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Lecture Notes in Medical Informatics

Edited by O. Rienhoff and D.A.B. Lindberg

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Nursing Informatics '91

Pre-Conference Proceedings

Springer-Verlag
Berlin Heidelberg New York London Paris
Tokyo Hong Kong Barcelona Budapest

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ISBN-13: 978-3-540-53881-3 e-ISBN-13: 978-3-642-95656-0
DOI: 10.1007/978-3-642-95656-0

2127/3140-543210 – Printed on acid-free paper

FOREWORD

The Fourth International "Nursing Informatics '91" Preconference sessions held in Melbourne Australia on the 12th and 13th April 1991 hosted by the Nursing Computer Group, Victoria Inc. (N.C.G.V.) and I.M.I.A. Working Group 8.

The aims of both the International Committee and the N.C.G.V.are to provide our Nursing Colleagues nationally and internationally with access to a wide range of information about computers awareness literacy ,and, the sharing of experiences.

As technology advances and nurses understand their particular practice setting needs, progress in the area of nursing informatics will be an expanding arena for Industry and knowledge. Papers such as those presented here will contribute greatly to the dissemination of todays knowledge base and hopefully assist in our expansion as we move toward the year 2000.

The vision and subsequent motivation of hosting an International Informatics Meeting is that a few very dedicated nurses can encourage their colleagues to approach this newly defined specialty with openness and enthusiasm. If nurses are not able to attend these sessions the papers presented here demonstrate care and commitment to the learning opportunities afforded nurses in Australia and Internationally.

It is my opinion that awareness, followed by knowledge of a specialty, even one so new and dynamic as Informatics is the primary legacy that the hosts can give to the country that supports an International Conference. I would like to envisage the time when conference forums not only saluted the presenters but encouraged the host country nurse participants to learn first hand from the "experienced". These forums should disseminate their findings to address nursing informatics as a whole and the unique needs of the host country. The profession would still be able to take informatics to the edge and involve nurses in nursing informatics. The future does require participation in decision making and nurses at all levels of competency and knowledge should be part of the "team".

This text owes much to the contributing authors and to the excellent editing of Jim Turley and Susan Newbold, to them all thank-you.

The Nursing Computer Group Victoria (Inc.) Australia has been honoured to be part of the international nursing informatics community and the N.C.G.V. knows they have in a small way contributed to the expanding knowledge of the use of computers and information science.

Joan Edgecumbe
President
Nursing Computer Group Victoria (Inc.)

PREFACE

These articles are the Proceedings of the Pre-Conference Workshops held prior to the Fourth International Conference on Nursing Use of Computers and Information Science. The Conference is more commonly known as Nursing Informatics '91. Nursing Infomatics '91 was held in Melbourne, Australia, 12-13 April, 1991. The Conference attracted those interested in Nursing and Computers from all over the world. The authors are thanked for their dedication to furthering the use of computers in Nursing and to sharing their views, opinions, successes, and failures so that others might learn. The ultimate goal is that clients receive improved nursing care as a result of the introduction of computers to the health care environment.

Some editing has taken place with the articles, but it was the intention of the editors to retain the author's style and flavor. The papers offer a wide variety of opinions and experiences from a set of individuals from all over the world--from the Americas, Europe, and the host-country, Australia.

The Pre-Conference Workshops provided in-depth coverage of important subjects including systems for use in critical care, bedside terminals, standards and minimum data sets, working with computer programmers, automated nursing documentation, computers and information technology in nurse education and training, system implementation and evaluation, and career planning. One workshop provided the opportunity to personally review educational software whilst one workshop aimed to introduce nurses with little prior knowledge to the use of computers and information science.

The planning for the Pre-Conference Workshops started approximately one year prior to the actual Conference and those committee members are herein recognised for their efforts. The Pre-Conference Workshop Committee follows:

Joan Edgecumbe, Convener

Barbara Carter	Phil Eltringham
Anita Griffin	John Hinterreiter
Sally Mizrahi	Susan Newbold
Martin Owen	Kate Stanistreet
Peter Torokfalvy	James Turley

We must also thank the corporate sponsors of the Pre-Conference Workshops :

Arthur Andersen & Co.
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IBM Australia, Ltd.
Marquette Electronics, Inc., U.S.A.
McDonnell Douglas Information Systems (Australia) Pty Ltd.

Others who gave special assistance to the Pre-Conference include: Nancy J. Gantz, Judith Ronald, Penny Baxter, Kathleen A. McCormick, Rita D. Zielstorf, Kathryn J. Hannah, Christine Bolwell, Betsy S. Hersher and ICL Corporation.

James P. Turley, Susan K. Newbold, editors.

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IV. SYSTEMS SUPPORTING NURSING PRACTICE

V. COMPUTERS AND INFORMATION TECHNOLOGY IN NURSING EDUCATION AND TRAINING

1 -- Participation Of Nurses In The Development Of A Computerized Bedside Charting System

Sherri Dorken, Gordon Tait, Janet Brophy

INTRODUCTION

Nurses in an eighteen bed multi-disciplinary Paediatric Intensive Care Unit (PICU) have helped to develop a bedside computer system which automatically records the patient's physiological variables such as heart rate, blood pressure, and respiratory rate from the bedside monitor on a minute to minute basis and graphically displays this information on a bedside microcomputer. The graphic display of this detailed information facilitates the astute observation of patterns and trends in the patient's physiological status (Figure 1).

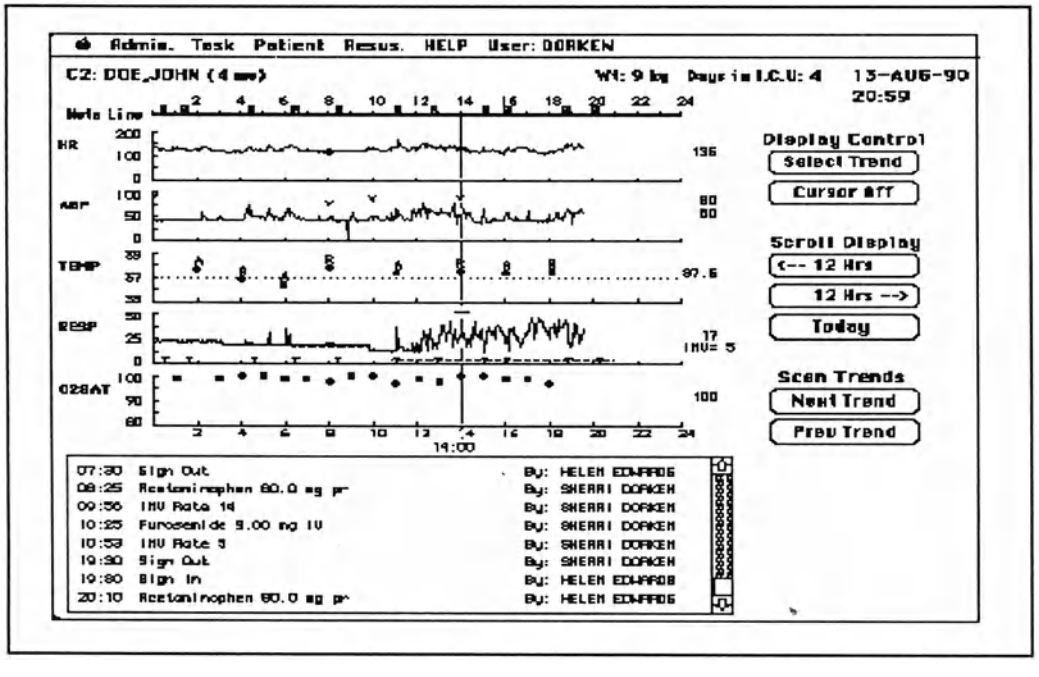

Figure 1: Physiological status

This system will eliminate the routine task of manually recording patient data while it improves the accuracy, legibility and completeness of documentation and provides a more detailed record of the patient's physiological status than is possible with a manual charting system. The system also functions as an information resource for nurses and physicians with features such as automatic calculation of resuscitation drug dosages based on the patient's weight, as well as a database of on-line drug information specific to the paediatric intensive care setting. Nursing care plans, and unit specific policies and procedures will be added to the system in the near future.

Nursing interactions with the computer include entering "manual points" for trends that are not being recorded on the patient's monitor, indicating the patient's ventilator rate, and documenting stat and prn medications and "significant event" notes such as pacing, intubation, extubation, to OR, from OR, etc. (See Figure 2).

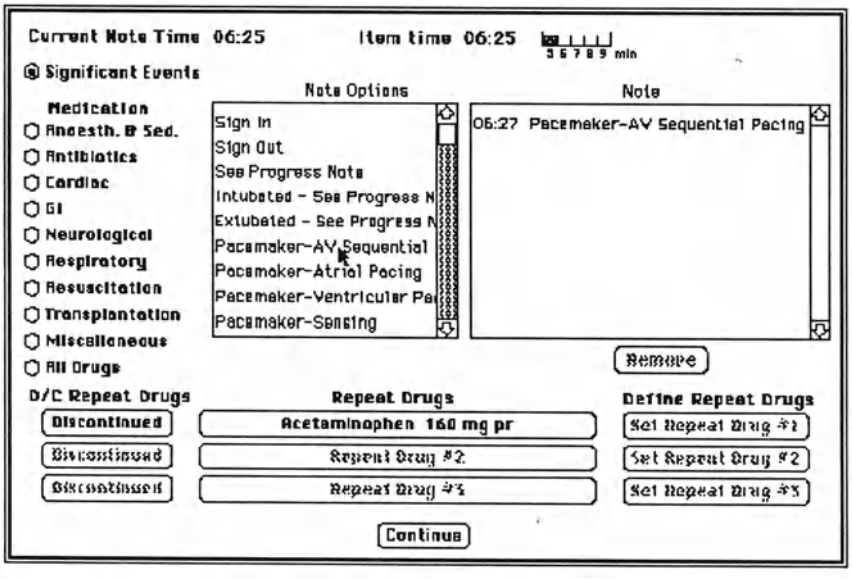

Figure 2: General screen.

Apple Macintosh computers are the selected hardware for this system because of the graphic user interface. The use of a mouse to control the system has allowed the keyboard to be eliminated, and results in less training time for the nursing staff. All nursing notes are created with the use of pull down menus and the "point-and click" interface. The microcomputers have been placed below the patient monitors at ten PICU bedsides so that the screen may be easily visible to both the nurse and physician caring for the patient.

Nurses have been involved in the development of this system from the project's conception. The position of Information Systems Nurse (ISN) was created to provide a liaison between the programmer, System manager, and the bedside nurses. The ISN works closely with the bedside nurses to ensure the system meets nurses' needs. Initially, small group sessions were held with general duty nurses to view the prototype software and identify areas to be changed prior to installation at the bedside.

Computers were installed at two bedsides for testing purposes and a feedback mechanism was established to encourage user participation in development. Nurses are kept informed through a training program, a bedside computer manual, nursing team Computer Representatives, a computer information board and daily bedside visits from the ISN. Nurses are encouraged to make suggestions for improvement directly to the Information systems Nurse, the Computer Representatives, or through a comment section in the bedside manual.

A questionnaire was distributed to PICU nurses about six months following the installation of computers at two bedsides in order to evaluate satisfaction with the development process and training methods employed in orientating nurses to the system. Eighty percent of the questionnaires were returned and showed positive results: 57% of the respondents were excited about the concept of utilizing computers at the PICU bedside, 43% were ambivalent and 0% were opposed.

Since fostering nursing participation in bedside developments was a primary goal of the ISN, nurses were asked to evaluate the opportunity they were given to contribute to development of the system. Over 56% felt they had contributed to the development of the program either through the Information Systems Nurse, the Computer Representatives, or the Computer Communication Manual. An overwhelming 94% of the respondents felt their input had been utilized by the computer development team in the design and function of the system. At least 75% of respondents stated they were pleased with the training program the ISN had implemented.

A second questionnaire will be distributed to PICU nurses three months following the implementation of legal computerized documentation. This should occur within the next two months.

It is the belief of the ISN and System Manager that the positive attitudes towards this system are primarily related to three factors:

1) Nursing involvement in the design and function of the system,
2) On-site development, to ensure the system is able to meet the needs of the users, rather than requiring the users to meet the needs of the system,
3) Ease of use of the system, guaranteeing minimal training time for full time and relief nurses alike.

Following implementation of legal computerized documentation at ten of the 18 PICU bedsides, a study will be initiated to determine if the goals of improving the accuracy, legibility and complements of documentation were met. The advantages and problems of computerized documentation compared to manual documentation will be examined, and nurse attitudes towards both the system, and the training and support programs provided by the ISN and Computer Representatives will be evaluated. Nurses in the PICU remain excited about the concept of automated charting and are eager to participate in future developments.

2 -- The Development And Implementation Of A Computerized Bedside Based Nurse Documentation System

Carol Robinson

ABSTRACT

The purpose of this presentation is to report on a Computerized Nursing Workstation Project underway at a large quaternary care teaching and referral hospital in Western Canada.

The industry of health care is information intensive. Nurses play a pivotal role in the accumulation, management and dissemination of patient information. The Nursing Administration at this hospital is exploring the use of automated source data capture by the nurses as a tool to support information management and the delivery of nursing care.

The Director of Nursing Information Systems together with colleagues from the Information Systems Department, have designed and implemented a computerized bedside nursing documentation system. The system automates most of the nurse documentation functions including: the medication record, the clinical chart record, the intake/output record, the wound care record, the neurological assessment record, the vascular assessment record, and the nurses notes.

The system was implemented on the test unit, a 26 bed Plastic Surgery unit, in the spring of 1989. Evaluation of the impact of this automated documentation system on the test unit is underway using a quasi-experimental research design. The objectives are to measure the effect of the system with respect to productivity, quality of care and nurse satisfaction. In addition, acceptance of the system by physicians and other health care professionals will be assessed.

3 -- A US Developed Nursing System - Will It Work In Australia ?

Dianne Ayres

INTRODUCTION

This paper reports on a study that was conducted jointly by the Repatriation General Hospital, Concord and IBM, Sydney to verify the potential benefits of a bedside terminal. The aim of the study was to evaluate the suitability of a nursing system developed in North America for Australian hospitals. The system studied was the IBM 7690 clinical workstation using the Spectrum point-of-care clinical series software.

Concord Hospital in Sydney, Australia is a 726 bed teaching hospital of the University of Sydney. Situated on a peninsula overlooking the Parramatta river, Concord is the largest of the Repatriation General Hospitals located in the capital cities of each Australian State. The hospitals are funded by the Commonwealth government and administered by the Department of Veterans' Affairs.

As the leading hospital in Integrated Hospital Information Systems in the Australasian region, Concord Hospital staff were well acquainted with clinical information systems and well placed to evaluate new technologies. In 1986, the Department of Veterans Affairs (DVA) made a decision to replace outdated and stand alone systems with an integrated Hospital Information System called the Patient Care System (PCS). Three modules of PCS were selected for patient management, appointment booking and order entry results reporting. The aim was to gain benefits in productivity, management control and strategic placement for future directions in information technology.

AUSTRALIAN PATIENT MANAGEMENT SYSTEM (APMS) was the first module of IBM's PCS to be implemented in November 1987 in DVA hospitals. This replaced a 13 year old ADT/PMI (admissions, discharges, transfers and Patient Master Index) system. APMS provided greater functionality than the system it replaced and was decentralised to wards and units where nurses and ward secretaries update patient data as changes occur. APMS was the base system for all other modules of the Patient Care System.

RESOURCE SCHEDULING MODULE (RSM) The second module of PCS, Spectrum's Resource Scheduling, was implemented in March 1989. This replaced an inefficient manual system of booking the hospital's 150,000 annual clinic appointments. RSM improved utilisation of clinics and specialists, saved time in making appointments, made better use of vacancies and provided better management information.

CLINICAL CARE SYSTEM (CCS) The third PCS module implemented in July 1990 was the Spectrum Clinical Care System. This is an order entry and results reporting system which is being progressively introduced to all ancillary, allied health and clinical measurement departments. CCS also has add-on modules for nursing care plans, charting, discharge planning and medications, although the nursing component has not yet been purchased by the department. Apart from the additional cost, it would not be prudent to introduce these modules for nursing care while computer terminals are centralised at the workstation. This may lead to untimely entry of information with a resultant increase in the number of errors of omission, increase the nurses workload, decrease productivity and propagate a negative attitude towards using computers. Nurses are accustomed to charting and documenting patient care at the bedside where the majority of charts are kept. Only the patients' medical records with progress notes are retained at the workstation. Clearly, a decision to fully implement the nursing component of CCS without the appropriate hardware will have the greatest impact on nurses and physicians as they are the people who enter treatment and orders and access results.

STUDY METHODOLOGY

Concord Hospital's advanced position in integrated systems for patient care provided a solid foundation for the study to evaluate the point-of-care system. The study methodology, jointly developed by IBM and Anderson Consulting, included demonstrations of the IBM Clinical Support System and interviews with all participants. Twenty-two nursing unit surveys and questionnaires were completed by nursing unit managers and senior registered nurses. The study participants included nine nurse administrators, twelve nursing unit managers, five clinical nurse consultants, ten senior registered nurses, six physicians, and eleven other department heads and executives.

RESULTS OF THE STUDY

The nursing unit surveys and interviews indicated that there were many areas of dissatisfaction with the current information systems. Several issues were related to deficits in the level of staffing while others dealt with the need for

greater accountability. The following is a summary of the most significant problems identified by the study participants:

GENERAL PROBLEMS

Shortage of Registered Nurses.
Higher patient acuity leading to an increased workload.
Less time for patient care due to excessive paperwork.
Decentralisation of data entry functions to ward level with insufficient computer terminals.
Lack of accountability and knowledge of legal requirements for documentation.
Less time for in service education.
Time spent moving between patient rooms and the central workstation.
Lack of experienced registered nurses to teach and guide junior staff.
Poor communication between health professionals.

CHARTING AND DOCUMENTATION PROBLEMS

Illegible records.
Excessive duplication of information.
Patient documents kept in various locations.
Missing charts and missing pages from documents.
Multiple parties requiring access to documents at the same time.
Omissions and untimely posting of data to charts.
Changes to patient care not accurately recorded.
Lack of uniformity in using abbreviations.
Poorly maintained charts.
Lack of standardisation in documentation methods.
Insufficient detail or unnecessary information in progress notes.

EXPECTED BENEFITS

The potential benefits of a point-of-care system were identified from data gathered in nursing unit surveys, questionnaires and interviews (see Figure). The benefits include the following:

INCREASED LEGIBILITY AND ACCURACY One hundred percent of nurses surveyed agreed that legibility and accuracy of documentation would be the most significant benefit of the point-of-care system. Legibility of handwriting is a consistent complaint which can lead to errors of transcription, interpretation and calculation. Accuracy in calculating data is guaranteed with automatic

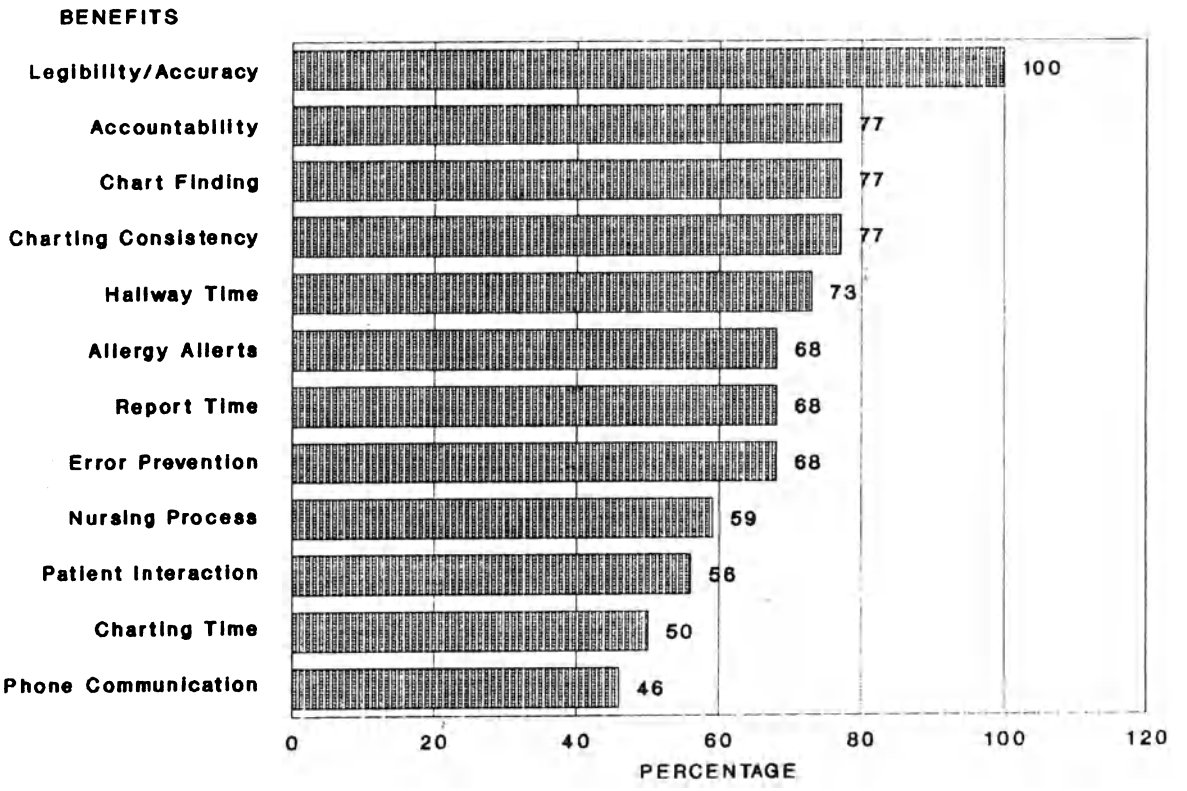

Figure: Clinical Workstation Expected Benefits

summation. Manual recording and transcribing from flow charts is eliminated as the convenience of direct entry to the bedside system facilitates immediate capture of data on completion of a task.

ACCOUNTABILITY FOR PATIENT DATA Seventy-seven percent of nurses surveyed perceived that a point-of-care system would result in increased accountability as the system captures the user identification for all data entries.

DECREASE THE TIME SPENT IN LOCATING PATIENT CHARTS Seventy-seven percent of nurses surveyed agreed that because the bedside system would allow access to information from any terminal linked to the network there would be significant time savings. The current system restricts access to one person at a time whereas the point-of-care system provides simultaneous access to health care providers.

IMPROVED CHARTING CONSISTENCY Seventy-seven percent of nurses surveyed perceived that charting would be more consistent because there would be standardisation of text, abbreviations and pre-determined data flows and formats.

DECREASE HALLWAY TIME Seventy-three percent of nurses surveyed believed that there would be a significant reduction in hallway travel because the need to move between patient areas and the central workstation to record data would be reduced. The data would be entered or accessed from any point which has a terminal. Tribulski (1989) claims that a bedside terminal saves each nurse 1.5 hours per shift in comparison to saving 0.5 hours per shift when the terminal is located at the central workstation.

PROVIDES ALLERGY ALERTS Sixty-eight percent of nurses surveyed agreed that because a point-of-care system requires a single entry to reflect allergies in a strategic area of the patient's charts it will be a more effective way of recognising allergies.

DECREASED REPORT TIME Sixty-eight percent of nurses surveyed believed that the system would significantly reduce the time spent at the handover report. This is because the need for manual transcription and lengthy verbal exchanges are reduced.

IMPROVED ERROR PREVENTION Sixty-eight percent of nurses surveyed believed that the system would reduce the error rate because of the clarity and legibility of information, particularly in relation to medications, calculations and interpretation of data. This is supported by Tribulski (1989) who claims that

one hospital virtually eliminated medication errors after installing a point-of-care system.

INCREASED USE OF THE NURSING PROCESS Fifty-nine percent of nurses surveyed indicated that the system would encourage use of the nursing process. The point-of-care system follows the steps of the nursing process and provides an integrated discharge planning facility which automatically identifies outcome criteria which have not been met.

INCREASE NURSE PATIENT INTERACTION Fifty-six percent of nurses surveyed believed that a point-of-care system would enable nurses to spend more time at the bedside as this will be the point of data entry. Tribulski (1989) reports on a study which found that increased nurse/patient interaction does occur with a bedside system, increasing patient satisfaction and decreasing patient falls.

DECREASED CHARTING TIME Fifty percent of nurses surveyed perceived a significant reduction in charting time because of the reduction in duplication and the ability to enter data at the source. This was expected to improve once nurses were familiar with the system.

DECREASED PHONE TIME TO MEDICAL STAFF Forty six percent of nurses surveyed believed that because medical staff can enter orders, add to progress notes and retrieve information from any terminal, telephone calls would be reduced.

BENEFITS TO PHYSICIANS

IMPROVE ACCESS TO PATIENT DATA Physicians frequently experience problems in locating patient charts which may be in use by another health care provider. This is seen as one of the major inefficiencies of the paper charting system. A point-of-care terminal linked to the host information system would allow simultaneous access to patient data.

EASIER REVIEW OF INFORMATION As all information is available from one location in standard formats with no problems of legibility, review of patient data will be made easy.

INCREASES THE TIMELINESS OF DATA COMMUNICATION Communication of data is often complicated by late entries in charts and progress notes. Frequently charts are unavailable as they are being used by another staff member or the medical record and patient charts may have left the ward with

the patient who is scheduled for a procedure. With automated information, data entry and retrieval is always possible at any terminal location.

BENEFITS TO OTHER DEPARTMENTS

PHARMACY A point-of-care system interfaced with pharmacy management and the host information system would reduce costs as there could potentially be a reduction in wastage of stock items. It was also postulated that with better information the pharmacists could more easily monitor drug prescribing to ensure appropriate ordering of drugs. The chief pharmacist believed that appropriate chemotherapy could lead to a reduced length of stay for some patients and potentially prevent readmissions.

MEDICAL RECORDS The review process with the current medical record is complicated by illegible handwriting, missing charts, inappropriate charts, irrelevant data or insufficient data to code and complete the medical record. Automated notes which could be printed in the medical records department would streamline the review process.

QUALITY ASSURANCE DEPARTMENT The quality and accessibility of information on the point-of-care system facilitates the utilisation review process. Auditing patient care processes is made easier and accountability for patient data is improved as a user identification is assigned to all entries.

OTHER BENEFITS

INCREASE DATA ACCESS FOR RESEARCH The volume and complexity of data collected in the manual system does not facilitate research. Automation has the advantage of speed, accuracy and flexibility providing better information at all phases of the data gathering, data analysis and communication process.

TANGIBLE BENEFIT ANALYSIS Showing the financial benefits that will accrue from implementing a point-of-care system is a difficult task as many of the benefits are intangible. In addition, as the IBM clinical workstation has not yet been released in Australia, the cost of implementing the system is not available. From the nursing unit surveys it was estimated that an average of 50 minutes per nurse per shift could be saved using a point-of-care system. It was agreed that time saved in nursing could be re-applied in six major ways.

1. More time for direct patient care.
2. Improvements in charting and documenting care.
3. More time for nurse education.

4. More personal time.
5. Expansion of hospital services.
6. Reduction in nursing expenses.

Other tangible savings opportunities which could accrue to the institution include: 1) Reduction in pharmacy costs, 2) Improved billing data for supplies and medications, and 3) Reduction in expenses. The total annual savings in nursing hours was further analysed to estimate the proportion of time saved that could be converted to a dollar value. For the purpose of the study four different cases for realisable dollar savings were compiled. The cases assumed from 20% to 100% of the total gross savings that could fall to the bottom line. From the tangible benefit analysis it was estimated that a bedside system could be cost justified over a period of three to five years.

DISCUSSION

The joint study conducted by Concord Hospital and IBM indicated that there were significant benefits to be gained from the introduction of a bedside system into an Australian Hospital. Hardy and Douglas (1990, p.62) assert that the nursing unit is "the most concentrated information, paper, people and process centre of operation in a hospital" with the central workstation as the focal point of communication. While the introduction of automated systems for patient care have provided timely and accurate data, information on a unit at Concord Hospital is only accessible at a central workstation where computer terminals are located. Centralisation of computer terminals inhibits updating patient data, ordering tests and accessing results in a timely manner which results in the Patient Care System not being used to its full potential (Herring and Rochman, 1990). For example, prior to the introduction of the order entry and results reporting system (CCS) at Concord Hospital, medical staff were accustomed to manually completing forms to order tests and procedures at the patient's bedside. Now they must return to the workstation to enter the orders, which is frequently on completion of ward rounds. Clearly, this is less efficient than the manual system as many of those tests or procedures could have been attended to before ward rounds were completed. This is a frequent complaint from medical staff who may be more accepting of the system if there was better access to computer terminals.

A point-of-care terminal at the patient's bedside would address these problems as it allows data to be captured at the source. As Mowry et al. (1986) contend, care is given to patients who are located in beds, and as more than 50% of information about the patient is gathered at the bedside, it seems logical that the terminal should be located at the source of the data. This saves time, reduces errors of omission, transcription and interpretation and eliminates

duplication. A point-of-care system interfaced with the host information system will enable health professionals to communicate with hospital departments from the bedside.

SUMMARY

A joint study conducted by Concord Hospital and IBM, Sydney verified the benefits of a bedside terminal and nursing system that was developed in North America. The aim of the study was to determine the suitability of a system for use in Australian hospitals. As Concord Hospital has successfully implemented three modules of Spectrum's Patient Care System, the challenge was to identify strategies to increase efficiency and accuracy of the documentation process while providing nurses with more time for patient care. This study indicated that a bedside system such as the IBM 7690 Clinical Workstation using the Spectrum point-of-care clinical software series, would provide a solution to the inefficiencies of the current system. This nursing system is designed to meet the unique requirements of the nursing process and the clinical environment in which nurses work. The introduction of a bedside system would bring positive benefits to health professionals by providing a means to manage scarce resources more efficiently and redirect time saved towards patient care.

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4 -- Vision On Bedside Nursing Information Systems

H.B.J. Nieman, A.R. Bakker

INTRODUCTION

In most hospitals nurses still use paper and pencil to document patient care. However, there is a clear need for new tools, supporting data handling in nursing. This paper describes the concept, scope and development of an information system for the nursing practice, based on bedside terminals.

The main aspects of the link between a nursing and a hospital information system are discussed. Progress and experiences of the BAZIS approach to create an integrated 'point of care' nursing system (VISY) are reported. Facts and figures about the state of the art of bedside information systems are presented.

BACKGROUND

The average length of stay of patients in hospitals has been reduced by several days over the past decade; the same volume of care has to be given within less time. Therefore nursing has become more intensive. In addition to this, due to developments in medical treatment and technology, the complexity of nursing has increased as well. These trends in health care have an impact on the nature and volume of nursing documentation and communication. Ever more data have to be collected and processed as care and cure processes rely on accurate documentation and efficient communication of patient data.

Changes in the nursing profession itself require an additional administrative effort, especially the introduction of the nursing process: the assessment, planning, providing and evaluation of care. In order to document these activities, care plans are used that reflect the patient's problems and the corresponding nursing interventions. The data of the primary process can be considered as a source for management information as well as for education and research. Cost reduction has become a major issue, since the fee-for-service system has been replaced by budget financing. Personnel costs are over 65% of the total hospital budget: about 45% of the employees are nurses. So, hospital management has become interested in the productivity of nursing services. Third parties and government need ever more data related to the care and cure processes of hospitals in order to control the increasing health care

budgets. However, data stored in paper patient files are available at only one location at the same time, in a format that is not suitable for further processing.

There is already a shortage of nursing and clerical staff in some hospitals, and it is expected that serious staffing problems will arise in future, since fewer young people enter the nursing profession. At the same time, the number of patients admitted to hospitals will increase due to the ageing of the population. Under these circumstances it becomes difficult to keep the quality of care, together with the standards for documentation, at the desired level (Bakker, 1986).

Nurses need an adequate tool to be able to improve the efficiency and quality of both data handling and patient care in a clinical environment: a Nursing Information System (NIS).

HIS AND NIS

The hospital information system (HIS) should facilitate the communication of data to other departments like radiology, the laboratories and the pharmacy and give access to historical data of the patients. The HIS infra-structure (terminal network) will serve as a vehicle for communication of data. The HIS should provide a central database for storage of patient data as well as sufficient computing power to process the clinical data quickly and efficiently. A nursing information system consists of a series of interrelated functions to support the daily care activities of nurses (Nieman, 1988). A NIS cannot be created by just combining existing HIS-functions: special attention should be given to conceptual and technical integration aspects, as many nursing interventions are inter-related. A stand-alone or departmental system will not meet the requirements as data entry at the ward initiates automatically activities in other departments. A NIS should be embedded in a Hospital Information System (HIS).

NIS CONCEPT

As any on-line and real-time information system, a NIS should provide facilities for:

- data collection at the source; the place where care data originate only once
- entry of data only once
- data processing and making information available to authorized workers, when and where they need it
- presentation of information in a structure and layout tailored to the needs of the individual user.

The functions of a NIS focus on support of clinical nursing care activities, like: patient assessment and care planning, A.D.T., vital signs, fluid balance, medication, X-ray appointments, meal selection, lab specimen collection, progress notes and order entry/communication. Care is only partly delivered from the nursing station; many nursing activities are performed in the patient's room. The place where most of the nursing and medical data originate, and where information is needed is at the patient's bedside (Heemskerk-van Holtz, 1988). In order to capture the data at the source, NIS technology should be based on either portable, handheld devices, a stationary terminal per room or bedside workstations. Nurses tend to prefer the bedside workstation (Pryor, 1988).

STATE OF THE ART

The development and implementation of "point of care" information systems has just started. In 1987 only 30 hospitals in the USA and Canada introduced bedside applications, on a limited scale. Presently in the USA 0.2% of the hospitals under 300 beds and 1.4% of the hospitals over 300 beds are using bedside terminals (Herring, 1990). Vendors offer a variety of technologies: from a fully integrated system (Ulticare by HDS) with standard bedside terminals, to stand alone systems for charting basic care data, based on specially designed patient room terminals, linked to a PC at the nursing station (MedTake, MHS) (Hughes, 1988). CliniCom focuses on medication, using a handheld device with barcode reader that is linked to a host via radio frequency (Clinicare). Critikon links an electronic vital-signs-measuring unit with a shoe box-sized nursing terminal mounted at each bed (Vitalnet). Hewlett Packard (Careview 9000), Emtek (System 2000) and Marquette (EPIC) offer data management systems for Intensive Care environments that include or might be linked with vital sign monitor systems. SpaceLabs introduced PCMS BS-Chart/Chart Master in ICU's for vital signs, medication, nursing notes and retrieval of laboratory test results.

Latter Day Saints Hospital at Salt Lake City has been replacing its dumb bedside terminals by personal computers (HELP System). T.D.S. moved standard terminals to the patient's bedside in three hospitals for an experiment of six months (Healthcare 4000). Recently IBM introduced an IBM 7690 Clinical Workstation to be placed at the bedside or in the patient room.

