THE IMPACT OF COMPUTERS ON NEIGHBORHOOD HEALTH CENTERS

by

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ABSTRACT

The advancement of computer technology and its impact on neighborhood health centers can be useful in the health care delivery system by making medical information more readily accessible.

Some of the major questions faced by neighborhood health centers are:

1) Will the system be cost effective?
2) At what period of time should a computer be incorporated?
3) What kind of application is needed for a comprehensive operation?
4) Which kind of system is most economically feasible to incorporate into a center's operation?

The goals and objectives of this thesis are to develop a manual for computer use in neighborhood health centers in order to:

1) classify information needs of neighborhood health centers,
2) identify the use and potential uses of computers in health centers,
3) identify the cost analyses of the different types of computerized systems (purchased, leased, or time-shared).

Chapter I reviews the history of neighborhood health centers. These institutions grew out of the recognition that existing medical needs were not satisfactorily meeting the complex health needs of the poor. The re-establishment of present day neighborhood health centers has necessitated a growing need for the development of techniques to measure and evaluate the quality of health care. Presently, no such system exists.

Chapter II identifies the information needs of neighborhood health centers. These needs can be classified:

1) demographic and socio-economic information,
2) utilization and cost-of-services information,
3) diagnostic and therapeutic information.

Chapter 3 looks at uses and potential uses of computer applications in neighborhood health centers. Currently computerized systems are being used in a number of neighborhood health centers across the country. They are performing such tasks as: 1) billing and accounting; 2) statistics up-to-date clinical reporting); and 3) computer-assisted history taking. The potential uses of computerized information systems could encompass: 1) laboratory applications; 2) pharmacy applications; 3) patient scheduling, and 4) medical records (problem-oriented).

Chapter 4 analyzes the costs of incorporation of serveral types of computerized systems into neighborhood health centers. These are purchased, leased, or time-shared systems. One analysis of these systems reveals that it is less expensive to utilize a computer service, over a manual system when computerizing a single applications (e.g., billing and account receivable). Another analysis illustrates the patient enrollment at which a computerized system becomes more economically feasible than a manual system. Still another analysis of data concerning computerized systems indicates that leasing for a period of up to 3 1/2 years is the least costly option for incorporation of a system; however, beyond 3 1/2 years purchase of a system then becomes the most feasible channel of cost effectiveness.

Recognizing the limited utilization of computers in ambulatory care at this time, the fact remains that there is a definite place for them in the future of improved health care delivery systems.

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CHAPTER I

LITERATURE REVIEW

INTRODUCTION

Among aspects of urban life in modern times which have been regarded as conducive to social dis-ease and decay, are poverty and ill-health. The correlation between poverty and ill-health has long been recognized as a major focus of community concern and action. Awareness of the widespread prevalence of disease among the poor and of the inadequacy of health care available to them has at various times motivated efforts to improve their health by providing more effective medical care. Historically, such concern has expressed itself in the creation of programs and facilities ranging from the dispensaries of the 18th century to the current neighborhood health centers[1].

The neighborhood health center has grown out of a recognition that existing arrangements and programs in the urban cities were not satisfactorily meeting the complex health needs of the poor. As a result, neighborhood health centers have been developed to remedy this situation by providing, "A one-door facility, in which virtually all ambulatory health services are available: close coordination with other community resources; professional staff of high quality; and intensive participation by and involvement of the population to be served."[2] In these terms, neighborhood health centers have been viewed by some as a new institutional form. Neither the concept of providing health services on a local basis, nor the creation of facilities to deliver such care, nor the stated objectives of the neighborhood health center are essentially new. The concept of a community health center providing service on a neighborhood basis and its embodiment in organizational

forms provided the core for a widespread movement which developed in the United States during the second and third decades of this century, reached its peak during the 30's and then declined[3].

The health center movement began around 1910. The roots of this movement are to be found in the changes which occured in American society during the preceeding decades. From 1860 to 1910 the flood of immigrants which poured into the cities and industrial towns caused a rise from 19% immigrant population to 45%. These immigrants lived together in segregated neighborhoods, which can be viewed as geographic expressions of maintaining their identity. These areas, however, were impoverished slums, which challenged and threatened the social, physical, and psychological integrity of its inhabitants. The great importance of health problems within this context became well-recognized. The earliest attempts to deal with these problems were evidenced in the establishment of social settlements in the 1890's.

Activities in New York and Chicago were indicative of the importance attached to health work among the poor immigrants. In 1893, Lillian D. Wald and Mary Brewster opened the Nurses' Settlement on Henry Street in New York in order to bring the benefits of public health nursing to an entire neighborhood. The Henry Street Settlement developed an organized community service intended toward disease prevention, as well as to provide curative services. Also, in 1893, Hull House, a public dispensary was organized in East Side Chicago. Studies and programs to improve health conditions were undertaken.

The last decades of the 19th century and the early years of this century, witnessed growing cities within this country. These cities

were increasingly confronted by problems of poverty, crime, disease and other attendant ills of the slums, problems most often associated with immigration. These inescapable urban problems, and the growing conviction of the need for social change led to a broad movement of reform. Campaigns were organized to deal with a wide range of problems: poverty and dependency; tenement house reform; prostitution; juvenile delinquency and others. Ill health was prominent as a cause or consequence of these social ills[4].

Pertinent questions concerning causation and prevention of communicable diseases were being answered by Kock, Pasteur and their contemporaries. This knowledge was being applied in public health programs. As a result, the trend of community health action expanded from the environment to the individual. Special programs came into being, and with these came an increasing knowledge of the need for better ways of organizing and administering health care. Yet, though those issues were apparent none of the programs took it upon themselves to devise an information system pertinent to the demands placed upon them. Consequently, services duplication and lack of coordinated effort among constituent health center units were irritating to health consumers, and wasteful and inefficient in terms of delivery of health care.

The History of Neighborhood Health Centers--1910 to the Present

Wilbur C. Phillips was the first to implement the idea of a neighborhood health center. In 1910, Phillips resigned from his position with the New York Milk Committee. He migrated to Milwaukee, Wisconson, and there found an area of need where his idea appeared feasible. The site where his conception was put into action was a Polish district of Milwaukee. This district had a high infant mortality rate, among other health problems. Phillips proposed his plan, and the district's residents accepted it readily, for they were ready to deal with health problems in terms of social change. In 1911, Phillips idea was expanded into a demonstration center for Maternal and Child Care on a broad democratic basis, using a so-called "Block-Plan". The program was carried out by the city's health department. The health department directed the work of social organization, promotion and education which was regarded as absolutely essential for the development of a child health program. The demonstration project served a 33 city block area and some 350 to 400 mothers and babies.(6)

In 1913, the New York Milk Committee established a health center on the lower West Side of Manhatten to serve a district populated largely by Syrians and Irish-Americans. Housing was poor and medical resources were limited(7).

In 1916, on the initiative of Charles F. Wilinsky, Deputy Health Commissioner of Boston, the Blossom Street Health Unit was opened in the West End, one of the most congested sections of the city(8).

The Red Cross developed a concept of a health center. This concept stated that the center could be locally operated with a

minimum of outside direction and an emphasis on education and information. However, it was thought that administratively combined guidance and control should be under local health agencies.[9]

In 1920, the East Harlem Health Center was initiated by the New York County Chapter of the Red Cross, and was opened in November, 1921. The demonstration was planned as a three year project involving the cooperation of the Health Department and 21 voluntary agencies, and was described as a department store of Health and Welfare[10]. Under one roof, consumers could find almost all of the health and welfare services needed.

The circumstances and needs of the urban poor were largely responsible for the development of the concept of the neighborhood health center. However, the First World War heralded the cessation of immigration, and the restrictive legislation of 1921 and 1924 undoubtedly were important in the change of circumstances of the foreign-born. Immigrants to America began to adapt to American life, educational and economic factors influenced their life styles and resulted in upward mobilization, and they began to leave the ethnic clusters and move toward the periphery of the American community. They became less and less inclined to utilize the local health centers, and more and more inclined to the use of the private physician and facilities. The result of this change "was practically no integration of preventive and curative services"[11].

The Depression of the 1930's tended to retard these tendencies, but following the end of World War II, economic conditions improved, people were again able to seek private medical care, and again the local health departments lost their impetus.

Another erosion of the theoretical framework of the health center was in the area of coordination of health and welfare services. The dominant facet of social work became case work.

Another operant negative factor which contributed to the hindrance of health center facility creation and development was the resistance of political forces in the broadest sense. Government had the ability to facilitate or hinder the creation and development of health center programs. As evidenced from examples such as Milwaukee, its choice was to hinder. The other major factor in weakening health center programs was municipal health department administrative infighting[12].

In 1960, neighborhood health centers were again organized and funded under the auspices of the Office of Economic Opportunity. The main objective of these centers was primary or preventive health care services to communities.

Primary health care emerged as one solution to the treatment of health care problems of the poor. Previous health care offered to the poor had missed its mark. The rate of disease, maternal morbidity, infant mortality and morbidity, disability and premature death was higher among the poor than any other segment of the population.

To meet these needs, legislation was introduced. In 1966, Senator Edward Kennedy introduced the legislation which allowed the Office of Economic Opportunity to expand its demonstration program. This program had established eight neighborhood health centers in various parts of the country. These centers offered comprehensive, family-oriented, locally determined health services to the community.

The 1967 amendment continued this program under Section 222(a) (4) (A), with minor modifications. (see Appendix A) For the first time, a government-funded program had encompassed in design many factors long lacking in both publicly and privately sponsored health programs. Emphasis on locally accessible prevention and therapeutic ambulatory services, affiliation with strong professional institutions, a role for the community in decision making were provided.

The goal of providing a high quality of health services is not only directed toward filling a vacuum that has existed in many areas, but also to enable the neighborhood health center program to serve as a major partner with the other programs attempting to break the cycle of poverty.

Certain general characteristics are present in most of the neighborhood health centers which have been established around the country. The center itself is usually located within the community to be served (most often an urban community), and it is organized to provide services to a clearly defined geographic area and a clearly defined population (usually the residents of that area). Although the Health centers may be established as self-contained, independently operating units, more frequently they are sponsored by and affiliated with some organized health or medical agency. An example of such is the Roxbury Comprehensive Community Health Center (RCCHC).

The RCCHC is located in a metropolitan area of Boston, Mass. It serves a population of approximately 30,000 residents. A complement of about 200 staff members take part in running the operation.

Included in the center's staff are a project director, administrative assistants, physicians, consultants, nurses, and paramedical personnal, two nutritionists, social service people, and clerical staff. The center is affiliated with Boston City Hospital and University Hospital in Boston.

The financial support for these centers are usually provided by a federal government program. Most frequently OEO or HEW funding is granted for a three to five year period to aid the center in its establishment and organization. The hope is that payments from Titles 18 and 19 (Medicare and Medicaid) and other third party payers will help the centers to become self-sustaining. Now that neighborhood health centers have been established and provide quality health care, there is a growing need for the development of techniques to measure and evaluate the effectiveness and identify the program strengths or weaknesses that exist.

Thus far, Bellin, Geiger, and Gibson are the only ones who have published any quantitative data on the effects of neighborhood health centers on medical care utilization. Morehead and Sparer's recent papers are the only published reports on any attempt to evaluate the quality of medical care in neighborhood health centers.

Evaluative Criteria of Today's Neighborhood Health Centers

The Economic Opportunity Act Section 222 states that neighborhood health center programs include:

"(A) programs to aid in developing and carrying out comprehensive health services projects focused upon the needs of urban and rural areas having high concentrations or proportions of poverty and marked inadequacy of health services for the poor. These projects shall be designed..."

"(i) to make possible, with maximum feasible use of existing agencies and resources, the provision of comprehensive health services, such as preventive medical, diagnostic, treatment, rehabilitation, family planning, narcotic addiction and alcoholism prevention and rehabilitation, mental health, dental, and follow-up services, together with necessary related facilities and services, except in rural areas where the lack of even elemental health services and personnel may require simpler, less comprehensive services to be established first; and...

"(ii) to assure that these services are made readily accessible to low-income residents of such areas, are furnished in a manner most responsive to their needs and with their participation and whenever possible are combined with, or included within, arrangements for providing employment, education, social, or other assistance needed by the families and individuals served..."(13)

The objectives and outcomes which have thus been gleaned from this legislation are most ambitious. They include eliminating poverty through the provision of jobs for the indigent poor, improvement of the

Community's health status; improved health care delivery system and gaining the indigent poor access to health and supportive services[14].

Given the history of the development of the neighborhood health center, it can be clearly seen that it has emerged as one of several ambulatory medical care models for low-income people. And since it is a model of ambulatory medical care for the poor, energies must be conserved for dealing with the real issues of health planning and care. This indicates the growing need for the development of a tool or tools by which to measure the quality of health care to the indigent poor through services offered at neighborhood health centers.

Sparer states nine questions which he feels could be answered by an ideal minimal evaluation effort. These questions are:

1. Are the program concepts being implemented?
2. Who is being reached? And just as important, who is not being reached?
3. What services are provided and to whom?
4. What is the quality of services?
5. What does it cost?
6. How does the community accept and relate to these services?
7. What changes have occured in use of services?
8. How do various projects compare to each other in; (a) client characteristics and utilization; (b) quality; (c) cost; and (d) community acceptance?
9. How does this concept of delivery compare to other options?[15]

Sparer's approach to answering these questions involved five steps. The first step was the Site Appraisal Review. Through such reviews, operational analyses of the extent of implementation of

concepts of family-centered care, utilization of manpower, community involvement, and agency back-up facility relationships were ascertained and evaluated.

Second, baseline health surveys were used to measure community health patterns prior to institutionalization of neighborhood health centers. Third, baseline assessment of care in health centers studied were compared to other health care providers. This step was the Quality Review. Step four was the standardized operational data systems. These data systems constituted the statistical report mechanism. And fifth was cost reporting. These reports provided comparisions of average unit and per capita costs[16].

Morehead audited twenty-four OEO neighborhood health centers in order to determine the extent to which selected criteria were met in the fields of adult medicine and obstetrical and infant care. The focus of these audits was on the medical care process, and how it contributed to or failed to contribute to the well-being of the individual health care consumer. Certain principles, relating to organization and function of the group practice afforded by neighborhood health centers, are implicit in the evaluation tool in order that recommendations can be made. This required development of several revelant operational concepts.

The first of these concepts is the team approach. The team is an interdisciplinary meld of professionals. The teams efforts are made to aid the patient to alleviate problems of a medical nature, but congruent with this is the improvement of his social condition[17].

