



BEIJING CHILDREN'S HOSPITAL

Challenge

Hospital clinicians often lack experience working with statistical analysis; that's why executives at Beijing Children's Hospital have brought expert statisticians on staff to collaborate on data-driven problem solving. For these partnerships to succeed, however, experts must find new ways to efficiently and effectively present results in a clear and intuitive way. This is the big challenge.

At China's premier pediatric hospital, evidence-based medicine means looking at the data

Data visualization software deepens collaborations between clinicians and statisticians at Beijing Children's Hospital

It's been said that children are the future, and as such, their health is of paramount importance.

In China, Beijing Children's Hospital – an affiliate of Capital Medical University – is one of China's leading pediatric institutions. With more than 3 million outpatient and 70,000 inpatient visits per year, the hospital is widely regarded as a model for international scientific and technological cooperation on major pediatric diseases as identified by China's Ministry of Science and Technology.

Both a center for top-rated clinical care and a leader in pediatric research and teaching, Beijing Children's Hospital is also home to the National Children's Tumor Monitoring Center, which applies big data approaches to the prevention and control of pediatric hematosis and malignant tumors. Innovative initiatives like these have gained the hospital its reputation for evidence-based approaches in medicine.

This philosophy, widely promoted by hospital leadership, led to the establishment of the hospital's Big Data and Engineering Research Center in 2018. "Few hospitals in China have set up big data departments on this scale," explains Dr. Feng Guo Shuang, who serves as the center's director. "Until recently, statistics and big data were seen primarily as the purview of universities and private enterprise."

Today, Feng leads a team of statistical experts in providing problem-solving and data support for wide-ranging clinical studies and research across Beijing Children's Hospital. More than that, he has become a vocal advocate for the use of statistics in clinical practice. And a big part of that advocacy has been in building collaborations and finding the right tools to help.

One of those tools is JMP® Pro statistical discovery software.

Reducing barriers to collaboration between statisticians and clinicians

Statisticians on Feng's staff at the Big Data and Engineering Research Center work both in support of the hospital system's institutional management and clinical departments. The work is highly collaborative, Feng says, and the team must adapt to partnerships in different contexts where clinical experts may have less familiarity with advanced statistical principles.

Clinicians, in particular, are kept busy with frontline patient care and therefore have little time to devote to learning the statistical methods they need to develop new tools or practices that improve diagnosis and treatment. The statisticians tasked with supporting them may bring a deep knowledge of data science but lack the clinical expertise to contextualize the data. Only by working together can clinicians and statisticians arrive at the best solutions for patients.

It often comes down to a difference in perspective, Feng explains. He says that while clinicians may see statistical methods as means of proving an association between two indicators, statisticians often feel further refinement is needed to produce a statistically significant result. "Do you want to find a correlation or agreement? Do you want to explore the impact of indicator A on indicator B? Or do you want to understand the correlation between indicator A and indicator B?" Feng asks. Statisticians may need to help clinicians better define their research questions to get the most meaningful result.

"The biggest challenge is not really the choice of statistical methods, but how to effectively communicate," Feng explains. "First of all, we need to translate clinical needs into a statistical problem, and build it into our model. Then we must explain results to clinicians so that they can [put data insights into practice]. Most statistical analysis methods are not difficult. What's difficult is the early communication and later, the interpretation and discussion." With the help of JMP, this communication becomes easier.

Mapping pediatric blood samples with probability distribution

After learning about JMP while in a previous role with the National Center for Disease Control and Prevention, Feng began using the software himself. One of the benefits that immediately stood out, he recalls, was the software's ease of use. "I found that JMP was very suitable for non-statisticians," he explains.

Unlike other software programs, JMP is intuitive even for those not formally trained in statistics. "The software's clear and intuitive visual display is ideal for statisticians and clinical experts alike, as it's very easy to understand," Feng explains. "In terms of statistical



JMP is very conducive to data exploration. The software's clear and intuitive visual display is ideal for statisticians and clinical experts alike, as it's very easy to understand. This is one of the most important features of the JMP product family.

Dr. Feng Guo Shuang, Director of the Big Data and Engineering Research Center



methodologies, this induction is more reasonable, and it allows software operators to better understand the correlation and structure of statistical methods, rather than looking at them separately."

