Design and Tradeoff Analysis of a Health Insurance Consumer-Based Decision Support System

Shavon Clanagan
Tygue Ferrier
Angela Leese
Sheel Patel

1 December 2010

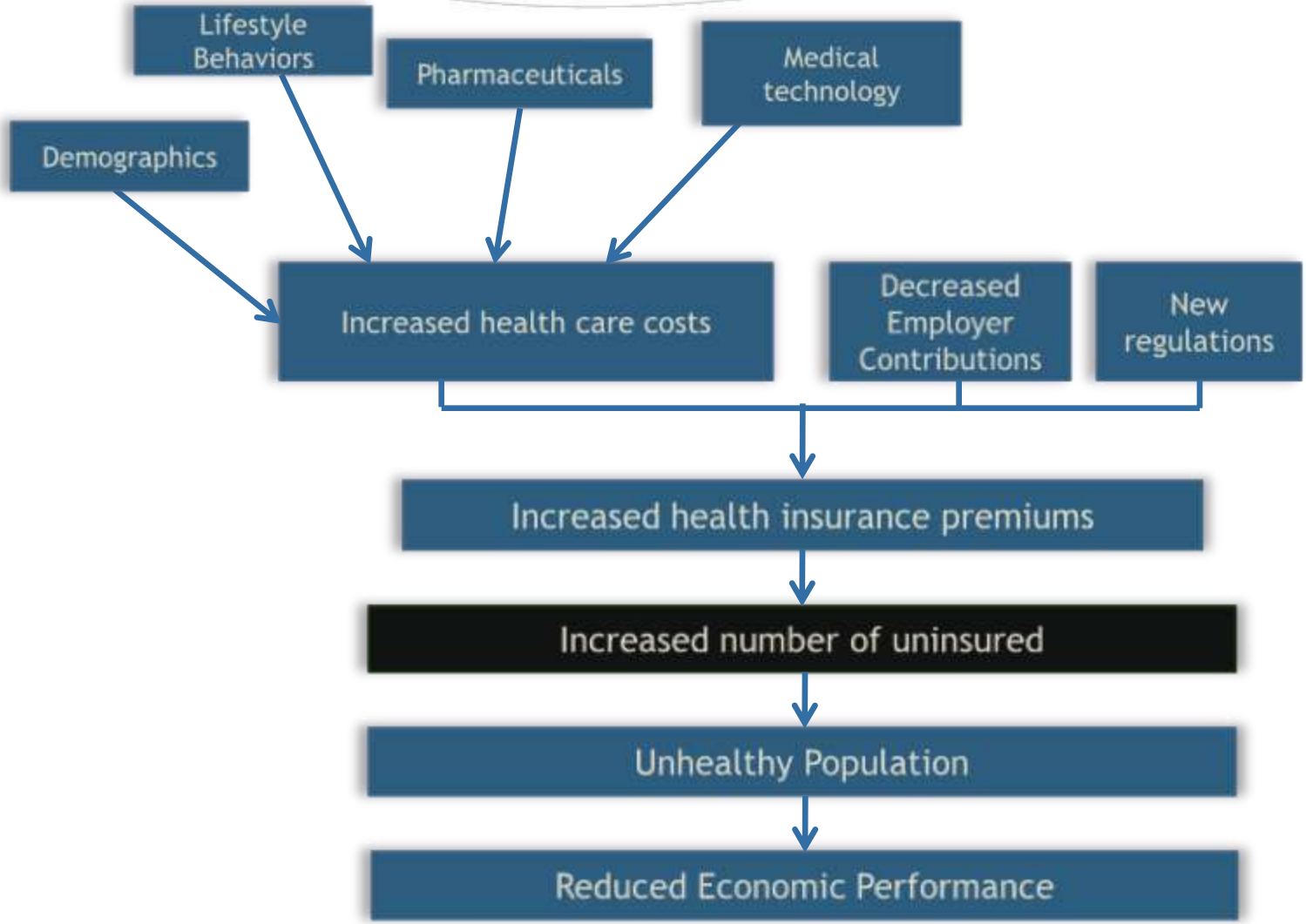
With support from Dr. Glenn Ackerman of the Center for Naval Analyses

GEORGE MASON UNIVERSITY

Agenda

- Context
- Need and Problem
- Value Hierarchy
- Design Alternatives
- Method of Analysis
- Design of Experiment
- Schedule
- Risk Management
- Budget and EVMS

Context


Lifestyle Behaviors
Pharmaceuticals
Medical technology
Demographics
Increased health care costs
Decreased Employer Contributions
New regulations
Increased health insurance premiums
Increased number of uninsured
Unhealthy Population
Reduced Economic Performance

