

Restructuring Military Healthcare: A Synthetic Control Evaluation on Surgical Volume and Outcomes

Patrick Richard, PhD¹, Daniel Gedeon, MPH², Neenah Young, MHS², Olivia Rodrigue²
Brenda A Leath, PhD³, Jangho Yoon, PhD¹, Douglas Robb, MD⁴,

¹Department of Preventive Medicine and Biostatistics, Uniformed Services University of the Health Sciences, Bethesda, MD ²Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc., Bethesda, MD

³The Public Health Institute, Oakland, CA ⁴National Defense University, Washington, DC

INTRODUCTION

- The 2017 NDAA mandated the reform of the U.S. Military Health System (MHS), transferring administrative oversight to the Defense Health Agency (DHA) to achieve medical readiness through improvement in efficiency and health outcomes [1].
- Despite existing literature in the civilian population, this study is the first to assess the impact of this administrative transfer on complex surgical care as defined by the leapfrog group [2,3,4]. Those outcomes include surgical volume, 60-day mortality, 30-day unplanned rehospitalizations, and AHRQ-validated patient safety indicators (PSI), which are key indicators of high-reliability standards for beneficiary care and operational readiness [5].

METHODS

Data: Semi-annual Military Health System Data Repository (MDR) spanning 2016 – 2025, targeting complex surgery defined by the Leapfrog Group [2].

Unit of Analysis: Aggregated Hospital level claims data for Direct Care Military Treatment Facilities (MTFs) [cases] compared to Purchased Care facilities [controls].

Study Timeline: Pre-Period: 2016 - 2020 (1st Half) | Transition Period: 2020 (2nd Half) - December 2021 | Post-Period: 2022 - 2025

Statistical Modeling: Two-Way Fixed Effects (TWFE) Difference-in-Differences (DiD) baseline models (BM) alongside DiD that uses the Synthetic Control Method (SCM).

Control Adjustments: Ensured robust, unbiased estimates by testing for parallel trends and accounting for patient level characteristics alongside facility-level fixed effects and underlying secular trends.

References:

- 1 - National Defense Authorization Act for Fiscal Year 2017, Pub. L. No. 114-328, 130 Stat. 2000 (2016). <https://www.govinfo.gov/app/details/PLAW-114publ328>
- 2 - The Leapfrog Group. (2024). Leapfrog hospital survey & surgical standard specifications. <https://www.leapfroggroup.org/>
- 3 - Wang, E., Arnold, S., Jones, S., Zhang, Y., Volpicelli, F., Weisstuch, J., ... & Rudy, B. (2022). Quality and safety outcomes of a hospital merger following a full integration at a safety net hospital. JAMA Network Open, 5(1), e2142382.
- 4 - Chang, V., Blackwell, R. H., Yau, R. M., Besser, S., Albright, J. M., Gupta, G. N., ... & Kothari, A. N. (2016). Variable surgical outcomes after hospital consolidation: implications for local health care delivery. Surgery, 160(5), 1155-1161.
- 5 - Agency for Healthcare Research and Quality. AHRQ Quality Indicators: Patient Safety Indicators Technical Specifications, Version v2024. Agency for Healthcare Research and Quality; 2024. Accessed [Month Day, Year]. <https://qualityindicators.ahrq.gov>

