Adapting IAIMS to a hospital library level

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The Children's Hospital of Michigan Medical Library has adapted several of the Integrated Academic Information Management Systems (IAIMS) concepts and implemented them at a hospital library level. These have included features of network development, electronic interfacing and interlinking, and implementing an integrated information system in the library. The library has incorporated several information systems into library operations, including a variety of in-house, local, and national automated systems and telecommunication networks. Hospital libraries can incorporate IAIMS features and promote an institutional framework of interconnecting communication systems and electronic linkages.

Director Donald Lindberg of the National Library of Medicine notes that medical libraries and their systems are frequently disjointed from intellectually related information systems such as patient medical records and institutional management matters [1]. As a hospital library striving for integration throughout its home institution and for interfaces with local universities, the Children's Hospital of Michigan (CHM) Medical Library has linked clinical and academic settings as a hospital-based variation of the Integrated Academic Information Management Systems (IAIMS) model. According to Richard West, IAIMS are defined as

> institution-wide computer networks that link and relate library systems with individual and institutional databases and information files, within and external to the institution, for patient care, research, education, and administration. The goal is to create an organizational mechanism to more effectively manage the knowledge of medicine and to provide for a system of comprehensive information access [2].

The goals of the CHM library are to implement selectively the guiding principles of IAIMS in a limited setting. CHM, which is affiliated with Wayne State University, is a 302-bed teaching hospital within the Detroit Medical Center. Although the hospital built its current facility in 1971, it has a 102-year history. The 2,000-square-foot library contains approximately 8,000 volumes. Specifically, CHM aims to:

- adapt features of network development into information management efforts, using systems to encourage the flow of information, thus making it more easily accessible;

Within CHM, the concepts of integration and networking were highly valued before plans for actual linkages began.

- act as an electronic interface between the patient's clinical record and recorded knowledge to improve the transfer of biomedical information and the use of recorded knowledge; and
- accept the concept of the library as a model of an integrated information resources management system that could be enlarged and extended from a central base [3].

EXPERIENCE AT CHM

Had the CHM administration not valued networking, the direction of the medical library's automation could have been vastly different. IAIMS has been portrayed accurately as an institutional framework [4]. Within CHM, the concepts of integration and networking were highly valued before plans for actual linkages began. Eventually, some linkages became intrainsti-

Figure 1
Simplified format for LATCH request form

ORDERING DOCTOR REQUIRED:

NAME:	MEDICAL RECORD NO.:	SURG: Y/NONE
CURRENT DIAGNOSIS:	AGE:	SEX:
INFORMATION: (e.g., etiology-car accident)		WEIGHT:
ORDER NO.:	PROCEDURE NO.:	
FREQUENCY: (e.g., once, daily)	DATE:	TIME:
LATCH REQUEST:	ORDER WORDS:	

COMMENT: Enter LATCH topic, be specific (DX, TX, etc.). Order words required.

tutional and others interinstitutional, but the library was able to retain an active, coordinating role.

Intrainstitutional links: CHIPS (Children's Hospital Information Processing System)

In 1982 CHM installed the Nadacom System to automate patient records. Originally the medical library was not included in the network, although it requested a terminal. In 1987, when a second system was installed, a library terminal was added. The system chosen was a (Burroughs) Unisys mainframe A10 system, which was installed and renamed CHIPS. The cost of adding the library to the system, thereby creating an intrainstitutional link for the library, was justified based on the need to automate existing clinical library services.

The primary clinical library service automated on CHIPS was LATCH (Literature Attached To the CHart), a program that was developed at the Washington Hospital Center [5]. A LATCH consists of a few relevant articles that provide current literature on a patient's disease. By 1987 LATCH was an established CHM library program designed to bring information closer to its point of use. Marketing of the service occurred through periodic orientations given to new staff, as well as through other staff uses. By offering LATCH on CHIPS, CHM expedited the request process and increased awareness of the service. LATCH became as routine an element for patient care as an x-ray or a lab test. Since the cost-effectiveness

Figure 2
Simplified patient education request screen

ORDERING DOCTOR REQUIRED:

NAME:	MEDICAL RECORD NO.:	SURG: Y/NONE
CURRENT DIAGNOSIS:	AGE:	SEX:
INFORMATION: (etiology)		WEIGHT:
ORDER NO.:	PROCEDURE NO.:	
FREQUENCY: (once, daily)	DATE:	TIME:
PATIENT EDUCATION INFORMATION:		ORDER WORDS:

COMMENT: Specify topic. Include audience, scope, and emphasis. Order words required.

of information was already documented [6], adding a LATCH to the list of available orders was justifiable. The library's request form was reformatted to screen requirements and given a procedure code (Figure 1).

