DOCUMENT RESUME

ED 225 043 CG 016 391

AUTHOR	Ambrosino, Robert J.
TITLE	Decision Making under Uncertainty: The Case of Adoption vs. Foster Care.
INSTITUTION	Texas Univ., Austin.
SPONS AGENCY	Administration for Children, Youth, and Families (DHHS), Washington, D.C.
PUB DATE	Nov 81
GRANT	ACYF-90-CO-1979
NOTE	74p.; For related document, see CG 016 390. Prepared by the Adoption Resource Center. Cover title--Decisions Analysis: Adoption vs. Foster Care.
PUB TYPE	Guides - Non-Classroom Use (055) -- Reports - Descriptive (141)
EDRS PRICE	MF01/PC03 Plus Postage.
DESCRIPTORS	Administrators; *Adoption; Child Welfare; Comparative Analysis; *Decision Making; Delivery Systems; Evaluation Methods; Financial Support; *Foster Care; Program Descriptions; *Resource Allocation; *Social Services; Social Work
IDENTIFIERS	Colorado State Department of Social Services; *Decision Analysis Technique

ABSTRACT

This report provides a detailed description of Decision Analysis, a program designed to help social services administrators make informed judgments about the impact of implementing various program alternatives which compete for funding. A familiar example, whether to place a child in long term foster care or a permanent adoptive home is used to highlight the use of the decision analysis tool. The materials reflect reimbursement guidelines for the State of Colorado. The procedures desribed include structuring the decision problem, assigning even probabilities and costs, and determining expected values. An extensive series of charts and figures illustrate the process described. Sensitivity analysis conducted to determine the effects of changes in assessment on various strategies under investigation is also discussed. The use of information provided by the decision analysis is detailed. An extensive reference list and a selected bibliography are also included. Appendix A provides notes on computing the present value of money; Appendix B contains the adoption components and purchase of service reimbursement formula; Appendix C is a glossary of common terms used in Decision Analysis; and Appendix D provides notes on computing the Expected Preference Criterion. (JAC)

DECISION MAKING UNDER UNCERTAINTY:
THE CASE OF ADOPTION VS. FOSTER CARE

Robert J. Ambrosino, Ph.D.

November, 1981

This publication was made possible by Grant No. 90-CO-1979 from the U.S. Children's Bureau, Administration for Children, Youth and Families, Office of Human Development Services, Department of Health and Human Services. Its contents should not be construed as official policy of ACYF/DHHS or any agency of the Federal Government.

PREFACE

The implementation of block grant funding for social services programs, coupled with significant cutbacks in available fiscal resources, has sharply refocused states' traditional decision-making role vis-a-vis the social services delivery system. Increasingly, social services program managers and administrators are faced with securing adequate funding to keep critical programs intact, as well as the additional burden of making numerous decisions regarding the allocation of limited funds to competing activities within these programs. This task is complicated by the scant availability within the social services environment of formal analytical tools with which to make informed judgments about the financial impact of implementing various program alternatives which effectively compete for the same dollar.

Staff of the Adoption Resource Center at The University of Texas at Austin, in interactions with individuals involved in adoption and foster care efforts within each of the five states in HHS Region VI, have noted a growing need for such formal analytical tools within the social services arena. This report, prepared as a response to this need, provides a detailed description of one such tool, Decision Analysis. This approach has been widely applied in business and industry to facilitate a variety of common decisions, but has seen little, if any, use in the social services field. A familiar example is highlighted, namely, the decision whether or not to retain a child in long-term foster or substitute care versus the provision of a permanent, adoptive home. The technique could be readily applied with equal success to other aspects of the social services delivery process.

The report was developed through the helpful assistance of many individuals. The Colorado State Department of Social Services provided the foster or substitute care data used as the basis for the numerous computations contained in the report. Feedback from a group of child welfare executives attending a fiscal resources workshop in Salt Lake City in the Spring of 1981 confirmed that the methodology was sound, and held considerable promise for general applications in the child welfare field. Many other colleagues provided encouragement, philosophical insight, and practical wisdom, all of which served as grist for developing the report.

Ms. Judy McDaniel typed the many drafts of the report and completed the intricate drawings contained herein. Her patience and secretarial skills were a sustaining virtue throughout the lengthy period during which the report was developed.

Finally, the report is dedicated to program managers and administrators throughout the country who face decision-making with uncertainty on a daily basis, with the hope that the methodology developed can alleviate some of the burdens imposed by that process.

Michael L. Lauderdale, Ph.D.
Principal Investigator

Ira Iscoe, Ph.D.
Co-Principal Investigator

Rosalie N. Anderson, M.Ed.
Project Director

REGION VI ADOPTION RESOURCE CENTER

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

I. INTRODUCTION AND BACKGROUND

Social services program managers and child welfare executives are constantly faced with making critical decisions about the programs under their direct control. Such decisions involve the delineation of appropriate target populations to receive services, determination of the needs of these populations, arranging for necessary staff to deliver required services, and securing of financial resources to support the various programs and activities identified.

The identification of financial resources to support programs and activities comprising a particular service delivery system has two essential components. The first, and perhaps the most obvious, is the securing of adequate funding to cover anticipated service needs. The second is the allocation of these resources to the various programs and activities within the service delivery system (e.g., adoption, foster care, protective services). When financial resources are plentiful, both of these tasks are greatly simplified. That is, there are usually sufficient funds available such that all programs and activities can be generously funded. Plentiful funding in the social services arena, however, was last seen in the form of the Great Society programs initiated by the Johnson Administration in the mid-1960s.

Today, the social services program manager is faced not only with the dilemma of securing adequate funding to keep critical programs intact, but the additional burden of making numerous decisions regarding the allocation of limited funds to competing activities within these programs. Additionally, these program managers are constantly being deluged with requests or mandates to trim budgets, despite constant or even growing service needs, as well as to provide substantive documentation to justify their various decisions. To complicate these matters further, there is scant availability within the social services environment of formal analytical tools with which to make informed judgments about the financial impact of implementing various program alternatives which effectively compete for the same dollar.

This paper presents a detailed description of one such tool, Decision Analysis, which has been widely applied in business and industry to facilitate a variety of common decisions (e.g., which new product to introduce, A or B; where to locate a new plant; which test market data to select), but has seen little, if any, use in the social services arena. Decision Analysis may be defined as "a discipline for systematic evaluation of alternative actions as a basis for choice among them" (Brown, Kahr, and Peterson, 1974, p. vii). Decision Analysis represents a highly flexible analytic tool designed to provide solutions to everyday decision problems, and to assist in formulating relevant policy.

To facilitate the reader's understanding of the Decision Analysis technique, a familiar example has been highlighted, namely, the decision whether or not to retain a child in long-term foster or substitute care versus the provision of a permanent adoptive home. Adoption and foster care represent but two options to meet the needs of children who cannot, for one reason or the other, return to their biological homes. The technique could be applied with equal success to other aspects of the permanency planning process, such as return to the biological family, through a program of in-home supportive services, or emancipation.

This paper is primarily intended for use by social services program managers, child welfare executives, policy analysts, and financial experts who have major responsibility for structuring program funding and allocating scarce resources among these programs. As noted above, a familiar example is presented as the overall backdrop for the paper, and empirical data are used to demonstrate the Decision Analysis technique. These data reflect reimbursement guidelines for the State of Colorado, in effect at the time of this writing. Thus, while the paper stems initially from an overall hypothetical situation, the results obtained are no different from those which would be obtained should the reader choose to replicate them with his own data.

A final note should be made regarding the application of Decision Analysis as described in this document. This tool is intended to supplement decisions made at the executive management level. It is not expected that the results of a Decision Analysis will necessarily replace or supersede other elements of the decision-making process (e.g., political constraints, policy restrictions, legislative mandates), nor should these results be used as the sole basis for making critical program or funding decisions. Finally, the case of adoption versus foster care as long-term placement alternatives was selected for illustrative purposes only. The extent of Decision Analysis applications is limited only by one's imagination and not by any restrictions inherent in the technique itself.

II. PROCEDURE AND METHOD

Structuring the Decision Problem

A Decision Analysis is typically started by drawing a decision tree, which can be likened to a road map, in that it serves to map the specific decision problem by including only the events and potential actions that are relevant to the problem. The decision tree is started with an initial act fork represented by a small box with several branches emanating from it. In our hypothetical example, the initial act fork represents the decision to place a child in a permanent adoptive home versus retaining the child in foster or substitute care (see $\boxed{S_1}$ in Figure 1).

The various branches emanating from each act fork represent the possible courses of action or routes available to the decision maker. In our hypothetical example, assuming that the decision maker has chosen adoption as the appropriate course of action, he is immediately faced with a second act fork $\boxed{S_2}$ relating to whether or not he chooses to purchase the adoption from a private child-placing agency or to provide the adoption directly through the public agency with custody of the child. Finally, should our hypothetical decision maker select foster care as a placement alternative, a third act fork $\boxed{S_3}$ is encountered, namely, whether or not to place the child in family foster care, special group care, or residential child care.[1]

[1]The reader can readily see that numerous other alternatives present themselves at act fork $\boxed{S_2}$. That is, other purchase-provide combinations could be equally possible.

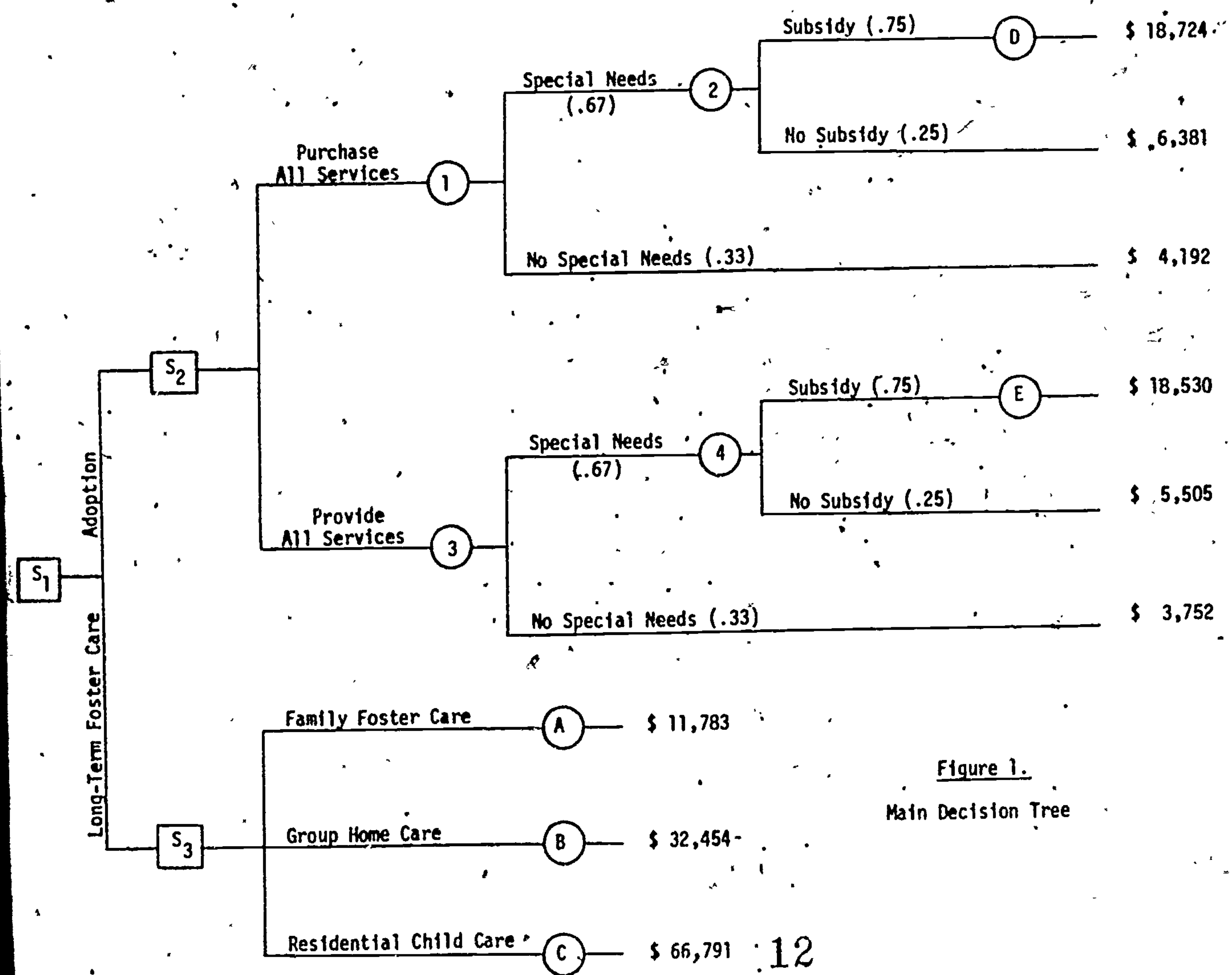


Figure 1.

