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MU Thyroid Nodule Electronic Database (MU-TNED), a Multidisciplinary Informatics Approach

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Abstract:
Thyroid nodules are common findings and thyroid cancer is projected to be one of the leading causes of cancer in women. The EHR includes the necessary data needed to connect clinical research with patient outcomes. The objective for this project was to develop and validate a usable informatics tool for clinicians and researchers to record, analyze, and be able to manipulate the clinical and research data to benefit all collaborators. The tool was specifically designed to enable follow- up in a longitudinal manner to support multiple aspects of research. The informatics tool MU-TNED was designed with a multidisciplinary team including the departments of pathology and anatomical sciences, endocrinology and health informatics to be able to transfer identified and validated clinical information directly from the EHR into a research database based on clinicians and research needs. The research database created has resulted in numerous quality improvement and clinical research studies enabling clinicians as well as researchers to be able to answer important questions on topics such as diagnostic modalities, quality of care and patient outcomes.

Keywords: Clinical Informatics; Electronic Health Record; Health Informatics

I. INTRODUCTION

Thyroid nodules are commons findings in patients; with a prevalence of palpable thyroid nodules in about 5 percent of women and 1 percent of men. While thyroid nodules are not a life threatening illness, once diagnosed, they need to be followed long-term; moreover there is an increase in thyroid cancer. By 2030, thyroid cancer is projected to be one of the leading causes of cancer in women, with the incidence projected to increase at a rate of 6.5 percent per year [1]. Differentiated thyroid cancer (DTC) comprises the majority (90 percent) of all thyroid cancers [2]. For the majority of DTC patients, life expectancy is not significantly reduced; however, there is an increasing number of patients that need long-term follow-up [3].With the majority of non-federal acute care hospitals having implemented an electronic health record (EHR), health care researchers have more data available than ever before. However, it is often stored in a manner that is not easily accessed and makes the identification of relationships between data points problematic [4, 5]. Data collection is a time consuming process and one that is often relegated to an afterthought in healthcare, as a result it is not collected or stored in a manner that is efficient and effective for research [6]. An integrated disease specific registry may help overcome the limitations of the EHR by providing data that is more efficiently extracted and in a format that is more conducive to research [7].Over the last 10 years, the guidelines for treating patients with thyroid nodules and DTC have changed substantially necessitating the need for long-term follow-up. The earlier guidelines recommended a total thyroidectomy with radioactive iodine ablation in the post-operative period. This was paired with thyroid stimulating hormone (TSH) suppression and long-term follow up. The current guidelines minimize the surgical approach and TSH suppression given the relatively high survival rate of DTC. The latest guidelines instead favor the long-term monitoring of serum thyroglobulin by a reliable assay with imaging studies recommended based upon disease progression [8].

II. AIM AND TARGET AUDIENCE

Our objective in these guidelines is to inform clinicians, patients, researchers, and health policy makers about the best available evidence (and its limitations), relating to the diagnosis and treatment of adult patients with thyroid nodules and DTC. These guidelines should not be applied to children (<18–20 years old); recent ATA guidelines for children with thyroid nodules and DTC were published in 2015. This document is intended to inform clinical decision-making. A major goal of these guidelines is to minimize potential harm from overtreatment in a majority of patients at low risk for disease-specific mortality and morbidity, while appropriately treating and monitoring those patients at higher risk. These guidelines should not be interpreted as a replacement for clinical judgement and should be used to complement informed, shared patient–health care provider deliberation on complex issues. It is important to note that national clinical practice guidelines may not necessarily constitute a legal standard of care in all jurisdictions. If important differences in practice settings present barriers to meaningful implementation of the recommendations of these guidelines, interested physicians or groups (in or outside of the United States) may consider adapting the guidelines using established methods (ADAPTE Collaboration, 2009; www.g-i-n.net). The ADAPTE Collaboration is an international group of researchers, guideline developers, and guideline implementers who aim to promote the development and use of clinical practice guidelines through the adaption of existing guidelines. Because our primary focus was reviewing the quality of evidence related to health outcomes and diagnostic testing, we decided a priori not to focus on economic resource implications in these guidelines. As part of our review, we identified some knowledge gaps in

the field, with associated future research priorities.[8] Other groups have previously developed clinical practice guidelines, including the American Association of Clinical Endocrinologists, Associazione Medici Endocrinologi, and the European Thyroid Association , the British Thyroid Association and The Royal College of Physicians and the National Comprehensive Cancer Network (www.nccn.org). The European Thyroid Association has published consensus guidelines for postoperative US in the management of DTC. The Society for Nuclear Medicine and Molecular Imaging and the European Association of Nuclear Medicine have also published guidelines for radioiodine (RAI) therapy of DTC. The Japanese Society of Thyroid Surgeons and the Japanese Association of Endocrine Surgeons have recently revised guidelines on treatment of patients with thyroid tumors .Given the existing controversies in the field, differences in critical appraisal approaches for existing evidence, and differences in clinical practice patterns across geographic regions and physician specialties, it should not be surprising that the organizational guidelines are not in complete agreement for all issues. Such differences highlight the importance of clarifying evidence uncertainties with future high quality clinical research.

