The Rising Value of Health: Implications for Basic & Applied Research

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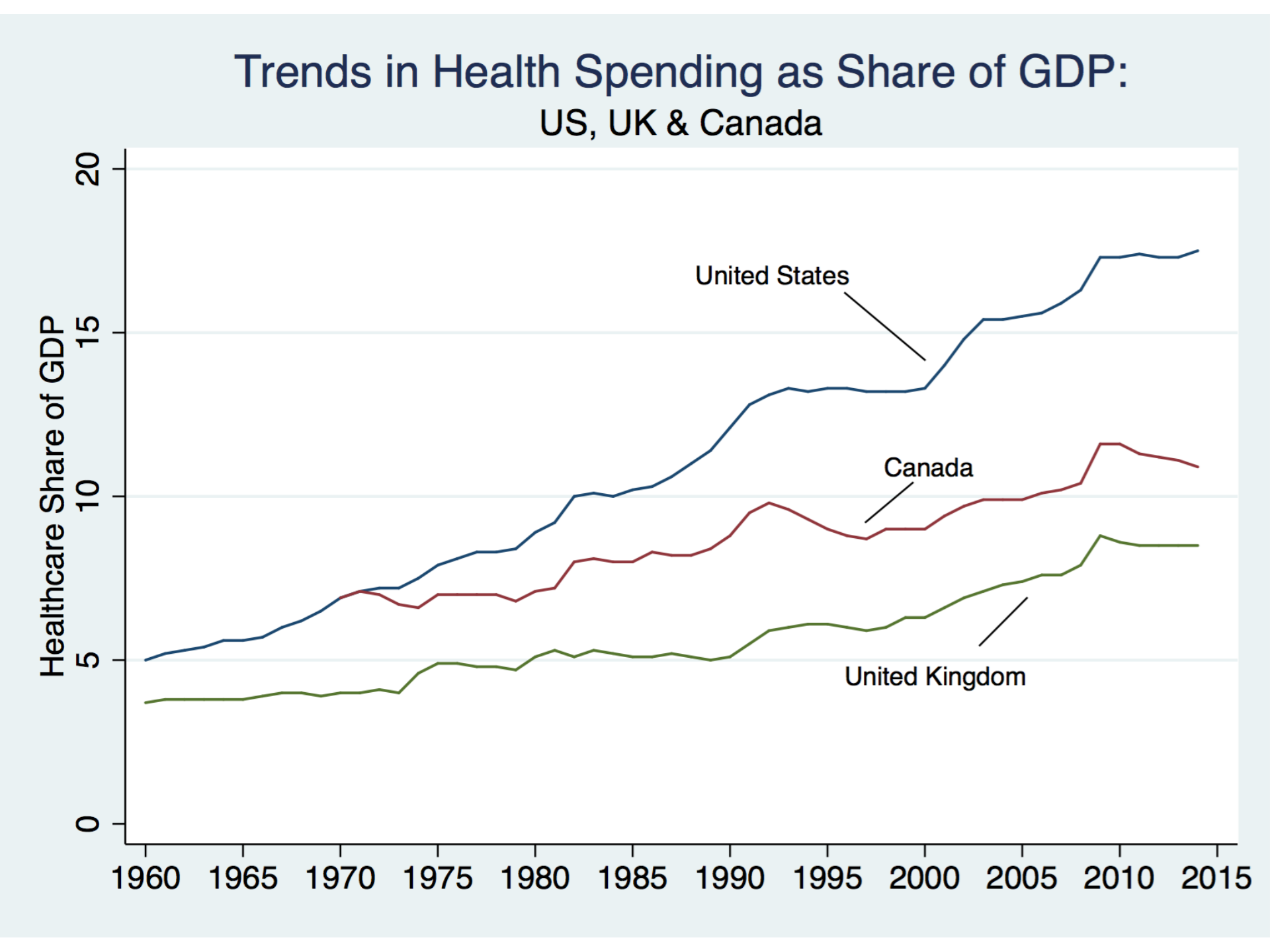
