



ORIGINAL ARTICLE

To determine the effectiveness of different interventions to reduce unnecessary requests of serum thyroid stimulating hormone levels in a hospital.

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ABSTRACT... Objective: To reduce unnecessary requests for Serum Thyroid stimulating hormone (TSH) levels in a hospital setting using targeted interventions. **Study Design:** Interventional study. **Setting:** Najran Armed Forces Hospital (NAFH), Saudi Arabia. **Period:** January 2019 to June 2020. **Material & Methods:** Sampling technique was non probability convenient sampling and included all the TSH requests received in the laboratory. The tests were categorized into three categories e.g., repeated requests within one month, requests as routine investigation and requests not related to diagnosis. The interventions made included the initiation of hospital guidelines, resolving the limitations of Laboratory information system (LIS) and increasing awareness of physicians. The effectiveness of interventions was calculated by measuring the number of unnecessary requests out of total number of TSH requests. The comparison was made between problem identification phase and post implementation phase. **Results:** The analysis of data showed a reduction in the routine unnecessary TSH requests by almost 11%. During the first half of 2019(Jan -July) total number of TSH tests were 5713 with 3427 (60%) unnecessary requests. After initiation and implementation of interventions the unnecessary requests reduced by 11% during Jan-July 2020. There were only 1857(49%) unnecessary requests out of total 3827 TSH tests. These results were statistically significant with p-value of less than 0.05. **Conclusion:** The application of appropriate interventions decreased the unnecessary requests of TSH. This reduction in turn reduced the wastage of the cost spent and the workload implied on staff for processing these unnecessary requests.

Key words: Information Technology, Laboratory Information System, Thyroid Stimulating Hormone.

INTRODUCTION

Laboratory over testing increases healthcare cost and leads to over diagnosis, overtreatment and at times negative health outcomes.^{1,2} There are studies which showed up to 95% of laboratory test were unnecessary or did not add any value to the patient care.¹ It commonly occurs when tests are advised haphazardly without considering the cause and possible result of the tests. This creates multiple problems, including high cost of tests, inappropriate labeling of patients and treatment of asymptomatic patients subsequently.³ These problems are especially common in cases of diagnosis and treatment of thyroid diseases.

Thyroid diseases are amongst the most

common medical conditions presenting in outpatient department in UK. In adult incidence of hypothyroidism is 4.1/1000/ year in women and in women it is 0.6/1000/year. Incidence of Hyperthyroidism is 0.77/100/year in women and 0.14/1000/year in men. Approximately 170,000 new cases are diagnosed each year in UK.³ Overtreatment and under treatment of these patients can result in grave consequences for patient, therefore accurate and timely diagnosis and monitoring are very important.^{4,5,6} Diagnosis of thyroid diseases is difficult as these patients present with vague and non-specific symptoms. A range of tests like Thyroid stimulating hormone (TSH), free thyroxine (FT4) and free Tri-iodothyronine (FT3) are available for their

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diagnosis. In UK thyroid functions tests (TFTs) alone cost 30 million pounds.⁷

Expenditure on laboratory testing has increased and cost \$ 8 billion dollars in Medicare spending alone in United States.⁸ Use of laboratory tests are important for diagnosis to physicians; however, overuse is of serious concern as 10-50% of these laboratory tests are ordered unnecessarily⁹ It is estimated by the institute of medicine that \$210 billion are spent on unnecessary services including laboratory tests¹⁰, and unnecessary laboratory testing alone account for wastage of \$ 5 billion.⁸

In laboratories TSH is the 8th most common test in United States which cost \$469 million every year, but the prevalence of thyroid disease is only 3.82% and incidence of 259.12 cases per 100,000 per year.¹¹

Various studies across the world have shown unnecessary requests have led to hike of laboratory tests especially TSH, when compared to population. These requests can be reduced by restricting the requisition pattern, applying proper criteria and guidelines for requisition, training of physicians and monitoring of respective parameters.

TSH test is also one of the most commonly advised tests in our hospital. The aim of this study was

to reduce the number of unnecessary requests for TSH test in our hospital using multiple quality improvement procedures. This study will help in reducing the cost spent on unnecessary TSH testing and also reduce workload on laboratory services which will lead to an overall better patient care and better laboratory services as well.

