

Comparison of Propensity Score Matching to Inverse Probability Treatment Weighting in Obstructive Sleep Apnea Patients with Cardiovascular Diseases

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BACKGROUND AND RATIONALE

Obstructive sleep apnea (OSA) is prevalent in patients with cardiovascular disease, such as atrial fibrillation (AFib) and heart failure (HF).

Positive airway pressure (PAP) therapy is used to treat OSA, yet patients need to be adherent to therapy to realize its benefits. A previous real-world data study has shown benefit of PAP therapy in patients with OSA and cardiovascular diseases¹, yet further research is needed to confirm these findings using alternative statistical analysis methods.

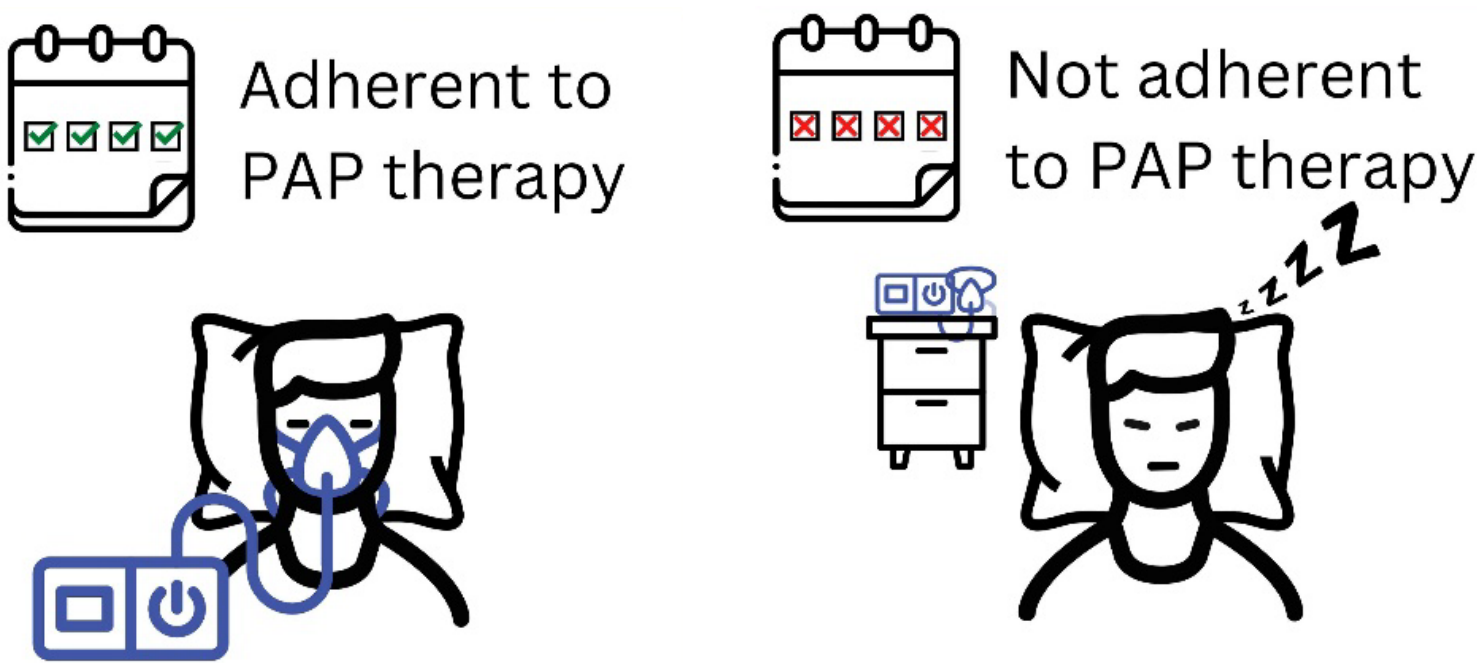
Propensity score methods can improve the validity of causal inference from retrospective data by balancing observed covariates. Two common propensity score methods are propensity score matching and inverse probability of treatment weighting.

Objective: We sought to compare outcomes of healthcare resource utilization in OSA patients with AFib, systolic HF, and diastolic HF using these two propensity score methods.

