

RESOURCE ALLOCATION IN A MENTAL HEALTH SYSTEM

by

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Submitted in partial fulfillment
of the requirements for the
degrees of

BACHELOR OF SCIENCE

and

MASTER IN CITY PLANNING

at the

MASSACHUSETTS INSTITUTE OF
TECHNOLOGY

May, 1976

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ABSTRACT

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The Massachusetts Department of Mental Health (DMH) is faced with the problem of allocating its resources under the guidance of two policies: (1) to provide a comprehensive set of psychiatric services in each area of the state, and (2) to provide resources equitably with respect to mental health care need. With an administrative structure that emphasizes decision-making decentralized to 40 mental health catchment areas, DMH implicitly gives the areas responsibility for implementing the first policy. The DMH central office's immediate concern is the policy of equity. This work was undertaken to provide an operational definition of equity and to show how it can be used to improve DMH decision-making.

Data on state psychiatric hospital utilization and expenditures, and demographic data from the US census for each of the 40 catchment areas in the state were used to estimate an equation for psychiatric inpatient demand. The equation was then used to calculate the expected demand for psychiatric service in each area. By comparing this demand for service to the resources available, we show the relative resource surpluses and deficits for each of the 40 Massachusetts catchment areas. Such an analysis points to where funds need to be put to redress an inequitable distribution of resources.

We compared the results of past work to those of the demand analysis completed here and found them to be inconsistent. Without a definitive statement on psychiatric need to compare the results to, they must be viewed with caution.

The procedure developed here deals only with nominal equity, leaving unaddressed considerations of service quality, accessibility, and effectiveness. In decision-making, this procedure cannot be divorced from these considerations.

While this type of procedure has proven itself useful to the DMH budget process, its effectiveness was diminished by the institutional constraints of budget-making. The procedure shows how resources should

be deployed, but the major problem constraining redistribution is how to free up resources already committed. Efforts to improve the procedure are likely to impact decision-making only minimally until the problem of budgetary inertia is solved.

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ACKNOWLEDGEMENTS

A number of people and a generous measure of divine providence saw me through to the completion of this work. I am grateful to my colleagues at the Department of Mental Health, Will Van Horne, Mark McGrath, and Steve Leff. As a budding professional, it is an encouragement to see work executed with such competence and compassion for the clients of the agency.

I am indebted to the residents of my living group for their many kindnesses in spite of the fact that their tutor remained crabby and cooped up in his room for the past month to finish this thesis. Phil Klenn showed me that no matter how horrible things get, we can still maintain a sense of humor. Jon Mayner provided a welcome supply of chocolate chip cookies for midnight (and later) snacks. Pete Siczewicz was a tremendous ego builder, coming in periodically to ask what planning was all about, and then listening with genuine interest when I'd try to answer him.

I thank Bill Felling for the use of his typewriter, and for expediting my computer runs through a recalcitrant IBM 370.

Bill Castellani appeared at a time when I most needed his excellent typing skills. Without him, this would not have been finished. He also made some helpful comments to clarify the text, but I was stubborn enough that I didn't always take his advice, so the shortcomings of this work are my own.

The two readers on my thesis committee, Larry Susskind and Rob Hollister, kept my eyes open to a broader perspective on this work than I originally had.

I find it difficult to convey enough appreciation to Karen Polenske, my thesis supervisor. Karen seemed to know just when a word of encouragement would be helpful, and when prodding to meet deadlines was necessary. She went to extraordinary lengths to be available for advice.

To my whole thesis committee - Karen, Larry, and Rob - I owe a debt of gratitude, certainly for their help on the thesis, but more so for the several years' contribution they made to my education.

Finally, I must acknowledge my parents and quite a few other people - y'all know who you are - who throughout my upbringing predisposed me to get as much from MIT as I have.

SECTION I

INTRODUCTION

No less than private business and industry, government is faced with the problems of allocating resources to meet its goals most efficiently. The problem has two parts: first, finding the appropriate criteria by which to judge competing demands for resources, and second, making these criteria operational and using them in decision-making

The Massachusetts Department of Mental Health (DMH) is beginning to address the first aspect of this problem through its departmental policy. It has stated that resources are to be allocated to provide comprehensive services to all areas of the state, and to provide them equitably with respect to the need for mental health care. The second part of the problem - how to make these broad statements operational - is the subject of this thesis.

The work presented here is an excerpt from an ongoing effort at DMH to bring planning tools to bear on deploying resources more efficiently. It looks at only one small aspect of this planning - the geographical distribution of funds across the state's 40 mental health catchment areas.

In an administrative structure that emphasizes decision-making decentralized to 40 areas, the first task of DMH central office in beginning the budget process is setting target allocations for distributing new money and other funds freed up by attrition and changes in the system. These target figures are to give areas a realistic

notion of the resource constraints under which they must plan.

How can DMH administration set these target allocations? A similar question is faced by any public agency providing a multiplicity of services over an area so large that administration has to be broken down by geographical subdivisions. The central administration of such an agency must deal with two considerations in its resource allocation decisions. One is the distribution of resources across geographical areas. How much of its resources should an agency put at the disposal of an area's administration, and how much freedom should this administration be given to allocate resources within its own boundaries? As decision-making becomes more decentralized, freedom in allocating resources rests increasingly with area administrations and the task of central administration becomes one of comparing areas in the aggregate to determine the relative amounts of resources to be given to each.

A second consideration is the distribution of resources across the categories of services offered by the agency. Of its pool of resources, how much should an agency spend on each service? The answer depends on knowledge of the services' clients and operational characteristics. In making service-specific resource allocations, a central administration assumes some of the authority that would be more diffuse in a decentralized system. This is a potential source of conflict between area administrations who deliver services and centralized authority.

From a central administration's point of view, these are the two basic allocation perspectives - whether geographical subdivisions are to be allocated resources and given free rein to distribute them, or whether these subdivisions are to be provided resources based on service-specific decisions

made by a central administration.

DMH has opted for a geographical perspective in allocating resources, and an examination of its policies shows why. DMH has two broad policies dealing with resource allocation: (1) to allocate funds within an area to provide comprehensive community service, and (2) to distribute funds equitably with respect to the (ill-defined) need for mental health care.

Implementation of the first policy is left to the catchment areas, and for some very good reasons. The DMH central office does not have information at hand about the nature of services offered in each area. To the dismay of the central office staff, there is an appalling lack of data on the deployment of personnel and programs across the state. At this writing, information systems are under development to fill the gap, but these are not yet implemented.

Catchment areas are the basic service delivery units of DMH, and as such are closest to the day-to-day needs and problems of providing care. This is a second reason for decisions on the specific nature of mental health services resting with the areas. A third reason is that the driving force for establishing community service is at the area level. Local service providers, concerned citizens groups, and area-based DMH staff are at the forefront of the community mental care movement.

DMH's second policy - that of equity - is one that can be implemented only from the central office because the trade offs involved cut across area boundaries. It is this criterion of equity that DMH administration used (albeit very roughly) to set initial target allocations for the FY '78 budget. This thesis documents an attempt to

provide an operational definition of equity.

From the outset, the limitations of this work should be clarified. First, the concept of equity that will be developed is highly aggregate. It lumps the demands for a myriad of mental health services into one measure that we call primary demand in an attempt to quantify the relative magnitude of mental disability in each area. The procedure we have developed does not indicate the services for which demand (or potential demand) exists (e.g., preventive care, rehabilitation) and leaves unanswered the question of who has the demand (e.g., children, married couples, the chronically-ill elderly). The work documented here does not touch on these, but they are, nonetheless, essential considerations in the allocation of resources - considerations presently left to decision-making at the area level.

A second limitation of this work is that it deals with nominal equity - equity defined by the dollar resources available to a catchment area. The differences across areas in the quality of services purchased by those dollars, and the differences in the degree to which those dollars are truly at the disposal of area administrations and not tied up in services and institutions over which they have no control are not dealt with. Again, such considerations are essential in making final decisions on resource allocations.

A third limitation is the validity of the methodology used in determining equity. We must state unequivocally that the results of this work are not definitive.

These caveats frame the limited scope of this work.

OVERVIEW

The next section is a description of the mental health care system, the community-oriented care that it is trying to provide, and the structure and budgeting process of DMH.

In section III, resource allocation and DMH policy will be discussed. The department has two main policies that guide its budget-making: providing comprehensive community services and allocating resources equitably. The procedure documented here serves only the equity policy. The comprehensiveness issue is more difficult to deal with. Though another effort is underway in the department to address this, its use in budgeting and its integration with equity considerations are still problems.

Section IV outlines the work of making the DMH equity policy operational. Using data collected from the state psychiatric hospitals, we will make some inferences about the relative demand for mental health services that would be expected in each area were their service characteristics to be the same, and will go on to show how this information can be used in resource allocation.

Four past efforts at developing operational criteria for allocating mental health funds will be reviewed in section V. Included in the review will be: (1) a procedure recommended by NIMH to assign funding priorities to catchment areas, (2) one completed for DMH in 1974, (3) a procedure developed by a group in California for allocating that state's mental health funds, and (4) a procedure recommended by a state advisory council member in response to the department's 1974 method. Section V will also show how the procedure developed

here was an attempt to improve upon these methods and will discuss how the results of all five procedures differ.

Section VI treats the mechanics of the work. Section VII is a summary of this effort and comments on some further work needed in mental health resource allocation.

Two appendices supplement the text. Appendix A is a brief introduction to multiple regression. Readers unfamiliar with the technique might want to read this appendix before looking at sections IV, V, and VI. Appendix B lists the values of the social indicators used in the resource allocation procedure developed here.

SECTION II

THE MENTAL HEALTH CARE
SYSTEM AND DMH

DMH is the dominant actor in the service network providing mental health care to Massachusetts.* But by no means is it the only one. Of 25 psychiatric hospitals in the state, 13 are private (both profit and non-profit). Of the other 12, nine (or 36% of the total) are DMH hospitals.¹ The number of psychiatric beds represented by these facilities shows the magnitude of the state's role in mental health. Of the 13,733 psychiatric beds in the state in 1974,** DMH hospitals accounted for 59%; the private sector administered less than 10% of the total.² Other governmental facilities accounted for the rest.

These figures show only the inpatient aspect of mental health, leaving undocumented the characteristics of a rapidly growing part of the system not dependent on inpatient psychiatric treatment as the mode of service. These characteristics are unknown at present; good data on the whole mental health system are simply not assembled. Each year, the National Institute of Mental Health (NIMH) attempts to change this through an inventory of mental health facilities, but falls short of complete coverage. Its 1976 inventory included 234 Massachusetts facilities, only 60% of the 392 facilities listed on documents compiled by

* Mental Retardation services fall under the auspices of DMH. To a large extent, mental retardation maintains an existence apart from mental health services. When this thesis refers to mental health, it should be taken to exclude mental retardation.

** Including psychiatric units of general hospitals, beds provided in community mental health centers, and in residential treatment centers.

DMH in advance of its own facility survey.³

While existing information probably covers all of the major facilities in the state, data are notoriously difficult to collect and maintain on the many smaller facilities and programs growing in number as the mental health system moves away from its dependence on large mental institutions. In 1966, the June 30 inpatient census in state mental hospitals was 15,259. This figure is expected to decline to about 4,400 for FY '76,⁴ and is still falling. The decline is the result of a DMH policy aimed at moving clients from a few large institutions into more dispersed facilities. These facilities have grown accordingly, not simply in response to a falling inpatient census but as part of a changing attitude toward mental health care that drives the census decline as well. The beginning of this change dates back 40 years:

"From Europe in the 1930's came new ideas about alternatives to inpatient care. Home treatment as an alternative to hospitalization was pioneered in Amsterdam in the 1940's due to the acute shortage of hospital beds. Concepts of social psychiatry gained prominence in England during the 1940's, and there was a major change in the attitude towards long-term hospitalization. The open-door policy became widespread, day hospital and domiciliary care programs were instituted, and the public mental hospital shed its image of being a fenced-in locked-up, far-away asylum..."⁵

In 1955, the US Congress approved the Mental Health Study Act setting up a commission to review mental health care in the nation and to make recommendations for its improvement. The recommendations returned, emphasizing a therapeutic rather than custodial orientation for mental health care.⁶

This departure from a custodial mentality has come to be known as community mental health care, an umbrella-like term covering several services having the common aim of providing mental health care while keeping

a client in the mainstream of everyday life.

In practice, this translates into providing a number of different service styles:⁷

Outpatient service: Outpatient service is a client's entry point into a community mental health system in non-emergency situations. Outpatient service consists of screening, referral to other parts of the system, and evaluation and treatment by staff psychiatrists, psychologists, and social workers. Treatment is typically through staff interviews and group therapy sessions.

Emergency service: Ideally, emergency service is available 24 hours a day, seven days a week. It should be flexible enough to handle any psychological problem that arises suddenly and at times when other services are unavailable. Such a demanding responsibility is met by "crises intervention teams" possessing clinical skills, the ability and license to diagnose clients and to administer medication, experience in the life-style of the community, and language fluency appropriate to the service's client population.

Day and evening treatment: Essentially part-time hospitalization, it provides clinical services to clients needing intensive treatment but not 24 hour care. Partial hospitalization programs are quite varied, with the time a client spends at a facility ranging from a few hours each day or evening to weekend hospitalization. Such programs have distinct advantages over full hospitalization. Clients can remain with their families and friends, they can be spared the embarrassment of explaining extended absences to curious neighbors, and client costs are reduced since a smaller staff and less extensive physical plant is required.

