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HEALTH-CARE DISTRICT MANAGEMENT INFORMATION SYSTEM PLAN

Review of Operations Analysis Activities During Calendar Year 1975 and Plan for Continued Research and Analysis Activities

by

George J. Nielson and William G. Stevenson

March 1976

The Charles Stark Draper Laboratory, Inc.

Cambridge, Massachusetts 02139

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16. Abstract

This is a report on operations research activities that were developed in order to identify the information required to manage both the efficiency and effectiveness of the Veterans Administration (VA) health services as these services relate to individual patient care. The clinical concerns and management functions that determine this information requirement are discussed conceptually. Investigations of existing VA data for useful management information are recorded, and a diagnostic index is provided. The age-specific characteristic of diseases and lengths of stay are explored. Recommendations for future analysis activities are articulated. The effect of the introduction of new technology to health care is discussed.

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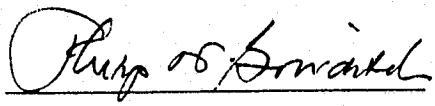
Approved: 
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PREFACE

In January 1975, some of us set out to explore the dynamics of patient care in the Veterans Administration (VA) system toward the 5-year goal of articulating the VA requirement for a management information system. Our premise was that the Management Information System (MIS), and the patient-care system that it supports, should address the provision of effective individual patient care, not simply the efficient production of goods and services within autonomous cost centers.

Toward this goal, we have established a program philosophy (Chapter 1). We have also explored the characteristics of a few key variables, already captured by the existing information system, and assessed their utility in resource management (Chapter 2, Appendices A and B). We have developed ideas for continuing operations analysis activities during 1976 (Chapter 3). And we have suggested an approach to the introduction of new technology in health-care delivery (Chapter 4).

At the outset, we felt strongly that the utility of this research activity lay in the interaction between members of the research community and the line management of the VA health-care system. Through this mechanism, the knowledge base arising from the research may be used and tested in the course of day-by-day problem solving in the VA system. During this first year, regular contact was maintained with Veterans Administration Central Office (VACO) personnel. In the forthcoming year, we hope to establish more formal seminar and working group activities involving VA personnel from both the central office and hospital stations.

This forthcoming year will represent the first chance the research team has had to address the development of this program within a unified organizational setting (The Center for Health Care Management: Boston VA Hospital). In this setting, we anticipate a more rapid rate of program development, and considerable broadening of the program scope. Research topics will develop, not only in data-base analysis,

but also in MIS development and evaluation, and in health-care-management problem definition. Of special import, we feel, are the analyses of experimental data sets to be prospectively captured in the ambulatory-care environment. These studies will represent the first steps toward the development of predictive models of resource needs in the outpatient environment.

Those who have followed our progress closely during the past year may wish to turn directly to Chapters 3 and 4 and Appendix A. Those who are not familiar with the underlying philosophy of health systems management should begin with Chapter 1.

The authors wish to express special thanks for the encouragement and assistance of the VACO staff and representatives of NASA, Johnson Space Center during the past year. We also wish to extend special thanks to Frank M. Holden, MD, Edward B. Roberts, John F. Rockart, and David D. Rutstein, MD, for their excellent advice and assistance in developing this program concept.

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CHAPTER 1

SOME CONSIDERATIONS OF HEALTH-SYSTEMS MANAGEMENT

1.1 Introduction

The principal function of the health-care-delivery system is the medical management of the individual patient. The physician holds the primary responsibility for assuring that the health and well-being of a patient are maintained or improved by his encounter with the system. The manager of the system is responsible for assuring the provision of resources needed to support the physician-patient encounter. The physician rarely has need to examine the entire care-delivery system. He considers only those segments of the system that will directly support the care of his patients, one at a time. The manager has no direct involvement in patient care and, historically, has gathered little information about physician-patient interaction and associated patterns of resource use. This is true even though the operations of the system are basically an aggregate of the physician-patient encounters and the activities that they generate.

Present methodology for managing health-care-delivery institutions has evolved largely from traditional concepts of managing cost centers. According to these concepts, a hospital is frequently viewed by management as 20 or 30 independently organized revenue centers, all housed under one roof, each of which sends customers to the others. The important management issue of efficiency in the production of goods or services is addressed by conventional cost-center control, where output may be maximized for a given dollar resource available to an autonomous cost center. But, the effectiveness and efficiency of the application of those goods and services to the individual user—the patient—has not usually been addressed.

The principal motivation of our research is to understand the dynamic operation of the system in order to identify the information that management needs for determining the efficiency and effectiveness

of the system in relation to individual patients. In order to identify this information, several basic characteristics of the system must be articulated. First, it is necessary to identify the principal functions of the physician in order to understand the types of information he seeks. The following section discusses these concerns. Second, it is necessary to define the basic functions that the manager must fulfill. For each of these functions we postulated questions that he must ask to make the concomitant decisions. The information required to answer these analysis questions provides the basic subject matter for analyzing the system. A discussion of these management functions and a summary comprise the remainder of this chapter.

1.2 Some Aspects of Clinical Care

This document does not attempt a comprehensive description of the clinical-care process which deserves and has received volumes of attention. This is a brief discussion designed to identify certain fundamental aspects of the complex subject of clinical care that management must consider. Clinicians initiate the largest amount of resource use in the system, and the entire system exists to support the clinical-care process. The researcher and manager must understand the basic motivations of the clinician and become familiar with the clinical-care process if they are to recognize and effectively control the patterns of activity that grow from it.

The clinician's motivation is always to identify and treat the patient's problem. Holden has articulated this motivation in the following way. "One could consider the physician as having five major categories of questions which he is attempting to answer. These categories could be represented by the following global questions.

What is wrong?

What is causing the problem?

What can I do about it?

Am I improving the situation?

When should I next review the situation?"[1]*

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* Superscript numerals refer to similarly numbered references in the List of References.

The physician begins to answer these questions by examining certain characteristics of the patient; by measuring certain variables that are related to the patient's health. These variables are derived from the patient's history, physical exam, or laboratory findings. Each measurement is designed to help the physician answer one or more of the five questions. Measurements may be either quantitative or qualitative, and variables will have varying degrees of specificity to a given medical problem. The medical profession assigns standards to the values of these variables so that measurements will indicate normality, abnormality, or danger. These standards are developed both implicitly, by observation of a large volume of patients, and explicitly, by statement of expert knowledge on the part of academic medicine.

During this process of patient examination and measurement, the system begins to apply its resources to the patient. If the physician were able to identify variables which completely represent all possible patient states, and to assign uniform requirements for diagnostic tests and therapy for each patient state, then standard specifications for care of the population could be articulated. All patient care could be practiced by algorithm. However, such a patient-care model is not possible. The number of variables which may be relevant to an individual patient's state is vast. Many variables contribute to answering more than one of the physician's analysis questions. The individual patient may suffer from multiple conditions of different severities, thus, the sequence of asking questions and seeking answers may vary. Furthermore, the physician's mode of articulating both problems and findings is not uniform throughout the system. Still, patterns observed in the information generated during the clinical-care process can identify trends in resource use. The manager, therefore, should begin to investigate the presently available elements of clinical information for use in helping him determine the resource requirement of his institution.

Consider one of the most important pieces of clinical information, the diagnosis. The diagnosis is the clinician's articulation of the patient's disease or condition. It is partially designed to answer the question, "What is wrong?" in that it is the identification of the patient's problem. Historically, in the practice of medicine, establishing a diagnosis has held first priority for the physician before initiation of the full treatment plan. While the considerations in making a diagnosis are numerous, the physician will generally be

concerned with establishing the presence of a disease for which effective treatment is available, rather than merely seeking to establish the most probable diagnosis.

It will be essential for the manager to understand the character of the diagnosis as a piece of information if the manager is to find a realistic use for this clinical input. Diagnoses are not one-dimensional identifications. They are intended to communicate a whole set of characteristics. Again Holden, "For example, the diagnostic statement 'adult onset diabetes mellitus', transmits much of the medical science information concerning the disease, family history, cause, future possible problems, and current options for therapy."[1] For all the communication power of the diagnosis, however, it rarely, if ever, contains an information base that is sufficient for treating the patient. The clinician must have other measurements of the variables that reflect his patient's health—ranging from the basic consideration of his age, height, and weight, to very subtle determinations of various chemical concentrations in the blood.

It is important to realize that the type and degree of information varies considerably from diagnosis to diagnosis. "Diabetes mellitis, late onset" implies something about family history, cause, prognosis, and a fairly specific range of therapy options, while "cardiomyopathy" implies nothing specific in any of those areas. The term "cardiomyopathy" locates the problem at the heart, implies that the nature of the problem is muscular and eliminates atherosclerosis as a principal cause. However, there are many different scenarios that could be implied by the term—a rather wide range of metabolic disease or other dysfunction. In some cases the cause will remain obscure or unknown, and prognosis may vary tremendously from patient to patient. We assume that a diagnostic statement is designed to communicate information on the etiology, morphology, topography, dysfunction, prognosis, and therapy options associated with a problem. Certain medical nomenclatures (i.e., SNOP and SNOMED) are designed to describe activities in each of these information fields. When these descriptions are linked together, they can act as a diagnostic statement. However, few diagnoses (of the more than 4,000 coded by the International Classification of Disease (ICDA)) will imply information in all of these areas. There are many diagnoses that yield little patient-specific information in any field. These are gathered in the ICDA under the phrase "other and unspecified" and coded usually under .9.

The manager and researcher can use the diagnosis to identify patterns of resource use. Patients with the same diagnosis tend to require similar resources. Of course certain diseases will display greater uniformity of resource use associated with their diagnosis and therapy than others. The length of time that two patients of the same age will stay in the hospital with a similar right inguinal hernia handled with similar procedures will not vary a great deal. On the other hand, two patients with paranoid schizophrenia could differ tremendously in their length of stay. Within any given diagnostic category, resource use will vary, and it will be important to examine subsets whose delineation is based on other patient characteristics, such as age or the presence of secondary diseases. The diagnosis can provide the manager with resource-use patterns which will help him identify his resource requirement. But the utility of this predictor will be lost if its varying import as a packet of clinical information is not considered.

Diagnoses are tools for articulating and communicating answers to the questions "What is wrong? What is causing the problem? What can I do about it?" But whether or not the diagnosis is stated, the clinician is always asking these questions. Sometimes the clinician will spend a great deal of time and resources on a patient before he is willing to make his diagnosis and initiate treatment. Sometimes he will initiate treatment without recording a diagnosis. This situation is most frequently observed in outpatient services when patients' symptoms are not severe and are frequently self-limiting. Considering the vagaries of diagnoses themselves, and the amount of resource use that occurs without a diagnosis with which to correlate it, the researcher and manager will clearly have to become more familiar with the clinical information process in order to find other variables by which resources can be aggregated. Problem descriptors such as SNOMED can be partially applied at the first stages of almost all care processes. If a problem cannot be diagnosed immediately its topography and major symptoms usually can be recorded. Resources aggregated by these descriptors might reveal helpful patterns. In the extreme, all resources used could be correlated with all clinical measurements. Even in the presence of the sophisticated techniques now available for analysis of variance among multiple variables, the vast number of measurements that can be taken make it basically impossible to produce one all-encompassing model of

clinical methodology. Also, seeking correlations between such detailed information elements may ignore some basic patterns of human disease that clinical care has learned to identify.

The clinician will always be seeking patterns of measurements in the individual patient which predict the presence of treatable conditions. The manager will need to seek resource aggregations and patterns that are repeatedly observed (predictable) in large populations of patients receiving health care. The manager's success at accomplishing his goal will depend greatly on how well he observes the physician persue his.

1.3 Management Functions

In order to identify the management information needs, it is first necessary to identify management functions. We have identified the following four functions as basic to managing health services.

(1) Planning for resource production.

(2) Controlling the efficiency of the system.

(3) Controlling the effectiveness of the system with respect to individual patient's outcome.

(4) Predicting the effects of change within the system or change in the population that it serves.

To perform each function, the manager will need to ask and answer a variety of analysis questions. The data that is gathered and structured to answer these questions will form the management information base.

We should remember that whether or not these management functions have been explicitly addressed in the past, the health-care system does work. Inherent in its day-to-day operation there occurs the production of goods and services, the evaluation of efficiency and effectiveness, and the assessment of the implications of change. Thus, there is already considerable information flowing through the system intended to support these functions. Most of it, however, reflects the cost-center orientation of present health-service management. Since we are not setting out to design a new health-care system, but rather to implement a management system that will perform specified functions for the

existing system, we need to consider two issues:

(1) How does the present system work with respect to these management functions?

(2) What are the limitations of the present management knowledge base and the present operational environment of the system that impede the management of these functions?

1.4 Planning for Patient-Care-Resource Production

There is no function more fundamental to the health-care manager than the provision of resources to the medical providers. Here we define a patient-care resource as a product or service which is used or consumed by an individual patient, either to provide for his normal needs while he is residing in the health-care system, or to effect his diagnosis or treatment. There are several questions that management must ask while preparing to provide patient-care resources.

(1) What resources are needed?

(2) Where are the resources needed?

(3) When are the resources needed?

(4) What is acceptable quality?

(5) What is acceptable cost?

Answering these questions implies establishing standards of some form—articulating minimum requirements for each resource. The accuracy with which these standards need to be met will vary from question to question and resource to resource. In many cases, these questions can be satisfactorily answered by observing the present operation of the health-care-delivery system. For example, such observation can answer the first question. Barring some change in the needs of the population served, the clinical knowledge base, or the technology available in support of clinical care, the patient-care resources required tomorrow would be about the same as those produced today. Yearly, seasonally, monthly, weekly, or daily variations in productions quantity should be identified, however, in order to establish the most efficient production capacity and inventory policy.

The question "Where are resources needed?" can also be answered by observation. In the inpatient environment, resources tend to go to patients, while in ambulatory care, patients tend to go to resources.

This is an important distinction in planning for the logistics of care, and requires the identification of patient areas and the identification of the nature and number of patient-care resources required by each area.

The timely provision of patient-care resources is essential in a clinical environment, especially in the case of life-threatening acute illness. In the past, little attention has been paid to this aspect of resource-production planning. Again, one can determine by observation of the system when resources need to be delivered. How long the delivery of a patient-care resource takes is also an important aspect of planning, and requires the development of a measurement not presently used, which we may call "resource-delivery-response time." This measurement should represent the time that elapses between a provider's order for a resource and the moment when the patient actually receives that resource. The time required to produce a resource from a given cost center (e.g., the time it takes to make a serum sodium determination in the laboratory) is only part of the response time. After all, it is the time from order to actual delivery that is important to the individual patient's health and well-being. Resource-delivery-response time can be measured by observation of present system activity with each patient-care resource. This measurement will be facilitated if the communication of orders and results is performed by an automated system because computers generally contain clocks.

Establishing quality standards for resources will require the participation of clinicians. While quality control appropriately abounds in many health-care-delivery activities (the laboratory, radiology, etc.) there should be some explicit statement of an appropriate quality description for each of the patient-care resources provided. Obviously, it will differ in nature from resource to resource, including as appropriate such factors as absolute accuracy of measurement, repeatability, cleanliness, reliability, etc. Observation of the system by clinical physicians who are aware of how quality descriptors relate to individual patient need can document this aspect of present operations.

Many methods are available for establishing and defining the cost of resources. Present accounting methods tend to focus on the cost center. Different cost centers may employ different methods of aggregating direct or indirect costs. If the manager is to determine the cost of providing a resource to a patient, he will have to aggregate

the activities of several different cost centers. For example, a patient who has his leg X-rayed and then a cast applied will use two cost centers. Even a single procedure such as a blood test can involve three cost centers: the nursing service to draw blood, the dispatch service to transport the sample and test result, and the laboratory to analyze the sample. Therefore, a uniform system of definitions for accounting patient-care resources is needed. We identify three cost elements for accounting patient-care resources.

(1) Direct Cost—This is the dollar cost of personnel, supplies and material, and equipment (amortization) which is required to produce a unit resource.

(2) Resource-Use-Dependent Overhead—This is the cost of maintaining the capability to produce a resource (or more of a resource) when production is not required at full capacity or all the time.

(3) Institutional Overhead—This is the cost of maintaining the health-care-delivery-system environment (plant, grounds, etc.) and maintaining and accounting the provider work force (payroll office, personnel office, etc.).

1.4.1 Functional Accounting

In the previous section we discussed the basic questions that the manager will need to answer in order to understand what resources are needed, and the characteristics of each resource that are essential to their use in clinical care. If he is to plan for the demands of a patient population, or evaluate the effectiveness of a mix of resources on one patient, the manager will need to account these resources by patient groups, not simply by cost center. We refer to this process as a functional accounting. Functional accounting keys the cost and disposition of all patient-care resources by individual patient identification. It is not sufficient to know the volume of resources used and the total patients handled. The cost of each resource should be identified in terms of its constituent components, and a user identified. The objective is to provide, for each value of the variable called "patient-care resources", descriptors which identify:

(1) The care areas where the resource is used and the frequency of occurrence of its use.

(2) The response time of the system with respect to providing a resource to an individual patient.

(3) Appropriate definitions of its quality.

(4) Its direct cost, and both the resource-use-dependent and institutional overhead.

(5) Its disposition by patient.

This data set should arise from actual measurement of the system activity. It should not be derived from averages or other disaggregations of cost-center data. However, such measurements may be made on a sample basis rather than continuously. Attention should first be focused on implementing functional accounting in those areas which produce resources for the volume health-care activities, the more significant cost components of the system.

Many of these measurements are already made in the health-care-delivery system. Some are even available in the present data stream that flows between functional areas of the system. Implementing this methodology thus requires attention not just to the definitions of new variables, but to the capture and communication of information already in the system.

1.5 Controlling Efficiency

The second management function, controlling efficiency, is concerned with minimizing the unit cost of the system output while assuring acceptable quality of all goods and services produced. To evaluate system efficiency, the manager will need the data set that results from functional accounting.

The concept of efficiency is basically related to change. Will some change in the system result in greater or less efficiency? For a given resource, a proposed change may increase or decrease the utility of the resource (its quality or availability) and/or increase or decrease its dollar cost. Thus, efficiency and inefficiency are defined by Table 1-1; those situations of change which may affect the utility of the resource when used by an individual patient are indicated by (I). In those cases, the manager's decision to effect change must be based on medical opinion about the possible effect on the individual patients who will be served.

Table 1-1. Efficiency as a quality/cost relationship.

Resource Quality	Resource Dollars Cost		
	Increase	Remain Same	Decrease
"Better"	I	X	X
Remain Same	0	No change	X
"Worse"	0	0	I

X = efficiency
0 = inefficiency
I = question of effect on patient

Health-care delivery must be considered as a system, a structured set of interrelated activities producing goods and services. Questions of efficiency must address the entire system, not a single resource-production center. A change in one resource (such as a diagnostic X-ray procedure) may affect the production of other resources (such as other procedures requiring the same machine). For example, a change in the laboratory communication system may speed laboratory operations at the expense of ward operations which must now accommodate two modes of ordering services, one for the laboratory and one for everyone else.

The first analysis question concerning management's evaluation of efficiency is: Is the volume/quality/time/cost trade-off optimum for each resource?

In order to assess the impact of change on the system, rather than an individual cost center or production center, it is necessary to provide a certain level of detail. For every patient-care resource, management should identify the contribution to its production made by each organizational component (cost center) of the system. In the case of laboratory test time, for example, one may readily identify the components of: communication time, sample collection time, sample transport time, test time, and result communication time. These components may all arise in different organizational settings of the care-delivery system, and changes in one may affect the dynamic operation of the others.

If this level of detail is measured, and if the cost trade-offs with respect to production volume, quality, and resource-delivery time are identified, it is possible to anticipate the result of management decisions at the system level, that is, to predict the effects of change at this level.

The separation of resource-use-dependent overhead from direct-cost and institutional overhead helps to identify the cost of less-than-full utilization of production capacity, or less-than-optimum resource load/resource mix. Again, for a given resource, the component of use-dependent overhead arising from each cost center involved in its production should be identified. This enables system-level analysis of the impact due to changes in resource load/mix production. Overall efficiency therefore, relates to:

(1) Minimum direct cost for resources of acceptable quality.

(2) Minimum institutional overhead.

(3) Optimum resource-use-dependent overhead, concomitant with the provision of an adequate inventory of goods and services to meet the nature and volume of resources required to serve the needs of a prescribed population.

The second question related to efficiency evaluation is: Is institutional efficiency maximum?

This question addresses the conventional cost-center management functions for maintenance of the institutional environment and the provider work force. The fact that these management methods are not outlined here in further detail does not mean that they are not important. They are simply much better understood and in more general use than the concepts of management with respect to individual patient care.

The management model which addresses the question of cost efficiency must identify the result of interactions between cost centers in the production and utilization of health-care resources. Thus, the development of an initial model of institutional efficiency must be based on a system of functional dollar accounting which identifies the organizational cost components of patient-care resources, while linking the utilization of these resources to individual patients.

1.6 Effectiveness Control

The ultimate responsibility for controlling the effectiveness of medical care lies with the physician. He has the knowledge base for evaluating the quality of care, and only he can implement changes in that care. For the evaluation and control of effectiveness to occur regularly and system-wide, management and the medical providers will need to cooperate and integrate their information requirements.

Evaluation will focus on two basic areas. First, physicians will wish to review individual cases, evaluating almost all aspects of care associated with that one case. Second, they will wish to evaluate medical and surgical procedures, looking at all cases in which they occur, in order to determine which one yields the best prognosis for the patient. In the first situation, physicians will need to articulate the criteria for selecting cases to be reviewed, as it would be impossible to review all patients in the system at all stages of their care. The manager will then need to develop systematic mechanisms for identifying those patients. In the second case, the information elements that should be collected on a given procedure must be specified by the physician. Information collected on a procedure may not be as all-inclusive as the information needed to evaluate a single case. But the manager will have to make sure that this information is captured for every patient who uses a given procedure. The highly experienced clinical specialist can provide valuable knowledge about certain procedures. Sometimes, however, only the observation of large populations—larger than a single clinician is likely to encounter—can yield the information necessary to evaluate the effectiveness of a procedure.

The evaluation of individual cases should be performed by physicians who have not been attending the patient. The evaluating physician tries to recreate the medical context in which the diagnosis was made and treatment prescribed. He asks again the same basic questions suggested by Holden (see Section 1.2), comparing his answers with the events that have occurred. He requires certain basic information about the patient. As a minimum this would probably include:

(1) The elements of the patient's history deemed relevant by the attending physician.

(2) The chronology of findings of physical examination.

(3) The chronology of therapy.

(4) The discharge and followup plan.

Having used this information to review the case, the evaluating physician will need to judge the effectiveness of the case. Some of the basic concerns related to that judgment are represented by the following questions.

(1) Was everything done that should have been done?

(2) Was anything done that should not have been done?

(3) Were goods and services ordered and provided in a timely fashion?

(4) Did preventable iatrogenic disease occur?

(5) Was the dollar cost of the individual encounter minimized (assuming satisfactory answers to questions (1) through (4), and efficient production of goods and services by the system)?

These are often difficult questions to answer. As we noted in Section 1.2, different diagnoses yield widely varying degrees of specificity to the history and prognosis of a problem. The clinical knowledge base is not uniformly developed for all diseases and conditions. Cure through the direct manipulation of an individual's biochemistry or biophysics is not always possible. The individual patient's response to a specific therapy may range over a broad spectrum. These facts of clinical life make it very difficult to define outcomes that uniformly reflect effective medical care for large numbers of cases. As previously noted, the clinical-care process, in its full range of concerns, cannot be easily reduced to algorithms. Thus, the evaluation of effectiveness must, in most instances, be performed for single cases reviewed one at a time.

Effectiveness control may concentrate on individual cases but the selection of cases to be reviewed will require the identification of large patient populations and their information bases. Cases can be selected randomly, of course, and in some contexts, random selection may be as useful as any other means of identification. In general, however, there are definite reasons for identifying specific populations, and definite advantages to selecting cases from them.

Patient populations are identified by a shared characteristic or characteristics. From these classes of patients, the evaluator identifies exceptions that he thinks may represent unsatisfactory outcome. Let us consider the most widely applied mechanism for evaluating care presently in use: concurrent review. Patients with similar or identical diagnoses are grouped together. Classes within these groups are established by considering other factors such as the patient's age, whether he had one diagnosis or several, and whether or not he was operated on. For each class of patients, an average length of stay (LOS) has been determined by the Commission of Professional and Hospital Activities. The average LOS was determined from data collected from over 1500 hospitals over the course of 1 year. At the time of admission each patient receives a projected LOS based on his provisional diagnosis when he enters the hospital, and this is revised as more diagnostic information is generated. When the patient exceeds his projected LOS by a given margin, he is identified for review. The suggestion is that for certain patients with certain diagnoses, an abnormally long LOS will have a high probability of reflecting ineffective medical care. One cannot, however, assume a priori that unusually long LOSs indicate poor health care, or that only these exceptions require evaluation. Even for conditions where LOS selection is no more likely than random selection to flag unsatisfactory medical outcome, minimizing LOS still serves to save the patient money and save the system resources. If medicine is unable to cure a patient, he need not remain in the system so long as his condition is stable and his prognosis does not suggest relapse. In this category, attention should be given to placement of the patient in proper special facilities or nursing homes in order to minimize cost. For this category of patients, a short course of inpatient stay should be encouraged.

For the process of concurrent review to function smoothly, the manager must collect the necessary information for each patient so that his projected LOS can be established and subsequently revised. The manager can also examine the statistical character of LOS, since average LOS will not reflect reality uniformly. One average LOS of 10 days may reflect a wide spread from 2 to 20 days and another LOS of 10 days might reflect a very high density of patients staying between 8 and 12 days.

Present methods of concurrent review are very helpful for controlling costs but may be little more effective than random selection for pointing towards ineffective medical care. Clinical medicine will be able to evaluate care most effectively when it is looking at conditions it understands well and can control. For patients with these conditions, outcome measurements can be developed, and patients who are not progressing adequately can be more easily identified on a regular basis. During the course of 1975, an HEW committee, chaired by David D. Rutstein, MD, has been developing a list of conditions identified by ICDA code number that, with the present clincial knowledge base and available resources, represent situations that could be reasonably expected to be prevented, arrested, or cured.[2] One would not expect some of the preventable diseases on the list to appear at all in our present society (i.e., malnutrition), and others one would expect to encounter very rarely. But it is important to flag cases representing these conditions as soon as they appear. Such identification may not help to evaluate the quality of care in a single institution, but it will be important for evaluating large health-care-delivery systems and the state of public health in general.

Numerous possibilities exist for using populations of patients with the curable or arrestable conditions to evaluate the effectiveness of care. For each of these conditions (or class of such conditions) physicians can identify certain descriptive patient measurements to be noted, and determine the range of values of those measurements that would be considered acceptable at a point in time. These measurements could vary from subtle laboratory determination, to multiple X-ray readings, to very simple but important qualities such as the patient's ability to stand up or breathe freely. If the course of a disease under specific therapy is well-established (little variation from patient to patient), then age-specific LOS would be a helpful indicator of outcome. Whatever measurements are relevant for each of these conditions (or class of conditions), they can be articulated. Patients whose measurements are distinctly out of range from the articulated standard can be identified as exceptional cases and reviewed. Unfortunately, this list of conditions only accounts for a fraction of the number of problems that could arise. In a few cases, however, they will represent significant volume of activity. In all cases they can be used to evaluate the effectiveness of health care.

One set of cases that any evaluation of effectiveness should review is those that end in death. These cases are not a priori more likely than others to identify instances of poor care. A patient's death is usually unavoidable. However, death is undeniably the least acceptable outcome and the one that effective health care devotes all possible effort to avoiding.

Any means of evaluating effectiveness will require that management systematically collect and relate certain information on all patients. Of course the information requirements will vary from method to method, but certain medical settings will simply not generate the information that is needed to make evaluations by the methods we have discussed. This is particularly true in most outpatient areas. Here different information will have to be developed and collected for the same purposes. This will be discussed more thoroughly in later sections on outpatient services.

In all cases, the patient's full medical record must be easily available as any of the information in it might be required for proper review. Whenever possible, subsets of the record that incorporate the important relevant information for reviewing a patient should be identified and separated. This separation can facilitate and hasten the review, clarify the basic considerations, and make it possible for more patients to be evaluated more frequently.

1.7 Predicting the Effects of Change on Functional System Performance

The ultimate objective of management planning with respect to providing effective individual patient care is to be able to predict the effects of changes in either the characteristics of the population or the technology and methods used in the clinical process. This function of management will require the information base associated with the previous three management functions. Resources will have to be identified, uniformly costed, and accounted functionally for each patient using them. Articulated information on patient outcome that measures the effectiveness of the system will be needed. As methods of measuring effectiveness are not highly developed, it is not now possible to devise a model of system operations which will address this management function. Measurements are also lacking that will be required to determine the change in system effectiveness which may be anticipated as a result of changes in the population served. These

measurements must describe the population served in terms of patient attributes which are related to the incidence, prevalence, nature, and severity of health problems.

Conceptually, if one knows how to predict the nature of individual outcome as a function of process performance, and how to predict the nature and number of process resources required on the basis of measurable population attributes, then it is possible to simulate the operation of the system for the purpose of assessing the effects of potential changes. Such a simulation does not practice medicine. Rather, it is intended to define the upper and lower limits of the nature and number of resources required to effect good medical care for a specified population.

1.8 Summary

We repeat, the principal motivation of this research is to identify the information that management needs in order to determine the efficiency and effectiveness of the system in relation to individual patients. This chapter has been designed to give a basic conceptual framework to that motivation, and to articulate the full scope of concerns that our research must eventually touch. We have discussed the basic motivations of the clinician and the basic functions of the manager. We have suggested kinds of information they require and some means of structuring that information. Were all necessary measurements of system-resource activity presently available, were all resources linked to patients that used them, and were all the relevant patient characteristics measured, we could easily develop an integrated data base that could serve as a model of the health-care-delivery system. This model could predict resource use, and predict the effects of change on both efficiency and effectiveness. For our recommendations of prospective studies we always have in mind the development of the data base needed to build the model. But the first analyses of the system (Chapter 2, etc.) must be performed with available data. The studies we have performed with the available data have been designed to identify tools for predicting system activity. The first consideration was to define that activity in terms of descriptors which could link resource use to patient characteristics and thus eventually incorporate it into the management model.

CHAPTER 2

MANAGEMENT STUDIES OF THE SYSTEM'S PRESENT OPERATIONAL CHARACTERISTICS

2.1 Introduction to Inpatient Analyses

Concomitant with the management philosophy outlined in Chapter 1, the first analyses of VA patient-care activities used data that has been traditionally collected by the present VA data systems. Most of this data, which is related to individual patients, resides in the patient treatment file (PTF). A 1-year file of selected PTF data, covering all inpatient admissions in calendar year 1973, was abstracted from PTF for installation on a rapid access-retrieval data-base management system. The findings of the initial analyses are presented briefly in this chapter. Details of the analysis procedures and the actual information output resulting from the studies are contained in Appendices A and B.

2.1.1 The Diagnostic Index

The diagnostic index of a health-care system is a tabulation of the frequency of occurrence, in the presenting population, of all diseases and conditions which are observed in the system during a specified period of time. Since we know that diagnostic and theraputic resource requirements are related to the diagnosis, the management utility of this index lies in predicting the case load-case mix, and its dynamics, which may later be related to the nature and number of patient-care resources that will be required. The confidence limits of long-range predictions, of course, depend on the stability of the disease-prevalence rates over a period of time.

Dividing the frequency of occurrence of a particular disease by the total number of patients observed yields the prevalence rate of that condition in the presenting population. Prevalence rate can

be converted to incidence rate only when the onset of illness can be established. Prevalence rates in the population at large can be developed only with survey data from the population that does not present for health care, or from a predictive model which relates the health characteristics of those who present to the characteristics of those who do not.

In the short term, the diagnostic index is useful for defining the number of care categories which must be considered if the bulk of system activity is to be described. Some 600 conditions, identified by ICDA (8th revision) nomenclature, each with a population of 200 or more patients, were found to describe more than 90 percent of the total VA inpatient activity in calendar year 1973 (Appendix B).

Consider the i^{th} diagnostic category (Dx_i). Over the course of a year, episodes in this category will include those who are presenting for the first time with the disease, and those who return for continuing or followup treatment. It is important to separate these two groups, since:

(1) Resource for followup care (largely therapeutic) may differ from the resource requirements at initial presentation (largely diagnostic).

(2) It would be useful to predict future resource requirements for those who are already captured by the system.

(3) Separating the occurrence of "new" and "old" patients in the system will allow us to study the dynamics of new admissions—toward the goal of predicting the nature and number of new cases that should be anticipated.

Two distinct populations of episodes were therefore identified in a 1-year PTF sample: those episodes representing the first admission for a patient with a particular diagnosis during the year (the nonrepeating population); and all episodes of all patients during the year. While a 1-year time span is not sufficient to establish long-term hospital admission requirements for any specific disease, the ratio of occurrence of nonrepeating episodes to total episodes was provided as a rough index of chronic resource reuse within a disease category.

The plan for development of this index as a predictor of case load-case mix (Chapter 3), must therefore address two issues.

(1) Separation of initial disease occurrence in the presenting populations from the chronic resource reuse within each disease category.

(2) Observation of the dynamics (time-varying trends) of both initial admission and readmission by disease category.

2.1.2 Age-Specific Prevalence of Disease

Consider the statement: Some diseases or conditions are specific to youth, and many chronic conditions require more care with advancing age. While, as a qualitative statement, this concept is true, it is not a very accurate predictor of the age-specific characteristic of disease. In order to obtain a better indication of the relationships between age and disease, an analysis of the PTF data was conducted (Appendix A) which identified, for selected disease categories, a measurement of the age-specific disease prevalence in the population who presented for VA care during 1973.

The establishment of a quantitative relationship between disease prevalence and age is an important step in predicting case load-case mix for two reasons. First, if the observed age characteristics of a particular diagnosis is very predictable (that is, if all observed age-specific prevalence rates follow a distinct pattern, and if this pattern is repeatably observed from year to year), then it will be a good predictor of the age distribution of any total number of cases. This will be especially useful if age is to be used as a descriptor of resource use. For example, age may be useful in predicting direct-care (hotel function) resource needs on the basis of age-specific LOS.

Second, if a distinct set of age-specific characteristics hold for a set of diagnostic categories which describe the bulk of individual patient cases, then we have a model which will allow us to predict the effect on case load-case mix that results from aging of the population. Where aging effects are significant, this model will be especially helpful in identifying the component of change which is due to effects other than population aging.

The eventual goal, of course, is to identify patterns of patient health which are specific to patterns of health-care-resource consumption. With this in mind, we should explore the stability of age-specific disease-prevalence patterns, not only with respect to principal diagnoses, but also with respect to:

(1) Whether or not a patient underwent surgery.

(2) Whether or not the principal diagnosis was the only problem (sole diagnosis).

The VA delivers health care over a wide geographic area. Thus, we should also explore the stability of this index over a variety of regional and institutional settings. If we observe reproducible patterns of variation from district to district, it will suggest differences in either the environmental or socioeconomic conditions of the populations, or the available health-care resources. Results of our early analysis (Appendix A) have been almost encouraging. Distinct patterns of age-specific disease prevalence are observed. Distinct changes in this characteristic are found as a result of differentiating between those patients with a sole diagnosis, and those with multiple diagnoses. Similar patterns were observed for some diagnoses at the national, regional, and institutional levels.

The continuation of these studies (Chapter 3) therefore is aimed at developing the VA system index of age-specific disease prevalence, identifying the effect of the aging population, and identifying regional variation within disease categories.

2.1.3 Diagnostic Clusters—Multiple Disease Observed in an Individual Patient

While we know that the utilization of diagnostic and therapeutic resources tends to aggregate by diagnosis, we observe that some diagnoses also tend to occur together in individual patients. This suggests that both the nature and number of diagnoses may be significant factors in identifying categories of patients whose resource needs may be accurately predicted.

Identification of diagnostic code pairs and triplets in the presenting 1973 input population (Appendix A), indicates that, in fact, significant numbers of these events do occur. Subdividing the disease-specific prevalence by associated diagnoses may provide a level of detail which will ehnance the confidence limits of predictive models

of resource needs. It is suggested, however, that the introduction of this "fine structure" to problem-category nomenclature should await the description of resource-use patterns which are associated with sole and principal diagnosis. If, in many or most cases, this fine structure of problem category is not required for accurate prediction of resource needs, then it will be prudent to avoid this complication. It is suggested that this mechanism of providing fine structure to problem categories be reconsidered after completion of the initial studies correlating patient attributes and process resource—in those cases where confidence limits on the model are marginal.

2.1.4 Length-of-Stay (LOS) Analyses

The elapsed time between inpatient admission and discharge may be a powerful tool for predicting resource requirements associated with normal life needs of the patient. These resource needs, largely independent of problem category, include food, maintenance of living quarters and the like. LOS has been shown to exhibit different age-specific characteristics for different diagnoses. Its characteristics are also observed to depend on the number of associated diagnoses, and the use of surgical procedures. It appears likely that the nature of associate diagnoses—the presence of a specific diagnostic cluster—may also influence the age/LOS characteristic for a given principal diagnosis. Initial studies (reported in Appendix A) considered age/LOS characteristics for specific disease groups subdivided by the presence of a sole or a multiple diagnosis. For those conditions studied, mean LOS generally fell in the 20-to-30 day range. The mode—most frequently occurring LOS—tended to fall in the vicinity of, or earlier than the mean. But, for any given condition and year of age, there was considerable variation in numbers of cases discharged versus LOS. It is axiomatic that a patient should be discharged as soon as his prognosis, with convalescence in his home, is at least as good as if he remained longer in the hospital. This implies an organizational system of care that maintains a discharge plan for each patient, and a plan for ambulatory-care followup as appropriate in the individual case. Within the VA health-care system, it is fair to hypothesize a significant number of cases where a longer than "normal" LOS may be anticipated. These situations will arise when convalescence at home is impractical, or suggests a poor prognosis,

because of family economics or lack of available family to assist with the post-hospital care. If LOS is to be used as an accurate predictor of direct-care resource needs in the individual case, we must find additional descriptors which can be used with LOS to define the individual case more specifically. Thus, we recommend both analyses to improve the predictability of LOS (Chapter 3), and the development of a systematic method for discharge planning.

2.1.5 The Assurance of Quality Care

During the course of 1975, a committee chartered by the Department of Health, Education and Welfare has been defining a systematized nomenclature for those diseases and conditions which are either preventable or treatable to the extent that unnecessary disease, disability, and untimely death can be clearly identified on the basis of individual patient outcome. This index, which includes some 200 of the 4500 odd diseases and conditions of ICDA-8, represents a starting point for the development of individual patient outcome indicators. A preliminary tabulation of frequency of occurrence and prevalence of these diseases and conditions is provided in Appendix A. Towards an operational VA system to monitor this index, the initial information base of such a monitoring system is explored in Chapter 3.

2.2 The Outpatient Sector

The diagnostic index, the age-specific prevalence studies, cluster studies, and LOS studies were designed to identify patterns of activity that could be linked to resource use and so help the manager predict his resource requirement. None of the data that was gathered from PTF and used to create these studies is available in the outpatient sector. The data that is available system-wide is the number of outpatient visits broken down by these categories:

(1) Compensation or pension.

(2) Determine need for hospital care.

(3) Outpatient treatment—service connected.

(4) Insurance.

(5) Aid and attendance.

(6) Prebed care.

(7) Outpatient treatment (nonservice connected).

(8) Nonbed care.

(9) Other.

Aggregations of visits by these categories may be useful in the analysis of the veteran population demand for care, but they offer little possibility for developing predictive relationships between required resources and the presenting population, based on individual patient-problem characteristics.

There is one useful data element in PTF that does not even apply to the outpatient sector: LOS. There is another important data element that cannot always be captured for outpatient visits: the diagnosis (see Section 1.2). Much of the outpatient activity occurs in the early stages of medical problems, and may require several visits for accurate diagnosis. Some of the acute problems of mild severity will heal themselves before diagnosis. Some drop-in patients do not take advantage of followup care and will not receive a diagnosis. More complex problems in specialized clinics may require multiple visits before a diagnosis is rendered.

Whatever analyses can be performed in the outpatient sector, they must rely on data that will be gathered prospectively. In some areas (e.g., problem descriptors like diagnoses), initial studies will be required to identify useful data elements. All studies will require the identification of patients, and not merely visits, if they are to help build a model which will predict both new-patient needs and continuing resource use by those already captured in the system.

CHAPTER 3

RECOMMENDATIONS FOR MANAGEMENT RESEARCH AND OPERATIONS ANALYSIS

3.1 Introduction

The purpose of management research is to identify and gather data from the health-care system which, through analysis, can become a sufficient information base to support both policy decisions and decisions regarding the appropriateness of management policy.

Traditionally, the management model of health-care delivery has been based on the assumption that, for a given set of clinical physicians, services performed should be of a quality acceptable to those physicians, and institutional operating cost per unit time should be minimized. This assumption is consistent with the social attitude that patients seek medical care on their own initiative, and receive the care that they can individually afford. During the past decade, the social attitude has begun to shift toward the concept of health care as a right, not a privilege which is constrained by the individual's economic status. The government, now in the role of informed consumer, since it has become a large third-party payer, and the Veterans Administration in the more complex role of both provider and payer, must develop health-care-delivery-management methods which will meet the challenge of modifying the health-care-delivery system to assure care of high quality at minimum cost to the individual patient. Evolution of this system can only occur concomitant with evolution of the management knowledge base. This new conceptual framework of thought (model) of health-care delivery as a system responding to patients (as users) implies the ability to:

(1) Aggregate component process resources so as to relate them to an individual patient.

(2) Relate resource-utilization patterns to individual patient attributes.

(3) Establish relationships between patterns of resource use in the individual case, and outcome measurements of the individual patient.

Concomitant with the development of this management knowledge base, we must consider the evolution of the information system—the mechanism for accomplishing data collection, storage, communications, processing, and retrieval within the health-care environment. As the nature and number of data elements required by management has been changing, the hardware and software associated with information-system technology have undergone vast improvement in recent years.

A principal assumption underlying operations analysis activities, not only at the VA, but also within the Professional Standards Review Organization (PSRO) structure and other federal and private sector health-care systems, is that the diagnostic statement may be used to describe the clinically relevant features of a patient, as well as to suggest a pattern of resource use that is specific to his care. Our previous studies have established the possibility of using disease discriptors to characterize the presenting population and successfully predict case load-case mix; it is appropriate to complete this model and establish its stability over time.

3.2 Age-Specific Characteristics of Disease Occurrence

Let X_{ij} equal the number of observed cases of diagnosis (i) at age (j). We define the age-specific prevalence rate as

$$R_{ij} = \frac{X_{ij}}{\sum_j X_{ij}}$$

Using the observed nonrepeating (NR) record population of calandar year 1973, the values of R_{ij} will be arrayed for the 200 most frequently occurring diagnoses over the age range 20 to 90 years. This array is a model of age-specific disease prevalence. Given a set of values for the number of patients presenting by their year of age ($X_j = \sum_i X_{ij}$), X_{ij} may be calculated. The diagnostic index of the NR record population may then be constructed as

$$\sum_j X_{ij} = X_i$$

Where F_i is the average frequency of return for a particular diagnosis during the 1-year period, the all-episode diagnostic index can be constructed as

$$X_i \times F_i$$

Our model of R_{ij} may be considered as a set of 200 one-dimensional arrays. In order to explore the possibility of describing this 200-dimensional space with fewer dimensions, a factor analysis will be performed. If diseases are observed to group together by age-specific prevalence characteristic, the diagnoses in each group may be identified.

This age-specific disease-prevalence model will be used to predict a 1975 case load-case mix for both NR and all-episode populations. The input to the model may be either actual 1975 data on the cases that presented by year of age, or an estimate derived from 1973 observations and trends. A projected 1983 age-specific case load will also be constructed and used as an input to the model. The results of these studies—the predicted case load-case mixes for 1975 and 1983—will be reviewed with VA management to assess the value of such predictive tools in planning long-range resource allocation to programmatic health-care activities of the VA system.

We anticipate that this initial model will not be a very accurate predictive tool. With only 1 year of abstracted PTF data now available, we are unable to separate patients who were previously captured by the system from those who are appearing at the hospital door for the first time. Some of the less frequently occurring diagnoses will contain only about 200 cases for analysis. Also, we are unable to establish the presence or absence of year-by-year trends in the prevalence rates. Refinement of this model is, however, straightforward.

