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Use of computer-assisted content analysis in large-scale program evaluation

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USE OF COMPUTER ASSISTED CONTENT ANALYSIS IN LARGE SCALE PROGRAM EVALUATION

by

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CHAPTER I.

INTRODUCTION

Narrative documents, such as proposals, progress reports, and final reports are commonly associated with new or experimental educational programs, demonstration programs, and programs where more than one institution is involved. Such documents are nearly always required of educational programs funded through government or private foundation grants. These narrative documents afford a potentially rich source of information for evaluation of educational programs if information relevant to program goals, or to other questions of interest, can be reliably abstracted and analyzed using a reasonable amount of effort and resources. Such information from program documents must also be presented in a form useful to program evaluators or sponsors.

Content Analysis

Content analysis is a general research method for systematic and objective classification and analysis of written communications. There are various definitions of content analysis, although it is most often viewed as a technique for quantitative text analysis, i.e., word frequency analysis and similar techniques. Content analysis as used in this study, however, is viewed in the broadest sense, including qualitative techniques for text analysis as

well as quantitative text analysis. The definition given by Stone in 1966 is useful:

> Content analysis is any research technique for making inferences by systematically and objectively identifying specific characteristics within text. (Stone, et al, 1966, p. 5)

Content analysis is an appropriate method for the systematic analysis of narrative program documents. Content analysis, however, is a labor intensive, often tedious method of analysis. Holsti probably sums up the impression which many, if not most researchers have of the technique:

> The most vivid impression in the mind of the reader may be that content analysis involves a certain amount of drudgery; nothing could be closer to the truth. Content analysis usually requires skilled and sensitive coders, the very persons who soon become bored and frustrated by the tedious and repetitive nature of the task. (Holsti, 1969, p. 150)

Large scale, multi-institutional educational programs may generate thousands of pages of program documents. The number of questions or categories of information needed in a comprehensive program evaluation may also be large. Without the availability of computers, content analysis probably would not be a practical method for evaluation of large educational programs due to the volume of information which must be abstracted, the repetitive, tedious procedures required in a good content analysis, and problems of reliability involved when several coders or abstracters are employed to perform the content analysis. Computers have been successfully used to automate or assist in performing some of the tasks involved in content analysis.

Computer Assisted Content Analysis

Since the early 1960's, computers have been used to perform various forms of content analysis with some degree of success (Stone, et al, 1966; Marcotte, 1969; Weiss, 1984; Frisbie, 1986; Fan, 1988). The use of computer programs to perform the repetitive and routine tasks involved in content analysis, such as counting words, tabulating phrases, and developing descriptive statistics was an improvement over performing these tasks manually and represented a significant advance in the field of content analysis. The reliability of the information abstracted from documents was also improved by the use of computers to perform content analysis procedures. Computers reduce or eliminate problems of fatigue, missed words, and differences in coding interpretation which affect the reliability of content analysis using human coders to identify and abstract information from documents.

Computer assisted content analysis through the early 1980's was confronted with the problems of (a) converting written documents from paper to electronic data files suitable for reading by computer; (b) limited availability of computer equipment; (c) a limited number of general use computer programs designed to perform content analysis; and (d) limited memory capacity of computers, which restricted the size of databases, the speed of information processing, and the ability of researchers to utilize more sophisticated programs to analyze textual data. Mainframe computers,

keypunch data and program cards or terminals, time share arrangements for computer use, having to rely on computer specialists to perform technical aspects of the procedure, and other factors served to make computer content analysis an expensive and sometimes frustrating venture. Carney (1972) advised that because of the expense and technical problems involved in preparation of the document data file and the computer programming necessary, computer content analysis was "worth the effort only for a major study" (p. 74).

Two relatively recent technological developments have increased the potential use of computer content analysis: the personal or microcomputer and the availability of low cost, high speed optical scanners. Optical scanners and reliable optical character recognition software largely solve the problem of converting written documents to a computer readable format. Optical scanning greatly reduces the time, expense, and error involved in preparing documents for computer content analysis. Microcomputers have largely solved the problems of computer accessibility and, to some extent, the problem of limited memory capacity. Most researchers now have at least a general familiarity with computers and no longer have to rely as heavily on specialists to prepare and perform analyses. General use software programs capable of searching documents for key words, strings of key words, phrases, and other word variations are readily available, along with a larger number

of customized software programs specifically designed to perform various forms of computer content analysis. Text identified by software programs can be copied and transferred to word processing programs, database programs, or other types of analytical programs for categorization, analysis, and reporting of results.

Use of Content Analysis in Educational Program Evaluation

In the field of education, content analysis has been used to describe and analyze the content of textbooks and children's readers (Stone, et al, 1966,). Content analysis, however, has not been widely reported as a method of educational evaluation or educational program evaluation. The evaluation of essay content and evaluation of responses to open ended survey questions are two of the areas where the content analysis has been used in educational evaluation (Marcotte, 1969; Frisbie, 1986). Factors which have limited the use of content analysis in educational program evaluation include the wide array of alternative evaluation methods available, the popularity of employing experimental and quasi-experimental designs in educational program evaluation, and the relatively high labor requirements of content analysis. The fact that content analysis is an infrequently used method of program evaluation may also imply that few program evaluators are well acquainted with the technique.

Locating, indexing, copying and assembling documents related to program operations or outcomes can be a major task. The sheer volume of information contained in program documents may also discourage their use. Abstracting information from documents generally involves reading them and sifting through the pages to gather the relevant facts. Analyzing program documents may involve reading through a large amount of irrelevant material in order to obtain information relevant to a specific question. Information contained in documents may be unstructured or incomplete, resulting in the need for rewriting and editing before the relevant information can be abstracted and used in evaluation of a program. In program evaluation, reading and abstracting information from documents may be viewed as an inefficient method of collecting data in comparison to surveys, interviews, or other well-established techniques of data collection. So, while program documents are a valuable source of information, the problems of document accessibility and the perceived lack of efficient techniques for analysis of documents has limited their use in program evaluation.

There are circumstances where documentary data is the best or the only available source of information for evaluation of a program. As Holsti (1969) states:

> Under these circumstances the options may be reduced to two - use the documentary evidence as skillfully and imaginatively as possible, or don't do the research at all. Content analysis may thus serve as a 'last resort' approach to research when more direct

> techniques of analysis are ruled out by circumstances. (p. 16)

Content analysis may also serve as a useful supplement to other forms of data collection and analysis. Validation of other data sources is one reason to provide information from program documents. "When two or more approaches to the same problem yield similar results, our confidence that the findings reflect the phenomenon in which we are interested, rather than the methods we have used, is enhanced" (Holsti, 1969, p. 17). Program documents may provide more complete or different information relative to other forms of program evaluation. Certain types of information, such as detailed descriptions of program operations or contextual information concerning development or outcomes of the program, may be available only from program documents.

Content analysis of program documents may be used to provide greater detail on aspects of the program identified as being of importance by questionnaires, surveys or other means of data collection. Alternatively, content analysis of program documents may be used as a means of exploratory data analysis in order to facilitate the use of other program evaluation methods.

Information contained in documents may be more reliable than information collected from surveys or other instruments relying on recall or on subjective statements. Webb quotes a Chinese proverb, "the palest ink is clearer than the best memory", to illustrate this point (quoted in Holsti, 1969,

p. 16). Unlike surveys, direct observation, and many other data gathering methods, documents have the advantage of being an unobtrusive, non-reactive measure.

Experimental and quasi-experimental designs have been widely used as the standard for conducting program evaluations. The results of quantitative approaches to program evaluation, however, have often failed to provide meaningful information to program sponsors on the operation or outcome of programs (Filstead, 1979; Cronbach, 1980; Guba, et al, 1981; Patton, 1986). Qualitative research techniques have been increasingly used in program evaluation to provide more useful information to program sponsors. Providing quantitative and qualitative information, particularly when the approaches are complementary, is desirable in program evaluation (Perkins, 1987; Mark and Shotland, 1987). Computer assisted analysis of text is a research method which potentially provides both qualitative and quantitative information in program evaluation applications (Conrad and Reinharz, 1984).

Purpose of the Study

The purpose of this study is to explore and describe the feasibility of computer assisted content analysis as a means of contributing to the evaluation of a large scale, multi-institutional educational program, the Preventive Cardiology Academic Award (PCAA) program. The Preventive Cardiology Academic Award program, initiated in 1979, is a

grant supported program sponsored by the National Heart, Lung, and Blood Institute of the National Institutes of Health. The primary objective of the PCAA program was to encourage development of high quality preventive cardiology curricula in U.S. medical schools and associated graduate medical education programs. Program grant documents from 26 of the PCAA awards, representing 26 medical schools in the United States, provide the source of data for the analysis. The 26 PCAA programs included in the study were in operation during the period from 1979 through 1988. The overall objective of the study will be to explore the question of whether the information abstracted from program grant documents using computer assisted content analysis can provide reliable, valid, and useful information for evaluation of the performance of the Preventive Cardiology Academic Award program relative to the major PCAA program goal:

> Encourage development of a high-quality preventive cardiology curriculum in schools of medicine and osteopathy that will significantly increase the opportunities for students and housestaff to learn both the principles and practice of preventive cardiology. (PCAA Program Guidelines, 1988)

Computer assisted content analysis of the PCAA program documents will attempt to describe samples of (a) the curriculum structures developed by the recipients of the Preventive Cardiology Academic Award, and (b) preventive cardiology subject matter included in the curricula.

Study Questions

There are three questions which this study is designed to address:

(1) Is computer content analysis a feasible method for abstracting, categorizing, and analyzing information from the 1500 pages contained in PCAA grant documents?

Feasibility is essentially a subjective concept, but it implies rational decision making founded on the gathering of reliable information. The determination of feasibility will be based on a demonstration of computer assisted content analysis applied to a sample of several questions of interest in the evaluation of the PCAA program. Using computer assisted content analysis, reports will be generated on curriculum structure topics, such as summer research fellowships and preventive cardiology clinics, and on one or two subject matter topics, such as nutrition and genetics. Experience with practical matters such as locating, indexing, and translating written documents into a computer readable format will be reported. Equipment, computer software, training, and cost questions will also be addressed. Procedures for selecting and entering search terms for information retrieval, categorizing information retrieved from program documents, and generating reports will be considered. The relative efficiency of computer assisted content analysis, as opposed to manual searching of documents will also be tested. Given a set of predetermined questions to be answered, a comparison will be made between

the time required to abstract information using computer content analysis and the time required to answer the same questions using a manual search of the documents.

The overall results of the feasibility study will be a report describing resources, procedures and results of the demonstration.

(2) Is the information abstracted on PCAA grant documents by computer assisted content analysis reliable?

The second question involves the inter-rater reliability of information identified, retrieved and abstracted by means of computer assisted content analysis. Given a set of predetermined questions on a single topic area, and a selected sample of PCAA grant documents, a comparison will be made between the passages of text identified and abstracted by three different reviewers. The three reviewers will have similar levels of expertise in terms of computer use and medical education curricula. A "passage" is defined as a unit of text containing the key word or words used in the search term, along with enough of the adjacent context to identify how the search term is used and to ascribe meaning to the text. The reliability study will involve a comparison of the number of lines of text abstracted, the number of passages abstracted, (i.e., the number of key word search terms abstracted), and a comparison of the number of lines of text in matching passages abstracted by the three different reviewers.

Matching passages are defined as passages containing the same search term on the same line.

(3) Is the information abstracted on PCAA grant documents by computer assisted content analysis valid?

The third question addresses the question of whether the text passages abstracted and categorized by the three reviewers are relevant to the performance of the PCAA program goal of developing high quality preventive cardiology curricula in U.S. medical schools. It is assumed that the information in the original documents is an accurate description of program operations and outcomes, although the limitations of program documents as a source of evaluation information are recognized and discussed in the literature review chapter and in the section on limitations in the discussion chapter. A standard set of passages for comparison to computer retrieved text passages will be established by means of a review of the program documents by a senior program evaluation consultant on the PCAA program. Given the same set of pre-determined questions on the single topic area used in the reliability study, and the same sample of PCAA grant documents, the consultant will read the documents and abstract a set of passages relevant to the questions. Relevant passages will be identified by means of a yellow highlighter pen. This set of passages will serve as the standard for comparison. The set of passages retrieved by the three reviewers in the reliability study

will then be compared to the set of standard passages retrieved by the program expert. Comparison will based on correlations between the number of lines of text retrieved, and on the number of passages retrieved. The number of matching passages and the variance of line numbers contained within matching passages will also be analyzed.

CHAPTER II

REVIEW OF THE LITERATURE

The areas reviewed and described in this chapter are Program Evaluation, Content Analysis, and Computer Content Analysis.

Content analysis has a long history of use in the social sciences and in applied fields such as marketing and journalism. Computer assisted analysis of written materials has been used with increasing frequency in sociology and anthropology, particularly in the analysis of field notes. Computer assisted text analysis techniques have also been used to a limited extent in educational evaluation, in applications such as the analysis and grading of written essays. Content analysis, however, has not had a major impact on research or practice in educational program evaluation. The objective of this review of the literature is to provide a framework for relating the use of computer content analysis to the evaluation of educational programs.

Program Evaluation

This section reviews the background of program evaluation, characteristics of evaluation which are important in content analysis, an overview of alternative views and approaches to evaluation, and the importance of selecting evaluation methodologies which are appropriate to the questions asked.

Background

Evaluation has been described as the oldest profession, as professor Michael Patton of the University of Minnesota outlines in his book on Utilization-focused Evaluation:

> In the beginning God created the heaven and the earth.
>
> And God saw everything that He made. "Behold," God said, 'it is very good.'
>
> And the evening and the morning were the sixth day.
>
> And on the seventh day God rested from His work.
>
> His archangel came then unto Him asking, 'God, how do you know that what you have created is 'very good'? What are your criteria? On what do you base your judgement? Aren't you a little close to the situation to make a fair and unbiased evaluation?' God thought about these questions all that day and His rest was greatly disturbed. On the eighth day God said, 'Lucifer, go to hell.'
>
> Thus was evaluation born in a blaze of glory.
>
> (Patton, 1986, p. 1)

The modern field of program evaluation traces its beginnings to the federal social programs of the mid-1960's. Program evaluation developed in response to the need for systematic methods of measuring and reporting how federal tax dollars were spent and for providing measures of accountability by program managers for the effectiveness of programs in achieving specified goals (Suchman, 1967; Wholey, 1970; Weiss, 1972; U.S. General Accounting Office, 1975). Legislation, such as the 1965 Elementary and Secondary Education Act, mandated evaluation of many federally funded programs (McLaughlin, 1975). Ralph Tyler,

an educational researcher, is recognized as the founder of program evaluation through his influence with the Kennedy administration in the development of evaluation legislation. The need to develop applied evaluation methodology and the desire to make evaluation both an academic discipline and a responsible applied discipline created an identity for professional evaluators and served as the impetus for creation of professional evaluation societies such as the American Evaluation Association, the Evaluation Research Society, and the Evaluation Network. Program evaluation has attracted practitioners from a wide variety of disciplines including education, psychology, sociology, medicine, statistics, anthropology, politics, law and science. The different academic and professional backgrounds of "evaluators" contributed to a diversity of traditions and methods used in program evaluation (Robinson, 1984, p. 148). "Economists, sociologists, psychologists, and educational researchers often found themselves bidding on the same contracts in competition with each other, a process that facilitated the transfer of knowledge, craft lore, and mutual respect across disciplinary boundaries, " (Rossi & Wright, 1984, p. 333). Debate over the adequacy of different methodological paradigms has been a constant factor in the field of program evaluation (e.g., Weiss & Rein, 1972; Balaban, 1973; Cook & Reichardt, 1979; Baker, Willer & Bartlett, 1981; Alkin, 1990). The development of program evaluation as a discipline over the past 25 years

has resulted in refinement of methods and designs, although there is no consensus among evaluators on a universal theory of evaluation or general agreement on the application of particular approaches to evaluation problems.

Glass and Ellett make the point that, "Evaluation needs diversity, but it also needs an intellectual discipline applied to the task of organizing and defending the various strategies, principles, and methods", (Glass and Ellett, 1980, p. 212). The identifying characteristics of evaluation which serve to organize and defend the use of content analysis as a legitimate research technique, and an appropriate and useful methodology in the field of educational program evaluation, are presented next.

Defining Characteristics of Evaluation

There has been considerable controversy regarding questions of the meaning or definition of evaluation, the appropriate use of various models of evaluation, what standards should differentiate a scientific approach to evaluation from less rigorous approaches, whether evaluation should be considered a scientific discipline at all, and which methods of evaluation produce the most useful evaluation results.

> Evaluation-more than any science-is what people say it is; and people currently are saying it is many different things. Evaluation is a set of theoretical and practical activities without a widely accepted paradigm. Few people agree on the best way to evaluate. (Glass and Ellett, 1980, p. 211)

Evaluation, by its dictionary definition, means "to examine and judge" (Webster, 1971). Evaluation, in this broad sense, can be applied to activities as disparate as buying groceries, selecting professional football players in the draft, or deciding at what level to fund the Space Shuttle program. Given the diversity of applications referred to as evaluation, it is perhaps not surprising that there is not universal definition of evaluation as a scientific discipline. What characteristics differentiate the discipline of evaluation, as used in the evaluation of educational programs, from various other forms of activity commonly referred to as evaluation?

One defining characteristic of evaluation which has received consistent emphasis in the literature is gathering of information in a systematic manner (Campbell and Stanley, 1966, Campbell, 1975; McClintock, Brannon, & Maynard-Moody, 1979; Patton, 1980). Definitions of evaluation presented at a recent conference on evaluation included references to the systematic collection of information:

> the systematic investigation of the worth or merit of some object. (Joint Committee on Standards for Evaluations of Educational Programs, Projects, and Materials, 1981)
>
> The term evaluation refers to the activity of systematically collecting, analyzing, and reporting information that can then be used to change attitudes or to improve the operation of a project or program. The word systematic stipulates that the evaluation must be planned. This plan should be aimed at obtaining information that will answer the specific questions to be addressed, identification of the appropriate information, collection and analysis of the data, and

> drawing justifiable conclusions from the data. (Alkin, 1990, p. 81).
>
> I include as evaluation the following elements: (1) systematic collection of information (2) for use by specific, identifiable people or groups for the purposes of (3) making decisions about and/or improving program effectiveness. (Michael Patton, in Alkin, 1990, p. 83).

Information collected in a random manner or in a manner which excludes potentially relevant information can be expected to produce unreliable, biased results. The systematic conduct of an evaluation study is necessary to provide a means for applying other standards of quality in the investigation: reliability, validity, and objectivity.

Reliability and validity are characteristics of evaluation frequently referenced in the literature (Guttentag and Struening, 1975; Cook, et al, 1978, Glass and Ellett, 1980; Berk and Rossi, 1990). Given the lack of a general theory of evaluation and the wide assortment of strategies and methods available, it is reasonable to assume that the results of any program evaluation involving vested interests will be challenged on methodological grounds (Berk and Rossi, 1990). Consideration should, therefore, be given to the standards of quality by which the results of evaluations will be judged.

Reliability and validity, measures of the merit of information in any scientific investigation, are standards emphasized in well conducted program evaluations. A means of comparison must be available to measure reliability and validity (Mehrens and Lehman, 1982). The quality of an

evaluation study is determined, in part, by the degree of consideration given to standards and methods of comparison. Reliability is essentially the ability to reproduce results in a consistent manner. Determination of reliability involves comparing the results of repeated measures of the same thing. For example, reliability of a temperature measurement might involve three measures of temperature taken by three different individuals or three measures of temperature taken on three different occasions. Validity relates to the degree of confidence which can be placed in a result or finding. A number of types of validity have been defined (Mehrens and Lehman, 1982), although the concepts of internal validity and external validity are perhaps the most useful. Internal validity is concerned with the soundness and logic of the information collected in a study. External validity is concerned with the relevance and general nature of the information to address broader questions of interest or goals of the study.

Objectivity is an important concept in evaluation. Evaluation, particularly program evaluation, has often been a controversial endeavor. Political and economic ramifications involved in decisions to continue or discontinue programs may often outweigh the results of even the most rigorously conducted evaluation (Weiss, in Alkin, 1990, p. 171-184). Because of the political and economic context, bias in program evaluation has been a difficult problem to control (Scriven, 1976). Charles Windle cites

Wilson's two laws of evaluation as an example of the political context which often impacts the results of program evaluation:

> First Law: All policy interventions in social problems produce the intended effect - if the research is carried out by those implementing the policy or their friends.
>
> Second Law: No policy intervention in social problems produces the intended effect - if the research is carried out by independent third parties, especially those skeptical of the policy. (Windle, 1979, p. 195).

Objectivity presumes reliability and systematic collection of data. "To have objectivity, the analysis must be carried out on the basis of explicitly formulated rules which will enable two or more persons to obtain the same results" (Holsti, 1969, p. 3-4). This perspective on objectivity tends to agree with Kaplan's view that "intersubjectivity" is a more useful operational term than "objectivity" (Kaplan, 1964). "It is quite beside the point of scientific rigor to ask whether an inquiry is objective, rather the central question is whether observers will agree in their subjective assessments" (Glass & Ellett, 1980, p. 221). Can the results be reproduced by two or more persons following the same procedures?

The usefulness of information provided by evaluation studies is a concept which has become increasingly important in the definition of evaluation (Patton, 1978). "Evaluation is the process of delineating, obtaining, and providing <u>useful information</u> for judging decision alternatives"

(Alkin, 1990, p. 82). Statements regarding the need for evaluation studies to provide useful information seem obvious - why would anyone conduct a study which does not produce useful information? The point, however, is that the information produced by the study should meet the needs of the program sponsors. Many program evaluations conducted in the 1960's and 1970's tended to focus on methodological issues such as sample size, internal validity, confounding variables, and other technical aspects (Barkdoll and Bell, 1989, p. 1). The usefulness of the information produced by the studies to the program decision makers was taken for granted; consequently evaluation studies were often reported to have little impact on program decision-making.

> During subsequent discussions of impact, utilization, and effectiveness, evaluators discovered a common denominator in many of the failures: the client. Over time, it became obvious that there were many factors related to the client (and the evaluator's relationship with the client) that helped determine whether the evaluator's work was put to use. Since then, evaluators have been actively exploring the client side of evaluation. To date, we have learned that understanding and managing the interpersonal, organizational, and political dimensions of the evaluation process are at least as important and difficult as understanding the analytical dimensions of evaluation methodology. (Barkdoll and Bell, 1989, p. 1)

Michael Hendricks reiterates the point that utility is one of the important characteristics of evaluation:

> Our evaluations are utilized when the findings and recommendations from our evaluation are considered seriously by persons in a position to act on our information if they choose to do so. On the surface, this criterion seems to simple, but, in reality, it is quite difficult. Who are the proper audiences? What matters to them? What will they find credible? How

> can we best communicate our information? In my experience, these are the critical issues surrounding utilization. (in Alkin, 1990, p. 23)

Going back to Webster's definition, evaluation is viewed as a two step process: (1) examination - the gathering and describing of relevant information to questions of interest, and (2) judgement - assigning value or decision making. The distinction between these two steps is important in the present study, since the focus of the investigation is on illustrating a technique for the gathering and describing of relevant information from the PCAA grant documents rather than on judging the outcome of the PCAA program or making decisions regarding the disposition of the program. Content analysis is also a two step process involving (1) describing content and (2) making inferences. Frisbie points out a number of similarities between evaluation and content analysis which will be elaborated on in the Content Analysis section of the literature review (Frisbie, 1986).

In summary, the characteristics of evaluation which are viewed as important in the application of computer assisted content analysis to educational program evaluation are (a) the systematic collection of data; (b) consideration of means to measure or estimate the reliability and the validity of information collected; (c) attention to objectivity or "intersubjectivity"; and (d) consideration of the usefulness of the information resulting from the study.

Evaluation may be considered a two step process consisting of gathering and describing relevant information and making judgements or decisions.

Multiple Approaches to Evaluation

The range of research methods which have been employed in evaluation is large and varied: ethnography, survey research, randomized experiments, cost-benefit analysis, quasi-experiments, naturalistic inquiry, grounded theory, ecological and ethnological approaches, case studies, participant and nonparticipant observational techniques, phenomenological analysis of interview data, and others (Rossi & Berk, p. 8; Hatch, 1980). Patton records 132 approaches to program evaluation as a "beginning list" (Patton, 1981, p. 186 -193). The diversity of methods has developed, in part, from the complexity of most programs and the need to use different techniques to address different types of questions. The variety of disciplines involved in evaluation have also contributed to a diversity of approaches. For example, the tradition of experimental research is strongly rooted in behavioral psychology, while anthropology and sociology have traditionally utilized naturalistic research designs, observational data collection techniques, and qualitative analysis methods.

In reviewing the literature on evaluation and program evaluation it is interesting to note the number of publications which attempt to develop classification schemes

for the range of models and methods used in evaluation (Tien, 1979; Borich and Jemelka, 1982; House, 1978; Patton, 1981; Glass and Ellett, 1980). The perceived need to unify or synthesize approaches to evaluation attests to the diversity of methods and models used in evaluation research and practice. To some extent, the calls to develop unified theory and a manageable number of standard methods also reflect the confusion which the wide variety of approaches and methods to program evaluation have created. "The field is in jeopardy of hopeless disintegration if its custodians fail to keep it tidy" (Glass and Ellett, 1980, p. 212).

A classification scheme presented by Glass and Ellett lists seven alternative conceptions or theories of evaluation (Glass and Ellett, 1980). The list is a useful outline of the major models used in evaluation.

(1) Evaluation as Applied Science - characterized by quantitative measurement and experimental methods seeking to discover causes. Results in a narrow, focused approach.

(2) Evaluation as Systems Management - social programs are viewed as complex systems involving planning, implementing, testing and revising. Evaluation is necessary to assess each component of the system to develop a means of rational decision making of an executive or administrative type.

(3) Evaluation as Decision Theory - evaluation is construed as the application of statistical decision theory. It may be argued that evaluating and deciding have no intrinsic link, as illustrated by the example of an assessment of value that is subsequently ignored by decision-makers.

(4) Evaluation as Assessment of Progress Toward Goals - evaluation consists of specifying goals, usually in terms of behaviors, and measuring progress toward them. The weak point of this model is the value of the goals themselves, i.e., progress toward worthless goals is not progress at all.

(5) Evaluation as Jurisprudence - evaluation is posed as though it were a question submitted to a court of law. Advocates for both sides of the question are selected and made adversaries. The merits of both positions are argued in front of a jury or a judge; rules of the common law control submission of evidence; and a verdict is rendered. The procedure may be vulnerable to the weakness of one or the other advocates as a debater and is expensive.

(6) Evaluation as Description or Portrayal - evaluation is the full description of the program: its events, its effects, people's expectations and their judgements of it. Evaluation is best pursued as a case study taking the program as a complex event, not merely the embodiment of a few abstract variables. The measure of

success or failure of a program is based on standards of value at large in the community.

(7) Evaluation as Rational Empiricism - the view that the best evaluation design is a unique compromise between the fundamental purpose of evaluation and the possibilities afforded by the situation. There is no general or mechanical formula for good evaluations.

In determining the place of content analysis in the armamentarium of evaluation methodology, it is useful to note that content analysis is a research technique with qualitative and quantitative characteristics. Simon (1978) suggests that, "Content analysis is a technique that stands somewhere between the case study and the 'open-ended question' in a questionnaire survey" (p. 211). For those less compulsive about categorization and hierarchy of research methods, it may be sufficient to note that content analysis is useful technique for gathering relevant information from narrative text in a systematic fashion. The results of a content analysis may be of use in program evaluation models based on assessment of progress toward goals, as description or portrayal, or rational empiricism.

The Experimental Paradigm in Program Evaluation

Early program evaluation efforts focused on program outcomes rather than on operational aspects or process.

> Evaluation research was initially seen as, quintessentially, the assessment of programs' net effects. Correspondingly, the main problem was to specify appropriate ceteris paribus conditions that would permit valid estimates of these net effects. (Rossi & Wright, 1984)

Use of the experimental, or applied science, model was dictated by the early characterization of program evaluation as a problem of determining cause and effect. Randomized, controlled experimental designs were widely regarded as the gold standard for evaluation of education programs. The U.S. Department of Education's Joint Dissemination Review Panel, for example, utilized the degree of internal validity of a study as defined by Campbell and Stanley (1966) as one of the primary criteria used to rank studies' worthiness of disseminating results to the education community and to the public (Lynch, 1987).

Studies and commentary on evaluation during the 1960's and 1970's often applied the "scientific method" as a kind of Procrustean bed for determining which evaluation methods were acceptable and useful and which were not.

> For evaluative results to be even minimally useful to other projects, however, certain requirements must be met. These are: (1) internal validity, (2) external validity, (3) specification of the population and treatment being implemented, and (4) standardization of indicators of treatment impact. (McCaslin & Ershoff, 1978, p. 1263)

Criticisms of the Experimental Paradigm in Program Evaluation

Despite the attraction of the tightly controlled internal logic of experimentally designed evaluation

studies, the randomized, controlled experiment is the exception rather than the rule in evaluation practice. Experimental designs are difficult to carry out due to practical considerations involved in design and implementation, questions of ethics in social experiments, and the limited usefulness of results reported from experimentally designed program evaluations (Weiss, 1973; Cronbach, et al, 1980; Chelimsky, 1987). Classic experimental designs as described by Campbell and Stanley (1966) emphasize control of threats to the internal validity of the design. The narrow focus of treatment and controls necessary to achieve sufficient internal validity in experimental and quasi-experimental studies tend to limit the ability to generalize findings. This is a substantial weakness in the context of evaluation of education programs, particularly large scale education programs where significant public resources are committed. Because of the focus on cause-effect and outcome measures, evaluation studies utilizing experimental designs usually do not provide a great deal of descriptive information on operational details of the program or on process considerations important to adapting the program to other settings.

Another serious drawback of experimental designs in program evaluation has been the frequency of non-significant outcomes (Rossi & Wright, 1984). When the only information

provided by a study is that there was no significant difference between an experimental group and a control group, it should not be surprising that the results of earlier evaluation studies were often reported to be ignored by program administrators in making decisions regarding the disposition or improvement of the program (Filstead, 1979; Patton, 1980).

> Proponents of experimental design stress the overriding need to establish internal validity. Cronbach counters that external validity is what matters. The people who shape program decisions need to know how the variety of interventions categorized under the rubric of "Voucher plans" or "job training" function. Since change in conditions or procedures can enhance, reduce, or even reverse the effect of a treatment, above all they need to understand the process by which the treatment works. Experiments are not the ideal design for exploring process. (Weiss, C., 1981, p. 399)

The narrow focus of experimental program evaluation, the practical problems involved in maintaining adequate experimental controls over time, the fact that ongoing or completed programs are not amenable to randomized experimental models of evaluation, ethical questions, and the expense of experimental approaches in terms of time and money have all served to reduce the utility of the experimental paradigm in evaluation research (Rossi & Wright, 1984, p. 141).

