Melbourne Health Realizes Research Efficiency With Information Integration

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Situation Overview

The completion of the United States Human Genome Project started a paradigm shift in data analysis for clinical research, propelling the demand for more sophisticated capacity to capture, store, and analyze clinical data. This case study examines Melbourne Health's information integration project to create the Molecular Medicine Information Model (MMIM), a next generation information infrastructure to advance clinical research in Australia's State of Victoria, and nationally.

One of six public health providers in Victoria, Melbourne Health is the healthcare provider to the city of Melbourne, delivering clinical services through three medical centers: Royal Melbourne Hospital, NorthWest Dialysis Service, and NorthWestern Mental Health. Melbourne Health also serves as a teaching and research hospital for Melbourne University; its mission is to advance medical knowledge through research, which has become one of the key areas the institution is measured on by its Board.

Situated in the Parkville Precinct, a major research and health and life sciences hub in Victoria, Melbourne Health is in the hotbed of research activities among other leading organizations. Melbourne Health's key research objectives not only include promoting itself and the Precinct as a leading center for research, but also fostering collaborative relationships that will optimize research opportunities. However, its legacy information management infrastructure presented several technology and research governance challenges that must be overcome to achieve these objectives.

The Challenges

Like many research hospitals and institutions in Australia, Melbourne Health's legacy IT environment created multiple barriers for effective medical discoveries. To make advances in human research, statistical analyses are required from a large number of databases containing high quality clinical information. A major hurdle hampering progress was the inability to optimize existing research, resulting from limitations in the access and sharing of available medical data.

In the legacy environment, researchers in Melbourne Health's medical centers were managing multiple disparate information silos. Discovery of meaningful data was difficult with such disconnected datasets. Research data, diagnostic results, and clinical documentation were stored in a mixed environment of Microsoft SQL Servers, Excel, and Access in different locations.
There were other obstacles, too. For instance, a single research query could take Melbourne Health many months to complete, partly due to the complex approval processes between various institutes and data integration technology limitations. In addition, there were other rollover points in quality and statistical accuracy. Accuracy can be improved with more data points, but regulations on patient privacy and ethical issues limit manual data access and sharing.

To achieve its research mission, Melbourne Health recognized that it needed to embark on an information integration journey, with an outcome that not only links databases together, but also addresses the ethical, legal, and social issues that arise. Stringent privacy requirements meant that creating a straightforward, centralized data warehouse was not a viable option and, thus, a different approach would be required.

Melbourne Health took the lead in finding a transformational solution, in collaboration with two other Victoria hospitals, namely, the Austin Hospital and the Peter MacCallum Cancer Institute. In 2002, a grant of A$1.6 million was secured from the Victoria Government to launch a proof-of-concept project, creating an information platform (the MMIM) that would connect research conducted in each of the three institutions. If successful, the second phase would extend the project across more sites and research areas. Ultimately, Melbourne Health envisaged the network to be the building block of a national grid to share research data for cancer, a priority disease group.

The Solution

Through a competitive tender, Melbourne Health selected IBM as the key technology provider for the pilot phase. The objective was to integrate research databases related to three disease groups (diabetes, epilepsy, and colorectal cancer) currently residing in silos within the participating institutions. According to Dr. Marianne Hibbert, the Senior Project Manager at Melbourne Health, IBM distinguished itself through its understanding of the use of genome and clinical data, as well its track record in delivering life sciences solutions globally, both of which added to its credibility. Further, Hibbert believes that strong industry consulting expertise is IBM's unique value proposition, particularly in niche markets such as those that exist in the healthcare industry. The core of the solution was IBM's data federation engine, WebSphere Federation Server, supported by data warehousing infrastructure using DB2 Data Warehouse, as well as DB2 Query Patrol to ensure that data movement complies with governance and patient privacy requirements. IBM's open technologies worked alongside other solutions from SAS and SeeBeyond.

According to Dr. Bruce Ross, IBM's Manager for Healthcare and Life Sciences Solutions, the data federation capability provided by IBM's WebSphere Federation Server was a key differentiator. A data-federating engine is critical to enabling data sharing, as it allows data to reside at the owning institutes but remain available for external query through the federation engine. This method addresses compliance with privacy legislation by keeping data ownership and control with the collaborating institutes.