MATERIAL & METHODS

This study was conducted at Najran Armed Forces Hospital (NAFH), Saudi Arabia over a period of 18 months, from Jan 2019 to Jul 2020 after approval ethical committee (REC-UOL-2022), Main specialties practiced in this hospital are Medical, Surgical, Obstetrics and Gynecology, pediatrics, family and community medicine. The laboratory provides general and specialized services with an average of 740542 lab tests and an average of 11000 TSH tests per year. As electronic ordering system is operational and the patients can be traced for the tests, results and diagnosis. During our trials to improve the laboratory services in accordance with population increase and introduction of new tests it was observed that some tests such as TSH was being ordered without any guidelines and restrictions. Data from of Jan to June 2019 revealed that 60 % of total TSH tests in our lab were unnecessary for various reasons. The whole process of TSH test requisition and processing was analyzed to identify the root causes and solutions as shown in the Ishikawa diagram Figure-1.

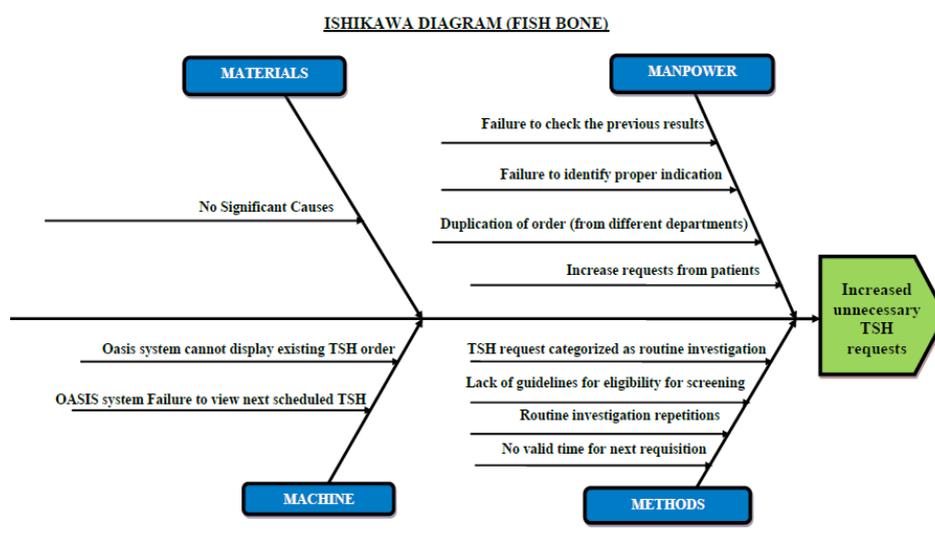


Figure-1. Root cause analysis

Action plan was made as shown in Table-I. The interventions were implemented based on the formulated action plan within the planned framework. Some of the interventions include as follows:

- a. Formulation of clinical practice guidelines that cover the actual process for requesting the TSH tests.
- b. Clinical Practice Guidelines covers the eligibility criteria, indication and criteria for repetition of the TSH tests.
- c. Training of the physicians of respective departments about the clinical practice guidelines including the frequency of performing TSH tests.
- d. Reinforcing the physicians to do proper assessment and identifying the indication for performing TSH test.
- e. Emphasizing the physicians to cross check the time and results of the previous tests.
- f. Discuss all the points of intervention in the departmental meeting.
- g. Modify OASIS system with the display of previous date of TSH test and any existing order from other physicians which helps in preventing the duplication.
- h. Set the time for next test in OASIS system which helps the physician to avoid the requisition of the test frequently.
- i. Educate and explain to the patients about the significance of TSH test, time frame that should be maintained between two tests of TSH.
- j. Promote effective communication between lab and physicians by communicating the overlaps of tests and repetition of the test.

The measures chosen to identify the effectiveness of interventions were the percentage of unnecessary requests of TSH test and total number of TSH tests which are process measures. Also, the process measure of unnecessary requests was categorized and measured under three main domains of repeated requests within one-month, routine investigation and requests not related to the diagnosis.

Another measure for analyzing effectiveness was the measurement of cost spent on the unnecessary

requests of the TSH tests, considered as outcome measure.

The impact of the interventions was analyzed by measuring these measures before and after implementation of action plan.

A 10 percent reduction was achieved in June 2020. Impact analysis was performed to calculate the costs savings in SAR.

Frequencies and percentages were calculated for numerical data. P value was calculated using Chi Square test.

The process measures used were the total number of TSH tests per month and unnecessary TSH requests per month. The average percentage was calculated biannually and the impact was compared between first six months of 2019 and first half of 2020.