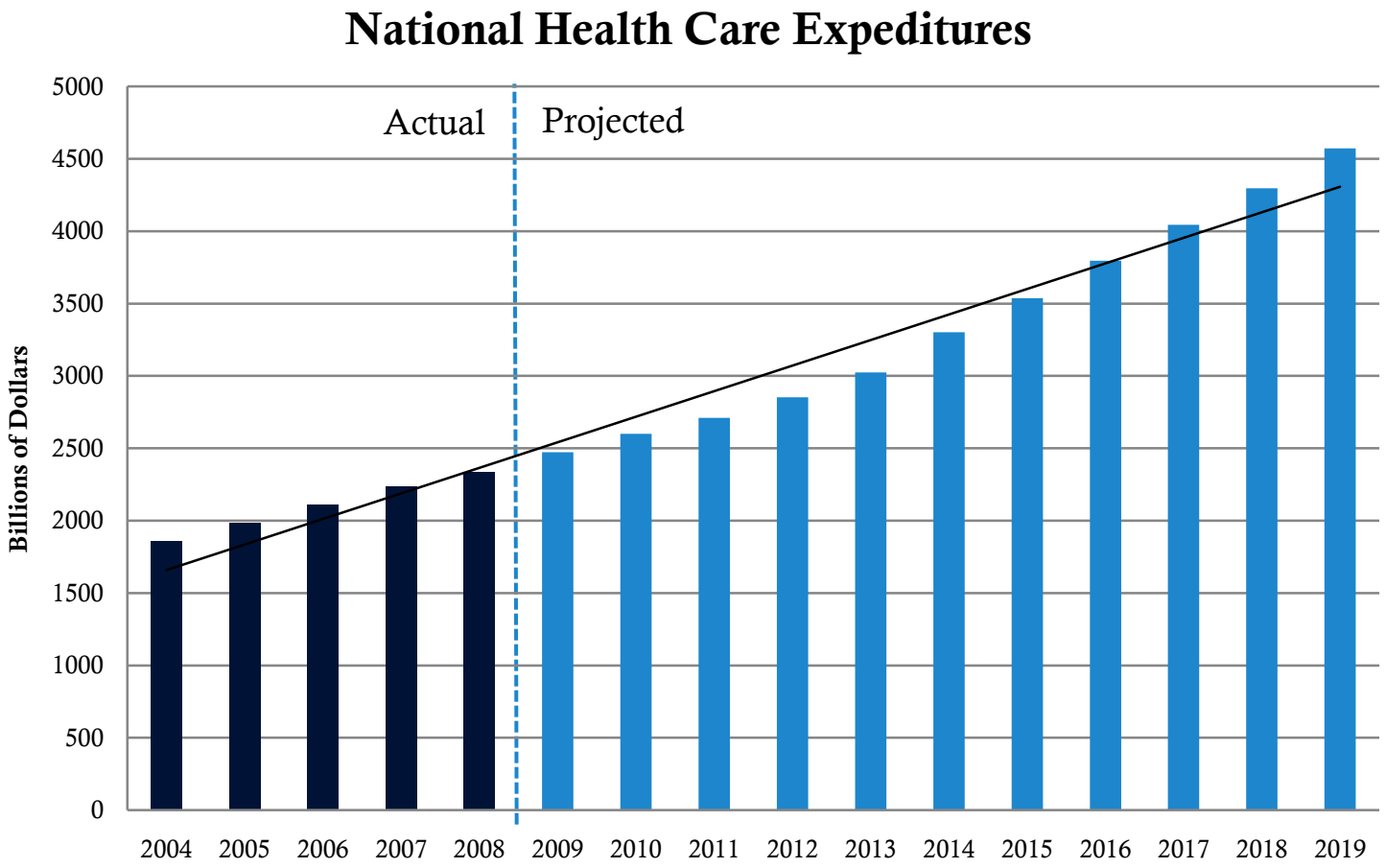
Stakeholders

Primary Stakeholder	Greatest Perceived Problem/Risks
Policy Makers	Uninsured lead to a higher cost to taxpayer provide care
Society	High cost of health insurance
Health Care Providers	Malpractice costs
Health Insurance Providers	Risk of paying out more than pooled
Lifestyle Decision Information Technology Vendors	Potential profits as result of reducing poor lifestyle choices
Employers	Unhealthy work force, resulting in reduced productivity
Medical Goods and Service Providers	Regulations reducing profitability
Secondary Stakeholders	
Commercial food industry, gym equipment providers, tobacco industry	

Conflicting Stakeholder Objectives Result in No Change to Current System

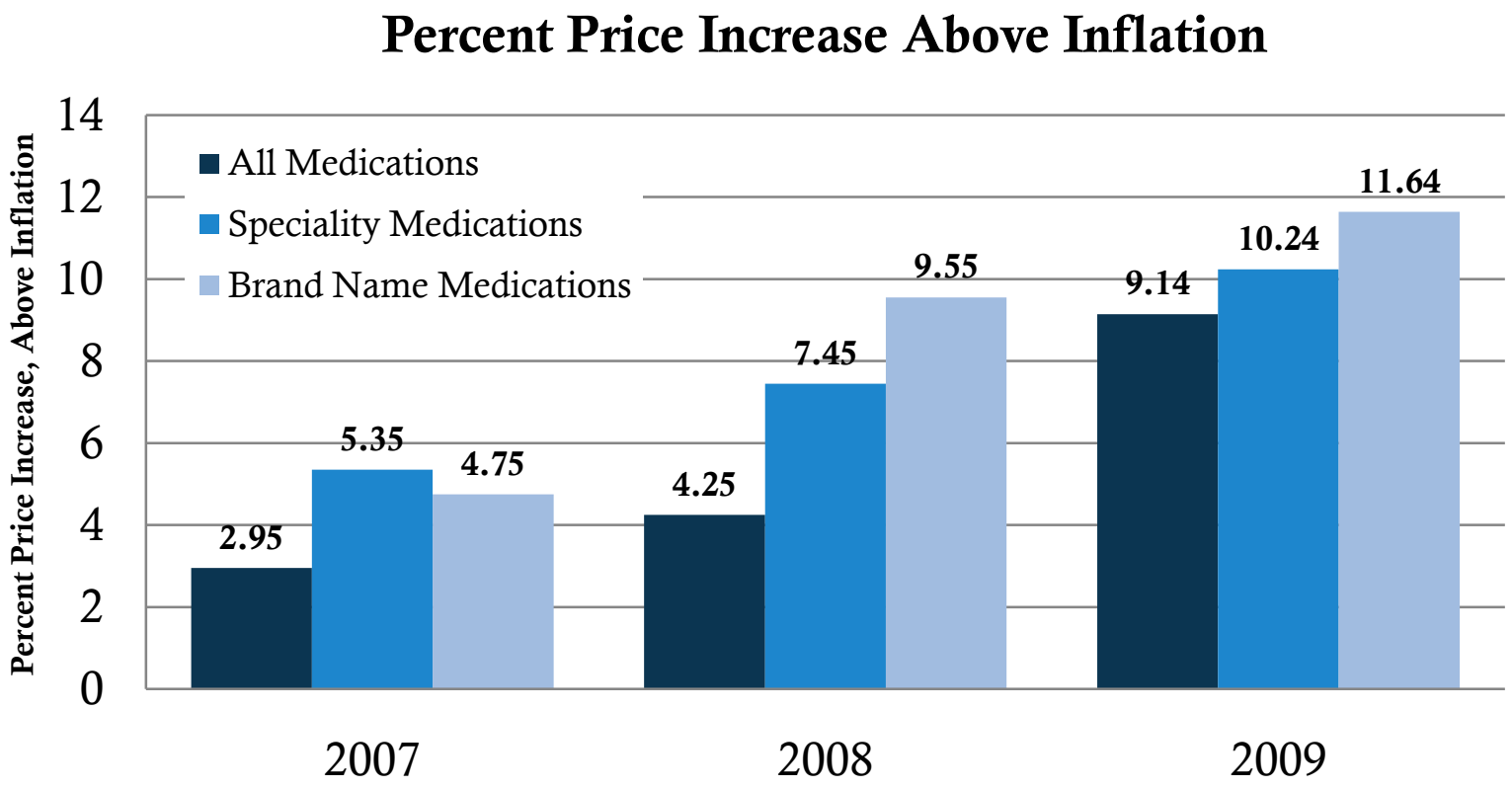
Increased Health Care Costs

Health Care Costs Increasing



Source: National health Care Expenditures Projections 2009-2019. Centers for Medicare and Medicaid Services (2010, Sept)