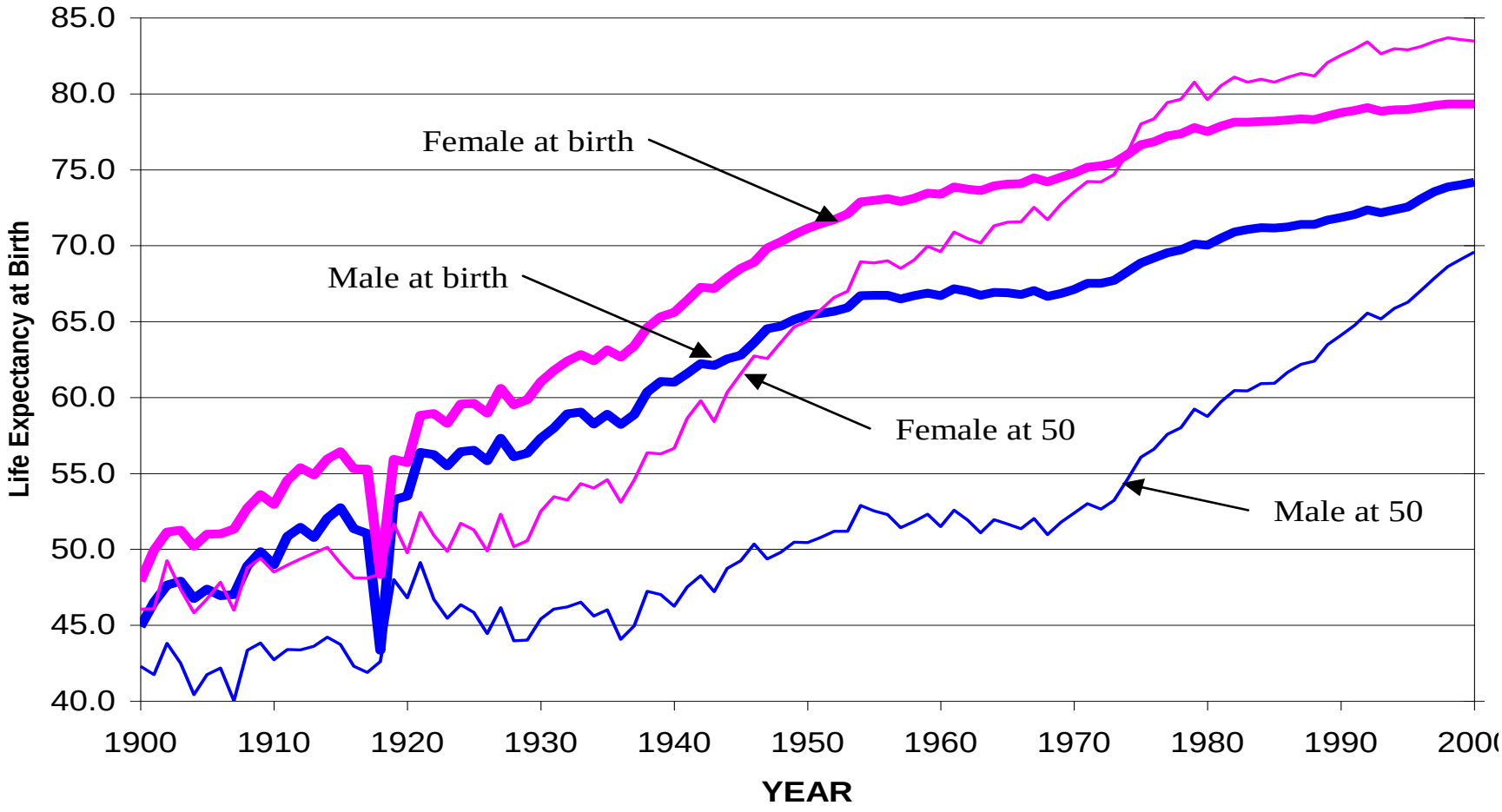
Much of what follows is based on joint work with my colleague Kevin M. Murphy. See Murphy & Topel (2003, 2006, 2007)


Trends in Health Spending as Share of GDP:
US, UK & Canada
Healthcare Share of GDP
0
5
10
15
20
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
United States
Canada
United Kingdom

Overview

- Why do we spend so much on healthcare?
  - Because it's valuable, and becoming more so
  - Because incentives are highly distorted
  - Downstream inefficiency distorts R&D incentives and returns
- Implications for Basic R&D
  - Basic R&D as public good (or bad!)
  - Prospective health gains are extremely valuable
  - Downstream inefficiencies reduce the value of upstream research, and distort research incentives toward high-cost technologies
  - Speed matters: biggest social returns to basic research on long-gestation projects

Life Expectancy in the U.S.: 1900-2000



Value: Basic Conclusions

- Historical improvements in life expectancy have been very valuable
  - 1900-2000 gains worth $1.2M per person to current population
  - Uncounted production of "health capital" about 25% of GDP—bigger in early 20th century
  - 1970-2000 gains were worth $95 trillion ($3.2 trillion per year)

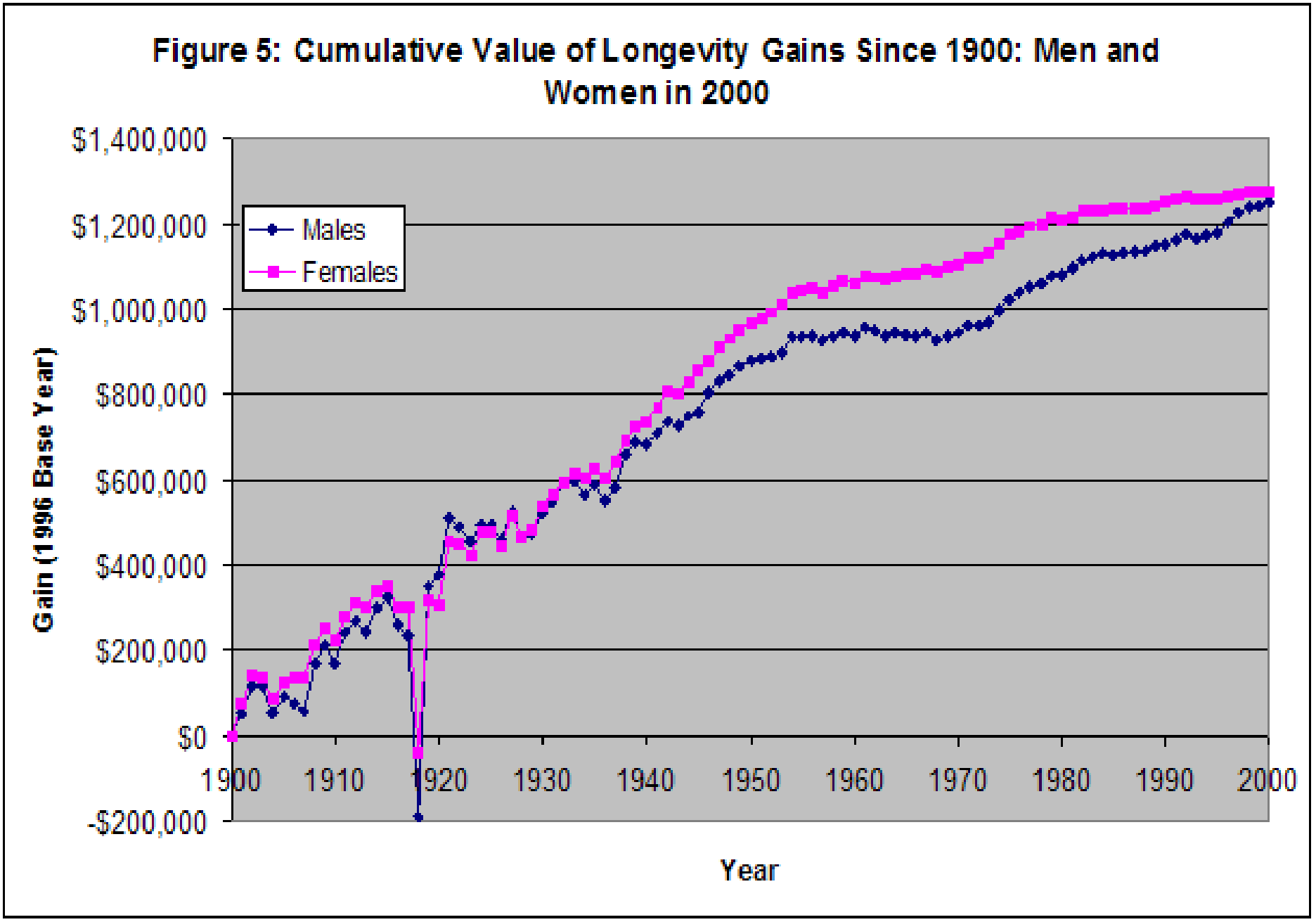


Figure 5: Cumulative Value of Longevity Gains Since 1900: Men and Women in 2000
$1,400,000
$1,200,000
$1,000,000
$800,000
$600,000
$400,000
$200,000
$0
-$200,000
Gain (1996 Base Year)
Males
Females
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
Year

- Potential future (gross) gains are very large:
  - Cancer cure: $47 trillion to current/future U.S. generations
  - Cure heart disease worth $45 trillion

- Modest progress would have great value:
  - 10% reduction in cancer deaths worth $4.7 trillion
  - Reduction in heart disease from 1970-2000: $35 trillion

- Calculated gross gains do not account for:
  - Public good spillovers—others gain from advances in US
  - Health-driven improvements in quality of life
  - Costs and speed of development
  - Costs & distortions in implementation/allocation

Medical Research and Costs of Care

- Investments in basic research are small in comparison to potential gains above:
  - About $60 billion/year in US. (PV » $2T)
  - About 3.5% of direct health expenditures
- Potential gains from medical research are large, but could be offset by increased cost of care
- Key issue: Costs of implementing innovations
  - More important than direct expenditures on research
  - Need more focus on the outputs of research rather than inputs
  - ***Ex Post* distortions in distribution/use (e.g. third party payment systems and politically driven allocations) affect *ex ante* value of innovations**

Valuing Longevity Gains

- Value of Statistical Life (VSL) for policy use in US (EPA):
  - VSL ≈ $6.3 million

- From willingness to pay for life years – what's a year of life worth to the person living it?
  - Flow of consumer surplus on income/consumption

- Yields life-cycle pattern of the "value of a life-year" for representative person
  - If you could "live" one more year at age 35 or age 85, which would you choose?

Figure 2a: Lifecycle Profiles of Full Income, Full Consumption and the Value of a Life-Year

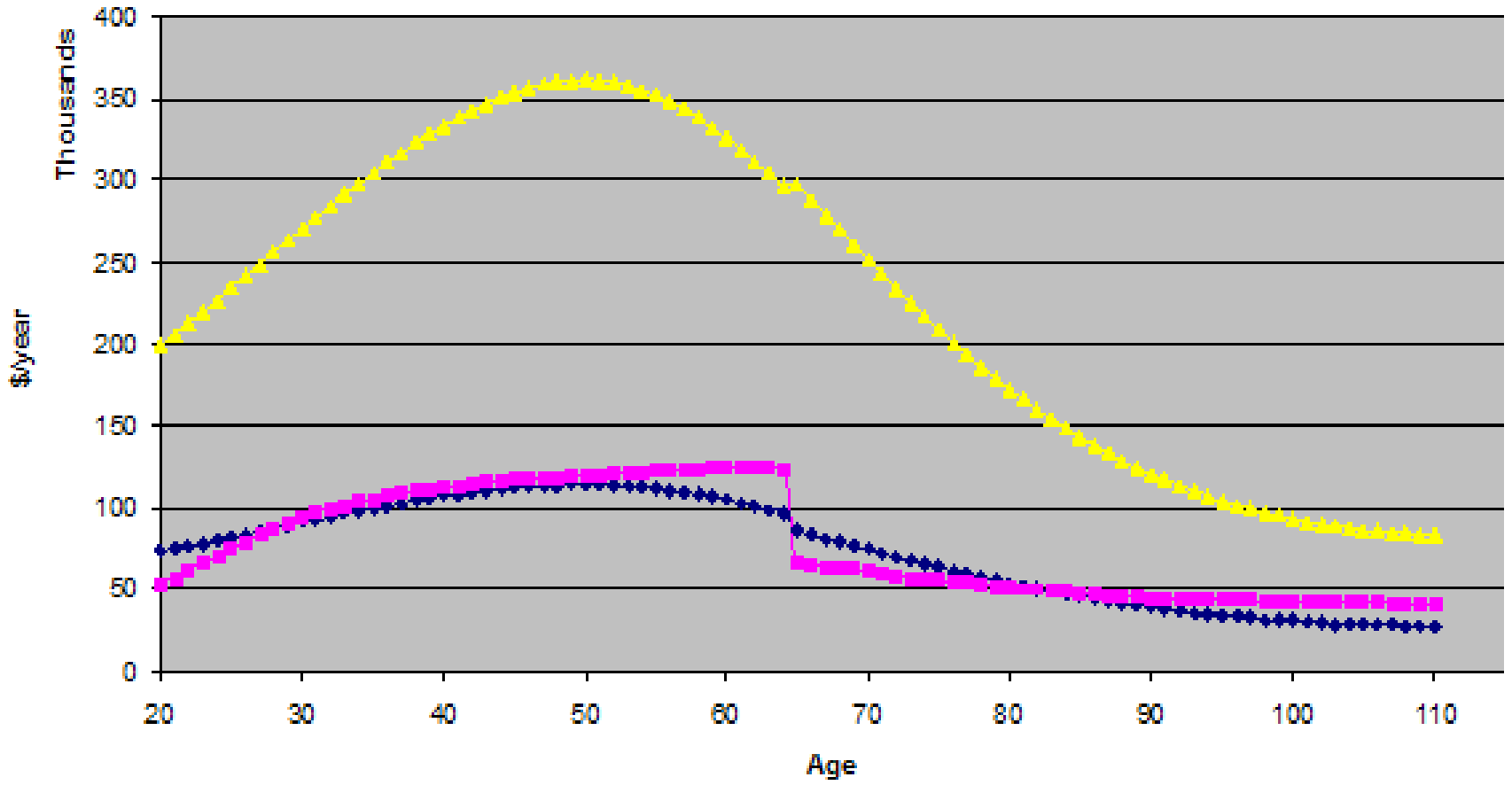
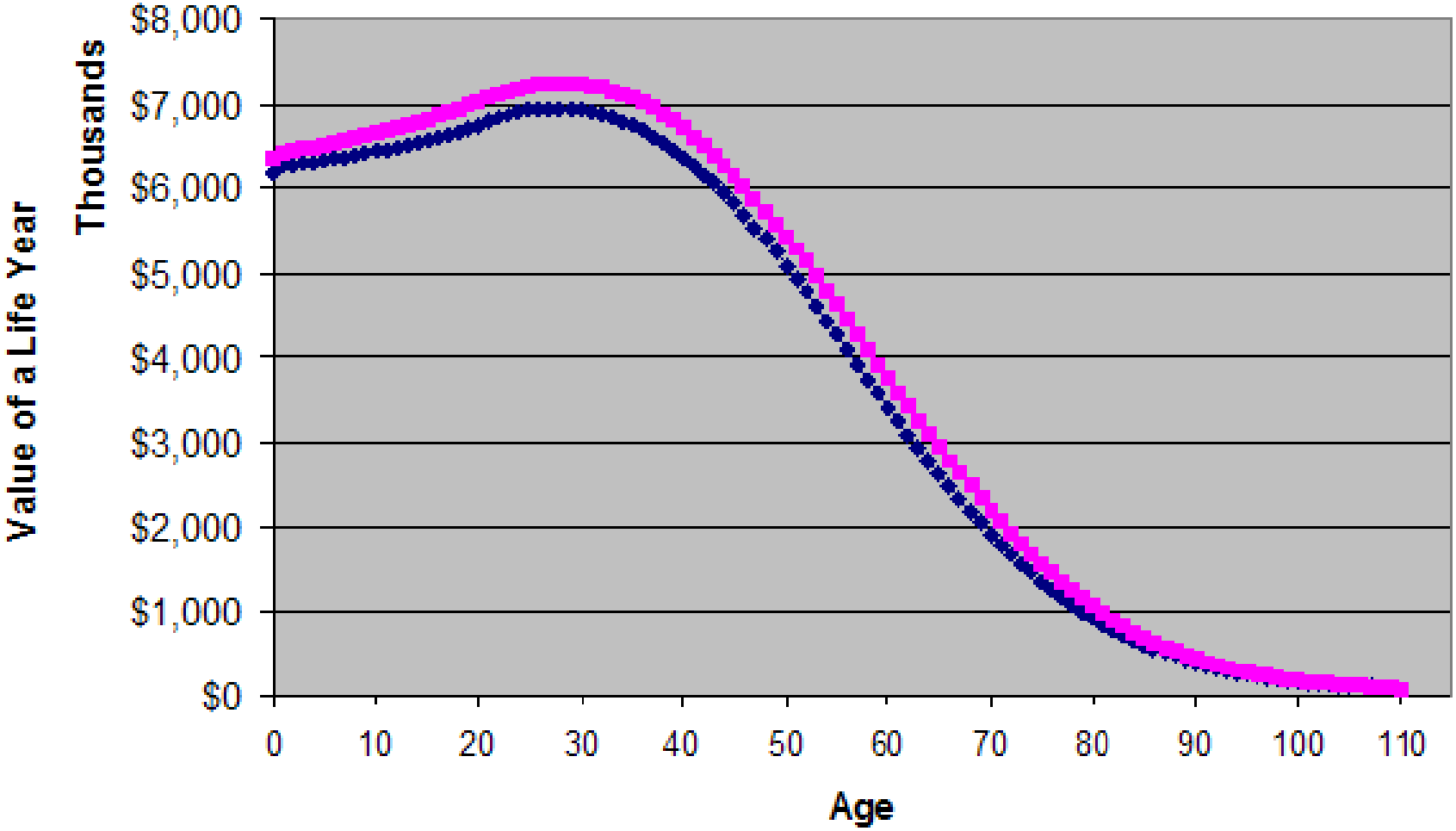


Figure 3: Values of Remaining Life Assuming $6.3 Million Value of a Statistical Life



Implications:
The Demand for Health Advances

- WTP for health rises with income
  - Income elasticity of WTP for health >1—as we get richer, a larger portion of income is devoted to ‘purchasing’ health
  - Economic growth raises value of health innovations—rich societies are willing to pay more
  - Optimal share of spending on health will continue to rise
  - Public good spillovers to other societies

- Value of progress against a disease is greatest when current age is close to, but before, typical age of onset
  - So aging population raises value of progress against age-related afflictions

Implications (cont)

- “Complementarity”:
  - Progress against one disease (heart disease) raises value of progress against other age-related diseases (cancer, Alzheimer’s) because we are alive to face them
  - Health advances raise the value of further health advances

High & Rising Value Interacts with Distortions

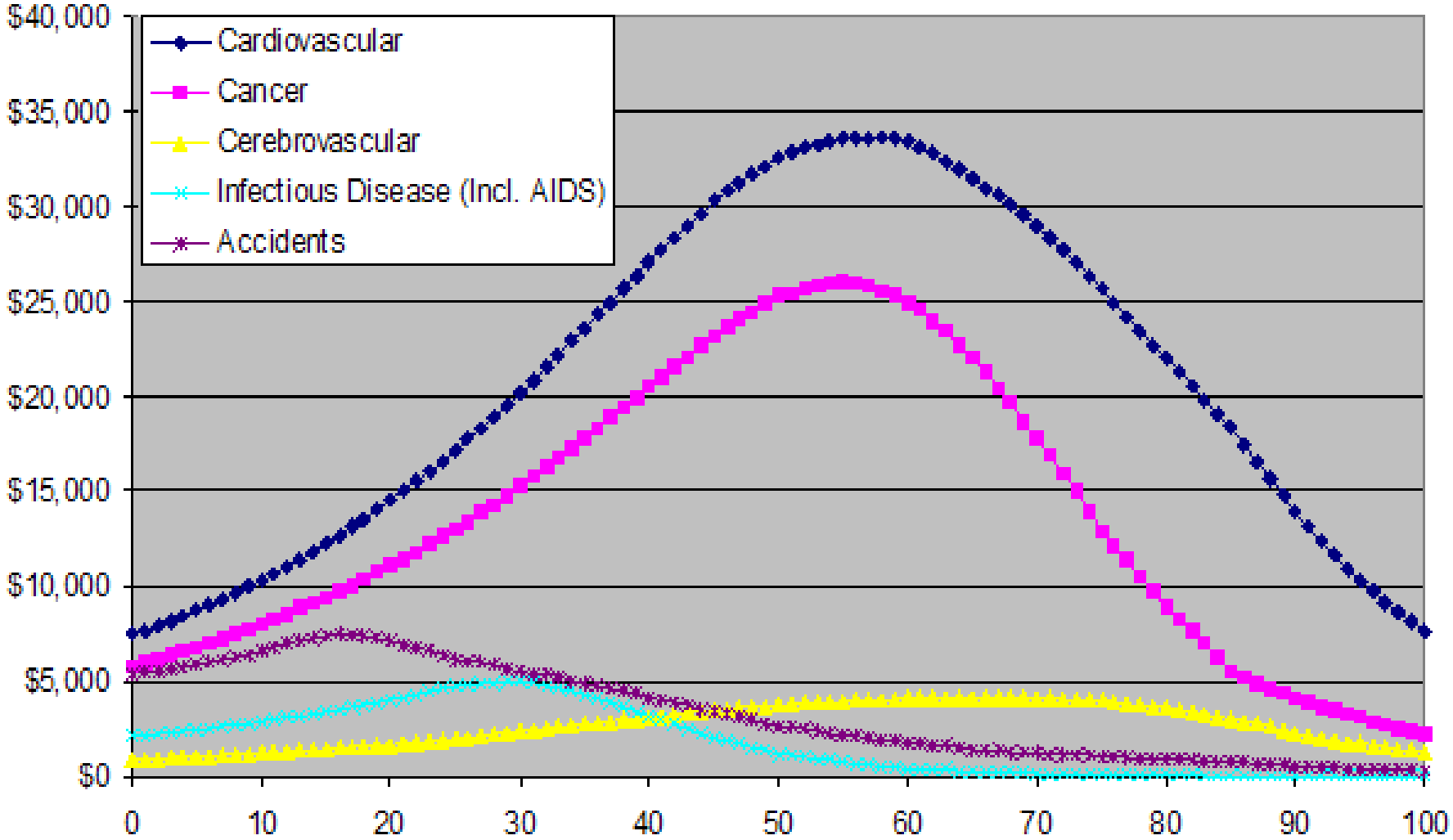
- Downstream distortions in use encourage consumption and distort upstream development
  - Untaxed consumption in employer plans
  - Health insurance vs. health care—routine & anticipated expenditure covered
  - 3rd Party payer distortions of use
    - Little or no price rationing
    - "Build it and they will come" coverage encourages development of high cost treatments
- Political factors block reform—"You can't get there from here."

Misconceptions

- The value of health improvements is not the contribution of health care expenditures to measured GDP, productivity or jobs—these are costs not benefits
- Value is not the additional productivity from longer lives
  - People care about much more than productivity
  - A reduction in mortality among, say, 80 year-old retirees is valuable because they enjoy life
- Improved health and longevity add to individual well being – this is what matters

Potential Gains From Future Health Advances

Figure 9a. Value of a 10% Reduction in Death Rates from Selected Disease by Age for Males



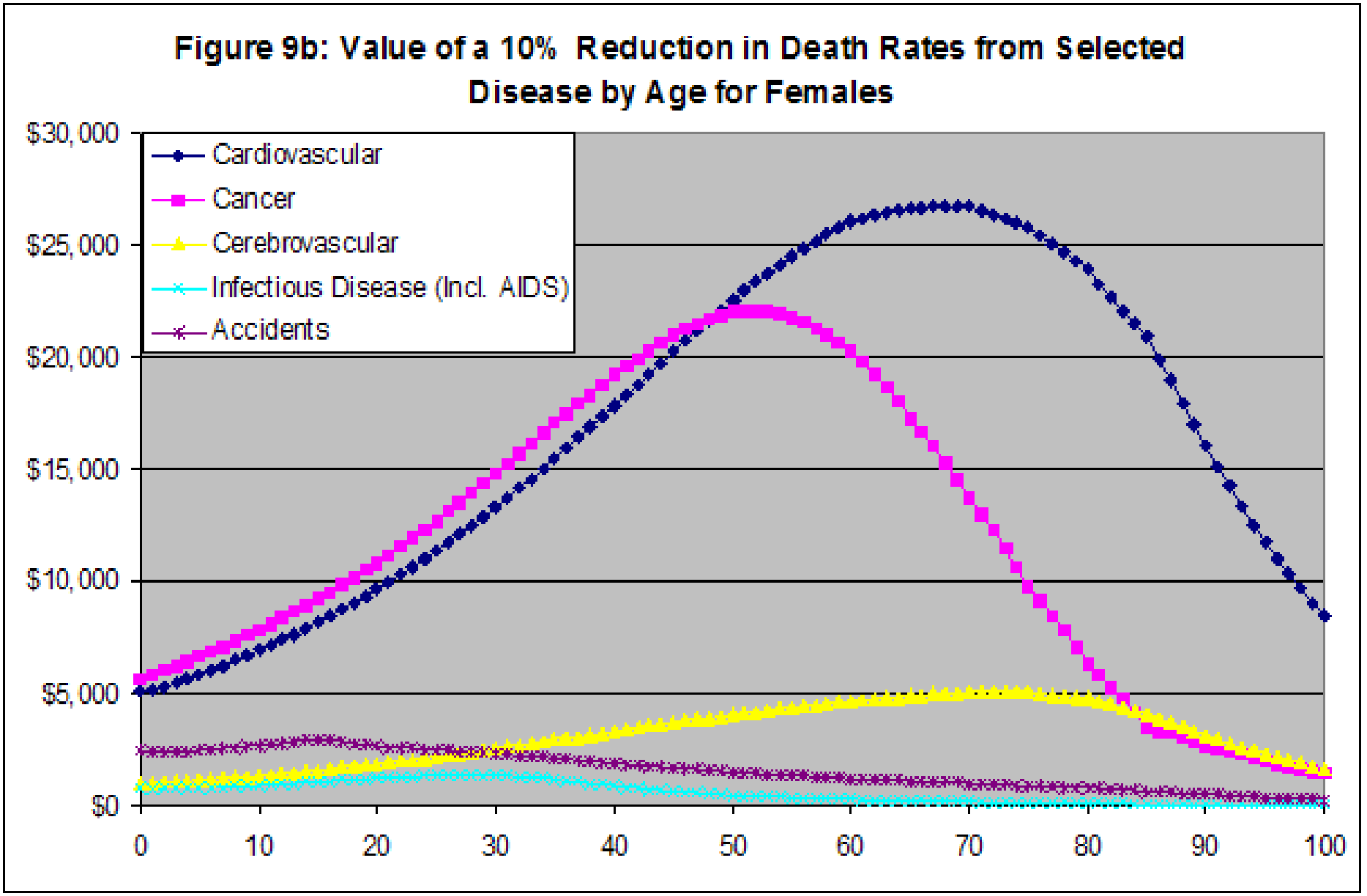


Figure 9b: Value of a 10% Reduction in Death Rates from Selected Disease by Age for Females
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$0
0
10
20
30
40
50
60
70
80
90
100
Cardiovascular
Cancer
Cerebrovascular
Infectious Disease (Incl. AIDS)
Accidents

Current Value of a 10 Percent Reduction in Mortality from Major Diseases (Billions of $2004)

Major Cause of Death	Males	Females	Total	Complementarity Effect	
All Causes	$10,651	$7,885	$18,536	$3,278	0.18
Cardiovascular Diseases	$3,254	$2,471	$5,725	$1,288	0.22
Heart Disease	$2,676	$1,852	$4,529	$1,013	0.22
Cerebrovascular Diseases	$393	$460	$852	$194	0.23
Malignant Neoplasms	$2,415	$2,261	$4,675	$863	0.18
Respiratory & Intrathoracic	$847	$557	$1,404	$278	0.20
Breast	$3	$444	$447	$51	0.11
Genital & Urinary	$301	$302	$603	$126	0.21
Digestive Organs	$575	$431	$1,006	$200	0.20
All Other Infectious Diseases	$500	$148	$649	$60	0.09
Obstructive Pulmonary Disease	$343	$331	$674	$153	0.23
Pneumonia & Influenza	$214	$194	$408	$98	0.24
Diabetes	$237	$249	$486	$91	0.19
Liver Disease & Cirrhosis	$217	$102	$319	$46	0.14
Accidents & Adverse Effects	$977	$421	$1,398	$133	0.10
Motor Vehicle Accidents	$519	$247	$767	$62	0.08
Homicide & Legal Intervention	$324	$90	$415	$29	0.07
Suicide	$411	$102	$513	$50	0.10

Balancing Costs & Benefits of Medical Advances

- In thinking about medical advances, must consider both benefits & costs
- Progress is important
- Controlling "downstream" costs is important
- Controlling costs raises the value of medical advances
- Cost containment (efficient use) and medical innovations compliment one another

A Simple Example

- $200 billion “war on cancer”
- 50-50 chance of success or failure
  - Success: new treatments reduce mortality by 10%
  - Failure: we lit the money on fire
- Value of success = $5 trillion (from above)
- What about downstream costs?

Downstream Costs of Care

- Two scenarios if "Success":
  - "good" outcome = treatment adds $2.5 trillion (50% of value) to costs of care
  - "bad" outcome = treatment adds $10 trillion (200% of value) to costs of care
    - e.g. use can't be denied or
    - Method of treatment is very costly
  - Assume each scenario is equally likely
- Three potential outcomes:
  - 50% chance of "Failure" = -$200 billion
  - 25% chance of "Good Success" = +$2.3 trillion
  - 25% chance of "Bad Success" = -$5.2 trillion
- Expected gain = -$825 billion

What matters in this calculation?

- Costs of research are small by comparison to costs and benefits (making them $100 billion or $300 billion has little effect)
- Probability of success matters some but not much
- Expected costs of care matter a lot
- **Question**: What can we do to improve things?
- **Answer**: Improve allocation of health resources

Example Continued

- Improve care system: don't implement if costs of care turn out to be high, even if treatment "works"
- Chance of "failure" now 75%
- But expected gain now +$425 billion
- Efficient cost containment raises the value of research, eliminating the major downside
- Downside to R&D and new technologies is not failure—it's unaffordable "success"
  - Distortions in "downstream" allocation of resources also distort R&D incentives, favoring high cost technologies
  - "Build it and they will come" distorts ex-ante R&D incentives and value

How do we get there?

- Best solution: Improve incentives and decisions in the delivery system – research will follow efficient resource allocation
- Second best: Change the direction of research to seek lowest costs solutions
- Both enhance the case for more research

Bottom Line

- Past improvements in health and longevity have had enormous economic value
- Potential gains from future reductions in mortality are also extremely large
- Results suggest we revise upward our estimates of the value of research
- Leaves the cost of treatment as the open issue for cost/benefit analysis

"The Economic Value of Medical Research" (with Kevin M. Murphy), in *Measuring the Gains from Medical Research: An Economic Approach*, edited by Kevin M. Murphy and Robert H. Topel. Chicago: The University of Chicago Press, 2003, pp 41-73.

"Diminishing Returns? Evidence on the Costs and Benefits of Improving Health" (with K.M. Murphy), November 2002, *Perspectives in Biology and Medicine*, volume 46, no. 3, (Summer, 2003): pp108-128.

"The Value of Health and Longevity" (with K.M. Murphy), *Journal of Political Economy*, October 2006, pp 871-904.

"Social Value and the Speed of Innovation" (with Kevin M. Murphy), *American Economic Review*, May, 2007.