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AN ECONOMIC ANALYSIS OF THE METHADONE MAINTENANCE TREATMENT PROGRAM

by

BERNARD BACKHAUT

A dissertation submitted to the Graduate Faculty in Economics in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

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CHAPTER 1

INTRODUCTION

During the past few years, a major shift has occurred in the United States toward the use of methadone maintenance as the main instrument for narcotics addiction treatment.[1] The original and currently largest methadone program in the United States was founded in New York City by Dr. Vincent P. Dole.[2] This thesis has, as its objective, an economic analysis of the New York City Methadone Treatment Program.

To assist in both the daily operations and research projects of the New York City Methadone Programs, the Methadone Information Center at Rockefeller University maintains extensive background, treatment performance, and discharge information on each of over 20,000 patients who have been admitted to the Program.[3] As an aid in the development of this thesis, the Methadone Information Center has provided the author with a computer tape containing the records of patients who were admitted to publicly operated Methadone Programs in New York City, from their inception in May of 1964 through June of 1972.[4]

Thesis Objectives and Outline

A brief summary of the history of heroin addiction and methadone treatment in the United States is presented in Chapter 2 of this thesis. Chapter 3 contains a description of admission, discharge, and treatment procedures of a variety of Methadone Programs.

Chapters 4 through 8 respectively discuss the major objectives specified for this thesis:

. to provide a critical review of the Methadone Program evaluation literature.

. to develop a behavioral model for analysis of Methadone Program patient performance.

. to evaluate the quality of data available for patients who have been admitted to the Methadone Program.

. to utilize multivariate techniques for the analysis of Methadone Program patient performance.

. to develop cost-benefit procedures for evaluating the performance of subpopulations and the overall population of the New York City Methadone Program.

The thesis concludes with a description of some topics requiring further research.

Summary of Major Findings

A summary appears in this section of the most significant findings related to the five major objectives specified for this study.

Literature Review. Two of the major studies of the Methadone Program are evaluated -- those conducted by Gearing and Leslie. The former is an evaluation of the Program based upon patient performance data while the latter is a cost-benefit analysis of the Program.

The Gearing Report is criticized for its:

. choice of statistical techniques. The Report utilizes univariate rather than multivariate analysis.

. failure to evaluate the quality of the data it utilizes.

. not specifying the limitations of its performance criteria. The retention, employment, and crime criteria adopted by Gearing have important qualifications which are enumerated in this study.

The Leslie Report is criticised for:

. its failure to disaggregate the patient population, making an evaluation impossible of the efficacy of the Program for particular subpopulations.

. not disaggregating Program costs, thereby precluding the evaluation of specific components of the Program.

. its omission of several important Program costs, such as the deterrence of illegal methadone and external neighborhood diseconomies caused by Methadone treatment centers.

. not distinguishing private from social benefits and costs. This distinction could have been helpful in suggesting the extent to which addict demand for treatment should be subsidised to bring it into accordance with public demand.

Behavioral Model Analysis. A behavioral model, structured within the framework of a household production function, is developed in this study for analysing patient performance in methadone programs. The model is used to formulate testable hypotheses connected with patient background characteristics. Several of these hypotheses are confirmed by the regression results.

Data Quality Analysis. The patient data available for this study are evaluated in terms of its relevance, completeness, and accuracy. It is estimated that there are several entire admission records missing, extensive data missing on almost all patient variables, and some impossible codes, ambiguous codes, and no-information codes for patient variables.

Out of the 22,310 patients whose records were made available for this study, less than 6,000 have data which is considered to be usable.

Despite this limitation, a comparison test made with missing vs. usable data indicates that the usable patient data set provides an unbiased estimate of the total patient data set.

Regression Results. Regressions were run, using three patient performance measures -- retention, criminal discharge, and employment -- as dependent variables, and 13 background variables as independent variables. The following major conclusions were reached:

. several background variables were found to affect patient performance significantly, varying from four in the case of retention to ten in the case of employment.

. different background variables were found to affect the three performance measures, complicating the usage of these variables as a guide to patient selection.

. the coefficients of correlation between the performance measures were of relatively small magnitude, complicating the usage of these variables in the decision process.

. background variables, as expected, much more strongly explain the variation in employment than criminal discharge or retention. However, surprisingly, it was possible to obtain almost as high an explanation of the variation in employment by omitting the employment explanatory variable as could be obtained by retaining this variable.

. the coefficients of correlation associated with each of the three performance variables ranges between .01 and .13, indicating that most of the variation in performance is unexplained by patient background variables alone.

Cost-Benefit Analysis. A cost-benefit analysis of patient subpopulations was developed. The following results confirmed the usefulness of disaggregating the patient data base into component subpopulations:

. a large difference was found in net present values for the low and high performance patients.

. for some subpopulations, a reversal in ranking appeared between those based on performance criteria and those based on cost-benefit analysis.

. conditions were found under which a subpopulation of the Methadone Program was likely to have costs exceeding benefits.

. a priority ranking of patients is demonstrated, based on cost-benefit analysis for patient subpopulations.

FOOTNOTES TO CHAPTER 1

1. James Delong, "Treatment and Rehabilitation" in Dealing With Drug Abuse, Praeger, 1970, p. 201.

2. Delong, op. cit., p. 200.

3. Alan Warner, "Two Standard Data Processing Packages for Methadone Maintenance Facilities in New York", Proceedings Third National Methadone Conference, 1970.

4. Bernard Backhaut, "Proposal to Dr. V. P. Dole, Director of the Methadone Maintenance Treatment Program, to Undertake "An Economic Analysis of the Methadone Maintenance Treatment Program", 1970.

CHAPTER 2

HISTORY OF PROGRAM

Starting with an experimental project in 1964, sponsored by the New York City Health Research Council and conducted by Drs. Vincent Dole and Marie Nyswander, methadone programs that maintain addicts have grown steadily in New York City, and since 1966 throughout the United States.[1] Table 1 demonstrates this rapid growth.[2]

The New York City Programs have undergone four stages of development: experimental (1964-68), moderate expansion (1968-70), rapid expansion (1971), and slow expansion (1972). Three stages of development have occurred outside New York City. initiation (1968), moderate expansion (1968-69), and rapid expansion (1969-72).

New York City Programs appear to have approached their maximum level[3], while growth continues outside of New York, presumably because of a later start there. Assuming that approximately 1/2 of all addicts reside outside New York City[4] and the ratio of potential methadone patients to addicts is approximately the same within and outside of New York City, the potential level of Methadone patients throughout the United States is approximately 60,000.

The estimate of potential patients depended upon a prior estimate of the number of addicts in a community. Two major problems exist in obtaining this latter estimate. It is not simple, from observation alone, to distinguish a non-addicted user from one who is addicted, and because heroin use is illegal, an estimate of the number of users must, of necessity, be very approximate.

TABLE 1

GROWTH IN METHADONE PROGRAMS

Date	New York City	United States
1964	6	6
1965	40	40
1966	200	200
1967	600	600
1968	1,139	n.a.
1969	1,744	n.a.
1970	3,485	n.a.
1971	21,000	30,000
1972	21,228	50,000

A heroin use is usually considered an "addict" if he displays physical symptoms such as sweating and cramps when he abstains from usage of the drug for a period of one to several days.[5] Thus, not every user should be counted as an addict, and it has been estimated that as few as 50% of the individuals who have used heroin during a year are addicted.[6]

From a policy viewpoint, it is important to distinguish between the heavy non-addicted user and the addicted user. An addicted user will presumably have a higher inelasticity of demand at relatively high prices and therefore will tend to respond to policies, such as law enforcement, which increase the price of available heroin, not by curtailing demand for heroin but by increasing criminal activities so as to obtain the funds to cover the higher prices.[7]

Several methods are currently employed for estimating the number of addicts in a community, based upon drug arrests, the percentage of prisoners who are addicted, and the number of recorded deaths from drug usage, but these methods yield widely varying estimates of addiction. For New York City, in 1972, estimates of heroin addiction, based upon what was reported to be a careful analysis, have ranged from 100,000 to 250,000, and for the United States, from 300,000 to 500,000.[8]

While it is generally held that heroin addiction has increased within the past 20 years[9], this apparent growth may be due more to better reporting of addiction than an actual increase of incidence. A valid estimate of the number of addicts would be helpful because it would aid in indicating the relative contribution methadone programs have made to the reduction of the heroin problem and in providing an upper limit to the possible expansion of future programs.

FOOTNOTES TO CHAPTER 2

1. Irving Leveson, "Drug Addiction: Some Evidence on Prevention and Deterrence, Urban Affairs Quarterly, 1972, p. 61.

2. This total does not include patients in private practice. It is estimated that there were approximately 4,000 patients in private practice in 1972.

3. J. Hornblass, "New Approaches to Drug Abuse Treatment in New York City", in Developments in the Field of Drug Abuse, Schenkman, 1975, p. 577.

4. Patricia Wald (ed.), Dealing With Drug Abuse, p. 4.

5. Delong, op. cit., p. 78.

6. Wald, op. cit., p. 5.

7. John Holohan, "The Economics of Heroin" in Wald (ed.) Dealing With Drug Abuse, p. 279.

8. Edward Brecher, Licit and Illicit Drugs, Little, Brown & Co., 1972, p. 62.

CHAPTER 3

PROGRAM DESCRIPTION

This chapter describes a typical New York City Methadone Program in terms of its admission, treatment, and discharge procedures.

Admissions

There are three phases in the admission procedure -- application, acceptance, and waiting.[1]

Patients apply for admission to a Beth Israel clinic by walking into a Methadone Intake Center during its hours of operation. At that time, a Basic Data form, appearing on the next page, is filled out with the assistance of an interviewer.

Applications are periodically reviewed by the staff. Applicants are accepted for immediate treatment, placed on a waiting list, or rejected, according to whether the patient meets current admission criteria. Since the initiation of the Program, there has been a gradual easing of restrictions for admission, as can be seen in Table I which contrasts admission criteria for the Beth Israel Program in 1965 and 1972.

When an applicant is accepted for admission and no clinic openings exist, he is placed on a waiting list with a first-in-first-out queue, except that a spouse of an applicant must be admitted with the applicant if both are addicted, and applicants from a particular location are given priority if the Program wishes to contain a drug "epidemic" in that location.

BASIC DATA FORM

SEX: 1. Male 2. Female

BIRTHDATE: _____

CLASSIFICATION: 1. Caucasian 2. Negro 3. Puerto Rican 4. Other

MARITAL STATUS: 1. Single 2. Married 3. Separated 4. Divorced 5. Widowed 6. Common-Law

EDUCATION: (last grade completed) 1. Elem. grades 1-4 2. Elem. grades 5-7 3. El. grade 8 4. Some H.S. 5. H.S. Grad 6. Some College 7. Coll. Grad. 8. Other

VOCATION: 1. Laborer 2. Semi-skilled 3. Skilled 4. Clerical 5. Professional 6. Sales 7. Other 8. None

WORK HISTORY: 1. Never Worked 2. Working Now. 3. Worked in past
If worked or working, longest job (months) _____
If worked but not now, months since last job _____

WELFARE: 1. On Now 2. On Previously 3. Never On

ADDICTION: Age when started using heroin daily: _____

LEGAL: Number of previous convictions: _____

TREATMENT: Number of times in hosp. or treatment center for addiction treatment, including detoxification. _____

MEDICAL COMPLICATIONS: 1. No 2. Yes (Specify) _____

ALCOHOL: 1. No problem 2. Had problem 3. Has problem.

OTHER DRUGS: 1. No problem 2. Barbituates 3. Amphetamines 4. Other

REFERRAL: 1. Voluntary 2. Involuntary

DISPOSITION: 1. Accepted, immediate treatment 2. Accepted, waiting list 3. Not accepted. 4. Accepted, waiting list

DATE ADMITTED: _____

PATIENT'S PROGRAM NUMBER _____

INITIAL CENSUS GROUP _____

TABLE 1

PROGRAM ADMISSION REQUIREMENTS

	1965[2]	1972
AGE: MINIMUM	21	18
YEARS OF ADDICTION: MINIMUM	2	1
PREVIOUS DRUG TREATMENTS: MINIMUM	2	0
RESIDENCE:	NYC	NYC
MEDICAL CONDITION:	GOOD	NONE
PSYCHOLOGICAL CONDITION:	NON-PSYCHOTIC	NONE
IN PATIENT TREATMENT: MINIMUM	6 MONTHS	NONE

The average waiting time in New York City has varied between approximately 6 months to 1 year from 1967 when a waiting list was first established, until the spring of 1973 at which time the Program had expanded sufficiently to accommodate all applicants who were accepted for admission.[1]

Discharges

A Discharge Record is prepared for each termination of a patient from the Methadone Program. An example of a Discharge Record appears on the following page. A clinic can stipulate as many as three reasons for the patient discharge, the first reason being the "principal reason for discharge". The reasons for discharge can be selected from among 19 codes which, for purposes of analysis, are grouped into six categories. The codes and their groups appear in Table 2.

Treatment

It is convenient to group treatment procedures into four basic divisions -- medication, counselling, surveillance, and maintenance.

Medication consists of "stabilizing doses" which are administered daily at the clinic, except for long-term patients who may be permitted to take home several days of medication.

Psychological, vocational, and legal counselling are provided for the patient.

Surveillance takes three forms. Urinalysis is used to check whether patients have recently taken heroin. To prevent diversion of methadone, treatment is initally confined to the hospital. Home dosages are minimal to prevent illegal diversion.

DISCHARGE RECORD

PROGRAM NUMBER: _____

SEX: 1. Male 2. Female

LAST CENSUS GROUP: _____

ADMISSION DATE: _____

ADMISSION NUMBER: _____

DISCHARGE DATE: _____

TIME BETWEEN ADMISSION AND DISCHARGE:

Days: _____ (if less than month)

Months: _____ (the nearest whole number of months)

REASON FOR DISCHARGE (CODE):

1. _____

2. _____

3. _____

TABLE 2

A. DISCHARGE REASONS

CODE	REASON	CODE	REASON
1	UNCOOPERATIVE BEHAVIOR	10	DRUG ABUSE, NON-HEROIN
2	ANTISOCIAL BEHAVIOR	11	ARREST
3	SEVERE PSYCHOTPATHOLOGY	12	ADMINISTRATIVE REASONS
4	DRUG ABUSE, NARCOTIC AND/ OR NON-NARCOTIC	13	LOST TO CONTACT
		14	TRANSFERRED TO NON-DATA UNIT
5	ALCOHOL PROBLEM	15	RELOCATED OUT OF NEW YORK CITY
6	MEDICAL DISABILITY	16	DRUG ABUSE UNDEFINED
7	DEATH	17	CONVICTION
8	VOLUNTARY	18	BARBITUATE ABUSE
9	DRUG ABUSE, HEROIN	19	CLINIC CLOSED

B. DISCHARGE CATEGORIES

CATEGORIES	CODES
DROPOUTS	8, 13
DRUG ABUSE	4, 5, 9, 10, 16, 18
BEHAVIOR	1, 2, 3
HEALTH	6, 7
ADMINISTRATION	12, 14, 15, 19

The treatment requires lifetime maintenance, because it is believed that abstinence from treatment will lead almost inevitably to recedivism.