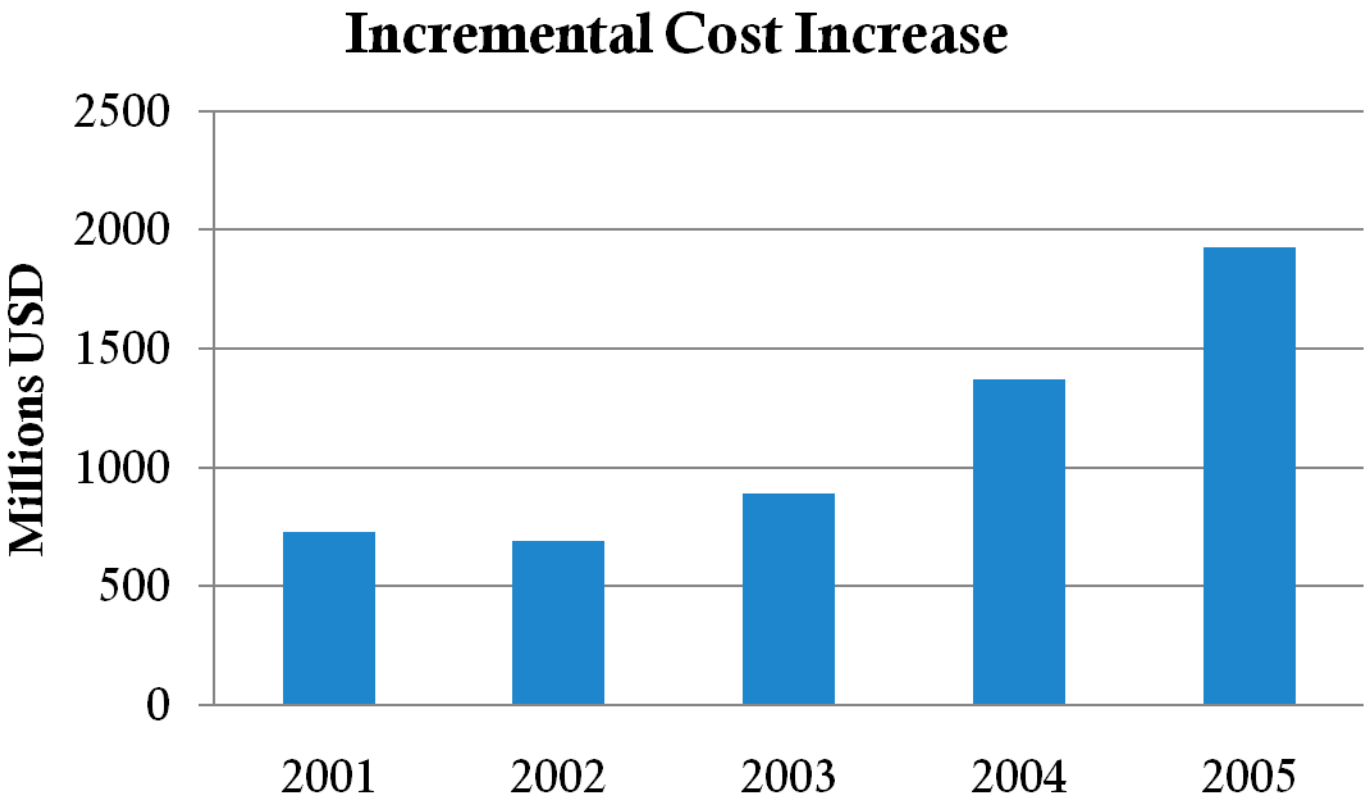
Runaway Costs: Pharmaceuticals



Percent increase well above inflation rate

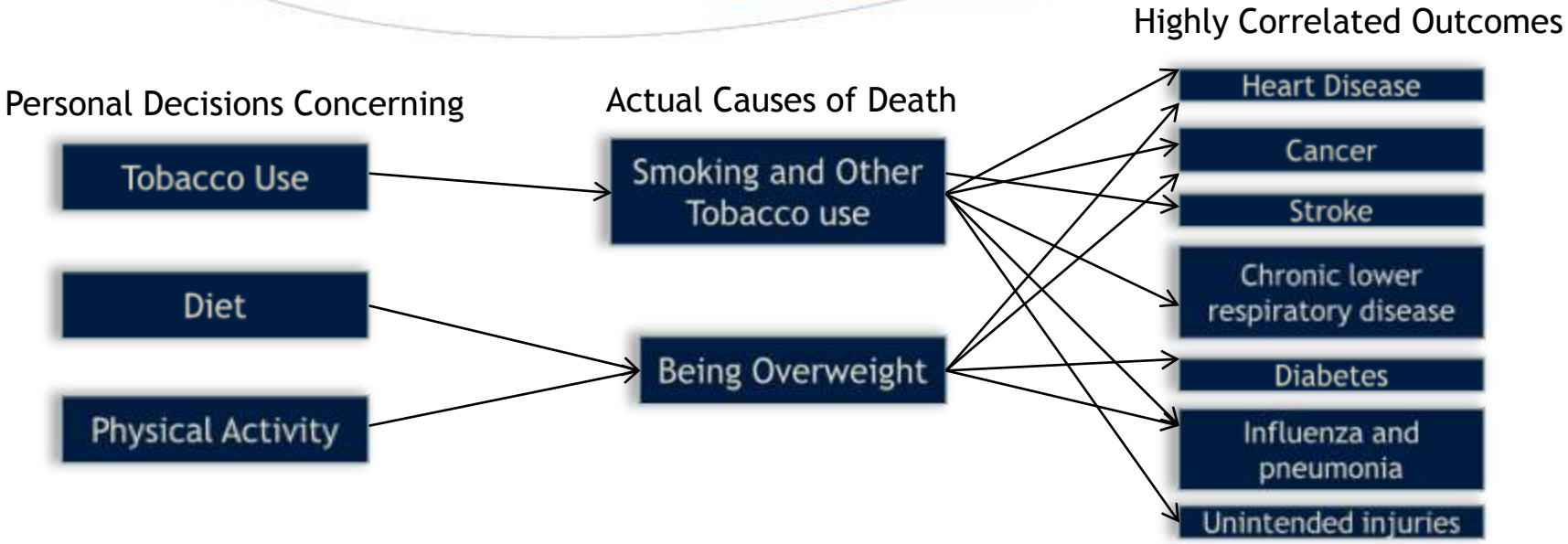
Runaway Costs: Medical Technologies

- Account for 40–50% of annual health care cost increases



Sources:
D. Callahan. Health Care Costs and Medical Technology. Heritage Foundation.
Impact of Medical Technology on Future Health Costs. Project HOPE. (2 Feb 2001)

Runaway Costs: Lifestyle Behavior Related Costs



Unhealthy lifestyle choices lead to:

- A rise in health care costs
  - Tobacco Use: 14.5 % increase
  - Obesity: 21.4 % increase
  - Lack of Physical Activity: 10.4% increase
- A rise in health insurance costs
  - Due to higher risk to insurer

Sources:

R.L. Keeney, Operations Research, Personal Decisions are the Leading Cause of Death

R.Sturn, Health Affairs, The Effects of Obesity, Smoking, and Drinking on the Medical Problems and Costs

Solutions to Runaway Costs

Runaway Cost	Means to Reduce	Impact of Solutions
Pharmaceuticals	Limit price of pharmaceuticals	Vendors – Lose Patients – Win/Lose
Medical Technologies	Limit price of medical technologies	Vendors – Lose Patients – Win/Lose
Lifestyle Choice Impacted Costs	Provide information on impact of lifestyle choice on behavior and cost	Patients, HC Providers, Insurers – Win

Reducing the impact of lifestyle choices on health care costs a win-win

Agenda

- Context
- Need and Problem
- Value Hierarchy
- Design Alternatives
- Method of Analysis
- Design of Experiment
- Schedule
- Risk Management
- Budget and EVMS

