

Causality in Comparative Effectiveness Research

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The Grand Challenge

what is possible ... what is delivered



Overuse

Underuse

Misuse



Expanding the research continuum

basic
science

pathophysiology

clinical
science

what is the
appropriate
intervention?

evaluative
science

does it work?

effectiveness
of alternative
treatments

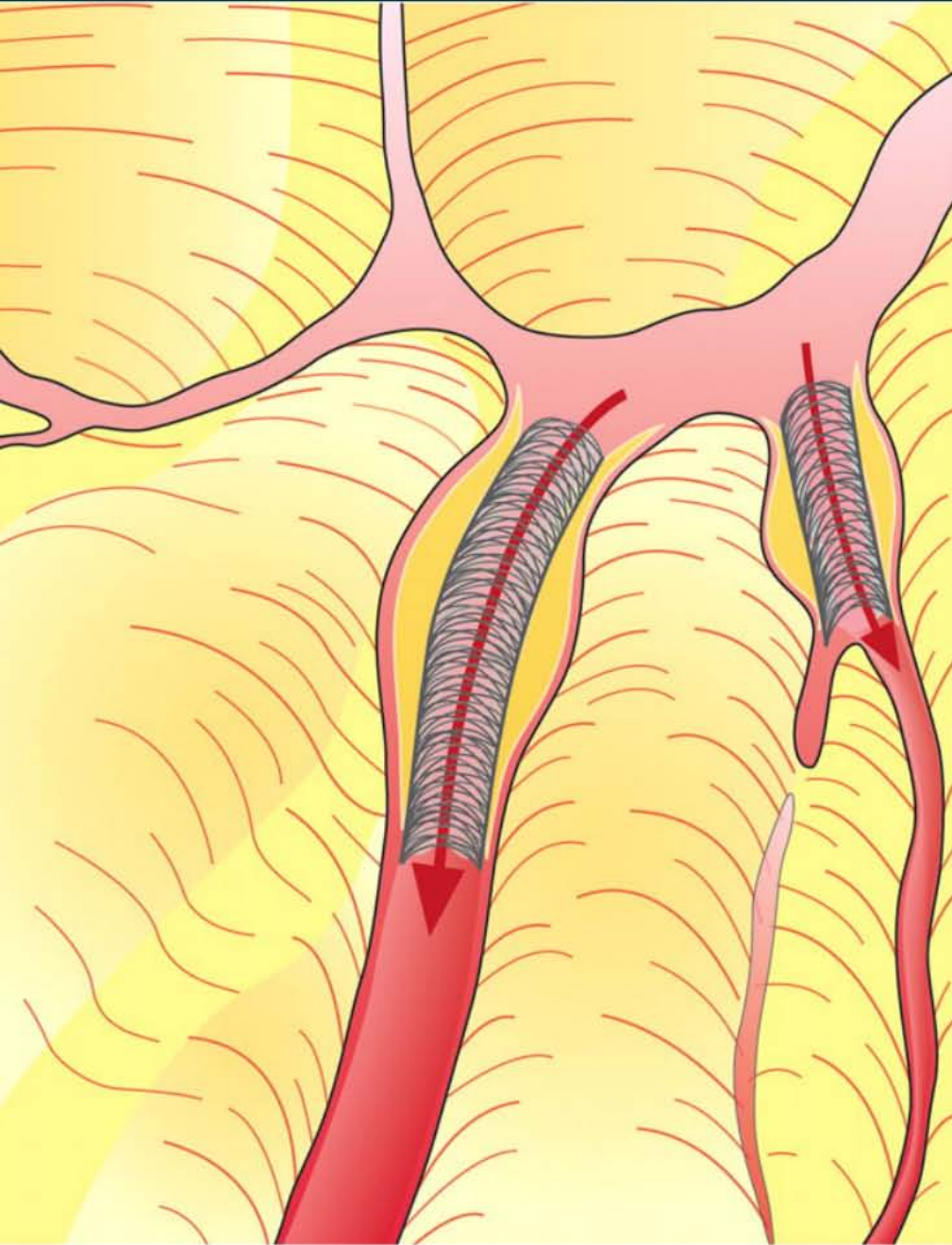
Comparative effectiveness research

Benefits and risks of alternative interventions

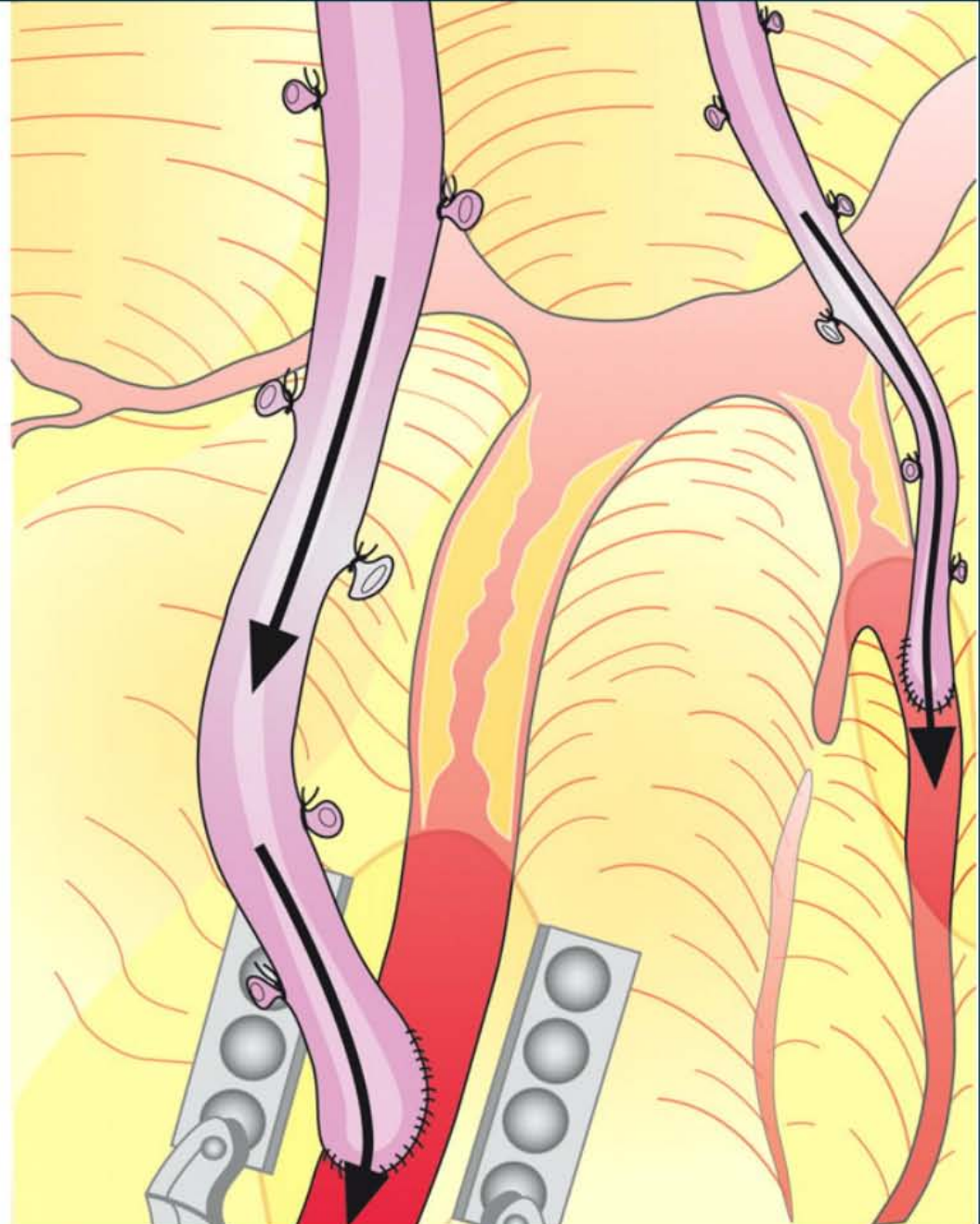
Treatment, device, timing, or policy

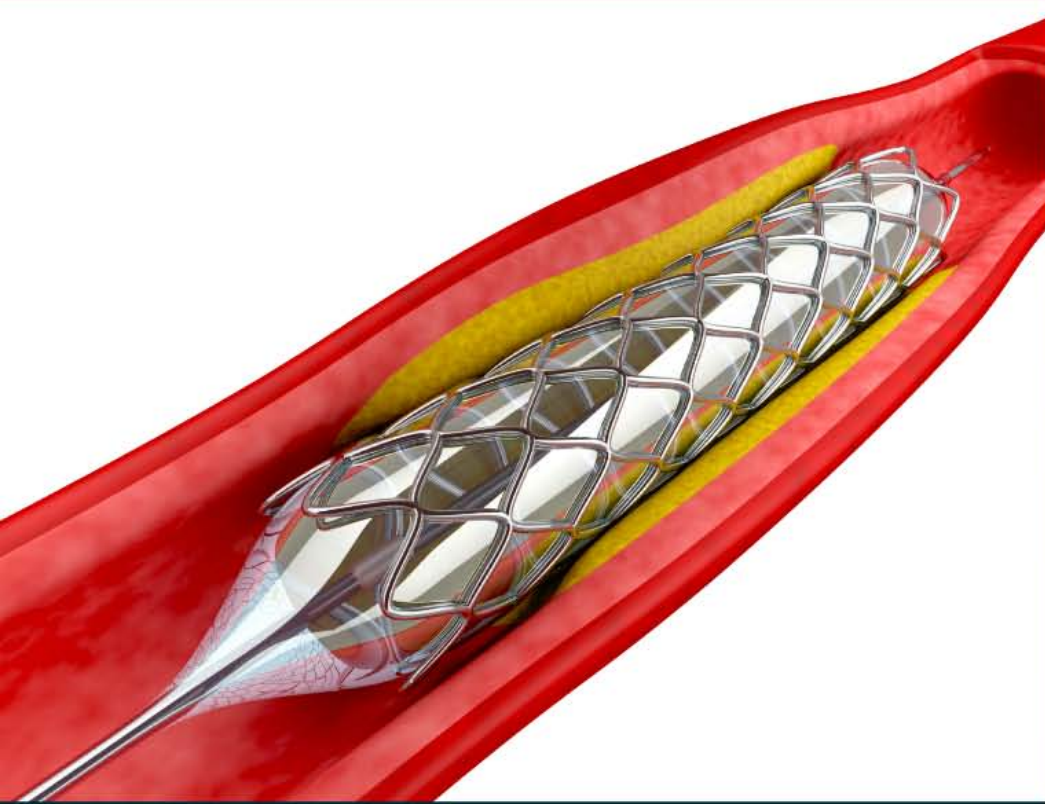
Learning what works in practice

Angioplasty (PCI)



Bypass surgery (CABG)





