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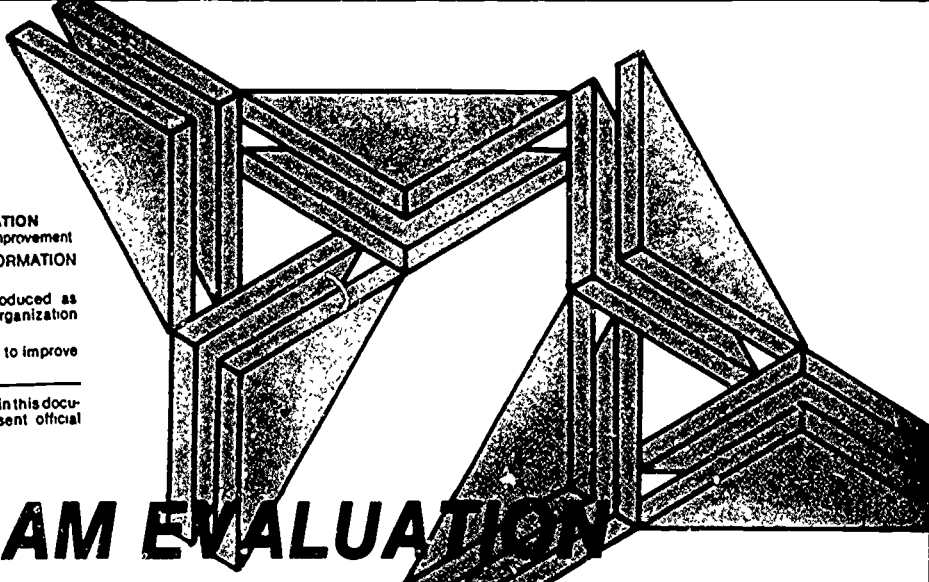
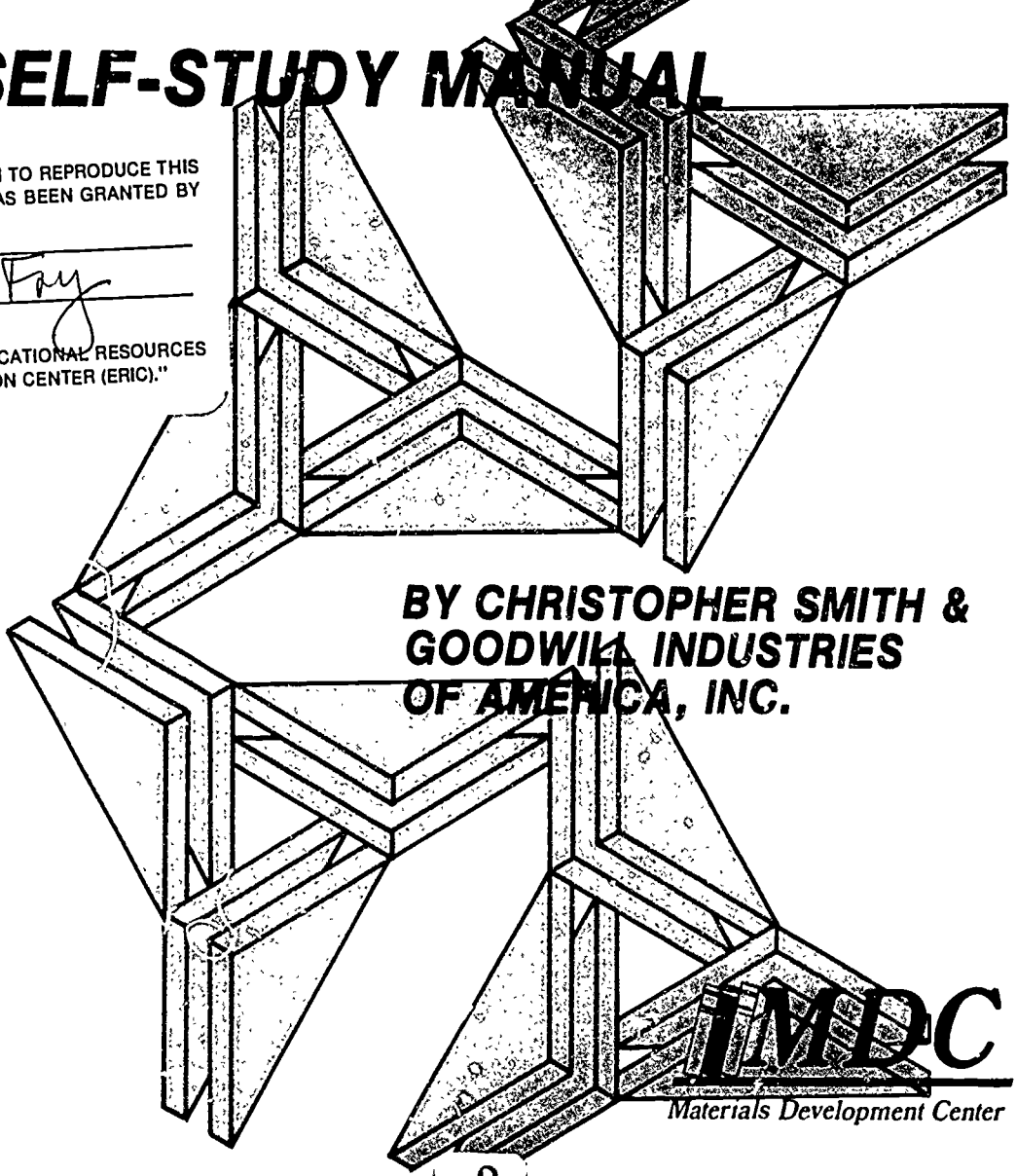
ABSTRACT

Based on two manuals developed by Goodwill as part of their staff training series on program review, this program evaluation manual is designed to help facility administrators implement and improve their service delivery. The book contains an introduction and nine chapters. The introduction defines program evaluation, provides a rationale and uses for program evaluation, and suggests ways to develop a program evaluation policy. The nine succeeding chapters cover these topics: types of program evaluation, designing a program evaluation, measures for goals and objectives, data collection, systems analysis, evaluation research, data analysis techniques, report writing, and developing a plan to implement program evaluation. Following the narrative of each chapter are exercises and self-tests with answer keys. An appendix provides definitions, lists of references and resources, program evaluation forms, and statistical formulas. (KC)



PROGRAM EVALUATION
A SELF-STUDY MANUAL



BY CHRISTOPHER SMITH &
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OF AMERICA, INC.

Program Evaluation:
A Self-Study Manual

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Foreword

Goodwill Industries of America, Inc. and the University of Wisconsin-Stout have entered into an agreement to jointly create publications that help improve service delivery in rehabilitation facilities. Manuals developed to supplement in-service training programs by the staff of Goodwill will be further developed by Materials Development Center for use by professionals in rehabilitation facilities nationwide.

Program Evaluation: A Self-Study Manual is based on two manuals developed by Goodwill as part of their staff training series on program review. The original manuals were titled "A Manual on Program Evaluation" and "Program Evaluation Exercise Workbook." In this publication, these manuals have been combined, edited, and expanded to provide a manual applicable to all facilities. The use of program evaluation, explained in this manual, will help facility administrators implement and improve their service delivery.

Kenneth J. Shaw, Director
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Preface

The focus of this manual is on the development of a practical and flexible data collection system to support facility program evaluation outcome and research models. Four basic criteria must be followed to maintain consistency between facility data collection efforts and to maintain integrity to the data collection system. They are:

1. Program evaluation measures what happens to all clients. The data collection system must track successful and unsuccessful clients.

2. Program evaluation includes outcome and research models to measure outcomes achieved following cessation of services and other specific evaluation questions. (An outcome model measures what happens after a client has completed a program.)

3. Reports should be produced on a continuous basis, providing quick feedback to administrators on the state of their programs.

4. The program evaluation report tells the facility administrator if program performance was acceptable according to the standard which the board has set. Therefore, each program must have predetermined standards for outcomes against which actual results can be compared.

Program Evaluation: A Self-Study Manual

Table of Contents

Instructions for the Use of this Manual

PROGRAM EVALUATION: A SELF-STUDY MANUAL is divided into nine sections to provide information within nine objective areas. Exercises at the end of each section allow readers to apply newly learned material by creating the various documents and using the various formulas and techniques common to program evaluation. Self-tests in each section allow the reader to check his/her knowledge of the area before moving into a new objective area.

Sections are Organized Progressively but Can Stand Alone

It is expected that the users of this guide will complete each section in the order they are presented. This is important for individuals without a background in program evaluation. However, strict adherence to the order in not essential. Some learners may be primarily interested in certain sections and will choose to focus their attention on them immediately.

Previously Learned Materials Can be Skipped

Learners who have already received training in some of the areas covered in this guide can skip those sections without sacrificing continuity. Learners are encouraged to do the exercises for each section, however, before deciding to skip an area.

Exercises for Each Section Check and Apply Learning

After reading each section, learners should complete the exercises provided. If any questions arise while completing the exercise, the answers can be gained by re-reading the section. These exercises, thus, also pro-

vide a "self-test" to learners, and the documents formed during the exercises may actually form the basis for program evaluation within the facility.

Reference Materials Provided

For learners who wish to gain more expertise in program evaluation, reference materials are provided in Appendix B.

Workshops

This manual is designed to provide the core of a self-directed (programmed learning) in-service. It may also be used to provide "workshop" training. The workshop leader may assign sections for individual learners to read, or assign the exercises as group projects.

Workshop leaders should tailor their presentation to the professional learners they will be instructing. They should select methods that draw on the experience of their learners, promote efficiency and effectiveness of learning, and encourage group participation. Leaders are encouraged to read Developing Effective In-service Training Programs (Smith, 1984) prior to modifying this guide for use with their classes. It is available from the Materials Development Center, University of Wisconsin-Stout.

Introduction

Good management depends upon good data. To improve the quality of services, identify service needs, develop new services, and provide services efficiently and effectively, facility administrators need timely, accurate and concise data that describe the successes and/or failures of their programs.

Program Evaluation Defined

Patton (1982) provided a comprehensive definition of program evaluation. He defined program evaluation as the systematic collection of information about the activities, characteristics, and outcomes of programs and services that helped administrators reduce uncertainty in the decisions they made regarding the activities, characteristics, and outcomes of the programs and services that they administered. Thus, program evaluation is a planned process of gathering and analyzing data to help make decisions less risky.

Practical Program Evaluation

The above definition leaves a lot of room for interpretation. It does not state how much data should be collected or what data should be collected, only that the data be collected systematically to help reduce uncertainty in decision making. Even these areas are loosely defined.

The biggest danger facing facility administrators is the tendency to think that bigger is necessarily better. More data gathered more frequently on more objective level may not make a significantly more effective program evaluation. Be practical. Determine evaluation questions, set data collection procedures, and choose analysis techniques that provide adequate levels of confidence but do not burden staff with unnecessary data collection tasks.

Why Bother with Program Evaluation?

Several general reasons for conducting program evaluation were outlined by Cook and Cooper (1978). They are: Vindication, Salesmanship, Verification, Improvement, and Understanding.

Vindication

Sometimes program evaluation is conducted to gather facts that show that the facility's programs are worthwhile. Thus evaluation hopefully justifies the work (and existence) of the facility.

Salesmanship

Evaluation is also performed to determine areas that can be expanded. The purpose of the evaluation is to find program components that have similar applications to potential clientele or to find similar need areas from potential client groups that can be met by existing programs.

Verification

Verification is another reason for conducting program evaluation. Facility administrators often need to discover if the stated goals of a program are actually being met. Additionally, the determination of program impact, effectiveness, and efficiency are essential needs for administrators that can be, at least partially, met through the application of program evaluation.

Improvement

The analysis of program evaluation data can be a great tool in the development of more effective and efficient program systems. Through program evaluation, system weaknesses are minimized and strengths are maximized.

Understanding

Finally, facility administrators use program evaluation to seek an understanding of how their programs function. Specific features of a

program may be evaluated as an administrator searches for reasons that a program is a success or a failure.

Uses for Program Evaluation

The facility's program evaluation system may be used for many purposes. They include:

The data can be used to increase benefits provided to persons served.

The data can be used to identify the need for new programs.

The data can be used to contain costs.

The data can be used as a marketing tool.

The data can be used to strengthen organizational relationships.

The data can be used to improve board relationships.

Increase Client Benefits

The data which is collected for program evaluation will allow administrators to better select those persons who have the need for services and who can benefit from service provision. Client benefits should increase when program evaluation is regularly provided because staff will be encouraged to strive for positive results. Program evaluation systems also allow specialized studies to be undertaken resulting in new benefits.

Develop or Expand Programs

The data collected will help identify new program or service needs and point the direction for the expansion of facility services. Program evaluation will reduce the risk of new program failure by providing a tool with which administrators can structure, plan, and monitor results.

Facilities with limited resources to invest can establish new programs utilizing zero-based budgeting and sunset strategies to determine, in the short run or by a fixed period, whether the program is showing positive results. Program evaluation can provide data that indicates if the extended

outlook for a new program looks good enough to invest resources necessary for its continuation.

Program evaluation also helps administrators replicate highly successful programs developed by others.

Contain Costs

Cost and efficiency objectives and measures in a program evaluation system provide essential feedback on the cost of the program in relation to client benefits. This information helps administrators determine if costs are acceptable compared to other program alternatives. These measures also encourage the minimizing of costs, and allow administrators to demonstrate to referral and funding sources exactly how much services cost, what areas are the most costly, whether the resources provided by the purchasers are sufficient to cover costs, and to establish any need for subsidized support by the community.

Decisions regarding the continuation, expansion, or termination of programs can most easily and accurately be made when this data is available. Decisions as to whether to provide services directly or to contract for services can also be made with greater confidence.

Provide Data for Market-Based Planning

Programs can be confidently sold to consumers using program evaluation data to demonstrate the actual results that can be achieved by the program. An enhanced ability to cite the program's record of providing services that satisfy specific needs and problems, or to serve special populations of disabled clients, will enhance marketing efforts. Program evaluation may also help administrators identify potential markets for existing or new programs. Data gathered from the system should provide information regarding new funding sources.

Strengthen Interactions with Other Organizations

Many accreditation commissions as well as regulatory agencies require program evaluation. Community funding agencies, such as United Way, who allocate their funds among many "worthy" causes respond favorably to solid information from program evaluation sources. These data provide the essential information needed by such agencies to determine their funding levels.

The facility's ability to show success is an asset for establishing and maintaining mutually beneficial relationships with consumer groups and other

organizations. Additionally, cooperative endeavors and working contract agreements are easier to obtain and maintain if program evaluation data is available. Cooperative projects involve joint planning. Maximum use of planning resources can be enhanced by the use of program evaluation data.

Provide Decision-Making Data for the Facility Board

The forced structure, format, and objective setting of a program evaluation system will help board members better understand the facility and its programs. Information gleaned from the evaluation data will help improve policy making and long range planning by the board.

The availability of proven statistics about programs, their costs and needs, will enhance the ability of the board to mount successful fund raising efforts. Regular management reports keep the board up-to-date and informed and make administrative presentations easier and more professional.

The use of program evaluation data is a matter of commitment. The Board, the Chief Executive officer, and all facility staff must collaborate to make evaluations useful. Commitment to program evaluation must start at the top and filter throughout the organization.

Because facilities exist to provide the best possible services, programs are never as good as they "could be." Continuous support is needed to improve the programs and to develop other programs and services should the need be identified. As part of the program evaluation process, data is compiled that will indicate the extent to which programs are effective and efficient. Using these data, administrators must develop methods, techniques, and plans to improve facility performance in the areas where program evaluation indicates that improvement is needed.

Staff, starting with the CEO, must be held responsible and accountable for results. Implementation of a program evaluation system requires commitment from every level within the organization. It is not sufficient that the CEO and staff recognize the need for program evaluation. The governing body should also go on record as desiring program evaluation by requiring its implementation and providing dollar support. Program evaluation, like any major undertaking in a facility, requires the expenditure of time and resources.

The Evolution of Program Evaluation

The use of program evaluation in rehabilitation settings has evolved over several decades. Beginning in the 1930's, activities in three areas shaped the face of program evaluation as it is practiced today. These three areas, applied action research, improved management monitoring techniques,

and awareness of political needs, have influenced both administrators and funding personnel and have provided the theoretical base and technical methods required to support evaluation research.

Applied Action Research

Experiments in social problems begun in the 1930's and spurred by wartime interests in the 1940's led to the development of scientific research techniques for investigating social activities. These techniques have evolved into data gathering and analysis processes that have a significant impact on the way rehabilitation programs are evaluated. Of particular use are the concepts of random sampling and the testing of means and percentages.

Improved Management Monitoring Techniques

Ever since the Westinghouse studies of productivity in the 1950's, administrators have investigated management related questions with ever more powerful and sophisticated methods. Their efforts at monitoring worker output have been given a great boost by the explosion in the computer industry. Even extremely small companies using personal computers can collate, store, and analyze large amounts of management related data at relatively low cost. The primary restricting factor today is the time needed to gather the data and enter it into the statistical records of the computer.

Awareness of Political Needs

Within the rehabilitation field, probably the most significant impetus to engage in program evaluation was given by a changing political climate that desired and then demanded accountability as a prerequisite for continued dollar support. This awareness that an accurate means for demonstrating program effectiveness and efficiency was needed led first to the creation of facility standards and then to a proliferation of systems.

Developing a Program Evaluation Policy

The purpose then, of establishing a program evaluation system for facilities is to clearly determine what services are provided, who receives the service, what the services intend to achieve, how successful they are at achieving their missions, and what changes may be needed to improve service performances.

Many uses and benefits should come out of the development of the system. Most important is responding to the increasing demand for accountability by the general public. This demand is reflected in the mandates of referral and funding sources. Program evaluation should also help the facility better describe and market its services, with the net result of an enhanced public image, increased community support, referrals, and funding.

To evaluate the facility's programs, an evaluator needs direction. Like a road map, the facility's program evaluation policy should give the evaluator a guide to the "paved roads." The evaluator needs to use the policy to determine the approach to use, specific tactics or methods to use within the approach, and the criteria or standard upon which the evaluation is based.

Determining a plan of attack for every evaluation that is performed can be a time consuming and chaotic task. Cook and Cooper (1978) state that program evaluations can use different criteria to reach a conclusion about a program's value:

> The most logical criterion of worth is the program's **effectiveness** or performance in meeting stated goals. The emphasis here is on impact or consequences. A program which has as its goals various operations may be able to show that it was effective in completing those operations. However, unless there is some measure of output or reason for the program; existence beyond mere performance, the evaluation will be of little ultimate value. Other criteria of program worth give attention to the process underlying the ultimate outcomes. One process related criterion is **effort** which is a measure of program inputs or resources expended. Closely related to effort is **efficiency** which Bennet and Weisinger (1974, p. 4) define as "a rate that is produced when the effort expended by a program is compared to the program's effectiveness." Efficiency is different from effectiveness. For example, Nazi Germany was seen, in an industrial/organizational sense, as being very efficient, but from their point of view, the ultimate outcome was not very effective. (p. 15)

Thus, it is essential that facility administrators develop a policy that will guide the development of program evaluation and give direction to the implementation of an ongoing evaluation process. The policy should be written and reviewed periodically to insure that the facility's program evaluation system is gathering needed data and that those charged with specific evaluation activities are carrying out their duties. Figure One is a sample of a facility program evaluation policy. It contains the usual elements assigning tasks and roles to administrative staff, and gives directions for the carrying out of the policy.

FIGURE ONE: A Sample Policy for Program Evaluation

Elk Mound Integrated Industries

Policy: An organized program evaluation system covering all programs operated by Elk Mound Integrated Industries (EMII) shall be developed by the EMII Executive Director under the instruction of the EMII Board. This policy is effective on May 19, 1986. The program evaluation system must be in effect by January 1, 1987, and will be revised yearly at the annual board meeting as needs dictate.

Purpose: The purpose of the program evaluation system is to provide the EMII Board and staff, and the clients and taxpayers supporting EMII data that identifies the effectiveness and efficiency with which EMII provides services, and to determine ways in which this performance can be improved.

Responsibility: EMII Executive Director, Robert Bell, is responsible for all aspects of the program evaluation system development and operation.

Authority: EMII Executive Director, Robert Bell, or his designee(s) are empowered with all authority reasonably necessary to undertake a comprehensive program evaluation and to ensure that such an effort is maintained.

Monitoring and Review: The monitoring and review functions will be carried out by EMII staff as assigned, on a semiannual basis. The results of these reviews will be reported to the Board semiannually.

Reports: The EMII Executive Director will report to the Board the program evaluation results. These results will compare expectations as outlined in establishment criteria with actual data.

Key Roles:

Board of Directors

1. Review the management report and the essential aspects of the program evaluation system.
2. Clearly articulate to all EMII administration the importance attached to this program evaluation effort and the expectation that cooperative efforts of all EMII staff will be made to insure satisfactory completion of the effort.
3. Review the management report to monitor actual performance as compared to established criteria and policy fulfillment.

Executive Director

1. Install a program evaluation system by the target date.
2. Maintain the evaluation activities and communicate results to the Board.

Executive Director and/or Designee

1. Implement a systematic and continuous program evaluation system to determine the effectiveness and efficiency with which results are achieved by the staff and systems of EMII.
2. Develop the program evaluation system using standardized guidelines as outlined by the Commission on Accreditation of Rehabilitation Facilities (CARF).
3. Provide leadership in the implementation phase of the installation of the program evaluation system.
4. Provide leadership in the analysis and reporting phases of the program evaluation system.
5. Ensure the accuracy of the data collected in the program evaluation process and establish systematic reporting procedures for the evaluation system.
6. Compile all results into a single management report, appending an analysis of the data, in preparation for filing with the Board.
7. Monitor and evaluate the status of the program evaluation system at least quarterly to insure that the system and the data collected remain relevant to the needs of EMII administration.

Program Directors and Staff

1. Develop data tracking mechanisms for all measures identified for the system by the Executive Director and/or Designee.
2. Compile accurate data and report the data on monthly management reports.
3. Make appropriate recommendations to improve EMII services and the EMII program evaluation system.

Adopted by the board as Policy # 3-86

Date: _____

Recorded: _____

EXERCISE ONE: Develop a Program Evaluation Policy

Using the model above, create a program evaluation policy for your facility. The policy you create may be used in the design of a system for your programs, so be thorough, and create a policy that "fits" with present operating procedures in your facility. Your policy should include the following elements:

1. Assignment of program evaluation responsibility.
2. General purpose of the evaluation.
3. An indication of where data about the approach to be used and the measurement criteria will be found.
4. Roles of key personnel.

SELF-TEST: Introduction

1. Good management depends on good _____.

2. Program evaluation is the _____ collection of information about the activities, characteristics, and outcomes of _____ and _____ that help administrators _____ _____ in the decisions they make.

3. When designing your program evaluation, be _____.

4. Five reasons for conducting program evaluation are: _____, _____, _____, _____, and _____.

5. Program evaluation data can be used to:

   _____,
   _____,
   _____,
   _____,
   _____,
   and _____.

6. Three areas have shaped the way program evaluation is conducted today. They are: _____, _____, and _____.

7. A program evaluation policy provides a _____ to the program evaluation.

8. A program evaluation policy is needed because many criteria may be used to determine program worth, including: _____, _____, and _____.

SELF-TEST: Introduction
ANSWER KEY

1. Good management depends on good data.

2. Program evaluation is the systematic collection of information about the activities, characteristics, and outcomes of programs and services that help administrators reduce uncertainty in the decisions they make.

3. When designing your program evaluation, be practical.

4. Five reasons for conducting program evaluation are: vindication, salesmanship, verification, improvement, and understanding.

5. Program evaluation data can be used to: increase client benefits, develop or expand programs, contain costs, develop market-based plans, strengthen interactions with other organizations, and provide decision making data.

6. Three areas have shaped the way program evaluation is conducted today. They are: applied action research, improved management monitoring techniques, and awareness of political needs.

7. A program evaluation policy provides a guide to the program evaluation.

8. A program evaluation policy is needed because many criteria may be used to determine program worth, including: effectiveness, effort, and efficiency.

Chapter One

Types of Program Evaluation

Program Evaluation Answers Questions

Evaluations are conducted for many reasons, but all the reasons have one thing in common: they are questions about the operation of programs. The questions initially may be vague, such as: What are our needs? What does our system look like from an outcome point of view? Are we meeting our goals? It is the evaluator's role to clarify the questions and determine the best evaluation methods to use to give the desired answers.

Select an Evaluation to Answer Specific Questions

When a facility board tells the administrator that they want a program evaluation, they will really be asking the administrator to answer questions in one of five different areas. These areas are:

Needs assessment
A description of the program in operation
Measurements of goal achievements
Continued and smooth program operation
Determination of the program's fate

(Morris and Fitz-Gibbon, 1978)

The deciphering of a request to determine an evaluation need is usually left up to an evaluation specialist. The specialist, however, must never proceed with an evaluation without consulting with the question givers, giving an explanation of the evaluation to be performed, the questions to be asked, and the expected results. In this manner, the evaluator affirms that desired information is being obtained and that all of the needs of the question givers are being met.

The evaluation specialist has three different types of evaluations to choose from when determining the approach to use. They are: formative evaluations, summative evaluations, and needs assessment. In addition, the evaluator may use one of many different models of program evaluation to obtain answers to evaluation questions. The models are variations of two program evaluation approaches: the objective attainment approach, and the systems analysis approach.

In all cases, data to support an evaluation is obtained from research. The investigative research that is conducted utilizes one of three broad tactics: experimental research, correlational research, and case studies.

Formative Evaluations Determine Future Activities

Formative evaluations are developed to answer broad questions such as: How can the program be improved? How can it become more effective and efficient? Thus, a formative program evaluation makes use of evaluation data to further develop the program. These evaluations tend to be ongoing in nature. This is the type of evaluation that CARF standards require, because, after the system is in place, data that describe and the status of a program are continually obtained.

Effort and efficiency are important to consider in a formative program evaluation. Once the data collection process has been implemented, staff time will be committed to a long term gathering process. Thus, in a formative evaluation it is important that program administrators formulate the most efficient ways to meet their stated goals.

Formative evaluations usually require the collection of a large amount of diverse data. To improve a program, it is necessary to understand how well a program is moving toward its objectives so that changes can be made in the program's components. It is also necessary to identify and gather data about the hundreds of tasks that are performed within the program system. Thus, formative evaluation is time consuming.

Summative Evaluations Describe Present Status

In a summative program evaluation, the emphasis is on program effectiveness or outcome and the adequacy of program performance or quality. Its task is to make "summary" judgments about the program and its value usually leading to decisions about the continued operation of the program.

To make judgments using a summative evaluation, it is necessary to compare the data gathered during the evaluation with another program aimed at achieving similar goals. If no rival program is available, the evaluation data could be compared with a group of individuals identical to the individuals in the program, but who did not participate in the program.

Summative evaluations are usually terminal or "one shot" efforts mounted to answer questions such as: Is Training Program A worth continuing or expanding? How effective is Training Program A? and What conclusions can be made about Training Program A? Summative evaluations are also titled outcome evaluations, consumer testing, or evaluation research.

Needs Assessment Measures Desires

Many requests for program evaluation actually require a needs assessment. Questions such as: What should the program try to accomplish? What areas of the program need attention? and Where is the program failing? are really questions regarding the discovery of weaknesses or problem areas in the current program. These questions are best investigated by a needs assessment rather than a formative or summative program evaluation because the resulting report is used for long term planning rather than immediate change. Requests for "evaluation" within large, complex programs are often really requests for needs assessment. See Smith, C. (1984) Developing Effective In-service Training Programs for a discussion of needs assessment techniques.

Objective Evaluations Measure Criterion Success

Many vocational rehabilitation facilities routinely use the objective, or goal, attainment approach to determine if their clients are making progress within training programs. They often use this approach for the evaluation of facility programs as well. Using the objective attainment approach, facility administrators ask if a program has accomplished what it was designed to accomplish.

The logic behind the approach is sound; the program is evaluated on the basis of meeting predetermined objectives. In practice, however, the application of the goal attainment approach is not as cut and dried. Because program goals and objectives are often set in reaction to value judgments, disagreement can arise as to the "real" value of the goals and/or objectives. If the value of the goals and objectives are in dispute, the value of data showing that the goals and objectives were met is also disputed. In fact, even if a goal or objective is perceived by many as valuable, clearly stating the terms and measures that describe "success" may be difficult.

In addition, it is important to emphasize that a program evaluation based on an attainment approach will not be able to clearly state that the program alone is responsible for the attainment of the goals and objectives. The evaluation will not be able to show if another program would have

been more effective or efficient. Goal and objective achievement does not, by itself, give any basis for judging comparative benefits of one program with another.

Systems Analysis Considers Activities and Flow

The systems analysis approach focuses on the analysis of functional organizational units to arrive at a judgment of program value. The effectiveness of a program, thus, is not determined only in relationship to stated goals, but also in terms of its contribution to the functional operation of the entire facility.

The systems analysis approach to program evaluation relies on the gathering of very large amounts of data. Thus, the popularity of the approach has grown with the proliferation of personal computers and the trend toward gathering large amounts of data for "accountability" purposes.

Data accumulated for program evaluation using the systems analysis approach is useful, in sophisticated programs, for the projection of outcomes under varying conditions. Thus, systems analysis allows program evaluation to be predictive, providing a valuable planning tool to facility administrators.

This approach is most useful for evaluations that examine production and management issues. It is less useful when the data to be examined is intangible, such as an evaluation to determine staff morale or client "happiness."

Cost Effectiveness Measures Cost Per Outcome

The basic idea of the cost effectiveness tactic in program evaluation is to associate each positive outcome of a program with the costs associated with obtaining the outcome. Cost/benefit analysis is the resulting equation.

"Cost effectiveness" of program services, stated in terms of specific objectives, will provide facility administrators with financial data by which to:

1. Communicate to referral agencies and public its actual costs for specific rehabilitation goals.
2. Substantiate expenses which are not being met by governmental sources and, therefore, must be subsidized. (This can be important data useful for requesting additional community funds through the united way, local government, fund raising campaigns, etc.)
3. Negotiate fair fees-for-service.
4. Maintain cost containment.

5. Make management decisions regarding the maintenance, decrease, or increase of a particular program and its associated costs.

To provide cost/effectiveness evaluations, one positive objective must be stipulated for each program though the objective is usually composed of several programmatic activities. Thus, the data in some programs may be added with data from other programs to obtain the total number of successful outcomes.

A special problem exists in regard to work activities, sheltered employment, and supervised residence programs. Due to the small numbers of clients from these programs who obtain competitive or independent situations (and thereby meet the objective characteristics for successful closure) it may be desirable to calculate the cost objective program evaluation twice: first using total costs when successful outcomes are plentiful and second, using the number of client/weeks in the program as successful outcomes. Figure Two illustrates a form used to compute the cost effectiveness of a program.

Program Costs

In computing the costs, it is desirable to do all programs at the same time. That is, that the distribution of administrative costs is made to all the programs at the same time. Not only is it easier to do it this way, but it also helps to avoid errors, since the amounts distributed to each program can be viewed at once.

Program Staff

The breakdown of the staff cost for the programs are done on the program staff form. See Figure Three below. The program staff should not include any administrative personnel higher than the position of Rehabilitation Director. The salaries are computed on a monthly basis and then distributed by percentage to each of the programs. The actual distribution of time across various programs is somewhat subjective, but not entirely so. Generally, the best way to distribute the time is to have the staff keep track of their time spent in various activities for a couple of weeks. Once the percentage of the staff time has been allocated to each program, this percentage is multiplied by the monthly salary which is shown in the salary column under that particular program.

