SAS® Macro to Automate Programmer Status Sheet

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ABSTRACT

When programming in clinical trials, you typically have a Production and QC programmer. For many, tracking the programs completion is dependent on the Production and QC programmers manually updating an Excel sheet with the status of their programming. Within this sheet, both programmers report the date their program was completed. This method presents problems, as the manual input can result in user error; it can be very easy to forget to update the date after several rounds of feedback and updating, particularly when these comments and updates occur in the same day and there is no real way to indicate the new completion date. Using Dynamic Data Exchange (DDE) in a SAS® macro can automatically input the completion dates and the user running the program. This macro will also be checking for log issues, as well as QC compare mismatches that are reported into the Excel sheet.

INTRODUCTION

The programmer status sheet is a crucial step for the validation of a deliverable. The status sheet being used in our examples is broken into two sections, Production and QC (Display 1). "Production Programming" contains "Program Name", "Programmer", and "Ready for QC date". This "Ready for QC date" gets filled in once the program is ready and log is clean. "QC Programming" contains "QC Program Name", "Programmer", and "QC Pass Date". "QC Pass Date" is populated once the Production program is done and the QC program has a clean proc compare, as well as clean log.

Production Programming				QC Programming		
Program Name	Programmer	Ready for QC date		QC Program Name	Programmer	QC Pass Date
adsl.sas	Jake Adler			qc_adsl.sas	Assir Abushouk	

Display 1. Example Programmer Status Sheet

In a delivery with many Analysis Datasets (ADs) or Tables, Listings, and Figures (TLFs), this spreadsheet can be difficult to keep up with. Furthermore, when Production and QC programmers are completing programs and/or making updates within the same day, the date field does not show the dates with enough precision; the only way to ensure that QC program was run after Production is to manually check the log date. Automating this process using DDE allows for real time updates of the status sheet and presentation of the dates in datetime format.

```
*------------;
* End Program;
*------------;


%checkHead(setupdir=&SetupPath.\Global);
%createLog;
%updatestatus;
%createLog;
%cleanup;
```

Display 2. Updatestatus macro is run at end of program after log of program is created

HOW THE MACRO WORKS

This is a global macro, so both the Production and QC programmer have access to it. The program executes based on what role you are programming in (we will identify this as &grole in the remainder of this paper); the macro will choose the correct sheet in the programming status Excel file to update based on this role.
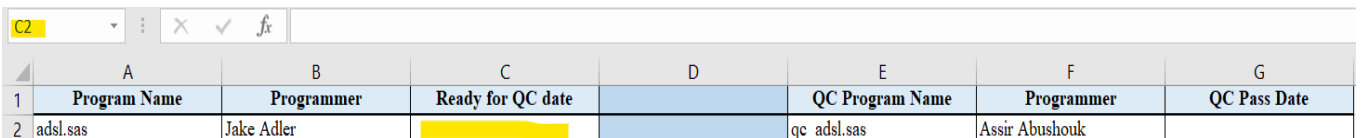
```
%if &grole=P %then %let type=%substr(%upcase(&srcfile),1,1);
%if &grole=Q %then %let type=%substr(%upcase(&srcfile),4,1);

%if &grole=P or &grole=Q %then %do;
        %if &type=T %then %let sheet=Tables;
    %else %if &type=L %then %let sheet=Listings;
    %else %if &type=F %then %let sheet=Figures;
%end;
%else %if &grole=PAD or &grole=QAD %then %do;
     %let sheet=%str(Analysis Dataset);
      %let type=D;
%end;
%else %if &grole=PSDTM or &grole=QSDTM %then %do;
    %let sheet=SDTM;
    %let type=D;
%end;
```

Selecting correct Excel sheet based on role

After importing the programming status sheet, the macro selects the row to be modified, using the name of the SAS® program. This row is given a numeric value within the macro. Next, the macro determines the column to be modified using &grole. These two stored values together give a positional location within the programming status sheet and are concatenated together for future use in DDE execution (Display 3).

```
%if &grole=PAD %then %do;

    rowcol=compress("r"||put(rown,best.)||"c&colnum.");

    if prgname=strip(upcase(sprgname));

%end;
```

	A	B	C	D	E	F	G
1	Program Name	Programmer	Ready for QC date		QC Program Name	Programmer	QC Pass Date
2	adsl.sas	Jake Adler			qc_adsl.sas	Assir Abushouk	

Display 3. In This example the concatenated value to be read into DDE will be r2c3

While running DDE in the status spreadsheet, there are four states that the program may be in - the program's log is not clean, there are mismatches in QC comparison (if using QC program), multiple comparisons in the LST file (if using QC program), or none of these conditions are present. If none of the conditions are present then the following will be output: the date, time, and the user who ran the program; however, if any of the first three conditions are true, the program will output the issue along with the date, time, and user. In the code below, we call the cell location using DDE and output one of the four results.

```sas
options noxwait noxsync;

x %unquote(%str(%'&STATUSSHEET%'));

filename ex dde "excel|&sheet!&rowcol" notab lrecl=32000;

data _null_;

file ex;

    D="&datetime"||" - run by &sysuserid.";

    L="LOG ISSUE "||"&datetime"||" - run by &sysuserid.";

    M=">1 COMPARE "||"&datetime"||" - run by &sysuserid.";

    C="QC FAILED "||"&datetime"||" - run by &sysuserid.";


    %if &logissue=0 and &multcom=0 and &comp=0 %then %do;

        put D;

    %end;

    %else %if &logissue=1 %then %do;

        put L;

    %end;

    %else %if &multcom=1 %then %do;

        put M;

    %end;

    %else %if &comp=1 %then %do;

        put C;

    %end;

    run;
```

The status sheet contains a column called QC_STAT that utilizes an Excel function. This function checks whether the "ready for QC date" column or the "QC pass date" column starts with a character or if the "QC pass date" is earlier than the "ready for QC date". If either of these conditions is true, then the QC_STAT column will display "Needs Attention". On the other hand, if the "QC pass date" is later than the "ready for QC date", the program will be ready for statistical review (Display 4).

