Kochi Medical School

April 11, 1988

Dr Kevin Austin

CEO
Enzyme Group
PO Box 1228
Crows Nest
Sydney NSW 2158
Australia
www.enzymegroup.com.au

kevin.austin@enzymegroup.com.au

Kochi Medical School

Visit to Kochi: June 1987

General Information

Kochi Medical School was opened in 1981 and is a government teaching hospital of 600 beds. It is situated on the southern Japanese island of Shikoku, on the outskirts of Kochi city. Kochi has a population of four hundred thousand people, out of eight hundred thousand on the island. The geographic situation is particularly attractive. The island is mountainous, with Kochi situated on some coastal flats beside the sea. Although a population of 400,000 would suggest an image of reasonably large city, and further images of Japan conjure up visions of a dense population, the reality is a most pleasant shock. The population is rather spread out amongst rice fields, giving a very "country" atmosphere, which is clean, fresh and pollution free. On approaching the hospital, one is impressed with the similarity of modern western establishments. You could be visiting the latest, most advanced hospital in Australia, Canada or the United States. This impression is only evident to those who actually look up towards the hospital, rather than keeping a check on the taxi driver who appears to be fighting a real battle to keep the car on the narrow road between the rice fields!

The hospital was built by the national government under a special agreement which encouraged a drive for excellence and research. Kochi Medical School has an outstanding reputation around the globe for its medical research. We were members of a party who were privileged to be able to visit the hospital in June 1987. The members were Dr Lee from the Ministry of Health in Singapore, the IBM representative from Singapore responsible for the Ministry of Health and the Singapore General Hospital, Mr Itoh, who is an IBM systems engineer from IBM Japan, and myself. The major reason for the visit was to see first hand the integrated hospital information system developed at Kochi Medical School, called IMIS (Integrated Medical Information System).

The data processing department is funded separately from the hospital and is formally part of the university. Hence patient data which is appropriate (privacy protected) is available to the medical school for research purposes.

Upon entering the main entrance, which is also the main foyer for the outpatient department, it appears as though no-one in Kochi gets ill. The foyer appears empty. The waiting room for all the outpatient clinics also appears empty. As the tour of the hospital continues one is often noticing the same feature in other areas of the hospital. You see very few people waiting at any department for service of any kind. Long waits at pathology, pharmacy, X-Ray or outpatients just do not occur.

When you meet the robots in pathology you realise that this is not just similar in appearance to a modern western hospital but may be beyond it!

But that is jumping the gun. What makes Kochi so special? Why are there no large queues of people waiting? Why is the technology in use so advanced? What has the impact of the use of technology been? What is the effect on the hospital staff? What is the level of quality? It just cannot be that good!... or can it? First stop, as we try to answer some of these questions, is the outpatient department.

Outpatients

The outpatient reception area resembles a comfortable waiting lounge at a modern airport.

To the left is a counter for reception, and to the right a bank of very comfortable chairs arranged in sequence to make it easy to watch the coloured television set perched high for easy viewing by everyone. But one should not get too involved in any programme because you won't be there for long.

A patient enters the hospital and makes their way to the reception counter. Before saying a word to anyone he or she places their patient card into an automatic card reader similar in appearance to an auto teller in banking. The card has basic account information on it. The patient receives a receipt/number from the machine. On the wall above the counter is a large notice board which flashes the patient number being served currently. This is for routine appointments of course. If an appointment has been made then the medical record is already with the outpatient department. It had taken about 2 minutes to transport the record to the clinic via a computer driven file/sample transport system.

If a doctor orders a drug for example, that order is posted to the pharmacy department and the prescription is usually ready at the pharmacy department BEFORE the patient has arrived at the pharmacy counter. If a pathology test is required then the patient walks around to the pathology department. There, he or she is greeted with a sign which says simply "If you have been waiting longer than ten minutes please come to the counter."!! Most patients do not wait at all, a few have to wait a couple of minutes. Samples are taken and more than fifty percent of the results are in the hands of the doctor within 26 minutes of the order being taken. Similar hospitals in Japan measure this time in days, as do many western hospitals.