Unadjusted Descriptive Trends

Figure 1: Overall Average Surgical Volume Trends by Care Setting

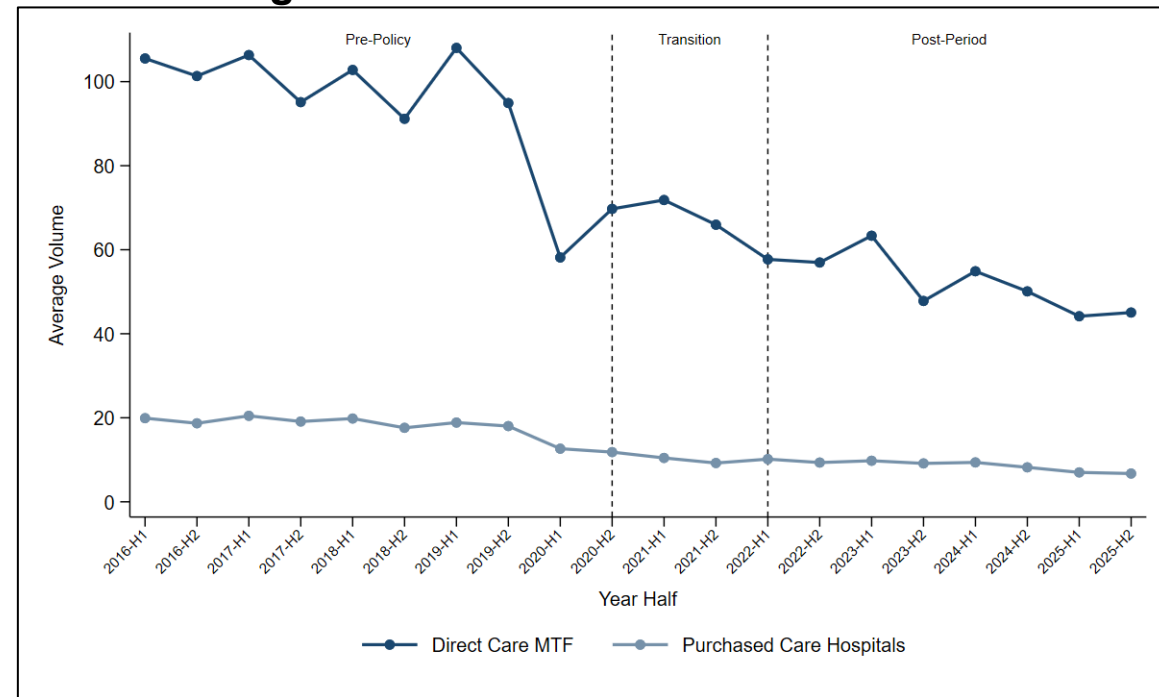
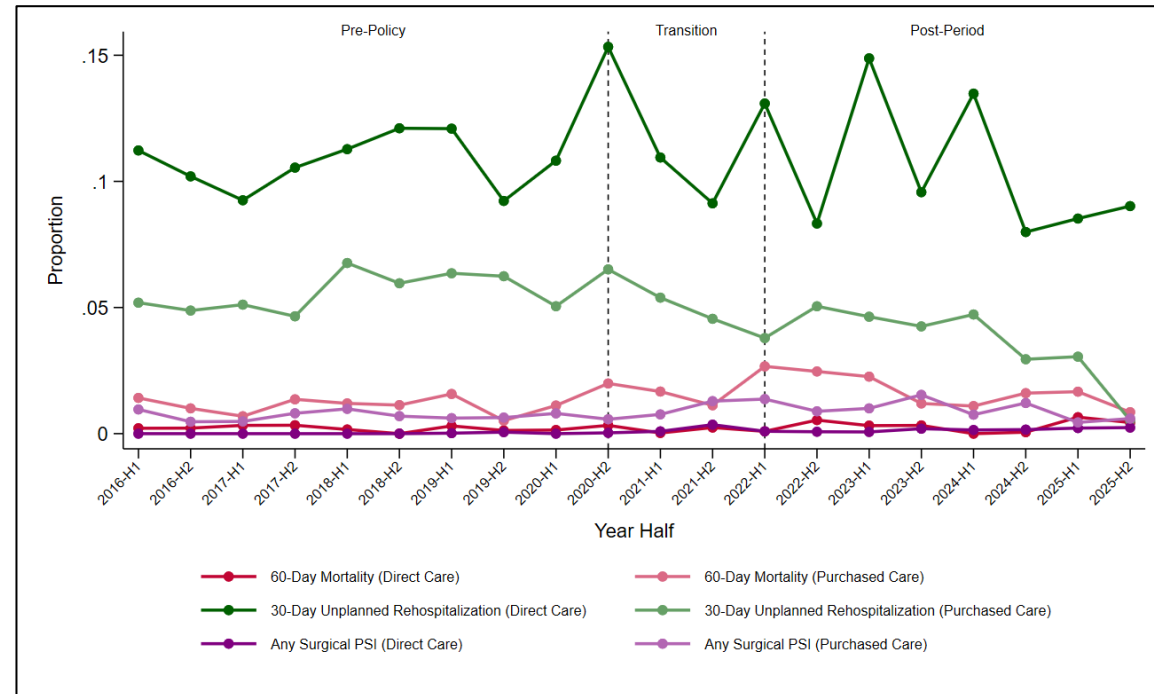


Figure 2: Overall Unadjusted Surgical Outcomes Over Time



Post-Period Results from Multivariate Models using DiD (BM vs. SCM)