The center's team has the responsiblity of seeing that all of the required professional and paraprofessional resources needed to provide the complexities of modern medical care are available. The concept here is comprehensive care[18].

Baseline care is still another concept[19]. Baseline care encompasses establishment of basic policy in order to assure consumer protection. It is an essential to adequate medical care.

Care continuity should be fostered by the team operation through a closely knit network between the patient, his family, one personal physician, and related team members[20].

Accompanying the responsibility of providing comprehensive health care, is the responsibility of providing care coordination. Total patient care coordination for all patient services from all referral sources can be facilitated through the establishment of an administrative mechanism for such[21].

Another operational concept is medical records. Medical records can enhance satisfactory professional skills and should enable any professional to obtain a clear patient picture. These require sufficient completion and organization of data[22].

Ancillary personnel from within the community of the health center are an important component. Ancillary personnel are provided a means of gainful employment, and their traditional roles are expanded in order that more effective use be made of medical manpower[23].

Neighborhood health centers require a mechanism for prompt follow-up on positive pathological or questionable findings in its health consumers. The mechanism should include prompt follow-up, recommended consultations, and maintenance programs as essentials[24].

Supervision should be built into the neighborhood health center scheme. Supervision and review of the quality of care should be clearly designated and actively implemented[25].

Lastly, an ongoing forum of educational opportunities and activities should be incorporated into the health care system[26].

Here have been reiterated Sparer and Morehead's conceptions of the medical audit, how it focuses upon the medical process, and the potential of this process to contribute to or fail to contribute to the well-being of health consumers. These audits were dominated by the concept of present day neighborhood health centers, namely, preventive care, health center location, community participation, and bureaucratic organization of the health care delivery system.

In terms of preventive care, the program of the health center must be derived from community problems presented, and the center's operation must be responsive to community expectations which then result. In order to arrive at a definition(s) of community problems and means of helping the community to reach the goal of health, there is a demand for "...a research interest in the social basis of health and illness."[27] Community fears of manipulation and fear of health center programs which have no relevance to their condition may be alleviated if community residents are invited and encouraged to actively participate in the development of programs to optimize their health. Not only should the consumer work with the provider in development of programs, but also in evaluation of them.

Community participation offers the options of governance, control, gainful employment, and rehabilitation. Not only are health services

being brought to the indigent poor, but the poor prosper in terms of economics and education. Community participation can also minimize and/or resolve impediments to the smooth function and delivery of health care services because of unnecessary conflict between the consumer and provider. In this light, both consumer and provider may gain educationally and politically.

Increasing attention is being given to the application of techniques of medical audit and utlization review to out-patient settings, (neighborhood health centers). Sparer and Morehead designed several techniques to assess the quality of medical care in neighborhood health centers. Their approaches to the medical audit were through patient interviews, assessment of medical records, follow-up mechanisms of patient care, team approach, etc. These techniques were designed to give the investigators a baseline care survey of the quality of medical care in a neighborhood health center. The same type of study can be carried out with a computerized information system.

The main emphasis of a computerized or manual information system would be a compilation of demographic and socioeconomic data of patients, patients' utilization of ambulatory services and facilities, the diagnostic and therapeutic information related to outpatient clinic visits, financial aspects of patient care services on both an individual and institutional basis, and direct input from patients regarding the kind of care they expected to receive, and the actual care received. Such a system could greatly contribute to rapid evaluation of services, enhance the speed of changes within the health care system and thus contribute to the improvement of quality

medical care for the poor.

Bureaucratic organization entails efficiency and coordination in the health care delivery system. Economic cost is an important consideration of such organization--the less the cost, the more widely distributed will be the services. Yet, economics is but one aspect of efficiency and coordination. Inclusive in this theme is that consumers not be handicapped by health care fragmentation. The goal here is achievement of optimal functional levels of health on an individual, family, and community basis.

Modifications in philosophy, direction, goals, and policies are imperative for quality medical care. The medical care process involves itself in life--and just as life, should remain in a dynamic state.

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CHAPTER II

THE INFORMATION NEEDS OF NEIGHBORHOOD HEALTH CENTERS

THE INFORMATION NEEDS OF NEIGHBORHOOD HEALTH CENTERS

Information is the basis of administrative decision making at all levels of an organization. At the higher levels the necessary information is often obtained directly by the decision maker, while at the lower levels it is frequently second hand. It is paradoxical that, although project directors, administrators, etc., may spend forty or more hours weekly in thinking about operational problems, few of them take the time to decide exactly what information they need in order to do their job effectively. If they did take this time, most of them would begin to realize that they require a considerable array of information: some of it formal, financial, and quantitative, and some of it informal and qualitative. Neighborhood health center administrators need relevant data about the financial condition of their operations, the patient load, the performance of staff, and many other facts about the internal operations of the organization.

As neighborhood health centers become more complex and their administrators more sophisticated, it is becoming more difficult to supply their requirements for information relevant to the process of decision making.

The decision maker must be able to appraise the effects of his decisions on a continuing basis in terms of how well his decisions are meeting the overall organizational objectives. He needs accurate information about both past experience and current conditions, making possible more effective decision-making.(1) He needs information to make possible more effective management control of health center operations, such as: patient information; clinic personel; and operating costs of the health center. At the same time he must know what alternative corrective actions are open to him and the probable effect of each. Unless information flow

is viewed in these terms, the resulting design for an information system can never be used to its potential by the decision maker for his particular purposes.

It is necessary here to keep in mind the importance of relevance of information, and the most feasible method of obtaining such information, (see Chapter I, pg.). Computers can be one such method for converting the clinical and administrative input into the desired, operational output.

The words "data" and "information" have often been used interchangably. Data can be defined as "bita and pieces of unrelated facts". Information can be defined as the result of compilation of unrelated bits of facts and statistics in such a way as to produce meaningful reporting techniques from which management decisions can be made.(2)

Information now being generated and collected by neighborhood health center information systems should be recorded and some of it retained. But what part of the information ---

1) should be considered transient and left undocumented?

2) Is needed primarily for departmental operations?

3) Is needed for high level decision making?

4) Is needed by the community?

5) Is needed for clinical and management reporting?

These are some of the key questions that project directors, administrators, doctors, and nurses should ask themselves.

It should be clearly recognized that no one information system can fit the needs of the many different kinds of neighborhood health centers and clinics in this country.(3) Even more obvious is the fact that not all potentially useful research data can be produced by operational records which must pass the test of administrative approval. Within these

known limitations, an effort was made to anticipate as many administrative and operational needs as would be realistic for ongoing comprehensive health programs.

The changing pattern of disease -- with emphasis on chronicity, complexity and disability requires more efficient organization of the multi-disciplinary services needed over extended periods of time for patients not yet, or no longer confined to hospital or long-term care facilities. Advancing medical technology makes possible, on an out-patient basis, the management of many conditions that formerly required hospitalization. This, in turn, calls for more extensive and complex resources to be placed at the disposal of the ambulatory care team.

As a result of changes in population and society, and related changes in disease patterns, there has been a continuing increase in the size and scope of ambulatory services.(4) This trend parallels and reflects a growing concern for the health of the population at large. Accordingly, the needs for accurate information with which to plan and operate neighborhood health centers are greater than ever, as is the need for expanded research into utilization and quality of services.(5)

In the face of such pressure for further growth and development of neighborhood health center services, present knowledge of patient characteristics, patient utilization of facilities, and the outcome of medical care are fragmented and frequently unsubstantially documented. Therefore, the information that is available to responsible staff personel is generally inadequate for efficient administration and planning needs. If neighborhood health centers are to respons to the challenges of the times, adequate data must become available for operative as well as investigative purposes.

An information system can be described in three separate stages, each of which should be designed to function independently of the others -- however, the data can be processed together for cross-tabulation purposes. These three stages are:

> Type A. Information required for planning purposes, demographic and socioeconomic information.
>
> Type B. Information required for evaluation of individual projects for assessing management and operational efficiency, utilization of services, and facilities and cost of services.
>
> Type C. Diagnostic and therapeutic information and the attitudes of patients concerning their care and treatment.

In order to meet the above requirements in an effective and efficient manner, it is important that the health information system reflect the needs of the neighborhood health center. The following are several criteria which should be taken into consideration in the design and implementation of a health information system in ambulatory health care programs. It should not be designed around any set of output requirements such as federal reporting. For example, certain information requested by federal agencies must be submitted by all grantees or delegate agencies that receive OEO funds under program account number 41, the comprehensive health program.(6) Each neighborhood health center is required to submit information in a tabular form both quarterly and annually. Reporting requirements for all OEO sponsored centers are as follows:

Registration Data

(1) Registrant profile
(2) Locations of registration and eligible families
(3) Income of newly registered families
(4) Primary payment status of registrants

Utilization Data

(1) Number of patient visits to center and resulting encounters
(2) Age and sex of patients using the center
(3) Center staff composition
(4) Center staff productivity
(5) Encounters with center staff
(6) Types of medical encounters with staff
(7) Types of dental encounters with center staff
(8) Home encounters by center staff

Selected Services and Drugs

(1) Use of selected services
(2) Prescriptions

Referrals

(1) External referrals to non-center staff
(2) Services performed by non-center staff

Costs of Health Care Delivery

(1) Health care costs
(2) Supporting health activity costs
(3) Allocable costs
(4) General services cost
(5) Personnel costs by department
(6) Unit and per capita costs
(7) Sources of funding[7]

Data obtained from such reports are valuable to agencies such as OEO in order to satisfy quarterly reports of utilization and expenditure information. However, should not this data be as useful to the internal operation of the health facility as it is to the federal agency? The author feels that, essentially, the primary focus for information obtained should be to aid health care providers in treatment of the problems of their clientele, and to aid management through information about the organization that will best facilitate the provision of quality health care. The information system should be organized in a modular, flexible manner

so that changes can be economical and rapid. Portions of the system which are already operating correctly should remain relatively untouched when changes are made.(8) It should be responsive (operational) to the needs of the administrators, providers, and consumers of the center.(9)

While a health information system may be well designed, its operation within a health care delivery program may prove to be unsatisfactory. For example, one health center, with which the author is familiar, has had some major difficulties with its information system in the area of data collection. Data collection has been a persistent problem area due to factors such as:

> (1) Insufficient and/or ineffective information because of poorly designed registration forms, which do not facilitate acquistion of adequate information;(11)
>
> (2) Oversights in enforcement of data collection procedures;(12)
>
> (3) Cross-referencing, which surfaces as problematic when one tries to work on large collections of data. Since the same data may be refferred to in different files, a health information system may have files from different sources, many of which refer to treatments of the same disease, use of the same drug, activities of the same clinic, or to patients from the same families. Evaluation of the effects of the treatments may require bringing together data from a variety of sources.(13)

Information to be Collected

Following is a discussion of the type of data that may be expected to contribute to operational goals, planning and program objectives. As noted in the previous paragraphs the author categorized suggested information into three broad classifications:

> Type A Information required for planning purposes, demographic and socio-economic information.
>
> Type B Information required for evaluation of individuals, projects for assessing management and operational efficiency, utilization of services and facilities, and cost of services.
>
> Type C Diagnostic and therapeutic information and the attitudes of patients concerning their care and treatment.

Definitions and Explanations

Type A - Demographic and Socio-economic Information

Information on the personal characteristics of ambulatory patients is collected to serve three types of needs: identification, administration, and epidemiological planning.

The items of personal information that should be collected on patients (or, in some instances, on the heads of households) are listed and discussed below:

(1) Name This is required for identification and cross-reference.(15)

(2) Social Security Number It is the author's belief that the social security number of all individuals seeking medical care from their health facility should be obtained. Social security numbers could serve as a check in regard to whom the center is servicing, as well as meeting the requirements of Medicare/ Medicaid Legislation.

(3) Address The address is used for both identification and location. It can serve a potentially useful administrative function by making possible analysis of the relationships between area of residence and use made of a given facility. Addresses can also be put to use in epidemiological studies concerned with the possible consequences of differential access to medical treatment.(14)

(4) Sex This item is coded because of its prime relevance to epidemiological studies and to interpretation of itilization of data.(15)

(5) Only the month and year of birth are recorded. From these two items can be extracted all that is needed for determining

whatever the period of reference. As with sex, a major reason for coding this item is its epidemiological relevance.(16)

(6) Religion Has some importance as a determinant of medically related attidtudes and behavior. However, its main relevance to data on ambulatory care is probably epidemiological; for it has been found on occasion to be associated with sizeable differences in diet, social patterns and natality.(17)

(7) Place of Birth Place of birth, particularly country of birth, is often used as an indicator of social status. It also has epidemiological relevance because of finding that there are differences among personal born in various countries, or in various regions of this country in; natality, diet, attitudes toward health and illness, etc.(18)

(8) Race/Color As used here, this is a social term, not a biological one. Race/color is important because it is a prime determinant in this country of socio-economic position, way of life, and use of health services.(19)

(9) Marital Status In this instance primarily relevant epidemiologically; because of its relationship to child-bearing and its probable relationship to way of life, attitudes, demands on one's time, sources of emotional and financial support, physical and emotional strain.(20)

(10) Duration of Present Residence This refers to the length of time the patient has lived in the house or apartment in which he resides at the time of interview. The item is of some planning relevance because of the importance of mobility in residence as a factor affecting receipt of medical care.(21)

Type B - Utilization of Services and Facilities and Costs of Services

Selected information relating to the process of medical care services should also be recorded on the clinic data form. These items are helpful for efficient clinic management and for analysis of patterns of use of ambulatory services.[22] The individual items are described as follows:

(1) Source of Referral This refers to the category of person or agency responsible for directing the patient to the clinic.[23]

(2) Classification of Service This is a formal scheme to designate the kind of medical responsibility which may be assumed by the clinic for each patient, e.g. maternity and pediatrics.[24]

(3) Consultation Service (Medical) Is that in which a physician (or other professional) upon medical request, provides an expert professional opinion on recommendation regarding diagnosis and therapeutic information.[25]

(4) Management Service May be provided by clinics which serve as the central sources of a patients care during the time of his registration at the center. Such a patient has no regular personal or family physician outside of the health center, and in effect this role is assumed by the center.[26]

(5) Usual Source of Care This category classifies the patient's most frequent source of medical care in or out of the health center. The categories include, for example, private physician, emergency service at the hospital, clinic, etc.[27]

(6) Ancillary Service Used These are the special supportive services established either for the purpose of assisting in the determination or confirmation of the physician's diagnosis or for the provision of special health care ordered by a physician. Specific examples are: social work, nutrition service, x-ray, laboratory, etc.[28]

(7) Costs of Services Income and expenses indicate the financial status of clinics in terms of the difference between the cost of operating a program, and the sources and extents of reimbursements to the program. Financial statements provide

an itemization of the costs of service. When cost is correlated with specific procedures, special services, and diagnoses, it is possible to obtain detailed estimates of the costs of medical care to both patients and clinics. In conjunction with information on patterns of utilization and illness and procedures used, financial statements should prove to be a most important tool for program planning. Examples of financial data on individuals are:

1) Cost/clinic visit
2) Cost/laboratory test
3) Health care costs
4) Personnel costs by department
5) Supporting health activity costs
6) Source of payment, etc.