Qualitative Approaches to Program Evaluation

As previously noted, the use of qualitative research methods is a well founded tradition in a number of the

social sciences, such as sociology and anthropology. From the perspective of these disciplines, qualitative research methods may be viewed as a primary rather than alternative means of approaching problems in evaluation. However, in terms of the history of program evaluation through the late 1980's, qualitative approaches have been viewed as alternatives to traditional experimental approaches (Rossi & Wright, 1984, p. 341).

A variety of qualitative methods for program evaluation have been described in the educational research literature and many of these methods have received increasing acceptance in the practice of educational evaluation (Stufflebeam, 1974; Filstead, 1979; Patton, 1980; Guba and Lincoln, 1981; Cronbach, 1982). Qualitative data analysis methods are not easily defined or formulated because of their innovative, exploratory, and individual nature (Pfaffenberger, 1988, p. 26). Eisner, however, has described a distinction between "scientific" and "artistic" approaches to qualitative research which may help guide selection of methods in some circumstances (Eisner, 1981). In this classification scheme, scientific approaches include naturalistic inquiry, grounded theory, ecological and ethnological approaches, case studies, participant and nonparticipant observational techniques, and phenomenological analysis of interview data. Artistic methodologies include educational criticism, aesthetic criticism, literary, film, and curriculum criticism,

phenomenological response; connoisseurship; photographic analysis; and investigative journalism (Hatch, 1986).

The perceived advantages of qualitative approaches include lower cost, faster results, and flexibility in response to program administrator's needs (Rossi & Wright, 1984). Qualitative approaches may be able to address questions beyond the net effect or outcome of the program. Information on why a program was successful or not is probably as important as measuring the program effect. Most large scale education programs evolve over a period of time (Deutscher, 1977, pp. 108-123). As the program is implemented, the original goals may be modified in response to practical realities. In other cases, the original program goals may be purposefully general or vague, and become better defined as the program is implemented (Cronbach, et al, 1980). Changes in program goals are difficult to address in evaluations based on the experimental model, but may be successfully dealt with by employing qualitative data analysis methods.

Criticisms of Qualitative Methods

Qualitative methods have been criticized for lack of standardization, lack of rigor in terms of a systematic manner of collecting data, and inadequate controls or checks on the validity of data collected. The lack of standardization, e.g. case studies, limits the ability to generalize results (Campbell, 1975). If qualitative data

are not collected in a systematic fashion, checks on reliability and validity through comparison to standards or other similar studies become impossible. Perkins, notes that many authorities (Campbell, 1975; McClintock, Brannon, & Maynard-Moody, 1979; Patton, 1980) have urged that qualitative data gathering should become more systematic (Perkins, 1987).

Qualitative approaches to program evaluation generally emphasize the usefulness of qualitative or descriptive evaluation studies for decisions involving program policy and disposition. It should be recognized that while the goal of any evaluation study should be to provide useful information, any claim of utility is weakened if studies are not conducted in accordance with scientific standards (Saxe, 1987). In her review of Cronbach's 1980 book, Toward Reform of Program Evaluation: Aims, Methods, and Institutional Arrangements, Weiss questions whether the indiscriminate use of qualitative methods presents a threat to the scientific standards of the field of evaluation:

> In their fervor to reform current scientistic [sic] practice (or at least the scientistic [sic] norms that academics writing about evaluation hold forth for the field), they come perilously close to an indiscriminate relativism; almost anything goes. They are in danger of devaluing the characteristics that distinguish evaluation as research from any other form of information gathering or expert consultation." (Weiss, C. H., 1981, p. 399).

Strengths of qualitative approaches to program evaluation include flexibility and ability to adapt to individual

research situations, provision of detail on the nuances of individual characteristics of programs, and provision of a basis for inductive reasoning regarding program results (Manning, 1982). In order to be effective, qualitative research on educational programs must meet the requirements necessary to establish validity and the rigor necessary to distinguish evaluation research from other forms of data gathering.

Selecting Methods Appropriate to Evaluation Purposes and Circumstances

The complexity and lack of experimental controls in most program evaluation studies tends to support the rational empiricism model of evaluation presented by Scriven - the view that the best evaluation design is a unique compromise between the fundamental purpose of evaluation and the possibilities afforded by the situation. There is no general or mechanical formula for good evaluations. What has become increasingly clear over time is that, "no one data technique, however elaborate, will adequately handle the range of issues inherent in most program evaluations," (Robinson, 1984, p. 158). Larger social or educational programs can be quite complex, presenting a number of issues to program evaluators beyond the need to determine program outcomes or net effects. The development of an educational program will create different evaluation questions and problems over time. In terms of external

validity, the question of how a program functions may be more important than its effect. Different parties may have special interest in different aspects of the program. Rossi and Berk point out the rationale for the use of multiple methods and approaches in program evaluation:

> A wide range of methods is used because different methods have different strengths and weaknesses, and because the particular questions being asked should be coupled with the most effective research methods. ... For example, research procedures that might well make sense as a program is initially being designed may be ineffective when the impact of an ongoing program is being addressed. Likewise, research procedures that are effective in determining how a program works will often differ from research procedures that are effective in determining whether a program works (Rossi and Berk, 1990, p. 8).

Selection of methods appropriate to the specific questions to be addressed is an important consideration in any program evaluation.

Content Analysis

Content analysis is a research technique for describing, analyzing, and drawing inferences from written materials. Content analysis and similar text analysis methods have been used in fields such as Communications, Education, History, Journalism, Marketing, Philology and Literary Analysis, Political Science, Psychiatry, Psychology, and Social Anthropology (Pool,1959; Stone, et al, 1966; Holsti, 1969; Rosengren, 1981). Examples of the type of documents used in content analysis studies include newspapers, books, transcriptions of psychiatric interviews,

transcriptions of radio broadcasts, government documents, personal diaries, written essays, open-ended survey questions, field notes, suicide notes, advertisements, and childrens' readers (Barcus, 1959; Stone, et al,1966; Krippendorff, 1980; Rosengren, 1981; Frisbie, 1986; Fan, 1988).

The reference by Dovring to a systematic analysis of the lyrics of Lutheran hymns in Sweden in the 1640's is often referred to in the literature as the earliest formal example of content analysis (Dovring, 1954). Use of content analysis in American journalism dates back to a study in 1893 by J.G. Speed of changes in the content of New York newspapers during the period from 1881-1893 (Stone, et al, 1966, p. 22). Content analysis techniques were used during World War II to analyze the content of Nazi propaganda broadcasts and to infer intentions of the Nazi leadership toward the war effort (George, 1959). Berelson's text on content analysis published in 1952 is frequently cited as one of the most important books in establishing content analysis as a recognized research technique (Berelson, 1952). Barcus's 1959 review of the literature on content analysis cited 1,700 studies at that time, including 500 master's theses (Barcus, 1959). Stone, et al, published the General Inquirer in 1966, an important early work on the use of computers in content analysis (Stone, et al, 1966). Holsti's short text, Content Analysis for the Social Sciences and Humanities (1969), provides an excellent

overview of content analysis which is still quite relevant in 1990. Carney's review of content analysis does not add anything new, but is another example of a general text on content analysis (Carney, 1972). More recent general texts on content analysis include Krippendorff (Krippendorff, 1980) and Weber (Weber, 1984). Readers interested in looking at the history of content analysis are referred to Krippendorff (1980, pp. 13-20). A European perspective on content analysis issues is presented in Rosengren (1981).

Definitions of Content Analysis

Holsti presents a list of some of the early formal definitions of content analysis (Holsti, 1969, p. 2-3):

> Content analysis is the statistical semantics of political discourse (Kaplan, 1943, p. 230).
>
> Content Analysis may be defined as referring to any technique a) for classification of the sign-vehicles, b) which relies solely upon the judgements (which theoretically, may range from perceptual discriminations to sheer guesses) of an analyst or group of analysts as to which sign-vehicles fall into which categories, c) on the basis of explicitly formulated rules, d) provided that the analyst's judgements are regarded as the reports of a scientific observer (Janis, 1949, p.55).
>
> Content analysis is a research technique for the objective, systematic, and quantitative description of the manifest content of communication (Berelson, 1952, p. 18).
>
> We propose to use the terms 'content analysis' and 'coding' interchangeably to refer to the objective, systematic, and quantitative description of any symbolic behavior (Cartwright, 1953, p. 424).
>
> The term 'content analysis' is used here to mean the scientific analysis communications messages. . . . The method is broadly speaking the 'scientific method', and

> while being catholic in nature, it requires that the analysis be rigorous and systematic (Barcus, 1959, p.8).
>
> Content analysis is a phase of information-processing in which communication content is transformed, through objective and systematic application of categorization rules, into data that can be summarized and compared (Paisley, 1969).

There is consensus that content analysis may be characterized as a systematic and objective research technique, i.e., a "scientific" technique rather than an "artistic" technique. In the definitions developed during the 1950's, measurement and description appear to be viewed as the primary purpose of content analysis, rather than including the second step of drawing conclusions or making inferences about the descriptive data.

> In a great many studies there is no real problem of inference at all. This is true for all those content analyses in which the description of content itself is the primary objective. (Berelson, 1954, p. 516)

Drawing inferences from the descriptive data produced by content analyses gained importance in the definitions developed in the 1960's. Stone provides a definition of this type which has frequently been cited in the literature:

> Content analysis is any research technique for making inferences by systematically and objectively identifying specified characteristics within text. (Stone, et al, 1966, p. 5)

Stone notes that the phrase "for making inferences" is by far the most important and perhaps the most controversial element of their definition. "Inference is presented in our

definition as the raison d'etre of content analysis," (Stone, et al, 1966, p.5).

Frisbie presents a balanced perspective on the inclusion of description and inference in the definition of content analysis (Frisbie, 1986). He notes that both evaluation and content analysis may be viewed as a two step process involving description and judgement/inference. He summarizes the contrasts between the two steps in the following table:

Surface and Underlying Contrasts for Evaluation and Content Analysis Information

Contrast	Evaluation	Content Analysis
Surface	Descriptions vs. Judgements	Descriptions vs. Inferences
Underlying	Knowledge vs. Value Statements	Observations vs. Logic

Note. Table 1 from Frisbie, 1986, p. 15

This two step process provides a useful distinction in looking at the application of content analysis to program evaluation. Measurement problems in content analysis, including issues of reliability and validity of data collection and analysis, can be examined separately from issues involving judgements, inferences, value statements and logic. The major focus of the present study is on

demonstration of computer assisted content analysis as a data gathering or descriptive technique rather than on inference or judgement of the program's performance. The utility of the descriptive data produced by the content analysis for making inferences about the performance of the Preventive Cardiology Academic Award will be looked at to a limited degree. An illustrative sample of all possible content categories, rather than the exhaustive set of categories required in a full scale content analysis will be included in the study. It is not possible to make comprehensive judgements regarding the performance of the PCAA program based on this limited sample of categories; however, the method for doing so will be demonstrated.

Qualitative versus Quantitative Content Analysis

The issue of the relative merit of quantitative measures and qualitative measures has been debated in content analysis since the early 1950's, and the arguments are much the same as in other areas of research.

> There is clearly no reason for content analysis unless the question one wants answered is quantitative. (Lasswell, Lerner, and Pool, 1952, p. 45)

> Quantitative content analysis is, in the first instance, a statistical technique for obtaining descriptive data on content variables. Its value in this respect is that it offers the possibility of obtaining more precise, objective, and reliable observations about the frequency with which given content characteristics occur either singly or in conjunction with one another. In other words, the quantitative approach substitutes controlled observation and systematic counting for impressionistic

> ways of observing frequencies of occurrence. (Pool (Ed.), 1959, p. 8)
>
> Despite the advantages of employing quantitative methods, the tendency to equate content analysis with numerical procedures has come under criticism on a number of grounds. The most general of these is the charge that such a restriction leads to bias in the selection of problems to be investigated, undue emphasis being placed on precision at the cost of problem significance. (Holsti, 1969, p. 10)
>
> So-called qualitative content analysis- content analysis 'without special regard for frequencies' (Kracauer, 1952-53, p. 637) - has staunch adherents. George (1959) argued that some of the most dramatic results obtained from propaganda analysis during World War II came from qualitative analysis -analysis sensitive to one-time category occurrences- rather that quantitative content analysis. (Wood, 1984, p. 292)

The need for quantitative measurement units is important in content analysis studies based on word frequency counts, while qualitative units are of importance in content analyses where context, detailed description, and latent inference are important. An example of a quantitative text unit would be a single word or phrase (Berelson, 1952). An example of a qualitative text unit would be a passage (Brent and Anderson, 1990, pp 269-270). Holsti points out, however, that "measurement theorists are generally in agreement that qualitative and quantitative are not dichotomous attributes, but fall along a continuum....Thus the content analyst should use qualitative and quantitative methods to supplement each other" (Holsti, 1969, p. 11). A content analysis study may utilize both qualitative and quantitative measures. As noted previously,

the provision of both quantitative and qualitative information is desirable in program evaluation.

General Content Analysis Procedures

The basic procedures in most content analyses involve development of a system for categorizing information contained in the text, identification of specified content in the document(s), coding and recording the relevant content into categories, and reporting results.

> The content analysis procedure involves the interaction of two processes: the specification of the content characteristics to be measured and the application of rules for identifying and recording the characteristics when they occur in the data. The categories into which the content is coded vary widely from one investigation to another and are dependent on the investigator's theory and the nature of his data. (Stone, et al, 1966, p. 7)

The development of a category system for classifying units of text is generally agreed to be the most important step in the content analysis process. The theory upon which the category system is based provides the logic for inference and interpretation of the data.

> Although competent performance in other parts of the analytic process is also necessary, the formulation and the definition of appropriate categories takes a central importance. Since the categories contain the substance of the investigation, a content analysis can be no better than its system of categories. (Berelson, 1952, p. 147).

> The problem of category construction is widely regarded as the most crucial aspect of content analysis. It is the step in which the data are tied to theory, and it serves as a basis for drawing inferences. (Stone, et al, 1966, p. 9)

Identification of specified categories of text requires definition of the basic unit of text to be used in the analysis. Krippendorff refers to the procedure of selecting and delineating text units in content analysis as unitizing. "Unitizing involves defining these units, separating them along their boundaries, and identifying them for subsequent analysis" (Krippendorff, 1980, p. 57).

Text units have been referred to by a variety of labels such as coding units, context units, recording units, sampling units, sign vehicles, etc. There are distinctions among these labels based on how the units are used in the analysis, but there is no pressing need to detail these subtle distinctions for purposes of the present study. For the interested reader, Krippendorff (Krippendorff, 1980) presents a more detailed description of text units.

Holsti lists examples of five of the most commonly used units of text in content analysis:

(1) the **single word or symbol** is generally the smallest unit that is use in content analysis research;

(2) the **theme**, a single assertion about some subject, is for many purposes, the most useful unit of content analysis. It is almost indispensable in research on propaganda, values, attitudes, beliefs, and the like. A major drawback is that coding themes is usually time consuming. Another difficulty is that its boundaries are not as easily defined as those of the word, paragraph, or item.

(3) Studies of fiction, drama, movies, radio, and other forms of entertainment materials have often employed the **character** as the recording unit.

(4) In part because grammatical units such as the **sentence or paragraph** do not usually lend themselves to classification into a single category, they have rarely been used as recording units. The sentence or paragraph is

rarely satisfactory when precision of measurement is important; in that case words or themes will probably be used.

(5) The **item** is the recording unit when the entire article, film, book, or radio program is characterized. (Holsti, 1969, pp. 116-117)

These unit types may be used in both quantitative and qualitative content analyses.

A system for recording the units in the proper categories for subsequent summarization and analysis is required. Data collection sheets are used in manual content analysis. With computer assisted content analysis, a database management program or a word processing file may be used for the data recording system. Generally, the computer will be a more efficient means of recording data than manual collection sheets.

Finally, results are analyzed, summarized, and reported. In quantitative forms of content analysis, statistical techniques ranging from simple descriptive statistics to correlation statistics and multivariate analyses may be used to analyze and present the findings. Qualitative content analyses usually result in descriptive reports, summaries, and inferential statements.

Advantages of Content Analysis

Content analysis provides a number of advantages over other forms of qualitative evaluation. Darrel Caulley, of LaTrobe University in Australia, has published an article on document analysis in which he lists a number of advantages

and disadvantages of document analysis (Caulley, 1983). The term "document analysis" used by Caulley refers to a range of both qualitative and quantitative techniques for analyzing narrative text, similar to the broad context in which "content analysis" is viewed in this study. The following summary of advantages and disadvantages listed by Caulley are relevant to both quantitative and qualitative analysis of documentary, or narrative data.

Advantages of Document Analysis

1. Document analysis is superior to interviewing for collecting some kinds of retrospective data.

   a. Interviewing depends on the interviewer knowing the right questions to reveal the relevant information. Analysis of documents can indicate questions to ask in an interview. For example, documents may reveal low school attendance, suggesting a potential dropout problem which could be asked about in an interview.

   b. Interviewing relies on the memory of the interviewer while document analysis is not subject to this defect. Document analysis may provide more detail on the chronology of events than interviewing.

   c. Document analysis may reveal information that could not be obtained through interviewing.

2. Certain kinds of information are most efficiently collected by means of document analysis. Very often the evaluator needs to know the stated goals of a program, and documents are a source of such information. Rather than wasting the time of program personnel, general background information might be obtained from documents. Background documents might supply information on lines of authority within the program, a list of staff, basic statistics and issues related to the program.

3. Information obtained from documents is often more credible than information obtained via observation and interviewing. A quote taken from an internal memorandum

is not subject to the evaluator's bias as are interviewing and observational data.

4. Document analysis may be the only way that certain information may be obtainable. Some program personnel may be unwilling to be interviewed. Program personnel may be uncooperative in supplying certain information.

5. Documents are convenient to use. With interviewing, the evaluator must make appointments and establish rapport. None of this is necessary with documents which can be worked with at any time. The gathering of information from documents does not require the cooperation of the individuals about whom information is being sought, as does the use of questionnaires, interviews and, frequently, observation.

6. Documents are often available on a no-cost or low-cost basis.

7. Documents are non-reactive.

8. Records save time and money that original data collection requires.

9. Unlike the one-shot evaluation study that collects information for a short period of time and then terminates, the recordkeeping system of an agency can provide continual feed-in of information. Statistical records contain information that is collected repeatedly and make possible the determination of trends over time.

10. Documents 'constitute a legally unassailable base from which to defend oneself against allegations, misinterpretations, and libel. The best defense in a challenge to an evaluation report is for the evaluator to be able to show that he did in fact tell the truth, and best evidence for truth is the public record'.

11. Program documents provide the evaluator with information about many things that cannot be observed because they may have taken place before the evaluation was begun or because they may include private interchanges to which the evaluator is not directly privy.

(Caulley, 1983, p. 21)

Disadvantages of Document Analysis

Despite the potential usefulness of documents in program evaluation, the utility of document analysis may also limited by several factors. Caulley (1983) has summarized some of the commonly encountered limitations of documentary data:

1. Often documents are written to make a program look good and thus can be misleading. There is also sometimes self-deception on the part of the writer of a document.

2. A document is a written report and can have some of the same faults as an oral report given in an interview. There is a dependency on the memory of the person doing the reporting. The writer of the report may be guided by predispositions or may be a poor observer.

3. Although reams of material may be available, much of the needed information may not be present in the documents or the information may not be sufficiently detailed.

4. Documents may reflect clerical lapses, typographical errors, biases, or outright deception.

5. Agency records may be inaccurate, out of date, or months behind on entries.

6. The definitions and categories used by an agency's records may be inappropriate for evaluation purposes.

7. No document can indicate more than what the author of the document thought- what he thought had happened, what he thought ought to happen, or would happen, or perhaps only what he wanted others to think he thought. Documentary facts never come 'pure' since they do not and cannot exist in a pure form. They are always refracted through the mind of the recorder. It follows that when we take up a document, the first concern should be not with the facts it contains but with the writer of the document. Ideally one should study the writer before studying the facts presented by the document.

8. Documents may provide unrepresentative samples. There is no easy remedy to this other than that information obtained from documents should be checked with the information obtained by other methods of data collection.

(Caulley, 1983, p. 22)

Stone, et al, (1966) summarize the advantages and disadvantages of documentary analysis by drawing an analogy between content analysis and archeology.

> Much as the archeologist infers the life of a culture from the pattern of remnants, so the content analyst infers the orientation and concerns of a speaker, subculture, or culture from the record of what is said.
>
> Studying artifacts rather than studying behavior itself has its drawbacks, but also its advantages. The artifact is static, not a fleeting event as is behavior. Text can be copied and shared with other investigators. It can be analyzed and reanalyzed until the investigator is satisfied with his work; and it can be reused later to test other hypotheses. Text is usually available, often being produced naturally as part of an event. Because it extends through history, text is an excellent vehicle for studying long-term changes of attitudes, concerns, and styles.
>
> However, like the archeologist's diggings, the available text fragments may be trivial and insignificant data about the situations they represent. The really significant documents may never become available or, for that matter, may not have been produced.... The diversity of possible interpretations, the proximity of verbal expression to the pressures of the situation, the multiple levels in which personality is reflected through speech and writing, usually all make the content of what is said an interesting subject of study, suitable for testing a number of hypotheses. Sensitively chosen text, like a well-chosen archeological site, can yield very worthwhile rewards. (Stone, et al, 1966, p. 19)

In summary, content analysis is any research technique for systematically and objectively identifying specified

characteristics within text for purposes of summarizing, describing, and analyzing the content of text or for making inferences from summaries, descriptions, and analyses of text. Content analysis has a relatively long history of use in the social and applied sciences. Content analysis procedures include development of a category system, selection of units of text, abstracting and recording units of text into specified categories, and reporting results. There are qualitative as well as quantitative approaches to content analysis. A number of advantages and limitations of content analysis have been described. An interesting analogy may be made between archeology and content analysis.

Computer Assisted Content Analysis

Computers have the capability of storing and processing symbols, including alphabetical symbols, thus creating the potential for computers to be used for word processing and text analysis. The application of computers to problems of qualitative text analysis has generated an enthusiastic response from social scientists in recent years (Pfaffenberger, 1988, pp 9-10). The greater accessibility and power provided by the microcomputer in the 1980's has broadened the interest in and appeal of computer applications to research involving analysis of text, particularly the qualitative analysis of text. Wood has described the basic rationale for using computers in text analysis studies:

> First, computers can act as powerful tools for the storage and retrieval of information, especially field notes and other records. Second, computers can perform tasks related to analyzing the form and content of texts and verbal materials (Wood, 1984, p. 290).

Computers have been used in content analysis since the late 1950's (Wood, 1984; Burton, 1981, Stone, et al, 1966). A number of software programs have been developed to count the frequency of text units, develop concordances, retrieve blocks of text, simplify categorization and recording of text units, and perform statistical analyses on the resulting data. Some of the more commonly used content analysis programs are listed by Brent and Anderson: "Content analysis programs have been available since the 1960's and now include the General Inquirer (Stone, et al, 1966), the Key-Word-In-Context Bibliographic Indexing program (Popko, 1980), TEXTPACK (Weber, 1984), the Minnesota Contextual Content Analysis (MCCA) Program (McTavish and Pirro, 1985), and the Oxford Concordance Program (Hockey and Marriott, 1982)" (Brent and Anderson, 1990, p. 268). Other programs which have applications to computer assisted content analysis include ZyIndex, Notebook II, and WordCruncher (Pfaffenberger, 1988). Windows Personal Librarian, the key-word search program used in this study, is one of the more powerful and flexible programs available. Features of Windows Personal Librarian are discussed in greater detail in Chapter III on methodology. Frisbie, Tarnai and others have described the use of general word processing and

database software programs to perform computer assisted content analysis (Tarnai, 1985; Frisbie, 1986).

Quantitative Computer Assisted Content Analysis

Content analysis evolved primarily as a quantitative technique in the 1950's and 1960's, "the statistical analysis of language" (Lasswell, Lerner, and Pool, 1952, p. 63). The earliest computer programs for content analysis were designed primarily to assist with the tedious task of identifying, abstracting, and counting words. The advantage of having an automated method of counting words was obvious to researchers as early as 1952:

> Perhaps the evolution of modern computing machinery may prove to be the key to the tremendously complex problems involved in the statistical analysis of language.... The advantage of a sufficiently flexible mechanical system would have been that we could have gone back to the original data at will. With the system actually used, tabulation was so laborious that, once the summary tables by periods were made up, it was almost never possible to go back for another look at them. (Lasswell, Lerner, and Pool, 1952, p. 63, quoted in Holsti, 1969, p. 193)

Improvement in the reliability of counting and coding words from text was another advantage of using the computer in quantitative content analysis. While the probability that human coders would miss occurrences of words, or code them in the wrong category, was quite high, the computer produced much more reliable coding. Stone (1966) likened the computer to "an energetic, compulsive, but stupid clerk"... who "has no ideas of his own but waits for specification of categories and scoring procedures supplied

by the investigator. Once these instructions are received and not found to be self-contradictory, the clerk is able to apply them systematically to endless amounts of data" (Stone, et al, 1966, p. 68).

The General Inquirer program developed by Stone, et al, in the mid 1960's has served as the model for most computer assisted content analysis programs (Wood, 1984, p. 293). Characteristics of computer assisted content analysis programs designed to produce quantitative results, such as the General Inquirer, include the ability to identify systematically, within text, instances of words and phrases that belong to categories specified by the investigator; count occurrences and specified co-occurrences of these categories; print and graph tabulations; and perform statistical tests (Stone, et al, 1966, p.68).

> To use the clerk-computer analogy mentioned above, the investigator provides the clerk with a list of words - that is, a dictionary. The clerk tirelessly searches a text for dictionary words and, when a match is made, adds the number one to a counter. Although the General Inquirer is a sophisticated program, the task it performs is not. (Wood, 1984, pp. 293-294)

Programs designed to perform quantitative content analysis have applications in marketing, public opinion studies, studies of newspapers and other news media, and political science (Rosengren, 1981; Fan, 1988). Content analysis studies have produced some fascinating and useful findings in these areas. It is interesting to note, however, that the "statistical analysis of language", or quantitative content analysis, has not had a major impact on

social science fields (Wood, 1984, p. 289). As with the field of program evaluation in general, the focus of content analysis in social science fields has shifted during the 1980's from quantitative analysis to computer programs designed to perform qualitative analysis.

Qualitative Computer Assisted Content Analysis

The analysis of qualitative data can be a time consuming, tedious process. The word processing capability provided by the computer, i.e, the ability to store, retrieve, copy, and manipulate text, provides a major advantage in qualitative content analysis. "Now that high quality text-processing programs are becoming available for qualitative data analysis, it seems likely that qualitative researchers will enjoy the same two benefits that quantitative researchers receive from the computer: the ability, first, to work quickly and conveniently with much larger units of data, and second, to apply more sophisticated analytical techniques" (Pfaffenberger, 1988, p. 13).

The basic problem involved in qualitative content analysis is that the quantity of data is often too large to adequately analyze by hand. Questions of reliability and validity are also more difficult to deal with in qualitative data analysis since analyzing the data once may prove to be a monumental task; repeating the analysis for reliability comparisons may be mind-boggling when large amounts of data

are involved. Questions of reliability may be disguised or ignored on grounds that descriptive and case studies are of inherent value, that the phenomenological experience of the researcher is of primary importance, and that reliability is an artifact of the hypothetico-deductive philosophy. The truth, often, is that reliability comparisons in qualitative data analysis are simply too much work, e.g., "tabulation was so laborious that, once the summary tables by periods were made up, it was almost never possible to go back for another look at them" (Lasswell, et al, 1952).

> Social scientists who use qualitative strategies...face what Sproull and Sproull (1982: 283) accurately called a 'cruel trade-off' between the richness of qualitative data and the tedium involved in analyzing it....nearly all qualitative techniques produce text, and in copious amounts. To 'capture' qualitative data is to write it down, to make it into field notes, life histories, interview transcriptions, case histories, protocol analyses, and rank listings. Unfortunately, to analyze this textually captured data is to engage in a paper-pushing enterprise of monstrous proportions. If the job is to be done properly, the researcher is in for such tormenting jobs as manually searching thousands of pages of notes for an obscure passage, recording all the field notes to suit a newly discovered framework of coding categories, and rewriting the notes to flesh out events from memory. (Pfaffenberger, 1988, p. 12)

> It is clear that qualitative data analysis, like any other form of analysis, requires that the material be broken down into its constituent elements, which must be compared, named, and classified so that their nature and interaction becomes clear. In qualitative studies, this process usually involves three activities: rewriting, coding, and comparison. (Pfaffenberger, 1988, p. 26)

If text can be translated to a computer readable database file, the word processing capabilities of the computer can be used to automate much of the work involved

in searching, rewriting, coding, comparing, and analyzing the text file. By reducing the time and effort required to analyze qualitative data, the computer allows the researcher to return to the data at will, develop and refine category systems, provide for data summaries, and provide for reliability and validity measurements through various comparisons of data. This capability is the fundamental basis for the present study. Recent literature on the use of computers in the analysis of text files recognizes the crucial ability of the computer to search, extract, and summarize text files:

> The retrieval and report generation capabilities of database software offer important possibilities for the social scientist, because some research tasks fit the extraction model better than the statistical data processing model. When an individual case needs to be examined in detail, it may be helpful to produce a display or print a report of all the data items for that case. In other instances analogous to editing, it is necessary to find out which cases meet a specified condition. (Brent and Anderson, 1990, p. 233)

Procedures used in the present study are recognized in the recent literature:

> In the analysis of a text file, it may be necessary to find out all the paragraphs or text units that contain a combination of words or strings. Such tasks require a search or query procedure, and provision is needed for definition of a complex variety of search conditions. (Brent and Anderson, 1990, p. 233)

> Evidence for an interpretation or a criticism often comes from text excerpts. With concordances, one can locate relevant text material more efficiently. A social science investigator interested in thematic analysis might first locate in the text an occurrence of the theme. The researcher can then search for characteristic words or simultaneous occurrences of words in the concordance printout. (Wood, 1984, p.293)

> It is possible to search and retrieve particular passages meeting some criteria such as the occurrence of at least one word in some category or the co-occurrence of two or more words from two specific categories. Those passages can be printed or stored in a separate file for later analysis. (Brent and Anderson, 1990, p. 270)

The power of the computer program used to search and retrieve passages from a text database is of critical importance in performing adequate content analysis of documents. As Frisbie (Frisbie, 1986) and others have pointed out, most standard word processing programs have the capability to search on a specified single word or even single strings of words to identify passages of text. However, most word processing programs do not provide the flexibility and power to retrieve text for analytical purposes (Pfaffenberger, 1988, p. 33). The single most important attribute of a computer program for performing qualitative text analysis is the ability to use Boolean operators (OR, AND, and NOT). "Boolean operators enable the researcher to achieve a high degree of control over the breadth of search questions, and they should be considered the sine qua non of a field researcher's computer tools" (Pfaffenberger, 1988, p. 35).

