Uppsala EHR: A Case Study

1. Executive summary

The organisation initially involved in the investment in an EHR was Uppsala University Hospital which wanted to procure an EHR to aid patient administration, to ensure better and faster access to patient information and to enhance patient safety. Uppsala County Council quickly became involved. Later, the decision was made by Uppsala County Council Administrative board to include publicly funded primary care providers, namely general practitioners (GPs). In order to secure a more efficient system of referrals the same system was chosen to be used across primary and secondary care at a county-wide level. The system is intended to be used by all healthcare professionals, which is a total of 10,000 users today.

The council decided to procure a user focused system and so a user reference group was set up with 50 potential system users. This reference group developed a set of requirements which made up a call for proposals which was placed in the Official Journal of the European Union (OJEU). 6 vendors answered the call. These 6 were sifted down to 3 by the application of a scoreboard designed by the reference group. Through a second round the vendors were reduced to 2. These 2 vendors were then asked to set up test sites. From the results of user feedback at the test sites the winning vendor, Cambio, was chosen.

Cambio were then contracted to set up a pilot at 2 clinics with different needs. Once the pilot was proven successful the vendor was then contracted for county-wide roll out. Judging the pilot's success was based on user opinion with the decision to roll out being made by the users. The EHR is now implemented in both hospitals and public primary care practices across Uppsala County. Although, not all modules are in place and updates still occur. In total there are 10,000 users in the hospitals and 800 users in primary care practices.

Lessons learnt focus on the need to ensure user acceptance as user refusal stalled the project. Acceptance was obtained through inclusion of users at most stages of the process and appropriate training. The project in Uppsala also benefitted from a multi-disciplined organisational team.

2. Context

2.1 Health system

Uppsala County, located north of the Stockholm region, has approximately 320,000 inhabitants. Responsibility for healthcare is mostly at the county level and control of healthcare provision remains at the local level. Financially, there is no re-distribution of money from central government and so the county manages its own resources. An elected representative heads decisions on healthcare in Uppsala in conjunction with a steering committee of county council representatives. It was this combination of actors, answering to Uppsala University Hospital's need for a new hospital information system, which made the decision for Uppsala County Council to invest in a region-wide electronic health record (EHR).

There are two hospitals in Uppsala County including the University Hospital of Uppsala (Akademiska sjukhuset), which is one of seven university hospitals in Sweden. One out of every 30 doctors in Sweden is employed here. The university hospitals' reputation leads to 30% of medical service being "sold" outside the county.

The majority of primary care in Uppsala County, 60%, is public. The rest is private, but the proportion is slowly growing.

2.2 Strategic setting

The move towards investing in an EHR came from Uppsala University Hospital. In the long term, the hospital hoped to achieve more comprehensive and faster access to patient information, increased patient security, better sharing of information between departments and increased opportunities to follow up with patients. The natural solution to this was an EHR. However, there were other motivations: the hospital realised that if it were to be in the market for providing high quality care, to maintain the excellent reputation which the hospital had both inside and outside the county and to secure an innovative image which would attract and retain good staff then it had to look at investing in an EHR. This conclusion was guided by the chief medical officer and deputy CEO of the hospital at the time, Leif Lyttkens, who had previously introduced a system for patient administration to the hospital.

It was generally accepted that the guiding principle behind investing in an EHR was for aiding staff and improving performance and that this improvement would automatically improve service provision for patients. To assess whether an EHR would really garner the expected benefits, an assessment was undertaken by a small university spin-off, IM-Gruppen i Uppsala AB. This company looked at the existing process of care provision and assessed to what extent an EHR would benefit it. The result of this assessment was that time-savings would be achieved. This saving was estimated, after an initial introductory period of 7 years, at 3%, which equates to roughly 15 minutes per person per day and 82 million SEK. This was carefully calculated by monitoring the time consumed by common procedures such as visiting a doctor, booking an appointment and making a referral. From this calculation an average saving of 15 minutes seemed plausible.