Vocational and rehabilitation services: Following periods of emotional disturbance, clients often need readjustment to work and social situations. Rehabilitation services are designed to meet this need. Some clients with chronic problems are unable to perform in the competitive workplace and look to rehabilitation services not for readjustment but for work in sheltered settings.

Community living services: These are of four types: (1) group residences having a live-in staff to supervise clients, (2) halfway houses similar to group residences but having the expectation of clients returning to independent living within a year or two, (3) cooperative apartments having no live-in staff, and providing simply a socially supportive living situation for mental health clients and (4) foster homes providing care within a private family. All four types have the aim of providing care while keeping a client thoroughly integrated with everyday life in the community.

Consultation and education services: Mental health care goes beyond the mental health system itself. Social service agencies, nursing homes, schools, and churches are examples of institutions that come into daily contact with mental health problems, even though their primary task is in some other field. Mental health staff provide consultation and education services to these agencies to enable them to cope better with their clients.

Inpatient services: Complete hospitalization is viewed as a resource of last resort in a community mental health system. Fully developed community programs are designed to reduce dramatically the need for psychiatric hospitalization. Considering day and evening treatment alone, estimates of 50% to 75% have been quoted as the possible reduction in the number

of persons requiring full hospitalization.⁸

But there are certain cases where inpatient care is appropriate: (1) when clients exhibit actively suicidal behavior, (2) when clients are likely to harm others, (3) when clients are agitated enough to require heavy medication, (4) when clients are too confused or disoriented to travel to other programs, and (5) where medical diagnostic and treatment facilities are needed.

Putting these concepts of community mental health into practice in Massachusetts was aided by two pieces of legislation. The first was the federal Community Mental Health Centers Act of 1963 making possible federal grants for the construction of community mental health centers. The second was the Massachusetts 1966 Comprehensive Mental Health and Retardation Services Act (Chapter 735) establishing a three-level administrative and service structure in DMH: the catchment area, the region, and the Central Office.

THE CATCHMENT AREAS

The Community Mental Health Centers Act of 1963 mandated the establishment of mental health catchment areas within each state. Federal guidelines stipulate that catchment areas are (1) to have a population between 75,000 and 200,000; (2) to provide services promptly accessible to the area's residents; (3) to have, wherever possible, boundaries conforming to political subdivisions; and (4) to be arranged so that physical and social barriers to service would be eliminated. Recent federal legislation requires that catchment area boundaries conform (to the extent practicable) to the boundaries of health services areas (HSA) set up by the National Health

Planning and Resource Development Act of 1974 (PL 93-641).

Following the 1963 act, the state received federal funds to conduct the Massachusetts Mental Health Planning Project. In its June, 1965 final report, it recommended the establishment of 37 catchment areas in the state. This was later expanded to 39, and in 1975 was changed to 40. These areas are still undergoing some minor changes to comply with PL 93-641 and with a state effort to form common human service agency boundaries.

The state's 40 catchment areas are the basic mental health service delivery units of the department (a map of these areas is included on page 18). The Commissioner of Mental Health appoints for each area a 21-member board representative of the communities comprising the catchment area. Local citizen associations for mental health and retardation are well represented on these boards, and since chapter 735 prohibits DMH employees from being members, these boards are strongly representative of interests outside of, and often in conflict with, DMH.

The area boards function to represent the interests of citizens and consumers and of mental health services. The boards advise area-based departmental staff, keep them informed about local needs, help set area program and facility construction priorities, and review and make recommendations on annual area plans and budgets before these are forwarded to the regional offices. Though area boards are hampered by low levels of clerical and professional support, the administration of DMH feels that they are workable and valuable components of the mental health care system.

Each area has (or will soon have) a director appointed by the Com-

missioner after consultation with the appropriate area board. The director is charged with providing mental health care to the whole area and is responsible for all the area's DMH clients, even though they may be under treatment at a distant state hospital.

Each catchment area is mandated by chapter 735 to provide within its own boundaries inpatient and outpatient services, emergency service, partial hospitalization, and mental health consultation and education. The decision-making structure of DMH places primary responsibility for the provision of these services on the area directors and area boards. The consequence of this decentralization of authority has been diversity in the way mental health services are provided. There is great variety in the mix of services in each area, in the mix of public and private providers, and in the referral arrangements among facilities.

DMH REGIONS AND THE BUDGET

Catchment areas are combined in groups of five to seven to form the seven DMH regions. Each region has its own office, and is headed by a mental health services administrator with an administrator of mental retardation, a director of legal medicine, and a business manager as top level staff. Regional offices provide administrative services for the area and coordinate the provision of services when more than one area is involved.

The regions are key elements in the DMH budget process. Accounts are kept by regions, and the preparation of the budget is done through them.

Table 1 provides a synopsis of the FY '75 DMH mental health budget.

TABLE 1: SYNOPSIS OF DMH FY'78 MENTAL HEALTH CARE BUDGET (EXCLUDES MENTAL RETARDATION FUNDS, STATE SCHOOLS, AND CENTRAL ADMINISTRATION COSTS.)

Expenditures on:	REGIONAL EXPENDITURES							TOTAL
	REGION I	II	III	IV	V	VI	VII	
STATE HOSPITALS	\$ 8994	\$13440	\$ 9057	\$ 9761	\$13164	\$11585	\$13185	\$ 79186
COMMUNITY SERVICES (Including Area Director Salaries)	2210	1415	1730	2369	2091	2225	1666	13706
MATCHING FUNDS TO FEDERALLY FUNDED COMMUNITY MENTAL HEALTH CENTERS	0	1000	2409	0	0	7819	1930	13158
DRUG, TRAINING, & OTHER PROGRAMS	380	222	412	597	278	2142	419	4450
REGIONAL ADMINIS- TRATION (Includ- ing Associate Area Directors)	241	238	243	281	255	251	284	1793
TOTALS	\$11825	\$16315	\$13851	\$13008	\$15788	\$24022	\$17484	\$112293
TOTAL PER CAPITA	\$15.70	\$23.14	\$17.18	\$14.23	\$19.14	\$30.29	\$19.58	\$19.74

(SOURCE: Figures compiled by Mark McGrath of DMH Central Office)

One of its most outstanding entries is the \$79 million total expenditure on state psychiatric hospitals - a lion's share of the budget at 71% of the total. About \$5 million of this is devoted to regional service programs, even though it is carried on the hospital accounts, leaving 64% of the mental health budget being spent on inpatient care.

\$77 million of the \$112 million total is spent on catchment area services, but of this, only \$30 million is for community programs. The other \$47 million is tied up in state hospitals, not in their administration and maintenance, but in the hospital personnel assigned to designated catchment area units within the hospitals.

The dominance of the state hospitals in the budget is overwhelming, and they represent the prime source of inertia in the system. These institutions are large, employing on average about 900 personnel each, and are location-bound because of their heavy dependence on a physical plant.

These factors taken together set before DMH one of the most stubborn obstacles to disinvesting in these facilities that it faces. The fact that so many personnel are employed at one facility makes the closing of one of these hospitals a significant localized impact. And this is particularly true for the hospitals located in less populous communities where they are major employers. Westborough, for example, employs 900 people in a town of 12,594.

The closing of a state hospital can be a politically difficult move - and not only because of the opposition from a local community facing the loss of a revenue source. Strong, unified labor leadership in the Massachusetts State Council of the American Federation of State,

County, and Municipal Employees keeps close watch for threats to job security.

State hospitals put DMH in a double bind. While they remain, they consume huge amounts of money that are needed for community programs. But the hospitals cannot be closed until adequate community programs are in place to accept the discharged clients and to re-employ mental health personnel from the institutions. DMH is left with very little room in the budget for implementing a community-based system of mental health care. It is forced to make the changes slowly, with the pace of deinstitutionalization being governed by the slack it can find in existing resources, by the new money it can squeeze from the legislature (a difficult task with the present state of the Commonwealth's finances), and by the federal funds it can leverage.

Budgeting in DMH is incremental. Funding for existing programs and staffing are taken for granted and, in the FY '78 budget process, will simply be increased by 3% over FY '77 allocations. An exception to this is the DMH deinstitutionalization program that releases funds for community programs that would otherwise be tied up in custodial care. Gardner State Hospital in north-central Massachusetts is presently being phased down and is scheduled to close by the end of June 1976. Its closing will result in an estimated \$4.6 million to be reallocated to community care in the state's central area.

Unencumbered resources and real increments to the department's budget are the funds around which budget decisions are made. Out of an expected mental health budget of about \$135 million for FY '78, the net amount unencumbered and available for reallocation is expected to be \$6

to \$8 million. In addition to this, the department hopes to pull in some of the \$3.5 million available in federal grants to the six-state New England region.

The decisions about how this increment is to be allocated, and about what areas will receive DMH support and priority for federal funding, are not yet final. The Commissioner and regional services administrators agreed on the initial allocation of this increment based on an analysis that preceded the one documented in this thesis comparing the demand for services in each area to the mental health resources available to its residents.

Each region has a target figure that is the sum of the allocations for its areas. Regional administrators are free to divide this total among their catchment areas as they see fit. As an aid to decision-making, regional administrators will be provided with the same information used to make allocations at the state level. The figures provided to catchment areas by the regions serve as targets for planning new and expanded programs.

Decentralized decision-making is embodied in this approach to budgeting. Areas make the primary decisions about how money is to be spent, the input of the regions and the central office coming only through target allocations and the criteria by which they will decide the final allocations in light of demands from all areas.

Area directors and boards submit plans and corresponding budget requests to the regions where, after review, they are combined into regional plans and budgets.

The budgets then go through a round of public hearings and revision

based on updated information about the availability of funds. After final regional office review, revision, and approval, the budgets are sent to the DMH central office for another round of evaluation. Finally, the DMH Budget as a whole goes to the Executive Office of Human Services to become a component of the state budget submitted by the Governor to the legislature.

The regions' central role in budget-making is emphasized by the timetable of the budget process providing 21 weeks to formulate and review regional budgets before the central office has them for only two weeks.

Of course, budget-making is not so cut and dried as the formal process makes it appear. Central to the whole process is the state legislature, a body that maintains control over the budget to the point of specifying each and every employment position in the state government. This remains a point of contention between the legislative and executive branches, the governor claiming a usurpation of executive power and the legislature wanting to maintain a tight hold on budget decisions.

By law, DMH is highly constrained in its deployment of personnel. Theoretically, the legislature could make every position in the department an item of bargaining, and DMH would be required to adhere to the legislature's decision. In practice, it probably does not always happen. The work employees do and their official job title may often be two different things. But clandestine juggling of employment positions does not provide as much administrative freedom to shape the budget as some in DMH would like. Until the role of the legislature changes, setting the budget will be a highly constrained process and the ability of DMH administration to

adjust its resources to changes between approval of one budget and the next will be hindered.

A variety of unofficial actors influence the budget-making process. State associations for mental health and mental retardation push for the interests of clients, and labor unions advocate the interests of their members, making their presences felt both through DMH channels and through the legislature when their positions are threatened.

Private providers of mental health care have an intrinsic interest in the DMH budget process, and some new DMH policy under discussion will draw some providers more tightly into it. General hospitals in the state are experiencing a decline in their bed occupancy - particularly in maternity wards. It is financially attractive to them to keep these beds filled, and they look toward psychiatric service as a lucrative way of doing this.

Coincident with lower utilization rates of maternity wards has been a change in many medical insurance policies to provide payment for short-term psychiatric treatment. By converting some wards to psychiatric use, general hospitals can tap a new source of revenue through insurance reimbursement, and keep their investment in physical plant in use.

Among the official hurdles they have to cross is a determination of need. The Department of Public Health (DPH) has to certify that the beds proposed for psychiatric use are indeed needed in the facility's region. DPH wants DMH involved in this determination and has asked for a statement on the matter from DMH. The policy under discussion in the department is one that includes a requirement that the provision

of new psychiatric beds in a catchment area be part of an area's plan. As the area planning process gets more thoroughly integrated with budgeting, it will become of critical importance to some private providers those services that will and those that will not be provided by DMH.

An added constraint on DMH budgeting is federal certification of psychiatric facilities for medicare/medicaid reimbursement. If DMH does not keep the level of funding for state hospitals high enough to provide the quality of service demanded by the federal government, they lose certification and DMH loses the revenue from federal reimbursement. (For example, DMH estimates that it could collect at least an additional \$500,000 in revenue were Gardner hospital clients to be in certified beds.⁹)

CENTRAL OFFICE

At the top of the DMH structure is the central office. DMH is directed by Commissioner Robert Okin with Associate Commissioner Mary Jane England, Deputy Commissioner Joseph Finnegan, and seven assistant commissioners dealing with: (1) mental health, (2) retardation, (3) information systems, evaluation, and planning, (4) drug programs, (5) children's services, (6) administration, and (7) legislative relations. Dr. Okin appoints all of the commissioners below him with the exception of the assistant commissioner for legislative relations; the Massachusetts legislature reserves the right to fill this position.

At present, there are no assistant commissioners for children's

services and administration, and drug programs are directed by an acting assistant commissioner.

