

Perspective: Economics of Health Care and Data Science,

Jasjeet S. Sekhon

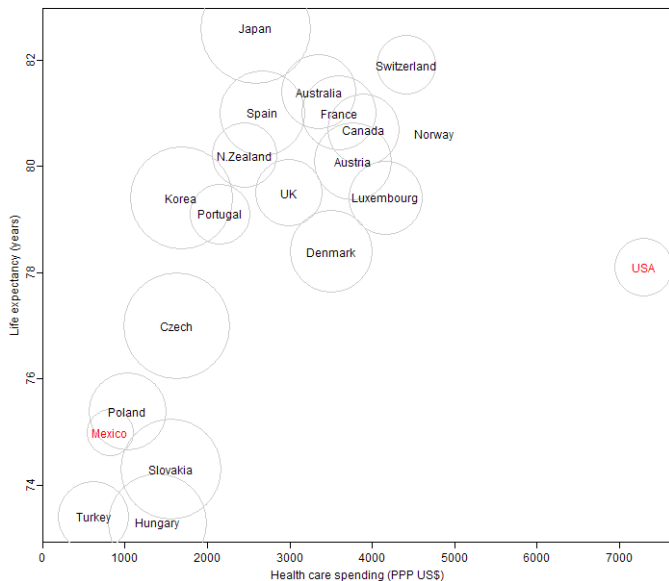
UC Berkeley
<http://sekhon.berkeley.edu>

March 28, 2016

The Opportunity

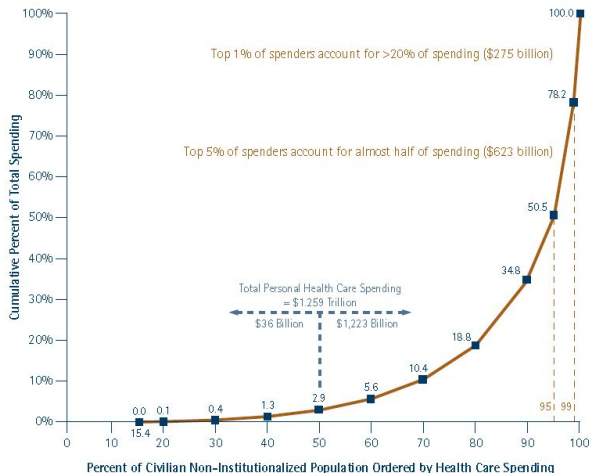
- Explosion of data sources: administrative, electronic medical records, online behavior
- Population data is becoming more common and precise
- How can it be used?
- Greater interest in:
 - Evaluating treatments in the field
 - Fine-grained inference: e.g., subgroups, precise targeting of treatments,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

Spending and Life Expectancy



Spending is Concentrated

FIGURE 1. CUMULATIVE DISTRIBUTION OF PERSONAL HEALTH CARE SPENDING, 2009



NIHOM Foundation analysis of data from the 2009 Medical Expenditure Panel Survey.

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"

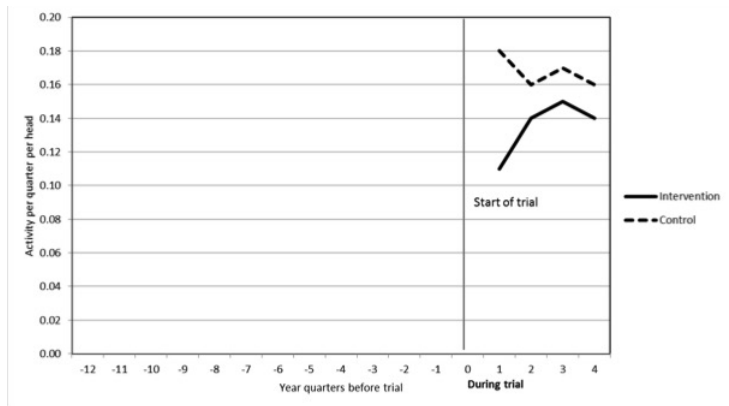
Telehealth devices enable items such as blood glucose level and weight to be measured by the patient and transmitted to health care professionals working remotely.



