Estimation of Adherence to Antipsychotic and Diabetic Medications in a Sample of Schizophrenia Patients

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Overview and Scope of the Presentation

- Discussion will focus on the use of SAS® and specific techniques.

- Medication Possession Ratio (MPR) is the measure used for adherence

- Limited discussion of literature, research background and statistical methodology
SAS Specific Focus on

- HASH: Data Step Object
- Narrow versus Wide Data Sets
- ARRAYS to calculate Medication Possession Ratio
- Special DO Loops to process Narrow Data Sets with ARRAYS.
Research Background and Study Objectives

- Adherence literature – plenty

- Adherence in the case of co-morbidity – limited

Study Objective: Examine Schizophrenia patients in relation to adherence to antipsychotics (ONLY) and compare with adherence to antipsychotics and Diabetic Medications.
Brief Results

- Co-morbid subjects more adherent than those ONLY on Antipsychotics but not statistically significant

- Direction of the relationship confirms findings from a recent study done on a different population (VA).
Sample Selection

- Schizophrenia cases: patients with at least one inpatient or outpatient medical claim with a diagnosis of schizophrenia (ICD-9 codes 295.xx) and at least one prescription for an antipsychotic medication in 2006.

- Cases were further restricted to those individuals participating in health plans that reported prescription drug data for both 2006 and 2007.

- Subset who were on Diabetic medication (had at least one prescription for a diabetes medication in 2006)
Sample Selection (Contd.)

- Independent Subset who were NOT on Diabetic medication (mutually exclusive to the above)

- Subset Diabetic patients to those who also took Antipsychotic medication.

- Subset NON-Diabetic patients to those who took Antipsychotic medication and no other chronic medication.
Sample Selection

- Schizophrenia
  - Antipsychotic
  - Diabetic
  - NOT on Antipsychotics
Schizophrenics on Diabetic Meds

- Subset based on Therapeutic Class of Medication Filled (172, 173 and 174)
- AntiPsychotic + Diabetic Meds
- Excluded – small number of subjects NOT taking Antipsychotics and also those Diabetics on Insulin
Comparator Population

- Subset of Patients taking ONLY antipsychotic medication.
- Excludes any non-Antipsychotic MORE than ¼ of the number of Days Supply of Antipsychotics
Code for Efficient selection

- Create a dataset of patients
- Use the Data Step Object: HASH
- Technique that loads a whole table to memory.
- Efficient to subset a large dataset such as Market Scan Data.
Load the dataset of SUBSET patients to memory

```declare HASH ht (dataset: "diabidlist");```
Data Step Object: Hash

- Declare ENROLID as the KEY to be loaded to memory.
- No additional DATA required.

- `ht.defineKey("enrolid");`
- `ht.defineDone();`
Extract from Large dataset the records with the same KEY as in `diabidlist`