The library's CHIPS terminal and printer link with all twelve inpatient care units and a total of 244 outpatient and office CHIPS terminals via the in-house computer. When a LATCH is placed on the chart, it is noted on CHIPS along with other orders that have been processed. In addition, the ability exists to request users to recontact the library if needed.

Electronic LATCH service takes the library from its fixed location in the physical facility out to the user. It foreshadows such systems as the knowledge network (K-Net) described by Lorenzi [7], since physicians, nurses, or others can access patient information and request academic information through a terminal on the ward.

A second clinical library service offered on CHIPS is "Patient Education," also an established CHM program. "Patient Education" serves as a backup and adjunct to the patient education function of the medical and nursing staffs. The "Patient Education" request screen is structured as a procedure code following LATCH (Figure 2).

Again, screen requirements dictated the form for the request. Once the request is received, the library searches pamphlets, lay medical texts, and allied health information sources for relevant information. A package of information is sent to the requester, always a health professional. In turn, the professional shares the retrieved information with the parent or

Figure 3
CHIPS article/book request

PMSG PROCESS MESSAGE SWITCHING

MESSAGE NO.: _____ MESSAGE ID.: _____ FROM: _____

TO: _____ OR DEPARTMENTS: _____

ARTICLE/BOOK REQUEST

AUTHOR(S):

ARTICLE TITLE:

VOLUME: ISSUE/CHAPTER:

PAGES: TO YEAR: PUBLISHER:

VERIFICATION: MEDLINE SEARCH (Y/N): IF YES, INCLUDE UI:

VOLUME: PAGE: REFERENCE: YEAR:

INDICATE (WITH 'X') MAIL ITEM: PICK-UP: ARE YOU ON WSU FACULTY (Y/N):

NORMAL TURNAROUND TIME FOR A LOAN IS ONE/TWO WEEKS. IN-HOUSE COPYING IS DONE FOR AUTHORIZED USERS AS TIME ALLOWS. PLEASE SEE LIBRARIAN IF YOU HAVE SPECIAL NEEDS.

patient. Few patient education requests have come through CHIPS so far, but this may simply reflect the need to educate users. The number of patient education requests has increased slowly but steadily.

In addition to placing procedure orders on CHIPS, requesters have access to preformatted message screens. These enable users on the hospital floors to send messages to various departments. There are two preformatted library message screens on the system. The first allows the clinical staff to request a book or article, if the citation is already known, from any CHIPS terminal in the building (Figure 3). Without leaving their offices, library patrons customarily sit at a CHIPS terminal and select citations from a com-

Figure 4
CHIPS information request form

PMSG PROCESS MESSAGE SWITCHING

MESSAGE NO.: _____ MESSAGE ID.: _____ FROM: _____

TO: _____ OR DEPARTMENTS: _____

LITERATURE SEARCH or INFORMATION REQUEST

DATE REQUESTED: DATE NEEDED:

PHONE/BEEP: DEPT: REASON CODE:

TOPIC: DESCRIBE SUBJECT FULLY: BE SPECIFIC—INCLUDE Key Terms, Synonyms, Drugs

QUALIFIER CODES) AGE: LANGUAGE:

YEARS) FROM: THRU SPECIES:

puter search or bibliography and transmit the requests to the library for fulfillment.

A second preformatted screen allows an information request to be sent to the medical library, thus providing electronic access to reference services (Figure 4). A database search is usually produced in response to these queries, although factual information also may be requested.

Since a LATCH is more closely related to patient care than an in-house reference interaction, it is not surprising that the number of LATCH requests coming through CHIPS is increasing.