The use of computer assisted content analysis has not been widely reported in the literature on educational program evaluation. Computer assisted content analysis or techniques like content analysis have been reported in the anthropology and sociology literature, focusing primarily on

the use of the technique to analyze field notes (Sproull and Sproull, 1982; Elder, Gassaway, and Kingsland, 1982; Podolefsky and McCarthy, 1983; Friedheim, 1984). Brent and Anderson (1990, pp. 274-282) present a classification of approaches to the qualitative analysis of text materials. The three approaches suggested by Brent and Anderson are labeled the Text Approach, the Database Management Approach, and the Knowledge-based Systems Approach.

The Text Approach utilizes word processing, text editing, and specialized text analysis computer programs to record, store, retrieve, compare, classify, and summarize text as whole units, i.e., sentences, paragraphs, passages. The procedures described are based on programs used in the analysis of field notes by sociology researchers. The Text Approach, however, closely resembles the procedures used in the present study to analyze the Preventive Cardiology Academic Award grant document files. The following summary is from Brent and Anderson (1990):

The Text Approach
To Qualitative Analysis of Text

Recording Data are recorded as text using a text editor or word processing program.

Storage Data are stored as text files consisting of a long string of characters.

Concept Formation and Typology Construction The text may be scanned, and particular segments referring to some concept may be identified and compared, moved around, and manipulated as part of the process of identifying concepts and typologies that help express the underlying meaning of the data.

Classification Categories describing subsets of the data may be indicated within the text itself as special codes.

Query and Retrieval Specific text segments which are representative of particular categories or concepts may be identified by scanning the entire text in sequence until the identifying code is found, then displaying that text segment or printing it out for later analysis.

Summarization The special-purpose qualitative analysis programs typically have provisions for counting occurrences of some category, summarizing those frequencies, and providing quasi-statistics described by Becker and Geer (1960). Some of the more advanced text editors and word processors also have this capability.

This approach manages to incorporate structure into the data while still meeting the requirements of qualitative analysis for flexibility, availability of the original data, and the capability to retrieve information selectively. The text approach is extremely flexible, permitting the user to do virtually anything involving text with the computer that they can do on paper, and the computer makes everything easier. Notes can be written, and passages moved from one place to another, deleted, changed, and added at will. The field notes written on a word processor become the data for later examination by the researcher. Through insertion of additional codes for retrieval and analysis, they are made accessible to the researcher and the computer may be used to retrieve passages quickly and selectively.
(Brent and Anderson, 1990, p. 274-276)

The Database Management Approach to qualitative analysis of text relies on structured coding of text data into records and/or fields. The work involved in translation of raw text into fields and records is one of the major disadvantages of this approach. The advantage of the Database Approach over the Text Approach is primarily the ability to store more data (more cases) and to retrieve it with greater speed. The Database Management Approach is therefore recommended when the amount of data is very large and readily coded or is collected in pre-coded categories.

The Knowledge-based Systems Approach utilizes artificial intelligence programming, expert programs, natural language-understanding programs, Lisp and Prolog languages, frames, rules, and network data structures. The advantage of this approach is that the computer may play a more direct role in the interpretation of the text data, based on pre-specified rules and frameworks. The primary disadvantage is that this approach is at present only theoretical - there are no operational programs at the present time.

Of the three approaches to qualitative analysis of text materials, the Text Approach is now in relatively wide use in performing qualitative analysis of certain forms of text, such as field notes from sociological research. The availability and ease of use of microcomputers and word processing programs have made this a practical, everyday method for many researchers. The development of more sophisticated key word search programs will help to improve the efficiency of the text approach. The Database Management and Knowledge-Based Systems Approaches may be used more frequently in the future, assuming that increasingly large text databases will be available. The technical problems in developing artificial intelligence (knowledge-based systems) programs to analyze text are formidable due to the complexity of language, and it is likely that practical applications using this approach are at least ten years away. It has also been argued that the

investment of time and resources necessary to create artificial intelligence systems may not be economically feasible when compared to human capabilities.

Use of Optical Scanners to Create Text Databases

The efficiency and reliability of translation of written documents to computer readable files can be greatly improved through the use of optical scanners and optical character recognition software.

Computer programs designed to search and retrieve specific items of text from a large natural language database were envisioned as early as 1945 and have been in use since the 1950's (Pfaffenberger, 1988, p. 11; Bush, 1945). The creation of text databases from existing written documents, however, presented a problem. Optical scanning technology provided one option to manual translation (keyboard typing) of documents into a computer file. However, the accuracy of translation and the high cost of earlier optical scanners limited its usefulness. Stone and others recognized the value of optical scanners in translating written data to a computer readable format:

> After the data have been gathered and the investigator has decided on his categories, all this material must be transferred into a form that the computer can process. In the future, optical readers that can convert any printed text directly into computer code may become very common. At present, optical readers are useful for only a very limited number of printing fonts and formats. (Stone, et al, 1966, p. 76)

For individuals or groups without major institutional financial support, the lack of a practical, low cost method of translating existing documents into computer files has essentially prohibited the use of electronic searches of large existing document files. Recent developments in optical scanning have improved the accuracy of translation and sharply reduced the cost. There are three basic parameters used in the evaluation of optical scanners: reading speed, accuracy of optical character recognition, and cost. Generally, speed and accuracy increase with cost, although dramatic reductions in cost have taken place due to increasing competition since 1985. An article entitled "Scanners Build a Better Image" in the March 28, 1989, issue of PC Magazine stated, "Four years ago, successfully scanning typeset documents would've cost over $40,000 and required a minicomputer. Today, your PC can have similar capability for under $5,000. The new breed of OCR scans columns in one pass, adds formatting codes, paginates, spell-checks, and produces nearly finished files." Desk top scanners capable of scanning page sizes up to 11x14" with an automatic document feeder are available in most computer supply retail stores for $1,100 to $16,000. Optical character recognition software is an additional $150 to $700. The scanning time per page varies from 30 seconds to more than 15 minutes, depending on the ability of the OCR software to recognize different font styles, the quality of print of the document, letter spacing, quality of paper,

etc. Accuracy of different software and different scanners is also widely variable, ranging from 100 percent to less than 40 percent of characters accurately translated to an electronic file.

> Optical character readers (OCR's) can scan and read text typed by many common typewriters on standard paper and enter it into a standard computer text file. OCR's are faster than most other input technologies, even speech recognition. Currently, OCR's are relatively expensive but reliable, and their price is coming down with mass production. Even now OCR's may be cost effective for massive data entry jobs where existing text must be reentered into the computer. The savings in personnel costs may more than make up for the cost of the equipment. Some people believe the contribution of OCR's will be far greater than even that of speech recognition, at least in the short term. (Brent and Anderson, 1990, pp. 28-29)

One of the newer approaches to document scanning is to scan documents as whole images, translating the page as a graphic image file rather than an ASCII file. The major advantage of this approach is that the quality of the document is largely irrelevant to the speed and accuracy of reproduction. Even handwritten documents can be stored electronically by means image scanning. Reproduction accuracy is 100 percent and the quality of the original document can be improved by manipulating the gray scale used to print. Since image files are stored as pages or as whole documents rather than individual words, they are not amenable to searches on individual words or phrases. This restricts their use in computer assisted content analysis applications. Image files also require enormous amounts of memory capacity; the usefulness of this approach has been

limited to minicomputers and mainframes until very recently. The current availability of low cost optical laser disk readers has largely solved the memory capacity problem and made scanning documents as image files practical on personal computers. A single optical disk system may hold up to 940mb of data scanned as images. The cost of a complete system in 1990 dollars, including a 20386 based computer, 150mb hard disk, 2mb RAM, laser printer, optical scanner, OCR software, and laser disk drive was approximately $21,000.

Optical scanning of documents is a commercially available service. Many companies which provide microfilm service are now also providing optical scanning of documents. The concept is essentially the same as microfilm, the major differences being the storage media and the retrieval mechanism. The average cost of document scanning with on-line editing was approximately $3.00 per page in 1988. Studies by Prospect Associates show a conversion accuracy of 98% with optical scanning and 99% accuracy with on-line editing.

Limitations of Computer Assisted Content Analysis

The limitations of computer assisted content analysis are determined by the type of research questions to be addressed, by technology limitations, by limitations of the key word search process, by limitations of documentary data described in the previous section, and by practical

considerations such as financial resources and access to documents.

Quantitative approaches to content analysis have been most useful in large scale analysis of newspapers, advertising, and other media sources (Rosengren, 1981; Fan, 1988). However, the use of word frequency analysis has not had a wide impact on the social science fields, and has not been utilized in the field of educational program evaluation. One of the criticisms of quantitative approaches to computer assisted content analysis is the difficulty of determining meaning of a word frequency count. Because it is possible to run a computer assisted word frequency count without looking at the actual whole text, the validity of inferences drawn from word frequency counts may be suspect (Stone, et al, 1966). Educational program evaluators who are inclined to use quantitative methods are more likely to utilize techniques other than quantitative content analysis, due to the availability of other well established quantitative methods for program evaluation and the limited amount of research published on content analysis in educational evaluation.

Qualitative approaches to computer assisted text analysis have been used extensively in sociology and anthropology, especially in the analysis of field notes (Gerson, 1984; Podolefsky and McCarty, 1983; Friedheim, 1984). The number of applications of computer assisted qualitative text analysis increased dramatically in the

1980's with the increasing availability of microcomputers and word processing programs (Pfaffenberger, 1988). Most qualitative researchers now use word processing programs to record their field notes (Pfaffenberger, 1988, p. 30). Because the media for field notes is computer based, the analysis of field notes by computer is likely to further increase in the future. In other applied social science fields, such as educational program evaluation, the types of questions likely to be addressed by computer assisted content or text analysis are most likely to be qualitative and retrospective in nature.

The capability of computers to store large quantities of data has increased dramatically since the early 1960's. However, there are still definite limits on data storage capacity. Text files occupy a relatively large amount of computer storage space, one of the technological limitations of computer assisted content analysis.

> ...the text approach has a number of important limitations. First, the text approach strains the capacity of present microcomputers. Because all the original data from field notes or other text must be included, the files can exceed the storage capacity of current machines. This is less of a factor as increased RAM memory and hard disks become more prevalent. But even when machine storage is not exceeded, performance may suffer as more time is required to search a database. (Brent and Anderson, 1990, p. 276)

While knowledge-based or artificial intelligence approaches to computer assisted content analysis have been proposed, current qualitative text analysis programs are capable only of the mechanical aspects of retrieving and

displaying specified passages of text. Categorization and interpretation of qualitative text data is still largely a human rather than a machine process.

> ...computers represent and process text as if it were data in the most general sense - that is, an inherently meaningless collection of representations. The word CAT for instance, is represented, stored, and processed as a sequence (a 'string', in computer parlance) of three binary numbers. What is not stored is all the information that allows us to make the connection between those three letters and such things as crunchies, Garfield, kitty litter, and a Broadway show. Efforts to represent such connections have made impressive strides in recent years, but the formidable complexity of human semantic systems ensures that a meaning-sensitive text-processing technology is still many years away - if, indeed, it is feasible at all. In practice, therefore, a qualitative researcher must understand that a computer-assisted search of text for the word BIRTH will retrieve all passages in which the string BIRTH appears; however, it will not retrieve passages that mention PARTURITION but omit BIRTH - unless it is specifically instructed to do so. So long as limitations of this sort are clearly understood, search techniques and other applications can be used with some profit. (Pfaffenberger, 1988, pp. 13-14)

Not all commentators on the field of computer assisted content analysis view this as a limitation. Wood, for example, makes two salient points against the use of artificial intelligence in computer assisted content analysis:

> The first is my conviction that social researchers interested in using the information-processing services of computers should focus their attention and efforts on computer-aided - not totally automated - research designs. Even if programs can be developed that will flawlessly emulate the interpreting activity of human beings, such systems will likely require exorbitant investments of resources and machine time. The experience gleaned, especially from machine translation attempts, shows that researchers eventually reach a point of diminishing returns after which programming a computer to perform tasks that human beings can handle rather simply becomes increasingly difficult.

> Furthermore, even if miraculous technological advances were made tomorrow, such sophisticated technology would take a long time to become available to most social scientists.
>
> The second assumption is a caveat stemming from my personal experience as a computer and language research novitiate: anthropomorphizing tendencies to the contrary, the researcher should recollect that present day information processing systems do not 'read', 'interpret', or 'analyze' human language. ...Computers 'process' symbols; they do not care whether the symbols are letters or digits, living or dead, dream or reality. (Wood, 1984, p. 290)

Key word search programs provide an excellent tool for identifying and retrieving selected passages of text of interest in a study. Search terms, however, may not include all synonymous terms used in the text database, resulting in missed retrieval of passages. The fundamental problem with the key word search method is that it must rely on words to represent concepts which are often quite complex. The construction of the search terms to deal with this problem involves a trade-off between precision and recall.

> As anyone who has ever searched a textual data base with these techniques knows all too well, any search is likely to produce false drops, or retrieved records that contain one of the search words used only in a peripheral sense. For example, a search of the Orissa data base for traditional Hindu concepts of pollution might turn up a record in which an informant is complaining about air pollution from a factory. A false drop, in short, is not relevant to the search concept. The trouble is that, as research in information science has demonstrated, a search that aims for perfect recall - the retrieval of all relevant records from the data base - will have low precision, measured as the ratio between the number of relevant documents retrieved and the total number of records retrieved. To put it another way, a high-recall search is bound to produce a great many false drops, messing up the otherwise pristine picture of computer efficiency. What is more, aiming for high precision

> sacrifices recall - some relevant records will be missed.... Computer-based retrieval techniques from textual data bases are, in short, inherently imperfect and should be viewed with some suspicion. And this point applies, it should be added, not only to automatic indexers, but more broadly, to all programs that use Boolean or proximity operators for data retrieval purposes. (Pfaffenberger, 1988, p. 39)

Recognizing that key word search procedures are usually imperfect, it is important to take appreciate factors which may serve to minimize search term problems. Understanding the proper use of Boolean and proximity operators may increase the sophistication of search terms used. Familiarity with the database may provide cues to the development of effective search terms. Knowledge of the content area of the database may allow the researcher to recognize common synonyms and develop finely tuned search strategies. Once valid search terms are established, the actual search and abstraction process is largely clerical.

The availability, quality, and completeness of documentary data can be limiting factors in computer assisted content analysis (Caulley, 1983). The availability of adequate computer equipment may be a limiting factor. Large text files require a significant amount of memory space. A relatively fast processing speed is required if the text file is large. The capability of translating written materials into computer data files either through retyping or through optical character recognition programs is a necessity.

Computer training may be a limitation in some cases. The amount and complexity of training required to perform a computer assisted content or qualitative text analysis is approximately equivalent to learning how to operate one of the standard word processing programs. Individuals already familiar with word processing functions should be able to learn the content analysis search, retrieval, and storage functions relatively quickly.

Summary

Analysis of archival records is an often mentioned, but underutilized form of qualitative program evaluation (Caulley, D.N., 1983, p.19). Narrative documents, such as accreditation documents, grant applications, progress reports, and consultant reports, are often a rich source of information for evaluation of the operational or process aspects of educational programs. Where a prospective evaluation plan for the education program has not been developed or implemented, narrative documents may also be the only reliable source of information on the performance of the program relative to program goals.

A variety of strategies and methods are available to conduct educational program evaluation studies. Both quantitative and qualitative approaches have been used. The use of qualitative approaches to program evaluation has increased in recent years. Methods for conducting educational program evaluation should be systematic,

objective, reliable and valid. The overall evaluation of the Preventive Cardiology Academic Award program consists of several evaluation components or studies. The component of the evaluation of the PCAA program investigated in this study is retrospective. Therefore, experimental and quasi-experimental evaluation designs are not feasible. Qualitative content analysis of the text contained in grant documents is one of the best and potentially most useful evaluation strategies available.

Content analysis is a research method for systematically describing and drawing inferences from the content of written documents or other written communications. The historical use of content analysis or techniques similar to content analysis dates back to the 1600's, but has been more clearly defined as a research technique since the 1950's. Content analysis usually involves creating a system for categorizing information relevant to a theory or a set of questions; development of units of analysis, such as words, themes, or paragraphs; and abstracting and recording units into appropriate categories. There are quantitative approaches to content analysis which emphasize word or text unit frequency. Qualitative approaches, including descriptions of the meaning of individual phrases or themes, inferences drawn from the presence or lack of particular text units of interest, and other individually designed approaches, have also been used, either alone or in conjunction with word frequency counts.

There are a number of advantages to content analysis, including the generally high reliability of documentary information, the unobtrusiveness of content analysis as a research technique, and the ability to return to the data over a period of time. Disadvantages center on the possibility of incomplete, inaccurate or biased information contained in documents. Content analysis is a non-experimental research method which offers a means of developing both qualitative and quantitative descriptions of the archival data. Content analysis is particularly well suited to evaluations where a retrospective study is the primary means of program evaluation. Information gathered through content analysis may more reliable and valid than information obtained from interviews or questionnaires, two of the more commonly employed qualitative methods in program evaluation (Caulley, 1983, p. 20). Qualitative content analysis is an appropriate research technique to use in the program document portion of the PCAA evaluation plan.

Computers have been used in content and other forms of text analysis to count and tabulate word frequency, store and retrieve blocks of text, simplify categorization and recording of text units, develop concordances, perform statistical analyses, and streamline reporting of results. Quantitative and qualitative approaches to computer assisted content analysis have been utilized since the 1950's. The use of the computer to search, identify, retrieve, and store selected blocks or passages of text from a larger document

database file is of key interest in the evaluation of the PCAA program documents. It is possible to search and retrieve particular passages meeting some criteria such as the occurrence of at least one word in some category or the co-occurrence of two or more words. These passages can then be stored in a separate file for later analysis (Brent and Anderson, 1990, p. 270). This is the primary research procedure to be used in the PCAA program evaluation. Computer assisted qualitative analysis of text has been used in sociology and anthropology to a greater extent than in educational program evaluation. The technique has been especially useful in the analysis of field notes. One of the objectives of this study is to demonstrate that similar techniques can be applied to the evaluation of an educational program. Optical scanners are a useful and practical technology for translating written documents to a computer readable file. Optical scanners are used in the present study to convert written PCAA grant documents to a computer readable file.

Computer assisted text analysis is probably most useful for questions involving qualitative analysis. The memory capacity and processing speed of microcomputers is a limiting factor in computer assisted content analysis which becomes more acute as the size of the text database increases. The computer cannot perform the analysis and interpretation functions involved in computer assisted content analysis, although artificial intelligence programs

are proposed as a means to automate these functions in the future. Key word search strategies necessarily involve a tradeoff between the precision or efficiency of the search terms and the need to recall all relevant passages. The more precise the key word search term, the higher the probability that some relevant passages which contain variations of the search term will be missed. The more general the search term, the more relevant passages will be recalled, but the more false hits - irrelevant passages containing peripheral references to the search term - will also be obtained. Other limitations include the accessibility and completeness of documents, the availability of necessary computer equipment, and possible training requirements for search workers. These limitations will be noted and tested in the use of computer assisted content analysis in the evaluation of the Preventive Cardiology Academic Award program.

CHAPTER III.

METHODOLOGY

Overview

Computer files suitable for content analysis by computer were created from the existing Preventive Cardiology Academic Award (PCAA) grant documents by means of optical scanning with on-line editing to ensure that the scanned documents were equivalent to the original paper documents. The resulting document database contained the equivalent of approximately 1500 pages of single spaced text. The document database files and a specialized key word search and retrieval software program were loaded onto the hardisk of an IBM PS/2 model 50 microcomputer. Three sets of content analysis categories relevant to determining the activities and results of the PCAA program at 26 different medical schools were developed. Specific questions were developed based on these category structures. Search terms, i.e., words, strings of words, phrases, and various combinations, were generated to identify and retrieve specific passages of text relevant to the category and questions of interest. A set of sample reports on preventive cardiology curriculum and content topics were produced to demonstrate the feasibility of computer assisted content analysis as a method of providing information relevant to the evaluation of a large educational program.

Other information was also provided on the feasibility of the method, such as necessary equipment, cost, limitations, and efficiency. A comparison of the efficiency of the computer assisted content analysis of a sample of the document database relative to manual review of the same portion of the document database was conducted.

The second phase of the study was conducted to estimate the reliability and validity of information collected using this form of computer content analysis. The reliability study involved a comparison of the similarity of text passages retrieved and stored by three different reviewers using a sample of the document database for a single content analysis category. The validity study involved a comparison of the set of text passages retrieved by the three different reviewers to a set of text passages retrieved on the same sample of the database by a consultant on the PCAA program.

Source and General Description of Documentary Data

The National Heart, Lung, and Blood Institute is one of the major divisions of the National Institutes of Health (NIH). In addition to sponsoring basic science research, the National Heart, Lung, and Blood Institute sponsors demonstration and education programs designed to disseminate information to the medical community and to the public. The Preventive Cardiology Academic Award (PCAA) is one of these programs.

The Preventive Cardiology Academic Award program has awarded grants totaling approximately $23 million to 42 medical schools since 1979 (National Heart, Lung, and Blood Institute, 1988). The PCAA is designed to be a five year award. Although selected aspects of the PCAA program have been evaluated since the program's inception, no comprehensive, formal evaluation of the PCAA program relative to stated goals has been completed to date. Program documents are the primary existing source of information available for such an evaluation of the program.

The available PCAA program documents include original grant applications, Internal Review Group (IRG) summary statements, annual progress reports, terminal reports and associated information such as letters collected during the course of program management. These grant documents are the source of data used in the study. Complete or nearly complete document sets were available from the first twenty-six (26) of the 42 medical schools which have received a PCAA grant as of 1988. The remaining 16 medical schools had not completed the term of their grant award at the time of this study and did not have complete document sets, therefore, they were not included in the study. The twenty-six (26) PCAA grant files used in the study cover the period from July, 1979 through June, 1988.

Information in the grant documents is presented primarily in a narrative format. The content and organization of information in the grant documents varies

significantly among institutions. Also, sections or subheadings in the reports are not labeled or indexed in a way which would provide for direct comparison of parallel reports from different institutions. Narrative style in the grant documents ranges from sparsely worded outlines to detailed chronicles.

The grant files were reviewed to determine the sections most likely to provide information relevant to the PCAA curriculum goal. Sections determined to be irrelevant or peripheral to the PCAA curriculum goal included cover sheets, budget pages, curriculum vitae of principle investigators and other grant personnel, and grant appendices. These pages were removed from the original document files prior to scanning in order to reduce the cost of optical scanning in the production of the computer readable PCAA document database.

Design

To review, there are three questions to be addressed by this study:

(1) Is computer content analysis a feasible method for abstracting, categorizing, and analyzing information from the 1500 pages contained in PCAA grant documents?

(2) Is the information abstracted on PCAA grant documents by computer content analysis reliable?

(3) Is the information abstracted on PCAA grant documents by computer content analysis valid?

The major steps involved in three studies to address these questions are outlined as follows:

I. <u>Feasibility Study</u>

A. Preparation

1. Locate all available PCAA grant documents.

2. Assemble the PCAA document database using optical scanning of selected PCAA grant document files.

3. Select content analysis key word search software.

4. Install the document database and the search software onto harddisk of the microcomputer.

B. Select Content Analysis Categories

C. Select search terms to identify specific passages of text relevant to selected categories

D. Conduct searches, retrieve and store selected passages

E. Produce reports summarizing findings of searches

F. Conduct comparison study of manual versus machine search efficiency

1. Select sample of the document database for comparison of manual review of text to computer assisted content analysis of text

2. Conduct computer search on a selected category using a sample of the document database; Note time and other relevant efficiency factors for later comparison to manual review of the text.

3. Conduct manual search on the same sample and produce report; note time and other relevant efficiency factors

4. Compare efficiency measures of computer assisted content analysis of sample text to manual review of sample text.

F. Report Overall Feasibility study results

II. Reliability Study

A. Select the sample of the document database and the content category

B. Train reviewers in use of the computer assisted search method

C. Reviewers conduct search and retrieve passages

D. Analyze variance in number of lines and number of passages retrieved by different reviewers

E. Analyze variance in number of lines of text in matching passages retrieved by different reviewers

F. Report results

III. Validity Study

A. Print the full text of the sample of the document database used in the reliability study

B. PCAA content expert conducts search manually (reads text sample) and retrieves a set of passages identified by yellow highlighter pen to serve as standard for validity comparison

C. Correlate number of lines and number of passages retrieved by reviewers with number of lines and number of passages retrieved by the expert

E. Analyze variance in number of lines of text in matching passages between reviewers and the expert

F. Report results

Feasibility Study

The determination of feasibility was based on a demonstration of computer assisted content analysis as applied to a set of content analysis categories and associated questions of interest in the evaluation of the PCAA program.

Preparation

Assembly of document database.

Preparation of the PCAA document database was contracted to Prospect Associates, Inc, Bethesda, Maryland, by the National Heart, Lung, and Blood Institute (NHLBI) under the supervision and guidance of Richard E. Gallagher, Professor, Department of Family Medicine, Wayne State University School of Medicine, Detroit, Michigan. The resulting document database was prepared according to the specifications and in compliance with procedures established by Dr. Gallagher and an NHLBI advisory committee. The following description of the preparation of the document database is summarized from a report dated September, 1989, from Prospect Associates, Inc., to NHLBI:

> The grant file on each awardee contains a sizable volume of papers. To maximize the cost-effectiveness of putting the files in machine readable form, it was necessary to identify the parts of the files that should be processed. An initial step was to screen each file to identify those documents (e.g., application form) or segments of documents (e.g., objectives of the program) that contained the information needed to conduct an evaluation of the program.
>
> The next phase was to review the awardee files, identify applicable materials, and put them into machine readable form. The process employed to create the document database was as follows:
>
> 1. Documents in the files for the 26 awardees who had completed the PCAA were reviewed to identify those pages that contained potentially useful information to address the evaluation study questions.
>
> 2. Pages containing evaluation-related data were clipped and replaced with slipsheets in the original files.

3. These pages were photocopied, and the originals returned to the NHLBI file.

4. The photocopied pages constituted the evaluation file for each awardee. Each page was inspected to make an initial determination regarding whether it was electronically scannable. Unscannable pages included those that were: (1) typed on tissue, (2) a poor photocopy, (3) in small type size, or (4) contained graphs, tables, or special symbols that would not scan.

5. Unscannable pages were placed in a hold file to be remerged with scanned pages.

6. Pages for which scanning would be attempted were reviewed to identify segments of interest. These were marked with nonphotographic blue.

7. These pages were then copied. Unmarked segments were masked to produce a copy that contained only the segment to be scanned to save on scanning cost.

8. Marked pages were batched by grantee number and sent for scanning to a subcontractor.

9. Pages were scanned, creating a file for each grantee on diskette files. The scanning equipment used has the capability to scan any type face with the exception of dot matrix, typeset material and copy set at an unreadable pitch (i.e., 10 or 12 pitch), or photoreduced copies. During the scanning process, the operator called up each page on the screen and cleaned up any errors. It was determined that approximately 350 pages could not be scanned.

10. The unscannable pages were typed onto diskette by a typist.

11. A printout of the pages typed onto diskette was proofread against the hard copy from the file (unscannable pages).

12. Diskette files of scanned documents were returned to Prospect. The text was called up on the computer screen, reviewed, and checked against the hard copy to check for accuracy. Any corrections were entered into the documents pulled up on the screen. Diskette files which had been typed and proofread (steps 10 and 11) were merged with the scanned text on diskette. In addition, the keyer

entered a set of identifying labels to facilitate searching and manipulation of files.

13. Once the first pass at all documents had been made, a printout was prepared showing the status of the file for each grantee. The status report indicated the presence or absence for each grantee of the basic information, application, summary statement, four annual progress reports and final report. After this first pass, approximately one third of the grant files were found to be missing at least one document from the complete set.

    An attempt was made to complete the grant files through the following steps:

    a. Substitute final reports which had been provided by NHLBI were used in place of the missing official final reports. The substitute final reports used were from presentations made by principle investigators of terminating awards at an annual meeting of all PCAA awardees.

    b. The hard copy files which had been scanned were reviewed again to determine whether the status report accurately reflected the condition of each grantee file. It was determined that selected scanned documents had been mislabeled as to year of progress report. Once properly labeled, the status report accurately reflected the presence of several reports previously thought to be missing.

    c. Several additional searches were made of the full files (either on file at Prospect or in Dr. Thomas Blaszkowski's NHLBI office). A couple of additional reports were located.

    d. Ms. Jane Davis and Ms. Jeannette Duggan (NHLBI) were contacted to determine whether any additional missing items could be located. One additional report was found by Ms. Davis.

    e. Finally, Dr. Richard Gallagher contacted four grantees to try to locate final reports. Two of the grantees were able to provide them.

All of the documents secured from various sources were scanned or keyed into the file. A total of 1,470 pages of single spaced, typewritten documents are contained

> in the document database. Of these, 1,120 were scanned into the database, the remaining 350 were keyed.
>
> (Prospect Associates, 1989)

Selection of Key Word Search and Retrieval Software

The selection of the key word search and retrieval software program was also conducted by Prospect Associates, Inc., in cooperation with PCAA program staff and Dr. Gallagher. The description of the selection of the software is taken from report of Prospect Associates, Inc., to NHLBI on September 29, 1990:

> Many standard word processing and database programs have the capability to perform simple key word match and retrieval functions. However, a more complex information retrieval system was necessary to conduct very specific, detailed text searches, block and copy text, and transfer the identified text passage to a separate word processing program file with the copy passage immediately visible and accessible on the same screen.
>
> Several commercially available software programs specifically designed to perform sophisticated key word searches were considered. Criteria used to evaluate the available key word search programs included: (a) the ability to search and retrieve information from a full-text database of a potentially very large file, record, and database size; (b) Powerful search and retrieval capabilities were required, including:
>
> (1) use of Boolean logic search operators such as AND, OR, NOT, greater than, less than, or with nesting (i.e., the use of parentheses to define subsets);
>
> (2) proximity searching or the ability to search for a concept within a specified number of words, sentences, paragraphs, etc. of the location of another term;
>
> (3) use of wild card and transition characters in the definition of search statements. For example, when entering the term 'flower', the user can retrieve anything with the terms 'flower', 'flowers', 'flowering', etc.

(4) ability to limit the search to one or more defined fields within a record (e.g, 'hypertension' in the first year progress report field)

c) The capability to copy a selected portion of text, i.e., word, line, or multiple paragraph, and save it to a disk or export to a wordprocessing program for further editing and printing. The user must be able to easily retrieve documents and/or topically relevant information and copy or 'cut and paste' blocks of information into a word processing file.

(d) A further requirement was the ability to generate a dictionary or key word list that includes all non-throw away terms (all terms that may contribute to the substance of the text materials) and eliminate other terms, (e.g., 'the', 'and', 'a').