III. LITERATURE SURVEY

Thyroid nodules are a common clinical problem, and differentiated thyroid cancer is becoming increasingly prevalent. Since the American Thyroid Association's (ATA's) guidelines for the management of these disorders were revised in 2009, significant scientific advances have occurred in the field. The aim of these guidelines is to inform clinicians, patients, researchers, and health policy makers on published evidence relating to the diagnosis and management of thyroid nodules and differentiated thyroid cancer.[9] The specific clinical questions addressed in these guidelines were based on prior versions of the guidelines, stake holder input, and input of task force members. Task force panel members were educated on knowledge synthesis methods, including electronic database searching, review and selection of relevant citations, and critical appraisal of selected studies. Published English language articles on adults were eligible for inclusion. The American College of Physicians Guideline Grading System was used for critical appraisal of evidence and grading strength of recommendations for therapeutic interventions. We developed a similarly formatted system to appraise the quality of such studies and resultant recommendations. The guideline panel had complete editorial independence from the ATA. Competing interests of guideline task force members were regularly updated, managed, and communicated to the ATA and task force members. The revised guidelines for the management of thyroid nodules include recommendations regarding initial evaluation, clinical and ultrasound criteria for fine-needle aspiration biopsy, interpretation of fine-needle aspiration biopsy results, use of molecular markers, and management of benign thyroid nodules. Recommendations regarding the initial management of thyroid cancer include those relating to screening for thyroid cancer, staging and risk assessment, surgical management, radioiodine remnant ablation and therapy, and thyrotropin suppression therapy using levothyroxine. Recommendations related to long-term management of differentiated thyroid cancer include those related to surveillance for recurrent disease using imaging and serum thyroglobulin, thyroid hormone therapy, management of recurrent and metastatic disease, consideration for clinical trials and targeted therapy, as well as directions for future research. We have developed evidence-based recommendations to inform clinical decision-making in the management of thyroid nodules and differentiated thyroid cancer. They represent, in our opinion, contemporary optimal care for patients with these disorders.

IV. ALGORITHMS

1)Navie Bayies

A Naive Bayes classifier is a probabilistic machine learning model that's used for classification task.It is a classification technique based on Bayes' Theorem with an assumption of independence among predictors. In simple terms, a Naive Bayes classifier assumes that the presence of a particular feature in a class is unrelated to the presence of any other feature. Naive Bayes model is easy to build and particularly useful for very large data sets[11].

Naïve Bayes algorithm:

```
# load the iris dataset
from sklearn.datasets import load_iris
iris = load_iris()

# store the feature matrix (X) and response vector (y)
X = iris.data
y = iris.target

# splitting X and y into training and testing sets
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.4, random_state=1)

# training the model on training set
from sklearn.naive_bayes import GaussianNB
gnb = GaussianNB()
gnb.fit(X_train, y_train)

# making predictions on the testing set
y_pred = gnb.predict(X_test)

# comparing actual response values (y_test) with predicted response values (y_pred)
```

```
from sklearn import metrics
print("Gaussian Naive Bayes model accuracy(in %):", metrics.accuracy_score(y_test, y_pred)*100)
```

2)SVM Algorithm

"Support Vector Machine" (SVM) is a supervised machine learning algorithm which can be used for both classification or regression challenges. It is mostly used in classification problems. In this algorithm, we plot each data item as a point in n-dimensional space with the value of each feature being the value of a particular coordinate.Then, we perform classification by finding the hyper-plane that differentiate the two classes very well.Support Vectors are simply the co-ordinates of individual observation. [10]

SVM Algorithm:

```
#Import Library
from sklearn import svm
#Assumed you have, X (predictor) and Y (target) for training data set and x_test(predictor) of test_dataset
# Create SVM classification object
model = svm.svc(kernel='linear', c=1, gamma=1)
model.fit(X, y)
model.score(X, y)
#Predict Output
predicted= model.predict(x_test)
```

