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Intensification at a Cost: Where is the Biggest Bang for the Buck?

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June 25, 2010

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Supported by the Agency for Health Care Research and Quality (R21HS017628) and the National Science Foundation (CMMI-844511)

Disclosure: No Conflict of Interest

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Summary

- Measuring efficiency
- Treatment guidelines
- Models
- Relative vs. absolute efficiency

Measuring Efficiency of Treatment

(“Bang” vs. “Buck”)

Measuring the "Buck"

- U.S. health spending grew 5.7% in 2009
- 10% of cost attributed to medication

National Health Expenditures (NHE), Aggregate and Per Capita Amounts, And Share Of Gross Domestic Product (GDP), Selected Calendar Years 2007–2019

Spending category	2007	2008	2009[a]	2010[a]	2014[a]	2019[a]
NHE (billions)	$2,239.7	$2,338.7	$2,472.2	$2,569.6	$3,225.3	$4,482.7
NHE per capita	$7,423.1	$7,680.7	$8,046.7	$8,289.9	$10,048.0	$13,387.2
Population (millions)	301.7	304.5	307.2	310.0	321.0	334.8
GDP, billions of dollars	$14,077.6	$14,441.4	$14,282.5	$14,853.8	$18,488.2	$23,283.0
NHE, billions of 2005 dollars[d]	$2,108.7	$2,155.9	$2,249.7	$2,308.3	$2,674.1	$3,301.0
Chain-weighted GDP price index	1.06	1.08	1.10	1.11	1.21	1.36
PHC deflator[e]	1.07	1.10	1.14	1.17	1.32	1.58
NHE as percent of GDP	15.9%	16.2%	17.3%	17.3%	17.4%	19.3%

Source: Truffer, C.J., et al, 2010, "Health Spending Projections Through 2019: The Recesssion's Impact Continues, *Health Affairs*, 29(3): 522 - 529

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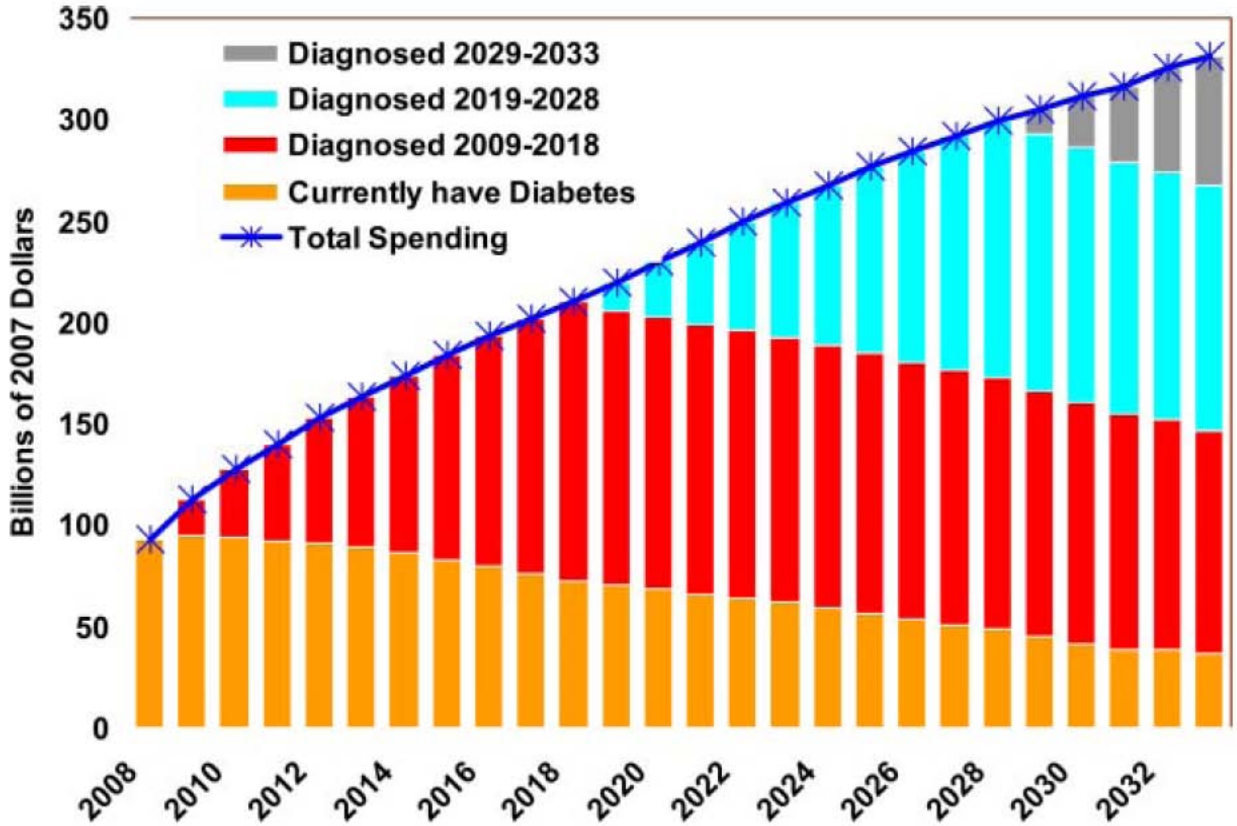
Measuring the "Buck"