Unit Director Reports

Each month, the Director of the clinic where the patient is located submits a form to the Methadone Information Center which, in effect, is a progress report on the patient. An example of a Unit Director's Report form appears on the next page.

This form includes information on the patient's means of support, schooling, criminal and drug activity, behavior in the clinic, health, and housing. An analysis of the Unit Director Report appears in Chapter 6, where the quality of the data available for this thesis is discussed.

UNIT DIRECTOR'S REPORT

METHADONE REACTION:	1. No 2. Yes
MEDICAL PROBLEM:	1. No 2. Yes
BEHAVIOR PROBLEM:	0. None 1. Disruptive 2. Assaultive 3. Other 4. No information
SELF-ADMINISTERED DRUGS:	1. None 2. Herein 3. Amphetamine 4. Barbituate 5. Other 6. No information
ALCOHOL PROBLEM:	1. None 2. Acute Episode 3. Chronic 4. No information 6. Potential Problem 7. Improved
LEGAL STATUS:	1. No problem 2. Arrested 3. Convicted 4. On Probation 5. On parole 6. No information 8. Case pending
HOUSING:	1. Lives alone 2. With friends 3. Parents 4. Family 5. No information 6. In hospital
JOB:	1. None 2. On same job 3. New Job 4. Homemaker (women) 5. No information
MEANS OF SUPPORT:	1. Job 2. Welfare 3. Parents 4. Spouse 5. Friends 6. Other 7. No information 8. None other than Program
SCHOOL:	1. No 2. Part Time 3. Full Time

FOOTNOTES TO CHAPTER 3

1. Vincent Dole, "A Medical Treatment for Diacetylmorphine Addiction: A Clinical Trial with Methadone Hydrochloride" in Methadone Maintenance: Experiences and Issues, Behavioral Publications, 1973, p. 41.

2. Delong, op. cit., p. 205.

3. Hornblass, op. cit., p. 577.

CHAPTER 4

LITERATURE REVIEW

In this chapter, the major evaluation literature to date will be reviewed. The literature is mainly of two types:

. Patient Performance studies, in which patient performance is measured mainly by the following criteria: patient retention in a methadone program, increase in patient employment, and decrease in criminal activity.

. Cost Benefit Studies, in which a benefit-cost comparison is derived for a particular Methadone Program.

One important example of each of the above types of analysis is examined in detail.

Patient Performance Studies

Patient Performance Studies have mainly used three criteria to evaluate successful patient treatment. Programs are considered successful to the extent to which patients are retained in a methadone program, increase their legal employment, and reduce their criminal activity.

In its analysis of patient performance studies, this thesis will mainly focus on the "Gearing Reports" for two major reasons. The Reports constitute the "official evaluation of New York City Methadone Programs. The Methadone Program's expansion in New York can be attributed partially to the recommendations contained in these Reports.[2] Second, the Gearing Reports utilise the same patient data as was available for this thesis.

Gearing Reports

A description of the Gearing Reports appears in Appendix A. In this section, some strengths and criticisms of the Reports are enumerated.

Strengths

The Gearing Report relates retention rate and reason for discharge from the Program to demographic variables such as age, sex, and ethnicity, providing some indication of which variables are significantly related to patient performance.

The Report compares employment rates and arrest rates prior to entry into the Program with those following admission to the Program, providing an indication of patient progress in the Program.

Finally, the Report contrasts the patients in the Program with those in a detoxification program to indicate the relative gain in performance from the Methadone Program.

Criticisms

The first criticism of the Gearing Report is that it utilizes multivariate statistical methods in its analysis of methadone patient performance. Univariate methods can yield very misleading results, as is illustrated by the example in Table 1 from a sample of 1000 methadone patients.

While the simple correlations suggest that years of addiction are positively related to program retention, this finding can be interpreted as a combined result of the high correlation of years of addiction with age and the high correlation of age with program retention. When age, along with other variables, are held constant, years of addiction is found to be negatively correlated to program retention. The negative partial correlation of years of addiction with program retention is, moreover, in the direction which is to be expected of these variables, since years of addiction, holding other variables constant, should imply a greater inclination of an individual to remain an addict despite the

TABLE 1

CORRELATIONS BETWEEN
AGE, YEARS OF ADDICTION, AND RETENTION

	YEARS OF ADDICTION	PATIENT AGE
SIMPLE CORRELATION WITH RETENTION	.005	.056
PARTIAL CORRELATION WITH RETENTION	-.059	.115
SIMPLE CORRELATION OF ADDICTION YEARS AND AGE	.850	

costs involved in this activity. On a univariate level, the contrary relation was exhibited between years of addiction and program retention, apparently because the simple correlation is more reflective of the patient's age than his years of addiction.

The findings from this same sample of patients similarly indicate that other patient variables correlated with age, such as number of previous convictions and number of previous treatments, exhibit a more positive simple than partial correlation with program retention, again presumably because of the implicit effect of age on the simple correlation results.

A second advantage of multivariate analysis, within the regression structure, is that it provides an estimate of the variance associated with a characteristic's effect. "T-ratios" can then be used to indicate the probability that the estimated coefficient could have been obtained by chance from a population in which the true coefficient was zero.

A third advantage of multivariate regression is that it computes the R^2 statistic. The R^2 value offers a further reason for utilising multivariate analysis, since unlike the univariate analysis of methadone programs, an estimate is now available to indicate what proportion of the total variation in treatment performance can be explained by the patient background characteristics.

A second criticism of the Gearing Reports is that it fails to describe the limitations of the data base from which it derives its evaluation of the Program. The reader is referred to Chapter 6 for comments on the limiations of this data base.

A third criticism of the Gearing Report is its choice of performance criteria. The Report utilises retention rate as a major patient performance criterion, and employment and arrest rates as the other two important performance criteria.

The retention variable has several limiations as an indicator of patient performance.

Retention is an input to rehabilitation rather than an output. Because of the costs associated with retention, retention should be minimised rather than maximised.

Retention can serve as a proxy for Program benefits to the extent to which retention is correlated with these benefits, such as reduction in crime and increase in employment. As indicated in Chapter 7, the correlation between retention and these performance measures is of relatively small magnitude.

Lifetime retention is claimed to be warranted on the controversial assumption that when a patient withdraws from methadone maintenance, he will return to heroin addiction.

Retention of patients is dependent both upon the criterion used for discharge and the degree to which this criteria is enforced. Because of the diversity among clinics both of criteria used for retention and the strictness of application of these criteria, patient retention will indicate different correlations with other benefits across clinics.

A cross-section retention rate can be very misleading, especially when the Program is undergoing rapid growth, since the latter would bias the retention rate upwards.

To measure the change in employment following admission to the Program, Gearing uses as a data measure the percentage of those currently in the Program who are employed compared with the percentage who were employed at admission.

This data measure gives a biased view in favor of an increase in employment. For example, if 80% of those retained are employed while 70% of the patients admitted are retained, then only 70% of 80% or 56% of the original patients are employed, rather than the 80% reported.

Some of the patient jobs are created by the Methadone Program itself[3], while other jobs are offered to patients because organizations, such as the "Off-Track-Betting-Corporation", view themselves as performing a "public service" by employing ex-addicts[4]. It would be inappropriate to compare individuals obtaining jobs under these conditions with those who have to seek employment without having these special services available to them.

Vocational counseling also provides special assistance to patients which is not available to others[5].

Data indicating a change in crime rates for individuals following their admission to the Methadone Program use, as a measure, the average number of arrests per person after being admitted to the Program compared with the average number of arrests prior to Program admission.

This data measures arrests, not crimes. There could have been a reduction in arrests without a reduction in crimes due to a greater

efficiency at which crimes are being perpetrated, now that the debilitating effects of addiction no longer exist, and the reluctance of law enforcement officials to arrest suspects who are methadone patients because the arrests will interfere with treatment.[6]

Arrests may also not be highly correlated with convictions.[7] Yet, it is convictions which measure evidence of crime while arrests only measure suspicion of crime.

Analogous to employment rates figures cited in the previous section, the arrest rate statistics are based upon the percent of those remaining in the Program. Thus, an average decrease of 20% in the crime rate, as reported, would be only among those remaining in the Program and not of all patients who have been admitted.

As was pointed out in the previous section dealing with employment, the period under study was one which had a relatively low level of aggregate unemployment. Under less favorable economic conditions, the crime rate may not have had as great a decrease in magnitude.

Law enforcement officials claim that the decrease in crime rates during the period were mainly due to improved law enforcement techniques rather than drug treatment programs. This hypothesis should be investigated further.

Cost-Benefit Studies

Cost-benefit studies of Methadone Programs generally consist of an enumeration and measurement of individual Program costs and benefits, culminating in the development of a benefit-cost ratio. The value of the Program is determined by the magnitude of this ratio, which indicates the extent to which Program benefits exceed Program costs.

Leslie Report

A description of the Leslie Report appears in Appendix B. In this section, some strengths and criticisms of the Leslie Report are enumerated.

Among the strengths of the Report are the large variety of valuable data which has been collected enumerating Methadone Program benefits.

The analysis includes future as well as present benefits and costs, so as to provide an intertemporal cost-benefit analysis.

The Report also includes a comparison of the cost-benefit performance of the Methadone Program with that of eight other drug treatment modalities. Most Methadone Program evaluations do not include such a comparison.

The first criticism of the Leslie Report is that it fails to disaggregate patient populations. Leslie specifies a single, aggregate estimate for the HSA Methadone Program patient population, rather than a set of estimates related to individual patient subpopulations.

A single aggregate estimate does not indicate which patient subpopulations raise or lower the aggregate estimate. The aggregate benefit-cost ratio estimate could be considered impressive, but this figure could be comprised of widely varying benefit-cost ratios due to their differences in program retention rates. In that event, excluding the lower ranking populations from the program could considerably increase the aggregate benefit-cost ratio. The lower ranking subpopulations would go undetected if only an aggregate estimate were available, as in the Leslie Report.

The importance of refining cost-benefit estimates to the patient subpopulation level is corroborated by some recent studies in this area. Babst et al.[8] derived patient program retention estimates for a wide variety of patient subpopulations which were admitted to a group of New York City Methadone Programs. The retention estimates vary from a high of 95.8% for patients with 5 or less years of addiction and no multiple drug problems, to a low of 55.6% for patients with 7 or more previous convictions and no vocational skill. Thus, assuming benefits were approximately linearly related to program retention, then, for a given cost, the benefits can be expected to be almost twice as high for the former patient group considered by Babst than for the latter one.

A second criticism of the Leslie Report is that it fails to disaggregate program costs. The Leslie aggregate estimate does not indicate which services in the Methadone Programs yield relatively high benefit-cost ratios and which depress this ratio. For example, the dispensing of methadone could yield a high benefit relative to cost while the urinalysis component of the program could have a lower benefit than cost. In that event, elimination of the urinalysis component could substantially raise the aggregate benefit-cost ratio.

DeLong[9] has focused on the wide variation in the cost of programs which are associated with inclusion or omission of specific services. Methadone programs range from what he calls the "barebones" program, costing $500 per patient per year, to the "deluxe" program, costing $2,500 per patient per year. Yet, success rates of the "barebones" programs do not seem markedly lower than the "deluxe" programs. DeLong concludes, "Although one could easily find widespread agreement that ancillary

With reference to benefits from crime reduction, Leslie includes the amount by which crime is reduced as a benefit of the Program. However, from a theoretical vantage point, many economists view the theft itself as a transfer payment rather than a social cost. The real cost of crime, they contend, is the amount of resources input into criminal activity by both the perpetrators and victims. While direct measures of these resources are not available, limiting values can be obtained. The value of the goods stolen could be taken as an upper bound. If the market for stolen goods is competitive, the value of time and capital invested in crime would be approximated by the market value of the loss to victims.[11] The lower bound could be taken as the earnings of former addicts following rehabilitation. However, earnings following rehabilitation are likely to understate inputs into crime to the extent that once the pressure to feed a habit is gone, less labor is supplied, and to the extent that former addicts are discriminated against in the labor market.

Leslie assumes that once the need to buy heroin is gone, much of the crime required to support this habit would disappear. Leslie's estimate is 50%. However, since the former addict has acquired special skills to increase his income, it is questionable whether he will ignore these skills or is more likely to continue to use them to purchase other commodities than herein. The tendency of ex-addicts to continue to commit crime, moreover, would be expected to increase as the Program expands, since the patients who were most highly motivated to lead non-criminal lives would have been likely to be among the earlier recruited patients.[12] Thus, the marginal benefits in crime reduction would be expected to be below the average benefits.

services would be clearly desirable if they were free, one seldom finds any explicit analysis of the cost-benefit aspects of the issue."

As indicated in Chapter 8, a disaggregation of costs could imply that for certain patients, with relatively high costs, Program participation would not be justified on a benefit-cost basis even though the Program could be justified on an overall basis.

The third criticism of the Leslie Report is its choice and measurement of benefits. These should be considered in addition to those qualifications mentioned earlier in connection with evaluation of the Gearing Report.

With reference to employment benefits, Leslie does not take into account either displacement or vacuum effects. Unless patients acquired jobs in which vacancies existed, the result would be to displace other individuals.[10] On the opposite side, the hired patients, if employed elsewhere, would have created a "vacuum" to be filled by others. Both opposing effects were not taken into account.

The "Program" effect is also not taken into consideration. If employers restricted hiring of some workers to those in the Methadone Program and these workers were consequently paid more than the value of their marginal product, private benefits would exceed social benefits and there would be overinvestment from a societal viewpoint.

Since many patients were among the disadvantaged, the favorable economic conditions in the years in which earnings were tabulated could have biased upwards the gain in earnings attributable to the program treatment. This factor was not taken into account by Leslie.

Leslie fails to distinguish private from social benefits and costs. He lists the social benefits and costs of the Methadone Program, but does not include their private counterparts. However, the latter are important to determine whether patients should have external inducements to participate at a level other than at their private demand.[13]

Below appear a comparison of some of the social and private benefits and costs of the program:

BENEFITS

SOCIAL	PRIVATE
1. Increases in earnings of patients gross of taxes.	1. Increase in earnings of patients net of taxes.
2. Reduction in transfer costs . unemployment operation . employment service . welfare operation	
3. Reduced crime-related costs . crime . crime-control	

COSTS

1. Gross opportunity costs	1. Net opportunity costs.
2. Program operating and capital costs.	2. Loss of transfer payments
3. Displacement effect	3. Costs related to Program participation, such as transportation

The above indicates the wide disparity between social and private costs. The benefits from crime reduction and the costs of treatment are social but not private items, while taxes and transfer items have private but not social effects.

In addition to not disaggregating costs, several non-treatment costs were not included in Leslie's analysis.

Costs of preventing sale of illegal methadone were omitted. The Federal Drug Administration and other government agencies spend considerable sums in attempting to prevent illegal sales of methadone.[4]

External diseconomies to the neighborhoods in which clinics are located were not included. These costs, consisting mainly of patient noise, theft, vandalism, and generation of fear, have recently gained considerable attention.[15] It is thought of as an important cost by the affected neighborhoods and should be taken into account in a cost-benefit study of methadone programs.