In order to distinguish between newcomers and those previously captured by the system, an abstract of IDDS information may be prepared covering the period fiscal years 1961 to 1969. The abstracted record format for all male inpatient admissions would include:

(1) Patient identifier.

  (a) Principal discharge diagnosis.

  (b) Admission date (YYMM).

From this information, the population presenting in 1970 and thereafter may be separated into those patients who represent:

(1) First observed admission to the system since 1961.

(2) First admission with a specified principal discharge diagnosis (but with previous admissions with other principal diagnoses).

(3) Readmissions.

The frequency of return characteristic of cohorts (2) and (3) above may be determined over the period 1961 to 1975. By diagnostic category, we may explore the specificity of this variable to both "age at first episode" and "age at time of encounter". From this information, a frequency-of-return model will be constructed for the previously identified 200 diagnoses.

Cohorts (1) and (2) above are analogous to the NR population defined for calendar year 1973 records. They may be used to develop a model of age-specific disease prevalence similar to that described for analysis of the calendar year 1973 record population. Observed trends in this model, during the period 1970 to 1975, will be identified and used to enhance the predictive capabilities of the model.

These two models, the age-specific disease prevalence and the disease-specific frequency of return, may then be compared with their counterparts developed from calendar year 1973 data. They will also be used to predict a diagnostic index for fiscal years 1976, 1978, 1981, 1983, and 1985. By the time this model is completed, actual fiscal year 1976 data will be available for comparison.

3.3 Inpatient Resource-Utilization Study

We have already been able to identify relationships between inpatient characteristics and discharge diagnoses that offer some potential for prediction of system-wide case load-case mix. If such models are to enjoy utility as predictors of resource requirements, we must establish the presence of patterns of resource use associated with diagnoses.

In order to begin this activity, an abstract of the Washington VA Hospital (WVAH) patient-care data base is being prepared during calendar year 1976. The abstract will include, for each WVAH patient discharge, the following data elements.

(1) Patient identification and age.

(2) Date of admission and discharge.

(3) Discharge diagnosis.

(4) Procedures and the dates they were performed.

(5) Radiology and laboratory orders, and the dates of these orders and of the availability of results.

The file layout of this tape is indicated in Figure 3-1. The initial analysis of this data will include consideration of the following relationships by diagnostic category:

(1) Frequency of use of X-ray and laboratory resources and surgical procedures.

(2) Frequency of reuse of these resources during the course of an episode.

(3) The relationships between resource use or reuse and LOS.

(4) The relationship between patient age at time of episode and resource use or reuse.

(5) The resource utilization patterns occuring as a function of time from the outset of the encounter.

Also, it may be possible to identify patterns of resource utilization associated with several diagnoses, or with a specific cluster of diagnoses.

The utility of this analysis lies in establishing whether or not, for a significant fraction of volume activity of the health-care system, resource use can be predicted in the individual patient case. If it can, then a "specification of care" may be developed for a disease or group of diseases, which will be useful in the management planning for individual care and in the assessment of whether or not the system is working properly (quality control). It will be important to distinguish between the diagnostic and therapeutic use of resources, since, a priori, therapeutic resource use should be rather specific to diagnosis.

This analysis seeks to define specifications of care within an institution. Thus, it forms the basis for comparative definition of different patient management techniques. For example, if three process methodologies were identified for a specific condition, and if outcome measurements were established for that condition, the relative utility of the three clinical methods could be compared. Confidence in the result of such a study is obviously related to the number of observed cases. But, in the VA system, for frequently observed conditions, such studies might be routinely conducted in a short period of time (i.e., 1 or 2 years).

HEADER RECORD	DISCHARGED RECORD NO. 1 (FIRST RECORD IN QUARTER)	DISCHARGED RECORD NO. 2	DISCHARGED RECORD NO. 3	DISCHARGED RECORD NO. N (LAST RECORD IN QUARTER)	TRAILER RECORD
80 BYTES	VARIABLE LENGTH	VARIABLE LENGTH	VARIABLE LENGTH	VARIABLE LENGTH	80 BYTES

HEADER/TRAILER RECORD

RECORD LENGTH	BLANKS	NOT USED	IDENT. (HEADER / TRAILER)	BLANKS
2B	2C	2B	6C	68C

80 BYTES

DISCHARGED RECORD

RECORD LENGTH 1	BLANKS	NOT USED	SOCIAL SECURITY NUMBER (SSN)	DATE OF ADMISSION	DATE OF BIRTH	DATE OF DIS-CHARGE	DISPO-SITION 8	MIN BYTES 1 MAX BYTES 57: NO. OF Dx CODES 9	ICDA CODE 1	ICDA CODES 2-8	MIN BYTES 1 MAX BYTES 26: NO. OF PROCE-DURE CODES	ICDA CODE 1	ICDA CODES 2-5
2B	2C	2B	5PS	3PU	3PU	3PU	1C	1PU	7C	49C	1PU	5C	20C

FIXED PORTION - 21 BYTES — VARIABLE PORTION

MIN BYTES 1 MAX BYTES 291: NO. OF SURG-ICAL DATES	NO. OF SURG. CODES THIS DATE	DATE OF SURG-ERY	ICDA CODE 1	ICDA CODES 2-5	SURGICAL DATES 2-10 (SURGICAL DATE 1)	MIN BYTES 2 MAX BYTES N: NO. OF X-RAY STUD-IES	X-RAY STUDY 1	MIN BYTES 3 MAX BYTES N: DATE/ TIME X-RAY STUDY 1 ORDER-ED	DATE/ TIME X-RAY STUDY 1 COM-PLETED	X-RAY STUDY 2-N 25	NO. OF LAB TESTS 25	LAB TEST 1	DATE/ TIME LAB TEST ORDER-ED	DATE/ TIME LAB TEST COM-PLETED	LAB TESTS 2-N 30
1PU	1PU	3PU	5C	20C	261 BYTES	2PU	2PU	4PU	4PU	VAR-IABLE	3PU	2PU	4PU	4PU	VAR-IABLE

VARIABLE PORTION

(a) Inpatient discharged file layout (tape).

Figure 3-1. File layout of Washington VA Hospital resource-use data tape (sheet 1 of 2).

HEADER RECORD	LABORATORY TESTS-WEEKLY/DISCHARGED PATIENTS RECORD NO. 1 (1ST RECORD IN QUARTER)	LABORATORY TESTS-WEEKLY/DISCHARGED PATIENTS RECORD NO. 2	LABORATORY TESTS-WEEKLY DISCHARGED PATIENTS RECORD NO. 3	LABORATORY TESTS-WEEKLY/DISCHARGED PATIENTS RECORD NO. N (LAST RECORD IN QUARTER)	TRAILER RECORD
80 BYTES	VARIABLE	VARIABLE	VARIABLE	VARIABLE	80 BYTES

HEADER/TRAILER RECORD - SEE INPATIENT DISCHARGED FILE LAYOUT

LABORATORY TESTS RECORD

								MIN BYTES 13 MAX BYTES N				
RECORD LENGTH 1	BLANKS	NOT USED	SOCIAL SECURITY NUMBER (SSN)	DATE OF ADMISSION	DATE OF BIRTH	DATE OF DIS-CHARGE	DISPO-SITION 8	NO. OF LAB TESTS 26	LAB TEST 1	DATE/ TIME LAB TEST ORDER-ED	DATE/ TIME LAB TEST COM-PLETED	LAB TESTS 2-N 30
2B	2C	2B	5PS	3PU	3PU	3PU	1C	3PU	2PU	4PU	4PU	VARIABLE
← FIXED PORTION - 21 BYTES →								← VARIABLE PORTION →				

TAPES - 9 TRACK, 800 BPI

Notes:

B - Binary representation
C - Character representation
PS - Packed signed decimal representation of arithmetic and nonarithmetic data (odd number of digits).
PU - Packed unsigned decimal representation of arithmetic and nonarithmetic data (even number of digits).

(b) Laboratory tests—weekly/discharged patients file layout (tape).

Figure 3-1. File layout of Washington VA Hospital resource-use data tape (sheet 2 of 2).

3.4 Functional Accounting

We have previously articulated the rationale of functional accounting—the ability to associate dollar cost accurately with unit goods and services supplied to individual patients. We have also defined the basic cost categories.

(1) Direct cost.

(2) Utilization-dependent overhead—overhead associated with the production of specific resources.

(3) Institutional overhead.

Traditionally, the VA has not billed patients, and budgeting and reimbursement has been based at cost centers or cost-control points. Hence, little impetus for aggregating individual patient costs has been present in the system. The implementation of functional accounting was addressed by the automated system that accomplished distribution of cost-control-point accounts to the VA 14-4 program summary accounting format. However, true functional accounting will require attention to:

(1) Developing a uniform treatment of utilization-dependent overhead for all cost-control points.

(2) Providing appropriate linkage between accountable items and the individual patient who is served.

Functional accounting does not require basic information that does not exist. Instead, it requires careful attention to making the right measurements in the system (some of which are not now captured by the existing information system), and providing a structure for them in the data base that will facilitate unit-cost analysis and audit of resource consumption by individual patients. The only way to determine the feasibility of functional accounting—and identify the barriers to its implementation in the VA system—is to attempt a pilot implementation. Because of its proximity to the VA Health Care Management Center, the Boston VA Hospital is suggested as the initial vehicle for functional accounting studies. While we cannot, before the fact, address organizational complexity of implementing such an accounting methodology, we can delineate the basic costing rules which must be observed.

Consider each health-care resource which may be used or consumed by an individual patient to be an assemblage of basic components such as provider time, use of equipment, or certain amounts of raw supplies

and materials. The direct element of cost associated with a given resource is the sum of all basic components which are consumed in the production and delivery of one of the unit resources. For example, in the utilization of one serum sodium determination, one would find (as elements of direct cost) specified quantities of certain reagents, a test time involving both equipment and personnel, a variety of disposable (consumed) items related to drawing the sample, and some cost associated with sample and result transport whether or not these functions are automated. The sum total of all such basic components consumed in the delivery of one serum sodium are the direct cost of that test. In order to establish which (or if all) of the components should be monitored on an individual test basis, one must first look at the variations in individual cost components associated with the production of a unit test. If the variation is small, then the cost element need not be measured for every output resource. If the variation of the sum of all basic components to direct cost is small, when observed in the production of many output resource units, then the entire direct cost need not be measured for each output resource. One must continuously monitor only those component costs which represent significant variation in the total cost. Other component costs may be established as fixed for a given resource, and their stability checked on a weekly, monthly, or quarterly basis as appropriate. Some observations of the system operation must be made to determine what is appropriate in each case.

In addition to the direct cost of a resource there will be some cost associated with the dynamics of producing that resource. Consider for example, the serum sodium determination. The cost-center (laboratory) that produces serum sodium determination also manufacturers other tests; some of the equipment and many of the personnel may come in to play not only in the production of serum sodium determinations, but in the production of other test results. The cost associated with maintaining such shared-cost components in the presence of a given volume and mix of output items is the utilization-dependent overhead component. In our example of the serum sodium determination, if a flame photometer is used, we may find that it is also used in other electrolyte determinations. But its cost, when not in use, should be distributed (as utilization-dependent overhead) to all the test types which require it. Similarly, laboratory equipment must be calibrated and standardized whether or not a large volume of tests are accomplished in the period between calibrations. Again, this is utilization-dependent overhead.

Observation of the present system will be required in order to establish the nature and dynamics of this overhead component. Further, since manufacturing methods differ from institution to institution, it will be necessary to explore this cost component in several settings before system-wide standards can be established.

The third cost component is independent of any unit resource production or consumption—the cost of maintaining the facility and the provider work force. It is commonly called institutional overhead and is characteristically independent of the functional activity in the institution over short periods of time (weeks, months).

The present plan is to conduct a 3-month study of budget accounting in the Boston VA Hospital, toward the identification of how to begin data collection, and estimate the cost associated with implementation of a pilot program of functional accounting.

3.5 Toward a Quality-Control System

Earlier we identified a set of diseases and conditions which is being promulgated by HEW as a list of diagnoses suggestive of unnecessary disease, disability, and intimely death.[2] The list is organized into three parts.

(1) Conditions suggested for immediate use as a quality-surveillance index, with an indication for each as to whether the occurrence of the disease is preventable and whether unnecessary disability or untimely death is associated with prevention or with treatment.

(2) Conditions where prevention or clinical management is highly effective but more than one case (or a single death) should be required to initiate immediate inquiry.

(3) Conditions requiring improved definition and special study.

We have previously reported a snapshot look at the prevalence of these conditions in the VA case load for calendar year 1973 (Appendix A). But we should establish the occurrence trends of these conditions in the VA system and develop the associated information about death rates. This can be done easily with the PTF data base defined later in this chapter. The result of this analysis will establish:

(1) The magnitude of the case-review job that we may associate with implementation of this quality-surveillance index.

(2) The conditions on which the VA clinical system should concentrate—those which we observed to occur in the population that presents for VA care.

Thus, it is recommended that occurrence, occurrence rates, and death rates for these conditions be tabulated for the years 1970 to 1975.

Prospectively, it is suggested that cases falling within the first list (conditions suggested for immediate use as a quality-surveillance index) be reported by exception within an institution at that time of their occurrence, and reviewed at the institutional and/or district level. Two appealing features of district-level review arise.

(1) It will tend to more clearly separate the review body from the attending provider work force.

(2) It will provide uniform review procedures for a more diverse population of patients than are encountered within a single hospital.

It is recommended that the second list of conditions be similarly handled—but with review on a district or national level (rather than institutional level). Thus, larger case aggregations will be available for determination of occurrence rates. The third HEW list of quality-surveillance conditions includes some conditions which represent a large volume of the VA patient-care activities—especially alcohol-related conditions. In this area, the VA should take the lead in studies to identify criteria related to the effectiveness of care. One such study is outlined below.

If one heeds the anecdotal observations of health-care providers, a question quickly comes to focus. Namely, do those who use detoxification and rehabilitation facilities actually manage to emerge with a comfortable and productive life? Perhaps, instead, they simply move about in the treatment system—their movement punctuated by periods of acute ethanol intoxication.

It is difficult to define a set of measurements of the individual patient that can be used, together with some criteria of "good" and "bad", to identify a successful outcome for the alcoholic. Thus, retrospective studies are hard-pressed to address the question of effectiveness of care in the individual case. The measurement called "time outside the treatment system", however, may be useful in assessing health-care-process effectiveness in three ways. First, by differentiating between

patterns of resource use which tend to result in reuse of resources and those which do not. Second, by identifying those programs which tend to promote long periods of departure from the health-care system. Third, by identifying variation, within each treatment method, in the nature of continuing use or reuse of the health-care facilities.

It seems likely that analysis of the existing care-delivery system can address these issues—so long as all institutional facilities available to the individual patient are identified. Such analyses will not solve the problem of defining "good" or "bad" patient outcome measurements. Nor will they relate individual attributes of the patient to his potential for rehabilitation in one treatment program or another. They will, however, size up the operating characteristics of the present treatment system in terms of identifying:

(1) The patterns of facility use and reuse which represent high-volume system activity.

(2) The relative dollar cost of alternative patterns of resource use by individuals.

(3) The effectiveness of alternative treatment methodologies with respect to the length of time patients spend outside the health-care system.

We contend that such a knowledge base is prerequisite to the design of prospective studies of either the effectiveness or dollar efficiency of treatment.

In order to perform such analyses, it is first necessary to define a data set which will describe:

(1) The range of available treatment plans—classifying each, for example, as medical/surgical, simple detoxification, halfway house, outpatient, or voluntary social-service program.

(2) The average cost of each treatment plan in each institution per patient per unit time.

(3) The geographic model of the location of each institutional facility for patient care.

(4) The population of individuals who have used the system, and their individual age at encounter, LOS (inpatient), or length of participation in the program, and geographic location of home.

In this light, the data set for a specific patient might take the form of records, repeating by patient identifier, with the following format.

Field Number	No. of Characters	Name of Data Element
1	9	SSN
2	4	Institution
3	3	Treatment plan
4	6	Admission date YYMMDD
5	4	Date of birth YYMMDD
6	6	Discharge (departure) date YYMMDD
7	5	Home location (zip code)
8	5	Principal diagnosis (if inpatient)
9	15	Associated diagnosis (maximum 3) (if inpatient)

After the cohort data set was obtained, and the system model of institutional operation defined, two analyses would be performed. One would track the use and reuse of resources by individual patients in time and geographic location. Another would identify the variation in patient time spent outside the health-care system as a function of institution and of treatment plan. Both activities should include cost and cost-variation analysis.

The goals, of course, are to identify the nature of volume activity in the system, and the variation in cost and apparent utility with respect to permanent rehabilitation. This information should point one in the direction of prospective studies with the maximum likelihood for early payoff in terms of improving efficiency or effectiveness, or suggest that few improvements were possible with the existing clinical knowledge base. The problem is that considerable interagency cooperation is essential for such activities. It may be relatively easy to define a patient cohort, but it is less simple to enlist the cooperation of all possible facilities to which a member of a cohort may have access.

Returning to the HEW list of conditions associated with health-care quality surveillance, let us consider some implications of implementing such an index. Two questions are immediately raised. First, should

this system be expanded to include the case review of conditions which are perceived to be intimately related to quality control? Second, can the expansion of this activity form the basis for a system of concurrent review?

With respect to the first question, one may note that a systemized nomenclature of such conditions is not well-developed. For example, in the present operational data stream it would be difficult to capture, at the time of onset, such conditions as:

(1) Post-operative hemmorrahage.

(2) Decubitus ulcers.

(3) Contractures, and contractures with stroke.

(4) Gram-negative pneumonia and septicemia.

(5) Post-operative wound dehiscence.

(6) Anaphylaxis, and renal failure caused by antibiotics.

(7) Mortality associated with certain procedures such as cardiac catheterization.

The first step in defining such a list of quality-control flags is to establish their presence or absence in the system. This may be explored using the PTF data base defined in this chapter and an interactive file management system. For example, conditional case sorting such as the selection of cases of death, under age 65, associated with operated inguinal hernia as a sole diagnosis may be rapidly accomplished. Based on the incidence of such untoward health events in the observed population, an initial set of quality-control indicators could be delineated. The problem, then, would be to implement a reliable mechanism for detecting and flagging these situations during the course of patient care. The alternative methods are:

(1) To assure their capture, after the fact, by record abstract.

(2) Attempt their source capture at the time of occurrence (difficult to implement without supplementing the provider team with someone directly responsible for the quality-control function).

The degree of difficulty associated with source-data capture is dependent on the organizational structure. Thus, the ability to implement this approach may vary in difficulty from institution to institution. Since source-data capture is always more appealing than record

abstracting, this possibility should be explored in a few institutional environments prior to a recommendation for such system-wide data collection.

The second suggested expansion of quality surveillance and control, concurrent review, should be aimed at the review of both process effectiveness and efficiency—assuring an acceptable quality of care for a minimum dollar cost, in support of the best possible patient outcome. We have already pointed out the complexity of the judgments involved; individual outcome is sufficiently complex to warrant care review by clinical committees. We recommend that a three-level (institution, district, and national) care-review system be established. Toward the development of such a system, we recommend the continued analysis of inpatient LOS. Initial studies in this arena may be performed using the PTF data base defined later in this chapter. They should address the quantitative definitions of:

(1) Number of cases by year of age for specific values of LOS associated with unique conditions or groups of conditions.

(2) Number of cases by LOS for specific values of age associated with unique conditions or groups of conditions.

(3) Items (1) and (2) above as a function of the use of surgical procedures, the presence of associated diagnoses, and the length of time a patient has been treated for a specific condition in the VA system.

These analyses are required in order to better define the role of LOS as a flag which is useful in discharge planning and resource utilization review. Mean LOS analyses will have much greater significance when the distribution of cases around the mean is better understood (when reproducible observations of this variation have been identified).

3.6 The Data Base for Inpatient Analyses

The analyses suggested in previous sections of this chapter may be accomplished with a PTF data set containing all records of male inpatient admissions to VA general medical and psychiatric institutions during the period 1970 to 1975. The record layout should be as indicated below.

Field Number	No. of Characters	Name of Data Element
1	9	Patient identifyer
2	4	Date of birth (YYMM)
3	5	Principal discharge diagnosis (this episode)
4	6	Admission date (YYMMDD)
5	6	Discharge date (YYMMDD)
6	2	Number of discharge diagnoses
8-11	20	Associated diagnoses (0-4)
12	1	Number of procedures (9 maximum)
13-16	20	Procedures (0-4)
17	3	Station number
18	1	Disposition (life-death-autopsy)
19	3	Blank
	TOTAL 80	

3.7 Outpatient Analysis Activities

As we noted in Chapter 2, no data that could be aggregated by patient (as opposed to visit) has been regularly collected on ambulatory care above the institutional level in the VA. In February of this year, such a data base was initiated. It will provide by abstract from the Clinic Routing Slip (VA form 10-2875) a data set for 10 percent of the visits in VA institutions. Initial analyses suggested for this data base will require the following data elements:

(1) Social Security Number (SSN)

(2) Zip Code

(3) Birth year

(4) Location of visit

(5) Disposition

(6) Clinics visited

(7) Date of visit

(8) Facility (station code)

(9) Diagnosis (beginning in fiscal year 1977)

At some point it is suggested that the data collected for the 10-percent sample be compared to data found on the same form but not included in the sample. Such a comparison may reveal something about the utility of the sample data for making predictions. For example, the sample data will always contain a diagnosis (once diagnosis is included in the sample in fiscal year 1977), but that need not be recorded outside the sample. If it is rarely found outside the sample, the accuracy of diagnosis as a resource predictor may be small, and other means of characterizing the population must be sought. Certain data elements, such as clinics visited, will be found on most all forms both in and out of the sample and can serve to accurately define volume activity.

3.7.1 Defining System Volume Activity

In lieu of a diagnostic statement, the initial characterization of system activity must be made on the basis of clinics visited. The format indicated in Figure 3-2 is suggested. By definition, a patient

CLINIC	NEW PATIENTS		REVISITS		TOTAL VISITS	
	NUMBER	PERCENT TOTAL	SAME CLINIC	DIFFERENT CLINICS	NUMBER	PERCENT
CLINIC 1						
2						
3						
4						
5						
⋮						
n						

Note: Clinics ordered by descending number of new patients.

Figure 3-2. Suggested format for clinic index.

presenting for ambulatory care at the onset of data collection (February 1976) is a new patient. Thereafter he will represent a revisit upon his return to the same, or a different, clinic. The local institutions have established their own clinic nomenclature. However, a complete list of possible clinic stops at all institutions will soon be available.

The later collection of the variable diagnosis offers several possibilities for investigating patterns of activity. In the ambulatory-care environment, especially during the initial (diagnostic) phase of a new patient's encounter with the system, the diagnostic statement will not be well-developed. On the other hand, when a course of therapy for chronic disease is established, one might reasonably expect both the diagnosis and clinic stop to repeat from visit to visit. Although clinic nomenclature has been locally developed, the idea of a clinic is to organize the provider work force of specialists. Hence, clinics tend to address problems of specific biological systems. ICDA diagnoses are also organized by human system. Thus, one might expect that many diagnoses would appear in only one or two clinics.

If we are to explore the specification of total patient care (linking inpatient and outpatient episodes) and, if we are to seek patterns of resource use by diagnosis, then it is important to establish the characteristics of the variable diagnoses in the clinic environment as soon as possible. A suggested variation of the clinic index, including the variable diagnosis, is indicated in Figure 3-3. The index will show us the characteristic distribution of diagnoses across clinics, and give us disease-occurrence information which may be compared with the results of previous inpatient analysis.

3.7.2 Developing a Characterization of Clinic Operations

In addition to actively defining the volume of the present clinic setting, and later defining the case load-case mix based on diagnoses, there are two analyses that may be performed with this initial data set. First, it will be useful to establish the difference in resource reuse that occurs, by clinic (and later diagnoses), as a function of patient age. Second, it is essential to seek ways of separating clinic use due to chronic treatment from clinic use for other purposes. Initially, it is suggested that, for each clinic, the age-characteristic return rates

	NEW PATIENTS		REVISITS		TOTAL VISITS	
	NUMBER	PERCENT TOTAL	SAME CLINIC	DIFFERENT CLINIC	NUMBER	PERCENT
CLINIC I						
Dx_1						
⋮						
Dx_n						
CLINIC II						
Dx_1						
⋮						
Dx_n						
CLINIC M						
Dx_1						
⋮						
Dx_n						
TOTAL						

Figure 3-3. Format for a diagnostic index of clinic operations.

to the same clinic, and to different clinics be calculated. The output format of such an analysis is indicated in Figure 3-4. If distinct reproducible patterns are observed, then this may become a useful predictive tool.

We may also explore the movement of patients among clinics through a cross-tabulation of clinics. For patients visiting a given clinic we can see what other clinics they most frequently visit. The output format of such an analysis is indicated in Figure 3-5.

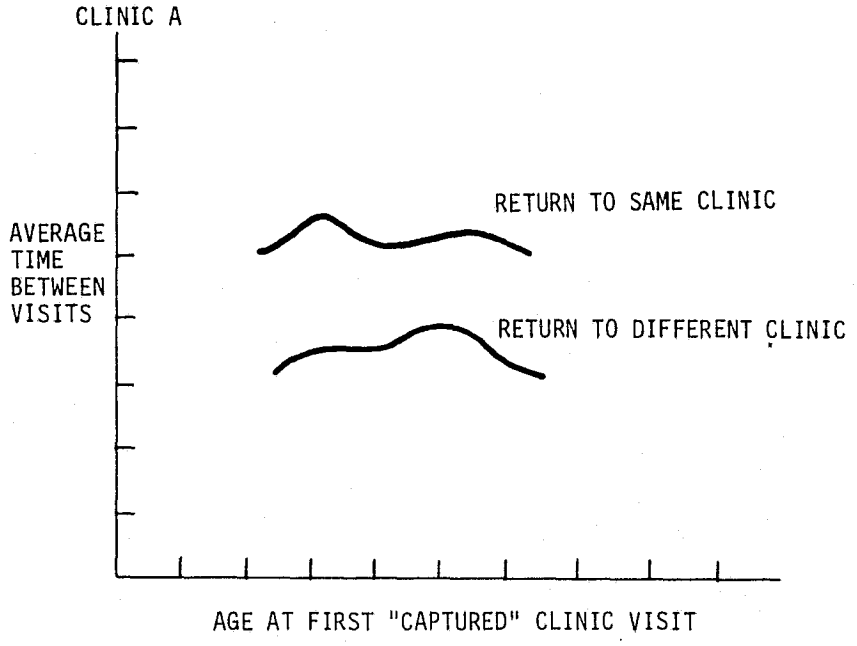


Figure 3-4. Suggested output format for analysis of age-specific clinic reuse.

	SECOND VISIT					
FIRST VISIT	CLINIC					
	A	B	C	D	.....	N
CLINIC A						
B						
C						
D						
⋮						
N						

Figure 3-5. Output format of multiple-clinic-use analysis.

With these basic indices as guides to the presence, or absence, of reproducible patterns in the outpatient activity, we may explore variation observed to occur in the several data elements of this initial data set. Such analyses are best performed on an interactive data retrieval and analysis system since, before the fact, it is impossible to tell which analyses will present distinct patterns of potential use in predicting patient activity.

With the advent of diagnosis in the data base, several analysis questions are suggested.

(1) What is the relationship between the age-specific disease-prevalence characteristic observed for inpatients and that observed in ambulatory care.

(2) What is the age-specific pattern of frequency of return (or time between visits) by diagnosis.

(3) What are the characteristics of visit disposition by diagnosis.

(4) What are the geographic variations in these indices.

(5) In an inpatient/outpatient-linked data set, what is the diagnosis-specific relationship between inpatient LOS or time between admissions and frequency of outpatient visits.

3.7.3 Outpatient Resources

After initial analysis of the outpatient activity, a prospective study must be designed to permit resource-use analysis similar to that now being initiated with Washington VA Hospital inpatient data. Resource use in the ambulatory-care environment may be less complex than in the inpatient setting. But, we will not have a quantitative model of this effect until orders for patient-care resources and provider time are accounted by individual patient. A pilot study of how to capture outpatient-resource utilization data should be performed during 1976, in order that data collection may proceed after the initial analysis of clinic-activity characteristics. It is logical to combine this study activity with the pilot study in functional resource accounting which has been suggested for implementation at the Boston VA Hospital Center for Health and Care Management.

3.7.4 Overall Quality Control and the Outpatient Sector

It is important to remember that the care of an individual patient is a continuum of activities. Many patients' care requires both inpatient and outpatient treatment for the same problem. The kind of care delivered in each area may be extremely different, even for that one patient. The quality of the care in each area may be evaluated separately. But these separate encounters must be related if the overall quality of care in the system is to be determined.

Dr. R. H. Egdahl, in a recent editorial in the New England Journal of Medicine[3] has pointed out the necessity of extending quality-of-care evaluation through the inpatient sector into ambulatory care. Several significant points are discussed. Dr. Egdahl concludes, "First of all it will be impossible without post-discharge ambulatory-care audit to assess the 'quality' impact of constricted lengths of stay or seemingly cost-effective diagnostic or therapeutic regimens. It will also be impossible to justify the creative use of screening procedures unless long-term evaluations, involving both inpatient and ambulatory dimensions or care, are undertaken." The appropriateness of given LOS for patients with given diagnoses will be much affected if those patients are found to be progressing very slowly in their outpatient followup. The frequency of return variable that can be derived from the 10-percent sample might be linked to LOS to help the providers determine the most appropriate course of inpatient treatment and outpatient followup. The evaluation of diagnostic and therapeutic procedures (see Section 1.6) will also require that the entire course of a patient's treatment be considered. As with LOS, what seems appropriate from evaluating hospital care may belie the facts which the patient's ambulatory care reveals. Again the frequency-of-return variable may be useful.

3.7.5 Quality Control within the Outpatient Sector

The difficulties associated with evaluating care (see Section 1.6) in general, are multiplied in the outpatient sector. One significant reason for this fact is that the ambulatory-care patient is not "captured". Whatever problems are associated with defining a satisfactory outcome in general, they will be greater for a patient who does not return to be checked. It will be difficult to review concurrently, for even if some criteria for selecting cases are developed, the patient may not be there when he is chosen to be reviewed. And, as we have

noted, an ambulatory patient, by definition, cannot have an LOS. Obviously, the large bulk of review will be retrospective.

There is one other problem which is unrelated to the patient's mobility. As of now, there is no large information base that contains data on patients and their medical problems in ambulatory-care settings. Without any observations of the presenting population it is impossible to develop implicit standards for care. Therefore, the first methods of evaluation must depend upon explicit standards. The list of conditions that the HEW Committee (see Section 2.1.5) has deemed able to be cured or arrested can serve this purpose. All cases representing these conditions can be flagged and the records reviewed retrospectively. The number of cases that can be reviewed this way will be relatively small so that further mechanisms for evaluation will need to be developed.

The 10-percent sample might provide an opportunity for developing other evaluation mechanisms. When a diagnostic index is developed and the age characteristic is explored, potentially useful patient groups can be identified. For the outpatient sector, a patient's frequency of return might be used in a way that is similar to the way in which LOS is used in the inpatient sector. If a given patient returns significantly more often or significantly less often than the norm of patients his age with his diagnosis, his case could be identified for review. A positive aspect of this process would be that the review need not be retrospective. Identified as requiring review after his last visit, the patient can be reviewed concurrently on the next visit. It will be important to examine the statistical character of frequency of return before using it for review identification. If the variation in that measurement is normally distributed it will be of little value. If diagnosis is not available for most outpatient visits, then alternate problem descriptors could be explored with several prospective studies. The presenting complaint might be used if it were structured so as to limit the number of possible values. SNOMED might provide a useful structure for describing problems since the values are limited and the division of the nomenclature into fields allows the problem descriptor to grow as diagnosis and treatment progress.

The utility of flagging cases by frequency of return (or LOS) for evaluating effectiveness will depend entirely on how those cases are reviewed. If outcome is not distinctly evaluated, the value of this

mechanism for identifying cases that have a high probability of representing poor outcomes can never be determined. If this is so, the measurement of frequency of return may only be useful for resource management. Since standards for outcome, either explicit or implicit, are scarce, mechanisms for developing them should be explored. One method might involve seeking articulations from the physician concerning his expectations for treating a particular patient. These articulations could take the form of goal statements. Consider the following examples: "I want to have a bacterial culture with phage type and antibiotic sensitivity for this patient"; or, "I want to reduce this patient's fever"; or, "I want to eliminate this patient's β streptococcus infection." These goals represent different types of medical care but each could be the proper imperative depending on the circumstances. In general, goals tend to be specific to the diagnostic process or to treatment. Though establishing a diagnosis is always a prime concern of the physician, sometimes treatment must be started before diagnosis is complete. Thus, a physician may wish to reduce a patient's fever before waiting for the nature of his disease to be identified. Or, in the case of trauma, a physician's goal might be to stabilize a patient's fluid balance before determining the full nature of the trauma. One might ask again Holden's five questions (see Section 1.2) and categorize goals accordingly. These questions will generally be addressed in a certain order, but, as with diagnosis and treatment, the order will not apply to all cases.

Sets of goal statements could be developed either explicitly or implicitly. The first method would involve having a group of physicians decide on a list of goals considered appropriate for a variety of medical care. Classes of goals could be established and requirements concerning the kind of information considered appropriate in each class could be set. The second method would require that each physician record what he considered to be the principal goal for that episode. These goal statements could be reviewed for similarities, seeking ways of limiting the number of possible different statements, or grouping these statements into a small number of classes. Most probably, a series of iterations using both methods would yield the best understanding of both the possibilities and limitations of creating goal statements that repeatably convey useful descriptive information.

The real value of goal statements would be their ability to act as interim outcome measurements. Whether or not a goal is achieved could

potentially reflect the quality of care delivered. However, this need not always be the case. The achievement of a goal will not reflect a good outcome if the goal was not appropriate in the first place, and the failure to achieve a goal will not reflect poor care if the subtleties and complexities of a case prove that goal to be unrealistic or inappropriate. However, no system for evaluating the quality of medical care can possibly develop concrete and universal standards. The utility of goal statements for evaluating care will be determined almost entirely during the process of developing those statements. Goal statements will need to:

(1) Be clear articulations of accepted medical activities.

(2) Be applied in specified contexts in which they are deemed appropriate (e.g., some goals would not be considered appropriately applied if certain diagnostic work had not preceded them, or if certain patient characteristics were normal at the outset).

(3) Represent activities that are agreed upon as potentially able to positively affect the patient's outcome (in a specific context).

The realistic possibilities of using goal statements for evaluating the quality of care can only be soundly determined when a group of practicing physicians representing experience in a variety of medical specialties and organizational settings, and a management representative familiar with the problems of gathering information, convene and systematically address the issue. The principal benefit of goal statements to the outpatient sector is that they would provide some measurement related to the quality of care for almost every patient visit. And only one measurement (or at least a small number of measurements) would be required for each patient. Even if evaluating all outpatient care is impossible, the number of cases that it would be possible to evaluate would be high. The goal statement method would not depend upon the establishment of a diagnosis and could be more suited to the variety of ongoing care found in the outpatient sector.

There is a great diversity in the nature of different kinds of ambulatory care, and different classes of care require different considerations for developing outcome measures. There will be some outpatient visits that do not require an extended course of diagnosis and treatment. These will include such categories of care as physical examination on patient request, preventive medicine visits, educational

visits, and administrative visits. It is difficult to attach a figure of merit to physical exams on patient demand, as no study has shown definitively how routine physicals improve the health of the patient. To develop a thoroughly applicable outcome measure for preventive medicine, one must establish the nature of the risk to the patient, and then follow him for an appropriate period of time, which may be a significant part of his lifetime. The success of educational visits cannot really be measured without tracing the patient's future actions to see if he has absorbed his new knowledge. There is no relevant medical evaluation of an administrative visit. Perhaps the only relevant outcome measure at the encounter level for these categories of care would be the answers to the questions: "Is the patient satisfied?" or "Is the physician satisfied?" or "Did the form get filled out?" These categories of visits will not represent a large percentage of ambulatory care, but still, identifying them can be quite important. These visits can be handled with a degree of routine that is impossible when dealing with disease states. Because the volume of visits in the outpatient sector is so high, the efficient handling of care in these categories could free more time for clinicians to deal with the treatment and evaluation of the diseases that demand the most from their professional expertise.

3.8 Management Information System (MIS) Development

A decision-making approach to the question of MIS centralization versus decentralization has been reported[4] in application to the health-care delivery environment. During the next year, this methodology will be applied to VA institutions in VA district 1, in order to illuminate the potential cost effectiveness of alternative MIS configurations in application to the VA health-care system.

At the same time, it may be possible to explore the operational problems of data capture, communication, and data-base management in one or more VA institutions. The mechanism for accomplishing this study will include the experimental installation of a data capture and data-base management system in the Boston VA Hospital. From the standpoint of implementing prospective management research protocols, the availability of such a data system is essential. Consider the following qualities of the proposed GIM II system:

(1) The ability to use data elements from the data base maintained for operational (hospital) applications in a separately structured research data base.

(2) The ability to add information to the research data-base off-line to hospital operations.

(3) The ability to restructure the research data base, without programming support, independent of the operational (hospital) data base.

(4) The ability to manage the research data base to select record populations on the basis of Boolean criteria, create variables derived from previously captured data elements, count events and total or average, and tape output files for subsequent statistical analyses.

Consider, for example, the utility of these qualities of the proposed MIS to three studies of ambulatory-care dynamics.

(1) Developing a predictive model of problem occurrence in ambulatory care.—Medical problems are well-defined and these definitions are uniformly accepted in inpatient care, such as the ICDA list of diagnoses. For various reasons, such nomenclature is not as well-developed in such wide use in ambulatory care. Developing such a structured nomenclature begins by considering numerous candidate variables (e.g., complaint, category of visit, diagnosis (conventional), clinic, etc.). In order to identify relationships that will predict volume activity in ambulatory care, such variables must be related to patient attributes (e.g., age, race, sex, geographic location, etc.).

Without a data-entry/data-management system in the institution where the research is to be conducted, all data would have to be abstracted for the research by hand. In an applications-oriented fixed data-base system (such as AHIS) the development of a research data base or its modification in either content or structure, would require programming support. In the proposed MIS environment, data elements which are used operationally in the hospital may be linked to the research data base, the research data-base structure may be modified without programming support, and data may be added to the research files off-line from institutional operations.

This reduces (probably by a factor of two to four) the costs associated with research-data acquisition and eliminates the need for programming support in maintenance of the research data base.

(2) Developing a predictive model of resource use in ambulatory care.—This exercise requires linking health-care resources which are ordered by providers to the individual patients who consume them, and subsequently identifying patterns that occur by problem category (item (1) above) or patient attribute. In the nonautomated data-processing environment, of course, all data capture for research would be by abstract. In the partially automated environment, research-data capture would require reentry of data, and attention to the structure and currency of the automated data-base segments providing the data (such as the laboratory information system). In the proposed MIS environment, with a link between the laboratory data base and the information system, the capture of research data may be accomplished without reentry or reformatting the data in many cases.

(3) Studying resource reuse.—At the time of data entry for the operational purposes of patient and resource scheduling, date/time information associated with both the return of patients and their continued reuse of multiple resources may be derived (from the MIS clock) and provided directly to the research data base. This eliminates preprocessing of research files before they are entered into an interactive data-analysis environment and, of course, manual collection or transcription of such data.

In scenarios such as the three operations analysis activities described above, the researcher is constantly faced with a need to:

(1) Explore new relationships between captured variables.

(2) Create or derive new variables.

(3) Structurally change his file system (invert on different key variables).

Such analysis activities must proceed with very limited scope when manual data abstracting and file maintenance is required. The conduct of such research is almost totally dependent on automated-data capture

and file maintenance. Recognizing this fact, we have thus far worked only with existing data bases (PTF, AHIS, etc.)—and even in these cases we have no ability to modify captured data or derived variables outside the data-processing/analysis environment of the research computer. A GIM II type of system will significantly speed management analysis activities—especially in the outpatient sector where even a basic operational data set is, at best, poorly defined.

CHAPTER 4

THE IMPACT OF NEW TECHNOLOGY ON THE DELIVERY OF HEALTH SERVICES

Rapid technical advances in the aerospace and defense sectors of our economy during the 1960's have created a sizable reservior of technology and technical expertise which has not yet enjoyed application to health-care delivery. There is considerable effort devoted to identifying specific clinical problems which may be solved, wholly or in part, by existing technology. While improvement in our society occasionally arises from the identification of a problem that fits a specific solution, this is the exception rather than the rule. If the objective of technological innovation is, in fact, to better man's lot, then perceived problems of social systems should be clearly articulated—and the priority or perceived value of solving the problem clearly identified—before engineering development activities are initiated.

Now what about priorities, specifically in the health-care sector? What are the yardsticks which may be applied to determine the relative utility of solving one problem or another? Two types of values must be considered.

First, there is the value of health and well-being to the individual. On the value scale of individual patient health, death is the least desirable outcome of medical care. When the physician must choose between a new innovation and conventional care, he will act conservatively; thus, the probability of inducing disability with new therapeutic methods is always carefully weighed against the probability of a poor prognosis with conventional care. Since the probability of inducing disability must be determined from observation of those who are treated, it may take a very long time to acquire clinical evidence in support of health-care innovations. This has the effect of lengthening the time between development effort and marketplace for a new product—frequently 5 to 10 years—which is long enough to make most

manufacturers wonder about the return on their investment. After all, in our society, many advanced technology products have become technically obsolete in 5 to 10 years.

Even if the new product is acceptable to clinical medicine—let us say it is foolproof in clinical application—there is the question of how much it will help the patient. What is the value of saving a life? For 1 year? For 10 years? Is one life worth more than another? This value scale is not very refined in our society. And what if the new product provides only temporary or incomplete rehabilitation for the patient? Should its production in volume be encouraged, or should the problem-solving activity press on until an ultimate solution is achieved?

In order to address these questions, one must consider not only the value of health and well-being to the individual, but also the value of an individual's health and well-being to the society. The resources which can be turned to saving or prolonging life are finite. Can we afford the overproduction of health-related goods and services associated with ensuring that everyone, regardless of where they are and when they are there, has access to all of the clinical technology that we can muster? The timeworn example of a situation where there are more people with clear-cut clinical need for a respirator than there are respirators is taking some new twists. We have apparently progressed. Ten years ago we were deciding that "equal care for all" did not imply that if there weren't enough respirators to go around, then no one should have access to any of them. Today we are beginning to see ethical guidelines for clinical care that are quite specific about these issues. The published recommendations of an ad hoc conference on "ethical issues in newborn intensive care"[1] includes, among its conclusions:

> "If an infant is judged beyond medical intervention, and if it is judged that its continued brief life will be marked by pain or discomfort, it is permissible to hasten death..."

In other settings this has been called euthanasia. And:

> "If it is necessary to discriminate between several infants [because of lack of space in a newborn intensive care unit] it is ethical to recommend that theraputic care for an infant with poor prognosis be terminated in order to provide care for an infant with better prognosis."

Perhaps this is a corollary to the old axiom "survival of the fittest".

In any event, it is neither our intention to establish ethical guidelines for the utilization of scarce clinical resources, nor to approve them. What we seek to do, is to identify the nature and magnitude of resource need toward the goal of providing measurements and information to the profession on the basis of which they can rationalize clear-cut decisions about clinical-care policy.

We recommend that the VA consider establishing a working group, from within their community of clinical providers and the most prestigious level of the profession, to consider the potential of scientific research, clinical research, technological innovation and technology development--and the reality of marketplace dynamics—for each of the top 200 most frequently occurring conditions treated in VA facilities today. The findings of this group, perhaps revised yearly, should take the form of clear-cut problem identification and the establishment of VA clinical research priorities for evolving better patient care.

But there are needs and opportunities for technological innovation in health-care delivery outside the arena of individual patient care.

We have suggested (at some length in this text) that the health-care system may be considered as a structured set of patient-care resource production activities. We have hypothesized that the production cost of output goods and services from the system may vary—independent of the quality of those resources. And we have discussed the nature of the information system—that portion of the structure through which data and information moves. As we begin to characterize the system structure—to identify the interactions between production centers in terms of the dynamics of patient-care-resource cost—we will begin to identify clear-cut issues of system efficiency. The available technology of process automation and information processing may be helpful in both increasing the output of goods and services, and in reducing unit cost.