EXPENSES	Vocational Evaluation		Training Program A		Training Program B			
	MONTH	CUM.	MONTH	CUM.	MONTH	CUM.		
STAFF	4,098	12,294	5,172	15,516	4,785	14,355		
FRINGE @ 15%	615	1,844	776	2,327	718	2,153		
ADMINISTRATION	292	876	1,350	4,050	1,650	5,750		
SUPPLIES	23	69	250	1,250	350	1,200		
DEPRECIATION	250	750	1,250	3,750	1,410	4,935		
TRAVEL	150	450	500	1,500	120	300		
CONSULTANTS	130	390	210	1,250	150	475		
UTILITIES	671	2,013	4,500	15,500	5,275	18,750		
TELEPHONE	55	165	250	850	85	350		
TOTAL EXPENSES	6,282	18,751	14,758	45,993	14,543	48,268		
CONTRIBUTED STAFF SUPPLIES			500	1,500	650	2,150		
TOTAL COST	6,284	18,751	15,258	47,493	15,143	50,418		
SUCCESSFUL OUTCOMES	8	34	6	21	5	9		
COST PER OUTCOME	786	552	2,460	2,262	3,039	5,602		
GRANT SUPPORT	4,713	16,495	10,250	36,550	725	3,250		
GRANT COST PER OUTCOME	589	485	1,708	1,740	145	361		
SELF-SUPPORT COST PER OUTCOME	197	66	751	521	2,894	5,241		

FIGURE TWO: Cost Effectiveness Worksheet

FIGURE THREE: Program Staff Worksheet

STAFF NAME	POSITION	SALARY/MO	VOC EVAL		TRAINING A		TRAINING B			
			%	SALARY	%	SALARY	%	SALARY	%	SALARY
	REHAB DIR	1750	30	525	40	700	20	350		
	SECRETARY	750	50	375	40	300	10	75		
	EVALUATOR	1250	100	1250						
	CLERK	700	80	500	20	140				
	COUNSELOR	1100			100	1100				
	COUNSELOR	950					100	950		
	PLACEMENT	1100	10	110	60	660	30	330		
	SUPER TEXTILES	750	10	75			90	675		
	SUPER FURNITURE	725	20	145	50	363	30	217		
	SUPER MAINT	800	30	240	30	240	20	160		
	SUPER CAFE	775	20	155	50	387	10	78		
	SUPER WAREHOUSE	650					90	585		
	SUPER UPHOLSTERY	775	20	155	50	387	10	78		
	SUPER T.V.	850	10	85	30	255				
	SUPER DOCK	725	20	145	20	145	60	435		
	STORE MANAGER I	750	10	75	30	225	40	300		
	STORE MANAGER II	690					80	552		
PROGRAM STAFF COST TOTALS				4,098		5,172		4,785		

Fringe benefits

Fringe benefits are not only the cost of hospitalization, retirement plans, etc, paid by the agency, but also workmen's compensation costs, unemployment compensation and the employers share of social security. These costs are usually stated as a percentage of gross payroll.

Administration

Administration in this context relates to the cost of the executive director, his staff, the accounting department, personnel, and portions of other line staff time. The distribution of administrative costs can be done in many ways. See the Materials Development Center publication Determining Effective Overhead Rates for Pricing Goods and Services for possible methods.

EXERCISE TWO: **Describe the type of evaluation most suited to your facility needs.**

SELF-TEST: Chapter One

1. Evaluations have one thing in common, they answer _____ about the operation of programs.

2. Evaluation questions fall into one of five different areas: _____, _____, _____, _____, and _____.

3. Three types of evaluations are common. They are: _____, _____, and _____.

4. Three approaches are often used for evaluation purposes: _____, _____, and _____.

5. Cost effectiveness associates _____ with _____.

SELF-TEST: Chapter One
ANSWER KEY

1. Evaluation have one thing in common, they answer questions about the operation of programs.

2. Evaluation questions fall into one of five different areas: Needs assessment, operating descriptions, objective attainment, client flow, continuation determination.

3. Three types of evaluations are common. They are: formative evaluations, summative evaluations, and needs assessment.

4. Three approaches are often used for evaluation purposes: objective attainment, systems analysis, and cost effectiveness.

5. Cost effectiveness associates positive outcomes with the costs of obtaining the outcomes.

Chapter Two
Designing a Program Evaluation

Planning for Program Evaluation

Probably the biggest problem that program evaluators face is the fact that program objectives are often stated in ways that are difficult to measure. Regardless of the evaluation approach that a facility administrator decides to use, it is essential that the basic documents of program planning be used to develop assessment procedures. Program mission, goals, and objectives, as well as such administrative policies as admissions criteria and client flow paths must be examined and redefined in measurable ways.

This redefinition is usually needed because the facility mission, goals, objectives, etc. are determined through a political process involving many "stakeholders."

The Political Process

"Stakeholders" are individuals or organizational groups that have an interest in the outcome of a program evaluation. Because the type of evaluation desired, the approach chosen, the model selected, the questions asked, the objectives measured, the comparison criteria selected, the research design used, and virtually every other facet of the evaluation design will require judgments that will effect the results obtained by the evaluation, all stakeholders need to be provided with input into the planning and implementation of a program evaluation. If, in fact, they are denied a voice, they may discount, disbelieve, or ignore the results obtained. Thus, all individuals that will be affected by the evaluation should be included in the evaluation, beginning with the initial question formulation stage.

These stakeholders should also be involved in the final reporting stage to ensure that the data gathered will lead to actions taken. Because the end purpose of program evaluation is to judge the program being evaluated, the "bottom line" for program evaluation is putting the results of the

evaluation to use. In order to be useful, the results must have basic utility.

Seek Utility

Program evaluators must balance the agendas of many stakeholders when translating facility structural elements into measurable goals. If any of the stakeholders are ignored, the utility of the evaluation may be impaired. Thus, to ensure the utility of program evaluations, an evaluator should take under consideration the following facts:

1. A balance must be struck among the differing value systems of stakeholders (facility administrators, funding agencies, and program clientele) by acting as a consultant to the development of the evaluation in the planning and formulation stages.
2. Evaluations will probably be used to redistribute resources and, therefore, resistance to the evaluation is inevitable from some stakeholders.
3. Program evaluation sometimes leads to decision making not in step with the successful achievement of program goals. Sometimes administrators make decisions that seem contrary to evaluation results for other, worthwhile, political reasons.
4. Program evaluators best serve the stakeholders by focusing attention on the utility of the program evaluation goals.

Structural Design Elements

No matter which evaluation model is used, program evaluation must be linked to program planning and, thus, to the facility's mission, goals, and objectives. Facilities were established to meet real needs; over time, the mission-goals-objectives can become politically influenced, unclear, and difficult to measure.

Influencer (Stakeholders)

The mission, goals, and objectives of the facility are influenced by interest groups. Other agencies, funding sources, and politically motivated client organizations attempt to influence your facility hoping to force you to meet their narrowly defined needs. These stakeholders will have a direct impact on your facility, either because they provide funding, referral, licensing, reporting, or regulatory pressures, or because they will change

your marketing patterns. The result of their influence will determine the mission and, in the long run, the programs offered by your facility. Examples of such groups are:

Consumers
State vocational rehabilitation agencies
Other purchasers of service
J.T.P.A. & P.I.C. organizations
United Way
Public officials
Association of Retarded Citizens
City, county, and state boards and commissions
Local and regional businesses and industry
School districts
Accrediting and licensing bodies
Individual and foundation donors
Granting agencies
Wage & Hour compliance boards
Etc.

Mission Statement

The most general statement of a facility's purpose is its mission statement. It spells out the purpose for the continued existence of its component programs.

Generally, the mission statement is found in the facility's governing documents. In those situations where the governing document statements are not adequate to clearly differentiate and define the purpose of the facility a new mission statement should be developed, and approved by the governing body.

Mission Statements Have Broad and Specific Characteristics

The mission statement is probably the least difficult and one of the most important components of program evaluation. It should be written in such a way that it describes, in general terms, what the facility is trying to accomplish, the services provided, and who it serves. It should be broad enough to cover all of the programs offered by the facility included in the program evaluation system, but should not limit the scope of potential programs or possible client groups. Although broad and general, the mission statement needs to be specific enough to distinguish one facility from others. The mission statement should contain the following elements:

1. Who is served
2. Service provided
3. Expected outcome
4. Features that distinguish one facility from other facilities
5. Specifics that enable goals and objectives to be set
6. Geographic and other relevant dimensions

Examples of Mission Statements

Mission statements must be tailored to each individual facility. Below are some examples:

Sample mission statement A

To provide vocational evaluation, work and personal adjustment training, skills training and sheltered employment to physically and mentally disabled and vocationally handicapped persons, which will help to decrease their social and vocational dependence and increase their ability to obtain an earned income.

Sample mission statement B

To assist persons who are physically and mentally disabled and otherwise vocationally handicapped to maximize their independent living capabilities and enhance employability and economic independence through the provision of personal and social adjustment training programs, work adjustment, and sheltered employment.

Sample mission statement C

To provide vocational rehabilitation and habilitation programs such as work adjustment training, extended employment, and pre-vocational training as well as supportive and personal adjustment services on a needs basis for adult recipients of XYZ county who are developmentally disabled, physically disabled, mentally ill or chemically dependent for the purpose of facilitating employability and independent functioning.

Admission Criteria

Two sets of admission criteria should be established. Each set provides control over those who are served consistent with mission statements, facility resources, and community needs.

The first screening set is the general facility admission criteria. The second screening set is the admission criteria for entrance into each individual program. If the facility provides only one program or service, then only one set of criteria need be established.

General facility admission criteria sets basic standards and requirements for admission to any and all programs in the facility. Some examples of criterion used to screen applicants are listed below:

1. Unemployed
2. Minimum age of sixteen
3. Able to care for own personal needs
4. Third party sponsorship
5. County/city resident
6. Able to provide own transportation
7. Program consistent with needs of client
8. Capable of independent living skills
9. Conduct not dangerous to self or others
10. Physical within last year
11. Diagnosed disability
12. Vocationally handicapped
13. Ambulatory or mobile non-ambulatory
14. Willing to participate voluntarily
15. Able to earn minimum wage (facility)
16. Desire to obtain employment

Facility Programs

Evaluations must also identify the separate programs in which specialized services are provided to eligible clients. The differences between programs and services should be understood; this helps properly establish the facility's program structure for program evaluation purposes.

Program services are a defined set of actions with the purpose of providing assistance to clients. A program, on the other hand, provides a variety of coordinated services with the purpose of achieving specific goals. These goals are aimed at the achievement of the facility's mission.

An activity, for example job readiness training, might be either a program or a service depending on whether it is provided by the facility as a free standing program meeting the criteria listed below or as a service provided as part of another program such as work adjustment. Job readi-

ness may be a separately defined set of activities with staff, a budget, and a physical location. In such a case, job readiness is probably a program. On the other hand, job readiness may be a set of activities that is provided to clients entered in the work adjustment program. Every client accepted for work adjustment would be eligible for the job readiness training. Thus, the activity is a service, not a program.

Each program should be clearly identified as either a program or a service. Programs include the following elements:

A program goal statement
Specific admission criteria
A description of the services provided
A description of the clients it serves
An identity separate from other programs
Identified staff members
A budget

Program Goals

Program goal statements are specific descriptions that clearly convey to individuals in and out of the facility the components and characteristics of a program. These characteristics should include: clients served, services provided, and results to be achieved. Most facilities have more than one program. However, if a facility has only one program and plans only to continue the present set of activities, the mission and goal statements may be identical.

It is much more likely that your facility provides more than one program. Therefore you must develop goal statements for each program that is provided.

Goal statements should be specific enough to determine each program's objectives and the measures that will be used to determine objective achievement. Below are some sample program goal statements:

For Vocational Evaluation Programs

1. To determine the specific assets and liabilities of physically and mentally disabled individuals, to develop appropriate vocational objectives with and for the client, to recommend the services which will best contribute to his or her vocational rehabilitation, and to provide information to the referring agency which assists in determining feasibility for other rehabilitation services.

2. To assess the capabilities and limitations of the vocationally handicapped to determine the appropriateness of referral for education, training, or employment resources, and to assist selected individuals to obtain employment through work adjustment, job placement, and follow-up services.

3. To provide a variety of assessment techniques to vocationally handicapped clients which will assist the vocational rehabilitation counselor and the client in determining further appropriate vocationally related services or job placement.

4. To assess vocational skills and interests, independent living skills, and behavioral skills of the mentally, physically, and socially disabled in order to provide appropriate vocational recommendations for utilization by referral/funding agency and/or placement team.

5. To provide information acquired through the assessment of employment capabilities, to disabled and multiply handicapped individuals and to the referring agency, which assists in determining the feasibility for vocational services, and identifies specific services needed by the individual in order to achieve individually developed rehabilitation goals.

For Work Adjustment Programs

1. To provide structured and planned, closely supervised, remedial work experience, including behavior modification and job readiness training to physically and mentally disabled individuals in order to assist them in obtaining employment.

2. To enable the mentally, physically and socially disabled to improve their behavioral and work skills through behavioral management, vocational counseling, and production activity in order to maximize their earned income.

3. To develop, modify, and support employment behaviors of mentally, physically, emotionally, and/or developmentally disabled persons at a level consistent with the demands of their individually developed rehabilitation goals leading to optimal earned income.

4. To provide employability development, support, social services, and counseling to the physically, emotionally, mentally,

socially, and economically handicapped in order to assist them in attaining competitive employment, and to reach their highest level of independent functioning.

5. To provide employability development in work habits, attitudes and behaviors, and supportive services to unemployed and the physically, emotionally, and mentally handicapped persons which will assist them to obtain an earned income.

For Sheltered Employment Programs

1. To assist vocationally disabled adults to achieve optimal earnings through extended employment opportunities in a sheltered environment with long range goals of eventual competitive employment.

2. To provide sheltered long term employment and other supportive services to persons whose handicapping condition is a continuing barrier to competitive placement in order to obtain an earned income.

3. To provide an authentic industrial environment to mentally, physically, emotionally, and economically handicapped adults in order to assist them in maximizing their employment potential.

4. To enable the mentally, physically, and socially disabled to maximize their earned income through sheltered employment or to gain competitive employment by providing remunerative work, vocational counseling, job placement activity and follow-up.

5. To provide work experience for those physically, emotionally, and mentally handicapped or underemployed whose disabilities limit them from obtaining competitive employment, and to provide transitional employment for those who are endeavoring towards competitive placement.

Program Admission Criteria

Program admission criteria differ from facility admission criteria. They describe the specific requirements imposed by individual programs. Clients must meet program criteria in addition to the facility admission

criteria. The establishment and enforcement of program criteria ensures that the program serves those for whom the services were intended.

Below are some examples of program admission criteria:

For Vocational Evaluation Programs

1. Employability questionable or unknown
2. Specific service need undetermined
3. Does not require one-to-one supervision
4. Identifiable vocational handicap
5. Unemployed/underemployed or industrially injured
6. Third party sponsorship
7. Possess basic self-care skills
8. Recent physical examination
9. Recent psychological examination

For Work Adjustment Programs

1. Able to obtain either sheltered or competitive employment
2. Third party sponsorship
3. Recent vocational evaluation with goals and objectives
4. Able to benefit from program
5. Potential to earn facility minimum wage
6. Unemployed/underemployed or industrially injured

For Sheltered Employment Programs

1. Sixteen (16) years of age or older
2. Low potential for competitive employment
3. Potential to earn facility minimum wage
4. Able to benefit from sheltered employment
5. Able to increase independent skills.
6. Produce at 50% of minimum wage.

Services Provided

Services are groups of activities provided to clients accepted into a program. The identification of a service involves the development of a process outline. Staff are assigned to carry out these processes. The service provided is related to the achievement of the program goal. It is not necessary for all clients to receive all services within a program.

A logical relationship should exist between clients, the services provided, and the program goal. Services must lead to the accomplishment of the goal.

Below is a listing of the kinds of services which may be provided in various programs:

Vocational Evaluation

1. Orientation
2. Psychometric testing
3. General Medical
4. Follow-up
5. Written Vocational Evaluation Report
6. Physical Therapy Screening
7. Career Exploration
8. Developmental Assessment
9. Functional Living Skills Assessment
10. Employability Attitudes Evaluation
11. Job Matching
12. Work Sampling
13. Situational Assessment
14. Psychological Assessment
15. Vocational Counseling
16. Independent Skill Assessment
17. Behavioral Assessment
18. Physical Capacity Testing
19. Job Site Analysis/Modification
20. On-the-job Evaluation

Work Adjustment

1. Orientation and Intake
2. Work habit and Attitude Training
3. Vocational Counseling
4. Personal Counseling
5. Vocational Skill Training
6. Off Site Evaluation
7. Off Site Training
8. Job Seeking Skills Training
9. Follow-up
10. Group Counseling
11. Behavior Modification
12. Role Modeling
13. Grooming and Hygiene Skills

14. Task Analysis
15. Pre-Vocational Skills Training
16. Personal and Social Development
17. Paid Work
18. Adult Basic Education/GED Preparation
19. Psychological Consultation
20. Controlled Work Experience
21. Referral Services
22. Social Case Work
23. Activities of Daily Living Training
24. Job Placement

Sheltered Employment

1. Vocational Counseling
2. Referral Services
3. Controlled Work Experiences
4. Remunerative Work
5. Job Development
6. Work Skill Training
7. Contract Work
8. Leisure Time Activity Development
9. Independent Living Skill Development
10. Remedial Education
11. Activity Therapy
12. Personal and Social Adjustment
13. Placement
14. Job Seeking Skills

Clients Served

In addition to establishing admission criteria, disability types and other client characteristics of those who will be served should also be provided in written statements. A "client served" list should be developed. There should be a logical relationship between clients and the goal and services that will be provided. Some of the population groups you may serve are:

1. Physically/Orthopedically disabled
2. Emotionally disabled
3. Spinal Cord injured
4. Economically disadvantaged
5. Hearing disabled
6. Visually disabled

7. Neurologically disabled
8. Developmentally disabled
9. Learning disabled
10. Culturally disabled
11. Multiply disabled
12. No previous work experience
13. Severely disabled
14. Substance abusers
15. Public offenders
16. Epileptics
17. Non-English speaking
18. Industrially injured

Your list should include all types of disabilities and conditions, both primary and secondary, which could be served according to the nature of the program and the mission of the agency. Therefore, do not necessarily limit the list to those types of individuals already receiving service. On the other hand, the goals and nature of some programs will limit the disability populations admitted.

Program Objectives

Objectives are often used as the statements tested by evaluation research. Evaluations need to discriminate among several different types of objectives. They include: process objectives, outcome objectives, and management objectives.

Objectives are specific statements of the results a program intends to achieve. The objectives for each program should be consistent with the goal statement for that program. If all of the stated objectives are achieved, the program will have accomplished its goals.

Objectives are the statements from which measures are derived, thus they must be stated in terms of the ultimate results or outcomes which clients of that program should achieve as a result of the services provided. Objectives must reflect both effectiveness and efficiency measures. Effectiveness measures tell evaluators how successful the client has been in achieving the benefits of the program. Efficiency measures tell evaluators how successful the program was at minimizing costs and/or time. Every program has at least one effectiveness and one efficiency objective.

Outcome Objectives

Outcome objectives specify the status of the client following the provision of services. For example: employed, in training, etc. are specifications of a client's status. They should reflect the benefits which clients may achieve as a result of the program.

Process Objectives

Process objectives are internal monitors of client progress. They are most often used to describe programs. For example: sheltered employment, extended employment, day activity centers, etc. are specifications of program activities in which clients may be spending many months or years before achieving a final outcome. Process objectives do not substitute for outcome measures. Process measures may reflect such things as:

"Percent of clients who obtained a wage increase."

"Percent of clients who move to a more independent living situation."

"Percent of clients who obtain an improved score on a social behavior checklist."

Management Objectives

Management objectives typically reflect the activities undertaken for "the good of the facility." Examples of such objectives are: "establish a vocational problems screening unit," "obtain additional funding," or "increase funding from present sources."

Principles of Writing Objectives

To help program evaluators create research models that provide solid data about the facility:

1. Objectives should be measurable.
2. Objectives should be achievable.
3. If all of the objectives are accomplished, then the goal will have been achieved.
4. The developer should keep in mind, the close relationship between goals, objectives, and measures.

5. Objectives should be listed in rank order as to their importance with the most important objectives listed first.

Examples of Program Objectives

Vocational evaluation

The primary objectives in evaluation should be consistent with obtaining positive results regarding the establishment of vocational objectives for the client. Other objectives are possible, though of less relative importance. As with every program, efficiency measures also need to be included. Below are samples of vocational evaluation program objectives:

Maximize client completions with positive vocational recommendations

Maximize client enrollment for community service recommendations

Maximize percent of terminees who complete their planned program

Minimize the average program length of all program participants

Maximize percent of clients on whom critical vocational recommendations are followed by counselor

Maximize acceptance of primary recommendations by referral or funding agencies

Work adjustment

The primary objective in a work adjustment program should be directed toward achieving job placement for the client with competitive employment as its major emphasis. Also of importance is the successful placement of the client in the vocational areas most suited to his skills and abilities as determined in evaluation as his vocational objectives. The time the client spends in his training should be minimized. Below are some examples of possible work adjustment program objectives:

Maximize the percentage of clients who obtain full-time competitive employment

Maximize the percentage of program terminees of all types that obtain employment less than full-time

Maximize the percentage of terminees who enter into skill training or OJT programs

Maximize the percentage of clients who enter sheltered employment programs

Minimize the time in program for persons meeting positive objectives

Maximize the wages of clients that are placed into competitive employment

Maximize the percentage of clients who complete their planned programming

Minimize expenditures (on a per client basis) for achieving positive program outcomes

Minimize the time spent in the program by all program participants

Sheltered employment

The ultimate goal for clients within a sheltered employment program is competitive employment. Although this may be of a long nature for many of these clients, it should remain as the emphasis and, therefore, the primary objectives should reflect this. Disabled clients who no longer realistically have the possibility of obtaining this objective should be closed out as sheltered and either hired as disabled employees or referred to more suitable programming. Some possible program objectives for sheltered employment programs are:

Maximize percent of persons who obtain competitive employment, OJT, or non-sheltered work.

Maximize percent of persons exiting the program who obtain skill training.

Maximize the earnings of all sheltered employees. (Note that this is also a process objective.)

Minimize time in program for persons obtaining competitive work, non-sheltered work, or OJT.

Maximize the earnings of trainees who have competitive outcomes

Maximize referrals to alternative community services for nonsuccessful trainees.

Setting Goals And System Structures

Administration Vs. Program Structure

Administrative Structure

All facilities are structured to implement the goals of the facility and produce results. This structure is usually displayed in the form of an organizational chart.

Program Structure

Program structure, in contrast, arranges the organization into distinct elements for the purpose of evaluation. This structure helps the facility know the degree to which it is achieving client benefits following the provision of services. It should be noted that the program structure for evaluation purposes is generally different from the organizational structure.

Principles of Program Structure

1. Program structures can vary between facilities, even those facilities with identical purposes.

2. Program structure should be designed in such a way as to maximize the effectiveness and efficiency of management decisions.

3. Program structure should be developed in such a way as to measure all clients entering the facility in at least one of the programs.

4. Program structure will more than likely vary from the current organizational structure.

Creating Program Charts

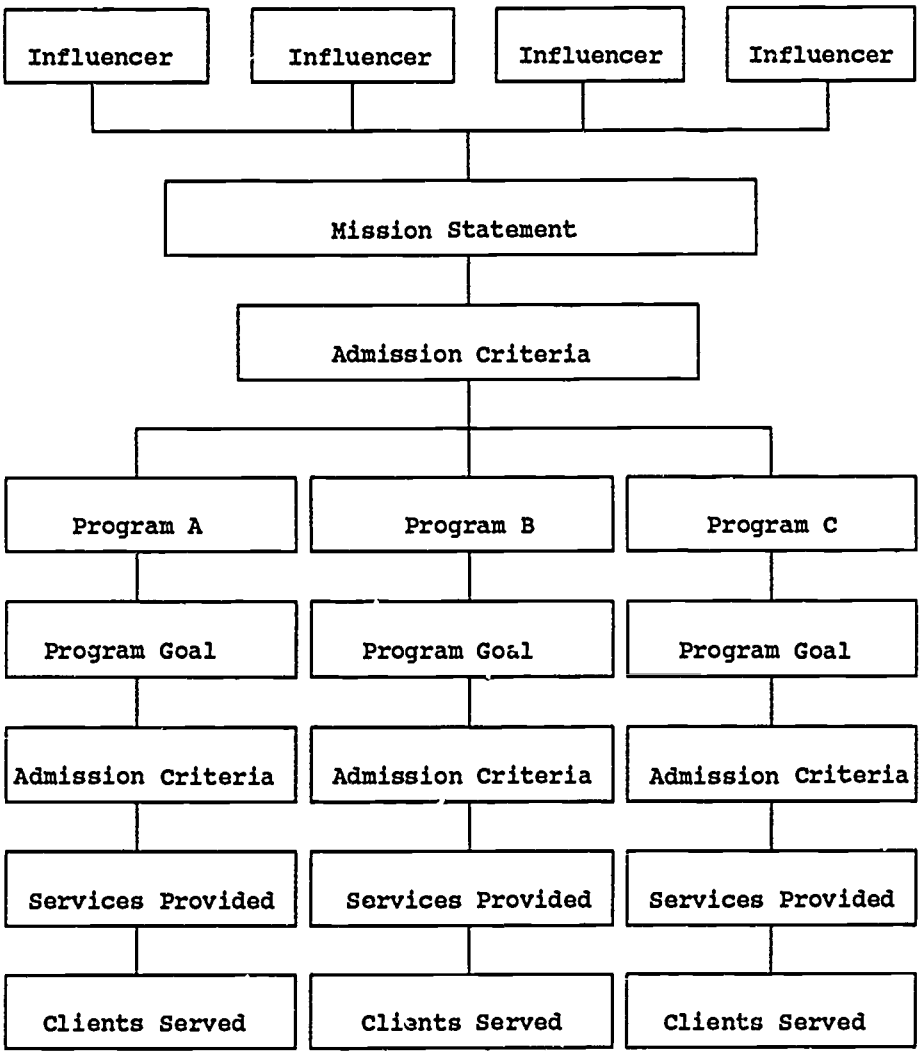
Program structure charts are the starting point for program evaluation because they outline the mission and goals for the facility. Program evaluators determine how well the agency is achieving these goals.

The easiest and most useful way to lay out the structure of a facility programs is to establish a flow chart as illustrated in Figure Four. The major structural elements are shown on this chart.

The chart also shows the organizations that influence the facility: its mission, the programs provided, and the specific goals, admission criteria, services provided, and the types of clients served for each program. This illustration shows the information in each box. For instance, the box labeled "mission statement" will contain the complete mission statement for the facility.

FIGURE FOUR: Sample Program Structure Chart

ELK MOUND INTEGRAGED INDUSTRIES
PROGRAM STRUCTURE CHART



EXERCISE THREE: Develop a Program Structure Chart

Using the charts on the following pages (or similar forms that better meet your facility's needs) create a program structure chart.

EXERCISE THREE: Continued

PROGRAM STRUCTURE WORKSHEET

LIST INFLUENCES:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

LIST MISSION STATEMENT:

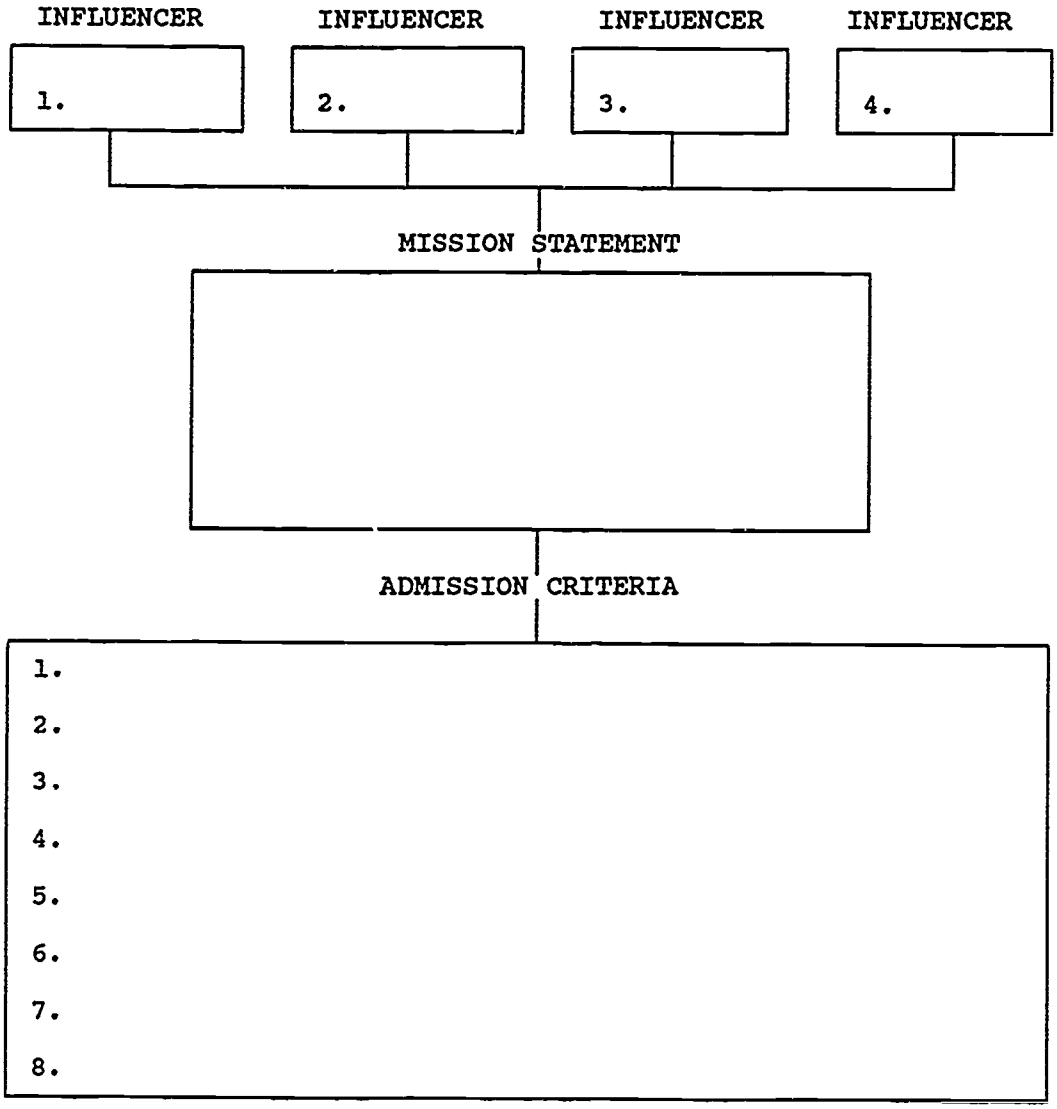
_____
_____
_____
_____
_____

LIST FACILITY ADMISSION CRITERIA:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

EXERCISE THREE: Continued

PROGRAM STRUCTURE CHART



EXERCISE THREE: Continued

PROGRAM ELEMENTS WORKSHEET

PROGRAM TITLE:

PROGRAM GOAL:

ADMISSION CRITERIA:

1. _____
2. _____
3. _____
4. _____

SERVICES PROVIDED:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

CLIENTS SERVED:

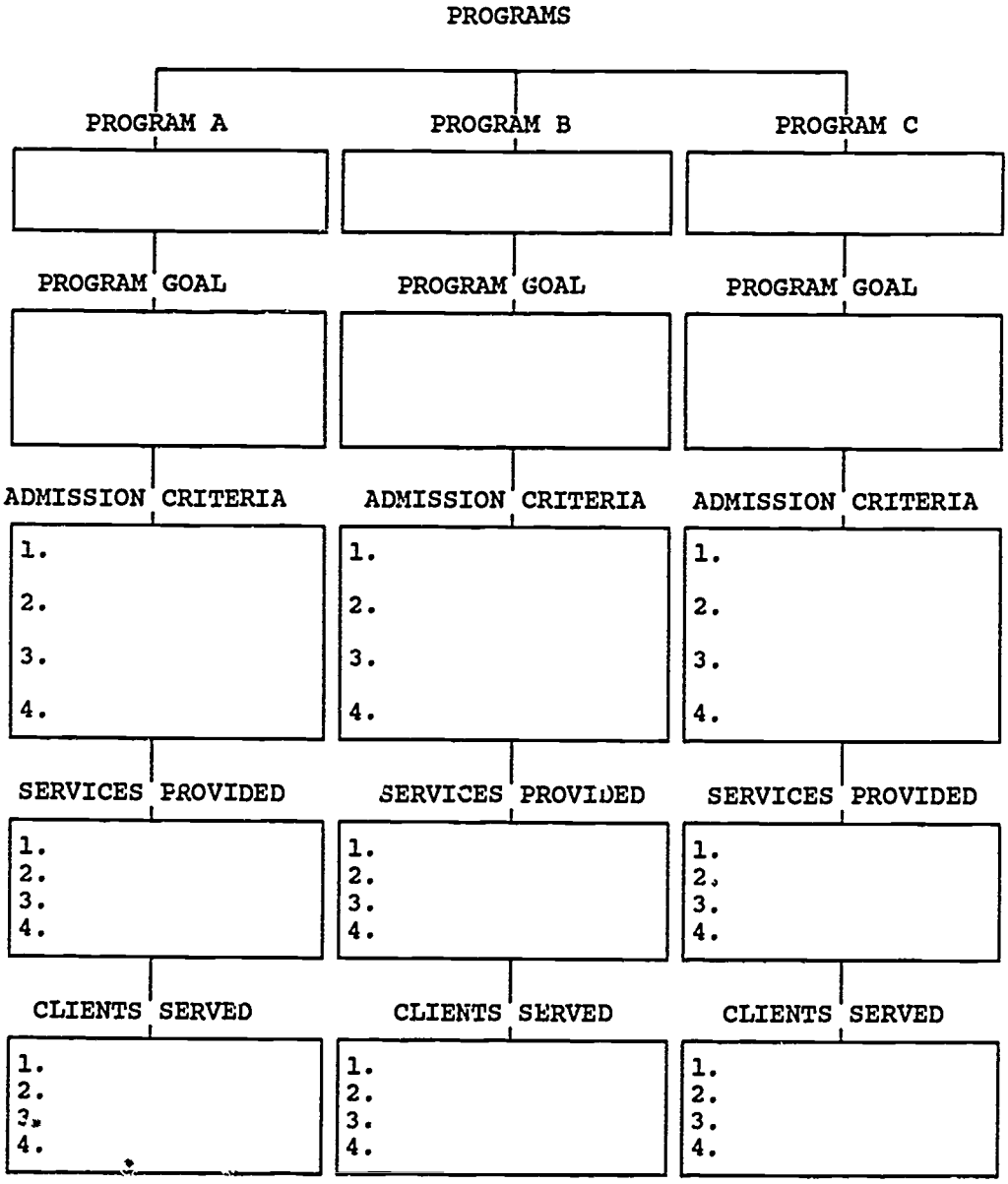
1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

PROGRAM OBJECTIVES:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

EXERCISE THREE: Continued

PROGRAM ELEMENTS CHART



SELF-TEST: Chapter Two

1. Program objectives are often stated in ways that are _____.

2. _____ are individuals or organizations that have an interest in the outcome of a program evaluation.

