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Application of Power BI in Clinical Trial Data Analysis

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ABSTRACT

In rare blood disease studies, bleeding data is crucial for reviewing. However, due to complex study designs and long-term trails, there can be large amounts of data, inefficient analysis, and complex management. To ease these situations, in the pilot study "Study A", the team adopted Power BI to enhance data visualization and reviewing flexibility. The innovative chart design, high interactivity, and intelligent drill-down function of Power BI, combined with time axis synchronization and advanced filtering, promoted efficient multi-dimensional analysis, strengthened the intuitiveness of the data and cloud collaboration of the team, and reduced the review time and cost. In the future, the research will integrate Power Automate to develop an intelligent monitoring system to automatically warn of changes in key indicators, such as abnormal antithrombin, to further promote the intelligence of the research and ensure quick response. Through these strategies, "Study A" successfully solved the problem of big data analysis and provided a new perspective and monitoring depth for blood disease related research. This innovation also provides a new idea for the data monitoring of other clinical trial projects.

INTRODUCTION

"Study A" is a comprehensive and in-depth study in rare blood filed. It aims to evaluate the efficacy and safety of the IMP through long-term follow-up, especially by monitoring the frequency changes of bleeding events to have a thorough understanding of the treatment effect. Currently, there're more than 50 thousand bleeding records, and therefore will generate a massive amount of data, posing a significant challenge to traditional analysis methods, including the increased complexity of data management, low processing efficiency, and the difficulty in intuitively depicting the dynamics of bleeding patterns. These problems may restrict the accurate assessment of the patient's health status and the progress of the study. Thus, the team starts to explore the possibilities of data visualization.

At the beginning of the visualization process, team considered drawing some charts with the help of Excel. Although this could achieve a more intuitive review, it requires manual drawing and refreshing of data, which is not automated enough, and the charts in Excel can't be customized too much. Faced with the limitations of Excel in visualization, the team selected Power BI as the main data visualization platform after careful consideration and weighing factors such as data security, economic costs, refresh speed and ease of viewing. This decision was designed to leverage the flexibility and efficiency of Power BI to break through the constraints of traditional analytical frameworks.

FINE MANAGEMENT OF DATA PREPARATION

In the preparation stage, the team implemented two key measures:

SPECIFICATION STANDARDIZATION

Data Manager (DM) and Data Manager Programmer (DMP) discussed the calculation rules and displaying contents according to the template, and jointly formulated a set of detailed visual chart specifications. This spec is not only a major innovation in our data processing process, but also lays a solid foundation for the subsequent programming work.

SAS FINE PROCESSING

Due to the huge amount of data and the fact that Power BI is not good at doing complex calculations, DMP uses SAS to preprocess the data, including meticulous data cleaning, missing value filling, format conversion, calculation of statistical values, etc., to ensure the high quality of the output data and meet the analysis needs of Power BI.

THE APPLICATION OF POWER BI

In Power BI, using the prepared data, a set of intuitive visual charts are constructed, aiming to enable reviewers to clearly identify whether the decreasing trend of subsequent bleeding events after drug administration is synchronously displayed with the increase of the antithrombin (AT) level, or whether there is a certain specific time period, and there is an unusual correlation between the frequency of bleeding events of the patient and the change of the AT level. Such a design not only greatly enhances the timeliness and efficiency of data analysis, but also deepens the comprehensive understanding and efficient monitoring of the patient's treatment progress, providing strong support for quickly locking the key elements or abnormal cases in clinical research.

OPTIMIZATION OF THE COMBINATION CHART:

In order to deal with the complex analysis requirements of bleeding events, the presentation form of the combined chart is optimized. The traditional combined chart is a bar chart plus a line chart. Through the configuration of the attributes of the graph, we make it look like the form of a bar chart plus a scatter plot. This chart not only clearly maps the trend of the bleeding frequency of each patient over time, but also makes obvious marks on the patient's surgical situation. In addition, it also incorporates a high degree of interactivity – users only need to simply hover or click to mine detailed data at a specific time node, see Figure 1.

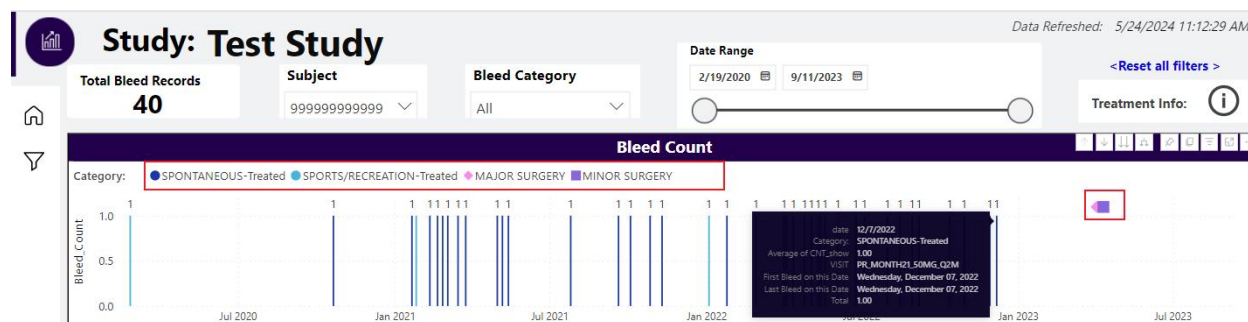


Figure 1. Combination chart of bleeding frequency and surgical information

ADVANCED FILTERING AND DYNAMIC SYNCHRONIZATION OF THE X-AXIS:

In order to fully meet the demands of multi-angle analysis, we have optimized and upgraded the filtering function of Power BI to ensure that users can flexibly customize query conditions according to patient ID, bleeding event types or treatment methods, and can even be precise to detailed data exploration within a specific time span. In addition, we innovatively implemented a unified time axis strategy, so that the charts of all key indicators share a dynamically adjusted X-axis timeline. As a result, the four core charts of bleeding event records, drug administration records, AT level changes and treatment progress can be visualized synchronously under the same time frame, greatly enhancing the intuitiveness and convenience of data review.

The ingenious design of this coaxial comparative analysis lies in that it can efficiently present the parallel changes of the patient's treatment path and physiological response within a limited visual interface, helping researchers to easily capture the subtle state changes and potential regular trends of the patient throughout the entire trial cycle. For example, by enabling the "Subject ID" filter, researchers can immediately obtain all the relevant information charts of the subject with the number "999999999999" in the entire clinical trial cycle. On this basis, by superimposing the fine filtering of "Bleed Category" and Date Range bar, it can quickly focus on specific types of bleeding events, the adjustment pattern of drug dosage within a specific time period, the fluctuation trend of the AT level and the detailed details of treatment intervention, providing strong support for the in-depth analysis of a single subject.

This highly flexible custom analysis ability opens up a shortcut for the scientific research team to tailor personalized research perspectives, ensuring that they can quickly build the most suitable data analysis view according to the core goals of the research and accelerate the discovery and application of insights.



Figure 2. Overview of Report on Power BI

INTERACTIVE ANALYSIS FEATURE OF POWER BI:

This is one of the core functions of this platform, which endows users with the ability to freely shuttle between various levels of data details, whether it is gradually delving from the aggregated level to specific information (drill-down) or rising from detailed details to a higher-level generalized perspective (drill-up) and supports flexible customizing of the display level of the X-axis. We fully utilize the drill-down, drill-up and X-axis level adjustment functions of Power BI to ensure that with just one click, users can transition from the macroscopic trend to the specific details of a single event. For example, it is easy to drill down from the comprehensive bleeding treatment information graph to the detailed records of the bleeding processing ID of a specific treatment stage or a single case. Users also enjoy the convenience of freely choosing the display level of the X-axis, such as combining the treatment date, time and specific treatment measure ID, etc. See Figures 3.1 and 3.2. This smooth exploration process significantly improves the efficiency and accuracy of data

review.

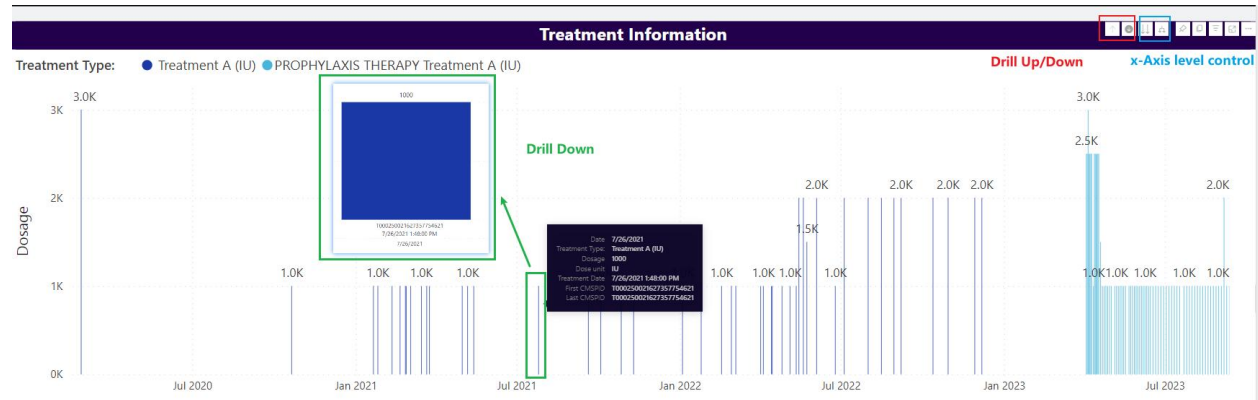


Figure 3.1 Demonstration of POWER BI drilling down/up in the treatment information graph