Figure 3: Average Treatment Effect on the Treated (ATT) for Surgical Volume (BM vs. SCM)

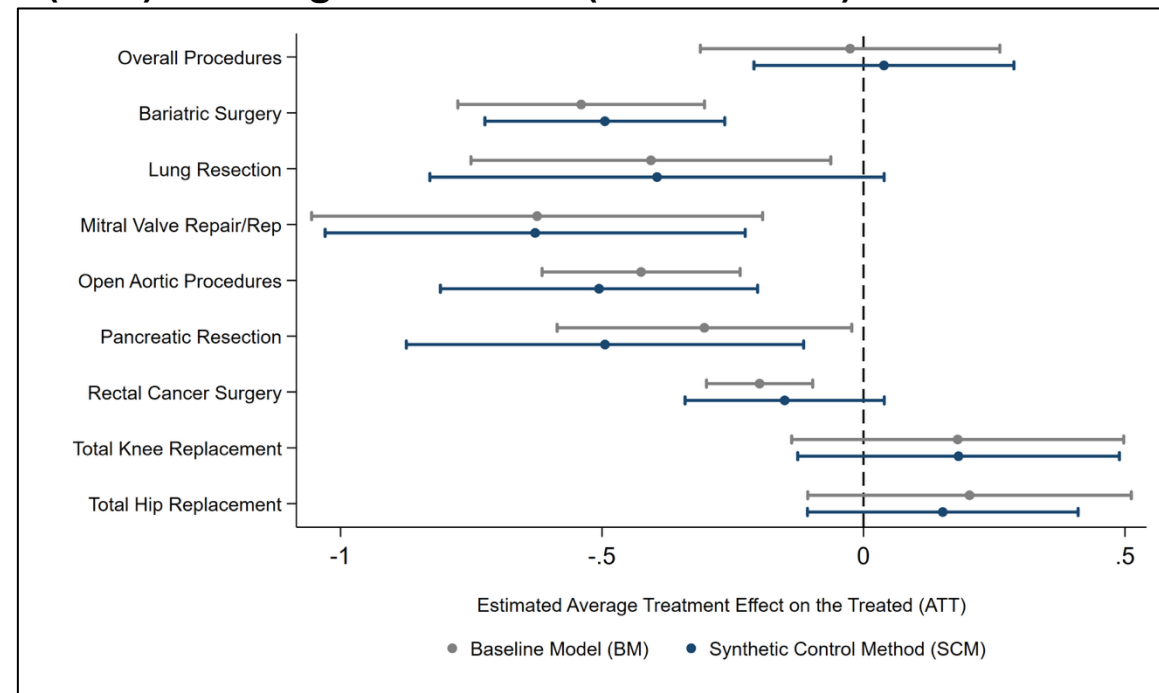


Figure 4: Average Treatment Effect on the Treated (ATT) for 60-Day Mortality (BM vs. SCM)

