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Standardized Approaches for Analyzing Quality Improvement Interventions in Healthcare Settings

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Author Biography

Polina is a PhD candidate in biomedical informatics at the University of Utah. She has a leading statistical role in several healthcare improvement research projects, many of which have been published in peer reviewed journals. She is a Fulbright scholar and holds a master of public health (MPH) degree in biostatistics from the University of North Carolina, Chapel Hill.

Abstract

Healthcare institutions across United States thrive to provide high value evidence based care. To attain such care, continuous and rigorous analysis of new interventions is important. However, interventions in the healthcare settings present many challenges to statistical analysis, including not-normally distributed values, missing values or zero-inflated distributions. In this paper, we describe some shortcuts for analysis of several types of health care data. More specifically, we compare using generalized linear models (GLM) evaluated by generalized estimating equations (GEE) with using interrupted time series (ITS) analysis. We also included two handy SAS macros which could simplify the data analysis while still accounting for secular trends in other covariates.

Tips

1. Use GEE and gamma assumption with log link function to fit GLM for cost data and length of stay (LOS).
2. Smart use of macro programs can speed up the analysis.
3. Interrupted time series analysis is a great method when some important covariate information is missing.

Keywords

Macro, Biostatistics, Healthcare

Background

This paper is a sequel of two previously published papers[1,2]. We are using macro programs which I wrote previously (analysis of missing data and background analysis macro). This paper describes macro programs created to analyze clean datasets and receive valuable insights into effects of the intervention. Combination of these four macros could allow to analyze many before-after and controlled before-after studies in healthcare and other industries. They save hours of work for statistical programmers and reduce programming errors.

Methods

Data Set

We used a simulated dataset containing predictor variables and outcome variables. Predictor variables included … . Outcome variable included . There were two study groups and two study periods. We include example of using just one group and using both groups.

SAS Macro Programs

Elegant macro code was written and validated at the University of Utah. SAS 9.4.

Results

Using GLM macro

Examples of using SAS macros on an artificially created dataset.

In our work we often meet for types of outcomes: binomial (e.g., 30 days readmission and mortality), gamma (length of stay and cost), negative binomial (e.g.,). We also added weighted option for … .

Repeated statement – could be used for patient, physician or hospital department.

Using ITS macro

Discussion

We used this macros successfully in analyzing healthcare data at the University of Utah. For example, we estimated effects of lab reduction intervention on ordering labs.[3] Another example includes using a new order set for cellulitis.[4] Communication[5]

Pros and Cons of GLM analysis

Advantages of GLM analysis include

1. Account for known co-variates such as demographics, Carlson comorbidity index, and case mix index

2. Does not account for time variables

3.

Disadvantages include:

1. Parametric assumption.

2.

3.

Pros and Cons of ITS analysis

Advantages of GLM analysis include

1. Account for unknown secular trends.

2. Estimates both trend and level changes

3.

Disadvantages include:

1. Cannot adjust for specific variables.

2.

3.

Macros should be used with caution and underlying assumptions should always be verified.

If using number of tests per LOS negative binomial distribution would be a good choice.

Conclusion

This paper is a sequel of two previously published paper. We are using macro programs which I wrote previously (analysis of missing data, background analysis macro). Combination of these four macros could allow to analyze many before-after and controlled before after studies in healthcare and other industries. They save hours of work and reduce programming errors.

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Appendix 1. GEE macro programs

Appendix 2. ITS macro programs