(e) the capacity to produce frequency of occurrence counts for substantive terms was required.

(f) the accuracy of the software in identifying matching words or 'hits', the availability of utilities such as counting mechanisms, buffer file transfer mechanisms, etc., and cost.

(Prospect Associates, 1989)

The software selected for use in the present study was Personal Librarian for Windows v2.0 b24 beta (WPL). The Personal Librarian program is a beta test version which is expected to be commercially available in 1990. Both the PCAA document database and the Personal Librarian search program reside on the 2.0 version of the MicroSoft Windows program. MicroSoft Windows is a commercially available program which is essentially an extension of the disk operating system (DOS). The Windows program allows simultaneous visual operation of the Personal Librarian search program, the PCAA document database, and a separate

word processing program to store and edit retrieved passages.

Software and Database Installation

The MicroSoft Windows v. 2.0 ; Personal Librarian for Windows v. 2.0 b24 beta program; and the PCAA database were installed on an IBM PS/2 model 50 Z. The computer is based on a 286 processor and runs at 16mhz processing speed. The computer has 1.0 MB of system (RAM) memory and a 40 MB hardisk memory capacity.

Content Category Structures

Content analysis is a systematic method of analyzing narrative data. The category structure used in a content analysis provides the basis for systematically reviewing, abstracting, and coding information contained in the text. In this study, the category structures provide the basis or guide for the key-word search strategies and terms used to identify and abstract information relevant to questions of interest concerning the activities of the PCAA program.

The feasibility study was exploratory in nature. The types of questions which could be answered by the content analysis were determined by the category structure employed. One of the purposes of the feasibility study was to investigate the effect which different category structures would have on the feasibility of the key-word search process. Three different category structures evolved over

the course of the study in response to problems encountered relative to abstracting information to address specific questions about the PCAA program activities. Since the purpose of the study was to investigate feasibility, complete content analyses were not performed on any of the three category structures. It is recognized that the procedures used to investigate feasibility in this study do not constitute a full scale content analysis of the exhaustive type described by Holsti (1969).

The content analysis category structures were designed to produce information useful in the evaluation of PCAA Program Guideline Objective number one, "development of a high quality preventive cardiology curriculum." The document searches were structured as a series of questions to assess the content and types of programs developed and implemented by the twenty-six PCAA awardees.

The original category structure was designed to determine the instructional approach taken, the instructional aids developed and used, the instructional content, the materials developed, and the internal evaluation of the grant in meeting its own goals (Appendix A). Each of the major categories contained up to 15 subdivisions. For example, one category with subdivisions was MEDICAL STUDENT: Basic Sciences: Lecture: Objectives: Risk Factors: Syllabus: Knowledge. These categories were repeated for each target group of students or for each curriculum level, including medical students, residents,

fellows, practicing physicians, medical school faculty, community or public education, patient education, and for other trainees.

As indicated in the results section, it soon became apparent that this search structure produced considerable redundancy and was not a feasible approach to examining the entire PCAA program, even with the assistance of the computer. The search structure was simplified by removing many of the subdivisions between categories, such as the division between medical students and housestaff.

The simplified category structure eliminated separate searches on each student level, and instead used larger, general curriculum or instructional categories. Where the level of student was specified in the text, this was noted for later reporting and analysis.

The second category structure was referred to as the Curriculum Categories and included the following categories:

A. Instructional Methods

B. Instructional Materials

C. Courses and Programs

D. Evaluation/Testing Methods and Materials

Searches were conducted on a sample of categories since the object of this study was to investigate feasibility of the computer assisted content analysis method, not to complete an exhaustive content analysis.

After conducting several searches on the Curriculum Categories, it became apparent that preventive cardiology content or subject matter, such as hypertension, smoking, and lipids, were presented to students in a wide variety of ways at different medical schools. Curriculum content was one of the areas of interest to the PCAA program sponsors. For example, how many of the awards included information on nutrition? on genetic factors? on exercise physiology? The results of searches based on the Curriculum Categories did not provide the comprehensive, program-wide information necessary to answer questions on subject matter topics. A third category structure was developed, this one based on the preventive cardiology subject matter topics.

The Content Categories used in this study included the following categories:

A. Epidemiology

B. Smoking

C. Nutrition

D. Exercise

E. Hypertension/Blood Pressure

F. Risk Factors

G. Counseling

H. Management/Treatment

I. Prevention

Again, only a sample of the content analysis on these categories was completed in order to investigate feasibility.

Search Terms/Procedures

A "search" is an attempt to locate and retrieve specific passages of text in the document database which match certain search terms and/or search operators entered into the WPL search window (Cichelli, 1989). The primary purpose of the search terms was to retrieve all relevant passages in the specific category of interest. The secondary purpose of the search terms was to retrieve all relevant passages as efficiently as possible by limiting the number of passages retrieved with spurious or peripheral reference to the category. The development of appropriate search terms was based on the unique nature of each category. To assist in identifying and later analyzing the information of interest in each category, a set of questions was devised for each category. For example, on the Instructional Methods: Guest Lecturers category questions included: Was the guest lecture elective or required? Was the program a basic science course, a clinical course, or another format? Was the program developed as part of a separate new course or integrated into an existing course? Who were the speakers? What types of preventive cardiology content were included in the lectures (epidemiology, smoking, nutrition, exercise, blood pressure, risk factors, counseling, management/treatment)? Were there plans to continue the guest lecture series after termination of the PCAA?

The Windows Personal Librarian program also contains a number of features which assist in the selection and use of search terms. Features include natural language requests; guided searches using previously prepared lists of search options; requests using adjacency, numeric range operators and Boolean operators; ranked output, according to the likelihood of usefulness; automatic statistical thesaurus and search on related items; use of documents in queries to find similar documents; automatic matching on word stems; truncation and wildcard searching; field restricted searching; and sorting retrieved documents by selected fields (Cichelli, 1989). The Search Assistance feature includes a Dictionary option which provides information on all words which appear in the database and how many times they occur. The Expanded Words feature is a statistical activity which produces a list of words drawn from the database which may be topically related to the current word search. The Query History feature records all searches performed during the current session, along with associated search terms. The available search operators in the WPL program are listed on pages 91 and 92. The list indicates the comprehensive search strategies which may be employed using Windows Personal Librarian. Proximity and stem search operators are often particularly useful in searching free form documents.

AVAILABLE WPL SEARCH OPERATORS

The following search operators are available in the standard WPL search mode:

AND Boolean logic operator. Retrieves documents containing both terms separated by the operator "AND".

OR Boolean logic operator. Finds occurrences of either of the search terms separated by the operator "OR".

NOT Boolean logic operator. Retrieves documents in which the term preceding the operator "NOT" appears and in which the term following the operator is absent. Example, **Iran NOT Iraq** will retrieve documents containing the word "Iran" but not the word "Iraq".

ADJ Proximity operator which finds occurrences of one term adjacent to another in the order in which the terms are entered. Example, **American ADJ embassy** will retrieve all documents containing the phrase "American embassy".

W/n Proximity operator. With "n" being a number, it will find occurrences of one term within n word(s) of another.

() Any level of nested parentheses is allowed. Example, **(President ADJ (Reagan or Carter)) AND deficit** will retrieve documents containing either the terms "President Reagan and deficit" or the terms "President Carter and deficit".

? A "wild card" which matches any string of characters. Example, **m?cro** will retrieve documents containing such words as "micro" and "macro".

***** A "wild card" which matches any string of characters. Example, **micro*** might retrieve documents containing "microbiology", "microscope", "micron", etc.

= Equates one item to another.

Q_n Refers to query number n in the current session, and will retrieve the same documents retrieved by that previous search.

D_n Refers to document identified by Document ID n.

SEARCH OPERATORS
(continued)

" Any word followed by a " (double quote symbol) in a search will retrieve documents containing the exact alphanumeric characters typed.

w! Expands word **w** to related words and begins a search from documents containing any of those words.

w:field-1, field-2 ... Limits the search for the word, represented by "w", to field 1, field 2 and any additional fields listed.

Numeric range searching

Two arguments in numeric range searching may be used, with < being "less than" and > being "greater than". A search using two arguments works much faster than one argument.

All of the following forms are permitted:

field>low value<high value

field<high value>low value

low value<field<high value

high value>field>low value

Stem searching

A stem search will retrieve not only the base of a word but also the word with any affixes or inflectional endings (endings due to changes in number, case, gender or tense).

Examples of such extensions of a word are:
-s
-ies
-ing

Note. From Windows Personal Librarian User's Manual by R.J. Cichelli, 1989, Nazareth, PA: Software Consulting Services.

An abbreviated version of the standard search and retrieval procedures are as follows. Interested readers are referred to the Windows Personal Librarian User's Manual, 1989, for more detailed description of the search procedures.

1. Access the WPL program, the database, and the Windows Write program. The WPL program occupies a window in the top half of the monitor screen, with the Windows Write program (wordprocessing program for storage of retrieved passages) in a window on the bottom half of the monitor screen.

2. Activate the Free Form (standard) Search mode of WPL.

3. Activate the Search Window.

4. Enter search terms. Search terms can be entered into the search window by (a) typing in text; (b) pasting in text from the Microsoft Windows Clipboard; or (c) using the Include option to copy tagged words, numbers and query of Doc ID# indicators from other windows such as the Dictionary, Expand, List and even the Document database itself.

5. Start the search by pressing the ENTER key.

6. Results of the search appear in the Document Window. The documents retrieved by a search will be displayed one document at a time in the Document Window. The document displayed first is always the document ranked first in terms of the number of "hits" of the search term.

A hit is a portion of the text in the database which matches the search term(s). If no passages matched the search terms, a dialogue box will open and present this information.

7. The search terms may be modified and the search repeated if necessary. The Search Assistance features of the WPL program may be used to develop appropriate search terms.

8. Block, cut and paste relevant passages of text identified by the search terms. Text is copied from the Document Window by making the Document Window the active window by moving the mouse pointer within the window and clicking. Next, the mouse pointer is moved to the beginning of the desired block of text containing the search term; the mouse button is pressed and held down while dragging the mouse to the position at the end of the block of text. The selected block of text is displayed in reverse video (highlighted). The Paste Button in Windows Write is then clicked to copy the highlighted text to the Write wordprocessing file. The space bar is used to separate the copied passage from the subsequent passage copied.

9. Label stored passages. The Windows Write wordprocessing file containing the stored passages retrieved by the search is labeled with the title of the search, the date, and time.

10. Edit stored passages in the Windows Write file. Windows Write program does not have features which allow the use of different font styles and other features to compress and/or edit the retrieved text in preparation for analysis and reporting. The Windows Write file containing the stored passages is transferred to Word for Windows, a more powerful wordprocessing program.

Comparison Study of Manual versus Computer Information Retrieval

This study is a comparison of the efficiency of computer information retrieval to manual (reading) information retrieval in terms of time. The study procedures are the same procedures used to collect data for the reliability and validity studies except for the notation of the time involved in data collection. The procedures were not repeated three times for the three studies. Three different analyses of the data were conducted; one for the efficiency study, one for the reliability study, and one for the validity study.

Procedures:

Step 1: The content analysis category "Visiting Professor/Guest Lectures" was selected. Appropriate evaluation questions were listed.

Step 2: The sample of the document database was selected. The sample was limited to the four documents with

the highest number of known occurrences of the search term(s) in the documents. The full text of the document database sample was printed out.

Step 3: Three reviewers searched the document database sample and retrieved and stored all relevant passages of text relating to the search term(s). The time required to perform this operation was recorded. The stored Windows Write files were transferred to Word for Windows format and then printed out.

Step 4: The full text of the document database sample was read by a content expert on the PCAA program. All text passages relevant to the "Visiting Professor/Guest Lecture" category were highlighted with a yellow highlighter marker.
The time required to perform this operation was recorded.

The efficiency study then involved comparing the time required to perform the computer search to the time required to perform the manual search.

Reliability Study

The second question involves the inter-rater reliability of information identified, retrieved and abstracted using computer content analysis. Three reviewers (senior medical students) with similar expertise in medical school curricula and in use of computers were trained in the use of the Windows Personal Librarian program. The reviewers were then provided with a set of predetermined evaluation questions on the topic "Visiting Professors/Guest Lectures" along with a selected sample (four documents) from the PCAA document database. The reviewers developed an appropriate set of key word search terms, located and retrieved all passages of text containing the search term(s) which were relevant to the content analysis category "Visiting Professor/Guest Lectures". A "passage" was defined as a unit of text containing the key word or words used in the search term, along with enough of the adjacent context to identify how the search term is used and to ascribe meaning to the text. Retrieved passages were stored in a Windows Write wordprocessing file. The Windows Write files containing the retrieved passages from each reviewer were translated to the Word for Windows word processing file and printed. Comparisons were then made between the passages of text identified and abstracted by the three reviewers.

The first comparison looked at the total number of text lines retrieved by each of the reviewers. Total line

numbers have been suggested in the literature as one unit of measurement of content (Holsti, 1969). Total line numbers serve as a rough measure of comparison of the passages retrieved by the different reviewers. The inter-rater correlations were calculated using the intraclass correlation for k series statistic suggested by Guilford:

$$rcc = \frac{(MS)r - (MS)e}{(MS)r + (k-1)(MS)e}$$

where (MS)r = mean square or variance between rows (documents)

(MS)e = mean square for residuals , or error

k = number of columns

(Guilford, 1973, p.263)

The second comparison looked at the total number of passages abstracted, (i.e., the number of key word search terms abstracted) by each of the reviewers. Since the number of lines in a passage may vary according to the judgement of the reviewer in abstracting surrounding context sentences, the total number of lines abstracted does not necessarily indicate that the same number search terms, i.e., "passages", were retrieved by different reviewers. The comparison of the total number of passages abstracted provides a more precise measurement. The intraclass correlation among k series statistic was also used to calculate the inter-rater correlations for the number of passages retrieved.

The third comparison was designed to analyze the similarity of any matching passages abstracted by different reviewers. A matching passage is a passage containing the same search term on the same line. The number of lines of text in matching passages were compared to measure the variance in the context abstracted by the three different reviewers. This "context" comparison provides an estimate of the completeness versus the efficiency of abstraction of the text relevant to the evaluation questions.

Training of Reviewers

A standard set of instructions for conducting searches was produced in order to provide a common skill base for the various reviewers who participated in the study. These instructions include program overview, start-up of the program, entry of basic key word searches, highlighting identified sections, transferring identified sections to the wordprocessing file, printing and saving the wordprocessing file, and variations of search patterns (e.g. AND, OR, w/in 10, ADJ). The instructions are not so specific as to eliminate any possibility of variation in search outcomes by different reviewers. On the other hand, without a common skill base for conducting a search, it was believed that the reliability of the electronic search method might be determined to be artificially low due to wide variations in search skills by different reviewers. Training was provided to increase the probability that the reliability of the

method would be determined by the search strategies employed rather than by differences in the computer skills of the reviewers, differences in familiarity with search operators, or differences in knowledge of the WPL program. The set of instructions attempted to provide all reviewers with a similar skill level in conducting searches.

Validity Study

The third study investigated the question of whether the text passages abstracted and categorized were relevant to the performance of the PCAA program goal of developing high quality preventive cardiology curricula in medical schools. It was assumed that the information in the original documents is valid, although the limitations of documentary data are recognized. A standard for comparison of text passages was established by means of a manual review (reading) of the sample of PCAA program documents by a senior program evaluation consultant on the PCAA program. Given a set of pre-determined evaluation questions, the program evaluation consultant abstracted a set of passages relevant to the search terms from the same sample of the document database (four documents on Visiting Professors) used by the other reviewers in the reliability study. Passages were identified through the use of a yellow highlighter pen. This set of passages served as the standard for comparison. Correlations for total line numbers and for total passages were calculated for the data

previously retrieved by each reviewer using the computer compared to the set of standard passages identified by the expert. The correlations were calculated using Spearman's rank-difference correlation method, or the Spearman's Rho. The formula for this statistic is as follows:

$$\text{rho} = 1 - \frac{6(\text{sum of the squared differences between ranks})}{N\ (N \text{ squared} - 1)}$$

N = the number of pairs of measurements

Guilford, 1973, p. 284).

Guilford suggests that this statistic is useful for small samples where the number of pairs, or N, is less than 30. He states that "rho is almost as good an estimation of correlation as the Pearson r ... When correlations are high, we may have almost as much confidence in rho for indicating the amount of correlation as we have in r applied to samples of the same size" (Guilford, 1973, p. 285).

A descriptive analysis of the number of matching passages and of the variance of line numbers contained in any matching passages was also performed. The purpose of this comparison was to examine the differences, if any, in the amount of text retrieved per passage by the computer and by the manual review.

Hypothesized Results

The following results were hypothesized:

(1) (a) Computer content analysis will be determined to be a feasible method of analyzing information contained in narrative documents and will contribute information useful to evaluation of the performance of the PCAA program. (Qualitative assessment)

(b) Manual retrieval of passages will require twice the number of minutes to review and abstract passages as the computer assisted method of searching and abstracting information from the same sample of program documents.

(2) (a) The correlation of the number of text lines retrieved by three different reviewers will be greater than .70.

(b) The correlation coefficient of the number of text passages by three different reviewers will be greater than .70.

(c) For any given matched passage, the total lines retrieved by three different reviewers will not vary more than 20 percent.

(3) (a) The correlation coefficient of the number of text lines and the number of passages by three different reviewers as compared to a standard set of text passages will be greater than .70.

CHAPTER IV

RESULTS AND DISCUSSION

Feasibility Study

Preparation

Locating Grant Documents

The PCAA program document database used in the study involved at least five separate grant reports for each of the twenty-six medical schools involved in the program, a total of 130 documents. A further complicating factor was the ten year time period covered by these twenty-six awards. Locating all available documents on the PCAA program was a large task. This initial task should not be overlooked in determining the feasibility of using computer assisted text analysis in a program evaluation. With large programs which extend over several years, it is unlikely that all program documents will be neatly filed or that clean copies of program documents will be easily found in a single location. Locating the PCAA documents included in the study was a time consuming and often difficult task. The vast majority, but not all, of program documents were located. The retrospective nature of the PCAA evaluation project necessarily involved problems of locating and organizing program documents. The fact that most of the documents were available made the initial stage of the project feasible.

Optical Scanning of Grant Documents

Optical scanning allowed 1,120 of the 1,470 pages of documents to be translated to a computer file automatically (76.2 percent). Not all the program documents were scannable, for reasons indicated in the report submitted by the contractor, Prospect Inc.:

> For the 350 pages that had to be manually entered into the database, the primary reasons they were not scannable were that copies were of poor quality or that they were typed on tissue. Many pages taken from NHLBI files were 2nd, 3rd, and 4th generation photocopies and had many dark photocopy ink marks on them. The next most common reason was the type size of the text. It was discovered that many times, the grant application text had been reduced to fit on the page. The scanners could not read the reduced text. Finally, other pages contained graphs, charts, or special characteristics that could not be scanned. (Prospect, Inc., 1989)

The initial translation accuracy of the optical scanning was greater than 98 percent, and improved to greater than 99 percent with on-line editing. For a program of this size, the optical scanning of program documents was an essential step in making the documents accessible for analysis. While there is room for improvement in the technology, overall, the scanning of the documents was very successful.

Cost must be considered a factor in determining the feasibility of optical scanning as a means of creating a computer readable document database. Prospect Associates, Inc., provided the following report on the cost of producing computer readable text on the PCAA project:

> The costs for producing machine readable text from the PCAA documents varied depending on whether the

> typewritten pages could be scanned or had to be typed. The costs reported include only those for the actual processing of the pages, not any costs for extracting, copying, or preparing of pages for processing.
>
> The cost per page for those scanned was $4.00/single spaced page including cost to scan and clean up the machine readable text. The clean up involved reviewing the text and correcting or entering any missing or garbled text.
>
> The cost for keying was approximately $11.50/single spaced page. This included costs for keying (approximately $5.50/page), proofreading the text for errors ($4.50/page) and rekeying the text to correct errors identified during proofreading (approximately $1.50/page). It is apparent that the overall cost of this process is greatly dependent on the proportion of pages that can be scanned. Scanning obviates the need for keying and greatly reduces the cost of cleaning the record. While we do not have a firm estimate of the accuracy of the scanned pages relative to the typewritten text prior to clean up, it appears that the scanning produced fairly high accuracy. (Prospect Associates, Inc. September, 1989)

The overall cost for producing the 1470 page document database was $8,505. Given the fact that the PCAA program was a multi-million dollar program extending over a ten year period, this may be considered a reasonable cost. In absolute terms, however, $8,500 is a considerable expense, approximately the cost of a small automobile. If other projects of a similar nature were anticipated, the cost of translating written documents to computer files could be dramatically reduced by owning and operating the scanning equipment. The cost of a mid-range high speed optical scanner and associated computer software (OCR, drivers, etc.) was approximately $8,500 in 1989 (PC Magazine, 1989). Another option which would reduce cost would be to have grant documents such as applications and progress reports

submitted on a computer disk rather than in paper form, thus eliminating the cost of translating the documents for analysis.

Key Word Search Software

Windows Personal Librarian (WPL) met all of the criteria listed by Prospect Associates, Inc. for the key word search program used in the PCAA project. Since the WPL program used was a beta test version, not all of the features listed in the Manual were operational at the time of the study. Most of the missing features involved the Search Assist options such as the Expanded Words and Thesaurus. This was not a major impediment to the use of the WPL program in the present study. Learning to use the program was relatively simple, involving about one hour of time to progress from starting the program to conducting sophisticated search operations. Familiarity with general microcomputer commands, use of a mouse device, and with the operation of the Microsoft Windows program are prerequisites to using Windows Personal Librarian. The Windows Personal Librarian Manual could be improved in terms of clarity of terms and completeness.

Installing the Database and Search Programs

Installation of the PCAA database, the Windows and Windows Personal Librarian software programs on the computer required approximately one hour to complete. It was

necessary to learn the basics of the MicroSoft Windows program prior to loading Windows Personal Librarian. The basic operations of the Windows program were easy to learn. Use of a high density disk drive is highly recommended due to the large volume of disk space involved in both the software programs and the document database files. General familiarity with IBM or compatible microcomputers, the disk operating system 3.0 or higher, and using a mouse are also necessary to install and use the Windows Personal Librarian program.

Content Analysis Categories

The initial set of categories listed in Appendix A was based on the common curriculum structure of medical education in the United States. This curriculum structure involves two years of pre-clinical or basic science education, generally during the first two years of medical school. The third year of medical school consists of blocks of four to twelve week clinical courses in the core clinical areas, such as internal medicine, general surgery, and pediatrics. These courses are generally held in teaching hospitals and ambulatory clinic settings. The fourth year of medical school is usually devoted primarily to elective four to eight week courses in clinical areas of the student's choice. Following graduation from medical school, a period of graduate medical education ranging from three to seven or more years is required to become eligible for

certification in the specialty area of the student's choice. Continuing medical education refers to occasional special courses and lectures attended by physicians to maintain skills and knowledge in their chosen field.

The initial set of content analysis categories was intended to provide a comprehensive analysis of all major instructional approaches, materials, and evaluation strategies employed by PCAA awardees at each level of training, from pre-clinical years through continuing medical education. After conducting three key word searches based on this category structure, it was apparent that the information in the document database did not always conform to the category structure. The result was redundancy in the passages retrieved on the same category (e.g., Instructional Methods, Materials, etc.) at different levels of training. For example, a search conducted on "Visiting Professors/Guest Lectures" for first year medical students retrieved virtually the same passages as "Visiting Professors/Guest Lecturers" for third year medical students. Again, the same passages were retrieved for visiting professors/guest lectures for the resident/housestaff curriculum category. Because bringing in an outside speaker to provide a lecture is expensive, most medical schools probably were inviting the whole medical school class rather than limiting the talk to just freshman or just residents. While it would have been possible to continue searching the documents based on the initial set of categories, it was

apparent that completing the study using this set of categories would not be feasible due to redundancy of information. The redundancy problem would have resulted in a greater volume of paper being produced by the computer assisted content analysis than was present in the original document database. If one of the limiting factors of content analysis is the problem of physically reading and interpreting the information contained in a 1500 page document, the production of a 5000 page analysis document would certainly represent a magnification of this problem. The analysis based on this category structure would also have produced an overly complex perspective of the operations of the PCAA program, reducing the usefulness of the results. The analysis of lecture programs at each training level, for example, might foster inaccurate interpretation. Given an analysis of a lecture program, one might conclude that one lecture program was produced for first year medical students, another for third year medical students, and another for cardiology fellows, when in fact one lecture program was produced for a mixed audience of medical students and housestaff.

In the first category structure, searches were highly focused and would have produced a large number of reports (at least 463) containing a relatively small amount of information. The advantage of this structure was that it would have provided a very detailed view and concordance of program operations and outcomes at each level of the medical

school curriculum. The major disadvantage was that producing an overall evaluation of the PCAA program using these categories would be an overwhelming task involving the synthesis of qualitative information from 463 or more content analysis categories. The reliability of the first category structure was not tested, but the literature suggests that category reliability may decline as the number of categories increases (Holsti, 1969, p. 98).

The second set of categories was a much simplified version of the first category set. The second category structure was produced by aggregating the categories contained in the first category structure by removing many of the subdivisions. In the initial category structure, the level of the curriculum, e.g., first year medical students, was a subdivision of the larger category, e.g. Instructional Methods. By eliminating the training level or target audience subdivisions from the category structure, the number of categories was reduced from 463 to four:

A. Instructional Methods

B. Instructional Materials

C. Courses and Programs

D. Evaluation/Testing Methods and Materials

Using this simplified category structure, it was still possible to address questions involving the training level of students by means of noting, retrieving, analyzing, and

reporting references to training level which appeared in the text retrieved on the larger categories.

The searches based on the simplified second category structure were not as focused as in the first category structure. The advantage was that reasonably complete, independent reports could be produced in about 3 hours. "Independent" meaning that the categories were large enough to produce reports containing meaningful information without necessarily having to be combined with information from other reports. One of the disadvantages was that some types of questions, namely questions regarding subject matter, could not be easily addressed by this structure. In one respect, this indicated the diversity of instructional methods or strategies used by awardees to achieve the goal of developing a high quality preventive cardiology curriculum. On the other hand, determining how many of the awards included content on Hypertension in the medical school curriculum would have required reanalysis of all the instructional methods and materials categories for reference to Hypertension.

The third set of categories was designed to address questions regarding preventive cardiology subject matter in the PCAA program, i.e., Nutrition, Hypertension, etc. These categories represented a further step in broadening the scope of the searches. The third category structure, based on broad subject matter categories, represented the opposite

end of the spectrum relative to the first category structure.

The advantage of the subject matter category structure was that it produced comprehensive reports. The subject matter categories could be reanalyzed to answer questions regarding instructional methods more easily than instructional methods categories could be reanalyzed to answer questions regarding subject matter. The subject matter categories were also relatively independent from each other in the sense that a search on Nutrition was not likely to retrieve closely related information on Genetics or Smoking. That is, passages retrieved on a lecture series on Nutrition were not likely to also include primary information on genetics. The one subject matter category which did not work well in the third category structure was Risk Factors. Much of preventive cardiology content contained in the grant documents did appear to relate to an emphasis on multiple risk factors. In fact, the Risk Factor category was so broad that it cut across all other subject matter categories, presenting the same problem of redundancy encountered in the first category structure. For example, smoking, nutrition, and hypertension, three of the Content Categories, are all regarded as risk factors. Risk Factors should probably have been viewed as a separate content analysis, with smoking, hypertension, nutrition, etc, as subdivisions.

One of the disadvantages of the Content Categories was the larger amount of time and effort required to complete the searches and produce the reports. Content or subject matter searches required much more time and effort to complete than earlier searches on curriculum structure categories. For example, the search on the content category NUTRITION required approximately 40 hours to complete as compared to approximately 2 hours to complete the curriculum structure search on COMPUTER ASSISTED INSTRUCTION. The greater time involved with content searches was due primarily to a larger number of documents retrieved and a larger number of occurrences or "hits" of the key word used in the search term. Both of these factors translated into a much larger number of passages which were required to be identified and copied to the recording file. As the size of the retrieved files increased, the processing time of the computer slowed dramatically. This slow down in processing time was a major contributing factor to the longer search time required for content searches. A secondary factor was the greater length of time required to determine the context of the passages in which the key word appeared. Whereas references to instructional methods or courses were often structured by headings or outlines, references to content were interspersed throughout the documents. The resulting reports on content categories were also much larger and required more time and effort to analyze. The Content Categories may have been so broad that in some cases,

important distinctions in terms of instructional methods, instructional materials, and evaluation methods were lost.

In summary, the selection of a category structure depends largely on the type of questions being asked. Questions dealing with "first year biochemistry laboratories on lipid metabolism" would probably be most efficiently addressed by using a detailed category curriculum structure, of the original category structure type, rather than using searches based on a broad subject matter category, e.g, Lipids. Broader questions such as "how many awards provided information on lipids" would be best addressed by a broad subject matter category, exemplified by the third category structure. In determining feasibility, both very narrow and very broad category structures increase the amount of effort and time required to complete a computer assisted content analysis.

In this study, the initial searches were conducted on very narrow categories, with subsequent searches proceeding on moderately extended categories and then to very broad categories. In retrospect, it is clear that the searches on broad categories provided a greater degree of familiarity with the structure of the document database than the searches conducted on the narrower categories. Familiarity with the structure of the database would have been useful in focusing the search strategies used in narrow categories and potentially reducing the number of searches required. For example, if the search on the broad category "nutrition" had

been the initial search, it would have been apparent that the instructional methods used to teach nutrition were only rarely structured in terms of the class rank of medical students. Therefore, the order of the searches should probably have been reversed, starting with very broad categories and then subsequently narrowing the searches to categories of interest.

Searches and Reports

Search Terms

The technical procedures for conducting searches were straightforward, involving entry of a set of words and associated search operators into the Windows Personal Librarian (WPL) search window and hitting the ENTER key on the computer keyboard. All strings of text matching the search term were identified and could be copied to a separate word processing program for storage and later analysis and editing. The WPL program performed these technical functions very well.

Determining the search terms to be used depended on the category structure and the questions being asked. The narrower the category, the more precise the required search term. One problem that was encountered in the initial searches based on the very narrow curriculum categories was with the use of numeric terms "first", "second", "third", and "fourth", along with variations such as "1st", "2nd", etc. These numeric terms were necessary to specify searches

at specific curriculum levels, e.g., "first year medical students". The WPL program contains an automatic "stop words" list of common terms such as "a", "and", "the", which are not recognized in the search process for obvious reasons. The numeric terms are also included in the stop word list. It is possible to edit and modify the stop words list to allow the use of numeric terms in the search. However, because it became apparent that searches on the very narrow curriculum categories would not prove feasible, the use of precise search terms involving numeric terms was not necessary. The editing and reindexing of the stop words file was not performed.