In reference to the development of a flexible and widely usable system of records and statistics within an ambulatory care setting much remains to be done. However, use of the primary instrument can reveal areas of problems with respect to selection of items of information, definitions, data collection and processing techniques. In turn these problem areas can serve as a basis for applications and modifications for improvement of ambulatory health care services.

Type C - Diagnostic and Therapeutic Information

An ideal data system might be considered one which reflects all significant facts pertaining to an individuals health and medical care. However, no where does such a system exist.

Attempts to bring medical records into the age of electronic data processing are still in an early stage of development. Their successes at present lie in the area most susceptible to quantitative reporting (e.g. laboratory tests). However, with medicine becoming more complex each day, a computer information system is becoming more essential.(30-33)

The Weed problem-oriented record, or a modification of such, is a concept which could bring some order out of this chaos. This system can make it possible to improve the delivery of health care to consumers, as well as make it possible to assess the quality of medical care.

A complete data base of predetermined size should include information obtained in search for asymptomatic, as well as symptomatic disease. The data base should consist of six basic elements, the patient's:

1) Chief complaint
2) Profile
3) Present illness
4) Past medical history
5) Physical examination
6) Baseline, laboratory examinations

Such clinical information has considerable medical, administrative and financial relevance and is also useful in analysis of utilization and quality of medical care.(34)

Collection and Processing of Data

Many demands are made on neighborhood health centers for information, both internally and externally. One of the purposes of data processing and collection is to meet those demands as cheaply, efficiently, accurately, and rapidly as possible. Some of these informational demands are explicit, while others are implicit in the delivery of quality health care. Explicit demands include those made by funding agencies, for quarterly and annual reports, expected third-party billing information, and the information required by research and evaluation units if any exist.

As noted above, there are various items of information which are of importance and need to be obtained from ambulatory patients, these being: demographic and socio-economic; diagnostic and therapeutic; utilization

of specific facility or specific service data; and the cost of services rendered.

When and how frequently should such information be collected? Generally, it is recommended that personal information be obtained on two separate occassions; initial admission and annual update of the patient's encounter forms. Some of these items are subject to change over time.[35]

An example of personal information and the frequency of collection of this information is as follows:

(1) Utilization of Data

At each patient visit, items indicating utilization of specific facilities or services can be recorded by the appropriately assigned person. This information should include: (see Figure #1)

(2) Cost of Services

Data regarding clinical costs and charges should be recorded in the clinical admitting offices and in the individual clinical areas. Clinical charges and income are cumulative, and should be readily available for monthly and annual tabulations. Use of patient identification numbers makes it possible to identify clinics and services, to analyze specific cost expenditure by individual patients, clinic visits, diagnostic categories, and the method of payment[36] (see Figure #1).

(3) Diagnostic and Therapeutic Information

Data regarding diagnostic and therapeutic information provides the basis for ascertaining patterns of disease and medical care among clinic patients. It provides the basis for quality control, and is essential for epidemiological research, for assessment of the effectiveness of medical care or prevention of illness, and for planning for facilities and staff. In fact, a record of the diseases treated is critical to

most considerations of the demand for and supply of specific medical care resources.(37)

Figure #1 is a description of the kinds of information that a neighborhood health center must obtain for its existence, and also a suggested frequency of collection of such information. There are certain kinds of information that should be entered into a patient's medical record, regardless of who enters it or where it is kept. One type of such information is demographic and socio-economic. This information describes the patient's personal characteristics (age, sex, ethnocentricity) and his environment (occupation, birth place).

Next is data of diagnostic and therapeutic information. It ascertains the patient's chief complaint, physical signs, past and present medical history, etc.(38)

Third is data regarding utilization and cost of services -- included here are medical care; age and sex of patient using center, and personnel costs by department and type of services rendered.

These categories of information are divided into two groups; which are (1) Fixed, and (2) Varied. Fixed information is that information that is not subject to change over a period of time, e. g. sex, birthplace and birthdate. Varied information is that which is subject to change from time to time, such as: name, address, and marital status, etc., which needs to be updated periodically.

This information can be used for various purposes as indicated in the chart; for example, educational training for upward mobility for both professional and non-professional staff members and also as a tool for promoting patient education, e.g. family planning, dental care necessity, etc. Research information is used as an indicator of what kinds of services should be planned to meet the community health needs; e.g.

age and sex of patient using the center will give the administrator some indication as to whether to plan for additional services. Additional services could be maternity care, pediatrics or adult medicine.

Frequency of Data Collection

Input information such as; name, address, sex, etc. are collected only once. But newly encountered and newly registered patient's data are collected daily. Some of this information should be active (name, address, sec, occupation of household head, etc.). While the other information should be accurate and 100% complete.

Output of information such as; number of patients treated, type of services rendered, etc. are usually generated weekly in cases of new patients; monthly for total listings of registered and encountered patients; and quarterly and annually for federal reporting.

The value of an information system lies in its role as part of a total purposeful system to facilitate and enable other elements of the system to achieve its objectives. Such an information system has three sequential processes 1) sensing, 2) interpretation and analysis, and 3) action to attain specific goals. If the system is stable, some form of evaluation is definitely possible, and thus, the processes form a continuous sequence.

The sensing mechanisms of a computerized system will aid the administrator in determining necessary services, tally of supply inventory, trends in disease patterns, and long-term expectations of consumers and staff. Interpretation and analysis aids in focussing in on planning and adaptation to the community being served.

The action function of a system becomes apparent when the information handled communicates to the user of the system alternatives to goal achievement. Short term, the activities of administration indicate

EDUCATION	RESEARCH	PLANNING	SERVICE	F	V	TYPE OF INFORMATION	ACTIVITY	ACCURATE	COMPLETE	FREQUENCY OF DATA COLLECTION: OUTPUT — DAILY	WEEKLY	MONTHLY	ANNUALLY
						Type A. Demographic & Socio-Economic							
		x			x	1. Name	x	x	x				
					x	2. Address	x	x	x				
x	x	x	x	x		3. Sex		x	x				
		x			x	4. Birthdate		x	x				
x			x		x	5. Religion	x	x	x				
		x	x	x		6. Ethnic group	x	x	x				
		x	x		x	7. Marital status		x	x				
x		x		x		8. Place of birth		x	x				
x	x	x	x	x	x	9. Occupation of household head	x	x	x				
		x	x		x	10. Primary language spoken	x	x	x				
x		x	x		x	11. Family size	x	x	x				
						Type B. Utilization & Cost of Service							
		x	x		x	1. Source of referral		x	x				
		x			x	2. Patient category (private & clinical)		x	x				
		x	x	x		3. Category of attending physician		x	x				
	x	x			x	4. Use of auxiliary services		x	x				
						OUT-PUT							
	x	x	x		x	1. Number of patient treated	x	x	x			x	x
	x	x			x	2. Age & sex of patient using center	x	x	x			x	x
		x	x	x		3. Type of services rendered		x	x			x	
						4. Number of home encounters		x	x	x		x	x
						5. Health care costs	x	x	x			x	
						COST ACCOUNTING SYSTEM							
		x	x		x	1. Supporting health activity cost		x	x				
		x			x	2. Personnel costs by department	x	x	x			x	x
		x				3. Third party reimbursement	x	x	x			x	
x		x		x		4. Educational training dept.	x	x	x		x	x	
	x	x			x	5. Transportation (patient)	x	x	x		x	x	

EDUCATION	RESEACH	PLANNING	SERVICE	F	V	TYPE OF INFORMATION	ACTIVITY	ACCURATE	COMPLETE	FREQUENCY OF DATA COLLECTION: DAILY	WEEKLY	MONTHLY	ANNUALLY
													OUTPUT
						Type C. Diagnostic & Therauptic							
	x	x				1. Chief complaint	x	x	x				x
x		x				2. Vital signs	x	x	x				x
x	x	x				3. Past medical history	x	x	x				x
						4. Family medical history	x	x	x				x
						5. Routine diagnostic test	x	x	x				x
	x	x				6. Progress notes (patient)	x	x	x				x
x	x	x	x			7. Medications (prescribed)	x	x	x				x
	x		x			8. Physical examination	x	x	x				x

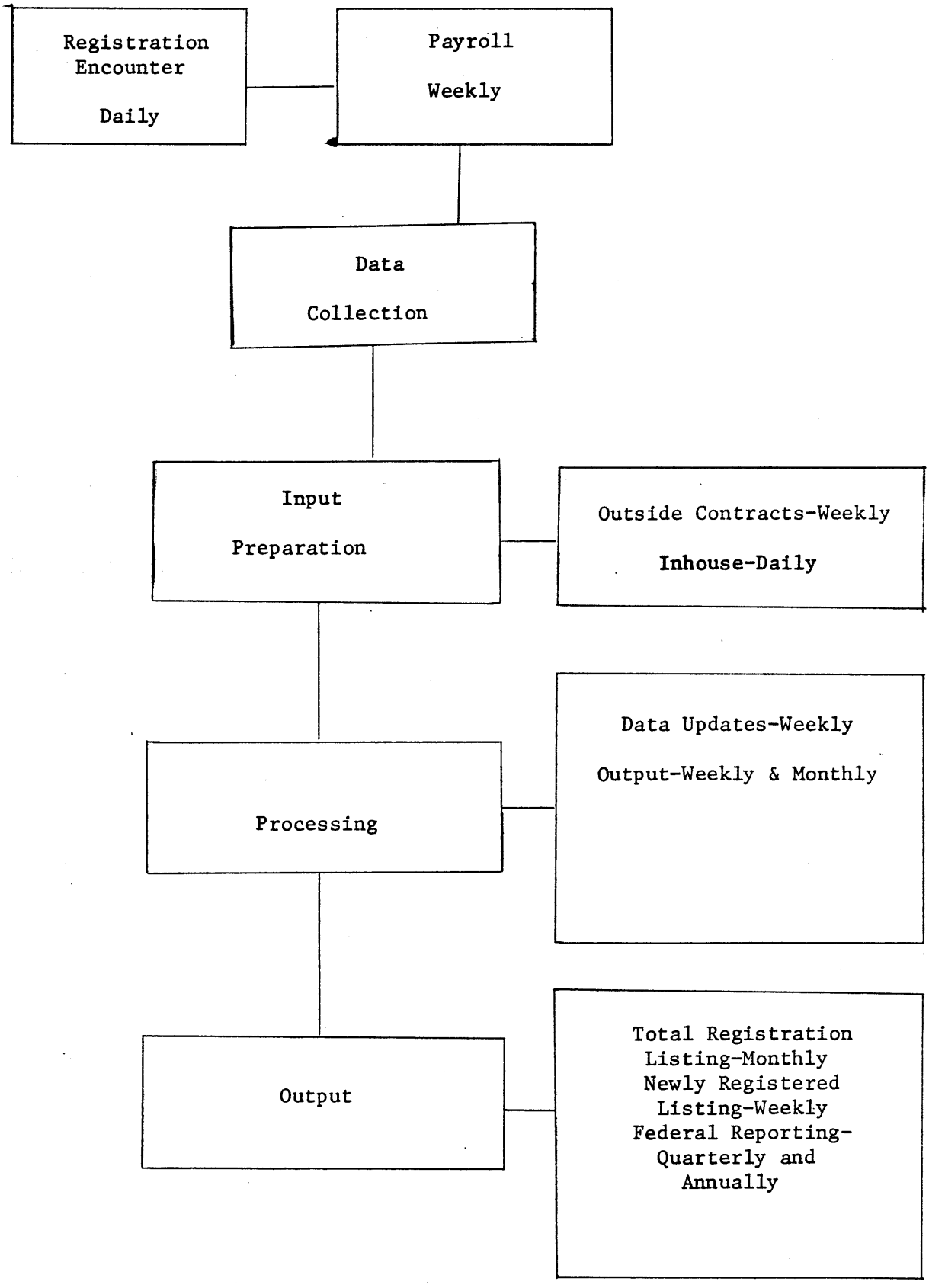

Figure #2 - Data Collection Flow Chart

a response to a need. Long term, these actions may facilitate expansion, or change facilities and functions as a result of change in goal.

In terms of evaluation, the information system must account for the dynamics and accuracy of information flow. Also to be taken into account is the ease with which information may be made to serve a wide range of functions.

Summary

Certain information needs are essential for the delivery of quality health care to a community and its people. These informational needs are the result of changes in disease patterns, population, and society. These factors have necessitated an increase in the size and scope of ambulatory services.

The establishment of health information systems for neighborhood health centers can give a more effective means of providing specific information about the patient and his surroundings (demographic, socio-economic, diagnostic and therapeutic information).

The push for further growth and development of neighborhood health center services indicates the need for increased knowledge of patient characteristics, utilization of facilities, and the quality of medical care.

Technological advances in the field of medicine have determined the need for accurate and complete information for application of sound principles and logic in day-to-day delivery of health care.

Ideally, that system should be easily accessible, complete, economical and functional.

Thus far, systems for information retrieval are not widely usable in the various types of ambulatory health care facilities. Problems encountered have been in the selection of items of information, definitions, methods of collection and data compilation. The future for a system of

health information points to two goals -- the institution of an overall system, and new methods of recording and computerizing clinical data to be applied to the technique of proving quality medical care.

Charles White: "Information Needs of Neighborhood Health Centers"

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CHAPTER III

THE USES AND POTENTIAL USES OF COMPUTERS IN NEIGHBORHOOD HEALTH CENTERS

THE USES AND POTENIAL USES OF COMPUTERS IN NEIGHBORHOOD HEALTH CENTERS

No estimate exists of the current national expenditure on information handling. However, Ithiel de Sola Pool, Stuart McIntosh, and David Griffel in there article "On the Design of Computer Based Information Systems" estimated, that 16% of the nations working force are clerical. Since 1965 employee compensation was 394 billion dollars, about 62 billion would be a rough estimate of clerical labor costs. Much of clerical activity is not routine and, therefore, not likely to become computerized, for example, drafting of letters. Much of it, however, is routine--filing, refiling, indexing, ordering, searching, etc. One might estimate that somewhere between 2 and 10 billion dollars a year could be saved as a result of the introduction of computerized information systems.(1)

Any organization providing medical service to patients is deeply involved in communication and information handling. A recent article(2) estimated "that about 30 percent of the total hospital costs are related to information commerce". This estimate applied to a 304 bed general hospital providing all major medical and surgical specialties.