Main Decision Tree

Let us assume for discussion purposes that our decision maker has chosen to purchase adoption services for the child under consideration. Given that decision, he must evaluate the logical-action implications (consequences) of that act. These consequences are designated by an event fork, which is represented by a circle rather than a box at the node or point of origin. Once again referring to Figure 1, and moving along the branch that indicates the decision to purchase adoption services, the first event fork (1) is encountered, namely, whether or not the child to be adopted is one with "special needs" (i.e., older; of minority parentage; sibling group member; physically, emotionally, or mentally handicapped). Should the child be one with special needs, a second event fork (2) is encountered relating to whether or not the child will be adopted with subsidy assistance.

Assuming that the child will be adopted with subsidy assistance, a third event fork (D) is encountered. This third event fork represents whether or not the subsidy assistance will constitute a one-time payment or a continuous payment (see Figure 2). For illustrative purposes, it is assumed that the child to be adopted is one with special needs for which a continuous subsidy payment is indicated. The average length of time assumed for subsidy assistance is fixed at five years for illustration purposes only.[2] It can be seen that at this point in the Decision Analysis one could specify other time limits for which subsidy assistance would be paid; however, we have restricted the average length of subsidy to five years to simplify the subsequent analysis of the decision tree.

---

[2]Furthermore, it is assumed that the financial needs of the adopting parent(s) are such that a full (i.e., 100%) subsidy will be required.

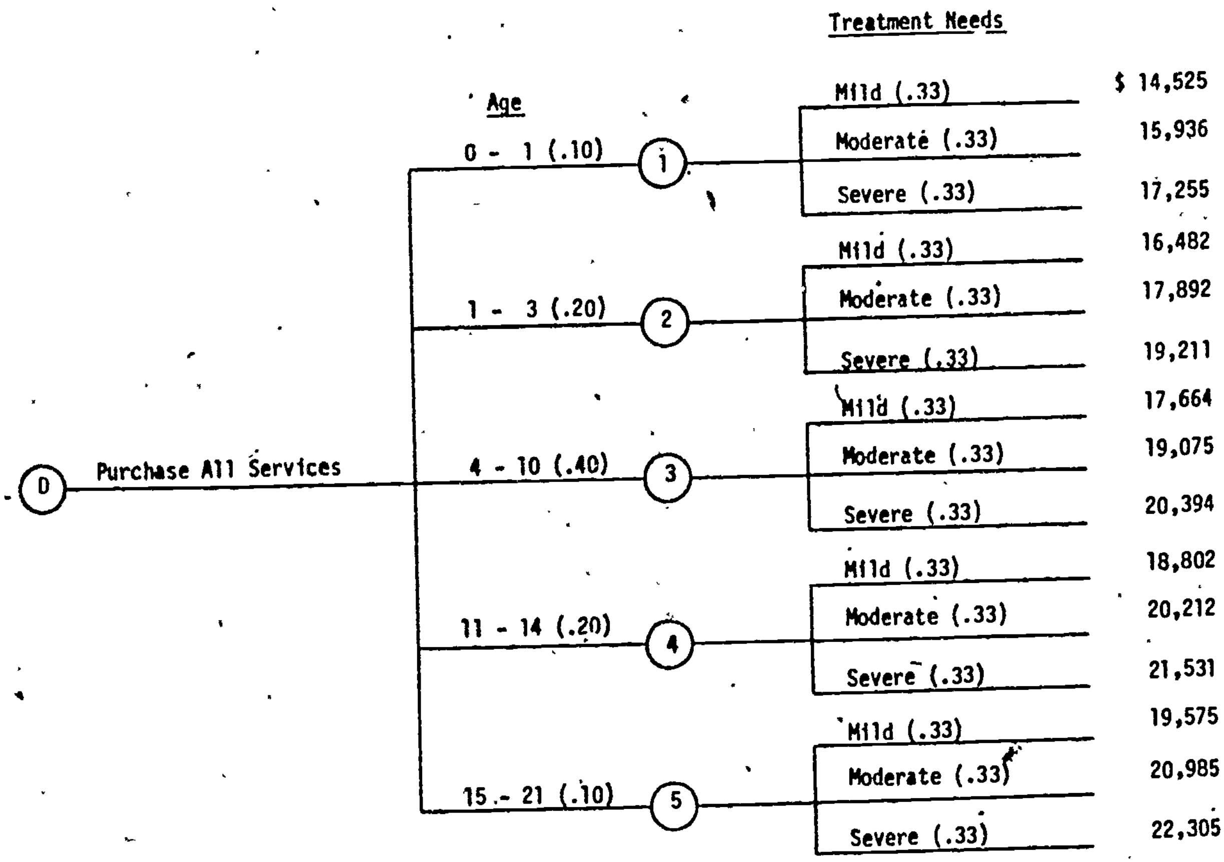


Figure 2.

Purchase All Services Branch

In our sample state, adoption subsidy payments are limited to the maximum amount paid under family foster care reimbursement ceilings. Family foster care reimbursement rates are established according to the age of the child, as well as any special needs conditions he/she may have (see Table 1).

The fifth event fork is encountered in determining the projected costs of the continuous-payment subsidy according to the age and specific treatment needs of the child at the time he is adopted. For our hypothetical example, let us assume that the child to be adopted is 13 years old, with moderate treatment needs. Thus, the fifth event fork would correspond to (4) in Figure 2.

At this point, the decision analyst must complete the remaining branches of the decision tree according to the paradigm discussed above. The complete decision tree is shown in Figures 1 through 6. It should be noted that for illustrative purposes we have chosen to highlight a very specific path through the decision tree. The reader should examine thoroughly the remainder of the tree, noting the various branches (event forks) relating to the five major decision strategies represented (see Figure 7).

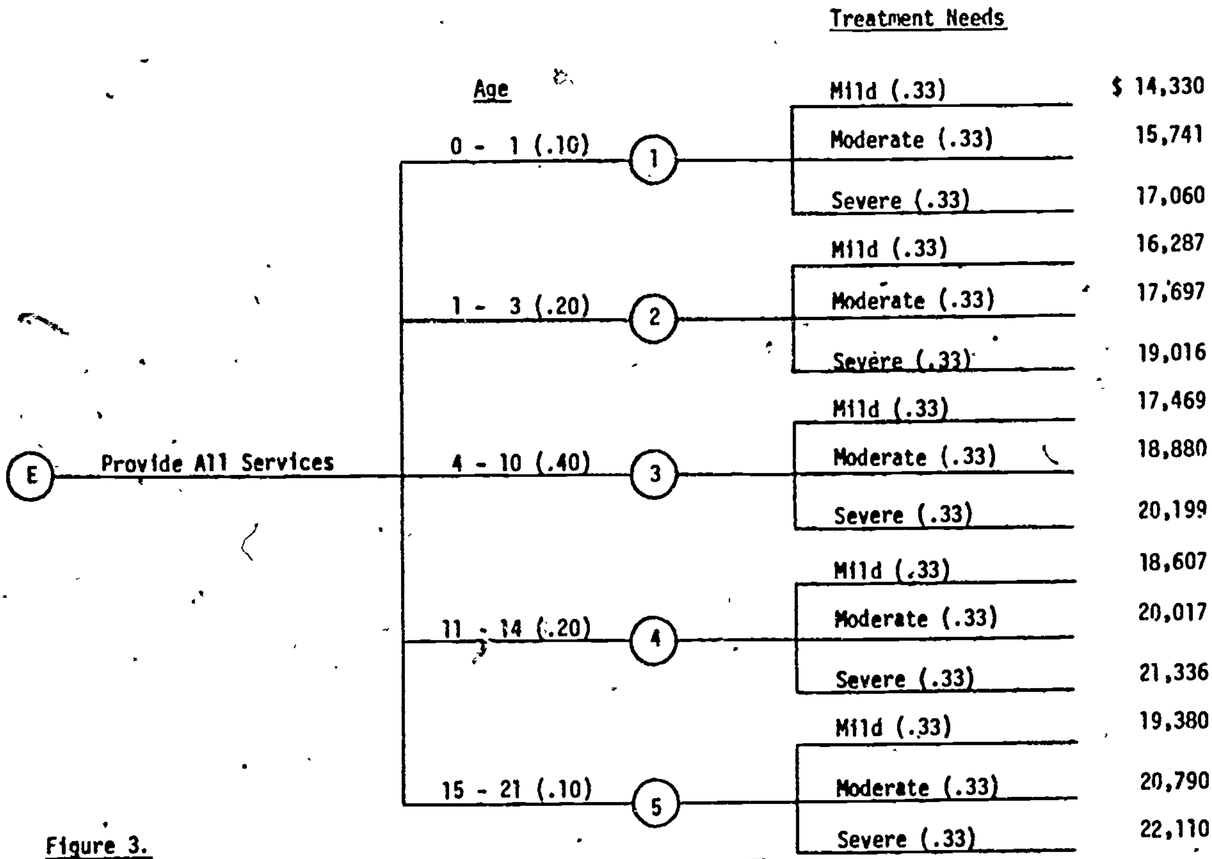


Figure 3.

Provide All Services Directly Branch

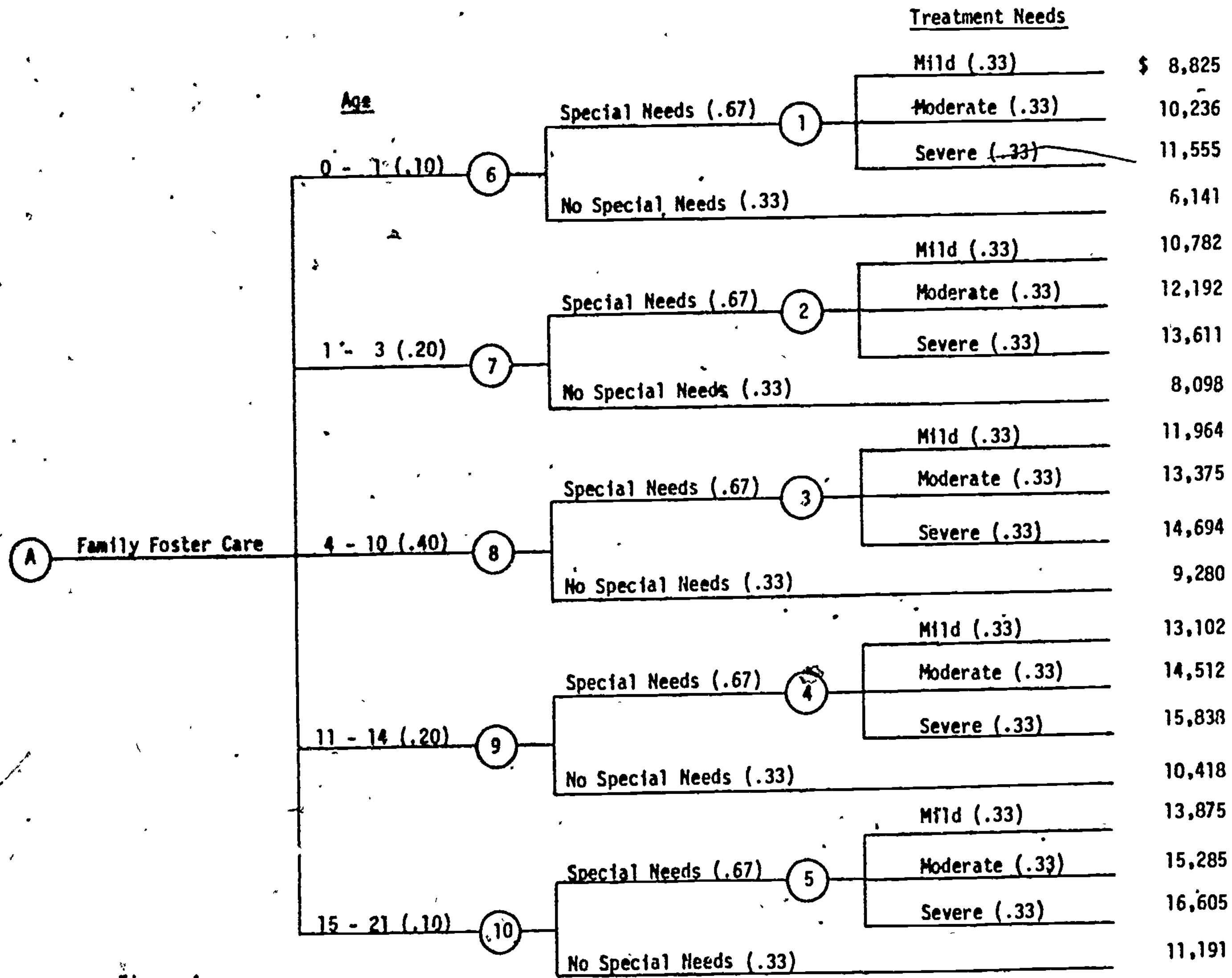


Figure 4.