A pattern is beginning to emerge as you tour the hospital. Everything you see has been designed to significantly reduce the waiting time of the patient and maximise the consultation time for the doctor. Indeed, the average patient waiting time (total time for an outpatient to be in the hospital) is literally half that compared to other major teaching hospitals in Japan.

Approximately ninety thousand magnetic patient cards have been issued to residents in the area so far.

Next stop, pathology laboratories.

Pathology Laboratories

The overpowering urge is to confirm what you had "thought" you had seen or heard about before. Does that famous sign actually exist! There was a sign on the reception counter. The translation via our host was, "If you have been waiting longer than 10 minutes please come to the counter!!". How often do people need to go to the counter…. very rarely. It is usually a couple of minutes at most before the patient is attended to.

First impression of the laboratory area include the following: very clean, very ordered, everything in its place, no one rushing, few people waiting, very few professionals within the laboratory itself, no batching, everything done immediately.

As we move into the laboratory area itself we meet the two large laboratory robots on their travels. Their job will be evident within a few moments. Work flow is organised like so:

> A patient sample for analysis either arrives at reception via a hospital professional (eg nurse) or via a computerised transport system, or a sample has just been taken from an outpatient who has just arrived at the laboratory reception.
>
> The sample is matched with the doctors order, via a terminal at reception. A bar code label is printed and attached to the sample tube similar to those used in many western counties (eg like a vacutainer tube). The same operator / technician then turns a quarter turn and passes the tube through a laser bar-code reader and places the tube in a coloured test tube rack. The location of where in the laboratory the tube is destined for determines what coloured rack is used. The readers around the laboratory are all colour sensitive. The rack is placed on a conveyor belt, which is the need of human intervention.
>
> The rack then travels around the laboratory via the beltway. The sample destination is controlled by the lasers, micro-robotics, and laboratory computers which in this case are a series of IBM S/1's.

The various automatic analyses have been modified slightly to allow for an uninterrupted flow of these samples around the laboratory. Quality control checks are there, of course. If a sample fails to measure up to the control checks, then the beltway system re-routes the rack containing the sample back for further analysis. The biggest difference one notices is obviously the use of robotics. However, there are other major differences not so obvious on the surface. A laboratory normally gathers enough of a particular type of test together so the samples can be processed in batches. Samples that have arrived in the laboratory early on are often "held up" until sufficient samples have collected in order for a full "batch" to be processed. Not so at Kochi. Because of the automated flow system, nothing has to wait for anything else. As soon as a sample arrives at the laboratory reception it is processed immediately. The effect is rather dramatic. Patient waiting time within the hospital is dramatically reduced for both outpatient and inpatients. The doctors have the results available, in most cases while the patient (even outpatient) is still in the hospital. Indeed the average time mentioned earlier is outstanding and would be unequalled anywhere in the world. The productivity of the Kochi pathology laboratories is double that of the average teaching hospital in Japan, and I suspect anywhere in the world. The entire system was developed by biomedical engineers at the university hospital, under the leadership of some very forward thinking professors of pathology. Most areas of pathology are now connected to

the system. The only area not yet fully on is histology. Even areas which would be considered to be difficult to manage via robotics are part of this advanced design. Haematology, which involves blood staining and microscopic examination, are included. Indeed high quality video's of what was seen in the microscope are recorded for closer analysis by the professionals. The latest technology is employed in the auto-analyses. Along side more conventional western or American machines are the very latest from Japanese manufacturers.

What was the role of the two larger robots mentioned earlier? When the test tube racks containing various specimens arrive at the end of their path through the laboratory, someone has to carry them back to the beginning! The larger robots used for this purpose travel around the laboratory by following a metal strip on the floor of the lab. As they travel classical music is played from small cassette players from within the robot. So, when you hear the music you know the "robots are coming".

More sophisticated uses of robotics are also now in production. A very complex advanced Seiko robotic mechanism is used to handle large volumes of muicro-pipetteing! It simulates the hand of the technician down to the small dab at the end onto a tissue or the "touch" to the side of a test tube when finished dispelling the volume. When the figures are available a "hand" appears and punches the readings into a keypad with a small finger. On the surface a little awkward but most effective.