METHODS

United States administrative claims data linked to objective PAP usage data was used for these analyses.

Adherence to PAP therapy was categorized as either **adherent** or **not adherent**. The first year of therapy was broken into four 90-day quarters. Those that used their PAP device for more than 4 hours per night on 70% of nights in a consecutive 30-day period within the 90-day quarter were considered compliant for that quarter. Adherent patients met this compliance metric for all four quarters in the first year. Not adherent patients did not meet this compliance metric for any of the four quarters in the first year.



A logistic regression propensity model based on risk of not adhering to PAP therapy was developed using baseline covariates for each cardiovascular cohort.

Propensity score matching (PSM) used the model coefficients to calculate a propensity score that was used in greedy matching, with additional exact matching on several covariates including gender, age, insurance payer, hospitalizations in prior year, and emergency room (ER) visits in prior year.

Inverse probability of treatment weighting (IPTW) calculated weights for each patient from their propensity scores and actual adherence. These weights were then applied to create a weighted pseudo-population that mirrored the distribution of the overall cohort. Patients with ‘expected’ PAP adherence (based on their baseline characteristics) are down-weighted, and those with ‘unexpected’ PAP adherence are up-weighted.

Comparisons of mean number of ER visits and hospitalizations between adherent and not adherent patients 1 year before and after starting PAP therapy were conducted for the unadjusted, PSM, and IPTW samples in each cardiovascular cohort.

RESULTS

The propensity model fit well for all 3 cohorts. Both propensity score methods created well balanced groups at baseline with most standardized mean difference (SMD) values less than 0.1 (Figures 1-3). PSM reduced the sample size by 47%, 34%, and 36% in AFib, systolic HF, and diastolic HF cohorts, respectively.

