Perspective: Economics of Health Care and Data Science,

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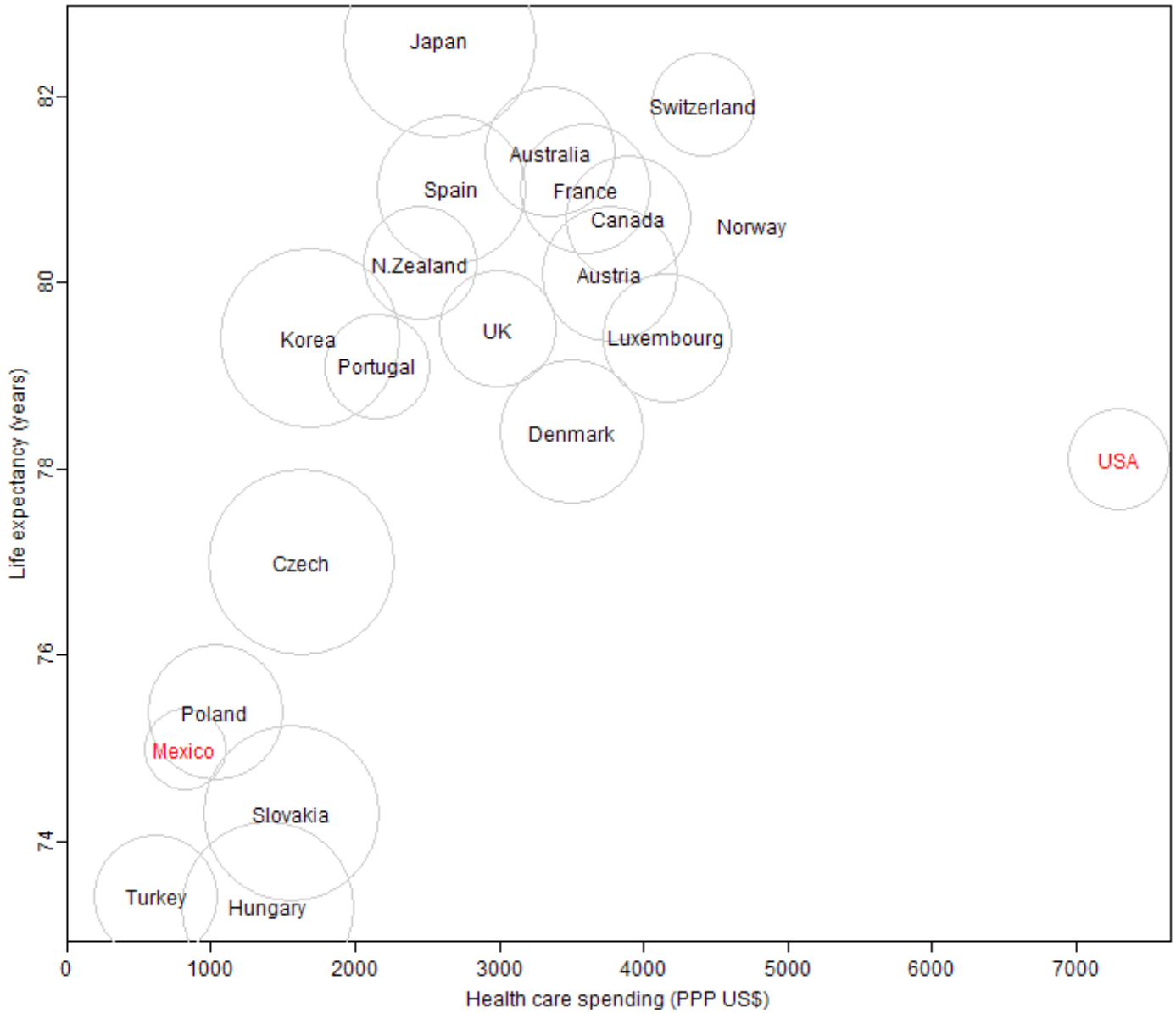
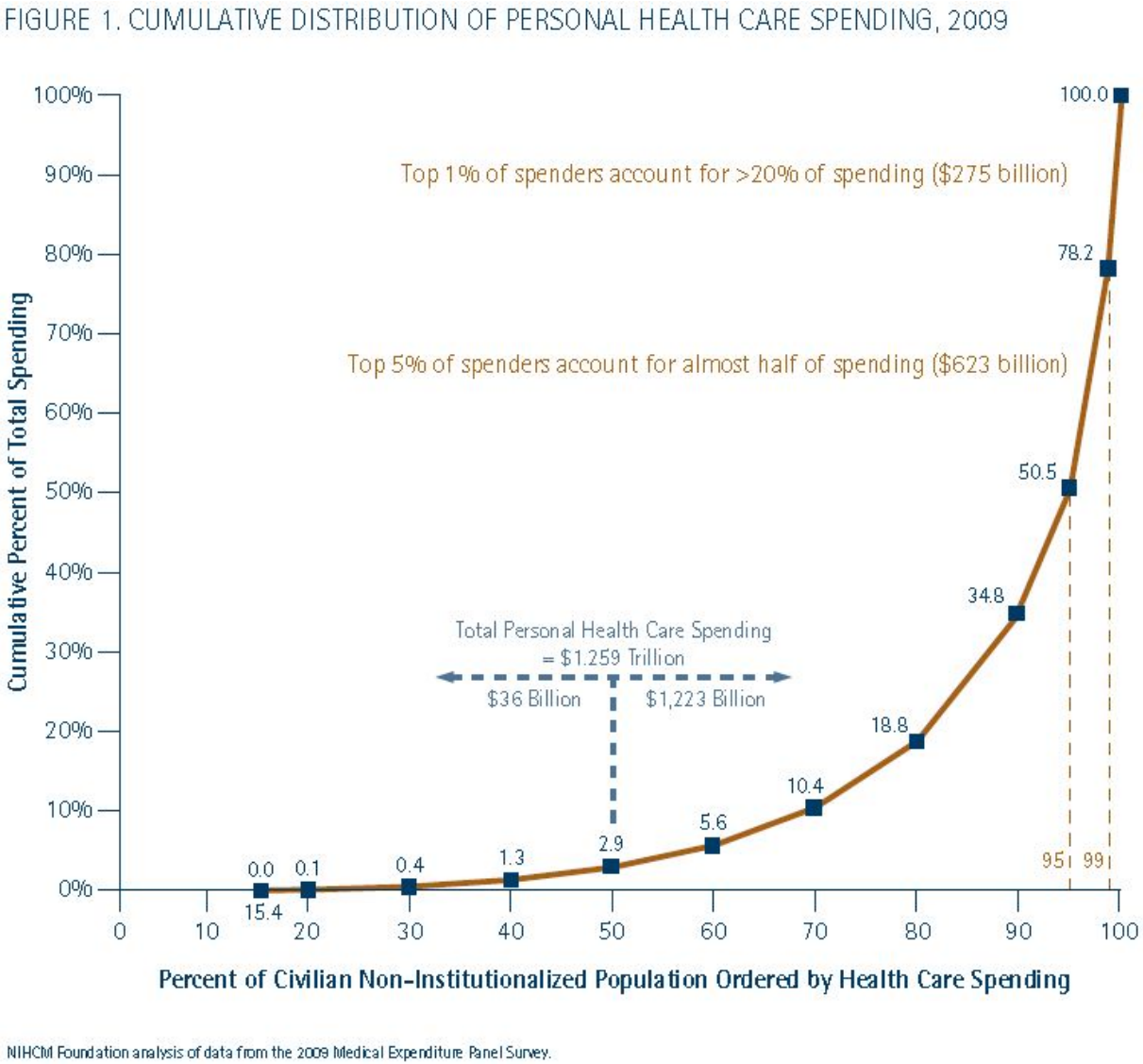
The Opportunity

