# Is There a VA Advantage?

## Evidence from Dually Eligible Veterans

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# Poll Question #1

How would you primarily describe yourself?

1. Clinician
2. Researcher
3. Policymaker, manager, or administrator
4. Veteran
5. Other

# VA vs. Non-VA

- Veterans Health Administration (VHA) is the nation's largest health care delivery system
- Performance of VA vs. non-VA care is important policy question
  - Medical literature: VA care is better on hundreds of process measures; mixed results on outcomes (e.g., O'Hanlon et al 2017)
  - Usually compare veterans in the VA with non-veterans in non-VA hospitals
  - Veterans in the VA generally sicker than non-veterans (Agha et al 2000)

- Reforms/proposals to privatize the VA (Choice Act of 2014, MISSION Act of 2018)

# Broader Motivation

- Government's role in health care
  - Should government or the private sector provide health care? (e.g., UK vs. Canada)
  - Important tradeoff: choice/competition vs. fragmentation

- Rigorous empirical evaluations are rare
  - Public and private providers serve different populations, by statute or by patient selection

# This Paper

**Design:**

- Veterans above age 65 who may use either VA or non-VA care (paid by Medicare)
- Doyle et al. (2015) [instrumental variables] ambulance design

**Findings:**

- In sick population of elderly ambulance riders (28-day mortality of 10 p.p.), VA reduces mortality by 4.5 p.p.
  - Evidence that sicker veterans use VA, that VA prevents mortality in first critical days
- Mechanisms:
  - Compliers have greater VA attachment, are more disadvantaged
  - Greater effect for sicker, more disadvantaged, and more VA-attached Veterans
  - VA also reduces spending (more productive)
  - Suggestive evidence of mechanism through IT and integrated care

# Outline

Setting and Background

Instrumental Variables

Quasi-Experiment and Main Results

Survival Analysis

Mechanisms

# Public vs. Private Delivery

- In the US, we have a mixed system of health care financing and delivery

| | Public Financing | Private Financing |
|---|---|---|
| Public Delivery | VA<br>Safety net hospitals | |
| Private Delivery | Medicare<br>Medicaid | Employer insurance |

- Simple idea: compare public vs. private performance by studying veterans dually eligible for VA and Medicare

# What Are We Comparing?

- Compared to the VA, private hospitals lag in IT adoption and integration of care
  - VA adopted health IT 15+ years earlier than private sector (Jha et al. 2009)
  - Private [non-VA] US health care system fragmented (Cebul et al. 2008; Cutler 2010; Agha et al. 2019)
  - Note: Not all public hospitals are integrated or have well-functioning IT (e.g., safety net hospitals) but government may be better able to coordinate these investments (Frandsen et al. 2019)

- In private sector, recent reforms spurred by federal legislation: HITECH Act of 2009 for IT, ACA for Accountable Care Organizations

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# Poll Question #3

How familiar are you with instrumental variables?

1. Very familiar. I have used them in analysis.
2. I have been taught them but not used them in analysis.
3. I have heard of them but have no formal training.
4. I have never heard of them.

# Instrumental Variables

Strong analogy with randomized trials

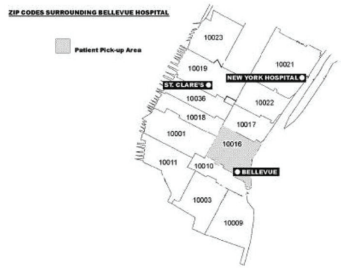
- Instrument akin to assignment to different trial arms
- [Quasi-]randomly assigned (**independence**)
- Drives treatment (**first stage**)
- Does not otherwise influence outcomes (**exclusion**)

Importantly, allows for non-compliers

- Scales intention-to-treat (**reduced form**) differences in outcomes to effects among compliers

# Ambulance Instrument

- Doyle et al (2015): Ambulance providers have different propensities to send to different hospitals. In New York:




Destination of Patients Picked Up In The Bellevue Hospital Zip Code Area

| Destination | All Voluntary Hospital Ambulances | Fire Department Ambulances |
|---|---|---|
| Bellevue Hospital (HHC) | 25%* | 61%** |
| Any Voluntary Hospital | 75% | 39% |