V. RESULT

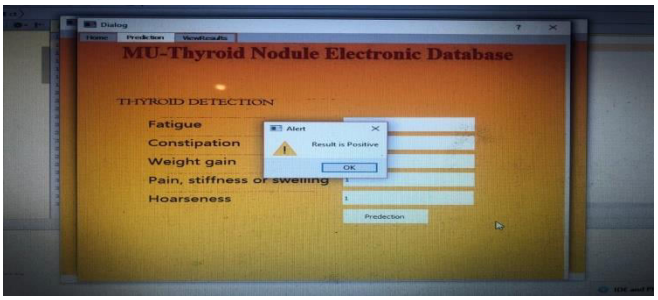

Figure. 5.1 Thyroid Detection

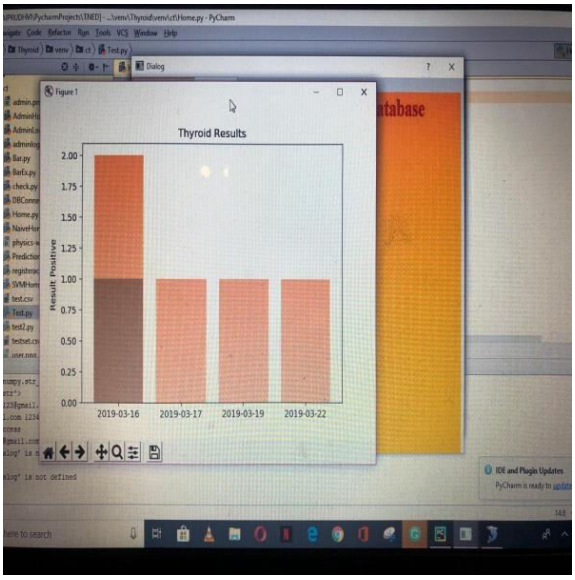

Figure 5.2 Thyroid analysis of patient

VI. CONCLUSION

Quality of care is a primary focus of health care delivery and methods of continuous quality improvement for clinical care are evaluated and implemented regularly enhancing patient care experiences and patient satisfaction. Further every visitor encounter adds to the amount of clinical data available in the EHR that can be studied to identify trends related to patient outcomes and quality of care. One method to identify these trends is through longitudinal research observing relevant information based on the clinical area of interest that can be retrieved and stored for analysis, patient results and outcomes over time.Therefore, benefits of creating longitudinal databases connected to the EHR allow for effective determination of development and trends making observations of changes more accurate than other available methods. Further allowing collaborations between scientists and organizations that share interests enabling future developments, analysis, of shared data. This encourages innovative multidisciplinary research using the data from the EHR; realizing that "informatics is an important aspect of current cancer research enabling researchers to record, analyze, and manipulate an increasingly cumbersome amount of data in a way that all participants benefit including the patients" [9].

VII. REFERENCES

[1]. L. Rahib, B. D. Smith, R. Aizenberg, A. B. Rosenzweig, J. M.Fleshman, and L. M. Matrisian, "Projecting Cancer Incidence and Deaths to 2030: The Unexpected Burden of Thyroid, Liver, and Pancreas Cancers in the United States," Cancer Research, vol. 74, no.11, pp. 2913-2921, 2014.

[2]. D. S. Cooper et al., "Revised American Thyroid Association management guidelines for patients with thyroid nodules and differentiated thyroid cancer: the American Thyroid Association (ATA)guidelines taskforce on thyroid nodules and differentiated thyroid cancer," Thyroid, vol. 19, no. 11, pp. 1167-1214, 2009.

[3]. F. A. Verburg et al., "Life expectancy is reduced in differentiated thyroid cancer patients >/= 45 years old with extensive local tumor invasion, lateral lymph node, or distant metastases at diagnosis and normal in all other DTC patients," (in eng), J Clin Endocrinol Metab,vol. 98, no. 1, pp. 172-80, Jan 2013.

[4]. J. Henry, Pylypchuk, Y., Searcy T. & Patel V. . (2016). Adoption ofElectronic Health Record Systems among U. S. Non-Federal Acute Care662Hospitals: 2008-2015 (no. 35 ed.). Available:https://dashboard.healthit.gov/evaluations/data-briefs/non-federal-acutecare-hospital-ehr-adoption-2008-2015.php

[5]. J. P. Cravero et al., "Creation of an integrated outcome database forpediatric anesthesia," Pediatric Anesthesia, vol. 26, no. 4, pp. 345-355,2016.

[6]. D. Kondziolka, B. T. Cooper, L. D. Lunsford, and J. Silverman," Development, Implementation, and Use of a Local and Global ClinicalRegistry for Neurosurgery," (in eng), Big Data, vol. 3, no. 2, pp. 80-9,Jun 2015.

[7]. S. A. Gallagher et al., "Roadmap for the development of the Universityof North Carolina at Chapel Hill Genitourinary OncoLogy Database--UNC GOLD," Urologic Oncology, Research Support, N.I.H.,Extramural vol. 32, no. 1, pp. 32.e1-9, 2014.

[8]. B. R. Haugen et al., "2015 American Thyroid Association Management Guidelines for Adult Patients with Thyroid Nodules and Differentiated Thyroid Cancer: The American Thyroid Association Guidelines TaskForce on Thyroid Nodules and Differentiated Thyroid Cancer."Thyroid, vol. 26, no. 1, pp. 1-133, 2016.

[9]. G. W. Hruby, J. McKiernan, S. Bakken, C. Weng, "A centralized research data repository enhances retrospective outcomes research capacity: a case report." *Journal of the American Medical Informatics Association*, vol. 20, no. 3, pp. 563-567, 2013

[10]. Understanding Support Vector Machine algorithm from examples www.analyticsvidhya.com/blog/2017/09/understaing-support-vector-machine-example-code

[11]. https://www.analyticsvidhya.com/blog/2017/09/naive-bayes- explained/