The preceding description sounds as though no cost was spared. They must have had millions of dollars backing with huge resources of the top companies in Japan to accomplish so much in such a small space of time. The entire development was done by the professionals at the university and hospital. All the programming was actually done by one of the laboratory specialists (a microbiologist medical laboratory technician). The cost for the robotics and beltway / conveyor system was approximately 1.4 million yen or about 140,000 Australian dollars, at current exchange rates. The laboratory system is not an isolated case of wizardry. It represents a unique approach by the management of the hospital and laboratory in their search for excellence. It was born from an overriding push for productivity gains and efficiency which would reduce patient waiting time, speed clinical results to the doctor and improve quality.

Perhaps the only difference which is not so visible is that the results from pathology are back very much faster than a conventional PCS system. A recent study of turnaround time at Kochi, which has been published in the medical literature, reports results which are rather staggering. Between receiving an order in a laboratory and the result available to the doctors via the system, the results was a minimum less then ONE (1) minute and only 26 minutes for 51% of orders. For outpatients, the minimum turnaround from the ORDER ENTRY and the return of the result to the doctor was 10 minutes and 50% of the results were returned within 56 minutes.

Pharmacy

The visit to the Pharmacy department was unfortunately very brief. However, it was learnt that the department is fully integrated with the rest of the hospital information system. Pharmacy orders even from outpatients are transmitted directly to the pharmacy department and the order is usually filled by the time the patient has walked around to the Pharmacy counter. This is in dramatic contrast to what normally occurs in most hospitals, but also more specifically in equivalent Japanese hospitals. As a comparison, a major hospital in Tokyo has an average wait of 40 minutes for the pharmacy order to be filled. The pharmacy uses the unit dose technique, for inpatients, with pharmacy orders being transmitted automatically from the doctors order to the pharmacy.

Perhaps the most dramatic feature was what the hospital pharmacy was working on currently. You guessed it … robotics within the pharmacy department. There are now a few cases of automated dispensing for tablets in use in Japanese hospitals. Kochi is working with the leading manufacturer of such a system to go one step further. The pharmacy order will be transmitted directly to the dispensing computer controlled robot, hence reducing the chance of error even further. The current systems still rely on a pharmacist to re-enter the data from the pharmacy chart or electronic order. The research programme is still controversial, even at Kochi with much debate from and between the pharmacists as to whether it should go ahead. A trail run will be beginning soon. The results should be most interesting for all concerned with drug delivery in a safe and efficient manner in hospitals. The error rates reported using historic techniques are very large and difficult to measure and monitor. Error rates from unit dose techniques are reported to be very much lower. The error rates from what is proposed at Kochi would be not only lower still but make the delivery far more efficient, improve pharmacy productivity and reduce patient waiting time even further. The "machine", automated dispenser, computerised pharmacist or just plain robot delivers individual packets labelled specifically for an individual patient and contain an individual dose. The major draw back to unit dose in developing countries or those where cost was a major issue in a public paid for health care system, was cost. Perhaps this technique will improve the productivity of the pharmacist to a level where other counties could afford to switch to unit dose. The development at Kochi will be watched with great interest.

Last stop this whistle-stop tour was the nursing station in a paediatric ward.

Nursing Station

Each nursing station is equipped with five (5) terminals with attached printers. This was to eliminate any waiting time for a nurse to gain access to a terminal. At Kochi there are approximately 12 nursing stations responsible for about 50 beds per major station. On average, the number of beds per room ranges from 2 to 6 depending on the patient needs. Most nursing functions are available via the information system. At Kochi there are approximately 300 nurses, and they operate the terminals themselves. At first there was some resistance but now it has been accepted that both doctors and nurses use the terminals. Some work was done in order to make it easier for the nurses to use the terminals. In Japan, IBM produces an intelligent "PC"/terminal or workstation which has full Kanji (and Katakana and Hirogana and Romanji) support and are called 5550's. The nursing terminals (also 5550's) have had touch sensitivity added. The technology is based on pressure on the screen, so any soft tipped object will trigger a response. Hence, if the nurse does not wish to use her finger she can also use one of the "light pens" designed for this purpose. It is a simple pen at one end and a small rubber tip at the other. Each nurse may have her own "light pen" as it is not attached to the screen in any way as a normal light pen must be, and is extremely cheap. Most were "home made" at the hospital. No programming changes need to be made to a standard PCS system in order to use the touch sensitivity, as a "touch" is recorded by the system as a light pen detect. All orders are loaded by either the doctor or the nurse. Results are returned in a similar manner to a conventional PCS integrated system found in the United States.