The PCAA program involved 26 medical schools in various locations in the United States, with a variety of approaches to curriculum and instruction, over a ten year period of time. Preventive cardiology, as a separate field of medical practice, is a relatively new concept with its own set of unique terms. The principle investigators of the PCAA grants represent diverse experience and training backgrounds. Given these facts, it is not surprising that a wide and complex variety of terms were present in the PCAA document database. The problem described by Pfaffenberger (1988) in using words to describe concepts is one of the problems encountered in the search process. For example, the term "FELLOWSHIPS" was used in the PCAA document database in reference to cardiology fellowships, preventive cardiology fellowships, public health fellowships, medical

student summer research fellowships, student fellowships, summer fellowships, research fellowships, post-doctoral fellowships, and educational fellowships, to name a few. While there is a pronounced difference in concept between a three year, fully accredited cardiology fellowship program and a six week student cardiology research fellowship, the use of the term "cardiology w/5 fellowship" in a search would identify passages relating to both types of programs.

There were variations on terms used within the same document, between documents, and within the same program (PCAA grant) over time. For example, "heart healthy", "prudent", "appropriate", and "cardiovascular" were used interchangeably in the description of low fat diets. The term "diet" must be used in conjunction with the adjective terms to make the search meaningful. These variations illustrate the problem between the precision of search terms and the completeness of the information retrieval necessary. A search using the precise term, "Heart ADJ Healthy ADJ Diet", would eliminate all other references to diet except heart healthy diets. Other references might include diet textbooks, diet biochemistry, and other matters of peripheral interest to the heart health diet information. On the other hand, synonymous terms such as "Prudent Diet" and "Cardiovascular Diet" would be missed. Since the use of interchangeable adjectives is not known prior to a search, the importance of recall must be addressed prior to the search. If recall is important, as was the case in the

present study, then the unmodified subject stem, i.e. "DIET*" will provide the greatest level of recall and retrieval of passages containing the search term. Once the range of synonymous terms is known, then the search terms can be refined and used with greater precision in a repeat search if desired. Repeated refinement of search terms by reading and hand coding generally has not been feasible. The computer is fast enough to allow discovery and refinement techniques to be used in defining final search terms. The Search Assist options in the WPL program also provide information on related or synonymous terms without having to conduct a complete search.

There are synonymous terms which required the researcher to have some knowledge of the database in order to recognize. For example, the term "fourth year" was used synonymously with "senior year" in reference to medical students. Knowledge of terms used to describe medical school curriculum levels is necessary to equate the two terms. Various abbreviations of terms were also commonly used in the PCAA database, requiring a knowledge of how these abbreviations are used.

One feature of the Windows Personal Librarian program which was initially confusing was that all individual words used in the search term were highlighted in the document window, not just the combined search term. For example, if the term "Summer ADJ Research ADJ Fellowship" was entered, all individual instances of "Summer", "Research", and

"Fellowship" were highlighted, but only the term "Summer Research Fellowship" was retrieved. This became apparent when, for example, "Research" appeared in the same document window as "Summer Research Fellowship". While initially disturbing, once the researcher adjusts to identifying only the stipulated search term in the document window and ignoring the other highlighted terms, the search and retrieval process proceeds in a straight forward manner. On occasion, a single highlighted term assisted in the recognition of synonymous or similar terms.

There is a learning curve associated with the search process and the selection of search terms. In this study, the initial search terms were simple and did not take full advantage of the power provided by Boolean and proximity search operators. As the search progressed, experimentation and familiarity with the search operators became second nature. The other factor, at least as important as learning the use of search operators, was the familiarity gained with the document database as the number of searches increased. If searches had been conducted on all 463 categories contained in the first category structure, 463 passes through the entire database would have been conducted. After even three or four searches, the names, programs, writing styles and other information contained in the 26 PCAA grant files became quite familiar. This familiarity with the database and the terminology used in the different reports assisted in the development of later search terms.

Speed of the Search Process

As previously noted, the speed of the search process was highly dependent on the number of documents retrieved by the key word search term and the frequency of occurrence of the search term within each document. A very narrow search retrieving only one occurrence of the search term in one document was completed in less than two minutes. A very broad search involving all 26 PCAA documents and high frequency of search term "hits" required more than 40 hours to complete. Another factor in search speed was the amount of time required to establish, copy, and record the context of the search term while the passage containing the search term was displayed in the document window.

As the number of documents in a search increased, the speed of processing by the WPL program decreased dramatically. This was one of the problems referenced by Brent and Anderson (1990) in the section on limitations of computer assisted content analysis in the Literature Review chapter. Retrieving information from the twenty sixth document required significantly more time than retrieving information from the first document due to the fact that the WPL program searches, "reads", the documents in sequence for occurrences of the search term. The time required to "cut and paste" the passage from the later documents also took significantly longer than the time required to copy passages from earlier documents. Refinements in the search

program and/or improvements in computer processing speed may alleviate this problem in the future.

The slow down in the processing speed of the computer search process as the size of the database increases is a definite limitation of the method. However, it should be noted that the relative efficiency of the computer search method increases as the size of the database increases when viewed in comparison to physically reading the document database. Reviewing the contents of any large (500+ page) document database is not an easy task. Utilizing the assistance of the computer, even a slow computer, is preferable to the alternative of reading through the document several times to answer a set of questions.

Retrieval, Storage, and Reports

Sequences of text matching the search term, "hits", were displayed in the document window of the WPL program. The mouse device was used to block and copy the section of the text containing the "hit" of the search term along with adjacent words, sentences, or paragraphs necessary to provide context to the use of the search term in the passage. Passages were initially copied from the PCAA database to the Windows Write wordprocessing program which operated simultaneously within another window on the screen. Two factors were important in this copying process; labeling the passages and using the space bar to separate passages in the Write file.

As mentioned in the previous section, the speed of the copying process declines sharply as the number of documents and the frequency of occurrence of the search term within the documents increases. This decrease in copying speed is a function of the computer search program. The problem is mildly irritating at best, and with very large databases, may seriously impair the efficiency of the search program. Based on the experience with a 1470 page text database, the problem of retrieval and copying speed becomes severe when approximately 1000 or more pages are involved in the search.

Analysis of the raw passages retrieved and stored in the Windows Write file was conducted by review of the retrieved information relative to answering the specific questions posed prior to the search. For example, the question, "how many of the awards implemented an educational program on nutrition" was addressed by reviewing (reading) all passages retrieved by the search term: "Nutrition* and Diet* and Food and (Heart ADJ Healthy)". The frequency of occurrence of the search term alone would not provide information necessary to answer the question because the search term might be in reference to a <u>planned</u> program in nutrition rather than to a program which had actually been <u>implemented</u>. The context in which the search term was used was necessary to make fine distinctions of this type. While, as discussed in the literature review, it may be possible in the future to develop a search program to make fine distinctions, a human review of the aggregated

references to a topic along with necessary contextual information, is currently feasible and reasonably efficient.

The Windows Write program is a simple wordprocessor and does not have the features necessary to produce tables, different font styles, graphs and options desirable for production of a final report on the content analysis category or subcategory. The advantage of the Write program is that it uses a small amount of computer memory and does not amplify the retrieval and copy speed problem discussed previously. Other wordprocessing programs, including Word for Windows, do require more memory space. The passages stored in the Write file were transferred to Word for Windows format for editing of the raw passages and reporting results of the summary and analysis. Other wordprocessing programs could be used at the researcher's preference.

Two examples of search reports, "Computer Assisted Content Analysis" and "Visiting Professors/Guest Lectures", are presented in APPENDIX B to illustrate the retrieval, storage, and reporting process used. Both searches are on subcategories of the Instructional Methods category (the second category structure). The questions to be addressed by the analyses are presented on the cover page of the report, along with the search terms used, and the date the search was conducted. The results of the search on the two Instructional Methods reports, Computer Assisted Instruction and Visiting Professor/Guest Lectures, generated 12 and 20 pages of retrieved passages respectively. The analysis of

the retrieved passages to answer specific evaluation questions involved reading through the 12-20 pages of raw data, identifying information relevant to the questions, summarizing and interpreting the results. The capability to distill 12-20 pages of relevant information from the original database of 1470 pages was a substantial advantage. Each search required approximately two hours to complete. The analysis and reporting of results required approximately two more hours.

The PCAA grant progress reports covered a five year time span for each award. One of the interesting findings in the analysis of retrieved passages was the ability to track the implementation (or lack thereof) of objectives listed in the original grant application. The grant applications typically listed a much more elaborate program than was reported to be implemented in the progress and final reports. In some cases, a major objective listed in the application never appeared in the progress reports. This finding is probably not unique to the PCAA program, but suggests that not all important information is included in progress reports. If the original goals stated for a program are assumed to be important in the evaluation of the program, then it is necessary to assure that information is available in program documents for evaluation of those goals or to assess changes in the goals over time. The improved ability to efficiently monitor progress reports for

information relating to original objectives may be one of the benefits of using computer assisted analysis techniques.

The category "Nutrition" was a broader content category involving many more documents and passages than either of the searches on the curriculum categories. The search retrieved 189 pages of text passages containing references to the topic of nutrition. While a reduction in the document database from 1470 to 189 pages was significant, the time and effort required to answer several evaluation questions by reading through the 189 page search results report was judged to be unacceptable (i.e., unfeasible) by the researcher. The reliability of locating and abstracting all relevant information from a 189 page report was also assumed to be lower than the reliability of abstracting all relevant information from a 12 to 20 page results report. The "nutrition" analysis proceeded by utilizing the search capabilities of the Word for Windows word processing program to perform a series of second level searches on the Nutrition results report. A second level search on "lectures on nutrition" was performed, for example, resulting in a 12 page report. The analysis of the 12 page report proceeded as before. Other second level searches on the 189 page Nutrition report were performed as indicated in Figure 1.

Figure 1

Search and Analysis Steps
NUTRITION Category

PCAA Document Database
1470 pages

first level search on NUTRITION

first level Results
189 pages

second level searches
on Nutrition subcategories
(using wordprocessor search)

Lectures on
Nutrition
12 pages

Clinical
Training
Programs

Biochemistry courses

Risk Assessment
Demonstrations

Diet Demonstrations

Efficiency Study

The results of the Efficiency Study, comparing manual versus computer retrieval of information from a sample of the database are presented in Table 1.

Table 1

Comparison of Manual and Computer Retrieval Time
(in minutes)

		Reviewer		
Document	Manual	A	B	C
1	69			
2	81			
3	65			
4	46			
TOTAL	**261**	**63**	**80**	**55**

Note. Times for individual documents (1,2,3,4) are included only for the manual review, since the computer reviews were all completed in one sitting.

The slowest reviewer, reviewer B, using the computer, was able to complete the document search and retrieval 3.26 times faster than the manual reviewer. The fastest reviewer, reviewer C, was able to complete the document search and retrieval 4.75 times faster than the manual reviewer.

It is important to note that reviewers using the computer spent considerable time copying, or "cutting and pasting", the passages identified by the search. On

average, 42 seconds per passage were required to complete the copying operation. Overall, copying time accounted for approximately 20 minutes, or one-third, of the total time involved in the computer assisted document search and retrieval. The manual reviewer highlighted the passages with a yellow highlighter pen, but did not perform an operation equivalent to the copying operation used in the computer searches. An equitable comparison of the computer search and the manual search in terms of time efficiency may be obtained by adjusting the computer search times for the time spent on the copying operation.

Table 2

Adjusted Comparison of Manual and Computer Retrieval Time
(in minutes)

Reviewer	Unadjusted total	Adjustment	Adjusted total
A	63	20	43
B	80	20	60
C	55	20	35
Manual	261	-	261

Using the adjusted times, the slowest reviewer using the computer completed the search 4.35 times faster than the manual review. The fastest reviewer using the computer completed the search 7.46 times faster than the manual review.

The question of the amount of information retrieved

by the two methods is of interest in determining the relative efficiency of the computer searches. The amount of information is measured by the total number of lines of text retrieved. A comparison of the computer versus the manual total number of lines is presented in Table 3.

Table 3

Comparison of Total Line Numbers Retrieved
Manual versus Computer

Reviewer	Total Lines Retrieved
A	298
B	394
C	278
Manual	564

The reviewers using the computer assisted search method retrieved, on average, 57 percent of the total lines retrieved by the manual review. The difference in line numbers between the manual review and the computer review was due primarily to the incomplete search terms used by the reviewers and to the lack of a general structure (i.e., section, paragraph) in two of the four documents for describing visiting professor activities. The reasons for this difference in line numbers retrieved will be discussed in greater detail in the section on validity. In terms of efficiency of time per line of text retrieved, however, the

computer search is still at least twice as fast as the manual search.

The usefulness of the computer assisted content analysis is dependent on the completeness, consistency, and relevance of the passages retrieved. These are issues dealt with in the reliability and validity studies.

Reliability Study

The primary objective of the reliability study was to determine the degree of agreement between three reviewers on the total number of text lines retrieved and the total number of passages retrieved. The inter-rater correlation of total number of lines is viewed as a rough measure of the reliability of the computer assisted search and retrieval method. The inter-rater correlation of the total number of passages retrieved is viewed as another measure of reliability which allows for the variation in the number of lines retrieved per passage by different reviewers.

While total lines and total passages provide a measurable method of estimating the inter-rater reliability, it is possible that different reviewers could be retrieving the same total number of lines or passages without retrieving the same lines or passages. In the extreme case, two reviewers would retrieve two sets of passages which were equivalent in number and in the number of lines, but which were completely different in terms of content. Therefore, it was of interest to also determine how many of the

passages retrieved were matching passages. Matching passages were defined as any text unit (i.e., a sentence or paragraph) containing the same key word (used in the search term) on the same line of text.

A secondary objective was to look at potential differences in the number of lines contained in any matching passages. This data was of interest in looking at the degree of similarity of the surrounding context sentences or paragraphs in matching passages.

The reliability study was performed on a sample of four documents selected from the PCAA document database. The documents were selected on the basis of the frequency of occurrence of the terms "Visiting Professor" and "Guest Lecture" in the text of the documents. The three reviewers were senior medical students who had received a brief training session on the use of the Windows Personal Librarian search program. All three reviewers had previous experience with the use of wordprocessing programs and with computer control devices such as the mouse. All three reviewers were from the same medical school and did not have any previous knowledge of the PCAA program. The three reviewers were provided with a set of instructions and a set of evaluation questions on the topic of visiting professor programs.

Inter-rater correlation of total lines of text retrieved by the three reviewers was utilized as a measure

of reliability of the method. Total lines retrieved by the three reviewers are summarized in Table 4.

Table 4

Total Lines Retrieved
by Document by Reviewer

	REVIEWER		
DOCUMENT	A	B	C
1	10	10	10
2	67	176	88
3	71	68	60
4	150	140	120
total	**298**	**394**	**278**

Other than the document 2, reviewer B cell (176), the total number of lines retrieved by the three reviewers appear to be quite similar. The 2,B outlier was due to the retrieval of a long paragraph containing the visiting professor/guest lecture search term. The paragraph was in reference to the overall plans and objectives contained in the grant application section of document 2. Presumably, reviewer B included the entire paragraph in order to provide the overall context of the visiting professor program. The other two reviewers selected a smaller section of the paragraph containing only the reference to the visiting professor program.

The intercorrelation of the three reviewers in terms of total line numbers retrieved was calculated using the

intraclass correlation statistic for k series. The result indicates that the typical intercorrelation of the three reviewers is .76. If the intercorrelation of reviewers is taken to be an indication of reliability of the retrieval of total line numbers, then the typical reliability of a single reviewer's total line number rating is of the order of .76.

The correlation of .76 exceeds the hypothesized .70 correlation standard. This finding suggests that the reliability of the computer search/retrieval method is adequate for this limited sample of documents.

The measurement of total lines of text retrieved is a rough estimate of reliability. Potentially two different reviewers could retrieve an equivalent number of lines without retrieving the same lines. That is, one reviewer could be retrieving a small number of passages with a large number of lines per passage, while another reviewer could be retrieving a large number of passages with a small number of lines per passage. Concluding that the reliability of the information abstracted from documents was equivalent to the correlation between the total number of lines retrieved by two reviewers would be erroneous in the absence of other measures.

The total number of passages retrieved by the three reviewers is probably a more important measure of reliability than total number of lines. A passage is a section of the text, such as a sentence or a paragraph, which contains the key word search term. The total number

of passages retrieved by the three reviewers is presented in Table 5:

Table 5

Total Passages Retrieved
by Document by Reviewer

	REVIEWER		
DOCUMENT	A	B	C
1	1	1	1
2	8	12	12
3	6	6	6
4	15	15	14
Total	**30**	**34**	**33**

A cursory examination of Table 5 indicates that the number of passages retrieved by the three reviewers is very similar. The small differences can probably be accounted for by minor differences in the search terms used by the different reviewers.

The intraclass correlation for k series was calculated for the total number of passages included in Table 5. The result indicates that the typical intercorrelation of the three reviewers is .96. If the intercorrelation of reviewers is taken to be an indication of reliability of the retrieval of total number of passages, then the typical

reliability of a single reviewer's total number of passages rating is of the order of .96.

The correlation of .96 exceeds the hypothesized .70 correlation standard. This finding suggests that the reliability of the computer search/retrieval method is adequate for this limited sample of documents.

While the intercorrelation of the number of passages is probably a better indication of reliability than the intercorrelation of the number of lines, the possibility exists that two reviewers could retrieve an equivalent number of passages without the passages being equivalent in terms of content. A conclusion that the method of abstracting information was reliable based only on the intercorrelation of the number of passages would be erroneous. Further information about the content of the passages would be needed before drawing any conclusions.

The content of passages retrieved by different reviewers was judged to be equivalent by the researcher if the passage, i.e., sentence, paragraph, etc., contained the same key word search term on the same line. This comparison was made by means of a visual comparison of the printout of the search results of the three reviewers. Given the relatively small sample of documents used, visual comparison was a practical method of measuring equivalence of the text passages. With a larger document sample, assigning line numbers to each line of text in the document sample might be necessary to determine the equivalence of passages on a

mathematical basis. A summary of the matching passages for the document sample in this study is shown in Table 6. The tabulation of matching passages indicates that most (90 - 100%) of the passages retrieved by the three reviewers were equivalent to those retrieved by at least one of the other reviewers. There were only five (5) passages which did not match one of the other reviewers.

Table 6

Summary of Matching Passages

	REVIEWER		
	A	B	C
number of matching passages	27	34	31
number of all passages	30	34	33
number of non-matching passages	3	0	2
percent of matching passages	90	100	94

Validity Study

The objective of the validity study was to determine the degree of agreement between the line numbers/passages retrieved by the computer searches and the standard set of line numbers/passages retrieved by a manual review of the documents by a senior consultant on the PCAA program. The validity study utilized the Spearman's rho statistic to calculate correlation coefficients between the total line numbers contained in the standard set of passages and each set of total line numbers retrieved by the three computer searches on the same document sample, as well as with the mean of the three reviewers for total line numbers and passages. Spearman's rho was also used to calculate correlation coefficients between the total number of passages contained in the standard set of passages and each set of total number of passages retrieved by the three computer searches on the same document sample. The results are presented in Table 7 and Table 8 respectively.

Table 7

Correlation Coefficients for Total Line Numbers

Manual/Computer

REVIEWER

A	B	C	Mean
0	.80	.40	.40

Table 8

Correlation Coefficients for Total Number of Passages

Manual/Computer

REVIEWER

A	B	C	Mean
.35	.35	.35	.35

Both of these results are less than the hypothesized .70 correlation coefficient, indicating that for this limited sample of documents, the passages retrieved by the computer searches did not meet the standard required for validity. In order to understand the possible reasons for the lack of correlation between the standard set of passages and the computer search set of passages, it is useful to look at the number and percent of matching passages presented in Table 9.

The number of matching passages in documents 1 and 2 is low, ranging from 0 - 50 % of the standard passages. The number of matching passages in documents 3 and 4 is quite high, ranging from 86 - 94% of the standard passages.

There are qualitative differences between documents 1/2 and documents 3/4 in terms of the structure of the sections of the documents pertaining to visiting professors and guest lecturers. "Structure" refers to section headings, specific paragraphs, outlines, or other features which might

Table 9

Number and Percent of Reviewer Passages Matching the Standard Set of Passages

	REVIEWER									
	Con		A			B			C	
Document Number	SP no.		no	%		no.	%		no.	%
1	16		0	-		1	6%		1	6%
2	24		8	33%		12	50%		12	50%
3	7		6	86%		6	86%		6	86%
4	16		15	94%		15	94%		14	88%
Total	63		29	46%		34	54%		33	52%
	Mean of all reviewers = 32/63 51%									

Note. Con = PCAA program consultant.
SP = Standard Passages.

facilitate identification of passages containing mention of visiting professor or guest lecture activities. In documents 1 and 2, the actual terms used to describe or refer to visiting professor and guest lecturer activities were varied. In these two documents, visiting professor activities were frequently described in terms which probably would not be recognized by a novice reviewer as a reference to a visiting professor program outside of the full context of the document. For example, in document 1, visiting professors are referred to by at least 13 different terms including, "nationally and internationally known scholars", "First and Second Annual Preventive Cardiology Lectureship",

"Visiting Lectureships", "Lecturers of national and international reputation", "Off campus speakers", "consultants to the PCAA", "Guest Speakers", "National and international authorities", "experts", "consultants", "nationally distinguished offcampus speakers", "intramural faculty", and by the proper names of the speakers themselves. In contrast, document 4 refers to visiting professors by only two terms, "Visiting professors" and "Visiting professorship", both of which would be identified by the single search term "Visit* adj professor*". Second, references to visiting professors in document 1 were interspersed throughout the document in a very loose structure, i.e., without a major heading to identify the visiting professor activities. In document 4, all activities regarding visiting professors were clearly identified under a major heading which was consistent in all program documents throughout the five year course of the grant. The qualitative differences between document 1 and document 4 illustrate the part of the reason for the difficulty which reviewers using the computer search technique had in identifying references to visiting professor activities in documents 1 and 2.

The search terms - key words - used by all three reviewers were variations on the terms visiting professor, guest speaker, invited speaker, and guest lecturer. Using broader search terms such as "lectur*" or "speaker" would have identified more of the passages in documents 1 and 2,

but would also have identified "noise" passages which were entirely irrelevant to the visiting professor activities. This is the tradeoff problem between efficiency and completeness which Pfaffenberger (1988) discusses in the Literature Review section. The balance between completeness and efficiency depends on the nature of the questions being asked of the documents. If 100 percent completeness is required to adequately address a question, then manually reviewing the documents, reading them, would be recommended. If anything other than 100 percent completeness can be tolerated, then the degree of completeness may be determined by the specificity of the search term used on the computer. The more specific and narrow the search term used, the higher the probability that relevant text will be missed.

Because of the qualitative differences between documents, sampling becomes an important consideration in determining validity. Any measure of reliability or validity in a document database of the size used in this study (1500 pages) can only be reasonably made on the basis of sampling. Reading through the entire database would obviously provide a very complete standard for comparison, but it would also obviate the need to perform the comparison. The size and the type of sample are important considerations. Selection of a set of highly structured documents with limited variation of terms used to describe activities could potentially have a large effect on the correlation coefficients used in this study. Similarly, a

set of documents with the opposite characteristics would have a large impact. While the sample of four documents used in this study was not randomly selected, it is interesting that two of the documents were highly structured, while the other two were largely free form. The documents were selected on the basis of the frequency of the occurrence of the term visiting professor and guest lecture.

CHAPTER V

CONCLUSIONS

Feasibility Study

The feasibility of retrieving specified passages of text from a 1470 page single spaced document database in order to answer questions of interest in the evaluation of the Preventive Cardiology Academic Award (PCAA) program was demonstrated by this study. The use of a powerful key word search program, the Windows Personal Librarian program, and the use of optical scanning to create the document database were key factors in achieving the feasibility of the method for qualitative analysis of the PCAA grant documents. The costs for equipment and for optical scanning were judged to be reasonable. Locating the PCAA documents, selecting appropriate search terms, and processing speed of retrieving passages from the document database were problems, but did not seriously impede the overall feasibility of the computer assisted content analysis of the PCAA documents. The selection of content analysis category structure was confirmed to be an important factor in determining the feasibility of conducting a content analysis. Category structures which were either overly subdivided or overly broad seriously reduced the efficiency and perhaps the feasibility of computer assisted content analysis. Standard

word processing programs are recommended for editing raw data and for reporting of results of analyses.

Reliability Study

The study demonstrated inter-rater correlations of .76 for the number of lines of text and .96 for the number of passages retrieved by three different reviewers. The number of matching (equivalent) passages exceeded 90 percent of the total number of passages retrieved. Together, these measures indicate that the information retrieved from one search of a limited sample of documents was reliable.

The relatively high correlations observed in the reliability study are accounted for by the similarity of the search terms used by the three reviewers. All three reviewers used variations of the terms visiting professor, guest lecture, invited speaker, and guest speaker. When the same search terms are entered into the computer key word search program, then the same passages should be identified by the computer regardless of how many times the search is performed. The reliability of computer assisted content analysis has been demonstrated in previous studies (Holsti, 1969), and, along with efficiency, is one of the primary reasons to use computer assisted, as opposed to manual, content analysis.

Variation in the passages retrieved was predominately due to minor differences in the key word search terms used by the different reviewers. The other source of variance

was the reviewers' judgement of the importance or relevance of passage identified by the search term. A passage identified by the computer did not necessarily mean that the passage was relevant to the question which the search was seeking to address. With the exception of one passage in document number 1, all passages identified by the search program were copied to the storage/analysis file. Therefore, the judgement of the reviewers regarding the relevance of passages did not appear to be a significant issue in terms of reliability.

Validity Study

The lack of significant correlation between the standard set of passages and the computer retrieved passages was probably accounted for by the free form structure and variable terms used in two of the documents in conjunction with the relatively narrow and efficient search terms used by the reviewers. The correlation between the standard passages and the other two documents was high enough to be considered valid. The question of validity of computer assisted content analysis centers on sampling and on the degree of inefficiency which can be tolerated in the search terms used. Since efficiency is the main point of using computer assisted content analysis, any tradeoff of efficiency for completeness must be recognized and expectations adjusted accordingly. The issue of validity in program evaluation is important, and therefore, any

compromise of completeness for efficiency must also be recognized in terms of the types of questions asked in an evaluation.

Significance of the Study

Program documents are underutilized as a source of information for evaluation of educational programs. The primary significance of this study was to demonstrate the feasibility of using optical scanning and computer assisted content analysis as a means of making the wealth of information contained in program documents more accessible and useful in program evaluation applications.

The confidence placed in qualitative evaluation data has been limited by the practical difficulty of finding measures to estimate reliability and validity. Computer assisted content analysis provides a method for making comparisons necessary to estimate the reliability and validity of qualitative data contained in documents.

The findings of this study may be important to the sponsors of large scale educational programs, such as the PCAA program. To the extent that computer assisted retrieval of information contained in program documents allows efficient comparison of information from previous reports, from reports submitted by other programs, and other related information, program sponsors may be able to more readily explore and establish standards for terminology and reports, anticipate problems in the program, improve

communication of program concepts and strategies among interested parties, and synthesize new concepts or strategies for future programs.

The accessibility to information contained in the narrative program documents presented by computerized information retrieval may be of benefit to program officers for responding to specific questions regarding the program or for generating comprehensive program progress reports. This capability may prove especially useful in responding to questions or issues raised by government or private foundation funding agencies.

Computer assisted content analysis may improve the quality of program reports and other program documents. The importance of producing accurate and complete program documents may increase with the knowledge that program sponsors possess the capability of efficiently and thoroughly reviewing the document content and making program disposition decisions based on the results.

Program evaluation is usually an expensive endeavor. To the extent that computer assisted content analysis improves the efficiency and reduces the cost of program evaluation, program sponsors will benefit from lower cost or from the availability of more detailed evaluation information at the same cost.

Limitations

The PCAA document database contains the inherent limitations of archival data discussed by Caulley (1983) in the literature review. The validity of self-reported data may be questioned. Since continued or supplemental funding of grants may be dependent on the achievements listed in progress reports, there may be a tendency to write progress reports to make the program look good. The information necessary to answer a specific evaluation question may be incomplete, inadequately detailed, or completely absent. In the PCAA database, the annual progress reports from year to year were very similar, often containing verbatim repetitions of large sections of the progress reports from previous years. Whether this implies that the activities of the program from year to year were very similar or whether the progress reports failed to note significant program activities is not known.

The PCAA document database contained only selected documents from the complete grant files for each award. Certain documents which were judged to contain only peripheral or irrelevant information to the evaluation questions were deleted to reduce the cost of translating the written documents to a computer readable file via optical scanning and editing. The removal of selected documents potentially introduced a source of bias in the database by deleting information which was actually relevant to evaluation questions. Steps were taken to limit this

problem by having several reviewers independently repeat the pruning of the files and then a cross-check of the documents deemed to be irrelevant by the different reviewers was performed. PCAA program officials and consultants at NHLBI determined that the degree of agreement between reviewers was adequate to justify removal of selected documents from the database. Statistical information on the degree of agreement between reviewers was not available.

The limitations of the search terms have been discussed previously. There is a trade-off between the efficiency and the completeness of computer assisted information retrieval based on the precision of the search term(s) used. This reflects the intrinsic difficulty of using words (search terms) to represent ideas or concepts.

The memory capacity and processing speed of the computer limit the efficiency and perhaps the feasibility of using the type of key word search program employed in this study when the size of the document database reaches approximately 1,000 pages.

The sample of the document database used in the reliability and validity comparisons was not randomly selected and may not have represented issues or problems present in other sections of the database. The size of the sample was limited by the practical consideration of the time required to read a larger sample of documents. The reliability and validity studies were based on only one search category, Visiting Professor/Guest Lecture programs.

The characteristics of other search topics may have resulted in different correlations for reliability and validity.

Suggestions for Future Research

The use of computer assisted methods for analyzing qualitative data is of interest in a number of fields. Application of methods similar to computer assisted content analysis have been described in the literature for the analysis of observational data, open-ended survey questions, essay questions, and other narrative forms of data. Development and refinement of computer assisted analysis techniques for qualitative data is anticipated, and indeed, is already well underway. Refinement of methods to improve the measurement of reliability and validity of qualitative data would be particularly useful. Further study of efficiency issues, such as the problem of reduced processing speed as the size of the database increases, would be of interest. Development of artificial intelligence systems to further automate the process of content analysis of narrative materials is of interest to many researchers using qualitative data analysis techniques.

Studies on the application of computer assisted content analysis in grant management are suggested by the results of this study. Maintaining program records in a computer readable format would be a powerful tool for formative and summative evaluation of grant programs, as well as an excellent means for communicating the progress and results

of multi-institutional programs. Analysis of the content of previous program reports may provide information of use in the development of new program concepts. In the present study, the degree of structure present in the documents and the number of synonymous terms used to describe activities had a large impact on the validity correlations of the text retrieved by different reviewers. Further study of ways to improve the usefulness of program documents may include studies of the effect of structure and limited variation of terms on reliability and validity of computer assisted content analysis.

