

Thyroid Function Testing: Choosing Unwisely in Saskatchewan

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INTRODUCTION & BACKGROUND

Thyroid dysfunctions are among the most common endocrine disorders in clinical practice. Thyroid dysfunctions (hyperthyroidism and hypothyroidism) are diagnosed based on abnormal levels of thyroid-stimulating hormone (TSH), thyroxine (T4), and triiodothyronine (T3), which comprise the thyroid function tests (TFTs). Current guidelines recommend TSH alone as the optimal test for screening for thyroid dysfunction in most clinical circumstances. A normal TSH result excludes the majority of primary thyroid dysfunction cases, and further testing of T3 and T4 are unnecessary unless clinical condition changes. Unnecessary testing can lead to patient harm and economic burden to the healthcare system. This study aims to evaluate our institution's TFT ordering practices and identify strategies to reduce inappropriate use of TFTs.

OBJECTIVES

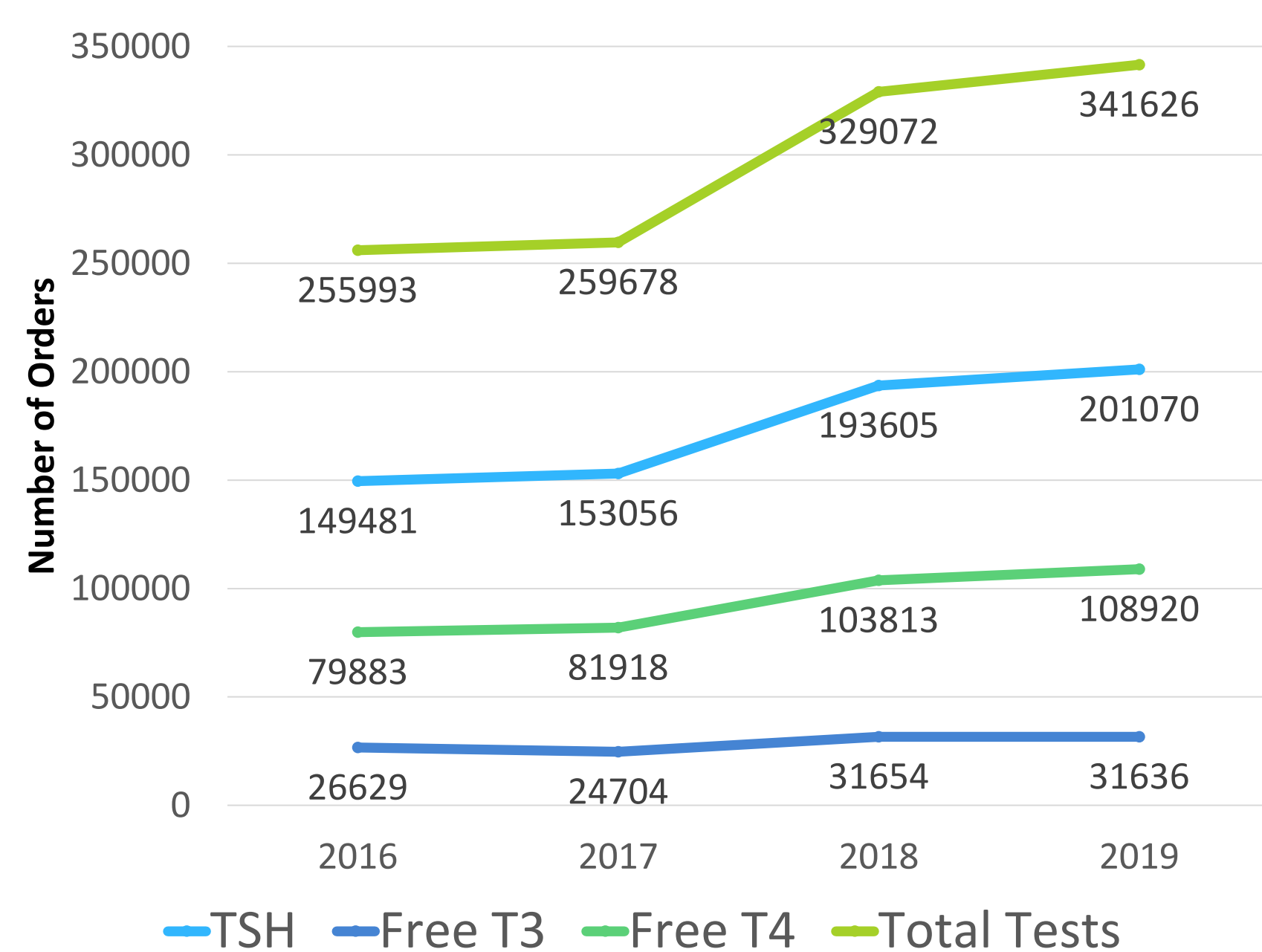
- (1) To evaluate and summarize thyroid function test ordering patterns using retrospective data analysis
- (2) To develop an appropriate ordering algorithm to align ordering practices with recommended guidelines
- (3) To create educational materials to assist with the ordering of thyroid function tests