Side effects of methadone, causing discomfort to patients, are not mentioned. These allegedly include constipation, diminution of sexual drive, and possibly reduction in life expectancy.[16]

Transportation and time costs to patients are omitted. The wages foregone by patients during treatment and other incidental costs of treatment should be included among non-treatment costs.

Inclusion of these costs could significantly lower the benefit-cost ratios derived for the Program.

FOOTNOTES TO CHAPTER 4

1. Frances Gearing, "Evaluation of Methadone Maintenance Treatment Programs" in Methadone Maintenance, Dekker, 1971, p. 171.

2. Richard Ashley, Heroin, The Myth and the Facts, St. Martin's Press, 1972, p. 191.

3. Ibid., p. 192.

4. "23 Former Heroin Addicts Work as Tellers in One OTB Bank", New York Times, December 14, 1971, p. 1.

5. DeLong, op. cit., p. 203.

6. Ashley, op. cit., p. 193.

7. Ibid., p. 193.

8. Dean Babst, "Characteristics of Patient Retention and Attrition", in Methadone, Experiences and Issues, p. 109.

9. DeLong, op. cit., p. 203.

10. Steve Barsby, Cost-Benefit Analysis and Manpower Programs, Lexington Books, 1972, p. 43.

11. Edwin Fujii, "Public Investment in the Rehabilitation of Heroin Addicts", Social Science Quarterly, June 1974, p. 41.

12. Ashley, op. cit., p. 194.

13. Davis and Morall, Evaluating Educational Investment, Lexington Books, 1974, p. 23.

14. "U.S. Plans to End Diversion of Methadone for Illict Use", New York Times, April 4, 1972, p. 16.

15. "Flatbush Pickets Call Methadone Clinic A Crime Breeder", New York Daily News, March 12, 1973, p. 2-B.

16. Ashley, op. cit., p. 195.

CHAPTER 5

PATIENT PERFORMANCE MODEL

This chapter describes a behavioral model for analysing patient retention in methadone treatment programs. Some implications of the model are stipulated in terms of a set of testable hypotheses.

The Patient Performance Model is structured within the framework of a household production function,[1] with a user of heroin assumed to obtain utility from three "commodities" related to the taking of heroin: "euphoria", "relief of withdrawal pain", and "relief of craving pain".

The quantities the individual obtains of these "commodities", in turn, are assumed to be dependent upon his utilization of four "market goods": heroin, methadone, non-opiate drugs, and methadone treatment.

The utility which a person receives for a given time period is assumed to be a function of the quantity obtained during that time period of euphoria (E), relief of drug withdrawal pain (W), relief of drug craving pain (C), and other commodities (Z)[2]. Euphoria is used here to represent all mood-transformations which the consumer seeks from taking a drug, other than W and C.

(1) $$U = f_o (E, W, C, Z)$$

E, W, C, and Z are assumed to be functions of the quantities of heroin (H), methadone (M), and non-opiate drugs (N) taken in a given time period; the number of days since H, M, and N were last taken (J); the current threshold (minimum required) dosages (*) for H, M, and N to produce E, W, and C (H^*_E, etc.); the quantity of treatment in a methadone

program (T), the consumer's own time in production (t); and environmental variables (V). H can be used to produce E, W, or C. N is assumed to be used to produce E but not W or C. M is assumed to be available in a form (non-injectable) which cannot produce E.[4] Any drug within one class of drugs (such as M, an opiate) is assumed capable of producing W or C for all drugs within that class (such as H).[5] M is distinguished according to whether it is obtained legally as part of T (M_L) or illegally (M_I). T is assumed to aid in producing Z.

(2) $$E = f_1 (H, N; M, H^*_E, N^*_E, M^*_E, V)$$

(3) $$W = f_2 (H, M; H^*_W, M^*_W, V)$$

(4) $$C = f_3 (H, M; H^*_C, M^*_C, V)$$

(5) $$Z = f_4 (T; V)$$

(6) $$M = M_I + M_L$$

The expenditures permitted by the full income of the individual (R) equals the sum of the market costs of the goods obtained and the opportunity costs of the time allocated in obtaining these goods.

(7) $$R = p_H H + p_H H + p_N N + p_T T + p_Z Z + wt_H + wt_M + wt_N + wt_T + wt_Z$$

Equilibrium is obtained when the ratio of the marginal utilities of any two commodities equal the ratio of their marginal shadow prices and the factors of production are optimally used.

The Utility Function is maximized subject to the constraints of the Production Functions and the full income constraint.

(8) $$L = u (E, W, C, Z) - (R - (p_1 x_1 + wt_1))$$

resulting in

$$(9) \qquad \frac{MU_i}{MU_j} = \frac{w\frac{t_i}{y_i} + p_i\frac{\partial x_i}{\partial y_i}}{w\frac{\partial t_j}{\partial y_j} + p_j\frac{\partial x_j}{\partial y_j}} = \frac{\pi_i}{\pi_j}$$

and

$$(10) \qquad \frac{\sum \frac{\partial u}{\partial y_i}\frac{\partial y_i}{\partial f_i}}{\sum \frac{\partial u}{\partial y_j}\frac{\partial y_j}{\partial f_j}} = \frac{pf_i}{pf_j}$$

The production functions relating "market goods" to "commodities" are given further structure in this section on the basis of drug characteristics such as thresholds, tolerance, addiction, detoxification, and recedivism.

Thresholds for H are assumed to be of increasing magnitude for C, W, E, and D, the latter being an overdose, resulting in sickness or death.[6] Thresholds for M are of increasing magnitude for C, W, and E.[7] The duration for which H produces E, W, or C is approximately 4 hours while for M and N the duration is approximately 24 hours.[9]

$$(11) \qquad H^*_D > H^*_E > H^*_W > H^*_C > 0$$

$$(12) \qquad M^*_D > M^*_W > M^*_C > 0$$

$$(13) \qquad N^*_E > 0$$

If J = the number of days addicted,

$$(14) \qquad \text{For } J > 1/6,\ (E_H(J))' = 0;\ (W_H(J))' = 0;\ (C_H(J))' = 0$$

$$(15) \qquad \text{For } J > 1,\ (E_N(J))' = 0;\ (W_N(J))' = 0;\ (C_N(J))' = 0.$$

Tolerance refers to an increase in the thresholds for E, W, C, and D which results from an approximately daily use of H and M at a level greater than the existing tolerance level for E.[9] A dosage between the

thresholds of W and E is known as a "stabilized dosage" since it does not induce E or tolerance, but does achieve W and C. The ability to determine a stabilized dose is greater for M than H.[10] It is assumed that an upper finite limit of tolerance exists for H to produce E, beyond which E cannot be produced.[11]

(16) Tolerance is defined by the conditions:

$$(E_{HH}^{*})' < 0;\ (W_{HH}^{*}) < 0;\ (C_{HH}^{*}) < 0$$

$$(E_{MM}^{*})' < 0;\ (W_{MM}^{*})' < 0;\ (C_{MM}^{*}) < 0$$

(17) A dosage is called stabilized if $H_E^{*}(J+1) = H_E^{*}(J)$

(18) H^S is a stabilized dose if $H_W^{*} < H < H_E^{*}$

(19) M^S is a stabilized dose if, for some $M^X > M_W^{*}$, $M_W^{*} < M < M_X^{*}$, $\exists\, U \ni$ if $H^X > U$, $E_H = 0$.

"Cross-tolerance" refers to the production of a tolerance for a drug within a class of drugs when another drug within that class is taken. The ratio of doses at which drugs are equipotent (same effect) is assumed to remain constant at different tolerance levels, with M and H exhibiting equipotent dosage ratios of 3:1.[12] Dosage levels of M at 80, 50, and 30 milligrams are, for the average addict, sufficient to produce respectively a tolerance to H higher than the quantity of H a user is likely to obtain, the amount of W desired by the user, and the amount of C desired by the user.

(20) H^k and M^k are called equipotent, $H^k = \phi(M^k)$ if $E_H^k = E_M^k$.

(21) If $H^k = \phi(M^k)$, then $W_H^k = W_M^k$ and $C_H^k = C_M^k$

(22) If $H^k = \phi(M^k) = aM^k$ and $M^U = \phi^{-1}(H_E^{*})$, then for $H^q < aM^U$, $E_{HM}^{*})' > 0$

(23) Correspondingly, $(W_{HM}^{*}) = 0$, and $(C_{HM}^{*})' = 0$

(24) For $H^k \geq aM^k$, $(E_{HM}^{k}U)' = (E_H^k)'$, $(W_{HM}^{k*})' = (W_H^k)'$ and $(C_{HM}^{k*})' = (C_H^k)'$

A user of H or M is respectively referred to as a "withdrawal addict" or a "craving addict" if he produces a substantial withdrawal pain or craving pain when he does not take the drug within approximately one day after the pain is first noticed by him.[14] The drug must be taken approximately at daily intervals for two weeks for the average person to develop a substantial withdrawal or craving addiction.[15]

(25) By definition, $x \in A_W$, the class of withdrawal addicts, if $(W_H)' \gg 0$ for $j > 1$

(26) $x \in A_W$ if $j = 1$ for 14 consecutive days

(27) $x \in A_C$, the class of craving addicts, if $W_C' \gg 0$ for $j > 1$.

Detoxification refers to a process whereby the thresholds for a drug are reduced to much lower levels. Detoxification for H can be obtained by repeated administration of an opiate at a level slightly lower than the previous threshold for W, creating constantly decreasing thresholds.[16] Detoxification for one opiate concurrently detoxifies an addict of all other opiates.[17]

It is assumed that craving pain for H (a tendency toward "recedivism") lasts throughout a person's life. A user of H and M, after detoxification, craves only H.[18]

(28) If $x \in A$ at t_0, then for all $t_1 > t_0$, $U(C) > 0$

The ability of an individual to attain other commodities is not affected by his use of H, M, or N unless he is undergoing withdrawal pain or craving pain or he is in a highly euphoric state.[19]

(29) If $U(W) = 0$, $U(C) = 0$, and $U(E) \gg 0$, then $\mathcal{M}_{U(Z),H} = 0$.

Discussion of the Model

Three major considerations have prompted the use of the household production function framework, rather than the classical consumer approach, in the development of this Behavioral Model.

Explicit specification of the final "commodities" which heroin users seek can significantly aid in predicting the demand for the "market good" heroin. For example, recognition that heroin is initially purchased for "euphoria" but later for "relief of withdrawal pain" helps to explain the decrease in price elasticity for heroin over time for a user of the drug. Similarly, the demand for "relief of craving pain", which occurs after a heroin user has been detoxified, leads to a prediction that the demand for heroin will reappear after the user has been detorified, even though he insists, during the detoxification process, that he will not exhibit any further demand for the drug.

The household production function framework aids in predicting the direction which drug and patient characteristics will have upon the demand for heroin, by formulating these characteristics as effects upon the costs of utilising the drug. For example, the drug characteristic of tolerance predicts an increase in the demand for methadone treatment over time, since the price of obtaining a given amount of euphoria or relief of withdrawal pain increases with tolerance, even though the price of a given amount of heroin remains constant. The characteristics associated with "age" leads to a prediction that demand for heroin decreases as age advances.

Time constraints play an important role in determining demand and should be explicitly considered. For example, the relatively higher opportunity costs of time of employed addicts helps to explain why employment should have a positive effect upon the demand for methadone treatment.

Research Hypotheses

Table 1 presents a summary of hypotheses related to the expected effects of patient background characteristics on treatment performance, as measured by four performance criteria. A fifth performance criteria - welfare status - is assumed to be strongly correlated with employment. The hypotheses related to welfare status will therefore correspond to those indicated for employment, with a "+" for welfare status signifying "not on welfare".

One hypothesis which could be tested is that age at admission is positively related to patient retention and crime, but not significantly related to employment or drug usage.

The acquisition of funds for heroin for most users involves participation in activities, such as thefts, which require a high degree of physical mobility. With advancing age, the efficiency, in terms of physical mobility, with which users are able to obtain funding for a given quantity of heroin will decrease, increasing the likelihood that an alternative to heroin use, such as methadone, will be sought. While experience can usually be expected to increase efficiency in activities, such as theft, heroin users have been found to be unusually myopic, not exhibiting any significant tendency to improve their techniques for acquisition of funds with increasing years of criminality.

TABLE 1

PATIENT PERFORMANCE HYPOTHESES
BASED UPON PATIENT BACKGROUND CHARACTERISTICS

DEMOGRAPHIC	"+" MEANING	DATA PRESENT	RETENTION (YES = +)	EMPLOYMENT (YES = +)	CRIME (NO = +)	DRUGS (NO = +)
AGE	OLDER	YES	+	o	+	o
SEX	MALE	YES	o	o	-	-
ETHNICITY	WHITE	YES	+	+	+	o
MARITAL STATUS	MARRIED	YES	o	+	o	o
SOCIOECONOMIC						
EDUCATION	COLL. GRAD	YES	o	o	o	o
VOCATION	SKILLED	YES	o	+	+	o
WORK STATUS	WORKED	YES	+	-	-	o
LONGEST JOB	MORE	YES	o	o	o	o
MONTHS NO WORK	MORE	YES	o	-	-	-
WELFARE STATUS	YES	YES	+	-	-	o
DRUGS & CRIME						
ADDICTION YEARS	MORE	YES	-	o	o	-
DRUG TREATMENTS	MORE	YES	-	o	o	-
MULTIPLE DRUGS	NO	YES	+	o	o	+
ALCOHOL PROBLEM	NO	YES	+	o	o	+
CONVICTIONS	MORE	YES	-	-	-	o
MISCELLANEOUS						
MEDICAL CONDITION	GOOD	YES	+	o	o	+
TRAVEL TIME	LESS	NO	+	o	o	o
OBJECTIVES	FAVORABLE	NO	+	+	+	+
PEER ATTITUDES	FAVORABLE	NO	+	+	+	+

The above association of the effects of age on heroin usage with the illegality of the drug is supported by three data sources. First, studies made in the 1880's, when opiate usage was legal in the United States, report an average age of narcotics users in Chicago of 39.7 years and in Iowa of 46.5 years.[20] Second, a recent study of physician addicts in the United States, a group which can allegedly gain access to narcotics in a manner which does not require a high degree of physical mobility, reports that these physicians, on the average, do not even initiate their usage of narcotics until they were over 30 years of age. Third, a relatively large number of alcoholics have been found to be former heroin addicts.[21] Since alcohol is legal and heroin is illegal, the lesser physical mobility required to obtain the former drug could well account for a shift of preference of drugs with an increase in age.

The hypothesis which could be tested regarding employment at admission to the Program is that employment at admission is positively related to program retention.

A heroin user's employment status can be taken as a measure of his market efficiency, the rate at which he can convert hours of work into money earnings. Hence, employment should be positively correlated with the benefits lost by having to engage in a time intensive activity such as raising funds for heroin, and the costs of incarceration if he is apprehended in the illegal funding or possession of the drug. Moreover, since the obtaining of illegal funds for heroin is highly time-intensive, a substitution of methadone for heroin will be induced by employment, conditioned by the utility which the individual receives from relief of withdrawal relative to the utility of acquiring euphoria from the taking of heroin.