Family Foster Care Branch

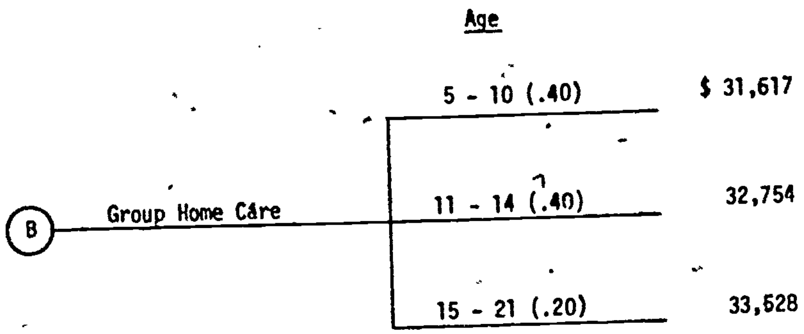


Figure 5.

Group Home Care Branch

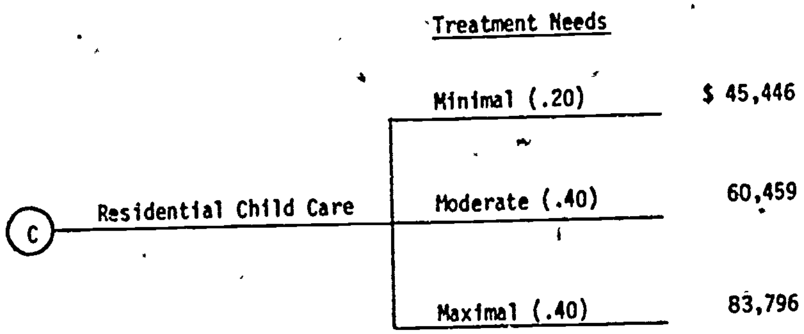


Figure 6.

Residential Child Care Branch

1: Adoption -- Purchase All Services

2: Adoption -- Provide All Services Directly

3: Long-Term Foster Care -- Family Foster Care

4: Long-Term Foster Care -- Special Group Home Care

5: Long-Term Foster Care -- Residential Child Care

Figure 7.

Major Decision Strategies
Represented by Hypothetical Decision Problem

Assigning Event Probabilities and Costs

The initial decision tree as reflected in Figures 1 through 6 is now structured. The next step in the Decision Analysis process is to assign specific probabilities to the various event forks (uncertain events). Thomas (1972) indicates that the most difficult problem in Decision Analysis is the process of assigning probabilities to uncertain events or outcomes. The decision analyst is faced with the prospect of assessing probabilities, not only for single uncertain quantities, but for simultaneous uncertain quantities as well. In many instances, these uncertain quantities are interrelated, thereby creating the need for conditional probability assessments.

As a first step, the decision analyst must decide which quantities really are uncertain. Once this step has been accomplished, he must process objective data for each uncertain quantity into meaningful, subjective probability assessments. Conventional wisdom in this matter (see, for example, Winkler, 1967) dictates that there is no way of ensuring that satisfactory probability assessments can be obtained. For example, different decision makers give different assessments for identical uncertain quantities, reflecting the different frames of reference used in processing the available information.

Formal statistical procedures such as Bayesian Analysis have been developed for integrating empirical data or observations with information known prior to the observations. A discussion of these procedures is beyond the scope of this document, however, and the reader is referred to Holloway (1979) for a treatment of same.

The mere sitting down and engaging in the process of assessing probabilities (albeit imperfect) to uncertain events in a formally-structured decision problem represents a significant step forward in refining our understanding of complex events leading to important public policy decisions. Furthermore, the availability of sensitivity analysis (see below), with which to empirically test the effects of certain modifications in event probabilities on decision outcomes, provides a much-needed measure of flexibility in the probability assessment process.

Consider as an example the probabilities associated with the first event fork ((1) in Figure 1) encountered in making the decision to purchase adoption services as described above. It will be recalled that this event fork reflected whether or not the child to be adopted would be one with so-called "special needs." Experience dictates that the majority of children available for adoption today could be legitimately classified as having special needs. Therefore, we have set this event probability at .67. The probability of the child not having special needs is equal to 1-.67, or .33. Furthermore, the bulk of these cases represent special needs at a level of severity which would require subsidy assistance if adoption were considered as a viable life plan. Thus, we have set the probability of subsidy payments at the second event fork ((2) in Figure 1) at .75.

The decision analyst, armed with the appropriate retrospective data and summary statistics, would then go on to assign specific probabilities to the remaining event forks in the decision tree.

To set the final stage for evaluating the logical-action implications (consequences) of various courses of action reflected by the decision tree, the decision analyst must now assign cost estimates to each. These cost estimates are found at the extreme right-hand side of Figures 1 through 6 and reflect the financial consequences associated with specific action agenda or decision strategies. For our hypothetical case, the various cost estimates were computed using the data of Tables 1 through 4. An example would be illustrative at this point. Consider the cost of deciding to

TABLE 1

Family Foster Care Monthly Reimbursement Rates[1]

Age of Child	Flat-Grant[2]	Special Needs Allowance		
		Mild	Moderate	Severe
0 - 11 months	$ 195	$ 59	$ 90	$ 119
1 - 3 years	238	59	90	119
4 - 10 years	264	59	90	119
11 - 14 years	289	59	90	119
15 - 21 years	306	59	90	119

[1]All costs are based on one child. There is no change in cost per child when more than one child is considered. Therefore, one can assume a linear increase in costs with any increase in the number of children in care.

[2]Inclusive of $60 per month for administrative costs.

TABLE 2

Special Group Care Monthly Reimbursement Rates[1]

Age of Child	Flat Grant[2]
4 - 10 years	$ 204
11 - 14 years	229
15 - 21 years	246

[1]All costs are based on one child. There is no change in cost per child when more than one child is considered. Therefore, one can assume a linear increase in costs with any increase in the number of children in care.

[2]Add $265 per month for direct care allowance, $120 per month for administrative costs, and $106 per month for "other" services.

TABLE 3

Residential Child Care Monthly Reimbursement Rates[1]

Category	Treatment Needs[2]		
	Minimal	Moderate	Maximal
Maintenance	$ 228	$ 228	$ 228
Direct Care	250	250	250
School	0	104	104
"Other"	491	717	1230

[1]All costs are based on one child. There is no change in cost per child when more than one child is considered. Therefore, one can assume a linear increase in costs with any increase in the number of children in care.

[2]All $30 per month for administrative costs.

22

TABLE 4

One-Time Adoption Placement Costs

Service Category	PUBLIC				PRIVATE			
	Special Needs		Regular		Special Needs		Regular	
	No. Hrs.	Hourly Rate	No. Hrs.	Hourly Rate	No. Hrs.	Hourly Rate	No. Hrs.	Hourly Rate
Legal Services[1]	10	$ 20.00	10	$ 20.00	10	$ 25.00	10	$ 25.00
Preplacement Services	20	20.00	10	20.00	20	25.00	10	25.00
Recruitment Services[2]	15	52.00	7.5	52.00	15	65.00	7.5	65.00
Homestudy Services[3]	25	25.00	12.5	25.00	25	31.25	12.5	31.25
Placement/Supervision	75	20.00	37.5	20.00	75	25.00	37.5	25.00
Postfinalization Services	10	20.00	5	20.00	10	25.00	5	25.00
TOTAL COST	$ 5,505		$ 3,752		$ 6,381		$ 4,192	

[1] Plus $1,800 attorney fees/legal court costs for public agencies, and $1,750 for private agencies.

[2] Base rate of $25.00 per hour adjusted upward to reflect unsuccessful recruitment activity (see Appendix B).

[3] Base rate of $25.00 per hour adjusted upward to reflect unsuccessful homestudy services activity (see Appendix B).

purchase adoption services for a child with no special needs. Using the figures of Table 4, it can be seen that the cost of purchasing adoption services for a non-special needs child is $4,192. On the contrary, the cost of providing directly these same adoption services is $3,752. Both figures include $2,000 for services to legally free the child for adoption.[3]

Computing the costs for decision strategies involving children in long-term foster care (i.e., more than one year), or in the case of a special needs child requiring subsidy assistance spanning several years, represents a slightly more complicated process. When an organization is faced with the decision of making a commitment of funds over more than one future time periods (years), it is necessary to consider the fact that a dollar has a different value today than at a future point in time. Accordingly, the Present Value Method (see Appendix A) is used to determine the costs of those aspects of adoption and foster care which span more than one year of activity.

Thus, for example, in determining the costs associated with event fork (B) (Special Group Care), the figures of Table 2 are used in conjunction with the Present Value Method to arrive at the costs reflected in the extreme right-hand portion of Figure 5. More specifically, in the case of Group Home Care for a 12-year old over a five-year period, the costs are computed as follows: the monthly cost of providing Group Home Care (inclusive of $265 per month for direct care allowance, $120 per month for administration, and $106 per month for "other" services) is $720. The Present

[3] The costs of services to legally free the child for adoption are fixed at $2,000 for illustrative purposes only. In actual practice, they are expected to vary according to the specific conditions surrounding the need for placement.

Value Interest Factor (PVIF) for a five-year period and a discount rate of 10% is 3.791. Therefore, the cost of maintaining a 12-year old child in Group Home Care for a five-year period is calculated as $720 x 12 x 3.791, or $32,754. All other calculations involving periods of care spanning more than one year are performed using this same general procedure.

Determining Expected Values and "Folding Back" the Decision Tree

Now that the decision tree is structured in terms of act and event forks and evaluated in terms of both event probabilities and costs, the next step in the Decision Analysis is to determine the implications of these evaluations for the various decision strategies represented by our hypothetical decision problem. This process is commonly referred to as folding back or rolling back the decision tree (Holloway, 1979). The goal of folding the tree back is to determine the financial impact or worth of each of the decision strategies.

The concept of an expected value (EV) is used to approximate the worth of the various decision alternatives. The expected value concept is central to formal decision models. Although the expected value is almost never the actual outcome, it may be used as an indicator of the relative value of several outcomes when the probabilities of those outcomes and their absolute values are known. For example, one can expect to pay about 30% of each dollar bet at a race track for the privilege of betting, or about 40% on slot machines in Las Vegas. In actuality, on a particular bet the individual bettor does not lose 30 or 40%. He either loses it all or wins it all. Taken over a sufficient number of replications, however, the expected value serves as a reasonable indicator of the amount or proportion of winnings (or losses) a particular bettor can anticipate.

For our hypothetical scenario, the event probabilities for the various uncertain events (event forks), as well as the costs associated with those events, can be ascertained with a high degree of certainty. That is, cost reimbursement schedules are fixed for different placement situations (e.g., age of child, specific treatment needs, subsidy assistance). Furthermore, historical or retrospective data can be used to assign probabilities of occurrence to the various uncertain events represented by the decision problem.

An expected value is simply a probability-weighted sum. That is, each of the costs entering into the expected value is weighted precisely by its probability of occurrence.

This principle can be shown by formula (1):

$$EV_A = p_1c_1 + p_2c_2 + \ldots + p_ic_i \qquad (1)$$

Where: p_i = probability of occurrence for the ith branch emanating from event fork (A)

c_i = cost associated with the ith branch emanating from event fork (A)

These probability-weighted sums are determined for each event fork in the decision tree. An iterative process is followed, until all event forks in the tree have been accounted for. At each step in the iteration process (except for the first), the expected values derived from the previous step (referred to as intermediate expected values) are taken as costs [i.e., the c_i in equation (1)] for computing the expected values for that step.

Consider, for example, event fork (A) (Family Foster Care) which is represented by Figure 4. Using the iteration process described above, it can be seen that there are eleven intermediate expected values for this particular decision strategy. These are represented by the circled numbers 1-10 reflecting the ten event forks in the diagram, and are computed as follows:

$$EV_1 = \$8,825\ (.33) + \$10,236\ (.33) + \$11,555\ (.33) = \underline{\$10,103}$$

$$EV_2 = \$10,782\ (.33) + \$12,192\ (.33) + \$13,611\ (.33) = \underline{\$12,040}$$

$$EV_3 = \$11,964\ (.33) + \$13,375\ (.33) + \$14,694\ (.33) = \underline{\$13,211}$$

$$EV_4 = \$13,102\ (.33) + \$14,512\ (.33) + \$15,837\ (.33) = \underline{\$14,337}$$

$$EV_5 = \$13,875\ (.33) + \$15,285\ (.33) + \$16,605\ (.33) = \underline{\$15,102}$$

$$EV_6 = \$10,103\ (.67) + \$6,141\ (.33) = \underline{\$8,796}$$

$$EV_7 = \$12,040\ (.67) + \$8,098\ (.33) = \underline{\$10,739}$$

$$EV_8 = \$13,211\ (.67) + \$9,280\ (.33) = \underline{\$11,914}$$

$$EV_9 = \$14,337\ (.67) + \$10,418\ (.33) = \underline{\$13,044}$$

$$EV_{10} = \$15,102\ (.67) + \$11,191\ (.33) = \underline{\$13,811}$$

The expected value of event fork (A) is calculated as:

$$EV_A = \$8,796\ (.10) + \$10,739\ (.20) + \$11,914\ (.40) + \$13,044\ (.20) + \$13,811\ (.10) = \underline{\$11,783}$$

This same iterative process is applied in determining intermediate expected values for the remaining event forks (B), (C), (D), and

(E)) in the decision tree. Once computed, these intermediate expected values are transferred to the extreme right-hand side of Figure 1. Intermediate expected value computations are summarized in Table 5.