Source: Huang et al, 2009, "Projecting the Future Diabetes Population and Related Costs for the U.S.", Diabetes Care, 32: 2225-2229, 2009

Measuring the “Bang”

- Cost avoidance
  - Hospital costs
  - Long term follow-up care costs
- Benefits to the Patient
  - Time to event
  - Quality adjusted life year (QALYs)
- Burden of treatment

Perspectives on Efficiency

- Patient
  - Maximize time to event
- Third-party Payer
  - Minimize cost
- Society
  - Balance between patient and payer perspectives

Treatment Guidelines

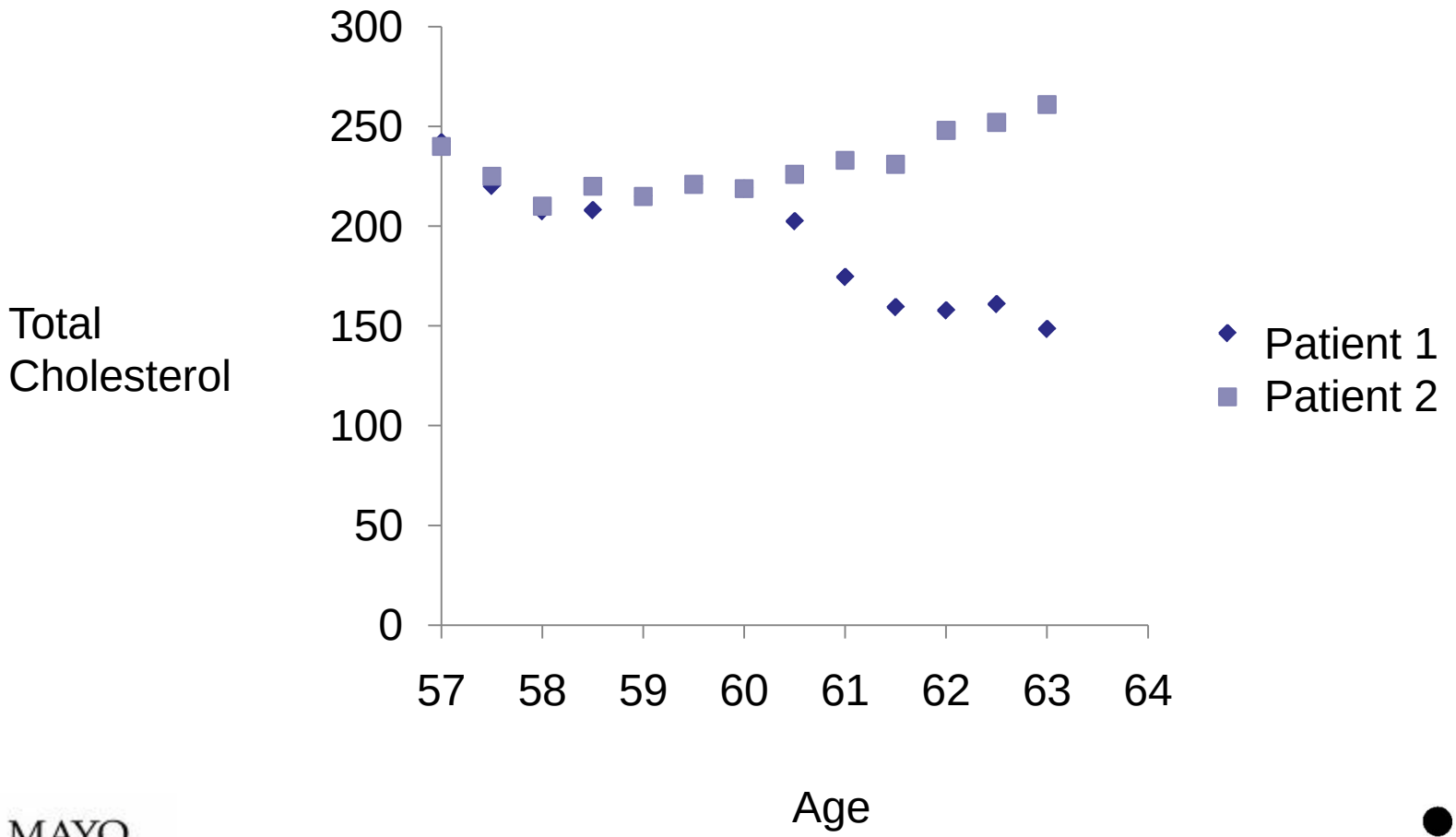
U.S. ATP III Guideline

- Raises diabetes to CHD risk equivalent