3. Program evaluation data must have basic _____.

4. Program evaluation should be linked to _____.

5. Evaluation planners should examine several facility policy areas before formulating an evaluation plan. They are: _____, _____, _____, _____, _____, _____, _____, _____, _____, and _____.

6. The mission statement is one of the _____ _____ and _____ _____ components of evaluation planning.

7. Facility admission criteria set _____ _____ and _____ for entry into all facility programs.

8. A service is a defined set of _____ provided within a program.

9. A program has: _____, _____ _____ _____, and _____ _____.

10. Goal statements should be specific enough to provide a _____ of _____ _____, how the _____ are _____, and the _____ of _____ _____.

11. _____ _____ _____ insure that services are provided to clients who need and can benefit from their provision.

12. Program services lead to the accomplishment of the _____.

13. _____ are statements describing the specific results to be achieved.

14. Program structure charts provide evaluators with a _____ of the facility's operation.

SELF-TEST: Chapter Two
ANSWER KEY

1. Program objectives are often stated in ways that are difficult to measure.

2. Stakeholders are individuals or organizations that have an interest in the outcome of a program evaluation.

3. Program evaluation data must have basic utility.

4. Program evaluation should be linked to program planning.

5. Evaluation planners should examine several facility policy areas before formulating an evaluation plan. They are: Mission statement, facility admission criteria, program entities, program goals, program admission criteria, program services, client populations, program objectives, and program structure.

6. The mission statement is one of the least difficult and most important components of evaluation planning.

7. Facility admission criteria set basic standards and requirements for entry into all facility programs.

8. A service is a defined set of actions provided within a program.

9. A program has: goals, specific admission criteria, and several services.

10. Goal statements should be specific enough to provide a determination of program outcomes, how the outcomes are measured, and the length of service provision.

11. Program admission criteria insure that services are provided to clients who need and can benefit from their provision.

12. Program services lead to the accomplishment of the program objectives.

13. Objectives are statements describing the specific results to be achieved.

14. Program structure charts provide evaluators with a map of the facility's operation.

Chapter Three

Measures for Goals and Objectives

Measures are statements that indicate how program goals and objectives will be achieved. Measures should reliably represent achievements. They are applied following the provision of services. Measures must clearly indicate who, what, where, and when they are to be applied. Some basic principles are:

1. The measures should determine whether the objective was achieved (valid/reliable).
2. The measures should report accurate information.
3. The measures should indicate a final result occurring following the provision of services (except in the case of process objectives).

Levels of Measurement

Measures are best stated in terms of real numbers, averages, percentages, time, or money. They should clearly reflect the method you will use to describe the provision of services that meet your objective. There should be no grey areas. The client either fits the criteria for measurement or does not fit the criteria for measurement. This gives stakeholders solid grounds for agreement on the actual amount of services that have been measured. Cook and Cooper (1978) state that measurement is the process of converting evaluation information into data that can be objectively interpreted.

Measurement can occur on four different levels. Assumptions for each level allow successively more accurate analysis methods to be used to interpret evaluation findings. These measurement levels are: nominal scale, ordinal scale, interval scale, and ratio scale.

Nominal

Nominal scales are the simplest. They are classifications (groupings) of people, things, or other units. Even when numbers are used to represent different classifications, relationships do not exist between the separate classifications. Thus, no numerical analysis of the numbers can be made. For example, a nominal scale may be used to class people as 1) amputee, 2) paraplegic, 3) blind, 4) mentally retarded, 5) other. If all clients were assigned these nominal numbers, determining an average or any other statistic using the 1 - 5 scale would give no meaningful data. Additionally, nominal scales do not have zero points.

Ordinal

Ordinal scales improve the nominal scale. They can be used when some degree of relationship exists between units. Ordinal scales are often used to describe subjective data. For example, if we asked clients how satisfied they were with the training they received, we may classify their answers on a scale of 1 to 5 with very satisfied being one and very unsatisfied being five. However, the amount of satisfaction between 1 and 2 is not necessarily the same as between 3 and 4. Thus, conclusions drawn from such data need to be carefully considered. Additionally, ordinal scales may or may not have a zero point. Ordinal scales are often used to evaluate rehabilitation programs.

Interval

Like ordinal scales, interval scales assume a direct relationship between scale units. Unlike the ordinal scale, interval scale units are equally separated. The amount of change from 1 to 2 must be equal to the amount of change from 4 to 5 and for any other full unit within the scale. Additionally, interval scales do not have a zero point. For example, IQ tests use interval scales and do not have zero points. To have zero IQ is to be unable to take the test (dead). Much of the objective data obtained for program evaluation can be placed on an interval scale.

Ratio

The highest level of measurement is the ratio scale. Like the interval scale, intervals between units have a direct and proportional relationship between themselves, but ratio scales always have a zero point. Thus, the data that is collected using a ratio scale must be capable of not existing.

Remember the Politics of Evaluations

When determining program evaluation measures, it is essential to recall that program evaluation is a political process. All stakeholders have a vital interest in the measures that are chosen. Some stakeholders, in fact, will have legal rights to regulate the measures that are used.

Where choices can be made, measures should be chosen to show the most programmatic impact relative to contemporary standards. For example, assume that it is possible to measure success by either the number of clients successfully entering competitive and/or supported work sites or by the total number of clients successfully leaving a training program. If we know that the principle source of program funds are obtained from a funding agency that is particularly under pressure to place clients into supported work programs, it will be politically expedient for the facility to choose that measure to examine when evaluating their program.

Consider the Data Gathering and Analysis Techniques to be Used

Another important area to consider when choosing measures for evaluation goals and objectives is the data gathering tactics and the analysis techniques that will be employed after data is gathered. Evaluators can employ the tactics of experimental research, correlational research, and case study to gather their evaluation data. And they can employ a wide variety of analysis techniques including multiple regression, chi-square, systems analysis, hypothesis testing, and sign tests to determine the meaning of the gathered data. All these tactics and techniques influence your data gathering techniques. It is essential that data gathered about the chosen measure be compatible with the technique that best answers the evaluation question. (We will examine these tactics in more detail in Chapters Four, Six, and Seven.)

Some Possible Measures

Figures Five, Six, and Seven provide a general comparison of possible measures for several types of facility programs. You will, of course, tailor the measures you use to the tactics of your program.

FIGURE FIVE: Possible Measures for Vocational Evaluation Programs

	(A)	(B)	(C)	(D)	(E)	(F)
#	OBJECTIVES	MEASURE	APPLIED	TIME	DATA	GOAL
1	Maximize client completions with positive vocational recommendations	% of clients with + voc objective	All closed clients	At program exit	Generate by evaluator	85%
2	Minimize average program length for program completors	Average program length	All clients completing program	At program exit	Generate by evaluator	4 weeks
3	Maximize percentage of clients for whom critical vocational recommendations are followed by counselor	% of clients with follow-up	All clients completing program	60 days after exit	Generate by counselor	80%

FIGURE SIX: Possible Measures for Work Adjustment Programs

	(A)	(B)	(C)	(D)	(E)	(F)
#	OBJECTIVES	MEASURE	APPLIED	TIME	DATA	GOAL
1	Maximize percentage of clients who obtain competitive employment	% of clients who obtain jobs	All closed clients	60 days after exit	Generate by employer	40%
2	Maximize percentage of clients entering skill training	% of clients who enter progrms	All closed clients	60 days after exit	Generate by Fd. cnslr	15%
3	Maximize percentage of clients obtaining sheltered employment	% of clients who enter program	All closed clients	60 days after exit	Generate by Prog. Mangr	20%
4	Maximize wages for clients attaining objective number one	Average wage at closure	Clients reaching objective No. one	60 days after placement	Generate by Employer	$3.75
5	Minimize time in program for clients attaining objectives one, two, and three	Average length in program	Clients reaching objectives # 1, 2 & 3	60 days after exit	Generate by prgrm mangr	24 weeks

FIGURE SEVEN: Possible Measures for Sheltered Employment Programs

	(A)	(B)	(C)	(D)	(E)	(F)
#	OBJECTIVES	MEASURE	APPLIED	TIME	DATA	GOAL
1	Maximize percentage of clients who obtain competitive employment	% of clients who obtain jobs	All closed clients	60 days after exit	Generate by Employer	25
2	Maximize percentage of clients obtaining skill training	% of clients who enter school	All closed clients	60 days after exit	Generate by Ed. Cnslr	15
3	Minimize time in program for clients attaining objectives number one and/or two	Average length in the program	Clients closed from objective 1/2	60 days after exit	Generate by prog. mangr	52
4	Maximize earnings of sheltered employees	Average wages per hr.	All active program clients	Every 6 months	Generate by bookkeepr	$2.50
5	Maximize percentage of clients utilizing program services	% of clients who use program service	All active program clients	Every 6 months	Generate by prog. mangr	75%

Determine Who/What Will Be Measured

Your statement of who or what will be measured must indicate the groups of clients whose results will be calculated for that measure.

Set Time of Measurement

Time of measurement is the point in time when outcome information is collected. It is important that the time of measure be made in relationship to the program flow and the objectives to be measured. Some measures are taken at program exit (for example: time in program or identified vocational objectives) while others may have to be taken after an extended period (for example: obtaining competitive employment, or acceptance of recommendations.) You must be sure that the time of measurement is clearly specified to ensure that the program impacts on the outcome.

Specify Data Sources

Specifics of where the information or data concerning the outcome of the objective will be located or stored should be recorded. Each client should have a "data sheet" in their main file that contains all the summary information on the client that will be used in the program evaluation. (The development and use of client data sheets will be discussed in Chapter Four.) Some sources of data are:

Final evaluation reports
Referral agency records
Counselor records
Client records
Employers
Vocational schools
Program managers
The clients themselves
Bookkeepers

Document Goal Expectancies

Goal expectancy is the level of measurement that indicates an objective has been achieved. Thus, it is the criteria against which actual performance is measured. Obtaining client performance data is the first step in determining program performance. If the facility is to find the data

useful, it should compare results against some explicit criterion or expectancy.

If goals have not been specified, consistent judgments and subsequent action to improve program performance cannot occur. Initial goals may be established using the experience of your facility. The experience of other facilities whose programs are essentially the same can also be used. Funding source expectations and information from literature related to the program being evaluated are other possible sources for expectancy data.

A major benefit from setting goal expectancies is the process of goal setting itself. It forces staff to think about outcomes. Too often, rehabilitation professionals can become so concerned with the process of rehabilitation that they forget the need to obtain an outcome. The expectancy setting process may also improve communication among the staff. For example, a program director may believe that anything below 70% placement is unacceptable. The program staff, on the other hand, may feel that if they get 15% placed they are doing a great job. The administrator and the staff must discuss their differences in expectations and resolve them.

Final expectations should be set by consensus between the facility director, the program director, and the program staff responsible for the delivery of the service. After data has been collected for a few months, goals may be reviewed and revised. If major changes are made in a program, goals should also be changed. However, once realistic goals are established, they should be maintained for at least one year. Establishing program evaluation goals at the beginning of the fiscal year may be a prudent step.

EXERCISE FOUR: Develop an Evaluation Measures Chart

Using the chart below, or a similar form that better meets your facility's needs, create an evaluation measures chart for your facility.

MEASURES FOR THE _____ PROGRAM

	(A)	(B)	(C)	(D)	(E)	(F)
#	OBJECTIVES	MEASURE	APPLY	TIME	DATA	GOAL
1						
2						
3						
4						
5						

SELF-TEST: Chapter Three

1. Measures are statements that indicate how program goals and objectives _____ be _____.

2. Measures must be stated in _____ of _____ _____.

3. The four levels of measurement are: _____, _____, _____, and _____.

4. _____ scales provide no numerical relationship among units.

5. _____ scales provide a numerical relationship among units, but the relationships may not be equal.

6. Equal numerical relationships among units are provided by _____, but they do not have zero points.

7. The highest level of measurement is the _____ scale.

8. All _____ have an interest in the measures that are chosen.

9. Elements that should be considered when determining a measurement type for evaluation purposes are: _____ or _____ will be _____, the _____ of the _____, the _____ _____, and the _____ _____.

SELF-TEST: Chapter Three
ANSWER KEY

1. Measures are statements that indicate how program goals and objectives will be achieved.

2. Measures must be stated in terms of real numbers.

3. The four levels of measurement are: nominal, ordinal, interval, and ratio.

4. Nominal scales provide no numerical relationship among units.

5. Ordinal scales provide a numerical relationship among units, but the relationships may not be equal.

6. Equal numerical relationships among units are provided by interval scales, but they do not have zero point.

7. The highest level of measurement is the ratio scale.

8. All stakeholders have an interest in the measures that are chosen.

9. Elements that should be considered when determining a measurement type for evaluation purposes are: who or what will be measured, the time of the measurement, the data source, and the goal expected.

Chapter Four

The Collection of Data

Evaluations of all types rely on the comparison of factual data to arrive at conclusions. They, therefore, can use the scientific method to assure that conclusions can stand public inspection.

The scientific method is the systematic collection of factual data by objective observations to answer measurable questions. The difference between program evaluation research and traditional scientific research is that evaluation research must be used for decision making to justify expenditures of time and energy. Traditional scientific research may be performed for purely esoteric reasons.

Research Tactics

Evaluation researchers use three tactics to implement the scientific method. They are: experimental research, correlational research, and case studies. Brief descriptions of these tactics are provided below. A detailed discussion is found in Chapter Six.

Experimental Research

Experimental research is the gathering of factual data to prove or disprove a hypothesis. The hypothesis is a tentative solution to the evaluation question. For example, if a program is evaluated to determine its effectiveness at providing training to clients relative to another program, a hypothesis may be stated: Clients of Vocational Training Program A are more employable after completing the program than clients of Vocational Training Program B.

To investigate this hypothesis using a scientific approach, it is necessary to choose the individuals that enter each program using a random sampling technique that allows all client referral to be equally likely to be entered into one or the other of the programs. This random assignment

helps reduce possible reasons for one group to be more employable to the program they had entered. It is also necessary to choose a measure (see Chapter Three) that represents employability. The measure must be quantifiable to allow data collection to proceed. In the language of researchers, the measurement is called the dependent variable because the data gathered will be dependent on the program from which it is gathered. Thus, each program is called an independent variable.

Correlational Research

Correlational researchers attempt to find associations or relationships between program components, other programs, and environmental considerations. This type of research does not provide any implication of cause. That is, a correlational study does not establish a hypothesis against which the data from dependent and independent variables are compared.

Case Studies

The case study is probably the most widely accepted data gathering tactic used by program evaluators in rehabilitation settings. In the case study tactic, existing data files on programmatic activities are examined to generate the data for use in making scientific comparisons. This tactic has many data gathering flaws that cause problems of interpretation for evaluators. The data are easily "contaminated" rendering any finding suspect. However, especially when ongoing collection systems are in place, this approach may be the least costly of the research tactics.

Ongoing Collection Systems

Programs of a long duration, such as sheltered employment programs, may not generate sufficient client closures in outcome objectives to allow frequent program monitoring. Forms and procedures must, therefore, be developed to allow you to monitor all your clients in all programs based upon process objectives alone. This allows "long term" programs to be monitored on a quarterly, semi-annual and/or annual basis. Process objectives based on an ongoing data collection system supplement outcome measures and allow for the interval monitoring of your program.

Set Procedures to Insure Accuracy and Completion

For program evaluators to accurately interpret the data that is obtained using any of the above tactics, procedures must be developed to insure that the data that is collected includes all possible variables, and/or identifies single variables with precision. Two possible methods may be employed: the ongoing collection of global data and statistical sampling.

Collection of all data points is not necessarily the most accurate method, though the proponents of ongoing collection of data often cite accuracy and completeness as a reason for the expenditure of time and effort. In fact, the global gathering of data for use in program evaluation may not only be a waste of data collection resources, it may actually be less accurate than representative sampling. This is true because more people are involved in global data collection, leading to a greater possibility for contaminated (inaccurately recorded) data.

Statistical Sampling

To insure that data samples are representative of the total data pool that is to be measured, samples must be randomly chosen to give each pool unit an equal chance of being chosen.

Advantages

Random samples that accurately reflect the population that they represent, have three advantages over the collection of data from the population total:

1. They provide real time and resource saving with little loss of accuracy because data is less likely to become contaminated.

2. They can produce more timely results because the time of sampling can be quickly determined and the data quickly collected.

3. They give program administrators more flexibility in the evaluation questions they ask because of their increased dollar and hour efficiency.

Randomization Concepts

Several descriptors are important to the creation of randomized samples:

Population mean: The sum of all the units of a population divided by the number of units in the population.

Sample standard deviation: A statistical measure of variability among sample scores. It is determined by subtracting the mean of the population from each score, squaring the products of the subtraction, summing the squared products, dividing the sum by the population total minus one, and finding the square root of the product of the division. (See "Estimating Mean Sample Sizes" below for an example using this formula.)

The selection of a random sample to insure accurate representation of the population most commonly uses one of three methods: a table of random numbers, a computerized random sample, or a "seat-of-the-pants" randomization method.

Tables of random numbers

Tables of random numbers are found in many mathematics books. They are made up of a randomly generated series of numbers that can also be randomly accessed. An example of a random number table is found in Figure Eight below.

FIGURE EIGHT: Table of Random Numbers

76484	83095	41282	48852
51764	23954	15324	81036
62749	33349	67455	55698
70853	00414	73689	94686
69123	85183	78599	85691
29459	20966	53998	19380
60725	10204	69175	30197
86799	39741	40321	63908
24052	88913	70212	81172
07767	97531	07586	97569
14474	93453	26053	25650
81477	19401	70255	36507
58981	47716	23038	27154
80615	88717	33872	41629
57078	85952	61034	26440

Using a random number table is one of the easiest methods of selecting a random sample. All population units are first assigned a sequential number. Then, the evaluator chooses any point on the table to begin listing numbers. If the population contains less than 100 units, only two digit numbers are chosen; if less than 1000 units, only three digit numbers, etc. Any number that is greater than the population total is discarded. Numbers continue to be selected by reading down or across the table until the total needed for a representative sample has been reached. Then the randomly selected numbers are matched to the corresponding numbers assigned sequentially to each population unit.

Computer generated samples

Some statistical software programs are designed to produce random numbers. This may be the quickest way to match a randomly selected number to a population unit. Sequential numbers are assigned to population units. The computer selects the representative sample, and the randomly selected numbers are matched to the corresponding number assigned sequentially to each population unit.

"Seat-of-the-pants" methods

If only small samples are needed, it may be feasible to draw numbers out of a hat or some other equally folksy container to obtain a random sample. The trick is to insure that all units are equally represented and that each unit has the same chance of being chosen as part of the sample as all other units.

Estimating Sample for Proportions and Means

Another key to insuring that samples are representative is to accurately determine the number of units that must be included in the sample. Two processes for estimating the most accurate sample size are used. One is principally employed when the program evaluation question can be phrased such that the measurement obtained through the data gathering process will result in a population proportion figure. The other process is employed when the data gathering process results in a mean (average) figure.

Estimating proportional sample sizes

Three factors affect the determination of a sample size: the margin of error, the degree of risk, and the estimation of the true proportion.

The degree of risk is a percentage representation of a reasonably accurate estimate of the true proportion. For example, we may want our final prediction to be accurate within 5% of the actual proportion for the data we are collecting. We would then specify a probability of .05.

The margin of error is the probability that we will accept that the true proportion will differ from the sample by more than a small percentage. For example, we may want to be sure that the actual proportion for the data we are collecting is within the margin of error at least 95% of the time. We would then specify a margin of error (represented in formulas as ME) of .05.

The estimation of the true proportion is simply an educated guess at what the true proportion may be.

We also need to determine a statistical amount that denotes a portion of a normal distribution curve. This amount is symbolized by the figure Zä/2. It is determined by using a table such as in Figure Nine below:

FIGURE NINE: Table of Zä/2 at Various Degrees of Risk

ä	=	.01	.05	.10
Zä/2	=	2.57	1.96	1.65

For example, assume that we wish to discover the proportion of clients who have been discharged from our facility into competitive vocational settings in the last ten years. Let us further assume that our facility has served 1,500 clients during this period. Because we wish to use the results of this evaluation to show how effective our program has been compared to a similar facility in the southern part of our catchment area, we want to be fairly precise. Thus we set our degree of risk at .05 and our margin of error at .05. After talking with the vocational supervisors, we conclude that a reasonable estimate of the true proportion of clients who have been discharged into competitive vocational settings (this estimate is denoted as P^ in our formulas) is about 34%.

We now use the following formula to determine the number of client files that we need to check to, with reasonable precision, determine the actual percentage:

$$\text{(Sample Size)} \qquad n = \frac{(Z\ddot{a}/2)^2 \ \hat{P} \ (1-\hat{P})}{ME^2}$$

Inserting our predetermined figures into the formula, we find that our sample size "n" equals 345 cases.

$$\text{(Sample size)} \qquad n = \frac{(1.96)^2 \ (.34) \ (.66)}{(.05)^2}$$

Because this equation was designed to determine the size of samples when they are very large relative to the population, a smaller sample may be used when the product of the division of the sample size (n) by the population size (N) is more than .05.

Dividing 345 by 1500 we determine the product of .23. Because this is larger than .05 we can use the following formula to obtain the actual, smaller, sample size:

$$\text{(Smaller sample size)} \qquad n' = \frac{\text{(Sample size) } n}{1 + (n/N)}$$

Filling the equation with our predetermined figures we note that:

$$\text{(Smaller sample size)} \qquad n' = \frac{345}{1 + .23}$$

Therefore, to be 95% certain that the true proportion falls within 5% of the figure determined by the sample we will need to select a random sample of 280 cases from the 1,500 cases the facility has on record.

Estimating mean sample sizes

Some program evaluation questions are better answered using mean (average) measures rather than proportional measurements. In this case, in addition to the margin of error and the degree of risk that we are willing to accept (see the discussion "Estimating proportional sample sizes" above) we must also determine an estimate of population variance. Population variance is the square of the standard deviation, thus we would solve the equation for standard deviations up to the point where the square root is determined to obtain the population variance.

Rather than guessing at the population variance, which could lead to extremely inaccurate estimates of sample size, it is best to conduct a simple pilot study. By randomly choosing cases to examine using the measurements that have been chosen, we can obtain an estimate of the population variance to use in the formula.

For example, assume that we wish to discover the average amount of time that a client spends in our facility before being placed into a competitive vocational setting. In the last ten years, our facility has served 1,500 clients. Because we wish to use the results of this evaluation to show how effective our program has been, compared to a similar facility in the southern part of our catchment area, we want to be fairly precise. Thus we set our degree of risk at two months and our margin of error at .05. We have decided to pull a sample of 50 cases as a pilot study to determine an estimate of population variance and also decided to define our measurement as months from program admission to discharge into a competitive setting.

After randomly selecting 50 cases from all the clients who entered our facility in the past ten years, we discover that only 15 cases resulted in a placement in competitive vocational settings. Because we decided to use months in programming as our measurement, we list each case with the length of tenure as below:

Case	Months	Case	Months
1	20	8	8
2	9	9	10
3	2	10	16
4	1	11	5
5	5	12	17
6	7	13	4
7	14	14	15
		15	7

To estimate the population variance of the pilot study we subtract the mean of the population from each score, square the products of the subtraction, sum the squared products, and divide the sum by the population total minus one. The formula for these steps is:

$$\text{Sample Variance} = \frac{E\ (Y - \bar{Y})^2}{n - 1}$$

(E is a mathematical symbol that means "the sum of.")

Continuing our table we determine the population mean, subtract the mean from each score, and square the product of the subtraction:

Case	Y Months	$Y - \bar{Y}$	$(Y - \bar{Y})^2$
1	20	11.2	125.44
2	1	-7.8	60.84
3	2	-6.8	46.24
4	1	-7.8	60.84
5	5	-3.8	14.44
6	7	-1.8	3.24
7	14	5.2	27.04
8	8	- .8	.64
9	10	1.2	1.44
10	16	7.2	51.84
11	5	-3.8	14.44
12	17	8.2	67.24
13	4	-4.8	23.04
14	15	6.2	38.44
15	7	-1.8	3.24
	E = 132		E = 538.40

$\bar{Y} = 132/15 = 8.8$

Now we can plug the data into our formula:

$$\text{Population variance} = \frac{538.4}{14} = 38.46$$

At this point we have nearly all of the data points needed to estimate the sample size: degree of risk of two months, .05 margin of error (.95 confidence level), and 38.46 population variance estimate. One more point needs to be determined. That is the Zä/2 normal curve computation. We obtained a Zä/2 figure of 1.96 from Figure Nine above.

Now we are ready to use the formula for estimating the sample size. It is:

$$\text{(Sample size)} \quad n = \frac{(Zä/2)^2 \; sd^2}{ME^2}$$

Entering our predetermined data, we calculate that our random sample should be drawn so that it includes at least 37 valid cases.

$$n = \frac{(1.96)^2 \; 38.46}{2^2} = \frac{147.75}{4} = 36.9$$

Because we drew 15 cases for our pilot test, we need to obtain a sample of only 22 more cases. Because the first fifteen were drawn from a sample of 50 cases (approximately 30%) we would need to draw a sample of 73 cases (22 divided by .3) to be assured that 22 usable cases will be selected.

As in determining sample sizes based on proportions, this equation was designed to determine the size of samples when they are very large relative to the population, a smaller sample may be used when the product of the division of the sample size (n) by the population size (N) is more than .05.

Dividing 37 by 1500 we determine the product to be .02. Because this is smaller than .05 we cannot use the formula for obtaining a smaller sample size. (The formula and its application, should your product be larger than .05, is found above in the section titled "Estimating Proportional Sample Sizes.")

Gather Data on Summary Sheets

All information necessary to track any clients in facility programs may be gathered on a client data sheet (see Figure Ten). As the client enters the program, a client data sheet is started by the person in charge of that particular program. For example, the vocational evaluator would fill out the form for those clients entering the evaluation program. This data sheet is placed in an "active client" file. All the data sheets for active clients are thus in a single folder. The "active clients" file remains in the program providing services at that time.

The data collection sheet is divided into several major sections: General information, Benefit status, Recommendations, Follow-up/Referral Information, and Client descriptors. This format is modified by your facility to meet your particular data collection needs.

General Information

This section contains information about the client, program status information, and client vocational objectives. This section is completed for every client at the time of each program entry. The dates the client exits and closes the program are also entered here. When the client exits a program and enters another, another client data sheet must be created.

The exit time is the day on which the client completes a specific program. Closure is the day on which a case or program manager determines that the client received (or did not receive but was terminated) the expected benefit from the program. Closure dates are determined for all objectives of each program when you measure each area.

If the client's program is interrupted, the starting time for the interruption is stated at the time it begins. The client data sheet is then placed in the "interrupted programs" file. When the client returns, that date is recorded on the form and it is returned to the "active clients" file.

If a client terminates the program prior to completion, this information is entered on the form as well, along with the nature of the termination (self or facility initiated.) (You may want to determine the number of self-initiated dropouts as compared to the number of agency initiated terminations.)

When a client exits the program, the staff providing services, such as the vocational evaluator, completes sections A and C on the client data sheet and sends it to the rehabilitation director or other personnel responsible for follow-up and program evaluation.