TABLE 5

Intermediate Expected Value Computations

UNCERTAIN EVENT A: Family Foster Care ($11,783)

1	$ 10,103	6	$ 8,796
2	$ 12,040	7	$ 10,739
3	$ 13,211	8	$ 11,914
4	$ 14,337	9	$ 13,044
5	$ 15,102	10	$ 13,811

UNCERTAIN EVENT B: Special Group Care ($32,454)

UNCERTAIN EVENT C: Residential Child Care ($66,791)

UNCERTAIN EVENT D: Purchase All Services ($18,724)

1	$ 15,746	4	$ 19,982
2	$ 17,683	5	$ 20,745
3	$ 18,854		

UNCERTAIN EVENT E: Provide All Services Directly ($18,530)

1	$ 15,553	4	$ 19,787
2	$ 17,490	5	$ 20,552
3	$ 18,661		

DECISION NODE S_2: ($11,472)

(D)	$ 18,724	1	$ 11,861	3	$ 11,472
(E)	$ 18,530	2	$ 15,638	4	$ 15,274

DECISION NODE S_3: ($11,783)

(A)	$ 11,783
(B)	$ 32,454
(C)	$ 66,791

DECISION NODE S_1: ($11,472)

[S_3]	$ 11,783
[S_2]	$ 11,472

28

At this point, we are ready to conduct the last step in folding back the decision tree. As can be seen from Figure 1 and the preceding discussion, there are three act forks in our hypothetical decision tree ([S_1], [S_2], and [S_3]). The first involves the decision whether or not to place the child in a permanent adoptive home versus retaining that child in a foster care setting. The second is based on the assumption that adoption is chosen as the placement alternative, and involves whether or not the adoption will be purchased from a private child-placing agency or provided directly by the public agency with custody of the child. Finally, the third involves the decision as to which type of foster care the child will be placed.

To determine the financially optimal decision regarding whether or not to purchase the adoption services from a (licensed) child-placing agency or provide them directly, one simply chooses the smallest expected value (since we are looking for the least costly outcome) from those represented by event forks (1) and (3) (see Table 5). In our hypothetical case, that choice would be $11,472, or provide the services directly.

Finally, to determine which of the two initial courses of action is the most desirable ("optimal"), two steps must be followed. First, one must choose the smallest of expected values at event forks (A), (B), and (C). In our hypothetical case, that choice would be (A), or $11,783. Given this choice, one simply chooses the lesser of $11,783 and $11,472 to determine which of the two initial courses of action is "optimal." For the data of our hypothetical example, that choice would be $11,472, or place the child in an adoptive home.

The rollback procedure described above can be summarized in general terms as follows (Holloway, 1979, p. 109):

Step 1 - Start at the right-hand end points of the decision tree and move backward along any branch until a decision node or act fork is reached.

Step 2 - Choose among the alternatives at this node.

Step 3 - Eliminate the decision node by discarding all but the preferred or "optimal" alternative.

Step 4 - Keep moving backward until the initial decision is reached and treat it like any other decision node.

This completes the folding back process. Through this process, we have determined the expected cost associated with each of the eight decision strategies, as well as determined the "optimal" strategy using the expected value criterion.

The expected value criterion has resulted in a series of interesting decision choices in our hypothetical decision problem. Referring to the intermediate expected value computations contained in Table 5, a number of critical observations can be made with regard to folding back the decision tree.

Firstly, the relative closeness of intermediate expected values at uncertain event nodes (1) and (3) in Figure 1 should be noted ($11,861 and $11,472, respectively). As previously discussed, for our hypothetical decision problem the expected value criterion dictates that we choose the lowest expected value figure from among those available at a particular decision node (i.e., S_1 through S_3 in Figure 1). That choice for decision node S_2 (whether or not to purchase adoption services or provide them directly) was $11,472, or provide adoption services directly. While this particular selection meets the requirements of the expected value process, it does not depart significantly from the other value present. Thus, the relative weight one places on this outcome as a sole choice for decision-making must be considered carefully. A slight modification in event probabilities at event forks (1) through (4) would surely have an impact upon the decision made at this particular decision node (see Section on Sensitivity Analysis, below).

Secondly, the majority of available studies which have compared the costs of adoption versus long-term foster care have failed to take into consideration the time value of money (see Appendix A), as well as include subsidy assistance in the adoption cost calculations. Furthermore, our hypothetical scenario considers full (i.e., 100%) subsidy assistance in all cases where subsidy is required, which tends to overemphasize the relative contribution of subsidy costs to the overall cost of adoption. The latter observation can be illustrated by examining the costs of adoption of children with no special needs (purchased or otherwise), which are on the order of $5,000 to $6,000 less than their subsidy-related counterparts.

Therefore, the expected value criterion, as evidenced in our sample decision problem, provides the manager/decision maker with highly appropriate evidence of the "true" costs of adopting a so-called special needs child.

Sensitivity Analysis

Only rarely will managers or decision makers be able to assess event probabilities by simply equating them to observable frequencies that they know for certain (Schlaifer, 1969). Usually, only incomplete information will be available about relevant long-run frequencies, thereby rendering the assignment of chance probabilities at each event fork problematic. Obtaining and weighing all the information necessary to reach a definite assignment decision may require a substantial investment of time and effort. Furthermore, should this process be arrived at by consensus, additional difficulty might be encountered in assessing the "correct" or "right" probabilities.

It is not absolutely necessary to reach a definite decision concerning a particular set of event probabilities. Tentative assessments can be made, and a sensitivity analysis can be conducted to determine the effects of changes in these assessments on the various decision strategies under investigation. This procedure may lead to the conclusion that no reasonable changes in the probabilities assigned to many of the event forks in the decision tree will have a marked effect on the ranking of available decision strategies. On the other hand, the sensitivity analysis may point to the need for more accurate and less tentative decisions regarding specific event probabilities, or highlight the need for additional empirical data upon which such assessments could be made.

For decision trees with relatively few branches, conducting a sensitivity analysis is simply a matter of sitting down with a hand calculator and recomputing expected values based on upward or downward adjustments in event probabilities at selected event forks. Table 6 reflects the outcomes of such an analysis for the four event forks (circled numbers 1-4) depicted in Figure 1. As can be seen from the Table, reversing the event probabilities at event forks (1) and (2), as well as (3) and (4), has no effect on the ultimate outcome of the decision at act fork S_2. That is, the expected value criterion still yields the direct provision of adoption services as the financially "optimal" outcome. However, when considering the slight modification in event probabilities reflected by scenario 2, it can be seen that the "optimal" decision at act fork S_2 shifts to purchase

TABLE 6

Sensitivity Analysis for Selected Event Forks From Figure 1.

Scenario	Event Fork	Probability of Occurrence[1]	IEU[2]	Decision
1	1	(.75) / (.25)	$ 12,036	PROVIDE
	2	(.67) / (.33)	$ 14,651	
	3	(.75) / (.25)	$ 11,612	
	4	(.67) / (.33)	$ 14,232	
2	1	(.75) / (.25)	$ 10,462	PURCHASE
	2	(.50) / (.50)	$ 12,552	
	3	(.75) / (.25)	$ 11,612	
	4	(.67) / (.33)	$ 14,232	

[1]The numbers in parentheses reflect the probabilities of occurrence of the adoption requiring subsidy assistance (event forks 2 and 4) and the likelihood of the child having so-called special needs (event forks 1 and 3).

[2]Intermediate expected value.

adoption services. Thus, our suspicion about the relative instability of the original decision at decision node $\boxed{S_2}$ was confirmed. That is, the results of the brief sensitivity analysis suggest the need for careful interpretation of the results obtained.

III. DISCUSSION

Utility of Information Provided by the Decision Analysis

In the Decision Analysis described above, we have obtained the "optimal" decision strategy using the expected value criterion. Effective use of this criterion is based on two important assumptions (Thomas, 1972):

(1) managers or decision makers will find little difficulty in expressing the value of certain outcomes of their decisions as monetary payoffs;

(2) the individual manager or decision maker is indifferent to risk.

The first of these assumptions will be discussed subsequently. A detailed treatment of the second assumption can be found in the next Section of this paper.

Our hypothetical decision problem has been structured in a manner that highlights the assumption that a manager or decision maker will have little difficulty in expressing the value of certain outcomes of his decisions solely in monetary terms. That is, we have seen that by folding back the decision tree representing our hypothetical decision problem, the expected value criterion leads us to the conclusion that we ought to place our hypothetical child in an adoptive home. In monetary terms, the payoff for selecting adoption as the placement alternative is greater than that represented by any or all forms of foster care.

Use of the expected value criterion as a means for determining "optimal" decision strategies does not always lead to clear choices, particularly for decisions with wide variations in consequences and a high degree of uncertainty. Decisions involving a high degree of uncertainty can be characterized as those which are very risky. That is, uncertainty introduces an element of risk. In practice, it is rare to find a manager or decision maker who is completely indifferent to risk (i.e., risk neutral). Typically, these individuals have a certain risk preference which reflects their underlying or basic attitudes toward uncertain outcomes.

A formal analytical procedure has been developed to accommodate such risk preferences. This procedure, which is referred to as expected preference analysis, as well as its application to the hypothetical example of this paper, is discussed in Appendix D. As can be seen from a review of the Appendix, the expected preference criterion yields a similar result to the expected value criterion, namely, that adoption is the "optimal" decision strategy, particularly when delivered by the public agency with custody of the child.

Concluding Remarks

The decision problem represented by this report reflects an excellent example of how Decision Analysis can be used as an analytic tool to assist social services managers and analysts faced with making complex decisions under uncertainty. We have seen how this tool can focus and quantify the impact of alternate decision strategies according to the expected value and expected preference outcome criteria. The relative effect of the decision maker's attitude toward risk was also considered.

There are, however, several caveats that deserve attention when using this decision-making approach in analyzing the relative financial merits of adoption versus foster care as alternatives to out-of-home care for children.

Firstly, there are almost as many scenarios possible as there are children in alternate care. Individual client differences and programmatic variations among agencies reflect many independent variables, thus creating a large number of event combinations and permutations. Figures 1 through 6 portray many of the complexities associated with the decision problem, but certainly not all of them. To further complicate the problem analysis, adoption and foster care are not always mutually exclusive or independent alternatives for any one child. For example, a child could conceivably go from short-term foster care (care for one year or less) back home, to short-term foster care again, to adoption, and still end up in long-term foster care if the adoption disrupts and a replacement is not found.

A second caveat to this Decision Analysis concerns the definition of resource inputs (costs) associated with the two "project" alternatives (foster care versus adoption). Three generic types of foster care are commonly known to exist: family or home-based care, specialized group care, and residential treatment, each with its own special characteristics (funding structure, program of services, clients served, etc.). "Routine" casework and specialized (ancillary) services required to support a foster care placement are highly variable, and are largely a function of the conditions surrounding or precipitating the need for placement.

For example, a child may be removed from his natural home and placed in temporary or emergency care through an abuse or neglect petition or due to some other crisis situation (alcoholism, mental breakdown, or incarceration of parents, etc.) in the household. The services (and, therefore, the costs) needed to further the goal of reuniting the child with his natural family or to develop some other permanent life plan (adoption, emancipation, or long-term foster care) will vary depending upon the gravity of the crisis, the willingness of the family to accept and benefit from services offered, and the rapidity with which the family responds to the program of services provided.

Additionally, the type of supportive services required by the child will depend largely upon his age, degree of traumatization experienced in the natural home prior to the (current) placement, need for medical attention and mental health services, and the willingness and ability of the child to respond to the program of services provided.

Legal services associated with a particular foster care placement will also vary depending upon whether or not the natural parent(s) sought placement on a voluntary basis, or formal court proceedings were necessary to transfer legal custody of the child to the placing agency.

A number of other "hidden" costs can also be identified in pursuing either program alternative. Included among these are casework and administrative time devoted to mandated court review of case progress, the costs of designing and maintaining a tracking system (computerized or otherwise) for determining the current location and status of each child in the system, the costs of replacing foster care and protective services workers who drop out of the system because of worker "burnout," and the special training required of foster parents in order to prepare them for the challenging role of foster parenthood.

There are similar "hidden" costs for adoption, such as the maintenance of an adoption listing service, as well as added resources required should the adoptive placement fail or disrupt. The likelihood of the latter is increased for so-called "special needs" children who tend to test the stamina of the adoptive parents to the fullest. Furthermore, it is difficult to predict the likelihood of disruption for children with special placement needs, as no two are exactly alike.

These resources, while not part of the day-to-day mainstream of service delivery, are, nevertheless, important elements to consider in analyzing the relative financial merits of adoption versus foster care as alternate placement mechanisms.

Figure 8 illustrates three major dimensions for consideration in identifying resource inputs for the two "project" alternatives (adoption versus foster care). Inspection of this Figure quickly shows the difficulty of capturing all of the salient input resources in a single scenario.