One might speculate that in a comprehensive neighborhood health center activity, the fraction of costs related to information handling is considerably high. For example, it can be estimated that a certain comprehensive health center spends approximately 1/8 of its total budget , 2.8 million in communication and information handling. Broken down into specific departments, the information handling budget looks as follows:

Comprehensive Neighborhood Health Center A

Data Processing	Billing Department	Medical Records
$50,000	$28,522	$64,460

Payroll	Clerical		
$25,000	$99,552	Total Cost	$267,534

The second example B is a comprehensive health center in Mississippi. It can also be estimated that the Mississippi project spends approximately 1/5 of its total budget (2.4 million) in communication and information handling. Broken down by specific departments:

Clerical	Medical Records	Payroll	Personnel
$78,332	$50,844	$20,656	$20,000

Data Processing		
$21,800	Total Cost	$191,632

In any case, there can be little doubt about the importance of information in the neighborhood health center program. If this is so, the computer has an important part to play. Considerable progress has been made in recent years in the development of computerized medical record systems. Many countries have developed systems, varying from national to individual hospital scope, to process data primarily for the production of statisics for epidemiology, clinical input, administrative and managerial purposes. In other words, the computer is being used primarily for data processing. Provisions for administrative functions are:

(1) Scheduling of patient appointments

(2) Scheduling of ancillary services (laboratory, dietary, ekg, etc)

(3) Inventory control of personnel supplies and equipment.

As well, the system can provide a data base useful for program evaluation and planning.[3]

There are several computerized information systems being used today for a large variety of medical care purposes ranging from scheduling bed vacancies to accounting and billing. Computers performing such tasks are usually in non-ambulatory settings, private hospitals being one of the primary users. These applications are primarily experimental research projects. One such system is P.A.S. (The Professional Activity Study of the commission on Professional and Hospital Activites) which serves 1153 hospitals in 46 states and provides a wide variety of computer-based information services of great value. However to date even the broadest of these systems is a collection of specialized solutions to specialized information problems.[4] The Advanced Reservation and Bed Utilization System, ARBUS is used to schedule hospital personnal and facilities, as well as beds.[5]

Historically, computer information systems had been a development which took place primarily in hospital in-patient settings. However, computer information systems are now beginning to find application in ambulatory care facilities.

A well developed and designed computerized information system should provide a descriptive statement of key elements, for the benefit of its

users. Objectives of the system should be clearly delineated and should provide specifications concerning the kinds of information it will provide.(6)

Output specifications should include types of data to be processed and the format of the data flow. Frequencies of data output and the full array of information available, at option, to the user should be specified. The system should also provide for and explain its capacity to generate other than routine information and how the user would go about obtaining such information.(7)

"Cookbook" instructions as to how a user would operate the system should be furnished. Such a manual should include models of information flow, variations of these models, and strategies which the user may use in operating the system. As mentioned above, there should also be a description of other than routine operations included in the systems instructions.(8) Raw data fed into the computer needs to be very specifically coded. This should be a requirement, especially in the case of the inexperienced user of the system. Information should be specific enough to aid in programming, yet have the flexibility of permitting individual programattic adaptive activity. Detailed information flow needs to be provided for in order that the program can be implemented with a minimum of work.(9)

Looking at a computerized system from the perspective of an ambulatory clinical environment, it is apparent that such a system could; (1) facilitate the vertical flow of information in the management pyramid; and (2) improve information flow between service areas.(10)

When applying computer technology to clinical management problems, the choice of the system must be secondary to the requirements of the applications. That is, the clinical management problems must first be defined and then the hardware/software combinations can be selected which best solve the problem. The system should be tailored to the requirements of the job, rather than vice versa. The primary objective of the system is the improvement of patient care, and included in this concept would be that a facility be able to obtain and maintain clinical information that is of value. The availability of this information can be obtained either in real-time or by batch processing.(11)

Real-time computing has been defined in many ways- - for the purpose of this discussion, we mean the use of a computer to process data as it is received from outside sources. Batch processing is the simplest and has been the almost universal system organization to date in computer installations. The essential feature of this system is that one job is run at a time and the entire system is dedicated to that one job until it has been completed. A major inefficiency of batch systems is the turn around time, which is simply the time lapse between submission of a job by the user and his receipt of the output. Another factor in the long turn around times of batch processing is due to the amount of operator intervention and required time lost by his having to handle cards, type in the input/output functions, or physically load the job on to the computer.(12)

The main advantage of a computerized system in an ambulatory care setting lies in its ability to perform data processing tasks

which are extremely time consuming by manual methods. The following are specific provisions inclusive in task performance:

(1) Up-to-date reporting statistics

(2) Current clinical data

(3) Third-party billing control

As mentioned previously, computerized information systems are presently being used in various ambulatory health care facilites. Systems have been introduced at the Atlanta (Georgia) Southside Comprehensive Health Center,[13] Indian Health Service (Tuscon, Arizona), Roxbury Comprehensive Community Health Center (Roxbury, Ma.), The David T. Wohl Health Clinic in St. Louis, Denver's community health care system Denver, Colorado, among others.

The computer has a variety of applications. Those ambulatory care facilities administrators who have incorporated the use of computers into their operation have found them to be valuable tools to management. (Roxbury Comprehensive Community Health Center, Atlanta Southside Comprehensive Health Center in Atlanta, Ga. and the Indian Health Service Center, Tuscon, Arizona, etc).

Data obtained from the computer can be used as a basis for planning the expansions of existing services, or for planning new services to the program. Summary reports of a community's epidemiological problems, such as the incidence of disease within the population, or the probable prevalence of that condition within the same population at any one of various times, should be easily obtainable through the use of a computerized system. Not only can such information be used as a

basis for administrative decisions, but for medical decision-making regarding a particular problem. The decision might involve only the ambulatory care setting or it might involve the health center in liason with the back-up hospital, or other resources within the community.(14)

Input of statistical information can yield output information which can be used to determine kinds and sizes of services relevant to the needs of the community.(15) This information would produce demographic, social, and environmental data describing population characteristics and indicate the populations specific health needs. In turn, the administrator is allowed a graphic picture of what he must plan for in terms of services, service professionals and non-professionals. Computer resources can also increase efficiency in activities such as accounting, inventory and billing. An administrator must have easy access to information about salaries and wages, financial costs of running the clinic, cost of medications and other supplies, and information regarding reimbursements or debits of third party payments. Scheduling and appointments are another important aspect of administrative function.

The administrator must have information regarding community demands upon the facility and he must have a tool which will help him to determine how he will meet those demands.(16)

Some Thoughts on The Legal Aspects of Computerized Information Systems

The function and efficiency of computerized information systems in neighborhood health centers are not without potential drawbacks. The one in particular to be discussed at this time is the patient's right of privacy and confidentiality. In order that a computerized system be a viable part of the delivery of quality health care services, besides storage and easy access to data the system needs to provide the health consumer protection. Certain safegards must be built into the system in order to secure patient data confidentiality.

The administrator of a computerized system will find it useful and necessary to follow certain guidelines in order to safeguard the quality of data stored in the computer and to control the access to that data. The same concept of privacy and confidentiality governing hospital records should be applied to patient computer records in ambulatory health care settings. Questions relating to who can use the data, who can acquire it, and what controls should be placed upon such use and acquisition needs to be answered. Controls should be established where by the system's user is required to identify himself to the system, and only after the required identification has been authorized, will the computer accept programming to release patient data. Privacy is a basic human right that has been violated too often in the past, particularly by agencies serving the low income communities.

Privacy

Patient privacy is threatened by the increasing numbers of medical and administrative personnel who have access to the patient's medical

history, by institutions that must use patient information in order to allocate payment for health care services, by centralized electronic data banks in which medical records are stored, and by the growing numbers of agencys that attempt to gain access to medical records for such varied purposes as law enforcement, medical and sociolgical research , commerical enterprise and government auditing[17].

The concept of privacy has been variously defined in legal commentary as "the right to be left alone,"[18] or"the right to live one's life in seclusion without being subjected to unwarranted, and undesired publicity" [19] and "the right to live without unwarranted interference by the public about matters with which the public is not necessarily concerned".[20]

The first prominent exposition of the right of privacy under the law can be found in the "Harvard Law Review". It was written in 1890 by Louis D. Brandeis and Samuel D. Warren[21]. At that time, there was no formal recognition in the courts or in legislation of a legally protected right of privacy.

Turning to more current legal literature, Charles Freed in the January, 1968 issue of the "Yale Law Journal"[22] discusses privacy as a substantive value, rather than as a social technique for assuring the protection of other substantive interests.

He defines privacy as "not simply an absence of information about us in the minds of others; rather it is the control we have over information about ourselves".[23]

Confidentiality

Many discussions in this field either fail to distinguish between privacy and confidentiality or confuse the two concepts. "Privacy,

as defined previously, means an individual's right to keep some information about himself or on the other hand, presupposes disclousure of certain information to another person for particular purposes. It requires an agreement, explicit or implied, among participants to restrict the information among them".[24] Examples of the communication of confidential information would be that between confessor and priest, client and attorney, patient and physician, and patient and clinical psychologist[25].

The most that can be said about a legal right of privacy in Massachusetts is that as yet, its existence under law has not been established. In a 1940 decision the Supreme Judicial Court said, "the present case does not require us to disclose whether any right of privacy is recognized by the law in Massachusetts". In a later case, the court also avoided the issue.[26]

In the 1967 session of the general court, a bill (Senate No. 1469) was submitted to create a civil course of action for invasion of privacy. The bill did not pass but was referred to a committee for further study. In the 1968 session this bill was not acted upon[27].

The Nebraska Act of 1961 is a legislative example of privacy and confidentiality. Other states might follow in enacting such legislation as it is needed[28].

The Nebraska statute protects the confidentiality of patient-doctor relationships but makes possible the reporting of information about patients as long as it is kept confidential. The legislative Bill 326 from the (72) Seventy-Second Session of the legislature of Nebraska is considered a "model bill".[29]

Summary

Computerized information systems are being used for medical information handling. Their use in ambulatory settings is experimental, but from what they have produced thus far, their long range potential seems promising.

At this point in time, computer applications to both hospital and clinic operations must still be classed as applied research and development. Differences of opinions regarding essential medical data have made it difficult to determine medical data requirements.

Any technological advance which tends to make medical information readily accessible carries with it the risk that access may be obtained by unauthorized persons. For this reason considerable attention has been given to the problem raised by computerization in regard to patient privacy and confidentiality of medical information.

At the present time computer applications in neighborhood health centers are limited to a few areas such as:

1) Third party billing control
2) Processing and up-to-data reporting statistics
3) Management control

However, the long term objective of a computer system is the development of a multifaceted system that will support medical data requirements of health consumers, administrators, physicians, and the compliment of professionals and non-professionals contributing to patient care.

Charles White: "The Uses and Potential Uses of Computers in Neighborhood Health Centers"

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CHAPTER IV

COMPUTER COST

Introduction

The uses and potential uses of computers in neighborhood health centers has been established. However, computer technology within neighborhood health centers has had limited impact because of its not being cost competitive. But does the situation have to remain as such? This chapter will present a realistic view of the economics of a computerized information system within a neighborhood health center.

The decision whether or not to use a computerized information system will depend largely on its cost and its cost-effectiveness.

Unfortunately, most computer users are very guarded regarding discussions about costs; reliable, detailed dollar figures of general interest and applicability are almost non-existent.

The cost studies that have been made public tend to be unrepresentative, primarily because the computer users have been large public and federal agencies facing specialized problems. This has been especially true of those large government funded organizations that pioneered in the use of automatic computers such as large hospitals (eg. Mass. General Hospital) and large federal agencies (eg. Defense Department).

The author's examination of cost expenditures in computerized information systems reflects a host of consideration peculiar to the small individual users.

In any organization, whether large or small, there are four main cost categories that the user incurs in the implementation of a computerized information system. First is the financial cost to prepare and implement applications and for initial applications to acquire and install the computer. (1) These costs are paid

only once; they represent investments in systems and in equipment which could otherwise be used in improving health care by adding additional services,

The second kind of cost is the periodic financial cost to maintain operations. These are costs that recur regularly; they represent operating expenditures. And third is the cost of staff. This cost includes professional staff such as (1) senior programmers, (2) senior systems analysts, (3) key puncher and code clerks, (4) machine operators. Finally, there are the development costs of computerization which include site planning costs, office space, machine configuration, and material requirements. These may involve consultant fees and/or several staff working fulltime for months. These costs should be computed to establish the cost of computerization.

Once incorporation of the computerized system has been authorized the primary problem then lies in the development of a well designed system which is appropriate to the needs of the center.[2] The design would need to consider how the bulk of center operations would be converted into the computerized system. Another factor is adequate personnel to support the operation and expansion of the system.[3]

The physical part of an information system is the computer itself. The component parts of the computer have been termed hardware. Such things as computer size, type of memory, input/output devices, and computation power determine about one quarter of a system's cost. Representative of this cost may be (1) monthly rental rates, or (2) the price of the purchased system[4].

Another segment of a system's cost is its programs and data files. These are referred to as computer software. Computer software costs are often as much as three times the cost of hardware[5].

Computer Hardware

Computers are machines which perform complex processes on information without need for manual intervention. The actual physical equipment which performs program manipulations is called hardware.

Computer hardware works in terms of some basic concepts which were developed with the first computer machines built. These concepts have changed very little to the present day.(6) What has altered drastically, though, are the size, speed, and cost of computers and their programs. It is not at all unusual to see a modern computer with several million cells of memory as part of its component parts.

The computer is organized into two parts: The memory and the processor. Most computer memories are constructed from devices called magnetic cores. These devices are arranged in large arrays called "core stacks", which are the basic memory media of the computer memory module. Computer memory using cores is called "core memory", or "core". The computer memory is usually divided into small cells called words. Each word typically contains one to six characters(7).