Need and Problem Statement

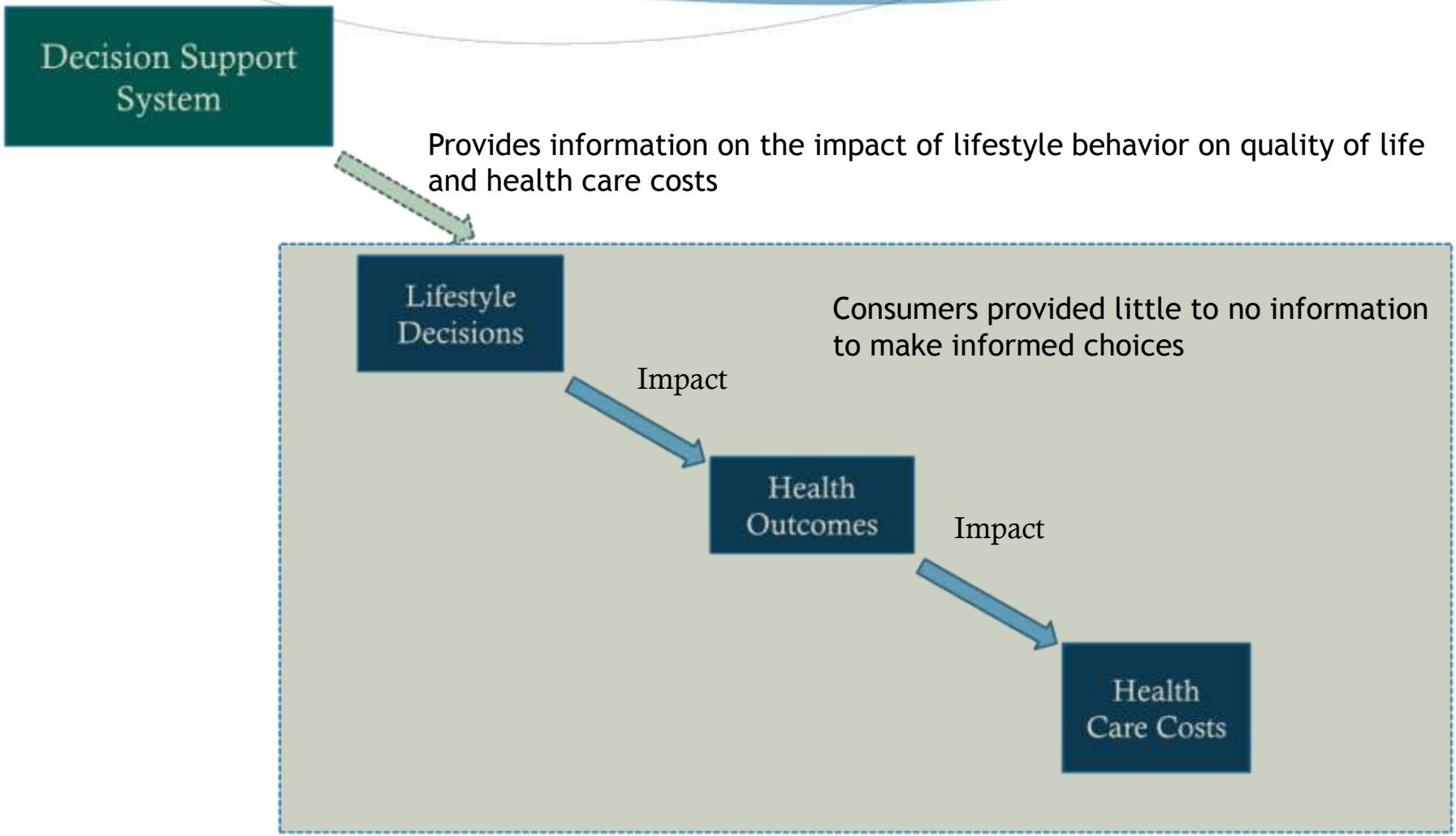
There is a need to:

- Control runaway health care costs to promote health insurance affordability
  - Focus on unhealthy lifestyle choices

Problem:

- Unhealthy lifestyle choices result in high health care costs
  - As a result health insurance rates are increasing
  - The number of uninsured are also increasing
- Require a means to inform consumers of the impact of lifestyle behaviors on overall health care outcomes and costs

