

What’s in a Name? A Cost-Effectiveness Analysis of the Noninvasive Follicular ThyroidNeoplasm with Papillary-Like Nuclear Features (NIFTP) Nomenclature Revision

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Abstract

Background: The noninvasive subtype of encapsulated follicular variant of papillary thyroid carcinoma (eFVPTC) has recently been reclassified as noninvasive follicular thyroid neoplasm with papillary-like nuclear features (NIFTP) to reflect the indolent behavior and favorable prognosis of the tumor. This terminology change has also de-escalated its management approach from cancer treatment to a more conservative treatment strategy befitting a benign thyroid neoplasm.

Objective: To characterize the reduced healthcare costs and improved quality-of-life from management of NIFTP as a nonmalignant tumor vs. previous management as eFVPTC

Methods: A cost-effectiveness analysis was performed by creating Markov models to simulate two management strategies for NIFTP: 1) de-escalated management of the tumor as NIFTP involving lobectomy with reduced follow-up, 2) management of the tumor as eFVPTC involving completion thyroidectomy/radioactive iodine ablation for some patients and follow-up recommended for carcinoma. The model was simulated for 5 and 20 years following diagnosis of NIFTP.

Results: Over a 5-year simulation period, de-escalated management of NIFTP had a total cost of \$12,380.99 per patient while the more aggressive management of the tumor as eFVPTC had a total cost of \$16,264.03 per patient (saving \$3,883.05 over 5 years). Management of NIFTP provided 5.00 quality adjusted life years, while management as eFVPTC provided 4.98 quality adjusted life years. Sensitivity analyses showed that management of NIFTP always resulted in lower costs and greater quality-adjusted life years (QALYs) over the sensitivity ranges for individual variables. De-escalated management for NIFTP is expected to produce approximately \$6-42 million in cost savings over a 5-year period for these patients and incremental 32-218 QALYs of increased utility in the United States.

Conclusion: The degree of cost savings and improved patient utility of de-escalated NIFTP management compared to traditional management was estimated to be \$3,883.05 and 0.02 QALYs per patient. We demonstrated that these findings persisted in sensitivity analysis to account for variability in recurrence rate, surveillance approaches, and other model inputs. These findings allow for greater understanding of the economic and quality-of-life impact of NIFTP re-classification.

