

Page Break Macro for Proc Report Procedure

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ABSTRACT

In Statistical Programming while working on development of different types of Summary Tables and Listings using Proc Report, Statistical Programmers come across a number of challenges as far as presentation of the report output is concerned. Some of the challenges faced by the Statistical Programmers are:

- 1.) Printing certain number of non-missing lines on one page
- 2.) Not ending the page with a new parameter starting
- 3.) Combining the groups and sub-groups on one page
- 4.) Continuation of main group heading in case the splitting of main group and subgroup is unavoidable example- adverse events
- 5.) Addition of suffix in case of group splitting into different page

INTRODUCTION

In this paper, we are going to present a Simple Page Break macro, which will help the statistical programmer to overcome all the challenges as mentioned above in generation of summary reports. The output generated from the Page Break Macro will be a SAS dataset, which in turn will be used in the Proc Report Procedure in SAS to generate output as per the Clinical Study requirement. This Macro when used in combination with Existing Reporting Macros in the Pharmaceutical companies will be quite helpful in cutting down the programming time taken in formatting of Tables and Listings.

THE EXAMPLE

This Page Break Macro is specifically meant for the AE tables where AEDECOD (Adverse Event decoded terms) belonging to a particular AESOC (Adverse Event System Organ Class) are being spread across multiple pages and it becomes difficult for a reviewer going through these tables and listings to keep a track of hierarchical relations between AEDECOD and AESOC. Below is the problem we often encountered in Adverse Event Tables: Gastrointestinal disorders is a System Organ class under which a number of AEDECOD terms are present and which are extended on the next page once the limit on number of non-missing terms on one page is reached. The Page break macro will not only provide an options of having the System Organ class being continued on next page alongside its sub-group of AEDECOD terms but it also provide the option of printing a certain number of non-missing lines on one Page.

Gastrointestinal disorders	xx (xx.x)	xx (xx.x)	xx (xx.x)
Abdominal discomfort			xx (xx.x)
Abdominal distension	xx (xx.x)		
Abdominal pain		xx (xx.x)	
Constipation	xx (xx.x)	xx (xx.x)	xx (xx.x)
Dry mouth		xx (xx.x)	xx (xx.x)
Dyspepsia		xx (xx.x)	xx (xx.x)
Flatulence		xx (xx.x)	xx (xx.x)

Source Dataset(s): ADAE.sas7bdat
Program Name: DUM_TAB.sas
[1] Percentage is based on number of patients in the Safety population.
Related adverse events includes events reported as possible or probable or related relationship to study drug.

XYZ
Protocol No.: XYZ

Date: 05AP1

Table xx.yy.zz Related Treatment-Emergent AEs by System Organ Class, Preferred Term
(Safety Set)

System Organ Class Preferred Term	Placebo	Active Drug 1	Active Drug 2
Gastrointestinal pain	xx (xx.x)		
Gastroesophageal reflux disease		xx (xx.x)	
Nausea	xx (xx.x)	xx (xx.x)	xx (xx.x)
Pancreatitis			xx (xx.x)

Below is the snapshot of the table output by the Proc report procedure, which will be using the SAS dataset generated by the Page Break Macro:

Gastrointestinal disorders	xx (xx.x)	xx (xx.x)	xx (xx.x)
Dry mouth		xx (xx.x)	xx (xx.x)
Abdominal pain		xx (xx.x)	
Constipation	xx (xx.x)	xx (xx.x)	xx (xx.x)
Abdominal discomfort			xx (xx.x)
Abdominal distension	xx (xx.x)		

Source Dataset(s): ADAE.sas7bdat
Program Name: t14_3_1_4_ss_fin.sas
[1] Percentage is Based on number of patients in the Safety population.
Related adverse events includes events reported as possible or probable or related relationship to study drug.

