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What Have We Learned from Economic Analyses of Prevention?

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Economics of Prevention Workshop

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The Prevention Agenda

- Australia: "Investing more in health promotion, prevention, and early intervention is on the policy agenda of State and Federal Governments in Australia. There is a wide range of options … "

- U.S.: *"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

History and Expectations

- Prevention has brought major gains in health and life expectancy 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 the disease/injury than to repair it
  - Prevent the disease, prevent the costs of treatment
  - Expectation: Prevention improves health and reduces medical spending
- But does it reduce medical spending?

Radio advertisement

- Man about to undergo bypass surgery.
- Cost of the surgery: 50,000 $US.
- Wouldn't it be better to avoid the need for 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 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** of them 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
- Recent reviews of prevention CEAs
- Features that make prevention more, or less, cost-effective
- Points to consider in conducting analyses and developing policy
  - societal perspective
  - patients' time

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, e.g., self-management vs. traditional care for asthma (next slide)
- Usual practice to count 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 life-year gained

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

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			

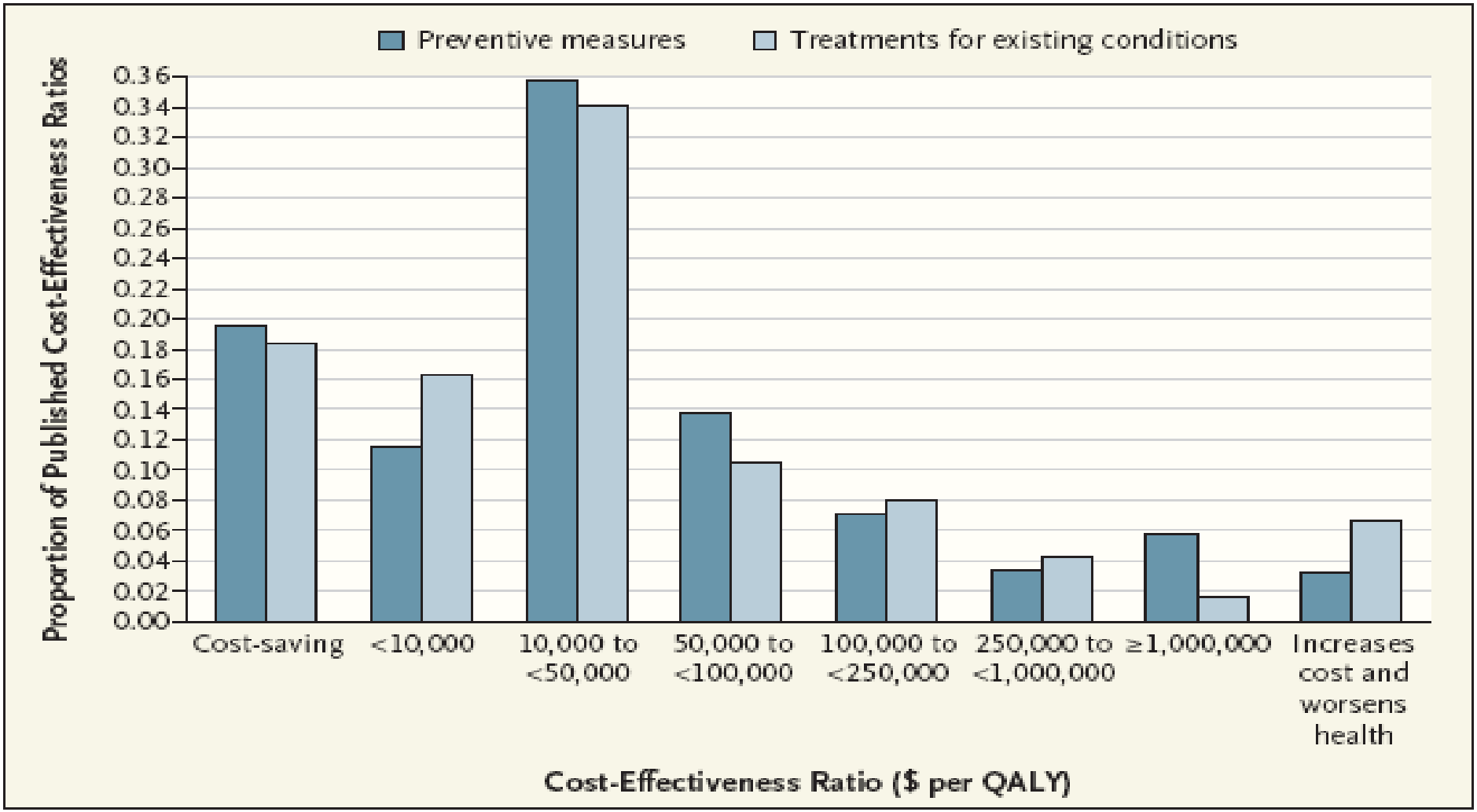
Terminology

- An intervention is cost-saving if its net costs are negative. No cost-effectiveness ratio is calculated.
- An intervention is cost-effective if it has positive net costs and net health effects and is judged to be good value for money.
  - The UK's National Health Service uses £30,000 per quality-adjusted life-year as a rough guide.
  - The WHO guide: < 3 times gross domestic product per capita (< GDP per capita is very cost-effective).
  - Australia's PBAC, 1991-1996: 37-69,000 $AUS, about 100,000 $AUS today (George et al. 1999).

Recent Reviews: United States

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.



Distribution of Cost-Effectiveness Ratios for Preventive Measures and Treatments for Existing Conditions.

Data are from the Tufts–New England Medical Center Cost-Effectiveness Registry. QALY denotes quality-adjusted life-year.

Recent Reviews: Australia

Dalziel K, L Segal, D Mortimer. *BioMed Central.* 2008;6:12 pp.

- 245 Australian-based studies, 1966-2005
- Of the 245, 21 "were both more effective and cheaper than their comparator."
- 78 prevention interventions, 33 screening.
- Total prevention: 111. If all 21 of the cost-saving interventions were prevention → 19% cost-saving, similar to Cohen et al.
- Probably lower (alternate count: 197 primary/secondary).

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 $US	
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$US

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 – screening every 3 years with screening every 2 – not just with no intervention (here, no screening)

Cervical cancer screening

Cost per life-year, 2007 $US	
at 3 years vs. no screening	40,955
at 2 years vs. 3	1,292,688
annually vs. at 2 years	3,277,294

Pneumococcal pneumonia vaccine

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

- At 16 $US per person (1995) -- about 25 $US 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 2008 cost/dose, excluding administration costs
  - 16-19 $US for the US Centers for Disease Control
  - 29-32 $US 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 $US per dose (1990). That is 75 $US in 2007, which is the current private-sector cost/dose.

CEAs and Policy: Points to Consider

- 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
  - Is taken from other societal uses

Self-monitoring of blood glucose

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

Cost per healthy year, 2006 $US

	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, www.nchc.org)

2007 $US	$/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		
all 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		
aged 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

When is prevention worth the cost?

"It will be important for decision makers to make decisions based on the individual merits of an intervention rather than rely on broad generalisations." Dalziel, Segal, and Mortimer 2008

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