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MATCH: A Maternal and Child Health Information Network

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Synopsis

The Maternal and Child Health Information Network—MATCH—was begun in 1984 as a demonstration project with support from the Division of Maternal and Child Health of the Health Resources and Services Administration, Public Health Service. The primary purpose of the project was the development of a system to manage data related to prenatal, child health, family planning, and genetic services that are delivered with State support in clinics in the State of Ohio. The design of MATCH enables the same data base to be used at both the State and local levels. Because it allows

all participants, central and district, to manipulate the raw data, it is called an end-user—as opposed to a batch retrieval—system.

Data recorded on individual forms during each client's visit to local service clinics are collected and entered into a microcomputer whose software package is a commercial data base. The clinic can then use the data for its purposes: program planning, management, evaluation, client referrals, appointment followup, quality control, and billing. The same data are also uploaded by central office staff to the State's DEC mainframe from data-filled disks mailed in by the clinics. Personnel who staff local projects can access their own data on the mainframe computer to generate reports for local use and send and receive messages electronically. That is, the system is "interactive."

The intent is to first link data generated by the primary care and preventive programs of maternal and child health (MCH) in an information system, then link that system to other health data arriving at the State health department (for example, birth and death certificates), and, finally, to use the system as the basis for a State level MCH primary care data system in Ohio for surveillance, planning, management, quality control, accountability, and research purposes.

ONE OF TWO MAJOR PURPOSES of the first White House Conference on Children, which was convened by President Theodore Roosevelt in 1910, was the gathering of information to plan programs and set priorities. Led by Jane Addams and Lillian Wald, advocates for maternal and child health (MCH) care were actually seeking rational planning at the Federal level for children's services. Since the beginning days of MCH programs, the activities for attaining program objectives have included the investigation of needs, reporting to the professionals and public, education and train-

ing, research and development, and management of service programs. All of these tasks entail the use of data.

Formalized data collection became a goal when the Children's Bureau was formed in 1912. About 25 years ago, when Congress became interested in holding agencies accountable for dollars that had been appropriated for reaching specific program objectives, program evaluation was added to the list of purposes for which data were needed. More recently, other uses of data have been emphasized: disease surveillance, advocacy, quality control,

resource allocation, monitoring of efficiency, appropriate referral, administrative and personnel management (1), and accountability. Data alone, however, are not sufficient for accomplishing any of these functions; a system is needed to organize the data so that they are usable. Together, the functions associated with the organized collection of data and the retrieval of data constitute an information system (2). The development of such systems, envisioned since the start of MCH programs, has been made possible and worthwhile by computer technology.

Background

About 165,000 children are born every year in Ohio. Title V of the Social Security Act, the Maternal and Child Health Block Grant, provides authority to the State to help ensure that each of those children is wanted and is born healthy and stays healthy. To fulfill this mission, the Bureau of Maternal and Child Health (BMCH), in the Ohio Department of Health, oversees a program that supports perinatal care, child health, and family planning services tied to a county-developed plan for those services. This program is known as Child and Family Health Services (CFHS).

The CFHS program is operated by grants to more than 200 agencies in 77 of Ohio's 88 counties. Although standards for care, personnel, planning, and community services are the same for each county, the exact array of services and types of agencies involved, as well as the organization of the services, are tailored to community needs, priorities, and resources. In addition, BMCH supports a network of nine university-based genetics centers.

To properly plan, manage, evaluate, and account to the public for the CFHS and the genetics program, usable information is required. But, as is true in many State MCH programs, such information has been difficult to retrieve and assess or rely on. Conflicting definitions for such terms as "client," "encounter," and "race," as well as multiple systems for collecting data, have made the aggregation of data across programs impossible. What was true at the State level was also true for the projects in the counties, only more so. The data that were collected by counties were shipped to the State; any information that came back was often late or irrelevant to local needs. It was always in an aggregate form that made impossible its use for client-related purposes or followup.