Prices of these systems range from about $2000 to more than $10,000 per bedside device. Vendors claim an increased nursing productivity, more complete billing, improved documentation, a reduced length of stay and savings of more than 30 minutes per nurse per shift. However, many bedside systems have yet to be evaluated and cannot be cost justified. The efforts demonstrate

that automation in health care is moving towards the place where the client/patient receives his care. It is likely that the concept of bedside data capture will become the standard for nursing information systems (Hannah, 1988). However, there is still a long way to go: a global (questionnaire based) survey on the use of computer applications by nurses at clinical wards showed that the area of NIS in Europe is still in its infancy (Heemskerk-van Holtz, 1989). The European survey covered 57 institutions (both HIS vendors and hospitals) in 11 countries. It indicated that there are not (yet) any complete Nursing Information Systems available and that the use of general HIS applications by nurses is very low. At more than half of the wards, as covered by the survey, there are no terminals or printers installed at all. Nurses' use of HIS applications is often indirectly by means of forms and printouts that are entered into the HIS by clerks. General patient administration functions (e.g. ADT) and general applications like word processing appeared to be the most frequently used applications.

Nevertheless, some promising developments have been started in Europe. At a pilot site in the Elizabeth Garrett Anderson Hospital and the Royal National Throat, Nose and Ear Hospital, London, UK, nurses use portable bedside terminals to store admission data and to create individual care plans for patients (Woods, 1989). In the University Central Hospital of Oulu, Finland 23 bedside workstations have been installed (orthopaedic clinic) for storage and retrieval of data from medical and nursing records (Niinimaki, 1989). BAZIS is developing an integrated nursing system called VISY (in Dutch referring to both NIS and vision). The software is implemented in a 32 bed pilot unit at the Leiden University Hospital in the Netherlands. From May 1990, nurses record vital signs on bedside terminals (Nieman, 1989). In the RICHE project of the European Community nursing has been identified as a major application area (RICHE, 1989).

VISY: AN INTEGRATED NIS

Since 1972 BAZIS, the Central Development and Support Group HIS in the Netherlands, has been developing an integrated HIS, including nursing applications (Pluyter-Wenting). The BAZIS-HIS is implemented in more than 45 Dutch institutions, covering over 20.000 beds (Bakker, 1990). In 1987 BAZIS started the development of an integrated Nursing Information System, called VISY. VISY is based on the concept of bedside terminals. The development initially has taken place at a pilot unit at the Leiden University Hospital, a 32 bed nursing unit for infectious and general internal diseases.

VISY: FUNCTIONAL COMPONENTS

In the design of VISY, the support of the nursing process takes a central place (Figure 1). The patient oriented care plan is fed by data coming from former stays and outpatient clinic contacts (history), the intake conversation (admission data), knowledge stored in standard care plans and continuous assessment of the patient's self-care deficits.

The care plan for an individual patient shows all problems identified for that patient, together with the corresponding interventions and goals. The development of care plans is the responsibility of professional nurses. The work plan shows all nursing activities to be performed for a single patient during a certain period of time. Apart from care plan data, a work plan contains also nursing activities that are based on orders from other disciplines. The work plan is also a tool that enables the scheduling and coordination of activities for an individual patient. A document (function) that reflects the work plan in a patient-oriented way is the agenda of the patient. The agenda shows patient-related events in terms that can be understood by the patient. Apart from work plan data the agenda contains general information like visiting hours, doctors rounds and dinner times.

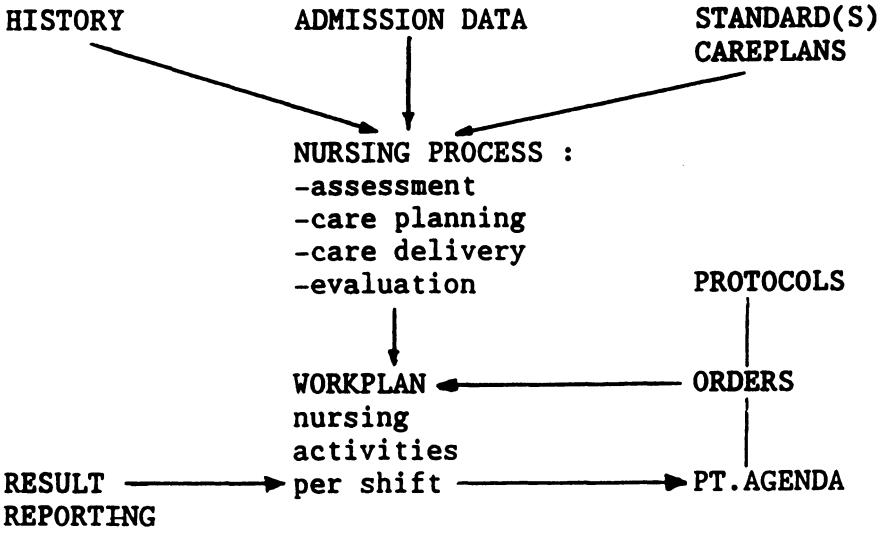

Fig.1 Major functional components of VISY.

VISY: DEVELOPMENT

In order to investigate and to demonstrate the feasibility of a NIS, a maquette called VISION has been developed by BAZIS (Gondelach, 1988). The maquette consists of a series of over 400 terminal (or PC MS-DOS) screens, showing the main functions of VISY:

- admission and discharge
- vital signs
- individual care plan
- fluid balance
- medication
- result reporting
- X-ray appointment
- protocol processing
- nursing work plan
- patient agenda
- information retrieval

The model is based on a script in which a patient with the diagnosis acute lymphatic leukaemia is being admitted to the hospital. The patient is being treated with chemical therapy. Requests are made for laboratory tests, orders for medication are given and an appointment is made for a colon X-ray. Since integration is essential for a nursing information system, several aspects of integration are simulated in the maquette.

An appointment for a colon X-ray "explodes behind the screen" into a series of actions and registrations. First the system checks if there are possible contra-indications or conflicts with other appointments for this patient. Then the agenda of the radiology department is checked to see if facilities are available at the desired date and time. When the appointment is made all nursing activities related to a colon X-ray are identified and recorded with date and time on the nursing work plan. Medication orders are registered and activities in which other departments are involved are initiated, e.g. transport to the radiology department, refilling of drug stock in the nursing unit. Finally the system gives the opportunity to add problems of standard care plans related to colon X-ray to the individual care plan of the patient.

The maquette-approach proved to be successful. Nurses participating in the development process got insight in the possibilities and constraints of the computer. Presentation of the model in BAZIS hospitals provided input for both the specification of software and the priorities in the development of VISY. The model provided standards for the design of the system (e.g. screen-layouts, menu structures, help function) in an early phase of the project. It stimulated data definition and uniformity of terminology. Informaticians got a better understanding of nursing activities. A high level of integration has been established even before any software has been developed.

After the introduction of the maquette, the development of VISY software started. At present a function for storage and retrieval of vital signs is being

used on bedside terminals. Nurses became familiar with bedside data processing and the VISY vital sign function has become daily routine. Encouraged by this successful first step, further developments are being prepared: care planning, work plan/agenda, medication, order communication and protocol processing.

A key for success in the development process is the close co-operation between nurses, doctors and informaticians. In a project team (meeting almost daily) feasibility studies and system specifications are being worked out. Apart from the project team, the VISY project is supported also by a multidisciplinary implementation group (meeting monthly) and a steering committee (meeting quarterly). Only a joint effort of all disciplines involved will make a NIS development successful.

CONCLUSION

There are many stand alone nursing applications marketed today. However, "island computerization" will not satisfy the needs of clinical users. The nursing practice requires an integrated system, preferably a bedside oriented NIS. Such a system should support the nursing process, generate a work plan, allow for order entry and communication of data, protocol processing and offer scheduling facilities based on an agenda-mechanism. These building-blocks of the NIS are all inter-related. So the NIS should provide a high level of integration of data and functions. The NIS itself should be embedded in a HIS-environment.

As the costs of technology decrease further, point of care data capture can be cost justified. An integrated nursing information system, available on bedside terminals, will provide a perfect match of functionality and technology. Such a combination allows nurses to enter data and retrieve information in a very efficient way. Therefore, an integrated bedside NIS will improve the quality and efficiency of nursing care.

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5 -- Bedside 90 -- A New Concept In Information Handling At The Ward

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ABSTRACT

During the past decades a vast number of new methods in diagnostics and therapeutics have been introduced into health care. Potent medicines are now available to treat successfully earlier "incurable" diseases. However, many of these new therapeutic methods also require strict(er) routines. Furthermore, more specific data concerning both the "method" and the patient may be needed (eg incompatibles, interactions) to accomplish safely the gains of these new and often costly methods.

Parallel with this development of a more "information intense" health care system, the number of physicians, nurses etc. per wardunit is increasing, and each hospitalised patient is today seen by more staffmembers. At the same time the information handling in the wards in Sweden is essentially the same as it was some twenty years ago.

The obvious need for alternative solutions prompted us to develop a new concept of handling patients' information in the hospital ward. The idea of providing and recording relevant information at the "point-of-care" was tested in a 22 bed ward at Huddinge University Hospital. By use of available Swedish software programs for medications with built in support systems (eg recommended and available drugs, side effect profiles, dose adjustments, interaction warnings) and an "unsophisticated" portable PC or terminal, we were able to test the idea in three real time periods in 1988.

The three weekly test periods illustrated well the technological demands a point-of-care "information processing/decision making" system (Bedside 90) will have to meet (response time, portability etc). It was also obvious that "medications" cannot be taken out of their medical context, and medications only cannot justify a bedside system. Such a system will justify itself when all medical data handling is integrated into a support system. Based on these experiences a prototype, designed in collaboration with nurses and physicians in 1990, was very well received by personnel outside the project exposed to the system, representing different medical fields in different Swedish hospitals.

Furthermore, our results support quality assurance (QA) findings from the USA and Sweden, showing that computerised bedside medication systems will have a significant impact on QA and that medication errors can be nearly eliminated.

6 -- Point Of Care Terminals: A Blessing Or A Curse?

Judith Shamian, Betty Hagen, Ruth Brenner, Philip Lohman

INTRODUCTION

Nursing is an information intensive profession: nurses constantly assess, plan and evaluate patient status and care. Nurses gather and organize patient data in order to make clinical decisions and maintain detailed documentation that follows the patient throughout the hospital stay. As in other information-intensive professions, the more the nurse can close the gap between the source of the information and the place where she must store it, the more effective she is and the more efficiently she can work. Hence, the growing interest in point-of-care computer systems.

Bedside, or point-of-care, terminals are an important option to consider when attempting to create a positive working environment. In the literature there are a number of reports on current experiences with point of care systems (POCS). St. Joseph Hospital in Milwaukee, is one of the hospitals that has evaluated the potential benefits of POCS. The financial pay back benefit was estimated at 28 full time equivalents (FTEs) or $1,218,000 on the low end. On the high end: $2,094,000 of saving was predicted. (K. Kahl, 1990). In Salt Lake City, G. Halford, M. Burkes, and T.A. Pryor, (Halford, Burkes, Pryor, 1989) compared bedside terminals with pod, or workstation terminals. A second study of bedside terminals was conducted by Peat Marwick Main and Co. of Baltimore, Maryland and reported by F. Cerne (1989). The study was conducted at Nebraska Methodist Hospital, in Omaha, Nebraska; Saint Joseph's Hospital in Atlanta, Georgia; and Frankford Hospital in Philadelphia, Pennsylvania. A review of these two studies revealed that the use of bedside terminals affected the professional nursing environment in five ways: decreased workload, improved quality of care, increased positive public relations, improved communication, and increased positive perception of administration. These findings and others led to a growing interest in POCS.

Before a hospital makes a decision on the acquisition of a point-of-care system, it should consider a number of facts very carefully. In this paper we discuss seven factors that should be considered prior to commitment to point of care technology.

FACTORS TO BE CONSIDERED PRIOR TO THE ACQUISITION OF POINT OF CARE TERMINALS

FUNCTIONALITY What do you want the system to do? Does it fit the organizational goals for automation? Most of the following functions can be done by most point of care systems, but not all systems can perform all functions. It is important to determine which applications are necessary. Those functions to consider include: patient assessment; nursing diagnosis; care planning; order entry; medication administration record; kardex; clinical flow records; planned activity list; nursing documentation; nursing progress notes; chart management; patient education; and, for intensive care environments: instrument/monitor interface, cardiac and neuro flow sheets, and ventilator monitoring.

LOCATION Where do you want to put the terminal? Different systems are designed for different types of placement, and allow different degrees of flexibility. The Critikon Vitalnet, Clinicom/Cliniview and IBM 7690 (with Hill-Rom mounting) can only be located on the wall. The IBM has to be placed at or near the headboard, because it uses the Hill-Rom Datalink. Other systems allow more freedom -- the MedTake system uses a small, proprietary terminal which is relatively easy to move around the room, although your options may be limited by cabling.

Check to make sure that the terminal has been approved for UL 544 for current leakage and placement at the bedside. Not all terminals have yet received this approval. Consider patient confidentiality policies when choosing the location of POCS. Patients will occasionally attempt to log on to the system so it must be password-protected and the nurse should make sure that the patient cannot see her enter her password. Otherwise, it is not necessary to place terminals so the patient cannot see them. Research findings indicate that many patients become quite interested in the clinical system and enjoy watching the nurse use it.

INTEGRATION To what extent will you require that your POCS be integrated with the hospital's existing/or planned patient care system? Most POCS vendors comply with the HL-7 interface standard, which eases interfacing. Integration at the bedside will be <u>functional</u> integration in most cases i.e., the nurse is able to access the order communications system without having to log off the POCS and log onto the Patient Care Information System (PCIS).

POCSs can, of course, be installed stand-alone at first, if the hospital has, or is in the process of obtaining, a new, non-POCS-capable Hospital Management Information System and Nursing wishes to automate the bedside early. This requires manual entry of some ADT data and tracking orders at the nursing station, as the hospital will probably be doing already. The full range of nursing

functionality is available regardless of whether the POCS is integrated with the patient care information system; it is just that more data has to be handled manually until the interface is completed. When evaluating systems integration, the hospital should be certain that the vendor reference sites are on the current releases of both the PCIS and POCS involved, and that reference sites are production sites.

POCS BENEFITS What are they and how are they achieved? Our experience suggests that clinical and financial benefits should be assessed when exploring POCS. We have also found that the highest clinical benefit of a fixed point of care terminal is in intensive care units, as the nurse spends many hours with a few patients, relies continuously on information and there is a large amount of information that must be managed on each patient.

An identification of expected benefits should be outlined. The following points should be considered during this identification process:

- Caution should be taken about vendor claims for time saved and other quantitative benefits (such as reduced med errors). The hospital will need to talk directly to people at the reference sites, rather than asking questions through the vendor.
- Caution should also be taken in managing expectations: Do not let the administration, or the board, get the idea that overtime is going to go to zero the day after the POCS is implemented; it will not. Rather, a realistic schedule (eight weeks, for example) should be worked out for overtime reduction and then care should be taken that this schedule is enforced.
- Spending more time at the bedside is not always a desired benefit. Many nurses report that they feel isolated unless they can spend some time at the nursing station.

Some benefits are hard to quantify, but they are real nonetheless. These include: 1) reduced medication errors. This is a key quality-of-care indicator, 2) improved quality of documentation, with Unit Managers and Head Nurses spending much less time in Medical Records trying to decipher charts for Medical Record Technologists, 3) improved morale (which leads to easier recruitment and retention of nurses), 4) reduced risk and liability exposure, 5) easier, faster patient education (applicable only if your POCS has a patient education module), and 6) cost benefit. Many of the vendors and users claim a real time savings by

POCS. The hospital should decide ahead of time what it will do with the predicted savings so it can be converted to real dollars if so desired.

When determining an analysis of benefits achieved, the hospital must distinguish between:

a) Benefits derived from bringing nursing capabilities (charting, assessment, etc.) to the nursing station.
b) Benefits derived from bringing these capabilities to the bedside.

Before reporting benefits, the hospital must also be certain they are sustainable benefits.

IMPLEMENTATION STAGING What is the best sequence of implementation activities for your hospital? The hospital will probably want to bring up a pilot unit initially, rather than converting the entire Medical/Surgical service at once (for example). Clearly, the choice of a pilot site should be made with training in mind: which unit has been most receptive to new ideas and change in the past? Which is likely to be the easiest to train? The hospital may then wish to make the next unit be the unit which has been the hardest to train in the past.

If there are separate systems for POCS and PCIS, it may be necessary to train on both systems. This is confusing and could inhibit consistent adoption by staff. The hospital should work toward one operational system so one training system will prepare nurses to perform on all information systems. The system chosen should be as user-friendly as possible, with clear prompts.

PHYSICIAN ACCEPTANCE How will the physicians react to the POCS? Our experience with various hospitals in North America suggests that usually five to ten percent of doctors oppose the POCS and refuse to have anything to do with it. Another five to ten percent are highly motivated, and the remainder are moderately and benignly interested. At some hospitals, many physicians are active participants and want to see what they can do with the system.

Some factors which influence physician acceptance are how the POCS is introduced to the physicians and has provision been made for physician involvement in the POCS procurement. Have the benefits to them been pointed out and have their concerns been addressed?

FINANCIAL What are the financial implications of the POCS project? This is a matter of comparing costs to benefits. To achieve a correct financial projection, it is important to conduct a joint clinical and cost analysis. With healthcare funding shrinking, there is an increasing demand for solid cost justification. It is becoming increasingly apparent that POCS benefits are there -- however, in many cases, costs have been higher than estimated. While it is common to find cost

overruns in adapting to new technology and costs are normally brought under control as an industry's experience with a technology matures, the hospital should be careful to examine the experience of a vendor's production sites in this regard.

Some vendors, such as IBM, have stated POCS product design requirements will save one hour per nurse per shift. If a POCS costs $5,000 per bed, the payback time will be approximately two years. But these are merely goals; it is important that the hospital validate any claims of time saved with production references -- and by looking at hospitals where the product is installed, but look at those not cited as references.

As the battle over clinical quality and the cost of care intensifies, nurses can find that the POCS, if carefully selected and properly managed, gives them a powerful tool. Institutions also have the responsibilities to collaborate with industry in further developing and strengthening the POCS systems.

In summary the POCS could become a curse or a blessing. In this paper we have attempted to offer you, based on our experience, factors to consider. If these factors are considered before and during POCS implementation, you have good potential to have a POCS which is a blessing. Any form of technology adoption to a clinical site requires collaboration among numerous groups. The more you anticipate and preplan as a project team the more blessed you will be.

The seven factors we have discussed in this paper are the main issues to consider. The examination and response to these factors should take place in a collaborative fashion between all stakeholders. Some the key stakeholders are nurses, physicians and information systems experts. Institutions should be realistic in anticipating benefits. Whether a POCS system is a curse and a blessing is strongly dependent on the upfront work and conclusions by the key stakeholders.

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7 -- An Introduction To Basic Computer Concepts

Lidia Mayner

INTRODUCTION: BASIC COMPUTER CONCEPTS

One of the more popular philosophical discussions about computers is "Do computers think?" or "Can machines think?" The way to answer such a question, like any other question, one would read about the topic then come to an opinion. This seems a perfectly logical and sensible suggestion until one starts reading computer books and becomes totally bewildered and lost with the computer "jargon".

Computer "jargon" is no more, than perhaps, a computer language, simple, descriptive, logical but most confusing if one is not familiar with the terms. Computing "jargon" uses terms to describe, for example, the hardware and software. Even these two simple terms are computing "jargon" and to the unsuspecting reader, these terms could be totally unfamiliar and meaningless. Why then use such terms? With every new invention there is new terminology, with new scientific discoveries there is new terminology and computing "jargon" has simply followed tradition. Those who work or are involved with computers use computing language as many people use English everyday, some computing experts may not even realise that what they are saying may be quite foreign to a great deal of the population. Where can one learn these terms, become familiar with computing language, learn how to use computers? These are some of the many questions, many people ask very often. The answer is quite simple, read many books, have infinite patience and think logically. I believe these three concepts are the underlying essentials for anyone to learn computing terms and how to use computers.

HISTORY OF COMPUTERS

Although the abacus and slide rule could be regarded as items to facilitate calculations, could these be regarded as the first "computers"? These instruments could be described more as mechanical devices rather than computers since they did not have electronic components. Nonetheless, it could be seen as a first step towards making some type of "instrument" facilitating a task which would otherwise be performed by one with pencil and paper. The first recognised computer is attributed to Charles Babbage, who in 1832 began work to design a general purpose computer (Baker and Beveridge, 1970). In

1945 a valve driven computer was produced in America. These models were bulky and slow, compared to our present standards (Baker and Beveridge, 1970). With the rapid evolution of electronic parts such as the microchip and integrated circuits, computers have become smaller and much faster. Today, most offices, schools, hospitals and homes have a computer. Each place will have quite a different use for a computer but nevertheless society nowadays has integrated itself considerably with computers.

THE BASIC PERSONAL COMPUTER

The PC is the most used computer at present, this hardware either consists of a monitor, system unit and keyboard or a portable where the three parts are all included in one easy to carry type unit. The system unit, the "heart and soul" of the computer, can contain up to four disk drives and even a cartridge slot. The disk drives are either hard disk, meaning a device which can store up to 20 or 40 or higher megabytes of information (a byte when referring to a hard disk or diskette is a measure of the storage capacity). The hard disk is usually inside the system unit and is not visible. The visible disk drives can be for either the 5 1/4 " or 3 1/2" diskettes. Usually the slots for these diskettes are placed on the front of the computer or in some computers, particularly portables, the disk drive is located on the side. The amount of storage (measured in K, Kilobytes or M, Megabytes) on diskettes varies from 360K to 1.2M for both 5 1/4" and 3 1/2". This amount must match the capacity of the disk drive. If the disk drive has a 360K capacity it will not handle another disk with 1.2M of information on it.

There is a wide range of computers available to the consumer at present. Often when one enquires about a MS-DOS PC one is faced with considerable choice such as an XT, an AT, a 286, a 386, a 386 tower or a 486. This list is not all that is available nor does it include the vast choice of portables. The basic difference between an XT and an AT (AT stands for advanced technology, usually refers to a 286) is the speed and memory (workable) capacity of the machine. The same applies to the 386 and 486. A 386 tower is a computer where the system unit is in the upright position. Needless to mention that as the speed and memory capacity increase so does the price! However, one can put into a computer more memory space (this is a board with electronic parts), so that a 286 can have more memory than a 386, this is usually referred to as the expandable memory. Also, a "top of the range" 286 can have the same speed as a 386. Therefore, it is wise nowadays, when choosing a computer, to choose a model that can be altered to the needs and demands of the future.

The most important aspect of the system unit and indeed the computer and how well it provides for one's needs is the memory capacity and CPU. There is to date three possible types of memory in a computer, RAM: (Random

Access Memory), ROM (Read-Only-Memory) and Cache system. RAM memory, physically is contained as memory chips, the function of these in the computer are to supply work space for programs and handle data (Arntson and Auvil, 1989). The RAM for a computer is customarily described as 640K RAM (K or KB for Kilobytes), 1MB RAM (MB for Megabyte) or 2MB RAM expandable to 8MB. ROM memory is computer storage where programs and data cannot be erased within the normal circuit operation of the computer (Townsend, 1983). Examples of ROM, now often seen as compact disks, are diskettes with Census information, or a set of diskettes containing all the information from an encyclopaedia, diskettes containing information regarding currently published articles such as Medline. The Cache system contains several memories which rely on different speeds. Each memory is dependant on a particular speed so that one could describe this system as fast memory for fast speed, slow memory for slow speed. The computer electronics know which memory speed to work from although all information always goes through the fast memory first (Fields, 1973). The memory of a computer is the amount of work space available, this is measured in bytes which represents a particular number of bits. A bit is the smallest unit in a computer for storing information (Arntson and Auvil, 1989). Another frequently used computer term is CPU, central processing unit. This has direct relevance to the type of system unit eg. XT, 286, 386 or 486. The CPU fetches instructions from memory and executes the instructions. The CPU and memory work together to allow a command eg PRINT to be interpreted and executed then, by a printer, which is sometimes described as a peripheral (Fields, 1973).

THE COMPUTER AT WORK

The keyboard allows one to type instructions into a computer. The monitor, will allow a visual display while the system unit interprets the typed instructions. For the computer to "understand" the typed instructions there is what could be described as "an electronic interpreter" which will read the instructions, transfer them into "electronic language" and allow the instructions to be executed. For example if one was to type 'FORMAT A:' the reply, visually displayed on the monitor is: 'Insert a diskette into drive A: and press enter when ready.' After the user has followed these instructions the computer would begin formatting the disk. The "electronic interpreter" in this situation is DOS (Disk Operating System). This program allows the user to type many instructions which the computer "understands" and replies to it either by asking the user a question, visually displayed on the monitor or carrying out the instructions.

The DOS program is an example of software. Many other programs can be installed on a computer, the restriction being the amount of memory space in the system unit. One of the more convenient software, used extensively, is

word processing. In this situation the computer acts as a typewriter, with extensive functions. Another very useful program is the desk top publisher, this allows so much typing, editing and formatting flexibility that the final product is almost book quality. In both cases, word processing and desk top publishing, the quality of the final printing is directly dependant on the printer quality. There is now a wide range of software available eg. games, graphics, spreadsheet, data base, statistical programs, accounting programs etc.

Computers have become almost an integral part of one's daily routine that it is almost difficult to think how society managed without computers for so long. Most written tasks are now done by computers. These are infinite, to mention a few: to help in human resource management, particularly in hospital wards; as a typewriter in offices; as a drawing tool to a graphics artist; multiple uses for electro-physiological experiments and other scientific experimentation; in advertising, to show predicted outcomes; writers and book publishers. The uses are vast, the service provided by computers is fast and efficient. Computers can be accurate in their calculations, predictions and general output. Indeed computers are extremely useful and very often to all that use them, make work much easier to complete with the final product professionally presented.

One should now go back to the original question: Do computers think? Is this a fair question or is it biased since the computer is unable to ask it?

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8 -- Role Of The Nurse In Implementing Nursing Information Systems

Rita Axford

INTRODUCTION

New roles and responsibilities are emerging in nursing as we become aware of the profession's information systems and the benefits of the computer as a tool to manage them more effectively. This new technology challenges us to do more than learn to operate new machinery. The complexity and cost of different computer systems and rapid changes in hospital computer technology require nursing leaders to have an understanding of many key issues. Only a sound knowledge of hospital information systems and a keen understanding of nursing practice and the information systems which support it will enable us to obtain computer tools useful to the profession. This paper will overview the general structures and functions of hospital information systems, describe common nursing information systems, detail the nurse decision-makers' role in system implementation, and finally, share principles for computer user training derived from a review of the literature and from the author's professional experiences as a nursing systems analyst/computer trainer.

HOSPITAL INFORMATION SYSTEMS (HIS): AN OVERVIEW

The specific set of elements of a hospital information system will be unique to each institution depending upon the structure, size, philosophy, clientele, and resources of the organisation. Computer systems may be described in terms of machinery -- their hardware. While knowing the difference between a mainframe and a personal computer, between a 'dumb terminal' and a local area network are useful, it is the understanding of the structure and functions of the information component the computer manipulates which enables the nurse decision-maker to conceptualise and communicate nursing's information processing needs.

The structures of HIS vary. Some are wholly integrated. That is, each operation of the system has equal access to data; data are entered only once and at their source. Some systems interrelate less cohesively, sharing data on a limited basis, i.e. interfacing systems. A person may be used at intervals to interpret and verify selected data (a 'human interface'). And some systems stand alone. This is the least efficient structure as redundant entry of data is

generally necessary, delays are created and there is increased opportunity for error.

An HIS model may be useful for understanding common terminology, interrelationships, and purposes of the health care industry's information base. Hospital computer systems can be described in terms of three non-discrete categories. Financial/Administrative systems automate such activities as cost accounting, receivables, payables, the general ledger, payroll, and property management. Decision-support systems assist management in the analysis of data produced by other (generally computerized) systems. Examples include case-mix and diagnostic related groups (DRG) analysis, medical records abstracting systems, incident reporting, workload management, and rostering systems. Clinical/departmental systems are designed to assist a clinical department such as pathology, pharmacy, or nursing, with its information management and may serve any or all of the following functions for the specific department: planning, scheduling and documentation of services, quality monitoring, and cost analysis.

Office automation functions do not fit neatly into this model, but are a key part of an HIS. These functions include word processing of supporting documents like policies and procedures, electronic scheduling, diaries, and electronic mail. The rapid expansion of microcomputer applications in the workplace during the 1980s redirected many hospital computer implementation plans as managers saw the immediate value of inexpensive and accessible word processing, database management, spreadsheet and graphic applications.

NURSING INFORMATION SYSTEMS (NIS): KEY ELEMENTS

Nursing may use each of the systems just described. NIS include the financial, decision-support and office automation functions. Nursing also has unique departmental/clinical information systems needs. These clinical systems can be seen to mirror nursing's professionally dependent and independent functions within hospitals: managing the patient environment, and providing direct nursing care. The two clinical information systems fundamental to an efficient nursing department are its order communications and nursing clinical record-keeping systems.

Order communications systems (also called order entry, order management, or patient information systems) track patient data from admission through discharge automating information collection at every phase of the patient's stay. While specifics may vary, the prime thrust of this system is to communicate data between nursing care areas and the ancillary or support areas. Patient supplies can be ordered electronically and ancillary departments provided with computerised requests for services, clinical reports, and costing data. Electronic communication of patient orders for diagnostic and therapeutic

services can provide nursing with a log of services and with outcomes or results reporting. Patient scheduling can be accomplished both for the service departments and for the individual patient. This system provides nurses, physicians, and other health professionals with information which aids patient care delivery while simultaneously providing data for effective resource management.

An order communications system is a most complex system in terms of the scope of interdepartmental interactions and the number of people using the system. Development and installation of the order communication system, by whatever nomenclature, is complicated and fraught with difficulties. The number of departments involved, their respective political and power relationships within the organisation, and the amount and level of compatibility of computer systems with each department, all impact on its complexity. This is often the most expensive system a hospital ever invests in, and whilst it is an inter-departmental information system, nursing is, by virtue of the number of users, the amount of time on the system, and the number of entry and retrieval interactions, its primary user. Nursing must therefore, have high level involvement in system design and implementation. We must understand, explain, and assert our requisites for patient information management.

Nursing clinical record-keeping systems automate the documentation tools used in nursing: care plans, flowsheets, progress notes, and graphics. These systems are relatively new to the marketplace and vary in complexity, flexibility and cost. The most sophisticated of these automate aspects of the clinical decision-making process and may be called 'expert systems.' Simpler systems automate the documentation process by storage of protocols and standard care plans for retrieval by the nurse for specific individualisation. Flowsheets for continued documentation of patient responses to nursing care may be constructed on the computer from the patient's care plan. Costing for nursing care services can be an important by-product of this system.

Decision support systems that serve the nursing department include resource management and quality monitoring systems. A number of software vendors provide rostering and dependency systems of varying degrees of sophistication. Programs that assist the budgetary process are available in the form of general-purpose spreadsheets and as specific budget packages tailored to an institution's own budgetary protocols. Employee record-keeping functions are often similar for the nursing department, personnel, employee health, and staff development, and may be part of an integrated system or a separate system with a shared data base.

Quality assurance information comes in a variety of forms depending on the questions being asked, the data being examined, and the methodology for analysis and reporting selected. Likewise, the computer tools vary. A quality monitoring system can be purchased as a stand-alone system with its own

vehicle for data collection, input, and analysis or may be an integral part of a clinical system. Alternatively, inexpensive and capable systems have been developed from generic spreadsheet, statistics, and graphics packages.

GUIDELINES FOR DECISION-MAKERS

Instrumental decision-makers enact a variety of roles in the hospital hierarchy and include charge nurses, middle managers, and directors of nursing. Armed with a global understanding of the kinds of computer systems we need, nurse decision-makers are prepared to participate with their management colleagues in the cost-benefit analyses needed for effective computerisation decisions. Identification of all costs and benefits is difficult as many outcomes are obscure and far reaching. The following may each be useful to evaluate:

BENEFITS

- Time savings through
  - Reduced duplication in charting and retrieving clinical data
  - Less time communicating relevant patient data
  - Less time developing patient care plans
- Money savings through
  - Decreased use of professionals in clerical activities
  - Better compliance with patient care plans
  - Better risk management due to fewer charting omissions
  - Fewer forms
  - Reduced overhead in managing resources
- Improved human satisfaction through
  - Better interpartmental communications
  - Improved patient and family outcomes
  - Increased professional autonomy by access to critical information

COSTS

- Time expended on
  - Planning and developing systems
  - Implementing large scale change and educational processes
  - Installing the system and initial data base
- Money expended on
  - Purchasing and maintaining machinery and materials
  - Personnel cost outcomes such as attrition or sabotage
- Human dissatisfaction related to
  - Industrial issues through changing work requisites
  - Role ambiguity
  - Computer anxiety
  - Perceived depersonalisation

A critical question remains: In light of current resources and overall department goals and priorities, what is the cost of implementing versus NOT IMPLEMENTING a given computer system, relative to the expected benefits as we know them now? The rapid change in the capabilities and the costs of computer technology makes answering this question difficult as well as tentative. Today's answer requires frequent re-examination.

In addition to cost-benefit analysis, other strategies useful in the computerisation process include mobilising key people to explore the critical issues collectively. This role ensures liaison between nursing, data processing, and other computerisation decision-making sub-groups. Information processing decisions are often political and require collaboration and compromise. Adequate nursing resources including people, time, and expertise must be allocated for successful planning, selection, education, and implementation. Appropriate staff involvement helps guarantee success of an effective system.

Often organisations purchase computer systems from companies specialising in these products. When dealing with vendors it is important to ask if your organisation has worked satisfactorily with this supplier before, and if possible, to find other hospitals who have also dealt with them. Careful deliberation and questioning can ensure a satisfactory purchase. You need guarantees about the specific applications and the hardware requirements to support them. Determine the true status of each application. Has the vendor actually installed each feature or are applications being developed specifically for you. Find out about the skill level and experience of their installation team: what is required of hospital resources including personnel, space, and money. Other questions to consider include:

How does the product protect the confidentiality of information about your patients?
What provisions have been made for upgrading the software as needed?
How much flexibility is allowed in the design and content of the various screens?
What are the noise levels and space requirements of terminals and printers?
How much scheduled downtime is required for maintenance?
What back-up systems are planned?

Good equipment and well designed software are two of the essential ingredients of successful system implementation. System user training is the third. Plan it in detail: who will do the instruction and the evaluation; what teaching methodology will be used; what resource materials will be needed; who will prepare them; and what is the expected implementation schedule and time commitment?

COMPUTER TRAINING: PRINCIPLES AND EXPERIENCES

The structure of a training programme provides the foundation for user success. Established learning principles are as applicable to computer training as to any other teaching-learning environment. Specifically, effective computer training needs organisational support. It should accommodate individual variations in learning styles, address cognitive, affective, and psycho-motor aspects learning and, embrace adult learning principles.

Learners vary in their response to written, oral, or graphic presentation of information. Information can be presented verbally and a written syllabus provided with instructions and pictoral representation of information. Audio-visual adjuncts and a healthy dose of humour aid a didactic presentation. Some learners perform better when working in groups; some when solo. While there is an inherent efficiency in group learning, individual or paired practice at computer terminals is most effective. Since group size must be limited because of the need for immediate feedback during interactive learning activities, experienced trainers recommend a group size limited to ten learners for one trainer and only one or two learners per terminal. Attention span for learning activities is enhanced if breaks in learning tasks are provided at hourly intervals. Reduce competing demands for learner attention through legitimised training sessions in off-duty time.