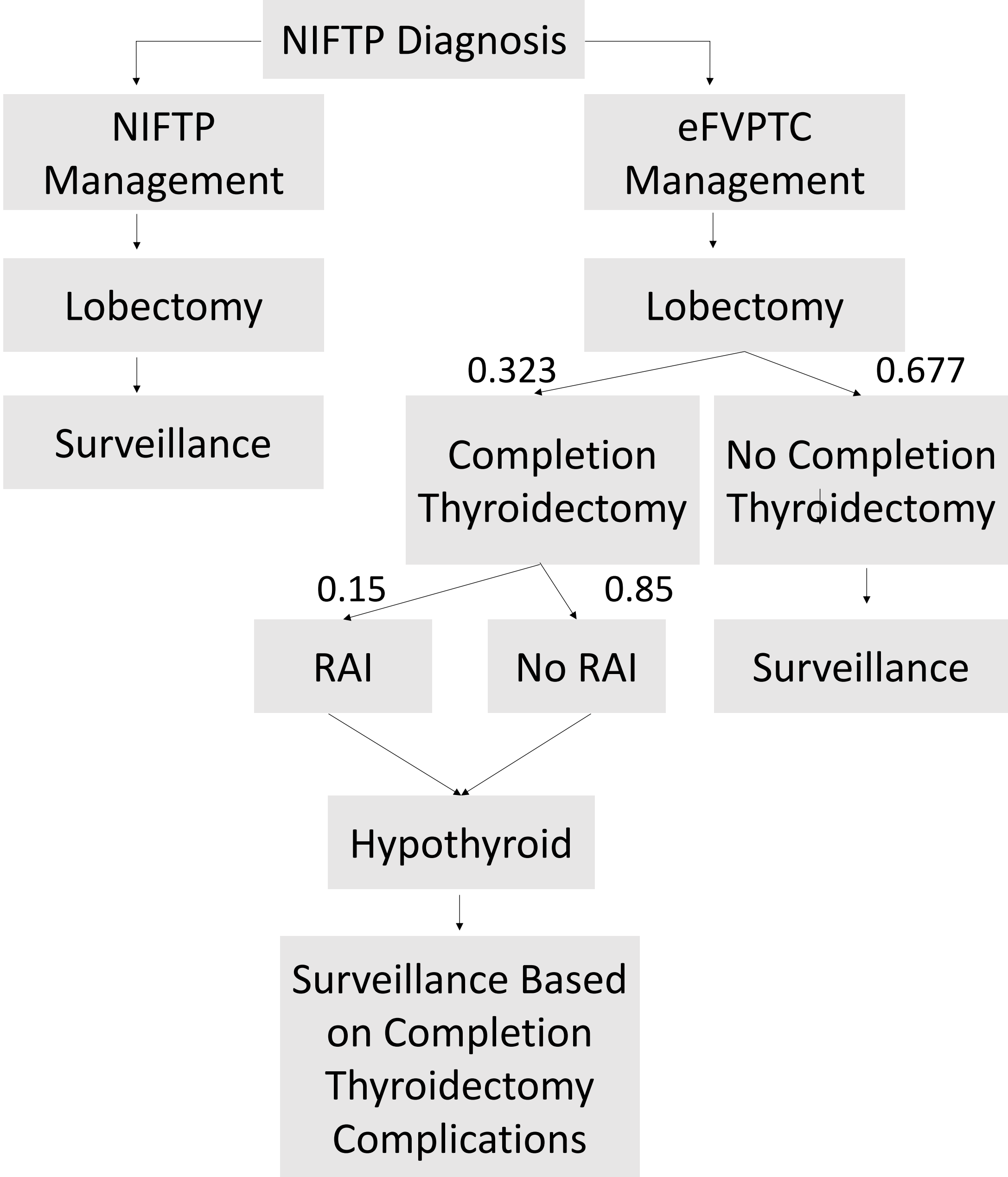
Introduction

In 2016, the term noninvasive follicular thyroid neoplasm with papillary like nuclear features (NIFTP) was proposed to reclassify non-invasive subtype of encapsulated follicular variant of papillary thyroid carcinoma (eFVPTC).¹ The change in nomenclature was suggested to more accurately reflect the indolent nature of the disease and favorable prognosis, a characteristic that has been demonstrated in numerous studies.¹⁻⁵. Revising the nomenclature to remove the designation of “cancer” reduces the psychosocial and financial consequences of a cancer diagnosis and decreases the morbidity by potentially curtailing aggressive treatment.

Encapsulated FVPTC had traditionally been managed similarly to low-risk classical PTC with the majority of guidelines recommending lobectomy.^{6,7}. However, therapeutic intervention has occasionally been more aggressive by incorporating total/completion thyroidectomy +/- radioactive iodine therapy given the malignant diagnosis despite the favorable prognosis.⁸ Thyroid cancer has a large financial impact with an estimated \$1.6 billion in U.S. healthcare costs in 2013 and projected \$3.5 billion in 2030.⁹ Diagnosis, surgery, and adjuvant therapy for newly diagnosed patients (41%) constitutes the greatest proportion of costs, followed by surveillance of survivors (37%).⁹ NIFTP is estimated to affect 45,000 patients annually and accounts for approximately 4.4-9.1% of all PTC cases worldwide, with higher incidence rates in the United States (15-28%) thus creating a measurable impact on the national costs associated with thyroid disease.^{10,11}

A Markov state-transition patient-level model was created in TreeAge Pro Healthcare 2020 to compare de-escalated management of NIFTP vs. management of the tumor as eFVPTC. Each outcome described in the model was represented by a probability. These probabilities were identified from the literature or from expert consensus and aggregated using a pooled analysis. Costs were measured in US dollars and were derived from the fee schedules from the Centers for Medicaid and Medicaid Services and the literature. Costs were inflation-adjusted for the year 2019 and a 3% discount rate was used. Utility values were identified from the literature to characterize different qualities-of-life caused by complications. Total costs and utilities were accrued to quantify differences between the two management strategies. While incremental cost-effectiveness ratios are typically used to compare management approaches, they were not applicable to this study as NIFTP management was expected to be less costly and more effective. One-way sensitivity analysis was also performed for cost, probability, and utility variables.

Methods



Results & Discussion

The estimated 5-year cost for managing a single NIFTP patient with the traditional eFVPTC approach was \$16,264.03, whereas 5-year cost of managing with a de-escalated NIFTP approach was \$12,380.99. De-escalated management of NIFTP had an incremental cost savings of \$3,883.05 per patient over 5 years (Table 3). Management of NIFTP as NIFTP provided 5.00 QALYs, while management as eFVPTC provided 4.98 QALYs. Thus, de-escalated management of NIFTP had an incremental effectiveness advantage of 0.02 QALYs (Table 3). Given the incidence of NIFTP in the United States is 1,613-10,885 (12.23 per 100,000 in 2017 from SEER explorer * 329,751,497 from US Census census.gov both accessed 6/8/2020 * 4-27% NIFTP rate)¹⁴, de-escalated management is expected to produce approximately \$6 – 42 million in cost savings over a 5-year period for these patients and incremental 32 - 218 QALYs of increased utility in the United States.

One-way sensitivity analyses for incremental cost and incremental effectiveness were performed over the following variables: utilities (hypothyroidism, hypoparathyroidism, and unilateral recurrent laryngeal nerve injury), probabilities (completion thyroidectomy, temporary recurrent laryngeal nerve injury, temporary hypoparathyroidism), and the costs of surgical death. The sensitivity analysis demonstrated that over the ranges of each aforementioned variable, NIFTP management yielded reduced costs as well as greater/equivalent QALYs than traditional eFVPTC management

Variable	5-Year Estimate	5-Year Range	20-Year Estimate	20-Year Range
Cost (\$)				
NIFTP	12,380.99	11,612.94 – 12,715.25	12,380.99	11,612.94 – 16,972.67
eFVPTC	16,264.03	13,243.55 – 16,890.07	21,031.43	17,579.91 – 21,731.68
Difference	3,883.05	1,630.61 – 4,174.83	8,650.45	4,759.01 – 5,966.97
Effectiveness (QALY)				
NIFTP	5.000	-	20.000	-
eFVPTC	4.983	4.919 – 4.995	19.878	19.670 – 19.905
Difference	0.017	0.005 – 0.081	0.122	0.095 – 0.330

Discussion

The degree of cost savings and improved patient utility of de-escalated NIFTP management compared to traditional management was estimated to be \$3,883.05 and 0.017 QALYs per patient. Given the estimated national annual incidence of 10,000 patients diagnosed with NIFTP in the United States, our estimates suggest that de-escalated NIFTP management may result in approximately \$40 million decreased expenditure and 170 QALYs saved annually. We demonstrated that these findings persisted in sensitivity analysis to account for variability in recurrence rate, surveillance approaches, and other model inputs. These findings allow for greater understanding of the economic and quality-of-life impact of NIFTP re-classification.

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