	Production Programming				QC Programming			
Program Name	Programmer	Ready for QC date		QC Program Name	Programmer	QC Pass Date	QC_STAT
adsl.sas	Jake Adler	17MAR2023 12:35:16 - run by jadler		qc_adsl.sas	Assir Abushouk	17MAR2023 12:35:59 - run by aabushouk	Ready
adae.sas	Jake Adler	LOG ISSUE 17MAR2023 12:36:57 - run by jadler		qc_adae.sas	Assir Abushouk	17MAR2023 12:37:46 - run by aabushouk	Needs Attention
adlb.sas	Jake Adler	17MAR2023 12:39:09 - run by jadler		qc_adlb.sas	Assir Abushouk	QC FAILED 17MAR2023 12:40:14 - run by aabushouk	Needs Attention
adeg.sas	Jake Adler	17MAR2023 12:42:12 - run by jadler		qc_adeg.sas	Assir Abushouk	17MAR2023 12:41:10 - run by aabushouk	Needs Attention

Display 4. Here we have four possible scenarios the macro will produce. ADSL is the only program ready for stat review.

CONSIDERATIONS

DDE (Dynamic Data Exchange) and ODS (Output Delivery System) are two ways to interact with Excel files using SAS®. DDE allows SAS® to directly manipulate Excel objects, while ODS allows SAS® to create Excel files based on SAS® output. During our development, we initially built this macro to use ODS and found that when ODS is used on the same file at the same time by multiple SAS® programs, it can cause conflicts and potentially corrupt the file. This is because ODS is designed to write data to a file in a sequential manner, and it does not have built-in mechanisms to handle concurrent access or updates.

After running into this issue and knowing that simultaneous use of this macro could occur, we decided to use DDE instead. In SAS®, using DDE (Dynamic Data Exchange) to communicate with other applications has several requirements:

1. DDE-enabled application: The application that SAS® wants to communicate with must support DDE. For example, Microsoft Excel and Microsoft Access both support DDE.
2. Application-specific requirements: Different applications may have specific requirements for using DDE. For example, in Excel, the data to be sent must be in a named range or cell, and the receiving application must be configured to receive the data in a specific format.
3. Active application: The DDE-enabled application must be running and active on the same computer as SAS®. DDE does not work between applications running on different computers.
4. Appropriate DDE commands: DDE communication between SAS® and the target application is accomplished using DDE commands, which must be appropriate for the specific application and action being taken.

Although DDE is an older technology that is often replaced by newer methods, it was the most suitable choice for our purposes. Our goal was to update a small number of cells with each macro run, the requirements for using other communication methods would have been too resource intensive.

CHALLENGES AND CONCLUSION

While testing this macro, we encountered certain difficulties. One such difficulty was attempting to use DDE to color code a cell to indicate whether the program needed attention or was ready for review. This led to the macro breaking, as both the Production and QC were attempting to color code the same cell. Another ongoing issue is running the macro in batch mode since the log file is inaccessible during batch mode. To address this problem, we are presently working on developing a program that can scan through every log and LST file, which would prove to be a valuable tool during batch mode.

Tracking the completion status of programs in clinical trials is crucial for the validation of deliverables; however, manually updating an Excel sheet can be prone to errors, especially when multiple rounds of feedback and updates occur in a single day. This paper has introduced the use of Dynamic Data Exchange (DDE) in a SAS® macro to automate the input of completion dates and user information. The macro also checks for log issues and QC compare mismatches, ensuring real-time updates of the status sheet and presenting dates in datetime format. Automating this process will improve efficiency and reduce the potential for user error, ultimately enhancing the quality of clinical trial programming.

REFERENCES

Yang Chen. 2010. "Let your title macro report study progress" Proceedings of PharmaSUG 2010 Conference, Paper AD07.

Lingjiao Qi, Bharath Donthi. 2019. "Automating SAS Program Table of Contents for your FDA Submission Package" Proceedings of the PharmaSUG 2019 Conference, Paper AP298.

Yuping Wu, Sayeed Nadim. 2020. "A SAS Macro for Checking the Status of Table, Figure and Listing (TFL) Programming" Proceedings of the PharmaSUG 2020 Conference, Paper QT315.

Yuping Wu. 2021. "Manage SAS Log in Clinical Programming" Proceedings of the PharmaSUG 2021 Conference, Paper QT159.

John He, 2003. "ODS or DDE for Dat Presentation – A Preliminary Comparison of Output from Different Sources". Proceedings of SUGI 28 2003, Paper 145-28

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