Risk Category	LDL Goal	LDL Level at Which to Initiate Therapeutic Lifestyle Changes (TLC)	LDL Level at Which to Consider Drug Therapy
CHD or CHD Risk Equivalents (10-year risk >20%)	<100 mg/dL	≥100 mg/dL	≥130 mg/dL (100-129 mg/dL: drug optional)*
2+ Risk Factors (10-year risk ≤20%)	<130 mg/dL	≥130 mg/dL	10-year risk 10-20%: ≥130 mg/dL 10-year risk <10%: ≥160 mg/dL
0-1 Risk Factor†	<160 mg/dL	≥160 mg/dL	≥190 mg/dL (160-189 mg/dL: LDL-lowering drug optional)

Source: Third report on the National Cholesterol Education Program Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III), NIH Publication No. 01-3670, 2001

Cholesterol



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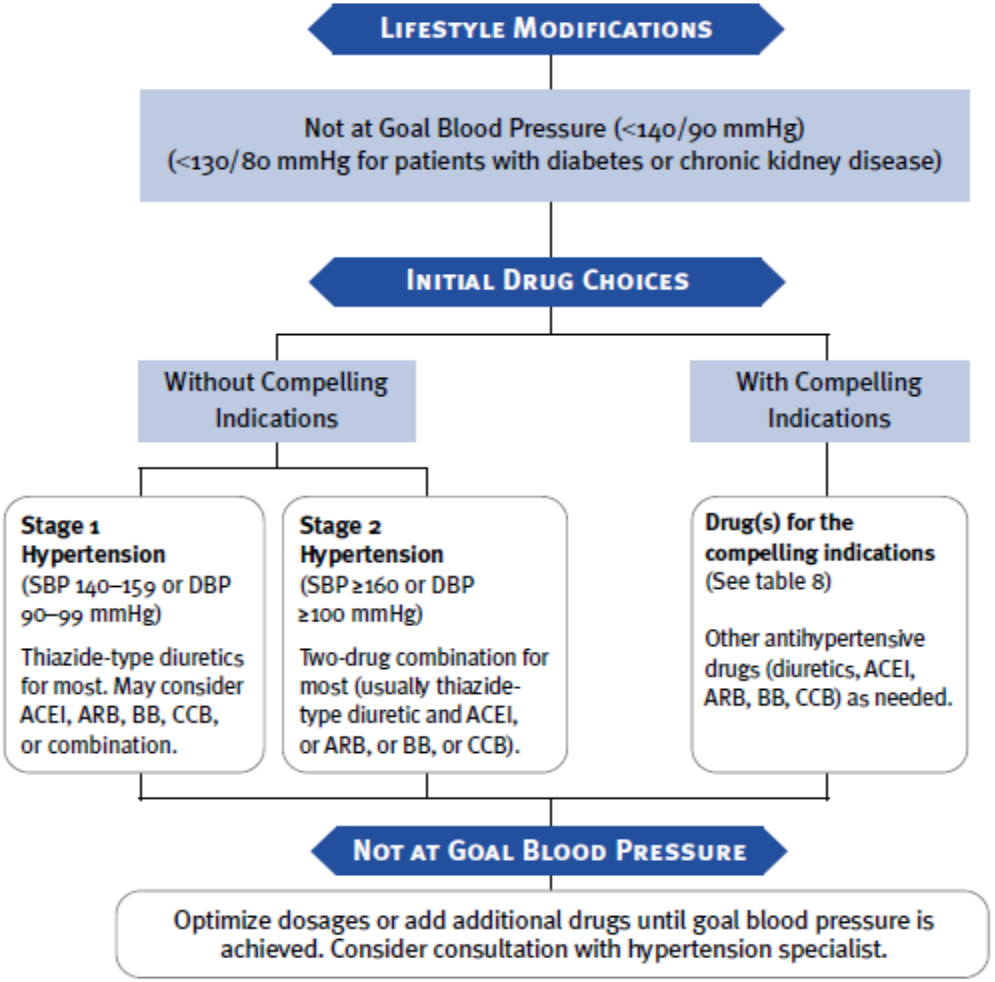