To address these problems, the Division of

Maternal and Child Health of the Health Resources and Services Administration, Public Health Service, in 1983 awarded a Special Project of Regional and National Significance (SPRANS) grant to the Ohio Department of Health. The purpose of this grant was to design and implement an interactive computer information network whose data set serves the information needs of both local MCH programs and the State health department. The major objectives of this information network called MATCH (Maternal and Child Health Information Network) are

- to design a uniform data base relevant to funded MCH programs throughout Ohio,
- to correlate collected data items into usable information, and
- to attempt to link the MCH data to other data collected in the Ohio Department of Health, such as vital statistics.

Data Versus Information

Information may be in the form of a summary report, a selective report, or a summary aggregate of data. The design of the MATCH system enables health professionals at the State health department and local service project to use a common data base to ask questions about research, management, evaluation, and planning and to receive answers within seconds. These answers, the information, are derived from data residing in an information system. Data provide the raw material from which accurate, appropriate, timely, complete, and relevant information can be generated on demand.

MATCH has taken less than 2 years to go from creation to full prototype implementation. This rapid development and implementation is noteworthy compared with the several years required previously to develop most large computerized systems. Now that commercial data base software is available that is relatively easy for nonexperts to use, the days of lengthy periods of programming and "debugging" and the attendant high costs for computer consultants should be over.

To progress from the initial conceptualization of MATCH to a working model, several tasks needed to be accomplished:

- How the data would be used had to be identified by the professional staff in State and local programs.
- The data elements had to be defined and agreed to.

- The forms organizing those data elements had to be developed.
- Appropriate software and hardware needed to be distributed to test sites.
- Issues related to confidentiality, consent, and access to data had to be addressed.
- The mainframe and microcomputer programs had to be prepared to accept data.
- Training and support had to be provided.
- The system's success needed to be measured against its goals.

Defining the Data Elements

Based on anticipated uses of the data, the MATCH program was designed to collect data on an individual client basis rather than in an aggregate summary report form. This approach enabled the collected data to be combined, manipulated, and broken down for any imaginable type of query. Client referrals, appointments, linking, billing, tracking, and followup—all are examples of how individual client record data can be used. None of these functions can be accomplished with summary data systems.

Within BMCH, professionals representing the relevant program areas—prenatal, child health, family planning, and genetics—as well as a data systems analyst, formed a working group. This group's task was to identify, compile, and define each of the elements to be completed on a per visit basis for each client. These indicators were combined to create the uniform Individual Client Record (ICR).

The process that led to agreement on the uniform data set for the CFHS program was difficult and tedious; it should not be underestimated in either its challenge or importance. Entire SPRANS projects have had as their primary focus the isolation and definition of just one set of data elements to assist in the evaluation of a particular clinical service component.

Some of the difficulties experienced in the creation of the CFHS data set stemmed from the diversity of data collection tools that were being used. Altogether, eight different clinical reporting mechanisms existed within the three major service components (family planning, child health, and perinatal) of the CFHS program. And in the eight reporting systems, there was very little overlap in data items. Even where overlap did exist, disparities in definitions related to a particular data element often appeared. As a result, even very simple and commonly asked questions such as,

How many clients are served by Ohio's MCH clinics? could not be accurately answered. The lack of coordination and disjointedness in existing reporting tools meant a lot of time had to be spent in deliberation and discussion on what needed to be collected across all programs, what needed to be collected within each basic clinical service, and what definition would be used for these data items.

Reaching a consensus on the data set's contents and definitions was a milestone in the information network's evolution. It should be noted that consensus was achieved only with the guarantee that a thorough and continuous evaluation of the record and system would take place and that this evaluation would lead to revisions and improvements as identified.

The record and the accompanying definitions were sent in draft form to directors of local projects for review, and amendments were made based on their comments. One of the suggestions from the field that was incorporated, for example, was to include on the form a "local use only" section. Clinics use this section to keep track of items that are of interest to them—but not necessarily to other programs—such as census tracts in urban counties, special study data, inventory items, and so on.