Employment, on the other hand, should be negatively associated with treatment relative to illegal purchase of methadone to the extent to which treatment interferes with employment. The hypothesis claiming that employed drug users are more heavily influenced by the effects of actions upon their time than their unemployed counterparts is confirmed by administrators of methadone programs who fear that new regulations increasing the number of times which patients must report to the clinic per week for medication will have a relatively significant effect on retention in the methadone program of employed patients.

The hypothesis that could be tested regarding ethnicity is that blacks have lower retention rates than whites. Three reasons are presented for advancing this hypothesis.

Black addicts tend to use alcohol more readily than whites as a secondary drug. Dismissal because of alcohol may be strongly enforced by clinics because of the alleged harmful effects of combining usage of methadone and alcohol. In terms of the model, blacks are therefore relatively less efficient at utilising a given quantity of treatment, because of their greater preference for alcoholic usage. This explanation for differences in ethnic retention is strengthened by the Gearing Report which indicates that 30% of all blacks but only 16% of all whites were terminated for excessive usage of alcohol.[22] The hypothesis could be partially tested by examining whether holding constant patient alcoholic background would diminish the effect of ethnicity on program retention.

Staffing at predominately white clinics may be more efficient than staffing at predominately black clinics. Blacks therefore become less efficient at utilizing a given quantity of treatment because the quality of their treatment is inferior to whites.

Blacks drop out sooner than whites because they find it more difficult to gain employment after entering treatment. Their realized opportunity costs of remaining a heroin user are less than their anticipated opportunity costs, by a greater extent than for whites. This explanation for the lower black retention rate can be tested by comparing employment after entry into the program by ethnicity, and testing whether, holding employment constant after entry, the effect of ethnicity on retention is diminished.

Two hypotheses are presented as to why a user of non-opiate drugs has lower retention rates. First, they respond negatively to one of the requirements for remaining in treatment, which is abstinence from other drugs. Second, their objective may be primarily to avoid opiate withdrawal rather than to avoid euphoria, an objective which can be accomplished through the acquisition of "street" methadone without undergoing the time costs of treatment. One test of this latter hypothesis could be obtained from correlating poly-drug use with the probability of seeking methadone on the street.

FOOTNOTES TO CHAPTER 5

1. Gary Becker, Economic Theory, Knopf, 1971, p. 45.
2. DeLong, op. cit., p. 72.
3. Avram Goldstein, "Pharmacological Basis of Methadone Treatment" in Proceedings, Fourth National Methadone Conference, p. 28.
4. Ibid., p. 29.
5. Ibid., p. 28.
6. DeLong, op. cit., p. 81.
7. Ibid., p. 86.
8. Ibid., p. 86.
9. Goldstein, op. cit., p. 28.
10. DeLong, op. cit., p. 86.
11. Ibid., p. 85.
12. Ibid., p. 72.
13. Ibid., p. 78.
14. Goldstein, op. cit., p. 28.
15. Brecher, op. cit., p. 15.
16. DeLong, op. cit., p. 83.
17. Ibid., p. 83.
18. Brecher, op. cit., p. 71.
19. Ashley, op. cit., p. 156.
20. Brecher, op. cit., p. 18.
21. Ashley, op. cit., p. 193.
22. Gearing, op. cit., p. 181.

CHAPTER 6

THE DATA BASE

This chapter examines the Methadone Data Base which was provided by the Methadone Information Center at Rockefeller University for use in this thesis. The patient data was compiled from three sources: Basic Data Forms, Unit Director Reports, and Discharge Records. The data base variables are described and evaluated in terms of their relevance, completeness, and accuracy. Procedures are also enumerated for selecting from the original patient data base the sample and variables to be utilized in the empirical analysis.

Data File Description

The patient data base was obtained from the Methadone Information Center on two computer tape files, an Admission File and a Discharge File.

An Admission File contains one record for each of 22,310 patients who were admitted to New York City Methadone Programs through June 1972. This file contains information from each patient's Basic Data Form (Background Variables) and most recent Unit Director Report (Performance Variables), as well as a cumulative record of the date and clinic associated with each Program admission and discharge (Status Variables).

A Discharge File contains one record per discharge for 1,895 patients who have been discharged from the program (Discharge Variables).

The tape files are updated periodically at the Methadone Information Center. A file prepared during July 1972 was obtained for this study. Longitudinal data on patient performance, requiring Admission Files at several points in time, were not obtained for this thesis. The Status

Variables are exceptions to the absence of data over time -- a current Admission File contains information on the dates and clinics of each admission and discharge of a patient since his initial application to the Program.

In Table 1, a summary appears of the patient data obtained for this study. The coded values over which the variables range and their meanings appear on the patient forms included in Chapter 3.

Two of the Data Base Variables, "Age" and "Years of Addiction" are derived from the original data base variables by simple transformations. "Age" = "Admission Date" - "Birth Date", and "Years of Addiction" = "Admission Date" - "Age of Addiction Onset".

Several discharge reason codes indicate essentially the same discharge reason. The 16 original codes and the six categories which these codes were grouped into were listed in Chapter 3.

Data Quality

The quality of the data collected at the Methadone Information Center is evaluated in terms of its relevance, completeness, and accuracy.

Data Relevance

The performance variables available for this study were listed in Table 1. They may be categorized roughly as "positive" -- additions by patients to "social productivity"; and "negative" -- reductions in the allocation of resources to heroin addiction control.

The major data available to measure these two categories of benefits are patient employment rates and patient arrest rates. Patient retention in the Methadone Program and patient drug usage have also been used

TABLE 1

METHADONE PATIENT DATA BASE VARIABLES

I. BACKGROUND VARIABLES

A. DEMOGRAPHIC

1. SEX
2. AGE
3. ETHNICITY
4. MARITAL STATUS

B. SOCIOECONOMIC

1. EDUCATION
2. VOCATION
3. EMPLOYMENT
4. LONGEST JOB HELD
5. MONTHS OUT OF WORK
6. WELFARE

C. SOCIAL ADJUSTMENT

1. YEARS OF ADDICTION
2. NUMBER OF DRUG TREATMENT HOSPITALIZATIONS
3. OTHER DRUG USAGE
4. ALCOHOL USAGE
5. NUMBER OF CONVICTIONS

D. OTHER

1. MEDICAL

II. PERFORMANCE VARIABLES

A. STATUS

1. ADMISSION DATE
2. DISCHARGE DATE
3. ASSIGNED CLINIC
4. ADMISSION CLINIC

B. DISCHARGE

1. REASON
2. CLINIC

C. REPORT

1. EMPLOYMENT
2. SCHOOL
3. WELFARE
4. CRIME
5. DRUG
6. ALCOHOL
7. BEHAVIOR
8. MEDICAL
9. HOUSING
10. METHADONE REACTION
11. REPORT DATE
12. REPORT CLINIC

extensively to indicate benefits from Program participation. Conceptual difficulties in accepting these measures were discussed in Chapter 4 under criticisms of their use by Gearing and Leslie.

Data Completeness

A patient record is considered incomplete if either a variable for the patient has no entry or the code representing "no information" was entered for this variable.

Preliminary analysis of the patient Admission File led to the conclusion that some entire records of patients admitted to the Program may be missing from the obtained sample.

The first of the two methods utilized to obtain an estimate of the number of missing admission records was based upon the manner in which patient program numbers are sequenced. A patient is assigned a five digit number from 01000 to 999999, the first three digits indicating the sequence group in which he is placed and the last two digits the number of patients assigned to this sequence group. Thus, if patient program numbers 20231 and 20233 were included in the patient data base but 20232 were not included, the record for "20232" would be assumed missing. However, if 20300 followed 20232, then 20231 would be assumed to be the final entry. Using this procedure, the total number of patients estimated to be missing were 1582.

A second method used to estimate missing admission records was to find discharge records for which there were no corresponding admission records. This method revealed 58 discharge records with no corresponding admission records. Of the 58 discharge records, 52 were from sequences

of records, from 32087-32142 and 33003-33088. From the sequencing method, it could be assumed that patient records 32060 to 32142 and 33000 to 33088 were missing, comprising 237 patients. The remaining 6 discharge records involved isolated missing program numbers. It could thus be estimated from the discharge records that a total of 243 admission records were missing.

By either of the above estimation methods, less than 10% of the total number of patient admission records would be estimated to be missing. It was therefore assumed that the available patient records were representative of the total records of patients who were admitted to the program.

Table 2 lists the usable, missing, non-response, and miscellaneous non-usable data for each of the variables in the original sample.

There is only one variable for which no data is missing — the sex of the patient. This occurs because it is part of the data which is called in by the intake clinic on the same day on which the patient is admitted, while the remaining background and performance data is sent periodically by the clinic.

Of the other variables, only age is significantly different from the others. The remaining 14 variables are approximately equal, ranging from 14937-19086. However, there is considerable variation in the usable data for these variables, because of the variation in the no-information entries.

The Status Variables indicate the dates and location of treatment. The dates of admission and discharge were used to determine the retention status of the patient and his length of stay in the Program.

TABLE 2

ANALYSIS OF DATA COMPLETENESS

PATIENT CHARACTERISTIC	USABLE DATA	MISSING DATA	NO INFORMATION	MISCELLANEOUS NONUSABLE
BACKGROUND				
SEX	22316	0	0	0
ETHNICITY	7319	14937	52	2
AGE	20270	1941	72	27
MARITAL STATUS	7292	14937	80	1
EDUCATION	7037	14939	98	236
VOCATION	6043	14947	143	1177
EMPLOYMENT	7092	14974	235	9
LONGEST JOB	5591	14937	1781	6
MONTHS OUT OF WORK	4129	14943	3236	3
WELFARE	6398	14958	949	5
YEARS OF ADDICTION	7184	14936	143	36
DRUG TREATMENTS	7143	14938	228	1
OTHER DRUG USAGE	6998	14944	276	98
ALCOHOL	6897	14943	464	7
CONVICTIONS	7273	14939	98	4
MEDICAL	7051	14986	259	4
PERFORMANCE				
ADMISSION DATE	22309	1	0	0
ASSIGNED CLINIC	22277	33	0	0
ADMISSION CLINIC	15966	6344	0	0
DISCHARGE CLINIC	5698	41	6	2
REPORT DATE	10523	11787	0	0
REPORT CLINIC	10523	11787	0	0
EMPLOYMENT STATUS	9349	11966	995	0
SCHOOL STATUS	9276	11973	1060	1
WELFARE STATUS	9398	11951	961	0
DRUG PROBLEM	9355	11955	1000	0
ALCOHOL PROBLEM	9378	11948	982	2
CRIME PROBLEM	9300	11964	1046	0
BEHAVIORAL PROBLEM	9450	11947	913	0
MEDICAL PROBLEM	9411	11978	921	0
RETENTION STATUS	22309	1	0	0
DISCHARGE REASON				
DRUGS	234	*	*	*
CRIME	269	*	*	*
BEHAVIOR	294	*	*	*
MEDICAL	141	*	*	*
VOLUNTARY	829	*	*	*

Only one patient did not have any admission date entry. The number of missing "intermediate" attendance records was determined by counting the number of gaps in attendance records, e.g. the presence of a second admission date but the absence of a first discharge date. Of the 1,152 patients who were admitted twice to the Program, 8 had attendance gaps in their records. However, no way could be found to distinguish between a "final" missing attendance entry (one not followed by a subsequent entry) and the lack of change in the status of the patient from the previous entry. Therefore, the number of missing entries is uncertain for the first discharge date and subsequent admissions and discharges.

Table 2 shows that 99% of all assigned clinic entries are present, but only 72% of the patients have an entry for the clinic where the patient was admitted. Analysis of the patients with both assigned clinic and admission clinic entries present indicates that 80% of all patients were admitted to the same clinic to which they were assigned. As a result, it was assumed that for missing admission clinic entries, the assigned clinic corresponded to the admission clinic.

Almost all Report Variables had the same number of missing entries, 11948-11973, except for the Report Date and Report Clinic, which had a slightly lower number, 11787. About 200 patients, thus, had only the latter two entries. There is less variation in the no-information entries for the Report Variables than the Background Variables.

Discharge Records were obtained for 1,895 patients. Of these, 63 records were found to have no corresponding admission records, leaving 1,832 discharge records which could be used for statistical analysis.

The original sample indicated that 5,748 patients had been discharged at least once. Therefore, approximately 67% of the patients who had been recorded as discharged at least once did not have a discharge record available for this study.

All data on Discharge Records except for Discharge Reason and Discharge Number were duplicates of information on the patient's Admission Record. Each Discharge Record contained up to three Discharge Reasons, the first being the Principal Discharge Reason, and a Discharge Number, the number of times a patient had been discharged from the Program. If more than one record were available for a patient, the latest available Discharge Record was selected for analysis. The Principal Discharge Reason was the only reason for discharge used in this study.

From Table 2, it can be seen that the number of "no information" entries varies considerably among Background Variables, although only "Longest Job", "Months Out of Work","Welfare", and "Alcohol" have "no information" for over 2% of its entries. Approximately 1,000 of the 22,310 records contains complete sets of Performance Variables containing "no information" entries. There is a small variation from this amount among individual Performance Variables. None of the Status Variables or Discharge Variables contain "no information" entries.

Data Accuracy

Very few impossible codes were found (less than 25 for any variable). A small number of responses seemed very unlikely to be accurate. These are listed in Table 3.

TABLE 3

IMPOSSIBLE CODES

VARIABLE	NUMBER OF ENTRIES	CODE
AGE	8	LESS THAN 13 YEARS
DRUG TREATMENTS	2	MORE THAN 50 (61, 197)
MONTHS OUT OF WORK	3	977, 990, 991
CONVICTIONS	2	MORE THAN 70 (91

Three variables contained codes which were believed to be too ambiguous to classify. These were "Education" -- Code 8 ("Other") and "Vocation" -- Code 7 ("Other"). Patients coded "Other" for education and vocation cannot be distinguished on the basis of their educational attainment or vocational skill. These entries were therefore classified as "Miscellaneous Nonusable".

Usable Data Sets

The three criteria for measuring data quality -- relevance, completeness, and accuracy -- formed a basis for the selection of "usable" data sets. Twelve data sets are defined in this section, for consideration in the subsequent empirical analysis.

Of the toal 22,410 patients in the original sample data set (Set 1), all but one patient had a retention status entry (Set 2). All patients were found to have at least one background variable present, "sex" and "age" (Set 3). However, less than 7300 patients had three common background variables present, "sex", "age", and "ethnicity" (Set 4), and only 2,695 had complete data on all 16 background variables (Set 5). This latter number, however, more than doubles in size to 5,454 (Set 6) with the exclusion of only 3 of the 16 background variables: "months-out-of-work", "longest-job-held", and "welfare background".

Of the status performance variables other than retention, only "employment status" has a large usable sample (Set 7). Of the 5,454 patients in Set 6, 3,495 also had information on employment status (Set 8).

