

The Implementation of Spotfire in Clinical Trials to Review Safety and Patient Reported Outcomes Data

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ABSTRACT

TIBCO Spotfire™ is a secure and strong tool to deliver visual and streaming analytics. Understanding Spotfire's advantages in dynamic visualization, Roche has made use of Spotfire in various fields and has developed mature templates to implement to clinical trials data. We would like to share the actual use cases of Spotfire at reviewing core safety data and Patient-Report Outcomes data in clinical trials. With the built-in framework for dynamic subgroup analysis and interactive functionalities, Spotfire can help users to quickly understand the data and drill-down into patient level details, thus speeding up decision-making. In addition to getting more knowledge about Spotfire, we need to be aware of its advantages and disadvantages. Therefore, we can choose the right tool for right analysis.

1.BACKGROUND

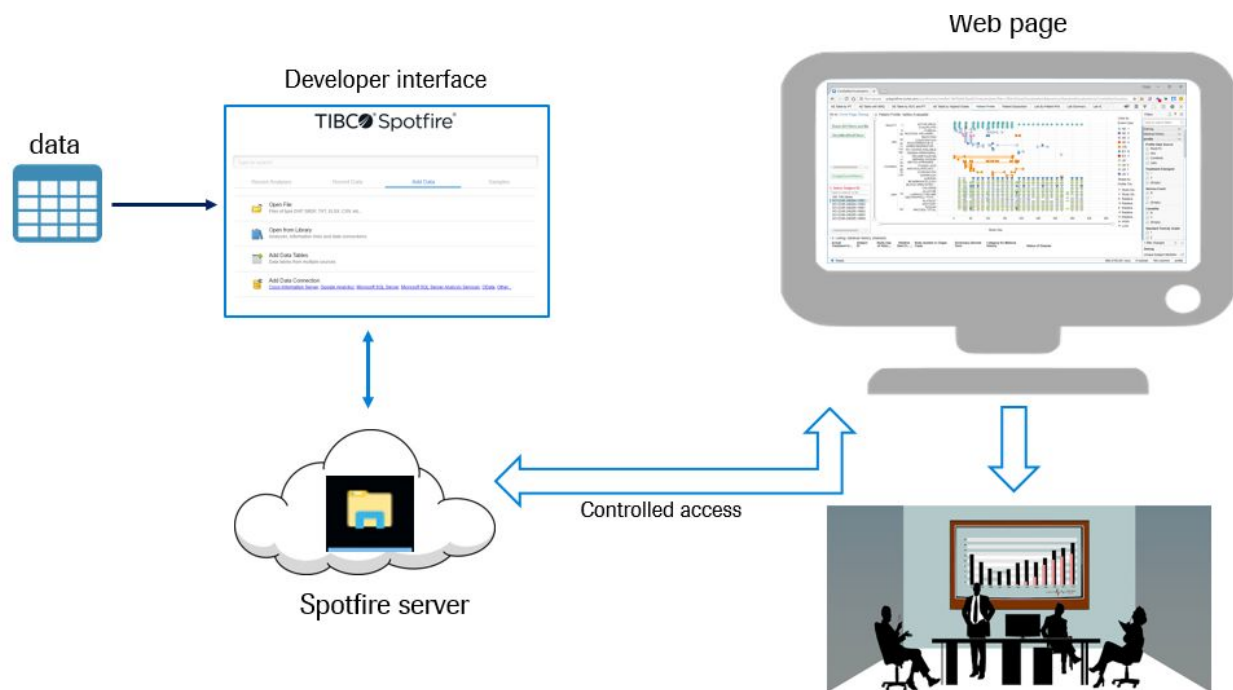
Why do we need interactive analysis and data visualization? The main advantage is that they could tremendously improve the efficiency of review and analysis of clinical data. Nowadays, Personalised Medicine has the potential to transform healthcare[1]. The business needs of our stakeholders have transformed accordingly. They need prompt first-hand information to react to requirements from the scientific world and authorities. Therefore, they want freedom and agility to explore the data by themselves. On the other hand, we, the programmers, also want to shift such ability to them so that we can allocate our time to more innovative work.

2.INTRODUCTION

Under such circumstance, Spotfire is one of the tools that Roche is using for interactive analysis and data visualization. Spotfire is an analytics platform where we can connect to various databases, manipulate data, derive summary analytics and create visualizations. It can also incorporate IronPython script and R code if we need to derive more complex statistics or graphics. In addition, Spotfire can provide a secured environment where access could be controlled.

Spotfire can import various types of data: data view from databases; SAS datasets; excel files; and many more. After importing data to Spotfire's user interface, we can perform data wrangling such as merging, pivoting and pooling so that analytics and visualizations can be generated. The finalized suite will be stored in the Spotfire server where access will be granted to different groups or people. Meanwhile, each Spotfire suite in the server would have a unique web link which could be shared with our stakeholders. As long as the stakeholders have the right access level, they should be able to open this Spotfire page and explore the data themselves.