Health Care



Propose decision support system to provide additional information to consumers

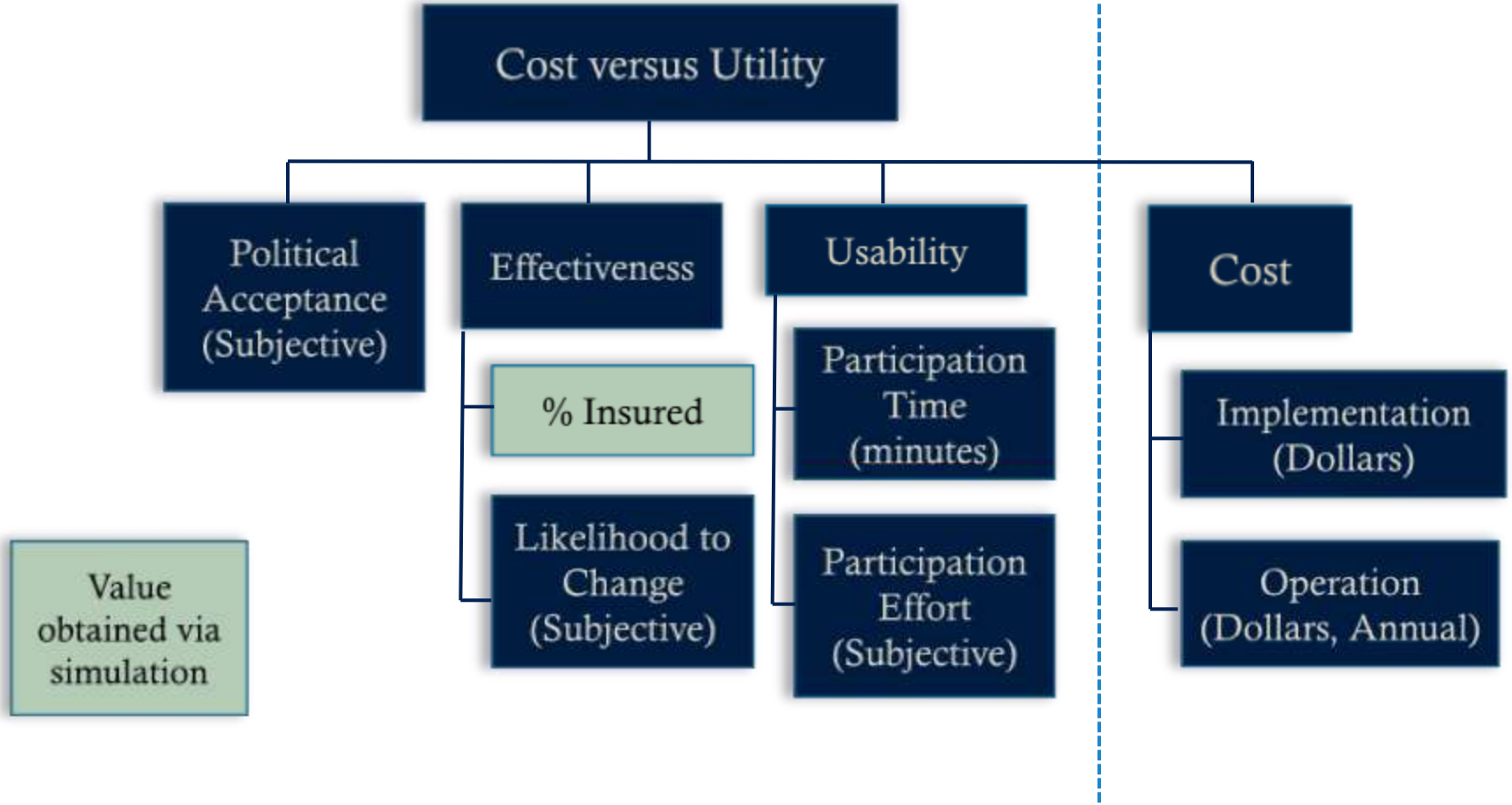
Mission Requirements

- MR-1: The System shall increase the number of insured Americans from 83.3% to 90% (1970 rate) by reducing health care costs related to lifestyle behaviors.
- MR-2: The System shall provide consumers information on the impact of lifestyle choices on health care outcomes and costs.
- MR-3: The System shall have an implementation timeline of less than three (3) months.
- MR-4: The System shall limit the cost of implementation and operation of the selected alternative.

Agenda

- Context
- Need and Problem
- Value Hierarchy
- Design Alternatives
- Method of Analysis
- Design of Experiment
- Schedule
- Risk Management
- Budget and EVMS

Value Hierarchy



Weights obtained through surveys of stakeholders

Agenda

- Context
- Need and Problem
- Value Hierarchy
- Design Alternatives
- Method of Analysis
- Design of Experiment
- Schedule
- Risk Management
- Budget and EVMS

Design Alternatives

Design Alternatives	Implementation Plan
Education	Focuses on educating society regarding nutrition, exercise, tobacco use, and the health care costs associated
Incentives/Disincentives	Focuses on adjustment of lifestyle choices through incentives and institutional nutrition programs
Personalized Risk Profile	Focuses on informing society by analyzing health assessments, genetic testing, family history, and the personal choices that influence health care costs

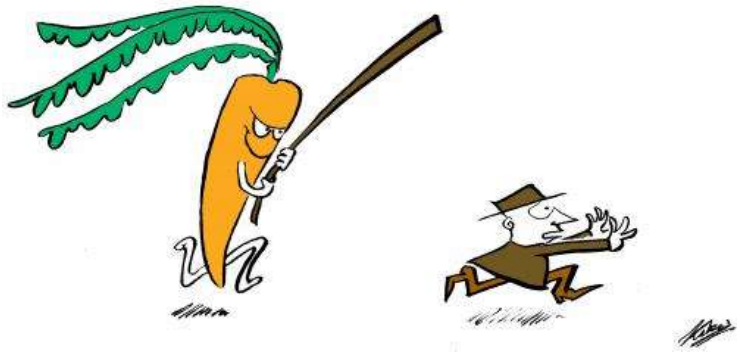
Design Alternative 1: Education

- Teaching adults impact of lifestyle choices on health outcomes and associated costs
- Often community-based programs
- Example Programs
  - Nutrition and physical activity: ALIVE!
  - Smoking cessation
    - Self-help program: Four step "Quit kit"
    - Cessation class: Stanford Five City program

Source:
Research-tested Intervention Programs,
National Institutes of Health

Design Alternative 2: Incentives

- Financial benefit received in exchange for improved lifestyle behavior choices
- Incentive versus disincentive (carrot versus stick)
- Example programs:
  - Discount on health insurance premium in exchange for lifestyle change (i.e. reduce Body Mass Index, join gym, stop smoking)
  - Rewards program: receive points in exchange for good behavior



Design Alternative 3: Personalized Risk Profile

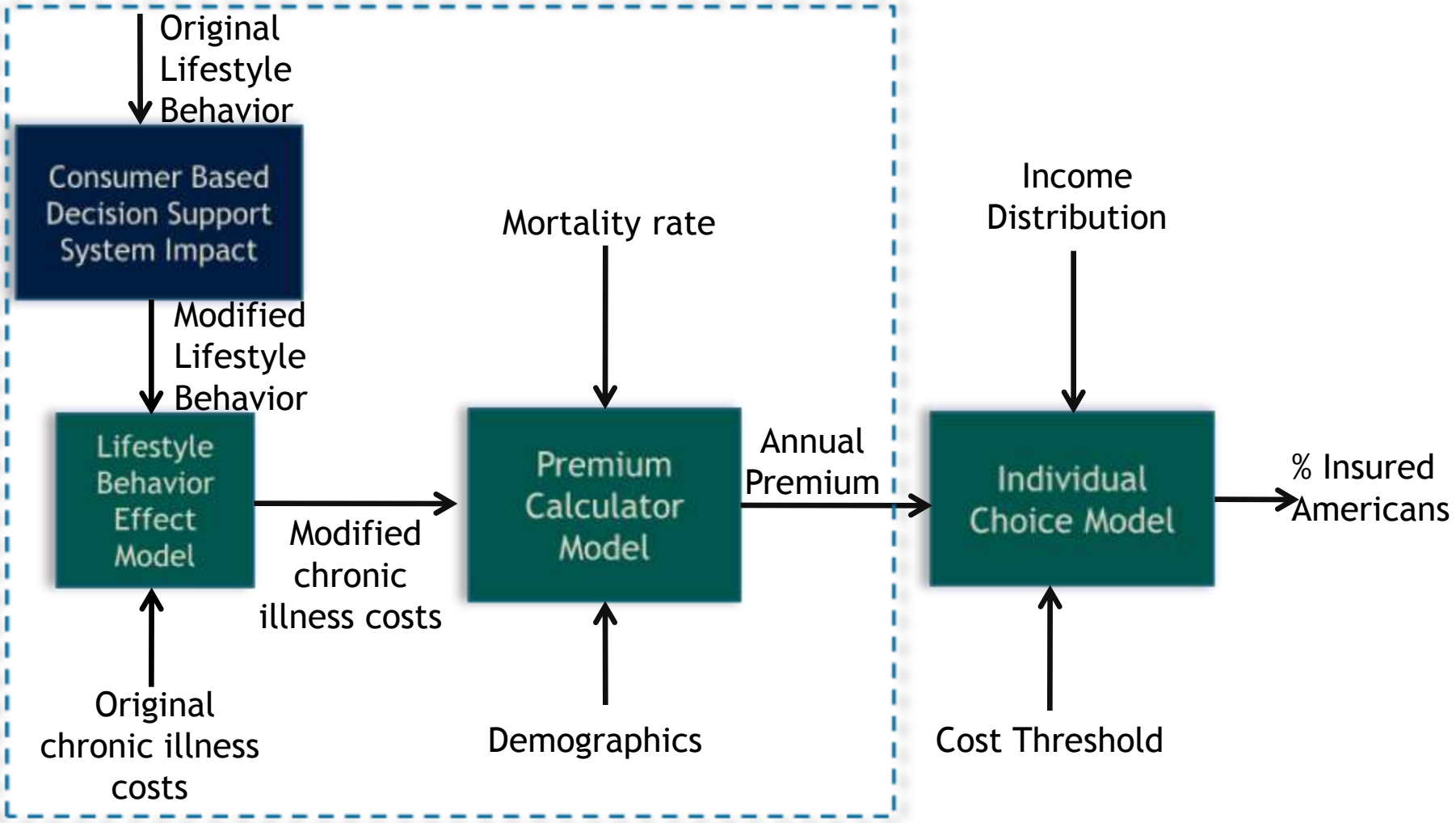
- Consumers provide personal information and receive information regarding quality of life and health care costs
- Obtain personal information via
  - Health assessments: series of questions related to lifestyle behaviors
  - Family medical history: series of questions related to incidences of common chronic diseases
  - Medical testing: genetic and medical screenings to determine current and possible future medical conditions
- Outputs:
  - Receive personalized statement including probability of obtaining chronic diseases, projected health care costs
  - Specific recommendations for improving health outcomes

