



What Have We Learned From Economic Analyses of Prevention?

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Health Economics Cyber Seminar
VA Health Economics Resource Center
January 19, 2011

The Prevention Agenda

- “*Healthy People 2010* is a comprehensive set of disease prevention and health promotion objectives for the Nation to achieve over the first decade of the new century. ... [It] identifies a wide range of public health priorities”.

<http://www.healthypeople.gov/About/hpfact.htm>

- In the health reform debate, prevention was promoted as a way to control medical costs.

History and Expectations

- Prevention has brought major gains in health and lifespan over the last two centuries.
- Today's leading causes of death – heart disease, cancer, diabetes – can now be prevented or delayed.
- Prevention's appeal
 - Better to avoid disease/injury than repair it
 - Prevent the disease, prevent treatment costs
 - Expectation: Better health, lower medical spending
- But does it reduce medical spending?

Radio advertisement

- Man scheduled to undergo bypass surgery
- Cost of the surgery: \$50,000
- Wouldn't it be better to avoid surgery through prevention? By losing weight, quitting smoking, exercising, taking medications to reduce blood pressure and cholesterol?
- Better for health
- Cheaper for the medical system

But – prevention is more complicated

- Medical science can only identify those **at risk** of heart disease, a much larger group than those who will someday be candidates for bypass surgery.
- Prevention must be delivered to **all** people at risk, often **repeatedly** over **many years**, to prevent **some** from developing disease → **costs mount up** .
- Some develop disease anyway, since prevention is not 100% effective; some do not develop it even without prevention → all receive prevention, but **not all experience savings**.

Cost-effectiveness Analysis

First applied to health and medicine in the 1970s

Weinstein MC, WB Stason. *Hypertension: A Policy Perspective* (Cambridge MA: Harvard University Press, 1976).

- Blood pressure medication extends life and reduces treatment costs for heart disease and stroke
- But the accumulated costs of medication over many years are greater than the savings
- Prevention costs more than treatment

Is Prevention Better than Cure?

Russell LB. *Is Prevention better than Cure?* (Washington DC: Brookings, 1986).

- Examined vaccines, blood pressure medication, cancer screening, lifestyle change.
- Prevention usually adds to medical spending.

When is prevention worth the cost?

Outline of the rest of the talk

- How cost-effectiveness analysis (CEA) addresses the cost question
- Review of prevention CEAs
- Features that make prevention more, or less, cost-effective
- Patients' time, the forgotten cost

Three Types of Prevention

- **Primary** prevention prevents the disease from occurring, e.g., vaccines.
- **Secondary** prevention detects risk factors, or pre-clinical disease, and intervenes to prevent further development, e.g., antihypertensive medication, cancer screening.
- **Tertiary** prevention intervenes to prevent or moderate consequences of established disease, e.g., blindness from diabetes.
- Focus here: primary and secondary prevention

How CEA addresses the cost question

- CEA compares the costs and health outcomes of alternatives (example, next slide)
- Usually counts only medical sector costs
 - Could count other costs and the societal perspective does
 - But medical costs are the point at issue
- **Difference** in costs and health outcomes between 2 alternatives: *net* costs and *net* health effects
- **Cost-effectiveness ratio:** *net* cost divided by *net* health effect, e.g., net cost per year of healthy life saved

**Annual Costs and Healthy Days per patient:
Guided self-management vs. traditional asthma care, 1997\$**

Lahdensuo A et al. *British Medical Journal*. 1998;316:1138-1139.

Costs/ Health effects	Self- management	Traditional	Difference
Counseling	348	179	169
Peak flow meter	32	0	32
Drugs	613	623	-10
Physician visits	47	80	-33
Hospital stays	33	52	-20
TOTAL COSTS	1074	935	138
HEALTHY DAYS	359.2	344.3	14.9