The central office also houses a number of functional offices serving DMH as a whole, including engineering, legal services, business services, and public relations.

The central office is responsible for setting and implementing DMH policy. No formal structure for policy-making has been established, but one has nonetheless evolved to include the seven regional mental health administrators, the associate commissioner, and the assistant commissioners as a discussion forum for departmental policy.

Commissioner Okin has stated his preference that the consensus of this group form DMH policy. While we sense that this is indeed happening, the final decisions on policy rest with Dr. Okin.

The 30-member State Advisory Council on Mental Health and Retardation provide the Commissioner with advice and reactions from outside of the department. Members are appointed by the Governor upon the Commissioner's recommendations to 3-year terms, with no more than two consecutive terms allowed.

Planning staff input to decision-making comes through the Office of Information Systems, Evaluations, and Planning (OISEP). Headed by assistant commissioner Dr. H. Stephan Leff, OISEP is divided into three divisions implied by its name, each with a director or co-directors, and staff. OISEP as a whole consists of about 25 regular personnel, and a varying number of part-time workers brought in as needed, usually for survey and data processing.

The OISEP budget is about \$200,000 - at least as carried on the

books. A number of the staff were paid from non-OISEP accounts.

The mechanism for including OISEP staff work in decision-making is twofold. Assistant commissioner Leff is a participant in DMH policy discussions and is therefore in a position to make the staff's work known to decision-makers, and at the same time bring back to the staff the concerns of policy-makers. The staff has direct communication with policy-makers as well. In the past when staff work was of immediate relevance to an impending decision, staff members met with the Commissioner and his associates. One example of this was when staff members met with the Deputy Commissioner on patient relocation before he set up the plans for closing Gardner State Hospital.

At the risk of sorting the work of OISEP into categories that appear more clear-cut than is the case, we will discuss briefly the three divisions of OISEP.

The information systems division is presently setting up three computer-based data management systems to provide what policy-makers consider essential information. The first of these is designed to fill the pressing need for client information. Until recently, DMH had no data on how clients seeking mental health care moved through various services, and lacked a systematic way of keeping information on the clients themselves - information that is necessary to establish client eligibility for programs covering the cost of care.

The other two systems attempt to keep track of how resources are allocated across both geographical areas and programs. One deals with personnel data, the other with fiscal information.

With the impending closing of Gardner State Hospital, the eval-

uation research division is working feverishly to complete an analysis of the recent closing of Foxboro State Hospital. DMH is looking to this division for guidance in relocating staff and patients as Gardner phases down. Though this division is more widely concerned with the effectiveness of DMH policy and programs, the urgency of the deinstitutionalization evaluation limits the range of work it can engage in.

The planning division is completing a new state mental health plan required for the distribution of federal funds under PL 94-63, and on integrating planning with the budget process.

Early in January, 1976, the OISEP planning staff decided that the work of producing a state plan for distributing federal funds should be a part of planning for the distribution of departmental resources. This decision was based on three factors:

1. NIMH guidelines for state mental health plans under PL 94-63 require that all catchment areas in a state be ranked in order of their need for new mental health resources, and that this ranking be used to set priorities for areas to receive federal funds for the construction and expansion of mental health centers.¹⁰ Internal budget decisions require more than simply a ranking of areas. More detailed information on the magnitude of the differences between areas was wanted by decision-makers, as well as data on the configuration of services offered to community residents. Since DMH needs were more stringent, an effort aimed at meeting them would provide the information required by NIMH as well.
2. The method suggested by NIMH for establishing the ranks was flawed; we had a more theoretically sound and pragmatically defensible procedure in mind. (A detailed discussion of this is provided in section V.)
3. Departmental goals would be served better by planning the distribution of both federal and state resources consistently. Integrating the state and federal planning requirements would avoid a double standard for resource allocation.

The procedure developed in this thesis is part of the current planning of DMH.

SECTION III

DMH POLICY AND RESOURCE ALLOCATION

Each year, the DMH budget process presents the Commissioner and his staff with two basic questions:

1. What target figures should be set and communicated to regions and areas so they can plan with a realistic idea of the funds available to them?
2. As the regional budgets are returned to the central office, how can the competing demands for resources be evaluated and compared to each other?

The policy statements of DMH frame the answers to these questions. In his memorandum included with this year's guidelines for area planning, Commissioner Okin said: "We are painfully aware that there are many areas in the state that have remained critically underfunded. We are hoping...to pay special attention to these areas in order to increase equity throughout the state system."¹¹ For FY '78, the explicit program priority for DMH is to develop comprehensive community alternatives to institutional care.¹²

Allocating resources commensurate to the mental health problems in an area to achieve equity, and providing alternatives to inpatient care are concepts that have been dominant in DMH policy for a while. Incorporating these policies in departmental decision-making in a self-conscious way is something new.

This move toward making policy more operational stems in part from the desire of the DMH administration to rationalize its resource allocation decisions. Additional pressure has been brought to bear from legislators demanding to know whether budget appropriations are having

their intended effect. Moreover, the federal government is asking for more explicit criteria by which to evaluate grant applications. In its guidelines for state mental health plans, NIMH is emphatic in demanding a clear defense of funding priorities for federal grants.¹³

In tallying the good points of self-conscious, rational policy implementation, one cannot escape the fact that the move toward rational decision-making is also a move on the part of administration to back its own position and buttress it against pressures contrary to its policy.

This call for explicitness and accountability in policy and program design has been strengthened by the recent recession. In an economic decline, human service agencies are pressured on one side by falling revenues and on the other by increasing demand; both are driven by the same economic forces. Caught between these, agencies must examine the services they offer and find ways to provide them efficiently within their limited resources.

For the most part, ours is an economy in which the impact of real wage increases can be partially offset by rising productivity, dampening the effect of higher wages on prices. However, some parts of the economy cannot increase worker productivity substantially; human service agencies face this problem. Wage increases cannot be absorbed by productivity-increasing capital investment. Instead, they push up the price of the "final product."

The provision of mental health services demonstrates this problem in the extreme. Mental health is a very labor-intensive business, with service based largely on the personal interaction between a client and a professional. Except in administration, there is little room for productivity

increases through capital investment. Some costs can be reduced by changing the way services are offered, deinstitutionalization being an obvious example. In addition to improving patient care, community alternatives to psychiatric hospitalization offer the possibility of reduced costs.

When Grafton State Hospital began its phasedown in January 1972, the 870 clients then under treatment cost an average of \$16.88 per client day. Community placements of 358 DMH clients transferred from state hospitals cost \$10.15 per client-day in August, 1973. This figure is an under-estimate in that it does not include the costs of medical services provided routinely at state hospitals. A rule-of-thumb estimate for this is \$1.00/day, making the cost of community placement \$11.15/day.¹⁴

One has to be cautious in comparing these costs and concluding community-based care is less expensive. The cost differential depends upon the services provided to clients. The figures cited above do not make clear whether the same type of client is represented. While some can receive adequate treatment in a relatively inexpensive residential setting, intensive community treatment of acute psychiatric illnesses demands a high level of professional staffing when compared to the less expensive staff of mental institutions oriented toward custodial care.

In the 10 Massachusetts mental hospitals operating in 1973, professional staff (including medical doctors, dentists, psychiatrists, psychologists, social workers, rehabilitation personnel, professional nurses, and education and program coordination staff) represented 21% of total personnel; the same average for all Massachusetts community mental health centers was 64%.¹⁵

There are hidden costs to deinstitutionalization as well, costs DMH does not incur because the clients have left the system. Discharged clients sometimes become dependent on other public agencies. Ex-mental patients left without appropriate community treatment are frequently arrested for minor legal infractions; psychoactive drugs may be overutilized as they become difficult to handle, and sometimes the clients show up in emergency rooms of general hospitals as alcoholics or drug abuse cases.¹⁶

Motivated by administrative professionalism, legislative pressure, and economic necessity, DMH is looking for ways to carry out its two overriding policies of equity and comprehensiveness. These policies represent two aspects of resource allocation - the geographical distribution of resources and the distribution across various services.

The geographical distribution of resources: The policy of equity is aimed at providing each catchment area funds commensurate to its demand for mental health services. Table 2 shows the geographical distribution of dollar resources including DMH, federal, local, and the private sector resources that could be estimated. The figures cover a wide range. Boston University's \$48.61 per capita is better than five times that of Eastern Middlesex at \$9.04. This difference is not necessarily out of line. Boston University area is beset with severe economic and social problems that have undesirable implications for the mental health of its population. The magnitude of its mental health problem is considerably greater than that of Eastern Middlesex, a stable area without a great deal of poverty.

But what of places such as the Concord area? Like Eastern Middlesex, it is stable and wealthy, but it has \$33.42 per capita. Lowell, not

TABLE 2: ESTIMATED PER CAPITAL EXPENDITURES FOR MENTAL HEALTH SERVICES IN 1976 (FIGURES INCLUDE FEDERAL, STATE AND LOCAL RESOURCES WITH PRIVATE RESOURCES ESTIMATED WHEREVER POSSIBLE. NOT INCLUDED ARE EXPENDITURES ON REGION-WIDE PROGRAMS.)

Area #	Area Name	Per Capita Expenditures
1.	Berkshire	\$11.93
2.	Franklin-Hampshire	16.40
3.	Holyoke-Chicopee	10.58
4.	Springfield	14.62
5.	Westfield	13.72
6.	Fitchburg	13.82
7.	Gardner-Athol	25.60
8.	Blackstone Valley	16.76
9.	South Central	17.64
10.	Worcester	16.95
11.	Cambridge-Somerville	30.57
12.	Concord	33.42
13.	Lowell	11.83
14.	Metropolitan-Beaverbrook	24.34
15.	Mystic Valley	20.07
16.	Danvers-Salem	10.36
17.	Haverhill-Newburyport	15.01
18.	Lawrence	14.93
19.	Lynn	38.12
20.	Tri-City	11.20
21.	Eastern Middlesex	9.04
22.	Cape Ann	15.86
23.	Medfield-Norwood	12.24
24.	Newton-Wellesley-Weston	13.47
25.	South Shore East	11.17
26.	Greater Framingham	22.26
27.	Marlborough-Westborough	22.50
28.	South Shore West	11.34
29.	Boston State Hospital	20.89
30.	Boston University	48.61
31.	Harbor	34.19
32.	Mass. Mental Health Center	30.66
33.	Tufts Mental Health Center	42.37
34.	Cape Cod and the Islands	27.65
35.	Brockton	18.33
36.	Fall River	23.50
37.	Attleboro	21.46
38.	New Bedford	24.97
39.	Plymouth	14.55
40.	Taunton	15.17

(SOURCE: Calculated from DMH budget and federal grant information assembled primarily by Mark McGrath and Will Van Horne.)

an area in destitution but nonetheless not as well off as Concord, receives only \$11.83 per person. It is this kind of inequity that departmental policy is aimed at.

Distribution of resources across services - As mental health care gets away from its reliance on psychiatric hospitals, policy makers must turn their attention toward allocating funds to the multiplicity of services that modern attitudes toward mental health care dictate. At present, DMH does not know what the allocation of resources across services is; nor does it know how far resources in different services go toward serving the mentally ill. Moreover, there are no generally accepted guidelines on how resources should be allocated across services to achieve comprehensive care.

Since the issues surrounding equity policy will be discussed in the next few sections, this section will concentrate on the policy of comprehensiveness and on its integration with equity.

As the distribution of resources across services in Massachusetts is vague, so is the whole notion of what constitutes a comprehensive set of services.

"We do not know what should be the mix of outpatient services, inpatient care in general hospitals, one-to-one psychotherapy, nursing homes or other smaller residential facilities...We have no accurate estimate of our need for each, of their cost effectiveness,...[and of] what is required in staffing for all these varied programs."¹⁷

The federal government recognizes twelve essential services that together make a comprehensive mental health program: (1) outpatient, (2) inpatient, (3) partial hospitalization, (4) emergency, (5) community residences, (6) consultation and education, services for (7) children

and (8) elderly, (9) drug abuse programs, (10) programs for alcoholics, (11) services for screening clients to avoid unnecessary inpatient care, and (12) after-care services to smooth the transition from inpatient treatment to everyday life.

This list is a mixed bag of things describing comprehensiveness along several dimensions:

1. Target populations - particular groups in need of special mental health attention. These include children, the elderly drug abusers, and alcoholics.
2. Dominant types of treatment - outpatient, inpatient, partial hospitalization, and community residences.
3. Elements in the chronology of a client's treatment - screening for appropriate treatment to avoid hospitalization if at all possible, and aftercare services that provide assistance to clients as they leave inpatient care.
4. The extension of mental health services beyond direct care - Consultation and education widens the scope of mental health care by providing professional assistance to agencies and individuals in the community who are presented daily with problems having a psychological component.

Some members of the state mental health advisory council have been highly critical of the federal definition of a comprehensive program being one that provides these twelve services. They object to a categorization which outlines elements of service describing the four aspects above but not considering how these aspects should relate to one another. NIMH provides no guidance for establishing comprehensive service other than these twelve simplistic categories.

To develop a better understanding of what comprehensive service is, OISEP staff developed the comprehensiveness assessment scale (CAS).¹⁸ Using the 12 essential services designated at the federal level, and adding a thirteenth dealing with administration, they set out to define

what a comprehensive area program should be.