Evolution Toward a Statewide Network

The next step in the development process, upon completion of the first version of the ICR, which included data elements to be collected in MCH projects, was to consider the *design* of the system. That is, the way in which data would be collected, entered, corroborated, and retrieved as information and how these activities would be supported technically and administratively had to be decided.

A basic principle in designing the system was that the same data base should be usable by and useful to both local clinics and the State MCH program. This principle implies that retrieval of information is distributed. This makes it a so-called end-user—rather than a batch retrieval—system. It also means that the system has to be so easy to use that health professionals in small rural communities who have little or no computer experience can be trained to use it.

A second principle in design was to keep costs as low as possible. One way to minimize costs is to use commercially available data bases, thereby avoiding the major expense of creating a tailored data base program. This principle not only saves

programming costs but also allows changes to be made easily as the system develops. Because equipment was placed in field sites to allow distributed retrieval (direct access by local program staff to its data set), a second way to minimize cost was to distribute the entry of the data to be collected. This approach has the added benefit of allowing improved error-checking, because unclear markings on the ICR forms can be reviewed with the person at the site who filled out the form. Given these two design principles, an ordinary commercial data base available for use on a microcomputer (personal computer (PC)) was provided to each participating agency in the pilot or test phase of the system's development.

Data from the ICRs are entered onto floppy disks by clinic staff using the data base program; the program has been set up by MATCH project staff to be consistent in format with the ICR form. A copy of the clinic's data disk is then sent to MATCH staff at the State office. From this point, the data are uploaded into the State's centralized data base management system (a program called System 1022), which resides on a DEC 2060 mainframe computer.

Each county's data are maintained in separate directories on the mainframe, to which all of the county's clinics have on-line access via telephone communication. Permission to access another county's data is required from the relevant agencies. The State also maintains a master data base to allow the generation of statewide reports. In addition, an electronic mail system is available to participants using MATCH to facilitate communication among MCH projects.

The files on the mainframe system are structured identically with those on the PC data base. The system is menu-driven to facilitate usage by State and local staff. A series of commonly asked questions are currently preprogrammed into the computer for ease in generating answers to frequently asked queries.

Extent of MATCH Participation Across Ohio

Twelve counties involved in the CFHS program served as pilot participants in the MATCH system. These counties represented a wide variety of agency structure, type, and size. The agencies ranged from small, rural, all-in-one service providers to large, urban, diversified service providers linked by the common CFHS plan. They included health departments, community action agencies, and freestanding hospital-affiliated clinics.

Each county received approximately \$3,000 toward the purchase of software and equipment. In return, each county was required to have at least two designated information managers who were responsible for participation in all training sessions, data collection for all funded agencies in the county, data entry, training of other staff, and evaluation of the system in their county.

Although each county had to meet these requirements for participation, it had a great deal of flexibility in managing and organizing its own system. This was, in large part, because the CFHS program generally has few specifications concerning the structural and administrative models for the provision of services. Within the 12 pilot counties, MATCH established 12 unique information centers.

Several health departments immediately began to build upon MATCH to create applications for billing systems and meet other programmatic needs. After the first 12 months of operation, 30 additional counties and 11 regional genetics centers and satellites joined the MATCH network; many of these new participants did not receive additional funds. Implementation of a third round of participants in early 1987 nearly completed the statewide CFHS network. Currently, MATCH is operational in 76 of Ohio's 77 funded CFHS counties, with the remaining county targeted for an early 1988 implementation.

Training and Technical Assistance

Because an end-user system involves all participants interactively in information management, maximum use and adaptability of the system to varying locations and purposes require both initial training and ongoing support. Needs for classroom training, on-site visits, and telephone support grew with the expansion of the program. Initially, 1 trainer worked with the 12 pilot counties. The training staff now includes a second full-time trainer. Both trainers work closely with the department's data services staff assigned to MATCH for editing, uploading data from disks, and preparing special programs that generate reports. The experience of the MATCH project has shown that 1 trainer can provide initial orientation to the system for about 150 users in 20 sites. That same trainer can then provide ongoing support to about 40 sites.