Figure 1: Spotfire visualization working process



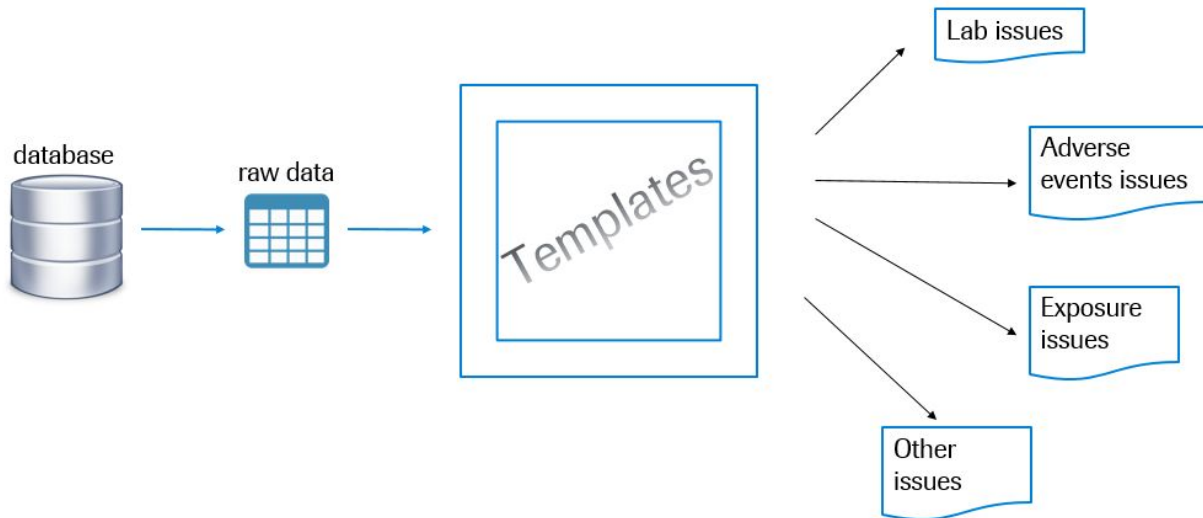
3.IMPLEMENTATION

Currently, Roche has mainly implemented Spotfire in three areas: data cleaning; Patient Report Outcome (PRO) Data Review; Safety Data Review. More exploratory analysis has also been performed per study needs. Beyond Biometrics and clinical trials development, Spotfire has also been implemented as administrative tool to monitor real-time resource allocation. These corporate-wide implementations has utilized the “save-as-template” function in Spotfire, that is, we pre-develop some Spotfire visualizations to serve different review purposes. These visualizations have been reviewed, validated and saved as template so that other programmers could directly open templates and replace with study datasets. These templates could provide consistent and validated visualizations across the company.

3.1 DATA REVIEW AND DATA CLEANING

Data review and data cleaning is the first area that incorporate Spotfire in Roche. The data used for data cleaning are eCRF raw data extracted from database. The responsible groups have created template suites to detect common data issues. These templates allow the programmers to quickly dump the data and generate data review reports.