Cost-effectiveness ratio: \$3,380 per healthy year

Terminology

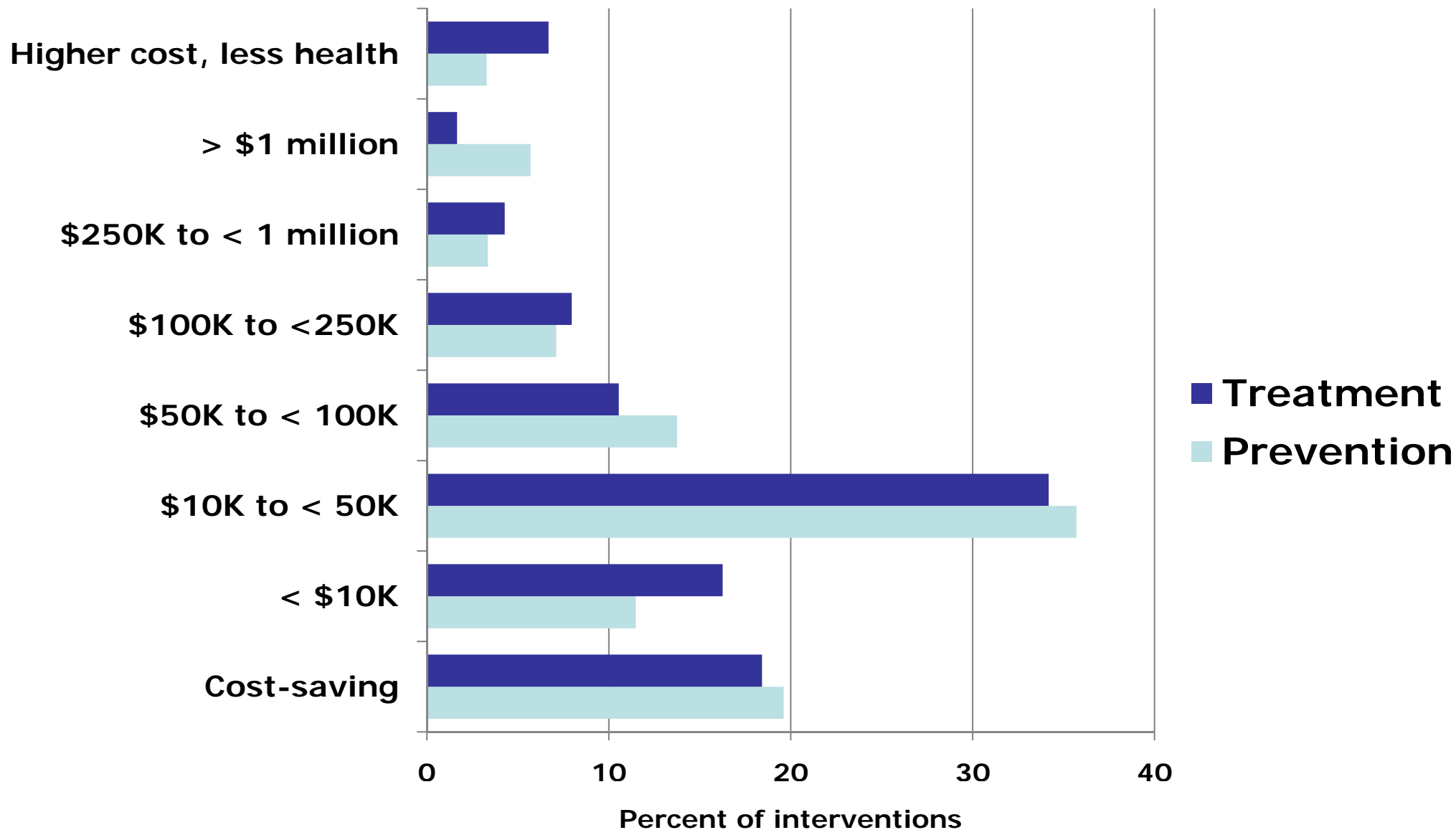
- An intervention is **cost-saving** if its net costs are negative. No cost-effectiveness ratio is calculated.
- An intervention is **cost-effective** if it costs more than the alternative but improves health and is judged to be good value for money.
- World Health Organization guideline
 - cost-effective: < 3 times per capita GDP (\$140,000 in the U.S.), for each year of life saved
 - very cost-effective: $< \text{GDP per capita}$ (\$47,000)

Recent Review of Prevention CEAS

Cohen JT, PJ Neumann, MC Weinstein. *New England Journal of Medicine*. 2008;358:661-663.

- Tufts-New England Medical Center CEA Registry
- 599 CEA studies published in 2000-2005
- 279 prevention comparisons
- 1221 treatment comparisons
- Less than 20% of preventive interventions, and a similar share of treatment interventions, reduced medical spending.

Cost per healthy year of life saved



What makes prevention more cost-effective?

- Component costs
- Risk profile of patients
- Frequency of intervention

Blood pressure medication

Weinstein, Stason. *Hypertension: A Policy Perspective*

- Medication is a better value for those whose blood pressure at diagnosis is higher.

Edelson JT et al. Long-term cost-effectiveness of various initial monotherapies for mild to moderate hypertension. *Journal of the American Medical Association*. 1990;263:407-413

- No medication is cost-saving
- Some are more cost-effective than others
- Diuretics, currently the first line of therapy, are among the most cost-effective.

Blood pressure medication

Updated to 2007\$ in LB Russell, Prevention's Potential

Cost per life-year in people aged 35-64, without heart disease, 2007\$

propranolol (beta blocker)	\$ 29,282
hydrochlorothiazide (diuretic)	44,057
nifedipine (calcium channel blocker)	84,890
prazosin hydrochloride (alpha blocker)	166,288

Statins to reduce cholesterol

Prosser LA et al. Cost-effectiveness of cholesterol-lowering therapies according to selected patient characteristics. *Annals of Internal Medicine*. 2000;132:769-779.

