

## Cross-sectional association between thyroid health and general health indicators (recent hospitalizations and the number of non-thyroid prescription medications concurrently taken): National Health and Nutrition Survey 1999-2002

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1

## Presenter Disclosures

Yutaka Aoki

*The following personal financial relationships with commercial interests relevant to this presentation existed during the past 12 months:*

No relationships to disclose.

2

## Two Major Thyroid Disorders

- (Euthyroid)
  - Normal thyroid
- Hypothyroidism—**More Common**
  - Underactive thyroid—not enough thyroid hormones
  - Tx: Thyroid hormone replacement therapy (THRT)
- Hyperthyroidism
  - Overactive thyroid—too much thyroid hormones
  - Tx: anti-thyroid

3

## Aim of Study

- Describe cross-sectional association between thyroid health and overall health
- Thyroid health
  - Biochemically-determined hypo/hyperthyroidism (thyroid status)
  - Tx for thyroid disorder
  - Combination thereof

4

## Status-Tx Combinations

		Treatment	
		No THRT	Under THRT
Biochemically-determined thyroid status	Euthyroidism	Healthy Reference	Appropriately-Tx
	Hypothyroidism	Untreated hypothyroidism	Under-Tx
	Hyperthyroidism	Untreated hyperthyroidism	Over-Tx

5

## Two “Overall Health” Indicators

- Hospitalizations during the past 12 months
- Number of prescription medications other than thyroid hormone medications

6

## Study Design

- Cross-sectional
- National Health and Nutrition Examination Survey (NHANES)
  - NHANES 1999-2000 & 2001-2002
- Nationally representative sample of non-institutionalized individuals age 0-85+
- Excluded due to small #:
  - Participants taking med for hyperthyroidism

7

## Predictors

- Thyroid hormone replacement therapy (THRT)
  - Yes/No
  - Interview sample (N = 20983)
- Biochemically-determined hypo/hyper-thyroidism: see *Aoki et al. (2007) Thyroid*
  - Normal/Hypo/Hyper
  - Based on blood TSH
  - Thyroid subsample (N = 4392)

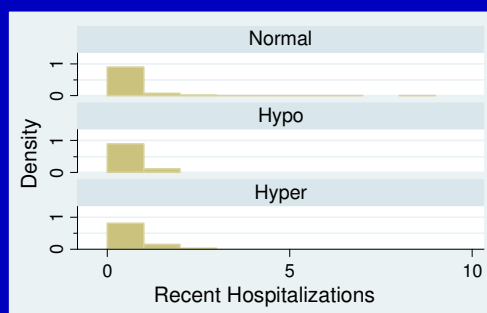
8

## Analysis

- Stata svy suite for complex survey data
  - Proper weighting & variance estimation
- Two outcome variables: both “count” type
- Generalized negative binomial regression
  - Similar to Poisson Regression
  - Over/under-dispersion as function of covariates
  - Effect Measure: rate ratio (RR), e.g.:
 
$$RR = \frac{\text{Mean \# of Rx meds in COMPARISON group}}{\text{Mean \# of Rx meds in REFERENCE group}}$$