Computer training encompasses all the domains of learning: cognitive, affective, and psycho-motor. Nurses are skillful at recalling new information, and more important, are great problem-solvers when given appropriate tools. Instructing users about system structure and about additional 'help' resources is invaluable. It is worth noting that the initial start-up steps of using a computer system usually involve specific commands for which no amount of problem-solving capability will help. A clear, comprehensive, and available user manual is essential as nurses begin to use a system. This document contains information different from the sequenced learning activities of the computer training syllabus. User manuals require highly specific system instructions with detailed indexing for easy reference. Identification of experienced resource people on the wards can also help reinforce learning and keep frustration at a minimum.

There is an unmistakable affective component to learning about computers. Computer-phobia is a real phenomenon and may be manifested in resistant behaviours. Computers commonly threaten the status quo, thus creating many real or imaginary fears. At the very least, many nurses must return to the role of novice learner and begin the often uncomfortable process of mastering new and unfamiliar skills. Computers also threaten to change decision control and social norms within an organisation. Nursing unit managers

may resist computerisation of rostering if these decisions have offered them significant influence and control over their staff. Barriers to computerisation may emerge if nurses feel that computers deprive patients of professional contacts or invade their privacy. A pro-active stance is needed to reduce apprehension and resistance about a new computer installation. Assess the pre-implementation environment, identify expected changes and threats, mobilise resources for planned change, market the computerisation effort, and involve users in the design, implementation and evaluation of the system.

The psycho-motor component of the computer learning also must be acknowledged. Generally rudimentary keyboarding skills are sufficient to operate a well-designed, 'menu driven' system (one in which the user selects an option from a pre-determined list of choices). While penlights, touch-screens and bar codes have limitations, they may be useful alternatives if user keyboarding skills are known to be limited.

Principles of adult learning have application to all adult learning activities. Examples of the application of these principles to computer training include:

Adults learn best when it is in response to a felt need.

> Staff nurses often feel they are "drowning in documentation." When instituting a nursing care planning documentation system, emphasis on the benefits to patient care through rapid, legible, and retrievable documentation can serve to capitalise upon this learning principle. Similarly, computer applications for nurse executives are best taught by learning activities dealing with the analysis of common management problems.

Adults respond best to immediate applications of new knowledge.

> Application, practice, and hands-on experience are essential to effective computer training. Because of their interactive nature, computers are very effective teaching devices for self-paced and experiential learning. Transfer of learning can be maximized by using training exercises that are as close to real applications as possible.

Adults mobilise their experience repertoires.

> The majority of nurses have used computers - perhaps only their automatic bank teller card. Comparing the steps of "logging on" a computer to bank card access is one of the many analogies that can be used successfully.

And finally, adults want to be treated as such.

> A collaborative relationship where there is mutual diagnosis and shared goal setting is more likely to succeed. Computer training lends itself to mastery-oriented learning with clear, pre-defined expectations and goals.

SUMMARY

Nursing leaders are currently faced with complex and costly decisions about how to computerise nursing department information systems. The unique configuration of the computer systems in a hospital and the goals and priorities of the nursing department influence the outcomes of these decisions. Being informed about the many options for computerisation, facilitating communications between nursing, other clinical departments, and the system provider, and ensuring effective computer training are powerful determinants of successful role implementation for NIS developers.

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9 -- Using Computers In Nurse Education, Staff Development And Patient Education

Bill McGuiness

INTRODUCTION

Imagine that you are living during the cave man era. You are sitting at home carving some notes onto your favorite piece of bed rock when a salesperson enters your cave and demonstrates a "marvellous new product called Paper." You select a piece and examine it. It seems to flimsy too be of any use but, being inquisitive by nature, you buy a ream and begin to experiment with it. Before long you find it has several advantages. You can carry much more information at any one time because it is lighter. There are associated cost savings because it is cheaper to buy and can be reused, and by drawing lines on it you are able to provide much neater presentations. Before long the stone axe you used for scribing has been discarded in preference for pencils, pens, typewriters, photocopiers and fax machines.

To some extent the relationship between the nurse educator and computers is like that between the cave man and paper. At first glance nurses have been skeptical about the advantages a machine has to offer a nurturing, caring profession such as nursing. Now, little by little, nurse educators are beginning to experiment with this teaching tool.

The purpose of this paper is to describe the advantages and disadvantages that have been identified, to date, in order to provide a foundation for the nurse educator who is beginning to use computers. The term "nurse educator" will refer to the undergraduate and post graduate college or university teacher, the staff development officer, and the patient educator.

In true nursing tradition this paper will begin by defining some common abbreviations. Although there can be a range of abbreviations (eg: CBT Computer based training, CAI computer assisted instruction) most fall into one of two categories. Computer Assisted Learning (**CAL**) uses the computer for the purposes of instruction or teaching. This includes most of the software used in nursing education, and can include drill and practice, tutorial or simulation type software. Computer Managed Learning (**CML**) means using computers for more than instruction. The computer is used to manage the learning environment, either by controlling a variety of media (eg video or compact disc players) and/or keeping records of student results, for the

generation of reports regarding student use, and performance trends, both on an individual or group basis.

WHY USE COMPUTERS IN NURSE EDUCATION?

To answer this question it is best to examine what currently happens in nursing and patient education. Presenting information to a student or patient is often limited to one or more sessions. The success of each session is dependent on a variety of factors, including the emotional status of teacher and student, the time of day, the environment and the material being taught. Problems such as teacher or student fatigue, boredom, inactivity, and a distracting environment will all help to decrease the effectiveness of any educational experience. This can be further complicated by the time teacher or student are forced to wait for performance feedback. Items such as tests, assignments and examinations are often the only evaluation tool available, and are conducted at a time that frequently prevents any identified deficits being addressed. Computers can help overcome some of these problems.

Computers don't get fatigued. When a computer presents material to students, it is consistent to every student. This helps eliminate the possible disadvantage to students that can arise from a fatigued or disinterested lecturer.

Computers don't sleep, which means that students are free to access material at their optimum learning time, rather than attending a scheduled lecture time when they may be fatigued or disinterested. We all have a preferred learning time. I prefer eight to twelve at night, a time prohibitive to most lectures, but convenient for a computer. This feature is also particularly beneficial for nursing staff who may wish to access information during an evening or night duty, or a patient who may wish to learn at a time when staff are busy or the clinical nurse specialist is off duty.

Computers don't have time constraints. Student are able to work at their own pace. They are no longer restricted by the scheduling of lectures or tutorials. If they require a break due to fatigue or illness they are able to do so and pick up where they left off. It also enables students to access information more than once.

Computers are able to assess student as they perform. This instant feedback allows students to review material while their motivation to do so is high. They are also able to repeat the assessment. This is particularly suited to clinical decision making where mistakes can be made without the patient consequences. Finally, computers can access a variety of media. Students can see video images, hear sounds, or watch animation, all of which encourage the students to become interested, or engaged, in the material.

Evaluation of CAL to date reveals that students learn faster using computers and that retention times are longer. This differs with content and

student anxiety regarding computer use (Bitzer & Bourdreax 1969; Koch, Guice & Ellis 1988).

For the teacher, CAL and CML offers the following: a range of media, earlier assessment of student understanding and more opportunities to have didactic material reinforced. At present nurse educators are forced at times to rely on painting mental images. By using the computer as a "control panel" for a variety of media, the teacher is able to present information using a range of student senses, either during a lecture or in a CAL environment. Computers can also be used as early warning devices for the teacher. By recording and storing student performance on CAL teachers are able to detect possible trends. Any deficiencies are detected early enough for the teacher to instigate the appropriate remedial strategies.

It would be remiss to finish this analysis without identifying potential cost benefits. Computer technology is not a cheap option but over time cost savings can be realised. For nursing schools, costs may be reduced by using computers to teach students the initial principles (eg: how to draw up injections, perform aseptic dressings or prime an intravenous giving set). The equipment needed, and hence the cost, to repeatedly perform these tasks will be reduced. Further cost reductions can be made by using CML to reduce the quantity of marking and the time needed to mark, especially if sessional markers are used. The latter will also provide the teacher with more time for the preparation of higher quality teaching thus reducing the costs of remedial or follow up mechanisms.

Hospitals may be able to reduce the cost of staff development by having a computer rather than an educator present selected content during evening or night shifts. Staff would also be able to access information form their ward unit thus reducing the time lost by having to meet in a central venue for educational purposes such as lectures.

Finally cost savings can be realised in patient education. By using computers to teach patients the basic information, nurses will be able to devote time to information specific to the patient's needs. This in turn can reduce the potential for return visits resulting from of a lack of understanding. Computer assisted instruction for patients would also increase the access for all patients, regardless of staff availability. This would assist in health awareness and help decreases non essential use of health care agencies. Of course any cost savings will initially be offset by the costs of computer equipment but, over time the savings described above may be realised.

IMPLEMENTING CAL AND CML SYSTEMS

There are four fundamental areas to consider when implementing a computer learning environment. Which content will the computer teach? What is the most appropriate software? What hardware configurations will be needed?

How much staff time is available for development? And, what are the attitudes towards computer assisted learning?

The latter is the most important area. Regardless of the "courseware", software or hardware used, if staff and students have a negative attitude towards the medium it will not reach its potential. Nurse educators have been criticised for their reluctance to use computers. Factors such as a lack of opportunity to learn, computer anxiety, little or no release time or the exclusion of computer development from promotional criteria are often cited as reasons (Jacobson, Holder & Dearner 1989, Christensen & Murphy, 1990). Computers, like other educational tools, require special skills to use. It is therefore essential that any move towards the use of computers is supported by appropriate time allocations and non-threatening familiarisation processes.

Locating a computer in a common room with "fun" activities (computer games) may encourage their use. Later, provide a selection of frequently used information, for example, educational time tables for teachers, exam results for students, leave entitlements for registered nurses and meal menus for patients. By keeping the access to this information simple, people will be encouraged to use it and at the same, time the computer. Next, invite some suppliers to demonstrate their range of software and hardware. Finally, conduct programming classes, as Volckell and Rivers (1984, p.1) state "one of the best ways to teach educators how to use computers for instruction is to teach them how to write actual programs". Authoring systems (described later) will provide the easiest entry into this skill level.

Once an interest has been generated, form a small development group. If you attempt to go it alone you may find that you expend large amounts of energy with little return. This group should be responsible for: 1) identifying strategies to free up staff from other commitments (eg reducing services or employing sessional staff), 2) choosing the most appropriate content to be presented by CAL, 3) selecting the appropriate software and hardware configurations, and 4) establishing quality assurance and evaluation mechanism.

Content that is suitable for CAL is really up to the imagination, but difficult concepts that students will have to access a number of times, content that is repeated several times to small groups of students, and content that is difficult to present in an interesting manner using didactic methods are all suitable. It is also a good time to determine the structure and purpose of any CML. Will the CAL results contribute to the overall grade of the unit or will they be for student feed back only? Who will have access to student results? Will audio and video images be needed? These are important questions when the selection of software and hardware are to be made, specifically the latter. If audio and video are to be used the purchase cost of both software and hardware will be substantially higher.

When selecting software, two major choices are available. The first is commercially prepared software that is purchased intact and run on the available hardware. The second is to develop software within the school either by contracting a programmer or using available teaching staff.

Commercially prepared software is usually developed using large budgets. As a consequence, the presentation quality is usually high as it is prepared using advice from expert nurses and the product will have been through a series of quality assurance tests before being placed on the market. Also, it is sold with instructions. All that the teacher need do is select the desired software from a catalogue (eg Directory of Educational Software Computers in Nursing , local suppliers) and make it available to students.

Problems with commercial software may arise from its contextual bias, operating system, ability to preview (at least in Australia) and costs. Within Australia the development of nursing software is in its infancy. This means software needs to be selected from either the United Kingdom or the United States. These packages may contain content not applicable to the Australian context. Having to explain to students that some content is not applicable (eg drug names, nursing practices) reduces the validity of the product in their eyes and may reduce its effectiveness.

Commercial software is available for one of two environments: Apple or IBM based. Unless the educator is fortunate enough to have both options available, the selection of software will be limited by hardware. Fortunately this is becoming less of a problem as more and more software is now being made available for both systems.

Obtaining software for preview may also cause problems. Suppliers are reluctant to carry stock as it is expensive and easily damaged. Experience has taught them that lending software on approval can result in it being copied or rendered unsaleable because of damage or breakage of licensing agreement seals. The result is that nurse educators, within Australia, may be forced to buy before they try, an option that is not viable either from an educational or cost containment stand-point. This is resolving, however, as the demand for nursing software within Australia increases. Finally, high quality commercial software is costly to produce, which means that it can be costly to purchase. The market for nursing software is not as great as for, for example, a word processing package, thus the cost per unit will be higher. This makes evaluation of software imperative to ensure that dollars are spent most effectively.

One solution to these problems is to develop the software within the school of nursing. By developing your own software it is possible to present content that is specific to either your curriculum, context or philosophical leanings. Three options are open to the software developer. Using programming languages (eg BASIC, Pascal or C), authoring languages (eg Hypertalk) or

authoring systems (eg Hypercard, Supercard, Macromind director, Authorware) (Christensen & Murphy 1990). Programming languages provide the maximum flexibility but require detailed knowledge of the language. Authoring languages are easier to use because of their plain language but still require extensive learning times. Authoring systems are the easiest to use because they are semi-programmed. The user is able to design software by simply selecting the features they would like and the computer constructs the finished article.

The disadvantage of "in house" development is the time and the hardware needed to produce software of acceptable standard. Even with authoring systems, time is needed to learn how to drive the software, and then to develop the CAL. In my experience forty to fifty hours can be spent developing a package of thirty minutes duration. Also, specialised hardware is sometimes required for development. Authoring systems can require large amounts of random access memory, which in turn requires the purchase of more expensive hardware for both development of the software and, in some instances, delivery to the student.

Hardware configuration is the next decision to be made. The basic configuration would be a micro computer with one megabyte of random access memory and potential for expansion, monitor (monochrome), and keyboard. To enhance the presentation, items such as colour monitor, compact disc, and video disc players can be added. To enhance access and retrieval items such as a mouse, bar code reader, touch screen monitor and a modem can be added. For large student numbers, computer laboratories will need to be established which house multiple computer stations, and can either stand alone or be connected to a computer network. Hardware configurations will be primarily determined by the content to be presented, number of students and the available budget. Generally the better the presentation the higher the cost.

When choosing hardware it is important to note that hardware selection can restrict software selection. The problems of Apple verses IBM have already been explained, selecting either will to some extent determine the availability of software. Also, at present, selecting either video disc or compact disc players will restrict software purchases. As many aspects of nursing are audio-visual it is easy to be lured into the interactive video disc or compact disc hardware configurations. However, it is important to remember that it is not possible to record video or audio to these media outside of the factory. Prohibitive costs of in - house development in this area, will often restricts the selection of software to commercial packages. On a brighter note advances are taking place in this area, known as WORM (Write Once Read Many). In the future, in house development of both compact and video disc storage may be possible.

CONCLUSION

To some extent this paper presents a picture of problems and frustrations for the nurse educator who is interested in using computers. But the problems presented here are for the purpose of awareness only not to generate further fear. Computers offer several established advantages for nurse education, staff development, and patient education.

Allowing students access to information several times over, at their own pace, during a preferred time will enhance their opportunity to learn. By allowing the teacher access to performance trends, multi media teaching environments and the facilities to develop software specific to their curriculum and contextual needs, will enable maximum use of this resource. The provision of inservice education during all modes of shift work will mean that practitioners find it easier to keep up to date. They will also benefit from being able to identify the efforts they make in continuing education, for promotional and personal reasons. Finally computers provide health education to a larger population than any nursing staff could hope to educate. This should increase patient understanding and thereby reduce complications and unnecessary use of health care services.

Like all change, computers have their disadvantages. The technology is costly and its implications not fully explored. But by prudent use and evaluation of this medium, nurses should be able to capitalise on the advantages and minimise the disadvantages. After all, where would we be now if the cave man had placed "paper" in the "too hard basket" and returned to his stone tablet.

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10 -- Changing Stereotypes

A.C. Lynn Zelmer

INTRODUCTION

Computers are strange beasts, and computer people even stranger. While those of us who exist primarily in the 'real world' may be a bit fearful of computers, hoping that they will get the work done quicker or more easily, we see 'real computer people' as something different from ourselves... and wonder if the computers haven't become an end in themselves.

Nurses, on the other hand, aren't at all like computer people. Years ago they may have been starry-eyed chasers of the Florence Nightingale myth, but these days they are more likely to be practical, almost super-human, individuals who can install a drip with one hand, deliver a baby with the other, and simultaneously scrub the bed pans and conduct a patient education session.

Interesting stereotypes, but are these stereotypes valid or even useful? This paper takes a quick look at the process of change as it applies to computers in health care institutions over the last decade or so before looking at the experiences and reactions of two Queensland nurses as they introduce computer technology into their daily work.

COMPUTERS AND THE PROCESS OF CHANGE

The computerisation of hospitals and other health agencies, like that of business and industry, started with the application of mainframe computers to speeding up financial and similar "data" functions. In general, it was the larger metropolitan (or "Capital City" in Australian terms) institutions which first used automated data processing. They were followed by regional and smaller institutions as the perceived benefits became apparent. Developments in microelectronics gradually decreased the size and cost of computer facilities; however computer use in health still primarily refers to the use by the business departments of mainframe systems with appropriate terminals rather than to microcomputers. Microcomputers have been used by individuals within patient care and support departments, as have minicomputers; however their use has not typically been part of an integrated plan.

The literature of the early 1980s was full of references to the Second Computer Revolution and the impact that microelectronics would have on the workplace and the worker. Predictions were as varied as the writers, especially

with regard to the impacts upon female workers, usually clerical workers. Nurses, predominantly female, hadn't been significantly affected by computerisation although their institutions may have been. In Canada, Heather Menzies, an Ottawa based author, wrote several books on the effects of informatics upon female [clerical] workers. Aside from noting that a third of Canadian hospitals were using data processing systems by 1978, she primarily indicated that "the galloping growth" of jobs traditionally held by women had been checked and reversed by automation (Menzies, 1982). Likely indicative of the degree of computerisation in the health field, her case studies (1981) on women using microchip based equipment ignored health institutions. Tom Forester's (1980) first anthology also failed to include health or social services, in Australia or elsewhere, in its examination of the economic and social implications of microelectronics.

By 1980 hospitals and other health institutions in Australia had computerised some of their data-oriented functions and state health departments were beginning to realise the potential benefits from a standardised approach. The planning for a statewide hospital information system in Queensland, for example, had begun although political events were to prevent the system from being implemented until 1990.

Computerisation has not come easily to any sector of the workplace, perhaps because of workers' concerns over the potential loss of employment have seldom been satisfactorily addressed. In addition, advocates of computerisation have often failed to understand how humans react to new innovations. Everett M. Rogers (1962) warned of the problems of introducing new innovations and noted that "it is the idea about the new... that is diffused as well as the product itself". In the 3rd edition (1983, 7) of his, by now only moderately well diffused book, he specifically refers to the technologist:

> "Many technologists think that advantageous innovations will sell themselves, that the obvious benefits of a new idea will be widely realized by potential adopters, and that the innovation will therefore diffuse rapidly. Unfortunately, this is seldom the case. Most innovations, in fact, diffuse at a surprisingly slow rate."

Some of my computer colleagues will undoubtedly point to the rapid spread of "personal computers" as a refutation of this argument. In response I would suggest that desktop personal computers have still only made a major impact on the "Fortune 500" companies and their worldwide counterparts. Many individuals do use microcomputers to assist with an ever increasing number of daily chores. Many more don't, and won't, often because they perceive the computer to be something that is too complex for them to understand, or that they fear. Since the health system is not yet run by the

Fortune 500 with unlimited resources for experimentation the situation is not likely to change without an understanding of how individuals react to change.

Making a decision to change, whether changing an attitude or a practice, is not an instantaneous event. Even with the most successful innovation, some individuals will make the change before others, the majority will accept the change some time later, and a small group will either be very late adopting or refuse to accept the change. The process which individuals, and collections of individuals, undertake as they accept (or reject) any change seems reasonably consistent. In Roger's model (1983, 163-209) it is a five step process:

- *Knowledge* comes from exposure or understanding of function;
- *Persuasion* occurs as attitudes are formed;
- *Decision* occurs from activities that lead to choice;
- *Implementation* occurs when the innovation is put to use; and
- *Confirmation* is needed because the decision must be reinforced.

The implication of the change process is clear. To be successful in adopting a new technological innovation, management of the people who will use the innovation is as important as managing the technology itself. The necessity of consulting the user within a health institution such as a hospital is even more important. Nurses form the largest staffing component of a hospital. Nurses worldwide are becoming more aware of their rights as individuals; they are being educated to understand and make decisions rather than simply being trained to follow orders; and are becoming more protective of their professional status.

The technology literature of the late 1980s has also discovered the health sector. One typical anthology (Blackler, 1987) includes articles which discuss the reasons why computers may not be accepted in the health field, the use of the computer as a health 'expert', and technology for assisting the disabled. Management and the technologists, however, still may not have the message. Canada's Institute for Research on Public Policy and the Canadian Medical Association (Feeny, 1986) jointly looked at the diffusion of health care technologies but were still preoccupied with costs.

To some extent the preoccupation with costs may reflect the limited impact of computers on the patient care side of the institution as versus administrative data processing functions. In Roger's terms, nurses and other health professionals are still primarily in the knowledge stage although there are a few who have moved beyond, especially in North America. The University of Victoria (Canada) as early as 1987, for example, was hosting an annual conference to assess information technology in community health with topics such as "Microcomputer Applications in a Community Health Unit", "A

FILEMAN-based Application for the Direct Entry of Oral Examination Data in Rural Alaska", and Hand-Held Computers and Environmental Health Inspectors" (Nusbaum, 1988). As well, there are an increasing number of books by nurses which address the impact of computers on nursing. Ball (1984) and Cox (1987) provide two examples.

While a recent Australian guidebook (Sinclair, 1988) on the hazards of hospital work scarcely mentions computers, even in the section on ergonomics, nurses here are beginning to use computers, and are writing about their experiences for their professional publications. In some typical articles from recent nursing journals, Litchfield (1990) and Hausman (1990) discuss computers and their place in nursing from a New Zealand perspective, Byrne (1990) and Spratling (1990) look at computer assisted learning in selected Australian tertiary nurse education institutions (universities and colleges), and Gray (1990) assesses the value of personal computers to the Australian remote area nurse.

Nurses are increasingly using computers and computer controlled equipment. Queensland nurses are actively involved in the implementation of a major Hospital Based Corporate Information System. Closer to home for me, the nurse educators and their students at the University College of Central Queensland (UCCQ) are seeing a different side to computing, and have adopted computer technology as a way of being more effective in their teaching. If the Common (Staff) Room gossip is any indication, they are also looking at ways that computers can be used to solve a wider variety of problems.

Is it possible that computer users within practical areas such as nursing and nursing education can accept computers as being real tools to support their work? The two examples which follow provide the first hand impressions of two Queensland nurses. The first is a relatively junior nurse involved in the implementation of Queensland's Hospital Based Corporate Information System (HBCIS). This system was more than a decade in planning and will hopefully supplement and/or replace a number of existing data processing and records management systems. The second details the reactions of a more senior nurse actively involved in the implementation of a computer system oriented towards assisting nurses to perform their nursing care activities more effectively. The italicised quotes represent her recommendations for a successful computer implementation.

A PLANNING EXPERIENCE

Elisabeth Vigar, a theatre nurse in one of Queensland's regional hospitals, is a member of one of the HBCIS user groups.

"[While] The State Health Department in Queensland began looking into an information system for state hospitals some years ago, it is only in the last year that the individual hospitals have been involved in any depth, specifically the few that have been chosen as 'prime sites'... after several hospitals put in proposals.

Personally I am very involved and have been right from the beginning. I assisted in the original proposal and am now on the Theatre User Group working through the module preparation. The whole process has not only been an eye opener for me but a very valuable experience.

My role on the theatre users group for HBCIS is twofold. Firstly, I am representing the hospital but more directly the theatre I work in, and secondly I am bringing the unique needs of my hospital to the group (as are the others on the group) so that the final module will be able to be incorporated into all Queensland hospitals without need for changes with each hospital.

Therefore, my own unique role is that of liaison person between the hospital/theatre I represent and the HBCIS committee, trouble shooting when the module is in the design stages, and when it is up and running I will become a trainer for the people I work with. My trouble shooting role will continue ad infinitum.

I consider that what I have to offer is knowledge that is unique to nursing. Doctors would have no idea of the basic day to day running of a theatre area, as I would have no idea of computer programme design. We all must work together to ensure that the information system we end up with is the best available.

At a recent conference I attended in Brisbane, several nurses from Greenslopes Hospital (the repatriation hospital in Brisbane) spoke about the implementation of a computer system into their hospital. The main point they made was that nurses were included throughout the whole life cycle, and they felt that because of that there have been few problems with acceptance by the nurses of the computer system. ...nurses need to be involved as they are the primary users of the system.

The nurses I work with in theatre are in favour of the information system as they can see the time and eventual cost saving the system will provide. However for the time being it is difficult for them to envisage what the system will actually be like, and some are fearful. Fear of the unknown is not unique, and one of my main tasks at the moment is to allay this fear so that everyone will benefit from the hospital information system."

AN IMPLEMENTATION EXPERIENCE

Estelle Bartley, Principal Nurse Educator with a hospital that is well along in the process of computerisation, is variously a user of the computer system, a trainer in the use of the system, and an administrator involved with the planning and implementation of the system. Her initial involvement with computers came about when the hospital became part of a larger computer trial.

> "...we were essentially given a password and logon and a terminal and that was it. ...we had a land line down [to Sydney] and that was initially a bit of a problem-- a few times farmers ploughed through it. So you learn lots of things.
>
> One of our main problems was that *we didn't know what questions to ask*. It is pretty difficult to know what to ask when you don't even know what you are looking at.
>
> We had a *working party that consisted of a representative from every department or service in the hospital*, and just gradually we went through all the screens and decided who ultimately owned what. Now two things that were a spin-off from this one: [one] that we looked at procedures and found out who was doing procedures that they shouldn't be doing - like some nursing people were doing discharges when that was a clerical function - so when we designed menus, nurses do not have discharge functions and now it is totally a clerical system - so that solved some of those problems.
>
> The other thing that happened here was the *networking between departments* because we got to know each other and grew this trusting bond within this network. We now ring each other for other problems, including having lunch of course.
>
> I have a nursing working party, what I call my trainers, and I get them to do all the work. It's been extremely successful because when we implement those people will own it. Its not my system. Although I'm seen as the in-house expert, they essentially drive the program. I think that's why we've had less problems than other hospitals in Australia."

Both Estelle and her colleagues are finding the use of the computer system rewarding:

> "I actually even get messages sent to me now over the message system, "See how well I can use the system!"; so I usually send them back a gold star or something.

...and certainly this has been one of the greatest boons to my professional career and my professional development and I certainly enjoy it. I picked it up by default but I'm not sorry about that in the least.

We've got everybody using it from people with extreme experience with computers, mainly microcomputers, doctors and that sort of people who have a great deal of education and exposure to mainframes at universities to people in the kitchen and our wardsmen who know nothing about them at all - with very little formal education, if any. Some of our people can hardly speak English and they don't seem to be doing too badly."

When asked whether anyone other than administrators use microcomputers, Estelle replied:

"I have one next to my office that all the nurse educators use. I occasionally have nurses who come along and just want to learn how to do word processing and I'm quite happy to do that.

The hospital has in fact bought a ...laptop and the patients find that very acceptable because it's like a toy. Whereas we initially thought about sticking them in front of a PC in an office I think they would perceive that as threatening. They perceive it as a toy, non-threatening, and it's got very soft keys. I found it [the diabetic software used by the patients] quite educationally acceptable, but it's aimed at the level of patients. Its not particularly high level and its usually just multiple choice, yes/no and 'enter' I think."

As with any system, there have been some problems, and often some interesting resolutions.

"we just had a major problem with the users almost rejecting the Nursing Care Planning process we are looking at. It wasn't so much that they didn't like the computer software, or the process that went on; it was more that they found the time it took to enter the data was so great that they wouldn't accept it. We got them to *identify what the problem really was*, and in fact it was time management and confusion over the division of labour between various nursing groups.

They identified that there was not good communication between the groups over exactly what they could do. The team function was really the problem. Now they've taken this in hand and they are starting to do a little *more open and honest communication*. Since they have recognized that's the problem and it's not the computer-- once again the process of implementing the technology has identified major problems in our current

procedures and processes. It's not the computer, it's what we currently do that's the problem.

It's brought out that much skeletons in our closet, for want of a better word, that it's just amazing. I didn't realize it was going to have this degree of impact upon what we do. I think in the long term the price we are going to have to pay is a *smartening of our act all around to find out who should be doing what tasks, and who should be accountable for that* . That's a spinoff I would never have predicted."

CHANGE CAN BE MANAGED

The old stereotypes are not very useful. Nurses, and other users of computer systems, do accept the challenge of adapting the system to their needs when they are given the opportunity to do so. As well, nurses do become very competent members of the team of computer professionals and users implementing a system. Their nursing background can often bring skills and attitudes that profoundly affect both the computer implementation and its impact upon the work place and ultimately the patient.

The Queensland Health Department was fortunate that the political climate in the state necessitated a very vigorous examination of the potential effects of a major computer initiative and thus the involvement of representative user groups from all levels of the hospital system. It may still be several years before the results of the involvement of users begins to do more than provide knowledge of the impending changes, however the staff involved in the project are already "spreading the word" as normal promotions and transfers take effect in the rapidly decentralising system. This roughly 70 million dollar project is planned to include 13 hospitals of various sizes over the next decade, thus the attention of many health professionals across the state is focussed, often with considerable apprehension, on system modification and installation activities at the two "prime" sites.

Greenslopes Hospital, which started the current computer implementation with almost as negative a process as one could imagine, provides an example of what can be accomplished with dedicated users rather than computer professionals managing the change.

Greenslopes is a 400-bed hospital of the Department of Veterans Affairs. The computerised system, also used in all other DVA hospitals throughout Australia, has taken approximately three years to implement to this stage. It is up and functioning with some modules; i.e., it is not a pilot as it is being used in the real world. Within the next couple of years the DVA hospitals are being integrated within the relevant state health systems. Greenslopes will thus become part of a state system which has a long history of hospital computerisation.

Greenslopes uses an Australianised variant of the PCS (Patient Care System) which was originally developed in the United States and is now used in 200 plus hospitals there. A simpler version of the PCS system may have been implemented by at least one more Australian hospital. PCS is IBM based and operates from a mainframe located in Sydney, two mini-computers on site at Greenslopes, 150 micro-computers (not all used as part of this system as some are used for word processing only), about 250 terminals and 60 printers throughout the hospital. The whole project throughout Australia cost about $25 million, although there are hidden time (related planning, development and implementation labour) costs not included in this total.

Hospitals are being required to 'pay back' costs to DVA from the supposed savings of the system, however it is still too early to see any real savings. Greenslopes can demonstrate that there have been savings in food used and that there are significant savings in time in processing information and orders. For example, instead of taking half a day for a requisition to get down to x-ray it now takes 6 minutes.

There are 4 terminals in each 40 bed ward (the fourth was just installed) and a proposal to have 6 terminals by the time all modules are implemented. Modules implemented so far are dietary, radiology, clinic scheduling and payroll/personnel. The nursing care module is scheduled for implementation late in 1990.

In general, nurses like the system because it is very user friendly. "It takes less time to place a dietary order through the computer than to try to ring the kitchen." Training of staff was basically done by training of trainers. There are approximately 600 nurses and other staff who had to be trained to use the system. Six terminals were used for training, but most of the training was done by peers on the ward.

As indicated in a case study of the Greenslopes experience (Bartley, in press), the lessons learned included:

- there is a long lead time in introducing such a system;
- must have middle and top management support;
- must put effort into internal marketing;
- management of change is most important;
- better to start using than wait until the system is perfect.

Computerisation of a social system as large and complex as a metropolitan hospital may be achievable without alienating the staff if the technologists learn from the current experiences. The challenges of implementing technology in smaller institutions will be similar, with planning for change no less important

"Computerisation will give a far greater dissemination of information. Management of information will certainly have a dollar cost against it... having to be accountable and justify how you spend your money, we'll need computers to do that.

I think that in the long term, and certainly the literature supports it, that we can predict where we are going with greater expertise and we can manage more people with the same amount of resources. Any hospital that doesn't have an integrated, comprehensive computer system by the year 2000 is not going to survive without a lot of money down the drain" (Bartley, in press).

ACKNOWLEDGMENTS

I would like to thank the several colleagues and students who have assisted in the preparation of this paper, in particular Ms. Estelle Bartley, Brisbane, for the quotes from her interview with me of September 7, 1990, [emphasis in original] and Ms. Elisabeth Vigar, Gold Coast, for the quotes from her papers for my 84132, Information Systems II, subject at UCCQ, Semester 2, 1990. The opinions and ideas contained in this paper are those of the authors and do not necessarily represent the opinions or policies of Greenslopes Repatriation Hospital, Gold Coast Hospital, or of the Queensland Department of Health.

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11 -- Future Developments In Information Technology: Potential Impact On Nursing And Patient Care

Carol Ingrid Bradburn

INTRODUCTION: THE INFORMATION EXPLOSION

We live in a world which has an obsession with information. Just a few hundred years ago, most individuals would have had little knowledge of events outside their immediate localities; news of national or world events would have penetrated slowly and, in general, would have had little effect on daily life. Now we are not only expected to know about world events as they happen, but to hold informed opinions on them. Television and radio pour information into our homes; our telephones and computers connect us to the world.

The nursing profession has not been immune to this information explosion. Even in the thirty years of my nursing lifetime, the nursing world has expanded. As a young student nurse, I was only exposed to the ideas and local knowledge of my own nursing school, augmented by a few carefully selected textbooks. Now we have libraries to store the proliferation of nursing journals; we could fill in the year with attendance at conferences; after a conference day we could pass the evening sitting before our computer terminals and browse through nursing bulletin boards or send electronic mail to other nurses.

And this is just the information about nursing. We also record information about our patients. It seems that each year we need to record more information about the health status of our patients and the care we give them. A common complaint of nurses is the increasing amount of "paperwork". Legal and research needs account for some of this but part of it is surely due to the pace of our modern life. Patients stay in hospitals, or even communities, for shorter times. Nurses do also. Care is more complex. It is no longer possible for a single person to remember what is happening to a patient and to be there when that remembering is required. We have reached the stage where the volume of the information exceeds that ability of the human brain to manipulate it.

A major question facing nursing, as many other professions, is how all of this information can be stored and retrieved and, most importantly, how it can be used to improve patient care. Some tentative answers may be found in current database research work.

DATABASES - ORGANISING INFORMATION

A database is simply a collection of related facts. Facts are organised according to a conceptual data model which allows information to be stored without unnecessary duplication. Most databases in current use are based on the relational model in which data is organised in related tables. In the attached example, looking up "bag-rubbish" in the INVENTORY table would tell you the number of rubbish bags in stock. Notes that, via the "ITEM" entry, this table is linked to the PRICE-LIST table which, in turn, is linked to the SUPPLIERS table via the "SUPPLIER" entry. By using these links as much (or as little) information as is required about the current status of rubbish bags may be obtained. Splitting information between tables cuts down on duplication; note that each supplier name and address needs only to be recorded once, enabling a smaller and more efficient database.