MATERIALS & METHODS

Our group analyzed deidentified TFT data retrieved from the Saskatoon Laboratory Information System. These TFTs were referred to Saskatoon biochemistry laboratories from January 1, 2016, to December 31, 2019 (4 years). The descriptive data were analyzed and visualized by using the R statistical program.

RESULTS

Figure 1. Total thyroid function tests ordered from 2016 to 2019 in the Saskatoon area.



RESULTS

Estimated cost of thyroid function tests ordered from 2016 to 2019 in the Saskatoon area:

Estimated cost per TFT: **\$5 CAD** (median cost per TFT across different Canadian laboratories)

Total TFTs performed: **1,186,369**

Estimated total cost: **\$5,931,845 CAD**

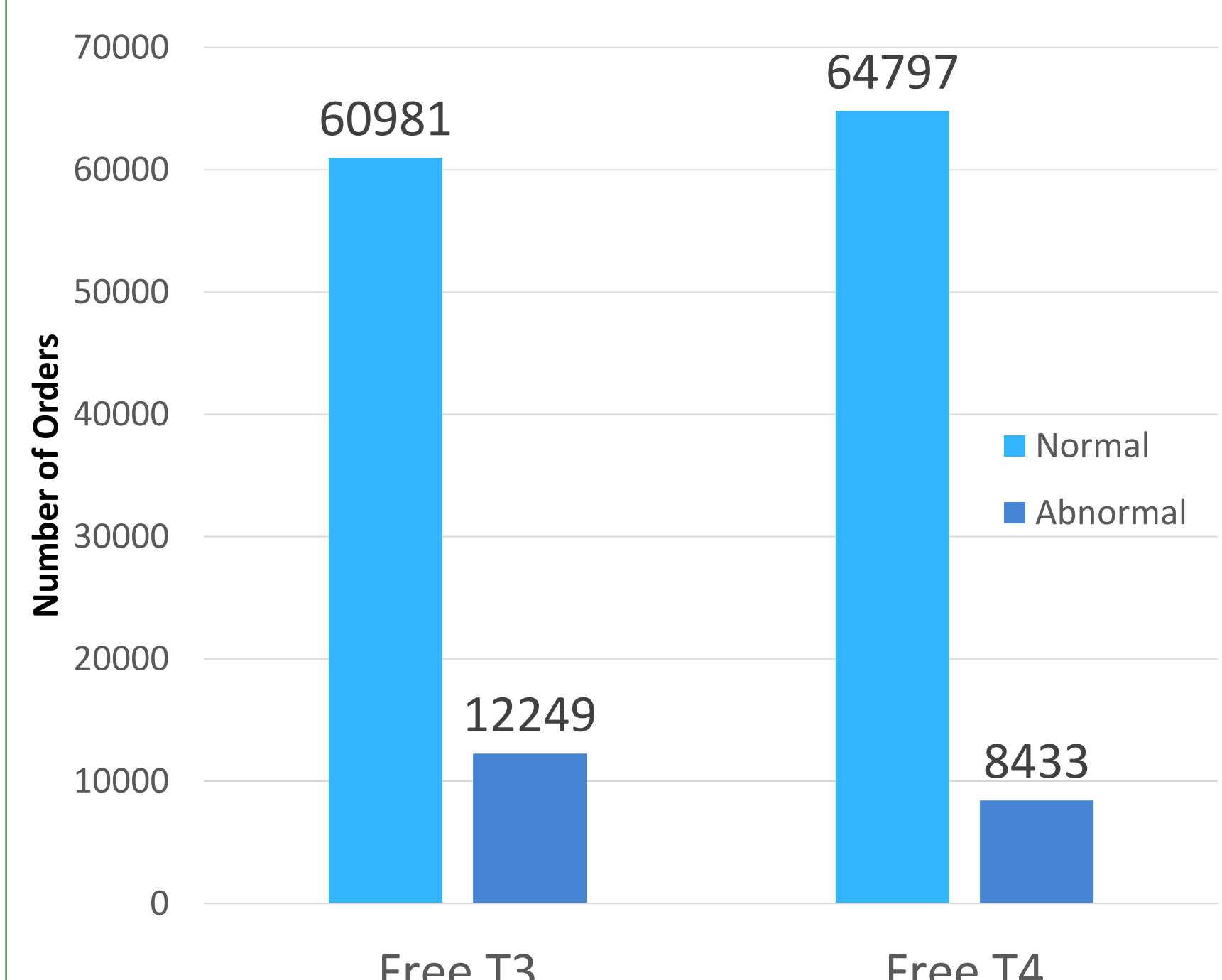
Table 1. Thyroid function test ordering patterns from 2016 to 2019 in the Saskatoon area.