Usable data regarding discharged patients falls into two categories: those who were discharged at some time from the Program but may or may not be presently in the Program (indicated by "a" in the table below) and those patients which are not presently retained in the Program (indicated by "b" in the table).

Of the 5,738 (b. 4,868) patients who have been discharged (Set 9), 1,832 (b. 1,386) had a recorded discharge reason (Set 10). In the latter set, 728 (b. 492) also had 13 background variables present (Set 11) and 153 (b. 26) had an "employment status" entry present as well (Set 12).

The pertinent data sets appear in Table 4.

Selection of Sample Data Sets

The following criteria were used to select the basic data observations and variables: presence of usable data, distribution of data, and relevance of data.

As indicated earlier in this chapter, there is an extensive amount of data which is deficient in meet the data quality criteria, especially in the area of missing data.

To specify a data set which contains a substantial amount of usable data, tests were conducted to discover the major determinants of missing data. The only significant determinant of missing data which could be ascertained was "Year of Admission to the Program".

Table 5 indicates the results of arranging the data according to "Year of Admission to the Program", with "ethnicity" data present used as the criterion of usable data, a proxy for the 13 background variables.

Table 6 illustrates that the presence of a discharge reason for discharged patients was also significantly related to "Year of Admission to the Program".

TABLE 4

DATA SETS

SET	DESCRIPTION		SIZE
1	Original Data Set; at least 1 B.V. present		22,310
2	Retention status present		22,309
3	2 B.V. and Retention present		20,270
4	3 B.V. and Retention present		7,222
5	All (16) B.V. and Retention present		2,695
6	13 B.V. and Retention present		5,454
7	Employment Status and Retention present		9,348
8	13 B.V., Employment, and Retention present		3,495
9	Discharged patients	a. 5,778	b. 4,868
10	Discharge Reason present	a. 1,831	b. 1,386
11	13 B.V. and Discharge Reason present	a. 728	b. 492
12	13 B.V., D.R., and Employment present	a. 153	b. 26

TABLE 5

USABLE BACKGROUND DATA
BY YEAR OF ADMISSION TO PROGRAM

YEAR	ENTRIES	PCT. USABLE
1964	6	33.3
1965	92	58.7
1966	249	79.5
1967	428	77.8
1968	542	71.0
1969	1201	70.3
1970	2700	57.6
1971	11878	33.6
1972	5213	0.2

TABLE 6

USABLE DISCHARGE REASON DATA
BY YEAR OF ADMISSION TO PROGRAM

YEAR	ENTRIES	PCT. USABLE
1964	0	100.0
1965	49	96.0
1966	92	96.2
1967	158	94.4
1968	195	89.2
1969	384	84.6
1970	810	55.0
1971	2851	15.6
1972	451	0.8

In the latter two years of the Program, 1971-72, only 22.3% of the patients admitted had usable background data and only 12.7% of the patients discharged had a suitable discharge reason. On the other hand, in the middle years of the Program, 1966-69, 73.4% of the admitted patients and 87.6% of the discharged patients had usable data.

The distribution characteristics of the variables were examined to determine if the variance of the variable distribution is too small for the variable to be useful in the analysis. Table 7 contains the distributions of the background, performance, and discharge variables.

The following variables have a highly skewed distribution (2% or less of the observations being other than one particular value): "Medical Problem" -- 1.4%, and "Methadone Reaction" -- 0.0%.

Except for the employment status variable, which indicates past as well as present employment, it is believed that the Discharge Reason is a preferable measure of patient performance to the corresponding Status Variable. The fact that the behavior led to discharge rather than just being reported meant the behavior was to the degree necessary to warrant this extreme action. The Discharge Reason, unlike most Status Variables, reflects a cumulative rather than a one-time presence of a patient performance problem.

The basic data set to be used in the regression studies was obtained by purging from the original data set those variables and observations which failed to meet the selection criteria.

TABLE 7

DISTRIBUTION CHARACTERISTICS
BACKGROUND AND PERFORMANCE VARIABLES

BACKGROUND		
SEX	PCT. MALE	76.1%
ETHNICITY	PCT. BLACK OR PUERTO RICAN	47.2%
AGE	MEAN YEARS	30.6
MARITAL BACKGROUND	PCT. MARRIED	20.2%
EDUCATION	PCT. HIGH SCHOOL GRADUATE	25.4%
VOCATION	PCT. UNSKILLED	38.8%
EMPLOYMENT	PCT. EMPLOYED AT ADMISSION	17.3%
LONGEST JOB	MEAN MONTHS	23.1
MONTHS NO WORK	MEAN MONTHS	36.4
WELFARE	PCT. WELFARE AT ADMISSION	60.9%
ADDICTION YEARS	MEAN YEARS	10.8
DRUG TREATMENTS	MEAN NUMBER	2.7
OTHER DRUGS	PCT. OTHER DRUGS AT ADMISSION	63.2%
ALCOHOL BACKGROUND	PCT. ALCOHOL PROBLEM AT ADMISSION	15.3%
CONVICTIONS	MEAN NUMBER PRIOR TO ADMISSION	3.9
MEDICAL	PCT. POOR MEDICAL CONDITION	39.1%
PERFORMANCE		
EMPLOYMENT STATUS	PCT. WORKING	56.6%
WELFARE STATUS	PCT. ON WELFARE	40.6%
DRUG PROBLEM	PCT. USING OTHER DRUGS OR HEROIN	10.6%
ALCOHOL PROBLEM	PCT. ALCOHOL PROBLEM	5.4%
CRIME PROBLEM	PCT. LEGAL PROBLEM	6.1%
BEHAVIORAL PROBLEM	PCT. BEHAVIORAL PROBLEM	2.4%
MEDICAL PROBLEM	PCT. MEDICAL CONDITION	1.4%
HOUSING PROBLEM	PCT. LIVING ALONE	2.1%
METHADONE REACTION	PCT. REACTION TO METHADONE	0.0%
SCHOOL STATUS	PCT. IN SCHOOL	3.6%

Because of the very limited amount of background data for 1964, 1965, and 1972, it was decided to include only years 1966-1971 in further studies.

Three of the sixteen background variables, months-out-of-work, longest-job-held, and welfare background were excluded because they exhibited a large amount of non-usable entries.

The following performance variables were included: retention-in-program, employment status, and discharge for criminal activity.

There were no background or performance variables excluded because of the distribution of the variable data.

Of the original 22,310 observations, 16 background variables, and 19 performance variables, retained for use in the empirical analysis were a total of 5,408 observations, 13 background variables, and 3 performance variables.

An estimate of the bias introduced into the findings by omitting the missing data can be made from the table below, where differences in patient retention in the program between usable and all patient observations is used as an indication of the bias present by omitting the non-usable set of observations.

The differences in retention rates between the usable data set and all patients is at most 3% when considered by year of admission, and only 2% on an overall basis.

TABLE 8

BIAS IN SAMPLE RESULTS

YEAR	PCT. RETAINED ENTIRE SAMPLE	PCT. RETAINED USABLE SAMPLE
1966	.63	.66
1967	.63	.66
1968	.64	.65
1969	.68	.72
1970	.71	.72
1971	.76	.73
66-71	.74	.72

FOOTNOTES TO CHAPTER 6

1. Warner, op. cit., p. 124.

CHAPTER 7

FINDINGS

This chapter describes the major findings of this study related to program performance and comments on their implications.

Regression findings are based upon the basic sample data sets which were selected in Chapter 6 in accordance with the criteria adopted in that chapter. The sample contains data during 1966-1971 for each of 13 of the 16 patient background variables which were available for this study.

Table 1 lists the codings for the regression runs for each of the 13 selected background variables, the variable "Year-of-entry-into-program", and the three performance variables -- "Retention in the program", "Discharge for crime", and "Employment status".

The next four tables contain a summary of the regression results. Table 2 lists the means and correlation coefficients for the data sets associated with each of the three performance criteria. Table 3 indicates the correlation coefficients associated with the three performance variables. Table 4 presents a classification of the 16 regression runs. Table 5 indicates the regression coefficients obtained for these runs.

The following major conclusions were obtained from the regression results.

Several background variables were found to affect patient peformance significantly, varying from four in the case of retention to ten in the case of employment.

TABLE 1

VARIABLE DEFINITIONS

VARIABLE	CODE	DEFINITION
SEX	SEX	MALE = 1
ETHNICITY-WHITE	ETW	WHITE = 1
ETHNICITY-PUERTO RICO	ETP	P.R. = 1
AGE	AGE	YEARS
MARITAL STATUS	MAR	MARRIED = 1
EDUCATION	EDU	GRADE
VOCATION	VOC	SKILLED = 1
EMPLOYMENT	EMP	EMPLOYED = 1
ADDICTION YEARS	ADY	YEARS
DRUG TREATMENTS	DGT	TREATMENTS
OTHER DRUG USAGE	DGU	NONE = 1
ALCOHOLIC BACKGROUND	ALC	NONE = 1
CONVICTIONS	LEG	CONVICTIONS
MEDICAL BACKGROUND	MED	NO PROBLEMS = 1
PROGRAM ENTRY YEAR	PRY	1964=1
RETENTION IN PROGRAM	RET	YES=1
DISCHARGE FOR CRIME	CRI	NO=1
EMPLOYMENT STATUS	EMP	EMPLOYED=1

TABLE 2

MEANS AND CORRELATION COEFFICIENTS

A. RETENTION

	u	SEX	ETW	ETP	AGE	MAR	EDU	VOC	EMP	DGU	DGT	ADY	ALC	LEG	MED	PRY	RET
SEX	.83	x	4	4	4	0	1	-7	16	2	2	9	0	7	8	-4	-1
ETW	.48	4	x	-46	-28	1	17	10	13	-10	-2	-22	11	-10	4	2	-2
ETP	.18	4	-46	x	6	1	-22	-13	-7	3	3	7	-1	2	3	4	4
AGE	29.1	4	-28	6	x	4	-22	-4	-2	5	27	83	-10	41	-9	-22	4
MAR	.24	0	1	1	4	x	2	8	14	1	-7	-1	1	-7	2	-5	3
EDU	.66	1	17	-22	-22	2	x	20	10	-3	0	-5	2	-11	2	3	-2
VOC	11.2	-7	10	-13	-4	8	20	x	9	-1	0	-10	-1	-8	-1	-7	-3
EMP	.29	16	13	-7	-2	14	10	9	x	2	-4	-5	3	-10	9	-8	4
DGU	.94	2	-10	3	5	1	-3	-1	2	x	-2	3	4	3	4	5	2
DGT	2.3	2	-2	3	27	-7	0	0	-4	-2	x	31	-8	23	-7	-29	-1
ADY	9.8	9	-22	7	83	-1	-5	-10	-5	3	31	x	-9	49	-9	-22	2
ALC	.96	0	11	-1	-10	1	-22	-1	3	4	-8	-9	x	-4	7	16	-5
LEG	3.3	7	-10	2	41	-7	-11	-8	-10	3	23	49	-4	x	-4	-13	-1
MED	.75	8	4	3	-9	2	2	-1	9	4	-7	-9	7	-4	x	7	1
PRY	7.3	-4	2	4	-22	-5	3	-7	-8	5	-29	-22	16	-13	7	x	2
RET	.72	-1	-2	4	4	3	-2	-3	4	2	-1	2	-5	-1	1	2	x
N	5408																

B. CRIME

	u	SEX	ETW	ETP	AGE	MAR	EDU	VOC	EMP	DGU	DGT	ADY	ALC	LEG	MED	PRY	CRI
SEX	.83	x	3	4	3	0	2	-7	16	1	2	8	0	6	7	-4	-3
ETW	.47	3	x	-47	-27	1	17	11	13	-11	-2	-21	10	-10	2	2	3
ETP	.19	4	-47	x	6	2	-22	-14	-6	3	3	7	-2	1	3	4	-1
AGE	29.4	3	-27	6	x	3	-23	-4	-3	5	26	82	-10	41	-10	-21	-1
MAR	.24	0	1	2	3	x	1	8	14	1	-7	-1	1	-8	2	-3	4
EDU	11.1	1	17	-22	-23	1	x	20	10	3	-5	-22	2	-11	1	2	-1
VOC	.65	-7	11	-14	-4	8	20	x	10	0	0	-10	-1	-9	-1	-9	1
EMP	.30	16	13	-6	-3	14	10	10	x	2	-6	-6	3	-10	9	-7	5
DGU	.94	1	-11	3	5	1	3	0	2	x	-3	3	4	3	3	6	1
DGT	2.4	2	-2	3	26	-7	-5	0	-6	-3	x	16	30	-7	23	-7	-4
ADY	10.1	8	-21	7	82	-1	-22	-10	-6	3	4	x	-9	48	-9	-22	-4
ALC	.96	0	10	-2	-10	1	2	-1	3	4	3	-9	x	-4	5	18	1
LEG	3.5	6	-10	1	41	-8	-11	-9	-10	3	3	48	-4	x	-3	-14	7
MED	.75	7	2	3	-10	2	1	-1	9	3	6	-9	5	-3	x	6	-1
PRY	7.2	-4	2	4	-21	-3	2	-9	-7	6	6	-22	18	-14	6	x	11
CRI	.97	-3	3	-1	-1	4	-1	1	5	1	1	-4	1	-7	-1	11	x
N	4236																

C. EMPLOYMENT

	u	SEX	ETW	ETP	AGE	MAR	EDU	VOC	EMP	DGU	DGT	ADY	ALC	LEG	MED	PRY	EMP
SEX	.83	x	5	2	5	-1	3	-6	17	0	1	8	-1	7	8	-5	9
ETW	.50	5	x	-45	-29	1	16	11	16	-10	-3	-22	10	-11	2	0	16
ETP	.17	2	-45	x	6	2	-21	-15	-8	1	3	7	2	3	3	5	-7
AGE	28.9	5	-29	6	x	3	-21	-6	-2	5	28	84	-9	-22	-9	42	-8
MAR	.25	-1	1	2	3	x	2	9	14	0	-9	-2	2	-6	1	-4	16
EDU	11.2	3	16	-21	-21	2	x	21	11	-4	-5	-19	2	-12	1	0	10
VOC	.67	-6	11	-15	-6	9	21	x	9	-2	0	-10	-1	-7	1	-9	11
EMP	.31	17	16	-8	-2	14	11	9	x	2	-5	-5	3	-11	8	-10	27
DGU	.95	0	-10	1	5	0	-4	-2	2	x	-2	3	4	3	3	6	3
DGT	2.2	1	-3	3	28	-9	-5	0	-5	-2	x	32	-6	23	-8	-32	-1
ADY	9.6	8	-22	7	84	-2	-19	-10	-5	3	32	x	-8	47	-8	-20	-9
ALC	.97	-1	10	2	-9	2	2	-1	3	4	-6	-8	x	-4	3	14	4
LEG	3.2	7	-11	3	42	-6	-12	-7	-11	3	23	47	-4	x	-3	-13	-7
MED	.77	8	2	3	-9	1	1	1	8	3	-8	-8	3	-3	x	4	7
PRY	7.3	-5	0	5	-22	-4	0	-9	-10	6	-32	-20	14	-13	4	x	-15
EMP	.52	9	16	-7	-8	16	10	11	27	3	-1	-9	4	-7	7	-15	x
N	4483																