In the field of Medical Education, applications of computer assisted content analysis to the evaluation of accreditation documents, such as ACGME reviews, would be of interest. Applications of the technique in medical quality assessment activities, such as the review of medical records, would be of interest.

Appendix A

Original Category Structure

ORIGINAL CATEGORY STRUCTURE

What types of programs have been developed and implemented in the PCAA programs to provide training opportunities for physicians at various levels?

A. Medical Student Level

1) elective/required
2) pediatric/adult
3) clerkship/clinical sciences
4) basic sciences
5) summer research fellowship
6) other

a) Approach taken

1) lecture
2) small group
3) discussion
4) case study
5) research project
6) self-instruction
7) CAI
8) simulated patients
9) courses
10) clinical rotation
11) tutorials
12) visiting professorship program

b) Instructional aids

1) objectives
2) syllabus
3) handbook
4) PC notebook
5) films
6) modules
7) audiovisuals
8) tests/examinations/instruments
9) ?

c) Content

1) epidemiology
2) smoking
3) nutrition
4) exercise
5) blood pressure
6) risk factors
7) counseling

8) management/treatment
9) prevention

d) Materials developed

1) objectives
2) syllabus
3) handbook
4) PC notebook
5) films
6) modules
7) audiovisuals
8) CAI
9) self-instruction
10) video tapes
11) simulated patients
12) tests, examinations
13) instruments
14) surveys
15) other

e) Evaluation

1) evaluation plan/models
2) process measures
3) outcome measures
4) grant review
5) skills
6) knowledge
7) attitude
8) assessment
9) intended results
10) unintended results

B. House staff (residents)

1) elective/required
2) pediatric/adult
3) clinical/didactic

a) Approach taken

1) lecture
2) small group
3) discussion
4) case study
5) research project
6) self-instruction
7) CAI
8) simulated patients
9) courses
10) clinic
11) tutorials

12) visiting professorship program
13) rounds
14) grand rounds

b) Instructional aids

1) objectives
2) syllabus
3) handbook
4) PC notebook
5) films
6) modules
7) audiovisuals
8) tests/examinations/instruments
9) ?

c) Content

1) epidemiology
2) smoking
3) nutrition
4) exercise
5) blood pressure
6) risk factors
7) counseling
8) management/treatment
9) prevention

d) Materials developed

1) objectives
2) syllabus
3) handbook
4) PC notebook
5) films
6) modules
7) audiovisuals
8) CAI
9) self-instruction
10) video tapes
11) simulated patients
12) tests, examinations
13) instruments
14) surveys
15) other

e) Evaluation

1) evaluation plan/models
2) process measures
3) outcome measures
4) grant review

5) skills
6) knowledge
7) attitude
8) assessment
9) intended results
10) unintended results

B. Fellows

1) elective/required
2) pediatric/adult
3) clerkship/clinical sciences
4) basic sciences
5) research
6) other

a) Approach taken

1) lecture
2) small group
3) discussion
4) case study
5) research project
6) self-instruction
7) CAI
8) simulated patients
9) courses
10) clinic
11) tutorials
12) visiting professorship program
13) rounds
14) grand rounds

b) Instructional aids

1) objectives
2) syllabus
3) handbook
4) PC notebook
5) films
6) modules
7) audiovisuals
8) tests/examinations/instruments
9) ?

c) Content

1) epidemiology
2) smoking
3) nutrition
4) exercise
5) blood pressure

6) risk factors
7) counseling
8) management/treatment
9) prevention

d) Materials developed

1) objectives
2) syllabus
3) handbook
4) PC notebook
5) films
6) modules
7) audiovisuals
8) CAI
9) self-instruction
10) video tapes
11) simulated patients
12) tests, examinations
13) instruments
14) surveys
15) other

e) Evaluation

1) evaluation plan/models
2) process measures
3) outcome measures
4) grant review
5) skills
6) knowledge
7) attitude
8) assessment
9) intended results
10) unintended results

D. Post Graduate Trainee Continuing Medical Educatin (CME)

1) Pediatric/Adult
2) Didactic
3) Other

a) Approach taken

1) lecture
2) small group
3) discussion
4) case study
5) research project

6) self-instruction
7) CAI
8) simulated patients
9) courses
10) clinic
11) tutorials
12) visiting professorship program

b) Instructional aids

1) objectives
2) syllabus
3) handbook
4) PC notebook
5) films
6) modules
7) audiovisuals
8) tests/examinations/instruments
9) ?

c) Content

1) epidemiology
2) smoking
3) nutrition
4) exercise
5) blood pressure
6) risk factors
7) counseling
8) management/treatment
9) prevention

d) Materials developed

1) objectives
2) syllabus
3) handbook
4) PC notebook
5) films
6) modules
7) audiovisuals
8) CAI
9) self-instruction
10) video tapes
11) simulated patients
12) tests, examinations
13) instruments
14) surveys
15) other

e) Evaluation

1) evaluation plan/models
2) process measures
3) outcome measures
4) grant review
5) skills
6) knowledge
7) attitude
8) assessment
9) intended results
10) unintended results

E. Faculty

1) Pediatric/Adult
2) Didactic
3) Research
4) other

a) Approach taken

1) lecture
2) small group
3) discussion
4) case study
5) research project
6) self-instruction
7) CAI
8) simulated patients
9) courses
10) clinic
11) tutorials
12) visiting professorship program
13) rounds
14) grand rounds

b) Instructional aids

1) objectives
2) syllabus
3) handbook
4) PC notebook
5) films
6) modules
7) audiovisuals
8) tests/examinations/instruments
9) ?

c) Content

1) epidemiology
2) smoking

3) nutrition
4) exercise
5) blood pressure
6) risk factors
7) counseling
8) management/treatment
9) prevention

d) Materials developed

1) objectives
2) syllabus
3) handbook
4) PC notebook
5) films
6) modules
7) audiovisuals
8) CAI
9) self-instruction
10) video tapes
11) simulated patients
12) tests, examinations
13) instruments
14) surveys
15) other

e) Evaluation

1) evaluation plan/models
2) process measures
3) outcome measures
4) grant review
5) skills
6) knowledge
7) attitude
8) assessment
9) intended results
10) unintended results

F. Community/Public/Lay Education

1) Pediatric/Adult

a) Approach taken

1) lecture
2) small group
3) discussion
4) case study
5) research project
6) self-instruction
7) CAI

8) simulated patients
9) courses
10) written materials/handouts
11) tutorials

b) Instructional aids

1) objectives
2) syllabus
3) handbook
4) PC notebook
5) films
6) modules
7) audiovisuals
8) tests/examinations/instruments
9) ?

c) Content

1) epidemiology
2) smoking
3) nutrition
4) exercise
5) blood pressure
6) risk factors
7) counseling
8) management/treatment
9) prevention

d) Materials developed

1) objectives
2) syllabus
3) handbook
4) PC notebook
5) films
6) modules
7) audiovisuals
8) CAI
9) self-instruction
10) video tapes
11) simulated patients
12) tests, examinations
13) instruments
14) surveys
15) other

e) Evaluation

1) evaluation plan/models
2) process measures
3) outcome measures
4) grant review

5) skills
6) knowledge
7) attitude
8) assessment
9) intended results
10) unintended results

G. Patient Education

1) Pediatric/Adult

a) Approach taken

1) lecture
2) small group
3) discussion
4) case study
5) research project
6) self-instruction
7) CAI
8) simulated patients
9) courses
10) written materials/handouts
11) media events

b) Instructional aids

1) objectives
2) syllabus
3) handbook
4) PC notebook
5) films
6) modules
7) audiovisuals
8) tests/examinations/instruments
9) ?

c) Content

1) epidemiology
2) smoking
3) nutrition
4) exercise
5) blood pressure
6) risk factors
7) counseling
8) management/treatment
9) prevention

d) Materials developed

1) objectives

2) syllabus
3) handbook
4) PC notebook
5) films
6) modules
7) audiovisuals
8) CAI
9) self-instruction
10) video tapes
11) simulated patients
12) tests, examinations
13) instruments
14) surveys
15) other

e) Evaluation

1) evaluation plan/models
2) process measures
3) outcome measures
4) grant review
5) skills
6) knowledge
7) attitude
8) assessment
9) intended results
10) unintended results

H. Trainee (Other)

1) Pediatric/Adult

a) Approach taken

1) lecture
2) small group
3) discussion
4) case study
5) research project
6) self-instruction
7) CAI
8) simulated patients
9) courses
10) written materials/handouts
11) media events

b) Instructional aids

1) objectives
2) syllabus
3) handbook
4) PC notebook

5) films
6) modules
7) audiovisuals
8) tests/examinations/instruments
9) ?

c) Content

1) epidemiology
2) smoking
3) nutrition
4) exercise
5) blood pressure
6) risk factors
7) counseling
8) management/treatment
9) prevention

d) Materials developed

1) objectives
2) syllabus
3) handbook
4) PC notebook
5) films
6) modules
7) audiovisuals
8) CAI
9) self-instruction
10) video tapes
11) simulated patients
12) tests, examinations
13) instruments
14) surveys
15) other

e) Evaluation

1) evaluation plan/models
2) process measures
3) outcome measures
4) grant review
5) skills
6) knowledge
7) attitude
8) assessment
9) intended results
10) unintended results

Appendix B

Sample Search Results Reports

(1) Computer Assisted Instruction

(2) Visiting Professor/Guest Lectures

PCAA DOCUMENT ANALYSIS

PRELIMINARY REPORT

VISITING PROFESSOR / GUEST LECTURES

Search Terms: (visit* adj professor*) or guest w/4 lectur* or (guest adj speaker*)

Rationale:

Were guest lecturers or visiting professorship programs used? If so, what was the objective of using guest speakers? What level or levels of student were these programs directed to? What was the content of the lectures or discussions?
Who were the speakers?

Date: April 13, 1990

OBJECTIVES OF THE PREVENTIVE CARDIOLOGY ACADEMIC AWARD:

1. ENCOURAGE DEVELOPMENT OF A HIGH-QUALITY PREVENTIVE CARDIOLOGY CURRICULUM IN SCHOOLS OF MEDICINE AND OSTEOPATHY THAT WILL SIGNIFICANTLY INCREASE THE OPPORTUNITIES FOR STUDENTS AND HOUSESTAFF TO LEARN BOTH THE PRINCIPLES AND PRACTICE OF PREVENTIVE CARDIOLOGY;

2. DEVELOP PROMISING FACULTY WHOSE INTEREST AND TRAINING ARE IN PREVENTIVE CARDIOLOGY TEACHING AND RESEARCH;

3. DEVELOP ESTABLISH FACULTY WHO HAVE A MAJOR COMMITMENT TO, AND POSSESS EDUCATIONAL SKILLS FOR, TEACHING PREVENTIVE CARDIOLOGY;

4. FACILITATE INTERCHANGE OF EDUCATIONAL IDEAS AND METHODS AMOUNG AWARDEES AND INSTITUTIONS; AND

5. DEVELOP AT THE GRANTEE INSTITUTION THE ABILITY TO STRENGTHEN CONTINUOUSLY THE IMPROVED PREVENTIVE CARDIOLOGY CURRICULUM, WITH LOCAL FUNDS, SUBSEQUENT TO THE AWARD.

PCAA DOCUMENT ANALYSIS
PRELIMINARY REPORT
4/13/90

VISITING PROFESSOR/GUEST LECTURES

The Provisions of the Award (page 6) allowed requests for funding:

"consultant fees for a limited number of experts in the area of preventive cardiology, education, or program evaluation;"

WERE GUEST LECTURERS OR VISITING PROFESSORS USED?

Of the 26 PCAA awards included in this analysis, 13 (50%) referenced visiting professor or guest lecture programs in their application or in their progress reports.

Eight (8) of the 13 awards which referenced visiting professors or guest lecturers described implementation of these lecture programs in their progress reports. Four (4) of the remaining programs did not present any information concerning implementation of visiting professor/guest lectures in their progress reports. One (1) award described the Principle Investigator's role as a visiting professor at other (non-award) institutions, but did not list any visiting professor/guest lectures at the award institution.

The eight (8) awards which describe implementation of visiting professor/guest lecture programs represent 31% of the awards included in this analysis.

WHAT WAS THE OBJECTIVE OF USING GUEST SPEAKERS?

A variety of objectives were listed for guest lecture programs:

1. Include preventive cardiology topics in Medical Grand Rounds
2. Provide a forum for interdisciplinary discussion of preventive cardiology topics
3. Supplement lectures provided to medical students on preventive cardiology
4. Present information to medical students on the conduct of cardiovascular clinical trials
5. Provide an opportunity for informal information exchange between participants in the Preventive Cardiology program and guest lecturers.
6. Obtain supporting information for development of a preventive cardiology clinic
7. Discuss research on cardiovascular prevention with fourth year medical students.

PCAA DOCUMENT ANALYSIS
PRELIMINARY REPORT

VISITING PROFESSOR/GUEST LECTURES

4/13/90

WHAT LEVEL OR LEVELS OF STUDENT WERE THESE PROGRAMS DIRECTED TO?

There were 26 lectures which were listed in the progress reports. The majority of these lectures, 14 (54%), were directed to a combined audience of students, housestaff, and faculty. The most common format for guest lectures was Medical Grand Rounds.

Five lectures were directed specifically to housestaff.

Five lectures were directed specifically to first year medical students.

One series of lectures was directed to fourth year medical students, while another series was directed primarily to faculty and cardiology fellows.

WHAT WAS THE CONTENT OF THE LECTURES OR DISCUSSIONS?

Preventive Cardiology - unspecified topics	9
Cardiovascular Clinical Trials or other Major Research Studies	3
Cardiac Risk Factors	
General	1
Cholesterol/Hyperlipidemia	4
Hypertension	1
Tobacco Use	1
Coronary Heart Disease,	
Epidemiology	2
General Etiology	1
Prevention Strategies	2
Computers- Medical Education	1
Humanism/Preventive Medicine	1
Epidemiology/Biostatistics	series

PCAA DOCUMENT ANALYSIS
PRELIMINARY REPORT

VISITING PROFESSOR/GUEST LECTURES

4/13/90

WHO WERE THE SPEAKERS?

Dr. Stephen Scheidt
Cornell University

Dr. E.J. Moran Campbell
McMaster University

Dr. Peter Kuo
Rutgers University

Dr. Gerald Berenson
Bogaloosa Heart Study

Dr. Abdulla Abdulla
Medical College of Georgia

Dr. Seymour Glick

Dr. James Wyngarrden
Duke University

Dr. Thomas Pearson
Johns Hopkins University

Dr. Nemat Borhani
University of California, Davis

Dr. George Mann
Vanderbilt University

Dr. Jeremiah Stamler
Northwestern University

Dr. William Friedewald
NHLBI

Dr. Henry Blackburn
University of Minnesota

Dr. William Castelli
Framingham Heart Study

Dr. Richard Carleton
Brown University

INTERNAL EVALUATION OF VISITING PROFESSOR/GUEST LECTURES

There was very little variation in the internal evaluation of the guest lecture programs - all awards which commented on the outcome of the lectures reported positive results. Terms used to describe the lecture programs included: "met with enthusiastic response"; "added much to the enrichment of our program"; "extremely popular"; "a great success"; "particularly helpful". None of the awards presented more specific information on the effectiveness of the guest lectures relative to goals for the guest lecture program.

CONTINUATION OF GUEST LECTURE PROGRAMS SUBSEQUENT TO THE AWARD

The University of Mississippi and St. Louis University reported that efforts were being made to continue their guest lecture series subsequent to the termination of their PCAA grant. Pharmaceutical companies and state funding were listed as potential sources of financial support. From the information presented in the PCAA documents, these two institutions appeared to have invested the most time and effort in bringing in outside speakers, which may account for their efforts to continue the lectures in the future.

The other awards did not comment on continuation of the guest lectures.

SUMMARY: VISITING PROFESSOR/GUEST LECTURE PROGRAMS

INSTITUTION	LECTURE TOPIC	PRIMARY AUDIENCE	SPEAKER
EINSTEIN	1. Cardiac Risk Factors	Housestaff	Dr. Stephen Scheidt Cornell University
	2. Medical Issues: Tobacco Consumption	Entire Medical School	Dr. E.J. Moran Campbell McMaster University
	3. Hyperlipidemia	Housestaff	Dr. Peter Kuo Rutgers University
	4. Bogaloosa Study	Housestaff	Dr. Gerald Berenson
	5. Use of Computers in Medical Education	Housestaff	Dr. Abdulla Abdulla Medical College Georgia
	6. Medical Humanism/ Preventive Medicine	Housestaff	Dr. Seymour Glick
DUKE	Epidemiology, Biostatistics Preventive Cardiology (Specific Topics not available in document database)	Faculty and Subspecialty Fellows	Dr. James Wyngaarden Duke University (Other Speakers not listed)
MISSISSIPPI	Preventive Cardiology	Medical Students, Housestaff, and Faculty	Dr. Nemat Borhani Univ. Cal. -Davis
	Preventive Cardiology	Medical Students, Housestaff, and Faculty	Dr. George Mann Vanderbilt University
	Preventive Cardiology	Medical Students, Housestaff, and Faculty	Dr. Jeremiah Stemler Northwestern Univ.
	Clinical Cardiovascular Trials	First Year Medical Students	Dr. William Friedewald NHLBI
	Controversial Findings of the Multiple Risk Factor Intervention Trial	Housestaff, Faculty, Staff, Students	Dr. William Friedewald NHLBI
GEORGIA	Preventive Cardiology (Topics not listed in document database)	First Year Medical Students	Four Guest Speakers (Names not listed in database)
LOMA LINDA	Note: Guest Lectures were listed as a goal in all four progress reports, but no evidence is present in the database that any guest lectures were given.		

SUMMARY: VISITING PROFESSOR/GUEST LECTURE PROGRAMS

INSTITUTION	LECTURE TOPIC	PRIMARY AUDIENCE	SPEAKER
NEW JERSY	Establishing a Guest Lecture Series was listed as a goal in the application. Progress reports indicate that some guest lectures took place, but specific topics were not discussed in detail.		
ST. LOUIS UNIVERSITY	Dietary Cholesterol and CHD	Housestaff, Students, Faculty (for all Lectures)	Dr. Jeremiah Stamler Northwestern Univ.
	Treatment of Mild Hypertension		Dr. Jeremiah Stamler Northwestern Univ
	Coronary Disease Prevention: Population Strategies		Dr. Henry Blackburn Univ. Minnesota
	Coronary Heart Disease: Evolution and Culture		Dr. Henry Blackburn Univ. Minnesota
	Obesity, Blood Lipids and Coronary Disease Prevention		Dr. William Castelli NHLBI/Boston U/ Harvard U/U Mass.
	How to Avoid Your Upcoming Heart Attack		Dr. William Castelli NHLBI/Boston U/ Harvard U/U Mass.
	Cardiovascular Disease Prevention: An Update		Dr. William Friedewald NHLBI
	The National Cholesterol Program		Dr. William Friedewald NHLBI
	The Rise and Fall of Coronary Heart Disease		Dr. William Friedewald NHLBI
	Preventive Cardiology (topic not specified)		Dr. Richard Carleton Brown University
UTAH	The third and fourth year progress reports discuss establishing a Visiting Professor Program, but no further specific information is presented in the database		
MICHIGAN STATE	Visiting Professors are listed as a goal in the application, fourth year progress report and final report, but no other information is presented		

SUMMARY: VISITING PROFESSOR/GUEST LECTURE PROGRAMS

INSTITUTION	LECTURE TOPIC	PRIMARY AUDIENCE	SPEAKER
CASE WESTERN	Principals of Preventive Cardiology (Presented at University of Nebraska)	not specified	Dr. T. Riemenschneider Case Western Reserve (P.I.)
WASHINGTON	Preventive Cardiology (cardiology grand rounds, health policy seminar, presentation on development of a preventive cardiology clinic)	not specified, except for the development of the clinic - which was presented to members of the hospital administration	Dr. Thomas Pearson Johns Hopkins Univ.
JOHNS HOPKINS	First and Second Year Progress Reports list guest speakers as a goal Third and Fourth Year Progress Reports state that Guest Speakers are presenting, but topics are not specified. The lectures are described as a "research seminar in cardiovascular prevention"	Fourth Year Medical Students enrolled in the Cardiology Elective	not specified
UNIVERSITY OF. VIRGINIA	A visiting professor program is listed as an objective in the summary report, but is not discussed elsewhere including the application.		

Passages Retrieved:

-DOCUMENT-
HL00653
-NUMBER-
K07-HL00653
-TITLE-
Preventive Cardiology Academic Award
-PI-
Frishman, William H. MD
-PIBIRTH-
11/09/46
-PIDISCIPLINE-
Adult
-INSTITUTION-
Albert Einstein College of Medicine of Yeshiva University, New York City, NY
IPF=9433501
AAMC=120
-INSTTYPE-
Private
-DISPOSITION-
Complete
-FUNDING-
$000,000.00
-DURATION-
07/01/80 to 07/01/85

sum Although the Graduate House Staff program is inpatient directed with
sum emphasis on acute disease processes, Dr. Frishman proposes a number
sum of activities (lectures, conferences, grand rounds, clinics) to
sum improve the preventive cardiology program including a comprehensive
sum cardiology rehabilitation program for patients with acute myocardial
sum infarction similar to that which Dr. Frishman set up while in the
sum army. Other possibilities include input into the Cardiology
sum Fellowship Program numbering 26 fellows, preventive cardiology
sum exposure for emergency room personnel, and postgraduate exposure
sum through the network of intramural and extramural postgraduate
sum educational programs. Additional opportunities exist in the research
sum facilities and projects in preventive cardiology, outreach medical
sum facilities and in a proposed VISITING PROFESSORSHIP AND GUEST
sum LECTURESHIP program.
sum

sum On the postgraduate level,
sum special preventive cardiology seminars, continuing education courses,
sum and all University VISITING PROFESSORSHIPS are being pursued.

1yr Medical Grand Rounds
1yr
1yr Medical grand rounds have been disease and case oriented in the past,
1yr and there is now a State of the Art lecture series being scheduled in
1yr preventive cardiology. Dr. Stephen Scheidt from Cornell gave a one
1yr hour State of the Art lecture on cardiac risk factors, and two
1yr VISITING PROFESSORS in preventive cardiology scheduled for this year,
1yr will give medical grand rounds as part of their VISITING PROFESSOR
1yr responsibilities.

ALBERT EINSTEIN COLLEGE OF MEDICINE

1yr VISITING PROFESSORSHIPS
1yr
1yr A program of VISITING PROFESSORSHIPS in preventive cardiology has been
1yr established. The first VISITING PROFESSOR will be Dr. E.J. Moran
1yr Campbell, from McMaster University, who will be addressing the school
1yr on medical issues in tobacco consumption. The second VISITING
1yr PROFESSOR is Dr. Peter Kuo, who is Chief of Cardiology at Rutgers
1yr University Medical School, and a noted authority in hyperlipidemia.
1

3yr VISITING PROFESSORSHIPS
3yr
3yr An active program of VISITING PROFESSORSHIPS in Preventive Cardiology
3yr has been established. The first VISITING PROFESSOR in 1981 was Dr.
3yr E.J. Moran Campbell from McMaster University, who addressed the
3yr school in its entirety on medical issues in tobacco consumption. The
3yr second VISITING PROFESSOR was Dr. Peter Kuo, who is Chief of
3yr Cardiology at Rutgers University Medical School and a noted authority
3yr in hyperlipidemia. The third VISITING PROFESSOR was Dr. Gerald
3yr Berenson who heads the Bogaloosa study. This year we invited Dr.
3yr Abdulla M. Abdulla, Associate Professor of Medicine at the Medical
3yr College of Georgia, who is a noted authority on the use of computers
3yr in medical education. Dr. Abdulla spent three days with us and will
3yr continue to Consult on an unofficial basis to our program.
3yr

4yr VISITING PROFESSORSHIPS
4yr
4yr An active program of VISITING PROFESSORSHIPS in Preventive Cardiology
4yr has been established. The first VISITING PROFESSOR in 1981 was Dr.
4yr E.J. Moran Campbell from McMaster University, who addressed the
4yr school in its entirety on medical issues in tobacco consumption. The
4yr second VISITING PROFESSOR was Dr. Peter Kuo, who is Chief of
4yr Cardiology at Rutgers University Medical School and a noted authority
4yr in hyperlipidemia. Last year we invited Dr. Abdulla M. Abdulla,
4yr Associate Professor of Medicine at the Medical College of Georgia, who
4yr is a noted authority on the use of computers in medical education.
4yr Dr. Abdulla spent three days with us and will continue to consult on
4yr an unofficial basis to our program. This year we have invited Dr.
4yr Seymour Glick, a noted medical humanist and preventive physician.
4yr

-DOCUMENT-
HL00633
-NUMBER-
K07-HL00633
-TITLE-
Preventive Cardiology Academic Award
-PI-
Kimm, Sue Y. MD
-PIBIRTH-
02/11/38
-PIDISCIPLINE-
Pediatric
-INSTITUTION-
Duke University, Durham, NC
IPF=2221101
AAMC=119
-INSTTYPE-
Private
-DISPOSITION-
Complete
-FUNDING-
$258,844.00
-DURATION-
07/01/79 to 10/31/84

app The specific aims of this program are to:

app c. organizing an InterDepartmental GUEST LECTURE Series in
app Preventive Cardiology

app C. Housestaff, Fellowship and Other Training in Preventive Cardiology
app
app 1. GUEST SPEAKER Series in Preventive Cardiology
app
app Funds have been requested to support the visits of experts in
app preventive cardiology to come to Duke to give lectures and seminars.
app This speaker series, we believe, will be very well received.
app
app To date, we have had such eminent visitors as Drs. Robert I. Levy,
app Rai Paffenbarger, Olli Miettinen, O. Dale Williams, etc., with an
app enthusiastic audience response.
app
app We will further expand our GUEST LECTURE series with the funds from
app the Preventive Cardiology Academic Award.
app
a

app a direct byproduct of the Seminar in Clinical Investigation Series.
app This series was jointly organized by Drs. Galen S. Wagner and Andrew
app G. Wallace as well as by Dr. Seymour Grufferman, a cancer
app epidemiologist, and myself. Seminars are being held bimonthly and
app were originally aimed at the Department of Medicine's Cardiology
app Fellows. The seminars are primarily addressed to issues related to
app epidemiology, biostatistics, and preventive cardiology. We have
app incorporated our PCAA VISITING PROFESSORSHIP Program into this series.
app We have met with enthusiastic response from all involved parties and
app now have a stable attendance of 15 to 20 persons. We intend to repeat

app this series again next year. (Please see the Progress Report section
app of this application for a more complete description.
app

app Minor items are an increase for Dr. Kimm because her salary was increased more than anticipated in the
app original application, an evaluation specialist at 10 percent, a
app teaching assistant at 25 percent, VISITING PROFESSOR $1,000, computer
app accessories, office expenses and $2,500 travel expenses for the
app principal investigator and students.

sum The Seminar in Clinical Investigation, organized by Drs. Wagner,
sum Wallace, Grufferman, and Kimm is held bimonthly and considers
sum epidemiology, biostatistics and preventive cardiology. The PCAA
sum VISITING PROFESSOR Program is incorporated in this series. There is
sum now a stable attendance of 15 to 20 persons.

1yr Perhaps, our greatest success this year, at least in terms of initial
1yr impact, has been the establishment of a Clinical Investigation Seminar
1yr Series. This series was at first aimed at the Department of
1yr Medicine's Cardiology Fellows. However, there is currently about an
1yr equal mix of Fellows and faculty from several Divisions (Cardiology,
1yr Nephrology, Gastroenterology, General Medicine) and three Departments,
1yr including the Pediatric Cardiology Division. The seminars are
1yr primarily addressed to issues related to epidemiology, biostatistics,
1yr and Preventive Cardiology. A copy of the current academic year's
1yr schedule is attached in the Appendices, p. 11. As can be seen from
1yr the schedule, we have incorporated our VISITING PROFESSOR Program into
1yr this series. We have met with enthusiastic response from all involved
1yr parties and now have a stable attendance of 15 to 20 (at times 30 to 40)
1yr persons. We plan to repeat this series again next year with slight
1yr revisions. At the suggestion of Dr. James B. Wyngaarden, Chairman
1yr of the Department of Medicine, we will seek the involvement of Fellows
1yr and faculty from all Divisions within the Department. Similarly, we
1yr will seek the participation of fellows and faculty from all Divisions
1yr within Pediatrics.
1yr

1yr III. Faculty Training
1yr
1yr The bimonthly Clinical Investigation Seminar Series incorporates PCAA
1yr VISITING PROFESSORSHIPS. The series has continued to expand since its
1yr inception last year. Although it was initially addressed primarily to
1yr cardiology fellows in Medicine, this year we have diversified topics
1yr well as audience. This year we have joined with Dr. Seymour
1yr Grufferman (Department of Pediatrics), a recipient of an Academic
1yr Award in Preventive Oncology, to make these seminars more oriented
1yr toward prevention medicine in both cardiology and oncology. Our
1yr audience consists of faculty (including many senior faculty members)
1yr and fellows, and we have had a stable audience of approximately 30 to 35
1yr for each session throughout the year. The audience response continues
1yr to be enthusiastic and our Seminars are gaining wide acceptance and
1yr recognition as a new interdisciplinary activity at Duke of high
1yr academic quality. Our first speaker for this year was Dr. James B.
1yr Wyngaarden, Chairman of the Department of Medicine at Duke. His
1yr participation has provided the Series greater visibility, prestige and
1yr audience attraction. We feel that this Seminar series provides us
1yr with an effective means of engaging the Duke faculty's interest and
1yr support in preventive cardiology and preventive oncology via
1yr nationally known speakers and provocative discussions. A copy of this
1yr year's schedule is appended (pp.21-22).
1yr

2yr III. Faculty Training
2yr
2yr The bi-monthly Clinical Investigation Seminar Series incorporates PCAA
2yr VISITING PROFESSORSHIPS. The series has continued to expand since its

2yr inception last year. Although it was initially addressed primarily to
2yr cardiology fellows in Medicine, this year we have diversified topics as
2yr well as audience. This year we have joined with Dr. Seymour Grufferman
2yr (Department of Pediatrics), a recipient of an Academic Award in Preventive
2yr Oncology, to make these seminars more oriented toward prevention medicine
2yr in both cardiology and oncology. Our audience consists of faculty
2yr (including many senior faculty members) and fellows, and we have had a
2yr stable audience of approximately 30-35 for each session throughout the
2yr year. The audience response continues to be enthusiastic and our Seminars
2yr are gaining wide acceptance and recognition as a new interdisciplinary
2yr activity at Duke of high academic quality. Our first speaker for this year
2yr was Dr. James B. Wyngaarden, Chairman of the Department of Medicine at
2yr Duke. His participation has provided the Series greater visibility,
2yr prestige and audience attraction. We feel that this Seminar series
2yr provides us with an effective means of engaging the Duke faculty's interest
2yr and support in preventive cardiology and preventive oncology via nationally
2yr known speakers and provocative discussions. A copy of this year's schedule
2yr is appended (.21-22).
2yr

3yr D. Faculty Training in Preventive Cardiology
3yr
3yr We have continued to expand our VISITING PROFESSOR program in the form
3yr of a regularly scheduled bimonthly faculty and subspecialty fellows
3yr seminar series called The Clinical Investigation Seminar Series. This
3yr year, we are able to offer CME Category I credit to our participants.
3yr We have a stable audience attendance of approximately 40 persons per
3yr session (mostly faculty), a tremendous growth compared to the 10 to 15
3yr regular attenders of the two previous years. We are appending this
3yr year's schedule as Appendix G. In addition, we offered a brief but
3yr intense modular course in epidemiology and biostatistics as a review
3yr and update session for our faculty and fellows. Approximately 25
3yr persons participated in this course. Our audience ranged from full
3yr professors to fellows. Again, CME credit was offered. We now have a
3yr full time teaching assist ant, 25% of whose effort is funded by our
3yr PCAA. The other 75% of support is from an Andrew W. Mellon
3yr Foundation grant in Clinical Epidemiology to Duke.
3yr

3yr A VISITING PROFESSOR program is established

4yr We have continued to expand our VISITING PROFESSOR program in the form
4yr of a regularly scheduled bimonthly faculty and subspecialty fellows
4yr seminar series called The Clinical Investigation Seminar Series. We
4yr continue to offer CME Category I credit to our participants. We have
4yr a stable audience attendance of approximately 40 persons per session
4yr (mostly faculty). We are appending this year's schedule as Appendix
4yr E. In addition, we offer a brief intense modular course in
4yr epidemiology and biostatistics as a review and update session for our
4yr faculty and fellows. Approximately 27 persons participated in this
4yr course. Our audience ranged from full professors to fellows. Again,
4yr CME credit was offered. We now have a fulltime teaching assistant,
4yr 25% of whose effort is funded by our PCAA. The other 75% of support
4yr is from an Andrew W. Mellon Foundation grant in Clinical Epidemiology
4yr to Duke.