Figure 1. Atrial Fibrillation Baseline SMD Values

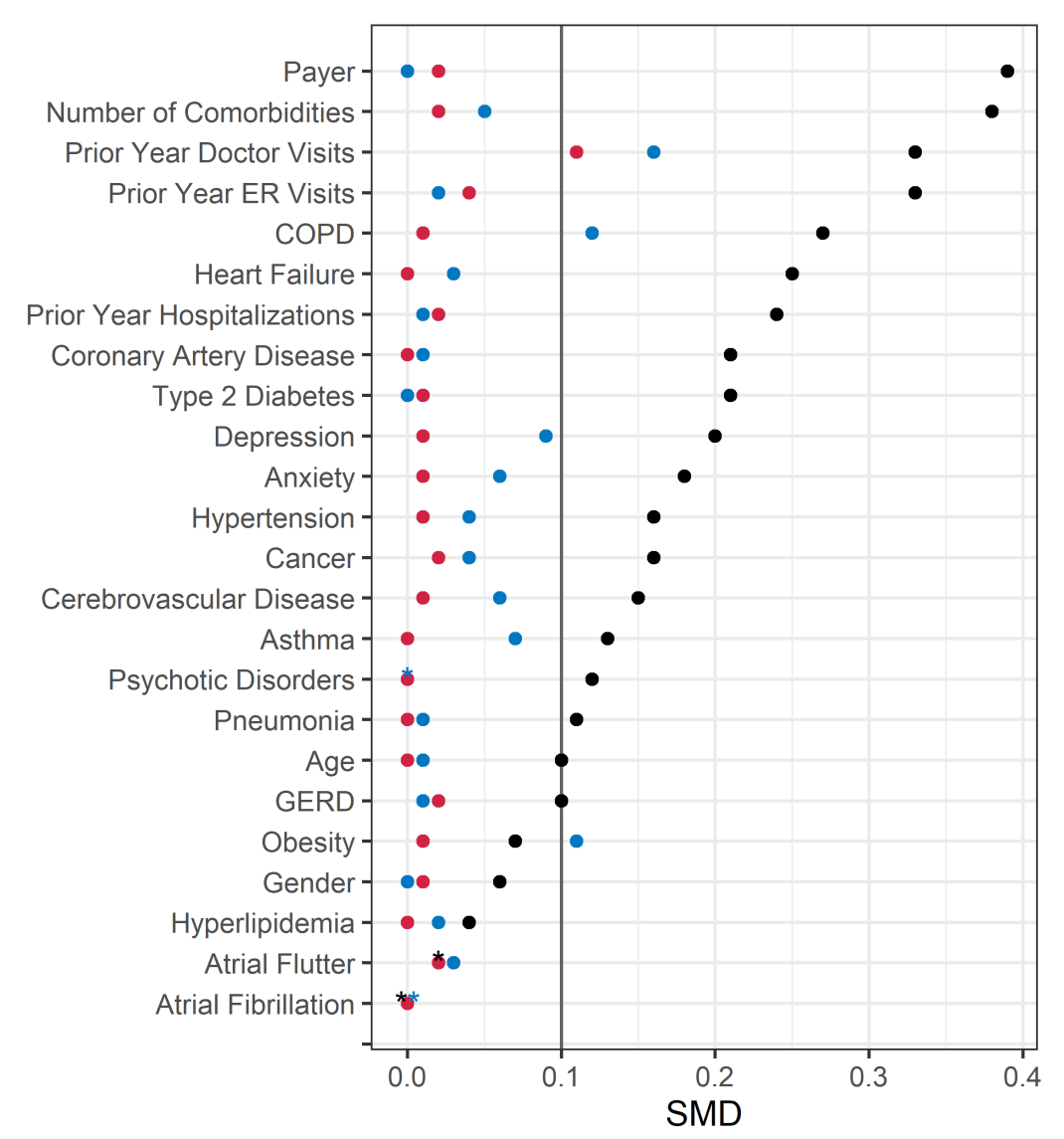