FIGURE TEN: Client Data Sheet

A: GENERAL INFORMATION

NAME JOHN RICHARD BOTTERBUSCH SS# 330-15-2345 AGE 26 SEX M
ADDRESS 14 EVALUATION DR, MENOMONIE, WI 54751 PHONE 715-232-7896
REFERRAL SOURCE WI DVR COUNSELOR T. JOHNSON (608) PH# 254-6825
DISABILITIES DIAGNOSED HEMAPLEGIA (338)

PROGRAM MANAGER: RONALD FRY

PROGRAM STATUS:	ACTIVE	INTERRUPTED	EXIT	CLOSED	SPAN
	011586	TO	031586	031586	8 WKS

PROGRAM TERMINATION: SELF-INITIATED AGENCY INITIATED

VOCATIONAL OBJECTIVES (OR EVALUATION PLANS):

DOT CODE	203-262-018	Terminal System Operator
DOT CODE	205-367-042	Registration Clerk
DOT CODE	215-362-014	Dispatcher Clerk

B: BENEFIT STATUS

OUTCOME OBJECTIVES:

OBJ#	1	Maximum completions with positive recommend	EXIT X	CLOSED	X
OBJ#	2	Minimum mean prog length for noncompletors	EXIT	CLOSED	
OBJ#	3	Max. % of clients with followed recommends	EXIT	CLOSED	X

PROCESS OBJECTIVES:

OBJ#	1	Evaluate on vocational objectives above	EXIT X	CLOSED	X
OBJ#			EXIT	CLOSED	

NON-BENEFIT ACHIEVER

C: RECOMMENDATIONS

VOCATIONAL OBJECTIVES: Evaluation indicates that Registr Clerk feasible
VOCATIONAL PLAN: Refer to Area One Tech Institute for instructional trng

D: FOLLOW-UP/REFERRAL INFORMATION

EMPLOYER/AGENCY WI Div of Motor Veh CONTACT R. Franke (715) PH# 232-6543
JOB TITLE MVD Applications Processor DOT CODE 205-367-042
STARTING WAGE $ 5.43 6 MONTH OTJ 12 MONTH OTJ

E: CLIENT DESCRIPTORS

PHYSICAL DISABILITY	X
MENTAL ILLNESS	
MENTAL RETARDATION	
HEARING DISABILITY	
VISUAL DISABILITY	
DEVELOPMENTAL DISABILITY	
LEARNING DISABILITY	
EPILEPTIC	
MINORITY	X
SUBSTANCE ABUSER	X
PUBLIC OFFENDER	
MULTIPLE DISABILITY	
SEVERE DISABILITY	X
INDUSTRIALLY INJURED	X
FORMER CLIENT	
PUBLIC ASSISTANCE	X
LESS THAN H.S. EDUCATION	
H.S. EDUCATION OR G.E.D.	
POST H.S. EDUCATION	X
NO PREVIOUS EMPLOYMENT	
UNDER 21	
MALE	X
FEMALE	
PREVIOUS INSTITUTION	
VR REFERRAL	
BLIND AGENCY REFERRAL	
SCHOOL REFERRAL	
JTPA	
WORKERS COMPENSATION	X
SELF-REFERRAL	
DMHMR REFERRAL	
OTHER REFERRAL SOURCE	

Next, the sheet is filed in an "exited client" file. The closure date used for the measurement of any client should be the most distant date of closure for his or her objectives. For example, if the client exits from vocational evaluation, his client data sheet would be placed in the "exited client" file 60 days after exit, rather than for the current month, if any of his objectives are measured 60 days past exit.

Benefit Status

This section relates directly to the client's achievement of the objectives of the program in which he/she is enrolled. When closure occurs, it is determined if the client has or has not attained the program benefits. When this is determined, the client is closed in that program and his program evaluation sheet is placed in a "closed client" file. At the end of each evaluation period program evaluation sheets from this file will be used to compute program evaluation data.

Recommendations

This section, includes the client's established vocational objective and vocational plan recommendations.

Follow-up/Referral Information

This section is used to enter employer or other service agency information to be used in follow-up and referral.

Client Descriptors

Finally, the client descriptor section is located on the back of the client data sheet or on a separate sheet. The client's descriptors are checked on entry and allow the facility's case population to be more narrowly and completely defined.

Tabulate The Data

Each program your facility includes in its ongoing data collection system will need to have its own results summary sheet to tabulate the data from closed client cases. The use of a summary sheet greatly simplifies the task and minimizes the amount of staff time needed. It allows for the

handling of each client data sheet only once. Each program summary sheet has space to record the results of 12 closed cases. Should you have more than 12 clients in closure status per program in any one month, simply use the number of sheets required and tally them on completion (see Figure Eleven).

Summary Procedures

Each month (or other regularly established period) the staff person(s) responsible for tabulating case data will take each program's "closed client" file and complete the summary sheets as follows:

A. All information on the summary sheet is filled out one client at a time. This allows you to handle each client data sheet only once.

B. Staff responsible for tabulating the results will take each program's "closed client file" for the evaluation period and complete the summary sheet.

The results of the facility's program objectives by client descriptors gives the facility a feeling for how successful certain clients and groups of clients are in its programs. This may give you important information regarding how the facility is meeting the needs of these clients, which clients it does well with and which it does not, which clients may be in need of a different type of program or different approach, etc. Information such as this can be useful in determining the direction of a facility's programs, new programs and services the facility may need to consider developing, and where to allocate its resources.

C. The results for each program are now totaled in the last column (see Figure Twelve) for each parameter that you have listed data for.

D. The results for each program objective is now totaled for the current and cumulative periods.

Program results by client descriptors are all in terms of the number of clients closed in each descriptive category. This is a tally of the number of clients closed achieving the objective listed divided by the total number of clients closed for the program.

FIGURE ELEVEN: Program Evaluation Results Summary Sheet

TIME PERIOD:	1	2	3	4	5	6	7	8	9	TOT
1 OR 2 OBJECTIVES	1	1	1		1	1		1	1	47%
3 OR MORE OBJECTIVES	1	1			1	1		1	1	40%
NONBENEFIT ACHIEVER				1			1			13%
PROGRAM LENGTH (WKS)	2	4	2		8	2		6	6	4.3
JOB PLACEMENT	1	1	1		1		1	1		40%
WORK ADJUSTMENT	1		1					1	1	27%
SHELTERED EMPLOYMENT		1								7%
WORK ACTIVITIES					1					7%
SKILL TRAINING	1					1			1	20%
HOMEBOUND										0
OUT REFERRAL					1		1			13%
AGENCY TERMINATION							1			7%
SELF-TERMINATION				1						7%
PHYSICAL DISABILITY	1		1				1			20%
MENTAL ILLNESS		1		1						13%
MENTAL RETARDATION		1	1		1	1				27%
HEARING DISABILITY								1		7%
VISUAL DISABILITY										0
DEVELOPMENTAL DIS.		1	1						1	20%
LEARNING DISABILITY				1						7%
EPILEPTIC									1	7%
MINORITY	1			1		1	1		1	33%
SUBSTANCE ABUSER	1									7%
PUBLIC OFFENDER				1					1	13%
MULTIPLE DISABILITIES	1	1	1	1					1	33%
SEVERELY DISABLED	1	1	1	1					1	33%
INDUSTRIALLY INJURED	1					1				13%
FORMER CLIENT					1					7%
PUBLIC ASSISTANCE	1	1	1	1	1	1	1	1	1	60%
LESS THAN H.S. ED.		1	1	1					1	27%
H.S. ED. OR G.E.D.					1	1	1	1		27%
POST H.S. ED.	1								1	13%
NO PREVIOUS EMPLOY.		1	1				1	1	1	33%
UNDER 21					1	1				13%
MALE	1	1	1			1				27%
FEMALE				1	1		1	1	1	33%
PREV. INSTITUTION	1		1	1						20%
VR REFERRAL		1	1	1				1	1	33%
BLIND AGENCY REFERRAL									1	7%
SCHOOL REFERRAL							1			7%
JTPA					1					7%
WORKERS COMPENSATION	1					1				13%
SELF-REFERRAL										0
DMHMR REFERRAL										0
OTHER REFERRAL SOURCE										0

FIGURE TWELVE: Program Results by Client Descriptors

PROGRAM: VOCATIONAL EVALUATION
OBJECTIVE/MEASURE: No. 1: Max. completions with positive voc. recommends
PERIOD COVERED: March, 1986 CUMMULATIVE: Jan-Mar 1986
NUMBER OF CASES CLOSED: 10 40

Descriptors	THIS PERIOD				CUMULATIVE		
	DESCRIPTOR DATA	NUMBER/TOTAL		%	NUMBER/TOTAL		%
PHYSICALLY DIS	11	2	3	67	8	10	80
MENTALLY ILL	1	1	2	50	5	12	42
MENTALLY RETARDED	1111	4	4	100	12	17	71
HEARING DISABLED	1	1	1	100	3	3	100
VISUALLY DISABLED	1	1	1	100	3	4	75
DEVELOPMENTAL DIS	111	3	3	100	10	12	83
LEARNING DIS	0	0	0	0	2	3	67
EPILEPTIC	1	1	1	100	1	1	100
MINORITY	111	3	5	60	11	13	85
SUBSTANCE ABUSE	1	1	1	100	3	3	100
PUBLIC OFFENDER	1	1	2	50	2	3	67
MULTIPLY DISABLED	1111	4	5	80	15	17	88
SEVERELY DISABLED	1111	4	5	80	14	16	88
INDUSTRIALLY INJ	11	2	2	100	5	6	83
FORMER CLIENT	1	1	1	100	1	1	100
PUBLIC ASSISTANCE	11111111	8	10	80	30	35	86
LESS THAN HS ED	111	3	4	75	14	16	88
HS OR GED ED	111	3	4	75	16	18	89
POST HS ED	11	2	2	100	5	6	83
NO PRIOR EMPLOY	11111	5	5	100	22	23	96
UNDER 21	1111	4	6	67	18	22	82
MALE	11111	5	5	100	20	22	91
FEMALE	111	3	5	60	14	18	78
PREVIOUS INSTITUTE	11	2	3	67	4	8	50
VR REFERRAL	1111	4	5	80	22	26	85
SCHOOL REFERRAL	1	1	1	100	2	2	100
JTPA	0	0	1	0	1	2	50
WORKER'S COMP	1	1	1	100	4	5	80
SELF-REFERRAL	11	2	2	100	5	5	100
DMHMR REFERRAL	0	0	0	0	0	0	0
OTHER REFERRAL	0	0	0	0	0	0	0

Data Tabulation

After the results summary sheets have been completed for each program, the staff responsible for collection and tabulation will complete the program results by objectives forms (see Figure Thirteen.)

FIGURE THIRTEEN: Program Results by Objective

RANK	OBJECTIVES	GOALS	THIS PERIOD			CUMULATIVE		
			DATA	RE-SULT	VARI ANCE	DATA	RE-SULT	VARI-ENCE
1	MAXIMIZE THE PERCENTAGE OF CLIENTS WHO OBTAIN COMPETITIVE EMPLOYMENT	40%	4/10	40%	0	14/40	35%	-5%
2	MAXIMIZE THE PERCENTAGE OF CLIENTS ENTERING SKILL TRAINING PROGRAMS	15%	2/10	20%	+5%	7/40	18%	+3%
3	MAXIMIZE THE PERCENTAGE OF CLIENTS OBTAINING SHELTERED EMPLOYMENT	20%	2/10	20%	0	6/40	15%	-5%
4								
5								

Frequency Distributions

The conversion of raw scores from summary sheets and other data gathering forms into group centered scores is a standardization process that allows data to be more easily compared with other groups. Several standardization methods will result in the expression of data in the form of a frequency distribution. They include: percentile ranking, histograms, and frequency polygons. Frequency distributions are representations of data based on their relative numerical groupings.

Percentile Ranking

One of the most common ways used to represent individual scores in relation to groups is to indicate the percentile ranking of the score. Percentile ranks are sometime converted into cumulative rankings to indicate the actual location of a score within a large mass of data points. Figure Fourteen below illustrates how raw data (in this case, the number of weeks from program admission until successful discharge) is listed by frequency, percentage of the total number of individuals entered into the program, and cumulative percentile ranking.

From this table, using both the percentage ranking and the cumulative percentages we can learn a great deal about the training program that each individual was engaged in. For example, we can see that the largest percentage of clients (21.053%) complete their training in 15 weeks by the percentage figure for clients completing 15 weeks of training. More significant perhaps, is the finding that 52.632% of the clients complete their training in less than 17 weeks. Of even more interest is the fact that only 1.754% of the clients complete training in less than 11 weeks, and that over 70% of the clients complete training in from 11 to 20 weeks.

FIGURE FOURTEEN: Weeks in Program

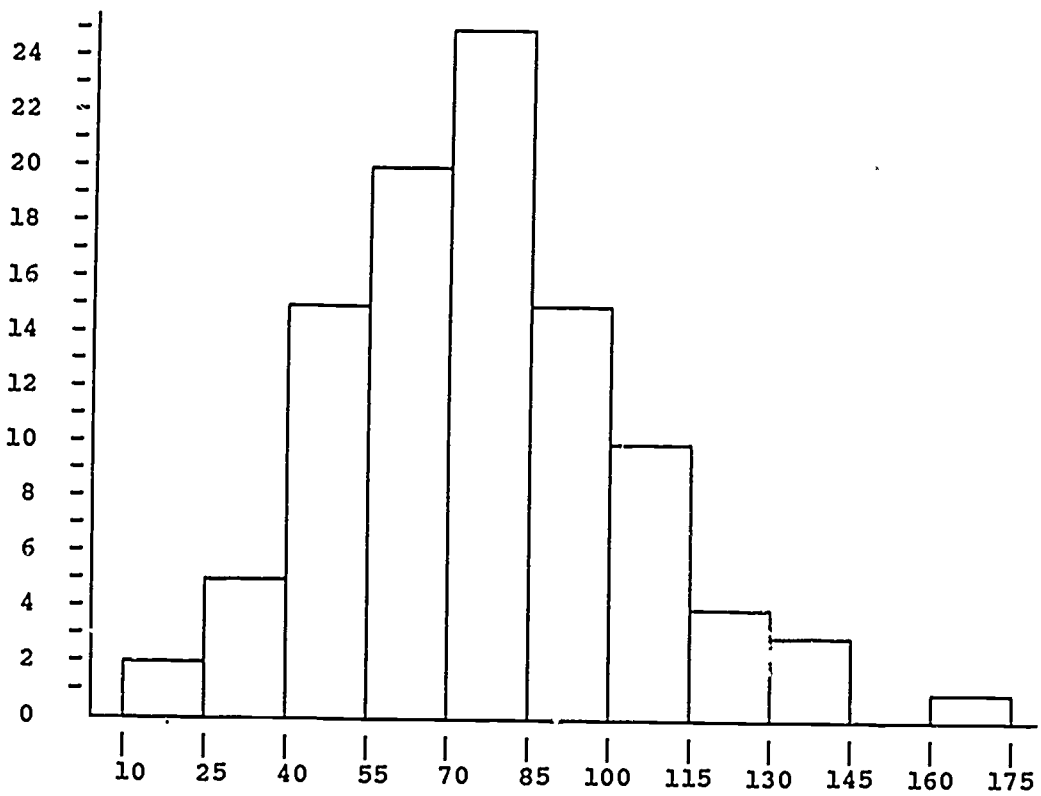
Weeks in program	Frequency	Percent	Cumulative percent
1	0	-	-
2	0	-	-
3	0	-	-
4	0	-	-
5	1	1.754	1.754
6	0	-	1.754
7	0	-	1.754
8	0	-	1.754
9	0	-	1.754
10	0	-	1.754
11	11	19.298	21.053
12	0	-	21.053
13	6	10.526	31.579
14	0	-	31.579
15	12	21.053	52.632
16	0	-	52.632
17	8	14.035	66.667
18	9	15.789	82.456
19	0	-	82.456
20	5	8.772	91.228
21	0	-	91.228
22	3	5.263	96.491
23	0	-	96.491
24	1	1.754	98.246
25	1	1.754	100.000
	57	100.000	$\bar{X}$ = 15.7

Histograms

Histograms are similar to percentile rankings because they also rank data from lowest to highest. However, histograms visually place the data into five to fifteen "ranges" allowing multiple individual scores to be more easily assessed. Each data range must be equal to all other data ranges. The size of each range is determined by the number of ranges and the size of the population. For example, the following table depicts the number of days of evaluation received by 100 clients who entered a training program.

Days of Evaluation	Frequency
10-24	2
25-39	5
40-54	15
55-69	20
70-84	25
85-99	15
100-114	10
115-129	4
130-144	3
145-159	0
160-174	1

Building a histogram from the table, we create a visual representation of the data that will allow us to clearly see the variance within the program.



Computing Standard Scores

Another method of raw score standardization is the computation of a standard score. Several methods are used. Like the process used for frequency distribution, one method is the percentile rank which we have already discussed. Especially useful in the development of standard scores, using a percentile ranking method is the use of the cumulative percentiles. Standard scores using the above methods convert each raw score into a score that can be related to other scores in the same group.

Another method for determining a standard score is to compute a derived score. A derived score differs from a group centered standard score in that it provides standardization that allows comparisons between studies. Two easily computed standard scores are in common use: the Z score and the T score.

Z Scores

The Z score transformation converts a raw score into a score that reflects the raw score's relationship to the group norm. This relationship is expressed as a figure that indicates how many standard deviations the raw score is from the group's mean. Thus, deviation from the mean can be compared for scores from any group.

Because deviation from the mean can be positive or negative, Z scores can also be positive or negative. In addition, it is rare to find score deviations that greatly exceed three standard deviations from the mean, therefore, Z scores usually range from -3.0 to 3.0 with 0.00 indicating the mean.

Z scores are computed by determining the group mean, subtracting the raw score from the mean, and dividing the product by the group standard deviation. Thus the formula for computing a Z score is:

$$Z = \frac{X - \bar{X}}{SD}$$

Let's use the example above regarding the time that a client spend in our facility before being placed into competitive vocational settings.

You may recall that fifteen cases in the pilot study resulted in a placement in competitive vocational settings:

Case	Months
1	20
2	1
3	2
4	1
5	5
6	7
7	14
8	8
9	10
10	16
11	5
12	17
13	4
14	15
15	7

To determine the group's standard deviation we must find the square root of the population variance. This is determined by subtracting the mean of the population from each score, squaring the products of the subtraction, summing the squared products, dividing the sum by the population total minus one, and finding the square root of the product. The formula is:

$$\text{Standard Deviation} = \sqrt{\frac{E\ (Y - \bar{Y})^2}{n - 1}}$$

Our tabulations would look like Figure Fifteen below:

FIGURE FIFTEEN: Sample tabulation of standard deviation

Case	X Months	$X - \bar{X}$	$(X - \bar{X})^2$
1	20	11.2	125.44
2	1	-7.8	60.84
3	2	-6.8	46.24
4	1	-7.8	60.84
5	5	-3.8	14.44
6	7	-1.8	3.24
7	14	5.2	27.04
8	8	- .8	.64
9	10	1.2	1.44
10	16	7.2	51.84
11	5	-3.8	14.44
12	17	8.2	67.24
13	4	-4.8	23.04
14	15	6.2	38.44
15	7	-1.8	3.24
	E = 132		E = 538.40

$\bar{X} = 132/15 = 8.8$

$$\text{Standard deviation} = \sqrt{\frac{538.4}{14}} = \sqrt{38.46} = 6.2$$

Now we can determine the Z score for any of the raw scores. For example, the Z score for case 9 is determined by converting the raw score, 10, using the following process:

$$Z = \frac{X - \bar{X}}{SD} \qquad Z = \frac{10 - 8.8}{6.2} = \frac{1.2}{6.2} = .19$$

T Scores

Based on the Z score, the process for determining a T score is designed to eliminate both decimals and negative numbers.

After a Z score has been determined, it is multiplied by 10. To the resulting product is then added 50. This creates a standard score distribution from about 20 to about 80 with 50 as the mean.

For example, using the Z score for case 9 in the above sampling of months to successful closure we would use the following formula to determine a T score:

$$T = (Z \times 10) + 50 \qquad T = (.19 \times 10) + 50 \qquad T = 51.9$$

EXERCISE FIVE: Determining Sample Size for a Proportional Study

Determine the size of sample that you would choose using the following data and problem. You must choose a margin of error and a probability of risk. Defend your choices.

The Director of Rehabilitation Services, Inc. was concerned that the percentage of clients referred to the placement program from janitorial crews was lower than the average in the wood products work station. This was a concern, because the janitorial crew program required a higher productivity rating for admission than the wood products area and should, therefore be providing quicker remediation. In addition, the county Department of Social Services was charging that the crew supervisor was holding clients in the program longer than necessary to insure that crew work was completed. Thus, either the training that was provided in the wood products area was superior to the crew or the measurements used by the crew supervisor were inaccurate. Other explanations for the difference (if a difference actually existed) included: inappropriate application of productivity measures by crew staff, inappropriate application of productivity measures by wood products staff, subjective application by either area's staff, failure of the janitorial supervisors to move clients out of the program after task mastery, etc.

The first task confronting the Director was to determine the percentage of clients referred to the placement program by the janitorial crew supervisors. The Director had determined this percentage for the wood products area in an evaluation completed last year. Because the comparison data included wood products clientele up through last year, the Director must search the files of clients who were entered in the janitorial crew program through last year.

The crew supervisor provides the Director with a list of all clients that had entered the program in the 13 year old program. It contains 372 names. The supervisor also told the Director that experience (the supervisor had been with the facility for five years) indicated that about 33% of the clients who entered the training program were eventually referred to the placement program.

How many files should the Director sample to estimate the true percentage?

1. My margin of error will be _____.

2. My risk of error will be _____.

3. My Zä/2 based on the risk is _____.

EXERCISE SIX: Worksheet for Sampling Means

Determine the size of sample that you would choose using the following data and problem. You must choose a margin of error and a probability of risk. Defend your choices.

The Director of Rehabilitation Services, Inc. was concerned that the average productivity of clients on the janitorial crews after one month of training was lower than the average in the wood products work station. This was a concern, because the janitorial crew program required a higher productivity rating for admission than the wood products area. Thus, either the training that was provided in the wood products area was superior to the crew or the measurements used by the crew supervisors were inaccurate. Other explanations for the difference (if a difference actually existed) included: inappropriate application of productivity measures by crew staff, inappropriate application of productivity measures by wood products staff, subjective application by either area's staff, failure of wood products supervisors to move clients out of the program after task mastery, etc.

The first task, in any case, is to determine the average productivity of the janitorial crew trainees after they had received one month of training. The Director had determined this average for the wood products area in an evaluation completed last year. Because the comparison data includes wood products clientele up through last year, the Director must search the files of clients who spent at least one month training on janitorial crews up through last year.

The crew supervisor provides the Director with a list of all clients that have received at least one month of training in the 13 year old program. It contains 278 names. The supervisor also told the Director that experience (the supervisor had been with the facility for five years) indicated that the average percentage after one month was likely to be 68% and that variance was likely to be from 60% to 75%.

How many files should the Director sample to estimate the true average?

1. My margin of error will be _____.

2. My risk of error will be _____.

3. My Zä/2 based on the risk is _____.

4. My estimate of population variance is _____.

EXERCISE SEVEN: Create Data Gathering Forms

Create forms that will allow the staff of your facility to summarize the following data in the most efficient manner.

1. Percent of clients competitively employed
2. Percent of clients entering each program
3. Percent of clients receiving supplemental income benefits
4. Percent of clients receiving placement training
5. Average hourly earnings of clients in each program
6. Average client productivity percentage in each program
7. Average working hours
8. Average length of training in each program
9. Percentage of clients self-terminating their training
10. Any other measure that your think will be valuable.

SELF-TEST: Chapter Four

1. Evaluations rely on the _____ of _____ data to expected data to provide information on which to base decisions.

2. The scientific method is the _____ collection of _____ _____ by _____ _____ to answer _____ questions.

3. Evaluation researchers principally use three evaluation tactics. They are: _____ _____, _____ _____, and _____ _____.

4. _____ _____ _____ _____ allow facility administrators to ask questions about the operation of their facility both after services have been provided and while they are being provided.

5. Data samples are chosen by _____ methods to insure that the samples are representative of the total data pool.

6. Random samples insure accurate data collection while providing _____ and _____ _____.

7. Three factors affect the determination of a sample size: the _____ of _____, the _____ of _____, and the _____ of _____ _____ or _____ from the _____.

8. Ongoing data collection systems gather client statistics on a _____ _____ _____.

9. _____ allows data to be more easily compared between groups.

10. _____ _____ are representations of data based on relative numerical groupings.

11. Percentile ranks provide an intergroup comparison of _____ _____.

12. Two common standard scores are the _ _____ and the _ _____.

13. The _ _____ reflects the raw score's relationship to the group on the basis of standard deviations from the mean.

14. _ _____ are based on ___ _____ and eliminate decimals and negative numbers.

SELF-TEST: Chapter Four
ANSWER KEY

1. Evaluations rely on the comparison of factual data to expected data to provide information on which to base decisions.

2. The scientific method is the systematic collection of factual data by objective observations to answer measurable questions.

3. Evaluation researchers principally use three evaluation tactics. They are: experimental research, correlational research, and case studies.

4. Ongoing data collection systems allow facility administrators to ask questions about the operation of their facility both after services have been provided and while they are being provided.

5. Data samples are chosen by random methods to insure that the samples are representative of the total data pool.

6. Random samples insure accurate data collection while providing time and cost savings.

7. Three factors affect the determination of a sample size: the margin of error, the degree of risk, and the estimate of true proportion or variance from the mean.

8. Ongoing data collection systems gather client statistics on a client data sheet.

9. Standardization allows data to be more easily compared between groups.

10. Frequency distributions are representations of data based on relative numerical groupings.

11. Percentile ranks provide an intergroup comparison of raw scores.

12. Two common standard scores are the Z Score and the T Score.

13. The Z Score reflects the raw score's relationship to the group on the basis of standard deviations from the mean.

14. T Scores are based on Z Scores and eliminate decimals and negative numbers.

Chapter Five
Systems Analysis

A system is an interactive relationship that exists between units, with the activity of one unit affecting the behavior of all other units. Programs within facilities are constantly transferring clients in and out to complete various phases of their rehabilitation program plans. Thus the facility is in a constant state of flux as internal and external relationships change. The daily status of the facility depends upon the interactions of each component rehabilitation program through client flow, staffing, and budgetary decisions.

The use of systems analysis for program evaluation is an attempt to describe the success of a facility relative to the flow of clients through the facility's programs. A complete discussion of systems analysis is found in Systems Analysis in Rehabilitation Facilities, (Smith, 1986.)

Types of Systems

Two types of systems can operate within an organization. They are closed systems and open systems. Of the two, only the open system is of major use for the analysis of facility operations.

Closed systems have no regular input or output. A fire alarm circuit operates as a closed system. Once the system's circuit is closed, the alarm rings. Because the closed system has no other inputs or outputs, the alarm will continue to ring as long as the circuit is closed, even when no fire exists. A closed system is rarely found operating in facilities.

In an open system, inputs and outputs can vary in intensity and duration. For example, a pot of water on a stove can be examined as a system. Heat is applied and absorbed by the pot until the water reaches its boiling point. When the water begins to boil, the heat input is no longer used to raise the temperature of the water, it is used to convert the water to steam. Thus a change has occurred in the system's output. If the amount of heat input is constant, the steam output will also be constant.

The system formed by the pot of water and the stove eventually reaches a state where the heat and steam outputs are constant. This state,

the state at which inputs and outputs do not fluctuate, is called a "steady state." When a rehabilitation program is begun, it will take time before the first clients complete the training process. At the beginning, clients are either filling programs or leaving through self-termination (dropout) or discharge. Eventually, the number of clients completing the training program, plus all terminations will equal the program's client intake, and the program system will have achieved a "steady state." For example, if an evaluation program is designed to be completed in one month, a training program four months, and a placement program one month, the minimum time required for the facility system to reach a steady state condition is six months.

Dynamics of Systems

Facility systems principally exhibit two dynamics: feedback loops and feedback delays. Both dynamics are important when analyzing facility operations.

Feedback Loops

Virtually every system requires feedback from its component units. Systems also need mechanisms (or regulators) that respond to the feedback. If no regulator is present or the regulator is not sufficiently sensitive to process feedback data, many problems may develop. An example of a feedback mechanism is a thermostat in a heating system. A thermometer on the thermostat registers the temperature in the house. The thermostat is programmed to trigger the furnace control when the temperature (as registered on the thermostat) drops below a preset level thereby providing "feedback" to the furnace, acting as a feedback mechanism. Turning on the furnace raises the level of heat in the house. As the temperature rises, the thermometer on the thermostat also rises and, when the temperature reaches a predetermined desired temperature, triggers a switch that turns off the furnace, again providing feedback.

Program evaluation provides feedback to rehabilitation programs like a thermometer provides feedback to a heating system. Without program evaluation there is no way to determine if the program is producing the desired results. Programs without evaluation feedback continuously provide the same training curriculum or make occasional, arbitrary changes.

Feedback Delay

Time is required for feedback data to be transmitted to and confirmed by the action generating parts of the system. This time is called "feedback delay." For example, within the system of "higher education" the prestige of a university is gauged by the accomplishments of its graduates. Because at least five years must pass following graduation for most graduates to be noted as major contributors to their chosen fields, the present reputation of the university is really based on the actions of the university five years earlier. Rehabilitation programs are also judged by "old" data, though the "old" data has been delayed only about two to five months.

Some facility decisions need to be made before feedback data is available. For example, a student may choose to enter a university degree program because existing data shows promising future openings for graduates of that curriculum line. Unfortunately, that data on employment, even if not subject to collection delays, will not be relevant for the job market four years later when the student graduates.

System Processes

Systems analysts look for the presence and dynamics of several processes that may, or may not, be at work in a facility system. They are: 1) Oscillation, 2) Routing, 3) Reservoir effects, 4) Trajectory, and 5) Valves.

Oscillation

"Oscillation" is the pattern of variation in system input and output. Input and output volumes fluctuate. Sometimes they are relatively large, and at other times they are relatively small. If these variations (oscillations) decrease with time, the oscillation pattern for the system is called "dampened."

Oscillations occur for five reasons: 1) Seasonal variations, 2) Feedback delays, 3) Insensitive control devices, 4) Long response times, 5) Overreactions to feedback information

Seasonal Variations

Some rehabilitation programs are subject to seasonal variations in their client loads. Variations in funding periods, staff and client vacation schedules, and seasonal changes in weather conditions can cause client count oscillations. The client referral source or funding agency may also have

seasonal factors (such as fiscal periods) that will affect the program's client count.

Feedback Delays

Oscillations can also be caused by feedback delay. For example, training programs that prepare clients for high demand occupations will experience high demand until the need for workers in these occupations is met. However, the demand for training in these occupations is likely to continue even after the need for workers has been filled. Thus more workers will be trained in the area than are actually needed by the field. As trained workers fail to obtain jobs, it will soon become known that an overabundance exists for workers in the area. The demand for training will, then decline rapidly. The oscillation cycle will continue as lessened demand for training creates a trained worker shortage, etc. ad. infinitum.

Insensitive Control Devices

A third reason oscillation occurs is poor sensitivity of control devices. For instance, our bodies are far less sensitive to temperature changes than are thermostats. People who stoke wood furnaces know that the temperatures within their homes vary widely. This is true because the furnace is stoked when their owners perceive the need for more heat; when they stoke their furnaces, they put in enough wood to lengthen the time until the next stoking, thus insuring that the temperature rises. Compared with temperature variations in homes equipped with thermostatically controlled furnaces, the wood heated home has a great range of temperatures.

Insensitive control systems are also responsible for wide variations within facilities. Sensitively controlled rehabilitation programs usually have targeted referral rates. When referrals fall below this targeted level, the program administrators begin to actively solicit referrals. Waiting until the client referral rate is low enough to cause concern before attempting to increase the rate is certain to increase the range of client flow oscillations within the facility.

Long Response Times

System oscillations often accompany long response times. In a heating system, for example, the thermostat must be set to activate the furnace before the room temperature actually falls to a desired degree setting. This allows the furnace to respond to a new heat demand even as the temperature in the house continues to fall. The thermostat also should be set to

trigger the furnace to stop producing heat before the optimum temperature has been reached, allowing the heat remaining in the furnace to deliver its final heat energy without overheating the house.

In training programs with exit criteria established as attainment of a certain level of quantity or quality of production, a response time gap exists between the time that the criteria level is reached and the time that it is recognized. Thus, as a client narrows the gap between the exit criteria and current skill levels, the frequency of measurement usually increases.