3. eHealth investment brief

As stated above the organisation initially involved in the investment was Uppsala University Hospital which then involved Uppsala County Council. Later, the decision was made to include publicly funded primary care providers, namely general practitioners (GPs). They decided to invest in an EHR in order to aid patient administration, to ensure better and faster access to patient information and to enhance patient safety. It was decided to use the same system across both primary and secondary care at a county-wide level in order to allow a more efficient system for referrals. The system includes a basic record (text + medication) and integration with the already existing patient administration system at the university hospital as well as other hospitals' shared systems. A platform for integration was also very important. As was a means to integrate paper based records such as letters, the solution to which was scanning. The system gives access to documents and reports, medication and dictation, also booking, planning and waiting lists. The system is intended to be used by all healthcare professionals, which is a total of 10,000 users today. The system was

intended to store the records of all patients of public health services across the county of Uppsala. The budget for the EHR's initial introduction and integration was 25 million Euro. The time scale was estimated at 6 years, and was kept to. For procurement, piloting and initial implementation a small project organisational team was set up. The annual cost of running and maintaining the EHR is now 8 million Euros.

4. eHealth investment description

4.1 Strategic planning

Before the decision was made to invest in an EHR the County Council Administrative board needed to be convinced that this was a worthwhile investment. The County Council Administrative board is similar to a cabinet within the county council, but it is made up of representatives from all the political parties in the Assembly. The County Council Administrative Board's responsibilities include running the county council's own health and dental care services, and preparing all matters that are to be dealt with by the Assembly. The County Council Assembly is the highest decision-making body in the county. Election to the County Council Assembly takes place in conjunction with the general election, and determines how the 71 mandates will be allocated among the political parties.

The champions of the EHR solution, led by Benny Eklund, a council employee, presented their ideas for its procurement to the County Council Administrative Board. However, this board rejected the proposal as there was no proof that savings could be made. The champions of the solution then turned to a respected Professor of Economics and asked for his opinion on the matter. However, the Professor believed that the merits of an EHR were unable to be proven. The decision was then made by the champions of this solution, who would later go on to form part of the project organisational team, to use a small consulting firm, IM-Gruppen i Uppsala AB, to consider the merits of investing in an EHR. Once this analysis had been undertaken and the results of 15 minutes saved per person per day, in monetary terms 82 million SEK per year, had been presented the County Council Administrative board were convinced of the value of obtaining an EHR.

The issue of extending the EHR solution to also include primary care, which already had an EHR in place, was supported in the form of a short survey, undertaken by one of the EHR's supporters at the council. The survey asked primary care providers how patients benefit from the use of different administrative systems in primary care to the one used in hospitals. The answers to which were generally in favour of a uniform EHR across both sectors. This hypothesis was, however, not the only cause for investment in an EHR for primary care, it was also realised that the EHR already in place was out of date and would need replacing in 3 years anyway so the decision to create a system that served across the care provision sector seemed logical.

Once the decision to invest in an EHR had been made a budget of 240 million SEK, 25 million EUR, was created very early on in the project by the county council steering group. The budget was estimated based on normal costs for licenses and hardware, education, and integration which were then scaled up to match the size of the project. A team at the council, which included members of the project's organisational team, assisted in researching and creating this budget. The team included experts from a variety of backgrounds including IT, finance and healthcare. In addition to

this team, experienced specialists were hired to help with budget creation. From combined experience it was foreseen that some unexpected delays could occur during the project and so a contingency was added to budget and time plan.

4.2 Design stage

Previously these type of projects had been IT focused, this time the decision was made by the County Council Administrative Board to have a user focused system where much more input from the users would be used to shape the system. A reference group of 50 potential users, which included nurses, doctors and administrative staff, was therefore set up comprising representatives of all types of user. Some of these users were selected by the project organisational team and some volunteered. Of course, IT staff were also included, mainly to assess the technical capabilities of a solution and its compatibility with existing systems, but the primary concern was meeting the needs of users.

Some discussions in this reference group were difficult due to a an organisational irregularity; hospital doctors and primary care doctors usually divide their work and don't interfere in each other's spheres, however now they were looking at working together in a much more overlapping manner. The clinical processes in hospitals would now be more dependent on information input by primary care professionals and so a new relationship had to be created. Added to this, primary care doctors were used to working with electronic records whereas hospital doctors were used to working with only paper-based records and so they had different perspectives on what would be useful to include in the EHR. The primary care doctors were sometimes limited by preconceived ideas they held as a result of the specific EHR system they were used to.