For each of the thirteen elements, they met at length with central office personnel and DMH field staff to discuss its important components and its relationship to other services. After writing and circulating several drafts, they put together a lengthy (104 pages) survey instrument that was sent out to each area director or associate director. The survey attempts to determine the extent to which each of the services are provided in a catchment area.

Every element of the survey had several questions associated with it. For example, the section on emergency service asks:*

1. At how many separate geographic locations within your catchment area are emergency services offered as part of the area program?
2. What percentage of the catchment area's population live within a 20 minute commuting distance of emergency services?
3. How many hours per week are emergency services available?
4. How many hours per week are medication, evaluation, and prescription services available to area residents on an emergency basis?
5. What is the maximum time an emergency client in acute need can remain in a holding status without having to be admitted as an inpatient?
6. What percentage of emergencies needing a home or field visit actually result in a visit by a member of the area staff?
7. How many hours per week are personnel who are specifically trained for crisis intervention available or on call?
8. Clients seen in an emergency service may require a wide range of referral services following their initial contact. How many of these services have emergency clients been referred to in the past month?

*Since these questions are taken out of the context of the survey, they have been reworded here for clarity and economy of presentation.

9. What percentage of emergency referrals are actually followed up?

10. For what percentage of emergency clients admitted to other mental health treatment programs after an emergency visit are written records of the emergency encounter forwarded to the admitting program?

Two important problems stand squarely between the data that CAS will produce and its interpretation into some useful statements about a desirable mix of services:

1. Within each of the 13 services, how important are the individual items in determining that service's contribution to mental health care?

2. What is the relative importance of each of the 13 services in providing comprehensive care?

The answers to these are simply unknown. An understanding of how various components of a service contribute to its effectiveness, and a clear notion of how these services taken together provide comprehensive mental health care presuppose a measure of comprehensiveness. To the knowledge of OISEP staff and the planning subcommittee of the state mental health advisory council, no one has put forth an operational definition of comprehensiveness. Compounding this is a dearth of knowledge about how clients pass through the mental health system, about the demands they place on it, and about how programs can be structured to meet these demands. Except in an intuitive way, one cannot at present assess the importance of a particular aspect of mental health treatment.

CAS is serving a double function. First, it will provide information for budget discussions, even though it is not yet clear exactly how that information can be used. Its second function will be as an exploratory tool to determine the services that exist in each catchment area and some of their detailed characteristics.

CAS begins to look at the relative importance of a service's particular components by asking area directors to indicate on a zero (worst) to four (best) scale how important each component of a service is in determining comprehensiveness. Directors are also asked to give an overall rating of each service using the same scale.

When the results are finally analyzed, we will have learned the opinion of an expert panel of 40 area directors and associate directors. OISEP staff is hoping this will provide some insights into developing better concepts of what should comprise a mental health system. Until there is such an understanding, mental health administrators will be left to fall back on informed intuition to allocate resources across services.

The picture of the service distribution across the state that CAS will provide will be incomplete in that the survey deals with services as they appear on paper, not as they are delivered. The whole issue of quality of care is beyond the scope of CAS. It remains an issue of burning concern in central office that has yet to be addressed systematically. Hopefully, CAS will provide some basis for dealing with quality of care.

The problem of allocating resources across services is of an optimizing nature. What mix of services provides the best mental health care for the available resources? As more work is done in the area, researchers can begin to answer this. A basic problem yet to be solved is to come up with an operational definition of comprehensiveness. Until one is found, specifying an appropriate service mix will remain analytically intractable.

COMPREHENSIVENESS AND EQUITY

In spite of the difficulties in measuring it, comprehensiveness is still an explicit policy of DMH, and along with considerations of equity enters in resource allocation decisions. The hypothetical example outlined below illustrates the relationship between these two policies as they impact budget decisions.

The example begins with four catchment areas having the same demand for mental health services - A, B, C, and D - and three services that taken together at the right level of funding, could provide comprehensive care - inpatient, outpatient, and emergency services. Assume that some definitive statement on the optimal mix of services were available, and that the translation of this statement into dollars means an ideal resource distribution of \$90,000 on inpatient services, \$675,000 for outpatient care, and \$135,000 for emergency services in each area.

The existing allocations across services for each area are given in the table below. Summing each row provides the total dollar resources allocated to each area.

AREAS	SERVICES			AREA TOTALS -000-
	INPATIENT -000-	OUTPATIENT -000-	EMERGENCY -000-	
A	\$400	\$675	\$120	\$1195
B	\$ 90	\$675	\$135	\$ 900
C	\$345	\$120	\$135	\$ 600
D	\$670	\$100	\$135	\$ 905

The total resources in this hypothetical mental health system amount to \$3.6 million, and since the area populations are assumed to have the same demand for services, an equitable distribution of resources under DMH policy would provide each area with \$900,000.

By the equity criterion, areas B and D are adequately funded. Looking at the distribution of funds across services shows something quite different. When compared with the ideal service funding, area B represents an optimal spending of \$90,000 on inpatient, \$675,000 on outpatient, and \$135,000 on emergency services. D, on the other hand is spending far too much on inpatient services at the expense of adequately funded outpatient care.

Of all four areas C is clearly in the worst position judged by either equity or comprehensiveness. Not only is it underfunded, but also the scarce resources at its disposal are not well distributed, inpatient services being well overfunded. Area A is at the other side of equity; it is \$295,000 overfunded but is spending \$15,000 too little on emergency services.

Faced with this resource distribution across areas and services, what budget decisions do policies of equity and comprehensiveness indicate? Discussion in the DMH central office suggests three options.

Option 1: Central decision-makers should be concerned with the aggregate equity of funding. Decentralized decision-making allows catchment areas to set their own priorities and budgets. Since they are free to do this, rectifying the maldistribution of resources is the province of area boards and directors; the state agency's role is to insure a fair share of resources to each area and to support local initiatives in structuring mental health care. While research might show

one or another distribution of funds across services to be optimal, local providers are in a position to judge what services are needed in their area.

By this reasoning, area C would receive the highest priority for funding and A the lowest; areas B and D are nearly equal, but since B has \$5000 less, it receives a higher priority for funding.

Option 2: Though equity considerations at the state level are paramount, the provision of comprehensive services cannot be ignored. The distribution of resources across services is information that can be used to make finer-grained distinctions between areas at the same, or nearly the same, equity level.

The implication here is that area C still receives highest priority for funding; B and D are nearly alike by equity, but since D is so deficient in outpatient service, D should be funded to bolster it.

As with the first case, area A is of lowest priority for funding.

Option 3: A third perspective takes the stance that the mental health care system is rife with inertia. Large mental institutions cannot be moved easily to provide community-based care; staffing patterns at these facilities differ greatly from that of a community-oriented center, and the retraining necessary or the restaffing implied are significant obstacles in reallocating funds across services.

While fine in theory to speak of decentralized decisions to provide a comprehensive service mix, the reality of the mental health care system constrains the allocation decisions of catchment areas. Equity considerations are meaningful only when speaking of unconstrained resources, and when comprehensive services are in place.

The implication of this reasoning is that area D is most in need of funding. Its \$575,000 deficiency in outpatient funds makes it more needy than area C which was set as the first priority under the previous two options. C is deficient in outpatient funds as well, but by \$555,000. The other two services in C are adequately funded. Area B provides comprehensive service, with adequate funding for all three types of care. Area A is sufficiently funded in outpatient services, overendowed with \$405,000 for inpatient care, but lacks \$15,000 in emergency service, ranking it ahead of B for funding, even though it has \$300,000 more in the aggregate.

To summarize the catchment area funding priorities under each of the three options:

OPTION	FUNDING PRIORITY (highest to lowest)
1. Equity considerations are paramount; catchment areas are responsible for establishing comprehensive service given an equitable level of funding.	C, B, D, A
2. Service comprehensiveness is a secondary policy consideration that can be used to discriminate better between two areas at or near the equity position.	C, D, B, A
3. Institutional inertia prevents areas from reallocating funds to achieve comprehensive service. Equitable funding is secondary to providing comprehensive service.	D, C, A, B

Which of these options is appropriate? All three entail trade offs between having equity and achieving comprehensiveness. The first option represents one extreme of equity considerations only, and the third option, by pushing comprehensiveness even at the expense of equity, sits squarely at the other. The decision about which of these, or what point in between, is to be adopted hinges on information about how much client benefit is lost or gained with different service configurations, and depends upon a conception among decision-makers about the equity they are willing to sacrifice to achieve this benefit, if that sacrifice were necessary.

DMH is, de facto, following something close to the second option. Target allocations to areas for FY '78 are being discussed primarily in terms of equity, with some adjustments to funding priorities being made by decision-makers based on their intuitive judgement of areas' needs for services. We sense that this lack of explicit service mix consideration is not troublesome to DMH decision-makers. It seems to be taken as common knowledge that any allocation decision will increase comprehensiveness because the system presently is so skewed toward inpatient treatment. This leave equity as the criterion to discriminate between good and bad decisions.

When the final FY '78 DMH is made in the beginning of September, 1976, the results of CAS may have some explicit impact on allocation decision, but this remains to be seen.

With this discussion of mental health policy and budget making as background, we return to the two questions opening their section:

1. What target figures should be set and communicated to regions and areas so they can plan with a realistic idea of the funds available to them?

2. As the regional budgets are returned to Central Office, how can the competing demands for resources be evaluated and compared to each other?

For DMH at present, the answers are being made according to equity; perhaps in a few months when CAS is complete and results are thoroughly analyzed, service mix considerations will enter decisions more explicitly. But until then, the departmental policy is to allocate resources according to the demand for mental health services. DMH administration has turned to its planning staff to measure this demand and show the resource allocation decisions implied.

SECTION IV

A RESOURCE ALLOCATION METHOD

Attempting to measure the absolute need for mental health service is futile because a firm concept of mental illness does not exist.

"Mental illness is defined socially...in our society psychiatrists treat individuals whose behavior would be ignored in a second society, punished by the criminal courts in a third, and in still others given over to priests."¹⁹

Some efforts have been made to bypass the abstract notion of psychiatric need and go straight to an operational definition of a population's need for treatment. These efforts have produced strikingly inconsistent results. A review of the literature shows estimates of the need for psychiatric beds to range from a low of 0.2 per 1000 population to 3.75.²⁰ Cited most frequently are 0.5 and 1.0 beds per 1000.²¹

Applying these figures to Massachusetts' 1975 estimated population of 5,904,000²² yields the following:

BEDS/1000 POPULATION	# OF BEDS IMPLIED
0.2	1181
0.5	2952
1.0	5904
3.75	22140

For comparison, Massachusetts had 13,733 psychiatric beds in 1974.²³

Direct observation of the utilization of mental health facilities in an area can provide a handle on a population's need for services.

However, there are two major problems with this approach:

1. Not all areas are equally endowed with facilities. Areas with extensive service might appear to have high need relative to another area whose population has similar problems but fewer resources to deal with them. This might be called "the 'iceberg' effect, by which new provisions in mental health seem inevitably to reveal new dimensions in demand rather than relieving pressure on existing provision."²⁴

2. Utilization data record only treated illness, without more information in untreated mental illness one can only hope that there is a stable relationship between facilities' caseload information and untreated mental illness across areas. The first point above suggests this hope is unfounded when areas are served unequally.

Attempts to correct for the inadequacy of utilization data have used community surveys to identify the magnitude of mental illness.²⁵

"These types of studies theoretically, will develop accurate data regarding the 'true' prevalence (treated and untreated) of mental disorders in the community. There are several problems with the execution of such operations. The high cost factor associated with these studies usually makes them prohibitive. In addition, there is as yet no adequate instrument to reliably assess mental disorders let alone the degree of mental disorder, and especially, no instrument available which does this quickly. Lastly, and perhaps most important, there is a need for a stable definition of mental health/mental disorder. Therefore, other methods, [such] as the use of social indicators, are needed to assess mental health needs."²⁶

The approach to mental health resource allocation documented in this thesis will draw on social indicators, and will do so backed by "one of the most prominent findings in psychiatric epidemiology, namely, the inverse relation between socioeconomic status and the incidence of treated mental disorder."²⁷

What is the logic behind this relationship?

"In the high SES [socioeconomic status], the widowed mother at least has money in the bank. Children of low intelligence or diligence can be expelled from a school or college, yet parents with financial means can assure their placement in another institution of learning.

Physical or mental ailments are less likely to impair the child's general functioning. These conditions are not only more easily recognized by parents who have a better education, but there is a positive attitude toward medical services, more money to pay for the best of such services, and more time available to see that the children get such services when the mother does not work. The high SES person has more freedom to move from jobs which are unsatisfactory. Thus, the 'hammer blows' that might originally be as damaging to mental health as they seem to be in the low SES could be cushioned by the generally favorable 28 circumstances in which the high SES people find themselves.

The social indicators approach to a needs analysis is based largely on rationale that these "hammer blows" and the lack of cushioning circumstances for people to fall back on are reflected in the characteristics of an area, and that by combining measures of these characteristics in some manner, one can come up with a relative estimate of an area's needs. Some past attempts to use social indicators in a needs analysis have depended on informed guesswork to combine these characteristics. (See section V.) The procedure developed here attempts to combine social indicators on the basis of empirical observation and through the use of standard multiple regression.