Finally, notwithstanding the advanced level of understanding and sophistication necessary to overcome the above caveats in computing the expected value of foster care versus adoption as placement alternatives, one must also consider the impact of the political process, as well as other "environmental" inputs, on the decision maker with responsibility for guiding the development and implementation of the human services delivery program in his state (see, for example, Goldman, 1967; Hinrichs and Taylor, 1969; Irvin and Brown, 1978; Mishan, 1975; Pearce, 1978; Rivlin, 1971; Sassone and Schaffer, 1978; Sugden and Williams, 1978; Thompson, 1980). These inputs can have a considerable impact on the shaping of relevant policy, as well as in determining the amount of potential risk a manager/decision maker is willing to take in formulating critical decisions.

REFERENCES

REFERENCES

Brown, R.J.; Kahr, A.S.; and Peterson, C. Decision analysis: An overview. New York: Holt, Rinehart and Winston, 1974.

Goldman, Thomas A. (Ed.). Cost-effectiveness analysis: New approaches in decision making. New York: Praeger Press, 1967.

Hinrichs, H.H. and Taylor, G.M. Program budgeting and benefit-cost analysis: Cases, text and readings. Pacific Palisades, California: Goodyear Publishing Company, 1969.

Holloway, C.A. Decision making under uncertainty: Models and choices. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1979.

Irvin, George and Brown, R. An introduction to financial, economic and social appraisal of development projects. London: MacMillan Publishing Company, 1978.

Mishan, E.S. Cost-benefit analysis: An informal introduction. London: Allen & Urwin, Ltd., 1975.

Pearce, D.W. (Ed.). The validation of social cost. London: Allen & Urwin, Ltd., 1978.

Rivlin, A.M. Systematic thinking for social action. Washington, D.C.: The Brookings Institution, 1971.

Sassone, P.G. and Schaffer, W.A. Cost-benefit analysis: A handbook. New York: Academic Press, 1978.

Schlaifer, R. Analysis of decisions under uncertainty. New York: McGraw-Hill Book Company, 1969.

Sugden, R. and Williams. A. The principles of practical cost-benefit analysis. Oxford: Oxford University Press, 1978.

Thomas, H. Decision theory and the manager. Bath, England: The Pitman Press, 1972.

Thompson, M. Benefit-cost analysis for program evaluation. Beverly Hills, California: Sage Publications, Inc., 1980.

Van Horne, J.C. Financial management and policy (4th ed.). Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1977.

Winkler, R.L. The assessment of prior distributions in Bayesian Analysis. Journal of the American Statistical Association, 1967, 62, 776-795.

SELECTED BIBLIOGRAPHY

Anscombe, F.J. and Aurman, R.J. A definition of subjective probability. Annals of Mathematical Statistics, 1963, 34.

Arrow, K.J. Social choice and individual values. New York: John Wiley & Sons, 1951.

Demski, J.S. and Feltham, G. Cost determination: A conceptual approach. Ames, Iowa: Iowa State Press, 1976.

Keeney, R. and Raiffa, H. Decisions with multiple objectives. New York: John Wiley & Sons, 1976.

Kreps, D. and Porteus, E. Temporal resolution of uncertainty and dynamic choice theory. Econometrika, 1978, 46, 185-200.

Middleton, M.R. Computer programs for elementary decision analysis. Technical Report No. 25, Graduate School of Business, Stanford University, 1973.

Miller, J.R. Professional decision making. New York: Praeger Press, 1970.

Mood, A.M. and Graybill, F.A. Introduction to the theory of statistics (2nd ed.). New York: McGraw-Hill Publishers, 1963.

Newell, A. and Simon, H.M. Human problem solving. Englewood Cliffs, New Jersey: Prentice-Hall Publishing Company, 1972.

Raiffa, H. Decision analysis: Introductory lectures on choice under uncertainty. Reading, Massachusetts: Addison-Wesley, 1968.

Savage, L.J. Elicitation of personal probabilities and expectations. Journal of the American Statistical Association, 1971, 66.

Sen, A.K. Collective choice and social welfare. San Francisco: Holden-Day Publishers, 1970.

Spetzler, C.S. and Stael von Holstein, C.A.S. Probability encoding in decision analysis. Management Science, 1975, 22(3).

Spurr, W.A. and Bonini, C.P. Statistical analysis for business decisions (Rev. ed.). Homewood, Illinois: Irwin Press, 1973.

Stael von Holstein, C.A.S. Assessment and evaluation of subjective probability distributions. Stockholm: The Economic Research Institute, Stockholm School of Economics, 1970.

Swalm, R.O. Utility theory insights into risk taking. Harvard Business Review (November-December, 1966).

Wagner, H.M. Principles of operations research. Englewood Cliffs, New Jersey: Prentice-Hall Publishers, 1969.

Winkler, R.L. An introduction to Bayesian inference and decision. New York: Holt, Rinehart and Winston, 1972.

Winkler, R.L. and Murphy, A.H. Good probability assessors. Journal of Applied Meteorology, 1968, 7.

42

APPENDIX A

Notes on Computing the Present Value of Money

The time value of money must be considered when an organization (in this case, the Department of Social Services in our sample state) is faced with analyzing a decision situation (adoption versus long-term foster care) which covers one or more future time periods (years). The rationale for considering this time value is to increase the weight given to costs which occur now and to weigh less heavily costs which occur at some future time.

The Present Value Method (van Horne, 1977) takes into account the fact that a dollar has a different value today than at a future point in time. Dollar outflows (investments) that occur at different time periods cannot be measured meaningfully by simply aggregating the amounts under consideration. Instead, the numbers must be converted to present dollar equivalents. Using the Present Value Method, a time span and a discount rate are specified. The three, five, and seven years contained as time periods in Figures 2 through 9 are based on four estimates of the length of time the child would remain in the foster care system if he were not adopted. A discount rate of 10% was adopted, representing the suggested rate of return recommended by the United States Office of Management and the Budget (OMB).

The reader should not confuse the analysis of expected value with the computation of time value. Computation of the time value assumes that the costs are certain to occur. Payments in the future are simply weighted less heavily than those which occur in the present. The time value of money should always be computed first. Only after the costs are differentially weighted for time value should the probability of their occurrence and the expected value be determined.

The formula used to discount to the present a single payment to be received n years from now, discounted at interest rate i is given as:

$$\text{Present Value} = \text{Future Payment} \times 1/(1+i)^n \qquad (1)$$

For example, the present value of a single payment of $1,000 to be received five years hence and discounted at 7% interest rate would be computed as:

$$\text{Present Value} = \$1{,}000 \times [1/(1+.07)^5]$$
$$= \$1{,}000 \times (1/1.40)$$
$$= \underline{\$\ 714.29}$$

It is clear from this computation that money received in the future is worth less (discounted) when time value is taken into consideration.

If a uniform series of payments are made over time (i.e., an annuity), the formula for determining the present value is given as:

$$\text{Present Value} = \text{Future Payments} \times [(1+i)^n-1)/(i(1+i)^n] \qquad (2)$$

Where: $\underline{n}$ = Number of years uniform payment is to be made

$\underline{i}$ = Discount (interest) rate

Using the above example, if the $1,000 were paid in $200 installments over each of the next five years, the total payment would still be $1,000. However, the present value would be computed as:

$$\text{Present Value} = \$200 \times [(1+.07)^5-1)/(.07(1+.07)^5]$$
$$= \$200 \times (4.100)$$
$$= \underline{\$820.00}$$

In this case, the present value is higher ($820 versus $712), since some payments were received earlier. The total present value is still less, however, than the lump-sum of $1,000 received right now.

The right-hand side of equation (2) above is referred to as the Present Value Interest Factor (PVIF) for an annuity. The PVIF can also be found for a given time span in years and a specified discount rate using a standard Present Value Annuity Table. In our hypothetical example, use of the Present Value Method is necessary because the foster care costs will be incurred each year and are not paid out in one lump sum. The PVIF used in the cost computations represented by Figures 1 through 6 is 3.791 for a time period equal to five years and a discount rate of 10%.

APPENDIX B

Adoption Components and Purchase of Service Reimbursement Formula

(Abstracted from Colorado Department of Social Services
Staff Manual, Volume VII)

ADOPTION COMPONENTS AND COSTS

Definitions and Descriptions:

(1) Preplacement Services - Identification and provision of services to children whose most appropriate long-term plan is or could be adoption. Services include:

(a) individual or group services to the child focusing on feelings, attitudes, and readiness for adoption;

(b) diagnostic assessment of the child's medical, educational, and emotional strengths and weaknesses;

(c) periodic review of the agency's long-term foster care population;

(d) case conferences to determine appropriateness of adoptive placement of identified children;

(e) decision-making concerning appropriate case strategy, such as preparation for legal action.

(2) Services to Legally Free the Child - The process by which children are legally freed for adoption; that is, their legal relationship to their biological parents is severed, by voluntary surrender or involuntary termination, through a petition of dependency and neglect. Services include:

(a) casework and groupwork with biological parents concerning the emotional implications of legally freeing a child for adoptive placement, either through voluntary relinquishment or involuntary termination of parental rights;

(b) casework/groupwork with the child concerning the implications of freeing;

(c) preparation of the case for legal proceedings;

(d) participation in court proceedings;

(e) agency legal staff preparation and presentation of case.

(3) Recruitment Services - The process, in the interest of a specific child, by which prospective adoptive parent(s) are informed of the adoption process and are encouraged to apply for adoptive parent status; the target population may be both the general population or special subpopulations, such as foster families. Services directed toward resources for a specific child include:

(a) development and implementation of publicity plans and planning of other recruitment strategies, such as advertising, media presentations, and special mailings;

(b) child-specific speaking engagements and/or orientation sessions;

(c) interviews and telephone contacts with prospective adoptive families.

(4) Homestudy Services - The process by which adoptive parent(s) apply for adoption and are assessed as to their readiness for adoption. Services include:

(a) group/individual preparation of adoptive applicants;

(b) group/individual assessment of emotional readiness for adoption of the type of child best suited for each family;

(c) visits in the home to discuss appropriateness of home situation for specific types of children;

(d) evaluation of application or first interview;

(e) processing of evaluation report and related materials;

(f) decision-making after completion of homestudy process.

(5) Placement Services - Clinical and case management services intended to prepare a child for adoptive placement, identification of a suitable adoptive family, and initial meeting of child and family. Services include:

(a) group/individual counseling with the child concerning the movement toward adoption;

(b) decision-making concerning appropriate placement strategies;

(c) group/individual counseling and parent training with prospective adoptive parent(s);

(d) family counseling and group/individual counseling during initial planning phases;

(e) utilization of state or regional adoption registration services for identification of prospective adoptive parent(s);

(f) presentation of family and child through such methods as videotape of child or parent(s), initial meetings of child and family, overnight visits, and preparation of scrapbooks describing the child's life history;

(g) discussion of the applicability and appropriateness of subsidy;

(h) coordination with other agencies regarding placement, especially when the child and family are being served by different agencies;

(i) arranging for group meetings with parent(s) who have completed the adoption process.

(6) Postplacement Services - Clinical and support services provided to the adoptive family during the time period between adoptive placement of the child and legalization. Services include:

(a) group/individual counseling to adoptive family concerning the initial adjustments to and feelings about adoption;

(b) case conferences to decide upon the family's service needs during placement, including determination of appropriate length of placement period;

(c) additional diagnostic assessment, if indicated;

(d) arranging for adoption subsidy payments, if indicated;

(e) coordination of community services for the child and family (i.e., educational, medical, recreational);

(f) preparation and presentation of documents for legalization of adoption;

(g) arranging for group meetings of adoptive parent(s) for purposes of problem-solving and peer support.

(7) Postfinalization Services - Supportive services provided to the adoptive family up to one year following legal finalization of the adoption. Services include:

(a) group/individual counseling of family;

(b) additional diagnostic assessment, if indicated;

(c) information/referral services;

(d) review of subsidy determination, if indicated.

Component Rate and Cost Calculations

Following are calculations of the service hour rate which shall be used by the agency provider for billing, by component, and the method which shall be used for determination of costs within each component. (Note that for some components the base service hour cost is adjusted upward to include other elements.)

(1) Preplacement Services - The agency provider shall use the base service hour cost in calculating the cost of this service. The cost of preplacement services shall be determined by multiplying

the base service hour cost by the number of staff activity hours spent in providing this service. Payment may not exceed the ceiling for this component.

EXAMPLE: 17 hours x $25 = $425 billed.

(2) Services to Legally Free the Child - The amount to be billed by the agency provider shall be determined by adding (a) the staff activity cost to (b) the legal services cost. (Note that this component includes the provider agency casework time directed toward freeing for adoption the child who is not yet freed.)

Staff activity cost shall be determined by multiplying the base service hour cost times the number of hours of staff time on the case. The attorney/legal services cost shall be determined by dividing the annual attorney and court costs for the agency adoption program by the number of adoptive placements during that year.