- Explosion of data sources: administrative, electronic medical records, online behavior
- Population data is becoming more common and precise
- How can it be used?
- Greater interest in:
  - Evaluating treatments in the field
  - Fine-grained inference: e.g., subgroups, precise targeting of treatments, e.g., precision medicine

Spending and Life Expectancy



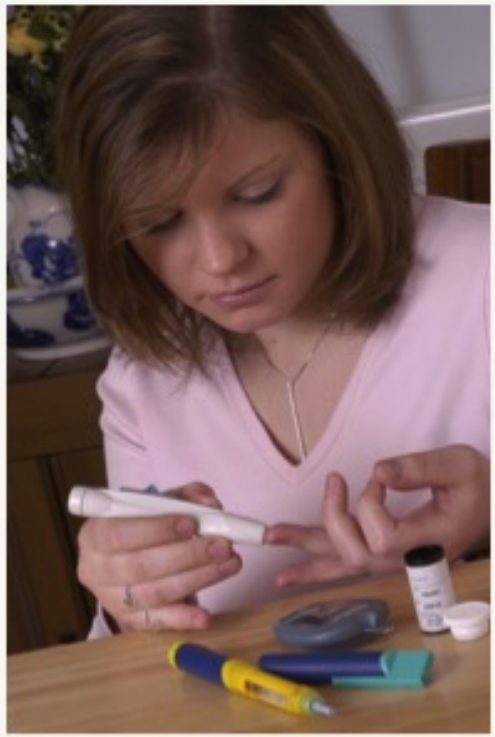
Spending is Concentrated



UK Example: TeleHealth

"the remote exchange of data between a patient and health care professionals as part of the diagnosis and management of health care conditions"