Despite these differences a set of requirements was created by a group of clinicians. From this set of requirements a call for proposals was then placed in the Official Journal of the European Union in Swedish. 6 vendors answered the call and were invited to present their solution and give demonstrations in order for the reference group to consider their proposals.

The reference group undertook study visits throughout Sweden to observe other solutions in place in other towns. The reference group was also heavily involved in the selection process and created a scoreboard of user demands with demands rated as either essential or desirable. The scoreboard was used to assess prospective vendors. Once the scoreboard had been applied the vendors were then reduced to three. These three vendors presented their solutions more thoroughly and through this process one vendor was eliminated. The remaining two vendors were then asked to set up a test site where users could use the system, from these test sites the users provided very detailed comments and selected their preferred solution. The vendor which won was able to translate the needs of users very well.

4.2.2 Organisational aspects

As representatives of all types of users were involved in the design of system requirements and the creation of the scoreboard there was already some understanding of what the system would be expected to provide and the impact it would have organisationally. What was paramount was that the system fulfilled the demands of the users. User acceptance was the success criteria.

The experience gained by the pilot highlighted that changes to working methods would be required. Through the experience of the first stages of implementation it was also realised that meetings to

discuss this need for change in working habits were necessary as was obtaining promises from users that they would do so. It was realised that some users were reluctant to work with such a system as the EHR as they were worried that it would remove some of their power of responsibility in the decision making chain.

In order to aid the smooth running of the pilot, and to ensure that such lessons were taken on board, a dedicated organisational team of 4 people was created who would work on the project, generally in full time roles. They were people with very different backgrounds and expertise. At least half the team had experience in running similar projects, although not on such a large scale. Within the team there was one designated contact person for the vendor and it was through this person that it was ensured that promises by the vendor were delivered. The organisational team also organised testing of the system. Whenever a new module or function was added to the system it was first tested by a select group of users, the organisational team would schedule this testing, recruit users to test it and ensure all elements were in place for testing.

User training

In addition to testing, training was another important element organised by the organisation team. The organisation team created a thorough implementation scheme which included a large portion of training for each site. The training was planned in waves. The first wave of training was the initial training; this involved 3 days of theoretical training as well as training with a trainer. It was important for a trainer to be physically present in order to reassure the user. The first wave was then followed up by the second wave of training, which refreshed users' initial training and corrected any bad habits or misuse of the system. A final, third wave of training involved maximising the time saving aspects of the system. This third wave eliminated any double documentation and trained users to use the system as efficiently as possible.

An issue was identified in the first round of initial training caused by small differences between the database used for training and the actual databases used in practice. These differences caused confusion for the users which resulted in frustration. The solution to this was the provision of on-hand support such as a trainer/supportive person being available to the practice after the initial training had taken place. It was important that these trainers/supportive staff were trained and prepared for difficulties. They were available for both the pilot and the implementation stages.

The process for implementing the EHR system was devised as a series of small steps which began with the pilot and evaluation and was followed up by roll out into small clusters of clinics/practices. Clinics/practices would be rolled out together according to shared patients and levels of preparation. Before training began the clinic/practice would be visited and all members of the team interviewed as it was considered important to have in-depth information on all members of staff so that trainers could adapt to each person's needs. A behaviourist was also engaged to meet with all the trainers on a bi-weekly basis to allow them to learn about managing different personalities during training. This was in order to provide a more friendly, adjusted training team and to get better results.

Ensuring user acceptance

Before deployment began it was also important to understand the organisation of the clinic/ practice and to try and encourage the director to lead the process. When the director led the implementation and communicated the usefulness of the EHR system to staff the training was much more successful.

A trend was also observed by trainers regarding users' willingness to train and their corresponding level of formal education. Often those with a higher level of formal education, for instance doctors, were less willing to spend the time training, they were often too busy and considered training unnecessary.