-DOCUMENT-
HL00641
-NUMBER-
K07-HL00641
-TITLE-
Preventive Cardiology Academic Award
-PI-
Hutchinson, Richard G. MD
-PIBIRTH-
08/18/33
-PIDISCIPLINE-
Adult
-INSTITUTION-
University of Mississippi, Jackson, MS
IPF=5390304
AAMC=147
-INSTTYPE-
Public
-DISPOSITION-
Complete
-FUNDING-
$293,485.00
-DURATION-
07/01/79 to 06/30/84

app The primary objective of our program during 1983/84 will be to convey
app to medical students the importance and relevance of preventive
app cardiology to clinical medicine and to teach them as much as possible
app about the practice of primary, secondary, and tertiary prevention. A
app subordinate goal will be to impart similar knowledge to medical
app house officers and senior staff.

app As supplementary means toward attaining our principal goals, VISITING
app PROFESSORS (consultants) will be invited to campus t give lectures and
app to critique our program.

app Funds will be
app sought for continuing the VISITING PROFESSOR (consultant) programs
app Alternative financial resources include
app state funds and assistance from the pharmaceutical industry with
app financing visiting professors.

app Two VISITING PROFESSORS are to be brought to the campus as consultants
app in Academic Year 1983/84. In their capacities as consultants, they
app will lecture and hold conferences for students, house staff and faculty
app and conduct an informal critique of our preventive cardiology program.
app Such consultant visits serve to focus widespread local attention on
app the subject preventive cardiology and are vital to our program. In

At the
app houseofficer level, a series of preventive cardiology conferences are
held and dietician rounds on each medical service have been instituted with emphasis on
app cardiovascular diets. Additionally, GUEST SPEAKER consultants are invited to
app the campus regularly for lectures and conferences.

App C ms 4

UNIVERSITY OF MISSISSIPPI

app GUEST SPEAKERS:
app
app Doctor Nemat Borhani, Professor and Chairman, Department of Preventive
app Medicine, University of California, Davis was brought to the campus as
app Visiting Consultant and conducted a series of highly informative lectures
and conferences for students, housestaff and faculty. These activities
included two lectures in preventive cardiology to combined sessions of
the freshmen and sophomore classes, a conference for medical residents
and third year students, a conference for cardiology fellows and a
lecture at medical grand rounds. These activities
app added much to the enrichment of our program.
ap

App B me 2/1

sum We will also selectively videotape GUEST LECTURERS for future use.
These materials will be sum used for classroom instruction and as self
instructional materials for students, sum houseofficers, and faculty.

1yr GUEST SPEAKERS:
1yr
1yr Through the preventive cardiology program, several internationally
1yr renowned speakers have been brought to the campus, specifically Dr.
1yr George Mann of Vanderbilt University (cosponsored with the Department
1yr of Preventive Medicine) and Dr. Jeremiah Stamler of Northwestern.
1yr Dr. Mann visited our campus in the fall of 1979 and Dr. Stamler in
1yr the spring of 1980. These renowned guests together with local experts
1yr and faculty members have provided the above housestaff conferences as
1yr well as the lectures and conferences given our students as described
1yr previously.
1yr

1yr GUEST SPEAKERS:
1yr
1yr Through the preventive cardiology program several internationally
1yr renowned speakers have been brought to the campus and, together with
1yr local experts, have provided the above housestaff conferences as well
1yr as lectures and conferences for students.
1yr

2yr GUEST SPEAKERS:
2yr
2yr Doctor Nemat Borhani, Professor and Chairman, Department of Preventive
2yr Medicine, University of California, Davis was brought to the campus as
2yr a Visiting Consultant and conducted a series of highly informative
2yr lectures and conferences for students, housestaff and faculty. These
2yr activities included two lectures in preventive cardiology to combined
2yr sessions of the freshmen and sophomore classes, a conference for
2yr medical residents and third year students, a conference for cardiology
2yr fellows and a lecture at medical grand rounds. These activities added
2yr much to the enrichment of our program.
2yr

guest consultants invited this year to our campus (see
3yr VISITING PROFESSORS) presented special conferences for the medicine
3yr residents and for the cardiology fellows as part of their consulting
3yr responsibilities.

we continued our visiting consultant program this year
4yr with conferences presented for the benefit of our housestaff,
4yr students, and senior staff (see VISITING PROFESSORS below).
4yr
4yr VISITING PROFESSORS:
4yr
4yr During the academic year 1982/83, we continued our program of VISITING
4YR PROFESSORS (consultants) having as our guest Doctor Bill Friedewald,
4yr Associate Director for Clinical Applications and Prevention Programs
4yr at the National Heart, Lung and Blood Institute. Among his activities

4yr while on campus, Doctor Friedewald lectured to the freshman students
4yr giving them an overview of the role of clinical cardiovascular trials
4yr as they relate to the practice of medicine and conducting a conference
4yr for University Medical Center housestaff, senior staff, and students
4yr during which he discussed controversial findings stemming from the
4yr recently completed Multiple Risk Factor Intervention Trial (MRFIT).
4yr It is our practice with each consultant visit to request comments and
4yr suggestions on how we might improve our program.
4yr
4yr

The VISITING PROFESSOR program will be reduced to one per
fin year and will use a combination of University funds and pharmaceutical
fin industry sponsorship.

-DOCUMENT-
HL00621
HL01025
-NUMBER-
K07-HL01025
K07-HL00621
-TITLE-
Preventive Cardiology Academic Award
-PI-
Strong, William B. MD
-PIBIRTH-
11/02/36
-PIDISCIPLINE-
Pediatric
-INSTITUTION-
Medical College of Georgia, Augusta, GA
IPF=0676605
AAMC=124
-INSTTYPE-
Public
-DISPOSITION-
Complete
-FUNDING-
$314,149.00
-DURATION-
07/01/79 to 06/30/84

3yr III. Prevention Day 1981
3yr
3yr Carry over funds from 1980/81 helped to underwrite the expenses of
3yr Prevention Day 1981.. Four GUEST SPEAKERS (Appendix 3) addressed the
3yr incoming freshman medical students during their orientation period.
3yr One half of the students also volunteered to have their aerobic power
3yr assessed by a 12 minute run for distance (Results Appendix 4). The
3yr experience gained from Prevention Day 1980 and Prevention Day 1981 has
3yr enabled us to formulate a better directed, more personal program for
3yr 1982.
3y

-DOCUMENT-
HL00663
-NUMBER-
K07-HL00663
-TITLE-
Preventive Cardiology Academic Award
-PI-
Fraser, Gary E. MD
-PIBIRTH-
02/13/46
-PIDISCIPLINE-
Adult
-INSTITUTION-
Loma Linda University, School of Medicine, Loma Linda, CA
IPF=4562901
AAMC=143
-INSTTYPE-
Private
-DISPOSITION-
Complete
-FUNDING-
$302,032.00
-DURATION-
07/01/80 to 06/30/85

app The purpose of the Preventive Cardiology Academic Award at Loma
app University is to improve the undergraduate and postgraduate teaching
app in preventive cardiology. We seek to accomplish this by a lecture
app series in sophomore year on cardiovascular epidemiology and also
app clinical applications. In senior year students participate in a
app behavioral, risk factor oriented cardiac rehabilitation program. The
app awardee is responsible for 8 to 12 senior students on a one or more month
app elective in preventive cardiology. In addition he gives a regular
app session to residents and fellows in the cardiology department. Two or
app three distinguished GUEST LECTURERS are also brought to our campus
app each year. The awardee is also developing a textbook, with the help
app of others, in this discipline.
app

1yr f) To bring to Loma Linda University two nationally recognized GUEST
1yr LECTURERS to talk to both students and faculty.
1yr

2yr vi) To bring to Loma Linda two nationally recognized GUEST LECTURERS
2yr to talk to both faculty and students.

3yr viii) To bring to Loma Linda two nationally recognized GUEST LECTURERS
3yr for faculty and students.

4yr viii) To bring to Loma Linda two nationally recognized GUEST LECTURERS
4yr for faculty and students.
4yr
4y

-DOCUMENT-
HL00610
-NUMBER-
K07-HL00610
-TITLE-
Preventive Cardiology Academic Award
-PI-
Lasser, Norman L. Ph.D.
-PIBIRTH-
06/28/33
-PIDISCIPLINE-
Adult
-INSTITUTION-
New Jersey Medical School, College of Medicine and Dentistry, Newark, NJ
IPF=0714202
AAMC=170
-INSTTYPE-
Public
-DISPOSITION-
Complete
-FUNDING-
$324,197.00
-DURATION-
07/01/79 to 06/30/84

Students will continue, of
app course, to receive their current lectures in behavior therapy, addictive
app behavior, psychiatric epidemiology, and obsessive compulsive behavior.
app They will also continue to be able, if they wish, to attend any of the
app series of GUEST LECTURES which are currently being given by the Department
app of Psychiatry, as well as any of the series of seminars planned as part of
app the postdoctoral training course in the "Behavioral Aspects of Coronary
app Heart Disease Prevention" proposed and pending funding by NIH.

app In addition, as also stated elsewhere, a series of distinguished GUEST
app LECTURES in preventive cardiology will be established. These will occur
app every two months and monthly where possible. A list of GUEST LECTURERS and
app potential topics is found on the following page. Letters documenting the
app agreement of these lecturers to participate in teaching at the New Jersey
app Medical School are found in the Appendix. These lectures will not always
app be in the same form, i.e., they make take place as part of Medical Grand
app Rounds, as a school wide lecture, as a seminar for students and residents
app taking part in the electives, etc. Where possible, use will be made of
app concurrently available funds from other sources, such as the proposed
app Primary Health Care Training Program, to facilitate as many distinguished
app lecturers as possible with the funds available.
app

um The proposed program includes (a) medical school curriculum, (b)
sum residency training, (c) library and audio visual aids, (d) GUEST
sum LECTURE series, (e) postdoctoral training program, (f) preventive
sum cardiology residency training program, (g) fellowship program, and (h)
sum seminar program.
sum

su
NEW JERSY MEDICAL SCHOOL

A series of distinguished GUEST LECTURES in preventive cardiology will
sum be established to occur every two months. Commitments from several
sum speakers have been received in letters attached to the application.

2yr Annual Symposium and periodic GUEST SPEAKERS at Grand Rounds, etc.

4yr The enrichment program has continued at an expanded level. John Nash,
4yr a post doctoral psychology trainee, has taken responsibility for this
4yr series, and they began earlier in the academic year this time. There
4yr have been a number of extra afternoon seminars of a more technical
4yr nature given by VISITING SPEAKERS for our group, and the visit of many
4yr of these speakers has been the occasion for social functions at which
4yr the participants in the Preventive Cardiology program have had an
4yr opportunity for informal exchange for GUEST LECTURERS. This series
4yr has remained extremely popular, and the quality of the speakers has
4yr been commented upon by other faculty members to the Awardee.
4

4yr In the second year, while continuing current components, we shall also
4yr try to arrange, at the Department's request, for a GUEST LECTURER in
4yr the Preventive Medicine Lecture Series, to talk on the subject of
4yr exercise and cardiac rehabilitation. At their request, we may add at
4yr least one such speaker to our Noon Seminar Series this year. One or
4yr more lectures will most likely be added to the second year curriculum
4yr to cover nutrition as it relates to coronary heart disease prevention.
4yr These will take place either as part of the core nutrition series or
4yr will be added to Introduction to Clinical Sciences. It would
4yr currently appear most appropriate that these be a part of the core
4yr nutrition lecture series.

-DOCUMENT-
HL01115
-NUMBER-
K07-HL01115
-TITLE-
Preventive Cardiology Academic Award
-PI-
Cohen, Jerome D. MD
-PIBIRTH-
07/17/39
-PIDISCIPLINE-
Adult
-INSTITUTION-
St. Louis University, School of Medicine, St. Louis, MO
IPF=7915401
AAMC=164
-INSTTYPE-
Private
-DISPOSITION-
Complete
-FUNDING-
$401,687.00
-DURATION-
07/01/83 to 07/01/88

A Preventive Cardiology library and
app VISITING PROFESSORSHIP will be established. It is planned to develop, implement
app and improve these curricular components over a period of five years after which
app they will be continued and supported by St. Louis University.
app

app St. Louis University will establish an annual VISITING PROFESSOR in
app Preventive Cardiology. Over the course of two days, the
VISITING PROFESSOR, of
app national prominence, will meet with the housestaff, students and faculty to
app discuss cases and topics related to his/her expertise within the area of
app prevention of cardiovascular disease. This will occur in both formal and
app informal settings with large and small groups, including medical Grand Rounds,
app which will be devoted to topics in preventive cardiology twice a year.
app

The VISITING PROFESSORSHIP in Preventive Cardiology will
1yr be continued.

1yr C. VISITING PROFESSOR in Preventive Cardiology
1yr
1yr Plans are now complete for the First Annual VISITING PROFESSOR in
1yr Preventive Cardiology which will be May 3/4, 1984. Dr. Jeremiah
1yr Stamler of Northwestern University Medical School has agreed to serve
1yr in this important undertaking which will culminate the academic year's
1yr PCAA activities. Special lectures will focus on diet cholesterol and
1yr CHD and on the issues relating to the treatment of "mild hypertension.
1yr In addition, smaller conferences are planned to include students,
1yr housestaff, cardiology fellows and members of the Cardiology Division.
1yr This professorship will be an annual event at the Medical Center. Dr.
1yr Stamler has agreed to review the educational activities related to the
1yr PCAA and his feedback will provide an important evaluation of the
1yr program and the basis for continued growth and improvement in the

1yr coming year.

ST. LOUIS UNIVERSITY

Several grand rounds were devoted to topics in Preventive
2yr Cardiology and the VISITING PROFESSOR in Preventive Cardiology was Dr.
2yr Henry Blackburn whose visit was a great success. It was thus a
2yr productive year for activities related to the PCAA, and it is planned
2yr to continue these activities in the 1985/1986 academic year.
2yr

2yr C. VISITING PROFESSOR in Preventive Cardiology
2yr
2yr Plans are complete for the second VISITING PROFESSOR in Preventive
2yr Cardiology which will be April 25/26, 1985. Dr. Henry Blackburn of
2yr the University of Minnesota has agreed to this important undertaking
2yr which will culminate the academic year's PCAA activities. A special
2yr lecture will focus on "Coronary Disease Prevention: Population
2yr Strategies", and Medical Grand Rounds will be the forum for "Coronary
2yr Heart Disease: Evolution and Culture". (See Appendix 7) In addition,
2yr smaller conferences are planned to include students, housestaff,
2yr cardiology fellows and members of the Division of Cardiology. This
2yr professorship is an annual event at the Medical Center and is
2yr supported by the PCAA. Dr. Blackburn has agreed to review the
2yr educational activities related to the PCAA and his feedback will
2yr provide important evaluation of the program and the basis for
2yr continued growth and improvement in the coming year. The Visiting
2yr Professor lectureship will be sponsored as part of the PCAA activities
2yr in 1985/1986.

Several grand rounds were devoted to topics in
3yr Preventive Cardiology and the VISITING PROFESSOR in Preventive
3yr Cardiology was Dr. William Castelli whose visit was a great success.
3yr It was thus a productive year for activities related to the PCAA, and
3yr it is planned to continue these activities in the 1986/1987 academic
3yr year.

Additional lectures which were added previously because of the
3yr PCAA include diet, lipids and atherosclerosis (2 hours, Dr. Cohen);
3yr salt and hypertension (1 hour, Dr. Cohen) and obesity (1 hour, Dr.
3yr Cohen). VISITING PROFESSOR in Nutrition,

3yr C. VISITING PROFESSOR in Preventive Cardiology
3yr
3yr Plans are complete for the third VISITING PROFESSOR in Preventive
3yr Cardiology which will be April 24/25, 1986. Dr. William P. Castelli
3yr of the Framingham Heart Study has agreed to this important undertaking
3yr which will culminate the academic year's PCAA activities. A special
3yr lecture will focus on "Obesity, Blood Lipids and Coronary Disease
3yr Prevention", and Medical Grand Rounds will be the forum for "How to
3yr Avoid Your Upcoming Heart Attack" (See Appendix J). In addition,
3yr smaller conferences are planned to include students, housestaff,
3yr cardiology fellows and members of the Division of Cardiology as well
3yr as a case presentation with dietitians, students and interns from the
3yr St. Louis University School of Allied Health Professions. This
3yr professorship is an annual event at the Medical Center and is
3yr supported by the PCAA. Dr. Castelli has agreed to review the
3yr educational activities related to the PCAA and his feedback will
3yr provide important evaluation of the program and the basis for
3yr continued growth and improvement in the coming year. The Visiting
3yr Professor lectureship will be sponsored as part of the PCAA activities
3yr again in 1986/1987.
3

Several grand
4yr rounds were devoted to topics in Preventive Cardiology and the
4yr VISITING PROFESSOR in Preventive Cardiology was Dr. William T.
4yr Friedewald whose visit was a great success. It was thus a very
4yr productive year for all activities related to the PCAA. It is planned

4yr to continue these activities in the 1987/88 academic year, and propose
4yr for their continuation after expiration of the award in July, 1988.

4yr C. VISITING PROFESSOR in Preventive Cardiology
4yr
4yr Plans are complete for the fourth Annual VISITING PROFESSOR in
4yr Preventive Cardiology which will be April 30 to May 1, 1987. The fourth
4yr Annual VISITING PROFESSOR in Preventive Cardiology will be Dr.
4yr William Friedewald, Associate Director for Disease Prevention at the
4yr National Institutes of Health. His presentations will include a
4yr special evening lecture "Cardiovascular Disease Prevention: An
4yr Update", a morning forum on "The National Cholesterol Education
4yr Program" as well as Medical Grand Rounds "The Rise and Fall of
4yr Coronary Heart Disease" (Appendix F). In addition, smaller
4yr conferences are planned to include students housestaff, cardiology
4yr fellows and members of the Division of Cardiology as well as a case
4yr presentation with dietitians, students and interns from the St. Louis
4yr University School of Allied Health Professions. This professorship is
4yr an annual event at the Medical Center and is supported by the PCAA.
4yr Dr. Friedewald has agreed to review the educational activities
4yr related to the PCAA and his feedback will provide important evaluation
4yr of the program and the basis for continued growth and improvement in
4yr the coming year. The Visiting Professor lectureship will be sponsored
4yr as part of the PCAA activities again in 1987/1988.
4yr

fin The fifth annual VISITING PROFESSOR in Preventive Cardiology will be Dr.
fin Richard Carleton, from Brown University. His presentations will include a
fin special evening lecture; a morning forum as well as Department of Medicine
fin Medical Grand Rounds.
fin
fin Through the PCAA, the Annual VISITING PROFESSOR in Preventive Cardiology
fin lecture series has been established. The VISITING PROFESSORS have reviewed
fin the educational activities related to the PCAA and provided important
fin evaluation of the programs. The Department of Medicine Grand Rounds serves as
fin the focus and special seminars and lectures are also given.
fin

fin Efforts to fund the VISITING PROFESSOR of Preventive Cardiology are
underway.

-DOCUMENT-
HL01114
-NUMBER-
K07-HL01114
-TITLE-
Preventive Cardiology Academic Award
-PI-
Castle, Hilmon C. MD
-PIBIRTH-
02/15/28
-PIDISCIPLINE-
Pediatric
-INSTITUTION-
University of Utah, School of Medicine, Salt Lake City, UT
IPF=8700101
AAMC=177
-INSTTYPE-
Public
-DISPOSITION-
Complete
-FUNDING-
$481,989.00
-DURATION-
07/01/83 to 07/01/88

3yr The system for receiving and disseminating information about
3yr preventive cardiology activity in all departments, especially grand
3yr rounds in Internal Medicine, Family Practice, and Pediatrics, and
3yr VISITING PROFESSORSHIPS was established and is being further refined
3yr for its full potential to be met.

4yr Program announcements and information regarding subjects relevant to
4yr preventive cardiology presented in Grand Rounds in each of the
4yr clinical departments. VISITING PROFESSORSHIPS and faculty who present
4yr lectures, seminars, and conferences on subjects relevant to preventive
4yr cardiology are communicated through the preventive cardiology office.
4yr Information received is not always complete but a continuous effort is
4yr made to inform all the faculty and trainees about preventive
4yr cardiology activities.
4

-DOCUMENT-
HL00613
-NUMBER-
K07-HL00613
-TITLE-
Preventive Cardiology Academic Award
-PI-
Sparrow, Albert W. MD
-PIBIRTH-
02/07/33
-PIDISCIPLINE-
Adult
-INSTITUTION-
Michigan State University, East Lansing, MI
IPF=5245901
AAMC=196
-INSTTYPE-
Public
-DISPOSITION-
Complete
-FUNDING-
$326,492.00
-DURATION-
07/01/79 to 06/30/84

sum
sum
s

H. Continue to support and recruit VISITING PROFESSORS and consultants in preventive cardiology.

4yr
4yr
4y

H. Continue to support and recruit VISITING PROFESSORS and consultants in preventive cardiology.

fin
fin
f

8. Continue to support and recruit VISITING PROFESSORS and consultants in preventive cardiology.

-DOCUMENT-
HL01191
-NUMBER-
K07-HL01191
-TITLE-
Preventive Cardiology Academic Award
-PI-
Riemenschneider, Thomas A. MD
-PIBIRTH-
09/03/36
-PIDISCIPLINE-
Pediatric
-INSTITUTION-
Case Western Reserve University, Cleveland, OH
IPF=0218601
AAMC=186
-INSTTYPE-
Private
-DISPOSITION-
Complete
-FUNDING-
$301,901.00
-DURATION-
07/01/83 to 06/30/88

[redacted]

1yr e) In March 1984, Dr. Riemenschneider served as VISITING PROFESSOR at
1yr the University of Nebraska Medical Center spending an entire day
1yr teaching on "Principals of Preventive Cardiology".

2yr f) VISITING PROFESSOR Dr. Riemenschneider served as VISITING
2yr PROFESSOR during the year at:
2yr
2yr 1. State University of New York Upstate Medical Center
2yr
2yr 2. University of Rochester School of Medicine
2yr
2y

-DOCUMENT-
HL01120
-NUMBER-
K07-HL01120
-TITLE-
Preventive Cardiology Academic Award
-PI-
Van Citters, Robert L. MD
-PIBIRTH-
01/20/26
-PIDISCIPLINE-
Adult
-INSTITUTION-
University of Washington, Seattle, WA
IPF=9087701
AAMC=183
-INSTTYPE-
Public
-DISPOSITION-
Complete
-FUNDING-
$477,604.00
-DURATION-
07/01/83 to 07/01/88

2yr Dr. Thomas Pearson, Johns Hopkins University, was VISITING PROFESSOR this
2yr year. Dr. Pearson presented cardiology grand rounds, conducted a health
2yr policy graduate seminar, reviewed and critiqued the activities of our PCAA
2yr program and was particularly helpful in sharing his experience in the
2yr development of a preventive cardiology clinic with members of the hospital
2yr administration.

-DOCUMENT-
HL01113
-NUMBER-
K07-HL01113
-TITLE-
Preventive Cardiology Academic Award
-PI-
Pearson, Thomas MD
-PIBIRTH-
10/21/50
-PIDISCIPLINE-
Adult
-INSTITUTION-
Johns Hopkins University, Baltimore, MD
IPF=4134401
AAMC=133
-INSTTYPE-
Private
-DISPOSITION-
Complete
-FUNDING-
$298,475.00
-DURATION-
12/01/84 to 12/01/87

1yr e. The Preventive Cardiology Component of the Cardiology Elective
1yr
1yr The didactic session will be changed to be more varied and on topics
1yr of common interest with GUEST SPEAKERS.

2yr e. The Preventive Cardiology Component of the Cardiology Elective
2yr
2yr The didactic session will be changed to be more varied and on topics of
2yr common interest with GUEST SPEAKERS.
2

3yr f. The Preventive Cardiology Component of the Cardiology Elective
3yr
3yr With the advent of a training program in Preventive Cardiology (see 3. p),
3yr the didactic session will be changed to be more varied topics of common
3yr interest with GUEST SPEAKERS. This will serve them as both a review a
3yr research seminar in cardiovascular
3yr

4yr With the advent of a training program in Preventive Cardiology (see 3. p).
4yr the didactic session now covers more varied topics of common interest with
4yr GUEST SPEAKERS. This serves as both a review session as well as a research
4yr seminar in cardiovascular prevention.
4

-DOCUMENT-
HL00827
-NUMBER-
K07-HL00827
-TITLE-
Preventive Cardiology Academic Award
-PI-
Ayers, Carlos R. MD
-PIBIRTH-
04/02/32
-PIDISCIPLINE-
Adult
-INSTITUTION-
University of Virginia, School of Medicine, Charlottesville, VA
IPF=8975602
AAMC=181
-INSTTYPE-
Public
-DISPOSITION-
Complete
-FUNDING-
$528,338.00
-DURATION-
07/01/81 to 06/30/86

sum The program will include specific courses, clinical elective
sum rotations, and participation in various clinical programs aimed at
sum prevention of cardiovascular diseases. Clinics are designed for risk
sum factor screening and reduction. A VISITING PROFESSOR program is
sum proposed. Responsibility for the program will be given to Dr. Carlos
sum R. Ayers, who is trained in clinical cardiology, and in addition, has
sum extensive experience in research and prevention of h.hypertension.
sum This is a well organized proposal, with a broad base of support from
sum the school. It is felt that the program will succeed and the stated
sum goals will be achieved. Approval is recommended with high enthusiasm.

PCAA DOCUMENT ANALYSIS

PRELIMINARY REPORT

COMPUTER ASSISTED INSTRUCTION

SEARCH TERMS: CAI or (Computer adj Assisted)

RATIONALE:

This search is being conducted to determine the extent to which computer assisted instruction was utilized as a teaching methodology for preventive cardiology. How many awards listed development of preventive cardiology CAI programs as a goal in the application or summary statement? How many of the CAI programs listed as goals were actually implemented? What was the content of these programs? At what level of the curriculum were CAI programs utilized? Were CAI programs evaluated for effectiveness in providing instruction? What are the titles of the CAI programs produced? Were these programs made available to other PCAA's and/or to other medical schools?

DATE: MARCH 26, 1990

OBJECTIVES OF THE PREVENTIVE CARDIOLOGY ACADEMIC AWARD:

1. ENCOURAGE DEVELOPMENT OF A HIGH-QUALITY PREVENTIVE CARDIOLOGY CURRICULUM IN SCHOOLS OF MEDICINE AND OSTEOPATHY THAT WILL SIGNIFICANTLY INCREASE THE OPPORTUNITIES FOR STUDENTS AND HOUSESTAFF TO LEARN BOTH THE PRINCIPLES AND PRACTICE OF PREVENTIVE CARDIOLOGY;

2. DEVELOP PROMISING FACULTY WHOSE INTEREST AND TRAINING ARE IN PREVENTIVE CARDIOLOGY TEACHING AND RESEARCH;

3. DEVELOP ESTABLISHED FACULTY WHO HAVE A MAJOR COMMITMENT TO, AND POSSESS EDUCATIONAL SKILLS FOR, TEACHING PREVENTIVE CARDIOLOGY;

4. FACILITATE INTERCHANGE OF EDUCATIONAL IDEAS AND METHODS AMONG AWARDEES AND INSTITUTIONS; AND

5. DEVELOP AT THE GRANTEE INSTITUTION THE ABILITY TO STRENGTHEN CONTINUOUSLY THE IMPROVED PREVENTIVE CARDIOLOGY CURRICULUM, WITH LOCAL FUNDS, SUBSEQUENT TO THE AWARD.

PCAA DOCUMENT ANALYSIS
PRELIMINARY REPORT
3/26/90

COMPUTER ASSISTED INSTRUCTION

How many awards listed development of preventive cardiology CAI programs as a goal in the application or summary statement?

Three (3) of the twenty-six awards included in this analysis listed development of computer assisted instruction as a goal in their application; the University of Iowa, the University of Minnesota, and Mt. Sinai School of Medicine. Both the University of Iowa and the University of Minnesota described extensive development programs and proposed use of CAI programs to provide a large portion of the core curriculum in preventive cardiology. The University of Iowa described plans for the immediate development and evaluation of three CAI modules, while the University of Minnesota proposed development of twenty three (23) modules over the course of the grant. The application from Mt. Sinai School of Medicine listed development of vaguely defined CAI programs to augment instruction and evaluation of students in an elective preventive cardiology clinical rotation.

Two other awards, Boston University and Loma Linda University listed development of CAI programs as a goal in their third year and first year progress reports respectively.

How many of the CAI programs listed as goals were actually implemented?

From the information presented in the progress reports and the terminal reports, three (3) computer assisted instructional programs on preventive cardiology topics were implemented.