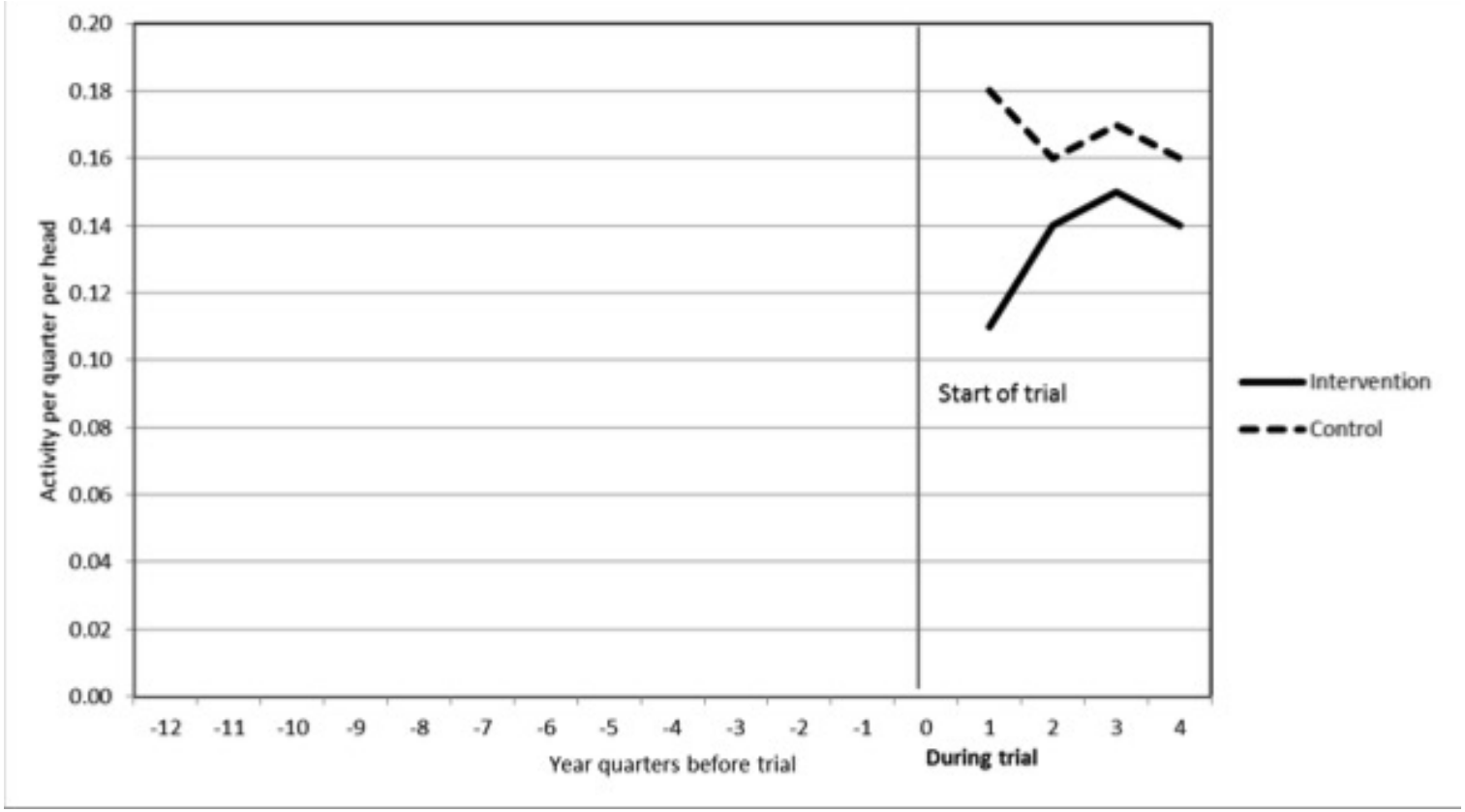
Telehealth devices enable items such as blood glucose level and weight to be measured by the patient and transmitted to health care professionals working remotely.



Whole System Demonstrator Trial (WSD)

- Telehealth vs 'usual care' (Steventon et al., 2012)
- Adult Patients with diabetes, COPD, heart failure
- Cluster Randomized design
- Randomized 179 GP practices, 3230 adults, 3 English counties
- Intervention: broad class of Telehealth devices
- Control: usual care, services available at the trial sites
- Outcomes: emergency admissions, outpatient visits
- Blinding: patients at consent, not for recruiters

