

Introduction:

This document ties together the five component files that make up the GRASP example demonstrating the technique of temporally successive multiple imputation as applied to data from the Precipitating Events Project (PEP) at the Yale Pepper Center. This example takes a sample of 100 pseudo subjects with eight covariates measured over six waves of follow-up. The procedure was used to impute missing observations for risk factors measured at face-to-face interviews performed at 18-month intervals. This example serves for demonstrational purposes only.

Keyword Categories:

Clinical: Longitudinal follow-up, Cohort study, Disability in Activities of Daily Living
Genetics: Not Applicable (N/A)
Statistical: Multiple imputation, missing observation, missing at random
Software: SAS 9.1
Related: Statistical method

References:

Gill TM, Han L, Allore HG. Predisposing factors and precipitants for bathing disability in older persons. *Journal of the American Geriatrics Society*. 2007;55:534-40.

Component Files:

a. PDF file explaining entire example: SeqMISummaryHan.pdf (file you are reading)
b. Sample input data structure: SeqMI_InputData.pdf
b1. Sample dataset (for testing SAS code): SeqMI_InputData.txt
c. SAS program: SeqMImacro.pdf
d. SAS output/summary for imputed data: SeqMIOutputHan.pdf
e. Sample output/imputed dataset: SeqMI_output ds.pdf

Optimal Use:

1. Read this Summary file completely	Component a listed above
2. Set up an input SAS dataset following the demonstrated structure	Component b listed above
3. Run the SAS program in concert with prepared input data.	Components b1 and c listed above
4. Check the output to make sure the procedure was executed correctly	Component d listed above
5. Manipulate the output/imputed data to fit desired analyses	Component e listed above

Prerequisites:

To run the example you must have a working knowledge of SAS PROC MI procedure and macro language. In brief, you first need to set up the input data structure as demonstrated in Component File c above. In addition to the variables whose missing values need to be imputed, you may include other variables that will supply information related to the imputation process. The program calls an embedded short macro program to run proc mi sequentially from the first wave (or baseline interview) to the next. This process was repeated iteratively until the missing value at the last wave was imputed. For details about the SAS proc MI and macro language, please look SAS Help and Documentation

Potential Applications:

The contents here may be useful in longitudinal analyses where missing data is a common problem. The multiple imputation procedures in SAS proc MI context allows you to replace each missing value with a set of plausible values based on observed values on the same variables from other subjects and different variables that correlated with them. The multiple imputation typically involves three distinct phases, filling the missing data m times to generate m complete data sets, analyze the m complete data sets using standard statistical methods and

finally, synchronize the results from the m complete data sets to produce inferential results. In our example, we made the following revisions: 1) instead of using data at one single follow-up wave, we used the data at both current and previous waves to impute the missing values for the target covariates at the current wave, except the first or baseline wave when no previous data are available; 2) instead of directly analyzing the imputed dataset and make inference using PROC MIANALYZE embedded with the SAS PROC MI framework, we focused on creating the dataset only, using the mean of the imputed values to replace the missing value at each follow-up wave. Then the imputed datasets across follow-up waves are compiled and can be used as input datasets for different analyses using SAS programs outside of PROC MI and PROC MIANALYZE. We hoped that this modification would increase the precision and efficiency for imputing missing values in longitudinal data context, but admit that both its conceptual and technical contents (i.e., SAS macro and proc MI code) are preliminary and need improvement.

Any feedback on how to make this example more useful is welcome.

Log into the main GRASP page, i.e.

<http://grasp.med.yale.edu>

and choose the “forum” link in the upper menu on the right to enter feedback on any GRASP submission.

Please refer to the specific file names when commenting so we can appropriately steer your suggestions.