

# Development of a School Health Information System

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*Computer control of school nursing records for the purposes of health planning and follow-up—an important aspect of a large scale health information system—is described and evaluated.*

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## Introduction

This paper represents an experiment in making school health records more responsive to the needs of school nurses, so that they in turn can be more responsive to the needs of the children. The availability of modern computer technology and the obsolete systems of record keeping in some school health programs indicated an obligation to bring these two areas together. Schneeweiss<sup>1</sup> describes the problem, but he emphasizes collection of data and gives little information on output.

Guidelines laid down by Churchman<sup>2</sup> for a systems approach helped to organize the thinking of this paper. Other useful sources were studied as well.<sup>3-6</sup> All emphasize the importance of working with a clearly defined set of measurable objectives, and all proceed in their thinking from analysis of objectives to design to management, in that order.

In the attempt to bridge the gap between the two diverse disciplines of computer methods and school nursing, considerable learning had to take place in both areas. Useful sources in the school nursing field are listed in the references.<sup>9-13</sup>

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## Objectives

The 1972 American Association for Health, Physical Education, and Recreation position statement on school health services<sup>14</sup> describes three direct and three indirect services that belong in a school health program. The direct services listed are health appraisal, counseling and interpretation, and emergency care. The indirect services listed are communicable disease prevention and control, services for exceptional children, and health of school personnel. This paper, however, is concerned with developing an information system which in turn provides data about a school health system. Objectives relate to the data system itself, and performance measures are those related to how the data system is performing, not how the school health program is performing. Within the framework of services offered, and subject to the constraints and quality of input of the school health system itself, the data system should provide information which is timely, accurate, complete, and (most important) useful.

Timeliness can be measured by whether the health information is available at the school when it is needed. Since nurses visited their assigned schools only once a week, weekly feedback of updated data from the computer was a reasonable and acceptable expectation.

Accuracy of data in the school health system depends on the source of reporting. However, accuracy of data within the data processing system is controlled by verifying and computer-editing all keypunched data. Recheck of a random sample could provide further quality control, if necessary.

Completeness of data in the data processing system can

be measured by suitable use of codes such as "not recorded" or "not applicable."

Usefulness can be measured after the data system has been underway for some time: the number of times a request is made for a particular report, the number of times a request is made which cannot be honored, etc., was evaluated formally at the end of the school year and informally throughout the year.

### *The System's Environment: Fixed Constraints*

Only 19 of approximately 100 schools using the same cumulative record card (those 19 schools under the jurisdiction of the health department) put the children's health records into the computer. Thus the problem of transferring cumulative health records when a child moved between one of our 19 schools and one of the remaining schools in the county was minimized if the same form was used. For this reason, the child's cumulative record card was retained as is, even though it is not convenient to keypunch from or to use. The plan for the second year of operation involves use of optical scanning sheets for computer input rather than keypunched cards, but the cumulative record cards are being continued in use. An additional 1500 children have been added to our data base since the start of the project, and yet more schools are anticipated. Thus, the problems of transferring records and of input formats may resolve themselves with time.

A second constraint concerned the need for identifying each child by number, for the purpose of uniquely defining and linking the parts of his/her record within the computer. Since each school had its own numbering system, duplication and confusion would result when records were transferred. Therefore, the convention of using state birth registration numbers was adopted. Sixty-eight per cent of the 4200 children were found to have been born in the same county where they were attending school, and their birth records were on file in the county health department. The other children were assigned a temporary number. The principals of the schools involved are now planning to ask for the birth certificate number at the time of each child's initial enrollment.

A third constraint concerned the emotionally charged issue of the confidentiality of records. Principals and school nurses alike needed assurances that computer records were appropriately used and available only to authorized personnel. Suitable safeguards are routinely instituted at our computer center for all data files, most of which do involve medical, financial, or personnel records. However, the types of school health services provided are mainly physical services such as inoculations, audiovisual screening, and dental fluoride programs at elementary schools. Psychosocial services, therefore, are not recorded on the computer.

### *Components of the System*

#### **Resources**

A remote job entry card terminal, shared jointly by the health department and the Rockford School of Medicine,

transmits data and programs to an IBM 370/155 at the University of Illinois Medical Center in Chicago. At present there are no interactive facilities. Therefore, one cannot get instant response to questions about a child's health by querying a computer over a telephone. The data which the computer stores must therefore be accessible to nurses, technicians, and school personnel from an intermediate storage such as a list. Future planning does involve limited use of direct access cathode ray tube terminals; these are, of course, more convenient and efficient, but also more expensive.

#### **Input Mechanism**

Originally, the input method was to code and keypunch the data from the cumulative health record cards kept at the schools. The entire cumulative record was not entered on the computer, since the system's main purpose is to monitor the current, not past, health status of the children. This input method has now been replaced by optical scanning sheets filled out by the nurses. Turnaround time has been reduced due to the elimination of the keyboard step.

#### **Output**

The output is of three types: lists, letters, and statistical reports. The lists are intended for nurses to use in working with entire classes or groups of students, such as in a screening program. The letters are primarily aids to follow-up, in that the computer identifies children needing referral or home contact and alerts the nurse and/or parent to a need. Statistical reports are required by law for some services and by administrators for monitoring the health program.