Source: The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure, NIH Publication No. 03-5233, 2003

Current Guidelines

- Problems with diabetes treatment guidelines:
  - Focus on a single risk factor
  - One size fits all
  - Independent of age

Models

When to Use Models

- When a randomized controlled trial would be
  - Prohibitive in cost
  - Unethical
  - Impossible

Caveat [1]:

"*All models are wrong…some are useful.* "

1: Quote by George Box

Models for Diabetes Care

- Risk models for patients with Type 2 diabetes:
  - Framingham
  - UKPDS
  - Archimedes

"Archimedes is a math model that represents the anatomy, physiology and pathology related to diabetes and its complications."

Source: http://www.diabetes.org/living-with-diabetes/complications/diabetes-phd/archimedes.html

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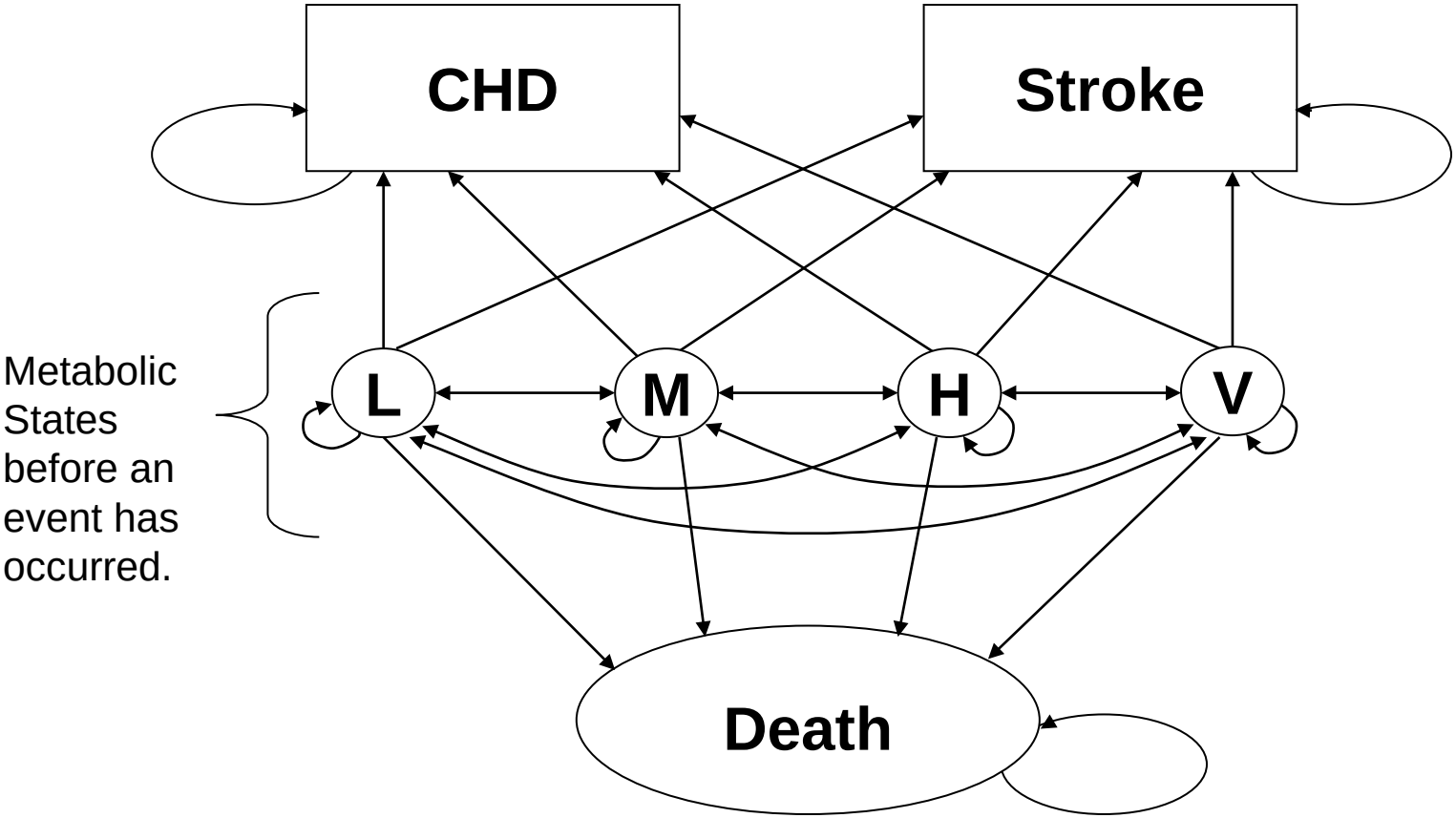
Types of Models

