

POSEIDON - A Composite Multimedia Hospital Patient Records System

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There have been many developments in the past few decades with respect to the provision of health care, its availability, administration, quality and complexity. Advances in technology have enable the provision and use of a range of computer aided diagnostic, analytical and procedural tools within medicine [1,2]. Development has also been under taken for the communication of the different data types produced by these techniques [3]. Health care has been subject to demands for increased efficiencies and ever greater provision.

The existing health care systems are undergoing numerous structural, managerial and operational changes, yielding savings and further efficiencies where possible [4]. However within any complex system such as health care, having dynamic and developing requirements, there is a point where certain static systems, practices and procedures, limit the systems possible developments and efficiency. An analysis of the health care system, with respect to its individual constituent systems, indicates that some of the existing patient systems, especially patient administration and records systems, are at present acting as system limitations for health care as a whole.

The development of a 'Composite Multimedia Patient Records System' would yield tangible benefits with respect to the more efficient use of clinical and administrative resources, the utilisation of advanced medical data, and an improved service provision. The proposed system would facilitate advances with respect to the administration and management of the patient records, the availability of the records, and the ability of the patient records to include multimedia patient data.

Thus the projects aim was to develop POSEIDON (PPrototype cOmposite hoSpital multimEdIa recorDs fOr patieNts). In order to develop the prototype system a detailed analysis of the systems requirements was required. Obviously to define the exact needs for every hospital department would be an immense task requiring resources beyond the limits of this project. Thus in order to maintain the validity and integrity of the project with respect to the systems analysis, it was decided to concentrate the research within a limited number of hospital departments, whose inter-departmental and intra-departmental interactions formed a comprehensive example of the hospitals requirements as a whole.

In conjunction with the Information Department and a number of clinical staff at the co-operating hospital, "Plymouth Hospitals NHS Trust" in Devon, the ENT department was selected as the base research department. It was felt that this was a particularly suitable department as it provides a number of different clinic types, caters to a large number of patients, is involved in a number of joint specialist clinics, and works closely with a number of other hospital departments. It also utilises multimedia data, has a surgical role within patient care, and has a large administrative work load. Thus the department encapsulates a large number of the hospitals requirements as a whole.

To analyse the remaining requirements not present within the ENT department itself, the project looked at a number of what were defined as 'Associated Departments'. These were hospital departments which had a close, and integrated, working relationship with the ENT department. These relationships necessitated the regular interchange of patients, patient data, and correspondence. The associated departments analysed included Maxillo-Facial, Radiology, Dental Specialities, and Plastic Surgery. The inclusion of these departments enabled the communicative system requirements to be defined.

A number of other departments including Microbiology, Medical Photography, Medical Records, and the Information Technology department were also involved in the research. Their inclusion enabled the systems requirements for clinical services and administrative tasks to be defined. The inclusion of the views from relevant community based care departments such as Paediatrics, and Speech Therapy, was also made so as to complete the systems requirements. Thus the scope for the projects research was defined as being a comprehensive and representative, as the research identified a sub-set of hospital departments which demonstrated the hospitals requirements as a whole.

The research methodology utilised to establish the system requirements was that of performing confidential discursive interviews in private surroundings. The interviews were performed in a relaxed manner, being recorded, and later transcribed for reference. This ensured that the interviews flowed, and that the interviewees had confidence in their confidentiality and were able to express their views freely.

The interviews were performed throughout the base ENT department and the other associated departments. For each of the associated departments a number of interviews were performed, in accordance with a sectioned interview schedule, with a range of departmental staff types, clinical, administrative, secretarial, and nursing. Whilst for the base department the number of interviews was increased, so that several staff of each type were interviewed, the same structure and methods were maintained.

The interview schedule was carefully designed into sections, each of these sections contained a number of non-leading questions, which concerned a particular area of health care practices. The interviewees were firstly asked to describe their usual range of duties and responsibilities. They then answered, if appropriate, questions from each of the interview sections. These sections concerned their dealings with patients, the patient referrals and appointments processes, patient paper records, separate items of patient data,

the generation, processing and interpretation of patient data, clinical systems, administrative systems, views on computers, and future systems development.

A number of the more senior, managerial, and clinical staff were given a slightly different interview schedule which was designed to identify the more managerial based departmental problems and development needs. These interviews concentrated on what the departments overall responsibilities, duties, aims and constraints were and upon how they felt the departments, and health care, would develop and evolve in the future. A number of clinicians from a comparable department within another hospital were also interviewed, using the same methodology, towards the end of the interview stage of the research. This enabled the defined requirements between the hospitals to be defined and compared. The comparison of results found that the requirements identified were apparently generic, being present at both hospitals.

Analysis of the interview results yielded groupings of systems and user requirements, both across and throughout the co-operating departments and the interviewees. Also found were a number of patterns of systems requirements, about established working practices, current system inefficiencies, and current system deficiencies. The research also identified a number of extremely good, practicable and efficient working practices, which were recognised to be suitable for maintenance and inclusion within the proposed system. The project aims to provide a system which would not require the unfeasible revolution of clinical and administrative practices but one which would integrate and embrace them, enhancing their efficiency where possible.

From the analysis of the results patient based models of all the processes, and their component parts which occur within the base department, were constructed. These models defined a number of possible patient states within the departments, a patients state being their situation within the care process at a particular point in time. For each patient state the models defined fully the system requirements with respect to the request for and receipt of patient data, the production of patient data, the administration of the patient records, and the patients care requirements.