EXAMPLE: (a) $25 x 10 hours = $250
(staff activity costs)

(b) $35,000/20 = $1,750
(attorney/legal services costs)

(c) $250 + $1,750 = $2,000
(legal services cost billed for freeing one child for adoption)

(3)* Recruitment Services - For this component, the base service hour cost shall be adjusted upward by allocating a portion of the annual time spent on general recruitment to those cases successfully recruited (child-specific cases). The adjusted service hour rate shall be determined by multiplying the annual number of recruitment hours (both general and child-specific) by the base service hour cost, and dividing that product by the number of all child-specific recruitment hours.

EXAMPLE: (a) Adjusted Service Hour Rate =

$$\frac{\text{Total recruitment hours x base service hour cost}}{\text{Child-specific recruitment hours}}$$

(b) Adjusted Service Hour Rate x contracted recruitment hours = amount billed

(c) $$\frac{\text{1040 hours x \$25 = \$26,000}}{\text{400 hours}} = \$65$$

(d) $65 x 10 hours = $650 billed.

* In this example, $65 per recruitment service hour is the adjusted service hour rate to be used when billing on contracted successful recruitments, within the component ceiling.

NOTE: It is assumed that the general recruitment activities of the agency contribute to the development of successful child-specific resources, so a portion of that cost is included in the billed rate. [The above example uses a ratio of 1.6 to 1 hours -- 640 to 400 -- for prorating the relationship of general to specific recruitment costs. The same ratio was used in developing the Recruitment Services payment ceiling (i.e., $65 x 15 hours estimated maximum component time investment = $975 component payment ceiling).]

General recruitment activities may include the following:

(a) development of publicity program and planning of recruitment strategy (i.e., expenses for advertising, media presentations, brochure development, etc.)

(b) public speaking engagements, agency open houses, or other events

(c) information/referral services to the general public on adoption procedures, the homestudy process, and available children.

(4) Homestudy Services - The cost of incomplete studies shall be partially included in the cost of completed studies, since the former are part of the process of developing successful resources for which the purchasing agency contracts. The adjusted service hour rate shall be determined by multiplying the annual number of homestudy hours (for both completed and uncompleted studies) by the base service hour cost, and dividing that product by the annual number of hours spent on completed, approved studies. The resulting adjusted service hour rate shall be used when billing for completed, approved homestudies for a specific child, within the component ceiling.

EXAMPLE: (a) Adjusted Service Hour Rate =

$$\frac{\text{Total homestudy hours x base service hour cost}}{\text{Annual hours spent on approved studies}}$$

(b) Adjusted Service Hour Rate x contracted approved study hours = amount billed

(c) $\frac{2000 \text{ hours x } \$25 = \$50{,}000}{1600} = \$31.25$

(d) $31.25 x 20 study hours = $625 billed.

The above example uses a ratio of 1 to 4 -- 400 to 1600 -- for prorating the relationship of incomplete to complete homestudies. That is, 80% of all studies are completed, approved studies. The same ratio was used in developing the Homestudy Services payment ceiling ($31.25 adjusted service hour rate x 25 hours estimated maximum component time investment = $781 component payment ceiling).

<u>NOTE:</u> While the cost of uncompleted studies shall be partially included in the cost of successful studies, it is conversely true that if the purchasing agency finds a different, more appropriate placement for the child after the agency provider has begun the study, the purchasing agency shall not pay for a partial study. That is, the product was not delivered. However, it should be relatively infrequent that the purchasing agency would contract for a service or resource which it plans to subsequently meet on its own, since adoption services would usually be purchased when other available resources are (or are likely to be) unfruitful.

<u>Group Studies</u>: In the above example, (4)(a) and (b), the following elements may include (for both completed and uncompleted studies) the homestudy time spent with families individually <u>or</u> in group studies <u>or</u> in a combination of individual and group time: (i) "annual homestudy hours," (ii) "annual hours spent on approved homestudies," and (iii) "contracted, approved study hours." For each of these elements in the above formula, any group study time must be prorated to each family. This means:

(i) the agency provider shall count the actual worker time in the "annual homestudy hours." For example, 6 hours of worker time spent in group interviews with 3 families (simultaneously) shall be counted as 6 hours, not 18. That is, the worker's time is prorated as if 2 hours were spent with each family.

(ii) in the "annual hours spent on approved studies," the portion of each approved family's homestudy time that is spent in the group process shall be allotted to that family on a prorata basis. For example, an approved family's homestudy time might include 9 hours in group interviews with 2 other families, plus 4 hours in individual contacts (face-to-face and telephone), plus 5.5 hours in collateral contacts, paperwork, travel, and dictation. The homestudy time counted for that family shall be one-third of the group time, or 3 hours, plus the remaining 9.5 hours spent solely on their case, for a total of 12.5 hours which shall be allocated from that case to the agency provider's "annual hours spent on approved studies."

(iii) regarding "contracted, approved study hours," when billing on a given case for a completed homestudy after a child has been placed, the agency provider computes the homestudy hours in the same manner as in Paragraph (ii) just above. For example, if the approved family with whom a child has been placed is one of three families who were studied in a group study process, that family's prorated portion of the group time (one-third, in this example) shall be added to the time spent solely on their case. The agency provider's bill shall be that total number of hours times the provider's adjusted service hour rate -- see example in (4)(a) and (b) above.

Decisions about what proportion of the homestudy time in a given case should be spent in group versus individual study shall be made on the basis of administrative and/or case considerations (efficiency, case dynamics, family interaction, and traits to be evaluated, etc.). Prorating the group study time to be counted, as described above, prevents an unintended financial incentive to expand the proportion of group study time on a given case, since the absence of prorating could result in multiple payments for a given unit of worker time spent in group study.

(5) Placement Services - Placement services shall be billed using the base service hour cost. The cost of placement services shall be determined by multiplying the number of staff activity hours spent in this service by the base service hour cost. Payment is limited by the ceiling for this component.

EXAMPLE: 18 hours x $25 = $450 billed.

(6) Postplacement Services - The cost of postplacement services shall also be determined by multiplying the base service hour cost by the number of staff activity hours spent providing this service.

EXAMPLE: 30 hours x $25 = $750 billed.

When a placement disrupts, time spent for postplacement services to the point of disruption is also billed at the base hourly rate, and is also limited by the ceiling for this component.

(7) Postfinalization Services - Postfinalization work with the adoptive family/child shall also be billed at the base hourly rate. The cost shall be determined by multiplying the base service hour cost by the number of staff activity hours spent providing this service. Payment is also limited by the component ceiling, and shall apply to a period of service of no more than one year following legal finalization of the adoption.

EXAMPLE: 8 hours x $25 = $200 billed.

The above examples are provided for illustrative purposes only. In summary, the cost of adoption components purchased in these examples would be as follows for a purchasing agency which elected to purchase any or all of them:

Services to Legally Free the Child	$ 2,000
Preplacement Services	425
Recruitment Services	650
Homestudy Services	625
Placement Services	450
Postplacement Services	750
Postfinalization Services	200
	$ 5,100

Maximum reimbursement ceilings as used in this report are as follows:

Services to Legally Free the Child	$ 2,000
Preplacement Services	500
Recruitment Services	975
Homestudy Services	781
Placement Services	625
Postplacement Services	1,250
Postfinalization Services	250
	$ 6,381

SPECIAL NOTE:

Payment for purchased adoption services shall be on an actual cost basis, up to a specified maximum for each adoption component (see above). The rate shall be based on the base service hour cost of the agency provider, which is: the allowable program costs divided by case service hours in the program (i.e., hours spent by professional staff in performing adoption services on a case).

The base service hour cost shall be determined through the following steps:

(a) determine annual adoption program expenditures of agency provider. These shall include professional case service time for adoption work (with clients and collaterals, in-person and by telephone; travel and dictation); administrative and supervisory time; clerical and reception time; rent, telephone, postage, equipment, and related costs. Any of the above which are shared with other programs or purposes must be prorated to show the adoption program-related time only.

(b) subtract unallowable expenses. These shall include the costs of fund-raising activities, purchase of land and buildings, or other capital purchases.

EXAMPLE:	$250,000	adoption program costs
	- 25,000	fund-raising or capital purchases
	$225,000	net reimbursable

(c) result is net reimbursable expense.

(d) determine annual casework hours. This shall be done by multiplying the number of annual work days times the number of hours in the work day, times the number of FTE adoption workers.

EXAMPLE: 225 days x 8 hours x 5 workers = 9,000 hours

Agency days may vary, but all agencies shall exclude from casework days their vacation leave, holidays, personal time, and sick leave. Furthermore, it is not expected that the entire work day will be devoted exclusively to direct service time. Therefore, to the extent that retrospective time study data are available in the agency, actual direct service days (or hours per day) should be included in this computation. Should these data be unavailable, then "best-guess" estimates should be used.

(e) determine base service hour cost (rate) by dividing net reimbursable expenditures obtained in (b) above by the annual professional case service hours obtained in (d).

EXAMPLE: $\frac{\$225,000}{9,000}$ = $25 per service hour

In its contract with the agency provider, the contracting agency shall require that the provider maintain fiscal and program records which shall clearly and fully reflect the costs of contract performance. The computations by which the agency provider developed its base service hour cost (and adjusted hourly rates for the recruitment and homestudy processes), in accordance with the formulas provided, as well as a copy of its operating budget, shall be available for review or audit by a contracting agency upon request.

APPENDIX C

Glossary of Common Terms Used in Decision Analysis

Act Fork (Decision Node)	a decision point for which specific action is required in a decision problem. Usually represented by a small box with several branches emanating from it.
Certainty Equivalent	that certain value [in terms of the evaluation units (dollars)] which a decision maker is just willing to accept in lieu of the "gamble" represented by the uncertain event.
Decision Analysis	discipline for systematic evaluation of alternative actions as a basis for choice among them.
Decision Tree	a map of events and potential actions that are relevant to a specific decision problem.
Event Fork (Event Node)	an uncertain event in a decision problem. Usually represented by a small circle with several branches emanating from it.
Expected Preference Criterion	the expression of the value of certain decision outcomes in terms of risk preference.
Expected Value	probability-weighted sum used to approximate the worth of various decision alternatives. Each of the costs entering into an uncertain event or decision is weighted precisely by its probability of occurrence.
Expected Value Criterion	the expression of the value of certain decision outcomes in terms of monetary payoffs.
Intermediate Expected Value	expected value calculation derived in folding back the decision tree up to the point a decision node (act fork) is reached.
Preference Curve	a means for converting from the unit of evaluation (usually dollars measuring costs) for a set of consequences to preference numbers.
Preference Scale	a numerical scale that represents an individual's preference for a set of consequences.
Reference Gamble	a simple, two-outcome gamble. One outcome is assigned a payoff greater than or equal to the maximum payoff for any outcome. The other is assigned a payoff equal to or less than the minimum payoff.

Risk Preference — a manager/decision maker's underlying or basic attitude toward uncertain events. Three categories of risk preference exist: risk neutrality, risk averseness, and risk seeking.

Rolling Back/Folding Back — process by which the financial impact or worth of various decision strategies is determined.

Sensitivity Analysis — process used to determine the effects of changes in probability assessments on the various decision strategies under investigation.

APPENDIX D

Notes on Computing the Expected Preference Criterion

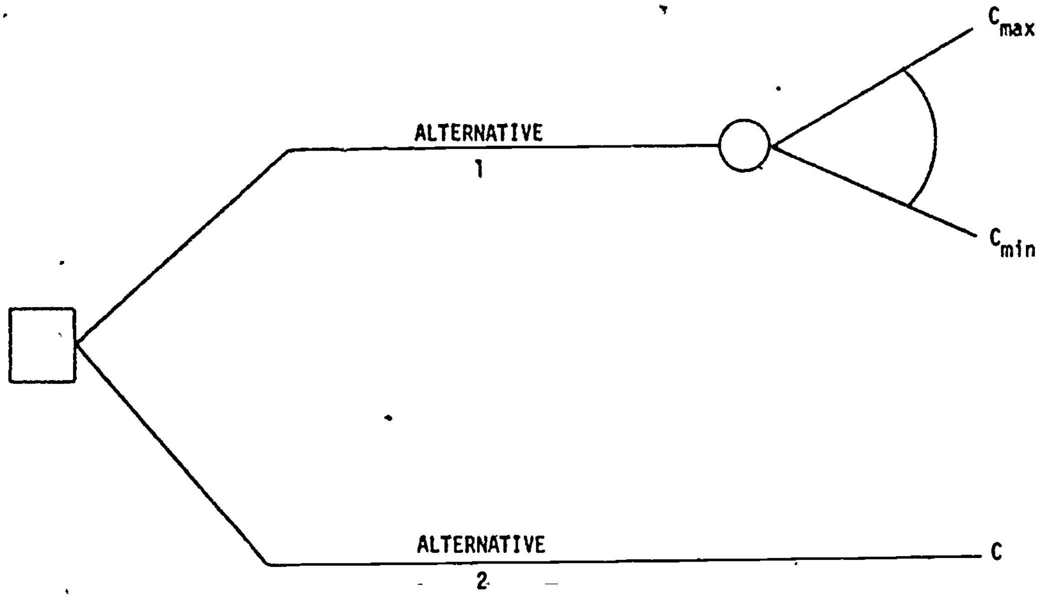
DETERMINING THE DECISION-MAKER'S ATTITUDE TOWARD RISK

The General Case

Use of the expected value criterion as a means for determining "optimal" decision strategies does not always lead to clear choices, particularly for decisions with wide variations in consequences and a high degree of uncertainty. Decisions involving a high degree of uncertainty can be characterized as those which are very risky. That is, uncertainty introduces an element of risk. In practice, it is rare to find a manager or decision maker who is completely indifferent to risk (i.e., risk neutral). Typically, these individuals have a certain risk preference which reflects their underlying or basic attitudes toward uncertain outcomes.