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Protocol No.: XYZ

Date: 05APR2020, 23:22
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Table 14.3.1.4 Related Treatment-Emergent AEs by System Organ Class, Preferred Term
(Safety Set)

System Organ Class Preferred Term	Placebo	Active Drug 1	Active Drug 2
Gastrointestinal disorders(continued)			
Nausea	xx (xx.x)	xx (xx.x)	xx (xx.x)
Gastroesophageal reflux disease		xx (xx.x)	
Pancreatitis			xx (xx.x)
Gastrointestinal pain	xx (xx.x)		
Flatulence		xx (xx.x)	
Dyspepsia		xx (xx.x)	xx (xx.x)

MACRO CODE AND SAMPLE DATASET

Below is the Snippet of the Page break Macro and following it, the detailed explanation of keyword parameter use in the Macro is given. The whole Page Break Macro is provided at the end of the paper.

```
%macro page_break_ae(input=%nrstr(), main=%nrstr(), sub=%nrstr(),  
    output=%nrstr(), page_no=, suffix=%nrstr());
```

Input = specifies the name of the SAS dataset.

Main = specifies the name of the variable in the input SAS dataset which act as the main grouping above the sub-grouping. In the example mentioned here, this is equal to AEBODSYS or AESOC.

Sub = specifies the name of the variable in the input SAS dataset which is the sub-group in the hierarchy

Output = specifies the name of the SAS dataset which will be the output of the Page break Macro.

Page_no = specifies the number of non-missing observations as per the discretion of user of this Macro

Suffix = specifies the sentence which can be used in continuation with the main heading which in this case is AESOC term and which is continued onto multiple pages.

The input SAS dataset used in the Page Break Macro has to be present in a particular format and is given below in the form of the snapshot. In addition, the variables present in it are as follows:

- a.) Nam = Variable which represent the hierarchical relation between AESOC and AEDECOD and will be present in the Table output
- b.) AEBODSYS = Main Group Term and in this case it is Body System or Organ Class
- c.) AEDECOD = Sub Group Term and in this case it is Adverse Event Dictionary-Derived Term
- d.) PLB = In this case it is Placebo, one of the Treatment Arm
- e.) ACT1 = In this case it is an Active Drug 1
- f.) ACT2 = In this case it is an Active Drug 2