There are three other types of memory devices used in computers. These devices are high speed memories, random access memories, and serial memories. Highspeed memory, the circuity of the modern computer can now operate within the order of a nanosecond (one thousandth of a billionth of a second). Random access memories are used for storage of information which can be accessed very quickly and at random (example magnetic drums, magnetic discs and magnetic tapes). Serial memories are those in which the physical position of the device determines which elements of information can be selected quickly (example plastic tape etc).

The Processor

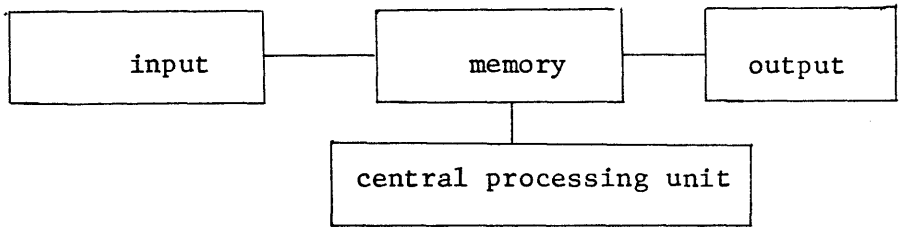
The processor, or central processing unit (commonly called c.p.u.) can usually understand between thirty and a few hundred distinct commands.

Data entered into the computer is stored in a device or set of devices called memories. It can then be directed to the central processing units as it is needed. The information that goes in is of two kinds--the data that is to be manipulated and modified to produce the desired results, and instructions that tell the computer what is to be done (programming).

The instructions of the program are sent, one at a time to the control units. The control unit interprets them and then does two things: it directs what data should be sent to the arithmetic/logic unit; and directs the arithmetic/logic unit about what operations should be performed on the data.

In addition to being able to send data between the memory and the peripheral storage systems, the c.p.u. can manipulate individual characters in the block stored in its memory. It can select the data from specific areas and perform computations with it.

The following illustration explains how a computer processor functions:



Input and Output Devices

Before information can get into the computer it must be transferred from its original form, usually a handwritten or printed document, into machine readable form (encoding). One means of accomplishing this is the key punch. A key punch encodes cards by punching holes into them. A key punch device requires that the computer also be equipped with a device called a card reader. The input family may also include input-teletypes, display devices that exhibit readable characters or graphic teletypes, display devices that exhibit readable characters or graphic information on the face of a cathode ray tube or CRT, etc.

Computer Output

Most computer systems have at least two online output devices, and some have multiple alternatives, including:

- typewriter or teletype
- online printer
- plotter*
- punched paper tape
- magnetic tape
- magnetic disk or drum
- video display (CRT)
- verbal output

It is apparent that certain of the devices (e.g. CRT) can perform dual functions, determined by their place in the anatomy of the computer.

Computer Software

Basically, software is a program or set of instructions for tunning computer hardware. Hardware provides the capability to make rapid calculations, make and compare decisions, send messages via communication links to geographically scattered terminals and discs, and search large files. But the organization of these capabilities into a comprehensive system capable of solving problems and realizing goals depends on computer software.

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*The plotter is a specialized piece of equipment that produces graphic representation (generally, line drawings) of values in storage.

The efficiency with which people use computers is crucially dependent upon the quality of the software. The most natural conclusion to follow here is that "there is good software, and there is bad software".

The same piece of computer hardware either will or will not work well for a system depending upon whether the software is functional. Software of quality can facilitate man-computer interactions by capitalizing upon the potentials of hardware. And though a computerized system purchased or leased with software is more expensive, a system having good, functional software applications increases efficiency of the system, while at the same time saving money in terms of system operation. Obviously, the system with poor quality computer software would be expensive, inefficient, and costly in terms of programming operations.

Software of leased systems is included in the lease cost. Many of the available software applications are supplied as part of a "package" in conjunction with the hardware. A few of these software applications are customer training, operating manuals and guides, diagnostic routines, and library programs. Briefly, the customer training software trains individuals to use computer equipment; operating manuals assist individuals in obtaining production from the computer by better organization and use of its functional units; diagnostic routines help in the maintenance of equipment; and library routines are prewritten programs which perform common functions such as mathematical computations.

Besides software that can be bought with a computer, there is software which has to be specially requested. Several software areas can be used in neighborhood health centers. These include: clinic scheduling; staff scheduling; automated medical history and summary reporting; ambulatory medical records (problem-oriented); clinical laboratory automation; radiology automation; billing and accounting; clinic screening (multi-

phasic); others can always be added to this list. Some such software is available from commercial software firms now, while others require custom-made programs.

Computer Cost

The cost of computing can be extremely high, but even if large systems were more cost effective, still many potential users could not even afford the basic cost.

However several commercial organizations have helped make computer power available without imposing enormous costs. "Computer Service Bureaus" are one such commercial organization. These computer service bureaus generally accept prepared data from customers, run programs for them and provide standardized reports.

Another commercial organization is the "Facilities Management Corporation". These corporations operate computer centers, complete with staff, on their client's premises.

A totally different approach and perhaps the most innovative method of distributing computer power to many small users is "Time Sharing". The primary advantages of time sharing systems for the users are probably that the system is convenient and accessible. The cost the user must pay for such a convenience is surprisingly small. Computers can operate this way with considerable efficiency. The actual cost of the system depends on how long the terminal is connected to the computer, how much actual time the central computer spends processing data, and the amount of space required for data storage.

There is also another avenue the user can take -- purchase of a computerized system. The systems he can choose from range in size from the mini computers to large scale computers. There is an increased interest in the mini computer because of its space-saving features and low cost

in comparison to the medium and large scale computers. The addition of special input and output devices can increase the cost of computers considerably. In purchase of such a system, the client will have to absorb the installation and site planning costs, as well as the hardware and software costs.

All in all, the expenditures of such an investment depend upon the computer configuration. If the users are going to lease the system, a large portion of the hardware cost will be the monthly rental rate. Lease contracts usually last from a period of one to four years. A computerized information system, whether leased or purchased, needs regular maintenance in order to ensure accuracy and reliability.

Technical Problems

It is difficult to define with certainty technical problems, when the very nature of a total computerized information system for a comprehensive neighborhood center is yet so indistinct. But even so, some major problems may be noted.

Failures and Reliability

The truth is that computers fail, they also require scheduled downtime for preventive maintenance. Reliability is a critical requirement of computerized information systems. They must perform with a reliability of almost 100 percent. A doctor or nurse should be able to enter and retrieve patient data anytime of the day. To the user, "reliability" means the percentage of time the terminals are operating satisfactorily. Equipment amd equipment components integral to computerized information systems should perform with an individual reliability of 99.9 % or more, or an equivalent "down time" of less than one day in 100. It is therefore essential to have a proper mix of backup equipment, parts and corrective maintenance capability to maintain operations despite failure and breakdown.

The configuration of a computerized information system can be determined by the type of information needed by its users for a day-to-day operation of a health facility.

In Chapter III an information matrix chart suggested three broad categories of information needs of neighborhood health centers. In the design of a computerized system, the user may or may not want to computerize the entire suggested list, but perhaps would find that computerizing a section or subsection would be most appropriate to his needs in terms of costs and efficiency to his operation.

The author interviewed a series of individuals knowledgeable and employed in the area of computer technology and computerized information systems. Out of those interviewed a determination of the major components and the costs of a computerized information system was developed.

Following are several examples of cost analysis of computerized information systems for neighborhood health centers. Example #1 is a cost analysis for purchasing a medium sized computer with extensive software for 12,000 registered (active) patients. Example #2 is a cost analysis for leasing a medium sized computerized system based on the same above patient population. Example #3 is a cost analysis for incorporation of a time-shared system based on the same above patient population. Example #4 is a cost analysis for a single computerized application for the same patient population (12,000). The outcome of such an investigation will give the potential user a realistic view of the cost of computerization, and also some alternative approaches to make computing power more available to neighborhood facilities without imposing enormous costs.

The financial foundation of neighborhood health centers is the predisposing factor in the decision to inquire into the feasibility of incorporating a computerized system, a number of questions have to be answered:

1) Number of patients to be served?

2) Types of information to be handled?

3) Personnel costs?

4) Equipment costs?

   A) Hardware costs

   B) Software costs

The following is a series of cost analysis studies in determining the feasibility of computerized information system installation in a hypothetical model neighborhood health center.

The model is based on a comprehensive neighborhood health center with an enrollment of 12,000 actively registered patients. Example #1 is an estimated cost for purchasing a computerized system. Besides paying the direct cost of the system, a user must also convert office space for installation of the machine and provide power, air conditioning, storage space, and material. Special materials used include punched cards, printed forms, magnetic tapes, and magnetic discs. All these materials are sensitive to heat and humidity, and require special care in their storage and use. Both operating and programming staffs must also be provided.

All-in-all, buying a computerized system is a decision requiring careful consideration.

Example #1

An estimated cost for purchasing a computerized information system.

A hypothetical model comprehensive neighborhood health center

Total number of registered patients	15,000
Total number of active patients	12,000
Total number of characters/patient	1,536 (2 blocks)
Total number of characters or blocks needed	18,432 char/24,000 blocks
The average number of patient visits/year	4 per year

Hardware Costs

Quantity	Item	Unit Cost	Estimated Cost
1	Computer PDP 15/75*	$40,000	$40,000
1	KF-15 Power Fail Detect	1,000	1,000
2	ME-15 Core Memory 8-K	8,000	16,000
1	RP-15 Disc Pack Control	18,000	18,000
2	RP-02 Disc Pack Drives	12,000	24,000
7	CRT (with couplers)	3,000	21,000
4	Univac Printers	3,700	14,800
		Sub Total	$134,800

Software Costs

(Software applications cost approximately $20,000 each)

1) Laboratory application
2) Pharmacy application
3) Patient scheduling application
4) Ambulatory medical record (problem oriented)
5) Computer assisted history application
6) Statistics application
7) Billing and accounts receivable application

Sub Total $140,000

Personnel Costs

Title	Monthly Cost	Annual Cost
1) Senior programmer	$1,250	$15,000
2) Junior programmer	1,000	12,000
3) Machine operator	833	10,000
4) Key Puncher and coder operator	625	7,500
5) File clerk supervisor	708	8,500
	Sub Total	$53,000

Site Planning Costs

Item	Monthly Cost	Annual Cost
1) Space (400 sq. ft.)	$200	$2,400
2) Electricity	200	2,400

*(PDP 15/75 medium scale computer)

Item	Monthly Cost		Annual Cost
3) Air conditioning	$100		$1,200
4) Insurance	100		1,200
		Sub Total	$7,200
Maintenance per year		Sub Total	$8,820

Example #2 is a cost analysis study for leasing a computerized information system.

Most large manufactureres who are actively interested in leasing computer systems offer contracts varying in duration from one to four years or more. Typically, the cost of a three-year lease is slightly less than the equipment purchase price (plus interest and maintenance).

Leasing companies use various arrangements, some of which offer tax advantages to the user. However, the cost of such arrangements is usually equal to the purchase price plus interest, regardless of the term.(10) Another disadvantage of leasing companies is that, as part of their sales effort, many manufactureres will provide free assistance in system installation and conversion. This benefit, however, is only extended to the original purchaser.(11)

Example #2

An estimated cost for leasing a computerized information system.

A hypothetical model comprehensive neighborhood health center

Total number of registered patients	15,000
Total number of active patients	12,000
Total number of characters/patient	1,536 (2 blocks)*
Total number of characters or blocks needed	18,432 char/24,000 blocks
Average number of patient visits/year	4 per year

General System Requirements

Hardware Costs

* 1 block = 768 characters

Quantity	Item	Monthly Lease Cost	Annual Cost
1	PDP 15/75	$1,230	$14,760
2	ME-15 Core Memory 8-K	392	4,704
1	RP-15 Disc Pack Control	646	7,752
7	CRT (with couplers)	482	5,784
4	Univac Printers	401	4,807
2	RP-02 Disc Pack Drive	548	6,576
		Sub Total	$44,383

Software Costs

Software applications, cost approximately $20,000, e.g.

1) Laboratory application
2) Pharmacy application
3) Patient scheduling application
4) Ambulatory medical record (problem-oriented)
5) Computer-assisted history application
6) Statistics application
7) Billing and accounts receivable application

Sub Total $140,000

Personnel Costs

Title	Monthly Cost	Annual Cost
1) Senior Programmer	$1,250	$15,000
2) Junior Programmer	1,000	12,000
3) Machine Operator	833	10,000
4) Key Puncher and Code Operator	625	7,500
5) File Clerk Supervisor	708	8,500
	Sub Total	$53,000

Site Planning Cost

Item	Monthly Cost	Annual Cost
1) Space (400 ft. @ $6/sq. ft.)	$200	$2,400
2) Electricity	200	2,400
3) Air Conditioning	100	1,200
4) Insurance	100	1,200
	Sub Total	$7,200
Maintenance cost/year	Sub Total	$8,820

Total system cost $244,583

Example #3

Estimated Cost for Computer Services Bureau

A hypothetical model comprehensive neighborhood health center

Total number of registered patients	15,000	
Total number of active patients	12,000	
Total number of characters/patient	1,536	(2 blocks)
Total number of characters or blocks needed	18,432	char/24,000 blocks
The average number of patient visits/year	4	per year

General System Requirements

Hardware Costs

Quantity	Item	Monthly Cost	Annual Cost
1	PDP 15/75 (8 terminal)	$372	$4,480
8	Multiplexer Ports	560	6,720
8	Data Sets & Telephone Lines	320	3,840
4	Printers	464	5,568
7	CRT	560	6,720
		Sub Total	$27,328
Storage Costs 24,000 blocks		Sub Total	$38,340

Software applications are part of the computer service package.

Personnel Cost

Title	Monthly Cost	Annual Cost
1) Senior Programmer	$1,250	$15,000
2) Junior Programmer	1,000	12,000
3) Key Puncher and Coder Operator	625	7,500
4) File Clerk Supervisor	708	8,500
	Sub Total	$43,000
	Total System Cost	$108,668/year

COST ANALYSIS

		Example #1 Buy	Example #2 Lease	Example #3 Service Bureau for 12K patients	Service Bureau for 16K patients	Service Bureau for 20K patients
Fixed Costs	Site Planning	$ 7,200	$ 7,200	- - - -	- - - -	- - - -
	Hardware	$134,800	- - -	- - - -	- - - -	- - - -
	Software	$140,000	- - -	- - - -	- - - -	- - - -
		$282,000	$147,200	0	0	0
Operating Costs/Year	Storage & Hardware	- - -	$ 35,563	$ 65,668	$ 76,528	$ 81,328
	Maintenance	$ 8,820	$ 8,820	- - - -	- - - -	- - - -
		$ 61,820	$ 97,383	$ 43,000*	$ 43,000*	$ 43,000*

*Minus Machine Operator

FIGURE #3

The costs of the different types of computerized systems has been established. Next will be the determination of the point in time at which incorporation of a computerized system becomes economically feasible. In order to justify the incorporation of a computerized system, it becomes necessary to compare the cost and efficiency of the computerized system to the already existing manual system. Following is an algebraic function showing the cross-over patient enrollment between a manual and a computerized system.