Throughout implementation the organisational team would visit clinics which were having problems and discuss any issues they had. Solutions included refresher training and on site trouble shooting as well as providing individual counselling sessions for users. Ensuring user acceptance was the ultimate goal of implementation, which was achieved through honestly addressing users' problems. Here it helped that this task was conducted by a clinician who was able to understand the user's problems. The organisational team documented the numerous issues reported by users and put them forward to the vendor, but they also asked users for patience as implementation and testing takes a while. To make this process as transparent as possible an electronic issue tracking system was set up whereby users could register their issue and then monitor its progress along the reporting pathway until it was resolved.

Another means to ensure user acceptance was by involving them in design decisions. One example of this is the search tool which is available for searching the records. Users were able to choose the key words which were included in the search tool. This was ultimately unsuccessful as too many key words were chosen and so the search tool was not effective which meant that some key words had to be removed later. However, user's acceptance has generally been a success.

In addition to the organisational team there was also a central running team of 10 people who were in contact with a local experts located at each site. A local expert is a person who has been trained, has experience of the system and takes responsibility for it at a local level. The running team were responsible for the day to day smooth running of the system and overseeing the testing process. The running team are still in place today. Once the system had been fully rolled out and was felt to be in a stable position the organisational team disbanded leaving the running team in place. Although the major deployment is done and in place all over Uppsala any reorganisation triggers changes in the EHR system. Together with the local experts the running team now manages any updates to the system, completes testing of updates and the training of any new users.

4.2.3 Technical aspects

As stated before, the reference group were key in outlining what was required of the system, and their scoreboard outlined which functions were essential and which were only desired. In order to achieve good integration between the various systems/modules required by all the different clinics and practices a standardised platform approach was essential. A means for integrating paper based records was also required and solved by scanning incoming documents. Smooth integration of the various modules and any updates was also assured by the testing which occurred before any extras were put into the system. Only once the testing by a selected group of users had been completed was anything added to the system.

There are still some modules which have not yet been introduced such as the operation surgery planning module. As well as some functionalities which were requested later on as a product of user experience. One of these functions is the ability to take data out of the system for research or patient

administrative purposes. Such a function would also be useful for informing the national quality registers. This function is being developed and expected to be introduced to the EHR in the future.

4.3 Procurement phase

In Sweden public procurement law ensures that all processes are open. The specification also has to be detailed according to law. This is necessary for evaluation later. One other criteria, according to Swedish public procurement law, is that all companies answering tenders have to be registered officially with the state and proven to be paying taxes etc.

4.4 Implementation and use

The EHR is now implemented in both hospitals and public primary care practices across Uppsala County. Although, not all modules are in place and updates still occur. The project organisation team was able to cease its functions in 2010 and now only the central running team with a network of local experts remains. In total there are 10,000 users in the hospitals and 800 users in primary care practices.

There were some problems during the implementation process such as a delay caused when implementation in GP practices started. This was because some potential users were resistant to the new system and so complained to the media. The solution to this was not to force users to accept the system but to modify the approach for educating and informing potential users about the system. A shift occurred towards a greater concentration on preparing users for the problems which may occur rather than on illuminating the benefits of the system. This approach helped gain user acceptance and the EHR system itself hasn't needed to be changed.

4.5 Monitoring and evaluation

Before the EHR was rolled out on a county wide scale two pilots at specially chosen clinics, involving 200 users in total, were held; one clinic's focus was operating care, the other was more medically focused. It was then decided that after a period of six months of pilot operation an evaluation of the EHR and the project would be made. The purpose of evaluation was to provide data for decisions on whether to call off the county wide roll out of the system. It also served as a basis for a decision on the possible width of the introduction by the council and how the EHR would be rolled out and implemented if the pilot were successful. The result of the evaluation was to be used for planning of implementation.

The evaluation intended to answer a number of general issues such as:

- Is the system good enough for the needs the county council have?
- What is lacking for further implementation to start?
- Does the supplier have the ability to develop what is missing?
- Will the system meet the agreed performance?
- Have our system requirements for usability and ergonomics been met?
- Does the supplier have a management structure that can respond to our needs?
- Does a change need to be introduced?
- How will training be handled?
- Team work?
- Will the supplier meet the demands of integration that we have or will occur?