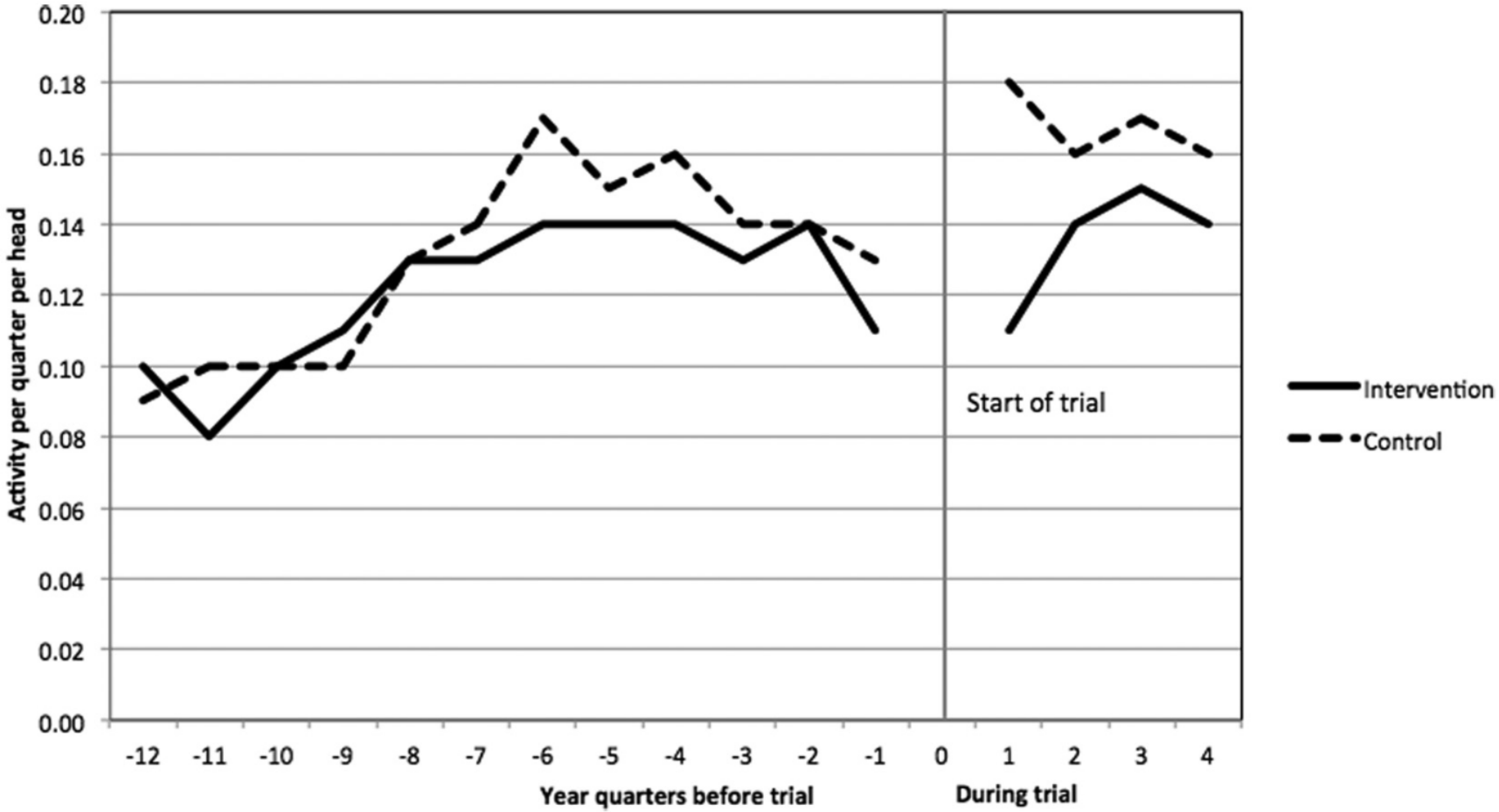
TeleHealth: Emergency Room Visits



One Interpretation of the Results

- British PM, David Cameron: "We've trialled it, it's been a huge success, and now we're on a drive to roll this out nationwide."
- BMJ paper: "...results suggest Telehealth helped patients avoid need for emergency admissions."
- Department of Health: "We funded a three-year randomized control trial..which clearly demonstrated that if implemented appropriately, telehealth can reduce emergency admissions by 20%..."

TeleHealth


0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
Activity per quarter per head
-12
-11
-10
-9
-8
-7
-6
-5
-4
-3
-2
-1
0
1
2
3
4
Year quarters before trial
During trial
Start of trial
Intervention
Control

The Sample Selection Problem

- Randomized experiments are not on the population of interest; may not even use the protocols of interest
  - Experiments raise issues of Randomization Bias: poor external validity