INVENTORY:

ITEM	I_NAME	IN_STOCK
010	swab	
012	towel	
022	forceps_d	
025	forceps_a	
030	lotion_red	
033	lotion_green	
039	bag_rubbish	

PRICE LIST:

SUPPLIER	ITEM	PRICE	
500021	365	010	1.25
9326	365	012	3.50
136	400	022	5.60
19	404	025	7.00
935	404	033	2.20
6	404	030	4.25
63900	501	039	0.25

SUPPLIERS:

SUPPLIER	NAME	ADDRESS
365	Hospital Supplies Co.	20 Beach Road. 3036.
400	Designer Equipment	Back Lane. 2033.
404	Flaky Hardware Inc.	3 Computer Crt. 3000.
501	Defunct Rubbish Co	No Fixed Abode.

Figure 1: Database for surgical dressing equipment

A database is normally controlled by a database management system (DBMS) which is a collection of programs with which users can create and maintain a

database. The database management system allows for addition, deletion, retrieval and modification of items in a database. It must, as necessary, allow for access by multiple users while still maintaining the integrity of the data and the security of the system.

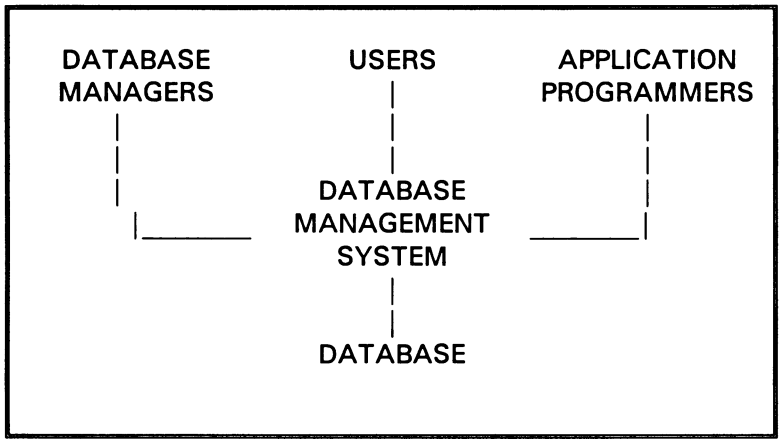

Figure 2: Data base management system

Relational databases and database management systems are widely used but do have some limitations:

- they operate very efficiently on small databases but tend to become increasingly slow in response as the volume of data increases.
- relational data structures are fairly simple and restrict the type of information that can be stored.
- database management languages can be complex, which may require the development of restrictive user interfaces. Users may need to learn "computerese".
- different types of database management systems have trouble communicating with each other making it difficult to exchange data between databases.

FUTURE DATABASES: IMPROVING ORGANISATION

What might happen to databases in the near future to enable nurses to use their information effectively? Here are some predictions that are being made by researchers in the area.

Databases will become very large. The generation of information is accelerating. The 1990 report of the NSF Invitational Workshop on the Future of Database Systems Research notes that the next generation of databases may be expected to be several orders of magnitude larger than those of today; databases larger than a terabyte (10^{12} bytes) may be expected. Imagine, for example, a database containing nursing care plans of all patients in Australia. It will not be possible simply to scale up present database management systems. To retrieve a single record might take days. In any case the database would consume so much time performing updates to incorporate new material that it would rarely be available to users.

Obviously, as size increases, there will have to be a corresponding increase in efficiency. Some help may come from current research into concurrent and parallel processing. These techniques enable computers to perform several tasks at the same time and can dramatically increase response time. However, each solution brings more problems. It is already difficult to ensure data integrity when multiple users access the same database; it becomes even more difficult if data changes (addition, deletion, modification) are being made simultaneously.

Databases will be distributed. In the above situation of a database of nursing care plans for all patients in Australia, it would probably not be most efficient to store all of the information in one large database. Slowness of access is only one problem. Long distance database access is expensive. Having all data at one site means that a fault at that site makes everything unavailable until the fault is rectified.

A distributed database allows information to be stored at multiple sites. It would seem reasonable to store care plans for Victorian patients in Melbourne and for West Australians in Perth. However, a person from Ballarat who gets sick while on holiday in Broome will need to have his nursing records retrieved there. This means that the databases must be able to communicate with each other. It may be necessary for multiple copies of the same information to exist. This obviously creates further problems with maintaining data integrity; changes must be made simultaneously to each copy. The user should be unaware of the control process seeing only the retrieved record without being aware of its origin.

The design of distributed database systems is not simple and it is compounded by the fact that it is seldom desirable to design and implement new systems from scratch. Rather what is required is to integrate the many existing systems. This requires the development of techniques to allow the communication of different database management systems.

Databases will be heterogeneous. We have noted that the data structures in relational databases are fairly simple. However, information of the future may be far from simple. We might, for example, along with a patients assessment

details, wish to store photographs, sound recordings or videos representing his progress. We would want to retrieve this material at the same time as his normal record. The database of the future must store such diverse information.

Much current research is addressing the development of new conceptual data models that are less restrictive than the relational model. "Object-oriented" databases, for example, allow all information about a data item to be stored together rather than being split across tables; functions as well as structures are stored within objects. This method of storage should allow heterogeneous objects to be stored in the same database. Many researchers feel that the concept of object oriented databases is not yet sufficiently well defined to be really useful. However, it is generally accepted as a potentially revolutionary idea.

Databases will be intelligent. As databases become larger and more complex, we no longer want the computer to just store the data, we want advice on how to organise and use the data. For a computer to give advice it must be able to emulate the thought processes of a human. The research area which deals with getting computers to behave like humans in Artificial Intelligence (A.I.). However, although both A.I. and database research fields have histories going back some thirty years there has, until recently, been little attempt to integrate the two areas.

A.I. is a vastly diverse field of study. One area of artificial intelligence that will be useful to nursing is that of expert systems. Weiss and Kulikowski (1984) defined an expert system as one that "handles real-world complex problems requiring an expert's interpretation" and "solves these problems using a computer model of expert human reasoning, reaching the same conclusions that the human expert would reach if faced with a comparable problem."

An expert system coupled to a large database would assist the nurse to make intelligent interpretations of the data. It could advise on the likelihood of a certain nursing diagnosis or the probable effectiveness of a particular intervention, based on stored knowledge and past experience.

Expert systems may vary considerably in scope. They need not always be large or be associated with very large databases to be useful. Davis (1985) describes three general classes of expert systems based on size:

ASSISTANT - small system, usually PC based, performs economically viable but limited subset of expert task.

COLLEAGUE - medium system, performs significant subset of expert task, may be on PC, larger workstation or mainframe.

EXPERT - large system, approximates expert level of performance in domain, usually use powerful "platforms" and specialised development tools.

Expert systems often, but not always, express their knowledge in the form of rules:

IF A THEN B.

For example:

IF (blood pressure is low and pulse is high)
THEN (consider haemorrhage).

A good expert system must search many, possibly conflicting, rules to suggest a possible solution; it must always be able to give reasons for its answers.

Current research focuses on methods for the integration of expert systems and databases. As with distributed databases, this is not always a case of designing new systems but, rather, of coupling existing systems. Several expert systems may access a single large database. For example a hospital database may be accessed by nursing, medical, dietary and other expert systems.

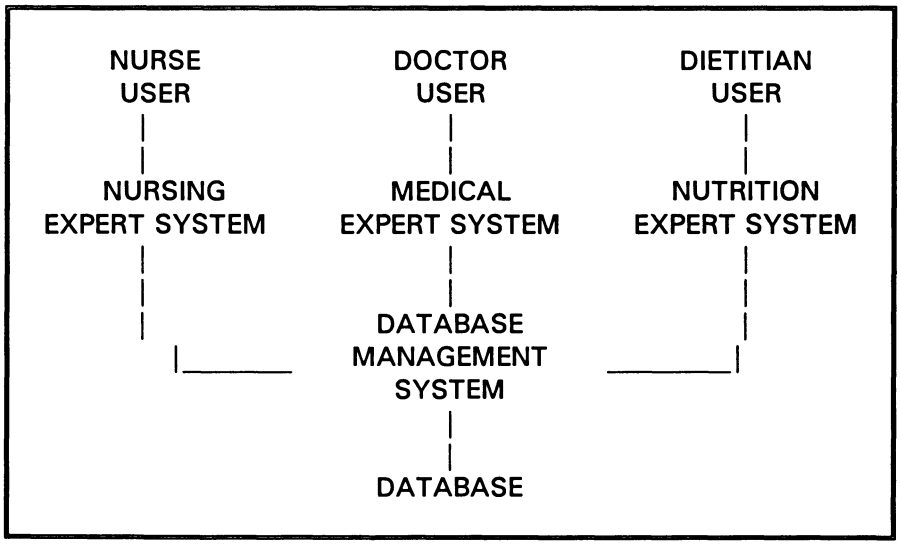

Figure 3: Database and expert system integration

In effect, the expert system provides an intelligent interface into the database. For example, the Database Research Group at La Trobe University, Melbourne, Australia is currently developing FLORENCE, an expert system to advise on nursing care planning. FLORENCE will operate on a database of nursing diagnoses and nursing interventions.

Another research area in AI that may change the way nurses and patients use computers in that of Natural Language Processing. This is concerned with enabling computers to understand English (or any other language). This is a difficult area of research. Not only must a computer be able to interpret the syntax (grammar) of English, it must also have knowledge of the semantics (content) of the language. English is, unfortunately for computers, an irregular language with the potential for massive ambiguities of meaning. Training computers to recognise speech or handwriting presents additional problems. The computers of Star Trek which chat with their users in colloquial English may still be a fair way in the future.

EFFECTS OF FUTURE INFORMATION TECHNOLOGY ON NURSING

Guessing the future is notoriously foolhardy. Indeed, some of the probable advances in technology may be slow in arriving. Brodie (1988) notes that "the computer industry has been very slow to connect heterogeneous computer systems" and "there has been considerable **talk** in the AI industry of the need for AI-DB integration". But let us take an optimistic approach, assume that progress will be made, and predict some results.

Communication between nurses will be enormously improved. An individual nurse will have access to world wide knowledge and will be assisted in the interpretation of this knowledge by his/her computer system. Conferences such as this one will be redundant. There will be no need to travel the world to listen to speakers when we can get the same result seated in front of our computer terminals. Computer communications will also play an increased role in education. It will not be necessary to travel to a central location to hear a lecture; instead we can retrieve the information from a computer network.

Statistical interpretation of nursing data will become more complex and yet easier for the nurse. A database may be programmed to seek out relationships between data items that a human would find it difficult or very time consuming to detect. In addition, large distributed database systems will allow comparison of data from many different sources. Nursing care will be increasingly based on sound statistical evidence.

Expert systems will give up to the minute advice on nursing activities. However, it is important to note here that the human nurse will always retain the ultimate decision. Later, the expert system can evaluate the results of that

decision and compare it to other possibilities; nurse and computer will help each other to learn.

Patient health assessment and education will be increasingly automated. Intelligent computer systems with attractive interfaces that communicate in natural languages will allow the consumer direct access to information and advice. The nurse can use her time to follow up specific or unusual problems identified by the computer.

Both nurse and patient will find computers easier to use. Intelligent interfaces will allow easier interpretation of user needs. The computer should be more able to think like a human, rather than the human having to adjust his thinking to the computer.

CONCLUSION

We have painted a rosy picture of a not too distant future where nurse and computer intelligently communicate with each other to plan and provide quality patient care. Will it be like this? As stated previously, predicting the future is difficult. It is hard for us today to imagine life without the computer and we tend to assume that computing input into our lives will continue to increase. It is worth remembering that some hundred years ago most people would have thought the same about transport technology based on the horse.

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12 -- Network Based Healthcare Computing Applications

Samuel Schultz II

ABSTRACT

This workshop concerns data standards and minimum data sets for nursing informatics. This session reviews the Health Level Seven (HL7) standard, the University Hospital Consortium (UHC) and the Clinical Information Network (CIN). Within the context of Network Based Healthcare Computing Applications, these three forces are examined as primary factors affecting the further development of standards and minimum datasets in nursing.

In addition to a review of three critical developments affecting standards, a reconceptualization of the process and goals of current efforts in data standardization and minimum datasets will be discussed. Specifically, new methods for generating standards (user agents), meta-dictionaries as large group process, meta-thesauri and maximum spanning data supersets will be discussed.

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13 -- The Challenges Of Developing The Challenges Of Developing A National Minimum Data Set In A Changing World

Maggie J. Wheeller

INTRODUCTION

This paper describes the challenges posed for the National Health Service (NHS) minimum data set (mds) by recent changes in health care and its delivery. The issues are not peculiar to the NHS, whilst some of the detail is unique to this system, many of the developments will correspond to changes in other countries.

The NHS has been experiencing a period of profound change. The changes include new legislation; the reprovision of large traditional hospitals for people with a mental health problem or a mental handicap; the changes in primary care, including the new contracts for general medical practitioners (GMP); the developments in clinical care; the effect of moving from a calender year to a financial year on information; the increased emphasis on quality of care; the availability of information technology; the use of the mds to provide valid comparisons in health care delivery in different locations.

The United Kingdom has been working on a national mds for more than a decade. In 1980, a central government steering group on health services information was formed under the chairmanship of Edith Korner (King,1985). Several working groups (Korner 1982) were set up to look at different parts of the health service. One of the steering group's reports (Fairey, 1985) explained their task, "We propose the routine collection of a series of minimum data sets to provide, at reasonable cost, the basic information which authorities and their officers need to discharge their responsibilities. The information on which they evaluate the implementation of those decisions must be relevant, reliable and readily available. The reliability and timeliness of data improve if they are collected as a by-product of operational procedures, and if their relevance to the management process is understood by the collectors". The groups concentrated on identifying the information needs of the District Health

Authority and its officers, on the assumption that information not required for operational use, and for the districts own purposes, would not normally be required regionally or nationally. Thus the district mds was planned to provide an adequate base to fulfil the information needs of those authorities above the level of the District Health Authority.

The NHS Information Management Centre was asked to support the change control procedure and to cope with the data definitions queries. To assist them, a Definition Group was set up. All definitions changes to the mds are sent to the Definitions Group, who advise the Committee for Regulating Information Requirements. This committee looks at the feasibility and timing of the implementation of changes to the mds.

The mds was not designed to provide all the information requirements for nurses and managers of nurses. It was envisaged that there would be further information requirements for local use. Some of these locally defined needs are being met through a centrally funded initiative on resource management. This initiative is contributing to the funding of hospital based nursing systems. To assist those planning local systems, there are also several projects working on common basic specifications.

THE IMPLEMENTATION OF THE NATIONAL HEALTH SERVICE AND COMMUNITY CARE ACT, 1990

Following a major review of the NHS, which resulted in the passing of the National Health Service and Community Care Act 1990, the market economy will be introduced in the NHS. The structure of the NHS has also been modified. Fifty-six NHS Trusts are being set up with a more independent status, they will be responsible to the Department of Health, and no longer responsible to District Health Authorities (DHA), or the Regional Health Authorities which fund and monitor the DHAs. The trusts include hospitals, community services or a combination of the two.

The hospital and community health services that are not provided in NHS Trusts will be in Directly Managed Units. District Health Authorities and some Groups of General Medical Practitioners will hold the funds to buy health care for their residents or patients respectively. Directors of Public Health have been asked to ascertain the health needs of the population, the health authorities will let contracts for health services based on these needs and following consultation with those who use the health services.

It has therefore been necessary for purchasers and providers of health services to have a contract mds with standard definitions for the setting and monitoring of contracts. The officers of the Department of Health and the NHS, who were in the working groups recommending the changes from the Korner mds, were asked to make as few changes as possible for implementation in 1991. Despite this, the definitions group supporting the change control process has had to make a large number of alterations to pre-existing definitions and devise new items for the mds. There are several changes planned for implementation in 1992 and 1993 and many areas of development work identified. Examples of several of the nursing related changes are described elsewhere (Wheeller, 1991).

The community care aspects of the new legislation include changes in the responsibilities for the social care of people with long term problems. This includes the transfer of the main responsibility for people with a mental handicap to Social Services. In England the Social Services are provided by local government. It has therefore become even more important to define standard definitions, so that the transfer of care can be monitored.

Several DHAs have merged, particularly in London. The mds has enabled managers to come to grips with the newly formed districts more quickly, despite the different types of hardware used in the predecessor districts. The validity of information is now a high priority. There had been a tendancy to put too high a value on the collection and speedy submission of data. The financial viability of hospitals, community services and health authorities will now depend on the quality of information that will support contracts. The data needs to be robust enough to be owned by both the purchases and providers of health care.

The financial systems have had a single unit of work measure for each part of the health service. These units of work are now receiving more critical attention as they do not necessarily characterize the area of activity which they represent. Units of work have the same disadvantages as performance indicators, providing a perverse incentive, with the risk that behaviour will change to conform to the letter of the indicators rather than to the spirit (Mullen, 1985).

THE REPROVISION OF LARGE TRADITIONAL HOSPITALS

Much of the care of people with long term problems is being transferred from large, old, traditional hospitals, to small local units. Many of the new

developments are a triumph of cooperation between several statutory and voluntary organisations (Graham and Wheeller, 1987). The challenge of standardising definitions across agencies is not yet met. When vulnerable people are transferred from one form of care, and the information from the service designed to provide better care is not compatible, it can appear that people rather than information has been lost. The research into the earliest reprovision schemes, suggests that very few people who have moved to the new local units have been lost to the supporting services (Dayson, 1989), but the current national statistics do not reflect these research findings.

The apparent loss of service includes not only the residential elements of care. Traditional outpatients for people with mental illness problems are to some degree now replaced with multidisciplinary teams working from community based mental health centres. The many new models of care provide an exciting challenge for clinical advisors to definitions groups. A patient/client based information system, rather than a facilities based system would solve this problem. The current community health statistics are based on face to face contacts. The hospital based services, such as outpatients are based on the use of facilities. Community mental health teams present a particular challenge to the information specialist, as the consultant when seeing a patient in a clinic in a mental health centre is doing an "outpatient clinic", but the community psychiatric nurse seeing their own list of patients in the room next door will be counting "face to face contacts". The introduction of the "nurse clinic" may be developed to include nurses running their own clinics in the community.

Day hospitals for people with mental illness problems have in many places changed their focus. The move towards individualised care has enabled community psychiatric nurses to facilitate the use of social facilities outside the day hospital, and the day hospitals are now offering more therapeutic programmes with more individual and group care on a sessional basis. The facility is therefore likely to be apparently less well used as the staff work more intensively, and fewer patients are present, at any one time, for social rather than therapeutic purposes. The effect of these clinical changes is the support of a greater number of individuals and families, but the facilities appear from the data to be used less intensively. This is one of the many examples of the need for a clinical commentary on the data before it can be appropriately interpreted.

CHANGES IN THE ROLE OF GENERAL MEDICAL PRACTITIONERS

General Medical Practitioners (GMP) were given new contracts from April 1990. The emphasis on prevention and the early detection of disease is now reflected in the way that they are paid. There has been a great increase in the number of nurses employed by GMPs. Many of their new targets can be met by delegating the tasks to nurses. The Family Health Service Authorities who hold all the GMP contracts publish very little information on the nurses employed directly by GMPs. It is likely that they are recruiting qualified community nurses, already a scarce resource. Compatible manpower data would enable appropriate monitoring. The workload of nurses employed by GMPs is not identified in the mds.

CHANGING CLINICAL CARE

There are further challenges caused by the structure of the NHS information system. It inherited from the Korner mds a hospital information system that is facility based, concentrating on the use of theatres, outpatient departments, beds etc. As medical science improves, through technology e.g. lasers and lithotripters, treatment that would have been given as inpatient becomes possible to give as a day case or even as an outpatient procedure.

To ease this problem the "Next Steps" (Department of Health, 1990) proposed an ambulatory mds. This will cover patients who had been classified as outpatients and ward attenders for implementation from April 1991. From April 1993, the "Next Steps" recommended that the ambulatory mds should also apply to patients currently defined as day cases.

The average length of inpatient stays has been shortened by improvements in analgesics and anaesthetics. Patients who were admitted for long periods are now cared for in the community. The NHS information system is not yet able to integrate the information for a spell of health care that is both in a hospital and the community.

Some of the changes in nursing care are reflected in the new defintions for the contract mds. There have been several nursing development wards established in the United Kingdom (Jardine, 1989). From 1991 the work of these units can be included in the mds (Wheeller, 1991). The role of clinical nurse specialists in enabling individuals to cope with their long term problems is recognised in stoma therapy, continence, diabetes, and many other specialties. The work of the clinical nurse specialist is not yet captured adequately by the

mds. The community visits made by some of these specialists is counted, and from April 1991 the work that they do in nurse clinics in hospital will be recorded.

CHANGING FROM A CALENDER YEAR TO THE FINANCIAL YEAR

When the Korner mds was introduced, the collation of annual information was changed from the calender to the financial year. In most areas of the health service this neatly married the workload and manpower figures to the finances and the change was therefore welcomed.

There was one specialised area where there were particular difficulties. In the United Kingdom there is a school health service, with specific targets for health programmes, most notably immunisation. The financial year runs from April 1st to March 31st. The school year, from September to August, has a holiday in March or April at Easter - at a date set by the church's complex rules. Some financial years have no Easter holiday, most one, and some two. It is therefore not easy to compare the performance of the school heath service from one year to the next without reference to the calender, and dates of the local school terms.

THE QUALITY OF CARE

Most of the mds has been concerned with process and structure, rather than outcome. For many years the NHS statistics combined the figures for deaths and discharges, so that even the most dramatic and recognisable indicator of outcome was not available.

Quality specifications must be reflected in the new contracts, "Improvement in the quality and responsiveness of patient care is a main aim of the move to a contract system" (Department of Health, 1990a).

The Next Steps (Department of Health, 1990) states that "The search for good measures of health care outcome and quality of care has undoubtedly been boosted by the NHS Review with its emphasis on medical audit and with the objective of building into contracts outcome and quality conditions." It comments that the number of established measures are relatively few and had not led to changes in the mds's, and promises that when good outcome and quality measures are established, the Department of Health will seek to support them with information systems and build them into the minimum data sets.

THE AVAILABILITY OF INFORMATION TECHNOLOGY

The aim is for each part of the NHS to have the Information Technology support that it requires to meet its business and service objectives (Department of Health, 1990b). Each NHS organisation should have a clear view of the long term shape of future systems and how they fit together.

When the Korner mds was first implemented, there was a tendency for the emphasis to be on the collecting the Central Requirements, often using manual or unsophisticated computer systems. This meant that those parts of the mds, not required centrally, were given a low priority. Many of the original systems were free standing and not able to communicate with other systems.

The mds will be much more useful as the information systems conform to national standards for data interchange (Department of Health, 1990b).

THE USE OF THE MDS TO PROVIDE VALID COMPARISONS IN HEALTH CARE DELIVERY

From the time of the first registrations of births and deaths in the early nineteenth century, health statistics have been collected in Great Britain. Prior to the introduction of the mds, some of these routinely collected statistics were used to provide indicators to make quantitative comparisons between health districts. John Yates was the first to develop indicators for mental illness and mental handicap hospitals and he went on to demonstrate that hospitals with poor indicators were also the ones that hit the headlines for one scandal or another (Day 1989). Performance indicators for the National Health Service were greatly increased in the early 1980s both by John Yates and the Department of Health and Social Security. Since 1985 there have been over 2000 aspects of the district's services which can be put into the context of all other districts in England. A system of performance indicators was published for each year 1983 - 1986. They were not universally popular, as publishing the data without an appropriate narrative was felt by many people to be misleading.

A more comprehensive system of health service and community indicators has been developed, using the mds. It is now possible to make many more comparisons between health activities in different districts. District profiles are available so that expert users can choose which districts provide the most suitable matches. Much of the data is organised at DHA level. Recent changes

to the health service structure will have a considerable effect on the indicator system.

CONCLUSION

The challenges identified in this paper have been recognised and there are plans to resolve most of the difficulties. The speed of the implementation of many of the changes, and particularly the number of changes that are taking place at the time, outstrip the resources available to find all the appropriate solutions.

There are other constraints to changing the mds. Those policy makers, who need good time series to monitor the effects of the new policies, request the minimum numbers of changes. The system managers share this wish, and have capacity problems in addition to other feasibility difficulties.

A minimum data set will only ever give part of the picture. It is important that staff undergoing periods of rapid change keep a record of new activities. Most of the mds has been devised through Department of Health and National Health Service officers working together. It could be described as a largely "top down" approach. The business planning that all parts of the health service have been doing to prepare for the market economy means that many more NHS staff have considered carefully the work that they are currently doing and how it should be costed. It should therefore be possible to capture some of this work and use it to inform future changes to the mds.

International minimum data sets will have more complex problems than those described in this paper. Epidemiologists and demographers have some standard definitions that are widely used. For example, the international classification of diseases was one of the first international data sets in the health field. The World Health Organisation (White,1977) recommended that the effort to acquire comparable health information systems should be extended rapidly. The increased interest in minimum data sets gives the profession an opportunity for increased comparability with nurses in other countries. This paper illustrates some of the challenges that an international minimum data set might face.

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14 -- Development of the National Minimum Data Set for Institutional Health Services

Manoa Renwick

INTRODUCTION

Of the national expenditure on health, by far the most significant allocation of resources - more than half recurrent expenditure (AIH, 1990) - is to the provision of institutional services. Until the mid 1970s it was generally accepted that spending money on health care was a good thing and that the more that was spent, the better. The growth in health technologies and demands for reasonable rates of pay, amongst other things, have changed all that. The need to control the rise in costs led to a demand for information about how resources are allocated between and within institutions and, particularly, how they may be capped if not reduced. There was a keen interest in comparing the performance of the States and Territories and this eventually led to the development of a National Minimum Data Set (NMDS) for institutional health services. This paper will trace this development, describe the implementation program to date, identify the problems and successes, and forecast likely progress.

HOSPITALS AND THE NATIONAL TASKFORCE

At the June 1985 meeting of the Australian Health Services Council (now the Australian Health Ministers Advisory Council (AHMAC)), the newly established Australian Institute of Health was asked to conduct a study of hospital utilisation and costs (HUCS). The aims of this study were to assist in planning and funding hospital systems by analysing their utilisation and costs and the factors that affect them.

The first HUCS collected data from the 1985-86 financial year and amongst its many findings was the fact that hospital information systems in the eight States and Territories of Australia were not always easily reconciled. Incompatibilities were numerous - as a result, by and large, of our federated system and the fact that the governments of the States and Territories have responsibility for the provision of health services, whereas the Commonwealth Government funds them. Some of these problems were already well-known (Jamison, 1981) but they became more visible with HUCS 1985-86 and led to AHMAC establishing a Taskforce on National Hospital Statistics in April 1987.

Its terms of reference were to review existing collections and the requirements for national statistics, and recommend how a national statistical system covering hospitals and health-related institutions could be devedloped (AIH, 1988).

The Taskforce wanted to collect statistics that would properly reflect the diversity of the organisational and institutional arrangements within the public sector and between the public and private sectors. Its terms of reference were restricted to the public hospital system, although it was to take account of the private sector.

The scope of its enquiry was all health care establishments with a substantial relationship or similarity to hospitals, in terms of either patients treated or the type of workforce employed. "Data" included activity statistics, and data on finances, staffing and patients. Disease registers and similar detailed program-based information systems were not examined.

Each jurisdiction was able to provide descriptive information for general hospitals that could fit into four main groups: resources (personnel and financial), service provision and use, patient characteristics, and facilities. This was not to imply that the data items themselves were either uniform or compatible but it raised the possibility of modifying the definitions of data items and/or the methods of analysis to provide more comparable information. Public psychiatric hospital systems gathered data on all the major groups except for patient morbidity which was collected, in 1987, only in NSW.

The situation was somewhat different in the private sector. Most States collected scanty information about the capacity of their private hospitals (eg bed numbers) and several States collected inpatient morbidity data from all or some of their private hospitals. Staffing, financing and activity data were gathered by the Australian Bureau of Statistics (ABS) in its survey of private health and welfare establishments but this was only in Queensland.

However, in 1987, the first private hospital survey was jointly conducted by the Commonwealth Department of Health and the Australian Private Hospitals Association (APHA). Since then these surveys have been run every six months, collecting information on resources and activity (but not patient morbidity). However, the coverage of this survey is incomplete and the data may not be representative of the private sector as a whole.

OTHER INSTITUTIONS

There were significant differences between States and Territories in the information from nursing homes and hostels, even about the number of available beds. These differences reflected, in part, the variations in levels at which nursing home type care was provided in acute hospitals or through domiciliary

services, or at which hostel type care was provided for psychiatric patients instead of institutional care. Reasonably comprehensive data were available from State nursing homes but, except for Queensland, this was not so for private nursing homes. Again, morbidity data were only available for NSW.

The CDCSH collected information about the reason for admission to nursing homes but this was not readily available to users. CDCSH also collected some information about hostels and their residents but the data were incomplete, and there was only limited information on staffing and financing.

SINCE THE TASKFORCE

The Taskforce established five working parties, comprised of experts in specialist areas, to develop, by consensus, a NMDS. This was a lengthy process that resulted in a set of recommended data items and definitions (AIH, 1989). The NMDS covers all types of institutions including psychiatric, and alcohol and drug hospitals; hospices; and non-residential health services. It contains data items relating to three units of enumeration (note the parallel with the Taskforce's groupings):

1. System-level, which is defined by capital and other indirect expenditure. In the public sector, this is the level of the State/Territory health or mental health authority. In the private sector, it is the enterprise or management unit level.

2. Establishment-level, which are separately administered establishments or services and are defined by activity and resources.

3. Patient-level, which are defined by inpatient episodes or non-inpatient occasions of services.

The Taskforce differentiated between the identification of a minimum data set and a data base. They saw the NMDS as an agreed set of data items and their definitions. A national data base was conceptualised as a centralised system for making available, for agreed purposes, the information contained in the NMDS (but not necessarily all of it). So we can think of eight health authorities, each holding a comprehensive data set (using the NMDS) of public and private sectors, which together comprise a national data base. The fact that it may not necessarily be collected nationally does not detract from the fact that it exists, at least notionally.

There have been three other important changes since 1987. Patient morbidity systems have improved and the coverage of the private sector has been extended. The coverage of data collection by the CDCSH under the

Residential Programs for Older Persons has been extended to all nursing homes and hostels for the aged and young disabled. The health authorities collections for psychiatric inpatients have become more comprehensive, although information about non-inpatients is limited.

The second Hospital Utilisation and Costs Study relating to 1987-88 was published earlier this year and the third HUCS, for 1989-90, is being processed. The HUCS surveys collected information about private hospitals indirectly - using information from the relevant Health Authorities and the latest CDCSH/APHA survey of private hospitals. There will be no need to have a fourth HUCS because the first NMDS survey will replace it.

NMDS IMPLEMENTATION PROGRAM

When the NMDS was presented to AHMAC, the AIH was asked to prepare an implementation program to cover public institutions and, with the cooperation of the ABS, the private sector. This program has the following method and scope:

1. The first collection will cover public and private acute and psychiatric hospitals and same-day establishments.

2 The first survey in the implementation program will collect data from September 1992, for 1991-1992, using NMDS data definitions for a subset of NMDS items.

3. The collection cycle will be annual.

4. For the public sector, the AIH will collect system- and establishment-level data from State/Territory Health Authorities.

5. For the private sector, the ABS will collect system- and establishment - level data directly from enterprises, managements units or establishments, as appropriate.

6. For both public and private acute and psychiatric hospitals, the Health Authorities will have four options to choose from to provide patient-level data to the AIH. These options relate to whether or not the data are made available at unit record level for establishments and/or patients. The option chosen will affect the flexibility of national reporting on institutional services.

Appendix A lists data items at system, establishment and patient level to be collected in this initial survey. Appendix B shows a selection of output tables.

PROBLEMS AND SUCCESSES

The cost imposed on providers of data by a national collection is one of the obstacles that have to be overcome. In devising the implementation program it was found to be helpful to separate them into:

Costs incurred by the introduction of new definitions into current information systems, including:

the costs of acquiring information for the management of the State/Territory health system; and

the costs associated with the management of the information system itself - to evaluate its accuracy and to improve its timeliness; eg edit checks, data audits, and other activities to train staff involved in data collection and processing.

Costs arising from the manipulation of data to comply with external definitions of use in a national context, where comparability is the central issue. While the Health Authorities are moving to modify their data definitions and information systems to reduce the extent of this manipulation, the pace of change varies and so, of course, does the cost of data manipulation. Even after appropriate data handling arrangements are developed, residual costs will remain because some additional manipulation will be unavoidable. The ongoing costs of repeat surveys should diminish, however, as the manipulation is reduced.

These costs are influenced by a number of factors such as the size of hospitals, the size of the health system, the extent to which definitions have been matched with the NMDS, and the relative sophistication of data handling techniques. Further, the one-off costs of developing appropriate data handling arrangements to meet these contingencies can be distinguished from the ongoing costs that arise from repeat surveys.

Implementation costs are especially keenly felt in the smaller hospitals, both public and private, where the number of individuals in administrative positions does not permit any allowance for the additional workload imposed by the gathering and collation of statistics. The Institute has recommended that some financial assistance from governments for the first collection for small private hospitals, to help overcome this burden, may act as an incentive to supplying accurate data. Alternatively, the encouragement and/or sponsorship of software houses to facilitate software development could be considered.

Another major problem was the need to overcome a degree of sensitivity about the autonomy of the various providers of data (State / public / private sectors) which was manifested in a variety of ways. The urge to protect the status quo is an understandable reaction to change, especially if that change is perceived to have an external source. Definitions that have been in use for years and "owned" by an authority are not going to be given up lightly. For example, some very state-specific definitions exist for some establishments, a hospital bed, and capital expenditure. Derived data items may also employ different methods, eg leave days and staffing costs. These difficulties will fade into the past, of course, once the NMDS is operational in all systems. However they can be a source of friction while consensus across a pluralistic institutional health system is being reached.

Now let us look at the successes. The last few years leading up to the implementation of the initial survey has seen the development of a gratifying level of commitment to the NMDS by most of the parties concerned. This can be evidenced generally by a willingness to adapt to a changing environment and review definitions. This may partly reflect, of course, the need to survive in a hostile environment - and anyone working in the institutional health system today would have to agree that feather-bedding has long gone. Whether this is true or not, it may well be that in five or ten years time, when people look back on the current situation, the introduction of the NMDS will be viewed as one of the successful outcomes of this difficult period, whatever the motivation may have been.

FUTURE DEVELOPMENTS

Further revision of NMDS definitions has already begun. The scope and coverage of the implementation strategy needs to have a phased expansion. The reason for the exclusion of nursing homes from the initial survey was to allow time for the most efficient strategy of data collection to be negotiated, since duplication of DCSH statistics should be avoided if at all possible. The Institute will be putting a plan to AHMAC next year to resolve the conceptual and methodological issues of data collection and the various responsibilities of the concerned parties. In addition, the national collection will be expanded as soon as possible to include patient-level information on non-inpatients in psychiatric hospitals; information from alcohol and drug hospitals, and information from hospices.