There are some significant costs associated with operation of the present system independent of the individual patient. They are necessary costs, but perhaps new technology can help us to reduce them. For example the data base of individual inpatient care (PTF) is acquired by abstract from from discharge records at each VA institution.

If an average of two FTE employees were required at each of 180 stations (at an average cost of $7,000 per year per employee) to accomplish this record abstract, then the annual cost would be $2,520,000. Suppose that, quite apart from any consideration of this PTF maintenance function, we rationalize a data capture, storage, and retrieval system that improves the efficiency of managing patient care. If such a system automatically provides PTF abstract data, from single-point-source data capture without additional record abstracting, then we have saved some or all of the PTF abstracting cost. One can buy a lot of sophisticated analysis capability—or a lot of data entry devices—for $2,000,000 a year.

But it takes time to clearly identify how the health-care system works and what barriers to improved efficiency presently exist. We argue that it is prudent to take that time and develop system improvements only after the requirement for change has been clearly articulated.

The objective always should be to seek the most efficient and effective way of operating the system day by day, not the quickest way to use the most exotic technology which is available. In the process of doing this, it will be necessary to exercise a certain amount of technological overkill. In research and pilot demonstration development, we will need to explore a range of solutions to identified problems in order to determine what works the best. The key to identifying "what works best" will be a well-defined evaluation protocol for all development and demonstration activities.

We believe that, through continuation of the EDP cost analysis of Rockart et al. (MIT, Sloan), evaluation criteria for a VA data system will emerge during the forthcoming year. This effort, concomitant with research and development related to the core-computer concept, should give rise, in a 2- to 4-year time frame, to a clearly defined EDP requirement for the VA system.

We believe that the information systems area will be the first to demonstrate increased system efficiency through the use of new technology.

APPENDIX A

ANALYSIS OF SOME VARIABLES CONTAINED IN THE
CALENDAR YEAR 1973 PATIENT TREATMENT FILE

A.1 The Data Base

A nine-track 1600-BPI, magnetic data tape was prepared at the Austin, Texas VA data-processing center by abstract from the 1972, 1973, and 1974 patient treatment file (PTF). For each episode with 1 or more days of inpatient stay in a VA-operated general medical and surgical (GM&S) or psychiatric hospital during calendar year 1973, the record layout shown in Figure A-1 was included. Subsequent processing of this tape yielded patient age in 1973 (from date of birth), and length of stay (LOS) using the dates of admission and discharge.

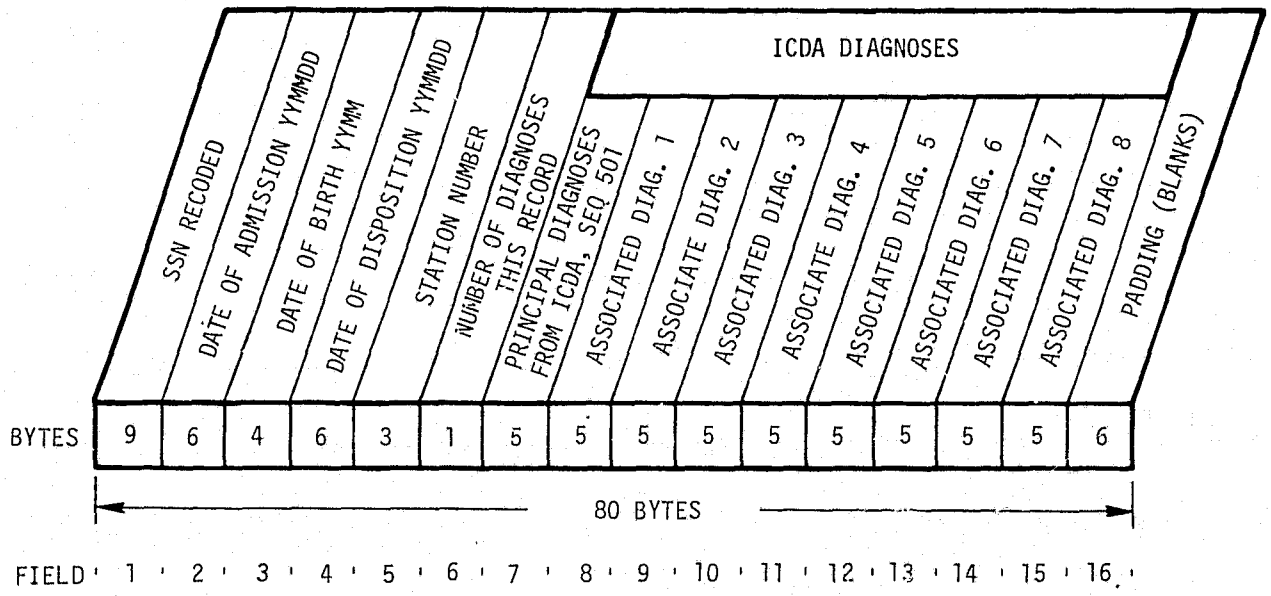


Figure A-1. Record layout of PTF abstract data tape.

When more than one episode involving time during calendar year 1973 occurred for an individual patient, the file was organized by repeating records within a social security number (SSN) recode.

A.2 The Record Population

Two populations of records were identified.

(1) All episodes included in the data base.

(2) Nonrepeating (NR) episodes. This population of records includes, for each observed ICDA-8 diagnostic code, the first record for each unique SSN recode with that ICDA code as a principal diagnosis. That is, one record per patient was selected after inverting the file on principal diagnosis.

In the VA system, the principal diagnosis is defined as the diagnostic code associated with the principal reason for the LOS of the inpatient episode. Associated diagnoses are defined as other conditions for which treatment was provided during the course of the episode.

The data base was found to contain 1,013,269 episodes, involving 621,973 unique SSN recodes (patients). The NR population numbered 801,817 records.

A.3 The Diagnostic Index

A diagnostic index (Appendix B) was prepared using the logical flowchart shown in Figure A-2 and the Fortran program that is listed in Figure A-3. For each unique value of ICDA-8 code on the data tape, the frequency of occurrence as a principal diagnosis (PDx), and as an associated diagnosis (ADx), was tabulated. This tabulation was performed for both record populations: all episodes, and NR episodes. Also for each record population, the number of times a particular ICDA code occurred by itself (as a sole diagnosis) or with one, two, three, or four other diagnoses, was tabulated.

A second tabulation, Figure A-4, was simultaneously prepared. It tabulated:

(1) The number of patients (discrete values of SSN recode) as a function of the number of inpatient episodes which occurred for any given patient during the course of calendar year 1973.

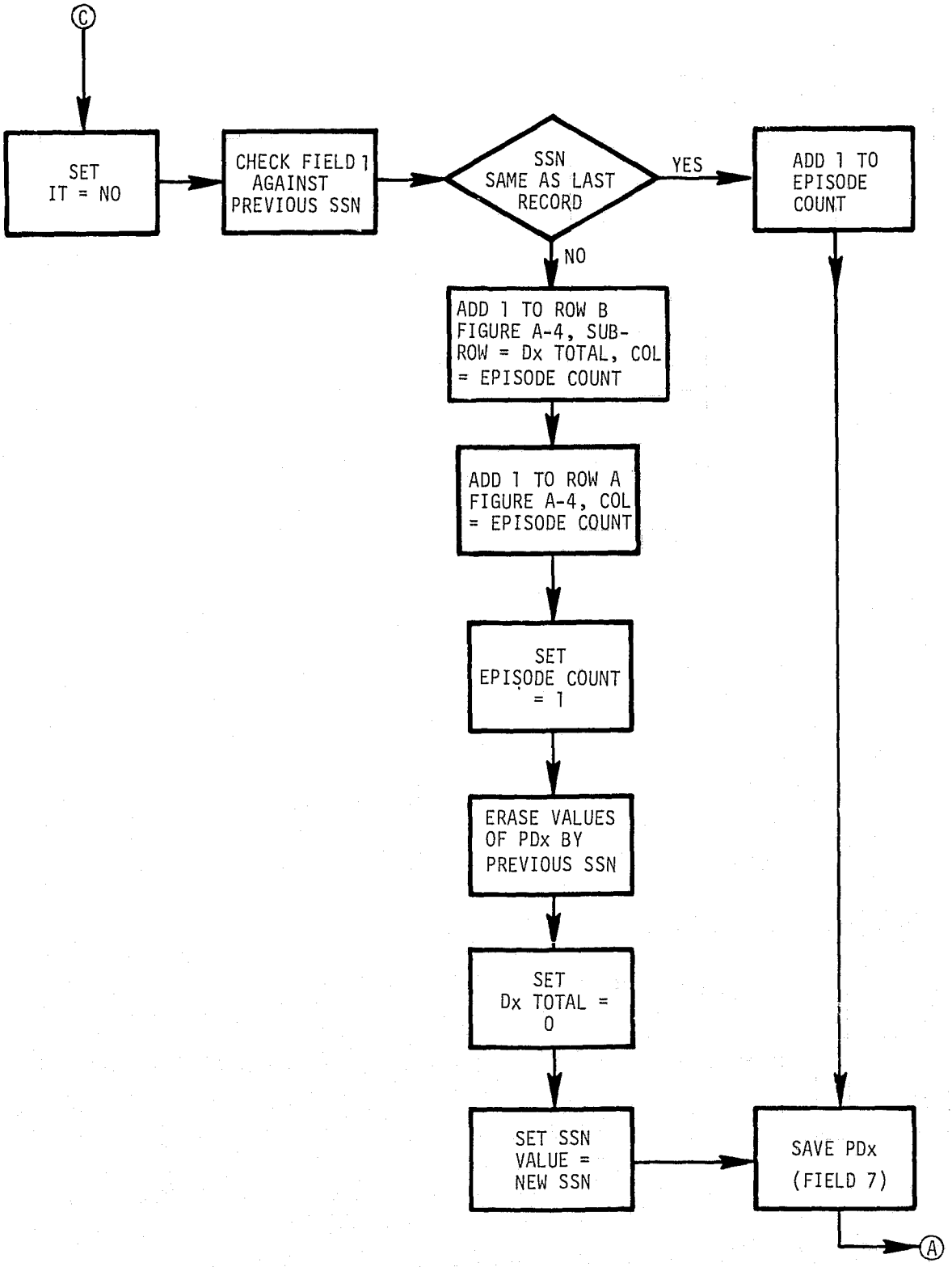


Figure A-2. Flowchart for preparation of the diagnostic index (sheet 1 of 3).

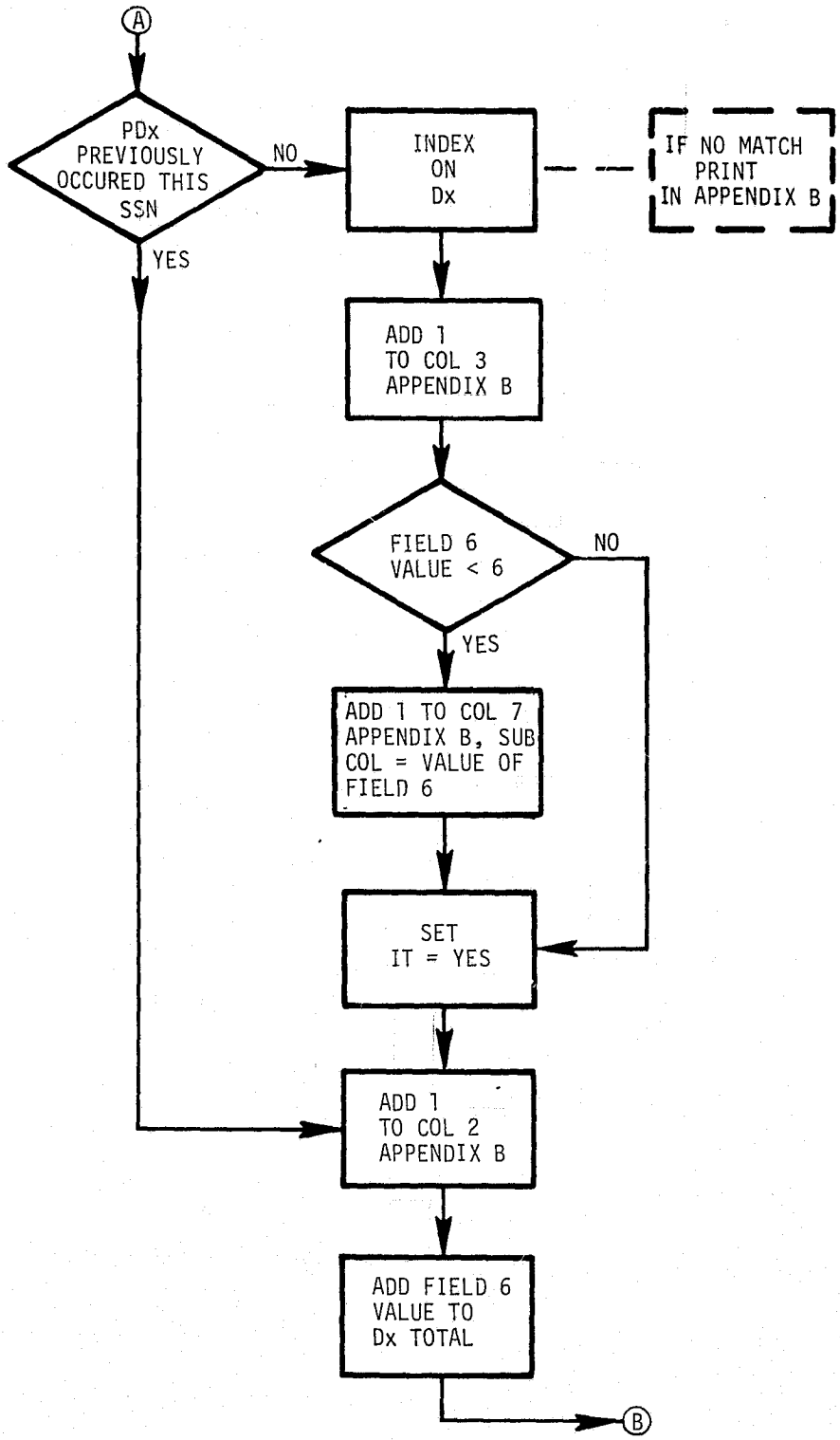


Figure A-2. Flowchart for preparation of the diagnostic index (sheet 2 of 3).

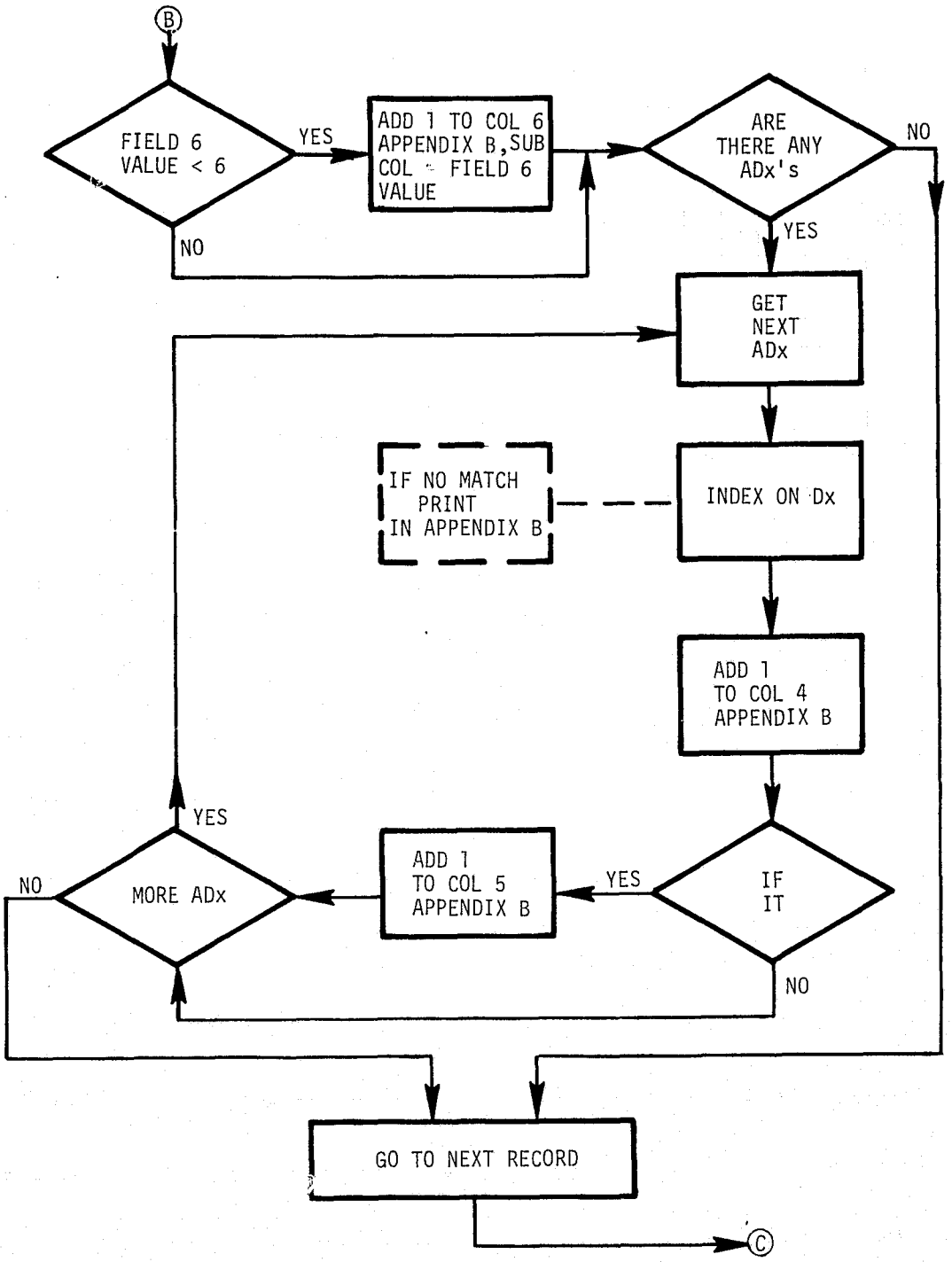


Figure A-2. Flowchart for preparation of the diagnostic index (sheet 3 of 3).

FILE: REPORT1 FORTRAN A1

```
      INTEGER I1(14),ICDA(5),I2(14)
      COMMON COUNT
      WRITE(3,10)
 10   FORMAT(1H1)
      CALL HEAD
      DO 15 I=1,14
      I2(I)=0
 15   CONTINUE
 17   READ(2,20,END=900)(ICDA(J),J=1,5),(I1(I),I=1,14)
      IF(COUNT.GT.50) CALL HEAD
      COUNT=COUNT+2
 20   FORMAT(5A1,14I6)
      WRITE(3,30)(ICDA(J),J=1,5),(I1(I),I=1,14)
 30   FORMAT(1H0,1X,5A1,14(1X,I7))
      DO 100 I=1,14
      I2(I)=I2(I)+I1(I)
100   CONTINUE
      GO TO 17
900   CALL HEAD
      WRITE(3,200)(I2(I),I=1,14)
200   FORMAT(1H0,' TOTAL ',14(1X,I7))
      STOP
      END
```

FILE: HEAD FORTRAN A1

```
      SUBROUTINE HEAD
      COMMON COUNT
      WRITE(3,10)
 10   FORMAT(1H1,///,8X,'OCCURANCE  PDX  OCCURANCE ADX    NO.',
     *' DXS KEYED ON PRIMARY DX',12X,'NO.  DXS KEYED ON PRIMARY DX')
      WRITE(3,20)
 20   FORMAT('  ICDA      ALL      NR       ALL      NR            ALL',
     *'    EPISODES',22X,'NON-REPEAT EPISODES')
      WRITE(3,30)
 30   FORMAT(41X,' -1-      -2-      -3-      -4-     -5-      -1-',
     *'      -2-     -3-      -4-      -5-')
      COUNT = 7
      RETURN
      END
```

Figure A-3. Fortran program for diagnostic index preparation.

	# EPISODES						
	1	2	3	4	>4 <25	>24	TOTAL
PATIENTS	439411	116449	39448	14277	11151	1237	621973
DIAGNOSIS							
1	149199	0	0	0	0	0	149199
2	107585	18887	0	0	0	0	126472
3	74360	18417	3641	0	0	0	96418
4	48158	18552	3836	843	0	0	71389
5	30222	15474	4515	1002	261	0	51474
6	13249	12946	4550	1150	393	0	32288
7	7921	9606	4266	1302	519	0	23614
8	4170	7322	3759	1345	572	0	17168
9	4547	5119	3298	1272	657	0	14893
10	0	3576	2703	1176	714	0	8169
11	0	2358	2175	1042	715	0	6290
12	0	1706	1641	944	766	0	5057
13	0	993	1381	759	666	0	3799
14	0	641	997	613	661	0	2912
15	0	356	776	581	582	0	2295
16	0	228	541	466	552	0	1787
17	0	139	393	397	490	0	1419
18	0	129	304	336	447	0	1216
19	0	0	198	248	419	0	865
20	0	0	374	650	2390	1237	4651

Figure A-4. Occurrence of patients and diagnoses as a function of number of episodes (NR population).

(2) The number of patients by the total number of diagnoses (up to 20) acquired by an individual patient and the number of episodes he experienced during calendar year 1973.

In the diagnostic index (Appendix B), ICDA diagnostic codes are ranked by decreasing frequency of occurrence of the codes in the NR population. The cumulative percentage of the total NR record population, as a function of the rank-order number of ICDA codes, is shown in Figure A-5.

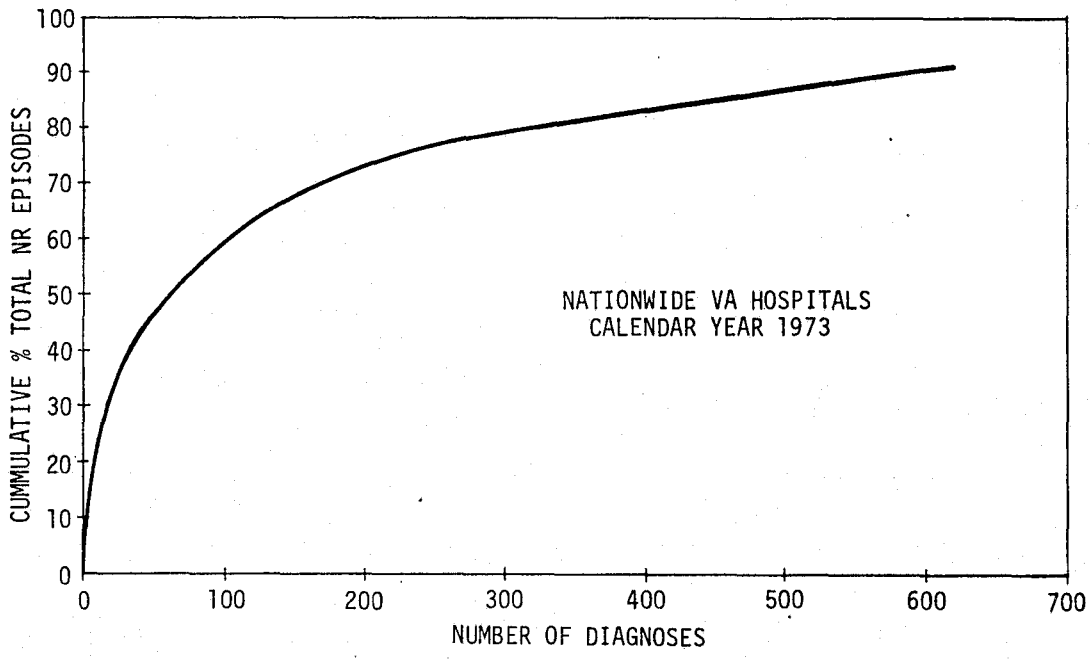


Figure A-5. Percentage of total episodes versus number of diagnoses.

A.4 The Age-Specific Prevalence of Disease

The objective of this analysis was to explore the nature of, and variation in, observed disease prevalence as a function of principal diagnosis and year of age. The age-specific disease-prevalence characteristic, γ, was defined as the percentage of observed cases (of a specific PDx) above or below the case load that would be expected if the disease prevalence were equal at all ages. In other words, let X_{ij} equal the number of cases with diagnosis (i) and age (j).

$$\sum_i X_{ij} = A_j$$

= the number of cases of age (j) with all diagnoses

$$\sum_j X_{ij} = D_i$$

= the number of cases with diagnoses (i) including all ages

$$\sum_{ij} X_{ij} = T$$

= total number of cases in the NR population

then

$$\frac{A_j}{T} = \alpha_j$$

= proportion of cases of age (j)

hence,

$$\sum_j \frac{A_j}{T} = 1$$

If the prevalence of a diagnosis were equal at each age in the population, the expected number of cases at age (j) with diagnosis (i) would be $\alpha_j D_i$. Thus, the difference between the number of observed cases (X_{ij}) and the expected number of cases ($\alpha_j D_i$) is

$$\delta_{ij} = X_{ij} - \alpha_j D_i$$

$$\sum_i \delta_{ij} = A_i - \alpha_j \qquad T = 0$$

$$\sum_j \delta_{ij} = 0$$

Although δ_{ij} may be computed and observed directly, it exhibits considerable variation among diagnoses. For the convenience of scale in the plotted output of this analysis, this difference (α_{ij}) was divided

by the expected age and diagnosis-specific case load ($\alpha_j D_i$), and expressed as a percentage above or below that case load. Hence

$$\gamma = \frac{\delta_{ij}}{\alpha_j D_i} \times 100$$

The initial analysis considered the NR record population of the following diagnostic categories (ICDA-8):

303.2 Alcoholic Addiction

571.0 Alcoholic Cirrhosis

162.1 Neoplasm of the Bronchus and Lung

492 Emphysema

412 Chronic Ischemic Heart Disease

550 Inguinal Hernia

304.0 Opiate Addiction

295.3 Paranoid Schizophrenia

295.9 Unspecified Schizophrenia

This age-specific disease-prevalence characteristic, γ, showed remarkably distinct patterns. The plotted output of these analyses are presented in Figure A-6. Asterisks (*) were used to represent populations of 50 cases or more at a given year of age. Zeros (0) represent less than 50 cases. The total number of cases represented by these ICDA-8 codes is summarized in Table A-1.

Let us explore some attributes of the output information which arose from these analyses. Consider the population with a principal diagnosis of chronic ischemic heart disease. Over the range of 37 years to 89 years, a span of 52 years, it may be approximated by the straight line

$$\gamma = 4.29a - 223$$

where (a) is the year of age.

In the case just described

$$r^2 = 0.97$$

Table A-1. Number of NR episodes for selected diagnoses—National VA Hospitals, 1973.

ICDA-8	Diagnosis	Number NR Cases
303.2	Alcoholic Addiction	42,707
571.0	Alcoholic Cirrhosis	9,134
162.1	Neoplasm of the Bronchus and Lung	10,723
492	Emphysema	10,407
412	Chronic Ischemic Heart Disease	35,488
550	Inguinal Hernia	12,982
304.0	Opiate Addiction	8,474
295.3	Paranoid Schizophrenia	20,056
295.9	Unspecified Schizophrenia	20,786

For the same data over the age range of 37 years to 59 years (a span of 22 years), the straight-line model

$$\gamma = 5.22a - 274$$

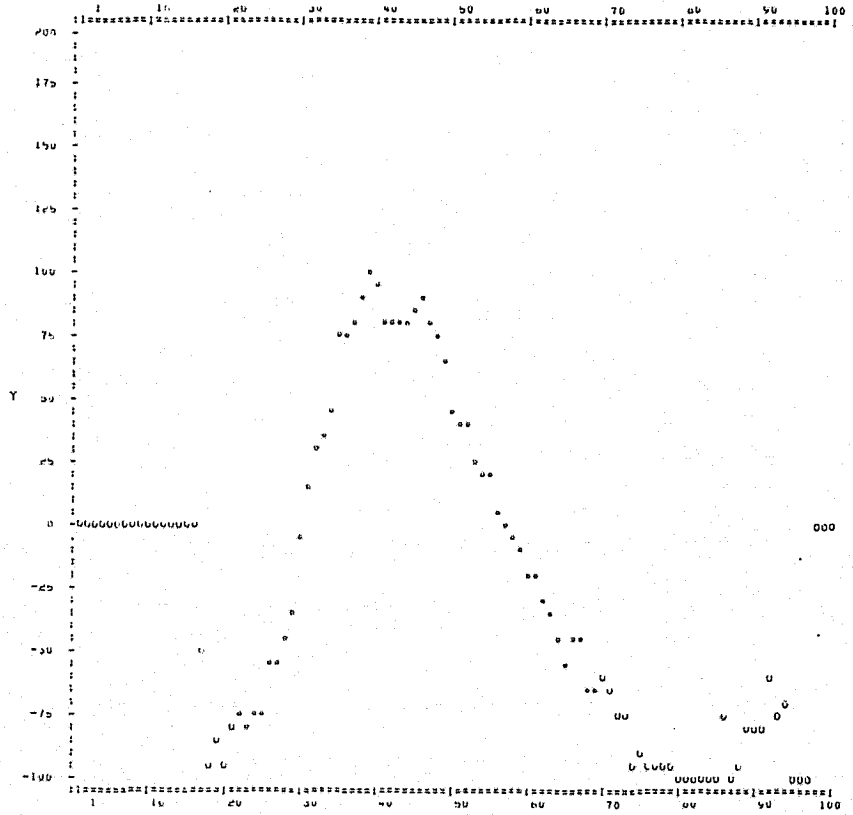
is found to yield

$$r^2 = 0.99$$

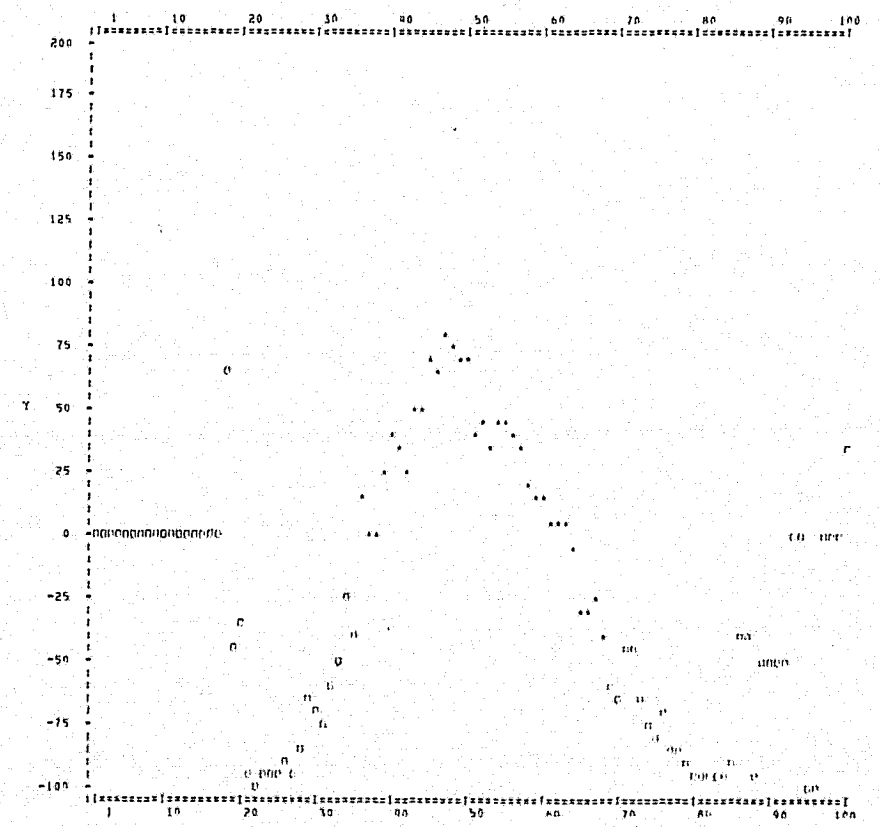
It is obvious by inspection of Figure A-6 that curved-line models could be constructed which would more accurately approximate the observed data than a simple straight line. These simple straight-line models are used here only to characterize basic attributes of the observed data. Linear-model coefficients, and values of (r^2), are tabulated in Table A-2 for several of the diagnostic codes that were examined.

While these simple models characterize most of the observed γ characteristics, some effects which are clearly distinct from the mainstream may be observed. For example, a significant number of

Dx 303.2 ALCOHOLIC ADDICTION NATIONAL VA 1973 ALL NR CASES



Dx 571.0 ALCOHOLIC CIRRHOSIS NATIONAL VA 1973 ALL NR CASES



YEAR OF AGE

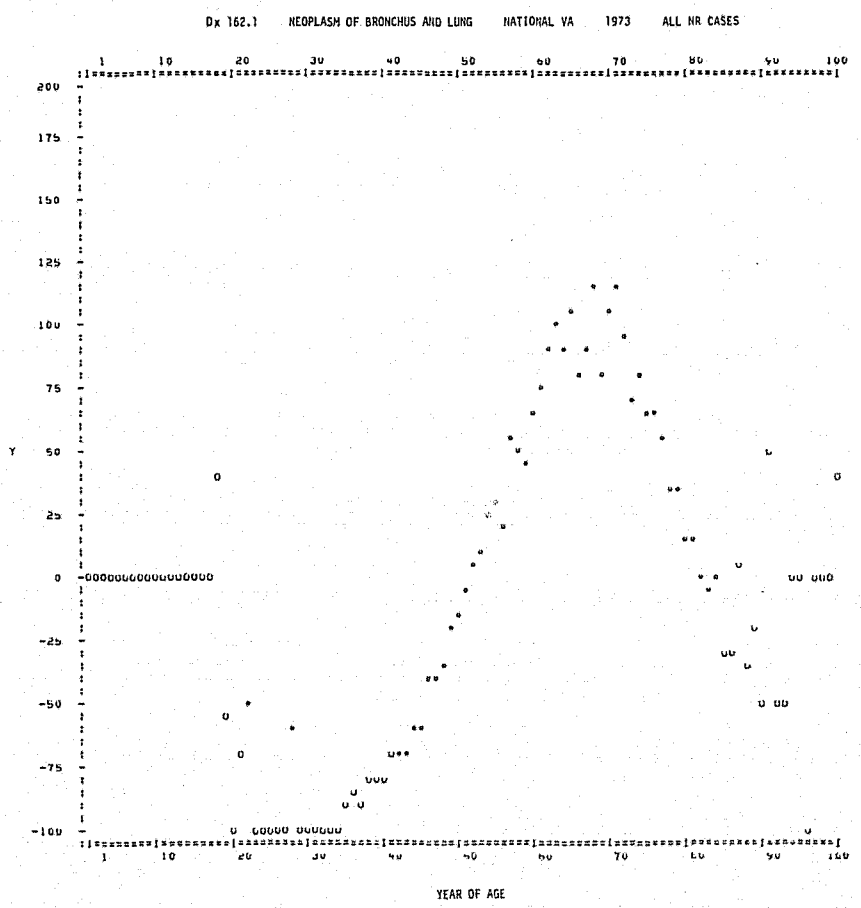
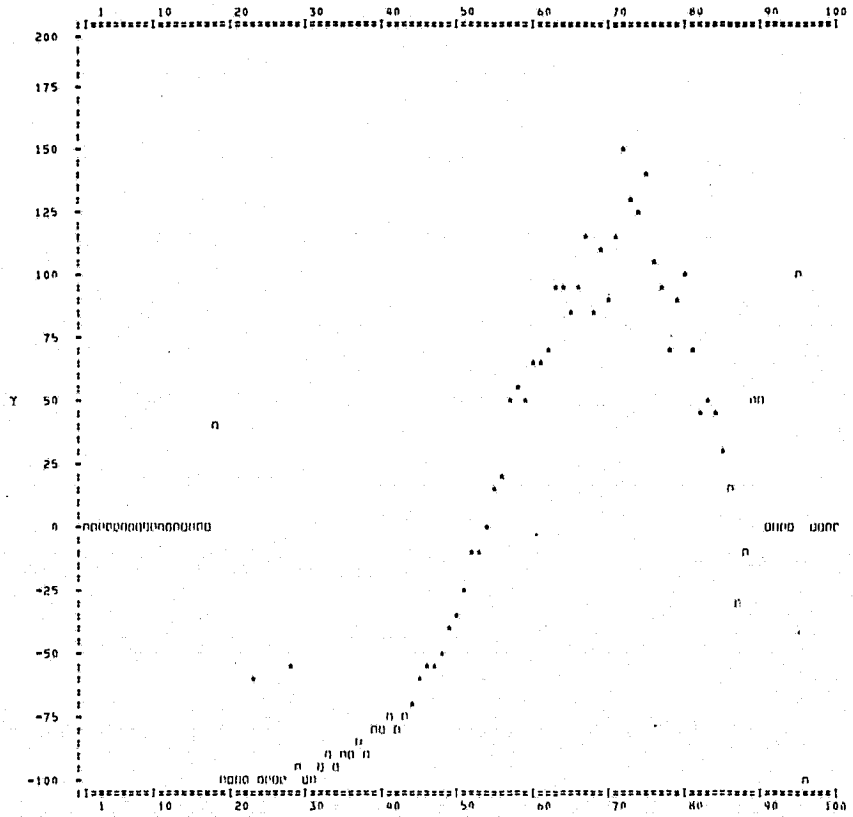
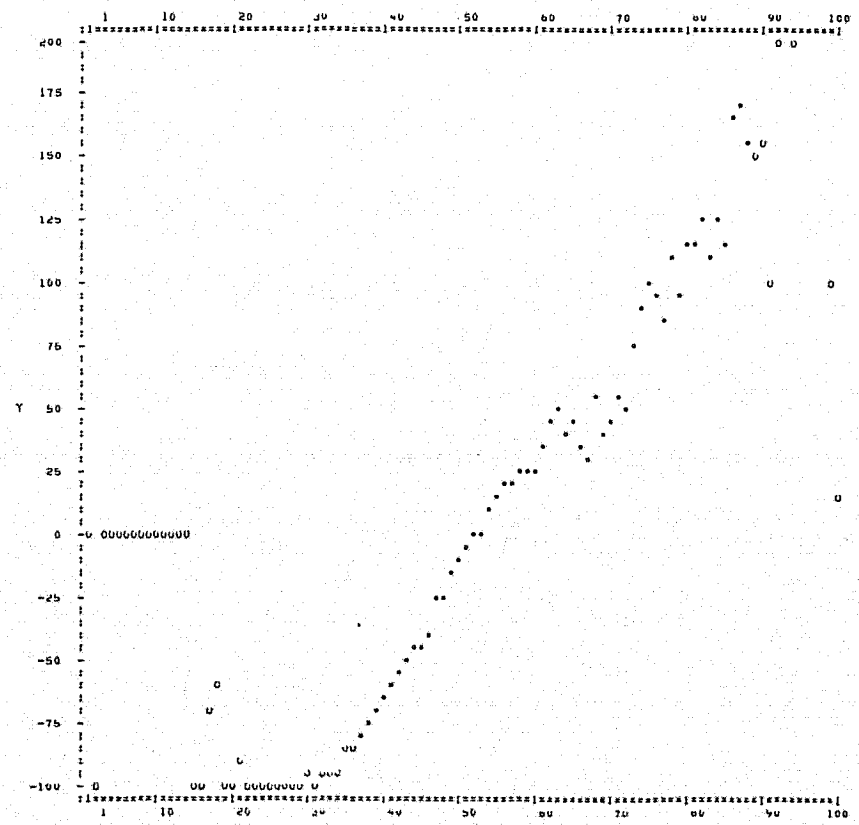


Figure A-6. Age-specific disease prevalence of selected ICDA conditions—— all NR cases in VA hospitals, 1973 (1 of 3).

Dx 492 EMPHYSEMA NATIONAL VA 1973 ALL NR CASES



Dx 412 CHRONIC ISCHEMIC HEART DISEASE NATIONAL VA 1973 ALL NR CASES



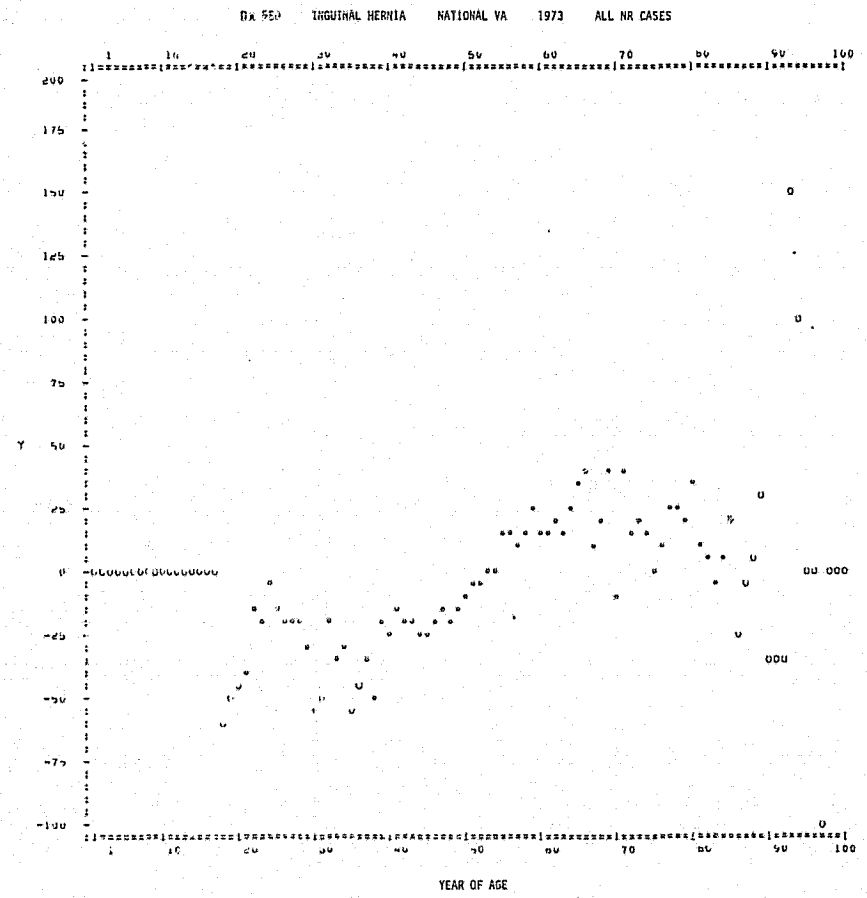
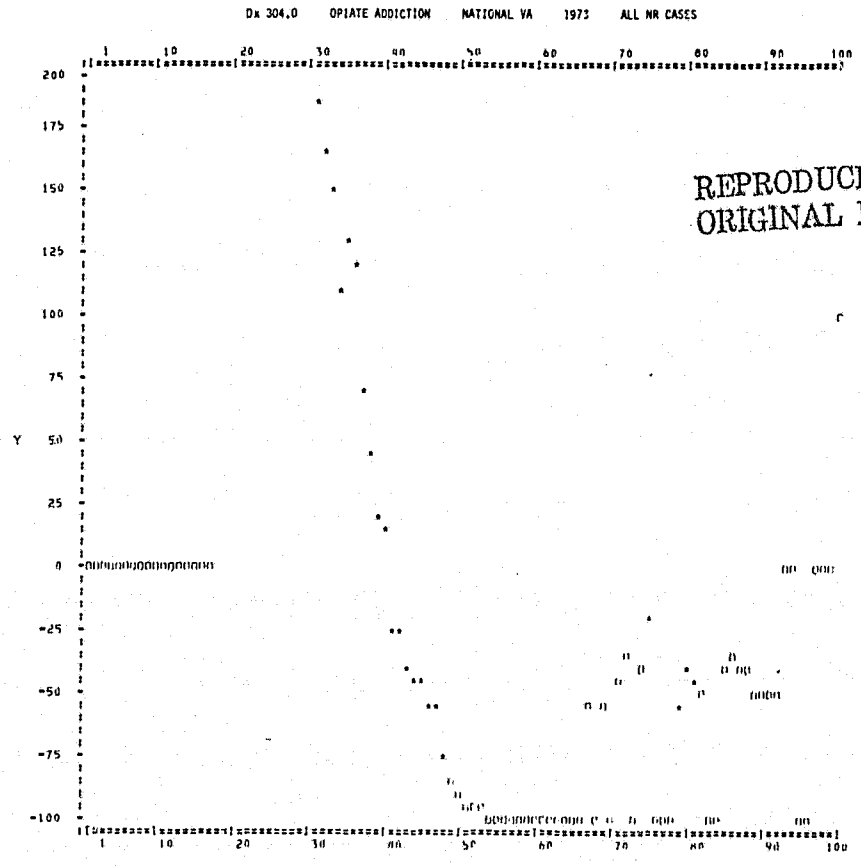
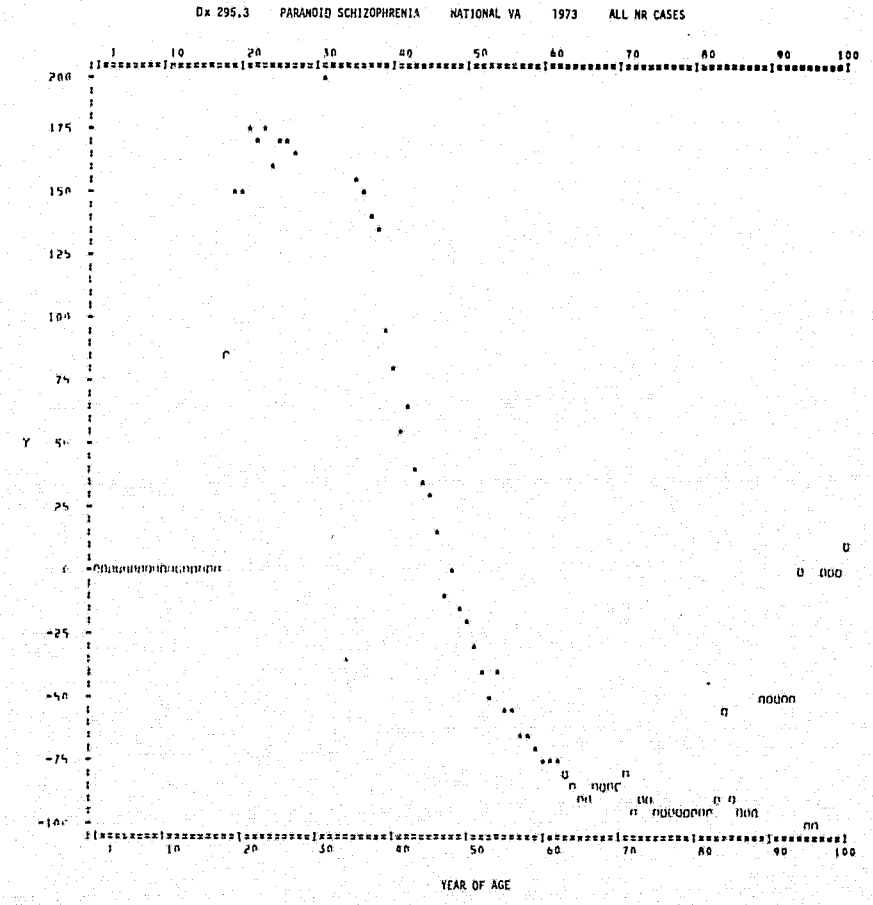


Figure A-6. Age-specific disease prevalence of selected ICDA conditions—all NR cases in VA hospitals, 1973 (2 of 3).