A formal analytic procedure has been developed to accommodate such risk preferences. With this procedure, a numerical scale called a preference scale is created that represents an individual's preferences for a set of consequences. Preferences for alternatives with uncertain outcomes are measured by the preference scale. A preference curve represents a means for converting from the unit of evaluation attached to the various consequences (usually dollars measuring costs) to the preference scale. The preference curve is obtained from certainty equivalents for reference gambles. A certainty equivalent (CE) for an uncertain event is that certain value (in terms of the evaluation units) which a decision maker is just willing to accept in lieu of the gamble represented by the uncertain event. The reference gamble for a decision problem has two outcomes. One outcome is assigned a payoff greater than or equal to the maximum payoff for any outcome. The other is assigned a payoff equal to or less than the minimum payoff.

A simple, two-stage reference gamble may be diagrammed as:



Where: C_{max} = the "best" or "optimum" outcome in terms of evaluation units (dollars)

C_{min} = the "worst" or "minimal" outcome in terms of evaluation units

Figure 9.

Decision Tree for Simple Two-Stage Reference Gamble

The basic procedure for assessing certainty equivalents is given below (Holloway, 1979):

Step 1 - Choose a value of C between C_{max} and C_{min}

Step 2 - Consider the decision between alternative 1 and 2 and make a direct choice.

Step 3 - If "1" is chosen, increase C by some amount and repeat the process. If "2" is chosen, decrease C by some amount and repeat the process.

Step 4 - Vary C until the decision maker is just indifferent between the two alternatives (i.e., he would just as soon have one or the other). This value is the certainty equivalent for the uncertain event.

This procedure can be illustrated with a simple example. Suppose that the reference gamble were represented as:

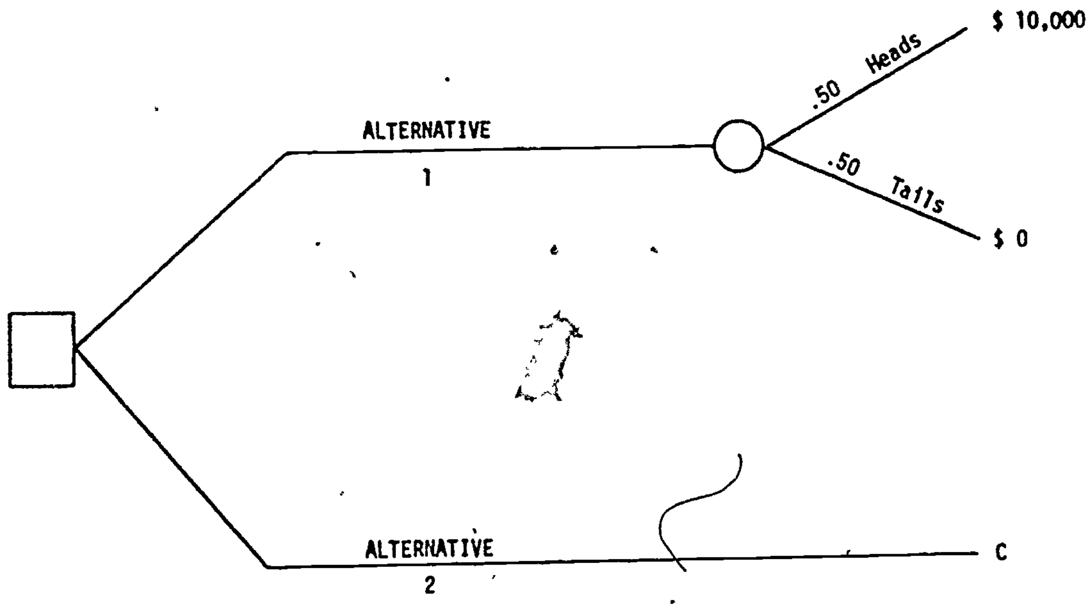


Figure 10.

Decision Tree for Two-Stage Reference Gamble Involving Coin Flip

As can be seen, this reference gamble depicts the uncertain event involved in the flipping of a coin. Two possible outcomes of that uncertain event are possible: a payoff of $10,000 should the flip result in a Head showing and $0 should the flip result in a Tail showing. By increasing/decreasing the value of C as specified in the basic procedure outlined previously and in the Table below, a certainty equivalent (CE) of $4,500 is established for a hypothetical manager/decision maker:

Alternative Chosen	Value of C
2	$ 10,000
1	0
1	2,000
2	6,000
1	4,000
2	5,000
1 or 2	4,500*

*CE = $4,500 (the point at which the decision maker is indifferent to alternative 1 or 2).

As noted above, an individual's preference curve is obtained from certainty equivalents for reference gambles. A series of reference gambles with different probabilities of winning is used to develop the curve. The basic procedure for assessing preference curves is given below (Holloway, 1979, p. 132):

Step 1 - establish the payoffs for a reference gamble for the decision problem.

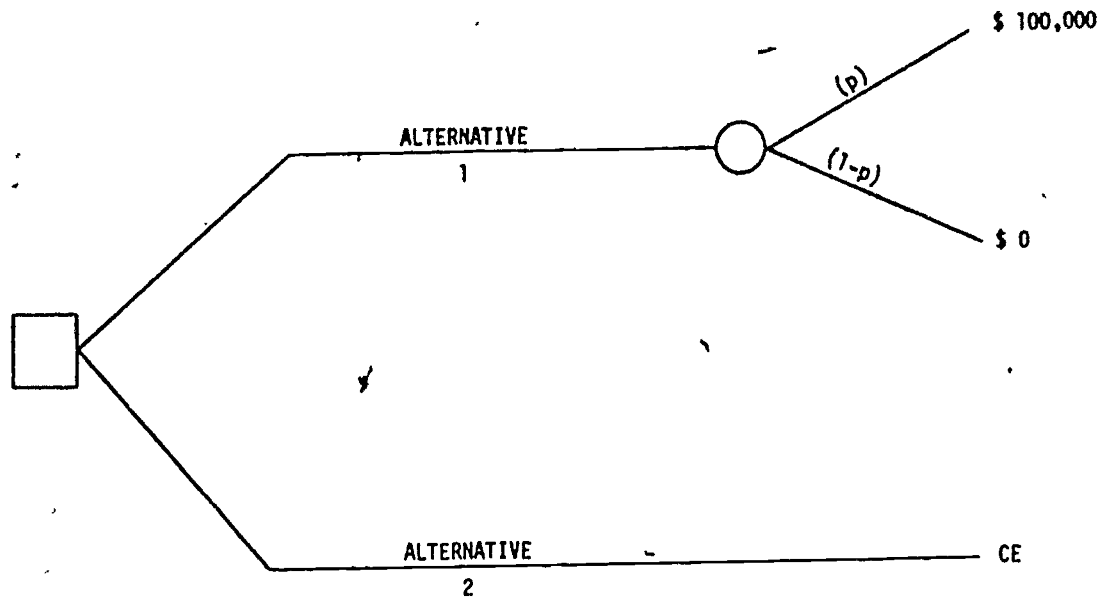
Step 2 - specify a value pf p, the probability of winning the reference gamble, and determine the certainty equivalent for the gamble.

Step 3 - record p and the certainty equivalent (CE) on a plot with p on the vertical axis and CE on the horizontal axis.

Step 4 - repeat steps (2) and (3) by changing p until the plot of p vs. CE is well-defined.

Step 5 - draw a curve through the plotted points.

The process of assessing an individual's preference curve is illustrated in Figure 11.



Where: p = probability of winning the reference gamble

1-p = probability of losing the reference gamble

Figure 11.

Decision Tree for Two-Stage Reference Gamble With $100,000 Payoff

Following the general procedure described above, a hypothetical set of certainty equivalents can be established for a particular manager/decision maker:

Certainty Equivalent	Value of p
$ 100,000	1
0	0
25,000	.5
50,000	.8
33,000	.6
18,000	.4
7,000	.2

The preference curve defined by these points is given as:

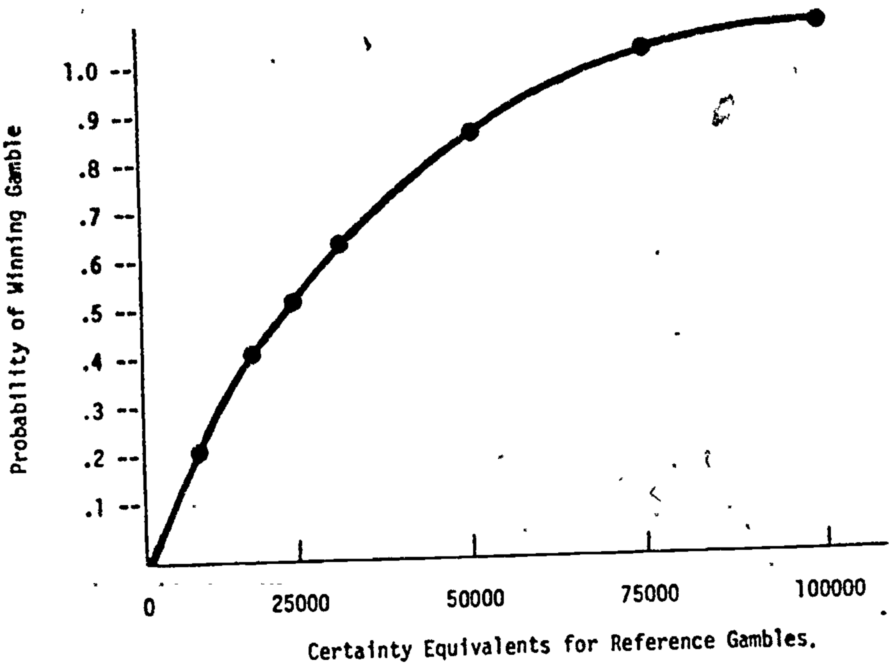


Figure 12.

Preference Curve for Two-Stage Reference Gamble With $100,000 Payoff

The preference curve depicted above encodes our hypothetical manager/decision maker's risk attitude over a range of payoffs of $0 to $100,000 defined by the reference gamble. The shape of the curve indicates that our hypothetical manager/decision maker is risk averse.

In general, three categories of attitude toward risk can be defined: risk averse, risk neutral, and risk seeking. The Figure below shows sample preference curves depicting each category:

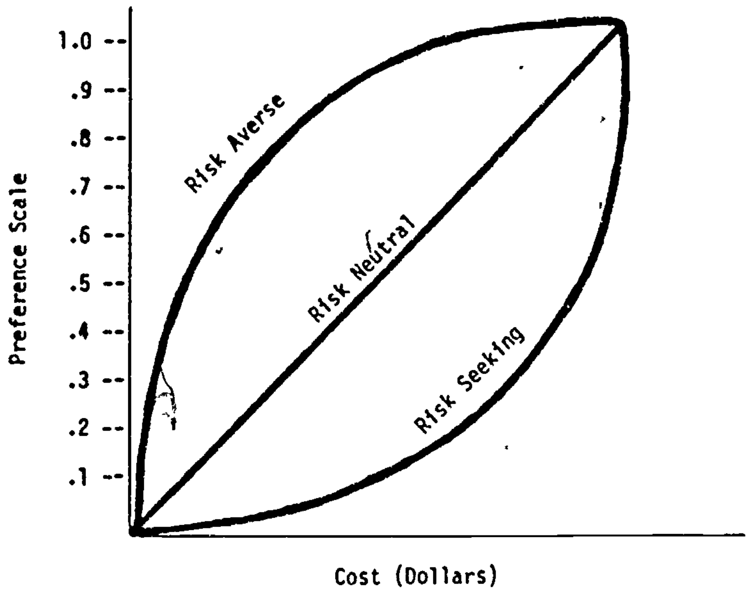


Figure 13.

Preference Curves for Three Categories of Attitude Toward Risk

When considering more complicated uncertain events, certainty equivalents (CEs) are calculated using preference curves and event probabilities. The basic procedure for calculating certainty equivalents is as follows (Holloway, 1979, p. 135):

Step 1 - for each outcome, convert the evaluation units (dollars) to preference scale numbers.

Step 2 - calculate the expected value ($\overline{U}$) of the preference numbers for each uncertain event.

Step 3 - use the preference curve to obtain the certainty equivalents corresponding to $\overline{U}$. This is the certainty equivalent for the uncertain event.