Figure 2. Systolic HF Baseline SMD Values

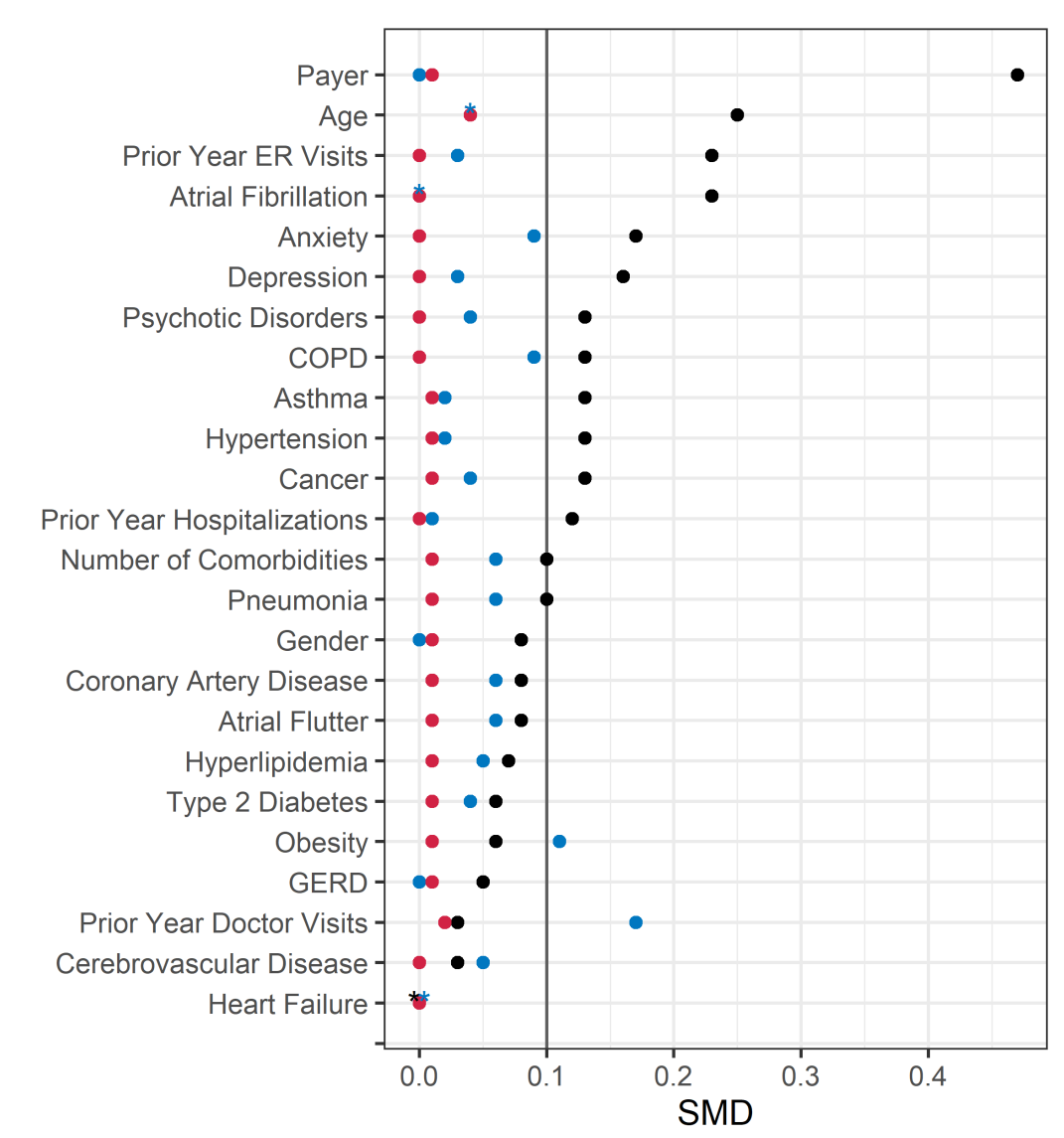
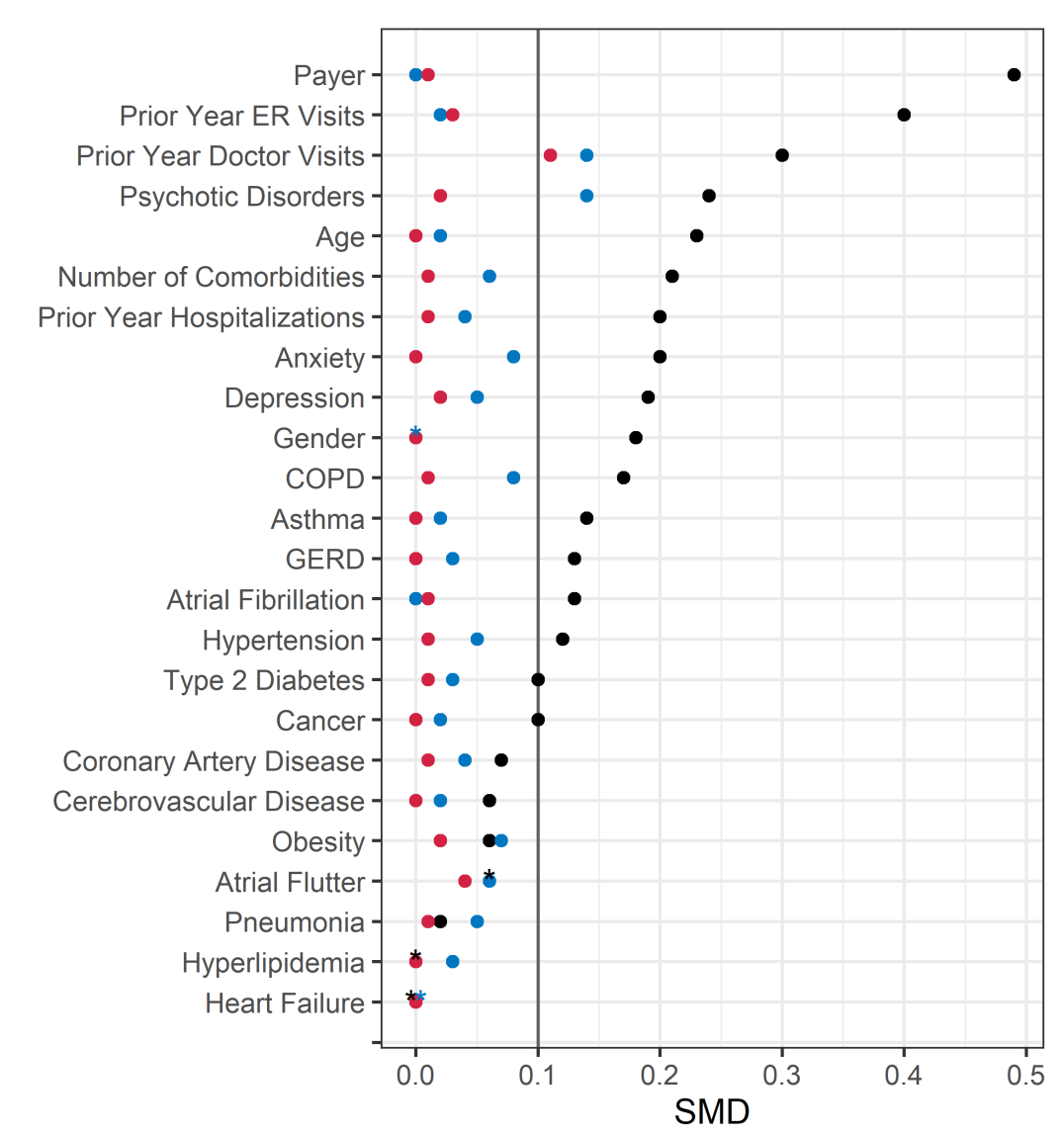