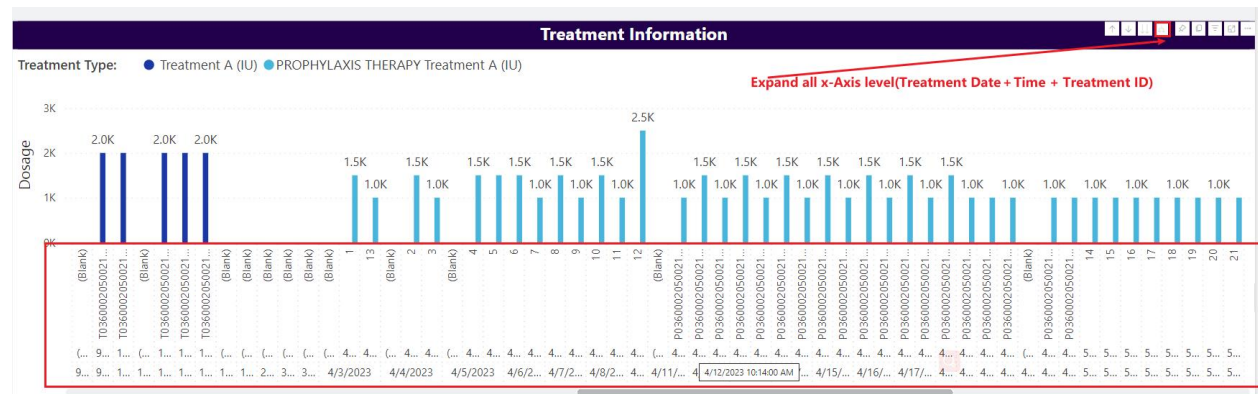


Figure 3.2 Demonstration of POWER BI X-Axis level control in the treatment information graph

AUTOMATION WORKFLOW AND COLLABORATION IMPROVEMENT:

During the implementation process of our research, through the integration of eWISE and Power BI, we achieved the complete automation of the data update process and also established an efficient abnormal monitoring system. This automated system eliminates the need for manual intervention, and when any abnormal situation occurs in the data flow, it can immediately trigger the system to automatically send an email alert to the preset relevant personnel, thereby ensuring the immediate identification and rapid disposal of problems. At the same time, we innovatively migrated the report review process from the offline physical environment to the online platform, allowing users to add comments directly on the report interface and instantly notify the involved team members. The members who receive the notification will receive an email reminder and be able to quickly view the information and take necessary actions. This transfer of clinical trial data monitoring activities from offline to online not only promotes efficient team collaboration in the cloud environment on the Power BI platform, but also makes the key links such as data review, opinion exchange, and report resource sharing seamless, greatly reducing communication costs and time delays. Figure 4 shows an overview of the data flow.

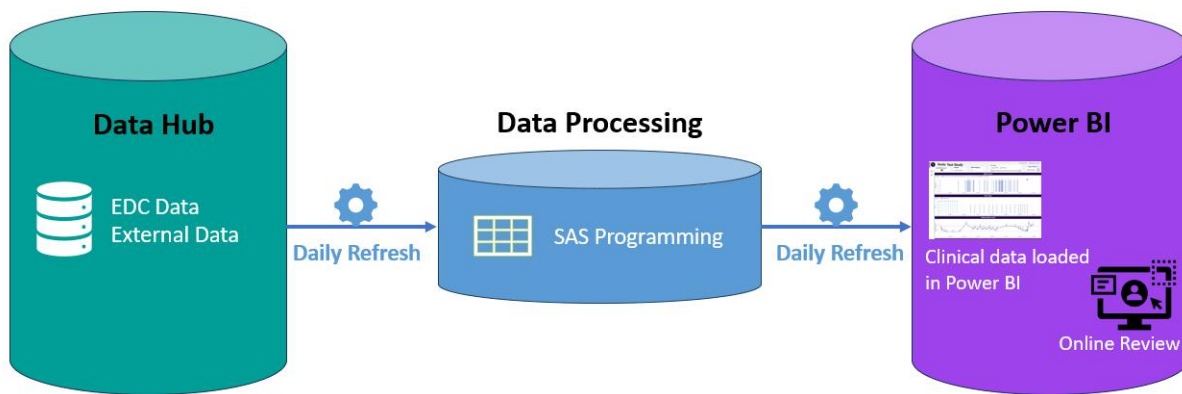


Figure 4 Overview of data flow

CONCLUSION

In view of the huge amount of data, the research team of "Study A" abandoned the traditional Excel analysis and instead adopted Power BI as the main data analysis tool, combined with SAS for precise data preprocessing, significantly improving the analysis efficiency and visualization effect.

The team innovatively implemented data standardization and SAS fine processing to ensure data quality, and realized interactive charts in Power BI, making the analysis of bleeding events intuitive and in-depth. Through advanced filtering, time-axis linkage and other functions, researchers can flexibly explore multi-dimensional data and quickly insight into treatment trends and patient responses. The introduction of intelligent drill-down and an automated data management system further accelerates the review process and promotes efficient collaboration among teams.

In the future, DMP plans to integrate Power Automate to develop an intelligent monitoring system to automatically alert changes in key indicators and continuously promote the intelligent process of clinical research. "Study A" is not only an exploration of treatment plans, but also a model of clinical research method innovation, showing how technology reshapes the boundaries of medical research. It is highly promisingly that this visualization technology will help more studies in the future.

CONTACT INFORMATION

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