Moreover, the dynamic link between the data and results allows JMP users to observe and understand how the results change as the data changes. "Even after outputting results in JMP, you can further explore your data without returning to the menu to re-operate," Feng explains. "For example, if you do a t-test first and then find that the data does not meet the normal distribution, you would need to instead use a rank sum test. With JMP, you wouldn't need to return to the data menu to do this. You would only need to check the corresponding option in the result to output it ... This feature makes JMP very suitable for data exploration and in-depth data mining. It's not available in other software, and one of the reasons I like JMP so much."

Feng has since discovered countless other ways JMP can be applied to the clinical setting. As one example, Feng cites a time in which he and his team were tasked to establish a reference interval for routine pediatric blood exams with cumulative probability distribution graphs. Using the Hoffmann method, they planned to select data along a straight line at the graph's center to establish a reference interval.

The challenge, Feng says, was twofold: First, the amount of data was very large, with close to 1 million individual data points; second, there was some uncertainty as to how to select data along a straight line as part of the probability distribution graph. The large amount of data was causing Feng's software to run slower. And the data he wanted to select was not a function that most statistical software could handle.

JMP resolved both issues almost immediately. Not only could JMP process millions of data points very quickly, it also enabled the team to interact with results and data tables. "The graphics that appear in the results can be directly selected with the mouse, and the selected data is directly oriented to the original data sheet," Feng adds. "With this function, you can do data selection quite quickly based on the results and proceed to the next step."

JMP® Pro provides key technical support for project development and implementation

While newcomers to statistics may be perfectly suited with JMP, Feng himself upgraded to JMP Pro in order to make use of the software's more advanced predictive modeling capabilities in tackling the hospital's operational and administration challenges - those involving larger data sets. When Feng was first approached about assisting the Futang Children's Medical Development Research Center in preparing medical record data for research, he turned to JMP Pro.

JMP Pro, he says, provides most industry standard methods including generalized regression, decision trees, neural networks and support vector machines. He says the generalized regression platform is especially comprehensive in scope with regression modeling techniques like cross-validation, ridge regression, Lasso regression, elastic networks and more.

The Futang Children's Medical Development Research Center, a unique medical consortium led by Beijing Children's Hospital and 34 partners nationwide, is committed to advancing pediatric medicine through scientific research and collaboration. Data sharing is central to the institution's mission, and medical records are currently being digitized in an effort to build a central archive.

The structure of medical record data itself is not complicated, Feng explains, but the data formats are not exactly the same from hospital to hospital. It can therefore be a challenge to standardize and combine different institutions' medical records, which in this case ran into the millions.

Called upon to help sort the data, it only took Feng half a minute to merge all the data from Excel into JMP Pro. Even merged JMP data files that exceed 1G, Feng says, take no more than 10 seconds to open, and analysts can perform exploratory analysis with just a few clicks. Given the size and complexity of the project, those time savings made an outside impact.

"Usually when the amount of data is large, JMP can process data faster and more efficiently [than other software]. Through its exploration functions, I can quickly discover the data rules, which makes me trust JMP more," Feng adds. In addition, the software's powerful ability to explore outliers motivated the team to further process the data and carry out subsequent analyses.

Statistics will, in the future, play a greater role in clinical medicine

With mounting pressure to publish scientific research, clinicians are increasingly seeking to deepen their understanding of statistics. And this, Feng says, will likely lead to even more collaboration with statistical experts at the Big Data and Engineering Research Center. Particularly in data mining and data exploration, statistical methods are indispensable, he says, and statistical software a must. His hope is that by using more advanced tools, statisticians and clinicians alike will achieve more statistically sound, replicable work - and have more time to spend caring for the patients who need them.

Solution

JMP® Pro statistical discovery software helps bridge the knowledge gap between research collaborators. With its concise and easy-to-use inductive menus, interactive data exploration features, advanced predictive modeling platform and rich visualization, JMP deepens the dialogue between statisticians and clinical subject matter experts.

Results

At Beijing Children's Hospital, interactive exploratory analysis, predictive modeling and visualization tools in JMP Pro not only eliminated the communication barriers between clinicians and statistical experts, but also provided invaluable scientific and technical support for the institution's big data initiatives.

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