As an example of this procedure, consider the decision problem below. As can be seen, it is from the problem that the reference gamble used in deriving the preference curve above was taken:

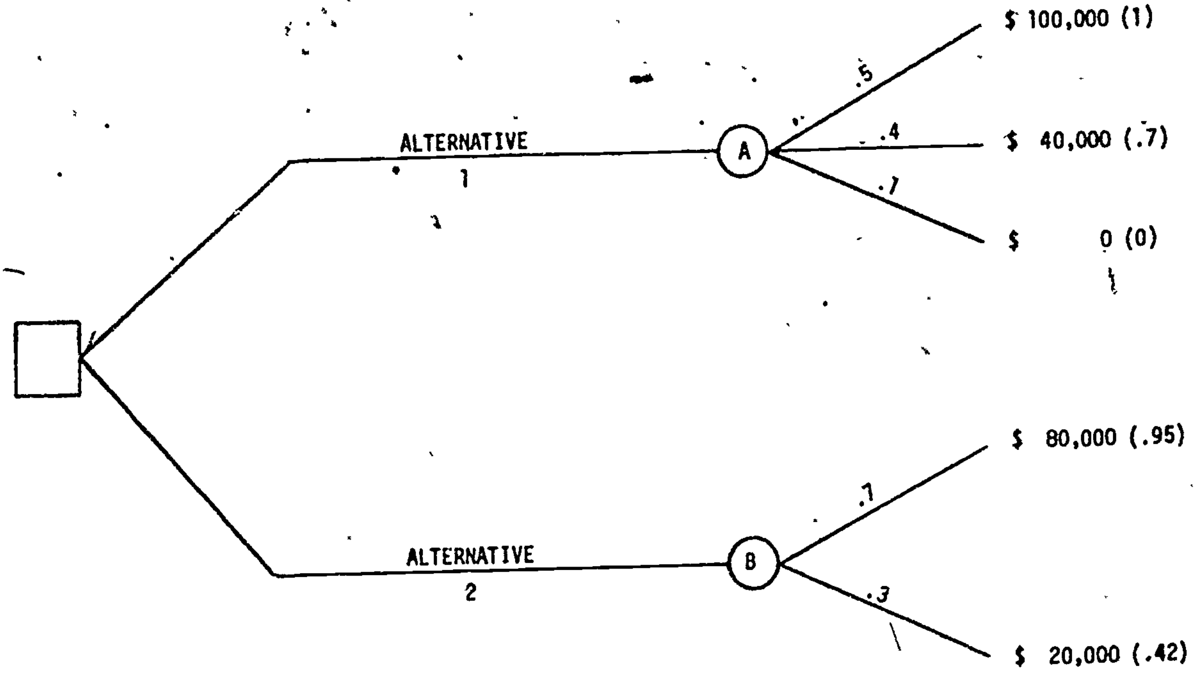


Figure 14.

Decision Problem With Two Alternatives, Each With Several Branches

The preference scale numbers are obtained from the preference curve and are represented in parentheses to the right of the end values (costs) reflected by the decision problem. Expected value ($\overline{U}$) figures are derived for each preference number as follows:

$$\begin{aligned} &\text{(Alternative 1)} \quad \overline{U}_1 = 1(.5) + .7(.4) + 0(.1) = .780 \\ &\text{(Alternative 2)} \quad \overline{U}_2 = .95(.7) + .42(.3) = .791 \end{aligned} \qquad (2)$$

Referring back to the preference curve, it can be seen that the certainty equivalent (CE) for $\bar{U}_1$ = .780 is $48,000 and for $\bar{U}_2$ = .791 is $49,000. Using the expected preference criterion, the "optimal" choice for this decision problem would be Alternative 2.

Using the expected value criterion, the "optimal" choice for the decision problem was also shown to be Alternative 2. That is, the expected value (EV) of event fork (A) would be computed as $0(0) + $100,000(.5) + $40,000(.7) or $52,800 and the expected value of event fork (B) would be $80,000(.95) + $20,000(.42) or $84,000. Apparently, for this particular decision problem, the manager/decision maker's risk averseness, as reflected by the concave nature of the preference curve, had little effect on the eventual outcome of the decision.

Applying the Expected Preference Criterion to our Hypothetical Example

To apply the expected preference criterion to our hypothetical example, we need to first assess a preference curve for the manager/administrator with ultimate decision-making responsibility for our sample state. The decision problem from which the reference gamble is selected is represented by Figures 1 through 6. Inspection of these Figures reveals that the highest cost contribution (dollar outflow) is $83,796 (see Figure 6) and the lowest cost contribution (dollar outflow) is $3,752 (see Figure 1). Recall that in our hypothetical decision problem, we seek to choose the alternative with the lowest dollar outflow (cost).

The basic reference gamble to be used in assessing the preference curve for our hypothetical decision problem is depicted as:

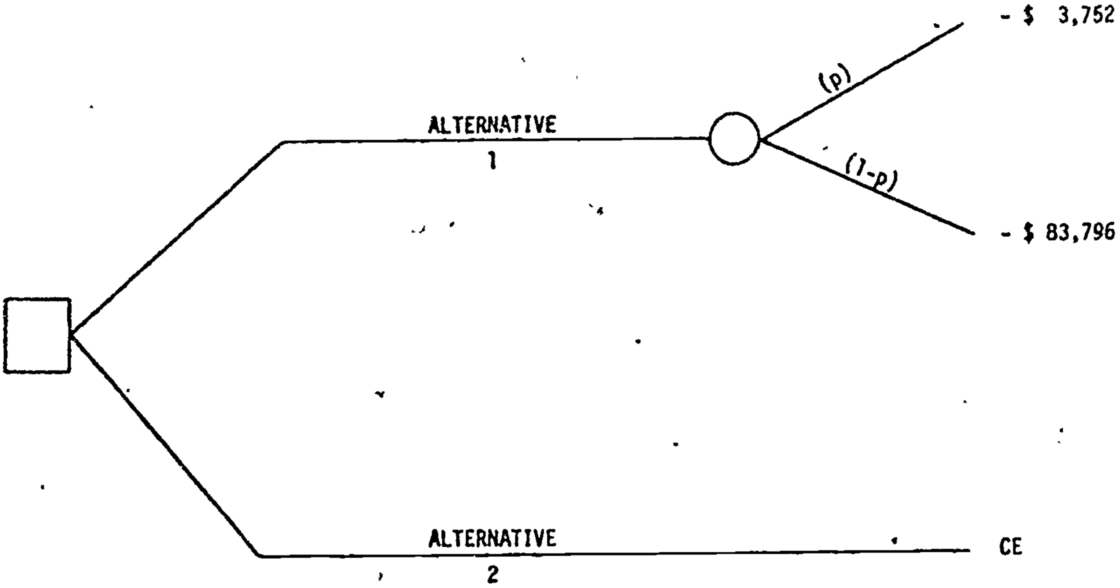


Figure 15.

Reference Gamble for Hypothetical Decision Problem

Following the general procedure described above for assessing an individual's preference curve, and assuming that the manager/administrator with ultimate decision-making responsibility for our sample state is risk averse, the following set of certainty equivalents can be established:

Certainty Equivalents	p
- 3,752	1.00
- 83,796	.00
- 73,785	.50
- 43,744	.84
- 60,000	.60
- 75,000	.40
- 81,150	.20

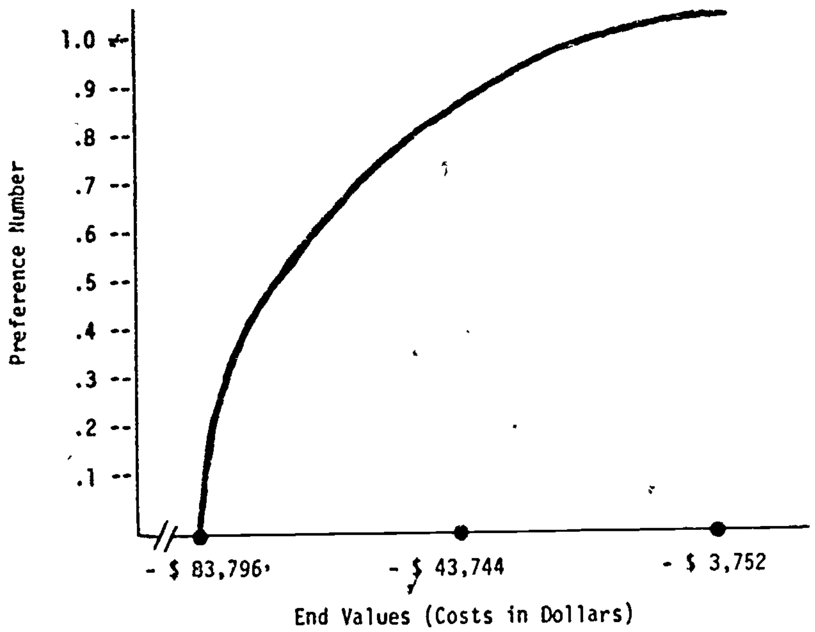


Figure 16.

Preference Curve for Hypothetical Manager/Decision Maker

Using this preference curve, the end values (costs in dollars) in Figures 1 through 6 are replaced by preference values (probabilities of winning the reference gamble). These are given in Table 7.

The expected preference values are then calculated for each of the uncertain events represented by Figures 1 through 6. These probability-weighted sums are computed in a manner identical to the one used to derive intermediate expected values as described by equation (1), and are given in Table 8.

TABLE 7

Reference Values (Probability of Winning the Reference Gamble) For Replacing End Values in Figures 1 through 6

UNCERTAIN EVENT A: Family Foster Care (Figure 4)

.83, .69, .67, .82, .68, .66, .59, .76, .665, .625, .58, .72, .64, .585, .57, .685, .588, .575, .568, .675

UNCERTAIN EVENT B: Group Home Care (Figure 5)

.335, .325, .320

UNCERTAIN EVENT C: Residential Child Care (Figure 6)

.23, .08, .00

UNCERTAIN EVENT D: Purchase All Services (Figure 2)

.585, .56, .55, .568, .543, .518, .545, .52, .515, .528, .515, .50, .517, .513, .48

UNCERTAIN EVENT E: Provide All Services (Figure 3)

.59, .575, .553, .57, .545, .521, .548, .527, .517, .53, .518, .505, .519, .515, .49

NOTE: Horizontal rows in the Table correspond to vertical columns in the Figures.

TABLE 8

Intermediate Preference Values (Probability of Winning the Reference Gamble) For Uncertain Events Represented by Figures 1 through 6

UNCERTAIN EVENT A: Family Foster Care (Figure 4)

1	.70	6	.74	(A) .661
2	.647	7	.78	
3	.627	8	.66	
4	.60	9	.63	
5	.581	10	.622	

UNCERTAIN EVENT B: Group Home Care (Figure 5)

(B) .328

UNCERTAIN EVENT C: Residential Child Care (Figure 6)

(C) .178

UNCERTAIN EVENT D: Purchase All Services (Figure 2)

1	.573	4	.519	(D) .534
2	.548	5	.508	
3	.531			

UNCERTAIN EVENT E: Provide All Services (Figure 3)

1	.577	4	.522	(E) .537
2	.550	5	.513	
3	.535			

The expected preference values calculated for each of the uncertain events represented in Figure 1 are contained in the Table below.

Uncertain Event	Expected Preference Value
1	.709
2	.603
3	.745
4	.631

As noted above, when applying the expected preference criterion, higher expected preference values are preferred to lower ones. Thus, the choice at each decision node can be made directly. In choosing between purchase all services versus provide all services at act fork $\boxed{S_2}$, the latter option is the most "desirable" or "optimal" selection using the expected preference criterion. The certainty equivalent (dollar value) for each of the uncertain events could also be determined from the preference curve, but, as noted above, the choice at decision node $\boxed{S_2}$ can be made without going through this conversion. The choice at decision node $\boxed{S_3}$ is made by comparing the expected preference values determined for end points (A), (B), and (C) (.661, .328, and .178, respectively). In choosing from among these alternatives, the decision maker would choose (A) or Family Foster Care. Once again, certainty equivalents for each of the two alternatives could have been computed, but it is not necessary to do so. Finally, the choice at decision node $\boxed{S_1}$ (i.e., the initial decision in the problem) is made by selecting the smaller of the expected preference values determined at decision nodes $\boxed{S_2}$ and $\boxed{S_3}$ (.745 and .661, respectively). In choosing from among these alternatives, the decision maker would choose .745 or $\boxed{S_2}$. Thus, alternative $\boxed{S_2}$ (Provide Adoption Services Directly) is the preferred alternative using the expected preference criterion. Using the preference curve assessed for our hypothetical manager/decision maker, and our sample decision problem, the certainty equivalent for alternative $\boxed{S_2}$ is approximately $52,000.

Using the expected preference criterion, which takes into consideration our hypothetical manager/decision maker's risk preference, we have arrived at a similar conclusion to the decision problem provided by the expected value criterion. That is, despite the decision maker's apparent risk averseness, as evidenced by the concave shape of his preference curve, providing adoption services was still observed to be the "optimal" or "desirable" decision strategy. For this example, either method (expected value or expected preference) could have been used with equal effectiveness to arrive at a solution to the initial decision problem. In practice, the expected preference method is recommended, however, since it takes into account the potential impact of the decision maker's attitude toward risk in making decisions.