The main process measure of unnecessary TSH requests further categorized to repeated requests within one-month, routine investigation and requests not related to the diagnosis. The balancing measure included the rate of normal and abnormal results in the sub category of routine investigation, which helped in identifying the improvement. The increase in abnormal results indicated that the routine investigation was performed as per the indications for TSH test. The outcome measures used was the cost spent on the unnecessary requests of TSH tests.

RESULTS

All the process measures and outcome measures were collected for three phases, i.e., a). Jan-June 2019 (Problem identification data), b). July-December 2019 (QIP initiation and implementation phase) c). Jan-Jun 2020 (Implementation phase and post implementation phase). The comparison was made between problem identification phase and implementation phase.

Root Causes	Recommendations (What)	Implementation	Duration
Requesting TSH as routine investigation Lack of eligibility criteria/policy/guidelines No guidelines for repeating TSH	<ul style="list-style-type: none"> To prepare a clinical practice guideline which covers the eligibility criteria for requesting TSH, criteria for routine investigation and the criteria for repeating TSH. To order TSH according to indication as per diagnosis guidelines. To send a memo to the department heads for the implementation of the clinical practice guidelines. To emphasize the head of departments for discussing and training for the physicians on the finalized criteria and guidelines in departmental meeting. To reinforce the physicians to avoid unnecessary requests for the patients with frequent follow up. 	Lab FCM/Internal Medicine OPD Concerned departments	6 months
Difficulty in checking previous order Duplication of orders Failure to view the existing orders in the system	<ul style="list-style-type: none"> To send memo to IT department to fix the issues with the oasis system. Inform IT department for blocking the duplication of requests. IT department should make provision to show all the tests requested by the physician including the future date of testing. IT department to consult computer system Company and make necessary provisions in Oasis. To promote effective communication between lab and physicians. Training and re-training of the staff on Oasis after establishment of mentioned 	Lab IT dept Concern Departments	6 months
No validity time for request	<ul style="list-style-type: none"> Increase the awareness of physicians about the period required for next requisition. As it is not considered as emergency test, TSH should not be repeated before 4 to 6 weeks. To include in guidelines regarding the valid time of request. Co-ordinate with IT department to set validity time for TSH request in Oasis. 	All departments IT Dept	6 months
Failure to check the previous results Failure to identify proper indication	<ul style="list-style-type: none"> Emphasize the physicians to cross check the previous result before requesting for next test. Encourage and reinforce appropriate assessment of the patient to identify the indication for TSH request. To contact IT department to incorporate the facility to review the previous result and time period for next test. 	All departments IT dept	6 months
Increase requests from patient	<ul style="list-style-type: none"> Educate the patients on the significance of the test and duration for rechecking the test. Involve health educators for education if necessary. Emphasize the physicians to order the test only if necessary. 	All Departments	6 months

Table-I. Action plan in summarized form

The primary process measurements included the comparison rate of total TSH tests and the unnecessary requests of TSH test between problem identification phase and post implementation phase. There were 3103 (60%) unnecessary requests from Jan-June 2019 out

of total 5173 TSH tests, which reduced to 1875 (49%) unnecessary requests out of total 3827 requests in Jan-June 2020 as shown in Table-II. The percentage reduced to 60% to 49% indicating improvement of 11% after implementation of action plan. This finding was statistically

significant as well with a p- value less than 0.05.

Time Duration	Total TSH Tests	Un necessary TSH Tests	Percentage of Unneces- sary reports (%)
2019 (Jan –Jun)	5173	3103	60
2019 (Jul- Dec)	5374	3009	56
2020 (Jan- Jun)	3827	1875	49

Table-II. Comparison of total number of TSH test and unnecessary TSH test requests

The Unnecessary tests were categorized as (a) requested in less than one month were the highest around 52%, (b) as routine investigation with a percent of 33 % and (c) not related to diagnosis 15% from Jan-June 2019. All these categories reduced to 25%, 13% and 5% respectively by Jan-June 2020, post implementation phase, which indicated the effectiveness of interventions. These findings are summarized in Figure-2.