This procedure for assessing an area's mental health service requirements is based on four considerations: (1) that relative demand for services rather than psychiatric need is the more useful concept, (2) that observed utilization of mental health facilities reflects relative demand, (3) that the demographic, social, and economic characteristics of an area influence the demands its population places on mental health systems, and (4) that DMH decision-makers need a procedure that can be applied consistently to all areas in the state to determine an equitable level of funding, that would be theoretically and empirically defensible, and that could be carried out within the time and data constraints.

NEED VS RELATIVE DEMAND

The absolute need for an area is so nebulous a concept as to be impossible to measure. Instead of need, the concept of relative demand for service across catchment areas will be used. Since the decisions to be made using this procedure entail comparisons among areas and not comparisons of areas to some standard, a relative measure is sufficient.

USING UTILIZATION DATA

The observed utilization of mental health facilities is an indication of an area's demand for services, though not a direct measure of it. Unless complete information in all facilities and programs serving an area is available, observed utilization is only a part of mental health care demand. The assumption made here is that observed demand data can serve as a proxy for total demand for services. This assumption cannot be avoided; complete data are unavailable. But it is not unreasonable. In the first place the data are for state psychiatric hospitals - a set of facilities that includes 59% of all known psychiatric beds in the state.²⁹ So if the set of data is thought of as a sample, it covers a large part of the universe from which it is drawn. In the second place, inpatient care still dominates psychiatric treatment; though no data exist to verify this, it is "folk wisdom" that is widely shared among the central office staff. Its implication is that variations across catchment areas in the demand for services show up in inpatient utilization figures because alternative services to absorb this demand generally do not exist. While this becomes less and less true as more areas establish community services, in 1974 when the data were collected,

only nine out of 39 areas had community mental health centers in place, and only two areas had curtailed expenditures on state hospital inpatient units because suitable alternatives were available.

Observed demand can differ from total demand for another reason. Since the data are collected from public facilities they represent the bias of a system mixed in its public and private components. Lacking the financial means to use private facilities and practitioners, the poor show up in the public sector.

This bias results in the characteristics of lower income groups being the best predictors of demand. While the bias is undeniable, it is not alarming. The resource allocations resulting from the procedure will be skewed toward areas with greater economic need. It is comforting to know that this bias counters the greater access to private facilities wealthier populations have.

The utilization data available for this analysis were collected in 1974 for nine Massachusetts psychiatric hospitals from a computerized patient information system which DMH was using at the time. Since each state hospital has separate units for the catchment areas it serves, the system was able to provide the number of first admissions to state hospitals by catchment areas, as well as statistics on client's length of stay. For each catchment area, an estimate of the demand placed on the state hospital system was made by multiplying first admissions times average length of stay.³⁰ (This figure will be referred to as observed demand.) This calculation represents a departure from the concept of mental health need referred to in the literature and in one of the need calculation procedures presented in section V. Traditionally, work in

this area is based on the number of first admissions only - not taking into account that the average length of stay across catchment areas varies from 1.12 in the Berkshire area to 3.97 in the Harbor area.³¹ The departure from tradition is justified in that the resources necessary to meet the requirements of an area depend not only on admissions but also on the length of time admitted clients spend in the system.

There are several other problems with these data that will be mentioned here but discussed later: (1) the data were originally collected for the 39 catchment areas recognized by DMH in 1974; now there are 40 areas, so some adjustments had to be made; (2) first admissions measures only new cases but the demand for resources depends not only on these but also on existing, continuing cases; and (3) observed demand is in part an artifact of the system of mental health care and does not reflect only the characteristics of the populations served.

AREA CHARACTERISTICS AND THE DEMAND FOR SERVICES

This procedure is based on the assumption that characteristics of an area's population affect their mental health, and that this phenomena will be manifest in the utilization of psychiatric facilities. By comparing the differing utilizations of state hospitals by area to these characteristics, one can infer the effect of specific characteristics. The inference will be made using multiple regression - a technique commonly used to investigate the simultaneous effects of several variables on a single dependent variable.

The characteristics used in the analysis were drawn from the 1970 census and were aggregated to DMH's 40 catchment areas. Included were

age breakdowns both by race and sex, income distribution, occupation characteristics, and housing information.

Two broad classes of indicators were of interest: (1) raw counts of persons or households showing the magnitude of a particular group, and (2) measures of the intensity that represent the geographic concentration of a particular group. The first is fairly straightforward, but the second requires some elaboration, perhaps best given by an example comparing the Boston University catchment area to the Harbor (sometimes called Lindemann) area. The pertinent data are given in the table below.

	Boston University	Harbor
Total population	115,853	174,297
Families in poverty	4,700	5,598
Number of Families	23,500	69,975
% of families in poverty	.20	.08

(Source: 1970 census)

In magnitude, the Harbor area has many more families in poverty than does the BU area; but the BU area has much more intense poverty, with 20% of the families there being below the poverty line compared to only 8% in the Harbor area. The importance of this difference for the procedure developed here is implied in the hypothesis that the more concentrated poverty is, the more pronounced will be its ill effects on mental health. The state of poverty is detrimental, and that detriment is made more severe when surrounding families are in poverty as well. The effects of poverty are reinforced when the better living environment of a wealthier community is not available because a large portion of the community is in poverty.

This is essentially saying that there are scale effects to poverty. We tried to capture this effect by weighting several indicators by the percent of families in poverty. Applying this to the Boston University and Harbor areas, the BU area would be assigned 6795 families in poverty and the Harbor area would have 3323.

DMH NEEDS AND TIME CONSTRAINTS

The work on this procedure began in early January, 1976. We needed to develop a planning tool that could be used to guide initial target allocations for the FY '78 budget process to begin in April and by May 15 had to establish priorities for catchment areas to receive federal grants. With these constraints in mind, and with an eye on existing or easily collectable data, we began discussing various approaches.

The staff felt profoundly uncomfortable about coming up with a one-dimensional statement of "need" that NIMH recommended as a means of setting funding priorities. Instead, we wanted to make some detailed statements about the deficiency or adequacy of service in each area by particular service types and by two age groups - children and elderly. Data problems prevented us from doing this. The information does exist - but in as diffuse a form as possible. The central office does not keep tabs on this information. Rather, it is recorded on a patient-by-patient basis at facilities throughout the state.

In view of the information at our disposal and the time constraints we decided that we would have to work with aggregate data for the state's 40 catchment areas. Simple as this seems, we ran into a number of persistent and frustrating problems. At the beginning of this effort,

DMH was involved in a redistricting plan mandated by the state's Administration and Finance Office and coordinated among the human service departments by the Executive Office of Human Services. The plan was to establish common sub-state administrative boundaries so that administration could be more organized, that data collection could be more systematic, and that service delivery could be more efficient. Some DMH staff felt that the real purpose was to make maps more orderly.

Of the department's 40 areas, 16 were caught up in boundary realignments, and ever since the current planning effort began, we have been resting uneasily with planning for areas whose boundaries are still points of contention.* In order to get work underway, we were forced to make a decision about what the catchment area boundaries would probably be in the near future. (The map on page 18 reflects this.) So far, our guesses seem to be holding.

An early step was to collect data on catchment area characteristics. Though NIMH maintains a demographic information system that supplies states with census data for any given area, we had to make a decision early on about whether we could count on NIMH. We felt we could not, and hindsight says we made the right decision to supervise our own

*The situation reached its most comical point in early March when, after a lull in discussions about boundaries, we put together a map of the "new" areas, and sent it off to the printer early in the afternoon. At 5 p.m. that same day, we received a call from the region V administrator trying to clarify his region's boundary status. He informed us that the towns of Holbrook and Norwell had become part of region V, having left region VII, contrary to our projection of this happening in three years. A quick call to the printer got the map back so that the old regional boundaries could be scraped off and replaced. Not hours after we sent the map off to the printer for the second time, someone from region VII informed us that Norwell and Holbrook had not yet become part of region V.

census processing.

Though we had some information "in house" on the utilization of state psychiatric hospitals and clinics, we felt it was insufficient. The annual survey of psychiatric facilities administered by NIMH was being collected through our office, but it did not ask for enough information on outpatient service. To get the data necessary, we decided to administer our own facility survey.

The survey was overly ambitious. Drafting it took longer than we planned for, and returns did not come in on time for us to use them for either the state plan going to NIMH or for the FY '78 budget process. Though results are now coming in, a great deal of follow-up is necessary until we have the needed information.

Essentially backed up against a wall with no other data but state hospital utilization and census information, we had no choice but to do as much as possible with what was at hand.

THE PROCEDURE'S RESULTS

Observed demand can be viewed as composed of two parts: (1) primary demand that is the result of the characteristics of the population served, and (2) secondary demand that is an artifact of the nature of the service offered. The only variable we had to represent the nature of service offered was the expenditure on state hospitals by catchment area for FY '75. Clearly this is not the most desirable indicator in that it expresses in only a very gross way the characteristics of service. But, coarse as it is, it is our only measure.

One way to look at secondary demand is to assume that there is an

overwhelming need for mental health care that far exceeds the capacity of existing facilities. Any service supplied simply will allow previously unserved demand to be observed. Different expenditures on service across areas will allow different levels of this demand to be observed.³² Another way to think of secondary demand is as demand induced by the provision of services. This view implies that service provided over and above that necessary to service primary demand generates an additional load on the service. The multiple regression procedure used is unable to distinguish between these two ways of viewing secondary demand.

Using data on 36 catchment areas (excluding the Lowell, Harbor, MMHC, and Fall River areas), a number of regressions were run to find the best set of predictors of psychiatric inpatient demand. The one chosen for this analysis was:

$$\begin{aligned} \text{DEMAND (in client months)} &= .00088 \times \text{TOTAL POPULATION} \\ &\quad (p < .05) \\ &+ .08282 \times \text{POPULATION LIVING ALONE} \\ &\quad (p < .001) \quad \text{WEIGHTED BY POVERTY} \\ &+ .02922 \times \text{STATE HCSPITAL EXPENDITURE} \\ &\quad (p < .03) \\ &- 9.7 \end{aligned}$$

$$\begin{aligned} \text{MULTIPLE R} &= .76 \\ R^2 &= .58 \\ \text{F RATIO} &= 14.48 \text{ (with 3 degrees of freedom in the numerator} \\ &\quad \text{and 32 in the denominator, } p < .001) \end{aligned}$$

For an explanation of the statistics used here, see appendix A.

Though only three variables are explicitly used here, a fourth is incorporated in the weighting by poverty. The weight is simply the proportion of families in poverty.

By setting an equal level of service in each area,* the primary demand for services in each area can be estimated using the above equation. By allocating the total resources in the mental health system in proportion to primary demand, one can get the "fair share" of resources due each area; a comparison of this figure to actual dollars allocated gives resource surpluses or shortfalls. These figures are given in Table 3.

Table 3 embodies a host of issues for budget decisions. First, how much trust can be placed in the numerical procedures behind the figures? The next two sections suggest that the procedure should be viewed with caution, that the resulting figures should be considered only rough indicators of resource deficits and surpluses, and that the relative funding priorities implied by the figures should be tempered with judgement based on knowledge of the state mental health system. More on these points later.

Setting the validity of the procedure aside, several issues demand the attention of the DMH administration, attention which has not yet been explicitly accorded.

How should DMH view its role in the provision of mental health services? Should it use state funds, and the leverage it has on federal grants, to redress the inequities in the private sector? Or should DMH consider itself apart from the private sector and, within its own

*An equal level of service is defined here to mean a constant dollar allocation per unit of demand.

TABLE 3: FAIR SHARE ALLOCATIONS COMPARED WITH ESTIMATED ACTUAL ALLOCATIONS FOR FY '76

Area #	Area Name	Percentage of Total Primary Care	Fair Share Allocation -000-	Estimated Actual Allocation -000-	Surplus or Shortfall (-) -000-
1.	Berkshire	2.52	\$2822	\$1782	-\$1040
2.	Franklin-Hampshire	2.18	2444	2211	-233
3.	Holyoke-Chicopee	3.33	3739	2043	-1696
4.	Springfield	4.00	4489	3057	-1432
5.	Westfield	1.39	1557	1296	-261
6.	Fitchburg	2.50	2801	2138	-663
7.	Gardner-Athol	1.17	1316	1916	600
8.	Blackstone Valley	1.86	2082	2161	79
9.	South Central	1.32	1476	1526	50
10.	Worcester	4.26	4777	4164	-613
11.	Cambridge-Somerville	4.19	4703	5782	1079
12.	Concord	0.94	1057	2553	1496
13.	Lowell	3.45	3870	2533	-1337
14.	Metropolitan-Beaverbrook	1.95	2186	3144	958
15.	Mystic Valley	2.61	2926	3697	771
16.	Danvers-Salem	2.17	2437	1452	-985
17.	Haverhill-Newburyport	1.77	1980	1584	-396
18.	Lawrence	2.49	2788	2125	-663
19.	Lynn	2.59	2908	5487	2579
20.	Tri-City	2.69	3018	1825	-1193
21.	Eastern Middlesex	1.56	1744	1023	-721
22.	Cape Ann	1.68	1879	1680	-199
23.	Medfield-Norwood	2.19	2457	1956	-501
24.	Newton-Wellesley-Weston	2.18	2447	2152	-295
25.	South Shore East	2.12	2379	1677	-702
26.	Greater Framingham	2.18	2447	3492	1045
27.	Marlborough-Westborough	0.96	1057	1612	537
28.	South Shore West	2.31	2591	1746	-845
29.	Boston State Hospital	3.73	4177	4343	166
30.	Boston University	5.48	6140	5632	-508
31.	Harbor	3.87	4338	5959	1621
32.	Mass. Mental Health Center	4.98	5578	6394	816
33.	Tufts Mental Health Center	2.26	2529	3705	1176
34.	Cape Cod and the Islands	2.04	2284	2944	660
35.	Brockton	3.10	3472	3665	163
36.	Fall River	2.77	3100	3329	229
37.	Attleboro	1.09	1227	1630	403
38.	New Bedford	3.54	3971	4145	174
39.	Plymouth	1.18	1319	1209	-110
40.	Taunton	1.40	1572	1407	-165

(SOURCE: Calculated from DMH budget figures and federal grant information assembled primarily by Mark McGrath and Will Van Horne.)

resources, allocate equitably?