TABLE 3

PERFORMANCE VARIABLES
CORRELATION COEFFICIENTS

	RET	CRI	EMI
RET	x	.27 (N = 18363)	.09 (N = 9348)
CRI	.27 (N = 18363)	x	.03 (N = 8177)
EMI	.09 (N = 9348)	.03 (N = 8177)	x

TABLE 4

DESCRIPTION OF REGRESSION RUNS

RUN NUMBER	DEPENDENT VARIABLE	BACKGROUND VARIABLES	PROGRAM YEAR AS VARIABLE PERMITTED	EMPLOYMENT BACKGROUND PERMITTED	PURPOSE OF RUN
1	RETENTION	13	NO	YES	SCREENING
2	"	4	"	"	SIGNIFICANCE
3	"	13	YES	"	SCREENING
4	"	4	"	"	SIGNIFICANCE
5	CRIME	13	NO	"	SCREENING
6	"	4	"	"	SIGNIFICANCE
7	"	13	YES	"	SCREENING
8	"	6	"	"	SIGNIFICANCE
9	EMPLOYMENT	13	NO	"	SCREENING
10	"	8	"	"	SIGNIFICANCE
11	"	13	YES	"	SCREENING
12	"	11	"	"	SIGNIFICANCE
13	"	12	NO	NO	SCREENING
14	"	10	"	"	SIGNIFICANCE
15	"	12	YES	"	SCREENING
16	"	11	"	"	SIGNIFICANCE

TABLE 5

REGRESSION FINDINGS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
SEX1	-.018		-.018		-.013*		-.011	.013*
ETHNIWH1	-.005		-.006		.010		.010	
ETHNIFR1	.033		.032		.003		.001	
AGE1	.003*	.002*	.003*	.003*	.001*	.001*	.001*	.001*
MARITAL1	.023		.025		.011	.013*	.012*	.013*
VOCATON1	-.024	-.026*	-.023		.000		.004	
EDUCATN1	-.003		-.003		-.002		-.002	
EMPLOYB1	.046*	.046*	.049*	.046*	.013*		.016*	.016*
DGUSGEB1	.025		.024		.006		.001	
DGTREAT1	-.001		.001		-.001		.000	
ADDYERS1	-.001		-.001		-.001	-.001*	-.001	
ALCOHLB1	.143*	.144*	.136*	.135*	.004		-.011	
LEGALFB1	-.001		-.001		-.002*	-.002*	-.002*	.002*
MEDPROB1	-.004		-.005		-.007		-.008	
PROGYER1			.009	.011*			.016*	.015*
CONSTANT	.534	.524	.472	.426	.077	.059	.869	.856
R^2	.011	.008	.011	.008	.013	.009	.025	.023

	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
SEX	.073*	.064*	.067*	.066*	.121*	.120*	.110*	.110*
ETHNIWH1	.096*	.110*	.094*	.097*	.127*	.125*	.123*	.121*
ETHNIFR1	-.003	.006	.005	.007	-.004	-.006	.005	.003
AGE1	.000		-.001		.002		.001	
MARITAL1	.142*	.140*	.135*	.135*	.172*	.174*	.160*	.161*
VOCATON1	.961*	.066*	.049*	.049*	.074*	.075*	.059*	.059*
EDUCATN1	.010*	.012*	.009*	.010*	.014*	.014*	.013*	.012*
EMPLOYB1	.233*	.235*	.218*	.219*				
DGUSGEB1	.082*	.081*	.101*	.010*	.097*	.099*	.117*	.118*
DGTREAT1	.007*		-.000	-.006*	.006*	.006*	-.002	
ADDYERS1	-.004		-.004		-.005*	-.003*	.005*	-.005*
ALCOHLB1	.042		.089*	.089*	.047		.100*	.100*
LEGALFB1	-.001		-.002		-.004*	.004*	-.004*	-.004*
MEDPROB1	.049*	.051*	.049*	.049*	.065	.064*	.064*	.065*
PROGYER1			-.066*	-.065*			-.075*	-.074
CONSTANT	.023	.008	.518	.487	-.087	-.001	.483	.486
R^2	.119	.115	.138	.138	.076	.077	.102	.102

Different variables significantly affect the three performance measures. For example, age affects retention but not employment, sex affects criminal discharge but not retention, and ethnicity affects employment but not retention or criminal discharge. Each of the 13 background variables affects at least one of the three performance measures. However, the number of variables affecting performance varies from a low of four, in the case of retention, to a high of ten, in the case of employment.

The lack of uniformity in significant variables among the performance measures complicates their usage as a guide to patient selection. Either a choice of a performance measure or a weighting of measures would be required.

The variables which were found to be significant for individual performance measures correspond to those anticipated. For example, it was expected that sex would be a more important determinant of criminal discharge rates than of overall discharge rates, and that ethnicity would play a greater role in employment than retention.

The coefficients of correlation between the performance measures are of relatively small magnitude. For example, the coefficient of correlation between employment and retention is .09. The data does not appear to support the hypothesis that in order to retain patients in the Program, it is necessary to provide jobs for them. Of the patients admitted to the Program, almost as great a percentage remained in the Program who were not employed while in the Program (85%) as the percentage who remained in the Program who were were employed while in the Program (91%).

Background variables much more strongly explain the variation in employment than criminal discharge or retention, and more strongly explain the variation in criminal discharge than retention (R^2 = .13, .02, and .01 respectively).

The hypothesis was explored that the relatively low R^2 for the aggregate retention equation could be explained by the diversity of reasons for patient discharge. From Table 6, it is clear that patient backgrounds of dischargees differ considerably, depending upon their reason for discharge.

In general, patients who were voluntarily discharged from the Program (drop-outs) are younger, more apt to be married, and more likely to be employed before Program admission than those who were involuntarily discharged (dismissals). This would suggest that drop-outs tend to leave because they are dissatisfied with the Program while dismissals leave because the Program is dissatisfied with them.

Of the patients who were dismissed, the background characteristics which stand out are those most closely associated with the reason for discharge, e.g., those dismissed for excessive usage of alcohol have more pronounced alcoholic backgrounds. Moreover, certain demographic characteristics also appear associated with specific reasons for discharge; males were dismissed relatively more often for crimes while females for non-opiate drug usage, and whites were dismissed relatively more often for non-opiate drug usage while blacks for excessive alcohol, etc.

The contrasting effects which background characteristics have for different discharge reasons would tend to obscure the significance of background characteristics as a determinant of discharge when discharged patients are analyzed on an aggregative basis.

TABLE 6

BACKGROUND CHARACTERISTICS
FOR SPECIFIED DISCHARGE REASONS

	BEHAVIOR	DRUGS	ALCOHOL	CRIME	HEALTH	VOLUNTARY	NO DATA	RETENTION
SEX: MALE PCT.	82	71	85	94	86	83	82	78
ETHNICITY: WHITE PCT.	44	64	17	39	37	41	54	49
AGE: YEARS	31	30	35	30	37	29	27	28
MARITAL: MARRIED PCT.	20	20	7	12	19	23	22	25
EMPLOYED: PCT.	22	19	5	19	13	29	28	30
DRUG USAGE: PCT.	8	18	11	10	14	8	6	6
ALCOHOL: PCT. PROBLEM	12	4	32	6	8	6	4	4
CONVICTIONS	6	5	7	6	9	3	3	3
MEDICAL: PCT. PROBLEM	31	24	49	24	41	27	24	27
PROGRAM YEAR: 1964=1	5.3	5.9	4.7	6.2	5.3	6.7	7.8	7.9
SAMPLE SIZE	294	234	55	269	141	829	3946	16531

It is possible to obtain almost as high an explanation of the variation in employment by omitting the obvious explanatory variable, employment at time of admission to the Program, as could be obtained by retaining this variable (R^2 = .13 vs. R^2 = .10).

The variable, year of entry into the Program, is a significant explanatory variable with all performance measures. As seen in Table 7, retention is heavily dependent upon the time elapsed since admission to the Program.

Table 8 indicates that the program year effect would tend to introduced biases into several background variables. For example, patients tend to be younger in later Program years, biasing the effect of age on retention upwards.

Table 9 demonstrates that reason for discharge is also correlated with year of admission. Thus, patient backgrounds, associated with reasons for discharge that are positively correlated with year of program, would tend to be negatively biased in their reported effect on retention.

The coefficient of correlation associated with the three performance measures varies between .01 for retention to .13 for employment, indicating that most of the variation is still unexplained. The unexplained variation could be due, among other factors, to omitted background variables more indicative of motivation to succeed in the Program, or of varition in clinic procedures which festered or discouraged employment and retention.

The considerable variation in patient performance depending upon patient background, which is implied by the regression results, is illustrated in Table 10 through a contrast of patients with low and high performance profiles, holding Year of Entry into the Program at 1969.

TABLE 7

RETENTION BY YEAR
OF PROGRAM ADMISSION

YEAR	RETENTION
1965	.58
1966	.63
1967	.63
1968	.64
1969	.68
1970	.71
1971	.76
1972	.92

TABLE 8

RETENTION FOR PROGRAM YEARS
BY BACKGROUND CHARACTERISTIC

	1966	1967	1968	1969	1970	1971	TREND
SEX-MALE	86	86	83	84	82	79	MORE FEMALE
ETH-WHITE	47	41	44	49	53	49	SAME WHITE
ETH-P.R.	15	16	12	13	15	20	MORE P.R.
AGE	32	33	33	33	30	28	YOUNGER
MARITAL	19	22	26	30	24	22	MORE MARRIED
EMPLOYMENT	30	23	23	42	34	25	MORE UNEMPLOYED
DRUGS	95	86	91	90	93	95	MORE DRUG FREE
ADDICT YEARS	12	13	14	13	11	9	LESS YEARS
ALCOHOL	84	75	92	95	96	97	LESS ALCOHOL
CONVICTIONS	4.6	5.3	5.5	4.7	3.9	3.8	LESS CONVICTIONS
MEDICAL	52	57	67	74	74	77	LESS MEDICAL
RETENTION	63	63	64	68	71	76	MORE RETAINED
N-TOTAL	249	428	542	1201	2700	11878	MORE ADMISSIONS

TABLE 9

DISCHARGE REASONS
BY PROGRAM YEAR

	1966	1967	1968	1969	1970	1971	TREND
BEHAVIOR	30	29	18	21	12	7	LESS DISRUPTION
DRUGS	8	11	15	13	13	4	LESS DRUGS
ALCOHOL	7	10	3	3	1	1	LESS ALCOHOL
CRIME	9	14	19	14	19	12	LESS CRIME
DEATH	11	11	10	6	4	3	LESS DEATHS
VOLUNTARY	29	22	32	40	49	72	MORE VOLUNTARY
N-TOTAL	104	153	174	325	445	451	MORE DISCHARGES

The data in Table 10 implies that a wide variation in patient performance, and especially in probability of employment, can be expected from patients who differ markedly with respect to patient background characteristics.

The regression findings in this chapter are limited by both the type of data available on patients and the quality of the data which was available. The patient variables utilized in the findings in this chapter may, in fact, be only proxies for other variables. For example, ethnicity could conceivably be a proxy for "hostility toward an administrative structure of a different ethnic background". If this were the case, then the implied policy would seem not to develop an admission policy which would give priority to whites over blacks because they perform better in the present program structure, but rather to adapt administrative structures to ethnic backgrounds.

The patient background characteristics which have been found to be significantly related to program retention may in fact be more indicative of the determinants of an addict applying for treatment than the determinants of his being retained in treatment. While a test of this hypothesis is limited by the information available on the addict not in treatment, data from the New York Narcotics Register tends to support this hypothesis by indicating a positive relation between characteristics which increase the probability of application for admission and characteristics which increase the probability of retention. In Table 11, increased age and white ethnicity, both of which were found to be associated significantly with program retention also appear to be significantly associated with program application.

TABLE 10

LOW AND HIGH PERFORMANCE PROFILES

A. RETENTION

	LOW RETENTION		HIGH RETENTION	
CHARACTERISTIC	VALUE	WEIGHT	VALUE	WEIGHT
AGE AT ADMISSION TO PROGRAM	20	.06	40	.12
EMPLOYMENT AT ADMISSION (YES=1)	NO	.00	YES	.05
ALCOHOLIC BACKGROUND (NO=1)	YES	.00	NO	.14
INTERCEPT		.45		.45
PROBABILITY OF RETENTION		.51		.76

B. CRIMINAL DISCHARGE

	HIGH CRIME		LOW CRIME	
CHARACTERISTIC	VALUE	WEIGHT	VALUE	WEIGHT
SEX (MALE=1)	MALE	-.01	FEMALE	.00
AGE AT ADMISSION TO PROGRAM	20	.02	40	.04
EMPLOYMENT AT ADMISSION (YES=1)	NO	.00	YES	.02
MARITAL STATUS (MARRIED=1)	UNMARRIED	.00	MARRIED	.01
CONVICTIONS BEFORE ADMISSION	20	-.02	0	.00
INTERCEPT		.90		.90
PROBABILITY OF NOT BEING CRIMINALLY DISCHARGED		.80		.92

C. EMPLOYMENT

CHARACTERISTIC	LOW EMPLOYMENT VALUE	WEIGHT	HIGH EMPLOYMENT VALUE	WEIGHT
SEX (MALE=1)	FEMALE	.00	MALE	.11
ETHNICITY (WHITE=1)	NONWHITE	.00	WHITE	.12
MARITAL STATUS (MARRIED = 1)	UNMARRIED	.00	MARRIED	.16
VOCATION (SKILLED=1)	UNSKILLED	.00	SKILLED	.06
EDUCATION (HIGHEST GRADE)	5	.05	12	.12
DRUG USAGE (NONE=1)	YES	.00	NO	.12
YEARS OF ADDICTION	10	-.05	0	.00
ALCOHOLIC BACKGROUND (NONE=1)	YES	.00	NO	.10
CONVICTIONS BEFORE ADMISSION	10	-.04	0	.00
MEDICAL PROBLEM (NONE=1)	YES	.00	NO	.06
INTERCEPT		.11		.11
PROBABILITY OF EMPLOYMENT		.07		.96

An additional limitation of the results is in the statistical techniques which were employed. It was assumed that the background variables were linearly related to the performance variables and that there was an absence of simulataneous effects.

CHAPTER 8

COST-BENEFIT ANALYSIS

In this chapter, a cost-benefit analysis is developed of the Methadone Maintenance Treatment Program, utilising a framework outlined in the first part of this chapter. The cost-benefit analysis in this study differs from those discussed in Chapter 4 mainly in that it is developed for patient subpopulations as well as for the entire Program.

The advantage of evaluating Methadone Program subpopulation performance within a cost-benefit structure can be illustrated by the patient characteristic "Age of admission to Program". In Chapter 7, it was indicated that older patients tend to be retained longer in treatment than their younger counterparts. On the basis of the retention performance criterion, older patients should therefore receive treatment priority. However, the benefits to be expected from successful treatment of a relatively younger patient are greater, since successful treatment of a younger patient averts a greater number of man-years of addiction. A cost-benefit analysis, unlike one restricted to treatment performance, will weigh the probability of a successful treatment against the benefits to be expected from successful treatment.