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

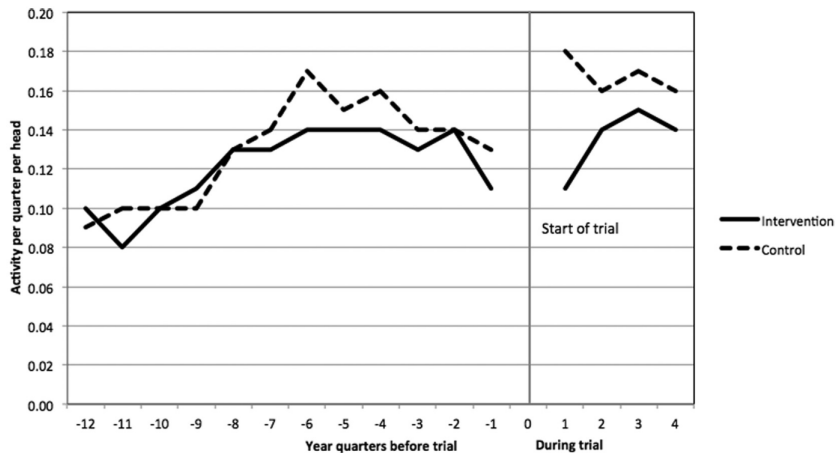
TeleHealth: Emergency Room Visits



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



The Sample Selection Problem

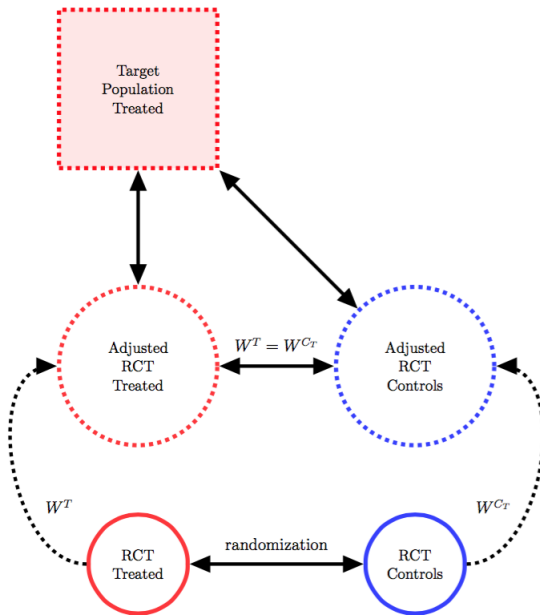
- Randomized experiments are not on the population of interest; may not even use the protocols of interest
 - Experiments raise issues of Randomization Bias: **poor external validity** assignment to treatment
 - Observational studies raise issues of Selection Bias, or non random assignment to treatment
- How to combine information from randomized control experiments and non randomized studies?

Pulmonary Artery Catheterization (PAC)

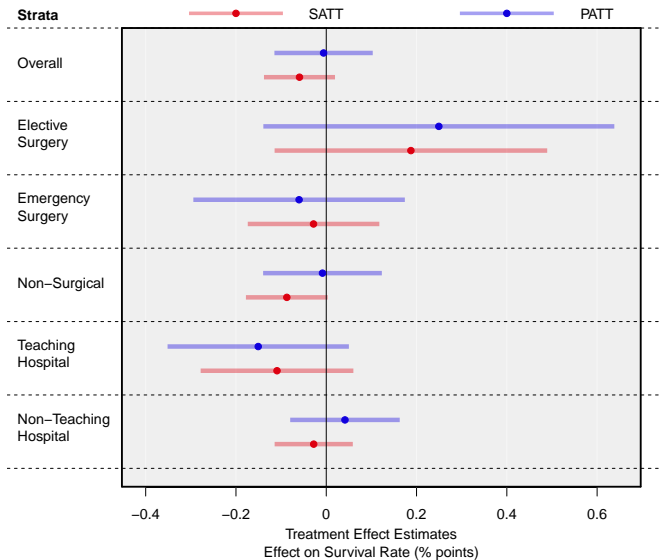
- PAC is an invasive cardiac monitoring device for critical ill patients (ICU)—e.g., myocardial infarction (ischaemic heart disease)
- PAC-man trial $n=1,013$
- Registry data: 1.5million ICU admissions. 1,052 PAC cases and 31,447 potential controls

Pulmonary Artery Catheterization

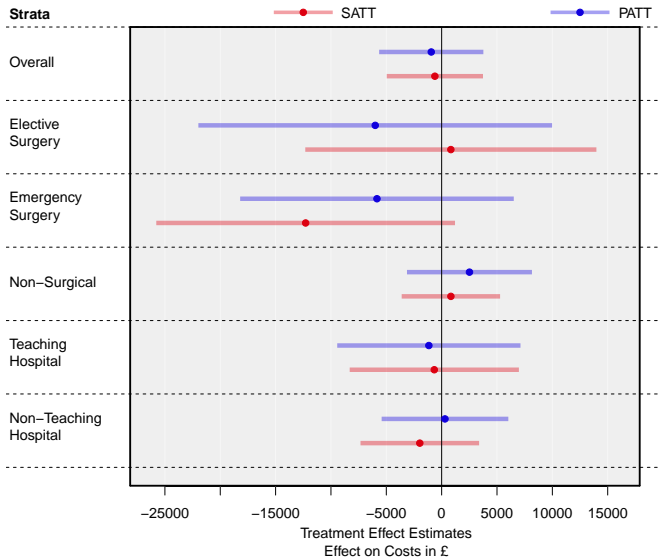
- RCT: a publicly funded, pragmatic experiment done in 65 UK ICUs in 2000-2004.
 - 1014 subjects, 506 who received PAC
 - No difference in hospital mortality ($p = 0.39$)
- NRS: all ICU admissions to 57 UK ICUs in 2003-2004
 - 1052 cases with PAC and 32,499 controls
 - One observational study was able 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.