Tests Ordered	Number of Orders	Percentage of Total Orders	Cumulative Number of Tests	Percentage of Total Tests
TSH alone	336,359	46.29	336,359	27.30
FRT3 alone	252	0.03	252	0.02
FRT4 alone	1,216	0.17	1,216	0.10
TSH and FRT3	1,217	0.17	2,434	0.20
TSH and FRT4	270,284	37.20	540,568	43.88
FRT3 and FRT4	773	0.11	1,546	0.13
TSH, FRT3, and FRT4	116,523	16.04	3,495,69	28.38

Table 2. Results of thyroid function tests ordered from 2016 to 2019 in the Saskatoon area.

Year	TSH		Free T3		Free T4	
	Normal	Abnormal	Normal	Abnormal	Normal	Abnormal
2016	82.2%	17.8%	87.6%	12.4%	87.4%	12.6%
2017	82.2%	17.8%	85.9%	14.1%	87.3%	12.7%
2018	85.5%	14.5%	70.5%	29.5%	87.4%	12.6%
2019	86.1%	13.9%	75.0%	25.0%	86.1%	13.9%

Figure 2. Results of free thyroid hormone tests which followed normal TSH tests from 2016 to 2019 in the Saskatoon area.



RESULTS

Figure 3. Repeat thyroid function tests ordered from 2016 to 2019 in the Saskatoon area.