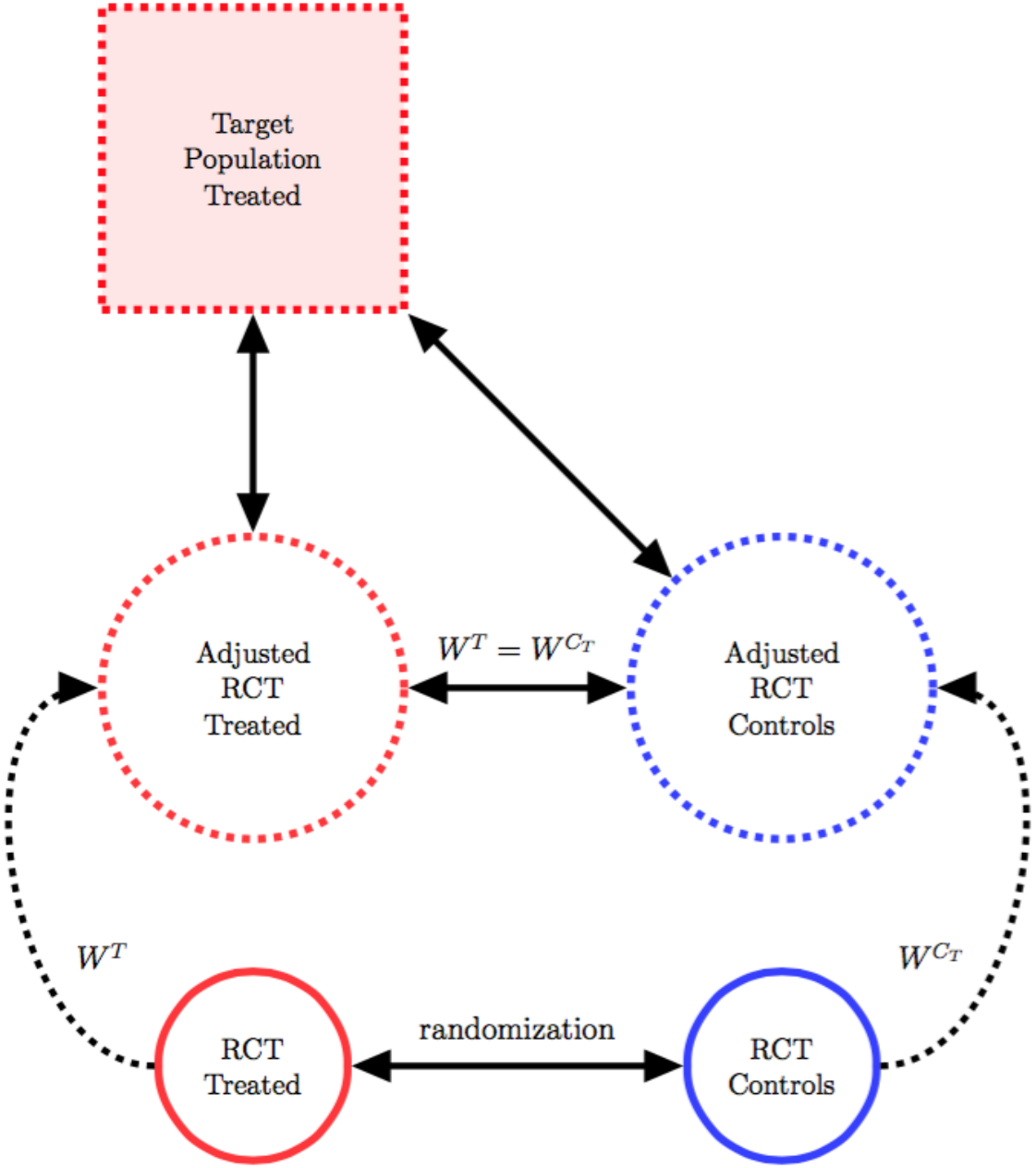
    assignment to treatment
  - Observational studies raise issues of Selection Bias, or non random assignment to treatment
- How to combine information from randomized control experiments and non randomized studies?

Pulmonary Artery Catheterization (PAC)