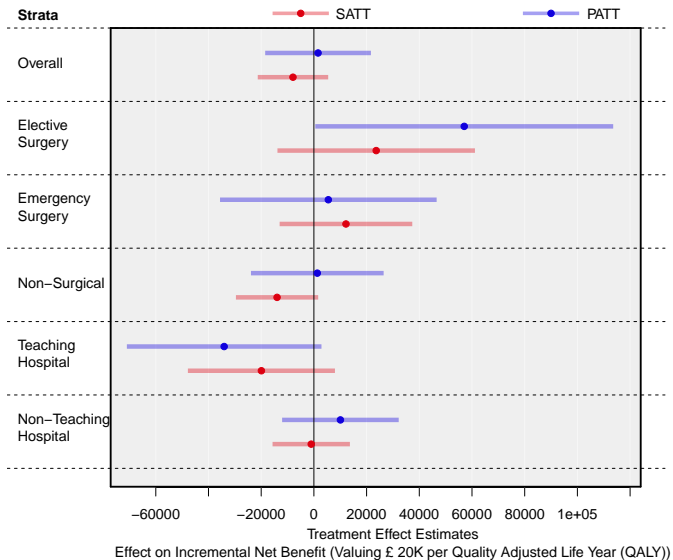
Population Treatment Effects on Hospital Survival Rates



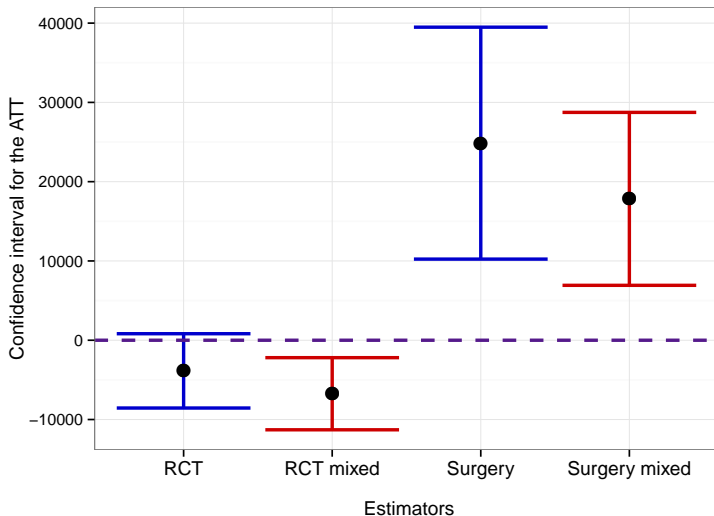
Population Treatment Effects on Costs



Population Treatment Effects on Cost-Effectiveness



Combined Estimates



References

- Künzel, Barter, Sekhon, Bickel, and Yu. (on-going). "Estimation of heterogeneous effect via Random Forests."
- Hartman, Grieve, Ramsahai, and Sekhon (2015). "From Sample Average Treatment Effect to Population Average Treatment Effect on the Treated: Combining experimental with observational studies to estimate population treatment effects" *Journal of the Royal Statistical Society, Series A*. 10.1111/rssa.12094.
- Bloniarz, Liu, Zhang, Sekhon, Bin Yu. (forthcoming). "Lasso Adjustments of Treatment Effect Estimates in Randomized Experiments." *Proceedings of the National Academy of Sciences*.
- Steventon, Grieve, and Sekhon. (2015). "A Comparison of Alternative Strategies for Choosing Control Populations in Observational Studies." *Health Services and Outcomes Research Methodology*. 10.1007/s10742-014-0135-8. 2015.
- Steventon , Grieve, Bardsley (2015). "An approach to assess generalizability in comparative effectiveness research: a case study of the Whole Systems Demonstrator cluster randomized trial." *Med Decis Mak*
- Steventon, Billings, Dixon, et al. (2012). "Effect of telehealth on use of secondary care and mortality: findings from the Whole System Demonstrator cluster randomised trial." *BMJ*;344:e3874.