*Baseline Data.* Baseline data on every child are contained on a master list (Appendix A). The data available to a nurse include inoculation and examination status, preferential seating in class, and special health problems. A working class list of names only, on which the nurses can make whatever notations they wish, is also available upon request.

The school system requires physical and dental examination reports at the start of the first, fifth, and ninth grades. Delinquencies in parental reporting of these examination results can be transmitted to the parent by computer-produced reminder letters and subsequently summarized nurse follow-up action.

At the end of the school year, a current summary of each child can be printed, and can thus become part of his cumulative record. Thus, data on the children need not be stored longer on the computer, since the primary purpose of the data system is to monitor current health status and services.

*Service Programs.* The health department provides four major health programs in the schools: audiovisual screening, a dental fluoride program, an immunization program, and the dental van, in which examinations and treatments are performed. Assistance with daily work flow,

follow-up needs, and statistical summaries of results are effected by the computer.

Class lists with previous audiovisual screening results, on which the nurses can make notations for their own uses and for updating of the computer, are prepared before and after screening (Appendix B). Notification letters to parents of children who fail hearing or vision screening could have been prepared by the computer, but the volume was small and manual handling was found more suitable. The computer prepares a list for nurse follow-up and teacher information after a suitable waiting period.

An immunization clinic is conducted at the schools for those children who return a signed permission slip, which is prepared by the computer and which indicates the immunizations needed. This same permission slip is later delivered to data processing with indications of immunizations performed, for purposes of updating the file on the children.

The computer was not found useful in monitoring the work flow of the fluoride or dental treatment programs, but did help select placement of the dental van.

*Communicable Diseases.* All schools must report weekly to the county health department the name, age, sex, race, and disease for each case of the 59 reportable communicable diseases. The list prepared by the computer is sent not only to the health department, but also to the school principal.

Two proposed letters linked to this reporting system were never used. One letter was to a physician from the health department informing him that a child patient of his/hers was reported to have had a communicable disease and asking for verification. The other was to parents of children in the same classroom as a child who had a reportable disease. School nurse staff felt that the possible values of both such proposed letters were outweighed by the problems they would generate.

*Incidents.* Accidents, illnesses, and other intermittent events which occur during school were reported to the computer center by the nurse or teacher as they occurred, in uncoded form. Experience with the types of incidents occurring was needed before it could be sensibly determined how to code and how to handle these special cases. The unique nature of some incidents precludes coding in any form. Narrative accounts of events which are not readily coded or tabulated were planned to be produced by the computer in the form of text narratives, on label paper, for inclusion with the child's cumulative health record. The pressure to use this form of reporting was minimal; experience showed that it was not useful, and it has been dropped.

*Statistical Reports.* The state health department requires trimonthly reporting of the results of audiovisual screening during the school year. The county health department produces monthly and annual statistical bulletins of activities (services performed and communicable diseases reported) as a supervisory tool for internal management and as a communication instrument in the community. These routine reports were generated by the computer.

Other statistical summaries can be generated upon request. One request was for data on "dentally indigent"

children by school and by grade, i.e., those children with no reported dentist and no dental report. This information was needed for appropriate stationing of the previously mentioned dental van in areas of greatest need. Another report requested was for data on inoculation levels and disease history, by school and grade. Again, the data were needed for planning health department programs.

### **Interfaces**

Children in the school system present themselves for health care at a number of places within the health community. A community health information system should be able to recognize an individual and trace his pattern of health care among the various providers of service. It should be able to ascertain whether or not an individual who was referred actually followed up on his referral.

The city of Rockford is hopefully moving toward a community health data network, with the health department and the medical school playing leadership roles. One requirement of this type of data network is a common numbering system for subjects (patients). An opportunity also exists to measure the extent of the interface between school health records and other health department programs: clinic enrollments of families, the lead screening program, and the new program for primary prevention of factors contributing to high risk pregnancies, etc.

### *Implementation of the System*

The school health records and nursing personnel were available during the summer to assist with conversion from a manual to a computer record system. In addition, a few college students performed clerical and programming tasks. Near the end of the summer, the principals of all schools affected by the changeover in health data procedures were invited to a meeting at the health department, during which the output from the data system was discussed with them and their reactions were invited. The most useful outcome of this meeting was the school administrators' offer to begin gathering birth certificate data on enrollments.

With the fall enrollment, all newly enrolled children were added to the data base and class lists were brought up to date. There was thus an initial updating process in the fall.

Updating changes occurring throughout the year were periodically reported by the nurses to the computer center, by sending the appropriate class lists with notations indicated.

During the process of conversion, it was obvious that some items that would be helpful to teachers and nurses alike had not been included in the children's computerized data files.

One such item was preferential seating (front seat placement for vision and hearing problems). This item has now been incorporated. Another item concerned absenteeism. No formal reporting mechanism presently exists between the school secretaries, who keep data on absences, and the nurses. Potentially, the computer could scan a

child's record for excessive absences and thereby indicate to the nurse the need for a parent contact (although such absences may not necessarily be health related). However, absenteeism has not yet been incorporated into the system.