*157 taken to Bellevue/632 total. **815 taken to Bellevue/1,346 total

# Ambulance Instrument

- Ambulances may differ in their propensities to send veterans to VA vs. non-VA hospitals (**first stage**):
  - Ambulance may be affiliated with certain hospitals
  - Ambulance may have different degrees to which they ascertain whether patient is a Veteran
  - Ambulance may have base of operation that is closer to VA or non-VA ED
- Assumptions for quasi-experimental design (**exclusion restriction**):
  - Ambulance needs to be randomly assigned, *conditional* on zip code
  - Ambulance cannot directly affect patient health

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# Quasi-Experiment

- Veterans above age 65
- Ambulance instrument (Doyle et al. 2015; Hull 2018)
  - Some ambulance companies are more likely to send patients to some hospitals (i.e., VA)
  - Ambulance company assigned is plausibly quasi-random
- Baseline controls: zip code + source (e.g., residential) + ambulance type (ALS/BLS) + time categories + prior utilization Controls

# Data

- VHA administrative records and Medicare claims
  - Ambulance rides, ED visits in VA and non-VA from 2000 to 2014
  - Veteran characteristics (diagnoses, utilization) prior to ED visit
  - Utilization outcomes post ED visit
- Mortality outcomes (Medicare, VHA, VBA, SSA)
- Characteristics of VA and non-VA hospitals from AHA, government sources
  - IT adoption (`healthit.gov`), Accountable Care Organization (ACO) adoption

# Study Sample

- Dual-eligible (VHA and Medicare) veterans brought in by ambulance
  - 9.4 million ED visits for 3 million veterans
- Further restrictions:
  1. Zip codes with VA and non-VA alternatives within 20 miles
  2. Zip codes with 2+ ambulance companies with $\geq$ 20 rides
  3. Veterans with some VA utilization in past year (for main specifications)
  4. Veterans with no ride in prior month
- 28-day mortality rate around 10 p.p., weekend share around 2/7 regardless of restrictions

# Study Sample

| | Dual eligibles | + zip x hospital | + zip x ambu-lance | + VA-attached | + VA-attached |
|---|---|---|---|---|---|
| Male | 0.90 | 0.88 | 0.86 | 0.96 | 0.96 |
| Age | 77.0 | 76.9 | 76.1 | 75.6 | 76.0 |
| Share black | 0.11 | 0.16 | 0.19 | 0.20 | 0.19 |
| Prior VA ED | 0.14 | 0.20 | 0.26 | 0.57 | 0.53 |
| Prior Medicare ED | 0.70 | 0.68 | 0.63 | 0.54 | 0.48 |
| Count comorbidities | 6.53 | 6.69 | 6.44 | 6.54 | 6.14 |
| Weekend rate | 0.27 | 0.27 | 0.27 | 0.27 | 0.27 |
| 28-day mortality | 0.12 | 0.11 | 0.10 | 0.10 | 0.10 |
| Present at VA ED | 0.04 | 0.09 | 0.17 | 0.34 | 0.33 |
| Number of rides | 8,828,997 | 3,465,588 | 1,051,093 | 491,193 | 401,319 |

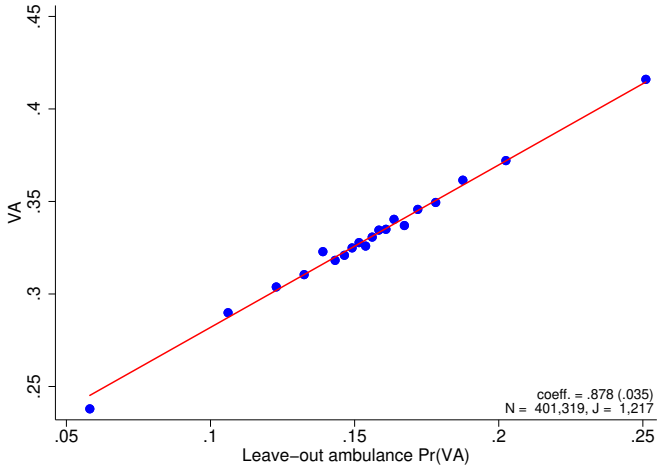
# Empirical Approach: IV vs. OLS

- Instrumental variables (IV) approach
  - Propensity of ambulance to send Veterans to the VA
  - "Jackknife" instrument: measure this propensity based on *other* Veterans it transports
  - Allows for non-compliers (i.e., Veterans who would never or always go to the VA regardless of the ambulance)
  - Baseline controls: zip code + source (e.g., residential) + ambulance type (ALS/BLS) + time categories + prior utilization