- Descriptive models
  - Use specific inputs to estimate outcomes of interest
- Prescriptive Models
  - Search to find the best decision(s)

Examples

Markov Model



Source: Denton et al, 2009, “Optimizing the Start Time of Statin Therapy for Patients with Diabetes”, 29: 351-367

Markov Model

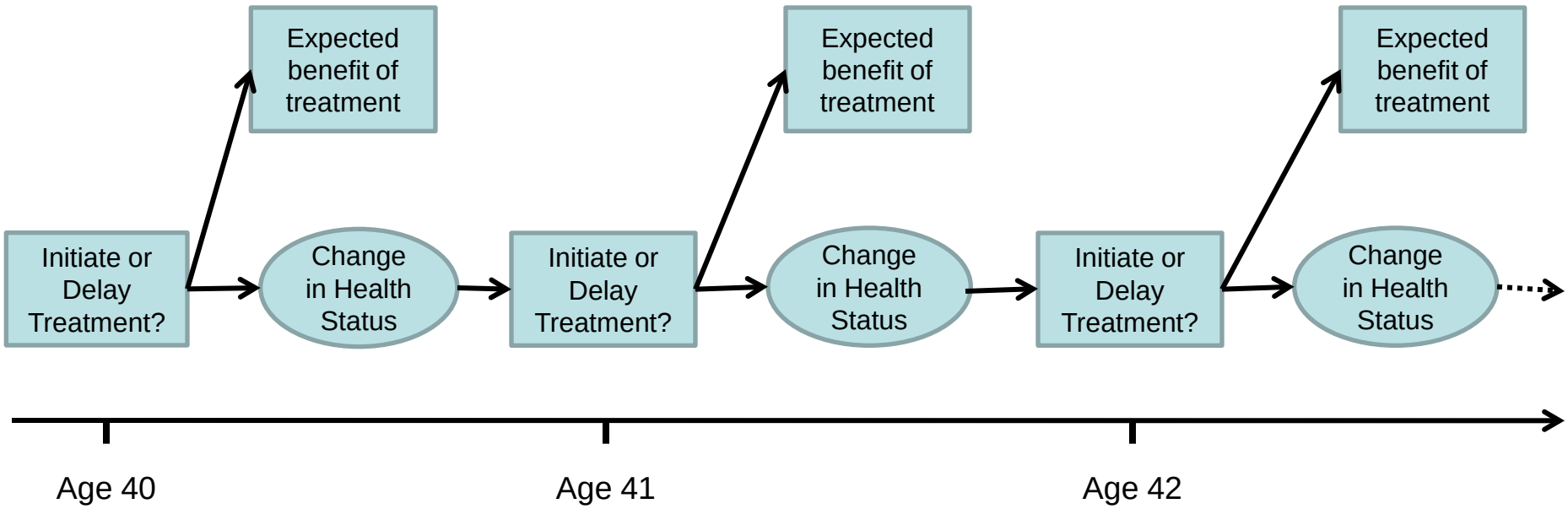
- Health States
  - Demographic: Gender, Race, smoking status
  - Metabolic: Cholesterol, Blood pressure, HbA1c
  - Outcomes: CHD, Stroke, Death from all other causes

- Transition probabilities
  - Metabolic states: Mayo Clinic EMR
  - Cardiovascular events: UKPDS
  - All cause mortality: CDC mortality tables

Optimization Model

- Choose the best action each year to achieve the goal

(Willingness to Pay)·(LY to Event) – Medication Costs



Study Cohort

- *Practice setting:*
  Type 2 diabetes patients seen in 6 primary care sites at Mayo Clinic Rochester