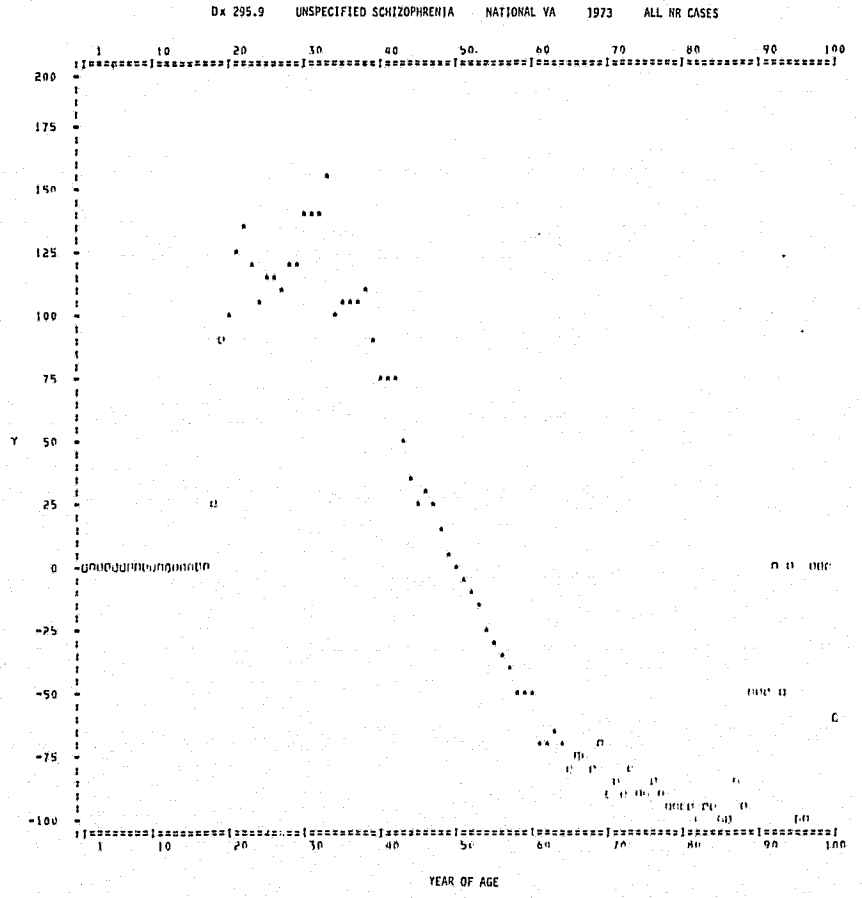


Figure A-6. Age-specific disease prevalence of selected ICDA conditions—all NR cases in VA hospitals, 1973 (3 of 3).

Table A-2. Linear-model parameters associated with observed age-specific disease prevalence.

ICDA	Condition	Year of Age		Age Range (years)	Coefficients		
		Lower	Upper		m	b	r^2
412	Chronic Ischemic Heart Disease	37	88	52	4.29	-232.8	0.97
162.1	Neoplasm of Bronchus and Lung	42 70	65 85	24 15	7.9 -8.7	-410.6 719.3	0.99 0.96
303.2	Alcoholic Addiction	23 46	39 69	17 24	12.6 -6.62	-383.5 383.1	0.98 0.98
304.0	Opiate Addiction	31	48	18	-15.97	666.7	0.95
295.3	Paranoid Schizophrenia	35 44	60 72	26 29	-9.40 7.44	462.1 -396.7	0.94 0.96
492	Emphysema	72	85	13	-8.74	774.7	0.9

patients is observed to constitute a cluster of opiate addicts in the 70- to 80-year age range. One may ask of the clinical research community: Where are these people coming from? More generally, are the secondary (or even the mainstream) effects a characteristic of the disease, or a characteristic of the aging population? Before progressing to the dynamics of these effects, however, we may consider a few more attributes of the 1-year observations.

If one is surprised by the specificity of the patterns observed in Figure A-6, perhaps it is because of the innumerable variables not accounted for in the observed population. One might anticipate, for example, that the presence or absence of hypertension would significantly effect the γ characteristic associated with ischemic heart disease. Or that the presence of multiple and related disease, in general, might have a significant effect on this population characteristic.

Thus, the population of alcoholic addiction cases was separated into categories of sole and multiple diagnoses, and the difference in the γ characteristic examined (Figure A-7). A higher peak value of γ

is observed in the case of sole diagnosis, and although the slopes of both ascending and descending linear models are larger than in the case of multiple diagnoses, the age spread at $\gamma = 0$ is slightly larger (31.6 versus 29.9 years). Onset of $\gamma > 0$ occurs earlier for sole diagnosis cases (age 28.3 versus age 32).

For another condition, neoplasm of the bronchus and lung, the results of separating sole and multiple diagnoses is shown in Figure A-8. Here, a higher peak value of γ is observed for multiple diagnoses, the slopes of the linear models are slightly larger in the case of multiple diagnoses, and the age spread at $\gamma = 0$ is larger for multiple diagnoses (30.7 versus 26 years). Onset of $\gamma > 0$ occurs earlier for multiple diagnoses (age 52.1 versus age 53.5).

A table summarizing some parameters of the sole- and multiple-diagnoses models of alcoholism and lung cancer is provided in Table A-3.

We noted earlier that a group of opiate addicts, around age 75, were observed to be clearly separated from the mainstream case-load effect. We noted (from Figure A-7) that a similar effect is observed between ages 80 and 90 with alcoholism as a sole diagnosis, and less pronounced (lower values of γ) with alcoholism as a multiple diagnosis. A more spectacular observation, in neoplastic disease of the lung (Figure A-8), is the distinct cluster of cases—apart from the mainstream feature—at ages 20 to 30 years. And that the occurrence of these cases is most frequently associated with a sole diagnosis.

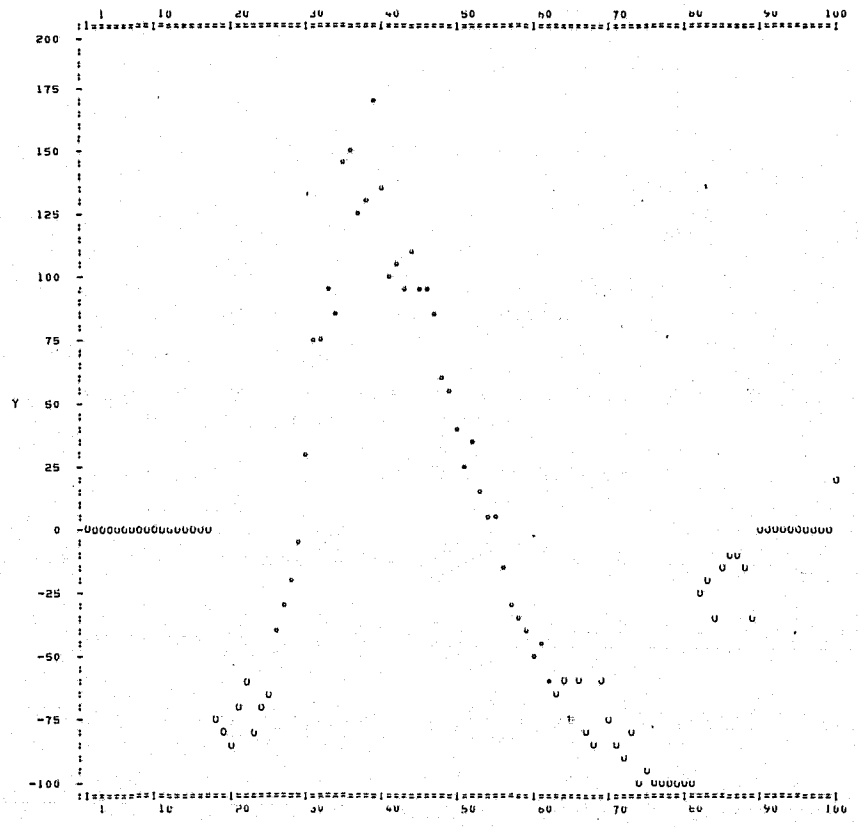
Have these people been at high-environmental risk (in the asbestos mines or downwind from petrochemical plants)? Have they been smoking tobacco for only a few years and acquired the disease—or found something to smoke with a more carcinogenic effect than tobacco? These are, of course, questions to be answered by the clinical research community.

Another diagnosis, chronic ischemic heart disease (CIHD), was analyzed to observe:

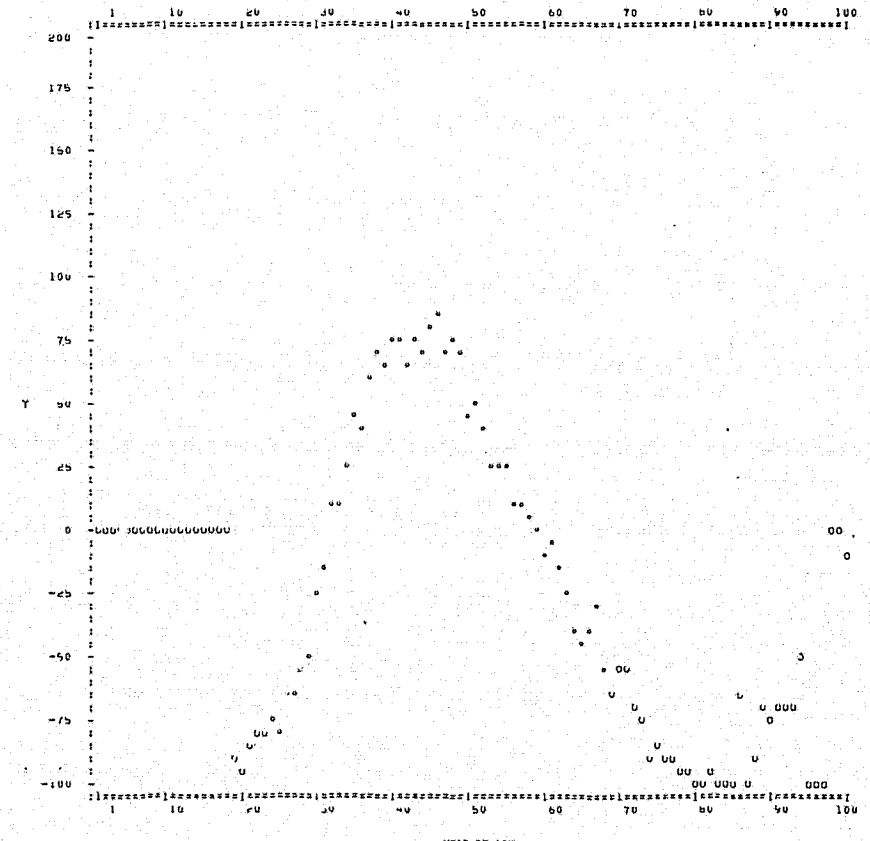
(1) The change in γ characteristic related to the presence or absence of an associated disease entity (hypertension).

(2) The effect, in each case, of considering sole versus multiple diagnoses.

Dx 303.2 ALCOHOLIC ADDICTION NATIONAL VA 1973 SOLE DIAGNOSIS



Dx 303.2 ALCOHOLIC ADDICTION NATIONAL VA 1973 MULTIPLE DIAGNOSES



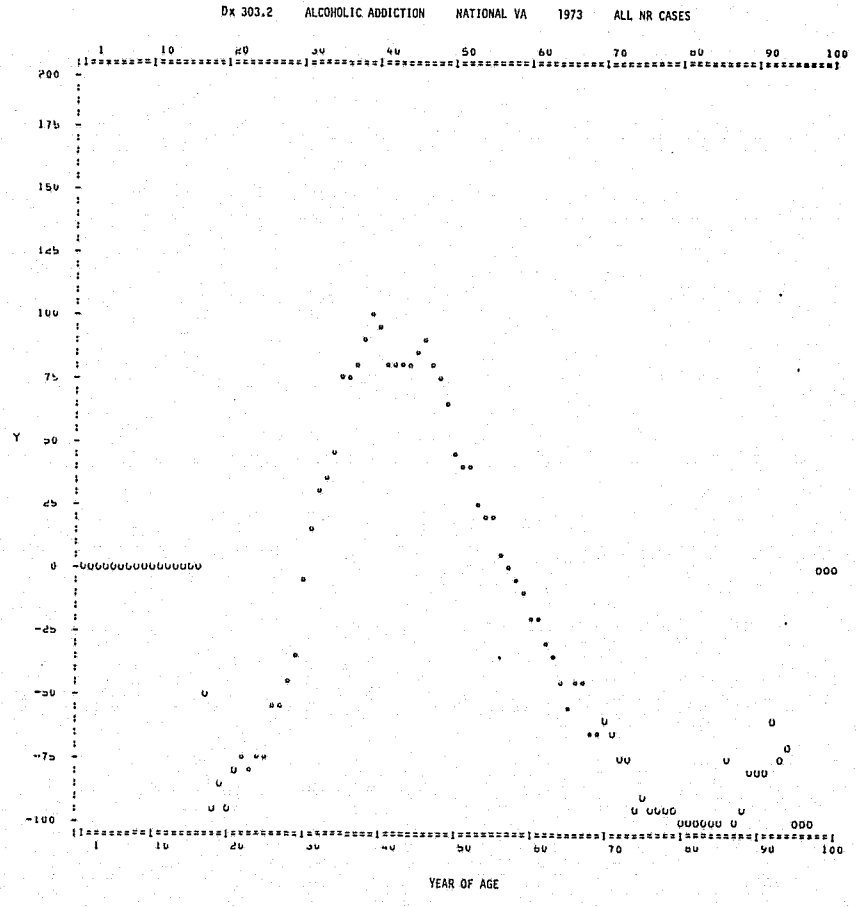
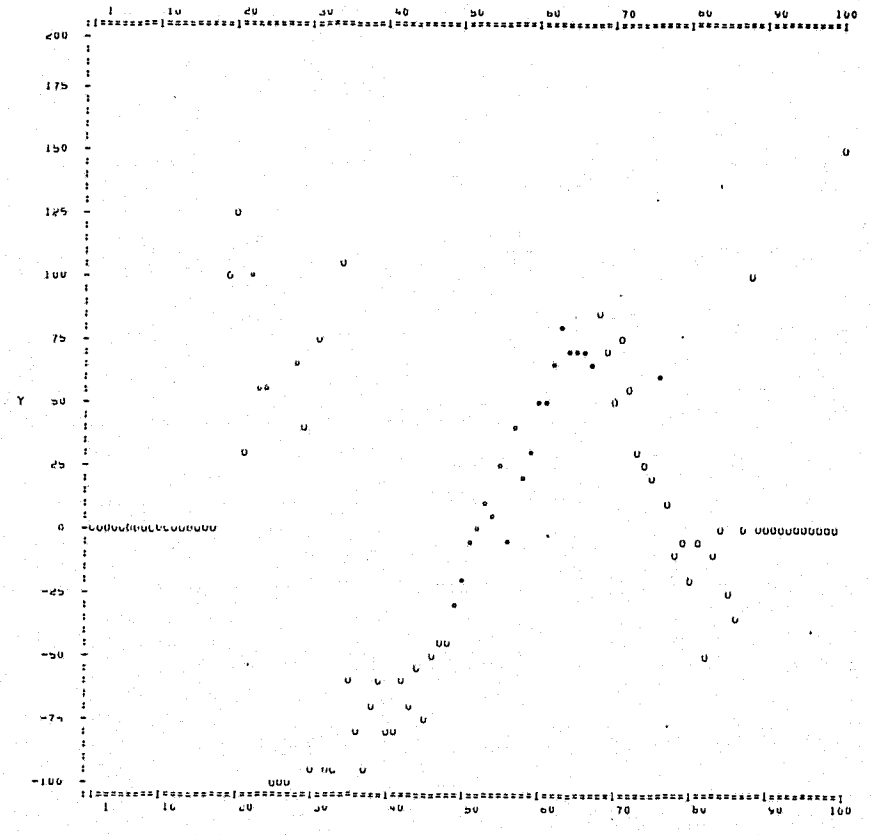
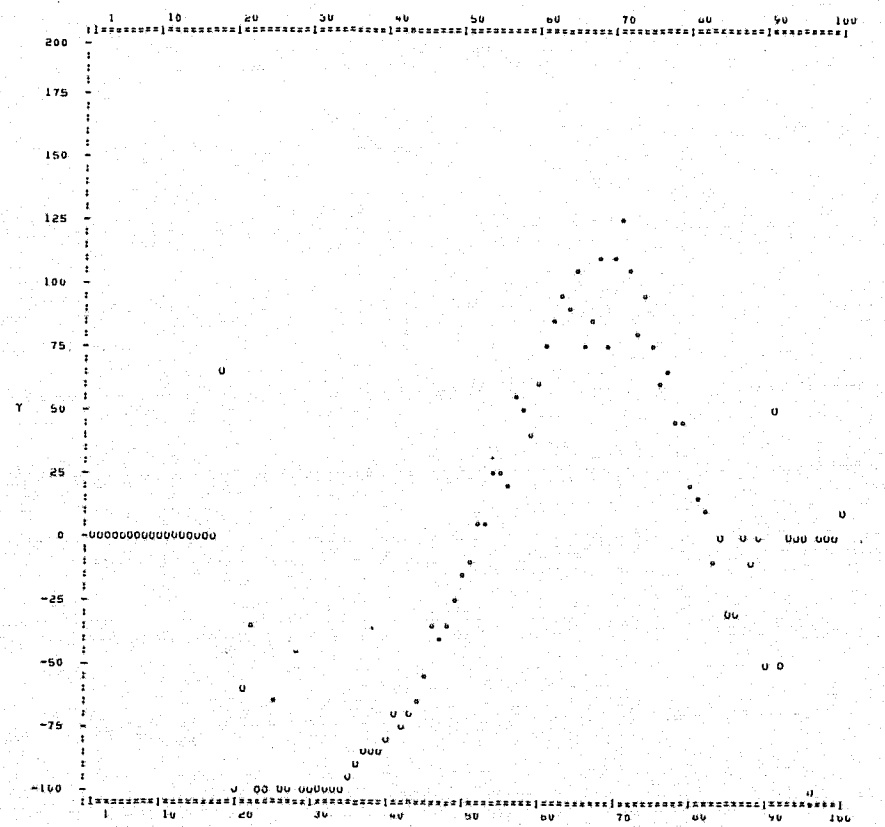


Figure A-7. γ characteristics for alcoholic addiction—sole versus multiple versus total.

Dx 162.1 NEOPLASM OF THE BRONCHUS AND LUNG NATIONAL VA 1973 SOLE DIAGNOSIS



Dx 162.1 NEOPLASM OF THE BRONCHUS AND LUNG NATIONAL VA 1973 MULTIPLE DIAGNOSES



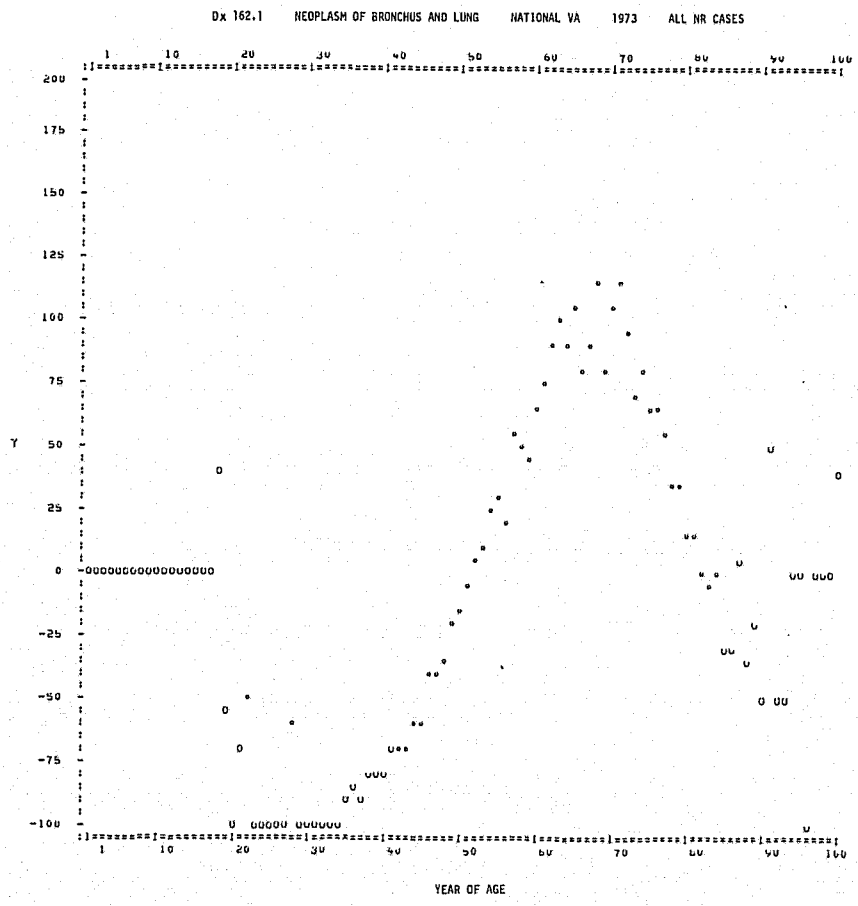


Figure A-8. γ characteristics for neoplasm of bronchus and lung—sole versus multiple versus total.

Table A-3. Linear-model parameters associated with the specified conditions.

		Sole Dx	Multiple Dx	S→M Trend
Alcoholic Addiction	Ascending m	16.5	10.7	↓
	b	-467.6	-343.3	↑
	r^2	0.96	0.97	↑
	Age at γ_0	28.3	32	↑
	Descending m	-9.2	-6.1	↑
	b	501.7	357.4	↓
	r^2	0.97	0.97	—
	Age at γ_0	54.9	58.9	↑
	Age Spread at γ_0	31.6	29.9	↓
Neoplasm of Bronchus and Lung	Ascending m	6.1	6.9	↑
	b	-323.9	-358.7	↓
	r^2	0.94	0.95	↑
	Age at γ_0	53.5	52.1	↓
	Descending m	-6.1	-9.5	↓
	b	486.6	793.7	↑
	r^2	0.71	0.97	↑
	Age at γ_0	79.5	82.8	↑
	Age Spread at γ_0	26	30.7	↑

Figure A-9 shows the γ characteristics of these CIHD populations. Table A-4 summarizes the parameters associated with straight-line models of these characteristics. A poor fit of the linear model to the data is observed in the case of CIHD occurring, without hypertension, as a sole diagnosis. This is also the smallest population of CIHD cases.

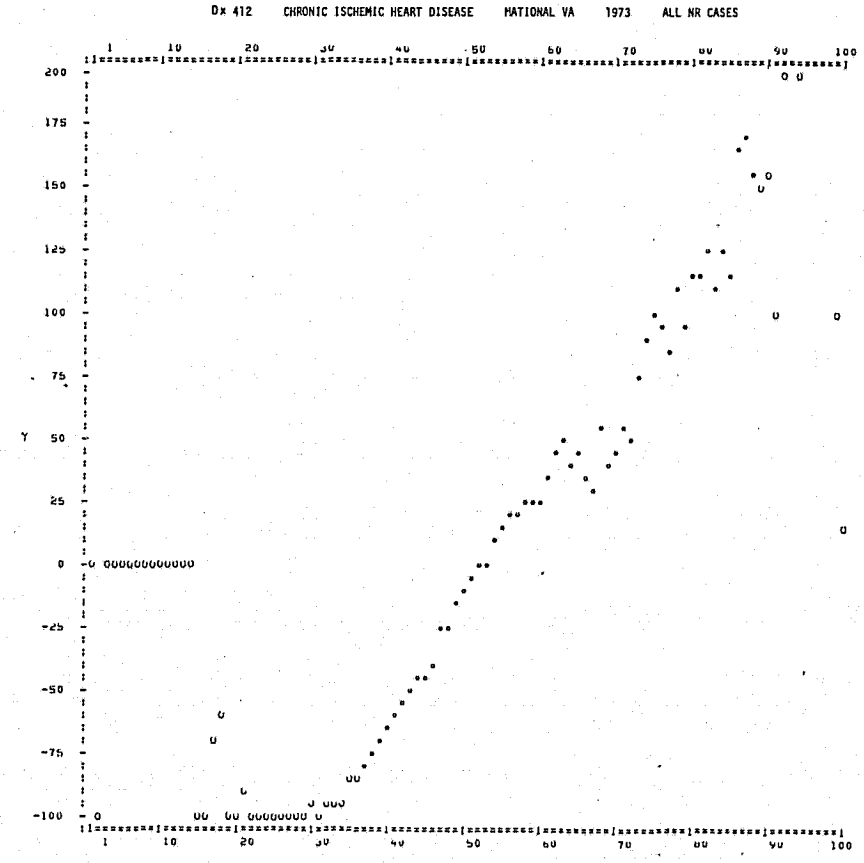
Table A-4. Linear-model parameters for observed age-specific prevalence of chronic ischemic heart disease (CIHD).

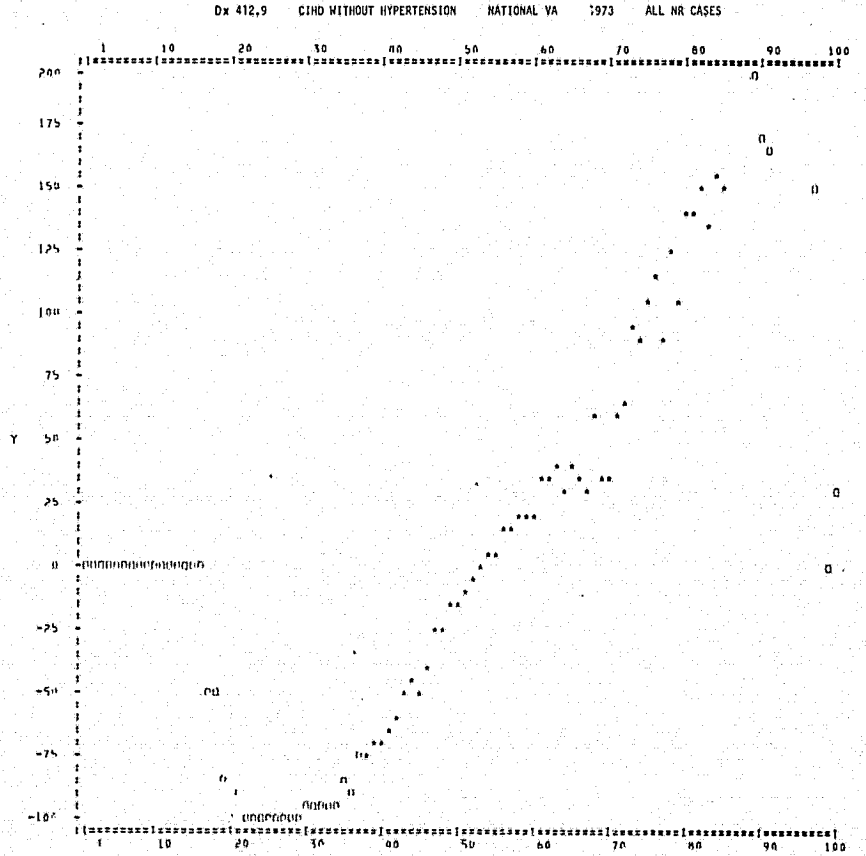
	Dx 412 with Hypertension			Dx 412.9 without Hypertension		
	Total	Sole Dx	Principal	Total	Sole Dx	Principal
Ascending m	5.22	3.37	5.32	4.65	5.74	5.38
b	-267.3	-184.7	-275.2	-253.3	-264.3	-295.5
r^2	0.97	0.71	0.97	0.97	0.92	0.97
Age at γ_0	51.2	54.8	51.48	54.4	46.1	54.9
Age range	35-65	36-60	35-65	35-85	30-55	39-85
Descending m	-0.22	-1.98	-0.27		-0.90	
b	63	121.7	71.9		67.9	
r^2	0.004	0.39	0.005		0.12	
Age at γ_0	289	61.6	266		75	
Age range	66-85	61-85	66-85		56-85	

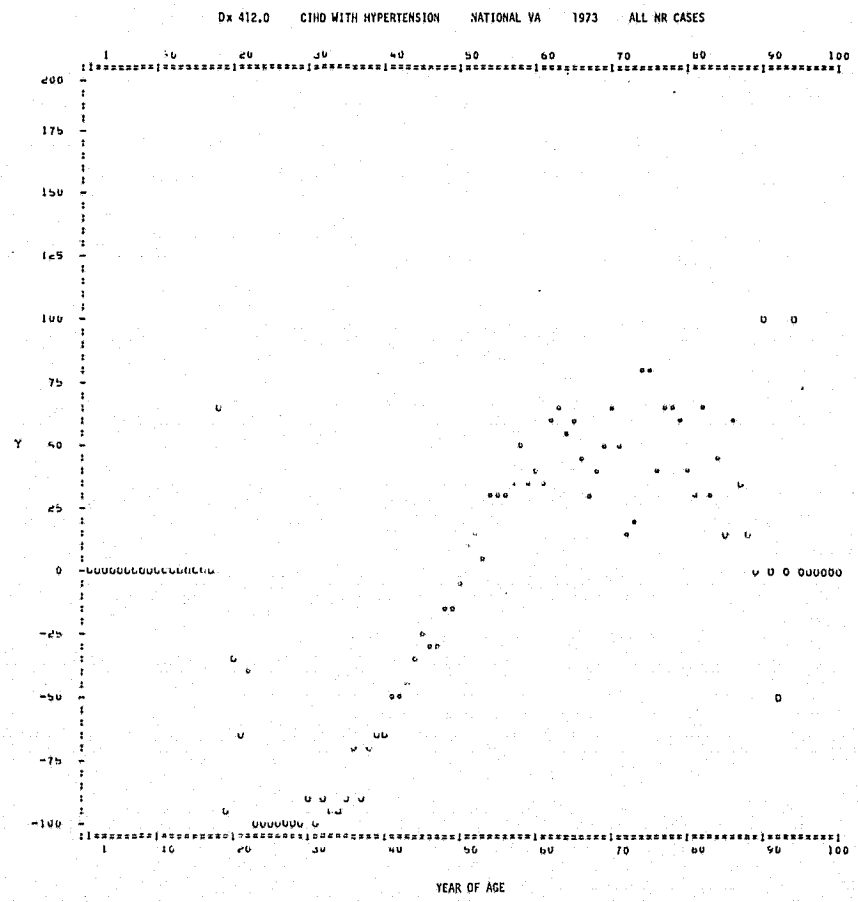
A poor fit is observed uniformly after age 65 in CIHD without hypertension. In this regime, the γ characteristic tends to level, and to acquire a high-frequency component of greater amplitude than is observed in earlier years. A similar phenomenon is observed in CIHD with hypertension as a sole diagnosis. Probably, the paucity of cases in which CIHD occurs as a sole diagnosis (with or without hypertension) accounts for the increased high-frequency component (i.e., noise) after age 65. The fact that CIHD has a less grave prognosis when hypertension is not present (or is controlled) probably accounts for the leveling-off in the γ characteristic of that population. Again, it is obvious by the inspection of Table A-4 that a straight-line model is not the equation of choice for a close fit to the observed data. A two-term exponential of the form

$$\gamma = b_1 e^{-b_2(a-b_3)^2} + b_4 e^{-b_5(a-b_6)^2}$$

plus a periodic noise component, perhaps dampened as a function of



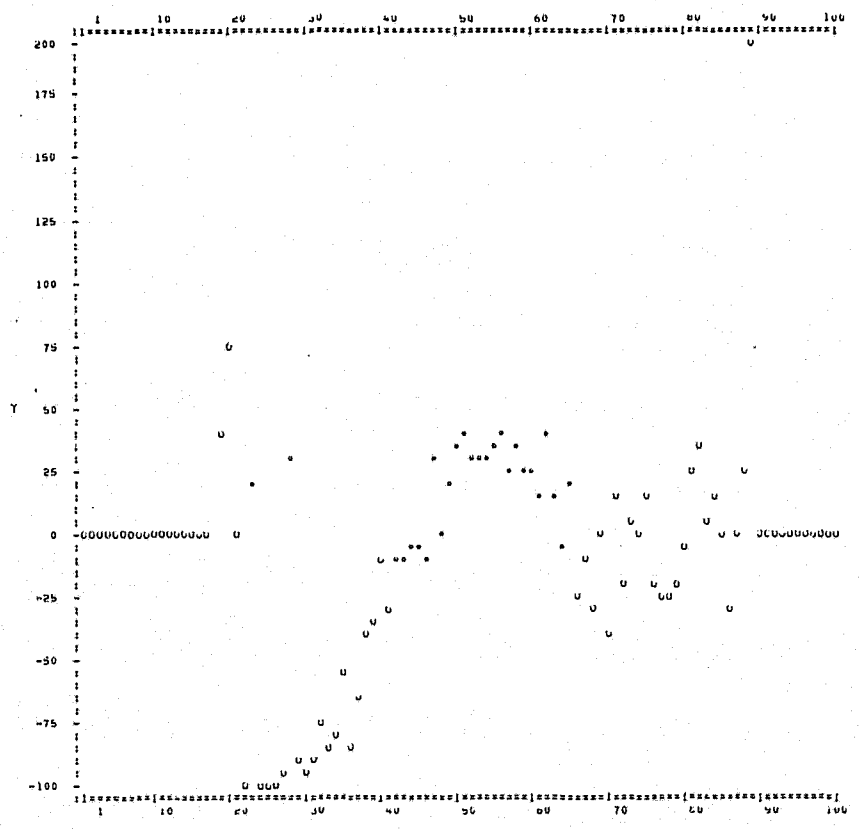




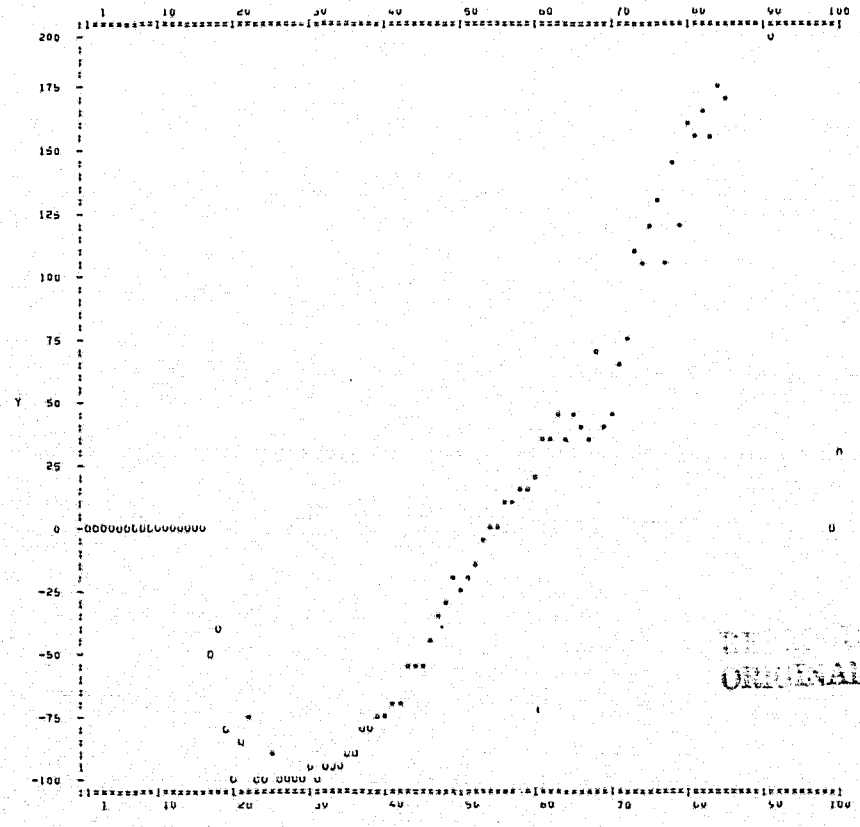
(a) CIHD versus CIHD without hypertension versus CIHD with hypertension.

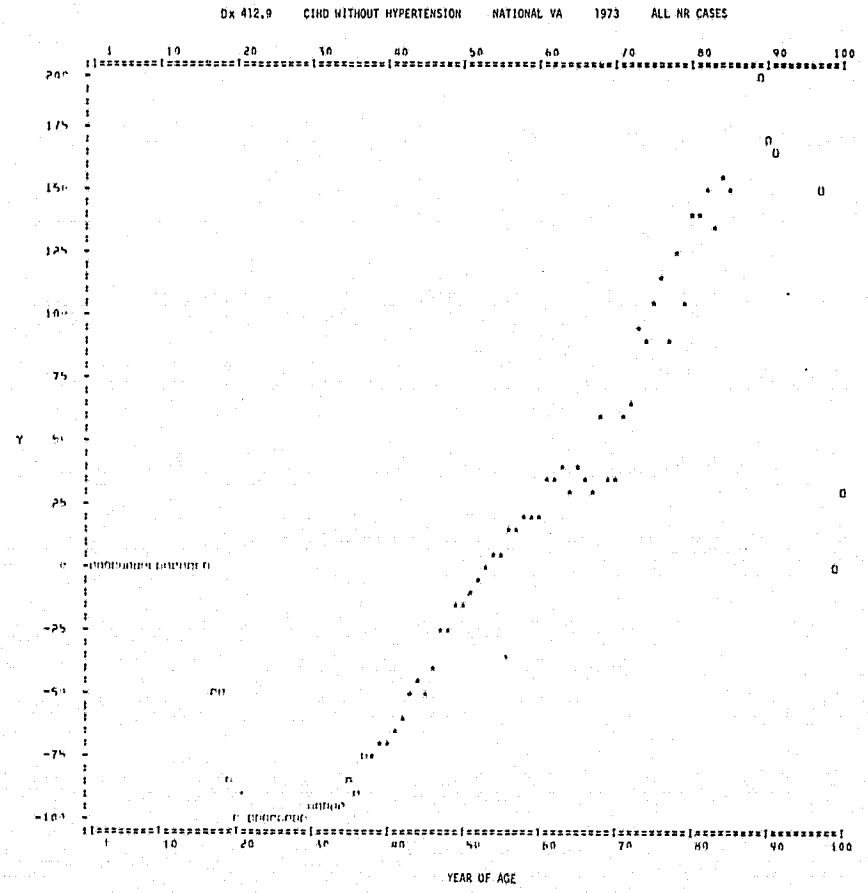
Figure A-9. γ characteristics of chronic ischemic heart disease (CIHD) (1 of 3).

Dx 412.9 CIHD WITHOUT HYPERTENSION NATIONAL VA 1973 SOLE DIAGNOSIS



Dx 412.9 CIHD WITHOUT HYPERTENSION NATIONAL VA 1973 MULTIPLE DIAGNOSES

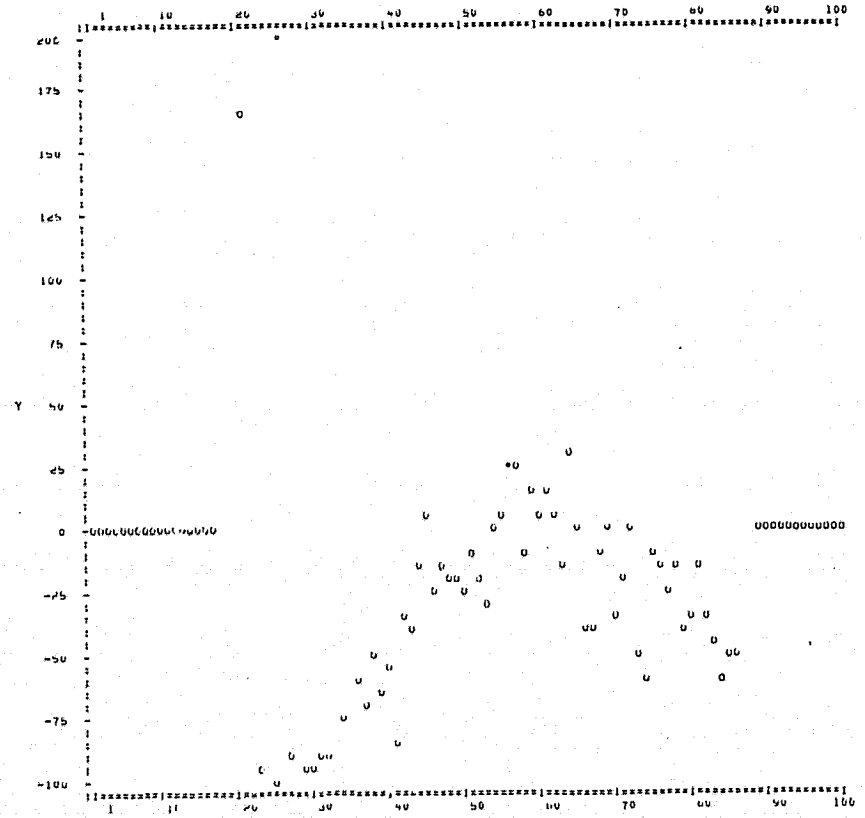




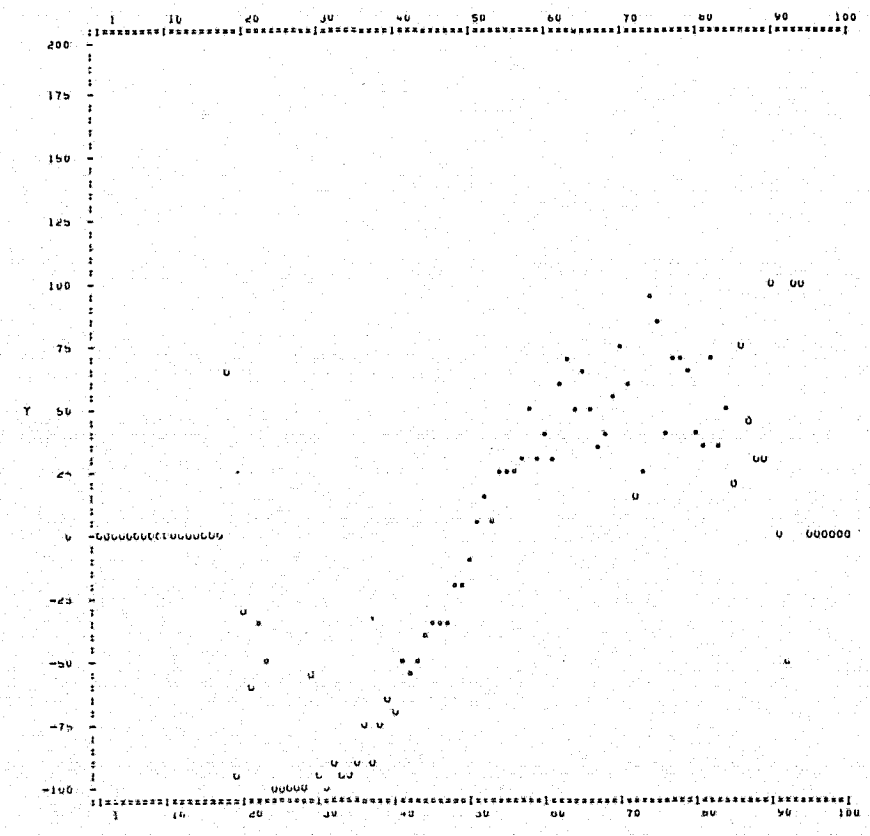
(b) CIHD without hypertension—sole versus multiple versus total.