During 1987, the first full year the library operated with CHIPS, only 2% of the database search requests were received electronically. Approximately 31% of the total LATCH requests, however, came through the system. In this same year, the number of LATCH requests rose 292% (from fifty-one to 149). After the first seven months of 1988, the percentage of database search requests processed through CHIPS has remained 2%, but the percentage of LATCH requests through CHIPS has increased to 46% of the total LATCH requests. LATCHs are requested for the patient chart, often at the same time as other procedures that are part of patient care. Health care professionals typically order medical procedures through CHIPS. Since a LATCH is more closely related to patient care than an in-house reference interaction, it is not surprising that the number of LATCH requests coming through CHIPS is increasing.

Intrainstitutional links: WANG and SCIMATE

The Wang System, a second system available to institutional users, links over 200 terminals throughout on-site and off-site CHM offices, and uses a Wang VS 7310 minicomputer. After the system was implemented, the library received a location code. This system links administration, housekeeping, faculty offices, and other departments. It provides word-pro-

cessing and electronic mail capabilities, and access to financial data. These functions enable the library to perform word processing, broadcast messages to all departments, or access current library revenue and expense reports. It is also used to receive free, text-information requests from faculty offices, as well as from departments lacking a clinical computer system.

To prepare for further intra-institutional links, the SCIMATE Software system, produced by the Institute for Scientific Information, was selected as the recommended bibliographic information management system for the institution. By sharing this common software system, the library can now download searches on a disk; later, users can review and upload the data into their personal files on their own computers. Users without their own copies of SCIMATE can use the library's copy within the library facility. Downloading enhances the transferability of information from the library, making it flow more readily into a form patrons can use and manipulate.

Interinstitutional links: automation network

The decision to automate was influenced by the Matheson Report [8]. CHM recognized the need to balance finite resources among tasks essential to department functions and patient-care information needs [9]. Justifying automation required documenting the needs and impacts of such a project. Part of the justification included discussing implications of the automated system, such as networking. Approval was just one step in the long process of planning for automation; selecting a system took several months. The steps involved:

- Creating a Request for Proposal (RFP) that outlined thoroughly the capabilities expected of the system. This eighty-page proposal offered standardized response codes for vendors.
- Creating a functional matrix to evaluate the RFP responses in a formal, fair, and systematic manner. A description of matrix analysis by Kline proved very helpful in the decision-making process [10]. The functional matrix developed from the RFP was transferred to a Wang 20/20 spreadsheet so that answers could be manipulated to factor features into and out of the alternative approaches. The vendor's development of a feature and the feature's value created the parameters of the matrix. Some features were designated as key, or crucial, capabilities. Key indicator points could be tallied separately. The spreadsheet of the matrix was mounted onto the hospital's Wang minicomputer and proved to be a valuable, flexible tool.
- A cost analysis accompanying the matrix to determine which systems were most cost-effective over five years of investment. Some systems required larger initial investments, but had lower maintenance fees. All expenses associated with the hardware, software, maintenance, training, telecommunications, support, etc. were included.
- A listing of the pros and cons of each alternative. Such variables as integration, networking, expertise, flexibility, etc. were determined for each vendor.
- A decision matrix summarizing the costs, matrix points, and key features (e.g., integration).

A basic issue was whether to select a stand-alone system or a network approach. Both systems could be integrated internally, but the ability to extend the boundaries of the limited facility and interface with larger, external information resources shaped the decision. Networking placed the library at a pivotal point in accessing the vast information resources that lay beyond its door; the library became an electronic relay point from our patrons to identifiable information sources. Positioning the library to retrieve and use information in a timely manner, as advocated in the Green article, meant linking into networks.

DALNET (Detroit Area Library Network)

DALNET was the system selected to automate the library. As described by the host institution, Wayne State University (WSU),

> DALNET is a nonprofit corporation formed in 1985 to enable its members to provide improved library service through shared automation. WSU is the host institution for managing the DALNET central site, and they 'pilot' the implementation of each module of the NOTIS (Northwestern Online Total Integrated System) software selected for use. NOTIS is a software package developed in the 1970s for Northwestern University Library. NOTIS currently supports cataloging, authority control, acquisitions, serials control, circulation, and online catalog functions using a central bibliographic database [11].