- Cost-effectiveness of statins varies widely with patients' risk profile
 - LDL
 - Blood pressure
 - Smoking
 - HDL
 - Existing heart disease
- Health gains and treatment savings are greatest for people at greatest risk.

STATINS: cost per healthy year in people 55-64, 2007\$

No CHD at baseline, high LDL cholesterol

Men, LDL 4.2-4.9 mmol/L (160-189 mg/dL)

DBP < 95, nonsmoker, HDL > 1.3 (49) 344,000

DBP ≥ 95, smoker, HDL < 0.9 (35) 165,000

Women, LDL 4.2-4.9 mmol/L (160-189 mg/dL)

DBP < 95, nonsmoker, HDL > 1.3 (49) 539,000

DBP ≥ 95, smoker, HDL < 0.9 (35) 224,000

No CHD at baseline, very high LDL cholesterol

Men, LDL ≥ 4.9 mmol/L (≥ 190 mg/dL)

DBP < 95, nonsmoker, HDL > 1.3 (49) 210,000

DBP ≥ 95, smoker, HDL < 0.9 (35) 88,000

Women, LDL ≥ 4.9 mmol/L (≥ 190 mg/dL)

DBP < 95, nonsmoker, HDL > 1.3 (49) 389,000

DBP ≥ 95, smoker, HDL < 0.9 (35) 180,000

CHD at baseline

Men 5,800

Women 12,600

Cervical cancer screening

Eddy DM. Screening for Cervical Cancer. *Annals of Internal Medicine*. 1990;113:214-226

- Another classic CEA
- Screening frequency is a major determinant of cost-effectiveness
- Compare interventions by intensity, not only with no intervention (here, no screening)
- Example: screening every 3 years vs. every 2 years

Cervical cancer screening

Cost per life-year, 2007\$

at 3 years vs. no screening	\$ 40,955
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at 2 years vs. 3	1,292,688
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annually vs. at 2 years	3,277,294
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Pneumococcal pneumonia vaccine

Sisk JE et al. *Annals of Internal Medicine*. 2003;12:960-968

- At \$16 per person (1995\$) -- about \$25 today – vaccination against pneumococcal pneumonia reduces medical spending for adults 50-64 with congestive heart failure, chronic lung disease, diabetes, and other chronic conditions
- The 2010 cost/dose, excluding administration costs
 - \$19 for the US Centers for Disease Control
 - \$38 for private US purchasers.
- Vaccination would be cost-saving at the CDC price, not at the private price

What about those 5:1 savings claims?

- CEAs of childhood vaccinations typically estimate
 - savings in parents' time, valued at the wage rate
 - children's future earnings
- They compare vaccination costs with medical savings, savings in parents' time, and children's future earnings.
- The reported ratio: all dollars saved to dollars spent.
- Often a vaccination strategy that saves when time/earnings are considered costs the medical system more than it saves.

Example of 5:1 savings

Lieu TA et al. Cost-effectiveness of a routine varicella vaccination program for US children. *JAMA*. 1994;271:375-81.

- Abstract: including parents' time and children's future earnings, varicella vaccine "would save more than \$5 for every dollar invested".
- Next line: medical costs of vaccination are greater than medical savings.
- Medical costs: vaccination saved 90 cents for every dollar spent (Table 4, "health care payer's perspective").
- Assumed a private-sector price of \$35 per dose (1990\$), about \$75 today. Current private-sector price is \$84.

Patients' Time: The Forgotten Cost

- Societal perspective, recommended by the Panel on Cost-Effectiveness in Health and Medicine, includes costs and health effects for all who are significantly affected by the intervention.
- Costs = real resources
- Unpaid time of patients and caregivers is a real resource.
 - Affects patients' decisions
 - Taken from other uses

Self-monitoring of blood glucose

Russell, Safford. *Am J Managed Care*. 2008;14:395-396.

Cost per healthy year, 2006\$

	Without patient time	With patient time
Once daily	\$7,856	\$41,720
Three times daily	6,601	38,619

Opportunity Costs (Russell LB, Prevention's Potential)

	2007\$	\$/yr	Yrs/\$1m
Chickenpox vaccine, pre-school children		5,367	186
Screening for colorectal cancer			
white men, sigmoidoscopy at 55		1,732	577
white men, sigmoidoscopy every 10 years vs. at 55		21,366	47
Mammography			
women aged 50-79, every 2 years		30,619	33
MRI for women with BRCA1			
mammography alone		20,494	49
mammography plus MRI		514,660	2
Screening for diabetes			
adults 55 with high blood pressure vs. no screening		51,211	20
all adults 55 vs. those with high blood pressure		537,756	2
Screening once for HIV			
prevalence 1.0%		34,713	29
prevalence 0.1%		68,412	15
Diet/exercise to prevent diabetes, high-risk adults		191,635	5
Smoking cessation, average of 15 programs		5,221	192

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