The Impact of Aspirin Daily Treatment in 8 Chronic Disease on Healthcare Utilization

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Author Note

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Abstract

Daily aspirin treatment has been prescibed for any number of different chronic diagnosis ranging from heart failure to cancer. This study attempts to understand the impact of healthcare utlization in total costs and utilizer categoty in regards to aspirin treatment on 8 different chronic conditions. The chronic conditions or diseases of interest are Alzheimer's, asthma, coronary artery disease, congestive heart failure, chronic obstructive pulmonary disease, diabetes, hypertension, and osteoarthritis. The total healthcare utlization costs are defined as the sum of inpatient, primary care physician, and emergency costs within the period window either pre or post treatment. The utilizer category is defined in 3 groups, low, moderate, or high utilizer within the period window either pre or post treatement.

Aspirin is a low cost treatment option that has already been shown to prolong life possibly due the anti-inflammorty properties(Vane & Botting, 2003). To date, and this author did not search all that extensively, no study has been performed to understand the impact of daily aspirin treatment on healthcare utilization and/or utilizer category.

This researcher believes that the daily aspirin treatment will lead to a decrease in total healthcare utilization per each chronic condition or disease but the decrease will not be enough to change the patients utilizer category.

Differences will be assessed on each chronic condition or disease category

Keywords: Aspirin, Healthcare Utilization

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Data and Analysis Overview

All of the data used to complete this analysis was obtained from the AHE505 data files located in SAS. Any patients without a preexisting disease or condition was removed the main data set.

To evaluate differences in total health care utilization per member per month, a difference-in-difference approach was used. An ordinal logistical regression was used to look assess utilizer category change. The pre-treatment data begin at some point and ended at some point later. The post-treatment data begin at some later point and end a little later than that. Additional nonparametric test was used to understand the data.

To prepare the data set for analysis, individual data sets were created for each disease or condition. A summary of the resulting descriptive statistics for age and sex is provided in Table 1.

Nonparametic Tests

Diff in Diff Analysis

To estimate the effect on the daily aspirin treatment, each disease or condition type was subsetted and to each subset of data, a linear model was fit with a gamma distribution with a log link. Once a model was fitted, the $Wald - \chi^2$ test was performed on the interaction term (treatment*time) to determine statistically significance. Finally, a difference in difference is calculated based on the time and treatment groups. A summary of these results is presented in Table x.

Ordinal Analysis

Results

For the difference in difference analysis, the $Wald - \chi^2$ p-value for Alzheimer's, asthma, coronary artery disease, congestive heart failure, chronic obstructive pulmonary disease, diabetes, and osteoarthritis were all > 0.1, indicating the results are not statistically significant. Hypertension, which had the largest sample size, was the only condition which had a $Wald - \chi^2$ p-value of 0.09 indicating the result is statistically significant at a significance level of 0.1.

Additionally, all of the difference in difference results were negative numbers indicating the treatment (daily aspirin dosing) actually increased the health care utilization of the treatment group. All of the increases were relatively small, ~$1.00 per member per month.

Discussion

While not a large difference, the difference in difference results were opposite of the expectation of the decrease in health care utilization would result with the daily dosing of aspirin.

R Packages

We used R (Version 3.6.3; R Core Team, 2020) and the R-packages *dplyr* (Version 1.0.5; Wickham et al., 2021), *forcats* (Version 0.5.0; Wickham, 2020), *ggplot2* (Version 3.3.3; Wickham, 2016), *haven* (Version 2.3.1; Wickham & Miller, 2020), *kableExtra* (Version 1.3.1; Zhu, 2020), *papaja* (Version 0.1.0.9997; Aust & Barth, 2020), *purrr* (Version 0.3.4; Henry & Wickham, 2020), *readr* (Version 1.4.0; Wickham & Hester, 2020), *stringr* (Version 1.4.0; Wickham, 2019), *tibble* (Version 3.1.1; Müller & Wickham, 2021), *tidyr* (Version 1.1.3; Wickham, 2021), and *tidyverse* (Version 1.3.0; Wickham, Averick, et al., 2019) for all our analyses.

References

Aust, F., & Barth, M. (2020). *papaja: Create APA manuscripts with R Markdown*. Retrieved from https://github.com/crsh/papaja

Henry, L., & Wickham, H. (2020). *Purrr: Functional programming tools*. Retrieved from https://CRAN.R-project.org/package=purrr

Müller, K., & Wickham, H. (2021). *Tibble: Simple data frames*. Retrieved from https://CRAN.R-project.org/package=tibble

R Core Team. (2020). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. Retrieved from https://www.R-project.org/

Vane, J. R., & Botting, R. M. (2003). The mechanism of action of aspirin. *Thrombosis Research*, *110*(5), 255–258. https://doi.org/https://doi.org/10.1016/S0049-3848(03)00379-7

Wickham, H. (2016). *Ggplot2: Elegant graphics for data analysis*. Springer-Verlag New York. Retrieved from https://ggplot2.tidyverse.org

Wickham, H. (2019). *Stringr: Simple, consistent wrappers for common string operations*. Retrieved from https://CRAN.R-project.org/package=stringr

Wickham, H. (2020). *Forcats: Tools for working with categorical variables (factors)*. Retrieved from https://CRAN.R-project.org/package=forcats

Wickham, H. (2021). *Tidyr: Tidy messy data*. Retrieved from https://CRAN.R-project.org/package=tidyr

Wickham, H., Averick, M., Bryan, J., Chang, W., McGowan, L. D., François, R., ... Yutani, H. (2019). Welcome to the tidyverse. *Journal of Open Source Software*, *4*(43), 1686. https://doi.org/10.21105/joss.01686

Wickham, H., François, R., Henry, L., & Müller, K. (2021). *Dplyr: A grammar of data manipulation*. Retrieved from https://CRAN.R-project.org/package=dplyr

Wickham, H., & Hester, J. (2020). *Readr: Read rectangular text data*. Retrieved from https://CRAN.R-project.org/package=readr

Wickham, H., & Miller, E. (2020). *Haven: Import and export 'spss', 'stata' and 'sas' files*. Retrieved from https://CRAN.R-project.org/package=haven

Zhu, H. (2020). *KableExtra: Construct complex table with 'kable' and pipe syntax*. Retrieved from https://CRAN.R-project.org/package=kableExtra

Table 1

Descriptive Statistics by Disease/Condition

dis	meanAge	sdAge	female	male
ALZ	55.46	15.12	135	181
AST	54.32	12.19	4621	3486
CAD	57.92	9.80	4145	1752
CHF	57.28	10.61	877	499
COPD	55.34	11.74	1869	2254
DIAB	55.28	11.02	6935	5323
HTN	55.44	10.78	16844	14513
OSTEO	60.47	8.27	83	1660

Table 2

Difference in Difference Result Summary

disease	sampleSize	diffInDiff	wald
ALZ	316.00	-0.02	0.89
AST	8,107.00	-0.02	0.40
CAD	5,897.00	-0.02	0.48
CHF	1,376.00	-0.02	0.77
COPD	4,123.00	-0.02	0.56
OSTEO	1,743.00	-0.02	0.68
HTN	31,357.00	-0.02	0.09
DIAB	12,258.00	-0.02	0.31