System designed to combine best aspects of existing programs

Agenda

- Context
- Need and Problem
- Value Hierarchy
- Design Alternatives
- Method of Analysis
- Design of Experiment
- Schedule
- Risk Management
- Budget and EVMS

Method of Analysis



Impact of Lifestyle Behavior

Cost Without Unhealthy Lifestyle Behaviors

Pass Tobacco Use Impact

Low Exercise Level Impact

$$HCC = BC \times [1 + .214 \times OB + .197 \times PT + .145 \times CT + .104 \times E]$$

Future Health Care Cost

Obesity Impact (21.4% higher health costs)

Current Tobacco Use Impact

Source for impact quantities:
Goetzel, Anderson et. al. Journal of Occupational and Environmental Medicine (1998, Oct)

Premium Calculation

Net Present Value, Cost to Care for Ill

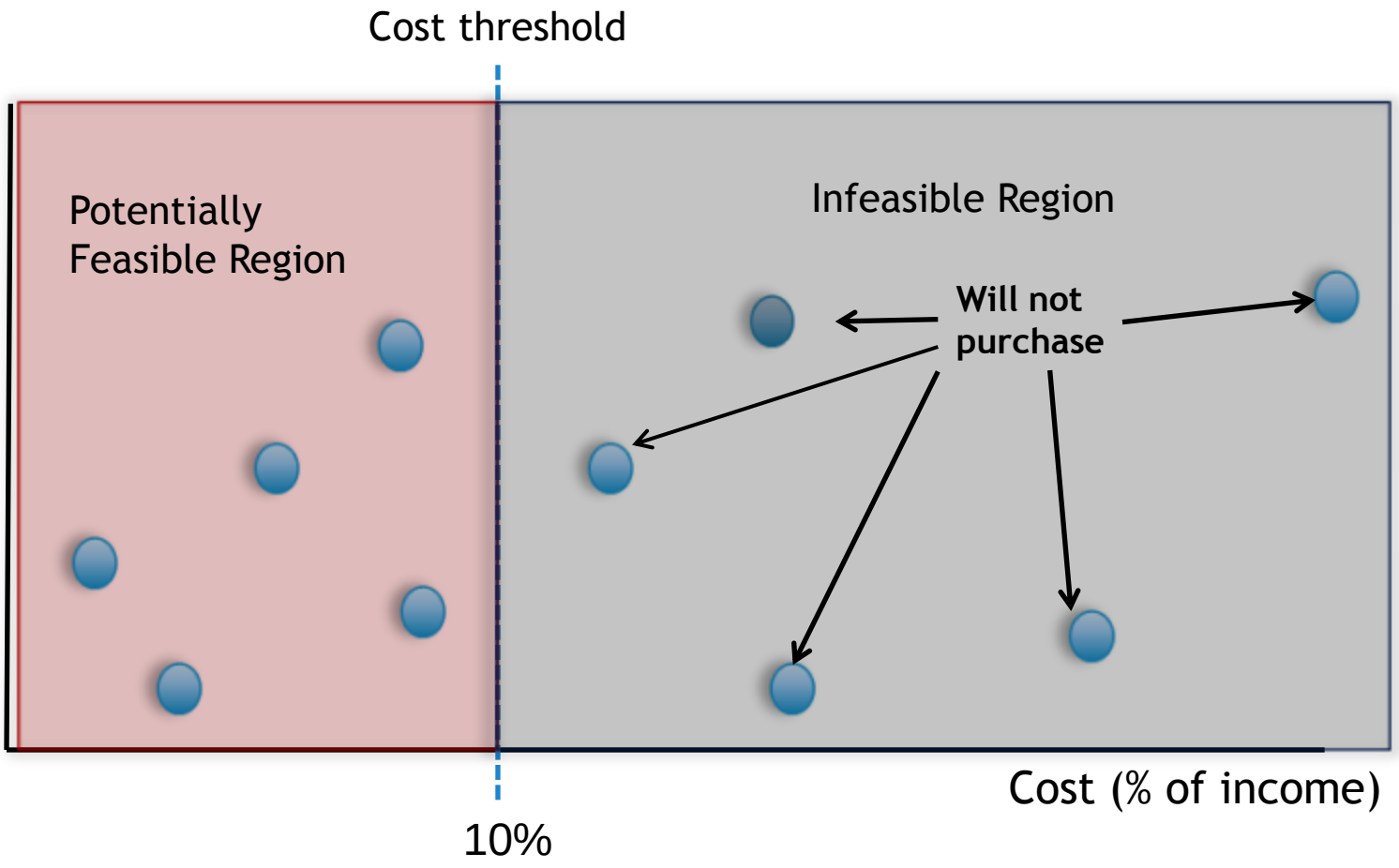
$$Premium = \frac{\sum_0^n \left[\frac{C_p}{(1+m)^k} + \frac{(NI_k - ND_k) \times \frac{C_I}{(1+m)^{n-k}}}{(1+i)^k}\right] \times \frac{i \times (1+i)^{EPY}}{(1+i)^{EPY} - 1}}{Equivalent\ Participant\ Years\ (EPY)}$$

Net Present Value, Annual Preventative Care

Convert to Annual Payment

Premiums pooled across participants within a given risk group

Individual Choice Model



Agenda

- Context
- Need and Problem
- Value Hierarchy
- Design Alternatives
- Method of Analysis
- Design of Experiment
- Schedule
- Risk Management
- Budget and EVMS

Design of Experiment

	Model Inputs				Intermediate Values		Model Outputs
Alternative	Nature of Alternative	Timeline of Alternative	Premium Incentive	Other Incentive	Modified Lifestyle Behavior	Annual Premium	% Insured
Incentive	Positive	Near-Term	High	High			
		Long-Term					
		Near-Term	Medium	Medium			
		Long-Term					
		Near-Term	Low	Low			
		Long-Term					
	Negative	Near-Term	High	High			
		Long-Term					
		Near-Term	Medium	Medium			
		Long-Term					
		Near-Term	Low	Low			
		Long-Term					