- Compare with ordinary least squares (OLS)
  - Assume that conditional on controls, transport to VA is as good as random

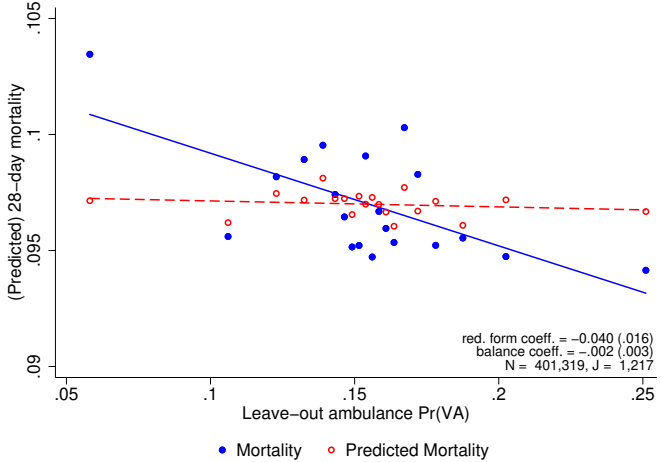
- Difference between IV and OLS could reflect residual selection bias [or heterogeneous treatment effects]

# First Stage




Note: controls for zip code + ambulance source + ALS/BLS + time categories + prior utilization

# Balance and Intention to Treat



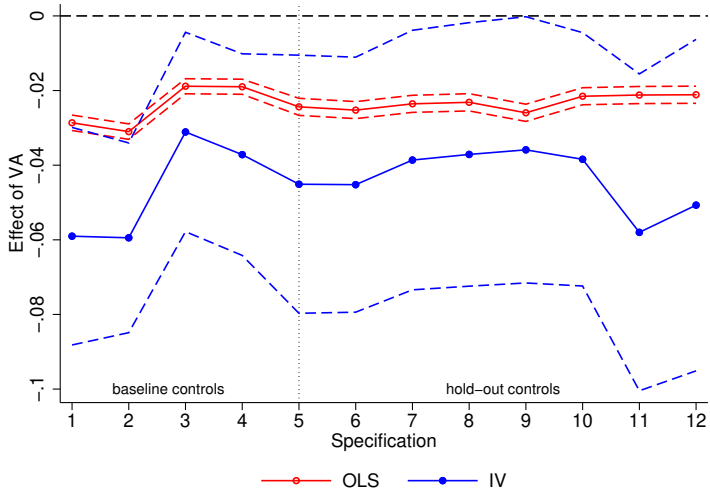

Note: controls for zip code + ambulance source + ALS/BLS + time categories + prior utilization

# Mortality Effects

- Implied IV estimate of VA effect on 28-day mortality: $-0.045$ (s.e. 0.018) (46% of mean) ▸ Visual IV
- OLS estimate: $-0.024$ (s.e., 0.001)
  - Precise but smaller in magnitude than IV estimate
  - Sicker veterans may be more likely to use VA (will explore later)

# Robustness

- Both IV and OLS estimates highly robust regardless of control variables Variables



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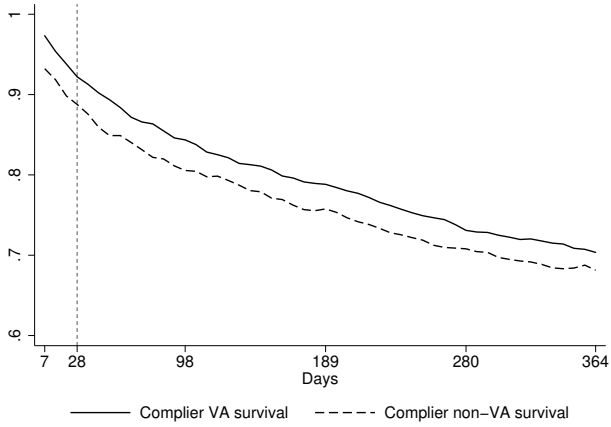
# Survival Analysis