In table 3 we assume the former - that the inequity that DMH should try to eliminate is that in the mental health system as a whole, including both the public and private sectors. The "estimated actual allocation" column includes state, federal, and local dollars, with local dollars including conspicuous private expenditure on mental health care. Were DMH to follow through with the use of the procedure, areas with significant private resources would show up less in need of DMH money.

But to what extent is a private resource a resource available to the population of an area, and to what extent does it permit access only to those who can afford it? The question of who has access to what cannot be answered by the data we have assembled.

Another factor the figures cannot address is the relative importance of the dollar figures for different catchment areas. Does the \$295,000 shortfall in area 24 (an area composed of Newton, Weston, Wellesley, and Needham) with a median income of \$17,000 mean the same as the \$233,000 shortfall in area two (Franklin-Hampshire) where the median income is \$10,000? Probably not. The relative access to psychiatric services in the two areas is likely to be quite different.

The distribution of surpluses and shortfalls provided by this procedure does not, in and of itself, imply specific resource allocation decisions on the part of DMH. It simply shows relative surpluses and shortfalls of resource allocations based on a uniform calculation for expected primary demand applied across all 40 areas in the state. It is subject to a variety of interpretations.

An earlier version of table 3 is presently being used by the

assistant commissioners, the regional administrators, and the Commissioner in initial budget discussions for FY '78. Evident in the discussions are the political realities of the mental health system as it stands now. The discussions did not begin with the problem of redistributing resources from areas with a surplus to those with short-falls; they did not begin with the assumption that the expected \$6 to \$8 million budget slack would be allocated only to areas in the deficit position; rather, the initial assumption was that all areas had to receive some money and that none could receive less than their current appropriation. The information like that in table 3 served to order catchment area target appropriations within these constraints.

This suggests the work presented here might be of very limited utility. It is, if the measure of success is whether or not allocations are made strictly according to the procedure and not informed by the qualitative considerations of decision-makers. But we who have worked on it do not have such grand designs for the procedure. It has proven itself useful in starting off early discussions in the budget process by presenting decision-makers an initial set of funding priorities about which they could discuss changes. Interestingly enough, they have been very reluctant to make changes in our work, even though we have been prodding them to do so.

The figures we have presented were a challenge to the intuitive notions of some, causing them to examine their personal ideas about the mental health system, both in terms of its clients and its resources. One of the most revealing things about a comparison of mental health resources to the demand for services is that it confronts decision-

makers with both sides of the system at the same time. This is not something unique to this procedure, but the procedure does indeed do it, and for the first time in DMH, such an active and explicit comparison is being made, albeit with the above caveats.

We feel strongly that the cautions have to accompany any discussion using the procedure. The next two sections will document why.

In addition to the procedure used here, four others will be discussed. The results of applying each procedure to Massachusetts will be compared to demonstrate the uncertainties of using the various psychiatric needs assessments described.

SECTION V

USING SOCIAL INDICATORS TO ASSESS
MENTAL HEALTH CARE REQUIREMENTS

Any assessment of the need for mental health services that is based on the social characteristics of the populations served has two distinguished predecessors. The first is a study by Hollingshead and Redlich,³³ and the second is The Midtown Manhattan Study known widely for the scope with which it was executed.³⁴

Both of these studies were designed to investigate the effect of social class on mental illness. Their results were consistent: there is a strong relationship between lower social class and increasing rates of mental disability. (See tables 4 and 5) Hollingshead and Redlich's results came from a study of New Haven's psychiatric clients and that city's general population characteristics. Clients' records maintained by cooperating facilities and practitioners³⁵ provided detailed information on their social and economic backgrounds, and a 5% survey of New Haven's population supplied the characteristics of the general population from which the clients came. Their methodology prevented the researchers from studying the overall prevalence of mental disorders. Instead, they were constrained to deal only with treated mental illness.

The Midtown study was more extensive, dealing with both treated and untreated mental illness. Like Hollingshead and Redlich, the investigators conducted a treatment census to determine the characteristics of those under psychiatric care. A survey of 1,911 Midtown residents (out of a total population of 110,000) was the basis for making inferences

TABLE 4: RELATIONSHIP BETWEEN CLASS AND TREATED MENTAL ILLNESS IN NEW HAVEN

Social Class	Mental Patients Per 100,000 Population In the Given Class
I - II (Highest)	553
III	528
IV	665
V (Lowest)	1668

(SOURCE: Hollingshead and Redlich, Social Class and Mental Illness, p. 210)

TABLE 5: RELATIONSHIP BETWEEN CLASS AND PREVALENCE OF MENTAL IMPAIRMENT IN MIDTOWN MANHATTAN

Parental Social Status	% of Population in Given Status Suffering Mental Impairment
A (Highest)	17.5 %
B	16.4 %
C	20.9 %
D	24.5 %
E	29.4 %
F (Lowest)	32.7 %

(SOURCE: Srole, et. al., Mental Health and the Metropolis: The Midtown Manhattan Study, p. 213)

about the psychological characteristics of the population at large. Using data from the 1950 US census, they related their findings to Midtown's social and demographic characteristics.

Both of these works were carried out from an academic perspective; the authors were broadly interested in the sociology of mental illness. But the Midtown study had another purpose: to establish the level of service necessary to treat mental illness in the population at large. However, this applied aspect of the work remains very general and divorced from any considerations of how the apparent need for services could be met.

Perhaps one of the reasons for these studies being only marginally relevant to discussion about mental health resources is that they concentrate on the psychological conditions of individuals, not on how these conditions place demands on a mental health care system. At first blush, it seems callous to be critical of an approach that deals with the characteristics of people as individuals. But it is not the individuals per se that necessitate the application of resources; instead, it is the severity of their problems, the time the problems remain active, and the way these translate into the money necessary to accomodate them.

In describing the magnitude of mental health disability, both studies rely on the epidemiological concepts of incidence and prevalence. Incidence refers to the number of new cases that arise within a time span. Prevalence is a count of cases active at a given time. Put another way, incidence is the time rate of disorder and prevalence represents its level.

The reliance on these concepts is perhaps a reason for the distance between social psychiatric research and decision-making in mental health. Neither concept alone provides information necessary to make funding decisions for mental health services. Taken together, the two concepts still lack information essential to informed resource allocation decisions.

Incidence represents a flow of clients into the mental health system. Its epidemiological importance is based on it being sensitive to current conditions. Prevalence, the number of clients in the system at any one time, is dependent not only on incidence, but also on the rate at which clients leave the system. It is this client outflow that completes the picture but it is absent in both incidence and prevalence figures.

If one had to make the choice between using prevalence and incidence figures to make resource allocation decisions, prevalence would clearly be the choice. Prevalence can be construed as an average caseload in the mental health system. This level of client demand is more closely related to the resources needed than incidence figures. Since the system is open at both ends - clients enter and leave - a single prevalence level can be consistent with many incidence figures.

For example, consider two hospitals, A and B, each serving the same type and number of clients, say 50. Hospital A receives 10 new cases a month, and releases the same number. B admits 40 per month, and discharges 40. In spite of substantially different incidences (10 and 40), hospitals A and B experience the same prevalence (50). It is this prevalence figure that is most closely associated with the need

for resources: 50 beds, staff to tend them, and physical plant to shelter them. For the same prevalence but different incidences, the resources necessary could be the same.

Though prevalence is preferable to incidence as a measure of the need for resources, it does not indicate the resources necessary to serve the clients it enumerates. This would be unimportant if all clients placed the same demands on the system; but they do not. 1974 data from Massachusetts psychiatric hospitals show that the average length of stay ranges from 1.12 months in the Berkshire area to 3.97 in the Harbor area; nearly a fourfold difference.³⁶

This points quite clearly to the problem of using client counts as the basis for resource allocation. Of importance is the demand for resources these clients represent. The procedure developed here was undertaken with hopes of predicting this level of demand, but fell short of that goal. The reasons for this will be discussed later.

In spite of their shortcomings in a direct application to resource allocation, the Hollingshead and Redlich work and the Midtown Manhattan study have influenced the formulae that have in the past been proposed for allocating resources. Reviewed in this section are four procedures that draw on this sociological work and extend it to express the relative need for services among geographical areas. A fifth procedure, one currently under development for DMH, is another drawing on this work. It will be discussed in greater detail. (It is interesting to note that these procedures deal only with the geographical distribution of resources - a comment on the pervasive influence of the federal government in mandating mental health catchment areas).

The five procedures have in common a two-sided approach. One side assesses the psychiatric requirements of an area; the other side deals with the resources available to meet these.

This section will focus exclusively on the psychiatric requirements side of these approaches. This is where the major differences among the procedures occur, where the major methodological problems are, and where the contribution of this thesis is made.

Four of the procedures are:

1. One recommended to the states by the National Institute of Mental Health as a procedure for setting priorities to award catchment areas grants under the 1976 State Mental Health Plan mandated by the federal government. This will be referred to as the NIMH procedure.³⁷
2. The approach used for the 1974 addendum to the 1969 Massachusetts State Mental Health Plan. (termed the 1974 DMH procedure)³⁸
3. An approach formulated by a group in California that is used to allocate new mental health funds in that state. (the California procedure)³⁹
4. A response to the 1974 DMH procedure by Dr. Edwin Newman outlining an assessment of need based on a simple regression analysis. (the Newman procedure)⁴⁰

The fifth procedure, the one behind this thesis, will be termed the demand analysis.

THE NIMH PROCEDURE

The NIMH procedure suggests the use of eight social indicators in an analysis:

- A. % of males 16 and over in low status occupations
- B. % of population in poverty
- C. % of households with husband-wife families

- D. % of households with primary individuals as heads
- E. Youth dependency ratio (youths/population 18-64)
- F. Aged dependency ratio (aged/population 18-64)
- G. % overcrowded households
- H. % recent movers

These variables were chosen as being "the best descriptors of an area in terms of its demographic and social dimensions."⁴¹ Put more simply, these eight indicators are representative of many additional measures that describe an area in greater detail. These specific eight are the results of a factor analysis using data for all mental health catchment areas in the United States.⁴²

The NIMH procedure is based on the positive association found between mental disorders and all of the above indicators but C. It bears a negative relationship.

The NIMH procedure establishes a ranking of catchment areas for each variable for both white and black populations. A rank of one reflects the greatest requirement.

After the ranks are calculated, a final indicator of the mental health care need of each area is determined by a two-step process. First, the ranks (not the indicator values) are combined into a summary score, one for the white population and one for the black. NIMH recommends the formula:*

*The indicators are those listed beginning on page 68.

$$2(A) + 2(B) + C + D \left(\begin{array}{c} \text{rank of} \\ \text{E or F,} \\ \text{whichever is lower} \end{array} \right) + G + H$$

The either/or possibility for indicators E and F is to reflect the mental health care needs of either children or the aged. The procedure implicitly assumes that the needs of the numerically smaller group (which would have the higher rank) are subsumed by the numerically larger group indicated by the lower rank. That is, the needs are not additive.

The second step combines the summary scores of the white and black populations by weighting each according to the relative size of the black population and adding. The weights are:⁴³

	Black (W ₁)	White (W ₂)
Blacks 35.6% or more of total population . . . . .	.50	.50
10.0 - 35.5% . . . . .	.30	.70
0.9 - 9.9% . . . . .	.15	.85
0.1 - 0.8% . . . . .	.10	.90
less than 0.1% . . . . .	.05	.95

The final score is:

$$W_1 \times (\text{BLACK SUMMARY SCORE}) + W_2 (\text{WHITE SUMMARY SCORE})$$

The final score is given a rank, with the rank of one assigned to the lowest score, indicating the greatest need for mental health care.

The 40 catchment areas of Massachusetts are ranked by this procedure in table 6.⁴⁴

There are several problems with this procedure. In converting the original indicators to ranks, some information is lost. For example, the most highly ranked areas for indicator B (% population in poverty) are:

Area	% Population in Poverty	Rank
Boston University	22.6	1
Tufts Medical Health Center	14.9	2
Mass. Mental Health Center	14.6	3

Though the real difference in poverty between the Boston University and the Tufts areas is much more pronounced than that between Tufts and Mass. Mental Health Center, the rankings do not register this difference.

The weighting of indicators is at best a qualitatively informed estimation; it is not based on data showing the relative contribution to mental health problems represented by each indicator. This same criticism citing the lack of empirical support applies to the relative weighting of the white and black summary scores.