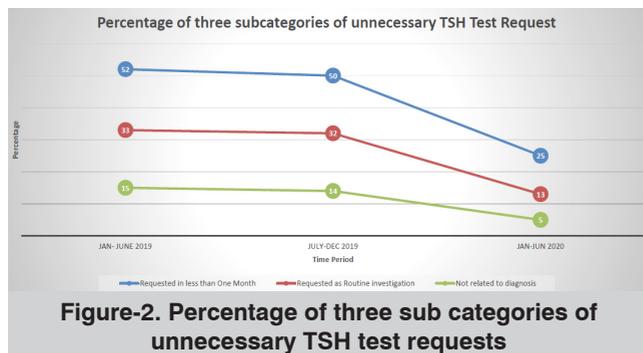


Figure-3 indicates the balancing measure of normal and abnormal results of routine investigation of Jan-June 2019 and Jan-June 2020. The abnormal results increased from 18% to 56% from 2019 to 2020, which shows that the tests order that is indicated has increased by 38% which in turn reduced the unnecessary TSH requests after intervention.

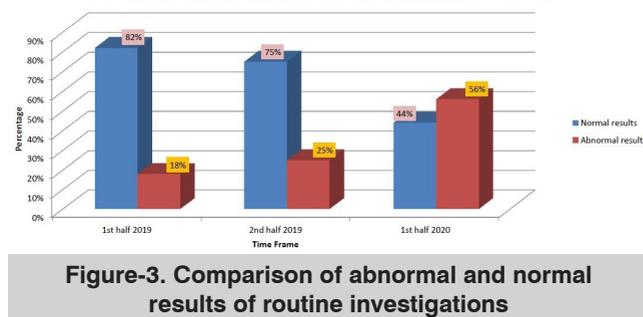


Figure-4 shows the impact analysis of interventions on cost spent on the unnecessary requests of TSH by comparing the cost before and after implementation of the interventions. The cost of each TSH test is 16 SAR. The cost was calculated with the unnecessary requests and it was revealed that around 49648 SAR was spent on unnecessary requests in Jan- June 2019. However, after implementation the cost was reduced to 30000 SAR in Jan-June 2020 and the cost saved by these interventions was 19648 SAR.



DISCUSSION

Unnecessary requests for laboratory tests are a common issue worldwide and studies have shown that there is approximately 20% overutilization.¹² Multiple factors contribute to the laboratory overutilization, these include physician related, system related, team related and institution related as well. Using combined interventions including education of physicians, audit and feedback mechanism can effectively reduce these unnecessary tests.^{13,14} Different studies have been performed to evaluate different interventions to reduce the total number of unnecessary tests. In these studies, most of the interventions were successful.^{15,16} Because of the heterogeneity it is difficult to compare these studies and their outcomes, however they showed that combined interventions were more effective than a single intervention. This was also seen in our study as well. A study done by Levick et al 2013, concluded that by introducing alerts in the computerized physician ordering system in a judicious manner had substantial impact and reduced the ordering of intended tests by 21% and had a financial impact as well saving approximately \$92,000 per year.¹⁷

Keeping in view the over utilization and

inappropriate ordering of Thyroid function tests various studies have been performed. In this era of rising healthcare costs, inappropriate thyroid function testing is an ideal target for efforts to reduce laboratory overutilization which can save millions in cost.¹¹

In our study our aim was to reduce the percentage of unnecessary test by 10% after applying these combined interventions. In the¹⁸ months experience of our study the lessons learnt were that total number of unnecessary TSH tests requests were on hike due to increase in re-ordering of tests within a month followed by its advice as routine investigation. The main cause for this was the failure of implementation of the guidelines about the ordering of the tests. After implementation of the guidelines along with the changes in intranet system, education, raising awareness and improving communication with the clinicians the percentage of unnecessary requests for TSH decreased by 11%.

All these interventions helped to reduce the unnecessary tests in total as well as the sub categories mentioned in the study. Moreover, the abnormal results increased which shows the improvement in indicated ordering. By improving in all these aspects, it saved the materialistic resources and thus to be cost effective by reducing saving of first half of 2020 to more than half the amount spent on first half of 2019. It also reduced the workload of staff and saved the time for the processing of TSH requests.

CONCLUSION

In conclusion this series of interventions targeting unnecessary testing demonstrated a sustained reduction in the number of tests ordered, without adverse effects on clinical care. Implementing a guideline for TSH test and improving the computer ordering system has an effective role in reducing the unnecessary TSH test by 10% which led to a significant reduction in the diagnostic costs.

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2	Muhammad Zubair	Data collection, Literature review and critical evaluation.	
3	Nabeel Khan Afridi	Data collection, literature review, Statistical analysis.	
4	Muhammad Tauseef Dildar	Review Literature, data interpretation.	
5	Hammad Javed	Data collection, literature review, drafting, critical evaluation.	
6	Samah Mohammed Alwalah	Data collection, data interpretation.	