
21. du Monde M. The KAP survey model (Knowledge, Attitude & Practices.
22. Saeedi M, Khalid Al-Mubarak A, Cris's era V, Qubaisi A, Kemish Z. Knowledge, Attitude, and Practice of Healthcare Practitioners towards Clinical Practice Guidelines: Findings from a Cross-sectional Survey [Internet]. Vol. 17, *Journal of Health Informatics in Developing Countries*. Available from: <http://www.jhidc.org/>
23. Hunt DP. The concept of knowledge and how to measure it. *Journal of Intellectual Capital*. 2003 Mar 1;4(1):100–13.
24. Asadullah MN, Asadullah H, Kamel S. Knowledge, attitude, and practice of evidence-based medicine among resident physicians in hospitals of Syria: a cross-sectional study. *BMC Med Educ*. 2022 Nov 14;22(1):785.
25. Andrade C, Menon V, Ameen S, Kumar Praharaj S. Designing and Conducting Knowledge, Attitude, and Practice Surveys in Psychiatry: Practical Guidance. *Indian J Psychol Med*. 2020 Sep 1;42(5):478–81.

9. Annexes

Annex: 1: Informed Consent

Research title: Use and associated factors of ACR TI-RADS among internal medicine and surgical residents at SPHMMC)

Investigator; Dr. Nebiyu Damtew MD

Email: nebexd@gmail.com

Saint Paul's Hospital Millennium Medical College.

Hello, I am Dr. Nebiyu, I am a final-year Radiology resident and I am conducting research on the Use and associated factors of ACR TI-RADS among internal medicine and surgical residents.

The aim of this study is to assess the knowledge and utilization of the Thyroid Imaging Reporting and Data System (TI-RADS) among surgical and internal medicine residents at SPHMMC. Your responses will provide valuable insights into the understanding and usage of TI-RADS among medical professional of thyroid imaging reporting and data systems (TI-RADS).

No personal data will be collected during the study, your responses will be kept unanimous. If you are willing to participate in the study please proceed to the next section.

Thank you for participating in this survey

Annex 2: Questionnaire

Section 1: Demographic Information

Age:		Experience as a GP (in yrs.)	
Sex:	Male	Department	Internal Medicine
	Female		Surgical:
Year of undergraduate graduation		Year of residency	

Section 2: Familiarity with ACR TI-RADS and training and workplace related factors

1	Have you heard of the American College of radiology Thyroid Imaging Reporting and Data System (TI-RADS) before?	Yes
		No
2	If yes, how would you rate your familiarity with TI-RADS? (please select one)	Very Familiar
		Somewhat Familiar
		Not familiar
3	How confident are you in interpreting TI-RADS classifications? (please select one)	Very confident
		Somewhat confident
		Not confident
4	Have you received formal training on ACR TI-RADS? (please select one)	Yes
		No
5	If yes to above question, please specify where (Check all that apply to you)?	Specific lecture on ACR TI-RADS
		Seminars
		Guest lectures
		Special training workshops

		Others (specify)
6	Have you ever encountered thyroid Ultrasound report containing an ACR TI-RADS score?	Yes
		No
7	Do you have interpretation tool for the ACR TI-RADS available in your work place?	Yes
		No
		I don't know
8	Have you ever had discussion with a colleague or a supervisor regarding the components or the use of ACR TI-RADS?	Yes, I have had discussions before
		No, I haven't had previous discussion
		I don't remember
9	Did you have a detachment to Radiology during your residency so far	Yes
		No
10	If yes to the No 9 question. Did you observe thyroid ultrasound scanning and reporting during your detachment to radiology?	Yes
		No

SECTION 3. Knowledge and attitude of TI-RADS (please select one answer from the following).