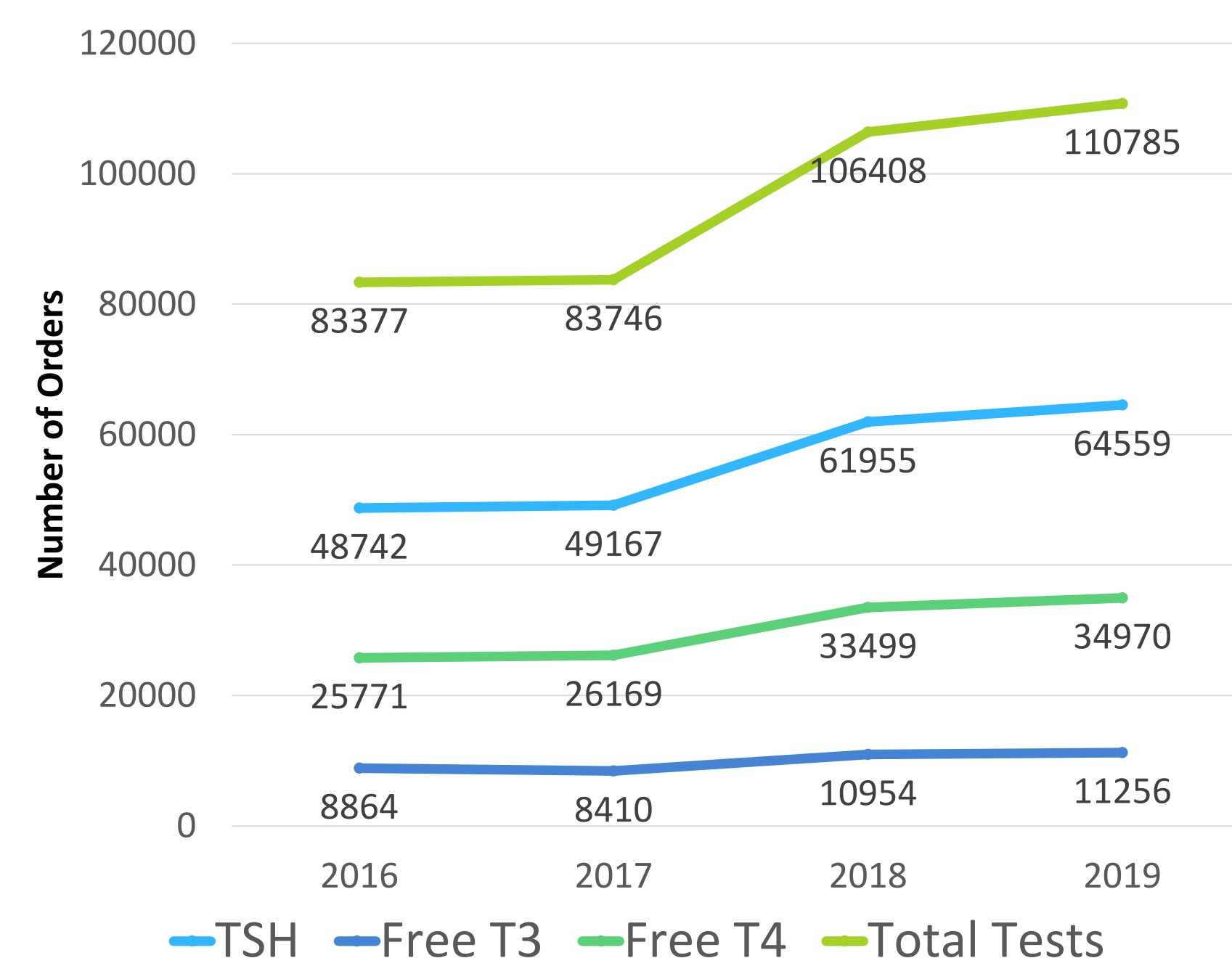


Table 3. Initial TSH test results which led to repeat TSH testing from 2016 to 2019 in the Saskatoon area.

Year	Number of Ordered Tests		Percentage of Ordered Tests	
	Normal	Abnormal	Normal	Abnormal
2016	2,0536	7,252	73.9%	26.1%
2017	23,223	5,003	82.3%	17.7%
2018	27,976	7,668	78.5%	21.5%
2019	29,288	7,702	79.2%	20.8%

Figure 4. Repeat TSH test results for normal initial TSH tests from 2016 to 2019 in the Saskatoon area.