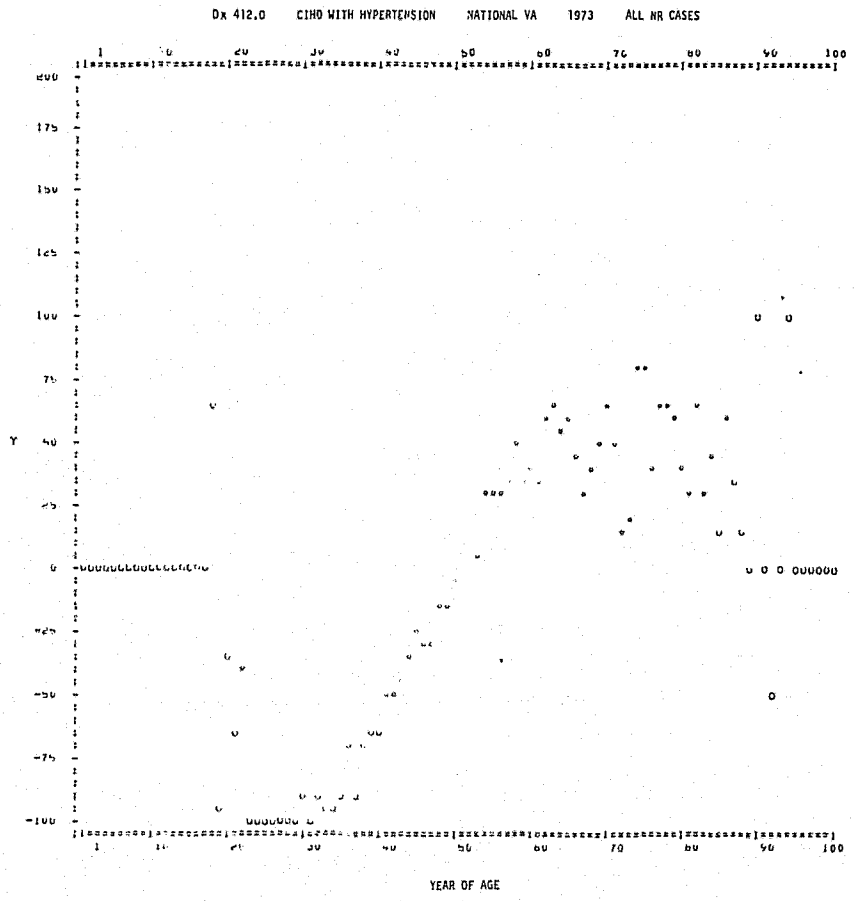
Figure A-9. γ characteristics of chronic ischemic heart disease (CIHD) (2 of 3).

Dx 412.0 CIHD WITH HYPERTENSION NATIONAL VA 1973 SOLE DIAGNOSIS



Dx 412.0 CIHD WITH HYPERTENSION NATIONAL VA 1973 MULTIPLE DIAGNOSES





(c) CIHD with hypertension—sole versus multiple versus total.

Figure A-9. γ characteristics of chronic ischemic heart disease (CIHD) (3 of 3).

number of cases by year of age, comes immediately to mind. The fact remains that even without mathematical subtleties, which might yield improved correlation coefficients, specific and readily discernable patterns are observed in this data.

Another attribute of the γ characteristic which was explored is the change, for cases representing a particular disease entity, which occurs as one progresses from the nationwide VA inpatient episode data, to the level of a VA health-care district, and finally to a single institution. Such a progression is shown in Figures A-10 and A-11 for alcoholic addiction and the CIHD-with-hypertension populations, respectively. The linear-model coefficients for this data are summarized in Table A-5. At least in these two cases, r^2 decreases from the national population through the district level to the institutional population. This is probably the effect of the decreasing number of cases

Table A-5. Parameters of regional disease-prevalence models.

	National	District I	BVAH
Dx 303.2 Alcoholic Addiction			
Ascending m	12.6	8.54	6.05
b	-383.5	-276.1	-191.3
r^2	0.98	0.71	0.25
Age at γ_0	30.4	32.3	31.6
Descending m	-6.62	-6.30	-4.63
b	383.1	367.3	246.8
r^2	0.98	0.90	0.64
Age at γ_0	57.9	58.3	53.3
Dx 412.9 Chronic Ischemic Heart Disease without Hypertension			
m	4.65	4.21	3.50
b	-253.3	-234.0	-196.5
r^2	0.97	0.75	0.48
Age at γ_0	54.4	55.6	56.1

available for consideration. Although the slope of the linear model varies considerably with this geographical dimension, the age corresponding to $\gamma = 0$ remains rather constant. A model more accurately replicating the observed data would improve the confidence in such statements.

To summarize the findings of this study:

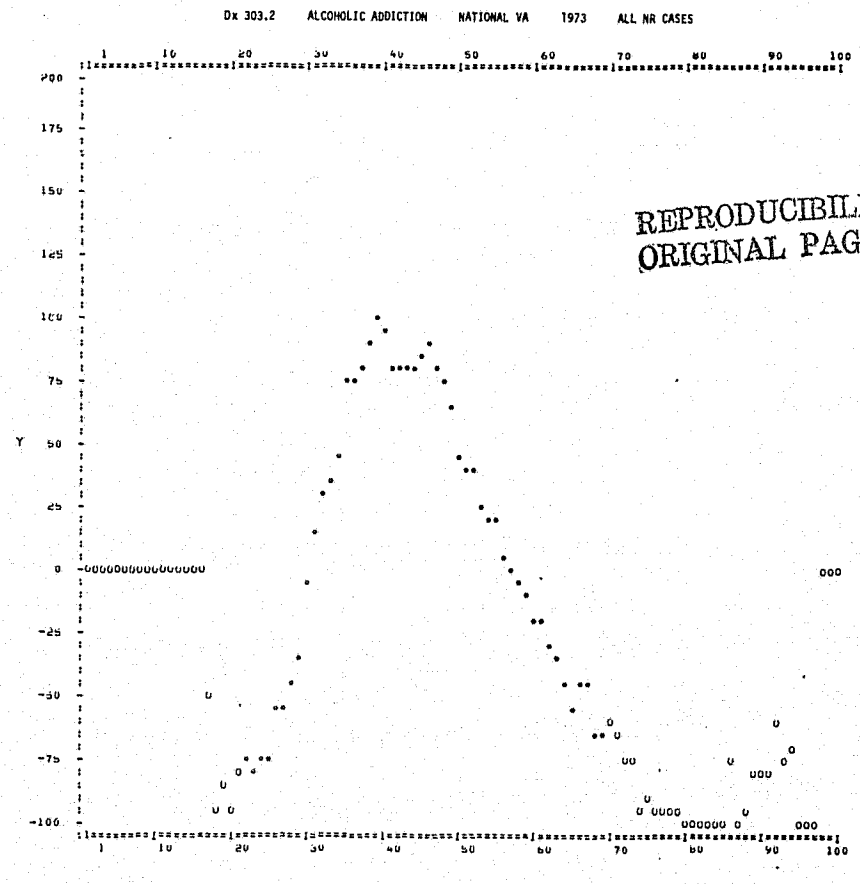
(1) Distinct patterns of the age-specifice disease-prevalence characteristic, γ, are observed in the nationwide VA population of cases.

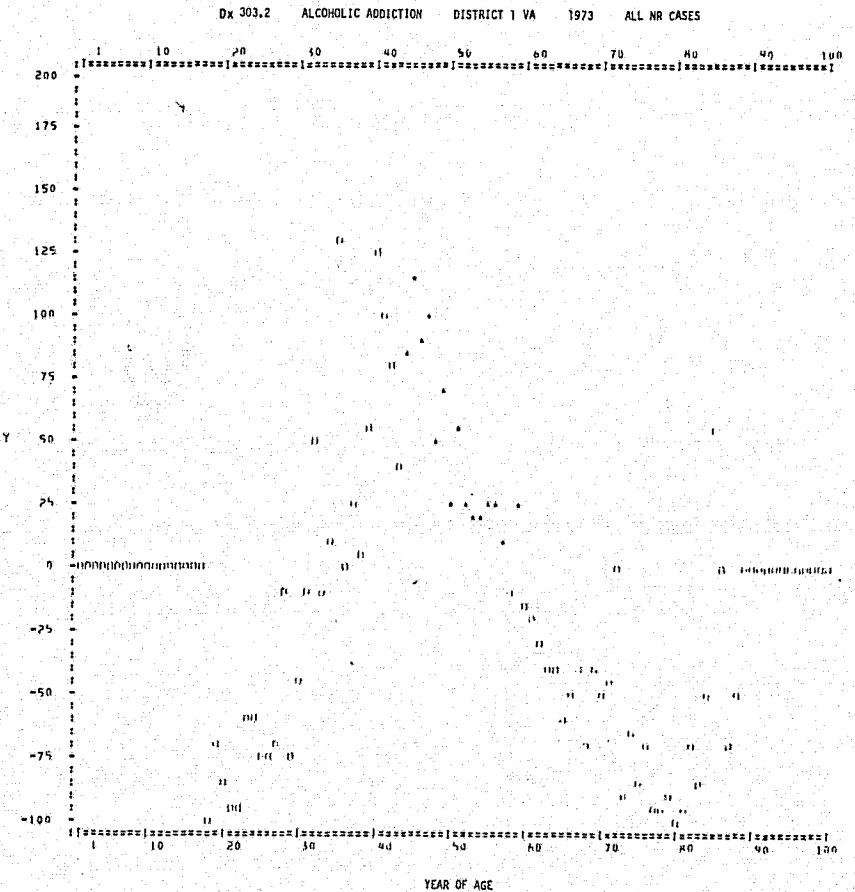
(2) For a given disease or condition, multiple patterns in the γ characteristic may be discernable in a population.

(3) Similar disease-specific characteristics may be observed at the national, district, and institutional levels.

A.5 The Age-Specific Length of Stay (LOS)

The same record populations used for analysis of disease prevalence were analyzed with respect to LOS. The results of these analyses (mean LOS by year of age for each condition) are provided in Figure A-12. The zero (0) character was used to indicate the mean LOS, and the (+) character was used to indicate the mode (most frequently occuring values of LOS). Since the LOS value 101 (days) represents all cases with LOS > 100 days, it is frequently larger than the actual mode of the distribution—especially when the distribution is fairly flat. Future analyses of this type should have a more extended LOS scale, or should recognize modes as occuring under 100 days. The true modes do lie generally below the mean. This indicates that the LOS distribution of all cases for a given year of age is skewed toward a longer stay than would be anticipated from a normal distribution around the mean. In many cases, increasing year-to-year fluctuation in mean LOS is found after about age 70. Shorter stays at advanced ages may be associated with death in the institution—a question that could not be resolved since the data base did not include life-death outcome by case. The parameters of linear models of the mean LOS observations are tabulated in Table A-6. Since the slope of these models is near zero, the coefficient r^2 is not a very useful indication of goodness of fit. The standard deviation(s) is therefore included.





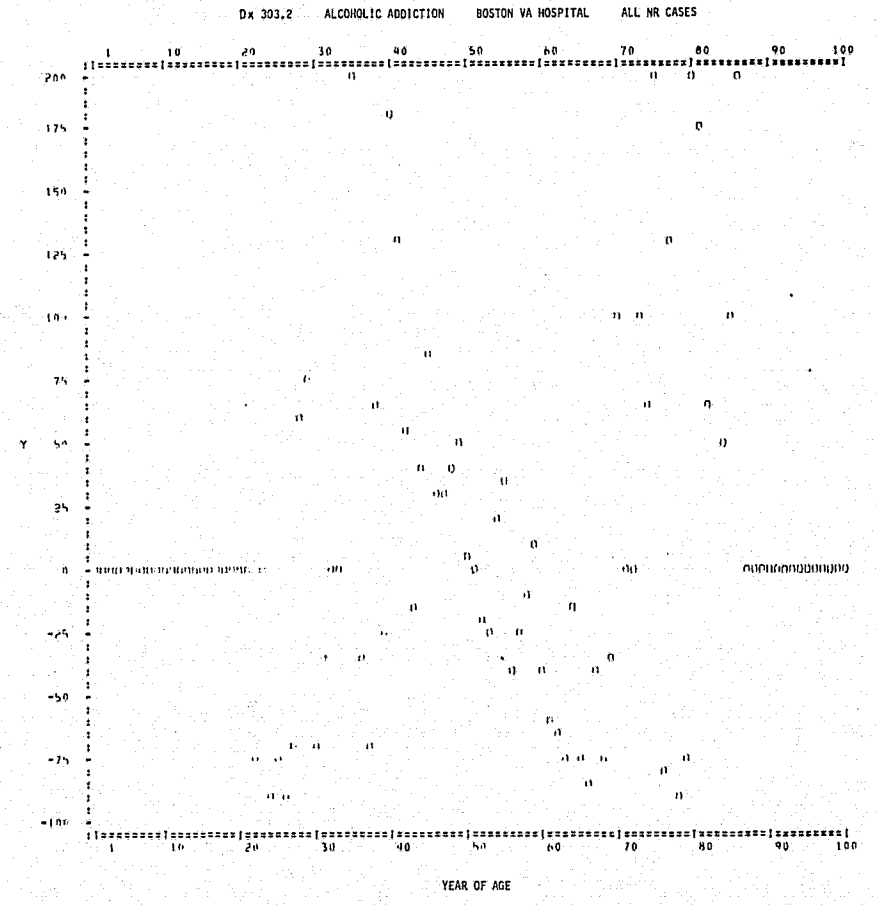
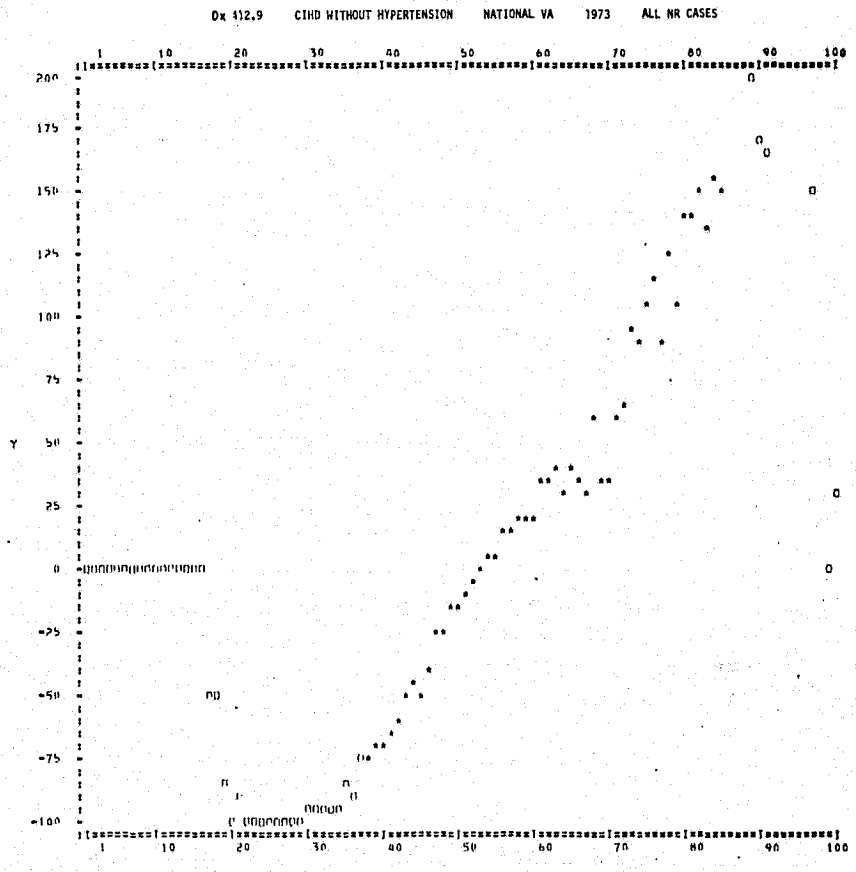
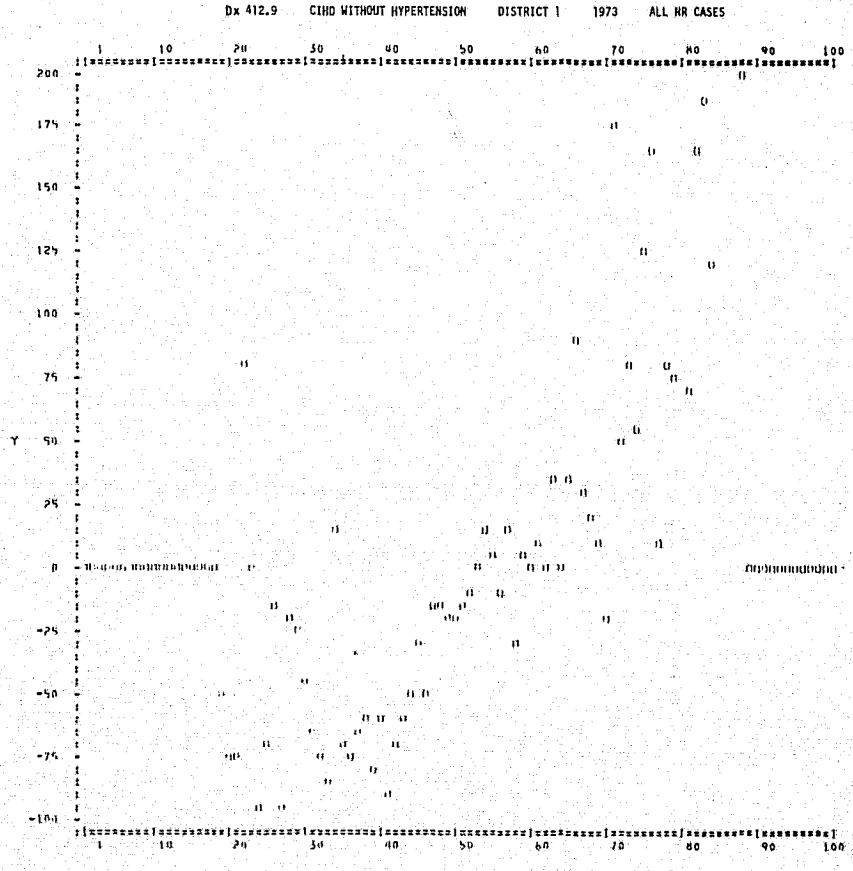


Figure A-10. γ characteristics of alcoholic addiction—national versus district versus institution.


Dx 412.9 CIHD WITHOUT HYPERTENSION NATIONAL VA 1973 ALL NR CASES
Y


Dx 412.9 CIHD WITHOUT HYPERTENSION DISTRICT 1 1973 ALL NR CASES
Y
YEAR OF AGE

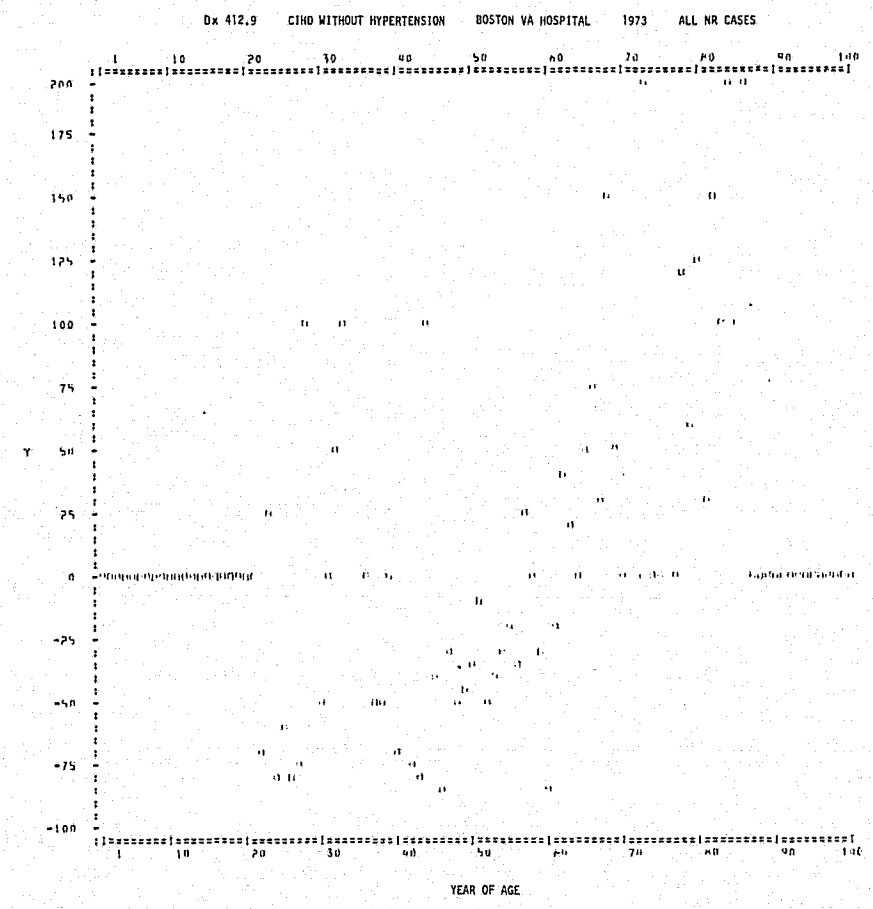
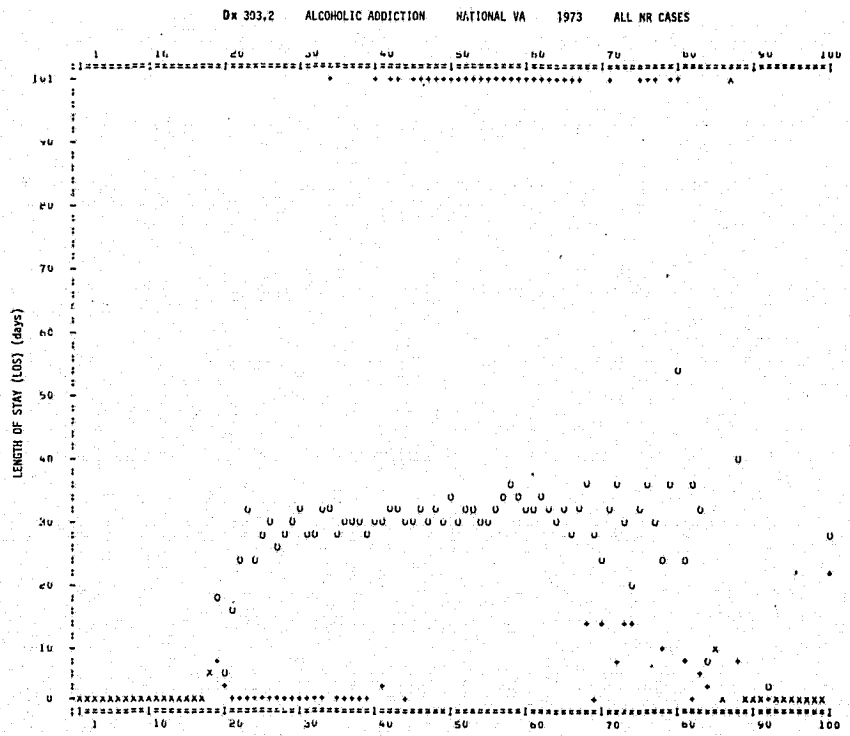
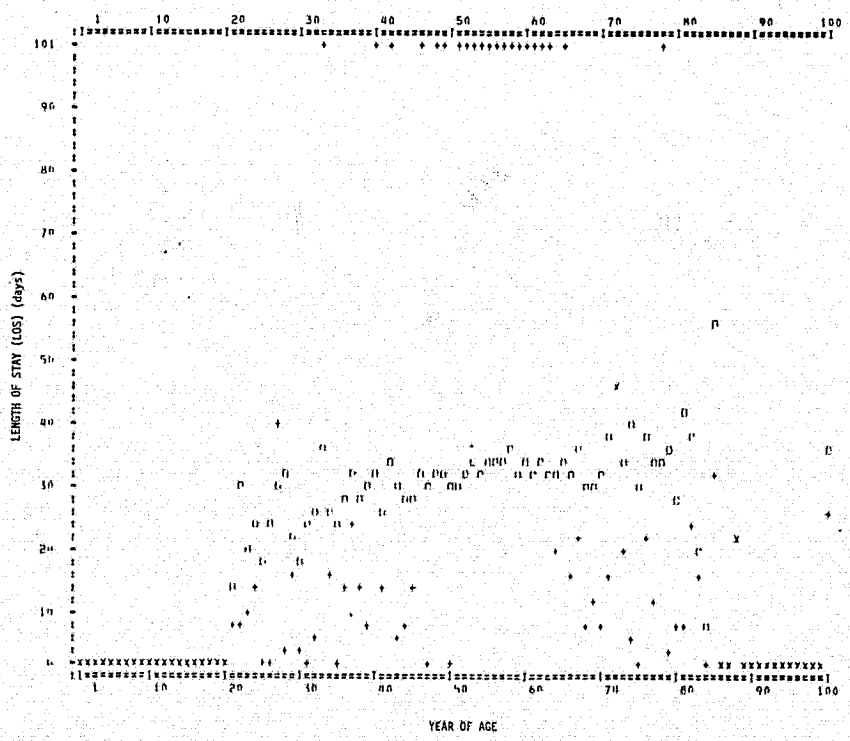


Figure A-11. γ characteristics of chronic ischemic heart disease (CIHD) without hypertension—national versus district versus institution.





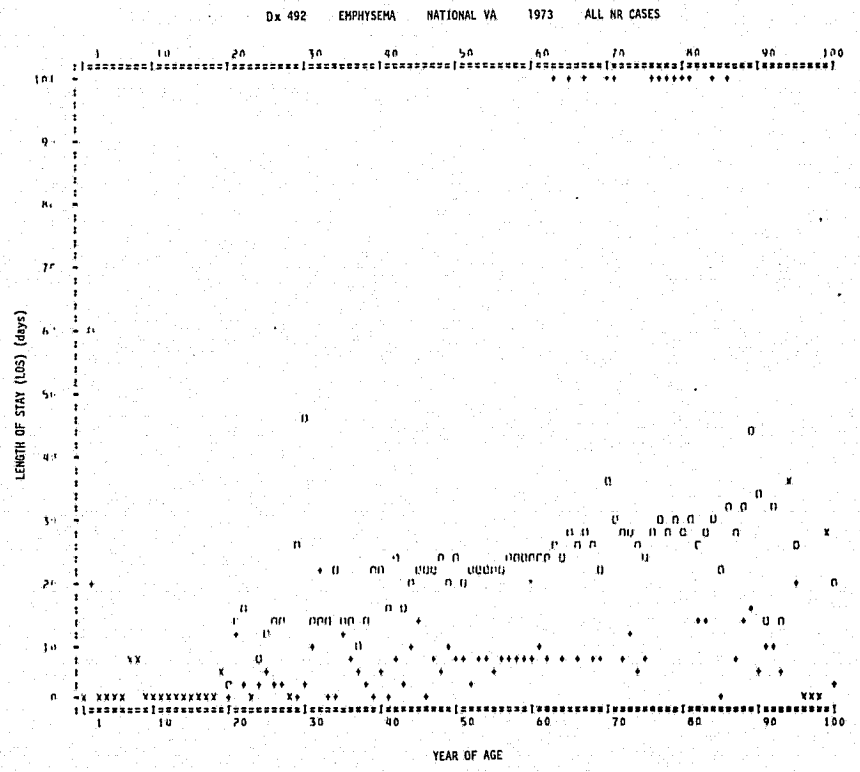
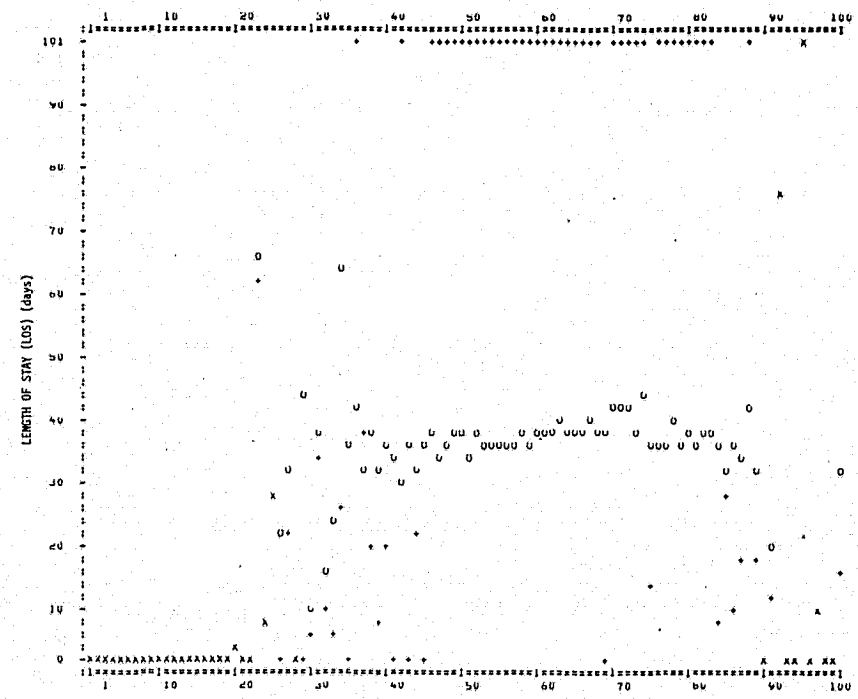
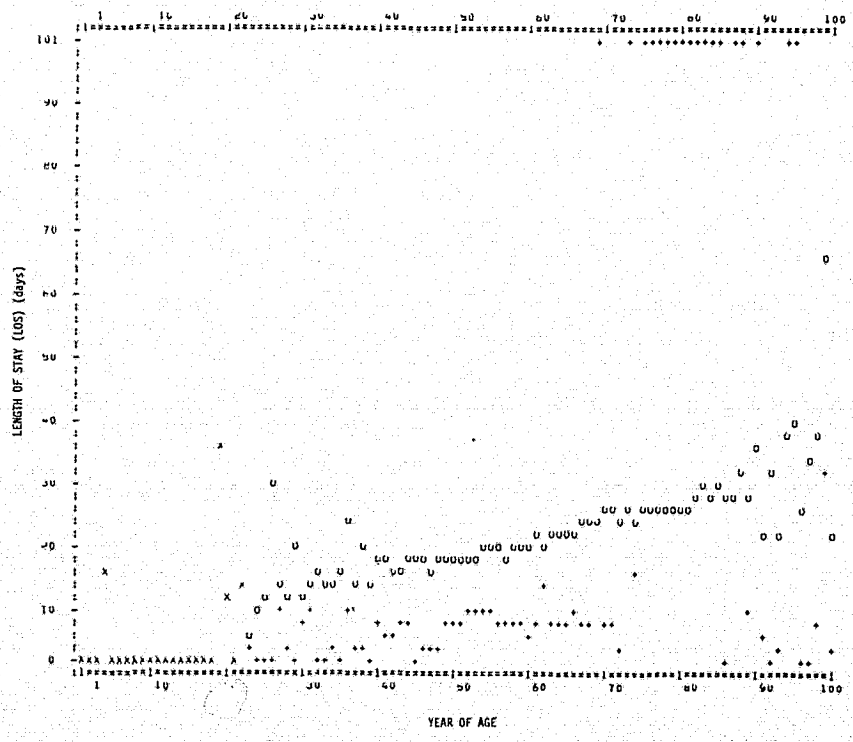


Figure A-12. Age-specific length of stay (LOS) for selected ICDA conditions—all NR cases in VA hospitals, 1973 (1 of 3).

Dx 162.1 NEOPLASM OF BRONCHUS AND LUNG NATIONAL VA 1973 ALL NR CASES



Dx 412 CHRONIC ISCHEMIC HEART DISEASE NATIONAL VA 1973 ALL NR CASES



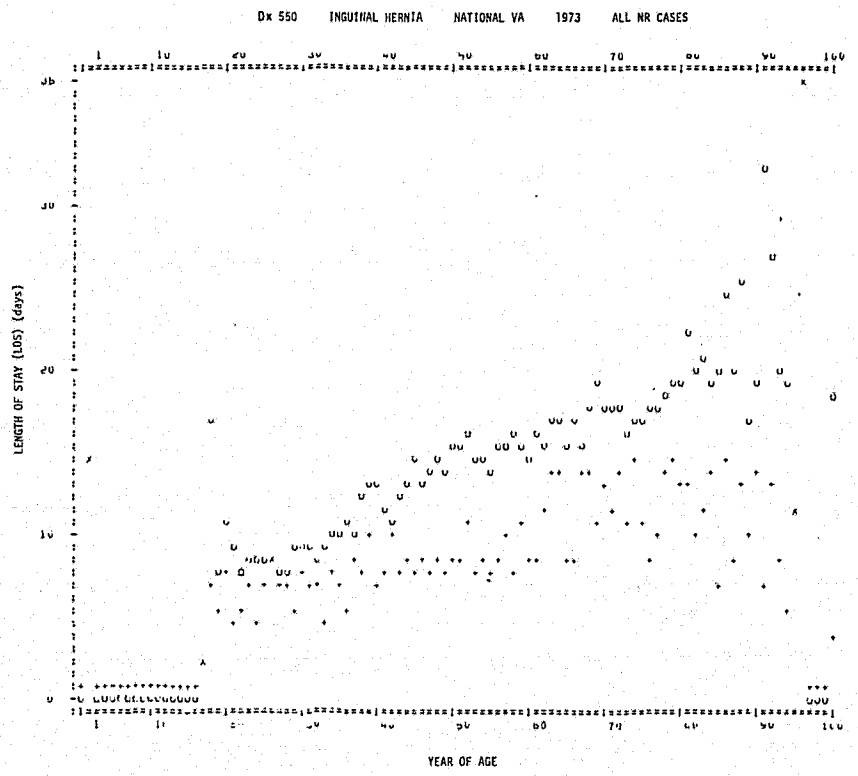
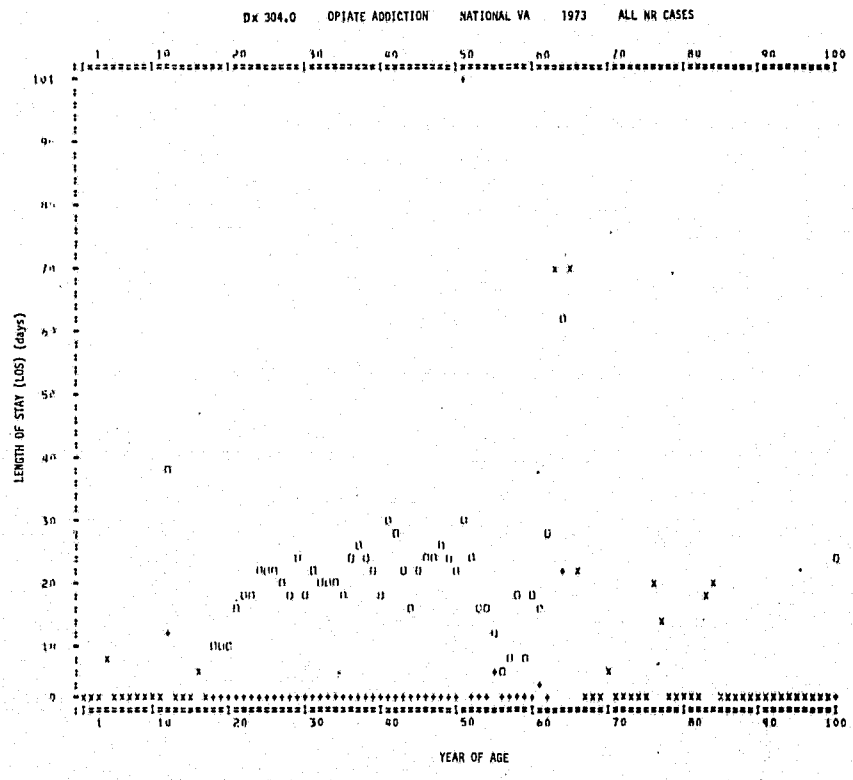
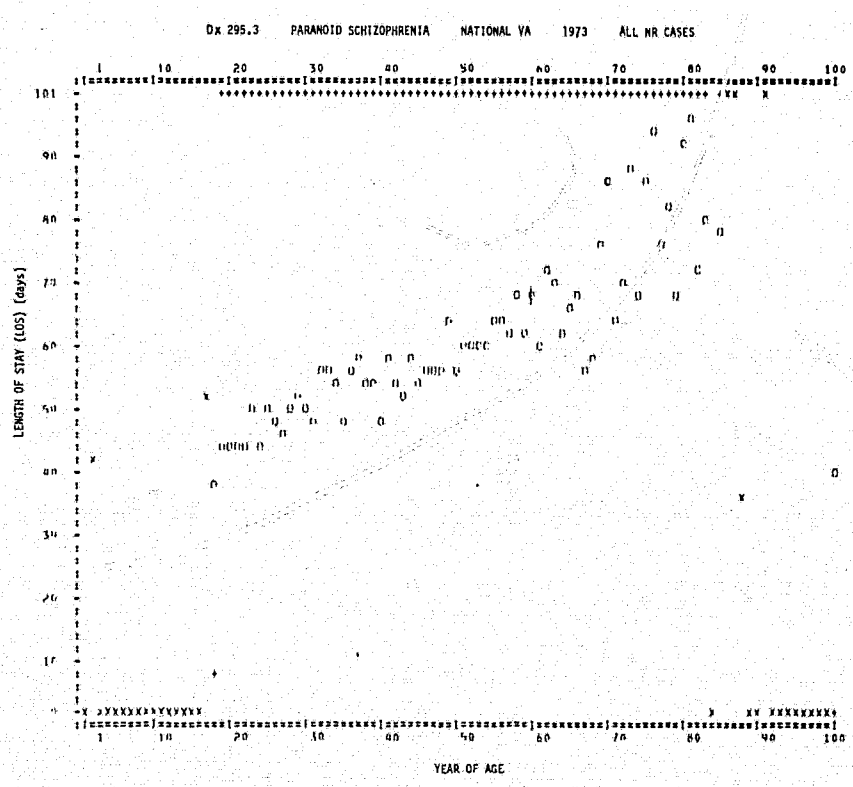


Figure A-12. Age-specific length of stay (LOS) for selected ICDA conditions—all NR cases in VA hospitals, 1973 (2 of 3).





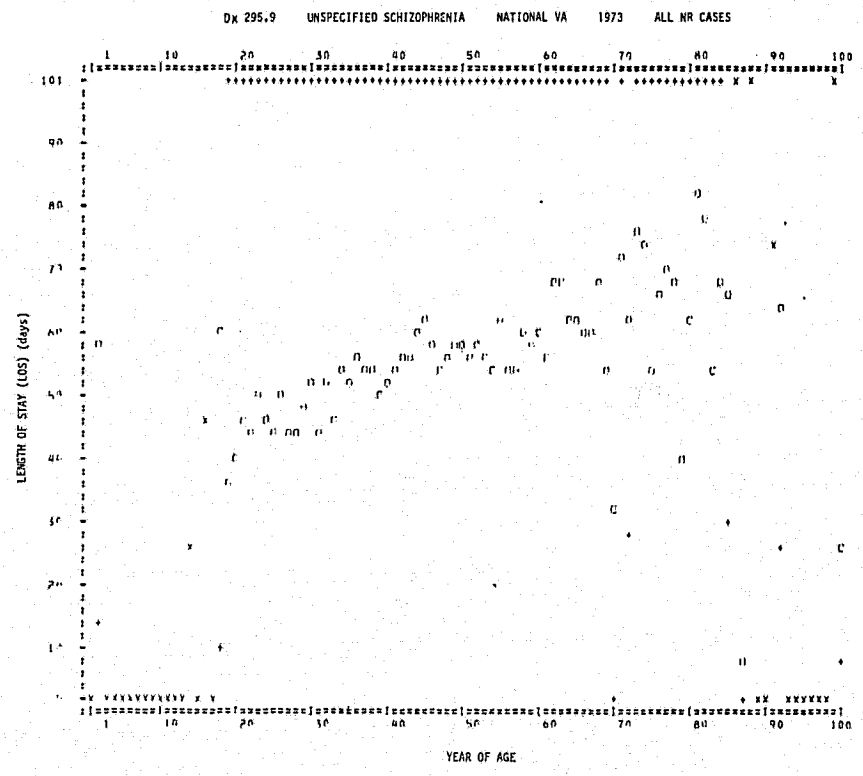


Figure A-12. Age-specific length of stay (LOS) for selected ICDA conditions—all NR cases in VA hospitals, 1973 (3 of 3).

Table A-6. Parameters of some linear models for length of stay (LOS).

Parameter	Alcoholic Addiction	Alcoholic Cirrhosis	Neoplasm of Bronchus and Lung	Emphysema	Chronic Ischemic Heart Disease	Inguinal Hernia	Paranoid Schizophrenia	Unspecified Schizophrenia	Opiate Addiction
Age Range	35-79	35-80	36-80	35-80	35-80	35-80	35-80	35-80	25-50
m	0.10	0.15	0.10	0.30	0.24	0.17	0.68	0.21	0.15
b	30.4	23.6	31.2	6.16	7.24	5.69	25.6	46.8	16.7
r^2	0.002	0.30	0.24	0.68	0.76	0.84	0.65	0.12	0.11
Average LOS	31	32.4	37.1	23.4	20.8	15.2	64.6	58.6	22.2
s	3.18	3.74	2.82	4.90	3.64	2.42	11.27	7.88	3.3

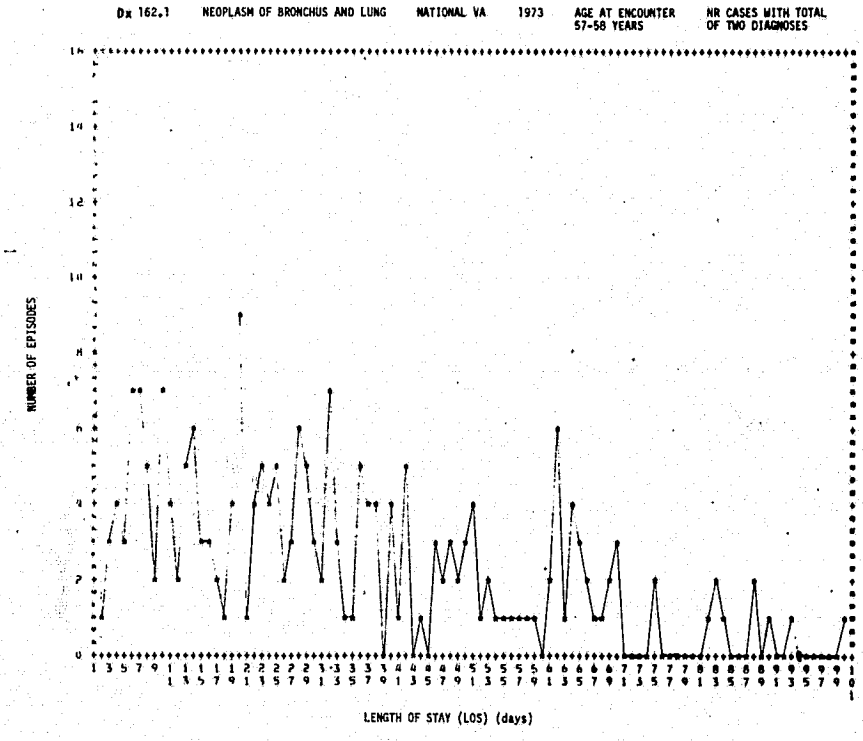
It is perhaps surprising that the slope of the models is so near zero in all cases—that significant increases in average LOS are not more frequently observed as a function of increasing age.