General Summary and Some Interesting Bits and Pieces

A few interesting facts and figures:

1. IMIS goes off-line at 6pm, every day for back up, for a duration of 20 minutes. This apparently has never caused any problems because everyone is fore-warned and completes necessary work beforehand.

2. The use of a patient card dramatically reduces patient waiting time on revisits with registration significantly shortened. The average time for an outpatient to be within the hospital walls is less than 2 hours. During this time most treatment / results are known. This compares with a Japanese average of between 3 to 4 hours for similar teaching hospitals. I have an example of a sample registration card used at Kochi. If people are interested please contact the IBM Health Industry Centre.

3. The data processing budget is separate from the hospital budget and is funded directly from the government to the university. The annual budget is approximately 300 million yen (approx. 3 million Australian dollars). This includes everything, including people.

4. IMIS was running from day one when the hospital opened in 1981 and is based on the IBM patient care system and PCS / ADS application generator.

5. The hospital has an "agreement or understanding" with the government that they will reduce full time heads at the hospital by an additional 24 people over the next 5 years from the increased productivity found with these application in IMIS. This is in spite of the fact that the hospital opened with fewer people than normal. Kochi staff levels are less (how much less I was not able to determine) than older hospitals but about the same as similar aged hospitals in Japan.

6. All development was done in house. The staff levels of the data processing department are a total of twelve. Four (4) of these twelve are PhD's. There are NO separate operators at all. This is similar to Keio who also run a major MVS based system without any operators. In effect the programmers and other staff do what is ever required, but the system has been designed to minimise the need for operators (out of the twelve, only one does not get in involved in operations.) Please remember when thinking about the level of staff, that Kochi is very heavily into development at an extremely high level of technology. Most of the staff work very long hours. The deputy manager of the DP department commented informally that most days for him were from about 6am to midnight. They believe they are under staffed but since they are keen to continue the development at blistering pace, everyone continues to work very long and dedicated hours.

7. The number one priority for the project has always been to gain the maximum possible productivity leverage they can. For example the first area of attack was patient waiting time. They did not reduce the time before a physician. However, the turnaround time of results etc is so dramatically improved that significant levels of increase are possible without any increase in professional numbers.

8. The hospital runs with a bed occupancy rate of approximately 90%, which is the practical maximum when service etc are taken into account. The LOS is about 1.5 days shorter than similar sized hospitals in Japan which do not have order entry systems.

Conclusions

Kochi Medical School is truly one of the most advanced hospitals in the world. Their Integrated Medical Information System is the single most impressive I believe I have seen anywhere. Similar comments were also passed by Dr Lee from the Singapore Ministry of Health. However, what makes it particularly exciting and most impressive is not just the use of information technology to improve the effectiveness or even efficiency of health care for the people of Kochi, but the whole management approach seen at the hospital. The search for excellence in EVERYTHING they do is evident everywhere. The drive for quality is seen in the nurses, doctors, laboratory and pharmacy professionals as well as the administrative management. This drive for quality has resulted in the highest award any business can achieve. The Japanese quality award. Kochi is the only hospital to achieve this Dr Demming award that they are aware of. In Japan it is know as the Mr Ishikawa award. Achievements of this magnitude could only be dreamed of a few years ago. The search for quality in health care has truly begun. Kochi is one of the leaders. The quality of health care and the techniques used in hospitals to treat patients will never be the same again.

Kochi …. What an experiment!!