- local anesthesia
- fewer complications
- fewer strokes

- major surgery
- patients live longer
- fewer re-revascularizations

Weintraub et al. NEJM 2012

190,000 patients

2 or 3-vessel disease

606 sites, 2004 -- 2007

3-year all-cause mortality

16% after CABG

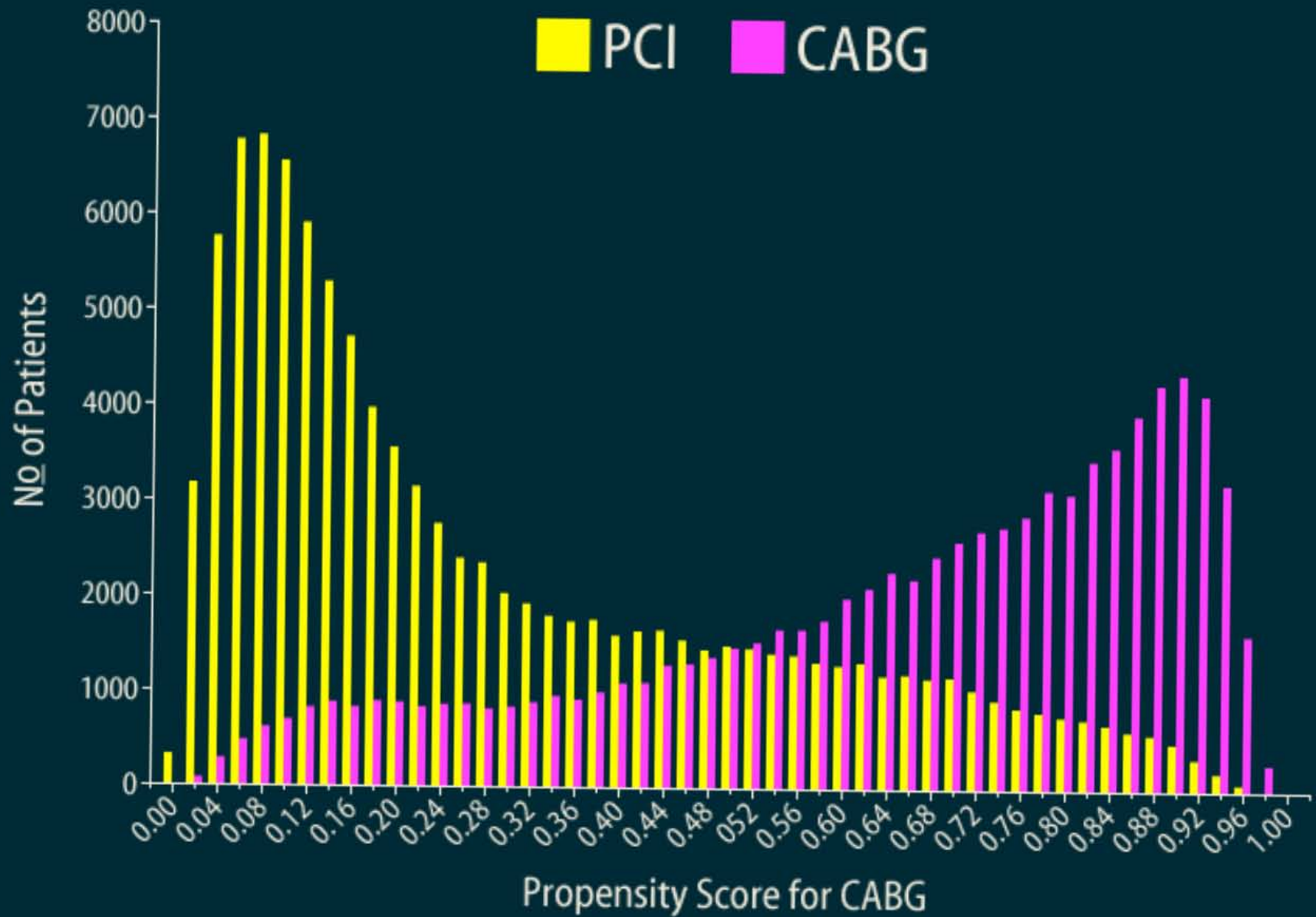
21% after PCI

Not attributed to
group membership

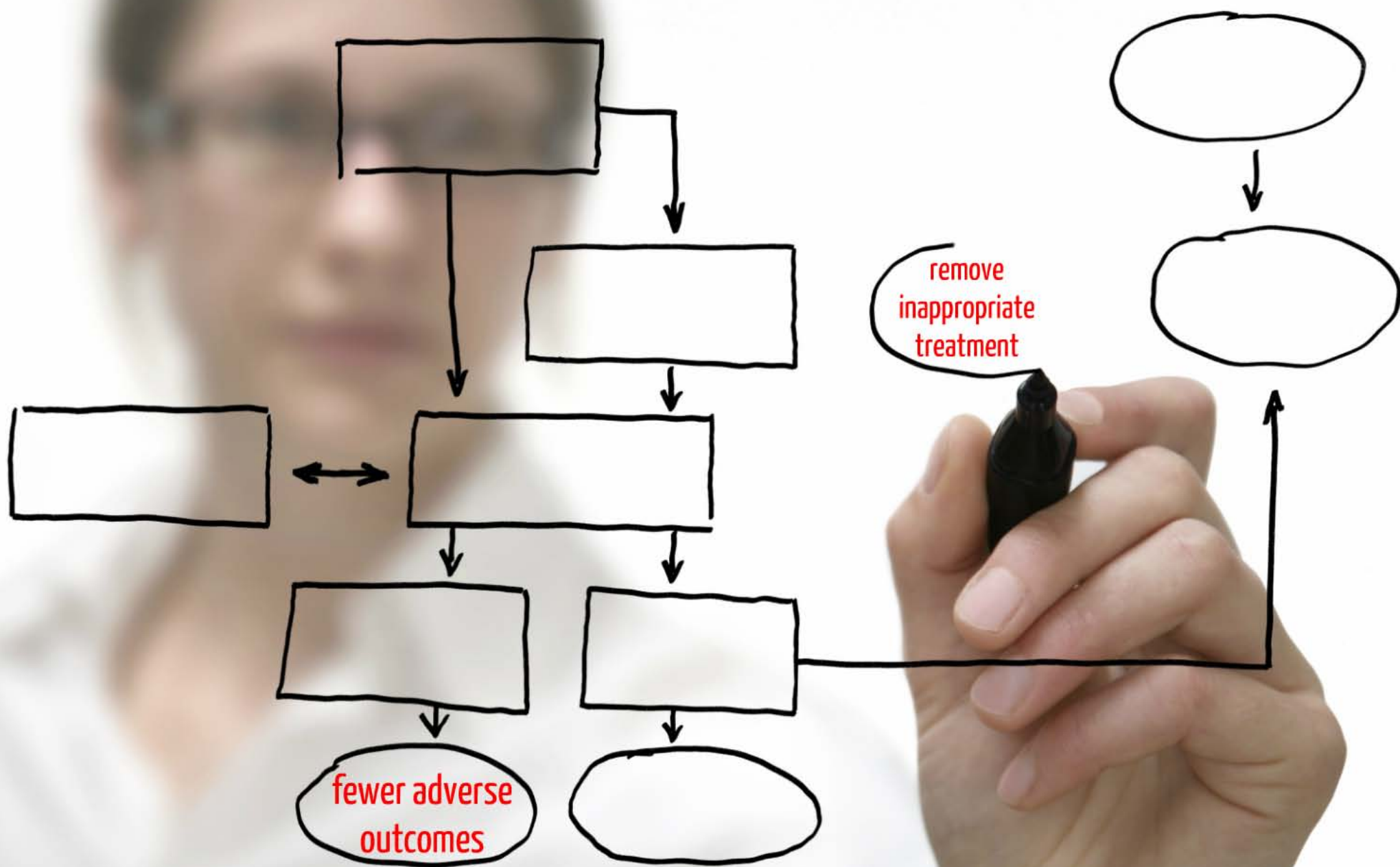
Could be explained
by other factors