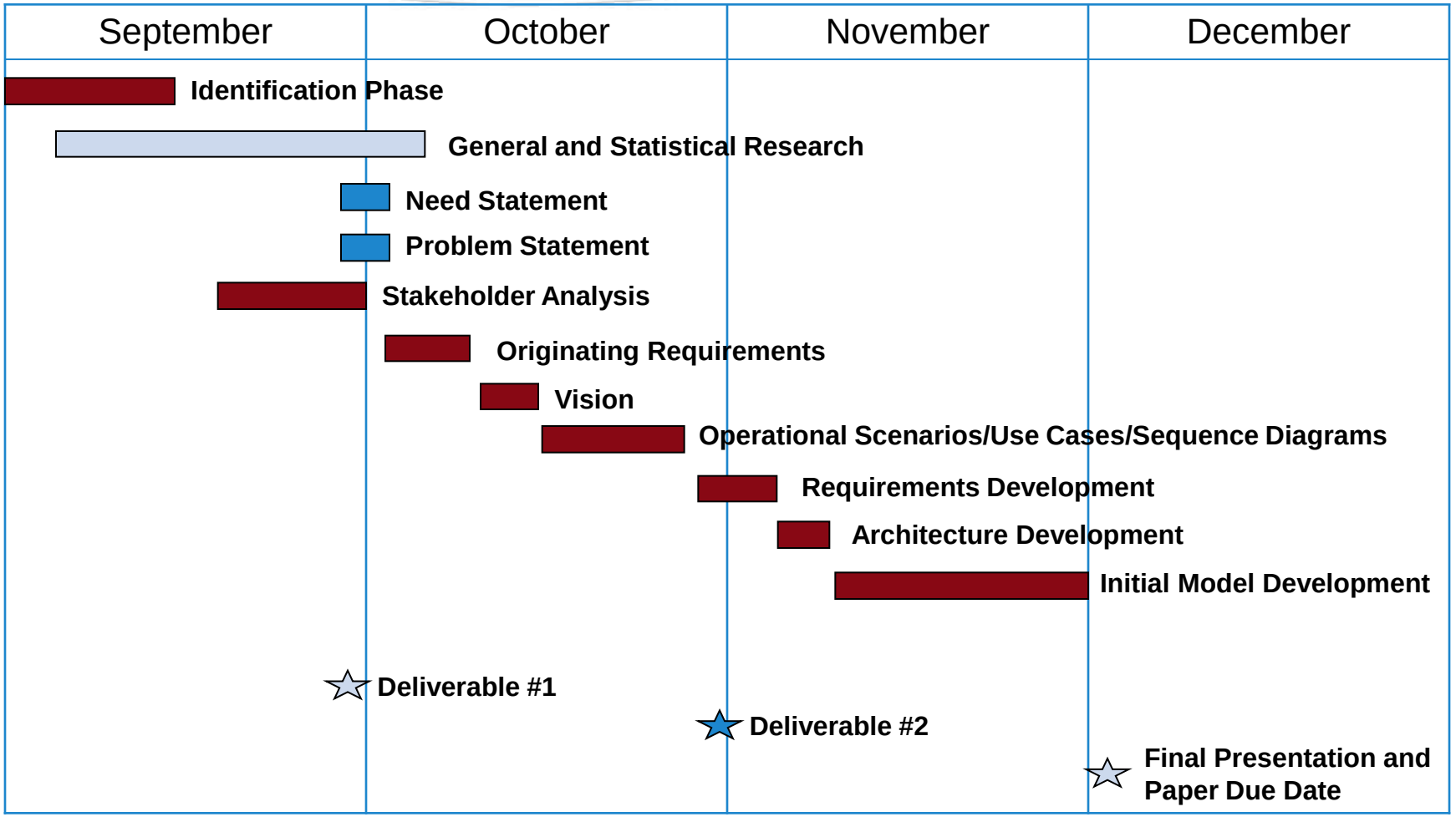
Design of Experiment, Cont

Alternative	Nature of Alternative	Timeline of Alternative	Premium Incentive	Other Incentive	Modified Lifestyle Behavior	Annual Premium	% Insured
Education	Positive	N/A	None	None			
	Negative						
Personalized Risk Profile	Positive	N/A	None	None			
	Negative						

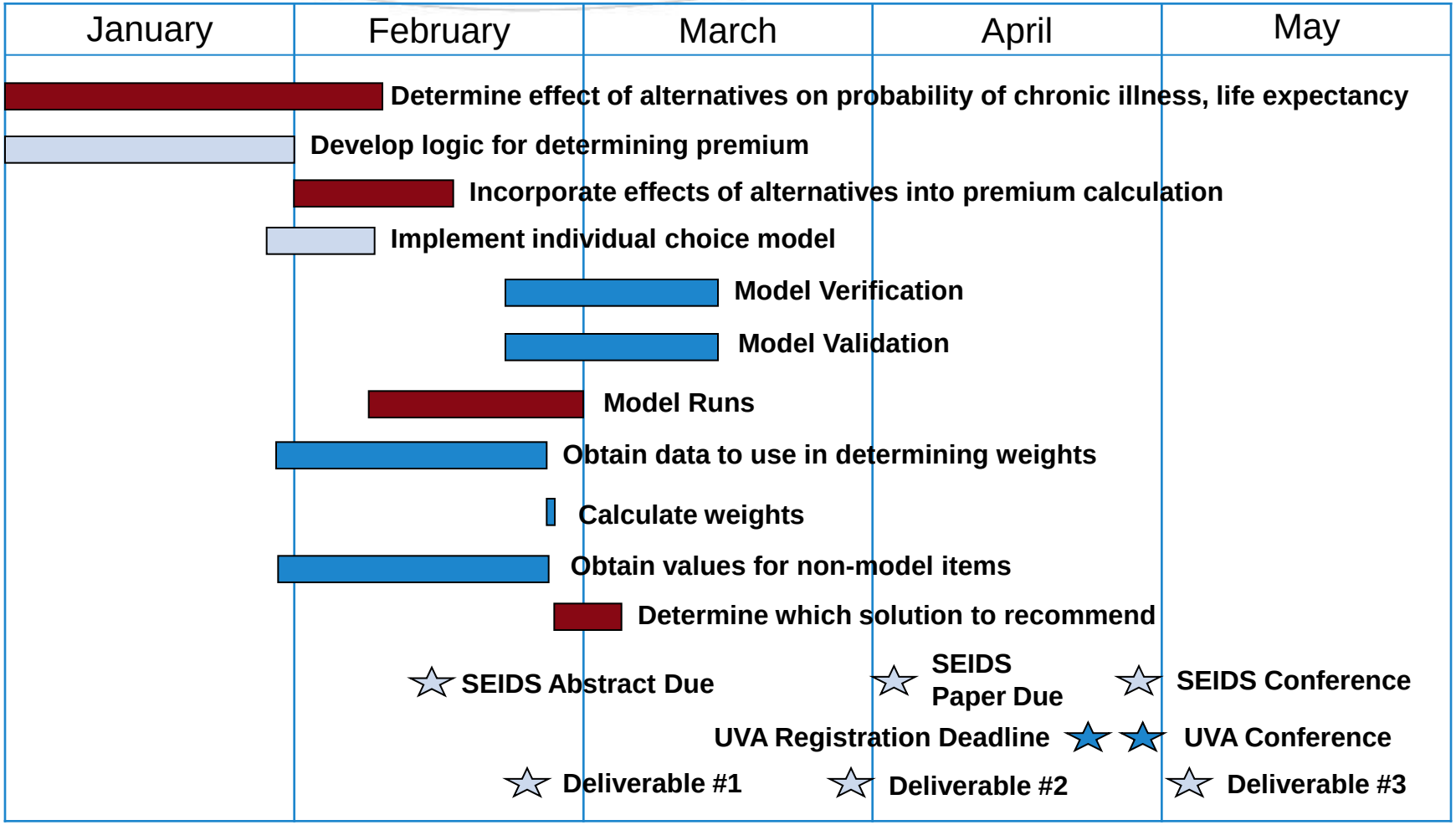
Agenda

- Context
- Need and Problem
- Value Hierarchy
- Design Alternatives
- Method of Analysis
- Design of Experiment
- Schedule
- Risk Management
- Budget and EVMS

Project Schedule



Project Schedule, Cont.



