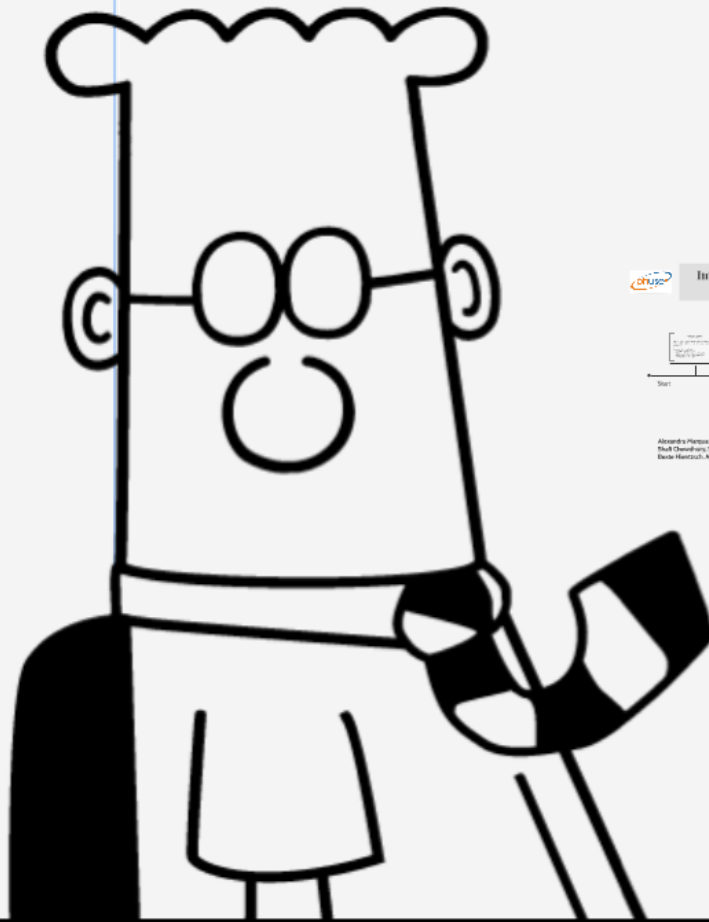


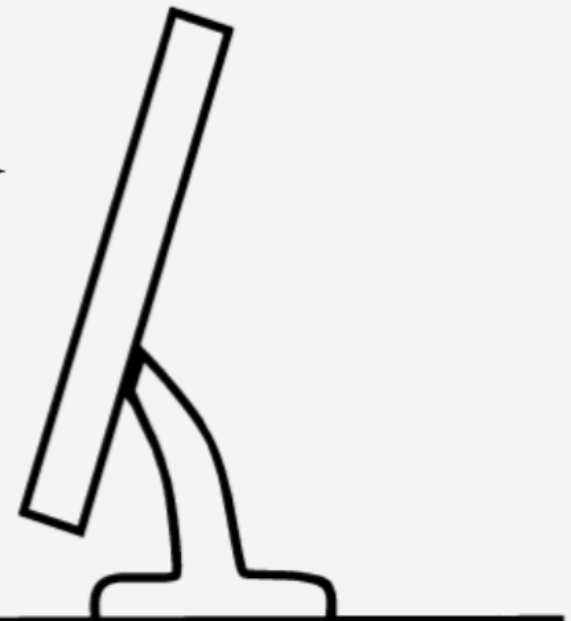


Introduction to GPP with Hints and Tips to make them Second Nature

Based on P276 Good Programming Practice Guide



Alvarado Marcos, Beckinger Ingelheim Pharma GmbH & Co. KG
Roth Chemisches Werk Garmisch-Partenkirchen
Bayer AG, Leverkusen