The complete training program consists of three phases. The first phase covers a basic introduction to the microcomputer, completion of forms (a

Comparison of Computer Systems

Typical batch system at the Ohio Department of Health

MATCH end-user system operating in BMCH, Ohio Department of Health

Approximate cost per record

Data entry	\$0.60-\$0.80	Data entry	\$0.10
Computer usage	0.20- 0.40	Computer usage	0.10
Total	\$0.80-\$1.20	Total	\$0.20

Typical problems encountered

Costs of data entry person	Training of end-users required to fully operate system
Inaccurate data entry by unfamiliar staff	Initial cost of microcomputers in remote sites
Timeliness of data entry inadequate	
Inflexibility of information generated	
Extensive time and expense involved in reprogramming	

Benefits of system

Stores large volume of information	Enables users to access all data entered for generation of customized reports
Generates summary reports as programmed	Decreases problems related to centralized data entry, that is, costs, timeliness, and accuracy
Improved data managed capabilities	Is easy to learn even for untrained staff
	Can readily be used as a management, evaluation, planning, and technical assistance tool by both local and State agencies

Number of records managed per year

1,000,000	1,000,000
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Total mainframe computer costs per year

\$1,000,000	\$200,000
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NOTE: BMCH = Bureau of Maternal and Child Health.

thorough understanding of data elements and codes is stressed), and use of the microcomputer software package for data entry. The first-phase training lasts 1 day with on-site followup by the trainer. Training sessions are limited to 5-10 trainees from 2 counties at a time because of the nature of the program and inexperience of trainees. The second phase deals with the use of the communications software and equipment (modem), generally, and communication with the State's mainframe, specifically, as well as basic use of the mainframe data software (System 1022). Phase 3 entails the generation of local reports with the use of the capabilities of the PC data base software. (Note: As a result of evaluation by the county participants, phases 2 and 3 will be reversed in order of presentation. This change is needed

because local agencies are garnering more benefits from local PC use than from the mainframe system.)

Of all the staff in the 12 pilot programs, only 2 had had any type of computer experience. They held positions at the clinics as clerk typists, secretaries, nurses, physicians, nurse practitioners, and health commissioners. Professional staff need to be included in the first phase of training, even though they may not be entering data on the computer, to establish good communication and an understanding of data elements and definitions.

Support to the users of the system, at both the local and State levels, is essential to system operation. Technical assistance ranges from advice on dealing with vendors to help in restructuring work procedures brought about by computers.

'Several health departments immediately began to build upon MATCH to create applications for billing systems and meet other programmatic needs. After the first 12 months of operation, 30 additional counties and 11 regional genetics centers and satellites joined the MATCH network'

Recently, BMCH consultants have begun working with individual counties to assist them in programmatic and administrative evaluation of their clinics with the use of collected data.

System Management

The MATCH system is directed by public health professionals with the technical support of data systems experts, and it is located organizationally in a maternal and child health division rather than a data services division. This location represents a shift from the initial strategy of placing the system under the direction of an information system specialist with a computer background. Direction of the system's development by health professional staff has facilitated communication with field staff, infused the design with greater program orientation, and ensured that all technical matters were clear to clinic personnel. This approach required support from the data services staff.

In addition to defining data elements, developing the statewide network, and providing training and support, central management involves such functions as (a) setting policies related to consent and confidentiality, based on State law and ethical considerations, (b) regulating access to the data base, particularly client identifiers and county-specific data requested by persons outside the county of interest, (c) uploading of data to the mainframe, and (d) checking the validity of the data. The essential management functions in the clinics are to ensure timely and accurate entry of the data and to call for help as necessary.