- *Sample definition*:
  663 patients with:
  - Research authorization
  - No prior hx: stroke-CHD
  - 10+ years of follow-up

Patient Attribute	Study Cohort
Age, years	52.46 (8.83)
Diagnosis, years	3.24 (5.33)
% Female	39.67
Total Chol mgm%	216.27 (51.61)
HDL mgm%	43.65 (11.58)
LDL mgm%	126.98 (37.31)
SBP mm Hg	139.11 (19.75)
HbA1c	8.01 (2.38)

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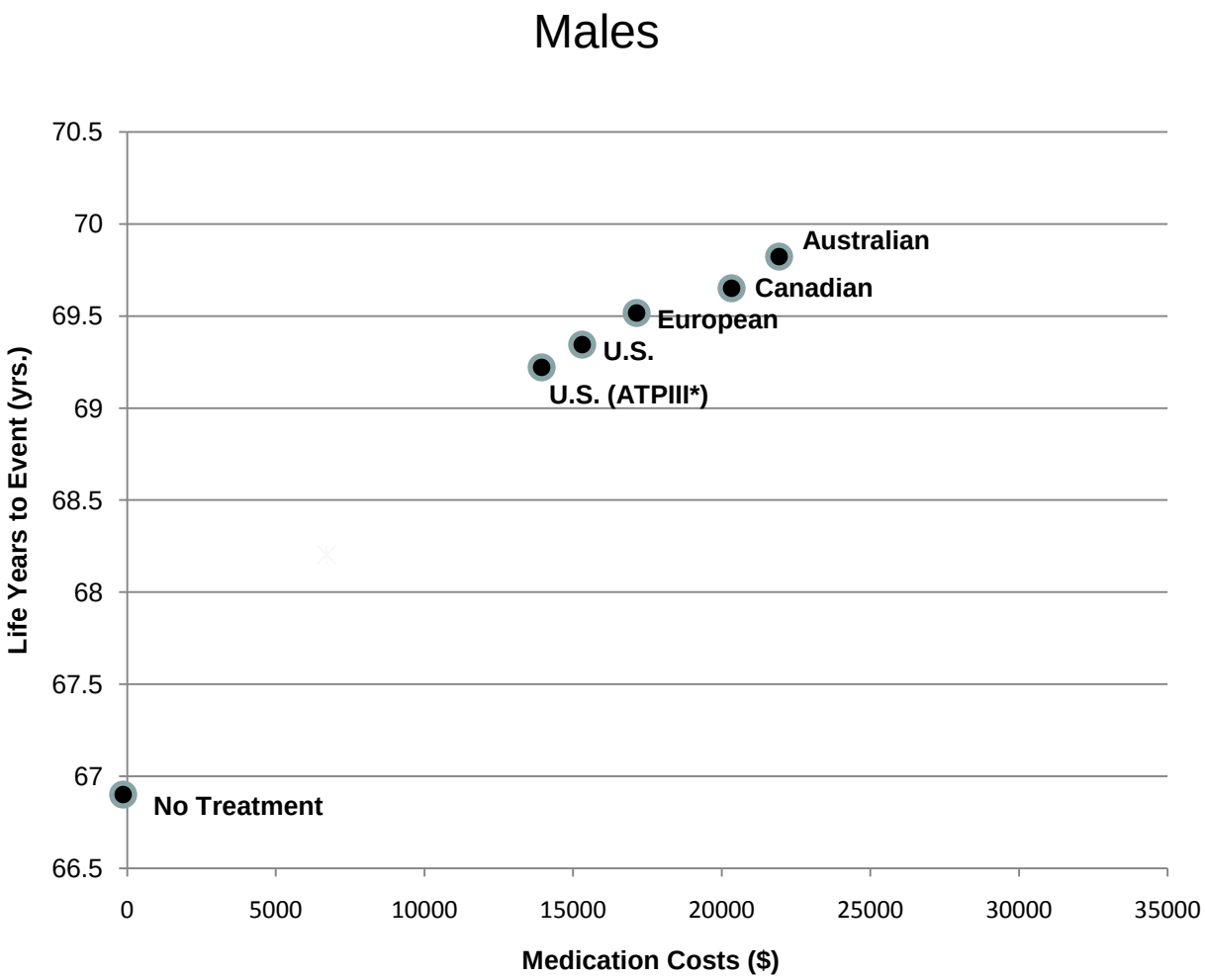
Treatment Effect