nam	AEBODSYS	AEDECOD	PLB	ACT1	ACT2
Subjects reported with at least one related treatment-emergent AE			xx (xx.x)	xx (xx.x)	xx (xx.x)
Blood and lymphatic system disorders	Blood and lymphatic system disorders			xx (xx.x)	xx (xx.x)
~{style ~{NBSPACE 2}}Agranulocytosis	Blood and lymphatic system disorders	Agranulocytosis			xx (xx.x)
~{style ~{NBSPACE 2}}Anaemia	Blood and lymphatic system disorders	Anaemia		xx (xx.x)	
~{style ~{NBSPACE 2}}Leukopenia	Blood and lymphatic system disorders	Leukopenia			xx (xx.x)
Cardiac disorders	Cardiac disorders		xx (xx.x)		xx (xx.x)
~{style ~{NBSPACE 2}}Atrial flutter	Cardiac disorders	Atrial flutter			xx (xx.x)
~{style ~{NBSPACE 2}}Tachycardia	Cardiac disorders	Tachycardia	xx (xx.x)		
~{style ~{NBSPACE 2}}Torsade de pointes	Cardiac disorders	Torsade de pointes			xx (xx.x)
Ear and labyrinth disorders	Ear and labyrinth disorders		xx (xx.x)	xx (xx.x)	xx (xx.x)
~{style ~{NBSPACE 2}}Hypoacusis	Ear and labyrinth disorders	Hypoacusis	xx (xx.x)		
~{style ~{NBSPACE 2}}Tinnitus	Ear and labyrinth disorders	Tinnitus		xx (xx.x)	
~{style ~{NBSPACE 2}}Vertigo	Ear and labyrinth disorders	Vertigo			xx (xx.x)
Eye disorders	Eye disorders		xx (xx.x)	xx (xx.x)	xx (xx.x)
~{style ~{NBSPACE 2}}Diplopia	Eye disorders	Diplopia		xx (xx.x)	
~{style ~{NBSPACE 2}}Glaucoma	Eye disorders	Glaucoma		xx (xx.x)	
~{style ~{NBSPACE 2}}Ocular icterus	Eye disorders	Ocular icterus		xx (xx.x)	
~{style ~{NBSPACE 2}}Photophobia	Eye disorders	Photophobia			xx (xx.x)
~{style ~{NBSPACE 2}}Vision blurred	Eye disorders	Vision blurred	xx (xx.x)	xx (xx.x)	
Gastrointestinal disorders	Gastrointestinal disorders		xx (xx.x)	xx (xx.x)	xx (xx.x)
~{style ~{NBSPACE 2}}Abdominal discomfort	Gastrointestinal disorders	Abdominal discomfort			xx (xx.x)
~{style ~{NBSPACE 2}}Abdominal distension	Gastrointestinal disorders	Abdominal distension	xx (xx.x)		
~{style ~{NBSPACE 2}}Abdominal pain	Gastrointestinal disorders	Abdominal pain		xx (xx.x)	
~{style ~{NBSPACE 2}}Constipation	Gastrointestinal disorders	Constipation	xx (xx.x)	xx (xx.x)	xx (xx.x)
~{style ~{NBSPACE 2}}Dry mouth	Gastrointestinal disorders	Dry mouth		xx (xx.x)	xx (xx.x)
~{style ~{NBSPACE 2}}Dyspepsia	Gastrointestinal disorders	Dyspepsia		xx (xx.x)	xx (xx.x)
~{style ~{NBSPACE 2}}Flatulence	Gastrointestinal disorders	Flatulence		xx (xx.x)	
~{style ~{NBSPACE 2}}Gastrointestinal pain	Gastrointestinal disorders	Gastrointestinal pain	xx (xx.x)		
~{style ~{NBSPACE 2}}Gastroesophageal reflux disease	Gastrointestinal disorders	Gastroesophageal reflux disease		xx (xx.x)	
~{style ~{NBSPACE 2}}Nausea	Gastrointestinal disorders	Nausea	xx (xx.x)	xx (xx.x)	xx (xx.x)
~{style ~{NBSPACE 2}}Pancreatitis	Gastrointestinal disorders	Pancreatitis			xx (xx.x)
General disorders and administration site conditions	General disorders and administration site conditions		xx (xx.x)	xx (xx.x)	xx (xx.x)
~{style ~{NBSPACE 2}}Abasia	General disorders and administration site conditions	Abasia		xx (xx.x)	
~{style ~{NBSPACE 2}}Chills	General disorders and administration site conditions	Chills		xx (xx.x)	
~{style ~{NBSPACE 2}}Device failure	General disorders and administration site conditions	Device failure			xx (xx.x)
~{style ~{NBSPACE 2}}Drug ineffective	General disorders and administration site conditions	Drug ineffective	xx (xx.x)		
~{style ~{NBSPACE 2}}Fatigue	General disorders and administration site conditions	Fatigue	xx (xx.x)	xx (xx.x)	xx (xx.x)
~{style ~{NBSPACE 2}}Feeling abnormal	General disorders and administration site conditions	Feeling abnormal	xx (xx.x)	xx (xx.x)	xx (xx.x)
~{style ~{NBSPACE 2}}Feeling jittery	General disorders and administration site conditions	Feeling jittery		xx (xx.x)	

OUTPUT AND PROC REPORT

Below is a snapshot of the Output SAS dataset, which will be used in Proc Report procedure to generate Adverse Event Table. The Extra variables generated in this SAS dataset as compared to the input SAS dataset are the key variables which are meant to be used in different statement in Proc Report Procedure.