While the institutional health care sector still dominates health services, the last few years has seen this dominance gradually reduce. For example, the growth in one day public hospital stays between 1985-86 and 1978-88 was over 50 per cent. The number of private same day facilities themselves grew over the last year by 270 per cent. Together with reducing length of stay for

acute hospital treatment of episodes of illness not amenable to day surgery, this will mean an increasing dependence on domiciliary/ community nursing and other outreach services. The non-institutional sector therefore will become increasingly important and the need to be able to describe those services, their clients and their providers, will become pressing. There is no need to tell this forum the great variation in data availability in the non-institutional sector or the problems that confront would-be collectors of information. Indeed, there is increasing pressure for the AIH to become involved in the collection of data for community health and other non-institutional services. Pressure has been necessary only because resources have not yet been available to begin this task - the need is fully recognised. It will be an exciting challenge for which this experience will have been a useful testing ground.

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APPENDIX A

Data Items

SYSTEM-LEVEL DATA

S1. Capital Expenditure	land buildings	computer equipm't /instalns	major medical equipm't	plant & other - equipm't	intang ible assets	other capital xpen

S1.1 gross capital expenditure
S1.2 net capital expenditure

S2. Indirect expenditure

S2.1 patient transport services
S2.2 public health & monit'g services
S2.3 central/statewide s'port services
S2.4 central administration
S2.5 other health care expenditure

ESTABLISHMENT-LEVEL DATA

1 Establishment Resources

1.1 **Characteristics**

E1 establishment type
E2 geographic location
E3 available beds for admitted patients
E3.1 - number at year end
E3.2 - average for financial year
E4 specialised service indicators
E4.1 obstetric/maternity service
E4.2 specialist pediatric service
E4.3 psychiatric unit/ward
E4.4 intensive care unit (level III)
E4.5 hospice care unit
E4.6 nursing home care unit
E4.7 geriatric assessment unit
E4.8 domiciliary care service
E4.9 alcohol and drug unit
E4.10 acute spinal injury unit (SS)
E4.11 coronary care unit
E4.12 cardiac surgery unit (SS)
E4.13 renal dialysis unit (acute) (SS)
E4.14 renal dialysis satellite centre - maintenance (SS)
E4.15 burns unit (level III) (SS)
E4.16 major plastic/reconstructive surgery unit (SS)
E4.17 oncology unit (SS)
E4.18 neonatal intensive care unit (level III) (SS)

E4.19 in-vitro fertilisation unit
E4.20 refractory epilepsy unit (SS)
E4.21 transplantation unit
.1 bone marrow (SS)
.2 renal (SS)
.3 heart (incl heart/lung)
.4 liver
.5 pancreas
E4.22 clinical genetics unit (SS)
E4.23 sleep centre (SS)
E4.24 neurosurgical unit
E4.25 infectious diseases unit
E4.26 AIDS unit
E4.27 diabetes unit
E4.28 rehabilitation unit
E5 teaching status

1.2 Staffing

C1 Staff category
C1.1 salaried medical officers
C1.2 registered nurses
C1.3 enrolled nurses
C1.4 student nurses
C1.5 trainee/pupil nurses
C1.6 other personal care staff
C1.7 diagnostic and health professionals
C1.8 administrative and clerical staff
C1.9 domestic and other staff

1.3 Recurrent expenditures

E8 salaries and wages by C1
E9 payments to visit'g med officers
E10 superannuation payments
E11 drug supplies
E12 medical and surgical supplies
E13 food supplies
E14 domestic services
E15 repairs and maintenance
E16 patient transport
E17 administrative expenses
E18 interest payments (nei)
E19 depreciation (priv sector only)
E20 other recurrent expenditure

1.4 Revenue

E21 patient revenue
E22 recoveries
E23 other revenues

2. Establishment Activity

2.1 Acute hospitals

A8	Type of inpatient episode	A1 Separations		A2 Occupied bed days	
		A7.1 Same day	A7.2 Other	A7.1 Same day	A7.2 Other
A8.1	psychiatric				
A8.2	alcohol & drug				
A8.3	nursing home type				
A8.4	rehabilitation				
A8.5	intell h'cap & dev dis				
A8.6	dental				
A8.7	social supp't & non-med				
A8.8	dialysis				
A8.9	endoscopy				
A8.10	perinatal				
A8.11	medical/surgical/obstetric				

A9	Type of non inpatient episode	A4 Occ of service	A5 Group sessions
A9.1	A & E		
A9.2	medical/surgical/diagnostic		
A9.2.1	dialysis		
A9.2.2	pathology		
A9.2.3	radiology & organ imaging		
A9.2.4	endoscopy & related procs		
A9.2.5	pharmacy		
A9.2.6	other		
A9.3	psychiatric		
A9.4	alcohol & drug		
A9.5	dental		
A9.6	allied health services		
A9.7	community health services		
A9.8	district nursing services		
A9.9	nonmedical & social supp't		

2.2 Same-day hospitals

A8	Type of inpatient episode	A1 Separations
		A7.1 Same day
A8.6	dental	
A8.8	dialysis	
A8.9	endoscopy & related procs	
A8.11	medical/surgical	

2.3 Psychiatric hospitals

A8 Type of inpatient episode

	A1 Separations			A2 Occupied bed days			A3 Inpats in residence	
	A7.1	A7.2.1	A7.2.2	A7.1	A7.2.1	A7.2.2	A7.2.1	A7.2.2
	Same day	Short	Long	Same day	Short	Long	Short stay	Long stay
A8.1	psychiatric							
A8.2	alcohol & drug							
A8.5	intell h'cap & dev dis							
A8.6	dental							
A8.7	social supp't & non-med							
A8.11	medical/surgical							

PATIENT-LEVEL DATA

		Acute Hospitals and Private Psych Hospitals	Public Psych Hospitals
P 1.	establishment ident	x	x
P 4.	sex	x	x
P 5.	date of birth	x	x
P 9.	area of usual residencex	x	x
P16.	patient accom status	x	x
P18.	compensable status	x	x
P19.	insurance status	x	
P20.	pension status		x
P21.	type of episode	x	
P24.	admission date	x	x
P26.	discharge date	x	x
P27	a total leave days	x	x
P31	mode of separation	x	x
P35.	principal diagnosis	x	x
P36.	additional diagnoses	x	x
P37.	principal procedure	x	
P38.	additional procedures (<4)		x
P39.	external cause	x	
P41.	case-mix (derived)	x	

APPENDIX B

Examples of Output Tables

SYSTEM-LEVEL

Capital/indirect expenditure by public/private by State

ESTABLISHMENT-LEVEL

State by public/private by type of episode by hospital size by expenditure
State by public/private by type of episode by hospital size by staffing levels
State by public/private by treatment mode by hospital size by location
State by public/private by hospital size by expenditure by treatment mode
State by public/private by type of episode by hospital size by treatment mode
State by by public/private by hospital size by staffing/ expenditure
State by public/private by type of episode by hospital size by treatment mode

PATIENT LEVEL

Activity information

- **Acute hospitals**
  Separations and occupied bed days by type of inpatient episode
  Separations and occupied bed days by treatment mode
  Separations and occupied bed days by sex and age group
  Separations and occupied bed days by patient accommodation status by compensable status by insurance status

- **Psychiatric hospitals**
  Separations and occupied bed days by type of inpatient episode
  Separations and occupied bed days by treatment mode
  Separations and occupied bed days by sex and age group
  Separations and occupied bed days by pension status

Epidemiological information

- Acute care hospitals

  Separations and occupied bed days for public and private hospitals for:
  DRG by age group by sex
  DRG by area of usual residence by geographic location of hospital
  Diagnosis (ICD-9-CM 3 digit) by age group by sex
  Procedure (ICD-9-CM 3 digit) by age group by sex
  External cause by age group by sex

Psychiatric hospitals
Residents, separations, and occupied bed days for public and private hospitals for:
- Diagnosis by age group by sex
- Diagnosis by area of usual residence by geographic location of hospital

15 -- Standardized, Comparable, Essential Data Available Through The Nursing Minimum Data Set

Harriet H. Werley, Jane S. Leske

INTRODUCTION

It is a pleasure to be participating in this preconference workshop on Standards and Minimum Data Sets, for it is important that nurses move forward in their work on developing nursing information systems (NISs) and computerization of data in such a way that their systems will provide access to comparable data across clinical populations and settings--locally, regionally, nationally, and internationally. It also is a pleasure to be participating in this program with colleague speakers, who represent a vendor, an information network of a United States consortium of university hospitals, the Project Director for the Australian Community Nursing Minimum Data Set, and others working on data sets in health care. Discussion among the workshop leaders and attendees should provide a rich learning experience.

Comments on standardization, comparable data, and essential core data will pertain, in the main, to the U.S. Nursing Minimum Data Set (NMDS). In this way, there will be some tangible content to refer to for discussion. To make certain that workshop participants are thinking about the same content and context, and their pertinence to the workshop topic under discussion, some background on the concept of uniform minimum health data sets (UMHDSs) and the development of the NMDS will be presented. However, because much of the work on the NMDS has been published previously (Devine & Werley, 1988; Werley, 1987; Werley, Devine, & Zorn, 1988; Werley, Devine, & Zorn, 1989; Werley & Lang, 1988a; Werley, Lang, & Westlake, 1986a, 1986b; Werley & Zorn, 1989), background presented initially will be limited but can be expanded as indicated by questions and discussion.

STANDARDIZATION OF DATA

In the U.S., the need for quantitative information to support health policy formulation, program planning, management, and evaluation in health at all levels of the health care system is widely recognized. But through the years it also has become apparent that health data are diminished because of lack of comparability of definitions, codes, classifications, and terminology used. Therefore, within the Department of Health and Human Services (DHHS) a

program of standards and guidelines was established in 1979. This program provides for the consideration of UMHDSs. For purposes of the standards program, a UMHDS is defined as "a minimum set of items of information with uniform definitions and categories, concerning a specific aspect or dimension of the health care system, which meets the essential needs of multiple data users" (Health Information Policy Council, 1983, p.3). Thus nursing and nurses profit by this emphasis on standardized data that will enhance the comparability and uniformity of health information and statistics. Minimum health data sets play a large role in the program of Health Data Standards and Guidelines. This was kept in mind as the developmental work on the NMDS was done.

The Health Information Policy Council (HIPC) is the principal internal advisory body to the DHHS Secretary on health data policy matters, and the National Committee on Vital and Health Statistics is a public body that advises the secretary on all statistical matters, including minimum data sets. The NMDS has been presented to both of these groups; and the research potential of the NMDS was recognized readily, with the suggestion that funds be sought for further development and research. For some of this, nurse researchers should be encouraged to conduct research using the NMDS in their clinical interest areas.

THE NMDS DEFINITION BASED ON THE UMDHS CONCEPT AND DEFINITION

Built upon the concept and definition of the UMHDSs, the NMDS is defined as a minimum data set of items of INFORMATION WITH uniform definitions and categories concerning the specific dimension of nursing, which needs the information needs of multiple data users in the health care system. It includes those specific items of information that are used on a regular basis by the majority of nurses in any care delivery setting. It is an abstraction system, or tool, designed for the collection of uniform, standard, comparable, minimum nursing data for use across various types of settings and clinical populations. These data also are useful to other health professionals and researchers, if the total health care picture is to be represented in clinical and health policy decision making.

UNDERPINNINGS OF THE NMDS: THE NURSING PROCESS AND THE UHDDS

First, the nursing process is a systematic problem-solving methodology that nurses use to deliver patient care. Bulechek and McCloskey (1985), in their book on Nursing Diagnosis and Interventions, did an excellent job of tracing the early work on the nursing process; this work was initiated in 1967 at the Catholic University of America in Washington, DC, where four phases of the Nursing Process were identified; these were: assessment, planning,

implementation, and evaluation (Yura & Walsh, 1978, 1982, 1983). Through the years, the four-step model became a five-step model by adding nursing diagnosis and changing implementation to intervention. Thus in the present model the steps are: assessment, diagnosis, planning, intervention, and evaluation. The nursing process constitutes professional nursing practice, that is, the diagnosis and treatment of health problems for which nurses are responsible (Bulechek & McCloskey, 1985).

The NMDS includes 16 elements that have been divided into three categories: Nursing Care, Patient or Client Demographics, and Service Elements. Three of the five-step nursing process phases are included in the NMDS, these are: Nursing Diagnosis, Nursing Intervention, and Nursing Outcome (sometimes referred to as nursing-sensitive patient outcome). Included also under the Nursing Care Elements is the Intensity of Nursing Care. This element should not be confused with "patient acuity", for Intensity of Nursing Care pertains to the allocation of nurse resources to provide care.

NURSING DIAGNOSIS. Through the nursing process, care is standardized while individual service is provided. Part of the standardization comes from the classification of nursing diagnoses in accordance with the work that has been ongoing since 1973 (Gebbie & Lavin, 1975), when the National Conference Group for Classification of Nursing Diagnoses was formed. The Group met biennially since then, with nine conferences conducted to date. The purpose of these conferences has been the development of a diagnostic taxonomy for nurses, that is, "the definition of a standard nomenclature for describing health problems amenable to treatment by nurses" (Kim & Moritz, 1982, p. xvii). There are currently 100 nursing diagnoses that have been approved by the North American Nursing Diagnosis Association (NANDA) for clinical testing; these are listed in NANDA's (1990) Taxonomy I Revised. Efforts have been made to have the categorized nursing diagnoses included in the tenth revision of the International Classification of Diseases (ICD 10). Work done to translate nursing diagnosis into the ICD code is available in the literature (Fitzpatrick et al., 1989). This movement will require the support of nurses internationally, and it would be a great step forward for nursing as it moves toward standardization of its nursing care language.

NURSING INTERVENTION. After having made the nursing diagnosis, comes the decision about what to do with or for clients, that is, what nursing intervention or nursing action is the appropriate treatment for the nursing problem or diagnosis. Bulechek and McCloskey (1985) defined the term: "A nursing intervention is an autonomous action based on scientific rationale that is executed to benefit the client in a predicted way related to the nursing diagnoses and stated goals" (p.8). Interventions are what nurses do with and

for clients to solve a patient problem, or prevent a possible problem. Their definition has been broadened somewhat more recently, during their work on developing a classification system for nursing interventions.

Unlike what happened with nursing diagnosis, there is no organization to work on a classification of nursing interventions. The most unique and the best work being done in this area, to date, is that of McCloskey and Bulechek at the University of Iowa College of Nursing, where they have a large team of people developing a classification of nursing interventions. Their team consists of nurse faculty, hospital personnel, and two statisticians who are valued for their contributions and want to be part of the team. The team has done extensive work on this project for several years without external funding. Fortunately, they were funded in June 1990 by a federal grant, therefore they will be able to work more productively. The funding will facilitate completion of their work on the classification system in a shorter period of time, so the coded interventions can be shared with the profession and used, as for example, in the NMDS. McCloskey and Bulechek brought in their project Advisory Committee in November 1990 to review their work on the classification system to date, react to it, and to offer advice or suggestions as indicated. The Advisory Committee was most impressed with their work and urged them to carry on.

NURSING OUTCOME. Another aspect of the NMDS that requires further work is that of nursing-sensitive outcomes. Marek (1989) conducted a pilot project to identify outcome indicators found in the nursing literature that were used or proposed for use in measuring the effectiveness of nursing. She then classified these indicators into 15 categories, but they were not mutually exclusive nor exhaustive. Later, in two articles on patient outcomes Lang and Marek (1990, 1991), from the University of Wisconsin-Milwaukee, focused on the end results of nursing and health care, pointing up the absence of nursing data in various data bases. In essence, these are review articles covering: the historical and contemporary influences on the work of outcomes, the American Nurses' Association role, and the establishment of the new, federal Agency for Health Care Policy and Research that focuses on effectiveness initiatives. There also is a Nursing Services Administration Research Team--a faculty group at the University of Iowa, led by Marion Johnson--whose members are exploring work being done on patient outcomes, in order to identify the nursing- sensitive outcomes. Their effort may eventually lead to the development of a classification system for nursing outcomes. This developmental work will be watched very carefully by all who are interested in the nursing process, which is the mode of professional nursing practice.

Until such time as a nursing-sensitive outcome classification is further developed, the proponents of the NMDS have coded the outcomes for nursing diagnoses as "resolved", "not resolved", or "not recorded" (Werley, Devine, &

Zorn, 1988, 1990). And, the coding for nurse documentation of the NMDS element labeled "Disposition of Patient or Client" might reflect "Discharged to home with referral to organized community nursing service" (Werley & Lang, 1988b, chap. 31, p.410). This could be discharge to a home health care agency or to a nursing home for short- or long-term care.

INTENSITY OF NURSING CARE. This element is to reflect the nurse resources required to provide patient or client care, as measured by the two sub-elements: Hours of Care and Staff Mix. To some extent, this element makes available costing of nursing care provided.

Second, as to the influence of the Uniform Hospital Discharge Data Set (UHDDS), ten of the NMDS elements in the demographic and service categories have been drawn from the UHDDS, which already is being collected for all hospitalized patients receiving Medicare benefits. In addition, the UHDDS serves as a linkage to other data sets within a facility. Thus, access is provided to additional client data that may serve as correlate or predictor variables when studying nursing practice or conducting research. This system linkage with the UHDDS "is valuable not only because of the information it contains but more importantly as the key to enter other data sets. Thus, through the UHDDS one can obtain an almost complete picture of the total period of hospitalization for a variety of uses" (Thompson, 1988, p. 284). Use of the NMDS can enhance the management of health care data, not only within hospitals, but also across settings in various long-term care, public health, and geographical locations, because of the inclusion of specific nursing care data.

EARLY BEGINNINGS TO DEVELOP A BASIC NURSING DATA SET

The NMDS effort is a follow-through on earlier work that was done at the University of Illinois. In a Nursing Information Systems Conference held in 1977 at the University of Illinois College of Nursing in Chicago (Werley & Grier, 1981), an effort was made to stimulate nurses to move toward computerization of nursing services data and toward submission of proposals for research and development of NISs. In addition, one of the small work groups was given the challenge of identifying a basic nursing data set. Their effort was reported by Newcomb (1981) in the Werley and Grier (1981) Nursing Information Systems book. However, the timing for movement in this direction apparently was not right for nursing at that time, and nurses did not move forward in this area. This was so despite the fact that in the 1970s federal funding was available for research and development of information systems, and physicians and hospital administrators developed medical and hospital information systems that today are well known throughout the country. Most of those investigators received several rounds of funding. Unfortunately, however, most of their information

systems were and are silent on nursing documentation whereby nursing practice and outcomes can be assessed in nursing's terminology. Nurses, too, should have been developing their NISs to complement and supplement the other data sets.

THE NMDS CONFERENCE: ITS CHARACTERISTICS AND PARTICIPANTS

Later, the subject of NISs was opened again, and in May 1985, a national, invitational NMDS Conference was held at the University of Wisconsin-Milwaukee School of Nursing to identify the NMDS. A national group of 64 experts participated in a three-day conference. Approximately 30 papers were commissioned to identify and discuss the issues involved in developing the NMDS, from the various authors' perspectives. These papers were assembled and distributed three months before the conference, to be studied prior to the conference so the participants would be ready to participate actively, in six task forces, to identify the elements for the NMDS.

The numerous conference participants included: nurse experts in a variety of areas; health policy spokespersons; information systems, health data, and health records specialists; governmental and proprietary agency personnel; and persons knowledgeable about the development of the previous minimum health data sets (HIPC,1983).

The first day of the conference, seven discussants, in turn, presented a brief synthesis of the issues identified in their block of assigned papers; then the discussant led a discussion of these issues among the total conference group. That evening, the charge was given for the next two workshop days, when the six task forces would be deliberating and identifying the NMDS elements. There was discussion of the task force plan, with the conferees having an opportunity to suggest changes. Consensus was reached to have everyone assigned to task forces in accordance with aspects of the nursing process, that is, nursing assessment, diagnosis, intervention, outcome, intensity of nursing care, and one on demographics. The resulting work then was reviewed by a Post-Conference Task Force several months later for agreement, modification, filling in nursing content, and approval for further work. Hence, the NMDS was consensually derived by this group of 64 experts at a national, invitational NMDS conference involving task force work (6 task forces) and consensus building--both within their separate task forces and across all task forces, or, the total group, followed with additional work by the Post-Conference Task Force. Thus, there was an element of validity.

COMPARABLE DATA

You will recall from the U.S. DHHS Program of Health Data Standards and Guidelines, discussed earlier, that in order to have comparable data collected,

there must be decisions on what essential data are to be collected for what purpose. Special attention must be focused on definitions, codes, classifications, and terminology used, if comparability of data is to be enhanced.

AGREEMENT ON DATA ELEMENTS REQUIRED

To have comparable data means that there is agreement on what data nurses will want to collect to portray their practice, and on standardization of language as they identify and define the elements to be collected for specific purposes. McCormick (1988) has written on the subject of the need for a unified nursing language system, indicating that the profession could or should define this language, that the language system should be seen as a part of health care language system developments generally, and that there should be clarity about frameworks and criteria for selecting content in a unified nursing language system. She also commented on advantages of a unified nursing language system, as well as on considerations essential to integrating clinical, scientific, and management data in meaningful ways. This latter point ties in somewhat with a statement made at the 1982 Cleveland conference on NISs regarding clinical and administrative data (Study Group on Nursing Information Systems, 1983). This Study Group stated that "management and practice data are interrelated or complementary and should be so perceived; ultimately, both kinds of information could be obtained from the same data" (p. 104).

To be assured of having comparable data, nurses also must learn to trust good work that has been done previously by others, without having each person start all over. There should be testing of this earlier work in a variety of settings in order to build on the work, changing things only as warranted by research and new developments. New knowledge is built in this way, that is, previous work is tested, research is conducted, and the results are shared as small accretions of new knowledge that add to the body of nursing and health care knowledge. It should be recognized that documentation of nursing diagnoses and interventions are the major building blocks of new nursing knowledge.

ADHERENCE TO THE DEFINITIONS OF THE NMDS ELEMENTS

The NMDS elements were defined as can be found in the Werley and Lang (1988a) book and the Werley, Devine, and Zorn (1988, 1990) data collection manual. But, in order to advance the work on the NMDS, there must be testing, implementing, retesting, modifying, and developing further the data set. And then, research must be conducted to test further the true potential of the data

set, in terms of both the projected benefits, the purposes of the NMDS, as well as the effectiveness of nursing care and patient outcomes.

Nurses should realize that information systems are improved with implementation and use; so they should move along with the research and development work, as well as testing and implementation. They could well take a lesson from the statement made in 1972 by the editors of the final report of the Uniform Hospital Discharge Data Demonstration. Hodgson and Kucken (1972) stated, "Hospital discharge data will be more valuable to users when they learn to manipulate the data to its fullest potential and to determine their own precise data requirements. . . .A uniform hospital discharge abstract data system will increase in value when data sets are developed and linked together for nursing homes, home health agencies, physician's offices, and other delivery sectors. The uniformity of data is also likely to enhance the worth of the hospital discharge information. The benefits to a medical community in adopting a basic data set increase proportionally to the number of hospitals in the area that collect uniform data" (p. 205). The essence of the above statement also will be true for nursing, once nurses implement and use the NMDS and then conduct comparative research across both units within facilities and across types of settings. Nurses, then, could make their own statement as it applies to the use and benefits of the NMDS implementation.

In addition, it must be recognized that, fortunately, more nurses prepared in informatics are beginning to contribute to nursing's growth in developing information systems and data bases. In recent years, since Judith Graves' completion of a two year post-doc in health informatics, Graves and Corcoran (1988a, 1988b, 1989) have been enriching the literature with articles on: designing NISs, identification of data element categories for clinical NISs, and the study of nursing informatics. These are excellent references that will help to advance the work on information management and computerization in the field of nursing; the first two articles mentioned are research-based. No doubt, these authors would welcome being called upon for consultation and assistance in promoting the forward movement of nursing's information systems.

ESSENTIAL CORE NMDS ELEMENTS PER THE NURSING PROCESS AND THE UHDDS

Within the broader concept and definition of UMHDSs, HIPC saw minimum data sets as groupings of data items with standard definitions pertaining to a specific aspect of the health care system. These data sets have the potential to be powerful tools in meeting the purposes of the specific data set and of supporting a program to enhance comparability of data. And, this is as the proponents of the NMDS saw it when the data set was developed.

NMDS ELEMENTS

The NMDS includes 16 items, or elements, that have been categorized in three general groups: nursing care, patient or client demographics, and service elements, as shown below:

Nursing Care Elements	Patient or Client Demographic Elements
1. Nursing Diagnosis	*5. Personal Identification
2. Nursing Intervention	*6. Date of Birth
3. Nursing Outcome	*7. Sex
4. Intensity of Nursing Care	*8. Race and Ethnicity
	*9. Residence

Service Elements

*10. Unique Facility or Service Agency Number
11. Unique Health Record Number of Patient or Client
12. Unique Number of Principal Registered Nurse Provider
*13. Episode Admission or Encounter Date
*14. Discharge or Termination Date
*15. Disposition of Patient or Client
*16. Expected Payer for Most of This Bill (Anticipated Financial Guarantor for Services)

*Elements marked with an asterisk are included in the UHDDS.

Ten elements of the NMDS are components of the UHDDS already being collected for all hospitalized patients receiving Medicare benefits; six items are new to the set. When health information systems are computerized and linked across different types of settings, only the new items would need to be re-collected for hospitalized Medicare recipients.

Through this powerful, small data set (the NMDS), nurses can: describe patient problems across types of settings, clinical populations, geographic areas, and time; identify the nursing diagnosis made; learn what nursing interventions or nursing actions were taken; observe nurse sensitive patient outcomes; and assess what nurse resources were used to provide nursing care. If the data from this set were part of ongoing nurse documentation, and computerized in such a way that the data could be retrieved readily, nursing would for the first time be in an excellent position to compare and contrast nursing practice locally, regionally, nationally, and internationally; offer pertinent, data based testimony on critical nursing and health care issues; develop data bases needed to conduct research on many aspects of clinical care; assess the cost effectiveness of nursing interventions for the respective nursing diagnoses; assess the cost of

nurse resources used to provide care; and provide data to influence health policy making. Further, through the linkages between nursing's and other professional's data bases, nursing could share data with various health providers and researchers and at the same time have access to their data. This should be a challenge and opportunity toward which all nurses will wish to direct their efforts. Examples of what some nurses in the U.S. are doing about moving forward with the NMDS, are listed in the Werley and Leske (1991) paper to be presented during the main conference here at the Fourth International Conference on Nursing Use of Computers and Information Science.

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The Blanke Foundation is acknowledged gratefully for continued partial support of ongoing work on the Nursing Minimum Data Set.

16 -- Community Nursing Minimum Data Set - Australia

James P. Turley

INTRODUCTION

Throughout the development of modern health care, there has been the recognition that information is necessary for the planning, development and delivery of adequate, appropriate and affordable health care. This recognition has lead to the development of many systems for the collection, abstraction and summarization of health related information (Werley & Grier, 1989). The need to standardize and formalize this health related information has been demonstrated in a number of arenas, from the organized patient record to the system of reports and statistics gathered for governmental purposes. Nursing has been involved in the collection and abstraction of health related information from the beginning. However, nursing has historically focused its supportive role and gathered information which was of use to other professionals, whether physicians or health planners.

More recently nursing has begun to focus on the needs of nursing. Patient records have begun to focus on the nursing needs of the patients. The gathering of patient related information has focused on the areas where nurses can intervene independently as well as in cooperative practice with other professionals. Thus patient records have begun to have a clear focus on functional assessments, the needs of the patient and the supportive structures which can assist in the meeting of those needs, whether by the family, or by informal or formal organizations. This perspective on information gathering and organization is very different than just supporting the needs of other health care providers.

The development of a Community Nursing Minimum Data Set for Australia (CNMDS-A) is another example of nursing's need to gather and structure information which will meet the needs of nursing. This paper will present a short history of the goals, the background and development of the CNMDS-A, the items which have been selected and the work which has yet to be done for the continued development of the CNMDS-A.

GOALS

Community nurses recognized that there was no common language to organize and describe the varieties of community nursing practice in Australia. Without a common language it was difficult, if not impossible, to describe succinctly what community nurses did and how they did it Gliddon, 1990). Nursing has historically focused on the process of doing nursing rather than on the outcomes which resulted from the process of nursing. One result of this process oriented focus has been that nurses have had difficulty explaining what nurses do to people who are not initiated into the profession and who do not speak ' the language of nursing'. Another aspect of being process oriented, is that nurses recognize the uniqueness of each client and each client situation. This focus on uniqueness has meant that nurses have been reluctant to adopt any standardized language which would inhibit the description of the unique client situation.

These aspects have made nursing language difficult to translate from one nursing arena to another, from one nursing organization to another and more importantly from nursing to a non-nursing organization. From this perspective, it was clear that a set of working goals had to be established in order to have a framework for discussing the development of the CNMDS-A. While nursing has focused on the uniqueness of clients, there has been evolving a growing need to demonstrate accountability based on the outcomes and cost effectiveness of nursing activities. This has mean that nursing must rethink the relation between its historical process orientated focus and the outcome based demands of funding agencies and accountability.

A series of discussions were established with community nurses across the country. This included making home visits with field nurses. During the home visits, they were asked to describe what they were doing, what information they were using, what records and reports they had to present, what information they found useful and what information they needed that was not easily available. Visits were made with community nursing managers, ranging from clinical coordinators to directors of nursing organization. They were asked to describe what information they needed from their staff, and what information they had to report upward to governmental and other organizations. They were asked to describe the information that they felt which they needed that they did not have immediate access to. In addition copies of forms and reports were collected. Also, meetings were held with state and commonwealth organizations who contracted with community nurses for the delivery of care. Again they were asked what information they required and what had to be reported onward, copies of forms were obtained when available. They were also asked what information they would ideally like to have available to them.

The variety of views and perspective resulted in a clash of expectations and goals. As a result of these discussions a set of temporary working goals were developed. These goals included:

1. Comparability of data on the delivery of community nursing services
2. Comparability of data on the clients receiving nursing care
3. Relation between the delivered nursing services and the perceived governmental need for services
4. The need to become outcome focused in discussing nursing care
5. Relation between the nursing problem, the medical diagnosis and the cost of services delivered
6. Cost benefit analysis for nursing services
7. Baseline comparison for new program development.

Clearly this set of goals was not going to be completely resolved, by the development of the CNMDS-A. However, the goals brought to the foreground issues which would be involved in the background of the development of the CNMDS-A. In addition to the development of the goals, it was clear that different groups valued the goals differently. As might be expected the field nurses had greater interest in goals which would make their practice more efficient. Nursing managers wanted to document that the complexity and time associated with the delivery of nursing care was rising. Governmental people wanted data which would assure that they were getting the best value for their money in the delivery of nursing services. The focus on goals, demonstrated the complexity of the arena into which the CNMDS-A was going to have to establish itself.

DEVELOPMENT PROCESS

After the draft goals were formalized, they were discussed with a variety of persons both inside and outside of community nursing. They were finally presented to the project steering committee before being adopted as working goals for the project. From these goals a preliminary list of items was selected. The items were grounded on the discussions with nurses and non-nurses. The preliminary list of items was put forward as a starting point for discussion.

These items were submitted to a broad base of persons using a delphi approach. Four groups were invited to join the delphi approach: community field nurses, community nurse managers, non-community based nurses and non-nurses who had an interest in community nursing. Each person was invited to photocopy the materials and invite any other interested parties to participate in the project. Over 300 persons expressed interest at different times in participating in the process.

During the first phase, people were asked to review the goals for the development of the CNMDS-A. After they examined the goals, they were to examine the preliminary list of items selected and to add to the list. The list of items grew from 23 to 66 items very quickly. At 66 items, the list reached saturation. Any items suggested were already on the list.

Many of the items were essentially similar, but since changes in terminology reflect differences to different people, no items were deleted at this stage. These items were grouped under five broad headings. The headings included: 1) Client characteristics, 2) Referral information, 3) Nurse/client information, 4) Outcome and 5) Organizational characteristics and resources. This grouping helped to frame the 66 items which would have been too long for a single list.

The list of 66 items was submitted to all persons who had expressed an interest int he project. They were asked to select the 15 items which were the most important to meeting the goals of the project. This was done not because 15 items was any limit, but rather it was an attempt to determine which of the 66 items had some consensus. Many expressed the difficulty of selecting 'only 15 items'. However, the pressure of selecting a limited number served its purpose and consensus was reached on 12 items. The 12 items provisionally selected into the CNMDS-A included: 1) Year or date of birth, 2) Gender, 3) Location, 4) Admission date, 5) Presence of carer, 6) Source of referral, 7) Medical diagnosis, 8) Nursing problem, 9) Nursing intervention, 10) Nursing goal or prognosis, 11) Outcome of nursing care and 12) Discharge date.

As important as the agreement on the twelve items, 21 items were identified which received virtually no support. These items were dropped from immediate consideration. A total of 193 people participated in this initial ranking. This represents 64 percent of people who had expressed any interest in the project at any time. It included people from all states and territories, and people from all four of the identified groups.

The remaining 33 items were listed in the same order that they had been on the original form and were returned to all of the people who had participated in the earlier Delphi round. During this second delphi round consensus was achieved on the following 8 items: 1) Client / family dependency, 2) Client / family resources, 3) Nursing utilization, 4) Client identifier, 5) Agency identifier, 6) Nurse identifier, 7) Program covering client and 8)Discharge status.

An important aspect of the approach was the addition of items often pointed to an area around which there was no common agreed definition but around which there was a sense of importance. Two of these are worthy of discussion. The first has to do with the notion of patient dependency or acuity (Gliddon, 1987). Nurses seemed to recognize that there was a need to record differences in 'how sick patients are'. Differences among the patients makes for differences in demand on nursing and nursing resources. However, it is clear

that recognition of patient dependency was only part of the issue. Different patients have different resources available to them. These resources differ in terms of family resources, financial and emotional resources and the availability of voluntary and formal organizations. Thus patients who may indeed be 'very dependent' may make little demand on nursing resources because they have a substantial amount of support from other sources e.g . family. In other cases, patients who are not as dependent may make substantial demands on nursing resources because they lack any source of support. In addition, this points to the need for the nurse to monitor not only the ongoing nature of the patient's dependency but also the need to monitor the patient's resources. For the older patient, it is often a change in resources, e.g. hospitalization of a spouse, not a change in dependency which results in increased demand on nursing resources. Culture , history, self care and many other concepts impact on the utilization of resources as well.

A similar area occurred around an area which could broadly be called the utilization of nursing resources. For some the issue was the number of nursing visits, for others it was the total cost of the care, for others it was the cost of support services. There is clearly not a single approach which can best monitor the expenditure of nursing resources for given clients. When this is combined with the discussion of acuity above, it is clear that a complete understanding of the allocation of nursing resources for a given client problem is a very complex undertaking. It deals not only with the amount and type of nursing visits but also the amount and type of resources which the patient has available from other sources. The other resources may or may not be charged services, resulting in a very complex model for patient costs.

