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## Modeling Remnant Ablation Protocols in Thyroid Cancer

Thyroidectomy of pediatric and adult patients with differentiated thyroid cancer is typically followed by radioactive iodine treatment to ablate thyroid remnants. A common protocol for this followup treatment is to give replacement thyroid hormone  $T_4$  after surgery as the patient recovers, and then withdraw replacement hormone for 2-3 weeks to raise TSH levels to 30 mU/L or higher, as radioiodine uptake is improved when TSH levels are high. Patients may be quite sick and impaired during these several weeks, due to the severe clinically hypothyroid condition generated. To explore whether this protocol can be improved, we adapted a physiologically based ODE model of adult hypothalamic-pituitary-thyroid axis regulation to incorporate severe hypothyroid effects, as well as adjusting the parameters to model pediatric thyroid cancer using pediatric clinical data. We simulated a range of replacement protocols to establish withdrawal times needed to raise TSH levels  $> 30$  mU/L, each for a range of tissue remnant percentages based on typical clinical remnants after thyroidectomy. We found that use of  $T_3$ -only after thyroidectomy, rather than  $T_4$ , can substantially reduce the withdrawal time needed prior to radioiodine ablation therapy, thereby decreasing patient morbidity.