Two programs were developed by the University of Iowa, one program on "Essential hypertension in Adolescents" and another on "Familiar Hyperlipidemia Type II". The hypertension program apparently went through several stages of testing and development, resulting in several versions or editions of this program. The program was utilized in the pediatric clerkship for third year medical students. The Familiar Hyperlipidemia Type II module was also referenced as "Children at Risk for Coronary Artery Disease". Presumably, this program was also utilized during the pediatric clerkship, although this is not clear in any of the progress reports.

One program, "Heart and Great Vessels", was produced by the University of Minnesota and implemented as part of an anatomy course for first year students. From the description given in the progress report, it is unclear whether this CAI program was used on an on-going basis.

Note: The University of Minnesota application stated that development of CAI programs would require 100 hours of development time for each hour of instruction. The model described for the CAI programs estimated the instructional time for each module to average

2.5 hours. By their own estimate, the development time required to complete the 23 modules listed in the application would be 5,750 hours – nearly three years working full time (40 hours/week). Given the content expertise required for each module, the requirements for instructional design and field testing, and the lack of an existing authoring system, even the estimate of three years required to complete 57.5 hours of CAI instruction is probably unrealistic. Therefore, it was not surprising that only one of the 23 planned modules was completed.

What was the content of these programs?

The University of Iowa programs focused on risk factors in the pediatric population. The hypertension module consisted of an interactive tutorial and a case management problem with history, physical exam, laboratory studies, differential diagnosis, and management components. The case management problem involved a 16 year old patient with high blood pressure. The hyperlipidemia module was described in less detail, but apparently involved identification of familiar hyperlipidemia as a risk factor in the pediatric population.

The University of Minnesota program involved the anatomy of the heart and great vessels. The model for the program is described as "a menu offering a quiz, a case history and a series of drills and tutorials". The Heart module is presumed to follow this format, although it is not clear how a case history would apply to instruction in basic anatomy. It is unclear if the information presented in this program was differentiated in any way from the information presented in the existing anatomy course in terms of preventive cardiology content.

At what level of the curriculum were CAI programs utilized?

At the University of Iowa, the programs were used in the pediatric clerkship for third year medical students.

At the University of Minnesota, the program was used in the anatomy course for first year medical students.

Were CAI programs evaluated for effectiveness in providing instuction?

The Hypertension module developed by the University of Iowa was extensively tested over four years. The progress reports note that the program would be modified based on the information gathered during field testing with third year students. No specific data regarding educational outcomes resulting from the CAI program were presented.

The Heart and Great Vessels program at the University of Iowa was evaluated by pre-test/post-test comparisons between experimental and control groups of students on a 20 item examination. The groups were not randomly assigned. Data for the pre-test scores were not reported. The control group used standard instructional materials while the experimental group used the CAI program in addition to standard instructional materials. A non-statistical comparison of the mean post-test scores indicated no difference between the groups. No correlation was noted between the number of hours reported studying and post-test scores. No interpretable data relative to the the educational effectiveness of the CAI program were produced by this evaluation.

What are the titles of the CAI programs produced?

"Essential Hypertension in Adolescents" – University of Iowa
"Familiar Hyperlipidemia Type II" – University of Iowa
"Heart and Great Vessels" – University of Minnesota

Were these programs made available to other PCAA's and/or other medical schools?

Distribution of CAI programs to other medical schools was discussed in the application from Ithe University of Minnesota. There is no information in the progress reports or the final report to indicate that the "Heart and Great Vessels" program was made available to other institutions.

Award Institution	CAI Goals in Application?	Curriculum level	required/ elective	Number of CAI Programs Produced
Iowa	Develop and test three CAI modules (Juvenile Hypertension, Juvenile Hyperlipedemia, Adult Risk factors for Coronary Artery Disease)	Year 3 Medical Students Pediatric Clerkship	required	2
Minnesota	Develop 23 CAI modules to be utilized as a major component of the medical school curriculum.	Year 1 and Year 2 Medical Students	required	1
Mt. Sinai	Develop CAI programs to augment instruction in the preventive cardiology elective	Year 4 Medical Students	elective	0
Boston U	No CAI goals in the Application. 3yr Progress Report lists development of CAI program on coronary heart disease prevention as a goal.	Year 3 Medical Students Internal Medicine Clerkship	required	0
Loma Linda	No CAI goals in the Application. 1yr Progress Report lists investigation of CAI as a means of teaching medical statistics as a goal.	n/a	n/a	0

Titles of CAI Programs Produced:

University of Iowa - (1) "Essential Hypertension in Adolescents" this module consists of an interactive tutorial and a case management problem with history, physical exam, laboratory studies, differential diagnosis, and management components.

(2) "Familiar Hyperlipidemia Type II" no description of this module was given, other than the author's name - Dr. Julia Lee.

University of Minnesota - "HEART AND GREAT VESSELS" - anatomy of the heart and associated vasculature for first year gross anatomy course.

PASSAGES RETRIEVED:

Preventive Cardiology Academic Award
-PI-
Mahoney, Larry MD
Schieken, Richard M. MD
-PIBIRTH-
00/00/00
05/06/39
-PIDISCIPLINE-
Pediatric
-INSTITUTION-
University of Iowa, Iowa City, IA
IPF=3972901

um COMPUTER ASSISTED INSTRUCTIONAL units are under development by
sum qualified and supportive faculty in computer technology and
sum development.

sum Concerns about the program include consideration of student acceptance
sum of the COMPUTER EDUCATION PROGRAMS. These have not been tested and
sum though planned to be administered to all medical students at some
sum point in their curriculum, the feasibility and probability of
sum achieving this end is not clear. If these modules are, as proposed,
sum to provide a large portion of the core curriculum in Preventive
sum Cardiology, the pilot testing phase is very important.

um C. Senior Elective. Jeff Boone, a fourth year medical student, has
sum scheduled a four credit hour elective in preventive cardiology for
sum this spring. He will design and implement a COMPUTER ASSISTED
sum INSTRUCTIONAL (CAI) module describing an adult at high risk for
sum coronary artery disease. He will modify our existing CAI modules into
sum a similar format and expand the data base, case material and design a
sum student evaluation format.
sum
sum D. COMPUTER ASSISTED INSTRUCTIONAL MODULE. Two CAI modules have been
sum designed which discuss juvenile essential hypertension and
sum hyperlipidemia. Both modules are being converted to a similar format
sum and style upon which subsequent modules will be based (see above for
sum planned additional CAI with senior medical student). These programs
sum will be ready for testing and evaluation by medical students during
sum the upcoming year.

um C. Test and evaluate three COMPUTER ASSISTED INSTRUCTIONAL modules.

sum C. COMPUTER ASSISTED INSTRUCTIONAL MODULES three modules will be
sum tested and evaluated and subsequently incorporated into the third year
sum medical student rotation through pediatrics. This teaching technique
sum will provide additional preventive cardiology education into the
sum medical school curriculum.

1yr III. COMPUTER ASSISTED INSTRUCTION (CAI)
1yr
1yr In November, 1981, plans to develop a COMPUTER ASSISTED INSTRUCTION
1yr program were initiated with the staff of the WEEG Computer Center at
1yr the University of Iowa.
1yr
1yr The goal is to develop an independent study program on Hypertension to
1yr be used by third year medical students. It is also intended that once
1yr the format is in place, other similar units can be added. (An
1yr additional module is currently being completed by Dr. Julia Lee on
1yr Children at Risk for Coronary Artery Disease.)
1yr
1yr A text was developed and then elements for a case example were
1yr submitted. A file was designed to include a patient history, family
1yr history and a physical examination profile.
1yr
1yr The program will be ready to test in late April 1982. Revisions will
1yr be made as necessary and the course will be given to third year
1yr medical students during their pediatric clerkship. Data and
1yr evaluation from the program will be gathered and stored in the
1yr computer.
1yr
1yr A computer terminal will be installed in Pediatrics for the convenient
1yr use of the students taking the course(s).
1yr
1yr Attached is Dr. Julia Lee's module on familiar hyperlipidemia type II.

2yr The development of the COMPUTER ASSISTED INSTRUCTIONAL module was an
2yr innovative teaching technique that certainly will be continued. Dr.
2yr Mahoney not only intends to broaden the spectrum of topics related to
2yr Pediatric Preventive Cardiology, i.e., cases involving other coronary
2yr risk factors and prevention of rheumatic fever, but with the support
2yr of members of the Advisory Board would develop modules pertinent to
2yr adult cardiology, i.e., angina, hypertension.

3yr F. COMPUTER ASSISTED INSTRUCTIONAL MODULES
3yr
3yr A CAI Module on essential hypertension in adolescents has been
3yr transferred from WEEG Computer Center to the IBM Personal Computer.
3yr We are in the process of revising and plan to test the program with
3yr first and third year medical students. The module has two components.
3yr The first is a interactive tutorial and the second is a case
3yr management with history, physical exam, laboratory studies,
3yr differential diagnosis and management components. We plan to further
3yr expand this module after receiving student input. In addition, we are
3yr simultaneously planning a CAI Module on hypercholesterolemia in
3yr childhood. It is anticipated that these modules will continue to be
3yr presented to third year medical students during their rotation in
3yr Pediatrics.

3yr G. Evaluate and expand COMPUTER ASSISTED INSTRUCTIONAL Module on
3yr Essential Hypertension and revise as necessary. Begin development of
3yr hypercholesterolemia module.

yr G. Evaluate COMPUTER ASSISTED INSTRUCTIONAL modules and revise as
3yr necessary.

3yr D. COMPUTER ASSISTED INSTRUCTIONAL MODULES convert existing modules
3yr to personal computer technology and modify accordingly. Plan senior
3yr medical student evaluation of the modules and modify accordingly.

yr e. COMPUTER ASSISTED INSTRUCTIONAL MODULES implement existing
3yr module and field test with medical students. Develop second module on
3yr hypercholesterolemia.
3

4yr F. COMPUTER ASSISTED INSTRUCTIONAL MODULES
4yr
4yr A CAI Module on essential hypertension in adolescents has been
4yr transferred from WEEG Computer Center to the IBM Personal Computer.
4yr We are in the process of revising and plan to test the program with
4yr first and third year medical students. The module has two components.
4yr The first is a interactive tutorial and the second is a case
4yr management with history, physical exam, laboratory studies,
4yr differential diagnosis and management components. We plan to further

4yr expand this module after receiving student input. In addition, we are
4yr simultaneously planning a CAI Module on hypercholesterolemia in
4yr childhood. It is anticipated that these modules will continue to be
4yr presented to third year medical students during their rotation in
4yr Pediatrics.
4yr

4yr G. Evaluate and expand COMPUTER ASSISTED INSTRUCTIONAL Module on
4yr Essential Hypertension and revise as necessary. Begin development of
4yr hypercholesterolemia module.
4yr

fin 4) A COMPUTER ASSISTED INSTRUCTIONAL module is near completion. This
fin module deals with the epidemiology of hypertension in a tutorial and
fin is followed by a case management of a 16 year old female with high
fin blood pressure. After successful piloting, this and other modules to
fin be developed will be offered to medical students and residents
fin rotating through Pediatric Cardiology.
fin
fin

Preventive Cardiology Academic Award
-PI-
Kottke, Thomas E. MD
-PIBIRTH-
09/18/48
-PIDISCIPLINE-
Adult
-INSTITUTION-
University of Minnesota, Minneapolis, MN
IPF=1450401
AAMC=146
-INSTTYPE-
Public
-DISPOSITION-
Complete
-FUNDING-
$287,860.00
-DURATION-
07/01/81 to 06/30/86

pp Work for year one of the undergraduate curriculum will continue in the
app two major areas of activity as in the past: COMPUTER ASSISTED
app INSTRUCTION module development will continue for the basic science
app curriculum related to preventive cardiology. The heart and great
app vessels module will be revised and reevaluated next Fall. The
app exercise physiology module will be finished and tested in a randomized
app trial. The CAI software driver program will be refined so that it can
app be used for case studies, drills and tutorials, or testing. This
app driver has been used by others at the University of Minnesota in their
app educational efforts and has been found to be helpful and easy to use.

Because this is a problem of acquiring a data base rather than of learning.
app skills or philosophical arguments, drill and tutorial are the most efficient
app approach to this task. Although drill and tutorial have not been feasible in
app the past because they require a one to one teacher student ratio, the development
app of COMPUTER ASSISTED INSTRUCTION (CAI) has made this learning method feasible.
app CAI is also preferable because the computer neither tires nor loses its patience,
app and CAI defines the level of knowledge expected by the school. Thus the student
app will not make the error of stopping at an unduly superficial knowledge level nor
app will he or she neglect other studies for the reason of learning the material at
app a level greater than required or expected. Educators outside of the medical
app areas have already used this technique with great success. For example, the
app Classics Department at the University of Minnesota uses CAI drill and tutorial
app to teach a course on technical language. The Health Sciences Learning Center
app is also developing the hardware capability to support CAI programs of the type

app proposed here. It is only the computer programs that need to be developed to
app take advantage of this potential innovation.
app
app Because a review of the learning resources catalogues failed to reveal the
app existence of programs such as these, prototype CAI modules on cardiac physiology,
app anatomy, histology and embryology, and on hypertension are being developed as
app models for a series of cardiovascular system learning materials. As experience
app is gained from the development of these initial modules, CAI programs will be
app developed for all Phase A and Phase B cardiovascular curriculum elements. These
app modules will be developed for the Apple II computer system so that they can be
app transported to other medical schools and other Apple II computer systems.

app At the University of Minnesota, the educational modules will be available in the
app Health Sciences Learning Center for use on the center's Apple computers. They
app will also be available for purchase at reproduction cost for medical students
app to use at home or at other sites. Each module will present a 'menu' offering
app a quiz, a case history and a series of drills and tutorials. Each menu selection
app will take about 15 minutes to complete. This time span is planned to allow the
app student to enter, complete a section, and exit within a limited time period
app for example, between classes. The quiz would be taken initially to advise the
app student where to concentrate effort and after the tutorials and drills ward to
app test for mastery. The case presentation will reinforce the importance of the
app data base, and the drill and tutorial sessions will be the major knowledge
app acquisition tool. For example, in the hypertension module the tutorial and drill
app sections will include sections on the epidemiology and impact of hypertension,
app the renin angiotensin system, the aldosterone system, secondary hypertension,
app sodium and hypertension, compliance and hypertension, drug treatment of
app hypertension, and nonpharmacological basis of treating hypertension. The report
app of the Working Group on the Training and Evaluation of Physicians in High Blood
app Pressure, "Education of Physicians in High Blood Pressure Performance
app Characteristics, Learning Objectives and Evaluation Approaches", will be used
app as the reference document for educational objectives. The entire module will
app offer 2 1/2 hours of instruction to the student.
app
app Experience with developing CAI materials suggests that one hundred hours of
app development time is required for each hour of instruction. Medical students are
app being used to develop the data base for the modules. It is expected that this
app strategy will help develop an interest in preventive cardiology by these
app students.

app CAI modules will be developed in each of the following disciplines:
app
app Phase A
app
app 1. Gross Anatomy The anatomical structure and relationships of the heart
app and great vessels.
app 2. Embryology The developmental features of the heart and great vessels.
app The relevance of embryology to congenital heart disease will be stressed.
app
app 3. Histology The histological structure of myocardium, conducting tissue
app and vascular tissues.
app
app 4. Biochemistry Lipid and carbohydrate metabolism and bioenergetics
app
app 5. Pathology Cell injury (atherosclerosis), acute and chronic inflammation
app (rheumatic valvular disease), resolution and repair, patterns of
app inflammation and shock. Also myocardial infarction and cardiomyopathy
app
app 6. Physiology Cardiovascular physiology during rest and exercise.
app Temperature regulation.
app
app 7. Pharmacology Cardiac glycosides, antiarrhythmic drugs, renin angiotensin
app system, antihypertensive drugs, diuretics, antianginal drugs,
app hypolipemics. (Drugs that act on the autonomic nervous systems or are
app used for the treatment of hypertension, angina pectoris, arrhythmias and
app congestive heart failure.)
app
app 8. Human behavior Type A behavior and stress in the pathogenesis of
app coronary heart disease and hypertension.
app

app Phase B
app
app In the second year, students are introduced to the pathophysiological basis of
app disease. Therefore, for Phase B, CAI modules will be developed which introduce
app the vocabulary and pathophysiology of the disease process. Over the period of
app the PCAA, materials will be developed for the following topics:
app
app 1. Sexuality and disability

app 2. Hypertension
app
app 3. Valvular heart disease
app
app 4. Chest pain
app
app 5. Congestive heart failure
app
app 6. Cardiovascular-epidemiology
app
app 7. Rheumatic fever
app
app 8. Syncope
app
app 9. Congenital heart disease
app
app 10. Primary myocardial disease
app
app 11. Dyspnea
app
app 12. Endocarditis
app
app 13. Peripheral arterial vascular disease
app
app 14. Heart murmur
app
app 15. Cyanosis
app

app Lynda B. Ellis, Ph.D. Associate Professor, Health Computer Sciences Computer
app Assisted Instruction (CAI) for teaching preventive cardiology concepts.

app Richard E. Poppele, Ph.D. Professor, Physiology CAI to augment the teaching
app of cardiac and exercise physiology

app Donald W. Robertson, Ph.D. Associate Professor, Anatomy CAI to augment the
app teaching of the gross anatomy of the heart

app The COMPUTER ASSISTED INSTRUCTION (CAI) modules described above are being
app developed for the Apple II computer system with the express intent of making
app these materials available to other medical schools.

pp Specific objectives for the coming year In the coming year, the major goal will
app be to implement at least four of the computer assisted instruction modules for
app the medical students.

2yr COMPUTER ASSISTED INSTRUCTION Heart and Great Vessels
2yr
2yr Thirty nine students participated in a trial which examined the
2yr practicality and feasibility of COMPUTER ASSISTED INSTRUCTION (CAI) as
2yr a study tool for gross anatomy. The group was randomized into
2yr experimental and control groups consisting of 21 and 18 students
2yr respectively. Since the amount of computer experience varied widely
2yr among the students and it was felt this might have some effect on the
2yr outcomes, the students were randomized out of blocks of approximately
2yr equal sizes: 15 claiming little or no experience ("Novices"), 11
2yr students having some experience with statistical packages ("Users"),
2yr and 13 students claiming to be able to write their own programs
2yr ("Programmers"). Demographic information collected included the
2yr students' undergraduate degree, graduate degrees, attitude toward and
2yr amount of experience with computers, and previous knowledge (clinical
2yr or lab experience) of the cardiovascular system A pretest was
2yr administered to the whole group of students. The students designated
2yr as the experimental group used the computer to study the heart and
2yr great vessels for any amount of time they desired to do so. Most of
2yr the students commented that they used other study aides in addition to
2yr the CAI. The lack of diagrams in the computer program was a
2yr frequently cited reason for needing other study materials. There was
2yr no relationship between the number of hours students spent studying
2yr and posttest scores.
2yr
2yr The 20 item posttest was administered following the thorax gross
2yr anatomy test. The posttest scores were similar for both the
2yr experimental and control groups (mean scores were 14.93 and 14.59
2yr respectively). An evaluation to elicit the students' opinion and
2yr attitude towards computer assisted instruction as a study aid for
2yr gross anatomy was given to the experimental participants.
2yr
2yr The evaluation instrument collected information using a ten point
2yr scale to assess the following: 1) the relevancy of the subject matter
2yr to student needs, 2) the organization of content, 3) the rate of
2yr development (and pace of the program), 4) the comparative value of the

2yr computer program when compared to other instructional materials, and
2yr 5) an overall rating of the program. Another scale was used to
2yr determine the scope of program content and the suitability of its
2yr length.
2yr
2yr The students who had some exposure to computers used the program
2yr readily than the novices. Students' with a B.A. rated the program
2yr higher than those with a B.S. degree in all respects listed above,
2yr and the B.A. students. tended to have a better attitude towards
2yr computers in general. The scores on the posttest, however, were not
2yr different for those with B.A.'s when compared to those with B.S.'s.
2yr The experimental group rated the relevancy of the program at 6.4 (out
2yr of 10) and the organization of content at 6.9. The overall rating the
2yr students gave the program was 5.89. Many of the students commented
2yr that CAI was a pleasant change of pace, and that it was "something
2yr new" as compared to traditional study aids, which by circumstance they
2yr have to use a great deal. Several mentioned that they would use CAI
2yr more if it could be modeled after video games many computer novices
2yr expected to see blood racing through the vessels and were disappointed
2yr when the program contained no diagrams.

2yr II. To complete the COMPUTER ASSISTED INSTRUCTION software driver and
2yr document its use for other PCAA awardees.

n A number of other programs have also been developed in association with
fin the Preventive Cardiology Academic Award. These include:
fin
fin A COMPUTER ASSISTED INSTRUCTION module for first year medical students
fin on the anatomy of the heart.
fin

Preventive Cardiology Academic Award
-PI-
Krakoff, Lawrence R. MD
-PIBIRTH-
10/10/37
-PIDISCIPLINE-
Adult
-INSTITUTION-
Mount Sinai School of Medicine of the City University of New York, New York City, NY
IPF=1605015
AAMC=801
-INSTTYPE-
Private
-DISPOSITION-
Complete
-FUNDING-
$398,919.00
-DURATION-
07/01/83 to 07/01/88

app 2. In order to augment instruction for the elective, extensive use
app will be made of computer resources. COMPUTER ASSISTED INSTRUCTION
app (CAI) will make use of existing systems in the Levy Library, OSU and
app MGH programs. However, we wish to develop our own CAI in Preventive
app Cardiology through the use of the Division of Cardiology Computer
app System. We will also adapt the HDFP patient care system provided
app through the courtesy of Dr. Wossertheil Smoller for online use in
app patient evaluation and followup. Finally, the fourth year evaluation
app will be performed on the computer terminal. We plan to administer
app this posttest in the last week of the elective, and at various times
app during the fourth year to students not taking the elective within
app class, for comparison. A second within class comparison will be made
app between students of the four year Mount Sinai School of Medicine and
app those transferring from the CUNY Sophie Davis School of Biomedical
app Science.

pp Several considerations have led us to propose that a strong
app computer based component will be a valuable part of the program. A
app large and flexible computer system is already in place in the Division
app of Cardiology. Medical students are using COMPUTER ASSISTED
app INSTRUCTION (CAI) with increasing frequency. Review of existing CAI

app programs, such as the OSU and MGH systems indicates that much
app pertinent material for a program in preventive cardiology is not
app available or is scattered throughout several different resources. We
app wish to proceed with the development of CAI programs dedicated to the
app Preventive Cardiology Program. Based upon these learning programs, a
app set of questions and test situations will be generated that will
app include the material sent to us by Dr. Ayers from the University of
app Virginia program for the development of the tests to be given to
app entering and fourth year students. Within each category of
app information to be tested (e.g., diagnosis of hyperlipidemias,
app epidemiology of cardiovascular disease, hypertension, etc.), a
app sufficient number of questions will be formulated and stored such that
app a random access approach will be created. While no two tests will
app then be identical, assessment of variability can be performed by
app having students take repeat tests. Questions will be reviewed by
app faculty of the program for suitability and the advice of Dr. Yens
app will be sought for the most meaningful form of evaluation.
app
app The existing number of terminals for the Division of Cardiology
app Computer System plus those requested in this application will permit
app students to have ready access for CAI and for evaluation. This
app obviates the need for scheduling of class wide or group wide written
app examinations, greatly increasing the flexibility of the evaluation
app system.
app
app The computer resource will also be used for instruction in decision
app analysis and assistance in patient management. For the latter, two
app programs are planned. One will permit calculation of relative risk in
app patients for whom pertinent risk factor data has been accumulated.
app The use of Framingham or pooling project statistics will be employed
app for these calculations. The computerized hypertension patient
app management program for the High Blood Pressure Detection and followup
app Program (HDFP) has been made available to us through the courtesy of
app Dr. Wassertheil Smoller. The original was written in FORTRAN for
app card based systems, prior to the development of interactive CRT
app terminals. We plan to adapt this system for use in management of
app patients with hypertension and other cardiovascular risk factors
app through terminals located in clinic areas so that data can be rapidly
app entered and retrieved.

sum A core faculty in medicine and community medicine will be formed and new
sum programs in COMPUTER ASSISTED EDUCATION will be introduced.

sum Candidate's Proposal: An educational program is designed to integrate
sum existing curricular offerings and add specific content material using
sum decision analysis and COMPUTER ASSISTED INSTRUCTION.
s

sum To facilitate instruction-in the elective, a COMPUTER ASSISTED
sum INSTRUCTION (CIA) module will be developed. Since there are no
sum existing materials, this will be developed de novo.

sum evaluation for house staff and faculty will be less systematic, but
sum the Candidate proposes, to carry out an evaluation of a sample of
sum house officers and faculty by means of COMPUTER ASSISTED INSTRUCTION
sum programs.
sum

FACILTIES AVAILABLE

sum
sum The Mount Sinai School of Medicine would make available the following
sum facilities, which Dr. Krakoff plans to utilize for his program:
sum classroom and seminar areas; library; computer facility with several
sum terminals for COMPUTER ASSISTED INSTRUCTION; general medicine clinic;
sum and a special risk assessment clinic which is being established at

1yr Implementation will be provided by the formation of a core faculty in medicine and
1yr community medicine who will work with others, and by introduction of
1yr new programs in COMPUTER ASSISTED EDUCATION. These will be used both
1yr for instruction and for evaluation of learning performance of
1yr students.

1yr The final year of the project will be devoted to a) completion of
1yr surveys for entering and graduating students, b) evaluation of
1yr developed COMPUTER ASSISTED INSTRUCTION and review programs, c)

MT. SINAI

Specific areas
2yr to be developed are: a) integration of several disciplines including
2yr epidemiology, lipid biochemistry, cardiovascular physiology and
2yr related pharmacology for focus of curriculum of the Mount Sinai School
2yr of Medicine on the overall goal, b) development of COMPUTER ASSISTED
2yr INSTRUCTION and self testing methods for implementation of the stated
2yr goals,

yr 3. Objectives for the Coming Year
2yr
2yr A. Completion of the first set of self tests for microcomputer
2yr resource and validation by suitable samples of students, house staff
2yr and faculty. Initiation of a second set of COMPUTER ASSISTED
2yr INSTRUCTION programs for micro computer resource and Division of
2yr Cardiology System.
2yr

3yr Specific areas to be developed are: a) integration of several
3yr disciplines including epidemiology, lipid biochemistry, cardiovascular
3yr physiology and related pharmacology for focus of curriculum of the
3yr Mount Sinai School of Medicine on the overall goal, b) development of
3yr COMPUTER ASSISTED INSTRUCTION and self testing methods for
3yr implementation of the stated goals,

Specific areas
4yr to be developed are: a) integration of several disciplines including
4yr epidemiology, lipid biochemistry, cardiovascular physiology and
4yr related pharmacology for focus of curriculum of the Mount Sinai School
4yr of Medicine on the overall goal, b) development of COMPUTER ASSISTED
4yr INSTRUCTION and self testing methods for implementation of the stated
4yr goals,

Specific areas
fin to be developed are: a) integration of several disciplines including
fin epidemiology, lipid biochemistry, cardiovascular physiology and
fin related pharmacology for focus of curriculum of the Mount Sinai School
fin of Medicine on the overall goal, b) development of COMPUTER ASSISTED
fin INSTRUCTION and selftesting methods for implementation of the stated
fin goals,

Preventive Cardiology Academic Award
-PI-
Stokes, Joseph MD
-PIBIRTH-
00/00/00
-PIDISCIPLINE-
Adult
-INSTITUTION-
Boston University, School of Medicine, Boston, MA
IPF=0894901
AAMC=105
-INSTTYPE-
Private
-DISPOSITION-
Complete
-FUNDING-
$340,834.00
-DURATION-
07/01/82 to 07/01/87

3yr g) The Dana Foundation has indicated interest in helping to introduce
3yr a preventive component into the third year clerkships, and the
3yr principal investigator is currently working with an ad hoc committee
3yr of the Subcommittee on Prevention to implement this plan. This will
3yr also include the development of self study carrels which will use
3yr computer assisted instruction and slide tape shows.

3yr Objective: To develop a self study unit including computer assisted
3yr instruction to teach preventive cardiology in clinical health
3yr maintenance

3yr Method: Plans for the carrel to be completed by the 04 Year

4yr software programs that had been developed and will be developed during
4yr the 05 Year regarding Health Risk Appraisal, Coronary Risk Assessment,
4yr and computer assisted instruction for self assessment in coronary
4yr heart disease prevention will be offered to other Preventive
4yr Cardiology Academic Awardees.

fin The Awardee has worked with Dr. Barry Chaiken, a Diplomat of the American
fin Board of Preventive Medicine and former Epidemiologic Intelligence Service
fin Officer of the Centers for Disease Control, in developing computer assisted
fin instruction to be used not only as part of a preventive component of the third
fin year medical clerkship at the University Hospital but also for students

fin enrolled in a School of Public Health course on The Epidemiology of
fin Cardiovascular Disease (SPH/EB 816) (*). The Awardee also continues to use
fin the Coronary Risk Assessment software developed by DMCubed (*).

fin d. To continue the development of computer assisted health and coronary risk
fin assessment programs and computer assisted instruction for BUSM and BU/SPH
fin students (with the assistance of Dr. BArry Chaiken).

-PI-
Fraser, Gary E. MD
-PIBIRTH-
02/13/46
-PIDISCIPLINE-
Adult
-INSTITUTION-
Loma Linda University, School of Medicine, Loma Linda, CA
IPF=4562901
AAMC=143
-INSTTYPE-
Private
-DISPOSITION-
Complete
-FUNDING-
$302,032.00
-DURATION-
07/01/80 to 06/30/85

1yr b) To explore the possibility of developing a COMPUTER ASSISTED
1yr teaching course in medical statistics using available equipment.
1yr Problems would use preventive cardiology examples.

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ABSTRACT

USE OF COMPUTER ASSISTED CONTENT ANALYSIS
IN LARGE SCALE PROGRAM EVALUATION

by

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May, 1991

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This study explored the feasibility, reliability, and validity of computer assisted content analysis as a means of abstracting and analyzing information from narrative program documents for the purpose of contributing to the evaluation of the Preventive Cardiology Academic Award, a multi-institutional medical education program sponsored by the National Heart, Lung, and Blood Institute.

Program documents were converted to computer files by means of optical scanning. A specialized key word search program was used to identify and abstract passages of text relevant to specific evaluation questions. Inter-rater correlations were calculated for total line numbers and total passages retrieved by three different reviewers on a sample of the document database. Correlations were calculated between a standard set of passages identified by

a senior consultant to the PCAA program and a set of passages retrieved by three reviewers.

The method was determined to be feasible for retrieval and analysis of evaluation information from program documents. Inter-rater correlations for reliability were .76 for total line numbers and .96 for total passages. Correlations for validity were .40 for line numbers and .35 for passages. Document structure, variance of terms, and sample size were important factors affecting validity.

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Education

1973-77 Central Michigan University
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