- Mean treatment effects for study cohort
- Costs based on 2010 Redbook

	Metabolic Factors			
Therapy	**SBP**	**DBP**	**Tot Chol**	**HDL**
ACEI/ARB	-3.72	-5.48		
Thiazide	-4.97	-3.73		
β Blocker	-4.64	-4.17		
CCBlocker	-2.49	-4.76		
Statin			-13.97	7.28
Fibrate			-3.91	4.73

Relative Efficiency



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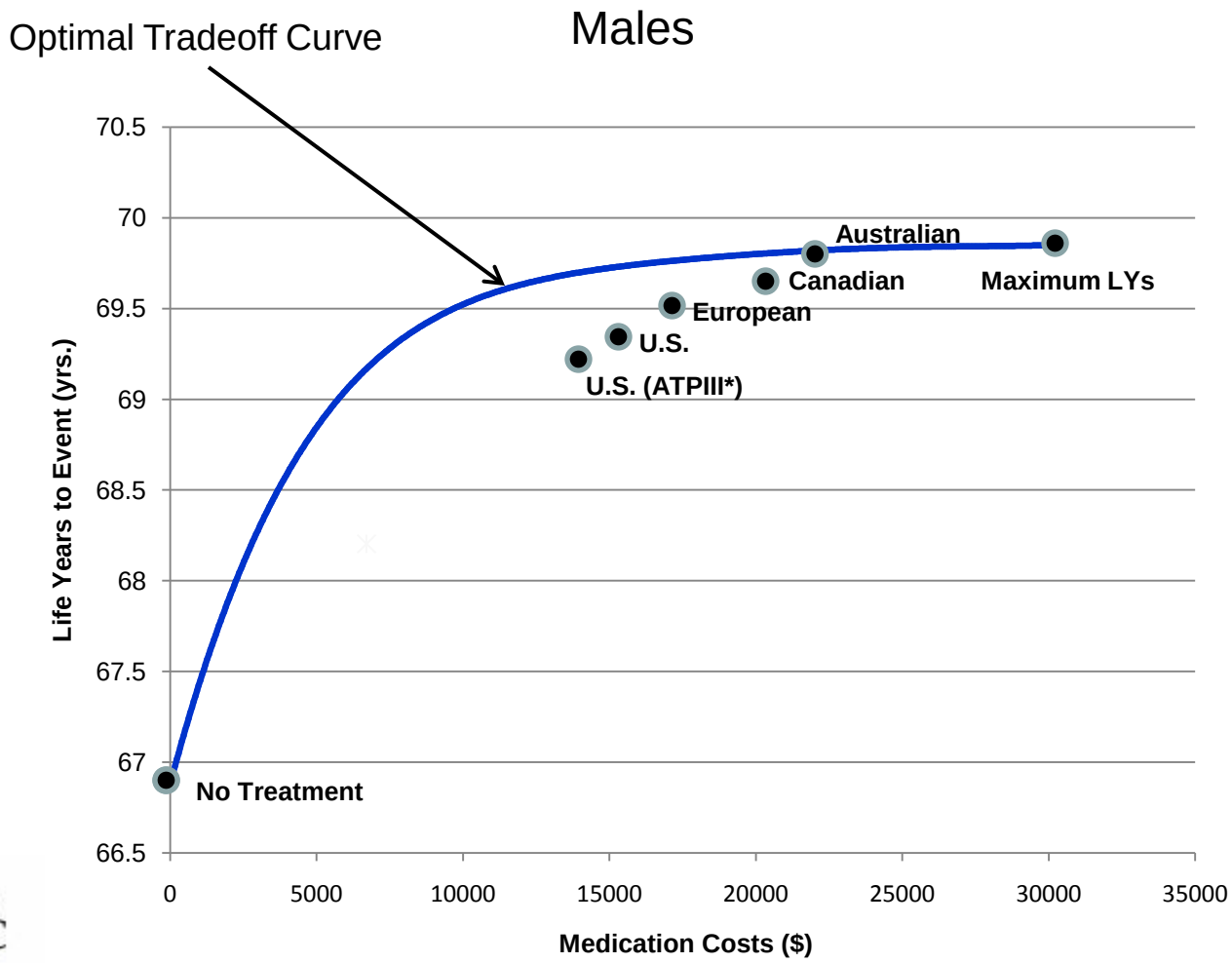
Absolute Efficiency