The procedure lacks any direct reference to the population of catchment areas. Taken alone, this analysis would calculate the need for mental health care solely on the basis of the rates of particular indicators without considering their magnitude. In that this procedure is designed to be used in conjunction with a per capita measure of mental health resources, this would not be a problem. The comparison of needs to resources would be made using the same (per capita) units.

TABLE 6: MASSACHUSETTS CATCHMENT AREAS RANKED ACCORDING TO THE NIMH PROCEDURE (RANKING IS FROM GREATEST TO LEAST MENTAL HEALTH CARE NEED.)

Area #	Area Name	Need Score
38	New Bedford	43.3
33	Tufts Medical Health Center	46.0
32	Mass. Mental Health Center	49.7
31	Harbor	50.1
11	Cambridge-Somerville	52.7
3	Holyoke-Chicopee	52.8
10	Worcester	53.3
30	Boston University	65.2
29	Boston State Hospital	67.4
36	Fall River	69.2
13	Lowell	70.0
6	Fitchburg	85.8
35	Brockton	88.4
18	Lawrence	90.4
2	Franklin-Hampshire	91.9
1	Berkshire	101.9
4	Springfield	103.8
19	Lynn	108.2
20	Tri-City	115.8
34	Cape Cod and the Islands	116.2
17	Haverhill-Newburyport	131.3
5	Westfield	141.7
8	Blackstone Valley	150.7
15	Mystic Valley	158.2
28	South Shore West	159.2
14	Metropolitan-Beaverbrook	162.7
16	Danvers-Salem	166.0
25	South Shore East	176.5
40	Taunton	179.0
26	Greater Framingham	181.8
24	Newton-Wellesley-Weston	185.8
23	Medfield-Norwood	186.0
7	Garner-Athol	186.8
9	South Central	188.7
22	Cape Ann	199.1
37	Attleboro	221.3
21	Eastern Middlesex	225.1
39	Plymouth	264.6
27	Marlborough-Westborough	304.9
12	Concord	359.6

(SOURCE: Calculated from data supplied by the NIMH Mental Health Demographic Profile System.)

However, since the purpose here is to compare procedures to each other, and since all of the procedures but NIMH's deal with the magnitude of need and not rates, the results of the NIMH procedure had to be adjusted for population size. This was accomplished by multiplying the final scores by the inverse of an area's population before the final ranks were determined.⁴⁵

Together with the 1974 DMH procedure following, this shares the drawback of producing an output measure having no dimension. The meaning of the final rank is obscured by the procedure of combining a number of variables not comparable in magnitude and meaning.

THE 1974 DMH PROCEDURE

Just as the NIMH procedure, the 1974 DMH procedure begins with social indicators:

- A. Population
- B. Persons over 64 (per 100,000 population)
- C. Median income
- D. Welfare reciprocity (per 100,000 population)
- E. Widowed separated and divorced persons
(per 100,000 married)
- F. Admissions to state mental facilities (per 100,000
population)
- G. Infant mortality (per 100,000 births)
- H. Abused and neglected children (per 100,000 children)

For each indicator, the catchment areas are ordered, highest to lowest, and assigned to percentile score. A high percentile implies high service requirements. The average percentile across all indicators

is computed for each area, and the areas are then ranked on the basis of this average percentile.

A ranking of the current 40 Massachusetts catchment areas using this procedure is shown in table 7.⁴⁶

This approach that has some of the same problems as the NIMH procedure creates a few of its own. Like NIMH's approach, this one does not use empirical evidence to weight and combine the indicators. The 1974 DMH procedure avoids the weighting issue simply by a straightforward averaging of all the percentiles; but this is an implicit weighting scheme implying that the indicators as they are expressed are equally important in determining the ultimate requirements for service.

This procedure mixes a number of concepts by including as part of an additive index population (a level), median income (another level), and a series of ratios. Doing this obscures the meaning of the final ranking by producing dimensionless results that are not easily translated into operational terms.

Unlike the NIMH procedure, this preserves the information in the original data by keeping the measure an interval scale. Converting the figures to a percentile preserves the data's metric quality while standardizing all variables to the same range of 0 to 100. Though the final output is a ranking, immediately behind it is a percentile that maintains an interval measurement.

THE CALIFORNIA PROCEDURE

The California procedure departs from the two above in that it eschews indicators expressed as rates favoring raw population counts. The authors of the procedure state:

TABLE 7: MASSACHUSETTS CATCHMENT AREAS RANKED BY THE 1974 DMH PROCEDURE (RANKING IS FROM GREATEST TO LEAST MENTAL HEALTH CARE NEED)

Area #	Area Name	Mean Percentile
30	Boston University	85.0
32	Mass. Mental Health Center	68.4
22	Cape Ann	66.5
33	Tufts Mental Health Center	58.5
29	Boston State Hospital	57.2
31	Harbor	55.6
11	Cambridge-Somerville	51.4
4	Springfield	49.1
36	Fall River	47.4
10	Worcester	45.9
38	New Bedford	44.5
34	Cape Cod and the Islands	43.4
20	Tri-City	42.0
7	Gardner-Athol	38.9
19	Lynn	37.9
2	Franklin-Hampshire	36.9
18	Lawrence	36.6
3	Holyoke-Chicopee	35.4
13	Lowell	35.1
17	Haverhill-Newburyport	34.5
35	Brockton	34.0
6	Fitchburg	33.1
1	Berkshire	31.4
14	Metropolitan-Beaverbrook	30.8
9	South Central	30.0
40	Taunton	29.4
28	South Shore West	27.2
16	Danvers-Salem	26.8
8	Blackstone Valley	26.0
5	Westfield	25.0
15	Mystic Valley	23.3
39	Plymouth	22.8
25	South Shore East	20.6
37	Attleboro	20.4
26	Greater Framingham	20.1
27	Marlborough-Westborough	19.3
21	Eastern Middlesex	17.9
24	Newton-Wellesley-Weston	15.1
23	Medfield-Norwood	13.0
12	Concord	5.6

(SOURCE: Calculated from 1970 census information and statistics assembled in DMH Central Office.)

". . . it is felt that quantity is the outstanding criteria. For example, if a community has a total population of 25,000 persons and a youth population of 5,000 (or 20%, or 200 per 1,000), and if another community has a total population of 5,000 persons and a youth population of 2,000 (or 40% or 400 per 1,000), the first community, though its youth population is less intense than the second, still needs twice as many school rooms than the second community."⁴⁷

Twenty social indicators expressed as counts are used in this procedure; these are shown in table 8 along with the weights assigned to each. These weights are based on the authors' estimates of the relative demand for services expected from the subpopulations and high risk groups represented by the indicators.

Two types of weights are used. The first applies to the population indicators (minority population, white population, youths, and aged); the specific weights used are drawn from a number of studies examining the prevalence of mental disorders.⁴⁸

The second type of weighting is a three-level scale of 4 - 2 - 1. A weight of four is assigned when 50 to 100% of the subgroup represented by the indicator is thought to be in need of mental health care; a two is given to indicators representing groups 25 to 50% of whose population is thought to need care. In the final category, a weight of one is given to groups in which 10 to 25% are in need of service. Note the judgemental factor involved.

The last item in table 8 is the small-county factor. It effectively boosts the mental health need index of smaller counties to insure that the allocations made on the basis of this procedure are of sufficient size to maintain a minimum acceptable staff. In the application of this procedure to Massachusetts, the small county factor does

TABLE 8: INDICATORS AND WEIGHTS USED IN THE CALIFORNIA PROCEDURE

Indicator	Assigned Weight	Indicator	Assigned Weight
Minority Population	.25	Mental or Emotional Illness:	
White Population	.20	Suicides	4.00
Youths	.20	Child Abuse	4.00
Aged Persons	.20	Special Education Problems	1.00
"Loners"	1.00	Involuntary Commitments	4.00
Lack of Full Parental Configuration	1.00	Small County Factor	
Crowded Dwellings	1.00	<u>Size of County</u>	<u>Weight</u>
Needy Families	2.00	Less than 1000	1.00
Physically, Mentally and Socially Disabled Persons	2.00	1000-4999	.80
Financially and Socially Impoverished Persons	1.00	5000-9999	.60
Deviate and Delinquent Persons:		10,000-14,999	.40
Youths	2.00	15,000-19,999	.20
Adults	2.00	20,000-24,999	.10
Sex Offenders	4.00	NOTE: Small County Factor's Weight is Multiplied by the Population.	
Alcoholism	2.00		
Broken Families or Homes	2.00		

(SOURCE: Sorokin, Weeks, and Freitag, "The Use of Social Indicators in Allocating State Mental Health Funds.")

not play a part; all of this state's catchment areas have populations greater than 24,999.

The California procedure produces a mental health need index simply by summing the weighted indicators. A ranking of Massachusetts catchment areas according to the California procedure is given in table 9.

Data were not conveniently available for all of the California procedure's indicators, so some of them had to be estimated from figures collected for geographical units other than catchment areas.⁴⁹ The inaccuracies in these estimations are probably of little consequence to the results of the procedure. Since so many indicators are included, the relative contribution each makes to the total is small; errors are not likely to be significant.

The California procedure solves some of the problems with the other procedures discussed so far. The full information of the data is preserved throughout the analysis. The procedure has intuitive appeal because of its straightforward summing of the weighted indicators and its output is quite clearly an estimate of the number of people requiring mental health services. Since all of the indicators are expressed as counts of persons, the summing up of all of them is also a count (albeit hypothetical) of a client population.

The California procedure still leaves some guesswork in the assigning of weights. They are "semi-empirical" in that they are distilled from a number of studies (for the population indicators) or from knowledge of the specific high-risk groups served (the 4 - 2 - 1 scale). But the lack of rigorous empirical estimation remains a valid criticism.

TABLE 9: MASSACHUSETTS CATCHMENT AREAS RANKED BY THE CALIFORNIA PROCEDURE (RANKING IS FROM GREATEST TO LEAST MENTAL HEALTH CARE NEED.)

Area #	Area Name	Need Score
32	Mass. Mental Health Center	206253
10	Worcester	195500
29	Boston State Hospital	191818
31	Harbor	190956
4	Springfield	184353
11	Cambridge-Somerville	169705
13	Lowell	160974
3	Holyoke-Chicopee	156230
38	New Bedford	155594
35	Brockton	150489
30	Boston University	150159
20	Tri-City	133757
19	Lynn	128432
36	Fall River	124988
15	Mystic Valley	120891
1	Berkshire	120805
6	Fitchburg	116218
18	Lawrence	114986
28	South Shore West	113931
16	Danvers-Salem	102391
23	Medfield-Norwood	101606
2	Franklin-Hampshire	100719
25	South Shore East	99922
26	Greater Framingham	99828
24	Newton-Wellesley-Weston	98774
34	Cape Cod and the Islands	96374
33	Tufts Mental Health Center	95427
14	Metropolitan-Beaverbrook	95105
8	Blackstone Valley	92372
17	Haverhill-Newburyport	86341
22	Cape Ann	79934
21	Eastern Middlesex	75178
5	Westfield	70615
40	Taunton	70325
9	South Central	66968
39	Plymouth	60887
7	Gardner-Athol	60061
37	Attleboro	55705
27	Marlborough-Westborough	48978
12	Concord	45985

(SOURCE: Calculated from 1970 census information and statistics collected in DMH Central Office.)

Some remarks that were made earlier about social psychiatric studies apply here as well. The output of this procedure is more directly indicative of the number of people in need of service than of the resources needed to serve them. To repeat the earlier point, the latter concept of resource need rather than number of clients is the more important for making allocation decisions.

THE NEWMAN PROCEDURE

After the completion of the 1974 addendum to the 1969 Massachusetts State Mental Health Plan, Dr. Edwin Newman of Harvard sent a memorandum to DMH commenting on the 1974 DMH procedure and suggested in some detail a different one.

The salient difference between his approach and the three above is that the weights assigned to each of a set of indicators are derived empirically using multiple regression. With the 39 Massachusetts catchment areas that existed in 1974 as the units of analysis, Newman took admissions to state institutions (including hospitals and mental health centers) as the dependent variable and regressed it against six indicators. The actual equation was:

$$\begin{aligned} \text{NEED INDEX} &= .250 + 9.29 \times \% \text{ OF FAMILIES IN POVERTY} \\ &+ .157 \times \text{MENTAL HOSPITAL PATIENTS PER 5000 RESIDENTS} \\ &+ 1.806 \times \% \text{ OF ADULTS WIDOWED, SEPARATED, OR DIVORCED} \\ &- 4.866 \times 1/\text{MEDIAN INCOME} \\ &- .234 \times \text{INFANT DEATHS PER 10,000 BIRTHS} \\ &+ .247 \times \% \text{ OF CHILD POPULATION UNDER STATE GUARDIANSHIP} \end{aligned}$$

Newman did not report t statistics for the coefficients, but did give a multiple R^2 of .68.

This equation is normalized to give NEED INDEX a mean of one. The final measure of mental health care need is called PERCENT RISK and is calculated by multiplying a catchment area's population as a percent of the state's total by its NEED INDEX.

$$\text{PERCENT RISK} = \% \text{ OF POPULATION} \times \text{NEED INDEX}$$

PERCENT RISK has a correlation of .87 with the admissions criterion variable Newman used to do the regression.