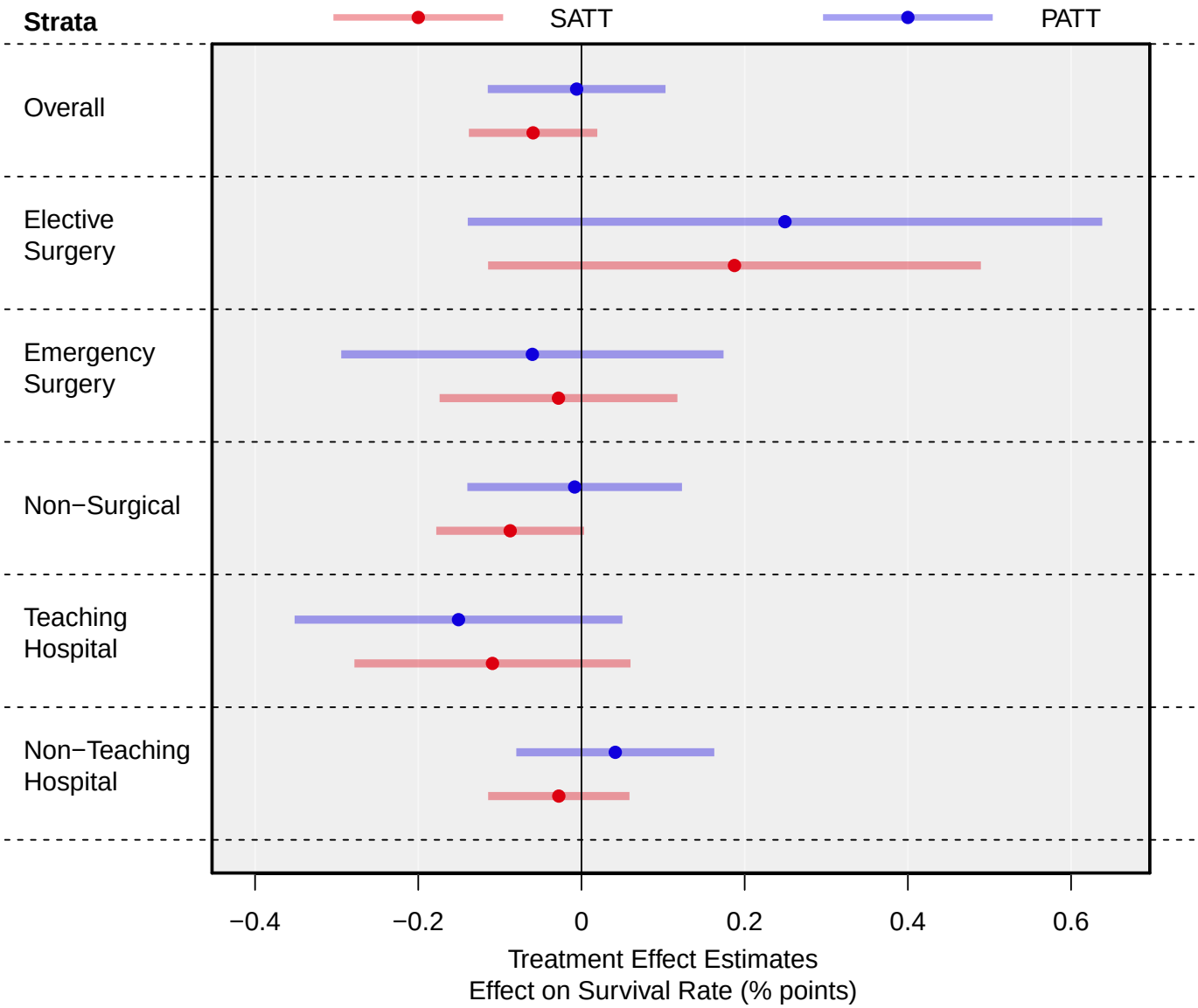
- PAC is an invasive cardiac monitoring device for critical ill patients (ICU)—e.g., myocardial infarction (ischaemic heart disease)
- PAC-man trail n=1,013
- Registry data: 1.5million ICU admissions. 1,052 PAC cases and 31,447 potential controls

Pulmonary Artery Catheterization

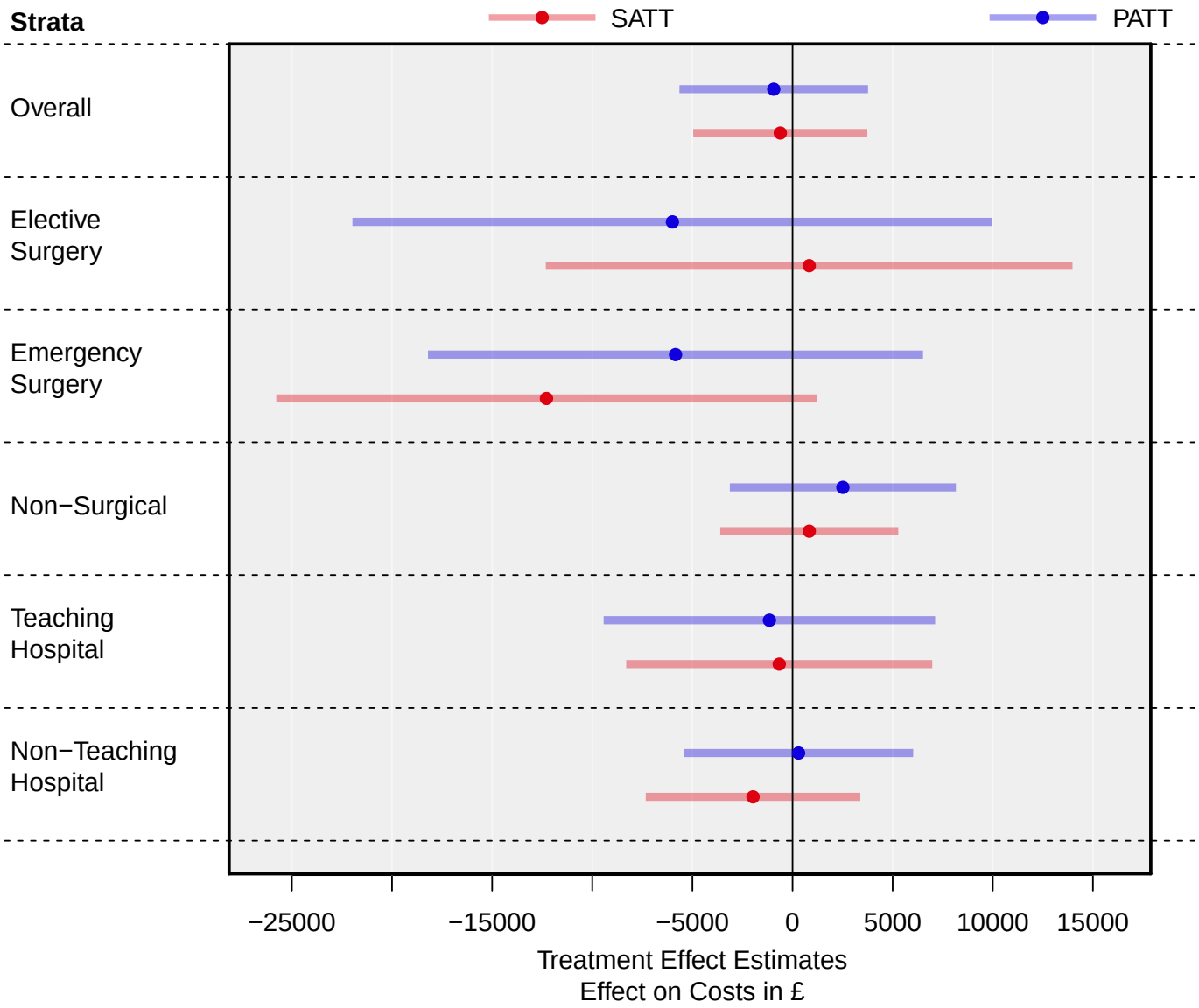
- RCT: a publicly funded, pragmatic experiment done in 65 UK ICUs in 2000-2004.
  - 1014 subjects, 506 who received PAC
  - No difference in hospital mortality (p = 0.39)
- NRS: all ICU admissions to 57 UK ICUs in 2003-2004
  - 1052 cases with PAC and 32,499 controls
  - One observational study was able to find no difference in hospital mortality (p = 0.29)
- However, the populations between the two studies differ, and we are interested in identifying population effects.