- Purpose
  - Understand how mortality unfolds over time (e.g., harvesting vs. prevention)

- Approach
  - Estimate weekly survival *potential outcomes* for compliers sent to VA vs. those sent to non-VA hospitals
  - The difference between these potential outcomes is the [week-specific] treatment effect
  - Can also estimate potential *mortality hazard rates*

# Complier Survival Curves




Notes: (1) controls for zip code + ambulance source + ALS/BLS + time categories + prior utilization; (2) sample excludes rides with prior ride within last year; (3) potential mortality outcomes $E[Y_{i1} | C]$ and $E[Y_{i0} | C]$ calculated by 2SLS regressions with outcomes $Y_i D_i$ and $Y_i (D_i - 1)$, respectively

# Implications

- Time course
  - VA advantage arises in week 1 after ED visit, relatively constant thereafter

- Hazard analysis reveals that mortality hazard is never higher for compliers sent to VA ▸ Hazards
  - Implies that VA *prevents* rather than *displaces* deaths (no “harvesting”)

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# Compliers

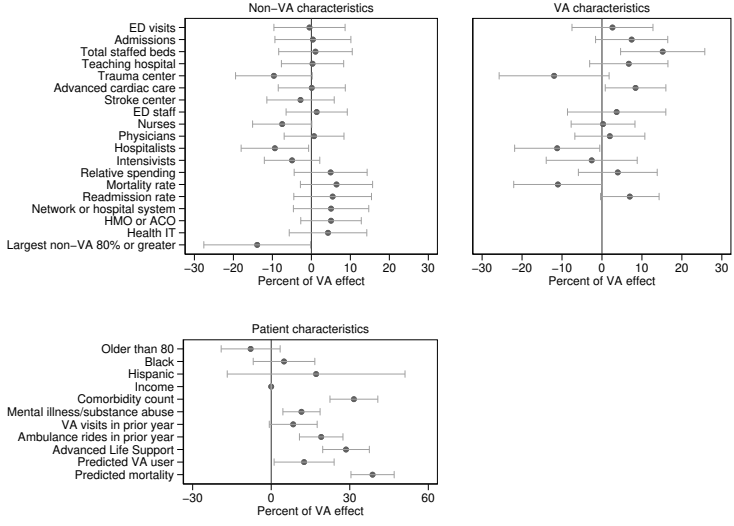
- Complier characteristics: Characteristics
  - more disadvantaged (Black, lower income, mental illness/substance abuse)
    - Note: VA investments to treat mental health
  - more prior VA visits

# Heterogeneity by Hospitals and Patients

- Some intuitive heterogeneity for VA advantage ▸ Heterogeneity
  - Larger for minority patients, patients with mental illness/substance abuse, prior VA attachment
  - Fewer consistent patterns for hospital characteristics

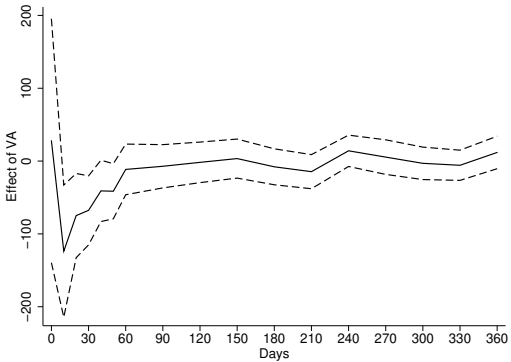
- However, differences in treatment effects are small
- VA advantage is strikingly homogeneous across locations
- No evidence that VA advantage reverses for any group or in any location

# Heterogeneity by Hospitals and Patients



# Spending and Productivity

- VA results in *lower* spending flow (suggesting higher productivity):




- $2,500 less spending by 28 days (20% reduction)