The pilot evaluation also discovered that one aspect was not good enough, this was the prescribing history to be used on the ward. However the vendor promised to develop a solution for this with assistance from users who are involved with dispensing drugs on the ward.

Continuous evaluation has been taking place informally. Through testing and the transparent problem reporting process user issues are raised and the vendor has been happy to supply alterations and adaptations.

In terms of trouble shooting it was easy to close down the system in order to make upgrades during the pilot, but much more difficult now that the whole county is dependent on the system. There have only been one or two occasions of system failure. However, there is a read only version of the system available as a contingency plan for those times when updates need to be made or if the system should fail.

Generally it can be agreed that the EHR has been a great success; 7 out of 24 counties in Sweden now have an EHR system from the same vendor. In Uppsala too, 17 private practices now use the EHR system voluntarily. This could be due to a regulation which was made in 2008 in order to allow public practice GPs to read each other's medical notes.

5. Procurement process

5.1 Decision to invest in an EHR

At the time of decision making in the early 1990s, electronic records for primary care had been around for about 10 years in Sweden, however these weren't sufficient to cover the complexity of clinical procedures. This meant that Uppsala university hospital only procured a central patient administration. In the year 2000, when the project of implementing the central patient administration system was finishing, the idea of including patient medical information came up again. Research into available EHRs was carried out in order to obtain a market overview. However, existing EHRs did not meet requirements. One examples of existing EHRs' deficiencies was that they didn't have systems for recording infusions.

In 2001, after this research into existing solutions was concluded and an investigation was made into the value of an EHR, the decision was made, by the County Council Administrative Board, to invest in such a system across primary and hospital care.

5.2 Organisational team established

In order to manage the process of procuring an EHR for Uppsala County the county council appointed an organisational team. The team was headed by the chief medical doctor of Uppsala University Hospital, Leif Lyttkens, who had experience in introducing the patient administrative system at Uppsala University Hospital and in hospital management. He also had a reputation for turning struggling hospital departments around. Joining him on the team was a nurse, Britt Ehrs, who had a background in financial matters and who had also assisted in implementing the patient administrative system at the hospital. She was to be the contact point for the vendor in the future and was in charge of the procurement process. There were also two other team members, Benny Eklund, and Brita Winsa with IT based and medical backgrounds.

5.3 Selection process

As has been explained above detailed specifications were developed by the reference group of potential user representatives and then a call to tender was made. An advertisement was also placed in The European Journal, in Swedish.

In January 2002 6 vendors had been selected by the reference group as potentially suitable and were invited to present their ideas to the group. From these 6 who presented their solutions, 3 were selected by the reference group as meeting their demands. After this a scoreboard was developed by the reference group of users demands and divided into groups of essential demands and desirable demands. The 3 remaining vendors were then asked to present their ideas further and were assessed according to the scoreboard by the reference group. From these 3 vendors 2 were asked to set up a test site where potential users could test the system. Alongside this the vendors also wrote a very detailed protocol which was inspected by the reference group. The vendor which won the tender, Cambio, was outstanding in that they understood the processes required by the site very well and could translate the users' needs excellently. Also, Cambio's use of layout, a graphical interface, was particularly intuitive and usable. They were the only vendors to use a graphical interface.

5.2 Pilots and roll out

Cambio was initially contracted for a pilot which involved 2 specially chosen clinics; the ear-nose-throat clinic and the psychiatric clinic. The reason behind this decision was that the vendor was not meeting all requirements fully and so the use of a pilot sites would allow for the development and testing of this solution. If the pilot was not successful it could be closed down and a new solution discussed which would have been more difficult to negotiate if county-wide roll out had started. Another reason for using pilots was based on the hope that the pilot was successful, if this was the case the pilot could then be used as a means to persuade users and the public of the system's worth. In terms of measuring whether the pilot was a success, a criteria was developed by the reference group as the pilot went along. A further reason for only initially contracting for a pilot was that the vendor was very small, only 60 people with a few small projects, so the pilots were a means of assessing the capabilities and potential of the vendor too.