nam	AEBODSYS	AEDECOD	PLB	ACT1	ACT2	pb_num	order1	pb_num2	aa	bb	order2	order3
Subjects reported with at least one related treatment-emergent AE			xx (xx.x)	xx (xx.x)	xx (xx.x)	1	1	1			1	1
Blood and lymphatic system disorders	Blood and lymphatic system disorders			xx (xx.x)	xx (xx.x)	1	2	1	1		1	1
~{style ~{NBSpace 2}}Leukopenia	Blood and lymphatic system disorders	Leukopenia			xx (xx.x)	1	2	1	1	1	1	2
~{style ~{NBSpace 2}}Agranulocytosis	Blood and lymphatic system disorders	Agranulocytosis			xx (xx.x)	1	2	1	1	1	1	2
~{style ~{NBSpace 2}}Anaemia	Blood and lymphatic system disorders	Anaemia		xx (xx.x)		1	2	1	1	1	1	2
Cardiac disorders	Cardiac disorders		xx (xx.x)		xx (xx.x)	1	3	1	1		1	1
~{style ~{NBSpace 2}}Tachycardia	Cardiac disorders	Tachycardia	xx (xx.x)			1	3	1	1	1	1	2
~{style ~{NBSpace 2}}Torsade de pointes	Cardiac disorders	Torsade de pointes			xx (xx.x)	1	3	1	1	1	1	2
~{style ~{NBSpace 2}}Atrial flutter	Cardiac disorders	Atrial flutter			xx (xx.x)	1	3	1	1	1	1	2
Ear and labyrinth disorders	Ear and labyrinth disorders		xx (xx.x)	xx (xx.x)	xx (xx.x)	1	4	1	1	1	1	1
~{style ~{NBSpace 2}}Hypoacusis	Ear and labyrinth disorders	Hypoacusis	xx (xx.x)			1	4	1	1	1	1	2
~{style ~{NBSpace 2}}Vertigo	Ear and labyrinth disorders	Vertigo			xx (xx.x)	1	4	1	1	1	1	2
~{style ~{NBSpace 2}}Tinnitus	Ear and labyrinth disorders	Tinnitus		xx (xx.x)		1	4	1	1	1	1	2
Eye disorders	Eye disorders		xx (xx.x)	xx (xx.x)	xx (xx.x)	1	5	1	1		1	1
~{style ~{NBSpace 2}}Diplopia	Eye disorders	Diplopia		xx (xx.x)		1	5	1	1	1	1	2
~{style ~{NBSpace 2}}Photophobia	Eye disorders	Photophobia			xx (xx.x)	1	5	1	1	1	1	2
~{style ~{NBSpace 2}}Vision blurred	Eye disorders	Vision blurred	xx (xx.x)	xx (xx.x)		1	5	1	1	1	1	2
~{style ~{NBSpace 2}}Glaucoma	Eye disorders	Glaucoma		xx (xx.x)		1	5	1	1	1	1	2
~{style ~{NBSpace 2}}Ocular icterus	Eye disorders	Ocular icterus		xx (xx.x)		1	5	1	1	1	1	2
Gastrointestinal disorders	Gastrointestinal disorders		xx (xx.x)	xx (xx.x)	xx (xx.x)	1	6	1	1		1	1
~{style ~{NBSpace 2}}Dry mouth	Gastrointestinal disorders	Dry mouth		xx (xx.x)	xx (xx.x)	1	6	1	1	1	1	2
~{style ~{NBSpace 2}}Abdominal pain	Gastrointestinal disorders	Abdominal pain		xx (xx.x)		1	6	1	1	1	1	2
~{style ~{NBSpace 2}}Constipation	Gastrointestinal disorders	Constipation	xx (xx.x)	xx (xx.x)	xx (xx.x)	1	6	1	1	1	1	2
~{style ~{NBSpace 2}}Abdominal discomfort	Gastrointestinal disorders	Abdominal discomfort			xx (xx.x)	1	6	1	1	1	1	2
~{style ~{NBSpace 2}}Abdominal distension	Gastrointestinal disorders	Abdominal distension	xx (xx.x)			1	6	1	1	1	1	2
Gastrointestinal disorders (continued)	Gastrointestinal disorders					2	6	2	1		1.5	2
~{style ~{NBSpace 2}}Nausea	Gastrointestinal disorders	Nausea	xx (xx.x)	xx (xx.x)	xx (xx.x)	2	6	2	2	2	2	2
~{style ~{NBSpace 2}}Gastroesophageal reflux disease	Gastrointestinal disorders	Gastroesophageal reflux disease		xx (xx.x)		2	6	2	2	2	2	2
~{style ~{NBSpace 2}}Pancreatitis	Gastrointestinal disorders	Pancreatitis			xx (xx.x)	2	6	2	2	2	2	2
~{style ~{NBSpace 2}}Gastrointestinal pain	Gastrointestinal disorders	Gastrointestinal pain	xx (xx.x)			2	6	2	2	2	2	2
~{style ~{NBSpace 2}}Flatulence	Gastrointestinal disorders	Flatulence		xx (xx.x)		2	6	2	2	2	2	2
~{style ~{NBSpace 2}}Dyspepsia	Gastrointestinal disorders	Dyspepsia		xx (xx.x)	xx (xx.x)	2	6	2	1		2	2
General disorders and administration site conditions	General disorders and administration site conditions		xx (xx.x)	xx (xx.x)	xx (xx.x)	2	7	2	2		2	1
~{style ~{NBSpace 2}}Peripheral swelling	General disorders and administration site conditions	Peripheral swelling			xx (xx.x)	2	7	2	2	2	2	2
~{style ~{NBSpace 2}}Oedema peripheral	General disorders and	Oedema peripheral		xx (xx.x)	xx (xx.x)	2	7	2	2	2	2	2