Figure 3. Diastolic HF Baseline SMD Values



Legend: Unadjusted IPTW PSM * overlapping points

Both propensity score methods led to the same conclusions in terms of statistical comparisons between adherent and non-adherent groups for hospitalizations and ER visits within the first year of PAP therapy (Figures 4-6).

Legend
Adherent
Not Adherent

Figure 4. Atrial Fibrillation Healthcare Resource Utilization Prior Year to 1 Year Post

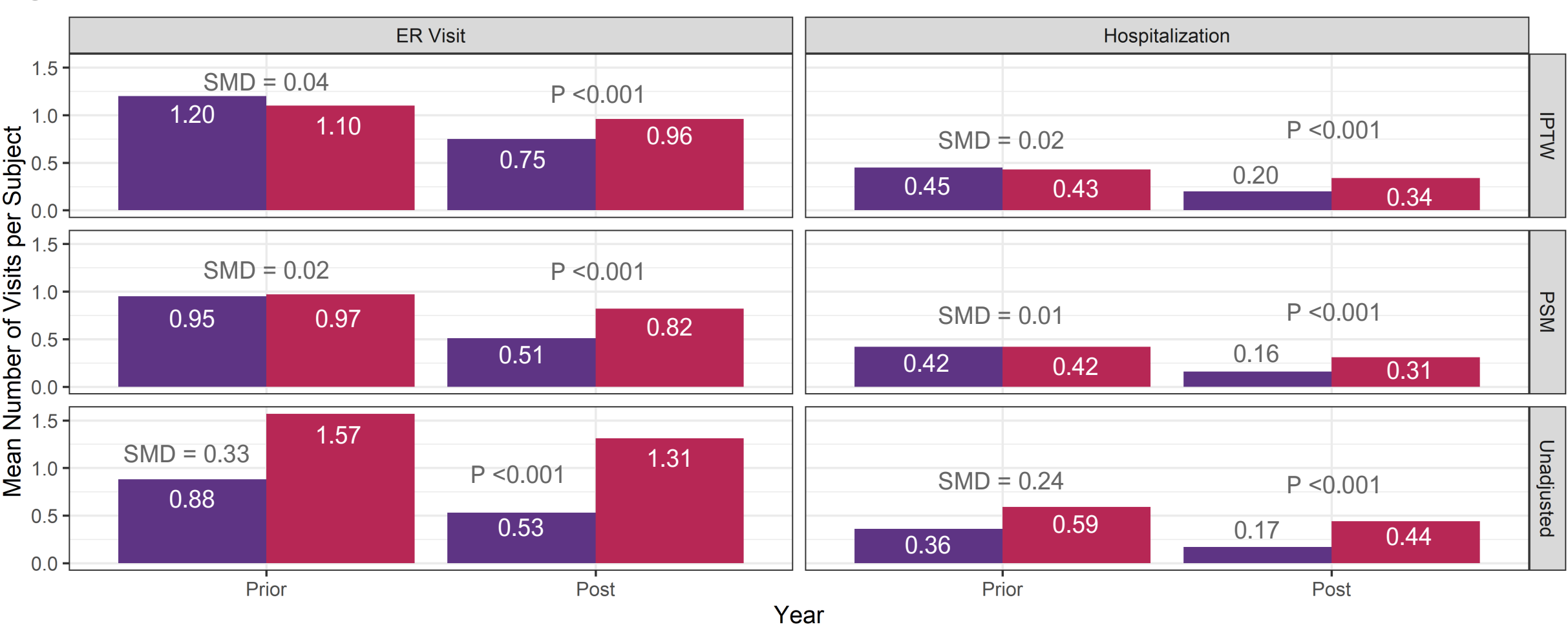


Figure 5. Systolic HF Healthcare Resource Utilization Prior Year to 1 Year Post

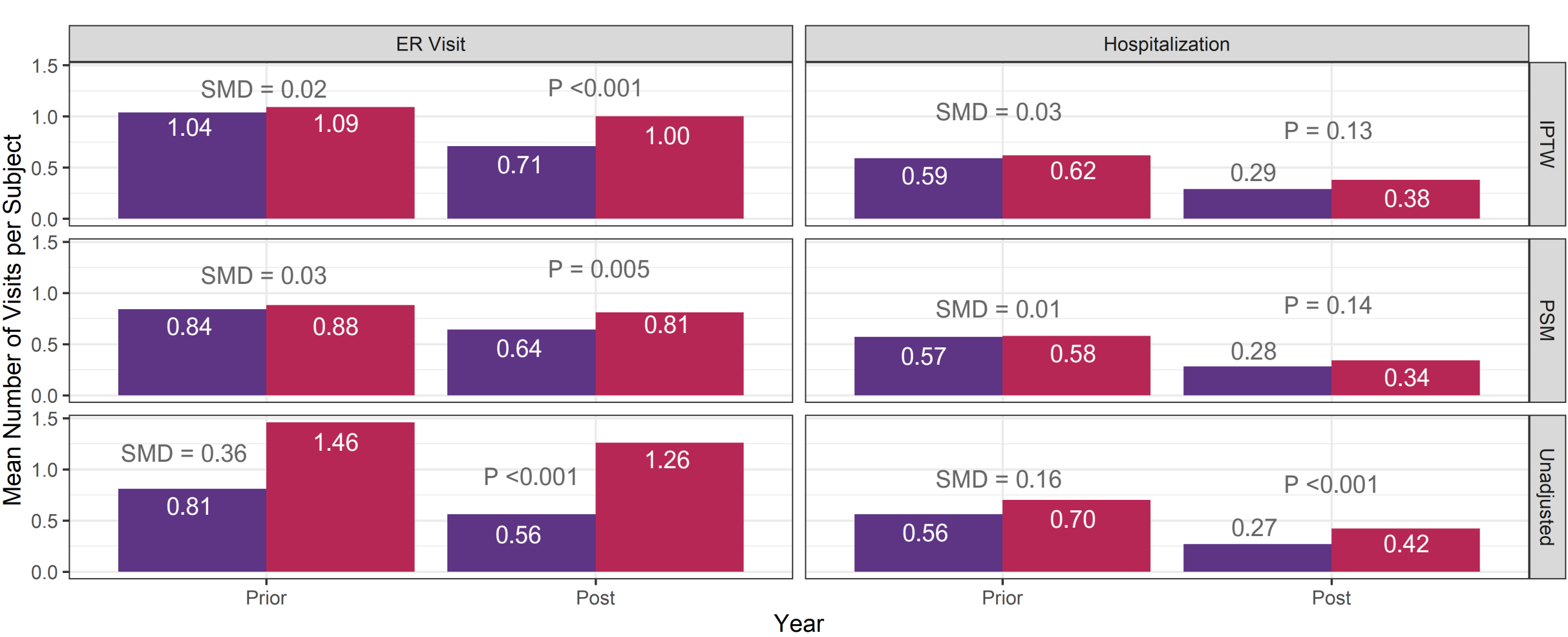
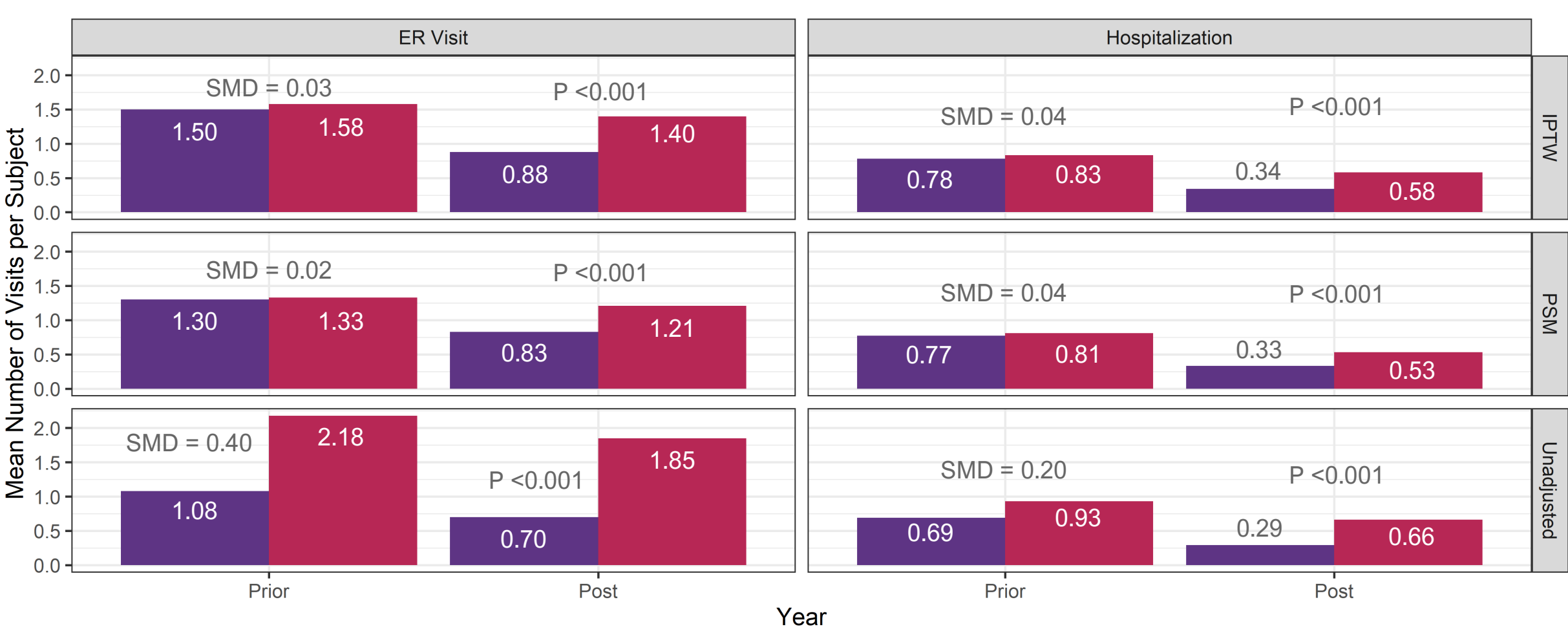


Figure 6. Diastolic HF Healthcare Resource Utilization Prior Year to 1 Year Post



CONCLUSIONS

Both propensity score methods generated similar results for associations between PAP adherence and number of ER visits and hospitalizations in all cohorts. This finding implies that both methods are suitable for comparing real-world changes in healthcare resource utilization.

However, both methods are not without their limitations. The reduction in sample size with PSM may impact generalizability of findings. Some may find IPTW to be less interpretable.

REFERENCES AND ACKNOWLEDGEMENTS

1. Wickwire EM, Bailey MD, Somers VK, et al. CPAP adherence is associated with reduced inpatient utilization among older adult Medicare beneficiaries with pre-existing cardiovascular disease. J Clin Sleep Med. 2022;18(1):39-45. doi:10.5664/jcsm.9478

This study was funded by ResMed. All authors of this poster are employees of ResMed.