A system such as MATCH—distributed-entry, end-user, and interactive—can be used for multiple and sophisticated purposes by users with various levels of computer experience and will cost the State an estimated \$400,000 a year to maintain. That cost includes expenses associated with main-

frame computer costs and personnel: a director, two trainers, and a secretary. Data entry, program development, data upload, retrieval, and report generation costs amount to about \$0.20 a record. Because program development costs are so low, and because the operator does not need to reprogram the software to answer any of the thousands of questions that the data can be used to answer, this cost is about one-fourth to one-fifth that of the usual per record cost of other information systems (see box).

Client names and other identifiers are collected to allow linkage with vital statistics, children with special needs data, and Medicaid data. Special permission is requested from the client for use of personal data for this purpose, with compliance varying from site to site between 60 percent and 95 percent. (This variability appears to be more dependent on the provider than on any other factor.)

Collection of client-identifying information has necessitated the development of safeguards related to storage of these data elements, passage of special administrative rules governing confidentiality of State-maintained medical records, and mechanisms to regulate access to those data. But it has also meant that the MATCH information system can expand through linkage with other record-keeping functions, including vital statistics records, in the counties and the State health department.

Currently, testing is underway to link CFHS service records (specifically, prenatal and child health records) to birth certificates. By doing this, researchers can, for example, examine longitudinal morbidity related to birth outcomes and prenatal care received. Initial attempts at linkage of child health records with birth certificates were successful enough to lead to the uploading of the complete registry of births in Ohio for 1985 onto the 1022 mainframe data base system. In addition, a birth-death match capability has been added to the information system network for all births and deaths occurring in Ohio. Other systems now a part of MATCH are mental retardation-developmental disabilities, children with medical handicaps (formerly crippled children's services), sickle cell programs, expenditure reports from projects, Title X family planning programs, and Medicaid prenatal outcome data.

Implications for Public Health Programs

Part of responsible public health programming should include the gathering of accurate data and

using an information system to transform these data into usable information. Without such a tool, the chain data ———> information ———> knowledge cannot be completed. Without this completed process, public health programs will suffer needlessly from inadequate planning, poor management, and incomplete evaluation.

The decision to install a health information system entails not only the weighing of costs against anticipated benefits but also the measuring of the benefits that are expected, particularly over the long term, against those of other health

activities. Ultimately, the choice to install a health information system is essentially a political decision, as it should be. But what has been learned through programs like the MATCH project makes that choice a more comfortable and practical one.

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Preparing and Presenting an Introductory Course on Motor Vehicle Injury

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Tearsheet requests to Janet A. Holden, PhD, the University of Illinois at Chicago School of Public Health, Environmental and Occupational Health Sciences, Box 6998, Chicago, IL 60680. Copies of the curriculum guide are available from Dr. Holden.

Synopsis.....

Health professionals are key to any progress in reducing motor vehicle injury and death, yet they have been slow to recognize their role in this important area. One factor contributing to this problem has been the absence of courses on motor vehicle injury from the curriculums of the health professions schools. A comprehensive course on motor vehicle injury and death was developed, presented, and evaluated at the University of

Illinois at Chicago School of Public Health. The major course objectives were for students to (a) comprehend that highway injury is a major public health problem, (b) understand that this problem can be mitigated by proven public health techniques, and (c) understand and be able to implement multidisciplinary solutions. It was hoped that students would champion the prevention of motor vehicle injuries as a high priority for public health agencies and other professional and community organizations. The course has now been presented twice.

A teaching guide was prepared and was reviewed by faculty at 13 schools of public health. This guide discusses practical aspects of introducing and implementing this type of course, overall course objectives, specific learning objectives, a model curriculum (with suggested readings) for nine topic areas, materials from which transparencies or slides could be made, and a geographic listing of resource persons. The objectives for the guide were for it to be a practical model for a motor vehicle injury course and to acquaint health professions faculty with the resources available to them for course development, as well as with a network of professionals who are willing to aid them in their efforts. The guide is not a programmed learning text or a collection of canned lectures, but rather it is intended to provide a framework and encouragement to those at other institutions who seek to develop such a course.