Overreaction to Feedback Information

The final reason that oscillation occurs is the tendency to overreact to feedback information. For example, when taking a shower it is natural to turn on both hot and cold faucets. Because the water from the "hot" faucet has been in the pipes for a while it comes out cold. To quickly discharge this cold water, it is natural to turn the "hot" faucet to full volume. When the hot water finally arrives, it is scalding, prompting the bather to quickly reduce the flow. Often, the flow is slowed too much and must be adjusted again. After several oscillations between extremely hot and extremely cold a balance is struck. Responding to feedback oscillation in this manner is called "control by successive approximations."

Routing

In a systems context, routing refers to the establishment of review points. When a review point is reached, the program administrator decides which one of several routes the client, data, or materials will follow. Review points, routes, and routing rules may be in the form of documented policies or based on experiential judgments.

Decisions tend to develop consistent patterns over time. An examination of routing decisions made at the end of an evaluation program, will probably show that consistent percentages of clients are referred to the various work adjustment and placement programs available in the facility and community. These routing percentages are one of the most important tools of systems analysis. The analysis of system behaviors depends on the analysis of routing patterns as well as intake and discharge rules.

Reservoir Effect

Reservoirs perform essentially the same function in human service delivery systems as in water delivery systems: they dampen input oscilla-

tions. They are called "waiting lists" when an attempt is made to quantify the units in the reservoir by listing each person eligible to enter the program.

Water reservoirs lose holding units through evaporation. Human service delivery system reservoirs (waiting lists) also lose "units" over time. Potential clients remove themselves from the reservoir as their time on the list is extended. They are lost to other training opportunities and to disinterest.

Trajectory

The trajectory of a system is the apparent direction of movement for the system's units. According to Newton's first law of dynamics, a body in motion continues to move in the same direction with the same speed, unless an outside force acts upon it. The facility's system also tends to demonstrate this dynamic principle. When a program is initiated, the clients receiving training, evaluation, or placement services could be seen to be "put in motion" within the system. They are likely to stay in motion, in the direction projected, unless an effort is made to change client flow direction.

The perceived trajectory as observed by persons that interact with the facility: the general public, potential customers, potential clients, and potential referral sources should always be considered when using systems analysis for program evaluation. This "image" of the program must be considered whenever programmatic changes are made.

Valves

A valve controls unit flow through a system. In facility systems, valves regulate the movement of clients. They may be located anywhere within the system.

Some valves restrict the numbers of clients. For example, a program intake valve might restrict the number of clients that are admitted to the program through the use of policy statements. Policy statements could restrict client capacity by simply stating how many clients can be served at any one time.

Policies regarding program entrance also act as values, restricting numbers by creating a screening device. For example, a pre-entrance staffing to screen appropriate clients is a system valve device because the staffing committee modifies the flow of clients into the program.

Visual Representations of Systems

Systems analysis involves the definition, depiction, and examination of the relationships between units. Thus the methods of systems analysis involve the defining of system flow, the diagramming of system flow, and the manipulation of the flow using system models. To be useful to program evaluators, systems analysis data needs to be represented visually. The representational method used is determined by the data available, the resources to be expended, and the results desired.

Representing System Flow

System flow is the movement of people or things through the organization following defined routes. Flow can be described numerically using actual unit counts, percentages of total units, or by trajectory. For example, movement of clients from evaluation into a vocational program can be stated as "Four clients per month," "Twenty-two percent of all referrals out of evaluation," or "Four referrals, vocational route." The method used is determined by the type of relationship that exists between system units, and the administrator's need for data.

Often, numerical or trajectory definitions can be better conveyed through the use of a chart or graph. Visual representations of the quantitative and directional data will assist administrators and analysts in spotting areas of concern.

Four types of visual representations are regularly used to analyze systems. They are: activity charts, layout charts, personal relationship charts, and data charts.

Activity Charts

An activity chart depicts the flow of people and things through processing centers. In fact, activity charts are sometimes called process charts. They are often used to analyze production operations. Each major part of the chart indicates an area where units are changed in some manner. Activity charts can be used to compare systems when similar symbols are used to denote activities at each system unit.

Layout Charts

Layout charts illustrate the actual physical locations of processing units within a facility area and the flow that occurs between the units. They differ from activity charts only in the fact that they represent actual

physical locations rather than abstract "unit" concepts. Actually, layout charts also incorporate elements of the activity chart because system flow is illustrated.

Personal Relationship Charts

These charts illustrate the relationships that exist between the decision making parts of the facility system. They may depict the facility's organizational structure, or indicate who is responsible for making routing decisions. The flow lines that are depicted usually represent lines of authority and indicate the persons responsible for carrying out system defined tasks.

Data Charts

Data charts give visual representation to numerical information. Data charts can take many forms. They may be bar graphs, line drawings of many types, or simply graphic displays of data. Pie graphs are not normally used to depict systems data because flow data is not easy to represent using this form. The important elements of data charting for flow analysis purposes are: equality of representation units and the use of time as an independent variable.

Flow Analysis

Flow analysis is a relatively simple process that allows administrators to create and examine system models, gathering data useful in preparing for program evaluations.

The data needed to complete a systems flow analysis includes the following:

1. Intake rates
2. Routing rules and rates
3. Exit ports and rates
4. Program tenure rates
5. Capacities
6. Waiting list figures

Intake Rates

Intake rates should be reported both as the number of clients per program and the number of clients per point of entry. The figures are usually reported as average weekly or monthly figures. If oscillation of the intake figures is great, notations of the oscillation ranges will help the analysts round out their picture of the system.

Routing Rules and Rates

Routing rules and rates should also be described for the program evaluator. The possible pathways that clients may take in their travel through the program should be illustrated, including documentation of rules that dictate movement through various routes.

Exit Ports and Rates

Exit ports can be described as the means by which clients leave the system. Many ports may be described, such as: job placement, sheltered employment, self-termination, referrals, dismissal for cause, etc. The actual number of clients using an exit port and a percentage breakdown should also be determined. When examining exit data, the analyst will look for percentages that are constant over time or oscillations that cannot be explained by changes in client population or in the program composition.

Program Tenure Rates

Program length may be defined as a specific time period or an average of indefinite time periods. For example, some evaluation programs have set program lengths such as a standard one week program. All clients are given standard, time limited tests and complete the evaluation in exactly one week. On the other hand, some evaluation programs start with a one day assessment that is standard to all clients, but the length of the rest of the evaluation is determined by the tests assigned after the initial assessment. In the case of time specific programs, the program length is self-evident. However, in non-specific programs, especially work adjustment and skill training programs, the varying length of time that clients spend in the program requires that an average be established.

Capacities

Program capacity may be set by many factors such as: desirable staff to client ratios, space, equipment, or available work. In most cases, any of these factors can be changed, thus influencing program capacity. One reason that administrators turn to systems analysis for data is to obtain information that will allow them to make predictions of future program size and needs. System flow analysis provides data that will give the administrator time to plan.

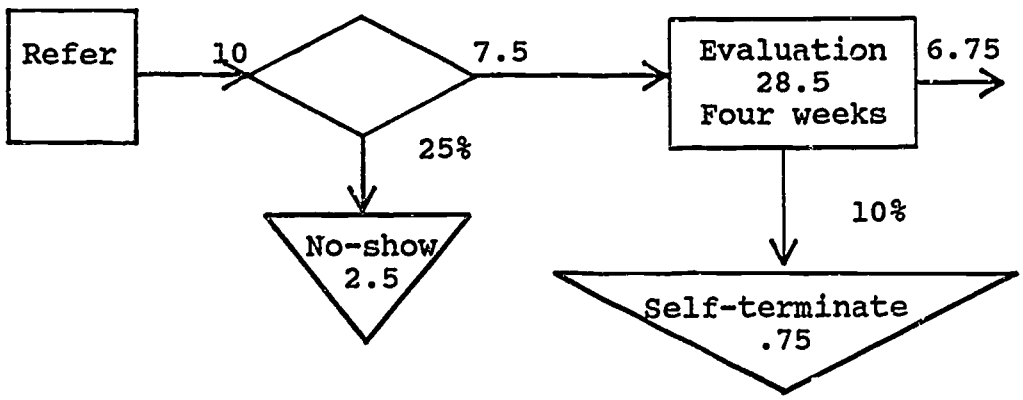
Waiting List Figures

The numbers of clients, or the lack of a waiting list, is valuable data for the systems analyst.

Examining the Flow

After gathering system data and building a system model based on the data, the data and the model are analyzed to gather information helpful for determining administrative courses of action, thus improving system functioning.

FIGURE SIXTEEN: Simple Flow Path of an Evaluation Program



To determine the number of no shows, multiply the no-show rate (25%) by the number of referrals. Thus, ten referrals times .25 equals 2.5 clients per week who do not show. The number of referrals minus the no-shows

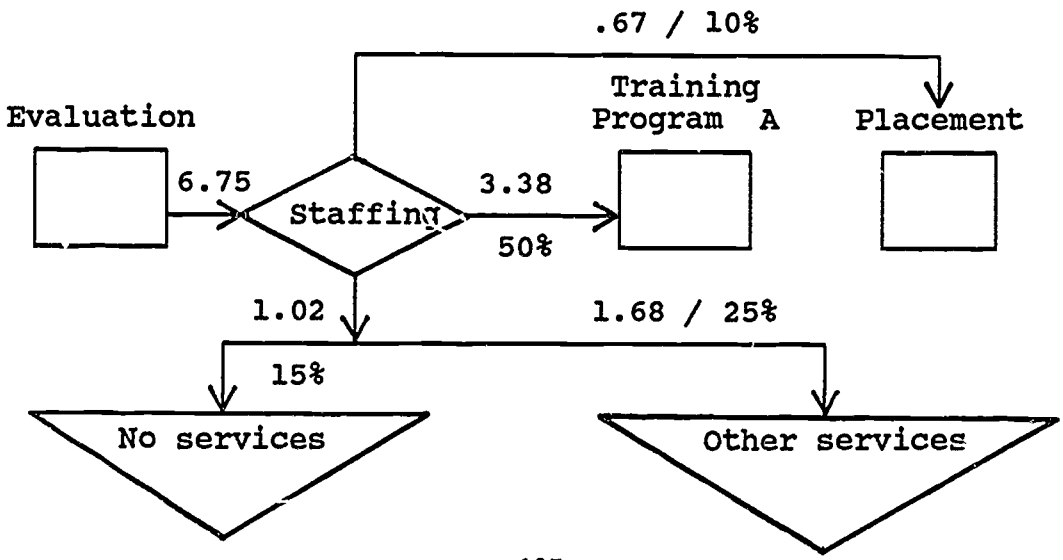
equals the number of clients who start evaluation each week. In this case it is 7.5. The dropouts from the evaluation program must be computed before the number of clients in a program can be estimated. In this example, 10% drop out per week. Thus, multiplying the number of clients entering the program (7.5) with the dropout rate (10%) results in the figure .75. Subtracting .75 (the dropout average) from 7.5 (the average number of clients actually entering the program each week) results in 6.75 (the number of clients actually flowing through the entire four week program.

To estimate the average number of clients in the program at any one time, we must determine the average point in the program that dropouts occur. In this example we will estimate that the average dropout occurs after two weeks of programming, or at the 50% point in the program. We must also take into account the four weeks it will take to bring the program to full capacity when it is initiated.

If dropout occurs at the end of the first two weeks, we can assume that 7.5 clients per week occupy the program for the first two weeks, and 6.75 clients per week occupy the second two weeks. Multiplying the numbers for each week we determine a grand total of clients per week. Two times 7.5 equals 15 and 2 times 6.75 equal 13.5. Fifteen plus 13.5 equals 28.5 or the number of clients in the program at any one time after steady state has been achieved.

Staffing decisions made at the end of the program are illustrated in Figure Seventeen below:

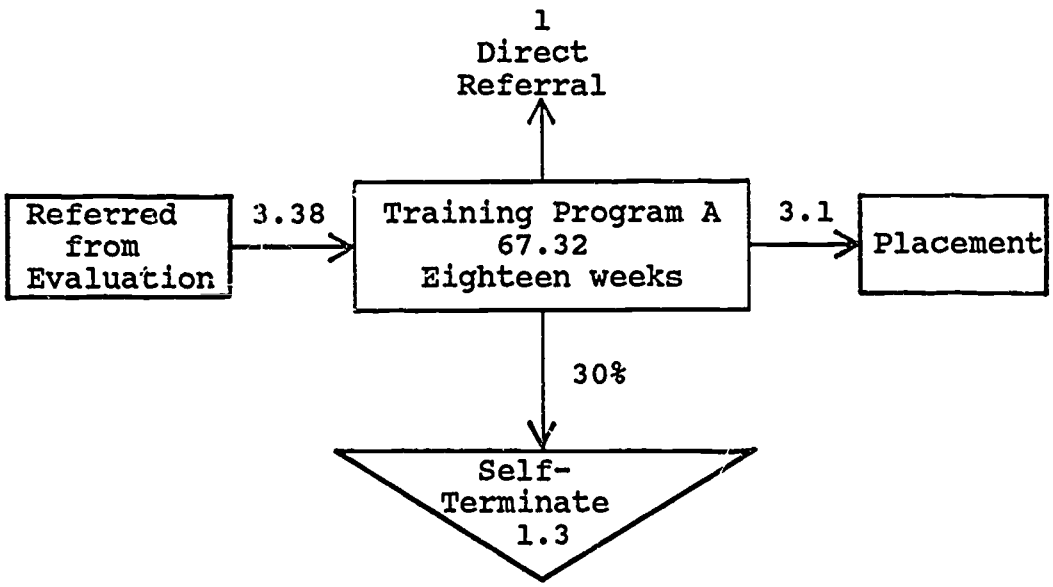
FIGURE SEVENTEEN: Sample Flow Path



In our example above of persons exiting an evaluation program, 50% are referred to training program A, ten percent directly to placement, 25% to other services, and 15% are not recommended for further services.

To compute actual figures from the percentages, each percentage in the route is multiplied by the number of persons exiting the evaluation program. In other words, in this example 6.25 multiplied by .5 equals 3.38, the number of clients per week entering the training program. The numbers in Figure Seventeen show the clients achieving each outcome or proceeding into other parts of the rehabilitation system. The next illustration (Figure Eighteen below) models the training program.

FIGURE EIGHTEEN: Sample Flow Path

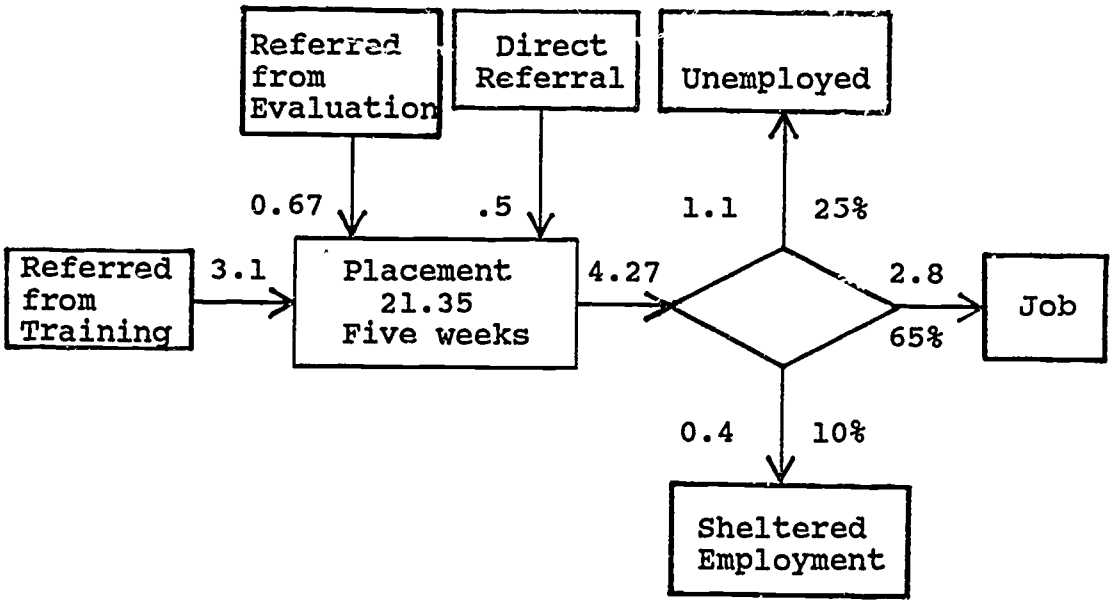


An average of 3.38 clients per week enter the training program from the evaluation program. Approximately one person per week also enters the training program by another input port. Thus, total client movement into the training program is 4.38 clients per week. Multiplying 4.38 by a projected dropout rate of thirty percent we determine that an average of 1.3 clients will dropout per week. Subtracting 1.3 from 4.38, we determine that 3.1 clients will complete the program per week. Because the training program has an estimated length of 18 weeks and because we assume that dropouts occur half-way through the program, we can determine the average number of clients in the program during any week by multiplying the first

nine weeks by the total number of clients entering and the second nine weeks by the number entering less the dropouts. Thus, 4.38 multiplied by 9 results in the figure 39.42, and 3.1 multiplied by 9 results in the figure 27.1. Adding 39.42 to 27.9 results in the figure 67.32 which is the average number of clients that would be in the training program at any time after a steady state is achieved.

We now need to examine the final system component, the placement program. A model of this program is illustrated in Figure Nineteen below.

FIGURE NINETEEN: Sample Flow Path of a Placement Program



Because .67 clients per week enter the placement program through the evaluation program port, 3.1 clients per week from the training program port, and one client every two weeks, or .5 per week who enter from other ports, 4.27 clients enter the placement program each week. Because the placement program has a five week average length the number of clients in the program each week is determined by multiplying 4.27 with 5 to obtain a figure of 21.35. In this example, 25% percent of the placement program clients do not obtain jobs. Multiplying 4.27 with .25 results in an average weekly termination of 1.1. The program figures indicate that 65% of the clients do obtain a job in competitive sites. Multiplying 4.27 with .65 results in 2.8 clients per week obtaining competitive positions. The remaining 10% (.427) of the clients are placed into sheltered employment positions.

Uses of Flow Analysis Information

Flow analysis is useful for program evaluation in four primary ways. First, the analysis data, usually presented in activity or numerical chart forms, provides a "picture" of the facility's present operating status. Second, the "picture" of the present system can be used to predict changes that need to be made to keep the facility healthy (effective.) Third, the system "picture" will help the administrator "balance" system units to keep them operating with peak efficiency. Finally, the "picture" can be altered by the administrator to assess the feasibility of changes, particularly the introduction of new services.

Create a "Picture" of the Present System

After computing weekly figures for the whole system, a yearly summary (which may be a prediction, or may be compiled from past activities) can be made. From these annual figures it is possible to predict program evaluation results. For instance, 105 persons would be placed in jobs from the training program. This was estimated by multiplying 3.1 clients per week who leave the training program by 65 percent, which is the placement rate, times 52. Because 105 people are placed out of the 228 persons served, a success rate of forty-six percent is determined for this program. In the placement program, 145 placements are made from a pool of 222 persons entering the program resulting in a success rate of sixty-five percent.

FIGURE TWENTY: Flow Summary Chart

	Evaluation	Training A	Placement	Total
Referrals	520	52	26	598
Served	390	224	222	468
Self-terminate	39	68	0	107
No benefits	92	68	7	167
Placements	23	105	145	145

Predict the Effect of or Need for Changes

Once a real or proposed rehabilitation program has had flow analysis performed, it can be used to predict the effect of changes in the system. For example, an analyst may observe that changes in referrals will cause the dropout rate in vocational evaluation to increase from ten percent to forty percent. By changing that figure and redoing the significant calculations, the analyst may find that the annual number of placements will drop from 146 to 94. Additionally, the change in referral rate will effect the number of persons in work adjustment at any one time, dropping from 67.32 to 49.77. While, this type of prediction does not solve referral problems, it does help administrators prepare for a problem's effects. Also, a little manipulation of figures shows that if the dropout rate is increased to forty percent in evaluation, the numbers in work adjustment and placement can be maintained - if the referrals to evaluation can be increased from ten to fifteen per week. However, this will also mean that the average number of clients in vocational evaluation will increase from 28.5 to 36. Other options are available, such as increasing the number of referrals directly into the training program, which will help the program return to it's needed load level.

Balance System Units

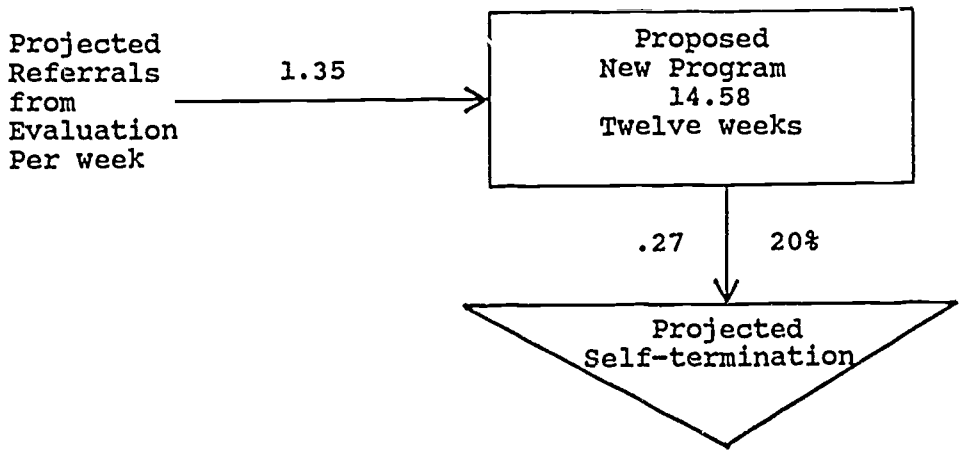
Possibly the most important use of flow analysis is to balance an existing program. For instance, if the capacity of the training program modeled above is 100, then this program is only operating at sixty-seven percent utilization. By a simple manipulation of the figures it becomes apparent that there will have to be 6.5 clients per week entering the training program in order to achieve the full load of 100 clients. If only one client per week continues to be referred directly to the training program, 5.5 clients per week must be referred from the evaluation program. An average of 16.2 referrals per week must, therefore, be made to the evaluation program to balance the system. If it is not feasible to increase referrals by six clients per week, perhaps the administrator should decrease capacity for the training program, allocating staff and space resources to other programs. Systems analysis may be used for all rehabilitation programs. The effects of changes in client flow for any one program tends to affect all programs in the system.

Demonstrate the Feasibility of New Services

Systems analysis can be used to determine the feasibility of initiating new programs. For example, if a significant number of clients are being

routed to other services, the facility administrator may wish to determine the feasibility of starting an "in facility" program to address those needs. In the example above, a total of 2.7 clients (1.02 "no service" plus 1.68 "other") fall in that category. If fifty percent of this group have a common need then there is the potential of 1.35 clients per week that could enter the new program. If the new training program lasts 12 weeks, needing twenty-five clients to be cost effective, the program will never achieve a steady state equal to the cost of maintaining the program. See Figure Twenty-one below:

FIGURE TWENTY-ONE: Illustration of a Projected Program.



Projections for proposed programs are performed exactly as for existing programs; estimated data is used when actual data is lacking. For example, when 1.35 (the projected intake figure) is multiplied by .2 (the projected dropout rate), the resulting figure .27 is an estimate of the average weekly number of dropouts. Subtracting .27 (the estimated dropout figure) from 1.35 (the projected intake figure) we establish a projection of the number of clients that will complete the program each week. Because the dropouts are expected to occur half way through the 12 week program, multiplying 1.35 by 6 results in an average first six week load of 8.1 and multiplying 1.08 by 6 results in an average second six week load of 6.48. Adding the figures results in a projected maximum load of 14.58 clients.

For the proposed program to be cost effective, the administrator would need to solicit referrals from other sources and/or increase the number of clients referred from the evaluation program. The administrator must also consider the effect that any change in referral pattern may have on the facilities other programs.

EXERCISE EIGHT: Create a Systems Flow Chart

Using the following data, construct a system flow chart that depicts the operation of Rehabilitation Services, Inc.

Rehabilitation Services, Inc. provided services to 152 clients in 19XX. Thirty-one clients received evaluation services, 134 received vocational training, and 18 received placement services. Of the 134 clients who received vocational training, 26 received training in the pillow-making work station, 43 received training in the janitorial services program, 67 received training in metals salvage, and 39 received training in the wood shop. Some received training in more than one work station. Nineteen clients who received training in janitorial services had first received training in wood shop (8) and pillow making (11). Twenty-two clients in the wood shop had also received training in pillow-making (2), metals salvage (16), and janitorial services (4). Nine of the clients who received placement services were referred from the janitorial program. Five of the others were referred from evaluation. The remaining clients in the placement programs were direct referrals. Evaluation services referred 8 clients to each vocational program. Twelve clients received competitive jobs through placement services. The number of clients who self-terminated from each program was exactly equal to the number of clients who were unsatisfactorily discharged from each program. At the time the chart was drawn, no clients were being evaluated, 14 clients were in the pillow-making work station, 23 in the janitorial program, 28 in the wood shop, and 4 were in placement.

SELF-TEST: Chapter Five

1. Systems analysis _____ facility programs on the basis of client flow.

2. Of the two types of systems, only the _____ system is of interest to program evaluators.

3. _____ _____ and _____ _____ are two dynamics that systems exhibit.

4. Five processes affect the flow of clients through a system. They are: _____, _____, _____, _____, and _____.

5. _____ is the variation of client input and output.

6. Systems analysis involves the _____, _____, and _____ of relationships between program units.

7. Four types of visual representations are regularly used to analyze systems. They are: _____ charts, _____ charts, _____ _____ charts, and _____ charts.

8. _____ _____ allows administrators to evaluate present system functioning and infer how changes in system components will effect programs.

9. Six information units are needed to completely analyze a system. They are: _____ rates, _____ _____ and rates, _____ _____ and rates, program _____ rates, _____, and _____ list figures.

10. Flow analysis models are used to: _____ the _____ _____ of the facility, _____ _____ that need to be made, _____ system components, and _____ the effect of system _____.

11. _____ _____ can also be used to demonstrate the feasibility of initiating new services.

SELF-TEST: Chapter Five
ANSWER KEY

1. Systems analysis depicts facility programs on the basis of client flow.

2. Of the two types of systems, only the open system is of interest to program evaluators.

3. Feedback loops and feedback delays are two dynamics that systems exhibit.

4. Five processes affect the flow of clients through a system. They are: oscillation, routing, reservoirs, trajectory, and valves.

5. Oscillation is the variation of client input and output.

6. Systems analysis involves the definition, depiction, and examination of relationships between program units.

7. Four types of visual representations are regularly used to analyze systems. They are: activity charts, layout charts, personal relationship charts, and data charts.

8. Flow analysis allows administrators to evaluate present system functioning and infer how changes in system components will effect programs.

9. Six information units are needed to completely analyze a system. They are: intake rates, routing rules and rates, exit ports and rates, program tenure rates, capacities, and waiting list figures.

10. Flow analysis models are used to: illustrate the present operation of the facility, predict changes that need to be made, balance system components, and assess the effect of system changes.

11. Systems analysis can also be used to demonstrate the feasibility of initiating new services.

Chapter Six

Evaluation Research

Even though ongoing data is gathered faithfully by facility program staff, some evaluation questions will require the use of more traditional research designs to interpret the collected data and provide answers. It may not be sufficient to simply know what happened and outcome data can only provide information on what happened.

Of paramount concern for any rehabilitation administrator is the need to tie program outcomes, easily measured by ongoing data, to program activities. For example, if a person is successfully placed into a competitive environment following vocational training, can we, in fact, attribute this competitive success to the training? It may be possible to use existing outcome data with traditional research design to show that the success can be attributed to the program.

Three tactics, mentioned earlier in Chapter Four, for establishing facts upon which conclusions can be drawn are normally employed by evaluation researchers. They are: case study, correlation, and experimentation.

Case Studies

Most existing data, especially data gathered for outcome evaluations, are found within client case files. Especially when evaluating programs after their completion (ex post facto studies) the only data that may be gathered must be gleaned from the existing case records.

Data based on case study has several limiting factors. First, the questions that are asked by the evaluators must conform to the statistical data that was collected. For example, an evaluator could not pose the research question "What is the mean income of clients placed competitively after receiving training in the Services Training Program," if the case files do not contain any data about the client's income following placement. Second, the data that is entered into a case file may be "contaminated" by the number of staff allowed to enter data, varying definitions of data

points between staff and over time, and simple typographical errors. Finally, accurate comparisons between groups may be difficult to establish.

Even with the above limitations, case studies are a popular method of evaluation research in rehabilitation facilities simply because many evaluations are not pre-planned. By formulating evaluations after the fact, program administrators force evaluation researchers to use case study techniques. Planned evaluations will also use data that eventually becomes part of the client's case file. However, the planning process allows data to be gathered that clearly leads to answers for desired research questions. Case study data may be randomly selected, but is not usually used to support an experimental design because of the difficulties in controlling variables.

Correlational Design

A correlation is the determination that a direct relationship between variables exists. Correlations, however, cannot provide data about why the relationships exist. For example, if we find a correlation between attendance in a training program with competitive placement, we may infer that the correlation provides factual data supporting the belief that the program is effective. However, the correlation does not in fact show that the training itself caused competitive placement. Many other factors, such as the selection process or the placement efforts, may have influenced the outcome.

Even with the above limitations, correlational design is often used to provide factual data for evaluators. Where true experimental designs using control groups and limited variables are not possible or may be too costly, a correlational study can provide a useful alternative or pilot study. In addition, the correlational study provides valuable descriptive data for use in both outcome and summative evaluations. Correlational data may be randomly selected and may, in fact, be used to support an experimental design.

Experimental Design

In true experiments a hypothetical "answer" to an evaluation question is "tested" by sampling controlled variable data that has been randomly selected. It is important that both random selection and variable control be included in the design to make the data collected by the experiment valid.

Random selection has been discussed above. Variable control simply requires the evaluation researcher to discover and account for the dependent and independent variables. Dependent variables are the qualitative outcomes. Independent variables are the prefacing actions prior to a quali-

tative outcome. For example, competitive placement status after training may be the dependent variable with the various training options or curriculums within the options serving as independent variables.

Experimental designs are often avoided by program evaluators because of the difficulties encountered in controlling variables, the time and expense of conducting the research, and because ethical questions regarding the with-holding of training options are involved. However, experimental designs can be employed to many degrees within rehabilitation facilities.

Traditional Research Design

Traditional design relies on several levels of experimental research methods that incorporate the above research tactics. The evaluator must choose the level of design that best balances their need for valid data with their data collecting capabilities. Three traditional designs are usually cited. They exist not as discrete entities, but as levels on a continuum. These designs are pre-experimental, quasi-experimental, and true experimental designs. Pre-experimental models can simply be called outcome or descriptive evaluations because the intent is only to describe a program not to infer correlation or causation. The quasi-experimental and true experimental models, however, try to establish correlations and infer causation between the variables under study. They vary only in their ability to control the variables with the true experimental model providing as close to full control over variables as possible.

Quasi-experimental Models

Many different quasi-experimental models can be created to meet the needs of various facility data collection problems and evaluation question needs. Three types are in common use. They are the single group pre/post test model, the nonequivalent control group pre/post test model, and the interrupted time series testing model.

Single Group Pre/Post Test Model

As the name implies, this research design is used when no control group is possible. Depending upon the type of information desired, the single group is first tested (data collected in some form) prior to their introduction to a training regime. Following training an identical testing (or data collection methodology) is applied to the group. Inferences are then based upon a comparison of the data from each testing. Note that the pre/post test may be an actual test, for example a skill test or productivity

test, or it may simply be the collection of descriptive data. The type of data collected is not important. That the same data is collected at both points is important.

Nonequivalent Control Group Pre/Post Test Model

Just as in the single group pre/post test model, the nonequivalent control group model requires data collection at two points, before training and after training. In this model, however, another group is added as a "control." The control group is tested as if they were to receive training and then tested again as if they had received training, however, no training is provided. Thus, such data as the mean increase (or decrease) in test scores between the two groups can be compared. This provides yet another indication that training was successful (or unsuccessful). While more powerful than the single group model, the nonequivalent group is still vulnerable to bias on the basis of the way the groups are selected.