Bibliographic and holdings data, as well as circulation and acquisitions information, are displayed to the user via the online catalog. CHM became a charter member of the network.

Although WSU functions like an information utility, DALNET has a board with elected officers that sets policy. WSU is the fiscal agent; member institutions sign a service agreement. Current members of DALNET include WSU, Detroit; Oakland University, Rochester, Michigan; William Beaumont Hospital, Royal Oak, Michigan; Botsford General Hospital, Farmington Hills, Michigan; Wayne County Community College, Detroit; Detroit Public Libraries; University of Detroit; Oakland County Law Library; and Children's Hospital of Michigan, Detroit. Pending members include Harper Hospital, Detroit, and Macomb Community College, Warren, Michigan.

Through this multi-type automated library network, CHM sought interinstitutional links that would help manage information resources and requests. The

system also could connect to the university's electronic mail system and all other libraries on the system. Beyond these interinstitutional links, patrons can use the statewide Merit computer network to dial into the merged online catalog from their offices or homes. The Merit network is a long-established regional packet-switching network that serves eight Michigan universities and governmental units including Wayne State University. Approximately 3 to 5 million people within a twenty-mile radius of WSU have local dial-up access to the university's mainframe computers, as well as online catalog capability using the Merit network [12].

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Deciding how to mount DALNET within CHM required further research. Even during the initial automation research, the integration allowed by a local area network (LAN) seemed essential. A LAN is a group of computers connected through cables and adapters, and confined to a small geographic area. Within the network, terminals can share devices such as printers, as well as files. A 1986 presentation by Angier and Hoehl describing a Data Trek LAN provided insight into its feasibility [13]. Within the CHM library, the DALNET system is mounted on a LAN. The software directing the LAN within CHM is IBM token-ring software, which uses a star-wired-ring configuration and token-passing as the method of network access. An IBM PS2 Model 60 system with a 44 MB hard disk operates as the file server to three terminals and two printers. The systems constituent hardware and functions are: a 20 MB hard disk IBM PS/2 Model 30 (for circulation), a 20 MB hard disk IBM PS/2 Model 30 (for technical services), a dual disk-drive floppy IBM PS/2 Model 30 (for the online public access terminal), a Quietwriter III printer (for library technical services), and an Epson MX-80 III F/T printer (for patron use at the online catalog). The software necessary for the LAN configuration includes:

IBM PC Local Area Network Program Version 1.20. This enables the system to become a local area network, making it possible to share data and print devices, send and receive messages, and link work stations.

IBM LAN Support Program. This provides adapter support and associated program interfaces for the LAN. These interfaces allow network applications to access the adapters.

IBM PC 3270 Emulation Program, Version 3.00. This enables the system to share resources with the host, transfer files, and act as an application program interface for the host.

A multi-drop from an existing, dedicated telephone line from the WSU Computer Services Center permitted telecommunications at minimal additional cost.

This configuration was purchased to permit use of the terminals for additional applications at times when a terminal was not in use for DALNET applications. Such library applications include FILLS (Fast Interlibrary Loan System by MacNeal Hospital [14]), bibliographic management, or the addition of a modem for database searching.

The DALNET system has numerous modules that allow a library to automate all of its functions. To date, the CHM library uses the cataloging, online catalog, and circulation modules. Plans are being made to add the serials and acquisitions modules. As each member library automates additional functions, the amount of shared data grows. With this expansion come shared links as well.