The cost of a computerized system can be expressed in an algebraic equation, e.g., $C_c = A_c P + b_c$. A manual system can also be expressed algebraically $C_m = A_m P + b_m$.

Where: the cost of a Manual System = $C_m + A_m P + b_m$

A_m = per patient cost for manual system

P = patient population in relation to cost

b_m = fixed cost for manual system.

Computerized System = $C_c = A_c P + b_c$

A_c = per patient cost for computerized system

P = patient population in relation to cost

b_c = fixed cost for computerized system.

$C_m = A_m P + b_m$ = Manual System

$C_c = A_c P + b_c$ = Computerized System

$C_m = C_c$ at cross-over point

$$A_m P + b_m = A_c P + b_c$$

$$P = \frac{b_m - b_c}{A_c - A_m}$$ General Equations

The above algebraic equations can aid the potential users to determine at what patient enrollment it would be economically feasible to incorporate a computerized system.

Figure #1

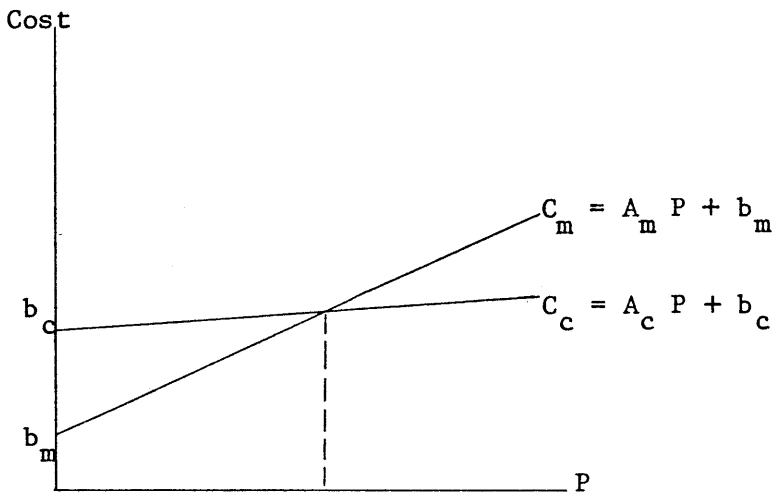


Figure #1 represents a curve showing the cross-over of patient enrollment of both manual and computerized systems, assuming that a fixed cost was given to both systems.

Following is an example of an actual situation of a neighborhood health center's incorporation of a computerized system. The application was billing and accounts receivable. Curve #1 is a comparison of cost of a manual versus a computerized system for a single application. The curve shows cost as it relates to clinic patient population ranging from 4,000 to 20,000.

Based on an average of 4 patient visits per year, a patient population of 4,000 would generate 16,000 billings. This health center, with which the author is familiar currently has two full-time employees handling a patient population of 4,000 at a combined yearly salary of $14,000. The "cost/patient" is $3.50/patient.

Equation for Manual Billing System

$$C_m = A_m P + b_m$$

$$A_m = \frac{\text{one man-year salary*}}{\text{number of patients}}$$

* one employee's yearly salary = $7,000

A_m = \$3.50/patient/year

The cost of the same application done by a computer service bureau was computed at \$2.04/active patient/year. The cost of a computerized billing application for 4,000 patients would be approximately \$8,160/year.

Computer Cost Equation

$C_c = A_c P + b_c$

A_c = \$2.04

C_c = \$2.04 P + b_c

It is assumed that there is no fixed cost for a manual system. However, a figure of \$9,200 can be assumed to be an overall fixed cost for personnel and outside services when a computerized system is installed.

Assuming that $b_c = \frac{\$8000}{\text{employee}} + \frac{(\$100 \times 12)}{\text{key punch services}} = \$9,200$

Equation = C_c = \$2.04 x P + \$9,200

By substituting the values into the formula, a potential user can determine the point of patient enrollment, when it is most economically feasible to incorporate a computerized system.

Formula $P = \frac{b_m - b_c}{A_c - A_m}$

$P = \frac{b_m - b_c}{A_c - A_m}$

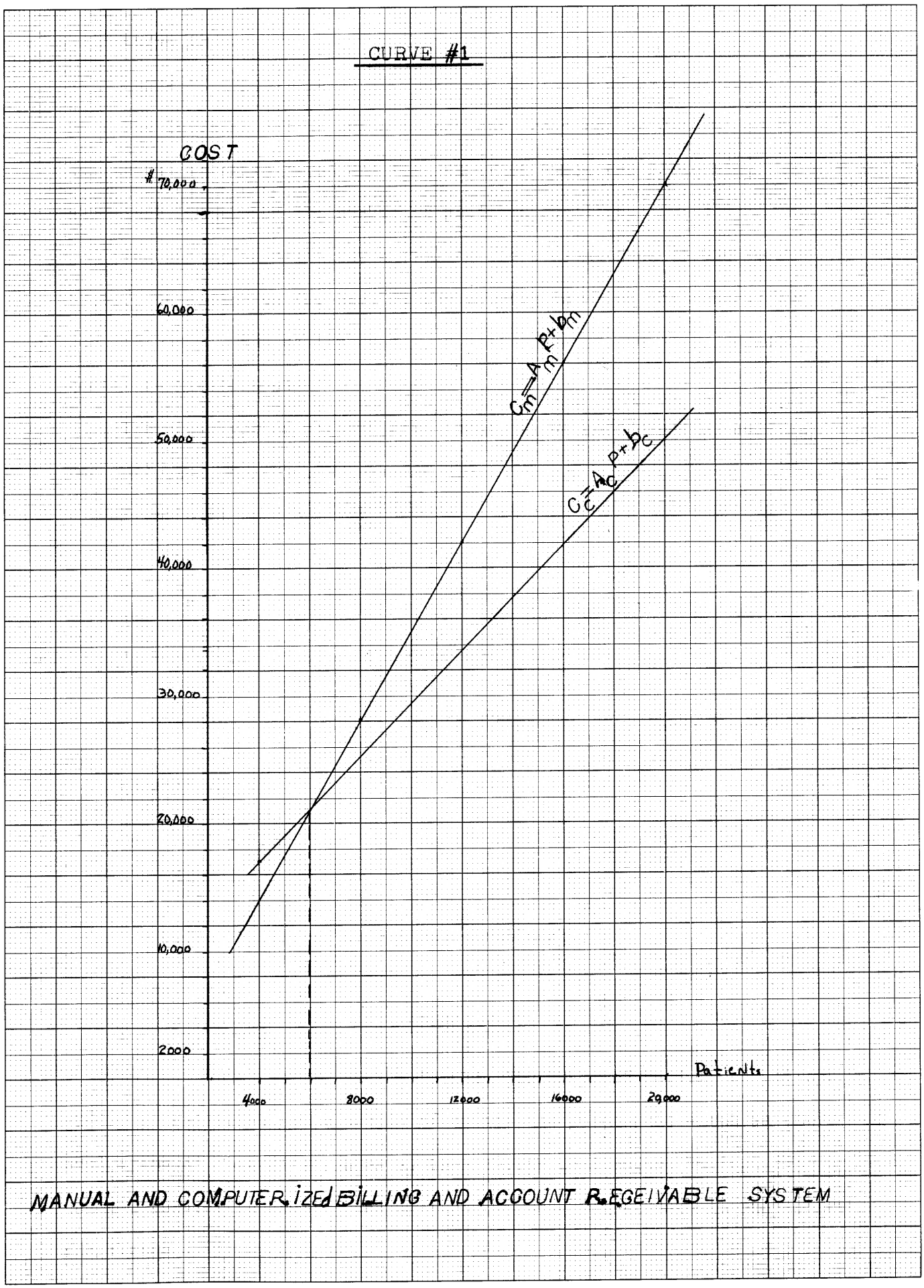
$P = \frac{\$9,200 - 0}{\$3.50 - \$2.04}$

$P = \frac{\$9,200}{\$1.46}$

P = 6,301 patient enrollment cross-over

The author estimated that for every 4,000 patients, a manual system would increase its billing clerks by 2 employees/4,000 patients as indicated by Curve #1.

CURVE #1



MANUAL AND COMPUTERIZED BILLING AND ACCOUNT RECEIVABLE SYSTEM

Curve #2

Curve #2 represents an increase and decrease of patient cost.

The increase and decrease in patient cost can be determined by the annual salaries payed and the number of employees performing the same task, divided by the number of patients enrolled.

The annual salaries for a billing clerk range from $5,000 to $8,500, depending on the area of the country in which the centers are located (e.g. urban health center in Massachusetts and a health center in Mississippi).

The crossover of patient enrollment can be determined by solving the following algebraic expression for P.

Example #1 $P = \frac{9,200 - 0}{204 - 425}$

$$P = \frac{b_m - b_c}{A_c - A_m}$$

$$A_m = \frac{17,000}{4,000} \qquad P = \frac{9,200}{2.21}$$

$A_m = 4.25$ $P = 4.163$ Crossover of patient enrollment

Example #2

$$P = \frac{9,200 - 0}{2.04 - 3.50}$$

$$P = \frac{9,200}{1.46}$$

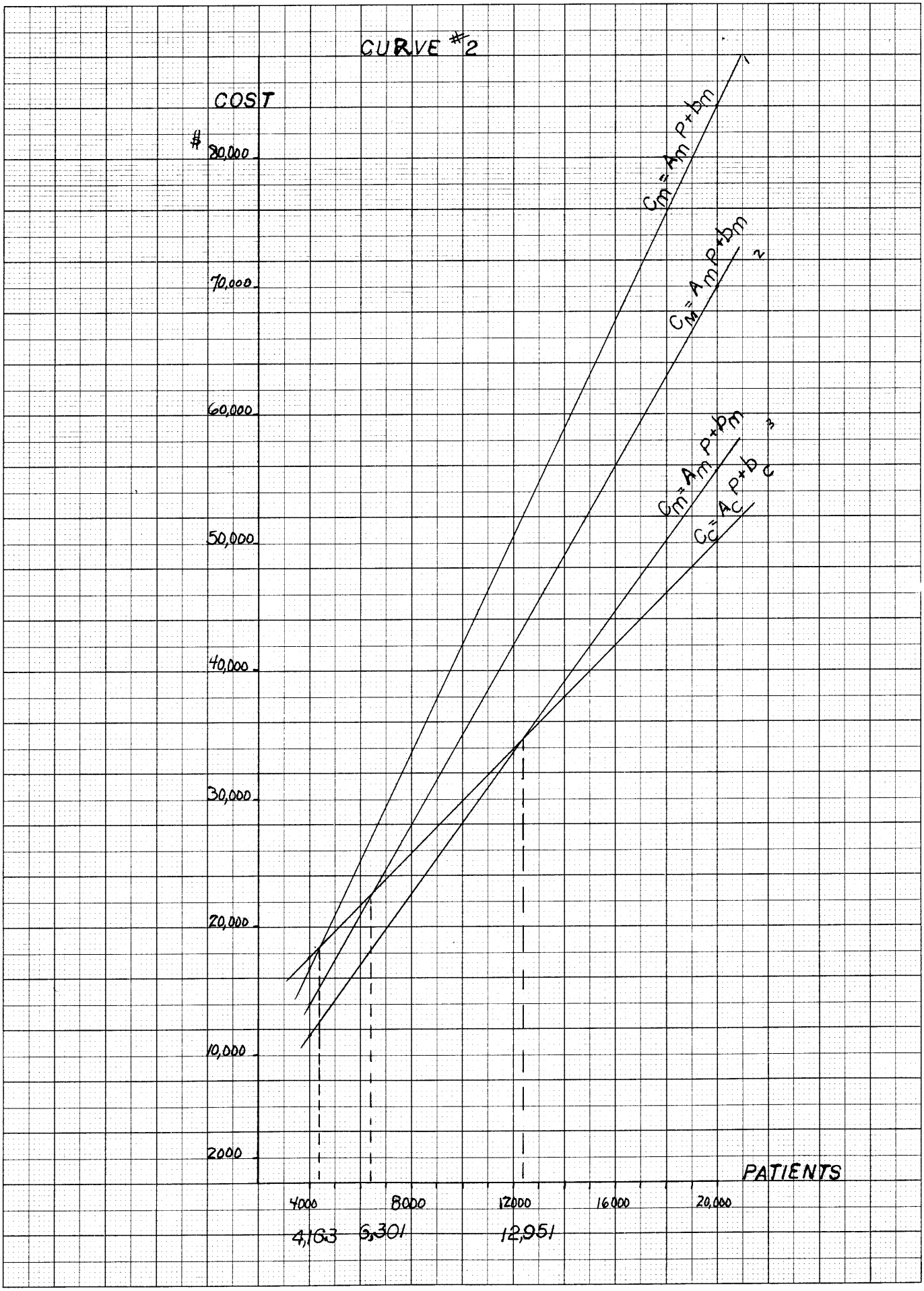
$P = 6.301$ Crossover of patient enrollment