Interrupted Time Series Model

Single or multiple groups can be exposed to the interrupted time series model. In this model, a group(s) is tested several times before and after providing training. By giving several pre and post tests and plotting the results, a linear relationship between the testing times can be established. The shape of the line helps the evaluator determine if increases (or decreases) in test scores can be attributed to program intervention or some other factor.

EXERCISE NINE: Design an Evaluation Study

To answer the program evaluation question below, describe how you would design an evaluation using any evaluation research design: experimental, quasi-experimental (single group pre/post test, nonequivalent group pre/post test, interrupted time series) correlational, or case study.

The administrator of Rehabilitation Services, Inc. has asked you to design a study to help establish that the pillow-making work station provides competitive skill training.

The administrator has stated your null hypothesis as: Trainees entering the pillow-making work station will show no increase in productivity before discharge or twelve weeks of training.

SELF-TEST: Chapter Six

1. _____ data can only provide information about what happened in the facility. They cannot provide information about _____ or _____ outcomes occurred.

2. Administrators use evaluation research to tie program _____ to program _____.

3. Three tactics for establishing evaluation research data are: _____ studies, _____ studies, and _____.

4. _____ _____ are based on the ongoing collection of data and, thus, research questions can be constructed after the data has "aged."

5. _____ studies attempt to find direct relationships between program outcomes and program activities.

6. Experimental studies test _____ collected data using controlled _____ to provide data that allows evaluators to accept or reject _____ evaluation questions.

7. _____ variables are the qualitative outcomes of the program or process being evaluated.

8. _____ variables are the prefacing actions, services, or activities that lead to qualitative outcomes.

9. Three types of quasi-experimental models are useful for evaluating rehabilitation programs. They are: the _____ _____ pre/post test, the _____ _____ _____ pre/post test, and the _____ _____ _____.

SELF-TEST: Chapter Six
ANSWER KEY

1. Outcome data can only provide information about what happened in the facility. They cannot provide information about how or why outcomes occurred.

2. Administrators use evaluation research to tie program outcomes to program activities.

3. Three tactics for establishing evaluation research data are: case studies, correlational studies, and experiments.

4. Case studies are based on the ongoing collection of data and, thus, research questions can be constructed after the data has "aged."

5. Correlational studies attempt to find direct relationships between program outcomes and program activities.

6. Experimental studies test randomly collected data using controlled variables to provide data that allows evaluators to accept or reject hypothetical evaluation questions.

7. Dependent variables are the qualitative outcomes of the program or process being evaluated.

8. Independent variables are the prefacing actions, services, or activities that lead to qualitative outcomes.

9. Three types of quasi-experimental models are useful for evaluating rehabilitation programs. They are: the single group pre/post test, the nonequivalent control group pre/post test, and the interrupted time series.

Chapter Seven
Data Analysis Techniques

In every program evaluation situation, data, either outcome or situationally related, must be analyzed, allowing program administrators to make inferences about the value of the program under examination. Because the data is most often numerically expressed (the alternative would be an evaluation that reports that a product was created or delivered), the analysis is usually of a statistical nature. The easiest way to express the answers to program evaluation questions is to statistically test the truth or falsity of a statement related to the question. This is called hypothesis testing.

Hypothesis Testing

A hypothesis is a statement, theoretical because it is unproven, regarding the relationship of variables under study. The task of data analysis is to statistically indicate the probability that the statement is true or false. Thus, a hypothesis must be capable of being either true or false. It is common to state a hypothesis in a negative statement called the "null" hypothesis. For example, the evaluators of a vocational training program may state the null hypothesis as "The correlation of mean scores on the janitorial skill training battery A after training will be less than or equal to zero to those prior to receiving training."

Corresponding to the null hypothesis, a "positive" hypothesis is also formulated. Thus the hypothesis "The correlation of mean scores on the janitorial skill training battery A after training will be greater than zero to those prior to receiving training," is the only alternative if the null hypothesis is shown to probably be false.

The formulation of a hypothesis is probably the single most critical pre-evaluation planning needed prior to gathering and analyzing data. The hypothesis will dictate the type of data that is collected and the type of analysis that will be conducted.

Techniques

Many different types of analytic techniques can be used to examine program evaluation data. (See Figure Twenty-two.) Many require statistical computer programs and sophisticated knowledge of data manipulation procedures. Others, however, can be simply performed using hand calculators. Three of the simple techniques, sign tests, simple linear regression, and chi-square, are described below.

FIGURE TWENTY-TWO: Standard Data Analysis Methods

DISTRIBUTION TYPE	DATA TYPE	ANALYTIC TYPE
Normal distributions	Interval/ratio data	Linear Regression
Non-normal distribution	Nominal data	Chi square
Non-normal distribution	Ordinal data	Sign test
Non-normal distribution	Interval data	T-tests

Sign Tests

This is probably the simplest test to use when determining if post-test ratings tend to be greater than pre-test ratings. Thus, for use with program evaluation data, the sign test will quickly help an evaluator determine positive or negative tendencies. The sign test will not tell the evaluator how great a change occurs but will indicate that change has occurred. Evaluators need only a table of critical values to determine a significance level for their findings.

First, the data from each case is listed together with pre-test and post-test ratings. Second, the evaluator determines if the post-test rating is greater or less than the pre-test rating and assigns each case a plus (+) or a minus (-). The number of plus ratings are counted. Third, the evaluator also notes the number of ties and subtracts the ties from the total number of cases. Fourth, the evaluator determines the level of significance that is needed to accurately test the hypothesis. Fifth, using both the adjusted total number of cases and the desired level of significance, the evaluator consults a mathematical table of critical values for sign tests. Finally, comparing the critical value found in the table with the number of plus ratings, the evaluator decides whether to accept or reject the null hypothesis.

An Example

To help establish the ability of the pillow-making work station in providing competitive skill training, the administrator of Rehabilitation Services, Inc. asked the supervisor of the pillow-making work station to provide: 1) A list of all clients entered into the work station during 19XX, 2) Their productivity ratings after one week of orientation and procedures training, and 3) Their productivity ratings after 12 weeks in the program (or their rating at the time of discharge if they were placed competitively, self-terminated, or dismissed prior to the end of 12 weeks of training. Twelve weeks was the length of time that the facility had targeted for reaching competitive ratings.)

The administrator determined the null hypothesis: Trainees entering the pillow-making work station will show no increase in productivity before discharge or twelve weeks of training.

List cases with pre-test and post-test ratings.

The work station supervisor provided the following data:

CASE NUMBER	PRODUCTIVITY RATING AFTER ONE WEEK	PRODUCTIVITY RATING AT DISCHARGE OR TWELVE WEEKS
1	41	48
2	15	81
3	67	55
4	73	94
5	78	85
6	53	51
7	69	61
8	40	63
9	70	81
10	07	97
11	26	25
12	70	77
13	23	23
14	33	41
15	61	26
16	46	60
17	12	49
18	79	84
19	83	88
20	40	67

Analyze the data

The first step in analyzing the sign test data is to determine if the post-training data is greater than the pre-training data. If the post-training rating is larger than the pre-training rating, a plus (+) is assigned to the case; if it is smaller, a minus (-) is assigned. The total number of "plus" signs is tallied as well as the number of ties. The ties are subtracted from the total number of cases. (See below.)

CASE NUMBER	PRODUCTIVITY RATING AFTER ONE WEEK	PRODUCTIVITY RATING AT DISCHARGE OR TWELVE WEEKS	PLUS OR MINUS ASSIGNED
1	41	48	+
2	15	81	+
3	67	55	-
4	73	94	+
5	78	85	+
6	53	51	-
7	69	61	-
8	40	63	+
9	70	81	+
10	07	97	+
11	26	25	-
12	70	77	+
13	23	23	0
14	33	41	+
15	61	26	-
16	46	60	+
17	12	49	+
18	79	84	+
19	83	88	+
20	40	67	+
- 1			14 "+"
			1 Tie
N = 19			5 "-"

Compare data to critical values.

Now that the number of "+" assignments and ties have been determined, the evaluator determines the level of significance desired. This

statistic indicates the probability that the test will reject the null hypothesis when it is actually correct. Two levels are usually considered, the .05 level and the .01 level. For most applications, the .05 level of significance (the test will accurately reject the null hypothesis 95% of the time) is sufficient. In this example, we will assume that the administrator is comfortable with the .05 level. All that remains is to determine the critical value for 19 cases at the .05 significance level. This is accomplished by consulting a binomial distribution table (see Figure Twenty-three.)

FIGURE TWENTY-THREE: Critical Values of One-Sided Sign Test

CASES	.05 SIG.	.01 SIG.
5	5	5
6	6	6
7	6	7
8	7	8
9	8	9
10	9	10
11	9	10
12	10	11
13	10	12
14	11	12
15	12	13
16	12	14
17	13	14
18	13	15
19	14	15
20	15	16

Reading across the case column at 19 to the .05 significance column, we obtain a critical value of 14. If the actual statistic is equal to or greater than the critical value we will be forced to reject the null hypothesis. Because 14 plus signs were found in our data we reject the null hypothesis that states that no change will be found. Therefore, we conclude that their is a significant possibility that a change in productivity occurred between the pre-training rating and the post-training rating. We can, with reservation, say that the program may have had a positive affect.

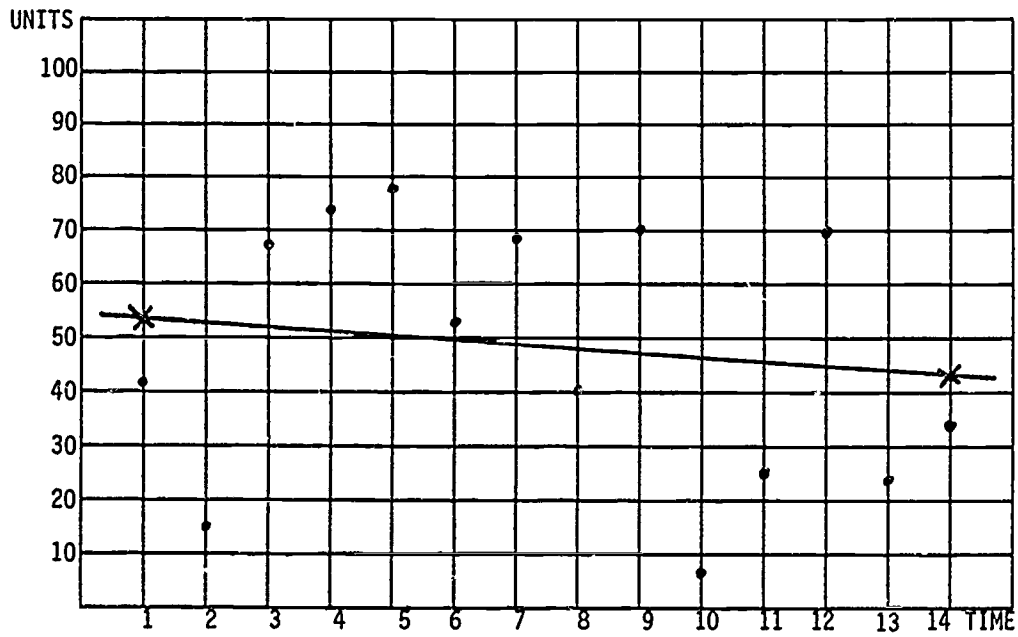
Linear Regression

Some data may lend themselves to analysis by trend line forecasting. This is particularly helpful when making predictions about client progress, but can also be used to illustrate program and/or facility directional change. In fact, change rate may also be of interest to program evaluators.

Least-Squares Forecasting

One of the easiest and most common linear regression techniques is the "least squares" forecasting method. This method is relatively simple in its use of mathematics and provides good trend line information. The method used is a statistical manipulation of data points. All of the squares (a number multiplied by itself) of these data points are added and reformulated mathematically. The resulting new data can be plotted to illustrate the differences between the statistically determined figures and the actual data. This graphic representation of the trend line data (see Figure Twenty-four) represents the least amount of difference between those data points above the line and those below the line. The line, therefore, can be used to predict, with reasonable accuracy, data for points in the near future.

FIGURE TWENTY-FOUR: Sample Least Squares Regression Line



The linear regression forecasting method employed by the least squares method cannot separate cyclical or seasonal effects on the points plotted on the demand graph. Thus, the data must be "deseasonalized" to give an accurate forecast of trends. (Some program evaluation data points may not be affected by seasonal or cyclic trends. Deseasonalization may not be necessary in that case or in the case of data that is stated in yearly terms.)

The following steps are used for creating data to use in least squares forecasting:

1. Obtain enough historical data to support a regression analysis. If forecasts are to be made with the trend line, twelve data periods (usually months) is usually enough to forecast up to twelve more periods of future data. More data points provide a better forecast. Less can be used, but the results may not be reliable.

2. Insure that the time increments within the data are incremental. That is, each period of time that the data represents should be equal to all the other periods. If you are gathering daily work data, remember that the number of work days in a month will vary. Thus, if the daily data is reflected in a monthly figure, you must adjust the periods to reflect the number of days that are actually worked.

3. Adjust the periods to a common point in time if units may change over time (such as dollars earned). Inflation can give a false picture within a forecast. To guard against bias, relate all periods to a common year.

4. Deseasonalize the data. Because some data figures may be used on a basis that fluctuates seasonally, the data needs to be adjusted to account for these fluctuations if an accurate forecast is to be made.

5. Plot the adjusted data on a time vs. quantity graph.

6. Using the seasonally adjusted data and the least squares regression formulas, determine the trend line existing for the plotted data.

7. Examine the trend line to make predictions about future data.

An example

We will use the following records of mean monthly wages in the pillow-making work station at Rehabilitation Services, Inc. to provide an example of least squares regression forecasting.

Obtain historical data

The work station supervisor is asked to examine all of the production records during the past year to determine, on a monthly basis, the mean hourly wage rates paid to the station's workers. The supervisor submits the following list:

Hourly wage rates: 19XX

January	47.50
February	62.50
March	55.00
April	67.50
May	57.50
June	70.00
July	77.50
August	87.50
September	92.50
October	62.50
November	50.00
December	42.50

Adjust time periods to a common base

Because the pillow making work station production reports reflected the wages paid on a monthly basis without regard to the number of actual working days in the month, we must first adjust the data to compensate for months with high and low numbers of working days. Monthly wages are first divided by the number of work days in the month. They are then multiplied by the average number of work days in each month, in this case 21, to arrive at the monthly adjusted wages. See Figure Twenty-five below:

FIGURE TWENTY-FIVE: Sample Time Period Adjustment

Month	Mean Wages		Working Days		Wages per working Day		Average Days Per Month		Adjusted Mean Wages
January	47.50	÷	22	=	2.16	x	21	=	45.36
February	62.50	÷	20	=	3.13	x	21	=	65.73
March	55.00	÷	19	=	2.89	x	21	=	60.69
April	67.50	÷	22	=	3.07	x	21	=	64.47
May	57.50	÷	21	=	2.74	x	21	=	57.54
June	70.00	÷	21	=	3.33	x	21	=	69.93
July	77.50	÷	23	=	3.37	x	21	=	70.77
August	87.50	÷	21	=	4.17	x	21	=	87.57
September	92.50	÷	21	=	4.40	x	21	=	92.40
October	62.50	÷	23	=	2.72	x	21	=	57.12
November	50.00	÷	18	=	2.78	x	21	=	58.38
December	42.50	÷	21	=	2.02	x	21	=	42.42
			252						

252 ÷ 12 = 21

Adjust periods to common dollars

In this example, the wages are being forecast on the basis of dollars in one year. The influences of inflation will not be a major factor in the variation. If inflation were a major factor, all of the dollar amounts would have been adjusted to a base year by multiplying all amounts by an inflation factor obtained from reports provided by the Government Printing Office.

Deseasonalize the data

A quick examination of the wages paid tells the program evaluator that seasonal factors may be involved in the production of pillows and reflected in the wages paid during the month. Late summer and early fall increases show the effect of the major purchaser of the facility's output, Pillowmatic, attempting to stock stores for holiday purchases. Therefore, to determine the true wage trend, the data must be deseasonalized.

To deseasonalize the data the adjusted wages per month are summed and divided by 12 to find an average for the adjusted data points. The adjusted monthly wages for each month are now divided by the average to

obtain each month's seasonal index. This seasonal index is now multiplied by the adjusted wages per month to obtain a deseasonalized figure for use in examining the data trends. See Figure Twenty-six below.

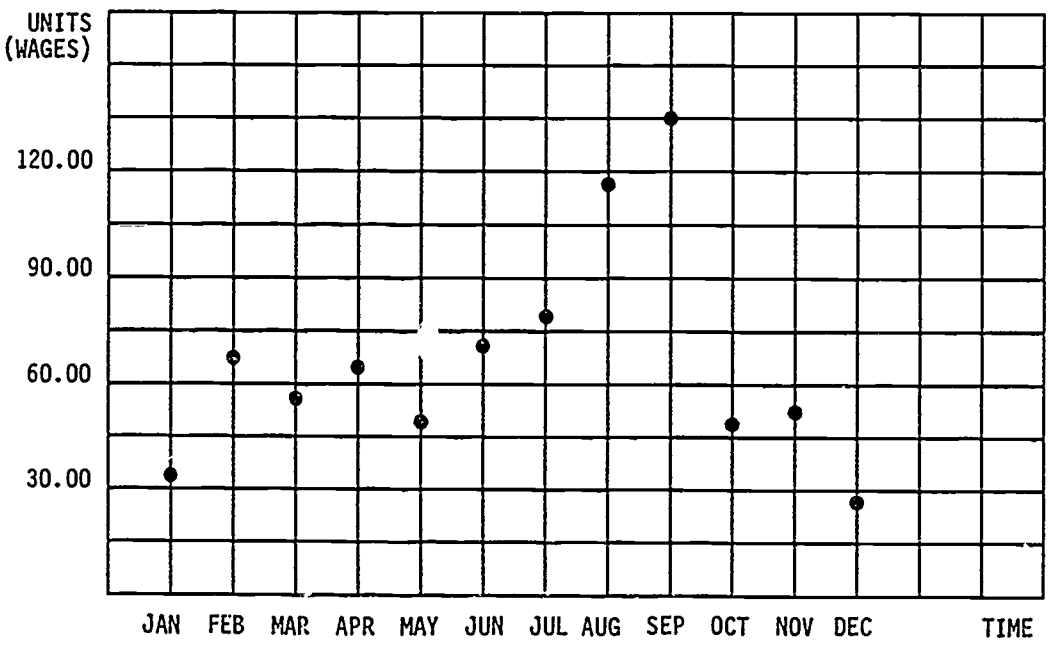
FIGURE TWENTY-SIX: Sample Seasonal Adjustment

Month	Adjusted Wages		Average Adjusted Wages		Seasonal Index		Adjusted Wages		Seasonally Adjusted Wages
January	45.36	÷	64.365	=	.705	x	45.36	=	32.00
February	65.73	÷	64.365	=	1.021	x	65.73	=	67.00
March	60.69	÷	64.365	=	.943	x	60.69	=	57.00
April	64.47	÷	64.365	=	1.002	x	64.47	=	65.00
May	57.54	÷	64.365	=	.894	x	57.54	=	51.00
June	69.93	÷	64.365	=	1.086	x	69.93	=	76.00
July	70.77	÷	64.365	=	1.100	x	70.77	=	78.00
August	87.57	÷	64.365	=	1.361	x	87.57	=	119.00
September	92.40	÷	64.365	=	1.436	x	92.40	=	133.00
October	57.12	÷	64.365	=	.887	x	57.12	=	51.00
November	58.38	÷	64.365	=	.907	x	58.38	=	53.00
December	42.42	÷	64.365	=	.657	x	42.42	=	28.00
	772.38								810.00

Plot the adjusted data

Now that the monthly data has been adjusted for both the number of working days in the month and seasonal fluctuations, we will graphically illustrate the data. See Figure Twenty-seven below:

FIGURE TWENTY-SEVEN: Sample Adjusted Data Plotting



Calculate a line of best fit

We are now ready to determine the regression line (line of best fit) for the data points. The easiest way to handle the data for determining this line is to create a graph of all the relevant data including time and the adjusted data points from above. See Figure Twenty-eight below.

FIGURE TWENTY-EIGHT: Gathering Least Square Forecast Data

X (TIME)	X'	Y (WAGES)	X'Y	X'^2
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
N =	E X'	E Y	E X' Y	$E X'^2$

Determine X'

In order to manipulate the data using the least squares method, we must transform the time increments into positive and negative figures. Each month will be assigned a number from one to twelve in succession. January is One, February is Two, etc. These numbers are then added, resulting in a figure of 78. Because there are 12 months, 78 divided by 12 finds a midpoint of 6.5. Therefore, X' (X prime) is assigned by giving each month above 6.5 a number sequentially from 1 through 6 and each month below 6.5 a number sequentially from -1 through -6. See Figure Twenty-nine. (If the data you are using has an odd number of data points, the midpoint should be labeled zero.) The sum of these numbers (E X') must be zero.

Determine Y value

The third column in Figure Twenty-nine is labeled "Y". This column is reserved for the adjusted data on the wages paid each month. Note that the sum of all the data points (E Y) is also determined.

Determine X'Y

The fourth column in Figure Twenty-nine is labeled "X'Y". This column holds the product of the multiplication of the assigned X' time value and the wages paid (adjusted for monthly and seasonal variations). These figures will be both positive and negative depending upon the assigned X' value. The sum of this column is also determined. It is labeled EX'Y.

Determine X' squared

The final column of Figure Twenty-nine holds the squares of the assigned time values (X'). When negative numbers are squared, they become positive. Therefore, -6 x -6 = 36. This column is also summed.

FIGURE TWENTY-NINE: Sample Least Squares Data

X (TIME)	X'	Y (WAGES)	X'Y	X'^2
1	-6	32.00	- 192.00	36
2	-5	67.00	- 335.00	25
3	-4	57.00	- 228.00	16
4	-3	65.00	- 195.00	9
5	-2	51.00	- 102.00	4
6	-1	76.00	- 76.00	1
7	1	78.00	78.00	1
8	2	119.00	238.00	4
9	3	133.00	399.00	9
10	4	51.00	204.00	16
11	5	53.00	265.00	25
12	6	28.00	168.00	36
78	0	810.00	224.00	182
N = 12	E X'	E Y	E X' Y	$E X'^2$

Calculate points on line of best fit

All of the data has now been determined to allow the line of best fit to be located. Each point is determined by using the following formula:

$$\frac{E\,Y}{N} + X' \times \frac{E\,X'\,Y}{E\,X'^2} = \text{Point on line of best fit}$$

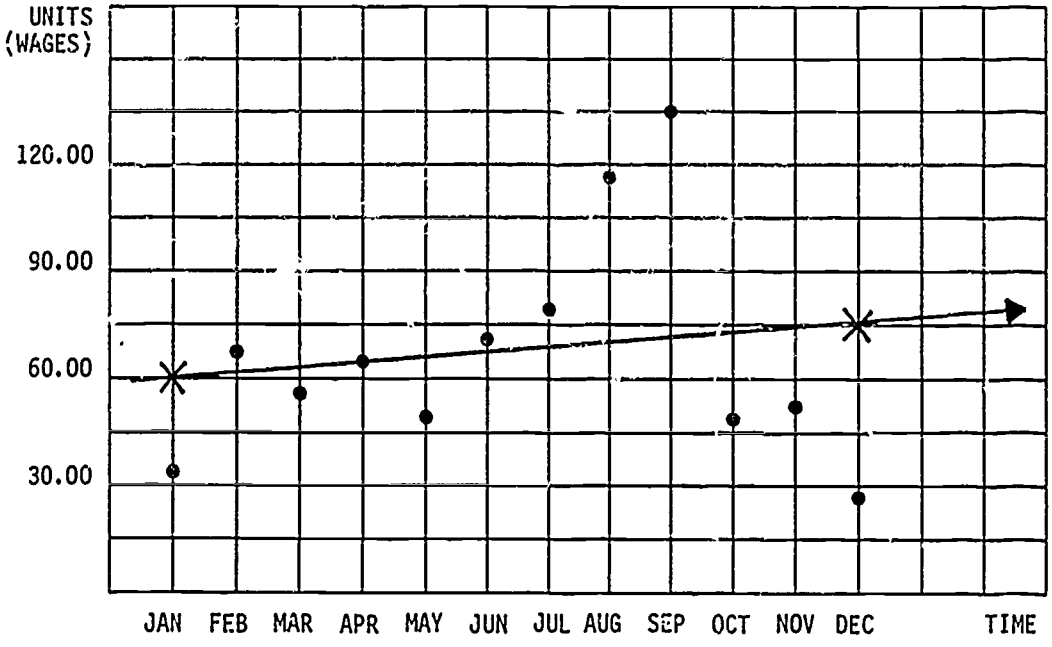
It is not necessary to determine all twelve points in order to draw the line on our graph. We need only to determine the points for January (1) and December (12). Therefore we insert the figures for January and December in the formula:

$$\frac{810}{12} + \left[-6 \times \frac{224.00}{182} \right] = 60.12$$

$$\frac{810}{12} + \left[6 \times \frac{224.00}{182} \right] = 74.88$$

These points are added to our graph and a line is drawn connecting them. This line represents the line of best fit and will be used to forecast monthly wage rates for the coming year. See Figure Thirty below.

FIGURE THIRTY: Sample Least Squares Forecasting Line



Use line of best fit to forecast mean monthly wages

Extending the line of best fit out on the graph for twelve more equal monthly increments, we can estimate the mean wage rates in the pillow-making work station for the coming year. Remember, however, that the line is premised on wages adjusted for seasonal variations. Thus, to know the projected mean wages for any given future month, we must remove the seasonal adjustment. This is accomplished by building a chart of projected mean wages and multiplying the projections for each month by the seasonal index (used above). See Figure Thirty-one below.

FIGURE THIRTY-ONE: Sample Mean Wage Projections

Projected Month	Forecast Mean Wages		Seasonal Index		Seasonally Adjusted Mean Wages	Wage Running Total
January	76.00	x	.705	=	53.58	53.58
February	77.50	x	1.021	=	79.13	132.71
March	79.00	x	.943	=	74.50	207.21
April	81.00	x	1.002	=	81.16	288.37
May	82.50	x	.894	=	73.76	362.13
June	84.00	x	1.086	=	91.22	453.35
July	85.00	x	1.100	=	93.50	546.85
August	87.00	x	1.361	=	118.41	665.26
September	87.50	x	1.436	=	124.93	790.19
October	89.00	x	.887	=	78.94	869.13
November	90.00	x	.907	=	81.63	950.76
December	92.00	x	.657	=	60.44	1011.20

Chi-square Tests

The task of a program evaluation may be to determine relationships between different classes of variables. Two primary variations are normally found. In the simplest variation, the data may be represented by a 2 x 2 grid. In more complex situations the grid may contain many cells.

Simple Chi-squares

A common relationship that is explored in program evaluation is the relationship between successful training closure and the obtaining of competitive employment. The grid for analyzing such a relationship may look like:

		Successfully completed training	
		YES	NO
Competitively Employed	YES	A	B
	NO	C	D

Rehabilitation Services, Inc. was interested in the relationship of successful training and competitive employment. The administrator of the facility formed the null hypothesis that a chi-square analysis would indicate that no difference was found between the number of clients successfully completing training and are competitively employed and those who do not complete training and are competitively employed. During the course of 19XX their twelve work stations served and discharged 138 clients. (More were served but remained in the training program at the time of this program evaluation). After making a list of all clients that had been discharged during the year for any reason, the supervisor tallied the number who had been discharged following successful completion of the program and those who had either been dismissed or had self-terminated. Eighty-five clients had been discharged following successful completion of training; fifty-three did not complete training successfully. Because all discharged clients, both successfully and unsuccessfully discharged, received follow-up services through the facility's case manager's office, most of the client files included notations regarding their current employment status. The case managers were asked to update those files that did not include this data. When all the files were complete, the supervisor tallied those clients who reported holding at least half-time competitive jobs. Seventy-nine former clients reported that they held at least half-time competitive positions; fifty-nine were unemployed, had jobs that were less than half-time, or worked in sheltered or voluntary situations.

The supervisor also paired the client data, tallying those who successfully completed training and held a competitive job, those who successfully completed training and did not hold a job, those who did not complete training and held a competitive job, and those who did not complete training and did not hold a competitive job. This data was used to fill out the following grid:

	Successfully completed training: YES	Successfully completed training: NO	
Competitively Employed: YES	A 58	B 21	A+B=79
Competitively Employed: NO	C 27	D 32	C+D=59
	A+C=85	B+D=53	N=138

To analyze this data, the administrator must determine both a critical value (which will be located in a chi-square table of critical values) and a test statistic for the data to be analyzed.

The test statistic is determined using the following formula:

$$X^2 = \frac{N\,(AD-BC)^2}{(A+B)\ (C+D)\ (A+C)\ (B+D)}$$

Thus, replacing the letters with the figures from the grid above, the administrator determines that the test statistic is 10.92:

$$X^2 = \frac{138 \times [\ (58 \times 32) - (21 \times 27)\ ]^2}{79 \times 59 \times 85 \times 53}$$

$$X^2 = \frac{229,289,898}{20,997,805} = 10.92$$

Critical values in chi-square tables are listed by "degrees of freedom." This statistic is determined by multiplying the number of rows in your data grid less one by the number of columns in the grid less one. Whenever your data conforms to the 2 X 2 pattern above, the degrees of freedom will be 1 because the number of rows (2) minus 1 = 1, multiplied by the number of columns (2) minus 1 = 1, results in a product of 1 (1 x 1 = 1.) (Note: as in the other tests, a significance level will need to be determined. For most program evaluation analyses, a significance level of .05 is sufficient. A level of .01 is very significant and should be reported if possible.)

Consulting a table of critical values for chi-square, see Figure Thirty-two, the administrator determines that the critical value at the .05 level with one degree of freedom is 3.84. The value at the .01 level is found to be 6.64. Because the test statistic of 10.92 is greater than either of these, the null hypothesis is rejected. Thus, successful completion of a Rehabilitation Services, Inc. training program is correlated with obtaining a competitive job.