One population of cases (carcinoma of the bronchus and lung) was used to examine the number of cases versus LOS for successive 2-year age groups. Figure A-13 shows two representative plots for the group 57 to 58 years of age. The first represents cases with a total of two diagnoses, the second represents cases with a total of three diagnoses. At least in this situation, the variation in LOS is rather large. Also, no obviously distinct pattern of difference is observed on the basis of the number of diagnoses. Perhaps, in surgical disease, a more distinct change in LOS characteristic would be available on the basis of "operated" versus "nonoperated" cases. The data base precluded such an analysis. Although there is a great deal of variation in number of discharged cases by LOS, the trend is better approximated by an exponential than by a logarithmic curve or a straight line (Figures A-13a, A-13b).

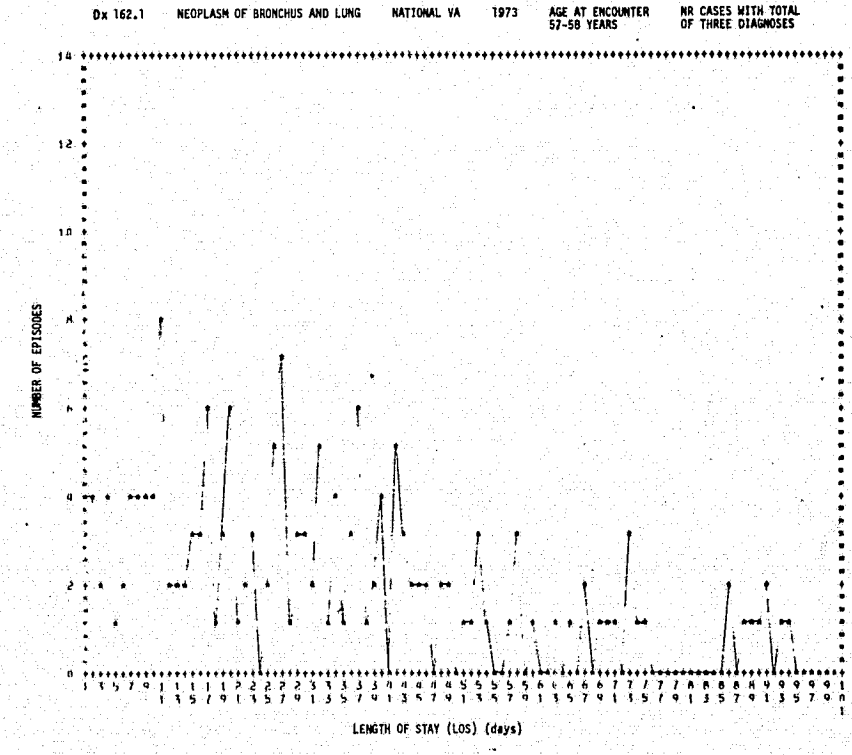
National age-specific LOS characteristics were compared with regional and local data (District 1 and the Boston VA Hospital) in several diagnostic categories. Figure A-14 summarizes such a comparative study for the diagnosis inguinal hernia. As the cases available for analysis decrease, from the national to the institutional level, the variation in mean LOS with year of age increases. Linear-model parameters for this analysis are summarized in Table A-7.

Table A-7. Linear-model parameters for national versus district versus institution—comparison of length of stay (LOS): inguinal hernia.

Parameter	National	District 1	BVAH
m	0.17	0.17	0.05
b	5.69	2.92	7.79
r^2	0.84	0.18	0.01
$\bar{y}$	15.2	12.7	10.4
s	2.42	5.43	4.78



(a) With one associated diagnosis.



(b) With two associated diagnoses.

Figure A-13. Number of cases versus length of stay (LOS) with one and two associated diagnoses, lung cancer—age at encounter: 57 to 58 years.

To summarize these findings:

(1) Mean LOS in the diagnostic categories studied exhibited rather linear age-specific characteristics over the range 35 to 80 years of age.

(2) Some diseases or conditions do not exhibit significant increase in LOS with advancing age.

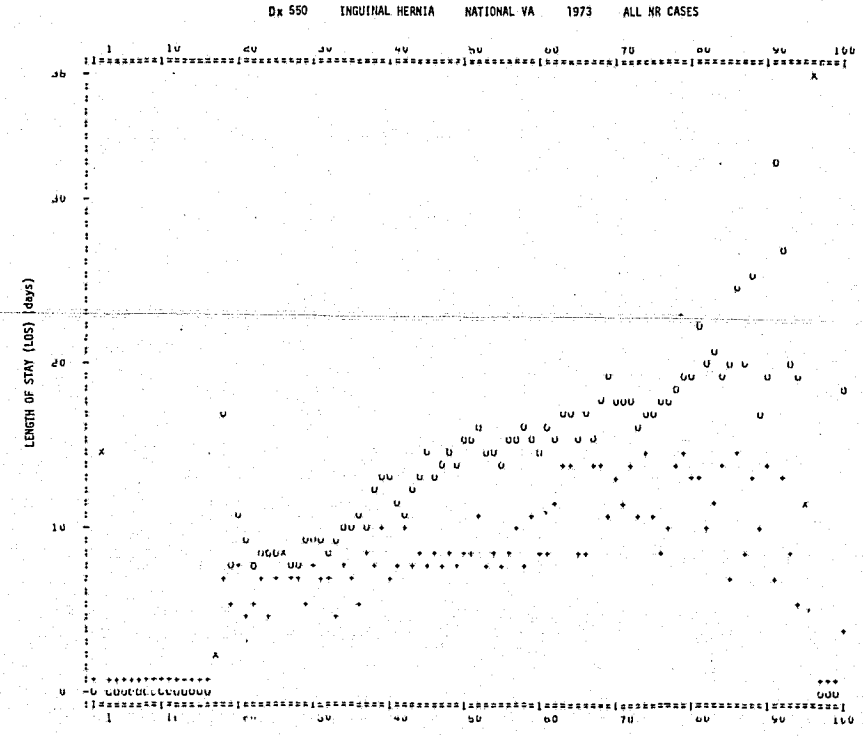
(3) Within a given year of age, there is considerable variation in the number of patients discharged as a function of number of days of inpatient stay.

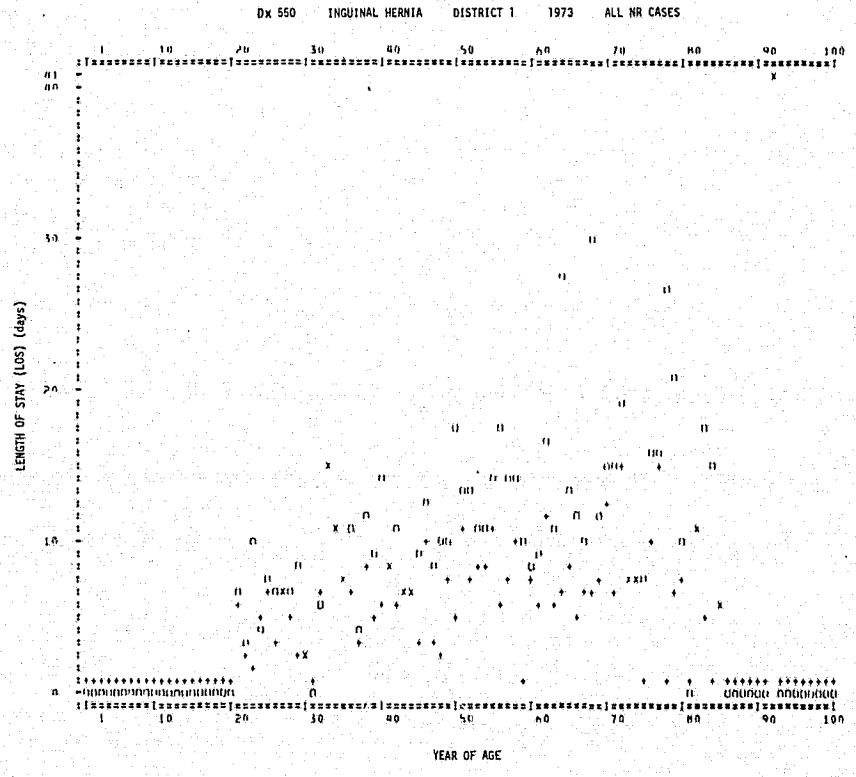
A.6 Clusters of Diagnoses Found to Occur Frequently in Individual Patients

About 32 percent of the nonrepeating (NR) population of cases had a sole diagnostic code. In cases of multiple diagnosis, however, it is reasonable to assume that some diseases may occur simultaneously in an individual more often than others. The presence of specific associated diseases and conditions may modify the pattern of individual care in predictable ways. Thus, the identification of naturally occurring clusters of diagnoses may provide a key to establishing patterns of resource use—patterns that are more predictable than those observed on the basis of principal diagnosis alone. Clearly, a "fine structure" could be added to the ICDA diagnostic nomenclature, based on the naturally occurring association of multiple conditions. Such a structure may be useful to management after more basic relationships between disease descriptors and health-care resource needs have been defined. In preparation for cluster analysis, however, several indices were defined which help to quantitate the likelihood of an association between specific diagnoses in the VA population. These indices are reported here because of their potential utility in establishing a starting point for future analyses of diagnostic code clusters.

For a total of 316 diagnoses (the 200 most frequently occurring diagnoses, plus 116 other diagnoses with occurrence of more than 1000 cases as an associated diagnosis) in the diagnostic index of all episodes, five indices were calculated.

(1) SNGNES.I—The percentage of occurrence of the diagnosis as a sole diagnosis.





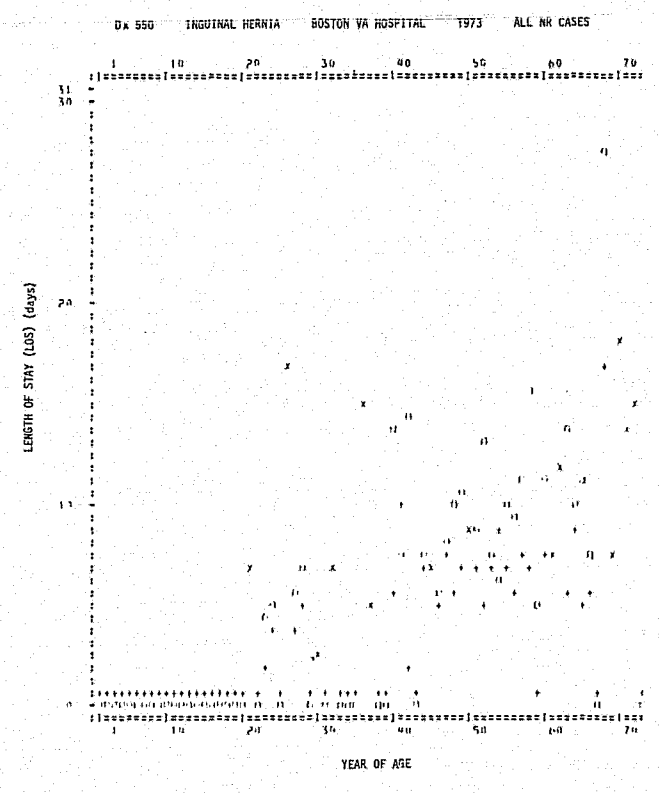


Figure A-14. Age-specific length of stay (LOS)—national versus district versus institution: inguinal hernia.

(2) ASNESS.I—The ratio of the occurrence of the conditions as an associated diagnosis to its total observed occurrence (PDx + ADx occurrence).

(3) PRCH.I—The percentage occurrence of multiple episodes during calendar year 1973 when the condition was a principal diagnosis.

(4) ASCH.I—The percentage occurrence of multiple episodes during calendar year 1973 when the condition was an associated diagnosis.

(5) SNGCH.I—The percentage occurrence of multiple episodes during calendar year 1973 when the condition occurred as a sole diagnosis.

A tabulation of these indices (Figure A-15) is organized into five sections. The first section includes those conditions which occurred most frequently as a sole diagnosis. Succeeding sections contain those conditions that occurred most frequently with one, two, three, or four other (associated) diagnoses.

The rank of diagnoses in this table is ordered by decreasing value of SNGNES.I. The table is potentially useful in two settings: first, in identifying case populations representing frequently observed multiple conditions; second, for exploring the stability (in a large population of cases) of the structure of multiple-word diagnostic statements.

Another tabulation (Figure A-16) was prepared for the 200 most frequently observed principal diagnoses (ranked by descending frequency of occurrence) in the population of all episodes. It lists the following characteristics associated with diagnostic clusters.

(1) TOTPER.I—The percentage of all episodes in which the condition appeared as a principal diagnosis.

(2) CUM.I—The cumulative value of TOTPER.I with descending value of TOTPER.I.

(3) CLUST.I—The ratio SNGNES.I/ASNESS.I. This index is provided on the assumption that conditions which occur rarely by themselves (as sole diagnosis), but occur frequently as associated diagnoses, may be grouping with certain other diagnoses. Such diagnoses would be expected to have a relatively small value of CLUST.I.

(4) SNGNES.I—Previously defined.

ICDA	SNGNES.I	ASNESS.I	PRCH.I	ASCH.I	SNGCH.I
DXY101	99.6594	.876453	94.5509	98.1937	94.6604
DX500	83.8454	.194089	3.96432	8.23045	4.13712
DX7062	78.6795	.482341	4.15406	7.41069	4.51049
DX582	76.1018	.045092	96.0389	34.4077	97.463
DX5206	75.3754	.772385	1.2012	9.82301	.398406
DX685	75.2695	.174493	10.1796	8.78187	10.1034
DX403	69.8116	.329732	77.9569	33.9772	91.4925
DX2140	68.9554	.49051	3.87144	6.98027	4.76695
DX7531	68.827	.305613	88.3194	67.0773	95.1665
DX3073	67.1411	.154369	5.2599	12.2034	4.97696
DX72518	65.4479	.244093	6.94948	8.12446	7.20682
DX7245	64.0599	.178401	5.07487	9.1954	5.58442
DX5932	63.7884	.450942	80.1858	17.6153	90.3407
DX7011	63.5151	.700653	3.27273	8.1305	3.24427
DX566	62.1913	.28162	6.52312	9.8546	6.61914
DX7099	61.7438	.711054	2.66904	9.68908	3.45821
DX605	61.4827	.419822	3.54553	6.57016	3.93185
DX070	61.2882	.182012	3.25309	10.2339	2.9724
DX3040	60.7815	.191602	19.8221	12.7345	19.3026
DX3049	60.1048	.471855	7.28014	13.5593	6.39535
DX4003	59.6583	.0682261	89.2259	42.381	93.4541
DX583	59.4716	.25	79.7639	28.8364	89.9811
DXY104	58.4807	.426156	9.10282	14.9912	8.84658
DX5225	58.1818	.817377	.909091	8.4631	1.5625
DX7061	58.0882	.888616	10.2941	11.6129	8.86076
DX2954	58	.0528415	3.57895	7.54717	2.54083
DX5259	57.9832	.970897	5.04202	7.07808	4.34783
DX2955	57.0313	.202847	9.82143	11.8421	10.1761
DX504	56.7713	.397041	4.41609	9.31446	4.66724
DXY033	56.0639	.562709	23.6733	11.1441	27.003
DX592	55.9823	.354623	13.2201	10.3047	12.9288
DX7939	55.4819	.4437	1.80723	8.91239	1.84582
DX3782	55.2224	.447059	9.8646	7.6555	12.0841
DX3702	54.5454	.994244	0	7.8421	0
DX1733	53.9043	.434204	11.2091	8.26039	11.5265
DX8360	53.6424	.19823	4.52539	7.14286	4.52675
DX2953	53.4627	.0985929	25.2841	11.8869	28.4161
DX9981	53.0067	.706919	2.89532	12.1884	2.10084
DX191	52.3476	.169983	24.8751	15.122	28.0534
DX5250	51.8919	.989277	3.78378	10.2355	4.16667
DX455	51.7341	.576482	4.32177	8.61793	4.8438
DX4549	51.325	.674682	6.20642	8.77606	7.47283
DX29574	51.2787	.0681332	14.0984	12.5561	15.601
DX5651	50.7428	.326923	6.17143	9.41176	6.75676
DX7311	50.5197	.70327	2.079	10.7018	2.46914
DX7287	50.4452	.427616	7.98553	8.97579	9.26641
DX2961	50.1499	.108884	16.1919	12.2699	17.3393
DX3751	49.8595	.626639	16.573	9.03766	16.338
DX9985	49.6556	.655598	8.12672	11.5412	8.04438
DX29590	48.9805	.165076	22.0914	11.4123	24.7704
DX2956	48.6577	.170686	14.6532	15.7609	14.4828
DX201	48.5096	.134985	54.5295	13.8577	62.5301
DXY105	48.4375	.633238	8.89757	15.3092	11.2007
DX2962	48.3431	.22449	8.2846	11.7845	9.07258
DX2114	47.5655	.680048	9.73783	6.43172	13.7795
DX2950	47.4522	.266355	10.9342	9.94152	11.1857
DX601	47.2737	.630979	5.04115	7.6414	5.87595
DX550	46.6532	.368476	6.463	9.00222	6.79537
DX603	46.5778	.62908	3.11111	7.07547	2.67175

(a) Conditions occurring frequently as a sole diagnosis.

Figure A-15. Cluster indices of some frequently occurring conditions (sheet 1 of 7).

DX604	46.2076	.460064	7.79989	9.72222	8.14901
DX5231	46.1538	.991534	3.84615	10.5747	8.33333
DX2113	46.1171	.588496	13.9785	8.5213	16.3212
DX4540	46.0105	.384808	19.4525	8.28678	29.1139
DX5233	45.8823	.954326	0	6.64414	0
DX3041	45.614	.528194	10.8553	19.3927	10.5769
DX2952	45.4423	.106216	12.0189	9.09091	14.1159
DX6079	45.4343	.743575	6.01336	11.7512	4.90196
DX3899	45.2727	.912629	6.18182	8.56397	7.22892
DX72899	44.4444	.579975	6.36364	12.7286	7.27273
DX3759	44.1471	.845358	9.0301	11.0431	9.4697
DX3749	44.0773	.470098	13.1646	8.74136	12.3942
DX3030	43.695	.485283	9.38416	16.3297	11.4094
DX0092	43.1891	.351068	2.25952	9.7852	2.39163
DX5234	42.9752	.952144	1.98347	8.19141	1.15385
DX700	42.9119	.849914	5.36398	12.111	5.35714
DXY106	42.8713	.674823	27.5247	11.5935	47.3441
DX7299	42.8218	.607767	5.19802	10.4633	7.22543
DX3031	42.7637	.254009	19.2101	16.4913	24.4188
DX690	42.647	.952646	7.35294	11.769	12.069
DX360	42.3581	.885842	.436681	10.242	0
DX1109	42.2764	.922593	1.62602	10.0273	0
DX846	42.0502	.342202	4.3933	7.7748	4.64345
DX7201	41.8335	.432077	15.2792	11.2188	15.6171
DX3017	41.5371	.463392	12.0035	18.1	12.474
DX3046	41.3828	.566087	9.21844	12.7496	8.47458
DX7871	41.332	.59274	6.17042	10.2961	7.8199
DX30013	41.2969	.381334	6.68942	11.2957	5.95041
DX5692	41.0555	.684626	3.30948	11.1248	4.57516
DX6929	40.7049	.703323	8.52757	10.5276	8.10056
DX598	40.6625	.524919	19.9415	9.49441	25
DX188	40.617	.214318	35.5898	11.0995	39.6624
DX3019	40.5607	.696368	6.54206	14.8329	7.37327
DX594	40.0273	.594909	5.19126	7.81395	7.16724
DX30181	39.7617	.540117	9.77021	14.3768	10.8305
DX7830	38.7615	.373863	5.9633	13.5723	6.70611
DX7855	38.678	.36752	4.24914	11.9375	4.03756
DX5512	38.6754	.497459	8.44287	10.2656	8.88889
DX0971	38.6667	.9764	2.66667	11.1827	3.44828
DX3042	38.594	.626073	12.769	16.2811	14.8699
DXY0394	38.4571	.799297	7.44762	15.3721	8.12283
DX7893	38.4483	.602921	7.47126	11.2793	9.56652
DX1619	38.2218	.194239	23.648	9.12547	26.3789
DX7873	37.7941	.628415	2.35294	11.8261	1.94553
DX7339	37.3796	.680222	4.81696	11.3225	4.12371
DX404	37.1512	.263383	53.4302	19.3496	76.0563
DX3004	36.7896	.404692	11.3427	14.5815	11.1663
DX5741	36.7323	.283223	2.89687	9.67742	3.15457
DX3039	36.4194	.488567	9.04055	9.91924	10.9723
DX575	36.3811	.425967	5.77478	11.1543	7.14286
DX2914	36.1429	.174528	9.71428	16.8919	10.6719
DX5609	35.2518	.486814	7.39979	13.0011	9.91254
DX6824	34.8993	.484726	4.64206	12.7229	5.28846
DX7130	34.8197	.712937	10.5232	9.26428	14.0581
DX5990	34.2543	.870699	5.07191	10.5728	40.9945
DX6961	34.2496	.685367	19.9108	11.8008	18.872
DX3055	33.7398	.428903	3.86179	9.60758	4.21687
DX150	33.6781	.127959	30.8985	8.81057	33.5892
DX493	33.631	.538596	24.6994	12.3308	30.7457
DX5749	33.2785	.590374	5.83402	10.5473	6.66667

(a) Conditions occurring frequently as a sole diagnosis. (Cont.)

Figure A-15. Cluster indices of some frequently occurring conditions (sheet 2 of 7).

DX715	33.1361	.745941	4.26035	8.34341	3.57143
DX791	33.0818	.577128	6.72956	9.53917	7.79468
DX1977	33.0677	.920845	26.2948	25.6849	57.8313
DX5320	32.933	.26487	2.33881	9.47368	1.72745
DX5379	32.5333	.738311	5.06667	8.79017	5.7377
DX5339	32.3943	.567461	5.17813	10.6094	6.26598
DX5329	32.3732	.494504	6.4672	9.74544	12.8588
DX2910	32.1718	.420385	5.67261	8.21229	7.43073
DX30470	32.1229	.762284	6.42458	10.453	7.82609
DX3032	32.1095	.441527	22.1471	10.579	27.41
DX4444	32.0855	.545012	8.25057	9.05612	9.7619
DX3000	31.9813	.545537	11.6046	12.6797	10.5116
DX1960	31.9277	.873572	16.5663	28.9887	21.6981
DX2001	31.6032	.178977	41.2918	8.99471	47.8102
DX53199	31.3043	.424084	9.80237	10.4133	13.8889
DX600	31.2789	.621158	6.51451	8.29576	11.3146
DX5039	31.2785	.828705	3.65297	9.20245	5.10949
DX3009	31.2655	.713778	2.72953	11.3433	4.7619
DX7123	31.1569	.487361	19.6424	9.37589	24.2609
DX6983	30.6991	.789103	9.72644	9.42323	12.9703
DX595	30.6279	.754742	5.97243	12.9137	8.75
DX5621	30.4681	.69025	11.5012	8.20355	13.3775
DX279	30.4478	.914147	14.0299	14.8304	23.5294
DX30451	30.3317	.791708	2.8436	12.4065	.78125
DX5969	29.6267	.780509	9.48678	13.2736	12.5984
DX5640	29.4627	.672159	4.67938	11.4962	3.52941
DX3579	29.437	.805337	6.85434	12.2633	7.90021
DX4510	29.1477	.498286	12.2316	12.7088	14.9554
DX7862	29.1262	.734809	17.0874	10.6517	23.3333
DX30913	28.9433	.346346	10.0689	12.3555	13.2275
DX7071	28.7868	.573017	8.84167	9.70378	10
DX7131	28.6287	.716329	6.18793	8.65981	7.00467
DX203	28.4455	.208122	46.875	9.7561	60.5634
DX4109	27.9952	.301544	4.69077	9.37716	5.17609
DX4541	27.8788	.731998	6.46465	10.2071	4.34783
DX43599	27.8027	.498313	4.93273	9.36795	6.45161
DX0091	27.6316	.62967	4.23977	12.8977	4.2328
DX470	27.6018	.47785	.339366	6.79852	.409836
DX1990	27.4382	.791768	11.7035	26.7442	17.0616
DX7805	27.1751	.586406	3.54458	8.33333	3.16206
DX1519	26.4706	.187355	23.6243	7.81893	27.957
DX4589	26.0208	.713269	6.08487	12.4236	6.15385
DX0122	25.6493	.802564	9.41558	19.6486	10.1266
DX9979	25.5486	.627336	8.62069	11.5456	7.36196
DX2899	25.5208	.90234	6.25	13.5851	2.04082
DX2951	25.3253	.181818	8.90891	8.10811	10.6719
DX01199	25.278	.592836	3.84226	10.8333	5.2
DX2915	25.0386	.171575	12.3648	9.70149	13.5802
DX3479	24.7646	.639049	10.1376	10.1431	11.4035
DX7889	23.5772	.872605	6.09756	19.3472	6.89655
DX5236	23.3333	.999069	0	10.9776	0
DX0111	22.5543	.186291	6.4538	10.9792	7.53012
DX0112	21.1751	.101881	8.31879	7.69231	13.7363
DXE819	0	1	100	3.88715	100
DXE885	0	1	100	4.9238	100
DXE887	0	1	100	5.07005	100
DXE960	0	1	100	4.51613	100

(a) Conditions occurring frequently as a sole diagnoses. (Cont.)

Figure A-15. Cluster indices of some frequently occurring conditions (sheet 3 of 7).

ICDA	SNGNES.I	ASNESS.I	PRCH.I	ASCH.I	SNGCH.I
DX8240	35.6083	.233045	3.67952	6.44531	4.16667
DX5900	32.849	.535886	75.4022	28.3146	87.2038
DX1101	31.9885	.872754	3.45821	8.90756	2.7027
DX1989	29.0155	.899374	18.1347	26.4928	23.2143
DX2720	28.9773	.941857	15.9091	13.7145	29.4118
DX8230	28.9234	.341742	5.56569	5.9754	8.20189
DX9989	28.4821	.722635	6.16071	12.2001	6.58307
DX5235	28.125	.973255	1.5625	7.29927	5.55556
DX340	27.9984	.292431	21.8801	7.94118	19.2475
DX5210	26.3699	.975279	1.19863	9.99566	1.2987
DX4139	26.1001	.840924	7.59494	17.0695	7.3903
DX3451	25.8389	.70565	11.4094	15.6495	11.6883
DX8737	25.6887	.522682	1.30854	8.23899	1.07239
DX4273	25.6449	.88109	11.5326	12.1237	12.426
DX7837	25.5765	.401661	5.74118	12.8286	6.71573
DX185	25.424	.375539	24.3584	8.70976	23.9079
DX4439	25.3977	.716391	11.3468	10.9992	10.8559
DX1541	25.133	.175439	25.7979	7.1875	24.3386
DX5199	24.9254	.6949	12.6866	16.055	17.3653
DX5770	24.4693	.435635	10.2277	9	11.1987
DX7891	24.2424	.949772	0	10.4968	0
DX1538	24.2128	.218166	20.4126	7.393	22.4215
DX3459	24.1692	.689493	8.45921	13.6961	9.58333
DX4329	24.0876	.554368	5.52659	8.96899	6.92641
DX9600	24.0506	.960381	3.79747	13.2115	0
DX1621	24.0412	.141945	31.8005	10.4191	36.5079
DX3791	23.9496	.828159	2.94118	8.63121	1.75439
DX490	23.913	.668429	5.07246	12.0058	6.66667
DX7802	23.913	.70896	9.98825	15.1351	10.8108
DX1533	23.4266	.209945	19.697	6.14035	22.388
DX465	23.3099	.626238	1.73067	12.0723	1.62413
DX5719	23.0098	.65591	9.59651	12.0709	12.3223
DX7831	22.8977	.549726	5.97771	14.1079	6.63717
DX7385	22.7876	.802361	6.85841	9.80926	5.82524
DX535	22.7161	.594762	3.49059	10.4051	3.72149
DX5963	22.3684	.963706	17.1053	12.9832	17.647
DX5309	22.3235	.728342	3.87244	13.0841	4.08163
DX3959	22.2464	.663486	17.2301	11.1173	18.1373
DX517	22.1041	.757036	11.1583	9.31105	8.65385
DX4279	22.0876	.854646	7.26934	13.4253	10.1266
DX5901	22.064	.686734	11.21	10.2273	19.3548
DX3099	22.0532	.632635	6.36018	10.4777	9.71787
DX401	21.6687	.754757	7.41747	10.8637	8.87134
DX4402	21.566	.613322	10.7383	10.2398	12.6556
DX342	21.5591	.632909	11.8149	8.01837	12.7119
DX2500	21.5493	.356593	10.0704	9.14867	15.0327
DX7832	21.4876	.715127	3.09917	12.5926	3.84615
DX274	21.408	.836274	9.57854	12.1707	8.94855
DX7886	21.1646	.701238	4.25532	15.8874	6.34921
DX5601	21.1111	.920983	1.11111	13.346	0
DX5962	20.7334	.658971	5.64175	8.32117	10.2041
DX7841	20.6544	.681433	2.65849	16.6348	2.9703
DX402	20.5304	.534096	7.85855	19.2802	9.09091
DX4459	20.0913	.630484	4.56621	8.92061	3.78788
DXY01	20	.986714	0	11.535	0
DX19839	20	.889737	13.0769	30.1239	13.4615
DX518	19.7154	.676953	13.0081	13.676	13.4021
DX3092	19.305	.336238	13.2046	10.9756	17.6
DX5771	19.2896	.523395	20.1776	12.4888	21.7391

(b) Conditions occurring most frequently with one other diagnosis.

Figure A-15. Cluster indices of some frequently occurring conditions (sheet 4 of 7).

DX7825	19.016	.515792	4.03538	10.6383	5.52326
DX4274	18.9873	.881464	7.8481	13.2433	10.6667
DX4100	18.7908	.262206	3.92157	9.42529	3.47826
DX5301	18.6495	.740905	7.3955	9.14543	8.04598
DX8204	18.6061	.311777	4.35594	7.96703	5.01672
DX5513	18.0141	.750398	6.27306	9.9085	5.77281
DX481	17.8775	.473884	2.43439	13.978	3.19149
DX3940	17.7254	.401227	28.1762	10.3976	29.4798
DX466	17.7061	.528415	3.54123	13.5849	.895522
DXY0301	17.3977	.861004	3.80117	9.67666	2.52101
DX5112	17.3469	.826651	4.7619	18.4023	3.92157
DX1890	16.6667	.224223	30.8017	21.8978	20.2532
DX1985	16.4122	.939056	14.1221	28.9324	9.30233
DX51920	16.4061	.650569	14.9744	12.037	16.7409
DX1970	16.2879	.881667	12.5	30.6558	6.97674
DX25093	16.2328	.748202	15.9304	12.2363	21.9893
DX3787	15.0592	.775371	6.76819	16.9118	7.86517
DX8202	14.7866	.238979	3.42988	6.31068	4.12371
DX244	14.7303	.792599	12.0332	15.3094	14.0845
DX7861	14.5867	.734966	5.18639	11.1631	7.77778
DX4369	13.7041	.483642	3.81307	8.69299	3.97489
DX5710	13.6274	.621247	14.6275	10.0633	15.1578
DX7884	13.5776	.744071	2.58621	8.08006	1.5873
DX9701	13.0148	.655701	2.47117	14.1869	5.06329
DX4360	12.9443	.391677	3.55466	8.75	3.62694
DX492	12.6116	.726443	20.5512	10.9099	25.8474
DX2859	12	.955642	8.14815	16.5452	18.5185
DX7815	10.4418	.927595	3.61446	6.55172	0
DX280	10.2745	.890313	10.0392	14.1946	9.92366
DX4560	7.83132	.866398	6.3253	16.5351	11.5385
DX792	3.38101	.871769	61.1183	40.8378	7.69231
DX514	2.74725	.851186	1.0989	12.3919	0
DXE819	0	1	100	3.88715	100
DXE885	0	1	100	4.9238	100
DXE887	0	1	100	5.07005	100
DXE960	0	1	100	4.51613	100

(b) Conditions occurring most frequently with one other diagnosis. (Cont.)

Figure A-15. Cluster indices of some frequently occurring conditions (sheet 5 of 7).

(SNGNES.I) PERCENT ALLEP PDX OCCURS ALONE
(ASNESS.I) PERCENT DX ASSOCIATED
(PRCH.I) PERCENT ALLEP PDX REPEATED
(ASCH.I) PERCENT ALLEP ASDX REPEATED
(SNGCH.I) PERCENT ALLEP PDX REPEATS ALONE

ICDA	SNGNES.I	ASNESS.I	PRCH.I	ASCH.I	SNGCH.I
DX5229	36.6667	.987484	0	8.78749	0
DX5236	23.3333	.999069	0	10.9776	0
DX4412	22.367	.597992	8.90337	15.1095	9.70874
DX3442	18.8834	.639645	15.1067	12.951	18.2609
DX7826	18.2767	.802679	4.69974	14.9551	5.71428
DX5699	17.3582	.615059	5.53203	12.065	6.01626
DX2900	15.3389	.578657	4.28062	6.40693	7.75194
DX4130	15.1515	.834699	4.40771	13.1478	1.81818
DX7230	14.8649	.800754	10	10.6927	10.9091
DX7960	14.359	.778241	2.90598	17.2918	3.57143
DX486	14.313	.648836	4.18112	11.615	1.93939
DX8070	14.3093	.619811	1.32341	9.58904	2.89017
DX7853	13.9073	.904551	6.62252	17.1209	19.0476
DX4389	13.8118	.638522	5.82261	7.7041	8.33333
DX428	13.6986	.939116	6.84931	14.5648	10
DX4129	13.536	.596394	20.7428	10.6341	24.2315
DX450	13.199	.675441	5.03778	11.1111	9.54198
DX4339	12.8816	.433378	3.75713	7.36842	4.42708
DX4580	12.7551	.772093	2.04082	11.8976	2
DX491	12.7234	.70879	13.7358	11.862	12.279
DX794	12.6829	.847697	5.85366	7.62489	7.69231
DX5739	12.0635	.778481	6.87831	13.1888	6.14035
DX425	12.0249	.474964	22.4603	14.9733	20.6897
DX7070	12.0214	.789385	12.8228	11.2378	8.88889
DX4120	10.933	.537449	13.5028	9.84542	13.9006
DX4330	10.906	.381422	2.93624	4.7619	2.30769
DX4379	10.6944	.770768	4.76432	7.552	4.2654
DX4272	10.4167	.76	0	11.1842	0
DX2812	9.72972	.851763	4.86486	8.56068	5.55556
DX4370	9.52381	.712919	3.80952	6.51965	2.5
DX4409	9.4149	.79336	6.53401	8.90384	10.7256
DX485	9.36876	.641539	1.52824	8.91034	1.77305
DX2930	9.05923	.308711	8.07201	7.6723	8.33333
DX277	8.96674	.927109	6.94774	9.81372	10.596
DX3441	8.93587	.858152	5.59345	7.18232	6.87023
DX4299	7.91367	.625438	8.56115	13.3563	13.6364
DX4270	7.9135	.844015	9.79986	15.7731	10.4651
DX426	7.41482	.918384	7.01403	22.5289	16.2162
DX2699	6.58823	.907829	2.11765	9.72289	0
DX3093	6.22837	.586907	8.16609	8.10196	8.14815
DX514	2.74725	.851186	1.0989	12.3919	0
DX8069	2.46011	.656464	16.0904	10.7864	13.5135
DX3494	2.27273	.721999	13.0165	12.0923	36.3636
DXE819	0	1	100	3.88715	100
DXE885	0	1	100	4.9238	100
DXE887	0	1	100	5.07005	100
DXE960	0	1	100	4.51613	100

(c) Conditions occurring most frequently with two other diagnoses.

Figure A-15. Cluster indices of some frequently occurring conditions (sheet 6 of 7).

(SNGNES.I) PERCENT ALLEP PDX OCCURS ALONE
(ASNESS.I) PERCENT DX ASSOCIATED
(PRCH.I) PERCENT ALLEP PDX REPEATED
(ASCH.I) PERCENT ALLEP ASDX REPEATED
(SNGCH.I) PERCENT ALLEP PDX REPEATS ALONE

ICDA	SNGNES.I	ASNESS.I	PRCH.I	ASCH.I	SNGCH.I
DXE819	0	1	100	3.88715	100
DXE885	0	1	100	4.9238	100
DXE887	0	1	100	5.07005	100
DXE960	0	1	100	4.51613	100
DX2819	19.1358	.929779	8.02469	10.2564	22.5806
DX3493	1.62003	.770995	14.1384	12.5109	0
DX4290	13.4387	.941217	6.71937	12.7129	5.88235
DX7851	10.1695	.925724	2.25989	10.9248	0
DX7880	6.40703	.869014	2.76382	13.4444	7.84314

(d) Conditions occurring most frequently with three other diagnoses.

(SNGNES.I) PERCENT ALLEP PDX OCCURS ALONE
(ASNESS.I) PERCENT DX ASSOCIATED
(PRCH.I) PERCENT ALLEP PDX REPEATED
(ASCH.I) PERCENT ALLEP ASDX REPEATED
(SNGCH.I) PERCENT ALLEP PDX REPEATS ALONE

ICDA	SNGNES.I	ASNESS.I	PRCH.I	ASCH.I	SNGCH.I
DX0389	8.88889	.835466	1.38889	12.2538	0
DXE819	0	1	100	3.88715	100
DXE885	0	1	100	4.9238	100
DXE887	0	1	100	5.07005	100
DXE960	0	1	100	4.51613	100

(e) Conditions occurring most frequently with four other diagnoses.

Figure A-15. Cluster indices of some frequently occurring conditions (sheet 7 of 7).

ICDA	TOTPER.I	CUM.I	CLUST.I	SNGNES.I
DX582	7.59	7.59	1,687.7	76.1018
DX3032	5.41	13	72.7238	32.1095
DX4129	3.25	16.25	22.6964	13.536
DX2953	2.65	18.9	542.257	53.4627
DX29590	2.63	21.53	296.715	48.9805
DX25093	1.83	23.36	41.6958	16.2328
DX1621	1.55	24.9099	169.37	24.0412
DX3000	1.44	26.3499	58.6235	31.9813
DX550	1.37	27.7199	126.611	46.6532
DX3004	1.3	29.0199	90.9078	36.7896
DX492	1.29	30.3099	17.3608	12.6116
DX3031	1.1	31.4099	166.355	42.7637
DX4120	1.07	32.4799	20.3425	10.933
DX600	1.07	33.5499	50.3557	31.2789
DX5710	1.06	34.6099	21.9356	13.6274
DX3040	1.04	35.6499	317.229	60.7815
DX401	.98	36.6299	28.7094	21.6687
DX491	.79	37.4199	17.9509	12.7234
DX3749	.74	38.1599	93.7618	44.0773
DX5932	.69	38.8498	141.456	63.7884
DX51920	.68	39.5298	25.2181	16.4061
DX4109	.66	40.1898	92.8395	27.9952
DX185	.66	40.8498	67.7	25.424
DXY033	.59	41.4398	99.6321	56.0639
DX403	.58	42.0198	211.723	69.8116
DX30181	.58	42.5998	73.6167	39.7617
DX486	.57	43.1698	22.0594	14.313
DX455	.54	43.7098	89.7411	51.7341
DX7855	.54	44.2498	105.241	38.678
DX5329	.53	44.7798	65.4658	32.3732
DXY0394	.52	45.2997	48.1137	38.4571
DX7131	.52	45.8197	39.9659	28.6287
DX3039	.5	46.3197	74.5432	36.4194
DX7130	.5	46.8197	48.8398	34.8197
DX4270	.43	47.2497	9.37602	7.9135
DX3093	.43	47.6797	10.6122	6.22837
DX7837	.42	48.0997	63.6767	25.5765
DX592	.4	48.4997	157.864	55.9823
DX7531	.4	48.8997	225.21	68.827
DX7123	.36	49.2597	63.9297	31.1569
DX535	.36	49.6197	38.1936	22.7161
DX7062	.36	49.9797	163.12	78.6795
DX7287	.35	50.3297	117.968	50.4452
DX72518	.35	50.6796	268.127	65.4479
DX5699	.35	51.0296	26.2219	17.3582
DX188	.35	51.3796	189.517	40.617
DX4369	.34	51.7196	28.3353	13.7041
DX7802	.34	52.0596	33.7297	23.913
DX4409	.33	52.3896	11.8671	9.4149
DX598	.3	52.6896	77.4644	40.6625
DX4510	.3	52.9896	58.4958	29.1477
DX29574	.3	53.2896	752.624	51.2787
DX485	.3	53.5896	14.6036	9.36876
DX4339	.29	53.8795	29.7237	12.8816
DX5513	.29	54.1695	24.006	18.0141
DX493	.29	54.4595	62.4421	33.631
DX3099	.29	54.7495	34.8593	22.0532
DX4003	.28	55.0295	874.42	59.6583
DX5990	.26	55.2895	39.3412	34.2543

Figure A-16. Some cluster indices for the 200 most frequently occurring conditions observed in the VA system (1973) (all episodes) (sheet 1 of 4).

DX481	.26	55.5495	37.7255	17.8775
DX30913	.26	55.8095	83.5676	28.9433
DX5770	.26	56.0695	56.1693	24.4693
DX53199	.25	56.3195	73.8164	31.3043
DX5621	.24	56.5595	44.1407	30.4681
DX2910	.24	56.7995	76.5293	32.1718
DX340	.24	57.0395	95.7434	27.9984
DX5339	.24	57.2795	57.0865	32.3943
DX1733	.24	57.5195	124.145	53.9043
DXY101	.23	57.7495	113.708	99.6594
DXY105	.23	57.9794	76.4918	48.4375
DX4402	.22	58.1994	35.1626	21.566
DX274	.21	58.4094	25.5993	21.408
DX3030	.2	58.6094	90.0403	43.695
DX504	.2	58.8094	142.986	56.7713
DX5771	.2	59.0094	36.8547	19.2896
DX450	.2	59.2094	19.5413	13.199
DX5512	.2	59.4094	77.7459	38.6754
DX4379	.19	59.5994	13.875	10.6944
DX601	.19	59.7894	74.9211	47.2737
DX5900	.19	59.9794	61.2984	32.849
DX466	.19	60.1694	33.508	17.7061
DX4439	.19	60.3593	35.4522	25.3977
DX604	.18	60.5393	100.437	46.2076
DX465	.18	60.7193	37.2221	23.3099
DX7825	.18	60.8993	36.8676	19.016
DX6824	.18	61.0793	71.998	34.8993
DX583	.18	61.2593	237.886	59.4716
DX6929	.17	61.4293	57.8752	40.7049
DX7893	.17	61.5993	63.77	38.4483
DX5741	.17	61.7693	129.694	36.7323
DX2930	.17	61.9393	29.3453	9.05923
DX404	.17	62.1093	141.054	37.1512
DX0112	.17	62.2793	207.842	21.1751
DX3049	.17	62.4493	127.38	60.1048
DX4540	.17	62.6193	119.567	46.0105
DX201	.17	62.7893	359.371	48.5096
DX8240	.17	62.9593	152.796	35.6083
DX277	.17	63.1293	9.67172	8.96674
DX685	.16	63.2893	431.36	75.2695
DX7938	.16	63.4493	125.044	55.4819
DX4139	.16	63.6093	31.0373	26.1001
DX342	.16	63.7692	34.0635	21.5591
DX3579	.16	63.9292	36.5523	29.437
DX3073	.16	64.0892	434.937	67.1411
DX8204	.16	64.2492	59.6775	18.6061
DX791	.16	64.4092	57.3214	33.0818
DX5320	.16	64.5692	124.336	32.933
DX566	.16	64.7292	220.834	62.1913
DX0092	.15	64.8792	123.022	43.1891
DX150	.15	65.0292	263.193	33.6781
DX070	.15	65.1792	336.727	61.2882
DXY104	.15	65.3291	137.228	58.4807
DX1541	.15	65.4791	143.258	25.133
DX8069	.15	65.6291	3.74751	2.46011
DX4360	.15	65.7791	33.0485	12.9443
DX3451	.15	65.9291	36.6172	25.8389
DX2952	.15	66.0791	427.829	45.4423
DX4389	.15	66.2291	21.6309	13.8118
DX0111	.15	66.3791	121.071	22.5543

Figure A-16. Some cluster indices for the 200 most frequently occurring conditions observed in the VA system (1973) (all episodes) (sheet 2 of 4).