In this study, as in most other cost-benefit analyses, the policy objective is assumed to be to maximise social welfare, with income used as a measure of social welfare.[1] Although income is an imperfect proxy for welfare, it is usually considered the best available.[2]

Several assumptions are implied in utilising income as a measure of welfare: income distribution effects are not relevant, individual utility functions are independent, market prices reflect the true social costs of production and consumer benefits, and only costs and benefits which can be expressed in income terms are considered.

A consideration of income distributions as well as the level of income would tend to increase the social benefits from the methadone program, since addicts tend to come from relatively low income segments of the population.

A failure to regard utility functions as independent would tend to decrease the social benefits of the methadone program, since society would tend to regard the utility of non-addicts to be more important than the utility of ex-addicts in the program (especially those who continue to use non-opiate drugs).

Several non-economic benefits would increase overall benefits from the program. These include the decrease in pain and anxiety to the addict associated with the addiction phenomenom, and the decrease to the community of fear from the prospect of addict crime and of discomfort from viewing addicts while they are under the influence of heroin.

Three major decision criteria are commonly utilised: the net present value rule, the internal rate of return rule, and the benefit-cost ratio rule.[1] In this thesis, the net present value rule will be utilised in the form:

$$V = \sum_{k=0}^{n-1} \left(\sum_{i} p_{ik} B_i - \sum_{j} C_{jk}/(1+r)^k \right)$$

where p_{ik} is the probability of a particular benefit B_i occurring in year k, C_{jk} is the jth cost in year k, and r is the social rate of discount.

The values of p_i were established in Chapter 7 by regressing treatment performance on the background characteristics of each individual admitted to the Program:

$$p_i = f_i\ (b_1, \ldots\ldots\ldots\ldots, b_n)$$

Net Present Values

While several reservations to the estimates of benefits made by Leslie were expressed in Chapter 4, those estimates will be used within this study, except that they will be applied to developing benefit-cost estimates for individual Program subpopulations rather than being restricted to an overall Program population estimate.

Several assumptions about subpopulation benefits and costs will provide a framework for deriving benefit-cost ratios for Program subpopulations.

It is assumed that the average patient under 35 will have ended addiction by the age of 40 and each patient 38 years or over will have ended addiction within 2 years even without treatment.[4]

The average unemployed patient will receive vocational services totalling $600 for the first year, which will not be received by patients who are employed.

The average patient with alcoholic problems at the time of admission will receive counseling services totalling $400 per year, which will not be given to patients without alcoholic problems.

Treatment costs for all patients who do not require the special services listed under items 2 and 3 averages $500 per year.[5]

Under the assumption of Leslie that typical benefits per addiction year averted is $13,672 and assuming the social rate of discount is 10%, net present values can be derived for the following high and low performance profiles.

	LOW PERFORMANCE			HIGH PERFORMANCE		
	VALUE	RETENT COEF	EMPLOY COEF	VALUE	RETENT COEF	EMPLOY COEF
AGE AT ADMISSION	40	.12	.00	40	.12	.00
EMPLOYMENT	NO	.00	.00	YES	.05	.23
ALCOHOLIC USAGE	YES	.00	.00	NO	.14	.04
INTERCEPT		.45	.38		.45	.38
PERFORMANCE PROBABILITY		.57	.38		.76	.65
NET PRESENT VALUE		$14,262			$22,996	

The net present value is computed from the formula

$$V = \sum_{i=1}^{k} \left[\frac{P(E)B(E) + P(R)B(R) + \frac{1}{2}Q}{(1+r)^i} - \frac{C_1 + C_2 + C_3}{(1+r)^1} \right]$$

where

k = years of addiction
P(E) = probability of being employed
B(E) = benefits from being employed
P(R) = probability of being retained
B(R) = benefits from being retained
Q = P(E)B(E) + P(R)B(R)
r = rate of social discount
C_1 = basic cost of treatment
C_2 = cost of treating alcohol
C_3 = cost of vocational assistance

For example, the net present value of $14,262 for the low performance patient is derived as follows:

$$V = \sum_{i=1}^{k} \left[\frac{(\$3260)(.38) + (\$10412)(.57) + \frac{1}{2}Q - \$1500}{(1.10)^i} \right]$$

where Q = ($3260)(.38) + ($10412)(.57) = $7174, and where all benefits specified by Leslie other than employment are based only on retention and are independent of the reason for discharge.

The above results indicate that the net present value for the high performance profile is $8,734 greater than for the low performance profile.

However, if the average age at admission to the Program for the low performance profile had been 35 rather than 40 then, even though the performance for the low profile would deteriorate further (retention of .55 vs. .57), the net present value for the low performance profile would exceed the high performance profile ($31,138 vs. $22,996) due to the fact that the benefits for the low performance profile would last 5 years while the benefits for the high performance profile would end after only 2 years.

In the above example, both the low and high performance profiles have positive net present values. However, the net present value would be negative for the low performance profile if the probability of retention were less than .20, for in that case discounted costs would exceed discounted benefits. While such a subpopulation cannot be identified from the available data, further data might permit its delineation.

The classification of subpopulations according to net present values can provide a guide to a priority ranking of applicants for methadone treatment. For example, for the patients listed below, the priority ranking would be A, E, C, D, B.

	A	B	C	D	E
AGE AT ADMISSION	35	40	40	40	40
EMPLOYMENT AT ADMISSION	N	N	N	Y	Y
ALCOHOLIC BACKGROUND	Y	Y	N	Y	N
NET PRESENT VALUE ($000)	31.1	14.2	18.8	18.4	23.0

Limitations of the cost-benefit results may be grouped into three categories: the criteria used to measure social welfare, the accuracy of the cost-benefit data, and restriction of the variables which were used for the cost-benefit analysis. A more comprehensive cost-benefit analysis would consider additional variables beyond age, employment, and alcoholism that contribute to significant differences in benefits and costs.

FOOTNOTES TO CHAPTER 8

1. Elchanan Cohn, Public Expenditure Analysis, Lexington Books, 1972, p. 42.

2. Ibid., p. 44.

3. Ibid., p. 37.

4. Irving Leveson, "Cost-Benefit Analysis of Narcotic Addiction Treatment Programs", American Journal of Economics and Sociology, March 1973, p. 72.

5. Cohn, op. cit., p. 52.

CHAPTER 9

FURTHER RESEARCH

This concluding chapter describes several topics associated with methadone treatment evaluation which were not included within the scope of this study, but for which it is believed further research could profitably be undertaken.

Clinic Analysis

The findings in Chapter 7 assumed that clinic procedures were not a significant determinant of treatment outcomes. Table 1, however, illustrates the considerable variation which occurs between clinics in program retention.

The variation in treatment outcome between these clinics could conceivably be attributed to differences in patient backgrounds. For example, patients at Rikers may be relatively younger, of poorer employment background, etc., than patients at Bernstein.

Therefore, it would be appropriate to test the hypothesis that the variation in clinics may be primarily explained by patient backgrounds. One method to accomplish this would be the Chow Test which would examine whether it were more reasonable to assume that the patients were from "common" or "distinct" populations.

Another approach to testing clinic characteristics would be to find clinics with different retention rates but with similar patient backgrounds. Table 2 could aid in achieving this objective.

TABLE 1

CLINIC RETENTIONS

CLINIC	PERCENT RETAINED IN PROGRAM
BERNSTEIN	75
VAN ETTEN	65
RIKERS	50

TABLE 2

RETENTION FOR CLINICS
BY BACKGROUND CHARACTERISTICS

CLINIC	124	190	162	129	142	193	180	187
SEX	87	83	83	86	82	76	77	82
ETW	86	76	45	58	58	16	20	29
ETP	3	10	1	0	21	18	15	42
AGE	25	24	24	24	27	29	30	27
MAR	29	18	20	23	12	18	17	32
EMP	66	41	31	31	22	13	12	27
DRU	99	97	91	94	92	93	98	98
ALC	100	99	92	98	98	98	98	98
CON	1.1	1.3	1.6	1.8	3.6	3.1	4.1	2.4
MED	99	97	62	73	83	90	61	89
RET	50	50	62	67	68	83	82	93
N	302	493	186	132	207	278	187	639

Table 3 contains a set of hypotheses concerning the effects of various clinic characteristics on patient performance. The second column in the table indicates whether the data is currently available for this study.

As an example of the use of data to test hypotheses regarding the effect of clinic discharge criteria upon patient performance, Table 4, based upon Bronx State Hospital termination records, indicates that enforcement of administrative regulations may heavily affect program retention.

Clinic A is believed to provide strict enforcement of patient regulations. It has a high discharge rate but a very low dropout rate. On the other hand, Clinic B is believed to be a clinic which loosely enforces patient regulations. It has no dismissals but a high dropout rate. One hypothesis developed to explain these results is that Clinic A may be overly rigid in its enforcement of regulations while Clinic B may be too lax. However, an alternative hypothesis is that the above results indicate that clinics are faced with the unfortunate choice of having either a high discharge rate or high dropout rate, depending upon the rigidity with which regulations are enforced, with there being little possibility of attaining some middle position. A test of this latter hypothesis can be made across clinics by determining whether there is a strong negative correlation between dropouts and dismissals.

Another patient factor within the above two clinics may explain the findings. Clinic A is predominately white (82% white) while clinic B is predominately non-white (4% white). Perhaps ethnicity rather than enforcement of administrative regulations is mainly responsible for the

TABLE 3

PATIENT'S PERFORMANCE HYPOTHESES
BASED UPON CLINIC CHARACTERISTICS

	"+" MEANING	DATA PRESENT	RETENTION (YES = +)	EMPLOYMENT (YES = +)	CRIME (NO = +)	DRUGS (NO = +)
ADMISSION CRITERIA	STRICT	NO	+	+	+	+
DISCHARGE CRITERIA	STRICT	SOME	-	o	+	+
MEDICATION						
DOSAGE	MORE	SOME	+	+	-	o
HOSPITALIZATION	MORE	SOME	o	-	+	+
COUNSELLING						
VOCATIONAL	MORE	NO	+	+	-	-
LEGAL	MORE	NO	+	-	+	+
SURVEILLANCE						
URINALYSIS	MORE	NO	-	o	+	-
CLINIC DOSAGE	MORE	NO	-	-	o	-
MAINTENANCE	MORE	NO	+	+	+	+
PATIENT ASSIGNMENT						
BLACK ETHNICITY	WHITE	YES	-	o	o	o
OCCUPANCY RATE	MORE	YES	-	+	+	+
CLINIC SIZE	MORE	YES	o	o	o	o
PROGRAM SIZE	MORE	SOME	o	o	o	o
FEE	MORE	NO	o	o	o	o

TAHLE 4

DIFFERENCES IN REASONS
FOR PROGRAM TERMINATION

REASON FOR PROGRAM TERMINATION	CLINIC A	CLINIC B
DROPOUTS	5%	50%
DISMISSALS	32%	0%
OTHER	63%	50%

variation in reason for termination. There may be a greater tendency for administrators of white clinics to require obedience of regulations, perhaps due to the belief that whites can be expected to be more likely to follow regulations if there is an appearance of strict enforcement, while non-whites have a greater tendency to drop out due to disenchantment from what they come to regard as a "white-man's program". This hypothesis could be tested by determining whether the percent of terminations due to dropouts is correlated with the percent of blacks in the clinics.

It has been claimed that the performance of an ethnic group improves with the percentage of that ethnic group contained in the toal clinic population. This hypothesis can be tested by generating the correlation coefficient across clinics of percent black in the clinic with percent of blacks retained in the program.

Crime-Rate Analysis

Cost-benefit studies to date of methadone programs uniformly point to a reduction in crime as the major benefit to be derived from these programs. To substantiate the magnitude of this benefit, data has been presented by Gearing and others to indicate that arrest rates are sharply lower for methadone patients following their entry into treatment.

However, as pointed out in Chapter 4, it should be recognized that many addicts were criminal prior to their entry into treatment, that it is unlikely that individuals who have acquired extensive criminal skills would abandon them even without the use of heroin, especially among the unemployed patients, that the lower arrest rates may be indicative to

some extent of the greater efficiency at which crimes are being perpetrated now that the need for daily theft for heroin is no longer required, that there is a cliam that law enforcement eofficials are relatively reluctant to arrest suspects who are methadone patients because the arrests will interfere with their treatment, and that the reduction of crime which has been reported may be mainly due, as claimed by some police officials, to improved techniques in law enforcement procedures.

Leveson, in attempting to determine the relation between opiate usage and crime rates, developed an inter-state regression model in which he found that 4% of the variation in crime rates were attributed to opiate usage.[1] An analogous regression study could be undertaken relating crime rates to methadone program enrollment. The study would attempt to determine the extent to which reduction in crime rates could be attributed to methadone programs, holding other factors constant.

Management Information Systems

To transform a cost-benefit analysis into a decision making instrument, it is necessary that procedures be clearly formulated for the entire decision making process and that, to a considerable extent, they be automated within a unified data processing package.

A framework has been developed for a Methadone Management Information System, known as METHA-SYSTEM.[2] METHA-SYSTEM consists of four components: METHA-PROCESS, an Information Management Program;

METHA-MODEL, a program for generating econometric models of methadone treatment programs, METHA-EVALUATE, a program for facilitating the computation of data related to the evaluative criteria employed in the decision making process; and METHA-CONTROL, a coordinator of the individual program components of the management information system.

FOOTNOTES TO CHAPTER 9

1. Gearing, op. cit., p. 174.

2. John Langrod, "A Comparative Review of Addiction Treatment in Two Communities" in Proceedings, Fifth National Methadone Conference, 1973.

3. Leveson, op. cit., p. 63.

4. Bernard Backhaut, "METHA-PROCESS: An Information Management Program for Processing Methadone Data Files," September 1972, unpublished.

APPENDIX A

Description of Gearing Reports

The Gearing Report provides detailed information on the extent to which the Methadone Program has been successful in meeting four performance criteria established for this Program: retention of patients in the program, increased legal employment, reduction of crime, and reduction of drug usage.

Examples of tables for each criteria have been included in this appendix.

Retention is examined in two types of tables. Survival charts, illustrated by Table 1, shows the probability that patients with a particular background characteristic are retained in the program for at least n months. Discharge charts, illustrated by Table 2, shows the probability that patients with a particular background characteristic are discharged for a specific reason, such as drug abuse. Retention tables indicate that over 70% of all patients are retained in the Methadone Program after 2 years from their date of admission.