FIGURE THIRTY-TWO: Critical Values of Chi-square.

d.f.	$\alpha = .05$	$\alpha = .01$	d.f.	$\alpha = .05$	$\alpha = .01$	d.f.	$\alpha = .05$	$\alpha = .01$
1	3.841	6.635	46	62.830	71.201	91	114.268	125.289
2	5.991	9.210	47	64.001	72.443	92	115.390	126.462
3	7.815	11.345	48	65.171	73.683	93	116.511	127.633
4	9.488	13.277	49	66.339	74.919	94	117.632	128.803
5	11.071	15.086	50	67.505	76.154	95	118.752	129.973
6	12.592	16.812	51	68.669	77.386	96	119.871	131.141
7	14.067	18.475	52	69.832	78.616	97	120.990	132.309
8	15.507	20.090	53	70.993	79.843	98	122.108	133.476
9	16.919	21.666	54	72.153	81.069	99	123.225	134.642
10	18.307	23.209	55	73.311	82.292	100	124.342	135.807
11	19.675	24.725	56	74.468	83.513	102	126.574	138.134
12	21.026	26.217	57	75.624	84.733	104	128.804	140.459
13	22.362	27.688	58	76.778	85.950	106	131.031	142.780
14	23.685	29.141	59	77.931	87.166	108	133.257	145.099
15	24.996	30.578	60	79.082	88.379	110	135.480	147.414
16	26.296	32.000	61	80.232	89.591	112	137.701	149.727
17	27.587	33.409	62	81.381	90.802	114	139.921	152.037
18	28.869	34.805	63	82.529	92.010	116	142.138	154.344
19	30.144	36.191	64	83.675	93.217	118	144.354	156.648
20	31.410	37.566	65	84.821	94.422	120	146.567	158.950
21	32.671	38.932	66	85.965	95.626	122	148.779	161.250
22	33.924	40.289	67	87.108	96.828	124	150.989	163.546
23	35.172	41.638	68	88.250	98.028	126	153.198	165.841
24	36.415	42.980	69	89.391	99.228	128	155.405	168.133
25	37.652	44.314	70	90.531	100.425	130	157.610	170.423
26	38.885	45.642	71	91.670	101.621	132	159.814	172.711
27	40.113	46.963	72	92.808	102.816	134	162.016	174.996
28	41.337	48.278	73	93.945	104.010	136	164.216	177.280
29	42.557	49.588	74	95.081	105.202	138	166.415	179.561
30	43.773	50.892	75	96.217	106.393	140	168.613	181.840
31	44.985	52.191	76	97.351	107.583	142	170.809	184.118
32	46.194	53.486	77	98.484	108.771	144	173.004	186.393
33	47.400	54.776	78	99.617	109.958	146	175.198	188.666
34	48.602	56.061	79	100.749	111.144	148	177.390	190.938
35	49.802	57.342	80	101.879	112.329	150	179.581	193.208
36	50.998	58.619	81	103.010	113.512	200	233.994	249.445
37	52.192	59.892	82	104.139	114.695	250	287.882	304.940
38	53.384	61.162	83	105.267	115.876	300	341.395	359.906
39	54.572	62.428	84	106.395	117.057	400	447.632	468.724
40	55.758	63.691	85	107.522	118.236	500	553.127	576.493
41	56.942	64.950	86	108.648	119.414	600	658.094	683.516
42	58.124	66.206	87	109.773	120.591	700	762.661	789.974
43	59.304	67.459	88	110.898	121.767	800	866.911	895.984
44	60.481	68.710	89	112.022	122.942	900	970.904	1001.630
45	61.656	69.957	90	113.145	124.116	1000	1074.679	1106.969

From: Bradley, James V. (1968). DISTRIBUTION-FREE STATISTICAL TESTS. Englewood Cliffs, N.J.: Prentice-Hall. P. 379.

Complex Chi-squares

A more complex program evaluation question may lead to a more elaborate grid structure. For example, we may wish to show that all of our supported work sites provide training for a cross section of severe disabilities. The grid for analyzing such relationships may look like:

Work Station	Severe disability type MR/DD	MI	VISUAL	PARA	QUAD
SEARS					
HOLIDAY INN					
TARGET					

The administrator of Rehabilitation Services, Inc. was concerned about accusations that some community members were making that the facility was not providing equal supported work opportunities to severely disabled clients in the various supported work sites developed by the facility. Discussing the situation with the supervisor of the support work program, the administrator decided to test the null hypothesis that there is a relationship between disability type and placement in one of the three supported work sites that the facility operates.

The facility served 74 clients with five disabling conditions in three supported work sites. Thus, the administrator asked the supported work program supervisor to complete the following grid by identifying the number of clients served in each site during the past year according to their primary disability classification:

Work Station	Severe disability type MR/DD	MI	VISUAL	PARA	QUAD	
SEARS	9	8	5	8	4	34
HOLIDAY INN	8	9	6	3	1	27
TARGET	4	2	2	3	2	13
	21	19	13	14	7	N=74

Chi-square analysis is a test that compares the expectations of frequencies in rows and columns with the observed frequencies in rows and columns. The following formula is used, where "O" equals the observed frequency (actual data) and "E" equals the expected frequency:

$$X^2 = \text{"E"} \quad \frac{(O - E)^2}{E}$$

Expected frequencies are determined using the formula:

$$E = \frac{\text{Sum of the Row} \times \text{Sum of the column}}{\text{Total sample size (N)}}$$

For example, the grid cell corresponding to the row for Sears and the column for MR/DD has an observed frequency ("O") of 9 and an expected frequency of 9.6. The expected frequency was determined by multiplying the row total with the column total and dividing the product by the total sample size ("N"):

$$\frac{34 \times 21}{74} = 9.6$$

Using this procedure, the supervisor determined the expected frequencies for each cell of the grid (Observed/Expected):

Work Station	Severe disability type MR/DD	MI	VISUAL	PARA	QUAD	
SEARS	9 / 9.6	8 / 8.7	5 / 6.0	8 / 6.4	4 / 3.2	34
HOLIDAY INN	8 / 7.7	9 / 6.9	6 / 4.7	3 / 5.1	1 / 2.6	27
TARGET	4 / 3.7	2 / 3.3	2 /2.3	3 /2.5	2 / 1.2	13
	21	19	13	14	7	N=74

To complete the formula for finding the test statistic, it is easiest to build a chart listing the observed frequencies with their associated expected frequencies, the result of subtracting the expected frequency from the observed frequency, that result squared, and the product of dividing the squared result by the expected frequency. The chart for our example is below:

Observed Freq. O	Expected Frequency E	Observed minus Expected Freq. $O - E$	Observed minus Expected Freq. Squared $(O - E)^2$	$(O-E)^2$ divided by Expected Frequency $\frac{(O - E)^2}{E}$
9	9.6	- .60	.36	.04
8	8.7	- .70	.49	.06
5	6.0	-1.00	1.00	.17
8	6.4	1.60	2.56	.40
4	3.2	.80	.64	.20
8	7.7	.30	.09	.01
9	6.9	2.10	4.41	.64
6	4.7	1.30	1.69	.36
3	5.1	-2.10	4.41	.86
1	2.6	-1.6	2.56	.98
4	3.7	.30	.09	.02
2	3.3	-1.30	1.69	.51
2	2.3	- .30	.09	.04
3	2.5	.50	.25	.10
2	1.2	.80	.64	.53

$N = 74$ $\quad X^2 = 4.92$

Completing the chart, the administrator adds all the figures in the right column to determine the chi-square statistic for this set of evaluation data. It is 4.92.

To find the critical value from a chi-square table, like in the example above, we must first establish the degrees of freedom for the data. This is accomplished by multiplying the number of rows in our original data (3) minus 1, with the number of columns (5) minus 1. Thus we multiply 2 x 4 and determine the number of degrees of freedom to equal 8.

Consulting the chi-square tables (see Figure Thirty-two) the administrator learns that the critical value for 8 degrees of freedom at a .05 significance level is 15.51. Because the test statistic is below this figure, the null hypothesis must be accepted. Therefore, this test indicates that a relationship between disability type and placement within a supported work environment does exis and that the concerns of those critical to the facility may have a basis in fact.

EXERCISE TEN: Linear Regression Worksheet

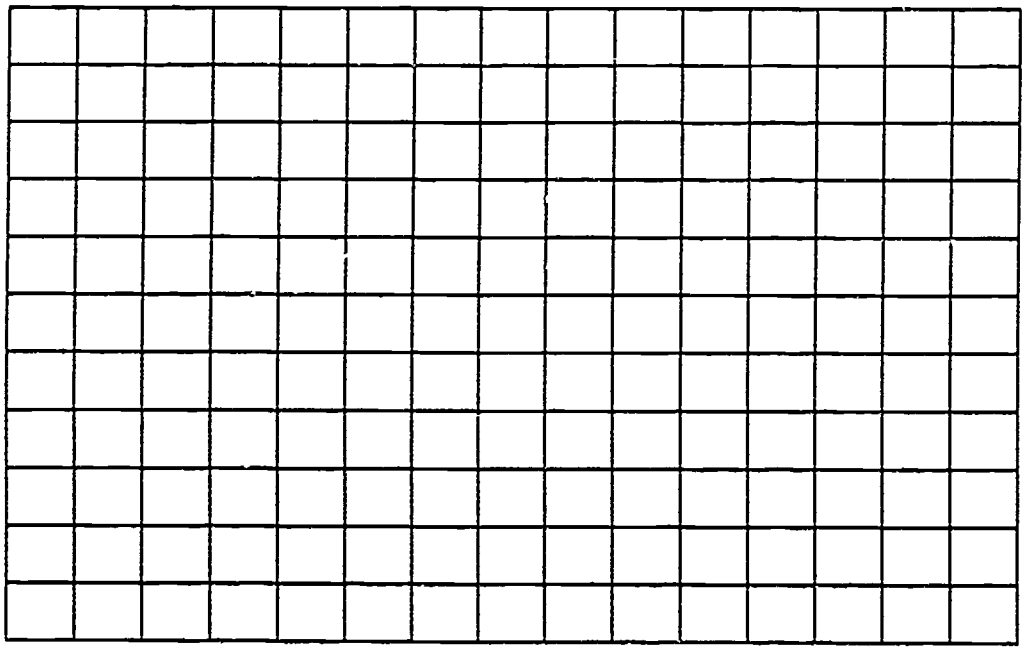
The Director of Rehabilitation Services, Inc. was concerned about the number of clients that were being referred to the placement program from vocational workstation four (shrink-wrapping). Because the numbers vary each month, the Director asks you to do a linear regression to find the trend line for these referrals. Use the following data and the least squares formulas to determine a projection line.

	Clients referred to the Placement Program from Voc Workstation Four
January	7
February	2
March	5
April	7
May	7
June	0
July	7
August	7
September	2
October	2
November	0
December	2

Month	Mean Referrals	Working Days	Referral per Working Day	Average Days Per Month	Adjusted Mean Referrals

EXERCISE TEN
CONTINUED

Month	Adjusted Referrals	Average Adjusted Referrals	Seasonal Index	Adjusted Referrals	Seasonally Adjusted Referrals



EXERCISE TEN CONTINUED

X (TIME)	X'	Y (WAGES)	X'Y	X'^2
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
N =	E X'	E Y	E X' Y	$E X'^2$

Projected Month	Forecast Referrals	Seasonal Index	Seasonally Adjusted Referrals	Referral Running Total

EXERCISE ELEVEN: Chi-square Worksheet

The Director of Rehabilitation Services, Inc. is writing a grant to obtain funds for the continued operation of a janitorial crew program. In the grant, the Director wishes to tie successful completion of the program with the client's competitive employment. The supervisor is asked to provide data about the clients and their competitive status. You are asked to use the data to determine if a relationship exists. You are to use a chi-square analysis.

Entered the program	= 327
Graduated from the program	= 132
Graduated and obtained employment	= 97
Did not graduate but obtained employment	= 63

	Successfully completed training: YES	Successfully completed training: NO
Competitively Employed: YES	A	B
Competitively Employed: NO	C	D

SELF-TEST: Chapter Seven

1. Program evaluation data must be _____ by end users or their representatives in order to make _____ about the program on the basis of evaluation data.

2. The task of data analysis is to _____ indicate the probability that a hypothesis (a theoretical statement of the relationship between variables) is _____ ___ _____.

3. Hypotheses are stated in _____ terms.

4. Three simple data analysis techniques are: _____ _____, _____ _____ _____, and _____.

5. _____ _____ are the simplest tests to use when determining if post-test ratings tend to be _____ than pre-test ratings.

6. Data forecasting using _____ _____ are most helpful when making predictions of future activities or illustrating positive or negative trends.

7. _____ forecasting is a representation of the difference between data points above and below the average.

8. To determine the relationships that exist between different classes of variables, a _____ test may be most appropriate.

9. Simple chi-squares involve only _____ variables.

10. The analysis of chi-square data requires the use of a _____ _____ table.

SELF-TEST: Chapter Seven
ANSWER KEY

1. Program evaluation data must be analyzed by end users or their representatives in order to make inferences about the program on the basis of evaluation data.

2. The task of data analysis is to statistically indicate the probability that a hypothesis (a theoretical statement of the relationship between variables) is true or false.

3. Hypotheses are stated in null terms.

4. Three simple data analysis techniques are: sign tests, simple linear regression, and chi-square.

5. Sign tests are the simplest tests to use when determining if post-test ratings tend to be greater than pre-test ratings.

6. Data forecasting using linear regressions are most helpful when making predictions of future activities or illustrating positive or negative trends.

7. Least-squares forecasting is a representation of the difference between data points above and below the average.

8. To determine the relationships that exist between different classes of variables, a chi-square test may be most appropriate.

9. Simple chi-squares involve only two variables.

10. The analysis of chi-square data requires the use of a critical value table.

Chapter Eight

Report Results

Graphic displays will help make the presentation of program evaluation research data more meaningful. Often used graphics are: pie graphs, bar graphs, and line graphs along with many other types of visual aids. A narrative report will most likely accompany any visual representation of the evaluation data. These reports are often called "management reports," especially when conducting summative evaluations.

It is important to include explanations of any data that is presented. When any of the analysis techniques discussed in chapter seven are used to give meaning to raw program evaluation data, the significance levels and means of the data should be reported along with the test statistics and critical values. It is not sufficient to state "The data indicate that there is a positive relationship of successful program completion to competitive placement." This statement must be qualified by stating "This conclusion was based on a chi-square statistic of 10.92 as compared with the critical value at one degree of freedom of 6.64 at the .01 significance level."

Report Formats

The results for the current and cumulative program evaluation periods are compiled in the form of a "management report" that should include: the program results by objective, program results by client descriptors, a narrative report that summarizes the results, and the results of any special program evaluation questions.

A good narrative report should be able to take the mystery and confusion out of the statistical reports so that either management or the board who are unfamiliar with the program evaluation process can fully understand how successful the agency was during the period in accomplishing its goals. They also need to understand the implications of recommendations made in light of the program evaluation results. Vocational evaluation programs have special needs concerning reports, especially reports of client evaluations. Some of the material included in the Thomas (1986) publication

Report Writing in Assessment and Evaluation can be used in program evaluation situations as well.

The narrative management report should include all of the agency's programs. There should be a separate narrative report section for each program. Significant developments should be highlighted in the report.

Following is a sample report of an evaluation of Rehabilitation Services, Inc.'s vocational programs and services for the month of March, 198X, and the cumulative period January 1, 198X through March 31, 198X.

FIGURE THIRTY-THREE: Sample Management Report

REHABILITATION SERVICES, INC.
Report to the Board

Program Evaluation for the Month of March, 198X
and
The cumulative period January 1, 198X - March 31, 198X

Program Effectiveness

During the month of March, 80% of the clients who were closed from the vocational evaluation program did so with positive vocational recommendations. This is 5% below our goal. For the period beginning 1/1/84 and ending 3/3/84, we maintained our goal of 85% for this objective.

For those who did complete their program, their average program length was five weeks for both March and the cumulative period. This is one week longer than our goal of four weeks.

Of those clients who completed their program in March with vocational recommendations, 88% of those recommendations were followed by their referring vocational counselor 60 days after exiting their program. This is 8% over our goal of 80%. For the cumulative period, our results were 76% or 4% under our goal.

Who Was Served

The major disability group for whom we provide services remains to be the mentally retarded with 40% of our case loads reporting this as the primary disability diagnosed at intake. Including the mentally ill (20%), 60% of our clients have some

mentally related disability. The physically disabled population (30%) has shown an increase, apparently due to an increase of referrals from insurance companies. They have increased the number of injured workers who have entered our programs. The remaining clientele show disabilities of hearing impairment (2.5%), visual impairment (2.5%), learning disability (2.5%), and epilepsy (2.5%). Fifty percent of our clients are multiply and/or severely disabled.

We continue to serve a large proportion of minority clients (50%), most of whom are black. Fifty percent of those being referred have had no previous history of employment. This has remained true for 50-75% of our caseload for the past year. Thirty percent of evaluees have been previously institutionalized.

Our major referral source continues to be the State Vocational Rehabilitation Office with 50% of our clients being referred from that source. However, we are seeing more referrals from private insurance companies who are referring workers compensation claimants. This month these clients comprised 20% of our client load.

Rehabilitation Costs

It cost the facility $6,284.00 to operate the vocational evaluation program for the month of March. The cost per client (8) for those who completed the evaluation program with positive vocational recommendations was, therefore, $786.00. The facility received $4,713.00 in purchase of service fees from state and local sources to provide evaluation programming during the month, and $900.00 was received from insurance companies. This left a balance of $671.00 that will be balanced by revenues from internal sources.

The total costs for the cumulative period were $18,751. This is $552.00 per client for those completing their program with positive vocational recommendations. Purchase of service from state and local sources amounted to $16,495 and $2,675 was received from insurance companies, leaving a net operating deficit of $1,019.00.

Program Recommendations

It is recommended that a closer look be taken at the reasons for our evaluations lasting an average of five weeks, or one week more than our goal of four weeks. We are receiving con-

tinued pressure from all purchase of service revenue sources to minimize the time that clients spend in the program. Possible solutions are:

1. Evaluate the amount of time spent in the evaluation program per data gathered. Could some of the data be gathered through situational assessment methods?

2. Examine what assessment tools and areas are taking the longest time and investigate alternative testing products now available on the market that would reduce testing time.

3. Determine if evaluations are being as individually structured as is needed for certain client needs and referral sources or whether all clients are going through the same procedures, some of which may be unnecessary.

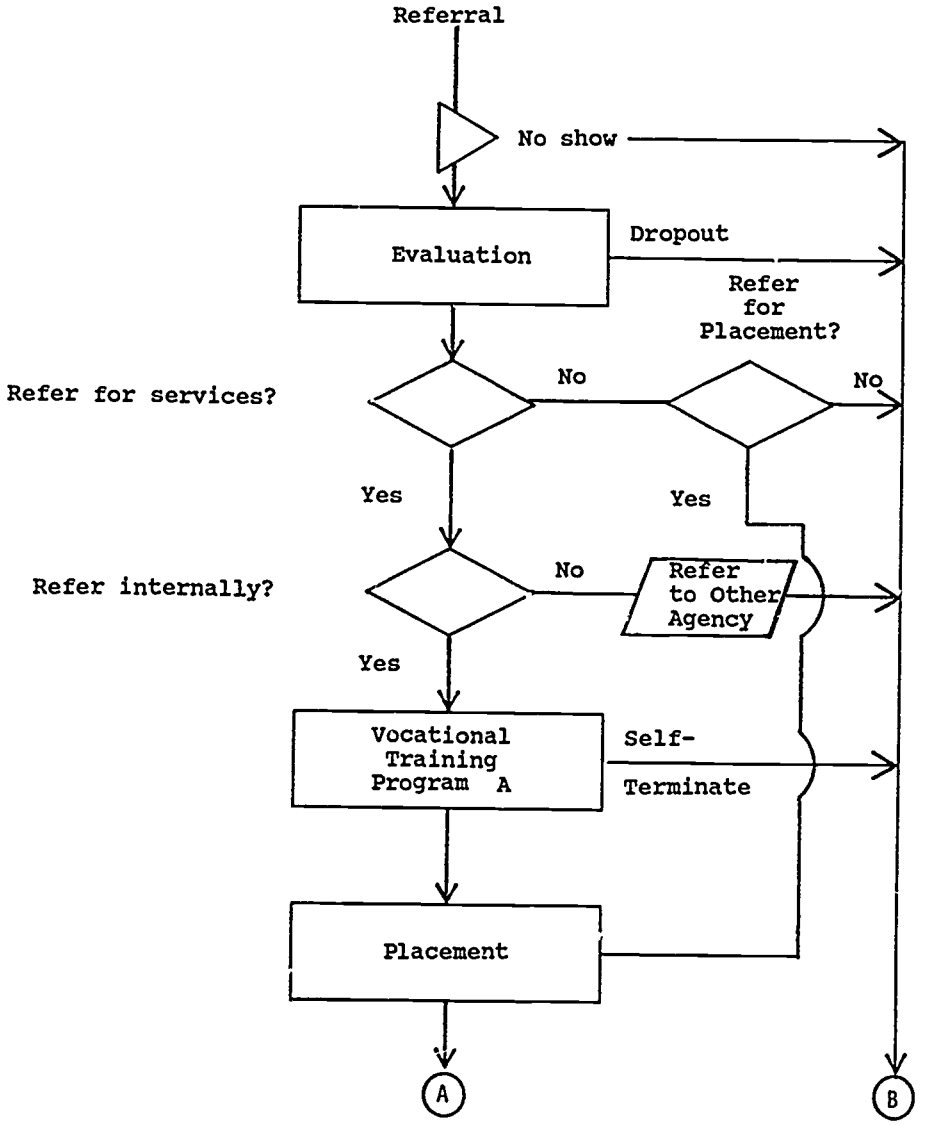
It is recommended that since we are now serving more physically disabled clients than before, that we determine whether we have sufficient evaluative tools to access the needs of these clients.

It is recommended that the facility further develop and market its services to workers' compensation claimants due to initial successes, increasing familiarity of this group by program staff, and insufficient financial support to operate the vocational evaluation program by governmental sources. An organized and structured program needs to be developed along with an appropriate brochure if the program is to be professionally marketed to insurance carriers and companies.

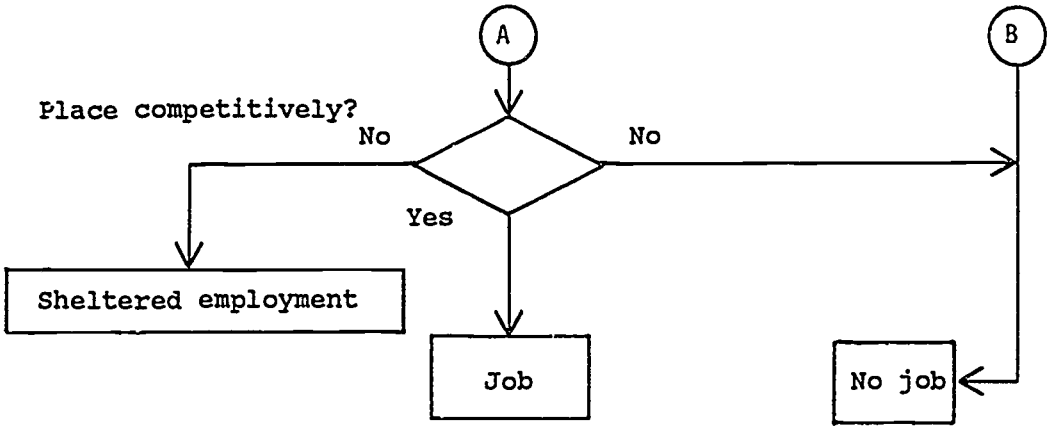
EXERCISE TWELVE: Write a Management Report

Using data below, write a management report that details the program's effectiveness, describes who was served, the rehabilitation costs incurred, and your recommendations for future operation (including decisions about program termination or expansion.) Include at least one visual representation of your findings.

FLOW PATH FOR REHABILITATION SERVICES, INC.



EXERCISE TWELVE CONTINUES



END OF 19XX CLIENT TOTALS FOR REHABILITATION SERVICES, INC.

	Evaluation	Training A	Placement	Total
Referrals	520	52	26	598
Served	390	224	222	468
Self-terminate	39	68	0	107
No benefits	92	68	7	167
Placements	23	105	145	145

SELF-TEST: Chapter Eight

1. _____ _____ make written reports more meaningful.

2. Program evaluation reports are often called _____ reports.

3. When data analysis is discussed, _____ levels and data _____ should be reported as well as test _____ and _____ values.

4. Program evaluation reports should include: program results by _____, program results by _____ _____, a _____ of results, and _____.

5. Evaluation reports should be designed to help _____ _____ make _____ about the facility and its programs.

SELF-TEST: Chapter Eight
ANSWER KEY

1. Graphic displays make written reports more meaningful.

2. Program evaluation reports are often called management reports.

3. When data analysis is discussed, significance levels and data means should be reported as well as test statistics and critical values.

4. Program evaluation reports should include: program results by objective, program results by client descriptors, a summary of results, and recommendations.

5. Evaluation reports should be designed to help stakeholders make decisions about the facility and its programs.

Chapter Nine

Develop a Plan to Implement Program Evaluation

No program evaluation will provide long term input into the facility's planning and accountability systems without ongoing commitment from the board of directors and chief executive officer.

Program evaluation, as defined by the Commission on Accreditation of Rehabilitation Facilities (CARF, 1985) is a systematic procedure for determining the effectiveness and efficiency with which results following rehabilitation services are achieved by persons served. Evaluation data collected regularly and/or continuously can provide a rich source of data to assess the facility's effectiveness and efficiency at providing rehabilitative services. Program evaluation data will keep the administrator appraised of the facility's status regarding the completion of its mission. In addition, these data will be used to identify and change client flow problems, resulting in better client service.

Program evaluation is also a tool for providing better services. In a program evaluation, administrators, accreditation agencies, and funding bodies examine the facility's ability to deliver the services they were organized to provide. By regularly examining facility programs, data is produced that is of great value to funding bodies. Essentially, program evaluation is an integral part of the service delivery system.

The essential elements of program evaluation, according to CARF (1975), are:

(1) A purpose statement.
(2) A structuring of programs.
(3) A system review mechanism.
(4) Management reports.
(5) Goal statements for each program.
(6) Admission criteria for each program.
(7) A listing of services for each program.
(8) A listing of persons served for each program.
(9) Measurable objectives for each program.
(10) Measurement criteria for each objective.

(11) Specification of who is measured for each objective.
(12) Specification of the time each measure is applied for each objective.
(13) Specification of variables for each person served, including severity and barriers.
(14) Specification of success criteria for each objective.
(15) Specification of relative importance of each objective.

Note that the major elements of program evaluation include an element requiring system review (element number 3). In addition, many of the elements call for the creation of ongoing data collection systems (underlined.) These data will be analyzed using many types of program evaluation research techniques, including systems analysis, experimental studies, case studies, and correlational research. Thus, ongoing program evaluation data collection systems support the activities of the entire facility.

Create an Implementation Strategy

The implementation of a program evaluation process into a rehabilitation facility must be carefully planned. Careful planning helps insure that the evaluation is relevant. It is also essential in order to counter the inevitable resistance that will be encountered from program staff.

Once the facility has developed its program evaluation structure, a trial implementation period is begun. This trial is undertaken for the following reasons:

1. To complete the development of all needed forms and documents.
2. To develop procedures for information flow, collection, tabulation, and reporting.
3. To prepare a manual of operations.
4. To train staff.
5. To collect data.
6. To generate initial reports.
7. To critique and modify the system.

A period of six months is recommended for the trial implementation period once data collection has begun.

FIGURE THIRTY-FOUR: A Sample Installation Plan

STEP	DESCRIPTION	ASSIGNED	STARTED	COMPLETED
1	Executive commitment			
2	Policy decision/resolution from governing body			
3	Appoint program evaluation committee and person responsible for developing the system			
4	Develop written policies, procedures, and system elements			
4.1	Schedule regular meeting with key individuals			
4.2	Develop a written plan which includes all system elements			
4.3	Analyze current data for a clear definition of needed changes			
5	Establish a trial implementation date			
5.1	Develop report forms and source documents			
5.2	Develop system data flow chart			
5.3	Merge data collection system into facility information system			
5.4	Prepare and publish manuals and forms			
6	Implement the system			
7	Review and critique the system no less than six months after implementation			
8	Analyze data and write management report			
9	Monitor the system			

Resistance to Program Evaluation

We have already seen that program evaluation serves many functions. While the improvement of services for program recipients is the most obvious and usual stated reason for engaging in program evaluation, it is also used as a management tool to monitor/evaluate program staff and to account for the function of program administrators themselves. The very term "evaluation" denotes a threat. If program participants perceive that an evaluation will be used for covert reasons, resistance will be present.

Often the issue of program evaluation will be as basic as the philosophical difference between service providers and administrators. They stem from two approaches on how best to understand and help human beings. Practitioners generally believe that knowledge can best be gained through studies of individuals. This point of view is rooted in the humanistic-holistic philosophy which sees the greatest good in the individual. On the other hand, program evaluation is steeped in the analytical-mechanistic tradition which holds that an individual can only be understood as a whole, but states that the best way to perceive the whole is to analyze the parts.

Other differences between service providers and those who would evaluate their services stem from job role perceptions. Practitioners have fixed schedules, administrators do not. Practitioners are deeply committed to individuals, administrators see their commitment attached to groups. Practitioners gain nothing immediately from evaluation, administrators do. It is not difficult to see why service staff are often suspicious of program evaluation.

Cook and Cooper (1978) cited Borgatta (1966) for the suggestion that facility staff will irrationally discount program evaluation findings both before evaluations take place and after they are implemented.

> "Among the arguments that program-related staff use to discount evaluation findings suggestive of program change (before the evaluation takes place) are:
>
> 1. program effects are long ranged, they can't be ascertained in six months, one year, two years, etc; or
> 2. program effects are too diffuse and general to be measured by any specific measurement device; or
> 3. no instrument or measurement device is sensitive enough to measure small but important program effects; or

4. the measurement process in and of itself disturbs the program processes involved." (p. 20)

"Borgatta also suggested rationalization that might be used to discount 'negative' evaluation findings after the fact; namely:

1. Some of the persons exposed to the program made great improvement;
2. some of the persons who most needed the program and would show the most benefits were in the control group; and
3. no difference on outcomes between the program and control group implies need for a more intensive program." (p.21)

Steps in Countering Resistance

There are several planning steps that the facility may engage to counter this resistance.

First, support for the development and implementation of a program evaluation must be generated from the highest administrative levels of the organization. Second, the plan should be flexible, allowing methodology and data collection to be gathered in ways that are the most accepted by the service staff. Third, program staff should be involved in the program evaluation. Their involvement should begin with the planning stage. Staff involvement may be generated by:

A. Meeting with small groups of service personnel to describe the need for program evaluation and the necessity for following a research design.
B. Encouraging suggestions on how the evaluation may best be carried out.
C. Remaining neutral as to administration-staff conflicts.
D. Pointing out the benefits the evaluation will have for staff, such as improvement in services, documentation of effort, increased professional growth. etc.

EXERCISE THIRTEEN: Develop an Installation Plan

Using the form above (or a similar form that better meets your facility's needs) create an installation plan for your facility.

SELF-TEST: Chapter Nine

1. Program evaluation needs _____ from the facility board and CEO to be successful.

2. One major element of a program evaluation plan is a plan for implementation that includes _____ _____.

3. Implementation of a program evaluation must be carefully planned to insure that the data collected _____ _____.

4. Preplanning also helps counter _____.

5. Trial evaluation programs:
   a. Insure development of _____ _____.
   b. Insure development of _____ _____.
   c. Allow time to prepare a _____ of operations.
   d. Provide staff _____ time.
   e. Improve data _____ _____.
   f. Show stake-holders initial _____.
   g. Give time for _____.

6. If program participants perceive that an evaluation will be used for _____, resistance will be present.

7. Resistance to program evaluation may be countered by three planned processes: gaining _____ _____ from the highest levels, using staff accepted _____ _____ methods, and by involving staff in the _____ _____.

8. Staff involvement can be gained by: meeting with _____ _____ in the planning stages, encouraging _____ on how to evaluate programs, avoiding administration staff _____, and stressing the _____ _____ that evaluation will have for the staff.

SELF-TEST: Chapter Nine
ANSWER KEY

1. Program evaluation needs commitment from the facility board and CEO to be successful.

2. One major element of a program evaluation plan is a plan for implementation that includes scheduled reviews.

3. Implementation of a program evaluation must be carefully planned to insure that the data collected is relevant.

4. Preplanning also helps counter resistance.

5. Trial evaluation programs:
   a. Insure development of needed forms.
   b. Insure development of flow procedures.
   c. Allow time to prepare a manual of operations.
   d. Provide staff training time.
   e. Improve data projection estimates.
   f. Show stakeholders initial results.
   g. Give time for modifications.

6. If program participants perceive that an evaluation will be used for covert activities, resistance will be present.

7. Resistance to program evaluation may be countered by three planned processes: gaining full commitment from the highest levels, using staff accepted data collection methods, and by involving staff in the planning process.

8. Staff involvement can be gained by: meeting with small groups in the planning stages, encouraging suggestions on how to evaluate programs, avoiding administration staff conflicts, and stressing the positive effects that evaluation will have for the staff.