Introduction to GPP with Hints and Tips to make them Second Nature

Based on FNU/SE Good Programming Practice Guidelines

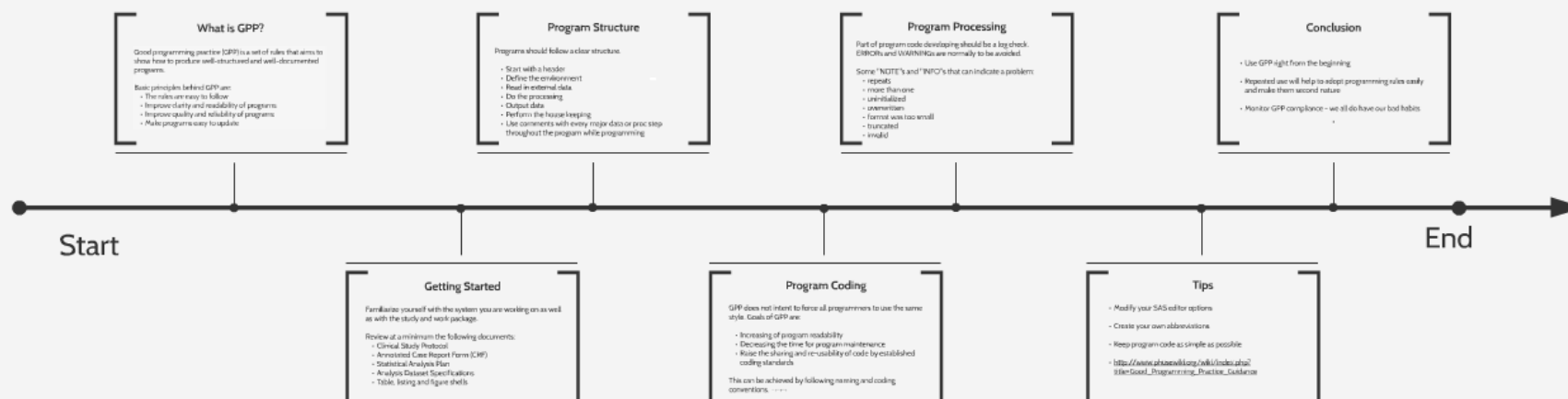


Alexandra Hargrave, Birmingham City University, Phoenix Growth & Co. Ltd
Staff Consultancy, Staff Consultancy Limited
Beech Hill, Birmingham, B15 2TT



Introduction to GPP with Hints and Tips to make them Second Nature

Based on PhUSE Good Programming Practice Guideline



Alexandra Marquart, Boehringer Ingelheim Pharma GmbH & Co. KG
Shafi Chowdhury, Shafi Consultancy Limited
Beate Hientzsch, Accovion GmbH

What is GPP?

Good programming practice (GPP) is a set of rules that aims to show how to produce well-structured and well-documented programs.

Basic principles behind GPP are:

- The rules are easy to follow
- Improve clarity and readability of programs
- Improve quality and reliability of programs
- Make programs easy to update

Getting Started

Familiarize yourself with the system you are working on as well as with the study and work package.

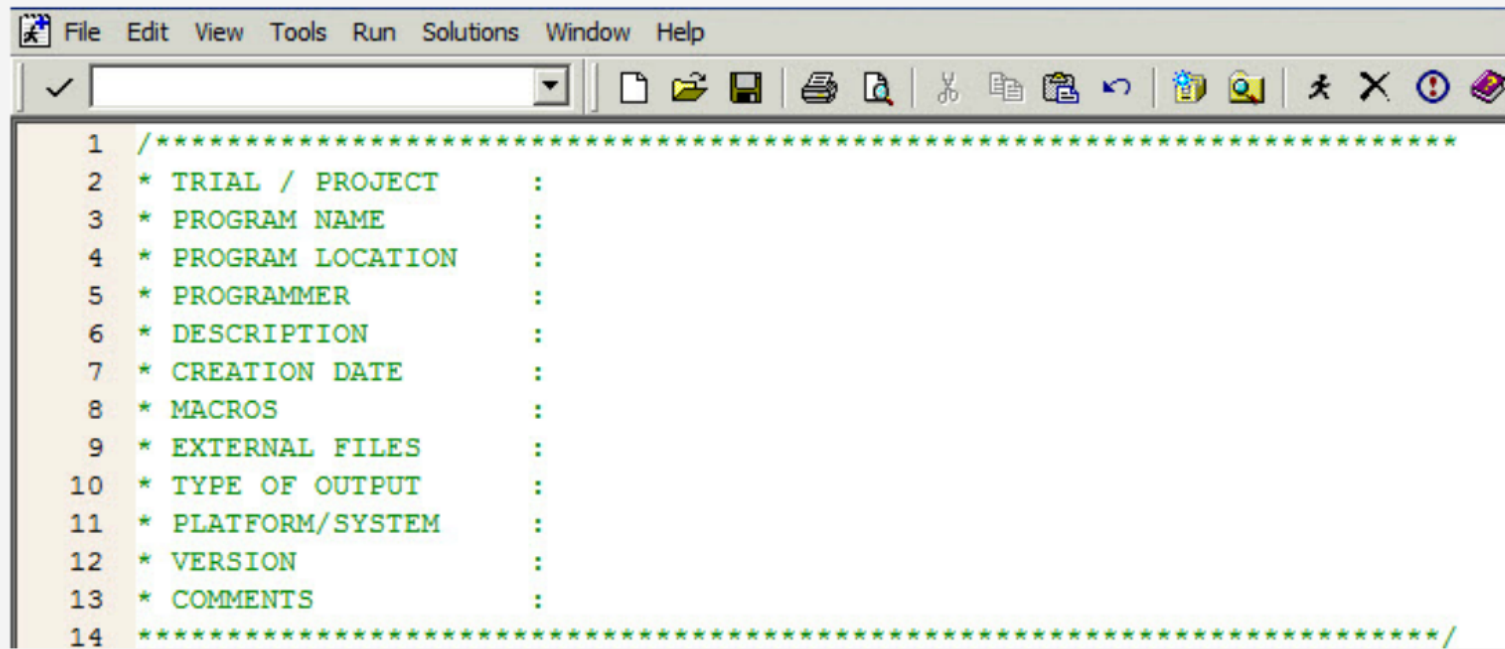
Review at a minimum the following documents:

- Clinical Study Protocol
- Annotated Case Report Form (CRF)
- Statistical Analysis Plan
- Analysis Dataset Specifications
- Table, listing and figure shells

Program Structure

Programs should follow a clear structure.

- Start with a header
- Define the environment
- Read in external data
- Do the processing
- Output data
- Perform the house keeping
- Use comments with every major data or proc step throughout the program while programming

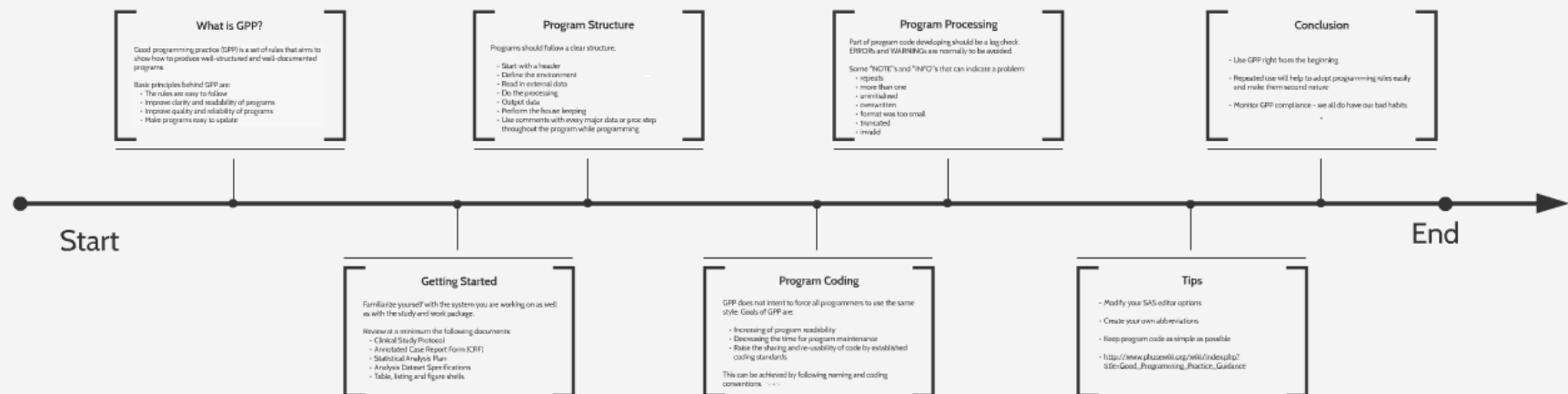


```
1 /*****
2 * TRIAL / PROJECT :
3 * PROGRAM NAME :
4 * PROGRAM LOCATION :
5 * PROGRAMMER :
6 * DESCRIPTION :
7 * CREATION DATE :
8 * MACROS :
9 * EXTERNAL FILES :
10 * TYPE OF OUTPUT :
11 * PLATFORM/SYSTEM :
12 * VERSION :
13 * COMMENTS :
14 *****/
```



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Program Coding

GPP does not intent to force all programmers to use the same style. Goals of GPP are:

- Increasing of program readability
- Decreasing the time for program maintenance
- Raise the sharing and re-usability of code by established coding standards

This can be achieved by following naming and coding conventions. [1] [2] [3]

Naming Conventions

Program Names:

- Group related programs, e.g. analysis dataset vs. output programs
- Group output programs belonging together, e.g. adverse event tables

Datasets and Variables:

- Names describe their content as best as possible
- Industry level standards (such as CDISC) where possible
- Temporary datasets and variables names should clearly identify their purpose

Required Coding Conventions

- Do not overwrite existing datasets or files
- Use meaningful dataset names
- Use KEEP/DROP statements
- Consistent usage of upper and lower cases
- Use “data=dataset” option
- Separate data steps and procedures with at least one blank line
- Write one statement per line
- Use consistent indentations, blank rows and comments
- Do not use tabs, use blanks instead
- Left justify global statements and data procedure statements
- Use RUN; or QUIT; at the end of each data/proc step
- Insert parentheses in meaningful places
- When converting character variables to numeric or vice versa, use the PUT and INPUT functions

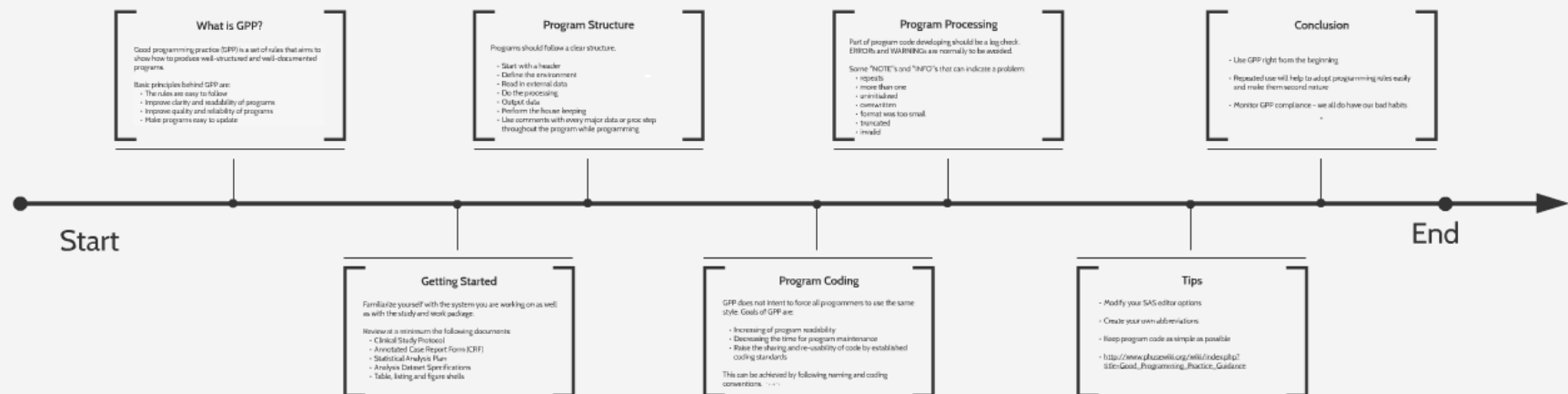
Recommended Coding Conventions

- Use logical groupings to separate code into blocks
- Double space between sections
- Group similar statements together
- Define new variables with the ATTRIB statement
- Use defensive coding
- Read and write only necessary observations and variables
- Do not re-read/import data more than once if possible
- SAS keywords should not be used for dataset and variable names
- Hardcoding should be avoided whenever possible



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Beate Hientzsch, Accovion GmbH

Program Processing

Part of program code developing should be a log check.
ERRORs and WARNINGs are normally to be avoided.

Some "NOTE"s and "INFO"s that can indicate a problem:

- repeats
- more than one
- uninitialized
- overwritten
- format was too small
- truncated
- invalid

Tips

- Modify your SAS editor options
- Create your own abbreviations
- Keep program code as simple as possible
- http://www.phusewiki.org/wiki/index.php?title=Good_Programming_Practice_Guidance

Conclusion

- Use GPP right from the beginning
- Repeated use will help to adopt programming rules easily and make them second nature
- Monitor GPP compliance - we all do have our bad habits

■



**KEEP
CALM
AND
BEGIN WITH THE
END IN MIND**



Introduction to GPP with Hints and Tips to make them Second Nature

Basiskonzepte GPP (Good Programming Practice) Guidelines



Alexandra Hinz, Dr. Ingrid Isenhardt, Dr. Ingrid Isenhardt & Co. KG
Dr. Ingrid Isenhardt, Dr. Ingrid Isenhardt & Co. KG
Berlin, Hamburg, München, Köln