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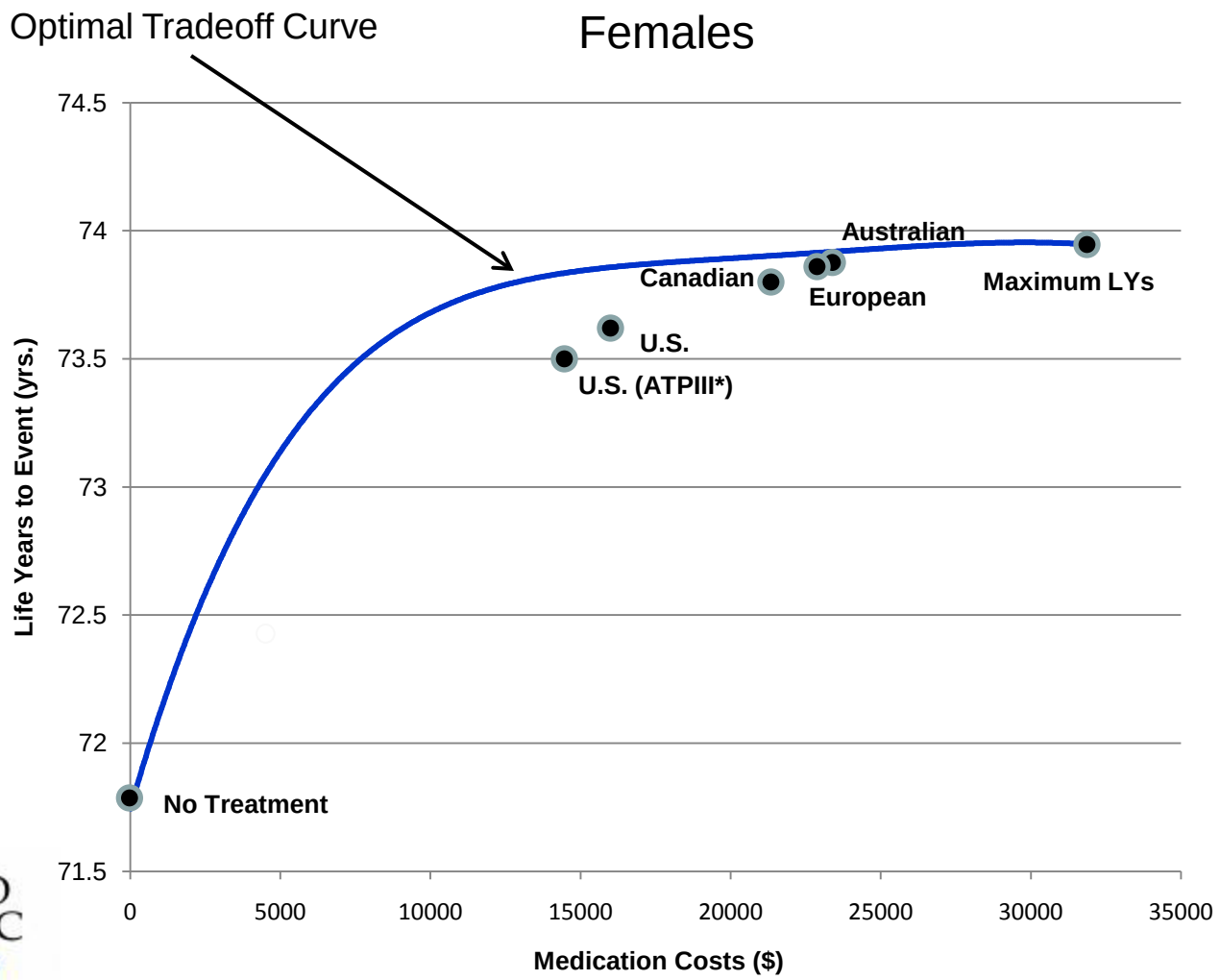
Absolute Efficiency



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Insights

- Optimal treatment plans differentiate patients based on risk factors
- Low variation in optimal sequence of medication
- Optimal tradeoff differentiated by timing of treatment
- Treatment significantly influenced by gender

Limitations

- Models are not a perfect representation of reality
- Patient cohort from one health system
- Sparse clinical data to model other races / ethnicity
- No consideration of burden of treatment or non-medication related costs

Key Points

- Measuring “bang for the buck” is difficult
- Choosing specific goals for coordinated and personalized treatment can improve efficiency
- Observational (EMR) data can help inform treatment planning