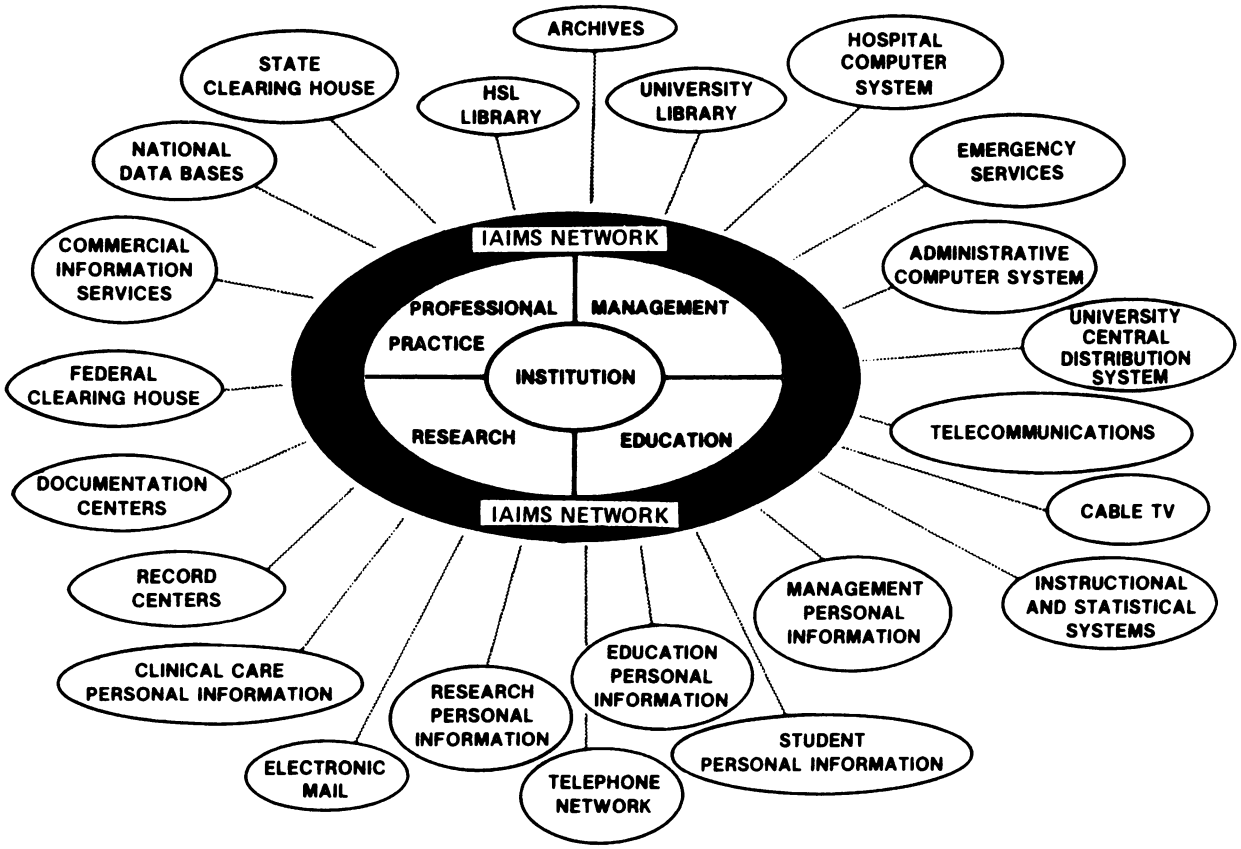
IMPLICATIONS AND APPLICATIONS

Many of the features of the IAIMS "Information World" diagram [15] are already electronically linked to the library (Figure 5). Although they are not all accessible from one terminal, many of the communications channels are already in place and operational. Within CHM (tieing into the academic medical center), the financial database, the institutional Wang system, the statewide Merit network, and the patient care database, etc., have created electronic linkages as shown in Figure 6.

Through these links, the library is able to coordinate the information flow. Although libraries traditionally transmit interlibrary loan information into and out of the building, the CHIPS, WANG, and DALNET systems enable the electronic processing of information throughout the hospital and over a network encompassing assorted statewide hospitals and universities. By coordinating these systems, a hospital library can provide the type of expanded electronic access to information usually found in larger university libraries. Although this is not quite the seamless electronic environment advocated by Matheson, it is an initial attempt to harness the communications potential of currently existing technology [16].

Expanding end-users' direct access to these links will require education. Even after presentations (including long and short orientation sessions) for the online catalog and distribution of flyers and hand-

Figure 5
IAIMS "Information World" integration*



*National Library of Medicine. Planning for IAIMS. 1984 Oct 17.

outs, clinical library patrons hesitant to use the system are not always successful. With the exception of a few medical hackers, most older hospital library patrons remain uncomfortable with computer tasks. This is true even in this highly automated institution. In busy, clinical environments, time must be used to apply information, not to learn the mechanics of retrieving it. Since clinical care is the first priority of cost-conscious hospitals, education comes second. Computer-literate hospital staff remain in the minority. In the interim, the hospital library must organize the various electronic information links. The library can function as a coordinated, sometimes integrated, information resource management system for academic, clinical, and administrative information. Hospital libraries can adopt IAIMS concepts and promote an institutional framework that focuses connecting communication systems and electronic links.