Phase 1, a three-year pilot that completed in 2005, represented the first project of its kind. Melbourne Health spent considerable time addressing issues involving intellectual property, patient privacy, and ethics. IBM also faced challenges particular to the health research industry, such as getting buy-in from protective clinicians, which is crucial to swiftly migrating research data off individual machines. Other obstacles, such as securing the time and commitment of key stakeholders, were also commonly experienced. From an IT perspective, a key challenge was to develop a user-friendly product and interface for use by researchers — who are often not IT experts.
Leveraging on the pilot's success, Melbourne Health subsequently secured further government funding to roll out Phase 2 of the integration project. Data models were expanded, capturing research in four clinical specialties from 12 hospitals and four research institutions across state borders. The quality and robustness of data models are also expected to be improved.

The team is currently in the midst of deploying Phase 2. Products from the IBM WebSphere Federation Server portfolio, including WebSphere Business Glossary and WebSphere DataStage, were selected to provide data management tools for searching, transforming, and cleansing data. According to Melbourne Health, IBM’s strengths lie in a well-integrated toolset and proven technology that can be trusted to meet strict data security requirements.

In both phases of work, IBM Global Services provided turnkey services that included consulting, project management, and systems integration. With Melbourne Health, IBM demonstrated its ability to deliver a complete solution in the niche sector of medical research, leveraging on its experience in delivering successful projects in the healthcare industry internationally.

The Results

According to Melbourne Health, the MMIM virtual platform currently linking research databases in 16 organizations is a world's first. Apart from being a milestone achievement for the Australian research community, the 16 medical institutions will also have a modern information infrastructure founded on a shared, standardized data model. Cross-database mining and query can now be carried out in a data-protected manner, and the platform promises to significantly increase research productivity because of more effective cross-hospital collaboration. Benefits include expanded access to a wider set of research data, which ultimately leads to improved research accuracy and quality.

Since the pilot phase of MMIM went live, six related research publications have appeared in peer-reviewed medical journals, and 10 related research papers have appeared at national and/or international conferences, indicative of the tangible research outcome that is expected to result from the MMIM project.

With a new IBM solution that has not been previously used, the first challenge after implementation was user education. To this end, IBM provided product training and promises skills transfer. Robert Merriel, Business Development Manager for Melbourne Health, related the benefits that researchers now enjoy: "At this stage, our researchers are already able to carry out previously impossible studies to stratify patients by genetic types. Researchers are already seeing the initial fruits of collaboration, which will stimulate further cooperation as MMIM is expanded. Ultimately, MMIM equips us with capabilities to accelerate clinical research through collaboration."

For IBM, the project demonstrated its ability to innovate in niche domain areas, such as healthcare research. "IBM has a big focus and commitment to the healthcare industry," Ross said. "With the success in this project, IBM is building a growing presence in the market." According to Ross, MMIM will provide IBM a boost in credibility, mindshare, and market development opportunities in the healthcare industry, both locally and internationally.

On a community level, the project's Internet site makes available details on the project and its progress, and also features a data model describing the contents of MMIM. For authorized researchers, a secure Internet portal allows queries through a single access portal.
The Future

The success achieved so far has laid a solid foundation for Melbourne Health to seed further grants to develop a nationally integrated information grid for cancer research. During its bid for funding in Phase 2, Melbourne Health had already demonstrated success in winning strong government endorsement for innovation in human health research.

While MMIM is currently supported by research grants from the Victoria government, in the long run, Melbourne Health believes opportunities for commercial ventures will arise, and an economically sustainable model more independent of government funding will develop to maintain the database.

Melbourne Health noted that interest to participate in MMIM is already being expressed by hospitals internationally, such as those in the United States and New Zealand. As the network grows, it is critical that the information management infrastructure be robust and scalable. A foreseeable challenge will certainly be the development of a governance model.

With a robust underlying technology, the vision of turning MMIM into a comprehensive platform for research collaboration is promising, placing Victoria at the heart of Australia's cancer research. And for Melbourne Health, the innovative use of information technology reinforces its reputation for world-class clinical research, and advances its research objective of fostering collaborative relationships to optimize research opportunities.