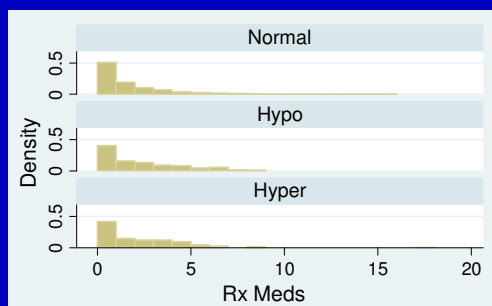
9

## Raw Data: Thyroid Status



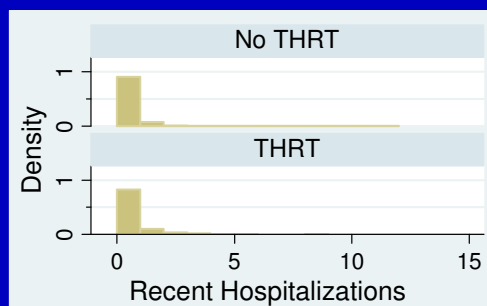
10

## Raw Data: Thyroid Status



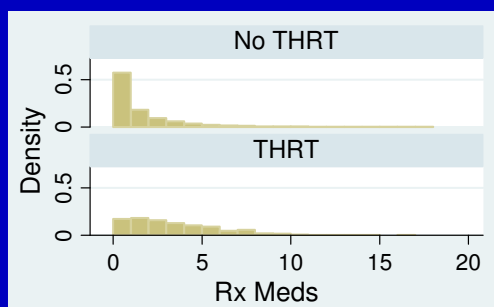
11

## Raw Data: No/Yes THRT



12

### Raw Data: No/Yes THRT



13

### Results: Hospitalization

	Thyroid Status				Treatment for Hypothyroid (THRT)	
	Hypothyroid		Hyperthyroid		RR**	p-value
	RR*	p-value	RR	p-value		
All age, both sex	0.79	0.52	1.35	0.25	<b>1.88</b>	<b>0.01</b>
Age<60, male	0.84	0.86	0.88	0.91	<b>5.03</b>	<b>0.001</b>
Age<60, female	0.97	0.96	1.22	0.49	<b>2.09</b>	<b>0.04</b>
Age≥60, male	0.91	0.85	1.76	0.36	1.68	0.26
Age≥60, female	0.45	0.24	1.74	0.14	1.47	0.14

\* Adjusted for race (& age-sex, for "All age, both sex")  
 \*\* p for age-sex subgroup difference = 0.02

14

### Results: Number of Rx meds taken

	Thyroid Status				Treatment for Hypothyroid (THRT)	
	Hypothyroid		Hyperthyroid		RR**	p-value
	RR*	p-value	RR	p-value		
All age, both sex	1.04	0.69	1.05	0.70	<b>1.50</b>	<b>1*10<sup>-28</sup></b>
Age<60, male	0.98	0.95	1.45	0.55	<b>2.45</b>	<b>0.001</b>
Age<60, female	0.94	0.76	0.92	0.77	<b>2.38</b>	<b>2*10<sup>-110</sup></b>
Age≥60, male	1.27	0.16	1.38	0.09	<b>1.29</b>	<b>0.02</b>
Age≥60, female	1.00	0.99	0.95	0.67	<b>1.22</b>	<b>0.003</b>

\* Adjusted for race (& age-sex, for "All age, both sex")  
 \*\* p for age-sex subgroup difference = 0.00001

15

### Thyroid Status-Tx Combination: All Ages, Both Sexes

Biochemically-determined Thyroid Status	No THRT		Receiving THRT	
	RR*	p-value	RR	p-value
<b>Recent Hospitalization</b>				
Euthyroid	1	(Ref)	1.20	0.59
Hypothyroid	0.93	0.85	0.29	0.07
Hyperthyroid	1.61	0.07	0.91	0.85
<b># of Rx meds taken</b>				
Euthyroid	1	(Ref)	<b>1.63</b>	<b>2*10<sup>-6</sup></b>
Hypothyroid	0.90	0.52	<b>1.74</b>	<b>2*10<sup>-5</sup></b>
Hyperthyroid	1.01	0.91	1.31	0.12

\* Adjusted for race & age-sex combination

16

### Tx-Hospitalization: Odd Results for Thyroid subsample

	Receiving THRT (vs. No THRT)	
	RR*	p-value
Total Sample	<b>1.88</b>	<b>0.01</b>
Thyroid subsample	0.97	0.92
Total Sample – Thyroid subsample	<b>2.17</b>	<b>0.006</b>