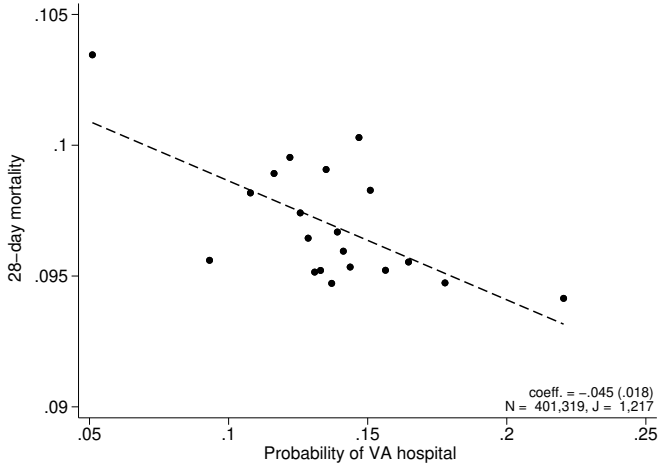
# Health IT and Integrated Care

- Qualitative literature on VA vs. private sector focuses on health IT and integrated care
  - Legislation to improve health IT and integration in private sector around 2010 (HITECH Act and ACA) ▸ IT Growth
- Difficult to directly study
  - VA data $\sim$ 6 years after transformation
  - Veterans with no VA attachment rarely sent to VA EDs
- Approach: study effect of care at (non-VA) modal hospital for veterans with only non-VA prior care
  - Small, statistically insignificant survival benefit (20% of VA effect) ▸ Modal Effect
  - Effects by year positive only after 2010 ▸ Effect by Year
  - Regressions exploiting IT and ACO timing suggest some role

# Conclusion

- Among dually eligible veterans in emergencies, we find VA reduces mortality by 46% at lower cost
  - Survival gains appear widespread across patients and areas
- Veterans with higher VA attachment benefit more
  - Suggestive of continuity of care
  - Also suggestive evidence of role for IT adoption and integrated care
- Relevant for understanding productivity in health care sector and for the societal decision of government's role in providing health care

# Visual IV




Note: controls for zip code + ALS/BLS + ambulance source + time categories + prior utilization

Back

# Robustness

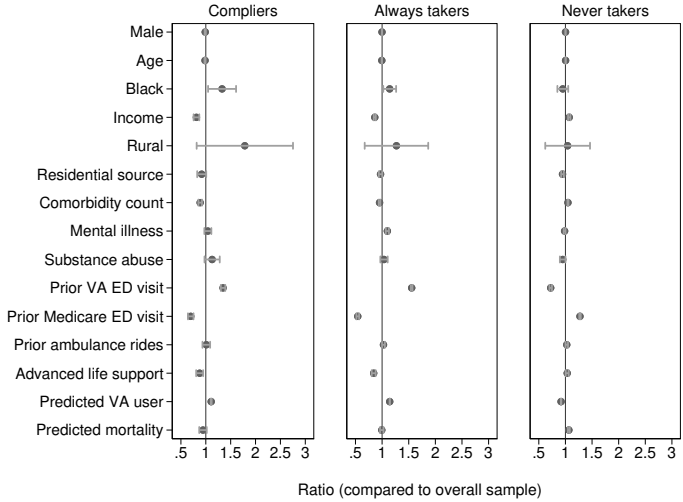
- Baseline controls:
  1. zip code (1,678 indicators)
  2. ambulance source (e.g., residential, clinic) (3 indicators)
  3. ambulance ALS/BLS type (3 indicators)
  4. time categories (year $\times$ month, day of week) (176 + 6 indicators)
  5. prior utilization (primary care, ED, inpatient in VA and non-VA) (6 indicators)

# Robustness

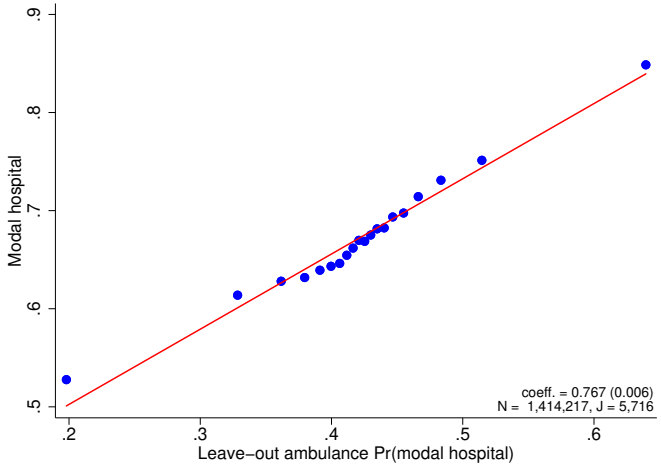
- Additional patient controls:
  6. demographics (age, race, gender) (31 indicators)
  7. socioeconomic status, combat history, and eligibility (21 indicators)
  8. extended prior utilization (8 variables)
  9. Elixhauser indices $\times$ source for prior diagnoses ($3 \times 31$ indicators)
  10. 3-digit ambulance ICD9 code (778 indicators)
- Additional co-rider controls (Altonji & Mansfield 2018):
  11. co-rider baseline controls (pickup source, ambulance service, prior utilization) (12 variables)
  12. co-rider hold-out controls (demographics, 1-digit ICD9 codes, predicted mortality) (21 variables)