The pilot involved 200 users who used the system in their day-to-day work. Once the pilot was completed the users at the pilot sites presented their views and experiences in using the system and whether they thought it was worthwhile continuing to use it. In short, an evaluation of the pilot was undertaken. Only one major issue was discovered which concerned the function for drug dispensing on the ward. In response to this the vendor promised to develop a solution with the assistance of users who are involved in this activity. The final decision on whether to start rolling out the system was made by judging whether this system could meet the demands of users.

The pilot, which began in 2003, was successful and implementation for county-wide roll out began in 2004.

6. Outcomes and lessons

On reflection the actual selection and final procurement of the EHR was one of the smaller problems in the whole introduction process of the region-wide EHR in Uppsala County. At the time of selection,

disappointingly, no vendor was able to match the requirements of the county. They needed to risk procuring from a young and small company that provided the most promising though immature product.

A more fundamental problem encountered was that of resistance by some users in accepting the system; such an obstacle was not expected at first. The level of training originally planned was not appropriate to deal with this. The solution was to invest more in the process of training and informing users. The training period was extended to 2 weeks, with one whole day spent on mechanical training. The trainers were physically available at the clinics/ practices where the implementation was occurring for the entirety of these two weeks. These training/ support staff were also given further and more advanced training, including a session every two weeks with a behaviourist. The trainers were also informed about the organisation of the clinic/practice as a whole and held profiles on staff members in order to enable them to assist staff in a more effective manner with understanding of their specific needs.

Communication was also key, if users are not prepared for the process of change then they panic, as was the case with some GP practices. There is a need to prepare users for the worst, but also to emphasise what they will gain. It helps if the people communicating this message are also users of the system too as this gives them authority and believability. The hierarchy of these environments is often not typical of other working environments, in that people at lower levels could be more educated than those above them, this means that experience is often a better tool for persuasion than rank. However, true appreciation can only be achieved personally, people have to discover the benefits themselves and this takes time.

Time is also something which was necessary for the successful implementation of the EHR. It was advantageous that the system was not fully developed when it was first implemented as this meant that it was able to respond to requests and complaints from users. However, as it wasn't perfected, due to waiting for this user feedback, it meant that time was required at later stages in order to develop all features.

The involvement of users was also something which proved to be an advantage, in terms of acceptance. It meant in that the system really met the purpose for which it was created. However, as was learnt when allowing users to suggest their own key words for the search function, perhaps more guidance from the top is required. It is impossible to please everybody and so some compromises have to be made and a lead taken.

It was also the experience that implementation really worked where the lead was taken from the top, where the director of a clinic or practice took an interest and ensured that changes to working habits were implemented all levels and training was taken seriously. Where an effort was made by such directors to communicate with staff and gain promises from them the EHR was more quickly integrated into everyday working life.

In terms of the organisation and procurement teams it benefitted Uppsala to have teams comprised of individuals with different backgrounds and experience. Only through experience were accurate estimations reached for the expenditure of time and money.

7. Generalisation of lessons

The success of the Uppsala EHR system relies greatly on the involvement of users, which indicates the importance of their involvement when purchasing an eHealth solution, such as an EHR system. Without users input there is a chance that the solution could lose some of its potential benefits and thus not be accepted by users who fail to see the value. The same is true in terms of user preparation, if users are prepared for change and are supported through it, preferably from the top, then there is more chance of acceptance and success as users see for themselves the system's benefits. Training of an appropriate length and intensity is one means of preparing users for using and accepting the system. In addition training should not be understood as a one-way street but as an honest and open dialog. These solutions were taken when problems with user acceptance arose in Uppsala County.

In addition to user involvement and preparation the EHR procurement, testing and implementation in Uppsala also had the benefit of a strong organisational team. Members of this team were experienced in different fields, this combined diversity of experience meant that planning was thorough and many issues were already accounted for and allowances made. That the project in Uppsala remained within budget despite the unexpected issues with implementation in GP surgeries, which halted progress, is testament to the success of the organisational team.