The crime tables shows the percent of patients who were arrested at least once during the past year, with the patients distinguished according to the number of years which have elapsed since they were admitted to the Program. Crime tables therefore display the extent to which the patient's crime diminishes as his retention period in the Program increases. Two sets of data accompany the Methadone patient crime tables.-- arrest data for the same Methadone patients during the period prior to their admission to the Methadone Program and arrest data for patients of similar arrest background who were admitted to a

TABLE 1

PROBABILITY OF RETENTION BY MONTHS
FOR MEN BY AGE AT ADMISSION
AS OF SEPTEMBER 15, 1969

MONTHS	AGE: 20-29	AGE: 30-39	AGE: 40+
3	.98	.95	.92
6	.92	.91	.86
9	.90	.86	.82
12	.88	.82	.78
15	.87	.79	.80
18	.85	.77	.76
21	.81	.73	.74
24	.79	.71	.72

TABLE 2

REASON FOR DISCHARGE
BY ETHNIC GROUP
AS OF SEPTEMBER 15, 1969

ETHNIC GROUP	DISCHARGE REASONS	PCT. OF TOTAL
BLACK	DRUG ABUSE	19
(N = 162)	ARREST	22
	ALCOHOL	30
	VOLUNTARY	12
	DEATH	10
	MEDICAL & BEHAVIOR	7
WHITE	DRUG ABUSE	30
(N = 162)	ARREST	26
	ALCOHOL	17
	VOLUNTARY	18
	DEATH	5
	MEDICAL & BEHAVIOR	4
HISPANIC	DRUG ABUSE	33
AND OTHER	ARREST	23
(N = 81)	ALCOHOL	19
	VOLUNTARY	15
	DEATH	5
	MEDICAL & BEHAVIOR	5

Detoxification Program instead of a Methadone Maintenance Program. Patients in the Methadone Program are shown in Table 3 to have lower arrest ratesthan before their entry into the Methadone Program and patients in the Detoxification Program.

The employment tables show the percentage of patients in the Program who are considered socially productive (employed, in school, or are homemakers) or who are receiving financial assistance (welfare, private sources) according to the number of months they have been retained in the Methadone Program. Table 4 indicates that social productivity increases and financial assistance decreases as months retained in the program increases.

TABLE 3

PERCENTAGE ARRESTED OF 1530 IN
METHADONE PROGRAM AS OF AUGUST 15, 1969
CONTRASTED WITH DETOXIFICATION GROUP
BY MONTHS OF OBSERVATION

PERIOD OF OBSERVATION	METHADONE PROGRAM	DETOXIFICATION PROGRAM
3RD YEAR BEFORE ADMISSION	12	17
2ND YEAR BEFORE ADMISSION	23	26
1ST YEAR BEFORE ADMISSION	20	21
1ST YEAR AFTER ADMISSION	6	25
2ND YEAR AFTER ADMISSION	3	28
3RD YEAR AFTER ADMISSION	2	19

TABLE 4

EMPLOYMENT AND WELFARE STATUS FOR 990 MEN
IN METHADONE PROGRAM AS OF AUGUST 15, 1969
BY MONTHS OF OBSERVATION

MONTHS OF OBSERVATION	PCT. EMPLOYED	PCT. ON WELFARE
ON ADMISSION	29	--
6	46	44
12	61	30
18	66	24
24	70	24
30	77	18
36	88	8

APPENDIX B

Description of the Leslie Report

The Methadone Program benefit-cost ratio suggested by Leslie is based upon the formula:

$$B/C = \frac{P(S)(B)(YB)}{(C)(YC)}$$

where

B/C	=	benefit/cost ratio for the first year of treatment
P(S)	=	probability of successful treatment
B	=	benefits per man year of addiction
C	=	costs per man year of patient treatment
YB	=	years of remaining addiction
YC	=	years of treatment costs

For the New York Methadone Program,

$$B/C = \frac{(.75)(\$13,674)(7)}{(\$1,300)(7)} = 7.9.$$

The above formula assumes that benefits and costs remain constant over the expected period of addiction, so that B/C is independent of the social rate of discount.

The total benefits per man year of addiction averted is estimated in Table 1.

Benefits from employment were based upon the following formula:

$$\text{EMPLOYMENT BENEFITS} = (1 - E)(1 + N - A - U)(M)$$

where

E	=	employment rate of addicts without treatment
N	=	New York City differential in income
A	=	ex-addict earnings differential
U	=	ex-addict unemployment rate
M	=	median U.S. occupational income

TABLE 1

TOTAL BENEFITS PER MAN YEAR OF ADDICTION AVERTED

INCREASE IN EMPLOYMENT EARNINGS	$ 3,260
REDUCTION IN CRIME	3,984
REDUCTION IN ENFORCEMENT COSTS	1,640
REDUCTION IN MORTALITY	1,510
REDUCTION IN MORBIDITY	380
REDUCTION IN HOUSING STOCK LOSSES	164
CONTAGION FACTOR (1.25)	2,734
TOTAL BENEFITS	$ 13,672

and M is estimated by the formula

$$M = \sum (P(J)Y(J))$$

where

P(J) = proportion of patients whose usual occupation is J
Y(J) = median U.S. annual income of occuption J.

The estimates for M are based upon data in Table 2. The formula for M yields an estimate of $5,660, which when substituted into the earnings formula, results in:

EMPLOYMENT BENEFITS = (1-.25)(1+.10-.20-.10)($5,660) = $3,260

To derive the costs of crime, Leslie classified addicts into seven catogies, with women lumped into the seventh category.

The formulas for developing crime costs utilize data in Tables 3-8. From Tables 3 and 4, drug purchases for each addict class I by source of income J can be computed from the formula:

PURCHASES(I,J) = ($/D)(DAYS)(B/D(I))(PTOT(I,J))

where

$/B	=	cost in dollars per bag of heroin
DAYS	=	days per year = 365
B/D(I)	=	bags per day used by addict of class I
PTOT(I,J)	=	percent of total income earned by addict in class I from income source J

From Tables 5 and 6, the cost to society of drug purchases for each addict class I by source of income J can be computed by the formula:

DRUG PURCHASE SOCIETY COSTS (I,J) = (PURCHASES(I,J)(ADD(I))(RET(J))

where

ADD(I)	=	percent of addicts in class I
RET(J)	=	retail value of income sources in class J

TABLE 2

OCCUPATIONAL DISTRIBUTION OF PATIENTS

USUAL OCCUPATION WHEN WORKING	PCT. OF PATIENTS	MEDIAN U.S. INCOME
PROFESSIONAL/EXECUTIVE	0.3	$ 9,370
BUSINESS MANAGER OR OWNER	5.8	9,270
CLERICAL/SALES PERSONNEL	26.2	6,600
SKILLED WORKER	16.6	7,224
SEMI-SKILLED WORKER	18.5	5,858
UNSKILLED WORKER	23.0	4,532
ILLEGAL ACTIVITIES	0.8	---
STUDENT	8.0	---
HOUSEWIFE	1.0	4,000

TABLE 3

DISTRIBUTION AND DRUG USAGE OF ADDICTS

CLASS OF ADDICT	PCT. ADDICTS IN CLASS	BAGS/DAY	PRICE/BAG
JOY POPPERS	10	0.4	$5
SMALL HABIT APPRENTICES	20	2.0	$5
MEDIUM HABIT HUSTLERS	23	5.0	$5
LARGE HABIT HUSTLERS	12	9.0	$5
LARGE HABIT DEALERS	11	18.0	$5
SMALL HABIT DEPENDENTS	9	2.0	$5
WOMEN	15	5.0	$5

TABLE 4

SOURCES OF ADDICT INCOME BY ADDICT CLASS

SOURCE OF INCOME	A*	B	C	D	E	F	G
SHOPLIFTING	5	40	22	15	0	5	12
BURGLARY	0	32	22	20	0	0	0
PICKPOCKETING	0	0	2	15	0	0	0
STEALING	0	0	21	0	0	0	0
ARMED ROBBERY	0	0	1	10	0	0	0
CON GAMES	0	0	0	15	0	0	0
PUSHING/LENDING	0	3	6	10	100	95	12
PROSTITUTION	0	10	20	15	0	0	75
WELFARE	0	5	4	0	0	0	1
LEGAL SOURCES	95	10	0	0	0	0	0

* A. Joy Poppers
B. Small Habit Apprentices
C. Medium Habit Hustlers
D. Large Habit Hustlers
E. Large Habit Dealers
F. Small Habit Dependents
G. Women

TABLE 5

RETAIL VALUE OF INCOME SOURCES OF ADDICTS

INCOME SOURCE	RETAIL VALUE
SHOPLIFTING	RETAIL VALUE IS 4 TIMES ADDICT INCOME
BURGLARY	40¢ CASH; REST IS 4 TIMES ADDICT INCOME
PICKPOCKETING	RETAIL VALUE IS 4/3 ADDICT INCOME
MUGGING	RETAIL VALUE IS 4/3 ADDICT INCOME

TABLE 6

DRUG PURCHASES BY SOURCE OF INCOME

CLASS OF ADDICT	SHOPLIFTING	BURGLARY	PICKPOCKETING	MUGGING & ARMED ROB.	CON GAMES
JOY POPPERS	35	0	0	0	0
SMALL HABIT APTR.	1,460	1,170	0	0	0
MEDIUM HABIT HUST.	2,005	3,915	185	95	0
LARGE HABIT HUST.	2,465	3,285	0	1,640	2,465
LARGE HABIT DEALERS	0	0	0	0	0
SMALL HABIT DEPEND.	180	0	0	0	0
WOMEN	1,140	0	0	0	0

Leslie adds 50% to Drug Purchase Costs in Table 7 to account for addict living expenses, obtaining Table 8.

The estimate of the reduction in crime which appears in Chapter 4 is computed according to the formula:

CRIME COSTS = (DRUG COSTS)(PCT.YR.ADDICT)(PCT.PAT.CRIME)

where

DRUG COSTS	=	total costs as tabulated in Table 8
PCT.YR.ADDICT	=	percent of year in which addict is not in jail or in treatment
PCT.PAT.CRIME	=	percent of crime which will be reduced by addict being in treatment

Leslie estimates the reduction in crime to be:

CRIME COSTS = ($13,180)(.60)(.50) = $3,950.

Law enforcement costs can be disaggregated into police, court, and correction costs.

Police costs are computed by the formula:

$$\text{POLICE COSTS} = \frac{(\text{POLICE BUDGET})(\text{PCT.CRIME.ADDICT})(\text{PCT.RED.})}{(\text{NO.ADDICTS})}$$

$$= (\$540\text{M})(.33)(.50)/(100{,}000) = \underline{\$900}.$$

where

POLICE BUDGET	=	annual New York City Police Budget for Crime
PCT.CRIME.ADDICT	=	percent of crime committed by addicts
PCT.RED.	=	percent of crime reduction due to addict treatment
NO.ADDICTS	=	number of addicts in New York City

Court costs are computed by the formula:

COURT COSTS = (COURT COST/ARR.)(PROB.ARREST)(PCT.RED.)
= ($600)(.30)(.50) = $90.

TABLE 7

COST TO SOCIETY OF DRUG PURCHASES

CLASS OF ADDICTS	SHOPLIFTING	BURGLARY	PICKPOCKETING	MUGGING & ARMED ROB.	CON GAMES
JOY POPPERS	$ 15	$ 0	$ 0	$ 0	$ 0
SMALL HABIT APPR.	1,170	425	0	0	0
MEDIUM HABIT SUST.	1,845	1,640	60	30	0
LARGE HABIT SUST.	1,230	745	410	270	310
LARGE HABIT DEALERS	0	0	0	0	0
SMALL HABIT DEPEND.	65	0	0	0	0
WOMEN	570	0	0	0	0
TOTAL	$4,895	$2,810	$470	$300	$310

TABLE 8

COSTS TO SOCIETY OF DRUG PURCHASES
WITH LIVING EXPENSES ADDED

CLASS OF ADDICT	SHOPLIFTING	BURGLARY	PICKPOCKETING	MUGGING & ARMED ROB.	CON GAMES
JOY POPPER	$ 20	$ 0	$ 0	$ 0	$ 0
SMALL HABIT APPR.	1,760	640	0	0	0
MEDIUM HABIT HUST.	2,760	2,460	90	40	0
LARGE HABIT HUST.	1,840	1,120	620	410	460
LARGE HABIT DEALERS	0	0	0	0	0
SMALL HABIT DEFEND.	100	0	0	0	0
WOMEN	860	0	0	0	0
TOTAL	$ 7,340	$4,220	$ 710	$ 450	$ 460

where

COURT COSTS/ARR.	=	court costs for each addict arrested
PROB.ARREST	=	probability that an addict will be arrested during the year
PCT.RED.	=	pct. of crime reduction due to addict treatment

Enforcement costs are computed by the formula:

ENFORCEMENT COSTS = POLICE COSTS + COURT COSTS + CORRECTION COSTS

= $900 + $90 + $650 = $1640.

Mortality costs are based on the assumption that as a result of premature mortality from heroin, 1/3 of an addict's lifetime earnings will be lost.

MORTALITY COSTS = (P)(Y)

= (.33)($4,530) = $1,510.

where

P	=	percent of lifetime earnings lost by addiction
Y	=	annual income of addict if employed year-round

The estimate for Y is based upon the EMPLOYMENT BENEFITS equation.

Reduction in morbidity costs are calculated from the formula:

MORBIDITY COSTS = (H)(C) + (P)(L) + (E)(Y)

= $45 + $113 + $226 = $380.

where

H	=	rate of hepatitis per year among addicts
C	=	treatment cost for hepatitis
P	=	percent of year an addict works
L	=	percent productivity loss from hepatitis
Y	=	median income from full employment
E	=	percent of lifetime employment lost from hepatitis.

The costs of housing due to drug addiction is disaggregated into rental costs, demolition costs, and fire costs.

Rental costs are computed according to the formula:

RENTAL COSTS = (BLDGS.ABAN.)(APTS.BLDG.)(RENT.MONTH)(MNTHS/YR.)(PCT.RED.)/(NO.ADDICTS)

= (3,000)(6)($100)(12)(.33)/(100,000) = $72.

where

BLDGS.ABAN. = buildings abandoned per year
APTS.BLDG. = apartments in abandoned buildings
RENT.MONTH = rent per month in abandoned buildings
PCT.RED. = percent abandoned due to addiction
NO.ADDICTS = number of addicts in New York City

Demolition costs are computed according to the formula:

DEMOLITION COSTS = (BLDGS.ABAN.)(DEMO.COSTS)(PCT.RED)

= (3,000)($5000)(.33)/(100,000) = $50.

where

BLDGS.ABAN. = buildings abandoned per year
DEMO.COSTS = demolition costs per building

Fire costs are computed according to the formula:

FIRE COSTS = (FIRE.BUDGET)(PCT.FIRES.ADD)/(NO.ADD.)

= ($12.5M)(.33)/100,000 = $42.

where

FIRE.BUDGET = New York City annual Fire Budget
PCT.FIRES.ADD. = percent of fires caused by addicts

Total housing costs are given by:

HOUSING COSTS = RENTAL COSTS + DEMOLITION COSTS + FIRE COSTS

= $72 + $50 + $42 = $164.

Elimination of four mean years of addiction results in the eradication of one additional potential year of addiction.

CONTAGION BENEFITS = (CONT.FACT.)(BENEFITS.MAN)

= (.25)($10,936) = $2,734.

where

CONT.FACT. = pct. of addict reduction due to contagion
BENEFITS.MAN = benefits per man year of addiction averted

On the basis of the Gearing Reports, the probability of successful treatment is estimated to be .75.

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