**Evaluation**

Much of what was learned through usage has already been referred to. Thus, after a year of operation, the number of items coded and stored had been reduced by two-thirds because there was no demand for their retrieval. Items eliminated included height, weight, number of siblings, histories of pneumonia, scarlet fever, etc.

No data are available concerning the effect of the new data system upon the efficiency or effectiveness of the school health service itself.

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**APPENDIX A  
MASTER LIST**

MASTER LIST, PREPARED ON AUGUST 15, 1974

ST. FRANCIS CC FERG - GRADE 3

NO	NAME	BIRTHDATE	PE	DE	DIP		PERT		TETANUS		POLIO		RUB	MEASLES		MUMPS	VISION		AUDIO	SPECIAL
					INOC	INOC	INOC	INOC	INOC	INOC	DIS	DIS		LATE	RES		DATE	RES		
12104741		3-18-65	70	70	70-BST 65-3RD	70-BST 65-3RD	70-RST 65-3RD	67-BST 65-3RD	72	74	NO	70	NO	9-73	1	9-73	1	7		
12027572		3-30-65	71	70	73-BST 68-BST	68-RST 65-3RD	73-RST 68-RST	69-RST 99-3RD	72	66		68	NO	9-73	1	9-73	1	2		
12099415		9-10-64	72	74	70-BST 65-3RD	70-RST 65-3RD	70-BST 65-3RD	72-RST 66-2ND	69	66	NO	0	YES	9-73	4	9-73	1	1		
12081672		8-22-65	72	72	69-BST 99-3RD	99-3RD 99-2ND	69-RST 99-3RD	99-RST 99-3RD	99	99	NO	0	NO	9-73	1	10-73	1	1		
99001064		7-13-65	70	0	72-BST 66-3RD	66-3RD 66-2ND	72-RST 66-3RD	72-RST 66-3RD	69	69	NO	70	NO	9-73	4	10-72	1	1		
99001491		12- 5-64	0	0	74-2ND 74-1ST	0-0	74-2ND 74-1ST	0-RST 0-0	0	0		0		9-73	1	10-73	1	0		
12029792		3-30-64	0	74	74-BST 71-RST	67-RST 65-3RD	71-RST 72-RST	74-RST 71-RST	71	68	NO	0	NO	9-73	1	10-73	1	1		
12047702		5-22-65	70	71	70-RST 66-3RD	70-RST 66-3RD	70-RST 66-3RD	73-RST 99-3RD	70	66	NO	70	NO	9-73	1	10-73	1	1		
12081638		8-18-65	70	70	70-RST 67-RST	70-RST 67-RST	70-RST 67-RST	73-RST 67-RST	70	66	NO	70	NO	9-73	1	9-73	1	2		
12104813		10-27-65	72	72	72-BST 71-RST	72-RST 71-RST	72-RST 71-RST	71-RST 72-RST	71	71	NO	0	NO	10-72	1	9-72	1	2		
12027520		3-23-65	71	71	71-BST 68-BST	71-RST 68-BST	71-RST 68-BST	71-RST 67-BST	73	67		71		9-73	1	9-73	1	2		
12081657		8-20-65	70	70	70-BST 68-BST	68-RST 66-3RD	70-RST 68-BST	73-RST 68-BST	72	66	NO	69	NO	9-73	1	10-73	1	1		
12007636		1-25-65	70	70	73-RST 66-BST	66-RST 65-3RD	73-RST 66-RST	73-BST 65-3RD	74	73	NO	0	NO	9-73	4	10-73	1	1		
12093419		9-20-65	70	70	72-BST 70-2ND	70-2ND 70-1ST	72-RST 70-2ND	72-RST 70-1ST	70	72	NO	0	YES	9-73	1	10-73	1	1		
99001065		1-22-66	71	71	71-BST 99-3RD	99-3RD 99-2ND	71-RST 99-3RD	71-RST 99-2ND	71	72	NO	70	NO	9-73	1	10-73	1	1		

The two latest inoculations are listed by year and type. BST means booster

In vision and audio results columns, the code is  
 1. ok  
 2. watch  
 3. referred  
 4. wears glasses/hearing aid  
 5. under doctor's care  
 6. preferential seating  
 7. preferential seating without glasses  
 8. absent  
 9. not conclusive

APPENDIX B  
VISION SCREENING LIST

VISION SCREENING, LIST PREPARED ON ST. STANISLAUS  
OCTOBER 15, 1973 GRADE 7

NO.	NAME	LAST TEST	RESULT
12141861		9-72	PASSED
12129723		9-72	GLASSES
1211787A		9-72	GLASSES
12011017		10-72	PASSED
99001250		9-72	PASSED
99001251		9-72	PASSED
12055965		9-72	PASSED
12105133		9-72	PASSED
12141867		9-72	GLASSES
99001252		9-72	GLASSES
12117880		9-72	GLASSES
99001253		10-72	PASSED
12141836		10-72	PASSED
99001254		9-72	GLASSES
99001255		9-72	PASSED

A similar list is prepared for audio screening.