```
set <schizophrenia data> ;
if ht.find() = 0 ;
```

**NOTE:** DATA statement used:

- **real time** 0.63 seconds
- **cpu time** 0.64 seconds
Data Step Object: Hash

- Selected mutually exclusive groups

- ANTIPSYCHOTIC and DIABETIC medications

- ONLY ANTIPSYCHOTIC medication.
## Data Structure – Wide v/s Narrow

<table>
<thead>
<tr>
<th>ID</th>
<th>Fill Date 1</th>
<th>Fill Date 2</th>
<th>Fill Date N</th>
<th>Days Sup 1</th>
<th>Days Sup 2</th>
<th>Days Sup N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1001</td>
<td>1/1/2006</td>
<td>1/31/2006</td>
<td>12/30/2006</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ID</th>
<th>Fill Date</th>
<th>Days Supp</th>
</tr>
</thead>
<tbody>
<tr>
<td>1001</td>
<td>1/1/2006</td>
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<td>30</td>
</tr>
<tr>
<td>1001</td>
<td>12/30/2006</td>
<td>30</td>
</tr>
</tbody>
</table>
## Wide v/s Narrow – Multiple Drugs

<table>
<thead>
<tr>
<th>ID</th>
<th>Fill Date 1 Drug A</th>
<th>Fill Date 2 Drug A</th>
<th>Fill Date N Drug A</th>
<th>Fill Date 1 Drug B</th>
<th>Fill Date 2 Drug B</th>
<th>Fill Date N Drug B</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>ID</th>
<th>Drug Name</th>
<th>Fill Date</th>
<th>Days Supp</th>
</tr>
</thead>
<tbody>
<tr>
<td>1001</td>
<td>Drug A</td>
<td>1/1/2006</td>
<td>30</td>
</tr>
<tr>
<td>1001</td>
<td>Drug A</td>
<td>1/31/2006</td>
<td>30</td>
</tr>
<tr>
<td>1001</td>
<td>Drug A</td>
<td>12/30/2006</td>
<td>30</td>
</tr>
<tr>
<td>1001</td>
<td>Drug B</td>
<td>1/1/2006</td>
<td>30</td>
</tr>
<tr>
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<td>Drug B</td>
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<td>30</td>
</tr>
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</tbody>
</table>
Why Wide versus Narrow?

- Principles of Data Bases rely on multiple NARROW data sets that can be linked together easily on a few common keys (Normalized Data).

- Wide Data – Useful for Hard Copies when Width is Manageable (De-normalized Data).

- Narrow dataset is Easier on the Eyes for On Screen Viewing and Filtering.
Working with Narrow Data Structure

- SAS Primarily Row Based but Flexible – Powerful Tools at your Disposal

- Temporary ARRAYS that disappear after the step

- Special DO LOOP that works with ROWS to fill ARRAY elements

- Collapses to one record per patient with - minimal column additions.
Special DO Loop and Temporary Array Manipulations

- array lup (300) _temporary_ ;

- do until (last.enrolid) ;
  set restpsych ;
  by enrolid thercls ;
  lup(thercls) = sumdaysupp ;
  end ;
## Special DO loop - Narrow Data Set

<table>
<thead>
<tr>
<th>ID</th>
<th>Lup(1)</th>
<th>Lup(2)</th>
<th>Lup(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1001</td>
<td>295</td>
<td>.</td>
<td>.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ID</th>
<th>Therapeutic Class</th>
<th>Sum of Days Supplied</th>
</tr>
</thead>
<tbody>
<tr>
<td>1001</td>
<td>1</td>
<td>295</td>
</tr>
<tr>
<td>1001</td>
<td>2</td>
<td>304</td>
</tr>
<tr>
<td>1001</td>
<td>3</td>
<td>275</td>
</tr>
</tbody>
</table>

```plaintext
do until (last.enrolid) ;  
  set restpsych ;  
  by enrolid thercls ;  
  lup(thercls) = sumdaysupp;  
end ;
```
### Special DO loop - Narrow Data Set

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<td></td>
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<td>304</td>
</tr>
<tr>
<td>1003</td>
<td>3</td>
<td>275</td>
</tr>
</tbody>
</table>

```sql
do until (last.enrolid) ;
set restpsych ;
by enrolid thercls ;
lup(thercls) = sumdaysupp;
end ;
```
Demo through Data Step Debugger

- Example – Data Step Debugger
- Special DO loop – Allows Powerful Manipulation
- Demonstrate How it Does
- Run Example
Special DO loop and Temporary Array Manipulations

```plaintext
do until (last.name) ;
    set _temp5_3 ;
    by enrolid name svcdate;
    if stopProcessDate then continue ;
    if first.name then
        do ;
        firstSupplyDate = svcdate ;
        AnniversaryDate =
            ( firstSupplyDate + 365 ) - 1 ;
        end ;
```
Special DO loop Manipulations

```
if svcdate >= AnniversaryDate
  then stopProcessDate = svcdate;

if not first.name and
  not (first.name and last.name)
  and (svcdate - PrevServiceDate > (.5*PrevSupply))
  then cumdays = sum(cumdays, daysupp);
```
Minimal Column Additions

- `array allrx (*) &_druglist ;`
- `array psych (*) &_druglist2 ;`

```plaintext
allrx(input(name,_indrg.)) =
    cumdays / 365 ;
```
MPR Calculations and Explicit OUTPUT Statement

```plaintext
if last.enrolid then
  do ;
  psychMPR = (sum(of psych(*))) /
        (dim(psych) - nmiss(of psych(*)) ) * 365 ) ;
  output ;
```
Ready for Analysis

- All this - just to get the data ready? YES!!!
- Data structure – relatively unchanged
- Statistical Models – Ready to run
Statistical Model

- Westfall’s recommendation of MULTITEST was used to guard against false significance.

- Cochran-Armitage Linear Trend and Linear Contrasts were used.

- Results confirmed Relationship found in recent study

- However, fell short of Statistical Significance.
Conclusion

- Hash Object – for efficient selection of subsets from large data sets.

- Metrics are found in many published papers – demonstrating superiority over regular subset.

- Special DO loop to work with a Narrow data structure.

- Use of temporary arrays to calculate MPR.
Contact Information

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