Agenda

- Context
- Need and Problem
- Value Hierarchy
- Design Alternatives
- Method of Analysis
- Design of Experiment
- Schedule
- Risk Management
- Budget and EVMS

Risk Mitigation Plan

Risk	Mitigation
Cannot obtain accurate effect of lifestyle choices on life expectancy	Use best available data and state possible inaccuracies.
Cannot obtain effects of lifestyle choices on costs and/or frequency of costs	
Cannot obtain data regarding weights of attributes in value hierarchy	
Cannot obtain values for items not determined via model	
Human resource availability reduced	Identify primary and secondary assignees for each task. Hold status update meetings regularly to ensure situational awareness.

Agenda

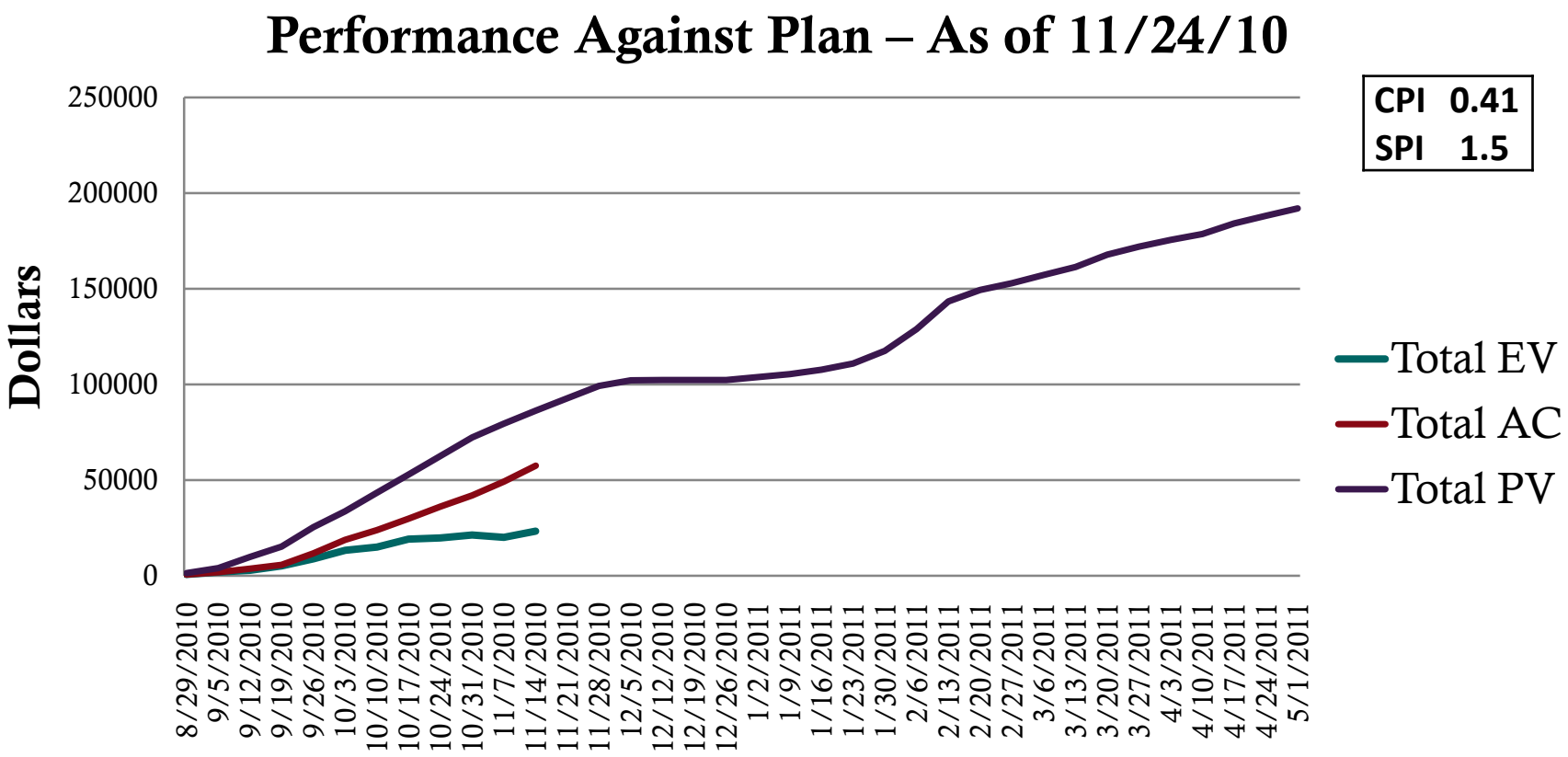
- Context
- Need and Problem
- Value Hierarchy
- Design Alternatives
- Method of Analysis
- Design of Experiment
- Schedule
- Risk Management
- Budget and EVMS

Budget

Level 1 WBS Item	Budget
Identification Phase	1600.00
Management	11200.00
Research	17800.00
Context Analysis	7400.00
Concept of Operations	5400.00
Design	13600.00
Design Alternatives	12800.00
Presentation Preparations	36000.00
Second Semester Management	4500.00
Second Semester Research	11,500.00
Model Refinement	16,800.00
Verification/Validation of Model	4,000.00
Obtain Results (Run Model)	8,000.00
Cost-Benefit Analysis	8,200.00
Deliverable Preparations	40,000.00

- Total budget: $198,800
- Task-based budget
- Assumptions:
  - $100 / hour loaded rate
  - No work takes place between Dec 20 and Dec 26
  - Work hours limited to 30 hours / week per person

EVMS


Performance Against Plan – As of 11/24/10
Dollars
250000
200000
150000
100000
50000
0
8/29/2010
9/5/2010
9/12/2010
9/19/2010
9/26/2010
10/3/2010
10/10/2010
10/17/2010
10/24/2010
10/31/2010
11/7/2010
11/14/2010
11/21/2010
11/28/2010
12/5/2010
12/12/2010
12/19/2010
12/26/2010
1/2/2011
1/9/2011
1/16/2011
1/23/2011
1/30/2011
2/6/2011
2/13/2011
2/20/2011
2/27/2011
3/6/2011
3/13/2011
3/20/2011
3/27/2011
4/3/2011
4/10/2011
4/17/2011
4/24/2011
5/1/2011
CPI 0.41
SPI 1.5
Total EV
Total AC
Total PV

Questions