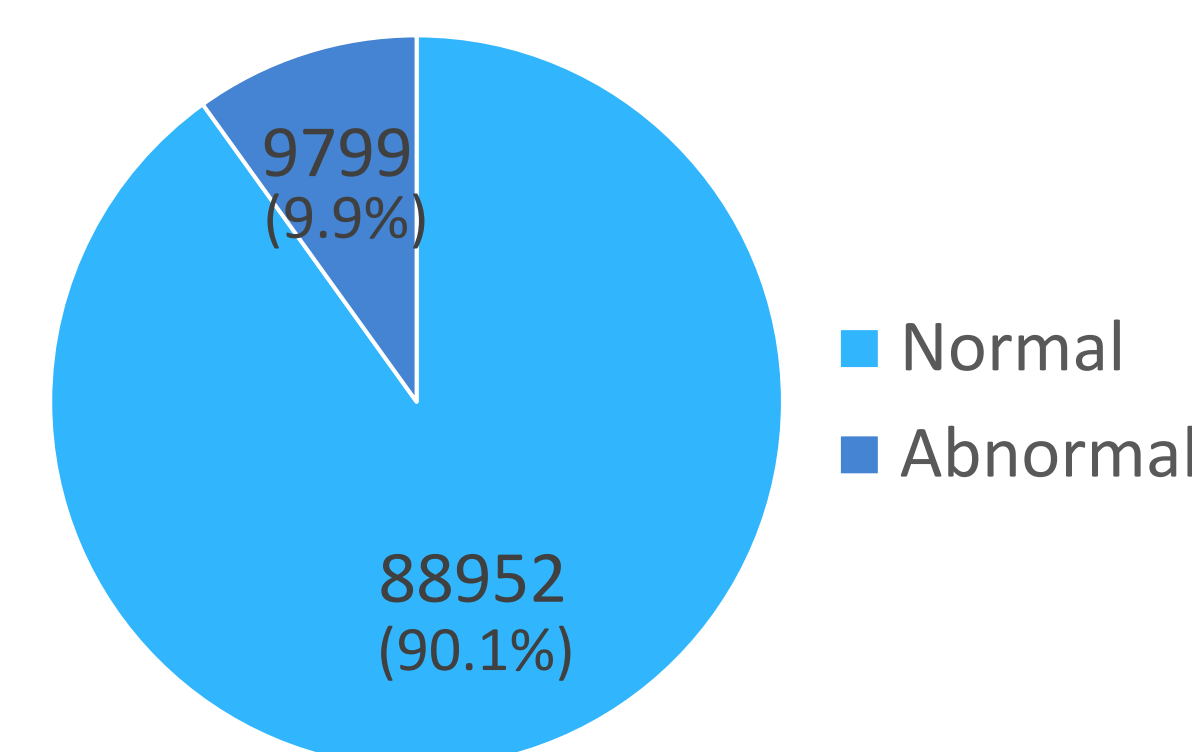
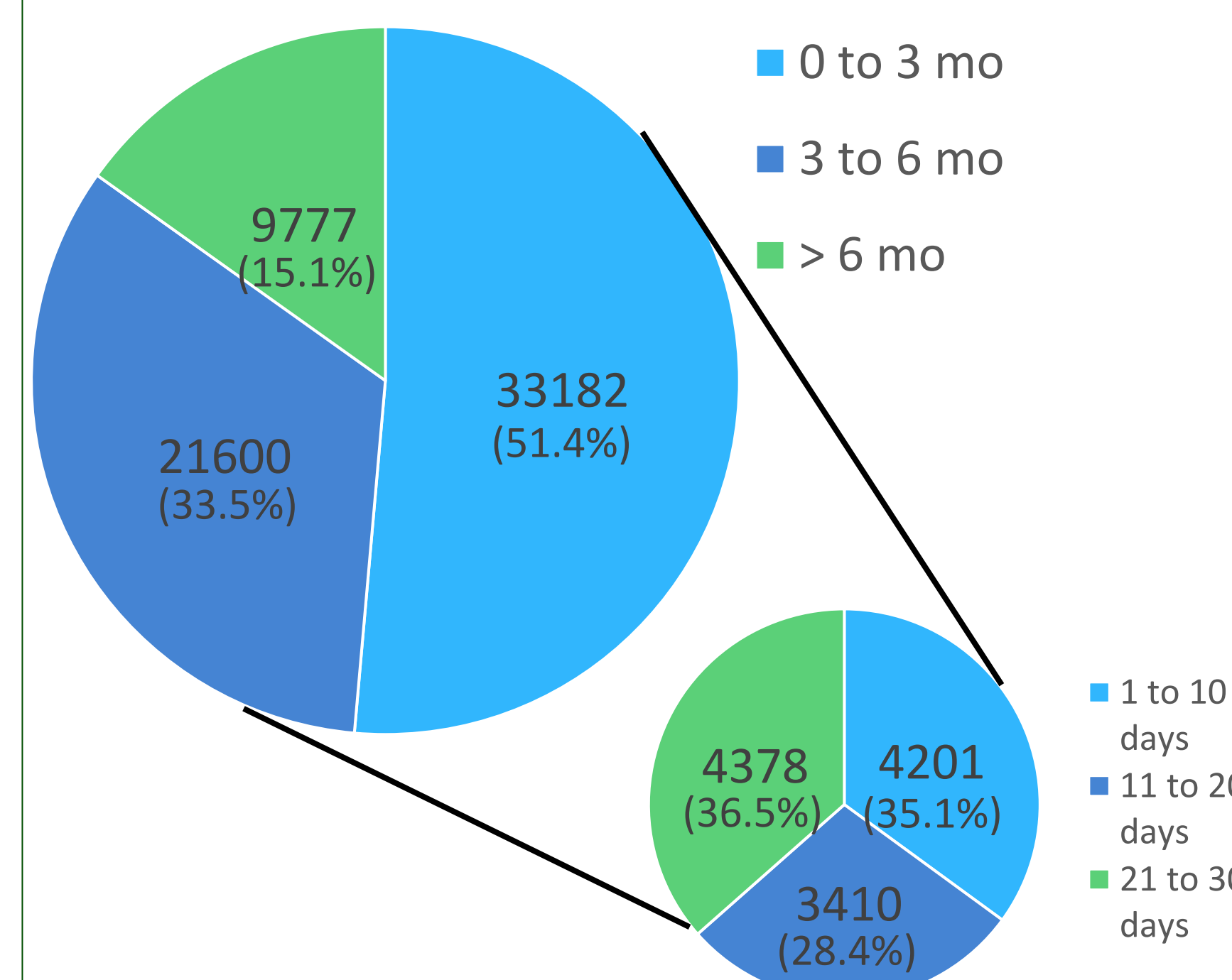
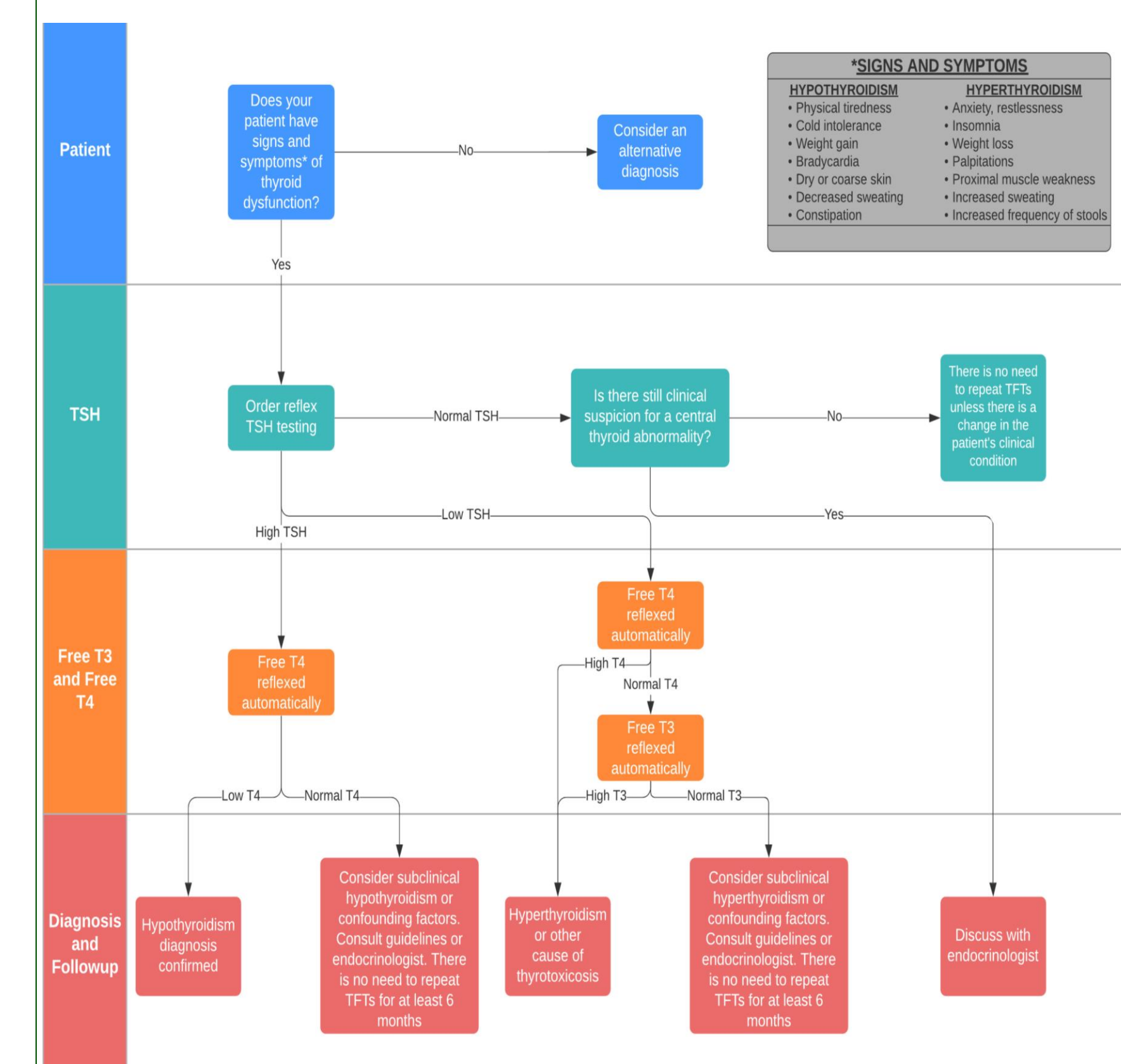


Figure 5. Repeat TSH tests ordered by time interval from initial test in 2019 in the Saskatoon area.



PROPOSED TESTING ALGORITHM

Figure 6. Thyroid function test ordering flowchart based on current ordering patterns, existing guidelines, and a revised laboratory reflex algorithm.



SUMMARY & FUTURE DIRECTION

The primary problems identified were (1) high volumes of TFTs, (2) TFTs ordered in combinations instead of primary TSH testing, and (3) inappropriate repeat TSH testing. Based on these findings and existing guidelines, a TFT flowchart was created based on a laboratory reflex algorithm. These data indicate a need to evolve a standard practice protocol with the involvement of clinical departments to rationalize the testing behaviour of clinicians about thyroid dysfunction. Once revised algorithms and educational materials are implemented into practice, post-intervention evaluation will need to be performed. Improving the appropriateness of TFT requisitions will definitely lead to more cost-effectiveness and enhance the sustainability of the healthcare system.

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