Appendix A

Definition of Terms

Addictive Disorders

Percent of clients who received treatment services for alcohol or drug addiction.

Assistance

Purpose of contact is to resolve or prevent a problem. Surveillance or casual contact is not included.

Blind

Percent of clients that have less than 5/200 visual acuity.

Cessation

The treatment services that are designed to achieve goals or resolve problems are no longer being provided.

Clients

Persons officially recorded as program starts. Normally a person becomes a client on the day they enter or begin receiving services from a program.

Continuous

Completion of 90 calendar days with one employer.

Developmentally Disabled

Polio, epileptic, cerebral palsy, and mentally retarded.

Emotional Illness

Percent of clients hospitalized for emotional problems or who received services from a mental health treatment facility.

Employment

A minimum of thirty hours of work per week at the same location or for the same person when compensation is received for time and effort expended is considered full time employment. This excludes seasonal and temporary positions.

Family

One other person with whom the patient may live, such as a spouse, brother, sister, son, or daughter. Excluded are multiple family members in an extended family.

Full-time Competitive

At least 30 hours a week, minimum wage, non-seasonal and permanent.

Hearing Impaired

Documented in referral data or by referral from the State Commission for the Blind.

High School Diploma

G.E.D. is an equal as is graduation from special education.

Income

Includes revenues from entitlement monies (such as SSI, private insurance, income earned by the release of a family to work, and food stamps). Excludes lump sum payments such as legal settlements and workmen's compensation.

Increase

The entitlement income at 90 days minus the entitlement at admission.

Mentally Retarded

Percent of clients diagnosed as retarded, with an intelligence quotient (IQ) of 80 or below.

Occupational Skill Training

Specialized training in a particular areas of employment. Obtainable in an accredited vocational school or OJT program.

On-the-job Training (OJT)

Involves a written client contract, wages earned in training. The expectation is that the client will remain on the job after the completion of training.

Orthopedic

Any skeletal or related deformities.

Other "Status 26"

Any other successful client case closure.

Poor Job Performance

Determined by application for services and on social history taken during intake period.

Program Length

The number of weeks between the first and last day of services which are paid by funding sources.

Severely Disabled

A disability requiring multiple services over an extended period of time.

Severely Handicapped

Percent of clients identified by funding agencies as having severely handicapping disability conditions.

Severely Unemployed

Percent of clients having no prior work experience. Percent of clients who were unemployed during the entire three month period just prior to program entry.

Social/Recreational Experience

These experiences can be achieved by a visit made by another family member or friend to the member (even for short periods of only five minutes.) They can also be achieved by attendance at an organized program of a social or recreational nature.

Special Person

Someone who is paid to provide assistance.

Terminees

All clients who have obtained benefits or clients who have completed the competitive employment program and have not entered a benefit category within 60 days of service completion.

Voluntary

Partaking of activities not mandated by self-maintenance.

Appendix B

References and Resources

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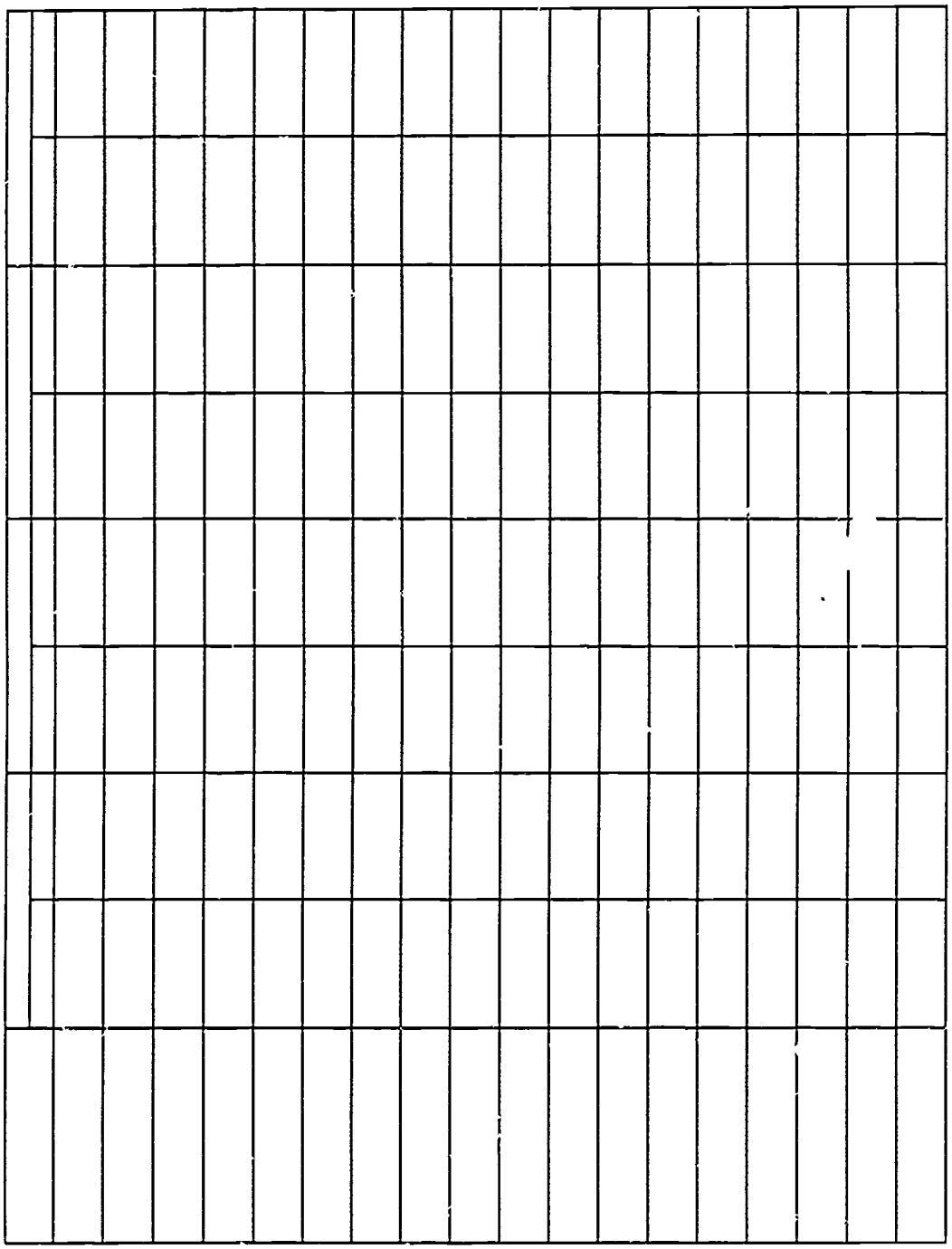
Appendix C

Program Evaluation Forms

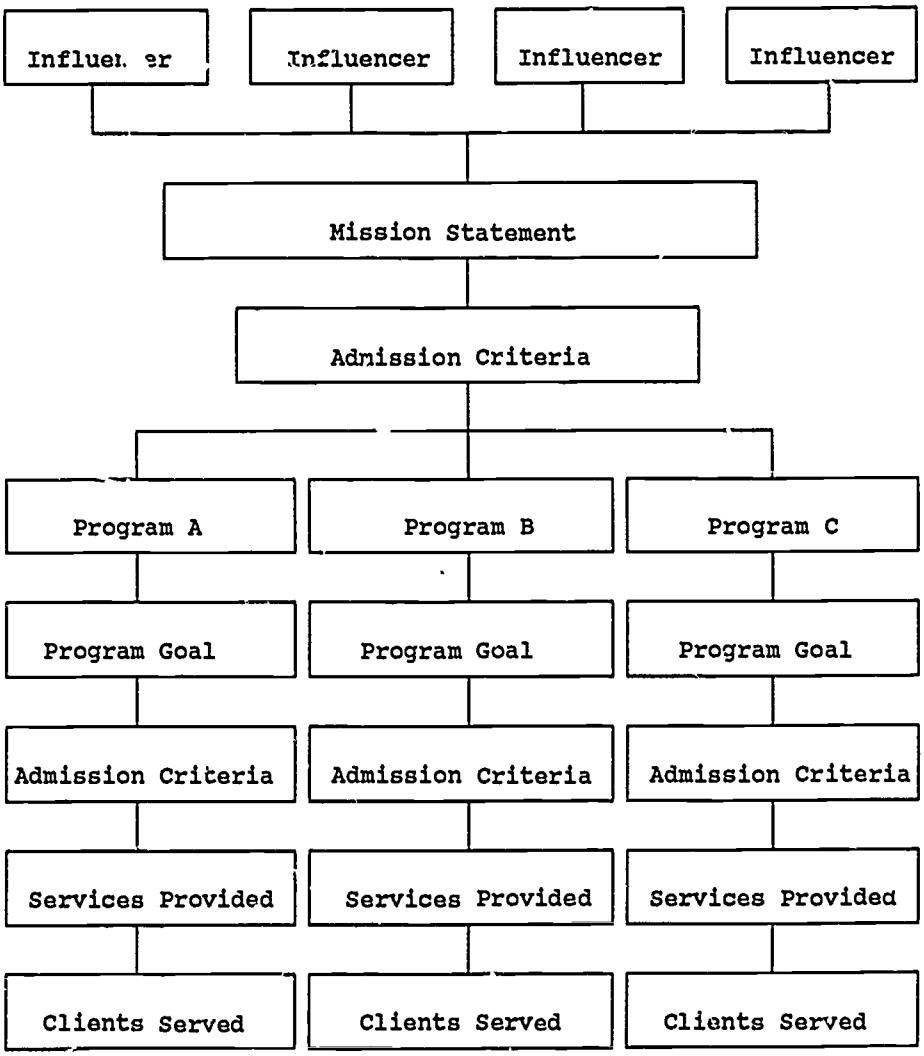
All the forms used in this manual can be found in this appendix. You are free to copy these forms and alter them to make them useful for program evaluation in your facility. They are placed in the appendix in the order that they appear in the manual.

COST EFFECTIVENESS WORKSHEET



PROGRAM STAFF WORKSHEET

PROGRAM STRUCTURE CHART



PROGRAM STRUCTURE WORKSHEET

LIST INFLUENCES:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

LIST MISSION STATEMENT:

_____

_____

_____

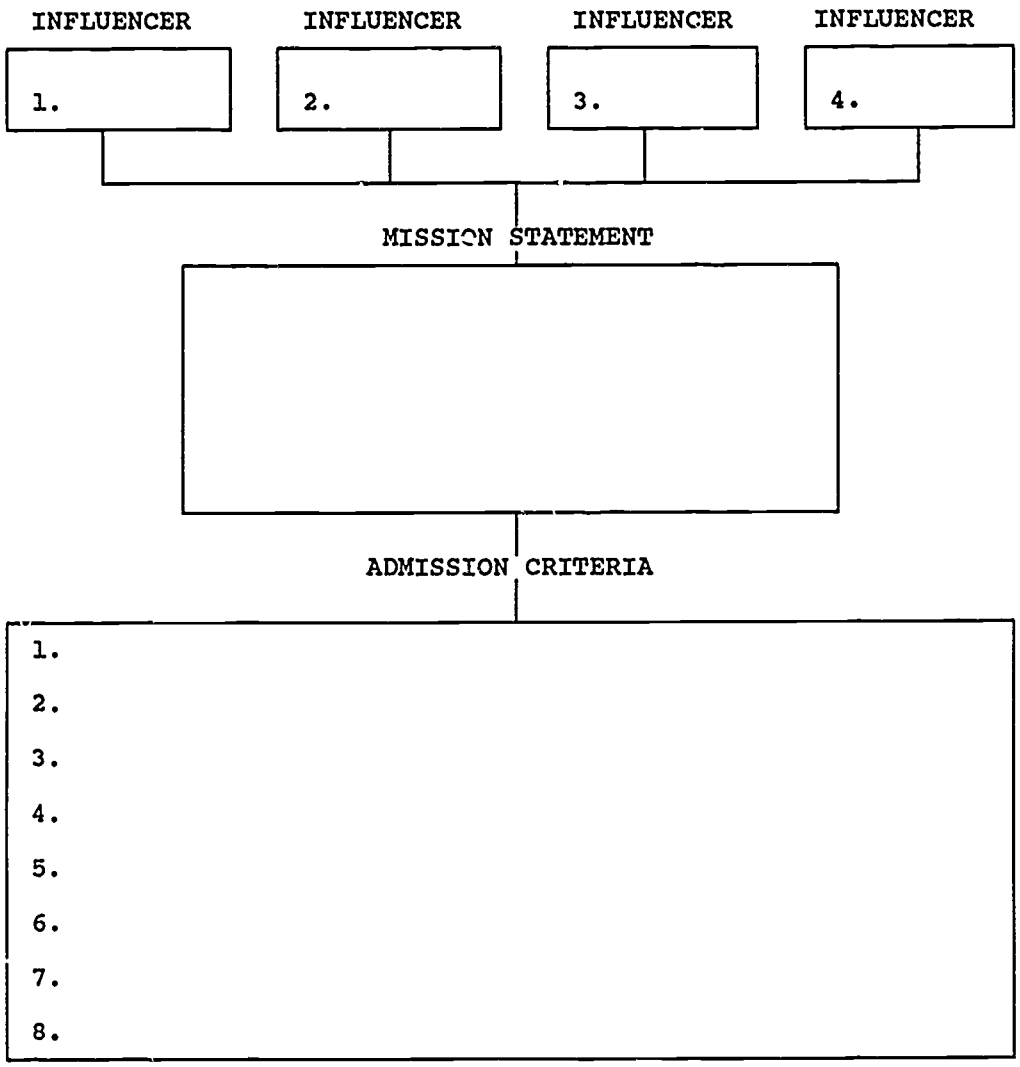
_____

_____

LIST FACILITY ADMISSION CRITERIA:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

PROGRAM STRUCTURE CHART



PROGRAM ELEMENTS WORKSHEET

PROGRAM TITLE:

PROGRAM GOAL:

ADMISSION CRITERIA:

1. _____
2. _____
3. _____
4. _____

SERVICES PROVIDED:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

CLIENTS SERVED:

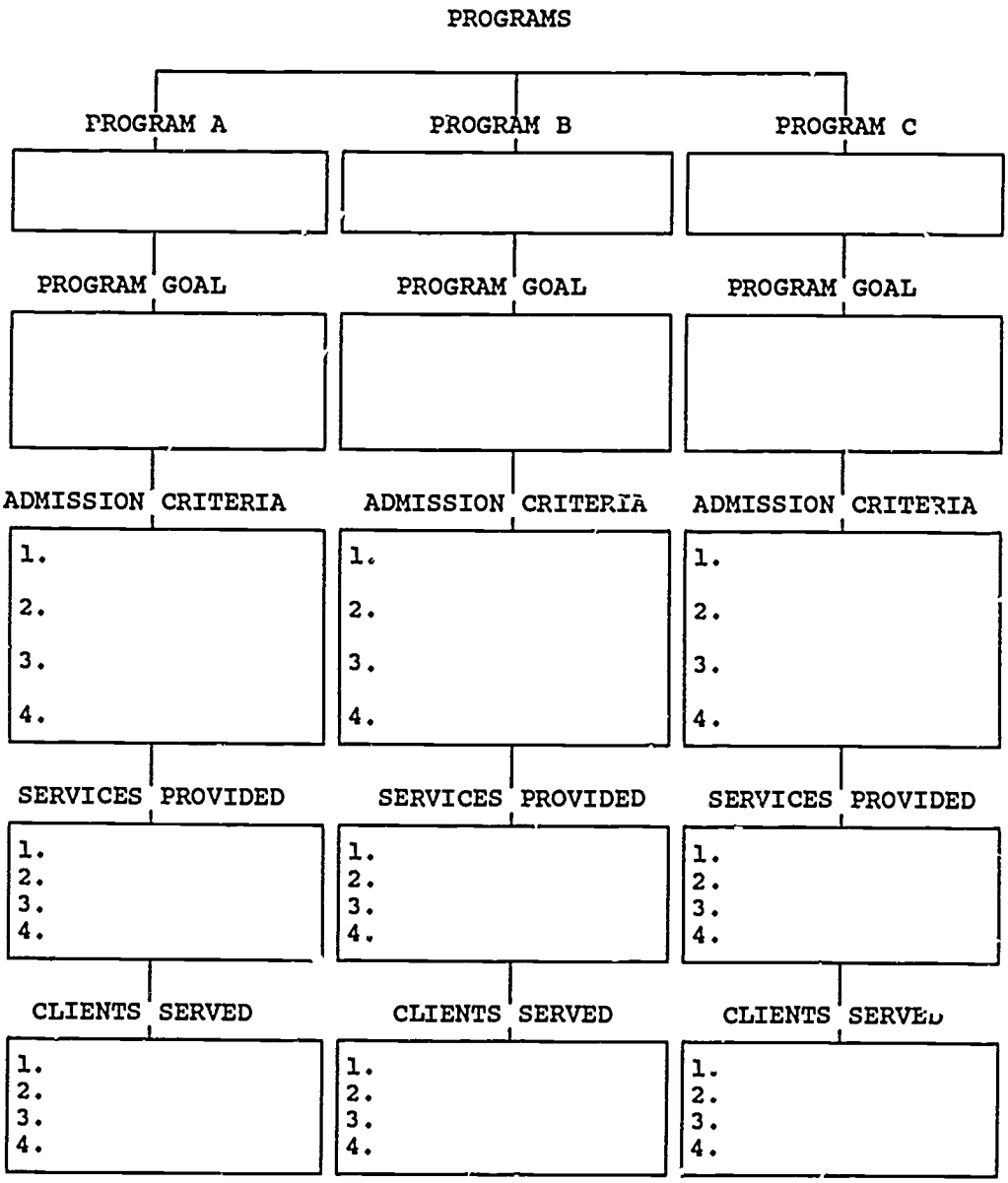
1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

PROGRAM ELEMENTS WORKSHEET CONTINUED

PROGRAM OBJECTIVES:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

PROGRAM ELEMENTS CHART



EVALUATION MEASURES CHART

MEASURES FOR THE _____ PROGRAM

	(A)	(B)	(C)	(D)	(E)	(F)
#	OBJECTIVES	MEASURE	APPLY	TIME	DATA	GOAL
1						
2						
3						
4						
5						

CLIENT DATA SHEET

A: GENERAL INFORMATION

NAME_____SS#_____AGE_____SEX_____
ADDRESS_____PHONE_____
REFERRAL SOURCE_____COUNSELOR_____PH#_____
DISABILITIES_____

PROGRAM MANAGER: _____
PROGRAM STATUS: ACTIVE _____ INTERRUPTED _____TO_____ EXIT _____ CLOSED _____ SPAN _____
PROGRAM TERMINATION: SELF-INITIATED_____ AGENCY INITIATED_____
VOCATIONAL OBJECTIVES (OR EVALUATION PLANS):
DOT CODE_____ _____
DOT CODE_____ _____
DOT CODE_____ _____

B: BENEFIT STATUS

OUTCOME OBJECTIVES:
OBJ#_____:_____EXIT_____CLOSED_____
OBJ#_____:_____EXIT_____CLOSED_____
OBJ#_____:_____EXIT_____CLOSED_____
PROCESS OBJECTIVES:
OBJ#_____:_____EXIT_____CLOSED_____
OBJ#_____:_____EXIT_____CLOSED_____
NON-BENEFIT ACHIEVER_____

C: RECOMMENDATIONS

VOCATIONAL OBJECTIVES: _____
VOCATIONAL PLAN: _____

D: FOLLOW-UP/REFERRAL INFORMATION

EMPLOYER/AGENCY_____CONTACT_____PH#_____
JOB TITLE_____DOT CODE_____
STARTING WAGE $_____ 6 MONTH OTJ_____12 MONTH OTJ_____

CLIENT DATA SHEET CONTINUED

E: CLIENT DESCRIPTORS

PHYSICAL DISABILITY .....
MENTAL ILLNESS .....
MENTAL RETARDATION .....
HEARING DISABILITY .....
VISUAL DISABILITY .....
DEVELOPMENTAL DISABILITY .....
LEARNING DISABILITY .....
EPILEPTIC .....
MINORITY .....
SUBSTANCE ABUSER .....
PUBLIC OFFENDER .....
MULTIPLE DISABILITY .....
SEVERE DISABILITY .....
INDUSTRIALLY INJURED .....
FORMER CLIENT .....
PUBLIC ASSISTANCE .....
LESS THAN H.S. EDUCATION .....
H.S. EDUCATION OR G.E.D. .....
POST H.S. EDUCATION .....
NO PREVIOUS EMPLOYMENT .....
UNDER 21 .....
MALE .....
FEMALE .....
PREVIOUS INSTITUTION .....
VR REFERRAL .....
BLIND AGENCY REFERRAL .....
SCHOOL REFERRAL .....
JTPA .....
WORKERS COMPENSATION .....
SELF-REFERRAL .....
DMHMR REFERRAL .....
OTHER REFERRAL SOURCE .....

PROGRAM EVALUATION RESULTS SUMMARY SHEET

TIME PERIOD:	1	2	3	4	5	6	7	8	9	TOT
1 OR 2 OBJECTIVES 3 OR MORE OBJECTIVES NONBENEFIT ACHIEVER PROGRAM LENGTH (WKS)										
JOB PLACEMENT WORK ADJUSTMENT SHELTERED EMPLOYMENT WORK ACTIVITIES SKILL TRAINING HOMEBOUND OUT REFERRAL										
AGENCY TERMINATION SELF-TERMINATION										
PHYSICAL DISABILITY MENTAL ILLNESS MENTAL RETARDATION HEARING DISABILITY VISUAL DISABILITY DEVELOPMENTAL DIS. LEARNING DISABILITY EPILEPTIC MINORITY SUBSTANCE ABUSER PUBLIC OFFENDER MULTIPLE DISABILITIES SEVERELY DISABLED INDUSTRIALLY INJURED FORMER CLIENT PUBLIC ASSISTANCE LESS THAN H.S. ED. H.S. ED. OR G.E.D. POST H.S. ED. NO PREVIOUS EMPLOY. UNDER 21 MALE FEMALE PREV. INSTITUTION VR REFERRAL BLIND AGENCY REFERRAL SCHOOL REFERRAL JTPA WORKERS COMPENSATION SELF-REFERRAL DMHMR REFERRAL OTHER REFERRAL SOURCE										

PROGRAM RESULTS BY CLIENT DESCRIPTORS

PROGRAM:____
OBJECTIVE/MEASURE:________________________________
PERIOD COVERED:___________________________________
NUMBER OF CASES CLOSED:_____________________________

Descriptors					

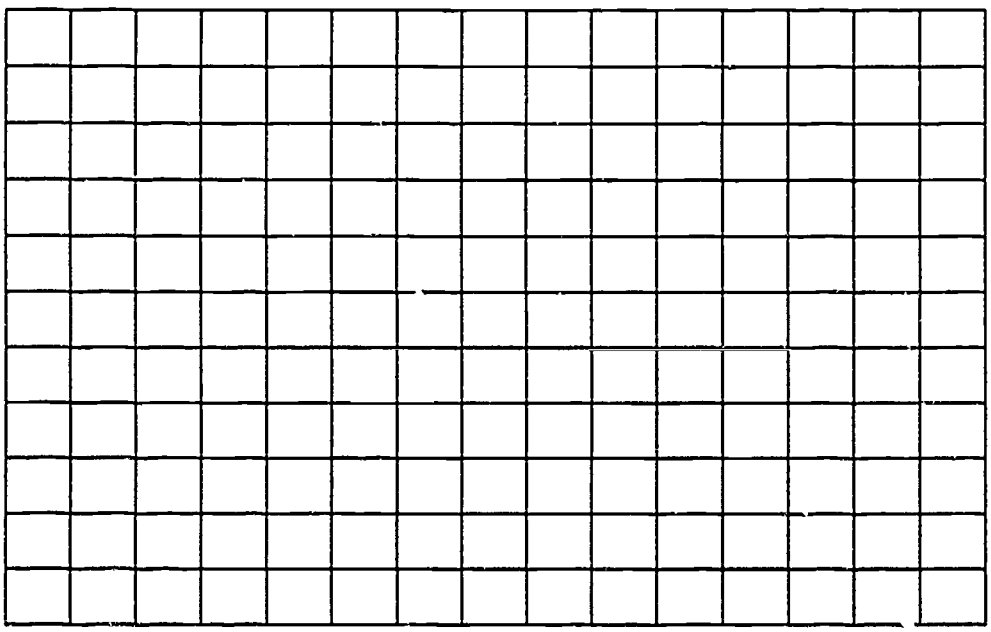
PROGRAM RESULTS BY OBJECTIVE

RANK	OBJECTIVES	GOALS	THIS PERIOD			CUMULATIVE		
			DATA	RE-SULT	VARI ANCE	DATA	RE-SULT	VARI-ENCE
1								
2								
3								
4								
5								

FLOW SUMMARY CHART

	PROGRAM TYPE			
DATA TYPE				TOTAL
Referrals				
Served				
Self-terminate				
No benefits				
Placements				

LEAST SQUARES REGRESSION LINE GRAPH



TIME PERIOD ADJUSTMENT FORM

Month	Mean	Working Days	Wages per working Day	Average Days Per Month	Adjusted Mean Wages
January	÷	=	X	=	
February	÷	=	X	=	
March	÷	=	X	=	
April	÷	=	X	=	
May	÷	=	X	=	
June	÷	=	X	=	
July	÷	=	X	=	
August	÷	=	X	=	
September	÷	=	X	=	
October	÷	=	X	=	
November	÷	=	X	=	
December	÷	=	X	=	

SEASONAL ADJUSTMENT

Month	Adjusted Wages	Average Adjusted Wages	Seasonal Index	Adjusted Wages	Seasonally Adjusted Wages
January	÷	=	X	=	
February	÷	=	X	=	
March	÷	=	X	=	
April	÷	=	X	=	
May	÷	=	X	=	
June	÷	=	X	=	
July	÷	=	X	=	
August	÷	=	X	=	
September	÷	=	X	=	
October	÷	=	X	=	
November	÷	=	X	=	
December	÷	=	X	=	

LEAST SQUARES FORECAST DATA

X (TIME)	X'	Y (WAGES)	X'Y	X'^2
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
N =	E X'	E Y	E X' Y	$E X'^2$

MEAN PROJECTIONS

Projected Month	Forecast Mean		Seasonal Index		Seasonally Adjusted Mean	Running Total
January		x		=		
February		x		=		
March		x		=		
April		x		=		
May		x		=		
June		x		=		
July		x		=		
August		x		=		
September		x		=		
October		x		=		
November		x		=		
December		x		=		

SIMPLE CHI-SQUARE

	YES	NO
YES	A	B
NO	C	D

COMPLEX CHI-SQUARE DATA SHEET

AREA 1	1	2	3	4	5
AREA 2	6	7	8	9	10
AREA 3	11	12	13	14	15

COMPLEX CHI-SQUARE FORMULATION SHEET

Observed Freq. O	Expected Frequency E	Observed minus Expected Freq. $O - E$	Observed minus Expected Freq. Squared $(O - E)^2$	$(O-E)^2$ divided by Expected Frequency $\frac{(O - E)^2}{E}$

INSTALLATION PLAN

STEP	DESCRIPTION	ASSIGNED	STARTED	COMPLETED
1	Executive commitment			
2	Policy decision/resolution from governing body			
3	Appoint program evaluation committee and person responsible for developing the system			
4	Develop written policies, procedures, and system elements			
4.1	Schedule regular meeting with key individuals			
4.2	Develop a written plan which includes all system elements			
4.3	Analyze current data for a clear definition of needed changes			
5	Establish a trial implementation date			
5.1	Develop report forms and source documents			
5.2	Develop system data flow chart			
5.3	Merge data collection system into facility information system			
5.4	Prepare and publish manuals and forms			
6	Implement the system			
7	Review and critique the system no less than six months after implementation			
8	Analyze data and write management report			
9	Monitor the system			

Appendix D

Formulas Used in Program Evaluation

This appendix includes all the formulas mentioned in the text. These formulas are listed in the order that they appear in the document.

Population Mean

$$\frac{E\ (X1 + X2 + Xi)}{Xi}$$

The sum of all the units of a population divided by the number of units in the population.

Estimating a Sample Size
When Problem is Expressed as a Proportion

$$(\text{Sample Size})\quad n = \frac{(Z\ddot{a}/2)^2\ \hat{P}\ (1-\hat{P})}{ME^2}$$

A mathematical statistic (determined by using a table that takes into consideration the margin of error and probability of error) is first multiplied by an estimate of the true proportion and that estimate minus one. The product of that multiplication is then divided by the square of the margin of error.

Reducing the Sample Size When n/N is Negligible

$$\text{(Smaller sample size)} \quad n' = \frac{\text{(Sample size) } n}{1 + (n/N)}$$

After the estimated sample size has been determined using the standard formulas for both proportions and means, divide the sample size by the total population. If this number is greater than .05 you may reduce your sample size using the formula above.

Divide the sample size by one plus the production of the division of the sample size by the total population.

Estimating Sample Variance for Use in Determining Sample Sizes When Problem is Expressed in Means

$$\text{Sample Variance} = \frac{E\ (Y - \bar{Y})^2}{N - 1}$$

The trial population mean is subtracted from each trial raw score. Each resulting figure is squared and all the products are summed. The summation is divided by the number of raw scores minus one.

Standard Deviation

$$\text{Standard Deviation} = (SD) = \sqrt{\frac{E\ (Y - \bar{Y})^2}{n - 1}}$$

To determine a group's standard deviation we must find the square root of the population variance. This is determined by subtracting the mean of the population from each score, squaring the products of the subtraction, summing the squared products, dividing the sum by the population total minus one, and finding the square root of the product.

Z Scores

$$Z = \frac{X - \bar{X}}{SD}$$

Z scores are computed by determining the group mean, subtracting a raw score from the mean, and dividing the product by the group standard deviation.

T Scores

$$T = (Z \times 10) + 50$$

Based on the Z score, T scores are determined by multiplying a Z score by 10 and adding 50 to the resulting product.

Time Period Adjustment for Least Squares Forecasting

$$\frac{\text{RAW PERIOD (DATA)}}{\text{WORK PERIOD DAYS}} = \text{(DATA) PER DAYS}$$

$$\text{(DATA) PER DAYS} \times \text{AVE. DAYS PER PERIOD} = \text{ADJUSTED MEAN (DATA)}$$

Seasonal Adjustment
for Least Squares Forecasting

ADJUSTED MEAN (DATA)	÷	AVERAGE MEAN (DATA)	=	SEASONAL INDEX FIGURE
SEASONAL INDEX FIGURE	X	AVERAGE MEAN (DATA)	=	SEASONALLY ADJUSTED (DATA)

Points on Line of Best Fit
for Least Squares Forecasting

$$\frac{\Sigma Y}{N} + X' \times \frac{\Sigma X' Y}{\Sigma X'^2} = \text{Point on line of best fit}$$

First sum all data points and divide by the number of data points. To that figure add the statistic determined by manipulation of the independent variable. Multiply the resulting sum by the product of the following division: Multiply the independent variable statistic with each data point and add the resulting products. Then divide that summation by the sum of the squares of all the independent variable statistics.

Seasonalizing
Least Squares Projections

PROJECTED DATA	X	SEASONAL INDEX	=	SEASONALLY ADJUSTED DATA

Simple Chi-Square
Test Statistic

$$X^2 = \frac{N\,(AD-BC)^2}{(A+B)\ (C+D)\ (A+C)\ (B+D)}$$

Complex Chi-Square
Test Statistic

$$X^2 = \text{"E"}\ \frac{(O-E)^2}{E}$$

Expected frequencies are determined using the formula:

$$E = \frac{\text{Sum of the Row} \times \text{Sum of the column}}{\text{Total sample size (N)}}$$