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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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.

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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

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Aim of Study

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

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Status-Tx Combinations

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

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Two "Overall Health" Indicators

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

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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

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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)

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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.:

$$RR = \frac{Mean\ \#\ of\ Rx\ meds\ in\ COMPARISON\ group}{Mean\ \#\ of\ Rx\ meds\ in\ REFERENCE\ group}$$

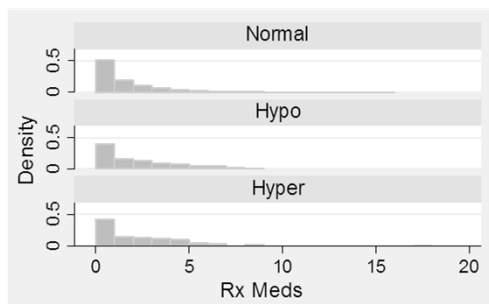9

Raw Data: Thyroid Status
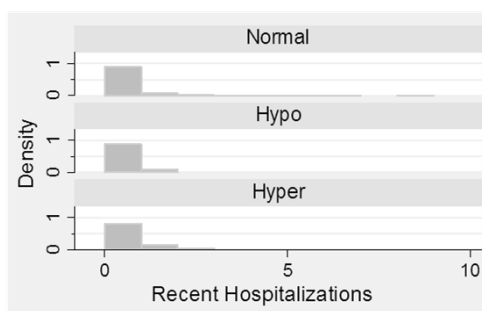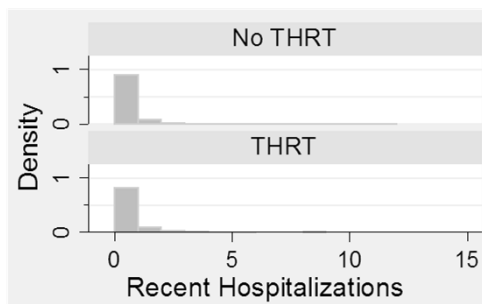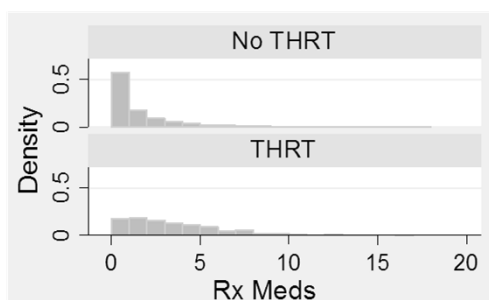

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Raw Data: Thyroid Status

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Raw Data: No/Yes THRT

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Raw Data: No/Yes THRT

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Results: <u>Hospitalization</u>

	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	**1.88**	**0.01**
Age<60, male	0.84	0.86	0.88	0.91	**5.03**	**0.001**
Age<60, female	0.97	0.96	1.22	0.49	**2.09**	**0.04**
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

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Results: <u>Number of Rx meds taken</u>

	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	**1.50**	**$1*10^{-8}$**
Age<60, male	0.98	0.95	1.45	0.55	**2.45**	**0.001**
Age<60, female	0.94	0.76	0.92	0.77	**2.38**	**$2*10^{-10}$**
Age≥60, male	1.27	0.16	1.38	0.09	**1.29**	**0.02**
Age≥60, female	1.00	0.99	0.95	0.67	**1.22**	**0.003**

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

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Thyroid Status-Tx Combination: All Ages, Box Sexes

Biochemically-determined Thyroid Status	No THRT		Receiving THRT	
	RR*	p-value	RR	p-value
Recent Hospitalization				
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
# of Rx meds taken				
Euthyroid	1	(Ref)	**1.63**	**$2*10^{-6}$**
Hypothyroid	0.90	0.52	**1.74**	**$2*10^{-5}$**
Hyperthyroid	1.01	0.91	1.31	0.12

* Adjusted for race & age-sex combination

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Tx-Hospitalization: Odd Results for Thyroid subsample