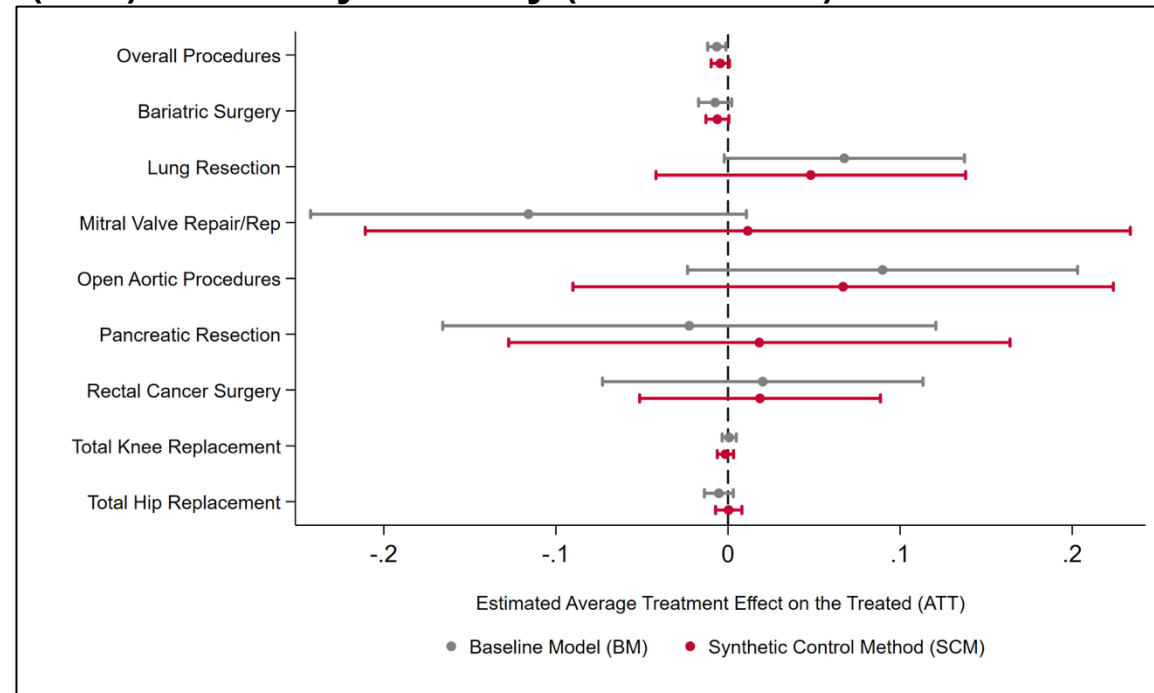


Figure 5: Average Treatment Effect on the Treated for 30-Day Unplanned Rehospitalization (BM vs. SCM)

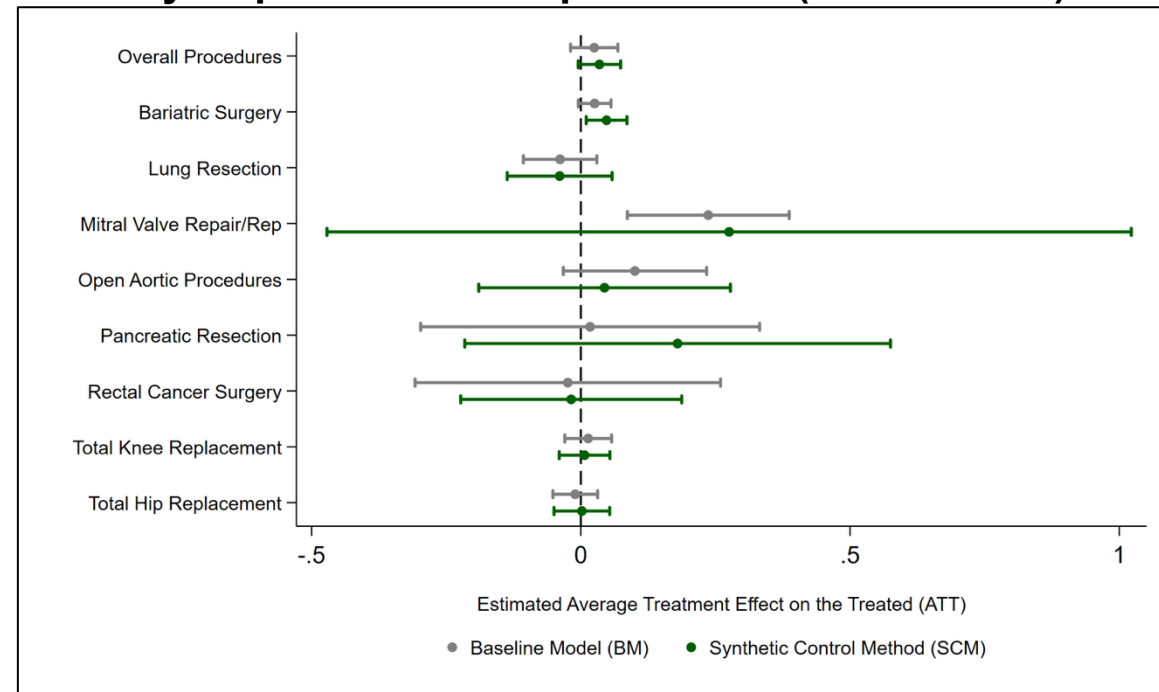
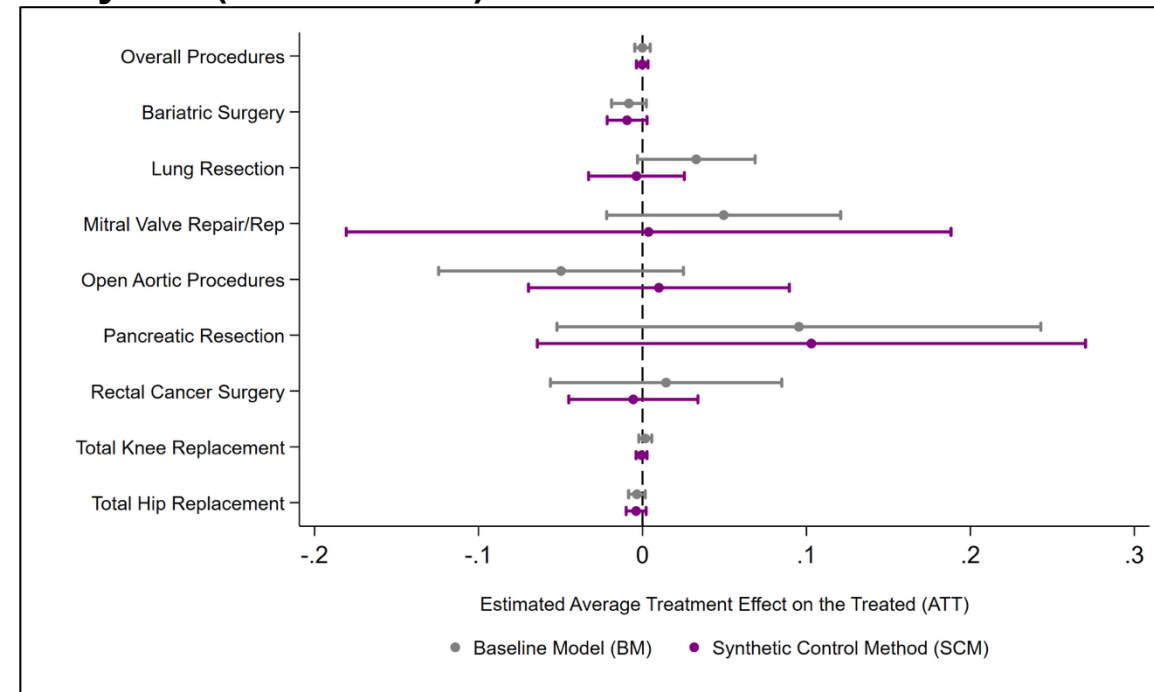