No causal inferences

Differences
between
groups



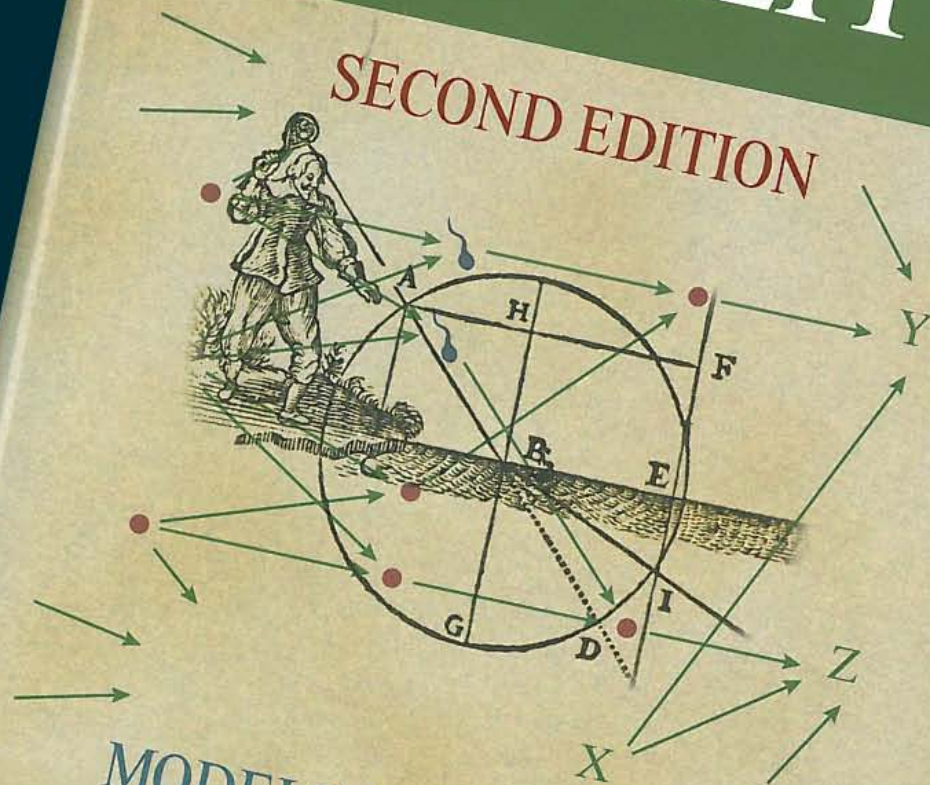
Weintraub WS et al. N Engl J Med 2012;366:1467-1476.



Potential outcomes of
counterfactual treatment

CAUSALITY

SECOND EDITION



MODELS, REASONING,
AND INFERENCE

JUDEA PEARL



A User's Guide

Developing a Protocol for Observational Comparative Effectiveness Research

Disablement

Necessity

Enablement

Susceptibility

Pearl's
counterfactual
probabilities

Necessity

What proportion of PCI patients suitable for CABG would have survived had they undergone CABG ?

Susceptibility

What proportion of patients alive after CABG would have died had they undergone PCI?

causeres.info

The causality perspective in CER

Causal inferences,
not just reporting differences

Closing the gap between the care that is possible and the care patients receive

Thank you!