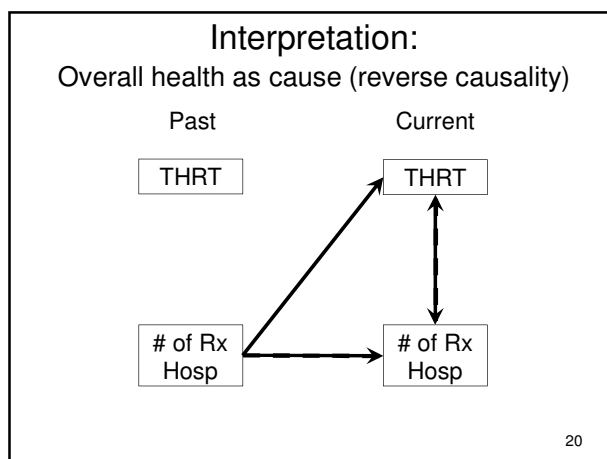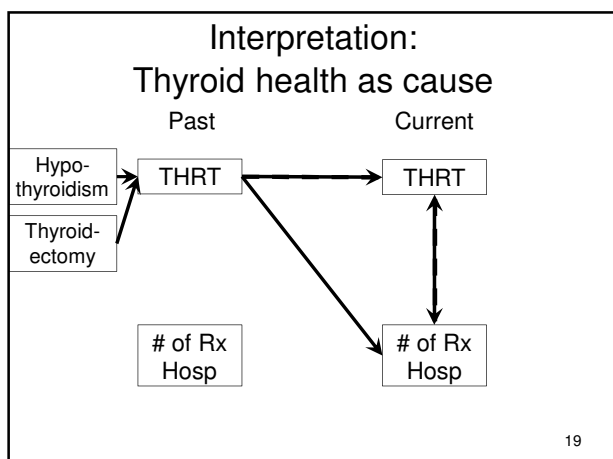|	Receiving THRT (vs. No THRT)	
	RR*	p-value
Total Sample	**1.88**	**0.01**
Thyroid subsample	0.97	0.92
Total Sample – Thyroid subsample	**2.17**	**0.006**

* Adjusted for race & age-sex combination

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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/
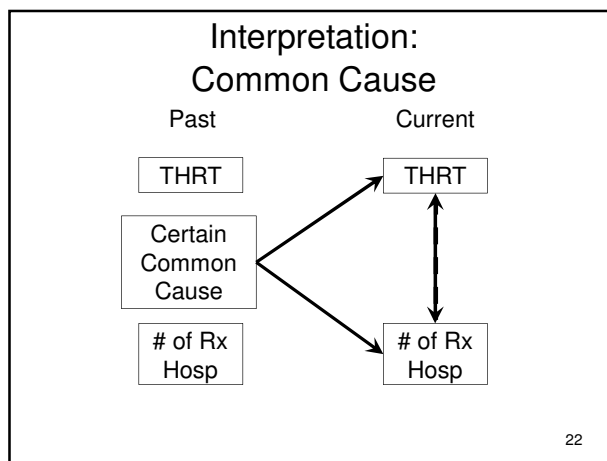 - ↑ # of Rx meds

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Interpretation: Thyroid health as cause

Past | Current

Hypo-thyroidism → THRT → THRT

Thyroid-ectomy →

# of Rx Hosp

# of Rx Hosp

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Interpretation: Overall health as cause (reverse causality)

Past | Current

THRT | THRT

# of Rx Hosp | # of Rx Hosp

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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**	**$2*10^{-8}$**
Age<60, male	**3.34**	**0.006**	**2.18**	**0.006**
Age<60, female	1.18	0.58	**2.51**	**$1*10^{-9}$**
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

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Interpretation: Common Cause

Past | Current

THRT | THRT

Certain Common Cause

# of Rx Hosp | # of Rx Hosp

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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

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