Figure 6: Average Treatment Effect on the Treated for Any PSI (BM vs. SCM)



RESULTS

Parallel Trends: SCM outperformed baseline models by improving parallel trends across most volume and outcome measures.

Surgical Volume: Overall volume and orthopedic procedures (total knee and hip replacements) remained statistically unchanged, while SCM revealed significant declines in complex cardiovascular, oncologic, and metabolic procedures, notably Mitral Valve Repair ($\beta = -0.628$, $p < 0.01$), Open Aortic Procedures ($\beta = -0.506$, $p < 0.01$), Bariatric Surgery ($\beta = -0.495$, $p < 0.001$), and Pancreatic Resection ($\beta = -0.494$, $p = 0.011$).

Quality Outcomes: Post-consolidation quality metrics showed mixed effects: overall 60-day mortality decreased marginally ($\beta = -0.005$, $p = 0.089$), supported by reductions in Bariatric Surgery ($\beta = -0.006$, $p = 0.069$). Conversely, overall 30-day unplanned rehospitalizations trended marginally higher ($\beta = 0.034$, $p = 0.086$), driven by a significant increase in Bariatric Surgery ($\beta = 0.048$, $p = 0.013$), while patient safety indicators remained stable across cohorts.

DISCUSSIONS & IMPLICATIONS

Surgical Capacity: MTFs successfully maintained capacity for routine joint replacements.

Clinical Readiness: Declining volumes in complex specialty procedures raise concerns for maintaining provider clinical readiness and complex surgical capabilities.

Quality & Safety: Patient safety was successfully preserved overall, despite a slight increase in readmissions.

Policy Recommendations: Policymakers should strive to maintain Leapfrog-recommended volume thresholds for complex surgeries and enhance post-discharge care.

Disclaimers: The opinions and assertions expressed herein are those of the author(s) and do not reflect the official policy or position of the Uniformed Services University or the Department of War. The contents of this publication are the sole responsibility of the author(s) and do not necessarily reflect the views, opinions or policies of The Henry M. Jackson Foundation for the Advancement of Military Medicine, Inc. Mention of trade names, commercial products, or organizations does not imply endorsement by the U.S. Government. This study was supported by the Defense Health Agency Military Health System Research Program (Grant #: HT94022310005).

Conflicts of Interest: The authors declare no conflicts of interest.