Example #3

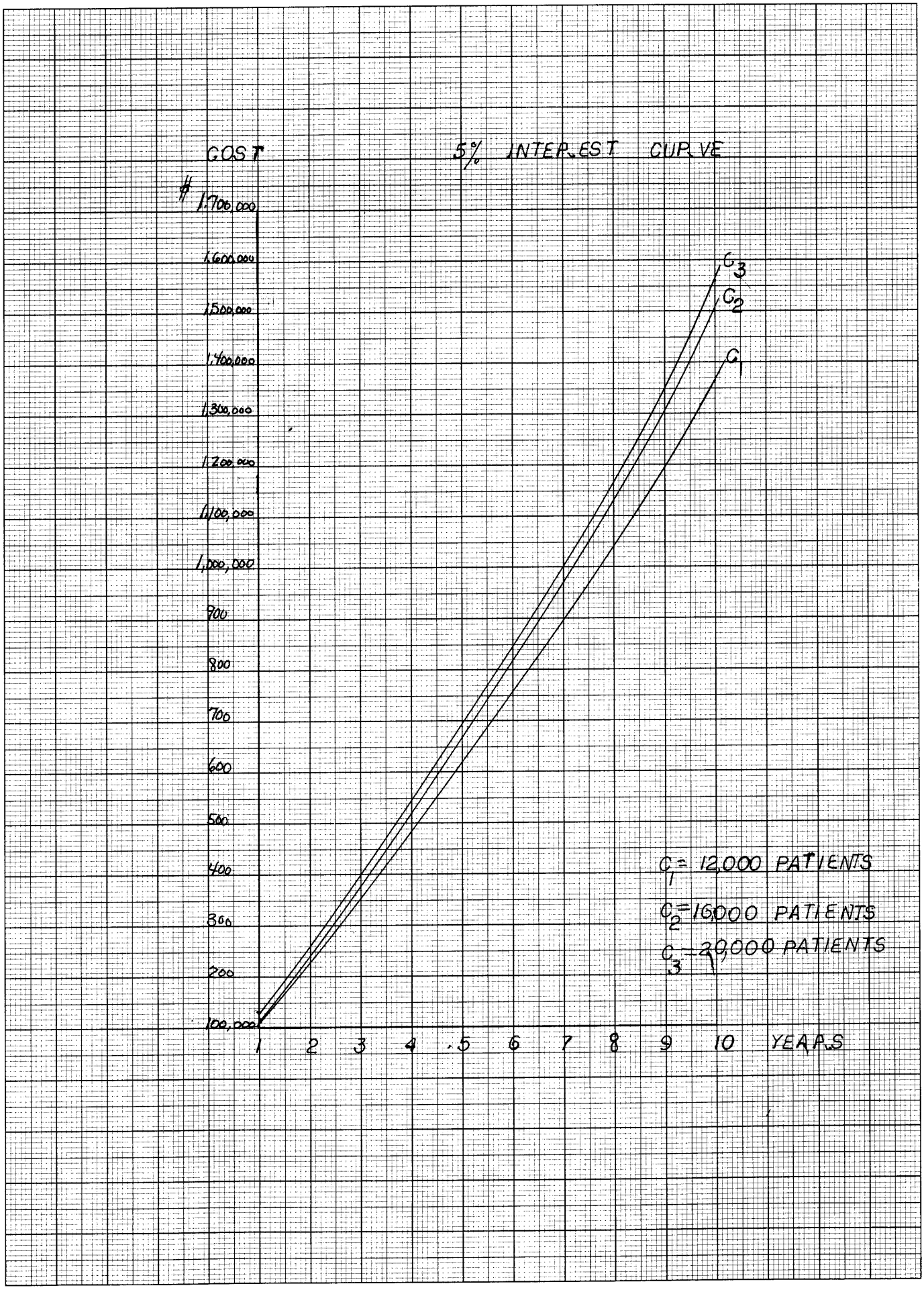
$$P = \frac{9,200 - 0}{2.04 - 2.75} \qquad P = \frac{9,200}{.71}$$

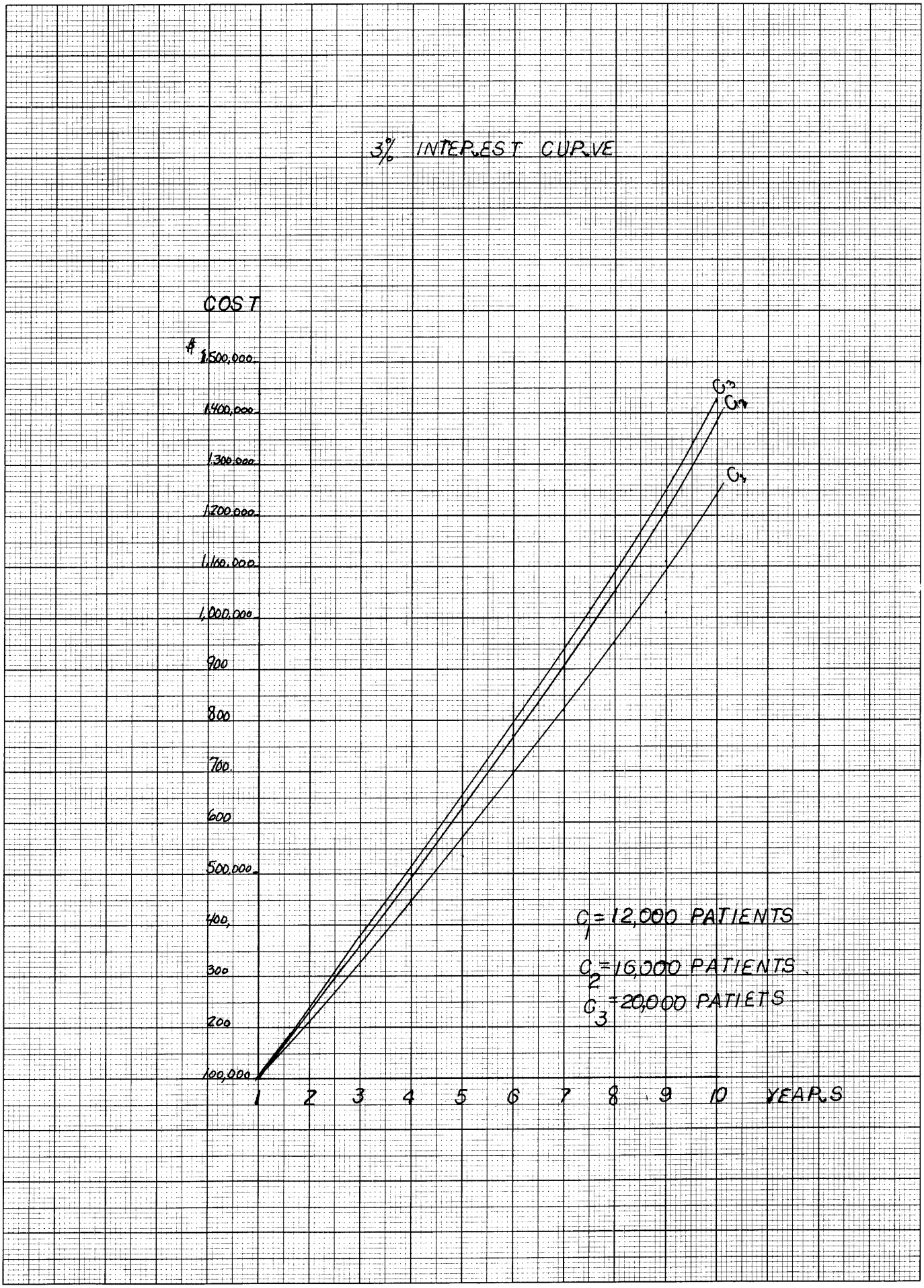
$P = 12.951$ Crossover of patient enrollment

Following are a series of curves the purpose of which is the projection of cost differences as they relate to leasing, buying, or using a service bureau for computerization of clinical data in ambulatory facilities.


CURVE #2
COST
#
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
2000
$C_m = A_m P + b_m$
1
$C_M = A_m P + b_m$
2
$C_m = A_m P + b_m$
3
$C_c = A_c P + b_c$
PATIENTS
4000
8000
12000
16000
20,000
4,163
6,301
12,951

Curves 3 and 4 illustrate the total cost of a comprehensive computerized system using a service bureau over a period of ten years. The curves are based upon clinic populations of 12,000, 16,000, and 20,000 patients. Each of the curves were calculated at 3% and 5% compound interest rates per year. The curves illustrate that the increasing patient populations enrolled do not increase cost proportionately to patient enrollment.


COST
$
5% INTEREST CURVE
1,700,000
1,600,000
1,500,000
1,400,000
1,300,000
1,200,000
1,100,000
1,000,000
900
800
700
600
500
400
300
200
100,000
1
2
3
4
5
6
7
8
9
10
YEARS
C3
C2
C1
C1 = 12,000 PATIENTS
C2 = 16,000 PATIENTS
C3 = 20,000 PATIENTS


3% INTEREST CURVE
COST
$
1,500,000
1400,000
1,300,000
1,200,000
1,100,000
1,000,000
900
800
700
600
500,000
400,
300
200
100,000
1 2 3 4 5 6 7 8 9 10 YEARS
C3
C2
C1
C1 = 12,000 PATIENTS
C2 = 16,000 PATIENTS
C3 = 20,000 PATIETS

Curve 5

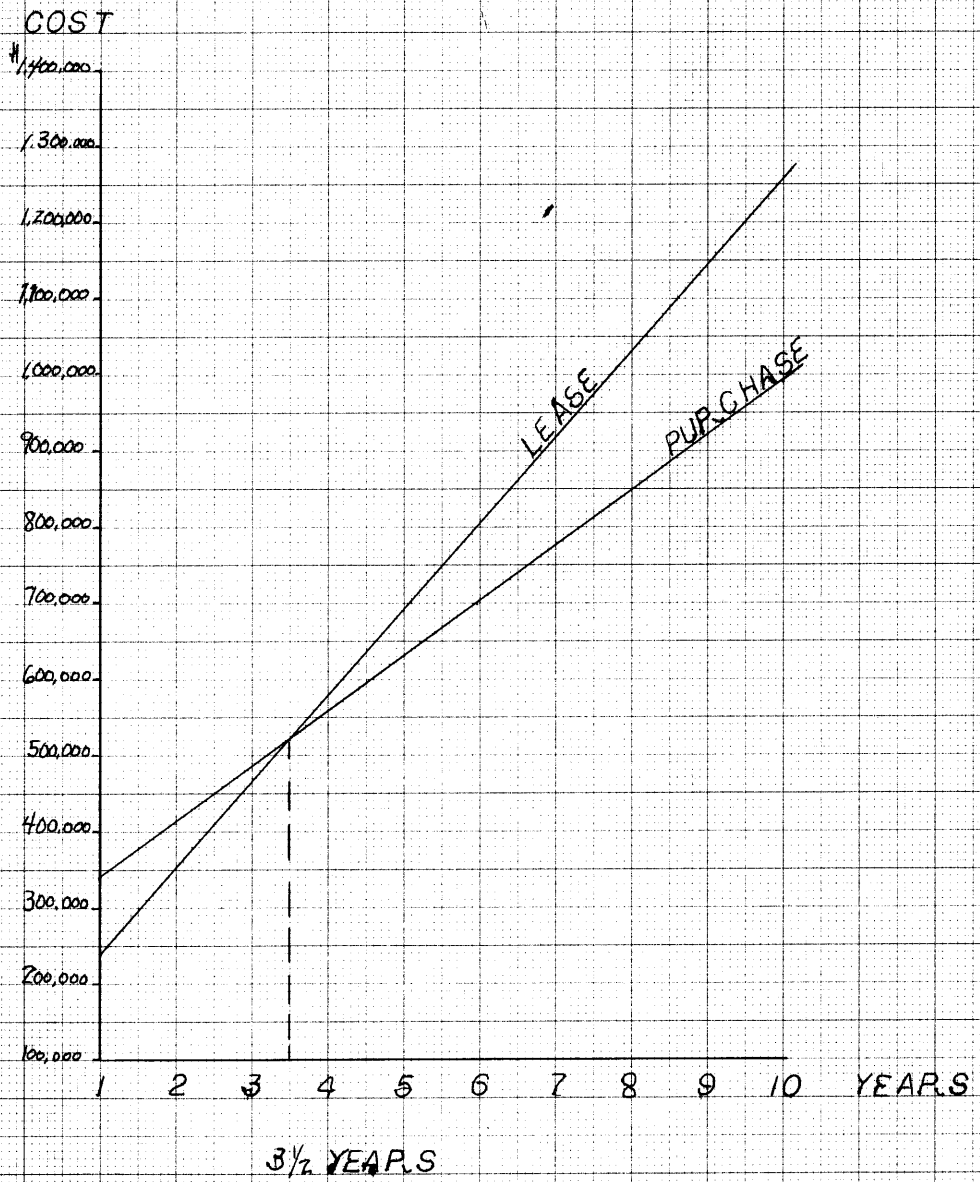
Curve 5 represents the difference in buying or leasing a computerized system over a period of ten years with an inflation rate of 3%. Also indicated is that in approximately 3 1/2 years it would be wise if the user were to buy a system if he feels he will continue to use it.

Curve 6

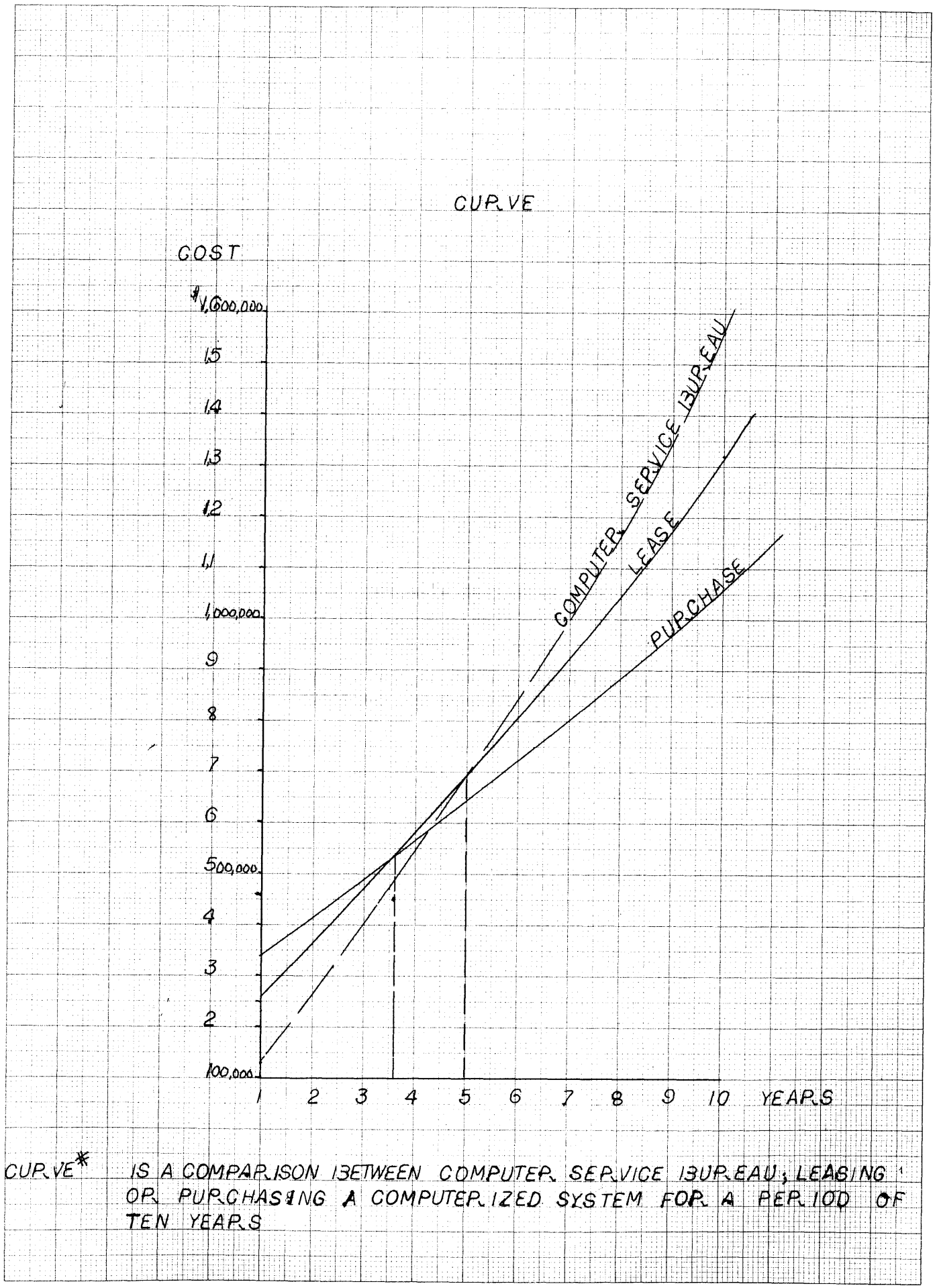
Curve 6 is a comparision of (1) leasing, (2) purchasing, and (3) using a computer service bureau for a ten year period. The curves indicate that it is cheapest to use a service bureau for a period of up to four years. It is clearly indicated that it is cheaper to use a computer service bureau over leasing a system for a period up to five years. The curve also indicates that it is cheaper to lease a computerized system rather than purchase one for a period of up to 3 1/2 years.