Figure 2: Process of data review and data cleaning using Spotfire

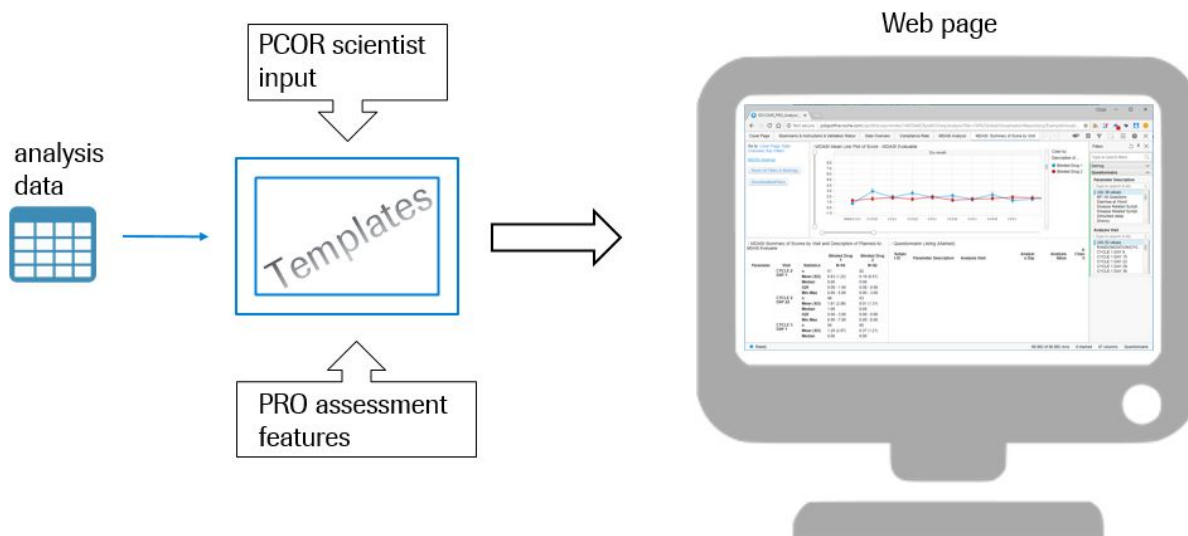


3.2 PATIENT-REPORT OUTCOMES (PRO) DATA REVIEW

PRO data review is another area that we are trying to implement interactive analysis. PRO data are data that are directly reported by patients. PRO data are commonly used to describe patients' experience on treatment, to evaluate patients' quality of life, or to be used as the primary efficacy point in some therapeutic areas. Doctors would use an established questionnaire to collect these PRO data. EORTC QLQ-C30^[2] is commonly used questionnaire in oncology. The Alzheimer's Questionnaire^[3] is widely used in Alzheimer disease diagnosis.

To create the Spotfire suite for PRO data, we would import the corresponding analysis dataset into an existing Spotfire template. Unlike the case of data cleaning, this PRO template only defines the appropriate layout of the visualization rather than the content. During the deployment process, we need to consult with Patient-Centered Outcome Research (PCOR) Scientists, who is the main user of this suite. Upon completion, it would allow PCOR Scientists early access to the PRO data and analysis results. They can visualize the change over time, explore difference among subgroups, investigate patient-level or item-level data. It also allows users to download the plot or table to attach to emails or create any presentation decks. Beyond that, it also supports the risk-benefit assessment.

Figure 3: Process of creating PRO data visualization using Spotfire



3.3 SAFETY DATA REVIEW

Spotfire is widely used in safety data review, since subgroup analysis can be easily done by applying filters, and the denominator for % calculation can be flexible as well. Outputs can be linked so that stakeholders can review the patient-level information by highlighting the records they are interested in.

When putting into business process, we need to ensure the visualization results are compliant and reproducible, which means the numbers from visualizations need to match the formal outputs. There are a few business use cases for using Spotfire in safety analysis.

The first case is internal regular reporting, such as the Internal Monitoring Committee (IMC). Benefiting from the save-as-template feature, we can regularly refresh the data.

Secondly, Spotfire is playing an important role in topline results release. It can help Safety Scientists quickly understand the data and prepare their presentation in topline meetings. When involving decision making, we must be sure of the accuracy, traceability and reproducibility. The business process in Roche for Spotfire's use for topline release is that final analysis data will be loaded to the Spotfire suite, and the results need to be verified by comparing with CSR outputs or by independent QC. Besides, Spotfire will help Safety Scientists to answer questions during the meeting. However, we must ensure to clarify that Spotfire is an interactive tool to support exploratory analysis. We still need to go with SAS and apply standard way for quality check for submission or big decision making.

The third example is to serve exploratory analysis. The end users can play around by themselves, which will save analyst's time. The ability to interact with data can speed up the decision making as visualizations are easily interpretable and helpful for communication.

4.CONCLUSION

Spotfire is very friendly to end users, and not much programming experience is needed. Objects can be easily dragged to the reporting panel. We can add code for advanced control. It is easy to play around with your mouse, and to connect with patient-level information. In addition, R and IronPython script can be embedded. However, we need to understand the database and content, and try to avoid complicated data manipulation in Spotfire, while you have the option to involve R or python code to manipulate data. It is suggested that the risks of analysis should be evaluated, and quality control is necessary

for important reporting. What is more, we need to partner with cross-functional teams to understand what they need, and prepare for the questions that are likely to come up.

5.APPENDIX

To better understand the features from Spotfire, and to choose the proper use case, below is a brief comparison with Shiny™-another popular visualization tool. First of all, we want to say that both R-Shiny and Spotfire are great visual analytical tools, but serve quite different purposes.

Function	Spotfire	Shiny
Subgroup Analysis	Easy to set up with Spotfire's built-in filter framework.	Requires development in program from scratch.
Interactivity	Can easily enter patient level data with its built-in feature, and it can make links at patient or data level across domains and visualization pages.	Need to do another layer in program.
Graphics	Quick ,easy,good quality and interactivity. Need to leverage R or Java script for complex graphics.	Quick and easy with good quality complex graphics such as forest plot.
Statistical Analysis	Quick and easy with built-in drill-down capability Doubt with modeling and complex analysis.	Quick and easy. Good at stat modeling and analysis using.
Data manipulation	OK for simple transformation and manipulation.	Powerful and transparent.
Reproducibility	Yes, may not seem intuitive for users	GOOD! Can allow quick and easy code generation.

6.ACKNOWLEDGEMENT

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7.REFERENCE

- [1] Mathur S and Sutton J: Personalized medicine could transform healthcare. Biomed Rep. 2017 Jul; 7(1): 3–5.
- [2] <https://qol.eortc.org/questionnaire/eortc-qlq-c30/>
- [3] <https://www2.gov.bc.ca/assets/gov/health/practitioner-pro/bc-guidelines/cogimp-alzheimer-questionnaire.pdf>

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