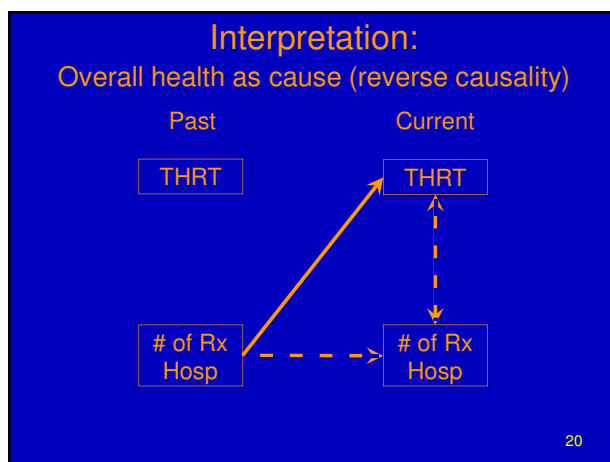
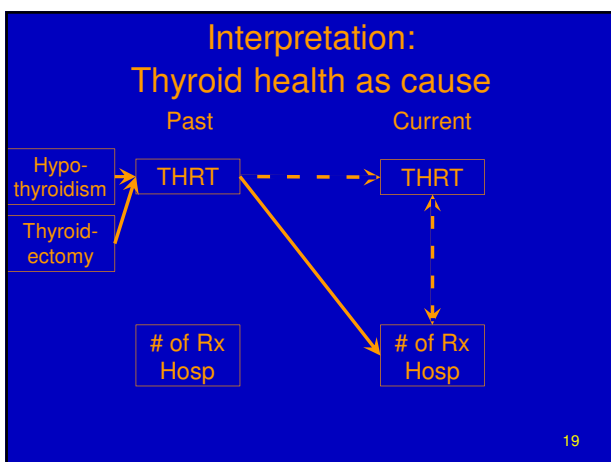
\* Adjusted for race & age-sex combination

17

### Main Results

- THRT (vs. no treatment) associated w/
  - ↑ Hospitalizations
  - ↑ # of Rx meds
- Hypo/Hyper-thyroidism NOT associated w/
  - Hospitalizations nor # of Rx meds
- THRT with hypo or euthyroidism (vs. no THRT with euthyroidism) associated w/
  - ↑ # of Rx meds

18

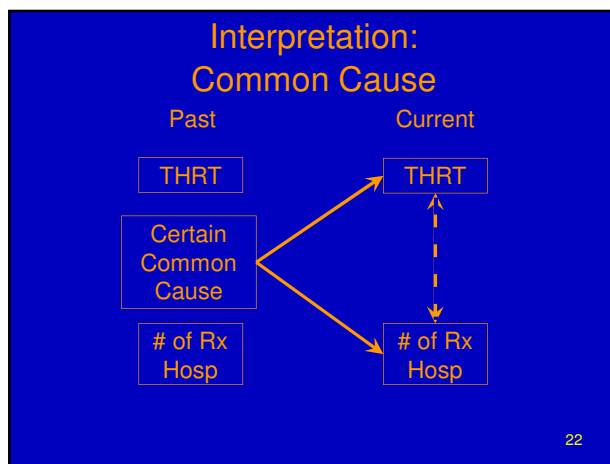


### THRT w/ thyroid disorder Dx of 2 years or longer (vs. No THRT)

	Hospitalizations		Number of Rx meds	
	RR*	p-value	RR	p-value
All age, both sex	1.38	0.08	1.49	2*10 <sup>-9</sup>
Age<60, male	3.34	0.006	2.18	0.006
Age<60, female	1.18	0.58	2.51	1*10 <sup>-9</sup>
Age≥60, male	1.45	0.32	1.24	0.10
Age≥60, female	1.33	0.38	1.18	0.01

\* Adjusted for race (& age-sex, for "All age , both sex")  
p for subgroup difference = 0.19 and 0.00002, respectively

21



## Conclusion

- Individuals receiving THRT, compared to those not receiving THRT, are taking 1.5 times greater number of prescription medications other than THRT meds.
  - Not only for those undertreated, also for "controlled"
- Males age under 60 receiving THRT, compared to those not receiving THRT, may be at higher risk for hospitalization.
  - Awaits longitudinal confirmation

23