The Proc Report Code mentioned below specifies how the extra variable generated in above mentioned output dataset is being used to generate outputs as desired.

```
proc report data=output;
column pb_num2 aebodsys nam PLB ACT1 ACT2;
  define pb_num2 /order noprint;
  define aebodsys /order order=data noprint;
  define nam /display "System Organ Class~{style~{NBSpace2}}Preferred Term";
  define PLB /display "Placebo";
  define ACT1 /display "Active Drug 1";
  define ACT2 /display "Active Drug 2";

  break after pb_num2 / page;
  break after aebodsys/skip summarize suppress;
run;
```

CONCLUSION

The Page Break Macro specified in this paper is defined specifically for the Adverse Event Table but it is robust enough to be used in generating summarizing reports for other Descriptive Statistical tables for Vital Signs, Demographics, and Laboratory etc. In addition, the full code is given below with explanation of steps and the user can further modify this Page Break Macro as per the Work requirements.

PAGE BREAK MACRO CODE

```
/******PAGE BREAK MACRO*****/  
  
/******KEYWORD PARAMETERS*****/  
A.) INPUT      = Name of the input SAS dataset  
B.) MAIN       = Name of the Variable under which Grouping has to be done  
C.) SUB        = Name of the Variable under which Sub-Grouping has to be done  
D.) Output     = Name of output SAS dataset from the processing done by Macro  
E.) PAGE_NO    = Number of Lines to be printed on one RTF page  
F.) SUFFIX     = The Suffix to be used alongside SOC  
/******KEYWORD PARAMETERS*****/  
  
options mlogic merror serror mprint symbolgen mcompilenote=all;  
%macro page_break_ae(input=%nrstr(adam.dum_tab), main=%nrstr(aebodsys),  
                    sub=%nrstr(aedecod),output=%nrstr(t14_3_1_4_ae), page_no=,  
                    suffix=%nrstr(continued));  
  
*Creating user-defined format from the dataset being given for page break and main  
group continuation;  
proc sort data = &input. out=format_1 nodupkey;  
    by &main.;  
run;  
  
data format_2;  
    length label 8.;  
    set format_1(rename=(&main. = start));  
    label=_n_;  
    retain fmtname 'Order' type 'C';  
run;  
  
proc format library=work cntlin=format_2;  
run;  
  
*Setting the page number according to the number of lines to be printed on one  
page;  
data &output._i;  
    set &input.;  
    pb_num=ceil(_n_/&page_no.);*PB_NUM is the variable which gives a whole  
    number for every observation in the dataset;  
    order1=input(put(&main.,$order.),best.);*It gives the order as per the main  
    heading in the SOC requirement;  
run;  
  
proc sort data=&output._i;  
    by pb_num &main.;  
run;  
  
data &output._i  
    dummy(drop=order2);*Creating Dummy dataset so as main group can be repeated  
    on continuing page;
```

```

        set &output._i;
        by pb_num &main.;
        if &sub. = '' and last.pb_num then pb_num2 = pb_num + 1;*If main
group(Parameter) is occuring on the last line of a page then this will take it the
next page;
        else pb_num2 = pb_num;

        aa=lag(pb_num2);
        if first.&main. then bb=.;
        else bb = aa;

        order2=pb_num2;

        if first.&main. and &sub. = '' then order3 = 1;
        else order3=2;

        output &output._i;
        if &sub. ne '' and bb = . and aa^=pb_num2 then output dummy;
run;

data dummy2;
    set dummy;
    order2=aa + .5;
    nam=strip(&main.) || " (&suffix.)";
run;

proc sql noprint stimer;
    create table &output. as
    select * from &output._i
    outer union corr
    select * from dummy2(keep=nam order1 order2 order3 &main. pb_num pb_num2 aa bb)
    order by order1, order2 , order3;
run;

quit;

%mend page_break_ae;
/*****PAGE BREAK MACRO*****/

```