The important aspect of this phase of the project was to have people name the concepts that they felt were important and to attempt to identify them. In some cases, as exemplified above, the concepts did not have a single clear name. In these cases, it was important to interpret the results of the delphi approach. Without interpretation, these items would have low rankings for each of the items which surround the concept and they would have been dropped from further consideration. But by noticing that there was a concept underlying the names, the items could be brought forward for discussion in the next phase of the project.

In summary, the delphi brought to the surface the important items for further discussion. It required interpretation so that important items were not lost. This then set the stage for the next aspect which was to provide definitions for the items. Delphi also demonstrated its limitation. In areas where there was no agreed upon definitions or where there was no consensus on how the concepts should be integrated, the delphi technique reflected the varieties of possible response.

DEFINITIONAL PHASE

The definitional phase acted as a synthesis between the descriptive aspects which occurred in the beginning and the priorities addressed in the delphi development phase. Once the items had some sort of priority, they needed to be examined in further detail. The items were examined in order of priority. The rationale was that the items with the highest priority should have the most agreement. This the group would have the ability to evolve their skills as they moved from the items of the highest agreement to those items which were less well understood as for example the costing and dependency items above.

As work on the definitions began, it was important to review the range of existing definitions which were already in use in different parts of the nursing community. Examining the range of existing definitions gave insight into the range and complexity with a concept was already being viewed. This also gave insight into the different needs of nurses in different community services. Nurses whose background was domiciliary care had different perspectives on clients than did those whose view was from the area health centers. If a comprehensive CNMDS-A was going to function and be accepted, it had to meet the needs of the community nurses regardless of their perspective or their place of employment.

The variation within previously existing definitions was interesting due to the lack of consistency which was evident within the existing definitions. This was so from both a theoretical and operational perspective. Many of the client descriptors had clearly just grown up with various organizations and there had probably never been a clear understanding of what information was supposed to be conveyed by the information. Marital status was the clearest example. There were eight different coding systems for marital status. In asking field nurses and supervisors WHY the information was being collected, a wide range of replies were forth coming. The replies ranged from a belief that this was required information, to the fact that it was on the form and therefore someone must need the information. This item as it was discussed and reviewed led to the understanding that the field nurse was very concerned whether the client had someone in the home to assist them. Marital status was a rather 'safe' way of seeking this information. The assumption was that if a person was married, then the spouse could be a helpmate to the client. Yet in and of itself, marital status does not determine whether the partner is in the home, of if the partner is in the home if the person is capable of giving the assistance required.

The confusion in the definition of marital status lead to an understanding that it was not marital status which was important, but rather the presence of a carer. It made more sense to see the presence of a carer directly rather than making the 'assumption' that if there was a spouse, that then the spouse was the carer.

In some cases, the examination of other definitions meant that it would be simpler to adopt an existing definition rather than attempting to redefine one. The adoption of the coding for gender and birth date meant not only not 're-inventing the wheel' but insure that the CNMDS-A would be consistent with the In-Patient Minimum Data Set (AIH-1989).

This consistency with other data sets is an area of considerable concern in the Australian context. There is no single client based identifier in the Australian system. Recent experience with the Australia Card and the current controversy surrounding the prescription scheme would indicate that this area will remain controversial for some time to come. Secondly, there has been the rapid proliferation of client based data gathering systems during the past few years. These systems have grown to meet individual needs without considering how multiple needs might possible be met. The difficulty is that they are all client based, meaning the client is often subject to multiple data gathering schemes all of which are slightly different. In addition it is often the community nurse who must gather the information. When the codings are different, the nurse must gather the same information on multiple occasions because the way in which it is already recorded and coded is not compatible with the latest request.

In some cases the definitions point to areas of controversy which will not be easily resolved. A prime example of this is the adoption of NANDA Nursing Diagnosis. There are some nurses who see this as the only viable scheme for the organization of nursing problems. There are other nurses who, when they review the unusual taxonomy of NANDA are convinced that it does not meet the needs of Australian nurses and that it should be avoided at all cost. While controversy such as this will come to a head under the rubric of the CNMDS-A, the final solution will take much more professional discussion.

The same reference group that was involved in the delphi aspects of the development of the CNMDS-A have been involved in the definitions. At every stage people have been encouraged to supply additions and refinements to the definitions of the items. The concurrent development of both the theoretical and the operational definitions has insured that members where quite clear as to the implications of each aspect of the definitions of the items (Werley, Devine, Zorn, 1990).

When the process of definition development is complete, the definitions and the items together will be reviewed in light of the original goals of the project. This will insure that the items as defined will be able to meet the goals as established.

The final process will be an in depth discussion of the goals, the items and the definitions by the steering committee of the project. This will allow for the re-examination of the project goals in light of the societal changes which have occurred during the past year. The items and definitions will be reviewed not

only in terms of their ability to meet the goals, but also they must be reviewed in terms of the functional ability of the nursing organizations to abstract the information in a which does not put unnecessary burden on the nursing organizations.

CONCLUSIONS

A number of conclusions can be drawn from this project. Some related to the process and others related to the product itself.

The method of this project combined both quantitative and qualitative research approaches. This combination, often referred to as 'triangulation' has a number of advantages. It combines the notions of inherent validity which are integral to qualitative research. Since people are free to discuss and add items using whatever language they prefer, it is possible to capture the essence of what people are trying to convey. The initial qualitative approaches were used for form the initial goals for the project. The goals then acted as terms of reference which guided the steps which followed. The initial discussions also provided the base the preliminary list of items for inclusion into the CNMDS-A. The use of a preliminary list accelerated the process of adding items to the list. Discussions with individual participants both before and during the process led encouragement that the use of a preliminary list was useful in suggesting items and accelerating the process of bringing items to the fore. Confirmation of this came, when saturation was reached in additions to the list when about 70 percent of people had responded. The remaining 30 percent, as they responded, suggested items which had already been suggested. This completeness of the saturation was good reason to bring the list forward to begin the prioritization.

The first round of prioritizing limited the respondents to choosing only 15 items. Numerous people commented on the difficulty of this restriction. One the positive side it indicated the amount of attention and concern with which people were understanding their task. It also reflected the complexity of the task involved. Community nursing uses a large amount of complex data. The data which is critical varies by client situation.

Yet the restrictive nature of this process did demonstrate the high degree of agreement in the selection of items. Four groups were involved. The congruence between the four groups acted as a validity check on the selection process. Field nurses, community nurse managers, non-community nurses and non-nurses, all had to agree on the importance of an item for it to be selected in the first round. This process resulted in the preliminary selection of 12 items.

As important as the selection of items into the CNMDS-A was the fact that many of the items had very little support. This was to be expected given the open nature of nominating items for possible inclusion. Items which had

only a small amount of support and where that support was not shared among the four groups were deleted from consideration at this time; the possibility remain for them to be accepted at a later time. By removing the items with high agreement and the items with minimal support, 33 items remained. These 33 items were then returned to the group for prioritization ranking. Even though there were some concepts which were similar to several of the items, the relative rankings assisted in finding a way to bring the elements together as an organized concept.

The interim result of the project is that 20 items have been selected for the working list of the CNMDS-A. These items include:

1. Date of Birth
2. Gender
3. Location
4. Admission Date
5. Presence of Carer
6. Source of Referral
7. Medical Diagnosis(es)
8. Nursing Problem(es)
9. Nursing Interventions
10. Nursing Goals
11. Outcome of Nursing Care
12. Discharge Date
13. Client / Family Dependency
14. Client / Family Resources
15. Nursing Resource Utilization
16. Client Identifier
17 Agency Identifier
18. Primary Nurse Identifier
19. Program Covering Client
20. Discharge Status

The project is currently in the definitional phase. This is examining both the theoretical and the operational definitions for each of the items. During this process,it is quite possible that some of the items on the interim list will be dropped, others may be added and some may be combined. Once a final list is devised, the goals must be re-examined to insure that the data allows for the achievement of the goals.

The development of the CNMDS-A is really just the first step. The CNMDS-A must be tested by nurse researchers. Administrators must examine its usefulness and nurses will be able to see how the CNMDS-A reflects their practice. The real work is yet to come.

The CNMDS-A was developed in Australia for Australian use. However, the items which describe the client and the nursing practice are very similar to the items which were adopted for the US Nursing Minimum Data Set as just presented by Dr. Werley. The areas of difference are in the areas related to SERVICE ELEMENTS (Werley & Lang, 1988). Differences in this area are appropriate. Service elements reflect the health care system in which the delivery of nursing care occurs. There are significant differences in the health care systems of Australia and the US. There should be expected differences in the service elements - and there are.

The CNMDS-A is still in an evolutionary phase. That the development has occurred so quickly is a testimony to the commitment of the nurses of Australia who have contributed so generously of their time and expertise. It is the community nurses who will see through the final development and evolution of the CNMDS-A. Combined with the work of nurses in other countries, NURSING continues the development of its own data as the basis for its practice knowledge.

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17 -- Developing Criteria And Guidelines For Nursing Documentation

Margareta Ehnfors, Anna Ehrenberg, Ingrid Thorell - Ekstrand

INTRODUCTION

This paper presents an ongoing project with the purpose of developing and to some extent testing criteria and guidelines for nursing documentation in Sweden. We suggest that information, relevant to nursing care, has to be documented in the patient record in areas indicated by special keywords.

BACKGROUND

There is a tradition in the Swedish health care system of very sparse nursing documentation in the patient records. Today one often finds nursing documentation which is incomplete, unspecific and mostly concerning dependent nursing actions such as drug administration. Since 1986, however, there is a Swedish law stating that registered nurses shall document nursing care in the patient record. National guidelines have not been developed so far. There is a need for uniformity of what should be regarded as basic nursing data in the patient record. This project puts special emphasis on the documentation of nursing interventions since this is an area which is less developed in Swedish nursing care documentation.

METHODS OF THE PROJECT

The project consists of different steps: first to formulate criteria and guidelines and then to some extent try out their usefulness through empirical studies.

In order to identify the relevant content of nursing documentation a review of the literature was carried out. Different kinds of sources were used, including national and international literature on nursing documentation such as reports on research projects, development projects, debate articles and textbooks (Stevenson, Tripp-Reimer, 1989; ANA, 1989; Bulecheck, McCloskey, 1987; Carnevali, 1984; Devine, Werley, 1988; Lang, Marek, 1990; Mallick, 1981; Marek, 1889; McCloskey et al, 1990; Romano et al, 1982; Werley et al, 1988). Also literature on theoretical nursing, on instruments for measuring the quality of nursing care and on nursing informatics were scrutinized (Ball et al, 1988;

Fawcett, 1983; Frank-Stromborg, 1988; Hannah et al, 1985; Marriner, 1986; Meleis, 1985; Waltz, Strickland, 1988). National laws and regulations regarding health care constituted another source.

As a result of the literature review and our own experience in this area, criteria and guidelines for practical documentation were developed as a model for nursing documentation. They were designed as a small folder for use in nursing practice. In the empirical study there were different parts. In one part nurses on wards in somatic care used the tentative guidelines in their practice after being introduced to the model. Furthermore nursing students used the guidelines as a part of their examination work in nursing practice. Both the nurses and the nursing students assessed the model regarding the usefulness of the guidelines in nursing practice. After this first empirical testing the criteria and guidelines were revised.

Another form of test consisted of an evaluation by an expert panel representing areas such as nursing research, nursing practice, nursing education, nursing and medical informatics. The expert panel used both a modified nominal group technique and discussions for their assessment. The purpose of the expert panel was to reach consensus on the criteria and guidelines.

Audit of the nursing documentation in the patient records was also performed on records from the wards involved in the empirical studies. A number of records from both before and after the introduction of the guidelines were examined with the purpose to identify if the different steps of the nursing process model were to be found and also to which extent the proposed criteria for documentation were used.

As a result of these first phases of the project, a final version of the criteria and guidelines are now being developed.

SOME BASIC IDEAS

There are some basic ideas to be considered and balanced to achieve both good nursing care and good nursing documentation. In the traditional record keeping one often finds the caregivers objective assessment but very little recording of the patient's subjective experience or desires. There is often a description of the needs and problems of the patient but very little of his or her resources for handling different problems. In case of illness there are some basic needs of care that always occur and should be recorded such as aspects of hygiene, nutrition, sleep etc but there are also often needs of specific nursing care related to the special situation which has to be considered and recorded such as special diet, treatment of different kind, e.g. skin care because of infusions or stomas, or the patient's needs for special position in bed. Today one finds good documentation of the implementation of the doctor's orders but very little of the

independent nursing interventions. Nurses perform but seldom record such interventions

The important aspects to be considered and balanced are:

* subjective versus objective data,
* normal function of the patient versus changed function due to health problems,
* resources in relation to problems and needs of the person,
* basic nursing care versus specific nursing care due to illness,
* independent nursing interventions versus dependent nursing interventions.

From the literature four key concepts for good nursing care are derived. These are optimal well-being, respected integrity, security for the patient and prevention of health problems. They can serve as a useful base for setting goals for nursing practice and for evaluating the different steps of nursing care. Criteria and guidelines for practical documentation were then developed taking the above mentioned aspects and key concepts into account.

GUIDELINES AND KEYWORDS

The structure of the guidelines is adapted to laws and regulations in our society and to the nursing process model. The guidelines include data collection on *nursing history* and *nursing status*, summarized in *nursing diagnoses* . *Nursing interventions* both planned and implemented are followed by *nursing outcome* and finally there is a *nursing discharge note.* These sections form a higher level of keywords. For every section certain keywords on a lower level are given. The keywords are given in an abbreviated form for use in the patient's record. Every keyword is followed by an explanation of the content and examples of how to use it. We have not found keywords representing nursing interventions made explicit anywhere else in Swedish health care documentation rules.

In a nursing record there are some facts which have to be documented beyond the date of the recording and the signature of the recorder, such as the name of the nurse responsible for the nursing care, the provider of information for the record if other than the patient and the patient's requests of confidentiality. It is also important to remember that only aspects and facts of relevance should be considered. Even if the guidelines give a number of keywords, only the relevant ones should be used for the occasion and they should be recorded in given order.

Some examples of the keywords are given here in full length with some explanations: as one aspect of *nursing history ,* the patient's lifestyle and living

circumstances should be considered, including physical environment, social network and aspects of culture, religion or values relevant for nursing care. Use of drugs, alcohol or tobacco, should be recorded if relevant. The nursing history concerns previous health condition and the patient's own ability of performing activities of daily living and amount of help needed previous to the actual episode.

Nursing status includes documentation determined by different keywords and should be recorded at admission as well as continuously. One important area to record is the patient's communication skills, such as his ability to express and understand, memory, consciousness, impairment and needs of aids, e.g. for hearing or vision. Examples of other areas included are respiratory, circulatory and neurological functioning as well as nutritional status. Information relevant for nursing care on sleep and pain together with psychosocial status are also included as part of the documentation on nursing status. These areas should include information and documentation from different perspectives such as if there are special patterns or habits to take into account while planning and implementing nursing care, if any impairment occurs, if the patient has any needs of aids and so on. One example of this within the keyword nutrition is documentation regarding appetite, thirst, meal habits (including parenteral nutrition) any cultural patterns of eating with relevance to nursing care, the patient's needs of help while eating, special demands related to the illness if any, etc.

Nursing diagnoses are expressed as a synthesis of problems, possible explanations and symptoms which can be influenced by nursing care. The goals for the nursing care should also be included, reflecting the views of both the patient and the professional.

Nursing interventions should also be systematically documented. They include specific and planned actions of what to do, how and when. In this section the suggested keywords are: participation, caring, support, observation, environment, information, teaching, dialogue, continuity, coordination and prescriptions.

The keyword *participation* means documentation of different ways of assuring optimal participation and communication of the patient as one part of the nursing care. The recording of the prerequisite and the interests of the patient and relatives to be involved and take part in the planning and decision making concerning the care is a part of this keyword.

Caring means recording of the kind of help the patient needs and/or the degree of self-care the patient can perform in areas such as eating, mobility, activity, sleeping, hygiene, dressing etc.

Recording related to the keyword *support* includes both physical support such as needs of assistance during walking or training and psychological support

such as requirements of stimulation or encouragement in connection to special training sessions or decision making etc.

Recording of *observations* regarding the patient are traditionally one part of the nursing notes and this keyword includes documentation of surveillance together with signs of alterations in the patient's status, complications and adverse effects

The keyword *environment* includes recording of ways adapting the environment for optimal security and convenience of the patient. Examples of this are documentation of needs of for instance bedside fences, aids to avoid joint contractions, to have something to do, social activities relevant for the patient's condition etc.

The keywords *information* and *teaching* could include documentation regarding preparation for medical examinations or situations with relatives involved in the nursing care. It could also be recording of teaching actions intended to prevent or eliminate risk factors influencing the patient's future health.

The keyword *dialogue* means recording of important communication through talking and listening to the patient or relatives as a planned or performed nursing intervention. Areas of concern for documentation are for instance talking about the patient's understanding of the situation or activities of prevention, about the prognosis and treatment of the disease and so on.

Documentation in regard to the keyword *continuity* means recording different ways and aspects of assuring continuity for the patient, such as continuity of caregiver, of the way the patient receives certain aspects of nursing care, of contact with relatives and previous to discharge, continuity of the information flow between hospital care and home care.

Coordination as a keyword could include for instance documentation of the patient's needs and the planning for distribution of resting periods during the day in relation to e.g. examinations, treatment, training sessions and mealtimes. This could also include recording other team members' contribution and participation.

The last keyword under nursing interventions to be mentioned here is *prescriptions.* This means recording in the nursing documentation different medical orders that have to be taken into account. The doctor's written orders are often to be found on other places in the patient's record, such as drug orders, etc. Other orders recorded in this area could be planned tests, special treatments, etc.

Nursing outcome as a keyword, concerns recording the evaluation of the nursing care and this is a keyword on a higher level. Continuous evaluation has to be done and recorded in relation to both the nursing diagnoses, the goals and the planned nursing interventions.

The final keyword for every nursing care episode is the *nursing discharge note* which should consist of a short summary of the nursing care given, the outcomes and a description of the patient's remaining needs of nursing care, together with the circumstances of the patient's discharge.

IMPORTANCE OF NURSING DOCUMENTATION

There are several reasons for the need to develop criteria and guidelines for nursing documentation beyond the legal demands, such as the assumption that the nursing care will be more systematic through better documentation, the nursing domain will be more visible, communication will be easier and the progress towards bedside computerization will be facilitated. Research and quality will also benefit. Assessment of the quality of nursing care often relies on the assumption that the documentation properly reflects the patient care given. With a relevant, uniform and accepted model for documentation, there is a greater possibility that the documentation really reflects the nursing care actually given.

This project is a national part of an international ICN-project (International Council of Nurses) on Nursing regulation, supported by the Swedish Nurses Association.

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18 -- Data Protection In Nursing Informatics; Balancing Privacy Aspects And Shared Use

Elly Pluyter

ABSTRACT

During the last two decades use of computer systems in health care has increased rapidly. The reasons are:

1. quality and efficiency improvement
2. lowering costs
3. enhancing care processes
4. easy use of data stored in computers.

This paper describes the tension between the privacy aspects and shared use of data. Especially in nursing, we have to balance these two aspects. Within some years bedside terminals will be general tools in nursing. The necessity of structuring data before storing it in a data bank makes it easier to handle data and to gain information at a time and place where needed. On the other hand, access to structured data gives free way for unauthorised use and misuse if we do not give attention to data protection and privacy.

In nursing we are obliged to handle patient data carefully and to give serious attention to privacy aspects. More and more nurses will be asked to decide when nursing data has to be stored in data banks and what use is allowed to which professional. The goal of this paper is not only to stimulate the discussion between informaticians and nurses about directions to handle such questions but also to point out such possibilities. Levels of data protection built into nursing systems might serve as barriers. If possible, the patient should be informed about patient registration rules and the data which will be stored in the data bank. Nurses always should be aware of data with a strictly confidential character and with respect to the private life of an individual. Such data should perhaps not be stored in a computer data bank. In a matrix, a hierarchical structure will be given. The guideline to the professional role of the user in relation to data access and the possibility of computer systems to give selective access to data.

Copying of data will be discussed. Especially in the area of personal computers, data protection might be handled with great care as copying data from floppies is an easy way to lose control. This cannot be tolerated. A proposal for a set of nursing principles in data protection will be given and classes of nursing roles will be defined. An organisational structure will be given to handle rules, conditions and security of information related to patients.

19 -- Development Of A Nursing Information System: Keys To Success

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INTRODUCTION

Since 1972 BAZIS, the Central Development and Support Group HIS in the Netherlands, has been involved in developing and implementing an integrated HIS. The HIS is presently in use in more than 30% of the Dutch hospitals (covering over 20,000 beds) and this percentage is still growing. The BAZIS-HIS contains over 70 applications, of which at least 14 are of value for nurses at clinical wards, e.g. ADT, duty roster and student scheduling, patient classification, meals ordering, results reporting, on-line handbook information, CAI, etc. However, these applications do not yet form one complete and coherent whole providing the nurses with extensive support of the daily information management activities in the nursing unit.

In 1987 BAZIS started the development of an integrated Nursing Information System (NIS), called VISY (in Dutch a term referring to both NIS and vision). VISY (Nieman et al, 1989) is based on the concept of bedside terminals. As the effects and implications of such a complex system could not be foreseen, VISY-developments initially take place at one pilot unit at the Leiden University Hospital (LUH), the 32 bed unit for Infectious and General Internal Diseases.

BAZIS has identified two major conditions that must be met for successful development of information systems in general: Integration and User Involvement. The next two sections will discuss the importance of these aspects both in general and for the development of a Nursing Information System in specific. Section III will then review the resulting overall design and Section IV will report on our progress so far in the development of VISY. Finally some conclusions and recommendations will be given in Section V.

I. INTEGRATION

Integration is an important aspect of Hospital Informations System (HIS) in general, and of Nursing Information Systems (NIS) in specific (Heemskerk and Leguit, 1990). Integration is a phenomenon with many aspects and there is not

yet a well defined concept. Integration can be addressed from many points of view, e.g. care taker, electronics data processing (EDP) personnel, or patient oriented.

THE IMPORTANCE OF INTEGRATION FOR THE PATIENT. Patient integration concerns the integration aspects that directly influence patients in terms of quality of care and individual service. To improve the quality of care the NIS should check on relations between different pieces of data of relevance for the patient's health status and assure that less mistakes are made (e.g. drug conflicts, contra-indications). Also the NIS should "protect" the patient from unnecessary or double questions and actions by providing all care takers with the right information at the right time.

Giving good patient service means optimization of appointments (e.g. when the patient has to visit two different outpatient clinics at once on the same day), update of patient data throughout all files in the hospital, authorized information exchange to and from care takers outside the hospital (like the General Practioner) and automatically processing of bills directly to the insurance company. By offering the patient and the nurse a good overview of all events scheduled for the patient, a more patient oriented coordination of activities becomes possible.

THE IMPORTANCE OF INTEGRATION FOR THE NURSE. The nurse, being a coordinator of care, will need to manage data coming from almost all other departments, and will have to communicate with their specific HIS subsystems. A NIS should therefore not only contain typical nursing applications like care planning, but also "other" applications like order entry and result retrieval. Three levels can be distinguished on which the integrated NIS should support the nurse:

- support of the different work processes, e.g. provision of care (nursing process), supporting other care takers, coordination activities,
- support of the different activities within each process, e.g. assessment, care planning, interventions, evaluation,
- support or, if possible performing of tasks to execute certain activities, e.g. ordering a colon X-ray leads to making an appointment, ordering a diet, ordering transport, giving a clysma, etc.

The NIS should provide one uniform, and therefore easy to learn and handle, human interface.

THE IMPORTANCE OF INTEGRATION FOR THE EDP DEPARTMENT AND HOSPITAL ORGANIZATION. One of the key problems of automating a multi-

departmental institution like a hospital, is the occurrence of island automation: several departments use their own dedicated system, that can be well adjusted to their specific requirements, but cannot communicate the subsystems of other departments. Island automation can occur in the form of dedicated departmental system (e.g. radiology, laboratory) or as stand alone personal computer (PC) applications (e.g. duty roster planning). Sooner or later, the need arises to exchange information with other departments or systems (e.g. patient classification data can be used for duty roster planning, which in its turn contains data used by the payroll system, etc.). Then the data processing department is called in to "integrate" the different systems. If the users are lucky, the integration is done in such a way that every user has his own application environment hiding the differences in software and database origin from the user (Leguit, 1989). However, due to time and financial constraints, the integration is often limited to mere coupling (or interfacing), meaning that only a reduced set of data is available for users of systems. Next to additional maintenance efforts for the EDP department, interfacing leads to double registration of data, forming a threat for the integrity of the data.

II. USER INVOLVEMENT

Informaticians will not be able to develop a NIS that is really supporting nurses, without the active participation of the (future) users. Therefore we have established a multi- disciplinary project structure. The "external" project structure is the same as for all other BAZIS-HIS applications, but the "internal" project structure has been set up especially for the VISY-project.

INTERNAL PROJECT STRUCTURE.

The internal VISY-project structure consists of three multi-disciplinary teams:

DEVELOPMENT TEAM: Responsible for the actual development of the software and its implementation at the pilot unit. The team consists of the following persons: one nursing officer, one physician, the pilot unit's head nurse, two other nurses from the unit, one person from the LUH EDP-department, and three informaticians from BAZIS. The nurses and physicians are all employees of the hospital. The members of the project team have daily contact. To become acquainted with each other's professions, the informaticians attended a course in nursing practice and the nurses attended a course on computers. The informaticians also stayed two days, during different shifts on the pilot unit, to experience nursing in practice.

IMPLEMENTATION TEAM: This team is to guide and evaluate the project activities. Its members are all working on a more administrative level and again include LUH nurses (five), physicians (three), EDP-personnel (two) and BAZIS-people (three). The linking pin with the development team is formed by one person for each of the four disciplines involved.

STEERING COMMITTEE: Responsible for the creation of conditions for successful development and implementation (budget, personnel, etc.). Members of this team are the managing directors of BAZIS and the LUH-departments involved and external specialists in the field of nursing informatics.

EXTERNAL PROJECT STRUCTURE.

To prevent VISY from becoming only suitable for the LUH, it is necessary that nurses coming from other hospitals are also regularly involved. This is done by means of user groups. BAZIS maintains user groups for each distinct application area, or sector e.g. nursing, medial care, financial administration, logistics, etc. In most sectors two types of user groups are active: one to advise on long term developments within the sector (the sector group) and one actually participating in the feasibility study as well as the functional design of new applications (the product specification group). Another group advising the management on ore technical matters is formed by the heads of the local information processing departments.

The chairpersons of the sector groups (which are user and not BAZIS employees) meet every few months to advise the BAZIS management on desired developments. The product specification group helps to identify the application's requirements and the possible organizational changes involved, and advises on the desired functions, overviews and reports, tailoring facilities, and sometimes even the lay-out of screens and overviews.

In the nursing sector, the sector group meets at least every three months, and product specification groups are formed for each nursing application, meeting on request (usually by BAZIS). Within the VISY-project there are, or have been, product specification groups for care planning, vital signs and medication.

III. NURSING INFORMATION SYSTEM DESIGN

Nurses and informaticians together specified the following overall design of the NIS, describing both the coherence of the different subsystems (modules) and the integration aspects with respect to data entry and processing, checking and data protection, standardization and tuning facilities.

The functions of the NIS are to support clinical nursing activities, like patient assessment and care planning, ADT (admission , discharge, and transfer), vital signs, fluid balance, drug administering, (X-ray) appointments, meal selection, lab specimen collection, progress notes, and order communication/entry. The basic philosophy behind the design is:

- registration of data at the time and place of generation, and
- access to information where and when needed (point of care systems).

As care is only partially delivered from the nursing station (about 50% of the nursing activities are performed in the patient's room (Nieman, 1988), NIS technology should allow the use of either portable handheld devices, a stationary terminal per room or bedside workstations. Nurses tend to prefer the bedside workstation (Pryor, 1988), (Herring and Rochman, 1990).

In the design of a NIS the patient's individual care plan takes a central place. The patient oriented care plan contains self care deficits, goals, interventions, reports, and is fed by:

- data coming from former stays (diagnoses, surgery, nursing summary, general patient data) and outpatient clinic information
- data generated during the intake conversation, observations
- knowledge stored in standard care plans
- problems relating to orders of other disciplines.

The individual care plan, together with the admission information, the doctor's orders and a nursing summary of reports on the progress of the patient, forms one integrated "electronic nursing record."

Where possible the NIS should, based on protocols also stored in the computer, translate the orders of other disciplines into nursing tasks. All required data concerning the execution of nursing activities and interventions (coming from the patient's care plan) and of orders (coming from other disciplines) should come together and form one integrated nursing workplan to support the activities of each (group of) nurse(s). Next to that all events happening to one patient must be integrated onto one patient profile or "agenda." Finally the NIS will have to support the reporting on all types of activities performed by the nurse. Figure 1 shows the coherence between the different NIS areas as described above. The meaning of integration becomes explicit in the specification of the following requirements:

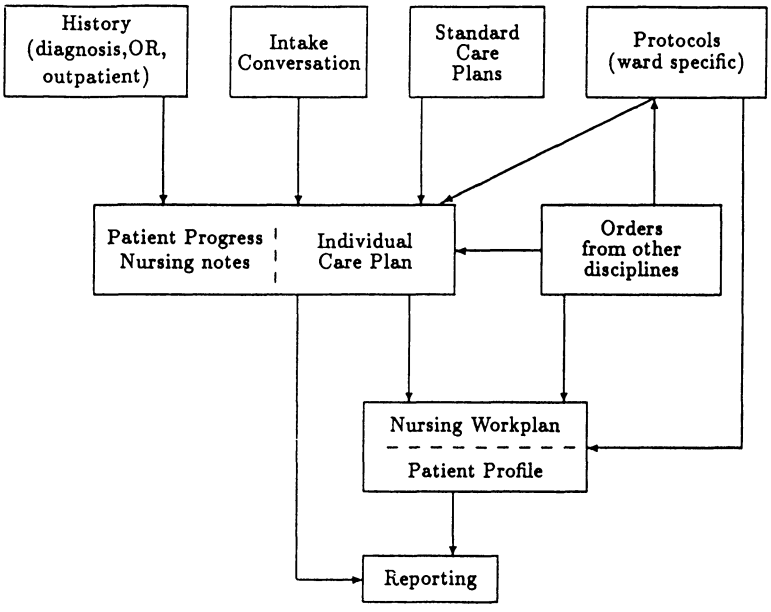

Fig. 1 Functional components of a Nursing Information System

ONCE - ONLY REGISTRATION OF DATA: The data then becomes readily available for other care takers to access, in words and a layout suitable for that specific care taker. For example, when the physician gives an order for a diet, the dietary consultant, the nurse, the kitchen, etc. are immediately notified. This also means automatic processing of data that is already known or deductible (e.g. automatic patient identification at bedside terminals, presenting relevant medication data to the technician interpreting a laboratory test), and the possibility to change only a single item of a composed data set, instead of re-entering the whole dataset again (e.g. change only the dosage of a medication order). This principle also results in a disclosure of data to hospital management, research, ward management, stock control, etc.

AUTOMATIC PROCESSING OF COMPLEX ORDERS based on protocols and procedures (explosion" of data and functions) (Heemskerk, 1988):

- splitting repeating orders into a series of single orders e.g. repeating laboratory tests, medication therapy

- processing related functions, e.g. medication, stock control based on drugs administered, printing a new patient name card when admitting the patient, etc.
- splitting compound orders into a series of separate interrelated functions, e.g. automatically ordering a diet when the patient is to have a surgery, cancelling a meal, ordering patient transport for a radiology test
- generation of "standard" (default) orders.

DATA PROTECTION: Both with respect to the integrity of data (correctness, consistency), and the protection of data against unauthorized use. The integrity of data includes all kinds of integrated checks, e.g. on data consistency (a male cannot be pregnant), interactions between orders (e.g. double medication), contra-indications (e.g. allergies), extreme values (e.g. blood pressure of 220/160), unexpected values (temperature not meeting the expected trend), alert when something might so wrong (administering double a dose) or is being forgotten (not administering a drug). Checks resulting into an alert should be automatically communicated to the responsible persons. To assure the usage integrity the NIS should take into account not only the professional duties of the user, but also the relationship between the user and the patient. For example, a physician is allowed to see other data than the hospital's receptionist, and a nurse is allowed to see data of only patients at his/her own ward, etc. Data protection should secure the privacy of the patients as well as the privacy of the health care provider.

STANDARDIZATION VS. FLEXIBILITY: Uniformity of the NIS is necessary to make the user interface easy to learn and handle. Uniformity concerns the layout of screens and paper output forms, the display of error messages and consistent presentation of data formats. There should be a standard structure for commands, keywords, menu choices, questions layout, error handling, etc., and the use of devices (mouse, light pen, keyboard). On the other hand, facilities are needed to tune or tailor the system to the specific needs of nurses, departments, and hospitals. Individual users may have different authorizations. Wards may have their own daily schedules with doctors' rounds, and nurses' rounds for vital signs, medication, dinner time etc., and they may opt for different care plan structures and work organization forms. Hospitals may opt for different data preservation times. Integration means a continuous balancing between standardization and flexibility.

IV. VISY DEVELOPMENT ACTIVITIES

ANALYSIS/PREPARATORY ACTIVITIES: The first year was mostly spent on an in-depth analysis of the then present situation. This information would then be used as a basis for comparison with the situation after the implementation of VISY. Several studies have been carried out:

- nursing activities and information flows
- medical activities and information flows
- quality of care
- work load assessment (conducted by means of work sampling and patient classification)
- attitude and expectations of nurses with respect to bedside automation.

It turned out that a major part of patient oriented nursing information is generated and needed at the bedside and that nurses role presently involves a lot of clerical work. At the pilot unit between 140 and 270 data items per patient per day are recorded, copied or transcribed, of which 55% is done by nurses, taking up about 20% of their time. This is time that could be better spent with patients.

INTRODUCTION OF EXISTING HIS APPLICATIONS. During the analysis phase it was found that many HIS applications suitable for use at the pilot unit were not optimally used or used at all. To gain more profit from the current HIS facilities and to become more familiar with the HIS in general, it was decided to introduce these applications or to intensify their use. Applications concerned are:

- Patient registration, to record or update demographic data
- Patient location registration and ADT
- Patient result retrieval, to access on-line laboratory results, operating room reports, radiology reports, former diagnoses, etc.
- Text processing, to compose admission and discharge letter, minutes, reports, etc.
- On-line handbook, containing protocol information and procedures, guidelines, and general hospital information (today's menu, minutes of the board, manuals, announcements, etc.)
- Mailbox system, to send and read personal messages, ward announcements, and to order internal transport (patients, blood, forms), kitchen stock, etc.
- Laboratory tubes labelling system, automatically printing tube labels and sampling lists, based on lab protocols and schema's.

- Meal selection system, to enter the individual patient's menu choices
- Computer Assisted Instruction system for student nurses
- Radiology system, to order and schedule radiology tests directly from the ward.

The implementation of these applications, though not originally written to be used by nurses, turned out to be quite advantageous for the ward. For example, the use of the mailbox system or order internal transport saves the unit over 3000 telephone calls per year, the labelling system saves the manual processing of 150 tube labels per week, the on-line handbook made all paper manuals and handbooks obsolete, providing always up-to- date information with an increased availability. The successful and profitable introduction encouraged other wards in the LUH to do the same. Another effect of the introduction was that the pilot unit's nurses lost their fears and doubts, and gained insight into the (im)possibilities of computerization and how they would like to make us of it. They have become better partners in development, allowing for a better design.