No	Questions	Choices	Check ()
1	Which departments do you think should use ACR TI-RADS in their clinical practice?	Radiologists	
		Endocrinologists	
		Surgeons	
		Internists	
		Don't Know	
2	What do you think is the purpose of ACR TI-RADS in assessment of	To assess thyroid nodules for malignancy risk and recommend further action	

	thyroid nodules in your clinical practice? (select one)	To evaluate thyroid nodules and definitely differentiate between benign and malignant	
		To grade the size of nodule and calcifications	
		Don't Know	
3	Which one of the following do you think is component of the ACR TI-RADS thyroid nodule risk stratification system (you can select more than one)	Composition, calcification, echogenicity	
		Shape, margined. Echogenic foci	
		Cellular morphology, nucleoli size	
		Presence of colloid material, cellular matrix, cytoplasm/nucleus ratio	
		Don't Know	
4	What advantages do you think the ACR TI-RADS risk stratification for patient classification and assessment has? (Can select more than one?)	To reduce unnecessary, cost and invasive procedures	
		Guide in management of the patient for the primary care physicians (GP, residents, endocrinologist)	
		Advice on the selection of medication for the patient	
		Advise on surgical management options and indications	
5	Do you think the ACR TI-RADS can assess the grade of neoplastic change of a nodule	Yes	
		No	
		I don't know	
6	Can the TI-RADS score affect the follow up time line	Yes	
		No	
		I don't know	
7	Do you think the descriptions used in ACR TI-RADS should	Yes	

	matter the same amount as the size of the nodule	No	
		I don't know	
8	ACR TI-RADS have a maximum score of 5	Yes	
		No	
		I don't know	
9	do you think the ACR TI-RADS risk stratification for patient classification and assessment can change grades on subsequent imaging o	yes	
		no	
		Don't Know	
10	Do you believe the ACR TI-RADS are reliable risk stratification system for assessing thyroid nodules	I strongly Agree	
		I agree	
		I don't Agree	
		I strongly don't agree	
11	Do you think thyroid ultrasound reports by radiologists using ACR TI-RADS can dependable to base your clinical decision	I strongly Agree	
		I agree	
		I don't Agree	
		I strongly don't agree	
12	Do you think the ACR TI-RADS can reduce unnecessary invasive investigations without increasing malignancy risk?	I strongly Agree	
		I agree	
		I don't Agree	
		I strongly don't agree	
13	In your opinion does using the ACR TI-RADS for assessing thyroid nodules have any advantage for patients	I strongly Agree	
		I agree	
		I don't Agree	

		I strongly don't agree	
14	In your opinion should the ACR TI-RADS risk stratification system for thyroid nodules be used as a standard guideline in clinical practice	I strongly Agree	
		I agree	
		I don't Agree	
		I strongly don't agree	

Section 4: use of TI-RADS (please answer the following based on your previous experience in managing patients with goiter)

No	Questions	Choices	Check ()
1	In your clinical practice, how often do you utilize TI-RADS for assessing thyroid nodules?	Always	
		Often	
		Sometimes	
		Rarely	
		Never	
2	How often do you order FNAC for thyroid nodules despite having ultrasound report with low TI-RADS score and no recommendation for cytologic assessment	Always	
		Often	
		Sometimes	
		Rarely	
		Never	
3	In your clinical practice Which one of the following patients have you recommended for Pathologic assessment	Goiter Patients with no prior pathology result	
		Goiter Solid & Calcified nodules	
		Patients with Large thyroid	
		Patients recommended for FNAC from ultrasound report only	

		Clinical suspicion of a malignant lesion even without ultrasound result	
		I don't remember	
4	Which patients did you recommend for repeated or follow up imaging in your clinical practice based on their ACR TI-RADS recommendation	Those patients recommended by the ACR TI-RADS assessment and recommended to have a follow up	
		Every patient with goiter until surgery is done	
		Based on clinical suspicion regardless of the ACR TI-RADS recommendation	
5	In your clinical practice do you use the ACRTI-RADS score to communicate with colleagues in the same department when assessing patients with goiter		Yes
			no

Section 4: Additional Comments

1. What challenges, if any, do you encounter in utilizing TI-RADS effectively? :

2. Do you have any additional comments or suggestions regarding TI-RADS or its implementation in clinical practice?

Thank you for your participation!

Annex 3: Declaration

I the undersigned agree to accept all responsibilities for the scientific and ethical conduct of the research project. I will provide timely progress report to my advisor and seek the necessary advice and approval from my primary advisors in the course of the research. I will communicate timely to my advisors all stakeholders involved in the study including any source of funding for this research.

Name of the student: Nebiyu Damtew (MD, Radiology Resident)

Signature:

Date: June, 2024

Approval of the Primary Advisor

Name of the primary advisor: Yared Dejene (MD, senior clinical radiologist Radiologist)

Signature:

Date:

Approval of the Co-Advisor

Name of the primary advisor: Takele Gezahegn (MPH, Assistant Professor)

Signature:

Date: