The Economic Impact of Preventable Drug-related Morbidity

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We know that Medication Errors are prevalent & costly…

- But is it cheaper to prevent them?
- And how much can we invest for prevention before we exceed cost savings?

The New York Times

"New Job Title for Druggist: Diabetes Coach"

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The New York Times
nytimes.com

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New Job Title for Druggists: Diabetes Coach

By IAN URBINA

ASHEVILLE, N.C. — In an office behind the Hershey's candy rack at a Kerr Drug here, Stuart Rohrbaugh shifts in his chair as his pharmacist stares at a dangerously high blood sugar reading from last month.

"I think that was the day a buddy of mine brought over his home-brew beer," stammers Mr. Rohrbaugh, whose diabetes was diagnosed six years ago.

Silently, the pharmacist lifts her eyes, sending Mr. Rohrbaugh's gaze to the floor.

"I know, I know," he says.

Mr. Rohrbaugh, 37, learned relatively late in life that he had Type 1 diabetes, a malfunction of the immune system that usually surfaces in childhood. There are hundreds in Asheville with that type, and even more with the more prevalent Type 2, which often hits as a consequence of obesity or age.

And so in this town of 75,000, where people like to use sugar in their coffee and in their iced tea, and as a term of endearment, Mr. Rohrbaugh and the others face the formidable challenge of either managing their diabetes or suffering its potential ravages: blindness, organ failure, stroke.

In trying to meet that challenge, the kind of polite browbeating that Mr. Rohrbaugh faced at his local pharmacy seems to be paying off.

For the past 10 years, the city of Asheville has given free diabetes medicines and supplies to municipal workers who have the disease if they agree to monthly counseling from specially trained pharmacists. The results, city officials say, have been dramatic: Within months of enrolling in the program, almost twice as many have their blood sugar levels under control. In addition, the city's health plan has saved more than $2,000 in medical costs per patient each year.

There are at least 21 million diabetics in the United States, and health officials have begun to despair of combating the disease because it involves getting people to do something much more difficult than taking their medicine or having surgery: altering their daily behavior, like their eating and exercise habits.

NYT continued: Pharmaceutical Care

- But the efforts to help people change their lifestyles are complicated by a health care system in which insurers typically do not reimburse doctors for the kinds of counseling and monitoring that might keep patients on track.
- So the Asheville experiment has enlisted pharmacists in its model. They serve as coach, clinician and cheerleader for patients, and they earn a fee for each session.
- “Once you have a sense of what motivates them, you set little goals each visit,” said Dana K. Arrington, a clinical pharmacist at Kerr Drug who sees at least one diabetes patient a day.
- “This month, get on the treadmill once a week for 15 minutes. Next month, we write down each time you take your pills. Then switch from whole to skim milk. It’s a slow process if you want it to stick.”

NYT continued: ROI

- “We get a four-to-one return on investment,” said Barry Bunting, pharmacy director at Mission Hospitals, which runs the program for about 450 city and hospital employees. For every dollar spent on medicines or counseling the city saves $4 by preventing emergency room visits, dialysis, amputations or other complications of diabetes.
- During the first five years of the program, participants took an average of six sick days from work a year, half the number of previous years. Within three years of enrolling in the program, patients had halved their chances of going blind or needing dialysis or an amputation, a founder of the program said.

NYT continued: Cost Savings

- John Miall, one of the founders of the Asheville program, who recently retired as the city's director of risk management, said that within its first year the average annual health care cost for diabetic employees dropped to $3,554 from $6,127.
- "Do the math," he said. "If just one employee is kept off dialysis, that is a $100,000 net savings for the year. That pays for a heck of a lot of preventative medicine and supplies."

Maybe it depends on the Indication?

- Randomized controlled trial of patients with depression in 19 pharmacies (Bosmans et al, Pharmacoeconomics 2007)
- Mean total cost over 6 months was €3,275 in the intervention group and €2,961 in the control group.
- Incremental cost-effectiveness ratio was €149 per 1% improvement in adherence and €2,550 per point improvement in the SCL depression mean item score (Hopkins symptoms checklist)

Expanding the Roles of Outpatient Pharmacists… (Bero et al., Cochrane Library 2007)

- Reviewed controlled trials, controlled before and after studies, and interrupted time series analyses that compared
  - Pharmacist services targeted at patients or health professionals
  - To absence of such services or similar services delivered by other health professionals
- No meta-analysis due to variety in outcomes and measurements

Cochrane Review - Results

- Generally positive findings related to improvements in health outcomes.
- Some intervention groups had decreases in health service utilization.
- One showed an increase in primary care visits but a decrease in specialty visits, but no change in ED visits or hospitalization.
- Some reported a decrease in drug costs while other reported an increase.

Cochrane Review - Discussion

- Studies that compare cost and outcomes of pharmacy services against similar services provided by other healthcare professionals are needed.
- There are numerous gaps in the study of the effects of pharmacist interventions on patient outcomes.
- Most studies lacked the power to differentiate between different types of healthcare utilization.
- Most studies did not calculate the cost of the intervention not allowing cost-effectiveness analyses.

Cost Studies

- Critical question: What is attributable to Pharmaceutical Care and what not?

"Our economic forecasts are based on a complicated mathematical formula."

Why are Cost Assessments so difficult in PC Studies?

- “Gun-shot” Pharmaceutical Care Studies
- Behavioral pathways for healthcare utilization
- Cost of pharmacy services (that are / are not part of pharmacists’ responsibilities)
- Study design and measurement
- Integrity: strength and consistency of the intervention
- Constraints in data access
- Follow-up time

Do the Math…

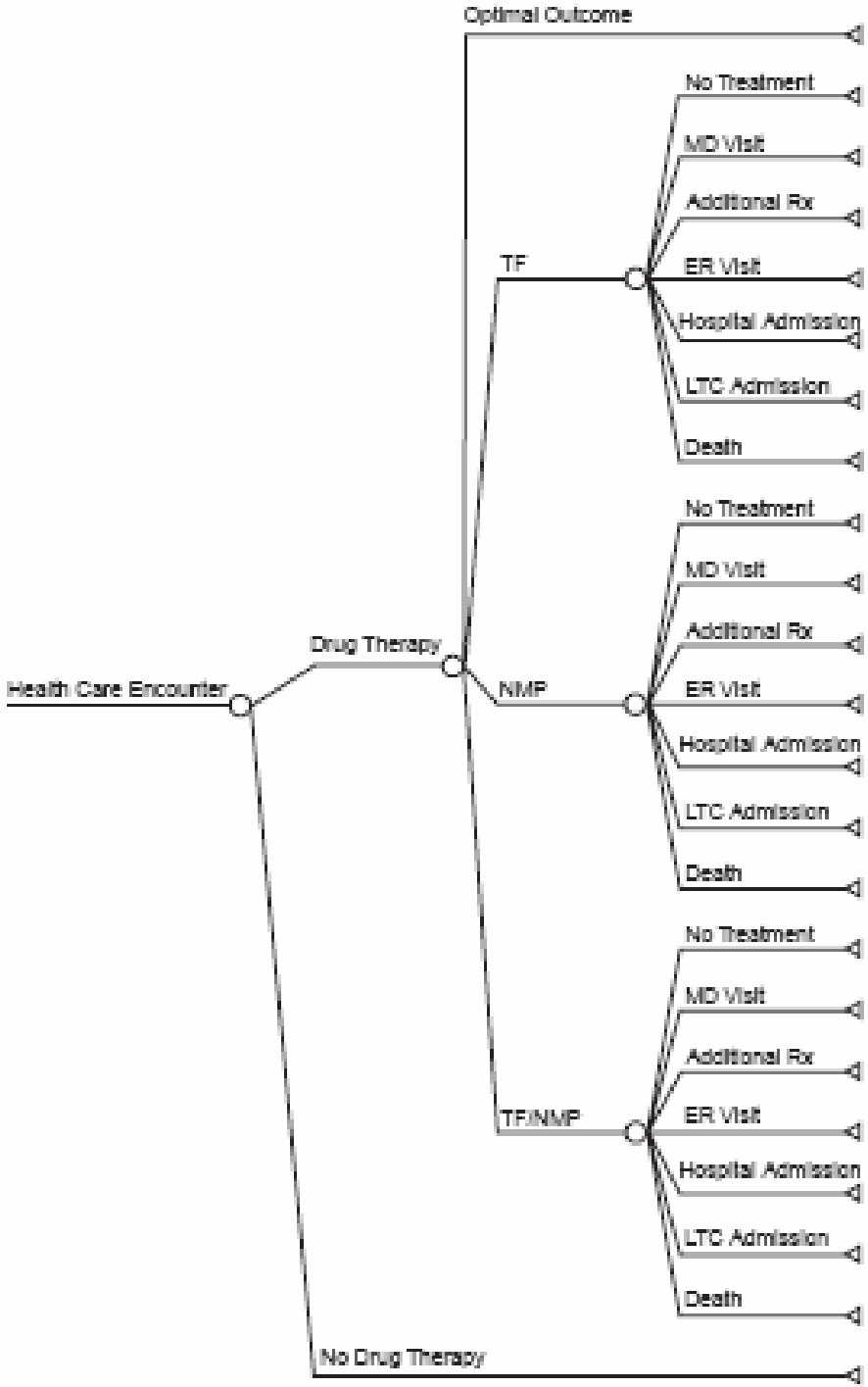
Two Ways to do the Math

- Decision-analytic models ("model-based studies")
  - Projecting cost savings associated with demonstrated improvements on processes / outcomes
- Patient-level data ("trial-based studies")
  - Clinical Trial Data
  - Quasi-experiments / observational studies

"Though the elements for recovery are in place this parrot does not have the feel good factor."

Model-based Studies I (Ernst & Grizzle 2001)

- Johnson & Bootman model
  - Model of PDRM incidence rates and associated healthcare utilization using a hypothetical cohort of ambulatory patients in 2000.
  - Probabilities based entirely on expert panel opinion
  - Cost for treatment failure was $977, for a new medical problem $1,105, and the combination of the two $1,488.
  - Cost of drug-related morbidity and mortality exceeded $177.4 billion in 2000. Hospitalizations accounted for nearly 70% ($121.5 billion) of total costs, followed by long-term-care admissions, which accounted for 18% ($32.8 billion).



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Cost-Benefit of Pharmaceutical Care

(Johnson & Bootman 1997)

- Extension of expert panel: reduction in negative treatment outcomes through PC estimated at > 50%

Table 1.
Health Care Utilization for and Cost of Drug-Related Morbidity and Mortality in the United States

Item	Drug-Related Morbidity and Mortality Events				Cost Avoidance ($1000)
	Without Pharmaceutical Care[a]		With Pharmaceutical Care		
	No.	Cost ($1000)	No.	Cost ($1000)	
Physician visits	115,654,949	7,459,744	46,178,945	2,978,541	4,481,202[a]
Additional prescriptions	76,347,604	1,933,121	30,297,467	1,070,106	863,015
Emergency room visits	17,053,602	5,320,723	6,739,140	2,102,611	3,218,112
Hospital admissions	8,761,861	47,445,477	3,520,520	19,063,615	28,381,862
Long-term-care facility admissions	3,149,675	14,398,644	1,254,181	5,733,450	8,665,194
Deaths	198,815		79,159		
Total	221,166,506	76,557,711[b]	88,069,412	30,948,326[b]	45,609,385

[a]From reference 1.
[b]Figures do not add exactly because of rounding.

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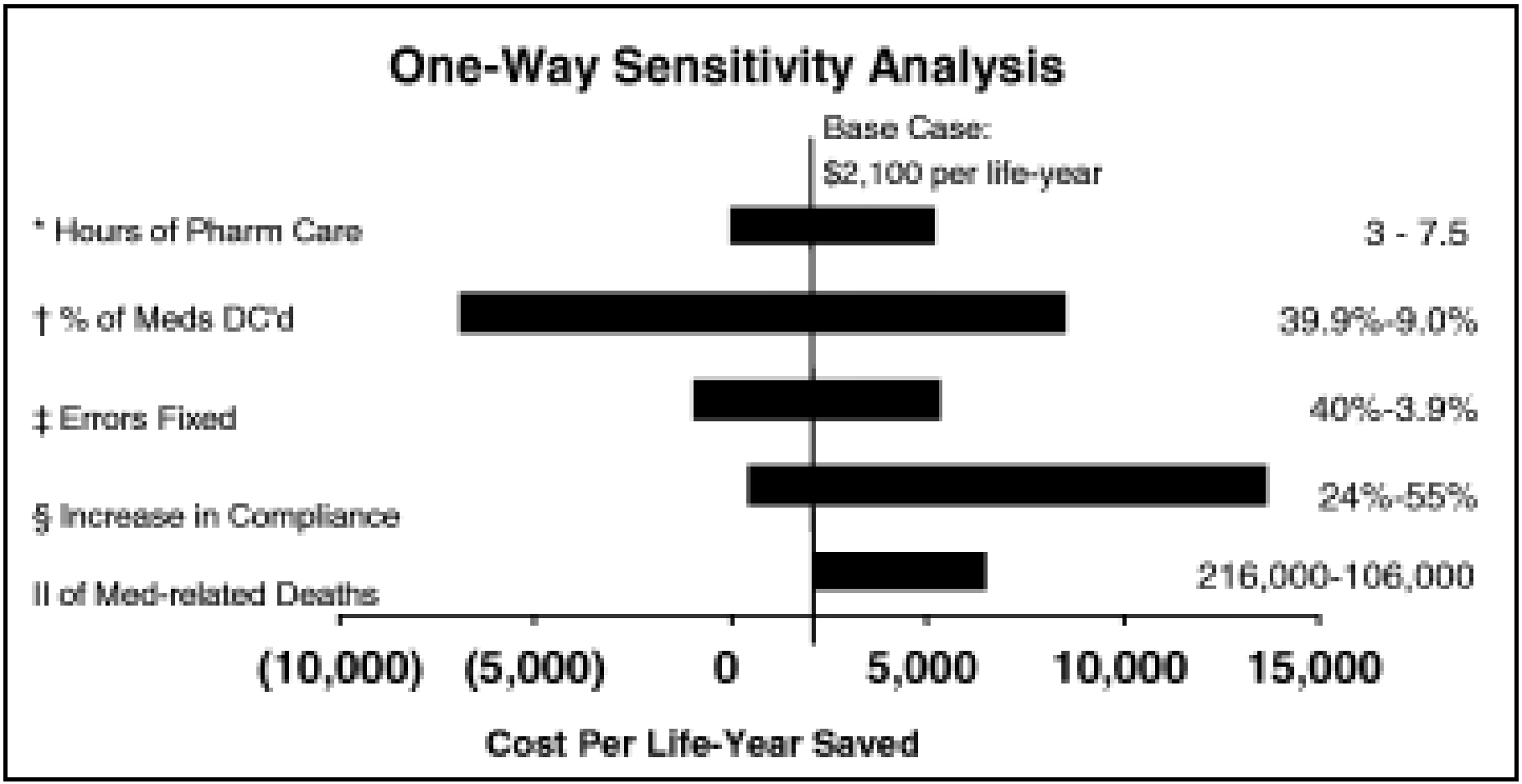
Model-based Studies II

- Cost-effectiveness analysis of pharmaceutical care in a Medicare Drug Benefit Program (Eternad & Hay 2003)
- Model parameters
  - Lifetime model of Medicare beneficiaries (>65)
  - Variety of observational studies and expert panel estimates for
    - % hospitalization and ER visits resulting from ADRs, noncompliance, inappropriate prescribing
    - Increase in compliance and decrease in inappropriate prescribing as a result of pharmaceutical care
    - % medications discontinued as result of PC
    - Decrease in mortality as result of PC (Yuan et al 2003)
    - Decrease in hospitalization as result of PC (Yuan et al 2003)
  - 5h PC in year 1 and 2.5h each follow-up year

Cost per Life-year saved (Eternad & Hay 2003)



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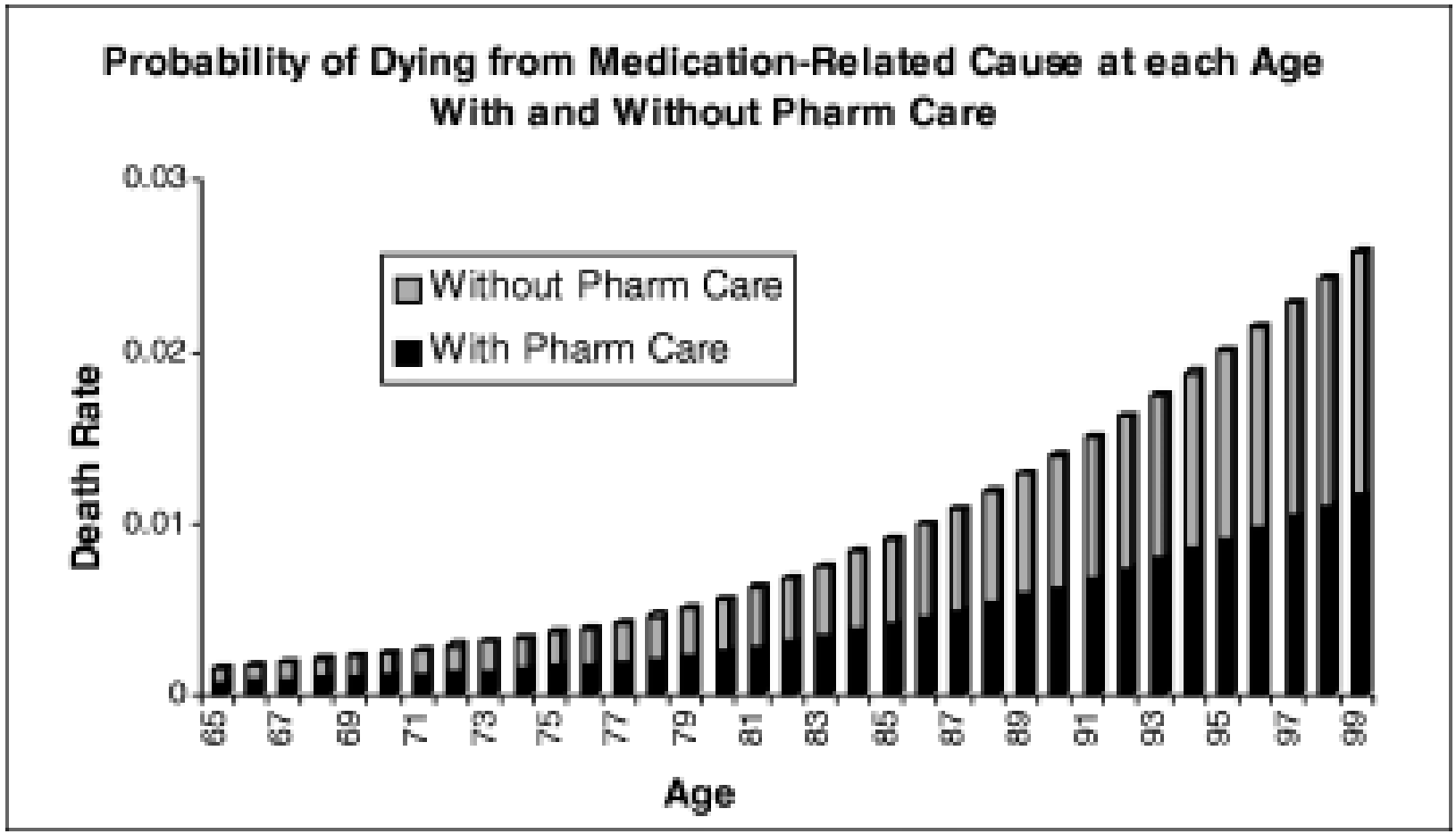
Impact of PC on Mortality (Eternad & Hay 2003)



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Trial-based Studies I

- Adverse Drug Event Study Group (Bates et al 1997)
  - Nested case-control study within 4,108 admissions to a stratified random sample of 11 medical and surgical units in 2 tertiary-care hospitals over a 6-month period.
  - Adverse drug events were detected by self-report stimulated by nurses and pharmacists and by daily chart review.
  - In paired regression analyses adjusting for severity, comorbidity, and case mix, and after adjusting for sampling, the estimated costs attributable to ADEs were $2,595, and $4,685 for preventable ADEs.

Trial-based Studies II

- Pre/post comparison of cost per patient per month at baseline and follow-up (time ~9 months) (Christensen et al 2003)

	t(0)	t(1)
HbA1c (n=60)	7.7%	6.9%
Encounters for diabetes (n=85)	60 ± 83	112 ± 137
Encounters for other dx (n=85)	465 ± 817	331 ± 564
median	124	133

- "Non-significant but economically important 29% decrease in non-diabetes cost."
- Long-term cost savings (follow-up over 5 years): $1200 per patient per year.

Diabetes-related Complication Incidences estimated in Florida Medicaid

- Incidence (per 1000 patient-years)
  - AMI 2.9
  - LEA 1.6
  - Ulcer 54.9
  - Background Retinopathy 15.3
  - Proliferative Retinopathy 6.5
  - ESRD 4.3
  - All-Cause Mortality 85.7

- Average reduction in incidence for any complication for 1% decrease in HbA1c: 20%
- 5-year average savings: $338

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Comparison of Approaches: Cost Savings associated with Diabetes Control

- Trial-based
  - HMO: 3-year total cost of cohorts defined by baseline HbA1c
    - 8-10 versus <8%: -$58 (Wagner et al)
    - 9 versus 8: $2,101 (Gilmer et al)
    - 8 versus 7: $1,505 (Gilmer et al)
  - UKPDS: 10-year patient-level total healthcare utilization data multiplied by average cost for each item
    - constant difference of crude 0.9%: $1,502 (Gray et al)
- Model-based
  - Variety of observational studies / trials (association of baseline HBA1c & diabetes complications) + healthcare utilization studies
    - 30-year cost for 9 versus 8.5: $3,611 (Caro et al)
    - Lifetime cost for 10 versus 7.2: $15,205 (Eastman et al)

(cost adjusted to 2000 values)

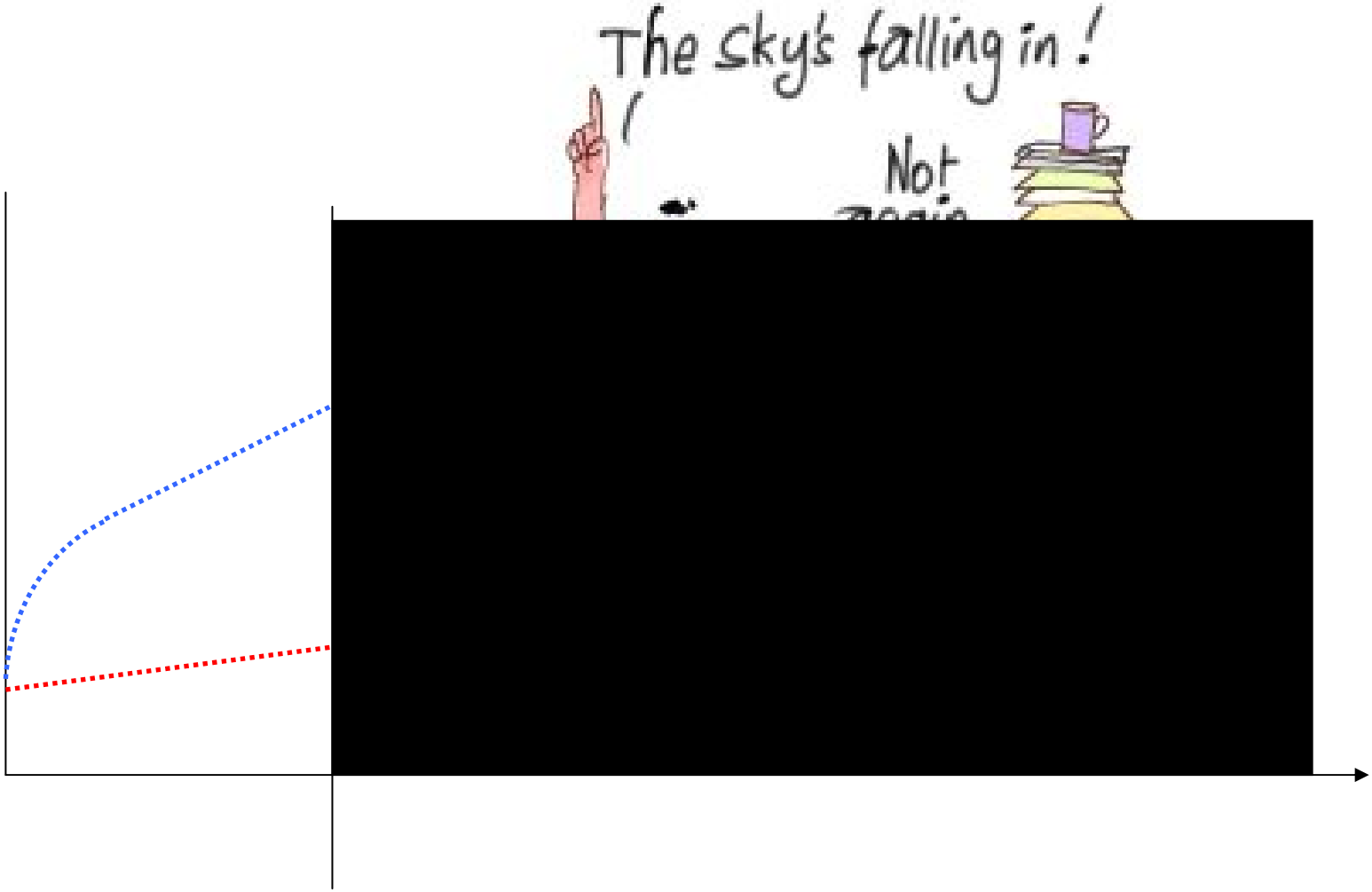
Considerations in Trial-based Studies

- Follow-up time and background incidence determine type of outcome (and cost) that can be assessed
- Power
- Cost for healthcare need to be separated from cost for data collection
- Measurement bias: PC may lead to detection (and healthcare) of previously undiagnosed health issues that are not discovered in control groups
- Generalizability

Considerations in Model-based Studies

- Combination of heterogeneous studies - “patchwork”
- Selective use of studies
- Omission of important outcomes or cost items
- Inappropriate extrapolation of short-term data
- Herculean task for “holistic” PC approaches
- Excessive use of assumptions
- Inadequate assessment and incorporation of uncertainty

Extrapolations



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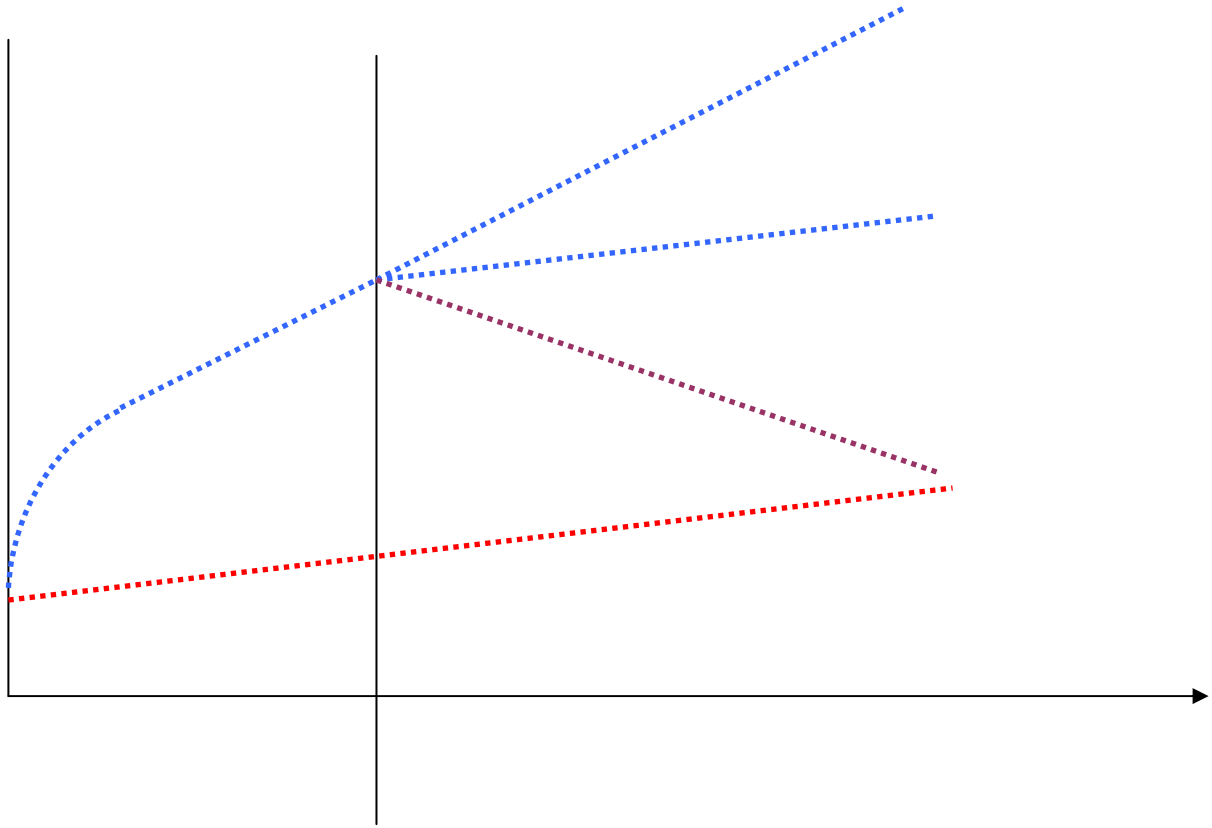

Other overarching issues

- Methodological Issues in Evaluating the Economic of PC in the Elderly (Crealey et al, Pharmacoeconomics 2003)
  - Downstream resource consequences
  - Transferability of cost results
  - Quality of life assessments

Recommendations

- Solid study design, conduct and analysis are the key.
- Outcomes data are usually the greater problem in economic studies than cost data.
- Small PC studies and multi-center studies benefit from extrapolations and modeling
- Consider two pathways in projecting impact of PC
  - Biological
  - Behavioral
- Itemize cost where possible to facilitate comparisons across healthcare systems, avoid shot-gun approaches
- Use QoL measures that can be translated into utilities

Recommendations continued

- Do not plan economic evaluations after the fact
- Train pharmacists to consider economics
- Be realistic
- And pragmatic

- Keep in mind that economic analyses are conducted to support decision-making on resource utilization.

Questions?

Have a great conference!