BRIEF REPORT

Thyroid Hormone Use in the United States, 1997–2016

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Background: Thyroid disorders are among the most commonly treated conditions by the United States health care system. The number of patients reporting thyroid hormone use has increased in recent years, but it is unknown if there have been differential increases in the number of treated individuals within different demographic groups. Previous research has also not evaluated how expenditures for different thyroid hormone medications have changed in recent years.

Methods: Using data from the 1997 through 2016 Medical Expenditure Panel Survey, we calculated the proportion of adults reporting thyroid hormone prescriptions by 3 demographic variables (age, sex, and race) and determined expenditures from thyroid hormone prescriptions by medication type (overall, generic, Synthroid or Cytomel, and other brand).

Results: Between 1997 and 2016, the proportion of adults who reported thyroid hormone use increased from 4.1% (95% CI, 3.7–4.4) to 8.0% (95% CI, 7.5–8.5). Most of the growth in thyroid hormone use occurred among adults aged >65, and use was also more common among females and non-Hispanic whites. Expenditures from thyroid hormones increased from $1.1 billion (95% CI, 0.9–1.3) in 1997 to $3.2 billion dollars (95% CI, 2.9–3.6) in 2016. Generic thyroid hormone prescriptions comprised 18.1% of all thyroid hormone prescriptions in 2004 (95% CI, 15.8–20.4) and 80.8% of all thyroid hormone prescriptions (95% CI, 78.4–83.2) in 2016.

Conclusions: Thyroid hormone use nearly doubled over the last 20 years, and increased use was associated with being older, female, and non-Hispanic white. During the same time period, thyroid hormone expenditures almost tripled. (J Am Board Fam Med 2020;33:284–288.)

Keywords: Data Analysis, Health Expenditures, Health Services Research, Hypothyroidism, Thyroid Diseases, Thyroid Hormones

Introduction

Thyroid hormones are among the most commonly used classes of medications in the United States.1 Although approved by the Food and Drug Administration for numerous conditions, including clinical hypothyroidism, thyroid hormones are also commonly used for unapproved conditions, such as subclinical hypothyroidism, depression, and weight reduction.2 Although the prevalence of overt hypothyroidism is thought to be between 0.2% and 2%, with a stable incidence, the proportion of the adult population who report using a thyroid hormone has increased in recent years.2 We, therefore, sought to characterize the proportion of adult individuals using thyroid hormones by age, sex, and race/ethnicity from 1997 through 2016. We also aimed to describe the costs associated with all thyroid hormone prescriptions between 1997 and 2016 and mean per user expenditures from different thyroid hormone types between 2004 and 2016.

Methods

The 1997 to 2016 Medical Expenditure Panel Survey (MEPS) was used for the analysis.3 The Agency of Health care Research and Quality
sponsors the survey, which is nationally representa-
tive of the noninstitutionalized United States popu-
lation. MEPS collects sociodemographic, medical
condition, and prescription medication information
from 2 overlapping cohorts over 2 years. Prescrip-
tion drug information is reported by indi-
viduals and confirmed through pharmacies. Re-
porting of chronic medications by MEPS partici-
pants has been found to be reliable.4

Our sample included all adult (age, >17) MEPS
participants. Thyroid hormones were identified by
therapeutic subgroup (Multum therapeutic sub-
class #1 [TC1S1] = 103) and confirmed with pre-
scription drug names. We differentiated thyroid
hormone medications by prescription drug name as
Synthroid and Cytomel, other brand, or generic
prescriptions starting in 2004, when generic levo-
thyroxine was available.

Thyroid hormone expenditures included out-of-
pocket and insurance payments. Expenditures were
inflation adjusted to 2016 US dollars by using the
Consumer Price Index.5

Adjusted Wald tests were used to determine if
there were statistically significant differences in the
proportion of medication users and medication
expenditures at different time points. A multivar-
iable logistic regression model that included age,
sex, and interaction terms between these 3
variables compared the proportion of thyroid hor-
mone users by age and sex during 1997 to 1999 and
2014 to 2016. Another model that included these
same variables but added race/ethnicity, year, and
an interaction term between race/ethnicity and year
investigated thyroid hormone use by race/ethnicity
during 1997 to 2016. Each model was followed by
postprediction average marginal effects.

The OhioHealth Institutional Review Board
ruled this study exempt. Stata, version 15, with sur-
vey weights applied, was used for the analysis. Four
outliers (>$2500/year) were excluded from expend-
iture estimates. P values less than .01 were consid-
ered statistically significant.