DEVELOPMENT PROCESS. We chose a phased development, for reasons of control and surveyability, and to allow for phased implementation. However to prevent that in a later stage the several modules do not interconnect, it is important to keep an eye on integration from the early beginning. Therefore, one of the first activities performed was the creation of a demonstration model (Gondelach and Bik, 1988). The model is a "mock up" prototype of the system, visualizing how the "ideal" nursing information system should act and look like. To ensure the coherence of the different modules an overall design has been made. The major objectives were to define a functional and technical framework in which all the modules to be developed would fit and to identify the interrelationships between the NIS subfunctions.

Since it would take at least another year before the first module (vital signs) would be finished, it was decided to opt for limited and temporary prototypes for vital signs and for care planning. The use of these prototypes gave both informaticians and nurses more insight in the nurses requirements, therefore leading to a better design of the applications concerned.

In the mean time, the final vital signs module has been developed. It contains functions to record both the orders and results for vital signs, urine and other excretion products, body measurements, etc. Several worklists and result overview are provided. The system alerts when extreme or unexpected values are entered. Alert values and messages can be defined per care unit and per patient. Each unit can define its own measurements together with their measuring units and methods, their possible values, results codes, selection

keywords, etc. Also the unit can define its own frequencies and rounds, schemas and protocols.

The module was taken into use in May 1990. While the prototype was still being used, the new module was introduced in several smaller steps: first the order entry functions, next the result entry functions, followed by the retrieval functions and overviews. Each step was guided by means of an "exercise" or test, that was to be performed by the nurses individually after, say 10 minutes of explanation. When the prototype was replaced by the new module, several members of the development team were on call for 24 hours a day, in case any vital problem would arise. Fortunately, this turned out to be completely unnecessary. Looking back, we can say that the new vital signs module has been accepted very well and the nurses appreciate its advanced functionality, its simplicity (by its uniformity), and its flexibility, as described above. For the nurses, working with the computer has become an ordinary part of their job. Encouraged by the success of this first module, we are presently developing modules for care planning, medication and decentral order entry.

PREPARING NURSES FOR NEW DEVELOPMENTS. Based on our experiences with the use of existing HIS applications at the pilot unit, and the results we obtained from introducing them, we decided to conduct a study on the use of applications in other BAZIS hospitals. The results of the study, together with a short description of the identified applications of value for nurses, have been processed in a report: the VISY Kick Off. This kick off report has been sent to the BAZIS hospitals, encouraging them - successfully - to introduce the existing HIS and new nursing applications (patient classification, duty rostering). In this way we are preparing the nurses for the more advanced data management facilities that will be offered by VISY.

To be able to assess the situation in Europe in general, we have also done a European study (Heemskerk & Kraamer, 1990), among 57 institutions (both HIS vendors and hospitals), in 11 countries (with a coverage ranging from 2% to 75% of the country's hospital beds). Only 40% of the respondents stated that all nurses are enabled to access the HIS/PC, either with a shared user number or a user number of their own. A frequently found distribution of shared user numbers among nurses is one number per ward, still, shared use of user numbers can be a threat for data protection. Other relevant finding in this exploratory survey are as follows:

- Nurses' training in computer use is mainly informal and do-it- yourself
- Nurses' involvement in automation projects is relatively high with respect to the decision to automate, but low with respect to the actual design and implementation

- More than half of the wards have no terminals or printers at all; the location of the terminals is almost invariably at the nursing station
- Nurses' use of HIS applications is often indirectly, by means of forms and printouts that are entered into the HIS by clerks at another place
- General patient administration functions and general applications e.g. word processing, are the most frequently used applications. Nursing applications like care planning have the lowest frequency of use. There are no complete NIS' in operation: new developments mainly deal with "stand alone" Nursing/HIS applications.

V. CONCLUSIONS

Integration and User Involvement are key factors to a successful development and implementation of an integrated NIS. Integration is essential both for patients (quality of care, patient service), nurses (one coherent whole allowing for more efficient data management), EDP personnel (maintenance), and data protection in general. To ensure the integration, it must be taken into account from the early beginning; the integration aspects must be made explicit, and processed in the overall design of the system. Only then can subsequently developed modules fit the requirements.

User involvement must take place from the early beginning. To be able to contribute to the design, nurses will have to be familiar with HIS applications. This is also valid for a smooth implementation. However, it turned out that many nurses are more or less computer illiterate. Obviously one cannot start with the introduction of a complex system like a NIS when nurses do not even know how to logon. Therefore one should start with the introduction of basic nursing applications, and allow for a gradual implementation of the more advanced NIS. Nurses as well as informaticians must be prepared for rapid developments in the area of the integrated Nursing Information System.

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20 -- Quality Assurance And An Automated Health Care Record

Mary Ann Lubno

INTRODUCTION

Much space has been devoted in the recent literature to quality assurance standards. The primary reason for so much devotion to quality assurance information is that the federal government as well as other organizations involved in accrediting and/or approving health care agencies (Joint Commission for the Accreditation of Healthcare Organizations [JCAHO], National League for Nursing [NLN]) have begun to focus on outcome measures of patient care. When quality assurance standards were first discussed, the focus was on structure and process. Structure involved details about the organization itself, including its governance, mission, communication networks, resources, and delivery systems. Process involved the procedures used to carry out policies and for other transactions that took place to operationalize the delivery systems.

Quality assurance monitoring of outcomes, both structurally and clinically, is a major step forward and is, what may be, a mechanism for controlling health care costs. Nursing is at the forefront of developing outcome criteria by which to measure the quality of patient care. Nursing has used the nursing process to develop standards of patient care and standards of nursing practice. Each of these sets of standards are organized around assessment, analysis, planning, implementation, and evaluation. Data are gathered, categorized, and synthesized into nursing diagnoses. A plan is then written based on outcomes expected of the patient if appropriate and effective nursing interventions are carried out. The plan is judged on the extent to which the patient demonstrates the expected outcomes. Quality assurance monitoring, therefore, is inherent within the nursing process based patient care and nursing care standards.

This article describes one method of developing quality assurance protocols (QAPs) for patient outcomes that were integrated into an automated health care record (AHCR). The QAPs were developed as part of a grant from the W. K. Kellogg Foundation. The primary goal of the Kellogg grant was to develop an AHCR to link rural West Texas to the services and expertise found in an academic health sciences center. The grant was also supported by hardware and software donations from AT&T. The AHCR contains all the elements of a paper medical record and quality monitoring is an integral part of the recording

process. The QAPs provide the user with the means to automatically, systematically, and efficiently monitor the quality and appropriateness of patient care, evaluate important aspects of care, and monitor problem resolution.

The general model of quality assurance developed by the JCAHO was used in developing the QAPs (JCAHO, 1987). That model describes a ten (10) step process for quality assurance monitoring which include: 1) assign responsibility for quality assurance monitoring; 2) delineate the scope of care or services; 3) identify important aspects of care or service; 4) identify indicators for the important aspects of care or service; 5) establish criteria for the indicators; 6) collect data related to the criteria and indicators; 7) analyze data collected; 8) take action to resolve any identified problems; 9) assess the action taken and document improvement; and 10) communicate relevant information to the organization-wide quality assurance program.

The first component of the model is to assign responsibility for quality assurance monitoring. As Site Director for the inpatient development and demonstration site, the author assumed the leadership role in developing the QAPs. The author was assisted in this endeavor by Suzanne Cooke, R.N., C., M.S.N.

The second component of the model is to delineate the scope of care or service. The inpatient development and demonstration site is an 18 bed unit managed by the School of Nursing in a private, general hospital. Patients' ages and diagnosis vary but the typical patient is between 60 and 80 years of age with chronic medical conditions. Many of the patients receive intravenous therapy as a part of the scope of care or service.

Identifying the important aspects of care or service is the third component of the model. An important aspect of care or service is one which occurs frequently or affects large numbers of patients. Additionally, patients are at risk for serious consequences or are deprived of substantial benefit if the aspect of care is not provided correctly and in a timely fashion or on proper indications, and the aspect of care tends to produce problems for staff or patients (JCAHO, 1987). For purposes of this paper, blood transfusion will be used as an example of an important aspect of care within the scope of care or service of intravenous therapy.

The fourth step of the model was to identify indicators. Indicators are like standards of care or standards of practice. They measure when optimum quality care is being delivered. Indicators can be, in essence, outcomes of patient care. The literature was searched to identify indicators or standards related to blood transfusion. Information was found in several sources, (Macklin, 1990; JCAHO,1990; Hahn, 1989; American Association of Blood Banks [AABB], 1986; Committee on Transfusion Practices, 1986; Devine and McClure, 1988; and Tofflemoyer, 1990). The indicators synthesized for blood transfusion were:

Standard of Nursing Practice - The nurse will administer blood products competently and safely and will take appropriate action should a blood transfusion reaction occur (Macklin, 1990, p. 251; Cooke, 1990).

Standard of Patient Care - The patient will experience no reaction to a blood transfusion.