After defining all the processes which occur within the base department, and between the base and associated departments, the models were verified with clinical staff for their accuracy. At this point a practical analysis of a busy clinic was performed. The speed, workloads, practicable responsibilities, and environmental factors for different staff types were analysed. This yielded valuable practical information with respect to the design, operation, and implementation of the prototype system.

The system structure, content, presentation and capabilities were discussed with hospital staff during the design process. This enabled the system to be developed about those working practices which are not able to be altered without detriment to clinical care. It also enabled the users to define what system features would or would not be of use, comment as to the proposed practicable ease of use of the system, and identify possible problems.

The basic system is a windows based one, with the records structure being hierarchical in its nature. Its use and operation is driven, and governed, by the use of a small number of 'universal' menus, these are menus which group together the required system capabilities in a logical manner. Some of the menus are concerned with the navigation and use of the system, others are concerned with the viewing, appending, use, and generation of items of patient data. There are seven 'universal' menus within the system, each has a number of options which are present every time the menu is included within a particular page of the patient records. The options availability within the menu, when present, is dependant on the individual users requirements (defined by the systems security manager) and on the exact nature of the patient records page.

The systems design was as concise and logical as possible, enabling users not fully conversant with all the peculiarities of health care to use the system effectively as they require. The simple hierarchical structure, consists of a title page, leading to three main records sections "Patient Details", "Patients Medical Details", and "Departments". The "Patient Details" section allows the user to access, all the required non-medical patient details. The "Patients Medical Details" provides access to three other sections, "Medical Conditions", "Medical Procedures", and "Patient Medication", containing all the appropriate patient data. The patient record structure is illustrated in figure 1 below.

Figure 1 : Basic Patient Records Systems Structure

The "Departments" section provides access to the patients departmental hospitals records, the contents of which may be examined as required, by selection of the required (named) departmental option. The systems operation is then via a number of separate 'universal' menus. Each enables the user to perform the full range of tasks associated with a particular aspect or need within any area of health care. The presence or absence of the individual menus about any of the individual patient records pages was easily defined by relating the nature of the page to the users requirements.

The use of a hierarchical records structure allowed the required patient data to be separated, grouped and ordered to a greater extent in a logical form. This separation, grouping and ordering of the data enables the increased speed of access for the desired patient data. It also allows for the easier review of associated patient data, i.e. patient data relating to a particular patient care episode.

The use of 'universal' menus, for the command of the system, was decided upon as the number of options required within the system at any particular point was too great to consider command buttons. It was also the option which used least of the screen space, which needs to be given over to the presentation of the actual patient data. The use of 'universal' menus throughout the system helps to ensure the systems correct use, eliminating the ability to abuse the system operations, as only those operations applicable to the particular page of the patient records are available.

The security of the prototype system was carefully considered both with respect to the systems access, and the integrity and validity of the systems constituent data. The users

were classified into a number of generic groups, and their privileges within the system were defined in accordance with their work place responsibilities, duties and needs. Although each member of staff could be placed into one of the generic groups, their required privileges could be flexibly and exactly tailored to their personal work place requirements. This ensures that the system does not impinge on, or compromise, the required working practices within the health care system.

Thus viewing and operational access for particular records, sections within the records, and particular data items within the records are defined in accordance with their needs. The system is able to carefully restrict users, as appropriate, with respect to their use of operational and viewing options within the patient records.

The validity and integrity of the data held within the individual patient records also needed to be ensured. It is vital that the system is able to show the users who have appended the patient data to the system, and the users who have, when required, verified the validity of the data appended to the system. Also recorded along with the appending or verifying user is the time and date of the operation. By creating an automatic record of those responsible for the appending and, when required, the verification of the data validity, the system avoids the possibility of anonymous and perhaps erroneous data appearing within the record and being acted upon in good faith by another user. Thus if a clinician has a query concerning an item of data, then they may contact the appender of the data. The integrity of the data and the appender is ensured by the use of digital signatures.

Although the system is presently being developed with respect to its actual coding, and has imitations with respect to its scope and aims, it is hoped that it will help to demonstrate the practical benefits which a future multimedia patient records system would bring to the field of health care. The system will show the benefits afforded by the use of a simple logical structure and operational ethos. It will also demonstrate the benefits afforded by its ease of access, viewing, incorporation and presentation of multimedia patient data, and its ability to facilitate clinical and administrative health care tasks and requirements. It is also hoped that the production of the prototype will stimulate further research and development so that the desired end system could be implemented and yield the numerous possible benefits to the health care providers and users.

References

1. Caponetti, L. and Fanelli, A. M. 1993. "Computer-Aided Simulation for Bone Surgery", *IEEE Computer Graphics & Applications*, Nov. 1993.
2. Yoshida, R.; Miyazawa, T.; and Doi, A. 1993. "Clinical Planning Support System- CliPSS" *IEEE Computer Graphics & Applications*, Nov. 1993.
3. Orozoc-Barbosa, L.; Karmouch, A.; Georganas, N.D.; and Goldberg, M. 1992. "A Multimedia Interhospital Communications System for Medical Consultations" *IEEE Journal of Selected Areas in Communications*, Vol. 10, No. 7, Sep. 1992.
4. Bowles, B.A.; and Teale, R. 1994. "Communications Services in Support of Collaborative Health Care" *BT Technology Journal*, Vol. 12, No. 3, July 1994.