Results
Based on the 470,067 adults in our sample, we
found that the proportion of the US population
who reported thyroid hormone use increased from
4.1% (95% CI, 3.7–4.4) in 1997 to 8.0% (95% CI,
7.5 to 8.5) in 2016 (P <.001) (Figure 1a). Use gen-
erally increased with increasing age, but the growth
in utilization between 1997 to 1999 and 2014 to
2016 was predominantly among individuals older
than 65 years of age. Use was also higher among
women than men (Figure 1b) and higher among
non-Hispanic whites (Figure 1c) than non-
Hispanic blacks and Hispanics. However, the
increase was not significantly different between
non-Hispanic whites and non-Hispanic blacks
(adjusted odds ratio [aOR] interaction term 1.01
[95% CI, 0.99–1.03], P = .29) or Hispanics (aOR
interaction term 1.00 [95% CI, 0.99–1.02], P = .74).

Thyroid hormone expenditure increased from
$1.1 billion (95% CI, 0.9–1.3) in 1997 to $3.2 bil-
lion (95% CI, 2.9–3.6) in 2016 (Figure 2a). Mean
annual per user expenditures followed a similar pat-
tern as overall expenditures (Figure 2b). Mean user
brand and generic thyroid hormone expenditures
increased toward the end of the study, with generic
thyroid hormone increasing from $64.6 per year
(95% CI, 60.3–68.9) in 2010 to $123.0 per year
(95% CI, 113.4–132.7) in 2016 (P <.001) (Figure
2b). The proportion of thyroid hormone users who
reported using generic thyroid hormone increased
to 80.8% (95% CI, 78.4–83.2) in 2016 from 18.1%
(95% CI, 15.8–20.4) in 2004 (Figure 2c).

Discussion
This study found that between 1997 and 2016 thy-
roid hormone use increased among all US adults.
Thyroid hormone use was associated with being
non-Hispanic white, female, and elderly. During
the same time interval, thyroid hormone expendi-
tures almost tripled.

Because our data source did not include informa-
tion on the specific indications for initiating thyroid
hormone treatment, we were unable to determine
why there was an increase over time in overall thy-
roid hormone use. However, previous research
strongly implies that recent increases in thyroid hor-
mone use are predominantly from a rise in the treat-
ment of subclinical hypothyroidism rather than
overt hypothyroidism. Subclinical hypothyroidism is
notably more common than overt hypothyroidism
and is unlikely that around 8% of the population has
overt hypothyroidism. In addition, research using
data from the National Health and Nutrition
Examination Survey showed that thyroid-stimulat-
ing hormone (TSH) values are greater among
females, increase with age, and are higher in non-
Hispanic whites than Mexican Americans and

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Figure 1. Top (1a): The figure identifies the proportion of US adults who reported filling a thyroid hormone replacement prescription in a calendar year between 1997 and 2016. Center (1b): Estimated proportion of US adults from 1997 to 1999 and 2014 to 2016 who reported thyroid hormone replacement by age and sex. Estimates were calculated using postprediction average marginal effects after performing the multivariable logistic regression described in the Methods section. Bottom (1c): Predicted proportion of population between 1997 and 2016 that reported thyroid hormone replacement by race/ethnicity, adjusted for age and sex. Error bars represent 95% CIs. Abbreviation: CI, Confidence interval.
African Americans. Higher TSH values among females, older individuals, and non-Hispanic whites combined with the trend toward initiating thyroid hormone treatment among individuals with lower median TSH levels, which was demonstrated in a study performed in the United Kingdom, may together explain why both overall thyroid hormone prescriptions and thyroid hormone prescriptions within certain demographic groups have increased over time.

If the increase in thyroid hormone use among US adults was truly from increases in the treatment of subclinical hypothyroidism, thyroid hormone use within the US adult population merits critical scrutiny because of the uncertain benefits from treating subclinical hypothyroidism and the substantial cost to our health care system from thyroid hormone prescriptions. There is no strong evidence to suggest that thyroid supplementation for patients with subclinical hypothyroidism results in improved cardiovascular or survival outcomes, quality of life, cognitive function, blood pressure, or body mass index. Moreover, despite increases in the proportion of generic thyroid hormone prescriptions over time, total expenditures on thyroid hormones increased steadily between 1997 and 2016. These increases were likely related to a greater number of individuals being prescribed a thyroid hormone and recent increases in per person expenditures from both brand name and generic thyroid hormone prescriptions.

This study’s limitations included the use of self-reported medications, lack of controlling for pharmaceutical rebates (which are not thought to flow back to the payer for most generic medications), and potential misclassification of brand versus generic levothyroxine. Moreover, because of the cross-sectional nature of MEPS and its lack of

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Thyroid Hormone Use in the United States, 1997–2016
laboratory data, we were unable to determine if the differential increases in thyroid hormone was due to increases in treatment for overt or subclinical hypothyroidism. In addition, we were also not able to add information about whether some of the increase in treatment could be related to more individuals being screened for hypothyroidism.

In conclusion, total expenditures on thyroid hormones almost tripled between 1997 and 2016. A disproportionate increase in thyroid hormone use was associated with being female, identifying as non-Hispanic white, and being older.

Michael Johansen had full access to all the study data and takes responsibility for the integrity of the data and the accuracy of the data analysis. The authors have no conflicts of interest to report. No funding was used on this research.

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