Target
Population
Treated
Adjusted
RCT
Treated
$W^T = W^{C_T}$
Adjusted
RCT
Controls
W^T
W^{C_T}
RCT
Treated
randomization
RCT
Controls

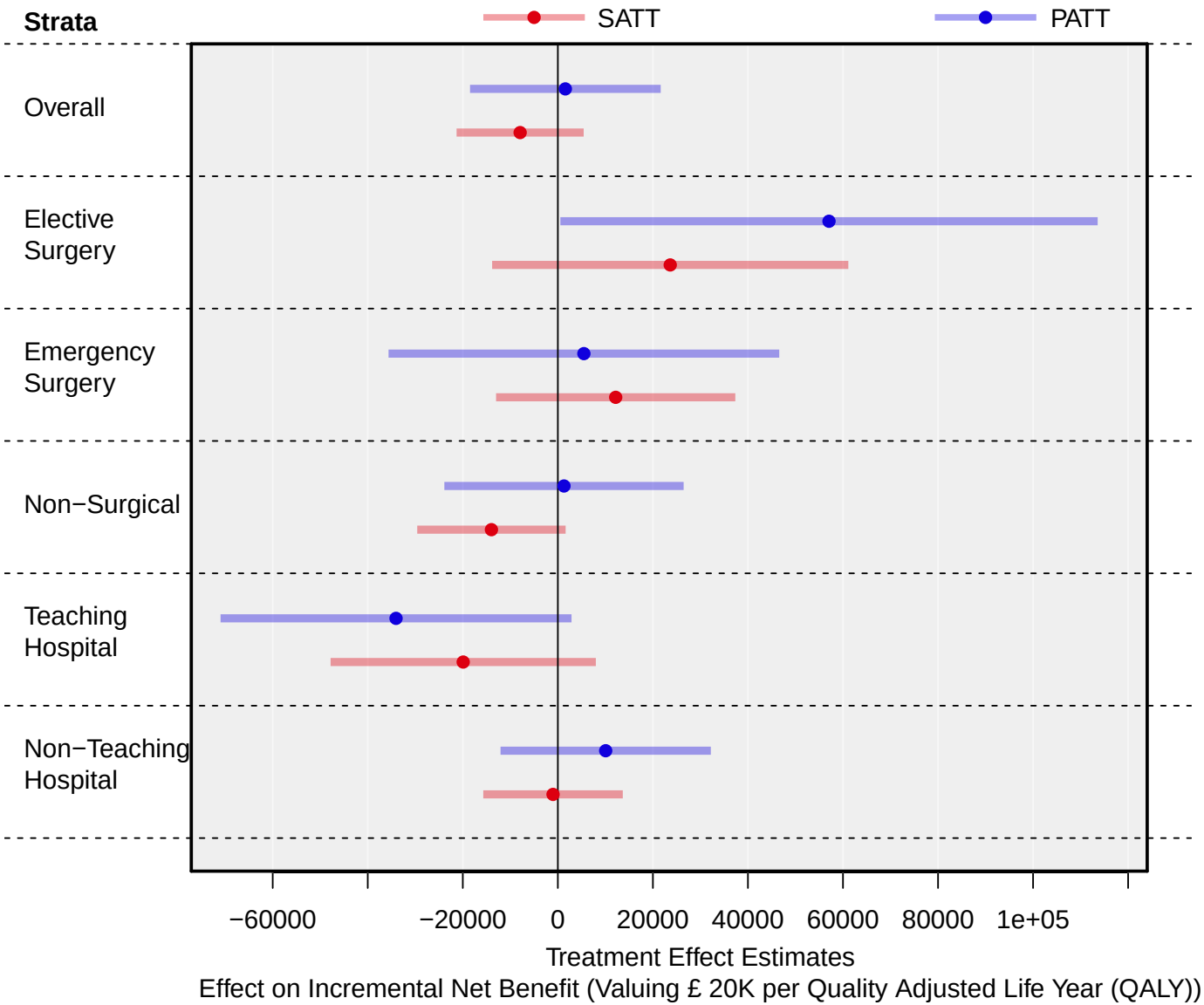
Population Treatment Effects on Hospital Survival Rates