DX3441	.14	66.5191	10.4129	8.93587
DX30013	.14	66.6591	108.296	41.2969
DX7071	.14	66.7991	50.2373	28.7868
DX8737	.14	66.9391	49.1478	25.6887
DX9985	.14	67.0791	75.741	49.6556
DX425	.14	67.2191	25.3174	12.0249
DX4549	.14	67.3591	76.0728	51.325
DX846	.14	67.4991	122.881	42.0502
DX2500	.14	67.6391	60.4311	21.5493
DX2914	.14	67.7791	207.089	36.1429
DX4299	.14	67.9191	12.653	7.91367
DX3479	.14	68.0591	38.7524	24.7646
DX2140	.14	68.1991	140.579	68.9554
DX6961	.13	68.3291	49.9727	34.2496
DX2961	.13	68.4591	460.579	50.1499
DX8202	.13	68.5891	61.8739	14.7866
DX4444	.13	68.7191	58.8712	32.0855
DX7830	.13	68.849	103.678	38.7615
DX595	.13	68.979	40.5806	30.6279
DX3092	.13	69.109	57.4147	19.305
DX2915	.13	69.239	145.934	25.0386
DX5969	.13	69.369	37.9582	29.6267
DX280	.13	69.499	11.5403	10.2745
DX4589	.12	69.619	36.4811	26.0208
DX203	.12	69.739	136.677	28.4455
DX605	.12	69.859	146.449	61.4827
DX4100	.12	69.979	71.6643	18.7908
DX5749	.12	70.099	56.3686	33.2785
DX8070	.12	70.219	23.0866	14.3093
DX7245	.12	70.339	359.079	64.0599
DX4330	.12	70.459	28.5931	10.906
DX4274	.12	70.5789	21.5407	18.9873
DX3017	.11	70.6889	89.6371	41.5371
DX603	.11	70.7989	74.0411	46.5778
DX7070	.11	70.9089	15.2288	12.0214
DX9989	.11	71.0189	39.4143	28.4821
DX5692	.11	71.1289	59.9677	41.0555
DX8230	.11	71.2389	84.6351	28.9234
DX1619	.11	71.3488	196.777	38.2218
DX4279	.11	71.4588	25.8441	22.0876
DX1519	.1	71.5588	141.285	26.4706
DX575	.1	71.6588	85.4083	36.3811
DX3782	.1	71.7588	123.524	55.2224
DX2962	.1	71.8588	215.346	48.3431
DX7871	.1	71.9588	69.7304	41.332
DX402	.1	72.0588	38.4396	20.5304
DXY106	.1	72.1588	63.5297	42.8713
DX500	.1	72.2588	431.993	83.8454
DX191	.1	72.3587	307.957	52.3476
DX2951	.1	72.4587	139.289	25.3253
DX3046	.1	72.5587	73.1032	41.3828
DX3459	.1	72.6587	35.0535	24.1692
DX72899	.1	72.7587	76.6317	44.4444
DX01199	.1	72.8587	42.6391	25.278
DX7831	.1	72.9587	41.6528	22.8977
DX3055	.1	73.0587	78.6654	33.7398
DX3940	.1	73.1587	44.178	17.7254
DX5609	.1	73.2587	72.4132	35.2518
DX4329	.09	73.3487	43.4505	24.0876
DX2954	.09	73.4387	1,097.62	58

Figure A-16. Some cluster indices for the 200 most frequently occurring conditions observed in the VA system (1973) (all episodes) (sheet 3 of 4).

DX7201	.09	73.5287	96.8196	41.8335
DX1890	.09	73.6187	74.3309	16.6667
DX5739	.09	73.7086	15.4962	12.0635
DX2950	.09	73.7986	178.154	47.4522
DX517	.09	73.8886	29.1983	22.1041
DX5301	.09	73.9786	25.1712	18.6495
DX7805	.09	74.0686	46.3417	27.1751
DX1538	.09	74.1586	110.983	24.2128
DX4412	.09	74.2486	37.4035	22.367
DX3959	.09	74.3386	33.5296	22.2464
DX5719	.09	74.4286	35.0807	23.0098
DX3041	.09	74.5186	86.3584	45.614
DX8360	.09	74.6086	270.606	53.6424
DX2955	.09	74.6986	281.154	57.0313
DX2956	.09	74.7886	285.071	48.6577
DX7886	.09	74.8786	30.1818	21.1646
DX43599	.09	74.9686	55.7936	27.8027
DX470	.09	75.0586	57.7625	27.6018
DX5651	.09	75.1486	155.213	50.7428
DX2001	.09	75.2386	176.577	31.6032
DX1533	.08	75.3186	111.584	23.4266

Figure A-16. Some cluster indices for the 200 most frequently occurring conditions observed in the VA system (1973) (all episodes) (sheet 4 of 4).

Note that in this tabulation, the first eight primary diagnostic codes include 26 percent of the total population of episodes. The first 43 codes represent 51 percent of the record population, and the 200 codes account for more than 75 percent of the record population.

One diagnostic-cluster analysis was performed. Forty-two diagnoses were selected from Figure A-16 because they either occurred seldomly as a sole diagnosis but frequently as an associated diagnosis (CLUST.I < 30); or frequently appeared as an associated diagnosis, and also enjoyed frequent occurrence as a primary diagnosis.

For each of these diagnoses, cross-tabulation of occurrence with the 316 conditions identified in Figure A-15 was performed. The logical flowchart of this analysis is shown in Figure A-17. The analysis results were used to prepare Figure A-18 which indicates, for each of the 42 selected conditions, the four diagnostic codes which associated most frequently (from the set of 316 most frequently occurring conditions) and the percentage of occurrence frequency. The population of records representing all cases of paired diagnoses (total number of diagnoses this record equals 2) in the NR population were used. Considering the situation when a first or second associated diagnosis occurs more than 10 percent of the time in the population of NR record with two and only two diagnostic codes, we arrive at Table A-8. Perhaps what we see here are common expansions of the individual patient's diagnostic statement which convey, as couplets, more information than the sum of the information conveyed by each. Further analysis of this type may be especially helpful in distinguishing "information packets" which are related to analysis questions addressed by the clinician. This may be especially helpful in the realm of ambulatory care when the diagnostic statement is not well-developed, and a statement of pathology is seldom available.

A.7 A Prototype Quality-Surveillance Index

During the course of 1975, an HEW committee, chaired by David D. Rutstein, MD, has been developing a systematized nomenclature for those conditions where the clinical knowledge base and the available clinical resources suggest definitive identification of unnecessary disease, disability, and untimely death. An early version of this index, derived from the working papers of the committee, was applied to the NR record population of our data base. Although case disposition

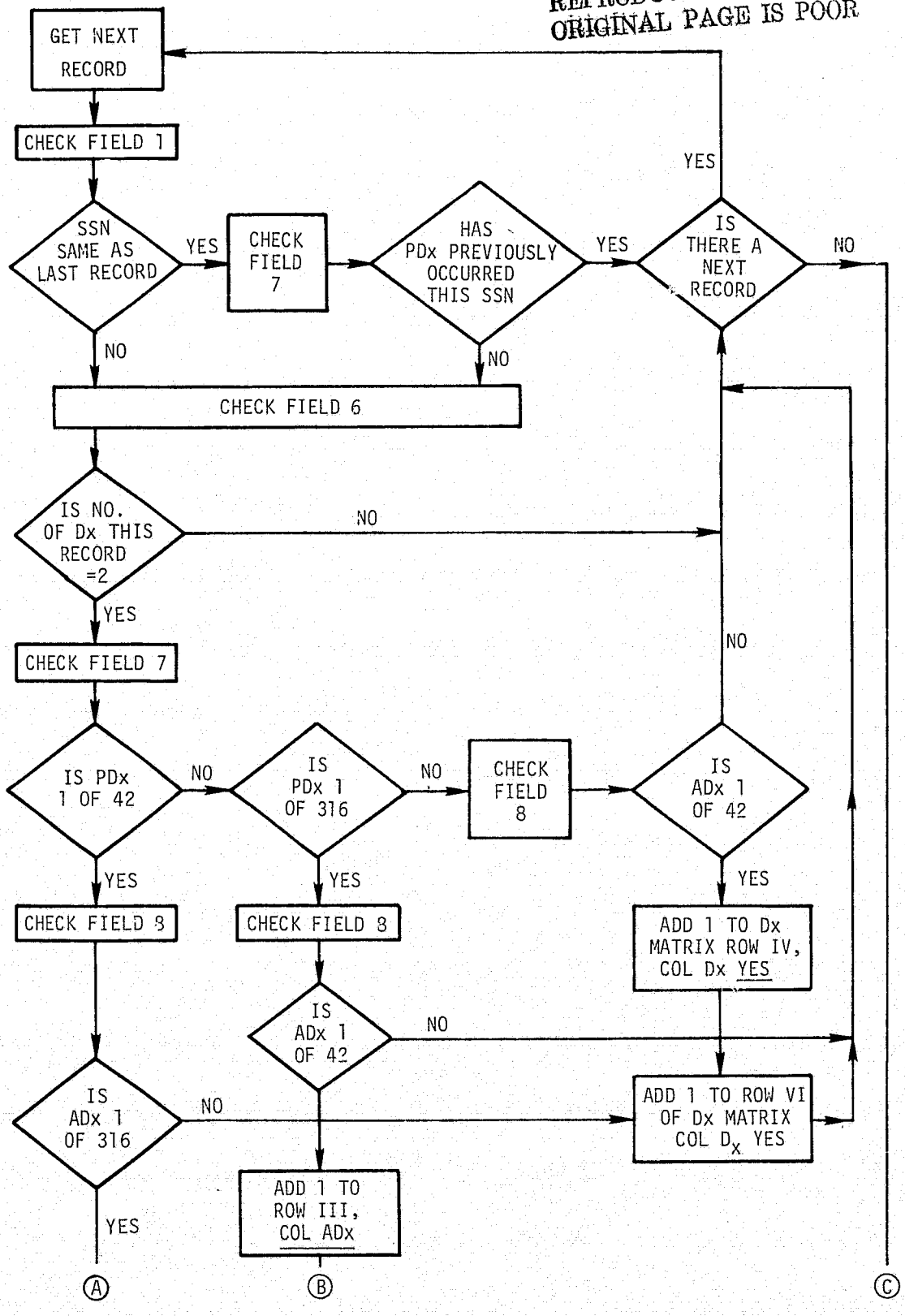


Figure A-17. Flowchart for preparation of Dx cross-tabulation matrix and cluster table (see Figure A-18) (sheet 1 of 3).

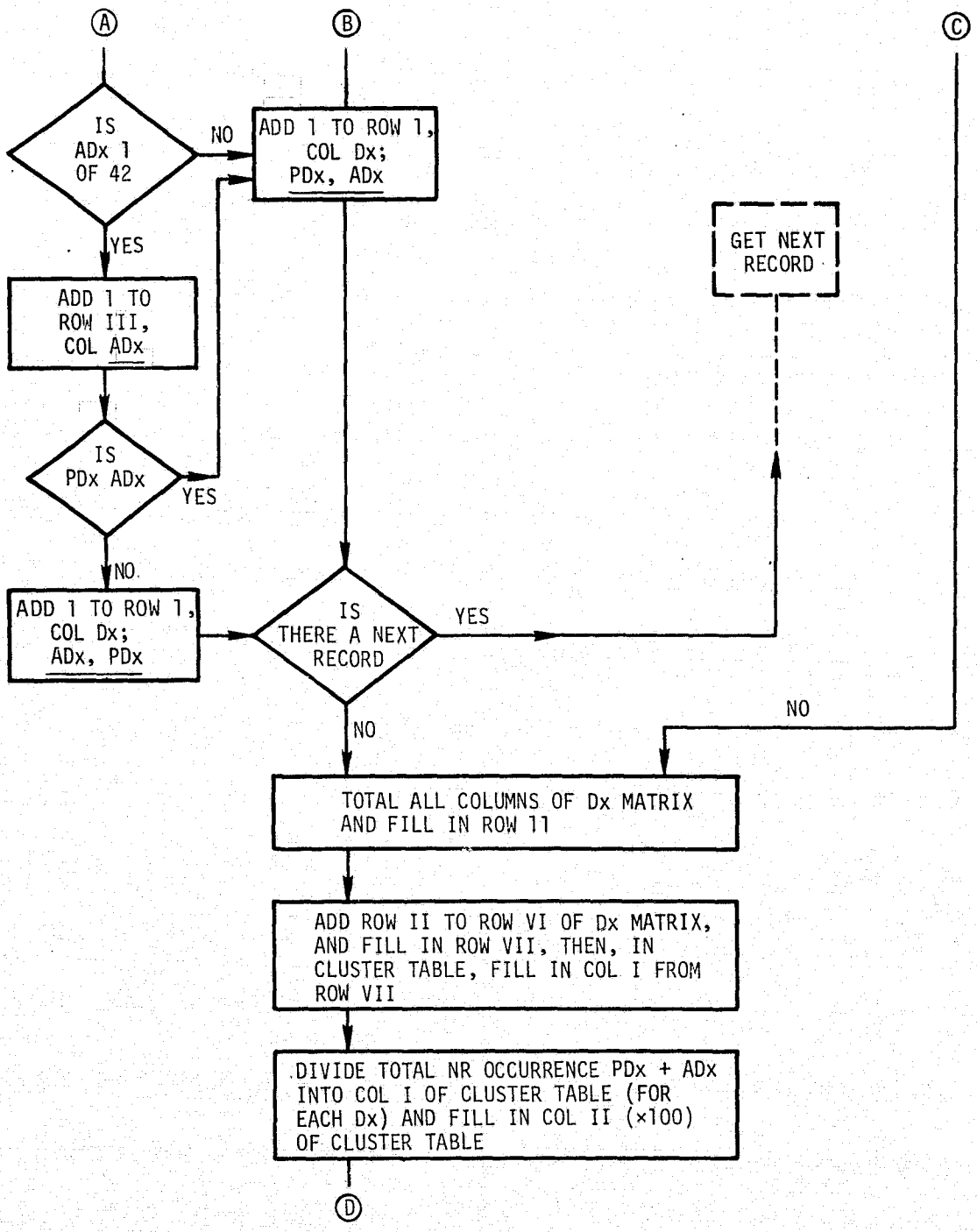


Figure A-17. Flowchart for preparation of Dx cross-tabulation matrix and cluster table (see Figure A-18) (sheet 2 of 3).

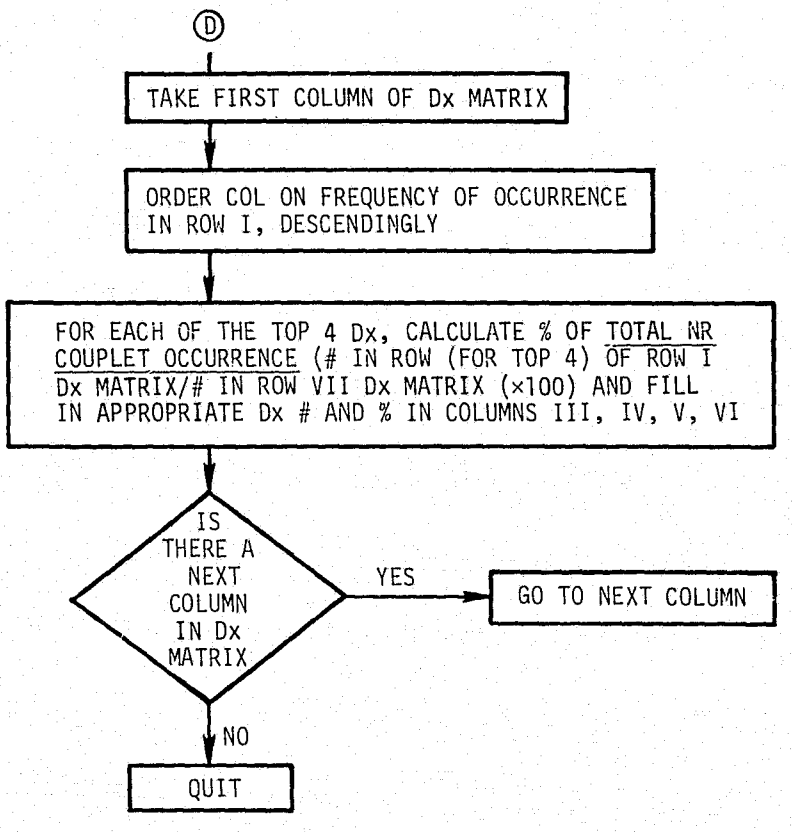


Figure A-17. Flowchart for preparation of Dx cross-tabulation matrix and cluster table (see Figure A-18) (sheet 3 of 3).

ICDA	TOT OCC PDx+ADx	% COL 1 TOT NR	MOST Dx	FREQ. %	2ND Dx	FREQ. %	3RD Dx	FREQ. %	4TH Dx	FREQ. %
	1	2	3		4		5		6	
Y035	2716	23.70	600	3.79	Y039	2.65	4129	2.25	2509	2.14
Y101	188	43.82	582	71.28	403	4.79	5900	4.79	2509	3.19
2140	309	20.02	7062	7.47	550	6.29	401	4.15	2509	3.54
2509	10533	16.49	4129	5.51	3032	4.05	401	3.78	2959	3.09
274	1263	11.22	401	10.85	4120	5.62	3032	4.91	4129	4.59
277	2489	11.92	401	8.24	4129	5.06	2959	3.98	3032	3.82
280	931	9.28	3032	5.80	5699	5.26	5320	4.51	5710	3.76
2930	344	15.00	4129	9.01	485	8.43	600	4.36	4379	3.78
3049	845	28.96	2959	7.81	3018	7.22	2953	6.15	3032	6.15
3093	797	8.27	4379	12.30	4129	10.79	4409	7.53	4120	2.26
3441	956	9.94	4339	11.30	4369	8.58	401	3.56	7815	3.56
401	6584	18.06	3032	6.87	3000	3.51	550	2.57	7830	2.55
4120	2547	12.27	4270	6.32	4130	4.28	492	3.57	3032	3.06
4129	8920	12.83	4139	8.63	4270	6.28	492	3.99	3000	2.98
425	287	12.84	4270	15.68	3032	10.45	4274	5.23	5710	4.53
4270	1289	5.43	492	9.78	4109	7.45	4274	4.50	5192	3.49
4274	541	6.19	3940	7.76	3032	5.55	492	3.33	600	2.03
4279	621	9.62	4109	4.83	7825	4.03	3000	3.38	3032	3.38
4299	316	9.63	600	4.43	3032	3.80	3000	3.16	4109	2.53
4330	159	8.51	7815	9.49	4360	5.70	402	4.43	486	4.43
4339	480	9.64	7815	5.83	4379	5.42	4369	5.21	4329	5.00
4369	663	10.46	7815	7.39	486	4.52	5990	3.32	3032	3.02
4379	465	5.78	4409	5.83	3099	3.02	600	3.02	4329	2.81
4389	386	10.16	7815	6.99	5990	3.11	550	2.59	600	2.59
4409	886	5.94	4444	5.30	3099	3.61	4109	3.05	492	3.05
450	595	10.71	4510	17.48	4109	6.22	492	2.52	Y039	2.02
485	740	9.40	492	10.54	3032	5.95	1621	5.81	491	3.92
486	1774	11.88	492	6.76	3032	6.48	1621	4.74	5192	3.49
491	2720	11.30	492	15.11	3032	9.89	426	3.20	3000	2.76
492	4511	10.90	3032	7.56	426	4.83	466	3.28	1621	3.19
517	303	8.67	3032	5.28	426	4.95	5192	3.96	550	3.63
5192	2011	11.81	3032	7.51	1621	3.93	426	3.23	550	2.69
5301	472	14.36	5513	32.42	535	8.05	3032	4.24	3000	2.33
5513	1156	10.64	5329	5.88	3000	5.02	3032	4.84	535	4.41
5699	949	11.40	3032	10.22	5710	10.01	535	5.80	5621	5.06
5710	3582	14.38	3032	34.00	5739	3.96	4560	3.88	2910	3.55
5739	232	6.17	3032	28.45	3040	6.90	5719	4.31	3039	3.02
5932	516	8.43	600	10.08	592	5.62	185	3.88	188	2.33
7062	1047	15.82	3032	6.88	550	4.78	2959	2.67	455	2.58
7070	327	6.94	340	11.93	3442	11.93	8069	5.50	3493	4.59
8069	287	7.50	3494	17.77	3493	13.24	5969	4.18	5990	4.18
8070	396	13.31	E887	10.35	3032	10.35	E885	3.03	E819	2.53

Figure A-18. Frequency of association of 42 selected conditions with the 312 most frequently occurring diagnoses observed in VA inpatient population (1973).

Table A-8. Summary of paired diagnoses occurring together more than 10 percent of the time (VA inpatient NR population, 1973).

	Most Frequent Association		Second Most Frequent Association	
ICDA-8 Diagnosis	Diagnosis	%	Diagnosis	%
Gout	Essential Hypertension	11		
Mental Disorder Associated with Circulatory Problem	General Ischemic Cerebrovascular Disease	12	CIHD without Hypertension	11
Hemiplegia	Cerebral Thrombosis without Hypertension	11		
Cardiomyopathy	Congestive Heart Failure	16	Chronic Alcoholism	11
Pulmonary Embolism	Congestive Heart Failure	18		
Unspecified Bronchopneumonia	Emphysema	11		
Chronic Bronchitis	Emphysema	15	Chronic Alcoholism	10
Inflammatory Disease of Esophagus	Diaphragmatic Hernia	32		
Intestinal Fistula	Chronic Alcoholism	10	Alcoholic Cirrhosis	10
Alcoholic Cirrhosis	Chronic Alcoholism	34		
Other Disease of Liver	Chronic Alcoholism	29		
Other Renal Disease	Hyperplasia of Prostate	10		
Decubitus Ulcer	Multiple Sclerosis	12	Paraplegic	12
Late Effects of Spinal Fracture	Quadriplegic	18	Paraplegic	13
Closed Rib Fracture	Fall	10	Chronic Alcoholism	10

(life-death) was not included in our data base, this information was available from previous analysis for a few of the conditions. The results of this tabulation are presented in Table A-9. PDx, ADx, and total (PDx + ADx) occurrence is indicated, together with associated occurrence rates per 100,000 in the observed population of inpatients who presented themselves for VA care.

Table A-9. Occurrence and occurrence rates of some quality-surveillance indices as observed in the VA system (1973) (sheet 1 of 6).

Name	ICDA	Total Occur	Rate	PDx Occur	Rate	ADx Occur	Rate	PDx Occur All/NR	Deaths with ICDA as Principal Diagnosis					Total <65	PDx Pop. Rate*	Total Pop. Rate*
									<25	25-34	35-44	45-54	55-64			
• Cholera	000	6	0.75	3	0.37	3	0.37	1—								
• Typhoid Fever	001	5	0.62	2	0.25	3	0.37	1—								
Paratyphoid Fever	002	1	0.13	1	0.13	0	—	1—								
• Salmonella (food as vehicle)	003.0	3	0.37	3	0.37	0	—	1—								
• Bacillary Dysentery	004	22	2.74	15	1.87	7	0.87	1—								
Food Poisoning (bacterial)	005	34	4.24	24	2.99	10	1.25	1—								
• Tuberculosis (all forms)		10,409	1,298.18	5,866	731.59	4,543	566.59	not computed	0	3	17	87	85	192	32.73	18.45
• Silicotuberculosis	010	92	11.47	47	5.86	45	5.61	1.128								
TB of Meninges and CNS	013	45	5.61	18	2.25	27	3.37	1.111								
Plague	020	2	0.25	2	0.25	0	—	1—								
Tularemia	021	23	2.87	17	2.12	6	0.75	1.235								
Anthrax	022			NOT FOUND IN INDEX												
Rat-Bite Fever	026			NOT FOUND IN INDEX												
• Diphtheria	032	17	2.12	5	0.62	12	1.50	1—								
• Whooping Cough	033			NOT FOUND IN INDEX												
• Strep. Throat and Scarlet Fever	034	277	34.55	122	15.22	155	19.33	1—								
Meningococcal Meningitis	036.0	32	3.99	20	2.49	12	1.50	1.300								
• Tetanus	037	4	0.50	0	—	4	0.50	—								
• Acute Paralytic Bulbar Polio	040	1	0.13	0	—	1	0.13	—								
• Acute Polio with Other Paralysis	041	4	0.50	2	0.25	2	0.25	1—								
• Acute Nonparalytic Polio	042			NOT FOUND IN INDEX												
• Acute Polio Unspecified	043	5	0.62	1	0.13	4	0.50	1—								
• Late Effects of Polio	044	131	16.34	34	4.24	97	12.10	1.059								
• Smallpox	050			NOT FOUND IN INDEX												
• Measles	055	8	1.00	6	0.75	2	0.25	1—								
• Rubella	056	5	0.62	2	0.25	3	0.37	1—								

Table A-9. Occurrence and occurrence rates of some quality-surveillance indices as observed in the VA system (1973) (sheet 2 of 6).

Name	ICDA	Total Occur	Rate	PDx Occur	Rate	ADx Occur	Rate	PDx Occur All/NR	Deaths with ICDA as Principal Diagnosis					Total <65	PDx Pop. Rate*	Total Pop. Rate*
									<25	25-34	35-44	45-54	55-64			
• Yellow Fever	060			NOT FOUND IN INDEX												
• Infectious Hepatitis	070	1,794	223.74	1,487	185.45	307	38.29	1.034	3	1	0	3	3	10	6.77	5.57
• Psittacosis	073	5	0.62	4	0.50	1	0.13	1—								
Louse-Borne Typhus	080			NOT FOUND IN INDEX												
Flea-Borne Typhus	081.0			NOT FOUND IN INDEX												
Spotted Fevers	082.0	9	1.12	8	1.00	1	0.13	1—								
Malaria	084	114	14.22	62	7.73	52	6.49	1.032								
• Congenital Syphilis	090	55	6.86	9	1.12	46	5.74	1—								
• Early Syphilis (symptomatic)	091	172	21.45	54	6.74	118	14.72	1—								
• Cardiovascular Syphilis	093	228	28.44	95	11.85	133	16.59	1.253	0	0	0	2	3	5	52.63	21.93
• Syphilis of CNS	094	485	60.49	131	16.34	354	44.15	1.061	0	0	0	1	2	3	22.90	6.19
Gonococcal Infections	098	651	81.19	163	20.33	488	60.86	1.031								
Yaws	102	11	1.37	3	0.37	8	1.00	1—								
Trichiniasis	124	9	1.12	3	0.37	6	0.75	1—								
Hookworm	126	94	11.72	27	3.37	67	8.36	1.037								
Ascariasis	127.0	15	1.87	5	0.62	10	1.25	1—								
• Malignant Neoplasm Lip	140	476	59.37	375	46.77	101	12.60	1.109								
• Malignant Neoplasm Buccal Mucosa	145.0	178	22.20	135	16.84	43	5.36	1.319								
Malignant Neoplasm Large Intestine (not rectum)	153	3,050	380.39	2,315	288.72	735	91.67	1.242								
• Malignant Neoplasm Rectum and Rectosigmoid Junction	154	1,732	216.01	1,369	170.74	363	45.27	1.318								
• Malignant Neoplasm Larynx	161	2,137	266.52	1,652	206.03	485	60.49	1.288	0	0	5	72	114	191	115.62	89.38
• Malignant Neoplasm Trachea, Bronchus, Lung	162	13,118	1,644.76	10,769	1,343.08	2,349	292.96	1.465	2	9	180	1,241	1,799	3,231	300.03	246.30
Malignant Neoplasm Pleura	163.0	48	5.99	32	3.99	16	2.00	1.688								
• Malignant Neoplasm Skin (not melanoma)	173	7,209	899.08	3,910	487.64	3,299	411.44	1.119								
• Malignant Neoplasm Cervix Uteri	180	57	7.11	39	4.86	18	2.25	1.462								
Malignant Neoplasm Vagina	184.0			NOT FOUND IN INDEX												

Table A-9. Occurrence and occurrence rates of some quality-surveillance indices as observed in the VA system (1973) (sheet 3 of 6).

Name	ICDA	Total Occur	Rate	PDx Occur	Rate	ADx Occur	Rate	PDx Occur All/NR	Deaths with ICDA as Principal Diagnosis					Total <65	PDx Pop. Rate*	Total Pop. Rate*
									<25	25-34	35-44	45-54	55-64			
Malignant Neoplasm Bladder	188	3,104	387.12	2,255	281.24	849	105.89	1.553								
Malignant Neoplasm Thyroid Gland	193	189	23.57	135	16.84	54	6.74	1.341								
Hodgkin's Disease	201	1,008	125.72	778	97.03	230	28.69	2.199								
Acute Lymphatic Leukemia	204.0	63	7.86	52	6.49	11	1.37	2.096								
Myeloid Leukemia	205	827	103.14	623	77.70	204	25.44	1.987								
Endemic Goiter	240.0	NOT FOUND IN INDEX														
Thyrotoxicosis (with or without goiter)	242	1,345	167.74	752	93.79	593	73.96	1.242								
Cretinism (Congenital)	243	13	1.62	7	0.87	6	0.75	1—								
Myxedema	244	1,984	247.44	424	52.88	1,560	194.56	1.137								
Diabetes with Acidosis or Coma	250.0	1,992	248.44	1,277	159.26	715	89.17	1.112								
• Avitaminosis and Nutritional Deficiency	260-269	6,757	842.71	948	118.23	5,809	724.48	1.056	0	0	5	15	31	51	49.56	6.92
• Nutritional Marasmus	268	617	76.95	81	10.10	536	66.85	1.012								
Hypervitaminosis A	278.0	1	0.13	0	—	1	0.13	—								
Hypervitaminosis D	278.2	2	0.25	0	—	2	0.25	—								
• Iron Deficiency Anemias	280	10,027	1,250.54	1,147	143.05	8,880	1,107.49	1.112	0	0	1	7	2	10	8.72	1.00
Pernicious Anemia	281.0	796	99.28	240	29.93	556	69.34	1.096	0	0	0	2	1	3	12.50	3.77
Other B_{12} Deficiency Anemias	281.1	109	13.59	13	1.62	96	11.97	1—								
Folic Acid Deficiency Anemia	281.2	1,148	143.18	176	21.95	972	121.23	1.051								
Vitamin B_6 Deficiency Anemia	281.3	5	0.62	3	0.37	2	0.25	1—								
Aplastic Anemia	284	632	78.82	219	27.31	413	51.51	2.251								
Alcoholic Psychoses	291	7,903	985.64	5,209	649.65	2,694	335.99	1.081	0	1	13	45	44	103	19.77	13.03
Alcoholism	303	106,334	13,261.63	58,342	7,273.98	47,992	5,985.41	1.256	0	6	88	244	176	514	8.81	4.83
Drug Dependence	304	24,378	3,040.35	14,096	1,758.01	10,282	1,282.33	1.186								
Enuresis	306.6	17	2.12	4	0.50	13	1.62	1.000								
Mental Retardation	310-315	766	95.53	204	25.44	562	70.09	1.088	0	0	0	0	1	1	4.90	1.31
• Influenzal Meningitis	320.0	2	0.25	2	0.25	0	—	1.000								
Epilepsy	345.1	4,333	540.39	1,320	164.63	3,013	375.77	1.129	0	0	5	11	9	25	18.94	5.77

Table A-9. Occurrence and occurrence rates of some quality-surveillance indices as observed in the VA system (1973) (sheet 4 of 6).

Name	ICDA	Total Occur	Rate	PDx Occur	Rate	ADx Occur	Rate	PDx Occur All/NR	<25	25-34	35-44	45-54	55-64	Total <65	PDxPop. Rate*	Total Pop. Rate*
• Glaucoma, Chronic, Primary	375.0	309	38.54	169	21.08	140	17.46	1.130								
Otitis Media without Mastoiditis	381	2,761	344.34	1,139	142.05	1,622	202.29	1.082								
Otitis Media with Mastoiditis	382	243	30.31	140	17.46	103	12.85	1.043								
Mastoiditis without Otitis Media	383	189	23.57	86	10.73	103	12.85	1.035								
Active Rheumatic Fever	390-392	326	40.66	192	23.95	134	16.71	1.068								
• Hypertensive Disease		43,561	5,432.79	12,760	1,591.39	30,801	3,841.40	1.719								
Acute MI with Hypertension	410.0	1,570	195.81	1,176	146.67	394	49.14	1.041								
Other Ischemic Heart Diseases with Hypertension	411.0	274	34.17	117	14.59	157	19.58	1.009								
Angina with Hypertension	413.0	1,939	241.83	347	43.28	1,592	198.55	1.046								
• Pulmonary Heart Disease	426	4,814	600.39	464	57.87	4,350	542.52	1.075								
Subarachnoid Hemorrhage with Hypertension	430.0	146	18.21	101	12.60	45	5.61	1.020								
Cerebral Hemorrhage with Hypertension	431.0	329	41.03	238	29.68	91	11.35	1.004								
Occlusion Precerebral Arteries with Hypertension	432.0	506	63.11	229	28.56	277	34.55	1.022								
Cerebral Thrombosis with Hypertension	433.0	1,857	231.60	1,157	144.30	700	87.30	1.030								
Cerebral Embolism with Hypertension	434.0	73	9.10	28	3.49	45	5.61	1.036								
Trans. Cerebral Ischemia with Hypertension	435.0	538	67.10	291	36.29	247	30.81	1.045								
Ill-Defined CV Disease with Hypertension	436.0	2,314	288.60	1,438	179.34	876	109.25	1.037								
General CV Disease with Hypertension	437.0	1,379	171.98	404	50.39	975	121.60	1.040								
Other CV Disease with Hypertension	438.0	1,318	164.38	550	68.59	768	95.78	1.053								
Pulmonary Embolism and Infarction	450	5,557	693.05	1,885	235.09	3,672	457.96	1.053								
• Acute Respiratory Infection (not flu)	460-466	11,640	1,451.70	5,017	625.70	6,623	826.00	1.025	0	1	2	7	9	19	3.10	1.39
• Influenza	470-474	2,063	257.29	1,115	139.06	948	118.23	1.004								
• Pneumonia	480-486	29,763	3,711.94	12,234	1,525.79	17,529	2,186.16	1.029	2	10	85	379	507	983	80.35	33.03
• Bronchitis (unqualified)	490	1,879	234.34	655	81.69	1,224	152.65	1.053	0	0	7	45	130	182	24.08	7.02
Chronic Bronchitis	491	24,066	3,001.43	6,902	860.80	17,164	2,141.89	1.159								

Table A-9. Occurrence and occurrence rates of some quality-surveillance indices as observed in the VA system (1973) (sheet 5 of 6).

Names	ICDA	Total Occur	Rate	PDx Occur	Rate	ADx Occur	Rate	PDx Occur All/NR	Deaths with ICDA as Principal Diagnosis					Total <65	PDx Pop. Rate*	Total Pop. Rate*
									<25	25-34	35-44	45-54	55-64			
• Emphysema	492	41,397	5,162.90	10,407	1,297.43	30,990	3,864.97	1.259	0	2	15	118	300	435	41.80	10.51
• Asthma	493	5,171	644.91	2,192	273.38	2,979	371.53	1.328	0	1	0	7	11	19	8.67	3.67
• Hypertrophy Tonsils and Adenoids	500	1,192	148.66	969	120.85	223	27.81	1.041								
• Pneumonoconiosis—Silica and Silicates	515	678	84.56	130	16.21	548	68.35	1.085								
• Other Pneumoconiosis and Related Diseases	516	33	4.12	15	1.87	18	2.25	1—								
• Chronic Obstructing Lung Disease	519.3	THIS CODE IS NOT LISTED IN ICDA-8														
Dental Caries	521.0	21,314	2,658.21	577	71.96	20,737	2,586.25	1.012								
Ulcer of Stomach with Hemorrhage	531.0	1,176	146.67	738	92.04	438	54.63	1.016								
Ulcer of Stomach with Perforation	531.1	181	22.57	128	15.96	53	6.61	1.047								
Ulcer of Stomach with Hemorrhage and Perforation	531.2	34	4.24	24	2.99	10	1.25	1—								
Ulcer of Duodenum with Hemorrhage	532.0	2,061	257.04	1,545	192.69	516	64.35	1.024								
Ulcer of Duodenum with Perforation	532.1	502	62.61	368	45.90	134	16.71	1.025								
Ulcer of Duodenum with Hemorrhage and Perforation	532.2	97	12.10	69	8.61	28	3.49	1—								
• Appendicitis	540-543	1,690	210.77	1,407	175.48	283	35.30	1.081	1	1	0	7	7	16	11.37	9.47
Inguinal Hernia without Obstruction	550	20,351	2,538.11	12,982	1,619.07	7,369	919.04	1.069								
Other Abdom. Hernia without Obstruction	551	16,036	1,999.96	5,271	657.38	10,765	1,342.58	1.072	0	0	1	13	16	30	1.60	0.81
Inguinal Hernia with Obstruction	552	371	46.27	280	34.92	91	11.35	1.004								
Other Abdom. Hernia with Obstruction	553	441	55.00	277	34.55	164	20.45	1.018								
• Alcoholic Cirrhosis of Liver	571.0	24,917	3,107.57	9,134	1,139.16	15,783	1,968.40	1.171								
Stricture of Urethra	598	5,544	691.43	2,465	307.43	3,079	384.00	1.249								
• Disease of Uterus and Female Genital Organs	620-629	996	124.22	402	50.14	594	74.08	1.114								
Disorders of Menstruation	626	294	36.67	171	21.33	123	15.34	1.123								
Menopausal Symptoms	627	93	11.60	19	2.37	74	9.23	1.105								
• All Maternal Deaths	630-678	DEATHS NOT IDENTIFIED														

Table A-9. Occurrence and occurrence rates of some quality-surveillance indices as observed in the VA system (1973) (sheet 6 of 6).

Names	ICDA	Total Occur	Rate	PDx Occur	Rate	ADx Occur	Rate	PDx Occur All/NR	Deaths with ICDA as Principal Diagnosis					Total <65	PDxPop. Rate*	Total Pop. Rate*
									<25	25-34	35-44	45-54	55-64			
Infections or Skin and Subcutaneous Tissue	680-686	13,529	1,687.29	6,951	866.91	6,578	820.39	1.200								
Other Eczema and Dermatitis	692	5,973	744.93	1,790	223.24	4,183	521.69	1.086								
Acute Arthritis (pyogenic organisms)	710	593	73.96	259	32.30	334	41.66	1.004								
Acute Osteomyelitis	720.0	239	29.81	136	16.96	103	12.85	1.022	0	0	0	9	10	19	20.21	11.28
Chronic Osteomyelitis	720.1	1,445	180.22	804	100.27	641	79.94	1.180								
Curvature of Spine	735	856	106.76	119	14.84	737	91.92	1.017								
• Congenital Abnormalities Associated with Rubella	744.3 747.0	52	6.49	28	3.49	24	2.99	1.143								
Coarctation of Aorta	747.1	NOT FOUND IN INDEX														
Infant Mortality (general)	760-778	NOT FOUND IN INDEX														
Symptoms and Ill-Defined Conditions	780-788	80,957	10,096.69	28,780	3,589.35	52,177	6,507.35	1.056								
• Accidents	E800-E845†	—	—	—	—	5,197	648.15	1.039**								
• Accidental Poison (drugs and medicines)	E860-E869†	—	—	—	—	117	14.59	1.068**								
• Surgical and Medical Complications	E930-E936†	—	—	—	—	1,045	130.33	1.121**	6	11	18	37	30	102	—	97.61**

Notes:

*Rates for Total, PDx and ADx Occur are per 100,000 presenting inpatients.

**Death rates are per 1,000 of presenting inpatient population with the specified ICDA code(s).

†Frequency of return ratio for "E" category ICDA codes is based on occurrence of ADx, not PDx ("E codes do not appear as PDx).

APPENDIX B

DIAGNOSTIC INDEX OF THE NATIONAL VA CASE LOAD

The following diagnostic index was prepared from records of calendar year 1973 inpatient admissions in general medical and psychiatric institutions. The format of the index is defined in Appendix A. Diagnoses are listed by decreasing frequency of occurrence in the nonrepeating (NR) record populations. The 600 diagnostic codes in this list were found to describe about 90 percent of the system activity.