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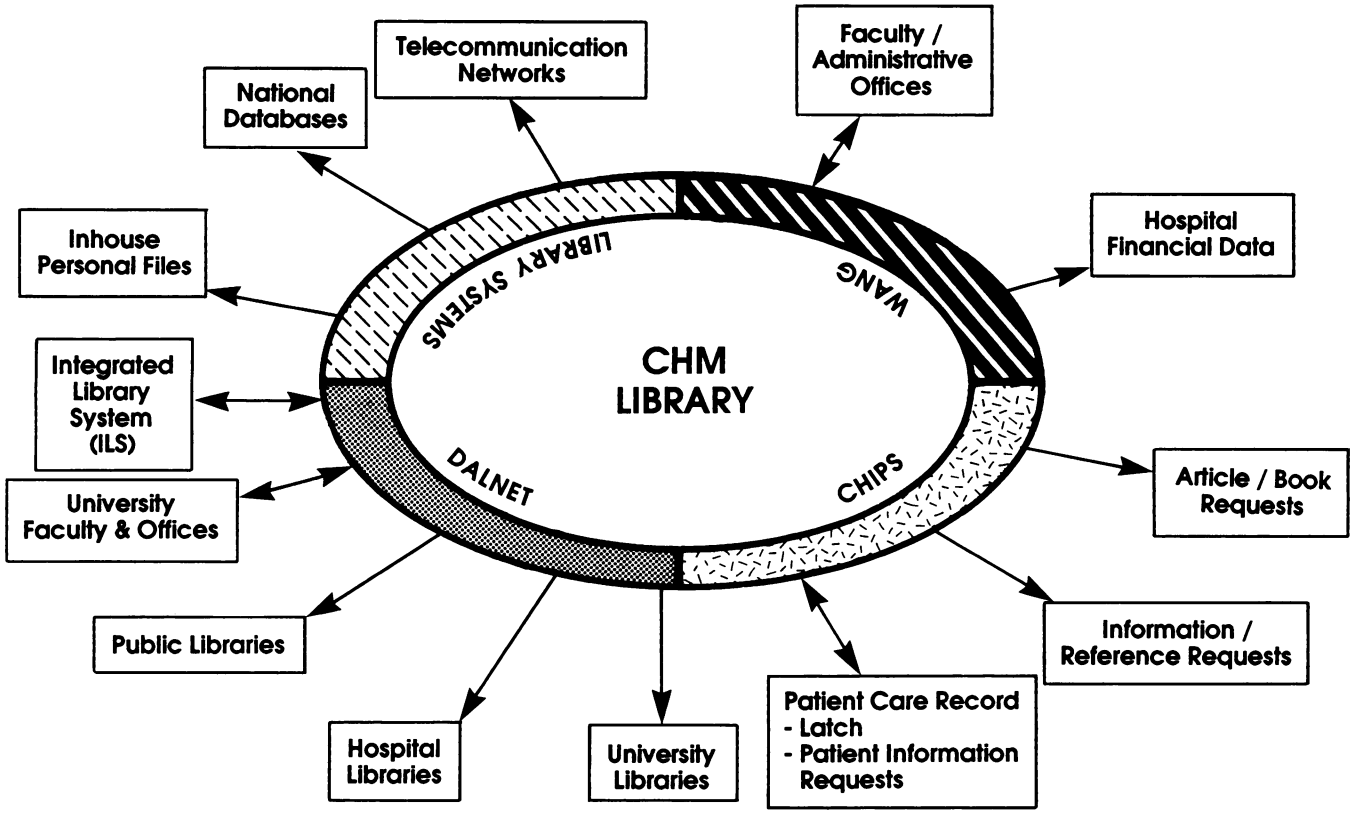
Figure 6
CHM adaptations of IAIMS



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