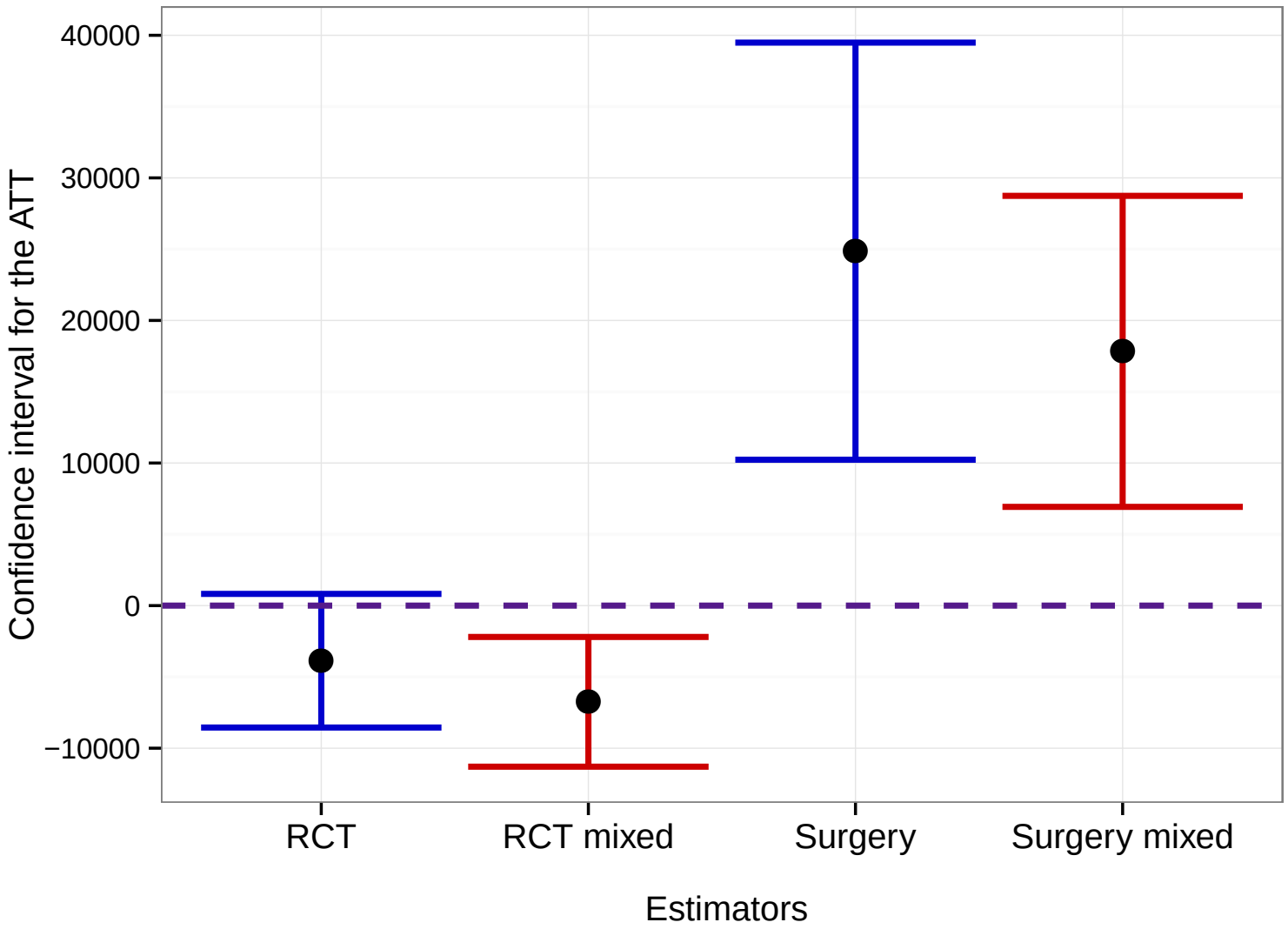
Population Treatment Effects on Costs



Population Treatment Effects on Cost-Effectiveness



Combined Estimates



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