The cost of the above systems were calculated at 5% interest rates for a ten year period. The curve illustrates that it is cheaper to purchase the system after 5 years because the cost of both lease and computer service bureaus continue to increase.

CURVE #5



CURVE #5 REPRESENTS THE DIFFERENCE IN LEASING OR PURCHASING A COMPUTERIZED SYSTEM



CURVE* IS A COMPARISON BETWEEN COMPUTER SERVICE BUREAU; LEASING OR PURCHASING A COMPUTERIZED SYSTEM FOR A PERIOD OF TEN YEARS

Example #4

Cost Analysis for a Single Computerized Application
(Billing and Accounts Receivable)

A neighborhood health center should determine the feasibility of change from a manual system to a computerized system. What will the Center gain? Will it be cost effective?

One of the most acceptable and successful areas for computerization is the billing and accounts receivable area. Such an application can be obtained from computer services bureaus.

The cost of this application is based on the total number of active registered patients. To illustrate this example, one Community health facility (Roxbury Comprehensive Community Health Center, Roxbury, Mass.) has a total of 12,000 registered patients. The total cost for an application is estimated at $9,000/yearly or $750.00/monthly.

What does the center gain from a commercially computerized billing system?

Monthly Statistical Report

File Maintenance Report
1. Alphabetical member list
2. Appointment list
3. Card input error list
4. Disenrollment list
5. Encounter audit list
6. Input list with errors and controls
7. New enrollments list
8. Service detail and batch totals

Encounter File Reports
1. Date
2. Professional
3. Service
4. Type

Enrollment File Reports
1. Enrollment file missing data items list
2. Enrollment list
3. Enrollment Statistics by age, sex and ethnic group
    a. Consus tract
    b. Member's last encounter date
    c. Payment source
    d. Payment source and family size

Monthly Income Analysis

1. Financial Class
    a. Blue Cross
    b. Blue Shield
    c. Medicare
    d. Medicaid
2. Professional service
    a. Doctor
    b. Dental
3. Clinic Service
    a. Lab
    b. X-ray

Proration of Charges

1. Third parites
2. Blue Cross
3. Medicare
4. Welfare
5. Follow-up statement
6. General ledger on cost accounting by department

The cost effectiveness of this application can be demonstrated via the Roxbury Comprehensive Community Health Center. Incorporation of the computer has made a considerable difference in total billing services. The computer enabled the center to increase the rate of billing from a manual 15% to an increased automated rate of almost 50%. Billable items climbed from $10,000 to $40,000 per/month.

What does the center gain from a commercially computerized billing system?

Monthly Statistical Report

File Maintenance Report

1) Alphabetical member list

2) Appointment list

3) Card input error list

4) Disenrollment list

5) Encounter audit list

6) Input list with errors and controls

7) New enrollments list

8) Service detail and batch total

Encounter File Reports

1) Date

2) Professional

3) Service

4) Type

Enrollment File Reports

1) Enrollment file missing data items list

2) Enrollment list

3) Enrollment statistics by age, sex and ethnic group

    a) Census tract

    b) Member's last encounter date

    c) Payment source

    d) Payment source and family size

Monthly Income Analysis

1) Financial class

    a) Blue Cross

    b) Blue Shield

c) Medicare

d) Medicaid

2) Professional Service

a) Medical

b) Dental

3) Clinic Service

a) Lab

b) X-Ray

Proration of Charges

1) Third parties

2) Blue Cross

3) Medicare

4) Welfare

5) Follow-up statement

6) General ledger on cost accounting by department

The cost effectiveness of this application was demonstrated in a neighborhood health center in a large eastern city. The incorporation of the computer has made a considerable difference in total billing services. The computer enabled the center to increase the rate of billing from a manual 15% to an increased rate of almost 50%. The value of visits that were billable climbed from $10,000 to $40,000 per month.

Chapter IV - Summary

Because of the large initial investment in hardware and software, it is yet to be determined what the impact of computerization will be on neighborhood health centers. Never the less,as a minimum, the computer should improve efficiency by making manageable a large information load at the same cost or less. An example is the comparison of a manual system to a computerized system for the specific application (billing and accounts receivable).

It was shown that the computer costs were much less than that of a manual system, assuming that there were no fixed cost on either systems. On the other hand the comparison between the lease costs curve and purchase costs curve showed that it is cheaper to lease the first 3 1/2 years, but thereafter it would be feasible if the user purchases the system.

It is possible that technology may not decrease the number of personnel, but it will change job content, increase productivity, effectiveness, and quality.

CHAPTER V

SUMMARY

SUMMARY

Around 1910, the neighborhood health center movement dawned in America. These centers were developed to alleviate some of the physical, social, psychological and health problems which threatened urban slum communities. However, at that time, there was no information system to evaluate their effectiveness for individuals, families, and communities. The 1930's brought a definite decline in the health center movement -- the trend at that time became contracting private medical care.

The inception of the Office of Economic Opportunity in the beginning of the 1960's ushered in a revival of the neighborhood health center movement. Legislation regarding the guidelines and operations of health facilities were a part of this new movement. These legislative acts (see Appendix) specify competent health care planning of quality health care delivery, community involvement, and appropriate, adequate evaluation tools for services provided.

Thus far, the medical audit has been the only means of evaluating health care in neighborhood health centers. It has served, with limitations, as a tool for assessing baseline care. But, because of the advances made in medical technology during recent years and the complexity of disease patterns in law and moderate income communities, the need for information in health facilities and for health care evaluation is becoming more demanding.

Neighborhood health centers have certain informational needs which are mandatory for their operations and provisions of services. Primarily, these can be classified into three categories:

(A) demographic and socio-economic information

(B) operation, utilization, and evaluation information

(C) diagnostic and therapeutic information

In order to acquire such information, neighborhood health centers have the option of designing and developing appropriate manual or computerized information systems. Informational demands are growing, and the author sees the use of computerized information systems as the best method of meeting those demands.

To this point in time, computerized information systems have been used primarily in non-ambulatory health facilities. Because these systems are still in very early experimental stages, broad statements regarding their effectiveness and efficiency cannot be made. However, the author is of the opinion that community health services is the area where computerized systems could exert their greatest force upon total health services.

The introduction of a system into ambulatory health care facilities can:

1) Improve operating and management tools (aid administrative decision making.

2) Create a single source of information and an integrated communication system for all departments.

3) Reduce transcription errors and information transmission.

4) Reduce clerical costs.

5) Increase accessibility and improve quality of records.

These things being true, data processing can be the catalyst for synthesis of bits and pieces of health care information. Through this process primary (preventive), secondary (hospital), and tertiary rehabilitative) care can be tied together for a consistent emphasis on positive health.

Much remains to be done in the effort to develop a flexible and widely usable system of records and statistics in neighborhood health centers. Several obstacles to initial inquiries into this accomplishment

are: the resistance to change; lack of unique identification of each consumer (which is essential, especially in view of our highly mobile society); ambiguous terminology; imprecise clinical information; legal implications; and equipment and training costs. Perhaps the greatest obstacle is the resistance to change and unwillingness to realize the potential of the system to the health facility. The effectiveness of a system becomes non-functional when it is not utilized properly. Obviously, the problems associated with computer technology are many. These problem areas relate to: 1) peripheral (input/output) interfaces, 2) data storage and retrieval, and 3) overall system designs. Since each of these topics is necessarily bound up with the others, I shall not discuss them separately. Each is an essential part of most of the future health-care systems.

A major problem in present system technology is that peripheral interfaces are complex and costly. Often this is due to the fact that most systems are ad hoc aggregates of many loosely coupled, fragmentary subsystems. This is generally true in health-care delivery systems, and it is particularly true in hospitals.

Collection of clinical and demographic data just for the sake of collecting it is a problem common to all information systems. In clinical areas where possible data items are so vast, there is a tendency to attach importance to every piece of data on the assumption that at some point in time this data may be required in the delivery of medical care.

For purposes of developing requirements for an information system for a neighborhood health facility, the user needs a way to characterize, both qualitatively and quantitatively, the expected nature of the operational system. Operational systems means those functions which lead

to policy making practices and sequential tasks, through which the center's resources are utilized to provide direct and indirect medical care to its community.

A computerized system in a N. H. C. should not be undertaken without good reason. Some reasons for considering a computerized system are -- the size of the operation (e.g. 8,000 - 12,000 actively registered patients) and the volume of data; comprehensiveness of services; and the speed with which information is retrieved and analyzed. But when should a computerized system be brought into a health center? It appears that incorporation of a computerized system would be most feasible when the health center has a comprehensive operation, rather than a small scale specialty operation.

As noted in Chapter IV (pg. 83) in the comparison of computerized system cost, regarding leasing, buying, and utilization of service bureaus, it was found that for a given time period the service bureau was the alternative of choice. After a period of four years, findings indicated that purchase of a system would be the most feasible alternative. Viewed as a service tool, the system will have to be more cost-effective than would be required of a research tool. Otherwise, many of the reasons for its implementation disappear.

Other problems arise as one considers the financial aspects of a computerized system. This points to the necessity for careful consideration of initial start-up costs, such as hardware costs, software costs, site planning costs, and personnel costs, with redundancy minimized insofar as is consistent with reliability, etc. On this question, as on many others which were touched upon in the body of the thesis, trade-offs must be reconciled between what kind of system is needed and what can be afforded.

Prospects of Computerized Information Systems in Neighborhood Health Centers

Presently, computerized information systems are working to prove themselves effective tools for administrative functions in the delivery of quality health care to communities. But must the potential of computerized data processing stop in the realm of administration?

How will the computers affect the health care team and, most important, the patient?

Use of a computerized system will give the health care team better information on which to base their judgments. Less repetitive paperwork will be done and time will be provided for patient care. But, here it is important to remember that time does not equal quality. The computer is faster, more accurate, and can reduce needless duplication of information. It can be a comprehensive source of information that can assist the provider in delivering quality health care. Members of the health team will be able to diagnose their particular discipline needs of the consumer from information accessible to them through incorporation of the computer. In turn, this should aid the definition of the appropriate intervention.

Patient care can be improved through continusous monitoring, and the discovery of his personal norms and variabilities. Certain disadvantages had been outlined such as care fragmentation, care standardization, and lack of protection of his rights as an individual. The author sees use of the computerized system as a tool of creativity for the expansion of efforts, not to perpetuate such old mistakes in the delivery of health care.

Charles White: "Computer Cost"

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1) T.J. Donovan, "Computers are Costly", Data Systems, 1968, p.48.

2) Ibid., p. 42.

3) Ibid., p. 39

4) Stanley Rothman and Charles Masmann: Computers and Society, Science Research Associates, Inc. 1972, p. 50.

5) Ibid., p. 59.

6) L. Daniel Massey: Computer Basics for Management, Braintree, Massachusetts, D.H. Mark Publishing Co., 1968, pp. 24,25.

7) Stanley Rothman and Charles Masmann: pp. 60-73

8) L. Daniel Massey: pp. 21-23.

9) Stanley Rothman and Charles Masmann: p. 114-115.

10) L. Daniel Massey: p. 40-41.

11) Ibid., p. 41.

APPENDIX A

Section 222 (a)(4)(A) of the Economic Opportunity Act, as Amended

"(4) A Comprehensive Health Services' program which shall include--

"(A) programs to aid in developing and carrying out comprehensive health services projects focused upon the needs of urban and rural areas having high concentrations or proportions of poverty and marked inadequacy of health services for the poor. These projects shall be designed--

"(i) to make possible, with macimun feasible use of existing agencies and resources, the provision of comprehensive health services, such as preventive medical, diagnostic, treatment, rehabilitation, family planning, narcotic addiction and alcoholism prevention and rehabilitation, mental health, dental, and followup services, together with necessary related facilities and services, except in rural areas where the lack of even elemental health services and personnel may require simpler, less comprehensive services to be established first; and

"(ii) to assure that these services are made readily accessible to low-income residents of such arears, are furnished in a manner most responsive to their needs and with their participation and wherever possible are combinedwith, or included within, arrangements for providing employment, education, social, or other assistance needed by the families and individuals served: Provided, however, That such services may be made available on an emergency basis or pending a determination of elegibility to all residents of such areas.

Funds for financial assistance under this paragraph shall be allotted according to need, and the capacity of applicants to make rapid and effective use of that assistance, and may be used, as necessary, to pay the full costs of projects. Before approving any project, the Director shall solicit and consider the comments and recommendations of the local medical associations in the area and shall consult with appropriate Federal, State and local health agencies and take such steps as may be required to assure that the program will be carried on under competent professional supervision and that existing agencies providing related services are furnished all assistance needed to permit them to plan for participation in the program and for the necessary coninuation of those related services;"

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