Development of criteria is the fifth component of the quality assurance model. Criteria are the measurable steps necessary to meet the optimum level of care as designated by the indicator. Criteria are the essential elements that must be documented to assure that quality care has been delivered. The criteria for blood transfusion were synthesized from the referenced literature. Following are some of the criteria for blood transfusion. The number of each criterion is linked to the automated screen for documentation of blood and blood products (See Figure 1).

```
================================================================
                                        Patient:
BLOOD PRODUCT DOCUMENTATION     Age:    Sex:    MRec:

BLOOD PRODUCT  View Find Add Change Next Previous Menu Report Quit

Blood Product:   Whole [ ]  PRBC  [ ]
Blood type: [   ]    Donor:  ABD Group: [1]  Rh Factor: [1]
Unit #  [1     ] Unit Expir Date: [1     ] Unit Expir Time: [1      ]
Blood Component Unit is Correct for Recipient  [1     ]
Verified by:  [ 1                          ], R.N. or L.V.N. (Certified)
              [ 1                          ], R.N. or L.V.N. (Certified)
SEE COMMENTS

Rate/hour: [       ]    Site Location: [         ]

Cross Matching Completed  [ ]  Time:  [00:00]

I.V. Started with 0.9% NaCl or tubing flushed with NaCl  [2  ]
SEE COMMENTS
Filter Used:  [3  ]  SEE COMMENTS
Was Blood Warmed?  [4    ]  SEE COMMENTS   Temp:  [  4   ]
Hemogloblin/Hematocrit Before Transfusion  [       ]
Tubing Change:  [    ]    Site Changed To:  [                  ]

Patient and/or Significant Other Education:

1. Procedure explained to patient and/or significant other?  [    ]

2. Signs and symptoms of reaction to blood products explained to
   patient and/or significant other?   [    ]

3. Patient and/or significant other instructed to call nurse if
   the following symptoms occur: [    ]  [                        ]
                                 [    ]  [                        ]
                                 [    ]  [                        ]

Transfusion Start Time:  [00:00] 5   Transfusion Stop Time: [00:00] 5

================================================================
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Figure 1. Blood and Blood Products Documentation Screen

Criteria

1. Two qualified nurses (RNs or certified LPNs) must "verify in writing that all information identifying the container with the intended recipient (recipient name, recipient hospital number, donor number, ABO group, Rh factor, expiration date and time) has been matched in the presence of the recipient, item by item" (AABB, 1986, p. 138).

2. No medication or I.V. solution other than 0.9% sodium chloride, USP shall be added to the blood component (AABB, 1986, p. 137).

3. Blood products shall be transfused through a sterile, pyrogen free transfusion set which has a filter capable of retaining particles potentially harmful to the recipient (AABB, 1986, p. 137).

4. Blood must not be warmed above 37 degrees C (AABB, 1986, p. 139).

5. The blood component unit must transfuse within four hours (Committee on Transfusion Practices, 1986, p. 37).

There are several other criteria used related to vital signs recording; monitoring of the patient during the initial ten minutes of the transfusion, and transfusion reaction. Two other automated screens are provided to document the above criteria. However, this short example demonstrates how quality assurance monitoring is an integral part of the AHCR. Help screens are also available to provide additional information about specific criteria. For example, on Figure 1, associated with "Was Blood Warmed?" you find the phrase "See Comments". The comments that are displayed with that field are: Normally blood is not warmed. However, the American College of Blood Banks states " . . . if warming of blood is ordered, it should be accomplished during its passage through the transfusion set . . ." (AABB, 1986, p. 139). In certain situations it is appropriate to warm blood. An order to warm the blood should be written by the physician. Commercial in-line blood warmers with temperature control devices, visible thermometers and warning systems to detect temperatures above 37 degrees C are available and recommended. Use of unmonitored, improvised devises are not acceptable, nor is it acceptable to warm the entire bag of blood (AABB, 1986, p. 139).

Components 6 - 10 of the quality assurance model are in progress. Data are collected through an automated program that lists the criteria. The program detects whether a data field associated with a criterion has been completed appropriately and then generates a report for the aspect of care requested. For example, a report for blood transfusions would appear as follows (Figure 2).

		YES	NO
1.	Two qualified nurses (RNs or certified LPNs) verify in writing all information identifying the blood component and the recipient. if no: comments	___	___
2.	Was medication or solution other than 0.9% sodium chloride, USP mixed with the blood component? if yes: comments	___	___
3.	Was a sterile transfusion set with an appropriate filter utilized: if no: comments	___	___
4.	Was the blood warmed? if yes: comments	___	___
5.	Were vital signs taken 15 minutes before transfusion? if no: comments	___	___
6.	Was recipient monitored at bedside for first 10 minutes of transfusion? if no: comments	___	___
7.	Were vital signs monitored every 15 minutes times two then every 30 minutes for duration of transfusion? if no: comments	___	___

etc:

Figure 2. Quality Assurance Report for Blood Transfusions

Analysis of data reveal that problem areas are related to documentation of vital signs at appropriate times, use of I. V. fluid other than 0.9% sodium chloride, USP, and teaching related to all the signs and symptoms associated with transfusion reactions. Appropriate follow-up with staff is done on a continuing basis.

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21 -- The Role Of Nursing In Computer Automated O.R. Systems: Bridging The Gap From Technology To Implementation

Donna Prokopczak

INTRODUCTION

Probably the most futuristic technology to enter the Operating Room in this century is the advent of the Computer, with its vast potential for an infinite array of applications. It is essential for Operating Room (OR) Nurses to become actively involved in identifying their specific computer applications and to participate in the selecting, planning, development and implementation of the system they have selected.

The automation needs for each OR, although generally similar, are also unique, based on the processes in practice. A close look at these mechanisms and their desirability is essential, as well as involving the key players in determining what applications would benefit from automation. Interviews were conducted to identify the needs and expectations of our OR Information Systems. The complexity of information that would be processed was carefully analyzed.

SEARCHING FOR THE RIGHT SYSTEM

In a search for a suitable system for booking, scheduling, capturing OR log data and reporting, one major Canadian Hospital embarked on the following journey.

Through conducting a 1988 study of 37 major Canadian hospital operating rooms, it was revealed that 17 were either using, or in stages of implementing, some form of OR Computer application. Eleven of these were using their main hospital computer system, while the rest were using a stand - alone system. Seven of these OR were using purchased software, while nine were using self-developed software. Of the 20 hospitals indicating no computer activity, all but six expressed interest in pursuing this technology.

When considering this technology, we can learn from the experience of others. What are some of the pitfalls and frustrations revealed by others? Those identified by this study indicated that frustrations emerged from an inability to obtain desired statistical information, undesirable formats, slow

computer response time, inability to program and implement required changes, the length of time required to obtain information, plus a distrust of the accuracy of the generated information.

Conducting A Needs Assessment Interviews conducted with Medical Staff, OR Nursing Personnel and Clerical Staff, who would ultimately be involved in and affected by computer automation, identified the interest, attitudes and expectations of this technology. By identifying the needs expressed in these interviews, the priority of automation and scope of the initial project was formulated. Interviewees were also encouraged to comment on their perception of the manual system and what changes might be necessary to facilitate automation. This testing of the waters provided insight into attitudes and interests that would either promote or hinder the success of the selected course of action. A review of the policies and procedures in existence was necessary to determine if these could support computer automation.

What Were the Alternatives? The OR is an integral part of the hospital and a major consumer of health care dollars. This department does not stand in isolation and requires a constant flow of information to and from many other areas. This study identified a need for information exchange between the OR and 23 other hospital departments. Based on this need for information integration, it was decided that the system of choice should be designed on the hospital's central computing facility.

The next step was to convince the Hospital's Administration as to the potential value of this system so adequate funding would be committed to its development.

The Benefits In order for a system to be of value, there must be some visible benefits. Probably one of the strongest arguments for this system was the ability to electronically produce a daily surgical slate, custom designed to the needs of the end user such as the Care Unit, Physician or Support Service, thus eliminating the standard format hard copy in circulation throughout the hospital, carrying patient information infringes on the right for confidentiality. Accuracy of patient care information through access to admitting systems programs, laboratory systems, pharmacy and patient care profiles were also viewed as desirable. The system was expected to reduce patient stress and extended stays through more accurate bookings, thus reducing delays or cancellations. Ultimately, the reporting capabilities, utilization statistics and cost analysis potential captured the attention of the Steering Committee who authorizes the allocation of funds to allow this project to unfold.

THE PROPOSAL

A proposal was put forward to the Hospitals' Information Systems Steering Committee and received approval to proceed on a multiphase plan to initially include surgical bookings, scheduling, slate production and management; procedural cataloguing to ultimately result in case costing; an OR patient care data capture, implant log and infinite reporting capabilities. The objective of this system was essentially to automate the mechanisms currently in practice with minimal change and disruption of the day to day routines. The system was to be designed to capitalize on other programs already in place, such as Admitting-Transfer-Discharge and Materiel Management Inventory, complete with a bar coded mechanism for replenishing OR direct buys. Following approval of the proposal, a project team was selected.

The Project Team The realization of this system has required the commitment and dedication of a team of experts striving collaboratively for approximately 16 months. This project team, consisting of three programmers, a methods analyst and those who would be implementing and using the system, worked together harmoniously to identify the programming requirements. Initially, it was essential that the Information Systems part of the team understand the dynamics of the way the OR functioned. The term "it must be flexible" became the core value of the project. Approximately 80% of the time was spent discussing the 5% exceptions to every rule. The user group, including nurses and clerical staff, had to expend equal energy in learning computer terminology and trying to envision how the system would work. The previous introduction of a micro computer, with an enhanced dBase program to capture the OR log and generate statistics, gave the involved staff an appreciation of computer technology.

The Commitment The tremendous commitment and manpower required to organize and prepare the supporting data base must not be under estimated. The data gathering for procedural cataloging is overwhelming and can truly tax the resources of an OR. In addition, supporting information to ensure case costing, block bookings, surgical schedule production, controlled circulation of the daily slate and conflict checking were essential.

Following is a discussion of <u>some</u> of the considerations commanding the attention of the User Group to bring this system into successful production.

The Procedural Catalogue A major university affiliated quaternary care facility provides an infinite variety and combination of surgical procedures. To

capture and harness these procedures into categories that facilitate statistical reporting can be very challenging.

All procedures were divided into surgical services and sorted by anatomical locations. In order to limit the number of procedures catalogued and to provide flexibility, three catalog fields were developed. The first field identifies the procedure itself and a nine digit catalog number is assigned to each procedure. The first four digits identify the catalog section and surgical service to which it belongs. For example, 7600-00000 identifies the procedural catalog number and 7670-00000 would indicate the Orthopedic Service (Subsection Number 70). The last 5 digits are system assigned and distinguish each procedure separately. The second field of the procedural description allows for the various methods that may be listed. For example, the procedure may be Total Hip Arthroplasty and the methods may be AML or HGP, actually indicating which prosthetic system is to be used.

The third field of 30 characters allows for a free text description specific to each patient. In the example of the total hip procedure, the side indicated as "left","right" or "bilateral". Because procedural terminology is not always the same, a mechanism for entering alias terms allows the system to search for the procedure by an alias name. Alias names to the hip procedure might be: Hip replacement; Femoral Arthroplasty or Acetabular Arthroplasty. These mechanisms allow the cataloguing process to be concise, but yet as flexible as possible. The development of the data to support this flexibility requires tapping knowledge and expertise of many people, particularly the supervisors of each surgical service.

Case Costing Closely linked to the procedural cataloguing is the gathering of the detailed information that identifies all supplies, equipment and resources specific to each procedure. A fully implemented Case Cart system, plus catalogued inventory on the hospitals' central computing facility, provided a great advantage in organizing the supporting data. This information was integrated into the cataloguing process. However, identifying and ensuring that all items were accurate, plus bringing both case cart lists and preference card information up to date for data entry, required infinite man-hours of attention. Case costing results from the tabulation of supplies used, procedural duration, implant devices and overhead costs, all of which have been incorporated into the design plan of the programs.

Block Bookings The design of the system had to support the block booking mechanism in practice. The supporting data had to include blocks by either surgical service or doctor groups. Templates were designed to simplify the booking block allocations and allow modifications to the blocks, as necessary,

on a daily basis. Standard templates were developed to include such considerations as summer and Christmas hours, theatre closures and scheduled holidays. With the block booking format in place, the booking clerk is computer assisted in formulating the daily surgical slate.

The Surgical Slate Circulation One of the primary initiatives for pursuing this system was the ability to produce the daily surgical slate electronically for access by only those who required the information. In the interest of the protection of patient care information, the circulated standard hard copy format of the daily slate has been of primary concern.

In order to identify who was actually using the slate information and to determine why, a survey was conducted. Information from the survey resulted in the formatting of five versions of the slate that would be made available electronically according to User sign-on privilege. A full version would be circulated only within the Surgical Suite. Care units would receive information pertaining only to the patients they care for and surgeons would receive information within their surgical service. Other support areas would receive only information relevant to the service they provide.

Conflict Checking Scarce resources are always a prime consideration in surgical scheduling. By developing a system that would recognize conflicts of equipment, personnel and time, delays could be averted.

. Other hospital departments that share the same surgeons are also implementing this system. The result will be the capacity to avert double booking of a surgeon in other areas like Day Surgery or Cystoscopy. Within the Operating Room, conflicts for equipment, such as the fluoroscopy unit, are deemed valuable.

Other Benefits The system is designed to track delays, postponements and cancellations of surgical procedures through a surgical slate management program.

THE PROJECT PROCESS

The project team moved through a series of events including preparation of a scope document, development of terms of reference; a statement of functional requirements; the conceptual design, data modelling and developing a time line for testing programs, training users and phasing the programs into a production environment prior to implementation. Refer to the Surgical Suite Management Sub System organizational chart, see attached figure, which demonstrates the relationship of the various aspects of the booking/scheduling component of the system.

The system was also designed to allow for modifications or enhancements and to seize the opportunities of future technology with the capacity for expansion. One aspect of the ensuing phase of this project will include the capture of the Nursing Operative Report directly on line at the point of care - the Operating Theatre.

CONCLUSION

Embarking on a journey into automation is complex and challenging. It is important to select the right system and encourage the involvement of key players. The tremendous commitment of resources toward collecting, loading and maintaining supporting data must never be underestimated as we bridge the gap from technology to implementation and utilization.

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22 -- How To Harness The Power Of Information Technology To Benefit Patient Care

Barbara Palmer

INTRODUCTION

Todays nurses must not only apply a plaster but must also charge for it, chart the procedure, direct others to do the task and evaluate the outcome. In addition, they must manage their own budget, workload, activities of health and other personnel and still spend 40% of their time with patients. The profession is turning to Information Technology (IT) to assist.

If IT is to be a help, the nurses must use the information to question and improve nursing to maximise the use of nursing resources and to understand the effect of other professionals on the requirement for nursing resources.

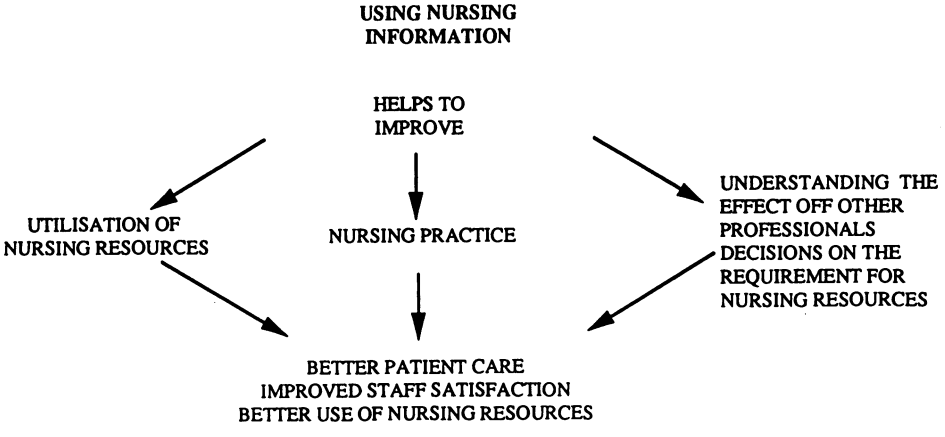

Fig 1

The resulting benefits to patient care combined with the up to date information, will leave nursing in a politically powerful position to control its own future.

Learning from Experience

Because of the pace of technological change, the changing organisational requirements and the evolving capacities of hard and software, it is extremely

difficult to plan for the new technology in a coherent way. There is high risk. The results are all too often a disappointment, in that the system usually does less than planned and the implementation almost always takes longer than estimated. However, many of the pitfalls can be avoided by taking a step at a time.

Nursing is ideally placed for this approach, however seldom have computing systems proved as useful to nurses as they have a right to expect. What went wrong? How can we learn from the experience? What has not been given sufficient attention is the linking of the units' stated mission - objectives to the daily tasks performed by nurses in their unit. If IT is to be of help the nurses must be crystal clear about their purpose of the job and the key roles, skills and competences they need to achieve it.

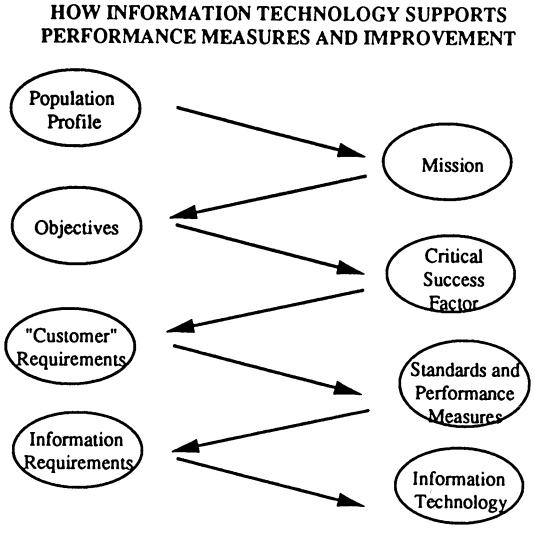

Fig 2

In most instances, nursing information requirements were badly analysed and the human implications to patient care were ignored. The overworked nurse spends all her time on the day to day issues of caring for more dependent patients with less resources and assistance. And the stressed manager spends all her time in further stretching the ever decreasing resources and patching the subsequent holes. Neither had time or energy to see that computers could be the very professional tool to assist them IN providing, planning and costing a quality service which answered the patients requirements.

To enable nurses to function most effectively, they must become more involved in business issues and work with the General Managers. Nurses cannot work in isolation. They must understand where to obtain the data, with whom to share it and how to use it. Nurses must set up the necessary

information systems to monitor, cost, prioritise and evaluate their service. These systems should enable the nurse to seek and share information on the patients' behalf, and should provide the Ward Managers with the necessary information to assist decision making and to plan quality health care.

NURSING INFORMATION SYSTEMS

- Care planning
- Patient dependency/workload analysis
- Rostering
- Personnel (Fig 3)

To obtain maximum benefit for nurses at all levels, these systems must be seen as part of a hospital or community information system.

Nurses in Systems Analysis

The first task of all nurse involved in systems analysis is to state clearly their information requirements. But this is not as easy as it sounds. Computerising information in nursing does not mean, for example, that the inefficient, administrative, archaic paper recording systems should be simply transferred to a computer.

New systems need to be developed, and this means going back to basics: the patient. When the person is taken ill, each 'episode of care' consists of a progression of events. The patient is assessed, his care planned, the treatment implemented and the outcome evaluated and costed.

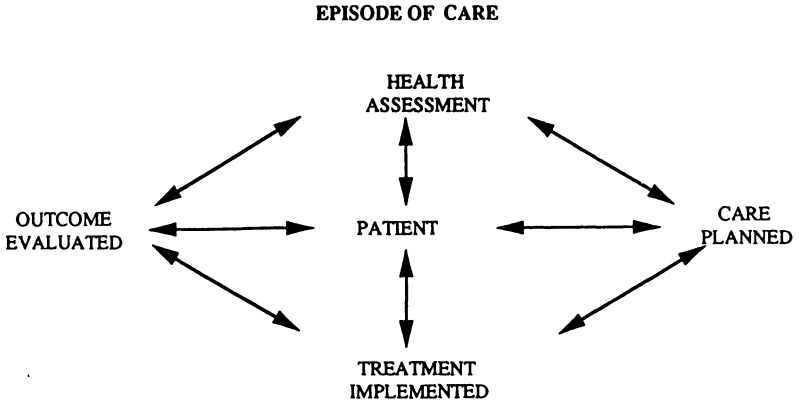

Fig 4

All of these procedures will generate information of different sorts to which other professions require access. Ward Managers are in a unique position to collect this type of information and to contribute to the wider aspects of health planning. Nurses are the originators of patient information, however, such information must be appropriate, accurate and accessible. This means that the technology used must allow information to be gathered where is originates - with the patient, not in the office or at the workstation, and this has implications to nursing practise.

The Implications of Computers on Nursing

To obtain the right nursing information which supports purpose and objectives, nurses must be open to question the assumptions concerning what is expected of them and whether expectations are being met. If we do not know what is expected of us or how effective we are we cannot plan and therefore cannot manage ourselves or others. It leads to loss of confidence and interest and so we take refuge in traditional safe tasks.
There are three main areas in nursing which computers will effect. These are:

> How do we collect information? (source data capture) - technology must allow information to be gathered where it originates, alongside the patient (not in the office or at the workstation). The computer must be discreet and data input quick and easy, in a method suitable to the bedside which does not influence patient care
>
> What's the minimum information we can collect? (nursing minimum data set) - nurses should gather only information which is essential for patient care. Nurses currently spend a great deal of time and energy gathering data either for someone else or ostensibly for themselves which is never looked at (such as voluminous nursing histories). Nurses must become discerning users and collectors of information.
>
> Which decisions need assistance? (decision support) - these systems must support rational decision making about individual patient care, (not provide standard answers, for the non existent standard patient). The systems must support primary nursing and the nursing process and allow nurses to develop an individual care plan using an appropriate nursing model which indicates patient dependency and workload.

When nurses decide what information they need, they should take as their guide those things they use on a daily basis. These are broadly of two sorts: hard and soft. The hard information relates to performance measures, standards, rosters, patient throughput, etc. The soft sources of information - comments, hearsay, opinions, patients' appearance or written notes or comments. Both sorts must be easily understood and interpreted by the ward staff and by management.

Once the information has been accurately recorded at patient level, each ward/unit of care can then determine the best way to collate the information for its own purpose, to enable the most efficient and effective allocation of resources to maximise patient care. When nurses have a clear idea about the information they need, they will be able to judge what type of software system they need. It is vital for nurses to help choose the software system they will be working with to ensure that the system installed is one they own and are happy with and will not dictate or detract from patient care.

Benefits to Patient Care

An integrated patient centered information system (of which the nursing systems are part) should provide benefits to the nurse and the patient from the time they enter hospital. If the system has been designed correctly all patient details will only have to be recorded once.

It is not unknown at present for a hospital to hold this information in 20 different places - a waste of resources taking time away from direct care - the performance measures, standards, rosters, patient throughput etc. The soft sources of information - comments, hearsay, opinions. patients appearance or written notes or comments. Both sorts must be easily understood and interpreted by the ward staff and by management. Once the information has been accurately recorded at patient level, each ward/unit of care, can then determine the best way to collate the information for their own purposes, to enable the most efficient and effective allocation of resources to maximise patient care.

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time they enter hospital. If the system has been designed correctly, all patient details will only have to be recorded once. It is not unknown at present for a hospital to hold this information in 20 different places - a waste of resources taking time away from direct care - the patient has often answered the same questions 4 times before treatment has even started!

Because information is held centrally, the potential for mistakes is reduced from using out of date information. As electronic communication is faster, ward orders and results can be sent and received more quickly; nurses do not have to waste valuable time chasing information.

The sharing of certain items of clinical data electronically makes the patient stay in hospital more comfortable, for example, when visiting other departments information badly written on scrappy pieces of paper does not have to be checked for accuracy, or by repeating the procedure - a waste of resources and an increase in stress for the patient and nurse.

Workload measurements and flexible rostering also reduce wastage of resources. Staff are costed accurately and allocated to areas of greatest need - not to who ever complains the most. In the UK the average time spent on direct patient care is 55%. If this could be increased by even 5%, the implications for nursing budgets are enormous.

This increase in accurate communication need not be restricted to the hospital, with terminals in health centres community staff can both send and receive information enabling care to be planned and executed more cost efficiently and effectively. The ward is also a more pleasant place as it is quieter, with fewer frantic telephones. IT can also be used for health education.

An often forgotten benefit to patients is that they can have their own daily agenda which allows them not only to take part in their care, but to plan in free time, trips to the hairdressers, chiropodists, etc. All those benefits mean that patients are happier, more satisfied and recover more quickly and therefore cost less. To obtain these benefits, nurses must be open to changes in practice.

Conclusion - Critical Evaluation

I hope I have shown that computerisation can lead to new and improved ways of working with potential benefits to patient care, providing IT is seen as supporting rather than dictating the business.

IT THE CATALYST FOR CHANGE

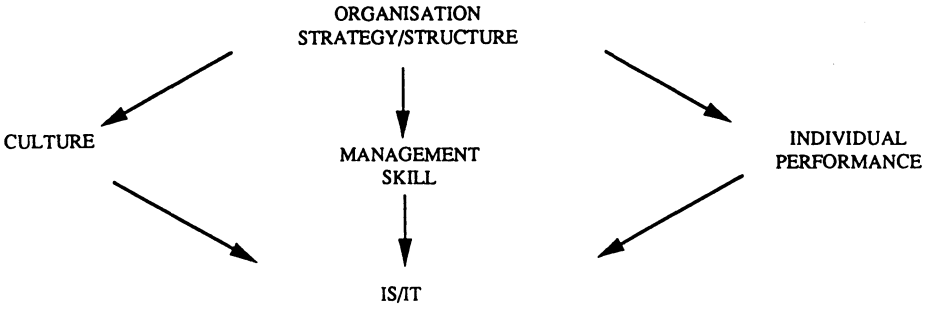

Fig 5

However it will also lead to new kinds of organisation. It will dramatically change nurse management who will have to become problem solvers rather than two way information relay links.

Ward Managers must also develop new attitudes to change. They must create an ethos which encourages nurses to take advantage of the opportunities new technology brings to improve their work and patient care. Indeed the full effect of computerised nursing systems can be realised only if nurses are prepared to use the information to change the nature of their work as they find smarter ways of doing things to benefit patient care.

Then nursing will be politically powerful and will be making the invaluable contribution to the future of the country's health it always should.

- Caring for the 1990s - HMSO
- Riding the Waves of change - Gareth Morgan
- The implications to clinical care of computerised nursing care plans - B Palmer 1989
- IT injects new life into the nursing profession - R Hoy
- A smarter way of Nursing - B Palmer, Nursing Times February 1990

23 -- Nursing Benefits Realization: Effective Nursing Information Management Systems

Charlotte A. Weaver

INTRODUCTION

Most industrialized nations are struggling with the need to contain health care costs (Abel-Smith 1984) and stretch nursing resources (Barry and Gibbons 1990). The forces driving these changes in the economic climates of industrialized nations began in the early seventies with the steady increase in oil prices. Global competition in manufacturing from the Pacific Rim nations furthered the economic woes of European nations, the Commonwealth countries, and the United States. As a result, the European Economic Community and other Western governments' health care funding will continue to emphasize cost containment and real cost decreases throughout the nineties. At the same time, the populations of Western nations are aging. Growing aged populations and higher chronic disease prevalence in the industrialized world are increasing the demand for nursing resources. In the United States for example, the ratio of registered nurses employed in hospitals per patient was 96 nurses per 100 patients in 1987 - up from 50 nurses per 100 patients in 1972 (Barry & Gibbons, 1990). These socioeconomic forces and the growing scarcity of available nursing staff cross international boundaries and cultural differences in health care delivery systems. As a consequence, Nursing Leadership throughout the world will be faced increasingly with he common challenge of "doing more with less".

BENEFITS OF NURSING AUTOMATION

Maximum use of information technology is key to stretching scarce nursing resources in the face of ever increasing patient care demands and shrinking government funding. Nursing Administrators and Managers should view automation as a needed friend. The VISION that Nursing Leadership needs to have in regards to automating is: automate every information processing task performed by nursing. To automate only part of the operations is to lose the efficiency potential of a paperless system.

The business operations side of patient care delivery is primarily the generation and communication of information. Performed manually, it is intensely time consuming. Furthermore, manual information management wastes nursing time in repetitive and redundant communication of information. Manual charting, care planning, and hand writing of chart forms, requisitions, logs, and the kardex are time hogs. Manual systems also depend on heavily on telephone communication of information. This is costly to efficient work flow in three ways: 1) time lapse in relaying critical information acts as a bottleneck to task competition; 2) it interrupts the work of those who have to place and answer the call; and 3) it is labor intensive. In the manual system of Patient Admission and Processing of Medical Orders, the task can require 13 steps to complete. In a functionally rich HIS environment the same task needs only five steps to complete. The assumptions underlying the automated system are support of physician order entry and electronic chart capability.

HIS FEATURES WITH MAJOR NURSE LABOR SAVINGS

The total system requirements for effective nursing information management within a Hospital Information System (HIS) are available in a booklet published by the Wisconsin Computer Applications in Nursing - Special Interest Group (WI-CAN, 1989). Workshop participants will receive a copy of the WI-CAN booklet. However, the applications that have the greatest labor savings potential for nursing fall under patient care. In our experience with North American hospitals who have installed functionally rich HIS systems, the percentage breakdown by feature and savings potential is as follows:

Charting = 39%
Order Processing = 21%
Printouts = 16%
Management Functions = 8%
Med Administration = 5%
Information Retrieval = 5%
Patient Care Plans = 5%
Admission, Transfer, Discharge = 1%

It is precisely because of the importance of the patient care applications to the Nursing benefits savings potential that Nursing Leaders need to understand the limitations of current HIS systems in the marketplace. There are good systems available, but many are functionally poor in their patient care applications. Historically, systems design and development of HIS systems were driven by financial needs and non-nursing clinical perspectives. Consequently, the nursing perspective was omitted in system design, and even

today, system selection at the hospital level often ranks Nursing needs below other clinical and financial departments' requirements. In our experience, however, when Nursing Leadership is informed, speaks the language, and can support their requests with quantifiable measures of labor savings, cost avoidance, and cost containment, they successfully obtain full administrative support in their automation efforts.

Well over 50 percent of benefit savings with total hospital automation come from Nursing (Weaver & Fredericksen, 1991). Whether these savings are calculated as full-time equivalent reductions (FTEs), or cost avoidance with the ability to provide more services within a fixed budget, the bottomline is the ability to provide more services while using less resources. Nursing Administration can capitalize on this savings potential as their power base to influence system selection and decision-making. To disregard the full automation of Nursing in the larger scheme of hospital automation is a lost opportunity of significant fiscal magnitude. It also guarantees that within 5 years a hospital will have to invest in a new system that will automate Nursing.

THE QUALITY/PRODUCTIVITY RELATIONSHIP

Nursing has long held the belief that quality care costs. This myth is directly contrary to the business industry where the relationship between high quality and high productivity have been the mark of successful companies, since the Japanese revolutionize manufacturing with the help of Dr. W. Edwards Deming in the 1950's (Peters, 1987). The Case Management literature in nursing has begun to provide a valuable analysis of the positive correlation between quality outcome measures and lowered costs (Ethridge & Lamb; 1989; Zander, 1988). Furthermore, studies measuring the relationship between quality and productivity in health care show unmistakenly that the higher the quality of care, the lower the cost to provide the care (Binns and Early, 1989). Thus, the higher the costs, the poorer the care.

The operations of a hospital operating in manual mode clearly show the relationship between cost, quality and productivity. The sheer magnitude of the paper management and human communication chain mandates upward flow of decision-making authority.In these types of systems those closest to the source of the information and patient are not empowered with decision-making authority. This heirachial structure means that problem resolution tends to be referred to a higher authority. The resulting delay causes an inevitable compounding of the problem and spiraling use of resource to fix it. Research shows that when Nurses at the front line are empowered with on the spot decision-making authority, patient mortality and morbidity rates are significantly lower than other like units no having Nurse autonomy (Knaus et al., 1986). Patients who recover quicker, with less complications and readmissions cost

less to care for than do patients who have prolonged hospital stays with complications and possibly death (Binns and Early, 1989).

Manual systems grossly waste Nursing time and place a heavy burden on Nurses for the management of all patient-care related information. Such "paper work" keeps Nurses from direct patient care. More importantly, the busy work involved in manual systems often does not allow Nurses sufficient time to think, plan and co-ordiante a patient's care management. When Nurses do not have time to think, care delivery reverts to a physical, functional task level. Nurses work at a frenetic pace, vulnerable to errors, burnout, and illness - all costly to quality and resource utilization.

In contrast, highly efficient hospital Nursing units are characterized by quiet, empty Nursing stations and computer terminals. The telephone rings only occasionally and Nurses tend to be in patients' rooms. Staffing levels are often 25-30 percent lower than like-clinical units that are not automated. Observers to such units will see terminals close to the patient's bedside for immediate charting and data retrievals. These terminals may be at strategic locations in the hallways, or in patients' rooms. There are also terminals in the Nursing station. Charting entries are made as care is performed and tasks completed without the Nurse ever returning to the Nursing Station. This avoids "charting at the end of the shift" and eliminates most overtime.

CONCLUSION

Computers alone do not automatically change organizational structures and Nursing Management practices. Nursing management excellence is the single criterion that accounts for the presence or absence of quality care delivery. However, with enlightened Nursing Leadership automation will greatly facilitate high quality patient care delivery and professional Nursing practice. Automation with its links to cost containment demands and scarcity of resources require that nursing management utilize nursing resources radically different in the future.

The business, practice and management of nursing has to change, and change rapidly. In August 1989, the Secretary's Commission on Nursing for the U.S. Department of Health and Human Services (DHHS) solicited inputs from a group of experts on patient care delivery systems. In recognition of the compelling circumstances impacting nursing, these DHHS Roundtable participants observed that "it is no longer a question of whether familiar systems need redesigning but rather how soon and by what means a different system will take its place" (Barry and Gibbons, 1990 pg66). Automation is a means, a tool, and a much needed friend to Nurse Leaders throughout the world in these changing socioeconomic times.

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24 -- Computers And Information Technology In Nurse Education - The English Experience.

Paula M. Procter

INTRODUCTION

This workshop will outline the three year Computer Assisted Learning (CAL) Project funded by the United Kingdom (UK) Department of Health through the English National Board for Nursing, Midwifery and Health Visiting (ENB), first announced at the Nursing Informatics conference in Dublin, 1988. The three years of the Project are from April 1988 to March 1991.

The Project is based upon a cascade training system, supported by a National and International telecommunications network. It is broadly aimed to increase nurse* educators awareness and effectiveness in the uses of computers and information technology within pre- and post-registration education. The workshop is divided into a number of sessions with a variety of activities for delegates.

BACKGROUND

The overall governing body for nursing, midwifery and health visiting in the UK is the United Kingdom Central Council (UKCC). One of the UKCC's responsibilities is to maintain a live register of practising nurses, midwives and health visitors. Accountable to the UKCC are four National Boards, England, Wales, Scotland and Northern Ireland. These are the statutory bodies for education, their role is both advisory and regulatory. The UKCC and National Boards were set up in 1983 by an Act of Parliament (1979).

Each National Board has a number of officers, and it is their responsibility to monitor and maintain standards in education, in clinical placement as well as curricula design. The Board itself is made up of professionally elected and nominated members. The Board meets regularly to discuss current issues affecting education and plans policy accordingly. The elected members are drawn from practising professionals voted in by those on the live register; the nominated members are determined by the Secretary of State for Health.

The size of the Board is related to the number of educational establishments overseen, in England some 300 such establishments divided into

some 90 Colleges of Nursing and Midwifery; Wales 8, Scotland 14 and Northern Ireland 8.

NEEDS ANALYSIS - OVERVIEW

In 1985, the ENB employed an Education Resource Officer, it was this person's responsibility to identify areas requiring attention in the uses of resources in nurse education. This was not a newly created post, the previous incumbent having been in post for ten years.

For some time, nurse educators had been working in an ad hoc fashion with computers. These were enthusiasts, burning the candle at both ends, teaching during the day and developing computer assisted learning materials at night. They were attempting to develop the use of computers, and the central initiative of the ENB CAL Project owed much to these individuals for their vision and determination.

Many Schools of Nursing had purchased computers for educational use, however, there appeared little thought behind the purchases. A survey of all Schools of Nursing and Midwifery undertaken in June 1986 (Procter, 1986) clearly indicated that there was no correlation between either the number of staff or students to the computer purchases made by the Schools. The only common feature resultant from the survey was that the hardware was purchased in February or March as 'year end' spending. (Note: We use an absolute budgetary system from 1 April to 31 March, funds must be spent.)

It became obvious from the survey, and through direct communication with a variety of individuals and establishments that there was a desperate need for coordination of direction in the use of computers and information technology in nurse education. This was especially true in the light of growing requirements by administrators to utilise ward-based terminals and the 'expected' nurse's role that ensued (NHS Management Board, 1986, 1989).

Many nurses, both clinicians and educationalists, had been highly motivated by the 1982 conference 'The Impact of Computers on Nursing' held in London (Scholes et al, 1983), and the time was ripe by 1986 to re-motivate educators. The scenario then was one of general interest in the uses of computers and information technology in nurse education, but development was marred by lack of direction and support from the Statutory Body, in addition to, pressure from administrators towards ward-based nurses using computers to input data for administrative uses. It was considered vital that the ENB supported a direction for educating nurse educators in computers and information technology, and undertook such a venture with thought but also with some speed.

THE STRATEGIC FRAMEWORK - OVERVIEW

In response to the needs analysis, a framework to progress such a National educational strategy was developed over the period July 1986 to August 1987 (ENB, 1987). G875 In September 1987 the ENB received and accepted the ENB CAL Project proposals and funds were allocated for the three year impetus stage in April 1988. The ENB CAL Project is a ten year strategy, with an initial impetus stage of three years concluding in 1991. It was considered that during the time of the initial three years, courses for the preparation of teachers currently held in Colleges of Further and Higher Education, would gradually develop modules concerned with computers and information technology, and that by the end of the impetus stage, such courses would ensure that all newly qualified nurse teachers have a base of such knowledge in this vital field.

The strategy thus, was a developmental educational framework with the first three years concerning the education of nurse educators in the use of computers and information technology in order to ensure a firm base for further development and consolidation following the initial stage. It was important to instigate the cognitive process as early as possible, thus one of the first considerations was that of a definition for Computer Assisted Learning (CAL) to be adopted by the Project. The working definition is:

> 'Learning about computers and information technology whilst using the technology within a planned and cognitive structure.' (ENB CAL Project, 1987)

This widened the more traditional view of CAL considerably, and permits elements of educational flexibility within the remit of the Project. A further definition we include is taken from a book by Seymour Papert (1980),

> 'The way a computer presence contributes to mental process, not only fundamentally but in more essential, conceptual ways, influences how people think even when they are far removed from physical contact with a computer.'

The development of a National body of knowledge was deemed the best way forward, educators would then be in a better position to make informed decisions related to computer and information technology use, such as 'how', 'when' and 'where'.

The Project's primary aim was not that of courseware/software design, however, part of the work of the Project during the three years was to ensure educational soundness of material produced. Two elements are included, the

first was to produce an assessment form for use (ENB CAL Project, 1988); the second was to include a section on 'authoring' within the main taught course.

In order to achieve the maximum benefit from the impetus three years, it was decided to use a cascade system of education/training with an in-house three day section supported by a twelve week distance learning section at the participant's own site. Once a participant had completed the full course, they instructed colleagues using the same material supported by the Project Team.

Cascade systems have been used before for a variety of education and training developments, but have tended toward failure when dealing with large scale ventures. It is believed that through supporting the participants with a National and International telecommunications network that the method outlined was not only workable, but offers immediacy of contact not available via more traditional routes.

CASCADE

The Project is managed by a Director appointed by the ENB and supported by an Advisory Group of the Board. The Advisory Group consists of knowledgeable experts and Board members.

The cascade commences from the Director to Centre Leaders. The centre Leaders were educators based in Schools of Nursing around England that had been identified as suitable sites for the Project. Each Centre Leader had a two year secondment contract with the Project. In June 1988 the first three Centres were set up in Sheffield, Bristol and London; in April 1989 a further four Centres were brought into the Project, these at Newcastle, Birmingham, Ipswich and London.

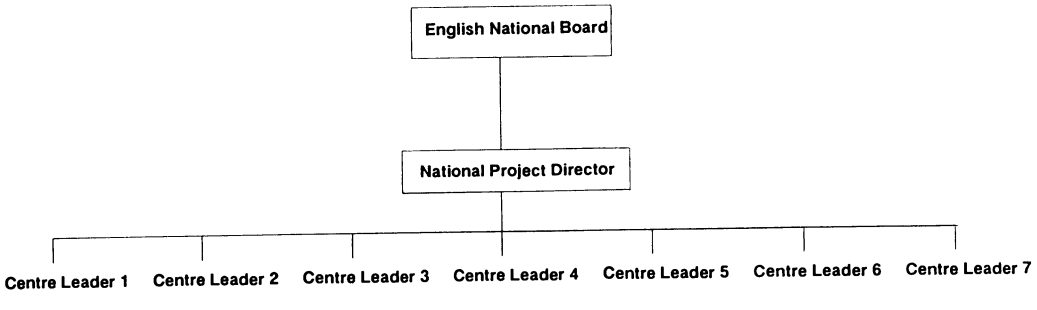


Fig 1. Diagram of Director to Centres Cascade

The Centre Leader role is to carry out the teaching and support of educators during their time as participants on the course. In order to satisfactorily meet the demands placed upon them, the Centre Leaders undertook a twelve week induction course covering an introduction to all areas anticipated.

The Centre Leader induction programme was designed in a rotational form, consisting of one week together in Sheffield for input with the following week based at their own site for consolidation. All communication during the weeks not together was undertaken through the telecommunication network. Such a structure appeared to have been effective.

With the first phase of Centre Leaders, part of their programme included the development of the material for participants during the course. This material was generated in two formats, the first being hardcopy (paper) - used during the initial three day course; the second being modules of Open/Distance Learning sited within the telecommunication network, accessible from within Schools of Nursing and Midwifery.

The cascade continues with educators attending Project courses at one of the designated sites, with completion of the course at the educator's own site through the telecommunications network. Once they complete the course, it is their responsibility to educate their peers in their establishment supported by the Centre Leader through the telecommunications network.

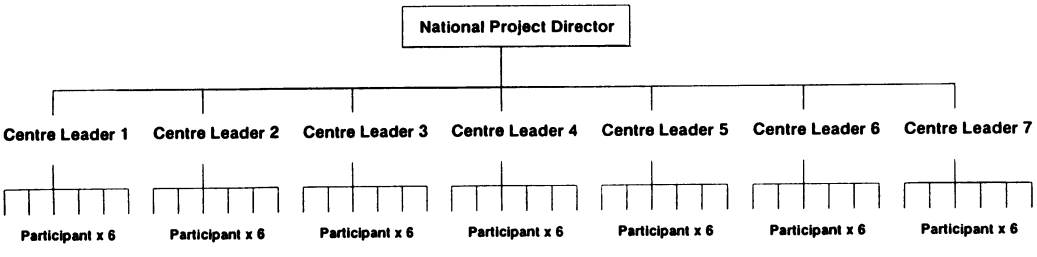


Fig 2 Diagram of CL to Participant to peers cascade

THE ENB CAL PROJECT COURSE:

The course is divided into two inter-related sections. The first being attendance at a designated Centre for a three day period, the second through Open/Distance Learning in their own environment linked to the telecommunications network. Throughout, methods of learning fall into four main categories:-

discovery learning
learning through discussion
formal instruction
peer learning

Educators self select to attend the course, there are a maximum of six participants per course and courses are held at all Centres concurrently each month for nine months of the year. Upon application, the form is signed by the educator's manager accepting agreement for the time required to complete the course to be allocated, without such an agreement it was suspected that busy educators would not complete the course within the expected time period.

The course aimed to build knowledge in the following areas:-considerations involved with integrating CAL information technology in curricula management of hard and software general approaches to computer applications available software/courseware and how to assess local and wide area networking design of courseware (authoring). In all of the above, but especially in the computer applications area, the emphasis was placed heavily upon information requirements and the handling of such rather than upon the technology.

During the initial three day section, the participant receives instruction supported by documentation in the form of a Participants Journal (ENB CAL Project, 1988). The Project Team found that original manuals presented with computers were often difficult to follow. The Journal is clear, concise, logical and includes summaries for quick reference as the individual's knowledge increases.

A requirement of participants is that their educational establishment has a link to the telecommunications network prior to commencing the course, this to ensure continuity of their learning upon their return from the three day section. Such a connection in place was felt to be important for two major reasons, the first being that it was their own environment and thus the participant should develop a sense of ownership during the knowledge building phase, it was considered that without such ownership there may have been a reluctance to continue in their knowledge acquisition. Secondly, as the aim was to utilise the technology during education, it was imperative that much of the course did just that, as a by-product it also meant that the participant was not restricted by time and place to continue their work.

The second section of the course was expected to take approximately twelve weeks to complete. The modules are linked to the in-Centre section and include some non-compulsory parts for those wishing to delve further into this fascinating world.

Modules can be taken in any order and at any time (the telecommunications network being on-line for 24 hours per day, seven days a week), many of the modules contain assignments for participant completion, these are returned via the network for assessment by the Centre Leader. If at any time, a participant is experiencing difficulty, they can, through the network, contact their Centre Leader for advice and support. In addition, each Centre Leader has one telephone number with an answering machine attached when contact via the network is not viable.

There is no 'pass' or 'fail' associated with the course. Upon completion, the participant receives a certificate of competence, and their educational manager receives a letter stating that this person is now ready to commence peer education within their School.

THE TELECOMMUNICATIONS NETWORK

The vital link in the cascade is the telecommunications network. Whilst in the process of setting up the Project Framework a number of possibilities were considered, such as a host system versus maintaining our own system, cost related factors were taken into account as well as technical, managerial and ease/portability for end users. It became apparent that to maintain our own system was not a viable solution.

The decision was made to use The Times Network System (TTNS). In January 1990 this system combined with PRESTEL Education to form Campus 2000. This is an educationally biased communication and information G#75 network, utilising Dialcom International protocols and connects with the major business network in the UK, British Telecom's 'Telecom Gold'.

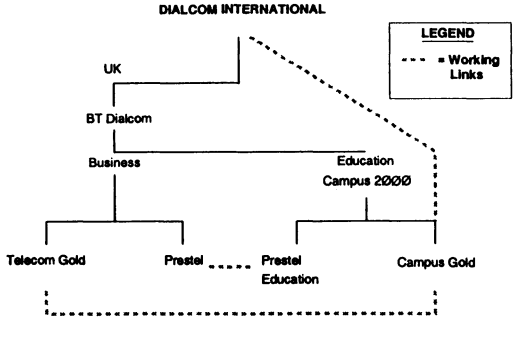


Fig 3. Telecommunication Links

Unlike Telecom Gold, the user pays an annual subscription rate, there are no charges for receipt of information/data, or on-line connection. The only additional charge is that of a local telephone call during use. It was felt that such financial considerations would assist education managers in planning with financial budgets, rather than receiving unknown bills each quarter as is the case with Telecom Gold.

Campus uses Prime Computers to house the communication and data. Each subscriber receives a 'Mailbox' or address to the computer(s), this permits entry to the many facilities available on the network. In the UK, most secondary (11-18 year olds) and primary (5-11 year olds) schools are connected, as well as, most Universities, Polytechnics and Colleges of Further Education. A link to such educational systems was considered appropriate during selection due to a general move in nurse education towards a college based training system. The link to secondary schools assists in recruitment.

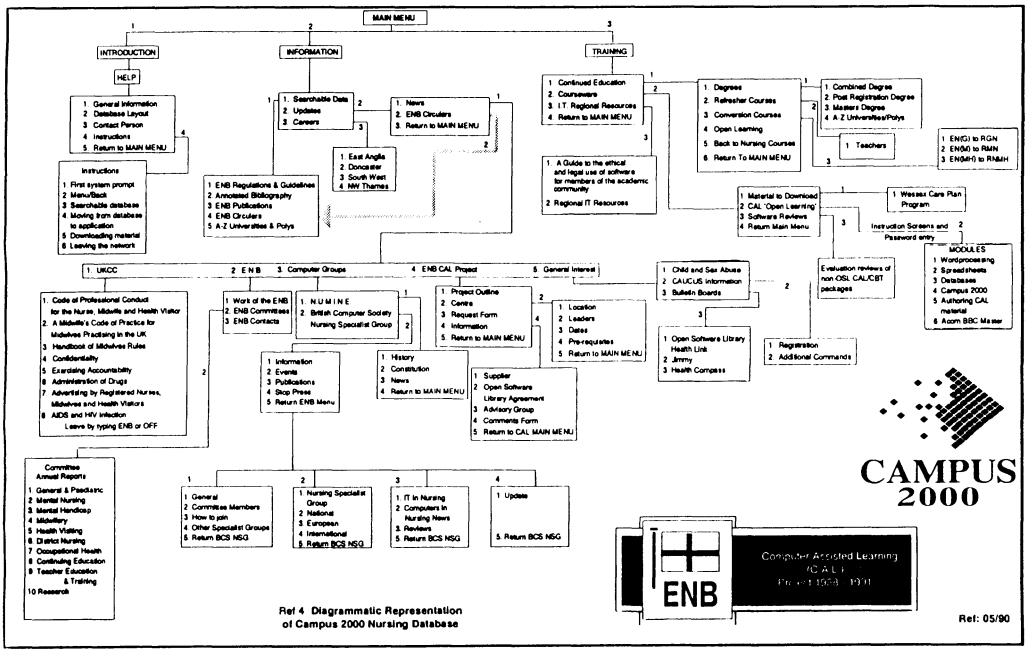
The Project director is system manager for the nursing section, a 'managerial mailbox' is used which entitles the manager to carry out greater functions than the general user. Such uses include:- assessing individual or group activities on the network identification and solution dissemination of innovative or problem areas overall control of the data input to the information source development of areas in communication or information data Without such a management function, it would be difficult to oversee the Project and its impact on Schools of Nursing.

A user connects to the network through local or specialised nodes (other designated computers) in their area, via the telephone system through a modem, these nodes in turn connect the user to London where the Campus 2000 computers are housed. Once the initial 'handshake' between computers is completed, the user then inserts their mailbox number and unique password. Access is then granted, the user has a choice of paths which they may wish to follow:

send/read electronic mail - Locally, Nationally or Internationally to other Dialcom users
accessing the nursing information source
accessing other information sources
accessing their individual file area
accessing the directory of users
access to electronic conferencing

The electronic mail (E'Mail) area stores 'letters' sent by others in an 'in-tray', letters sent by the user in an 'out-tray', the user can read the E'Mail, then file, delete, forward, leave for later or reply immediately to the correspondence. No letter need ever be 'missing' again.

There are a number of alternative information sources to the nursing one on the network, these in the main, set up by local education authorities. The nursing information source is a large hierarchically based data base (Figure 4).



Ref 4 Diagrammatic Representation of Campus 2000 Nursing Database

As well as structured information, there is a keyword searchable section for user interrogation. The purpose of the section is to assist users in understanding such database access to meet their information requirements without cost; other searchable databases can be accessed through Campus 2000 which do incur a cost, thus it is appropriate for users to build their knowledge in use before examining cost inducing databases.

Each user has a file area housed within their access mailbox number. They can upload files and send those via E'Mail or include in Electronic Conferencing (E'Conferencing); they can receive files (text and/or programs) from others and download these to disk or printer as necessary. Such file manipulation was deemed necessary in order to educate users not to try to read files on-line, rather to obtain locally what they required and examine them off-line.

Users can access information on all Campus 2000 users, this has proved useful when considering communication exterior to the nursing section, such as Careers Advisors, Universities/Polytechnics or NHS personnel.

A growing area to which users may access is that of Electronic Conferencing (E'Conferencing). Under this section, topics for Local and national professional discussion are open to all nursing users. They can read previous comments, add their own in response or, move to another conference topic. This is most useful when issues concerning nursing are under discussion at higher levels, it means that the 'grass-root' level can quickly make others aware of their feelings and rationales for alternative or collaborative thinking. Already it has shown to be a medium in which National decision-making can be enhanced, with all 'delegates' accepting ownership of the resultant decision.

By stipulating that a prerequisite of course attendance is connection to the network, it does mean that there are telecommunications network links now to all Colleges of Nursing and Midwifery in England, Wales and Northern Ireland. There has been a reduction in hierarchy and parochial pressures in proactive development.

DEVELOPMENTAL AREAS

Each Centre Leader has been encouraged to develop an area of specialisation, those under examination include:

Interactive Audio
Interactive Video
Desk Top Publishing
Compact Disk ROM (CD-ROM and CD-ROM Interactive)
Expert Systems
Clinical Nursing Systems, both Hospital and Community based
Interactive Databases
Home-based technological networks for post-registration courses
Direct links between College and Clinical computers

The Centre Leader dealing with each looks at ways of using such technology in education and examines systems currently available, writing reports at appropriate times which are made available to Colleges of Nursing and Midwifery.

The Project Team has, with assistance from identified specialists, completed an evaluation of the main stream courseware available suitable for nurse education. These evaluations are available to all to assist in purchase decision-making. Standards and criteria have been set, both in educational and technical terms, to assist prospective authors. Following such evaluations, it does mean that we are now in a position to determine areas of curricula which could be enhanced through the use of CAL/CBT and have as yet no known courseware available. As part of the continuation of the Project, beyond the

three year impetus stage, it is expected that generation of specified courseware will occur.

The Project team has been involved in developing curricula guidelines for the integration of computers and information technology. The emphasis of the guidelines is upon 'information' and not 'technology', indeed, it is the Project Team's belief that,'Information is the foundation of every activity involving everyone everyday and as such, we have devised an information framework, as diagrammatically shown below:-

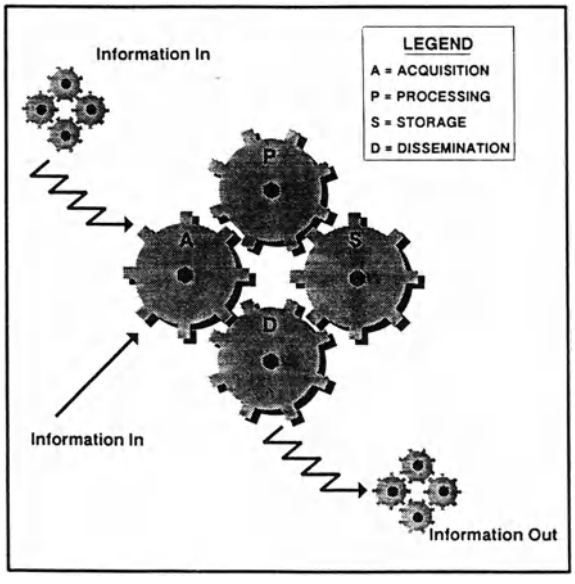


Fig 5 Theoretical Information System

The four cogs can be representative of an individual, a group or organisation. Each cog is dependent upon the other engaging cogs, as one turns they all turn, such turning generates power, for information is power. The acquisition cog is fed externally by information in two main forms, 'value-laden' (non-straight line) or 'less value-laden' (straight line); this cog can also be fed internally as described later.

Once information is acquired, it is then processed where analysis and synthesis of the newly acquired information takes place, a direct link to storage means that previously retained knowledge or information can be used to assist with the newly acquired information.

Following processing, the information is either stored or disseminated/rejected. If it is stored, it could be in a format on paper, other media, or internally by the individual, group or organisation.

Once ready, the information is disseminated in one of two ways, either externally with values placed upon it as a natural occurrence for professional growth, or internally for self-growth.

There is no direct link between process and dissemination, that is to ensure that part thought through ideas are not passed on for action externally to the individual, group or organisation who thought of the idea initially.

Through using a non-linear approach to information, the Project Team believe that a more realistic representation has been attained.

To link the information framework to that of curricula, we designed four competency levels, from skill based to that of inference (knowledgeable understanding allowing for consideration of implications both professionally and sociologically).

The information elements and competency levels interrelate as shown in the diagram below:-

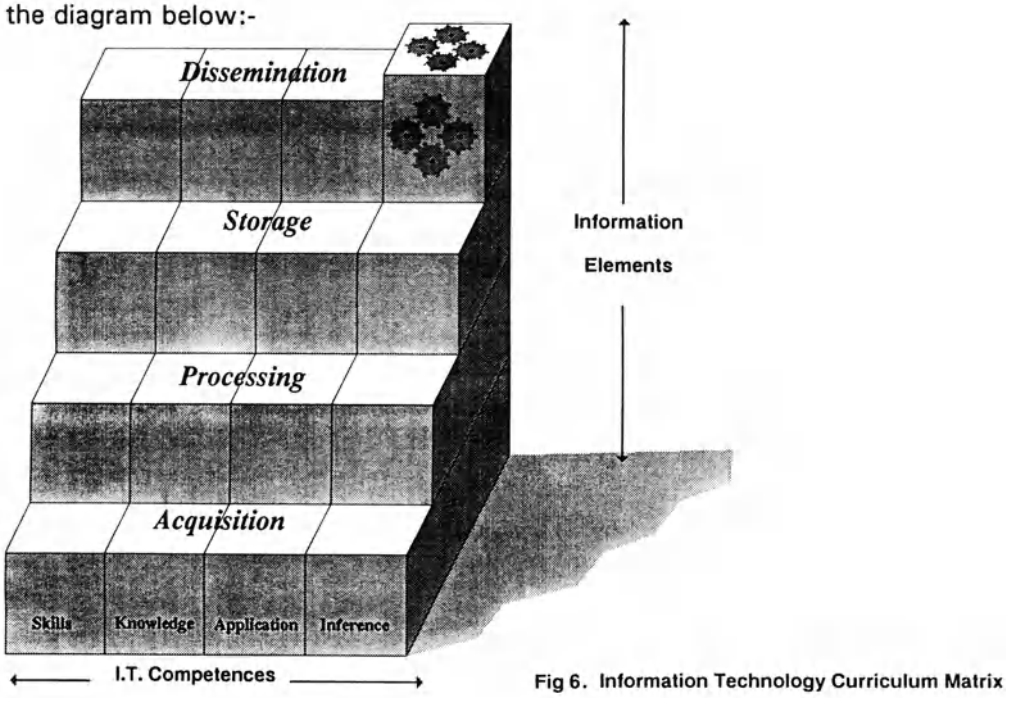


Fig 6. Information Technology Curriculum Matrix

with individuals, groups or organisations commencing at the skill-acquisition level and progressing at their own pace to the inference-dissemination level. It is suggested that movement occurs between all elements and competences during the individual's, group's or organisation's development.

CHANGE AGENT - COMPUTER CATALYST

It can be seen that in today's society, the use of computers and information technology affect everyday existence, through the development of the strategic

framework the ENB CAL Project has attempted to harness the technology to develop information management in education, and as such, the computer has acted as a catalyst to further developments.

Considering the lack of knowledge of some participants of computers and information technology, their present abilities to determine their information requirements and utilise the technology has astounded the Project Team. The participants' potential has found a release and is now being used constructively for the benefit of peers and students Nationally.

The use of the telecommunications network has ensured that participants once afraid of computers, now find that they are generally at ease with the technology and are developing creative ways of integrating information technology for student use. The computer is no longer regarded as a solution to educational problems, more as a tool within a dynamically changing environment to assist in educational change through information exchange.

We have experienced no difficulty in participants transferring their newly acquired knowledge from one computer to another, indeed, many of them are now utilising their home computers more effectively following the course even though these are generally a different type to that used on the course and in the Colleges of Nursing and Midwifery.

We have found that intra-communication between Colleges across the country has increased, and that sharing of curricula knowledge is beginning to occur. On a slightly lighter note, over Christmas, there was a wealth of greeting darting around the country in a variety of formats, from graphically drawn 'cards' to general messages of 'good cheer'. Our assumption that the network might ease communication seems to have been correct.

A major change has occurred in the cognitive development of computer and information technology use in Colleges in England. The time is now ripe for a consolidation of the dramatic impetus stage of the framework and for further development in educational use of computers and information technology for the benefit of the professionals of the future.

CONCLUSION

The strategic planning of the Project took approximately eighteen months, judging by the comparative smooth running of the logistical management of the impetus stage since implementation, this time was invaluable.

Computers that had laid dormant for some time are being used, but we have some way to go yet. We are encouraged by the participants' enthusiasm - even those previously with 'computer phobia' -, and by the support of all the Colleges in England.

There is a gradual dawning of the potential of computers and information technology in education and nursing. This will assist practitioners of the future

to determined their information requirements and to ensure that these are met, rather than becoming 'keyboard operators' for others' benefit. It is not generally felt that the Project has stifled individual enterprise, which is good; it has assisted in directing such enterprise towards meeting identified curricula needs and 'ownership' toward a common goal, that of valuing the potential of computers and information technology operationally, a freedom to share concepts, ideas, practical solutions and more fundamentally 'information'.

In the words of Hales (1988): "In an increasingly computerised environment, power will belong to those who control information". It is believed that the ENB CAL Project has over a very short period of time assisted in giving such power to educationalists for the greater benefit of patient care in the longer term.

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