Hypothyroidism Treatment: A Regression Discontinuity Approach Manuel Hoffmann* Manuel Hoffmann Hsu-Hang Yeh Pascal Geldsetzer

Hypothyroidism is affecting millions of adults globally. It is the underproduction of thyroid hormone which manifests itself through symptoms such as fatigue, depression, and impaired memory. Hypothyroidism is diagnosed based on blood tests and commonly treated with the oral medication levothyroxine. To guide doctors when to diagnose and to prescribe, laboratories label their tests with recommended cutoffs which are evident to the physicians upon return. However, little is known whether the prescription for patients close to these cutoffs is beneficial. In this study, we use quasi-random laboratory test variation via a novel regression discontinuity approach to first provide clean evidence of a jump in prescriptions of levothyroxine around the cutoffs. In the second step, we estimate the local average treatment effect from levothyroxine on health outcomes and costs. We use an initial dataset of more than 3 million unique patients provided by the United States insurance company Optum. The laboratory blood tests span the years from 2003 to 2020. We select a conservative bandwidth of 1.25 mIU/L around normalized cutoff values from different laboratories where the cutoffs 4.5 mIU/L and 5.5 mIU/L capture over 85% of the tests. Dropping patients with prior hypothyroidism results in over 700,000 unique patients. Within 30 days after the blood test, we find a large 10 pp. (200%) jump in the prescription probability around the normalized cutoff (see Figure). We do not find any significant changes due to levothyroxine on one-, two-, three-, and five-year all-cause hospitalization and mortality. In contrast, we find that diagnoses of secondary hypertension and patient costs increase. We conclude that the prescription of levothyroxine may not provide substantial benefits and may even result in side-effects and only increase patient costs. Our study implies that prescription behavior should be re-evaluated, and higher laboratory thresholds may be beneficial to patients.

Figure: Thyroid stimulating hormone and Levoxythroxine uptake