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
3032	54856	42707	43369	38781	17614	14905	9967	5993	3463	12786	11619	7951	4937	2923
4129	32927	26097	48655	43481	4457	7134	7405	5685	4101	3377	5509	5835	4605	3356
29590	26680	20786	5275	4673	13068	6012	3658	1995	1091	9831	4639	2954	1643	945
2953	26843	20056	2936	2587	14351	5690	3414	1788	871	10273	4239	2695	1455	741
25093	18518	15568	55025	48292	3006	4558	4165	2926	1940	2345	3680	3606	2563	1714
550	13879	12982	8098	7369	6475	3536	2032	1057	483	6035	3289	1922	1002	446
3000	14546	12858	17461	15247	4652	4187	2623	1555	853	4163	3678	2273	1393	731
3004	13145	11654	8936	7633	4836	3776	2127	1258	692	4296	3312	1867	1120	637
1621	15723	10723	2601	2330	3780	4314	3190	2032	1234	2400	2938	2158	1451	894
492	13099	10407	34785	30990	1652	3244	3123	2275	1488	1225	2564	2466	1857	1201
600	10822	10117	17744	16272	3385	2845	1970	1321	820	3002	2646	1854	1244	776
4120	10857	9391	12615	11373	1187	2191	2485	1959	1473	1022	1865	2158	1721	1270
401	9936	9199	30579	27257	2153	2680	2228	1405	857	1962	2482	2068	1307	811
5710	10699	9134	17549	15783	1458	2519	2478	1754	1255	1237	2122	2120	1498	1090
3031	11166	9021	3802	3175	4775	3026	1671	918	458	3609	2468	1427	815	416
3040	10569	8474	2505	2186	6424	2168	1012	495	286	5184	1724	804	387	230
491	8001	6902	19474	17164	1018	1784	1806	1467	1008	893	1528	1563	1264	859
3749	7505	6517	6658	6076	3308	1883	1121	640	334	2898	1605	975	551	300
4109	6694	6380	2890	2619	1874	1683	1326	857	483	1777	1601	1260	825	470
51920	6845	5820	12744	11210	1123	1585	1500	1128	790	935	1339	1274	961	686
486	5764	5523	10650	9413	825	1140	1283	996	707	809	1101	1237	900	685
30181	5875	5301	6900	5908	2336	1749	890	482	247	2083	1571	821	445	227

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
7855	5507	5273	3200	2818	2130	1391	874	522	310	2044	1326	841	492	297
455	5507	5269	7496	6850	2849	1296	663	373	199	2711	1247	632	360	196
185	6663	5040	4007	3658	1694	1739	1239	887	580	1289	1268	940	686	449
5329	5381	5033	5264	4751	1742	1481	1012	623	336	1518	1388	945	594	314
7131	5236	4912	13222	12077	1499	1306	1052	663	407	1394	1217	996	625	385
Y0394	5250	4859	20908	17694	2019	1446	879	453	258	1855	1334	819	425	237
3039	5055	4598	4829	4350	1841	1419	854	499	239	1639	1283	792	468	223
Y033	6011	4588	7735	6873	3370	1292	646	343	210	2460	1016	506	287	186
7130	5046	4515	12532	11371	1757	1218	904	521	339	1510	1114	811	484	317
7837	4250	4006	2853	2487	1087	1126	881	573	327	1014	1064	830	545	307
3093	4335	3981	6159	5660	270	607	906	870	683	248	555	820	793	622
4270	4347	3921	23521	19811	344	837	989	865	623	308	753	894	779	563
535	3667	3539	5382	4822	833	1007	797	502	288	802	963	770	489	283
592	4062	3525	2232	2002	2274	864	430	245	133	1980	747	368	214	116
7062	3635	3484	3387	3136	2860	478	188	59	35	2731	463	184	58	34
4369	3488	3355	3267	2983	478	734	720	580	463	459	708	688	560	445
5699	3543	3347	5661	4978	615	689	751	636	434	578	643	712	604	419
72518	3583	3334	1157	1063	2345	680	306	154	58	2176	637	280	144	58
7287	3594	3307	2685	2444	1813	925	429	234	117	1645	863	404	216	109
4409	3367	3147	12927	11776	317	558	676	592	548	283	515	644	554	521
7802	3404	3064	8292	7037	814	994	721	415	247	726	884	655	379	225
582	76872	3045	3630	2381	58501	14675	1955	998	400	1484	553	357	254	179

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
7123	3691	2966	3509	3180	1150	928	683	421	262	871	766	552	349	220
485	3010	2964	5387	4907	282	516	641	555	472	277	505	635	545	463
4339	2981	2869	2280	2112	384	567	623	520	417	367	549	600	500	402
5513	2981	2794	8962	8074	537	742	680	440	308	506	682	642	412	291
3099	2893	2709	4982	4460	638	658	553	422	274	576	623	512	402	262
4510	3074	2698	3053	2665	896	815	592	339	231	762	720	522	301	210
29574	3050	2620	223	195	1564	659	395	227	124	1320	576	334	204	111
481	2629	2565	2368	2037	470	582	537	450	292	455	575	522	440	284
5990	2642	2508	17791	15910	905	616	531	448	232	534	581	508	424	216
598	3079	2465	3402	3079	1252	810	490	284	142	939	651	420	242	124
30913	2612	2349	1384	1213	756	709	485	291	189	656	631	439	275	179
2910	2468	2328	1790	1643	794	700	440	256	156	735	659	425	239	150
5770	2591	2326	2000	1820	634	780	529	329	175	563	690	483	296	161
5339	2414	2289	3167	2831	782	645	431	262	170	733	614	411	249	164
53199	2530	2282	1863	1669	792	586	497	320	193	682	543	445	293	184
188	3501	2255	955	849	1422	842	525	324	212	858	555	336	227	152
5621	2478	2193	5522	5069	755	658	430	274	176	654	571	386	246	164
493	2911	2192	3398	2979	979	742	534	334	171	678	556	427	269	138
1733	2382	2115	1828	1677	1284	557	287	120	76	1136	507	245	105	68
Y105	2304	2099	3978	3369	1116	547	318	163	91	991	497	299	157	87
4402	2235	1995	3545	3182	482	564	443	342	189	421	497	396	307	177
504	2038	1948	1342	1217	1157	521	218	91	34	1103	502	212	82	32

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
340	2468	1928	1020	939	691	697	502	308	133	558	528	391	239	100
274	2088	1868	10665	9367	447	493	440	321	209	407	437	399	292	193
450	1985	1885	4131	3672	262	389	451	334	264	237	371	418	325	258
4379	1973	1879	6634	6133	211	352	404	377	271	202	341	389	356	252
3030	2046	1854	1929	1614	894	605	279	138	87	792	561	257	126	79
601	1944	1846	3324	3070	919	529	252	126	77	865	498	242	126	76
466	1892	1825	2120	1832	335	452	450	301	211	332	430	436	289	199
465	1849	1817	3098	2724	431	505	385	245	145	424	494	377	242	144
5512	1978	1811	1958	1757	765	526	312	188	107	697	476	292	170	101
7825	1809	1736	1927	1722	344	434	380	273	191	325	418	369	263	186
604	1859	1714	1584	1430	859	451	279	141	69	789	419	251	129	66
6824	1768	1705	1682	1468	624	430	300	202	125	591	405	288	199	119
5741	1726	1676	682	616	634	409	326	188	76	614	398	316	182	76
4439	1886	1672	4764	4240	479	543	349	247	148	427	472	306	221	138
7938	1660	1630	1324	1206	921	349	195	104	58	904	343	190	102	58
8240	1685	1623	512	479	600	661	223	105	49	575	645	214	97	49
5771	2027	1618	2226	1948	391	523	493	289	182	306	410	395	242	144
7893	1740	1610	2642	2344	669	477	260	171	97	605	440	249	161	93
6929	1759	1609	4170	3731	716	443	268	164	90	658	405	245	149	78
3049	1717	1592	1534	1326	1032	404	162	64	32	966	363	151	60	29
2930	1722	1583	769	710	156	326	352	288	249	143	296	319	267	224
0112	1719	1576	195	180	364	356	352	261	156	314	326	325	245	149

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
277	1684	1567	21419	19317	151	386	409	322	209	135	355	390	304	193
5320	1582	1545	570	516	521	370	258	171	143	512	362	247	167	140
8204	1607	1537	728	670	299	425	304	243	166	284	410	287	233	156
4139	1659	1533	8770	7273	433	468	360	201	124	401	429	334	186	115
3073	1616	1531	295	259	1085	291	130	65	32	1031	272	121	63	31
3579	1634	1522	6760	5931	481	377	305	212	123	443	349	286	198	117
0092	1549	1514	838	756	669	363	243	144	67	653	358	236	141	66
685	1670	1500	353	322	1257	278	82	28	16	1130	247	71	28	15
070	1537	1487	342	307	942	361	139	60	23	914	347	133	59	22
791	1590	1483	2170	1963	526	442	297	169	89	485	405	283	159	86
566	1579	1476	619	558	982	312	157	68	35	917	290	146	64	34
342	1642	1448	2831	2604	354	416	345	217	131	309	359	303	194	116
4360	1491	1438	960	876	193	331	323	267	173	186	319	312	254	170
8737	1452	1433	1590	1459	373	607	269	102	51	369	598	265	100	51
4389	1477	1391	2609	2408	204	302	329	251	191	187	289	310	236	179
Y104	1527	1388	1134	964	893	330	174	63	33	814	296	159	57	30
5932	6995	1386	5745	4733	4462	1636	344	207	150	431	249	245	173	125
3441	1466	1384	8869	8232	131	319	322	305	197	122	306	303	293	183
4540	1717	1383	1074	985	790	383	240	156	74	560	336	208	140	67
0111	1472	1377	337	300	332	325	305	211	146	307	307	286	201	136
846	1434	1371	746	688	603	416	220	112	53	575	399	213	105	53
30013	1465	1367	903	801	605	413	228	107	57	569	390	213	94	52

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
4549	1434	1345	2974	2713	736	323	176	111	45	681	305	171	103	44
9985	1452	1334	2764	2445	721	419	167	69	49	663	386	149	66	46
7071	1459	1330	1958	1768	420	353	288	193	107	378	324	257	178	102
3451	1490	1320	3572	3013	385	450	308	172	92	340	404	268	144	88
2140	1369	1316	1318	1226	944	232	114	49	16	899	228	112	48	16
2952	1481	1303	176	160	673	297	199	127	82	578	265	172	117	71
403	5893	1299	2899	1914	4114	766	490	239	138	350	313	232	162	116
2500	1420	1277	787	715	306	335	299	213	133	260	308	256	202	125
4299	1390	1271	2321	2011	110	242	291	241	211	95	220	272	217	193
8202	1312	1267	412	386	194	315	297	195	155	186	303	290	187	151
2914	1400	1264	296	246	506	443	224	134	50	452	394	206	124	46
8069	1504	1262	2874	2564	37	174	225	220	218	32	158	196	170	184
3479	1381	1241	2445	2197	342	336	284	177	124	303	297	262	160	114
7830	1308	1230	781	675	507	355	209	102	71	473	331	197	100	67
595	1306	1228	4019	3500	400	361	213	146	97	365	337	203	142	96
4444	1309	1201	1568	1426	420	358	242	151	80	379	334	219	138	76
605	1241	1197	898	839	763	283	106	46	21	733	275	104	43	21
8070	1209	1193	1971	1782	173	274	295	200	147	168	272	292	197	146
4100	1224	1176	435	394	230	307	272	167	135	222	297	253	164	130
4589	1249	1173	3107	2721	325	323	241	165	98	305	308	221	154	93
5969	1286	1164	4573	3966	381	353	263	141	90	333	326	240	129	82
4330	1192	1157	735	700	130	242	288	206	156	127	235	279	197	151

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
280	1275	1147	10349	8880	131	278	265	225	169	118	204	253	215	162
5749	1217	1146	1754	1569	405	293	244	120	84	378	275	231	114	80
7245	1202	1141	261	237	770	271	102	32	17	727	263	96	30	15
2915	1294	1134	268	242	324	307	273	165	105	280	263	237	147	95
3092	1295	1124	656	584	250	317	292	193	119	206	268	265	164	110
425	1447	1122	1309	1113	174	301	311	277	201	138	218	251	221	146
2961	1334	1118	163	143	669	296	194	82	46	553	247	173	69	38
1541	1504	1116	320	297	378	408	320	175	109	286	292	234	131	81
4274	1185	1092	8812	7645	225	292	265	170	120	201	277	241	151	113
603	1125	1090	1908	1773	524	317	149	72	38	510	307	143	69	36
5692	1118	1081	2427	2157	459	264	177	114	44	438	259	172	109	44
6961	1346	1078	2932	2586	461	338	267	136	78	374	265	216	109	61
150	1547	1069	227	207	521	409	291	158	93	346	271	208	113	70
9989	1120	1051	2918	2562	319	415	188	94	65	298	389	180	89	59
8230	1096	1035	569	535	317	373	189	116	42	291	356	180	110	41
3017	1158	~~1019~~ 522,507	1000	819	481	323	174	106	46	421	280	155	95	42
4279	1073	995	6309	5462	237	270	217	168	83	213	249	202	161	78
7070	1123	979	4209	3736	135	146	231	189	147	123	125	200	166	131
575	1039	979	771	685	378	260	151	121	74	351	250	142	114	72
500	1009	969	243	223	846	116	35	6	4	811	111	35	6	4
7871	1021	958	1486	1333	422	303	143	76	40	389	287	137	72	39
01199	989	951	1440	1284	250	244	192	141	86	237	235	185	134	86

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
3055	984	946	739	668	332	302	174	80	54	318	293	163	80	51
2962	1026	941	297	262	496	233	133	94	33	451	212	126	88	30
402	1018	938	1167	942	209	265	238	140	79	190	246	221	127	74
3782	1034	932	836	772	571	231	141	55	24	502	212	130	52	24
7831	987	928	1205	1035	226	243	209	137	75	211	236	196	126	68
72899	990	927	1367	1193	440	253	155	74	37	408	236	147	73	33
2954	950	916	53	49	551	199	94	52	37	537	193	91	49	31
2951	999	910	222	204	253	198	157	126	106	226	177	143	115	94
3459	993	909	2205	1903	240	309	204	106	80	217	277	190	99	75
3046	998	906	1302	1136	413	260	141	88	45	378	227	127	82	45
4329	959	906	1193	1086	231	249	208	117	80	215	234	198	109	79
5609	973	901	923	803	343	253	180	92	54	309	237	168	88	49
7805	931	898	1320	1210	253	219	184	132	72	245	208	179	126	69
470	884	881	809	754	244	240	170	121	58	243	240	170	120	58
5739	945	880	3321	2883	114	169	224	174	126	107	152	213	165	114
8360	906	865	224	208	486	284	80	27	18	464	268	77	27	18
5301	933	864	2668	2424	174	256	187	137	95	160	237	173	130	86
7886	893	855	2096	1763	189	220	164	143	73	177	211	156	138	72
43599	892	848	886	803	248	197	203	118	67	232	193	198	112	61
5409	846	842	111	104	614	137	53	21	12	612	135	53	21	12
2950	942	839	342	308	447	209	130	77	33	397	188	113	68	29
4412	921	839	1370	1163	206	203	209	122	98	186	187	189	114	86

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
517	941	836	2932	2659	208	215	201	146	89	190	192	176	126	79
1619	1091	833	263	239	417	310	146	110	64	307	245	107	88	52
5719	917	829	1748	1537	211	227	166	138	79	185	206	156	124	72
5651	875	821	425	385	444	239	95	52	28	414	224	90	48	28
3041	912	813	1021	823	416	218	145	71	35	372	193	128	63	33
715	845	809	2481	2274	280	220	158	80	55	270	210	151	76	52
2955	896	808	228	201	511	191	101	60	23	459	177	87	57	19
1519	1054	805	243	224	279	278	215	122	71	201	208	170	99	60
2900	841	805	1155	1081	129	174	183	134	104	119	171	174	126	102
7201	949	804	722	641	397	268	140	78	37	335	228	117	65	32
404	1720	801	615	496	639	501	233	139	96	153	199	161	118	78
7011	825	798	1931	1774	524	167	65	40	21	507	161	63	40	19
5089	841	791	812	746	450	230	85	41	20	427	209	80	40	20
2980	847	785	192	156	365	189	130	86	43	334	177	119	81	41
2911	857	781	494	459	216	207	167	105	78	196	193	143	97	71
201	1711	778	267	230	830	379	231	122	78	311	199	115	70	45
7880	796	774	5281	4571	51	120	151	159	144	47	119	148	153	140
8730	780	773	649	592	193	335	130	77	22	193	332	126	77	22
3012	839	772	701	612	404	219	106	68	25	369	202	96	64	24
7299	808	766	1252	1121	346	230	113	56	29	321	215	111	56	29
2956	894	763	184	155	435	243	101	62	22	372	205	86	54	17
3959	917	759	1808	1607	204	237	197	121	83	167	195	155	100	77

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
8022	805	756	313	292	225	282	146	82	36	205	268	140	76	35
191	1001	752	205	174	524	224	140	61	33	377	166	110	52	31
6821	774	742	675	588	380	176	111	59	23	360	171	108	56	22
5310	750	738	475	438	183	168	128	110	78	181	164	124	109	78
1538	921	733	257	238	223	259	187	121	72	173	193	152	93	68
Y106	1010	732	2096	1853	433	211	168	97	52	228	172	146	95	49
2960	801	729	228	214	340	176	131	72	51	307	161	120	65	47
2113	837	720	1197	1095	386	176	118	79	47	323	152	102	72	44
3811	795	718	719	661	385	218	103	49	19	345	197	94	47	17
6111	759	717	776	671	384	180	99	48	24	361	172	93	46	22
3940	976	701	654	586	173	264	213	141	99	122	182	164	96	71
8209	785	701	663	606	229	218	138	83	50	195	199	122	75	46
8120	732	694	335	306	208	251	108	81	38	196	239	101	78	35
594	732	694	1075	991	293	163	114	71	42	272	157	110	67	41
372	783	693	752	691	569	115	56	32	7	499	103	52	28	7
8052	707	690	644	585	157	249	119	68	37	151	243	118	64	37
1533	858	689	228	214	201	217	169	124	83	156	164	139	110	63
7336	707	685	494	457	461	148	57	24	12	449	140	56	23	12
0999	777	681	619	558	587	124	40	17	7	508	112	36	16	7
1990	769	679	2924	2142	211	206	134	80	72	175	184	120	73	66
512	752	679	822	714	332	168	108	81	36	299	148	98	76	33
5962	709	669	1370	1256	147	193	166	86	65	132	185	159	81	62

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
7873	680	664	1150	1014	257	166	116	68	47	252	162	114	65	46
203	1248	663	328	296	355	257	215	176	113	140	130	125	111	63
8500	668	663	363	351	126	213	153	75	58	126	210	152	75	57
9972	748	660	554	497	298	203	113	72	33	254	177	104	68	31
Y0301	684	658	4237	3827	119	173	150	111	67	116	165	145	106	62
1890	948	656	274	214	158	297	211	130	88	126	175	148	91	67
490	690	655	1391	1224	165	177	137	102	56	154	167	132	99	52
0091	684	655	1163	1013	189	156	121	99	53	181	148	117	96	51
6825	684	652	750	687	241	176	127	67	35	229	167	121	64	34
7969	670	650	450	412	460	84	53	36	21	450	80	50	34	20
8024	669	642	387	356	158	256	133	66	32	152	246	130	61	29
4459	657	627	1121	1021	132	152	129	98	64	127	145	118	96	64
2859	675	620	14542	12136	81	159	156	111	85	66	144	145	106	80
5083	684	613	452	407	414	150	65	33	16	366	134	62	31	14
29634	678	611	50	44	310	163	89	50	39	285	144	78	45	35
144	842	609	250	230	314	231	146	77	46	223	163	104	63	33
3042	697	608	1167	977	269	173	124	55	41	229	156	108	45	36
3751	712	594	1195	1087	355	169	90	42	31	297	137	77	36	27
6822	617	594	498	436	325	143	79	35	19	309	140	77	34	19
4450	621	593	834	763	104	135	128	117	75	97	123	124	115	73
5234	605	593	12037	11051	260	159	90	52	24	257	156	87	50	23
7335	708	592	723	666	352	158	108	54	20	288	137	92	45	16

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
9701	607	592	1156	992	79	198	163	86	51	75	193	160	85	49
5303	759	590	967	858	236	189	131	86	62	157	147	113	74	49
7179	612	589	770	674	194	155	123	69	43	187	151	115	66	42
5199	670	585	1526	1281	167	169	135	79	78	138	151	124	66	66
7861	617	585	1711	1520	90	170	142	84	62	83	158	137	82	60
8250	603	585	385	346	200	263	74	37	13	195	253	72	37	13
5631	682	583	349	316	253	194	101	67	34	213	160	87	64	30
3493	679	583	2286	2000	11	64	125	146	117	11	54	100	121	98
4273	659	583	4883	4291	169	184	131	79	52	148	160	114	72	48
9979	638	583	1074	950	163	139	145	92	51	151	123	128	89	49
463	600	583	241	216	443	99	41	11	2	426	99	41	11	2
8134	594	581	325	303	204	235	86	34	26	199	230	86	34	23
5210	584	577	23040	20737	154	199	112	49	43	152	196	110	49	43
376	709	576	377	331	329	186	87	58	33	260	158	73	45	25
7090	636	573	463	418	394	144	53	29	12	344	136	49	28	12
7140	620	573	931	849	245	170	79	50	38	228	156	74	45	34
9992	585	569	338	278	242	189	77	40	23	234	186	73	39	23
7960	585	568	2053	1698	84	97	119	91	69	81	95	115	89	67
505	605	556	586	545	296	171	85	22	17	271	154	80	21	17
5730	569	553	590	524	264	129	85	42	28	257	127	85	41	25
8239	655	552	451	415	274	226	86	33	20	223	189	73	31	20
5641	566	552	595	548	187	166	91	59	28	180	164	87	59	27

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
3787	591	551	2040	1695	89	255	124	65	40	82	235	116	62	38
4380	579	550	834	768	69	123	120	92	83	66	116	115	88	78
5640	577	550	1183	1047	170	152	104	55	49	164	144	100	50	47
299	568	549	810	738	213	107	94	68	38	206	102	93	66	35
7099	562	547	1383	1249	347	111	46	25	14	335	111	44	25	14
3573	607	545	678	606	313	138	78	48	17	275	126	69	47	15
0113	569	545	291	260	155	121	134	73	41	150	114	128	70	40
8830	555	545	232	205	246	262	32	7	5	241	259	30	7	5
9220	552	545	623	579	132	181	97	65	43	131	180	96	63	42
3759	598	544	3269	2908	264	123	109	53	30	239	105	102	51	29
3068	559	544	716	664	182	165	97	55	35	177	162	92	54	35
386	589	540	324	294	414	95	51	12	12	386	81	47	11	10
8478	555	539	336	302	234	177	71	39	15	229	169	71	36	15
3048	601	534	416	361	319	138	61	38	29	283	127	53	33	23
5630	731	528	286	253	261	222	124	58	32	191	148	91	45	25
4119	548	525	807	697	158	146	114	71	35	153	140	108	68	33
6869	537	525	856	731	229	131	88	50	22	222	127	88	50	21
2901	596	522	253	234	224	146	101	57	36	191	129	88	49	35
1959	587	518	362	322	228	162	85	52	30	194	145	80	45	28
3442	609	517	1081	941	115	134	146	94	62	94	110	120	83	59
3899	550	516	5745	5253	249	143	89	35	21	231	135	83	34	20
513	540	514	586	513	108	145	96	88	48	101	137	94	86	44

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
2160	520	513	993	941	355	97	43	14	6	349	97	43	13	6
7124	580	511	792	721	193	125	103	78	41	175	109	91	64	34
2001	867	509	189	172	274	199	166	91	75	143	111	115	52	42
5604	529	508	202	190	207	125	85	48	39	196	119	81	48	39
9270	514	507	541	481	151	159	87	55	37	147	158	85	55	37
2943	541	505	196	174	231	140	63	46	38	211	133	59	44	35
681	517	505	559	492	276	114	63	31	14	270	111	62	29	14
7312	538	504	689	622	283	127	71	34	14	268	116	64	33	14
3453	558	503	448	385	202	172	88	60	21	185	159	79	49	17
5650	525	502	500	455	261	150	66	26	14	248	145	63	24	14
72508	529	501	431	392	273	125	55	35	25	257	120	52	34	24
3019	535	500	1227	1045	217	139	85	50	27	201	133	77	50	22
5901	562	499	1232	1106	124	140	113	74	56	100	112	108	72	54
7561	569	497	809	743	267	156	80	34	22	222	136	75	32	22
72029	543	495	684	615	226	143	78	49	28	203	130	72	44	28
7339	519	494	1104	979	194	126	91	46	30	186	121	85	43	29
2935	556	492	144	131	100	138	101	90	56	90	117	86	78	53
3572	547	491	361	323	289	117	74	41	15	259	106	64	37	15
3013	545	489	286	243	270	147	73	39	8	241	132	67	34	7
3960	670	487	347	305	133	150	134	100	78	96	104	96	75	56
8210	512	486	275	259	90	139	95	81	47	84	133	92	73	45
5369	500	486	591	532	182	133	82	57	24	175	130	80	56	24

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
2114	534	482	1135	1062	254	138	74	35	15	219	127	70	33	15
4272	480	480	1520	1350	50	91	102	77	74	50	91	102	77	74
1530	562	479	163	153	124	139	117	87	40	100	115	103	74	38
8150	486	478	411	369	230	190	40	16	5	229	186	40	13	5
1610	585	477	145	126	285	145	74	38	22	228	120	58	30	22
4319	490	476	351	315	146	123	89	60	48	141	118	87	59	48
7841	489	476	1046	872	101	114	88	83	56	98	110	86	83	54
844	488	476	282	263	223	151	60	29	12	216	147	60	29	12
7531	4058	474	1786	588	2793	838	239	87	47	135	99	107	60	34
5900	1927	474	2225	1595	633	793	222	110	59	81	71	87	77	56
7311	481	471	1140	1018	243	92	67	36	24	237	91	66	35	23
7832	484	469	1215	1062	104	111	97	74	51	100	107	96	73	48
2912	489	467	127	110	235	129	70	26	16	222	128	63	26	15
5400	475	467	99	93	245	118	53	26	22	240	117	52	26	21
426	499	464	5615	4350	37	81	121	101	77	31	77	117	93	71
4541	495	463	1352	1214	138	125	92	58	42	132	118	85	53	36
7313	487	462	201	180	351	86	27	11	7	335	80	25	10	7
1732	515	460	374	338	255	143	59	31	18	230	128	52	24	17
7235	537	459	417	368	247	127	77	40	20	213	103	71	34	16
3872	504	457	553	499	300	127	47	21	4	267	118	44	19	4
9975	490	456	511	413	194	144	74	32	24	182	134	66	29	24
9976	523	452	569	353	195	150	98	39	26	163	133	86	35	21

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
7884	464	452	1349	1240	63	93	92	80	62	62	88	91	78	61
8080	456	449	378	359	62	135	97	70	49	60	132	96	70	49
3015	506	448	446	386	209	138	79	46	17	186	121	70	41	14
1460	640	445	167	140	189	203	108	67	44	125	136	79	50	36
398	518	445	640	585	57	98	131	86	61	50	90	105	80	49
7240	510	445	126	119	389	86	22	10	2	343	74	17	8	2
8310	465	444	180	171	190	178	59	21	14	180	169	58	20	14
2041	683	443	415	365	136	164	143	98	72	94	103	91	71	45
4275	511	439	878	758	158	151	92	50	35	134	127	74	46	34
5511	452	437	754	668	187	116	69	45	21	182	109	67	44	21
9981	449	436	1083	951	238	110	50	27	12	233	105	48	26	12
0110	451	433	239	213	84	113	89	61	48	80	106	89	57	46
518	492	428	1031	890	97	129	110	77	45	84	112	96	62	42
7862	515	427	1427	1275	150	149	83	68	30	115	119	75	58	27
135	633	426	301	273	187	257	72	64	32	161	124	61	43	23
6820	434	426	333	297	214	108	67	21	11	209	106	66	21	11
244	482	424	1842	1560	71	111	93	82	59	61	103	77	74	52
6079	449	422	1302	1149	204	108	74	29	20	194	102	67	26	19
5309	439	422	1177	1023	98	120	98	54	37	94	113	96	52	36
5039	438	422	2119	1924	137	127	79	48	17	130	122	79	47	16
3494	484	421	1257	1105	11	57	89	84	78	7	51	68	70	71
7385	452	421	1835	1655	103	132	104	58	26	97	122	95	53	26

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO, DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO, DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
0791	438	417	906	840	320	69	24	9	5	308	62	23	9	4
7939	426	417	56	53	348	47	19	8	2	340	46	19	8	2
2699	425	416	4186	3779	28	60	95	89	69	28	59	91	87	69
462	418	415	767	664	156	112	74	41	19	155	112	73	40	19
3950	523	413	432	383	115	132	110	68	50	90	105	86	54	41
5030	446	413	916	836	208	116	66	25	23	190	105	63	24	23
7316	428	413	346	318	245	97	37	29	15	235	94	36	28	15
8520	439	412	219	197	105	136	92	51	32	98	129	85	48	31
5740	420	411	106	94	157	96	64	51	33	156	94	62	49	33
1579	511	410	148	135	119	169	100	62	27	90	127	94	52	22
30451	422	410	1604	1405	128	112	58	49	36	127	109	55	48	33
3016	430	409	802	682	174	118	70	42	18	161	114	68	41	18
307	420	407	309	262	198	111	61	25	14	191	109	60	25	12
8130	421	405	281	261	125	180	62	26	23	120	172	59	26	23
5718	441	404	941	838	62	114	87	76	54	58	103	78	70	50
4370	420	404	1043	975	40	70	96	87	53	39	69	94	83	52
8540	406	402	242	217	57	118	89	60	42	57	117	88	59	42
7827	422	401	664	603	183	121	57	30	20	175	116	56	27	18
2022	575	399	151	138	180	138	107	63	44	122	100	75	42	31
2919	417	399	236	218	145	107	71	41	29	140	101	67	41	26
9200	395	394	559	513	70	125	92	54	27	70	125	92	53	27
8810	395	394	495	440	121	175	65	18	9	121	174	65	18	9

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
2422	485	393	496	451	167	140	89	42	25	133	117	72	33	21
8509	428	392	466	417	96	97	89	62	49	92	84	83	58	41
3009	403	392	1005	891	126	114	93	38	19	120	113	90	37	19
8219	443	391	286	272	151	135	74	38	19	132	120	62	36	17
8549	417	390	681	606	75	126	78	65	31	70	120	71	60	31
3010	415	384	449	395	200	103	60	31	13	187	95	53	29	13
4580	392	384	1328	1170	50	76	84	61	65	49	73	83	61	64
346	397	379	460	417	171	106	65	27	19	162	103	60	27	18
3789	410	378	933	847	174	126	59	22	19	158	117	57	20	18
3480	457	377	143	133	179	123	82	36	27	150	104	64	25	25
561	385	377	373	322	150	79	58	46	33	149	78	56	45	31
1410	542	372	158	133	169	159	104	47	34	112	116	65	36	21
7844	389	372	692	615	104	98	76	51	29	97	93	73	49	29
8220	387	371	155	140	120	152	54	34	17	114	147	53	31	17
8450	378	370	324	292	203	119	27	20	6	200	117	25	19	6
5321	377	368	144	134	169	75	46	32	26	162	73	46	32	26
442	390	366	355	319	138	96	70	37	25	132	92	65	35	23
8100	379	366	344	324	107	133	72	32	13	101	130	69	31	13
2969	396	365	166	150	201	94	47	28	17	186	85	46	25	15
3559	392	365	756	656	139	94	66	53	18	123	90	64	50	18
7826	383	365	1558	1325	70	61	80	64	59	66	60	77	61	54
5649	371	364	467	406	141	98	61	42	20	137	96	61	42	19

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
4519	389	363	803	710	104	90	83	56	23	95	83	82	50	22
30439	383	362	743	645	149	113	61	28	20	134	107	61	28	20
583	1779	360	593	422	1058	503	89	60	32	106	77	67	51	28
3819	375	360	922	831	171	106	48	24	16	161	104	48	21	16
7059	419	359	445	398	217	108	51	21	10	181	92	46	18	10
5379	375	356	1058	965	122	92	81	34	19	115	89	78	32	17
0389	360	355	1828	1604	32	40	58	57	71	32	39	57	56	71
3094	419	354	222	191	116	106	76	51	40	93	90	64	43	37
7803	363	353	962	881	115	81	82	43	27	111	81	79	42	25
1419	455	351	140	114	150	124	83	45	25	123	93	61	34	19
510	396	351	632	552	120	109	71	49	26	103	93	66	43	26
8820	354	350	220	200	133	172	37	6	5	133	170	36	5	5
3096	369	347	423	386	68	83	82	44	40	61	76	78	43	37
4130	363	347	1833	1592	55	94	97	53	37	54	90	91	50	37
1618	452	342	137	120	189	119	67	42	24	150	88	47	35	13
0799	347	341	289	255	137	87	46	37	24	134	87	43	37	24
8249	370	336	275	247	176	118	40	21	11	163	103	36	20	10
4309	366	336	162	153	152	89	55	27	22	140	77	54	25	21
30470	358	335	1148	1028	115	91	68	35	32	106	86	66	31	30
1101	347	335	2380	2168	111	122	72	23	11	108	118	68	22	11
7298	356	334	437	386	195	88	39	19	5	181	86	34	18	5
7230	370	333	1487	1328	55	76	79	68	44	49	70	69	61	37

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
7860	343	331	294	269	188	94	30	10	15	182	91	29	9	14
3051	343	329	292	270	141	84	54	43	11	133	82	54	39	11
5206	333	329	1130	1019	251	62	8	7	1	250	59	8	7	1
1731	379	327	243	219	180	88	47	31	23	154	74	42	27	21
597	335	327	700	650	166	92	35	20	5	161	90	35	20	5
5225	330	327	1477	1352	192	65	36	18	11	189	65	36	18	11
447	353	326	555	487	91	79	68	56	31	81	76	68	49	28
7562	344	323	458	412	123	110	49	32	14	114	104	46	31	13
3443	388	322	605	535	68	85	106	61	29	59	68	84	54	24
8010	329	320	217	203	43	86	89	55	30	42	81	87	54	30
7387	343	319	479	440	148	116	47	14	11	141	105	44	13	10
7901	325	319	730	642	65	72	60	51	37	65	69	59	51	36
7297	347	318	312	299	197	95	35	9	7	178	87	33	9	7
7816	331	315	929	847	113	84	56	36	24	103	83	53	35	23
2149	316	314	432	399	201	60	35	11	6	200	59	35	11	6
2420	399	313	130	114	167	107	71	28	15	136	82	54	20	12
350	338	311	711	633	116	81	64	41	22	103	76	63	38	19
4560	332	311	2153	1797	26	88	84	45	53	23	79	79	44	52
4003	2868	309	210	121	1711	874	200	31	27	112	77	49	27	22
8910	314	309	227	216	90	154	48	13	7	87	154	46	13	7
8059	324	305	657	576	70	92	59	29	29	63	91	53	29	29
8369	315	304	97	86	160	102	34	12	5	151	100	34	12	5

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
6075	314	303	371	340	158	69	37	29	15	151	68	37	27	14
2000	547	302	79	70	198	134	87	63	33	100	77	53	30	20
3190	305	302	11	10	282	16	2	2	2	279	16	2	2	2
2313	317	301	367	326	100	84	48	49	21	94	81	42	49	21
3949	345	300	991	848	86	92	64	48	29	70	81	58	43	24
8020	308	300	418	378	94	99	65	27	14	91	97	63	27	14
2168	307	300	469	438	216	52	24	8	2	210	51	24	8	2
792	769	299	5228	3093	26	495	57	65	48	24	53	46	58	43
2050	686	298	54	49	268	164	106	56	49	85	69	49	34	31
6983	329	297	1231	1115	101	97	55	35	17	98	85	50	26	16
7030	316	297	467	415	237	44	19	9	4	221	42	18	9	4
5603	309	297	413	359	87	74	62	34	28	85	71	57	32	28
3310	352	292	163	155	159	87	44	22	23	132	68	37	20	19
4350	304	291	258	247	51	63	71	63	32	48	60	71	59	31
6823	299	291	177	148	146	67	36	29	11	142	66	34	29	10
1401	326	290	72	61	172	85	38	15	9	154	73	36	11	9
7239	305	289	784	688	124	79	38	30	17	116	75	35	30	16
279	335	288	3567	3038	102	72	52	42	23	78	65	45	36	23
385	322	287	268	247	131	72	62	24	22	118	62	55	21	20
8050	308	285	99	89	74	98	63	28	17	68	91	56	28	15
7845	290	285	446	387	54	60	69	41	30	52	60	68	40	30
1570	344	284	77	66	73	114	61	38	27	62	92	46	30	27

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
7284	300	284	379	350	96	73	45	29	29	90	70	44	27	29
9589	322	281	529	476	17	71	74	62	41	14	63	65	52	35
702	296	281	637	600	176	63	26	13	13	167	59	25	12	13
480	282	281	174	152	97	79	33	38	21	96	79	33	38	21
5112	294	280	1402	1144	51	82	64	39	32	49	77	60	39	29
552	281	280	104	91	116	56	50	25	23	116	56	49	25	23
8139	310	279	230	210	146	91	40	21	10	129	85	36	18	9
0122	308	279	1252	1006	79	75	57	30	34	71	69	54	27	29
726	291	279	180	171	131	81	32	21	12	128	75	32	20	11
5779	302	278	709	625	77	80	56	42	20	68	69	54	41	20
1960	332	277	2294	1629	106	91	62	38	19	83	77	54	33	16
4829	276	276	393	346	55	65	46	46	24	55	65	46	46	24
5933	363	274	512	429	166	86	51	27	15	107	68	44	23	14
6073	278	274	420	394	141	58	41	21	11	139	58	40	21	11
9986	304	273	447	371	121	106	36	20	12	107	92	34	19	12
7288	294	273	185	169	156	69	33	17	6	146	62	3[illegible]	16	6
Y121	293	273	152	138	112	96	53	13	11	103	90	50	11	11
8212	286	271	98	93	57	83	52	37	25	53	76	51	35	25
8510	281	271	201	195	43	60	65	48	25	42	59	60	45	25
9290	271	271	498	472	57	81	51	36	22	57	81	51	36	22
9670	290	270	361	317	43	92	58	48	27	39	88	52	46	24
9779	276	270	503	431	70	72	50	36	26	70	68	50	36	25

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
1481	405	269	99	85	114	134	77	32	25	70	88	48	27	19
251	293	269	617	549	66	82	57	43	20	59	76	51	41	18
2051	476	268	136	115	131	109	104	59	35	79	53	57	32	19
5370	275	265	485	432	66	86	53	36	21	63	83	52	36	18
3879	284	263	283	252	142	84	22	17	12	134	79	20	14	12
7817	269	261	563	497	27	54	62	51	39	25	54	62	47	37
8479	268	261	172	156	106	85	43	20	9	104	84	39	20	9
7571	262	260	520	477	174	54	19	10	4	172	54	19	10	4
581	350	258	444	328	119	78	52	51	23	73	61	42	40	21
186	511	256	65	61	188	158	74	38	29	94	73	43	24	10
4400	278	255	699	585	62	71	50	37	28	57	66	45	34	26
5110	259	255	551	497	61	73	54	36	22	59	72	54	35	22
1929	309	251	64	62	130	87	47	18	13	103	70	39	15	11
6076	256	251	392	362	112	67	48	20	7	108	67	47	20	7
8470	255	250	156	148	78	89	42	23	12	76	89	40	22	12
8140	254	250	190	174	98	102	28	13	8	96	101	28	12	8
1991	294	249	403	334	49	80	70	30	32	36	68	57	28	29
2419	270	248	381	334	128	77	32	23	7	114	74	29	21	7
1734	267	248	329	300	124	79	29	18	10	112	73	28	18	10
700	261	247	1478	1299	112	70	37	27	8	106	65	36	25	8
3870	265	246	295	275	144	69	29	16	3	137	63	23	16	3
9100	247	246	534	465	58	79	49	35	12	58	79	48	35	12

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
9987	246	223	256	211	100	59	44	20	10	88	54	39	20	10
3771	246	223	771	694	135	47	35	12	8	119	43	32	12	8
5081	240	223	118	108	165	44	13	9	5	154	39	12	9	5
7314	234	223	137	123	168	49	13	2	1	159	47	13	2	1
8900	225	223	95	92	49	118	34	12	9	49	116	34	12	9
7291	232	221	373	348	96	65	38	14	9	92	62	35	13	9
Y103	477	220	225	129	315	95	47	13	4	134	49	25	7	3
6829	224	220	351	305	89	51	41	23	8	87	51	40	23	8
284	493	219	589	413	165	90	77	72	46	51	45	38	37	25
3007	229	219	275	250	67	59	42	27	14	65	56	40	26	14
1540	257	216	63	58	57	60	54	38	25	48	54	46	27	21
7244	229	215	42	41	142	56	18	7	5	136	48	18	7	5
5760	229	214	317	285	54	74	45	23	24	50	65	44	22	24
174	298	213	59	53	56	90	76	27	26	43	67	50	20	16
366	231	213	403	373	78	60	42	26	16	68	58	38	25	15
2931	224	213	128	120	27	42	52	30	35	26	40	49	29	32
215	219	213	197	191	131	44	23	12	6	126	43	23	12	6
3449	227	212	631	567	44	55	47	34	19	42	51	42	32	18
2255	223	211	166	153	120	49	29	18	6	111	48	28	17	6
4249	222	211	985	891	48	58	35	42	19	47	53	34	39	19
9650	235	209	377	323	82	72	37	25	11	67	62	37	24	11
8700	213	209	183	169	48	90	40	23	10	46	89	40	23	9

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
3059	244	232	246	225	85	67	40	26	12	81	60	40	26	11
1970	264	231	1967	1364	43	65	59	38	30	40	50	54	33	25
591	253	231	846	746	61	66	56	33	20	55	61	49	33	17
7889	246	231	1685	1359	58	43	54	39	22	54	41	50	35	22
3791	238	231	1147	1048	57	61	48	36	18	56	59	46	34	18
8790	234	231	129	120	32	115	49	23	8	32	113	48	23	8
7089	243	229	293	260	86	68	53	22	11	82	65	49	20	10
4320	234	229	301	277	34	54	54	33	30	32	53	53	32	30
360	229	228	1777	1595	97	53	33	19	19	97	52	33	19	19
3209	256	227	289	258	97	59	50	30	12	83	54	44	26	12
3499	251	227	255	229	63	53	43	27	26	59	51	36	24	22
23819	247	227	181	170	104	64	29	20	13	101	58	25	17	12
380	235	227	891	799	100	63	37	19	6	97	61	34	19	6
9731	230	227	802	684	14	33	48	45	42	14	33	46	45	42
19839	260	226	2098	1466	52	95	45	31	22	45	81	42	26	20
5272	236	226	217	186	98	70	34	18	8	96	68	31	15	8
3786	232	226	554	489	103	63	36	13	6	99	62	36	13	6
7930	228	226	39	37	166	33	14	7	6	164	33	14	7	6
2825	306	225	857	766	95	90	62	27	14	67	67	45	21	9
1985	262	225	4037	2869	43	84	61	33	26	39	69	50	29	24
3630	250	224	198	177	121	50	39	25	7	106	44	34	25	7
5286	227	224	421	396	111	59	27	13	11	109	59	26	13	11

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
3770	277	245	533	467	104	78	40	25	10	89	66	38	23	10
7835	255	245	453	401	110	72	41	12	6	107	71	37	12	6
1730	264	244	168	159	131	62	31	17	12	122	56	27	16	12
7852	251	244	736	653	44	57	48	29	33	43	56	46	28	32
208	300	243	773	673	54	59	65	52	41	40	51	52	41	34
8029	278	242	254	232	107	87	44	19	9	94	71	41	15	9
9983	253	242	813	736	121	68	34	13	12	113	67	33	13	11
7319	246	242	307	273	157	47	26	11	4	154	47	25	11	4
1451	303	240	171	135	114	80	54	23	16	92	63	43	17	13
2810	263	240	620	556	54	58	66	32	23	49	52	58	30	21
7815	249	240	3190	2981	26	71	60	43	19	26	67	60	41	18
1531	311	239	76	71	70	88	52	40	28	51	55	42	35	26
03104	278	238	116	103	56	73	66	36	24	45	61	61	32	23
691	267	238	344	294	92	76	42	36	14	80	71	36	33	11
5999	248	238	930	828	60	64	57	26	15	57	62	55	25	14
4310	239	238	102	91	48	69	50	32	16	47	69	50	32	16
4290	253	236	4051	3536	34	48	54	55	29	32	41	52	51	29
8122	243	235	174	159	59	74	39	26	27	56	71	38	25	27
1468	317	234	121	98	93	95	71	27	20	71	61	60	19	16
8129	278	234	276	247	95	64	54	38	15	77	53	47	33	13
7079	241	234	464	412	78	62	40	33	14	77	61	37	31	14
351	270	233	248	202	120	60	50	27	6	103	53	44	22	5

ICDA	OCCURANCE ALL	PDX NR	OCCURANCE ALL	ADX NR	NO. DXS KEYED ON PRIMARY DX ALL EPISODES -1-	-2-	-3-	-4-	-5-	NO. DXS KEYED ON PRIMARY DX NON-REPEAT EPISODES -1-	-2-	-3-	-4-	-5-
6959	244	208	301	262	66	70	40	32	22	58	59	30	30	19
8160	214	208	338	302	78	91	24	12	7	76	90	23	10	7
5349	222	207	145	134	69	54	40	34	14	64	52	36	32	13
2270	215	205	395	371	149	40	17	4	5	142	38	16	4	5
99779	379	204	697	184	88	153	48	52	21	63	60	37	16	16
353	210	203	324	301	78	63	31	20	15	76	60	30	20	14
72596	209	203	210	198	133	35	20	11	3	129	34	20	10	3
9210	206	203	349	311	31	67	44	35	19	31	67	44	33	18
1550	255	202	96	83	74	58	50	28	23	53	44	42	22	19
2169	203	202	318	295	143	32	18	4	1	142	32	18	4	1
4210	223	199	233	205	29	42	46	37	28	27	41	36	34	24
1736	220	199	250	224	109	64	19	13	14	95	61	16	12	14
7370	211	199	303	271	67	61	37	22	15	59	59	36	21	15
3780	201	195	263	238	163	21	9	4	2	157	21	9	4	2
507	195	194	893	819	63	62	32	18	10	62	62	32	18	10
423	218	193	594	459	61	62	36	28	15	57	55	30	23	15
794	205	193	1141	1054	26	41	54	34	13	24	40	50	32	13
1737	209	192	238	214	116	53	22	11	4	103	49	22	11	4
7800	194	191	343	313	25	40	29	21	33	25	40	28	21	32
506	200	190	248	224	114	40	23	15	5	109	38	22	13	5
Y0001	220	188	991	865	166	40	12	0	1	143	31	12	0	1
7171	196	188	365	319	88	37	30	23	10	83	37	28	22	10
TOTAL	1013269	801817	1504738	1312949	375976	246720	162066	103249	64531	259392	197865	140641	91020	57624

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