Back

# Complier and Non-Complier Characteristics

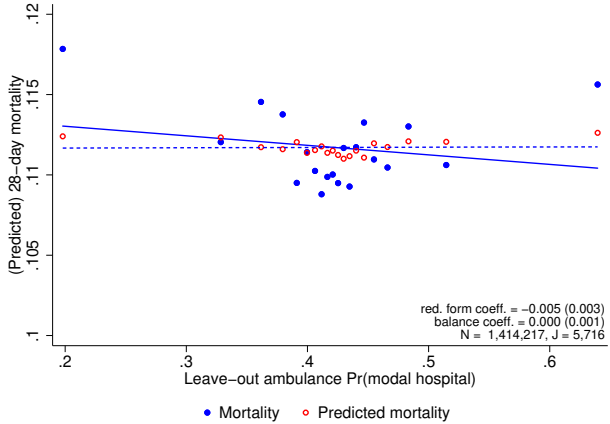


# First Stage for Modal Hospital




Note: controls for zip code + ALS/BLS + ambulance source + time categories + prior utilization

# Effect of Modal (Non-VA) Hospital



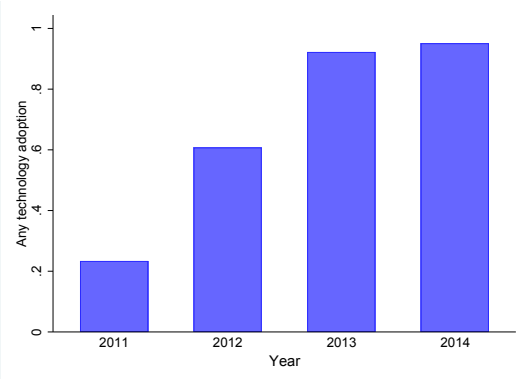

2SLS Coeff = $-0.006$ (0.004)

Note: controls for zip code + ambulance source + ALS/BLS + time categories + prior utilization

Back

# IT Adoption in Sample (`healthit.gov`)

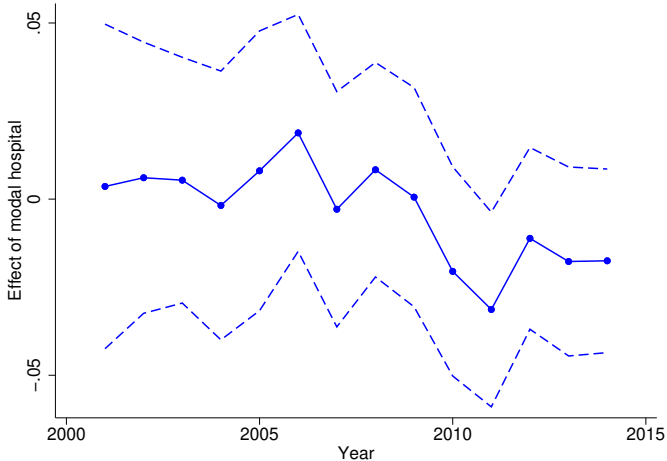
- HITECH Act passed in 2009; Office of the National Coordinator for Health Information Technology (ONC) begins recording adoption (`healthit.gov`) in 2011




Note: hospital IT adoption percentages weighted by ambulance rides in sample in each year

Back

# Effect of Modal Hospital by Year




Note: controls for zip code + ambulance source + ALS/BLS + time categories + prior utilization

Back