An ordering of the state's mental health areas using the weights and indicators from Newman's procedure is shown in table 10.⁵⁰

This procedure maintains the information content of the indicators by maintaining the interval scale. Though all indicators are expressed as rates, this procedure accounts for population differences by basing the final PERCENT RISK figure on both the population and the NEED INDEX.

In basing his regression admissions to state institutions, Newman has estimated weights based on a biased sample. Compared to the mental health system as a whole, the public sector cares for a disproportionate share of the poor, of the elderly without families, and of minority groups.

Newman was (and is) well aware of the problem but was constrained to use the data available at the time.

Just as in the California procedure, Newman's approach focuses on

TABLE 10: MASSACHUSETTS CATCHMENT AREAS RANKED BY THE NEWMAN PROCEDURE. (RANKING IS FROM GREATEST TO LEAST MENTAL HEALTH CARE NEED.)

Area #	Area Name	Percent of Need
32	Mass. Mental Health Center	5.17
31	Harbor	4.89
30	Boston University	4.88
4	Springfield	4.62
3	Holyoke-Chicopee	4.16
29	Boston State Hospital	4.15
11	Cambridge-Somerville	3.94
10	Worcester	3.85
38	New Bedford	3.43
35	Brockton	3.19
19	Lynn	3.17
13	Lowell	3.00
33	Tufts Mental Health Center	2.93
6	Fitchburg	2.84
20	Tri-City	2.81
36	Fall River	2.64
1	Berkshire	2.58
24	Newton-Wellesley-Weston	2.41
23	Medfield-Norwood	2.29
14	Metropolitan-Beaverbrook	2.25
16	Danvers-Salem	2.15
15	Mystic Valley	2.12
28	South Shore West	2.03
18	Lawrence	2.00
25	South Shore East	1.98
26	Greater Framingham	1.96
8	Blackstone Valley	1.95
2	Franklin-Hampshire	1.76
17	Haverhill-Newburyport	1.70
22	Cape Ann	1.66
34	Cape Cod and the Islands	1.62
21	Eastern Middlesex	1.46
7	Gardner-Athol	1.43
39	Plymouth	1.25
5	Westfield	1.20
9	South Central	1.16
40	Taunton	1.15
37	Attleboro	1.14
27	Marlborough-Westborough	1.03
12	Concord	.74

(SOURCE: Calculated from 1970 census information data supplied in Newman's 4 June 1974 memo, and statistics collected in DMH Central Office.)

the number of individuals (admissions) that are in need of mental health care. But the number of clients from an area is not necessarily a measure of resources necessary to serve them because of differences across catchment areas in length of stay. For resource allocation purposes, a variable more indicative of the demands placed on the system would be more appropriate.

Along with the multiple regression used in this procedure comes a problem. This statistical technique seeks as tight a fit as possible between the observed dependent variable (admissions) and its predicted values. But if the ideal result of this procedure is the mathematical duplication of admission, why not use the observed admission figures as a need index, and have 100% concordance?

The answer is that admission figures reflect not only mental disability but are also artifacts of the level of service offered, of the specific characteristics of that service, and of the alternatives available to inpatient care. The problem with the Newman procedure is that it does not capture the effects of the system's characteristics on the statistics reported and therefore runs the risk of biased parameters.⁵¹

Compared with the other procedures outlined so far, Newman's is a welcome bit of empiricism, but it can be improved. The analysis described below extends Newman's analysis in two ways: (1) by using a dependent variable that accounts for differential lengths of stay, and (2) by controlling for the level of service offered - even if only in a crude way.

A DEMAND ANALYSIS

The analysis developed here began as a much more ambitious undertaking. It was to include data on both the public and private sector, to control more explicitly for the effects of service characteristics on utilization by collecting data on direct care staff and inpatient bed capacity available to each catchment area, and was to predict both inpatient and outpatient service demand. All of these improvements depended on a survey of 392 mental health facilities in the state. The survey was not completed in time for this analysis.

Still, the two contributions of using patient-months rather than admissions as a demand variable and of controlling for the level of service offered remain.

Using the product of first admissions and average length of stay in inpatient units for each catchment areas as a dependent variable, a number of multiple regressions were performed on the data until we found an equation that could replicate the observed pattern of utilization, that had stable coefficients, and that produced coefficients having the sign expected on the basis of past work in the field. The equation chosen was:

$$\begin{aligned} \text{DEMAND (in client months)} &= .00088 \times \text{TOTAL POPULATION} \\ &\quad (p < .05) \\ &+ .08282 \times \text{POPULATION LIVING ALONE} \\ &\quad (p < .001) \quad (\text{Weighted by poverty}) \\ &+ .02922 \times \text{STATE HOSPITAL EXPENDITURE} \\ &\quad (p < .3) \\ &- 9.7 \end{aligned}$$

$$\text{MULTIPLE R} = .76, R^2 = .59$$

$$\text{F RATIO} = 14.48 \text{ (with 3 degrees of freedom in the numerator and } 32 \text{ in the denominator, } p < .001)$$

For an explanation of the statistics used here, see appendix A.

The effect of state hospital expenditure was controlled for simply by setting it equal to zero for all areas. In that the ultimate measure of demand used here is a relative one, setting state hospital expenditures to zero has the same outcome as providing each area with the same number of dollars per unit of demand.*

Massachusetts' 40 catchment areas are ranked according to this formula in table 11.

The demand data on which this analysis is based were originally collected for the 39 catchment areas recognized by DMH in 1974, so some adjustments to the new 40 areas had to be made. To avoid the possibility of exaggerating the relationship between the social indicators used in the analysis and the demand variable, these adjustments were made on the basis of population rather than on an index known to correlate more highly with inpatient demand. For example, before the change to 40 areas, the Greater Framingham area included the town of Millis (population 5795, or 3.6% of that area's population). In recent boundary changes, Millis was reassigned to the Medfield-Norwood area, so 3.6% of Framingham's inpatient demand (3.6% of 170 patient-months) was subtracted from its demand figure and added to that of Medfield-Norwood.

The measure of demand used here is calculated from first admissions and therefore has the drawback of not measuring demand on the mental health care system of existing, continuing cases, and does not account for clients leaving the system. To think of this measure as a

*See pages 101 and 102 for a proof of this.

TABLE 11: MASSACHUSETTS CATCHMENT AREAS RANKED BY THE DEMAND ANALYSIS DEVELOPED IN THIS THESIS (RANKING IS FROM GREATEST TO LEAST MENTAL HEALTH CARE DEMAND.)

Area #	Area Name	Percent of Demand
30	Boston University	5.48
32	Mass. Mental Health Center	4.98
10	Worcester	4.26
11	Cambridge-Somerville	4.19
4	Springfield	4.00
31	Harbor	3.87
29	Boston State Hospital	3.73
38	New Bedford	3.54
13	Lowell	3.45
3	Holyoke-Chicopee	3.33
35	Brockton	3.10
36	Fall River	2.77
20	Tri-City	2.69
15	Mystic Valley	2.61
19	Lynn	2.59
1	Berkshire	2.52
6	Fitchburg	2.50
18	Lawrence	2.49
28	South Shore West	2.31
33	Tufts Mental Health Center	2.26
23	Medfield-Norwood	2.19
24	Newton-Wellesley-Weston	2.18
26	Greater Framingham	2.18
2	Franklin-Hampshire	2.18
16	Danvers-Salem	2.17
25	South Shore East	2.12
34	Cape Cod and the Islands	2.04
5	Westfield	1.39
14	Metropolitan-Beaverbrook	1.95
8	Blackstone Valley	1.86
17	Haverhill-Newburyport	1.77
22	Cape Ann	1.68
21	Eastern Middlesex	1.56
40	Taunton	1.40
9	South Central	1.32
39	Plymouth	1.18
7	Gardner-Athol	1.17
37	Attleboro	1.09
27	Marlborough-Westborough	0.96
12	Concord	0.94

(SOURCE: Calculated from 1970 census information)

proxy for the full demand we are truly interested in is a tenuous assumption that requires full demand to be proportional to first admissions demand across all areas. That this relationship exists is doubtful, particularly in view of an active DMH effort to reduce psychiatric inpatient census. This effort is progressing unevenly across the state.⁵² The test of whether this unevenness introduces systematic bias or simply increases random error awaits more data.

The observed demand figures we used result in part from the characteristics of service in an area. Some of these characteristics might be: (1) the size and number of facilities available, (2) the mix of services available, (3) charges for service, (4) admissions and referral policies, and (5) geographical locations of facilities relative to population distribution. If one could estimate the effects of these characteristics, and control for them, the results would be demand "purified" of variation due to service characteristics.

Information is available to control for some, but not all of these factors. Dollar allocations for state hospitals were available to control for the size of the facility and hence the level of demand it could show. Since there was only one reporting unit for each area, the number of facilities was not a concern. But the mix of services in each area was. The Lowell, Harbor, Massachusetts Mental Health Center (MMHC) and Fall River areas have community programs that reduce substantially their dependence on inpatient units of state hospitals. Lacking any information on the degree of these program's impact on hospital utilization, Lowell, Harbor, MMHC, and Fall River were simply excluded from the analysis. This is equivalent to setting a dummy

variable equal to zero for these four areas and equal to one for all others.

Though figures are available on the charges for psychiatric treatment in state hospitals, they were not included in the analysis. The complicated mix of payments for services made through insurance and governmental subsidies makes it difficult, if not impossible, to assess the charge that a client faces. State hospitals are the most inexpensive psychiatric facilities in the state, with an average cost per day of \$25.67 compared to \$82.68 for private facilities.⁵³ As the lowest priced facilities, state hospitals cannot lose clients to more inexpensive facilities, and since these facilities have a captive clientele in the predominately low-income groups they serve, clients cannot go to other facilities even if they wanted to.⁵⁴

We had no information on admissions and referral practices for the state hospitals. Such data are, theoretically, available, but it would be a minor research project in itself to collect them. Not only would it involve the state hospitals but also the practitioners and clinics making referrals to these facilities. The importance of this information is to establish whether the differences across areas in the average length of stay are due to variations in service delivery systems or variations in area characteristics. We believe it to be some of both, but have to tolerate for the time being the inability to learn the influence of each.⁵⁵

The locations of state hospitals relative to the populations they serve was information that could have been put together, but was not. In initial discussions about this analysis, location factors did not

come up, and the exclusion of location data was more oversight than anything else.

COMPARING THE PROCEDURES

A side-by-side comparison of these procedures shows vividly the fact that they disagree about mental health care need or demand. Table 12 demonstrates this. The lines connect areas involved in some of the more pronounced differences. (In an effort to depict this conveniently on one page, only the area numbers are given in table 12. Table 13 provides the area names for these numbers.)

Why do these procedures differ so markedly? It is difficult to be specific because the differences are intrinsically tied up with the interaction of the variables and weights used. In the California, Newman, and demand analysis procedures, the population size has considerable influence on the results when compared with the 1974 DMH procedure where it is only one of eight indicators equally weighted. The NIMH procedure leans heavily on using variables expressed as a percentage of the population to differentiate areas, whereas the California procedure does not use rates at all and so is more sensitive to the gross magnitude of an indicator than to its intensity.

But which is the better procedure? Regardless of the technical sophistication of any of these procedures, there is no clear-cut benchmark against which to compare results and verify their correctness. The fact remains that these procedures can be evaluated only in very rough, imprecise ways, with a judgement about which is appropriate depending on one's prior notions about the characteristics that

TABLE 12: COMPARISON OF CATCHMENT AREA RANKINGS BASED ON FIVE PROCEDURES (AREAS ARE LISTED UNDER EACH PROCEDURE IN ORDER FROM THE GREATEST TO LEAST NEED. TABLE 13 PROVIDES THE CATCHMENT AREA NAMES ASSOCIATED WITH EACH NUMBER. LINES CONNECT CATCHMENT AREAS INVOLVED IN THE MORE PRONOUNCED DISCREPANCIES.)

NIMH PROCEDURE	1974 DMH PROCEDURE	CALIFORNIA PROCEDURE	NEWMAN PROCEDURE	DEMAND ANALYSIS
38	30	32	32	30
33	32	10	31	32
32	22	29	30	10
31	33	31	4	11
11	29	4	3	4
3	31	11	29	31
10	11	13	11	29
30	4	3	10	38
29	36	38	38	13
36	10	35	35	3
13	38	30	19	35
6	34	20	13	36
35	20	19	33	20
18	7	36	6	15
2	19	15	20	19
1	2	1	36	1
4	18	6	1	6
19	3	18	24	18
20	13	28	23	28
34	17	16	14	33
17	35	23	16	23
5	6	2	15	24
8	1	25	28	26
15	14	26	18	2
28	9	24	25	16
14	40	34	26	25
16	28	33	8	34
25	16	14	2	5
40	8	8	17	14
26	5	17	22	8
24	15	22	24	17
23	39	21	21	22
7	25	5	7	21
9	37	40	39	40
22	26	9	5	9
37	27	39	9	39
21	21	7	40	7
39	24	37	37	37
27	23	27	27	27
12	12	12	12	12

TABLE 13: CATCHMENT AREA NAMES AND NUMBERS

REGION I

1. Berkshire
2. Franklin-Hampshire
3. Holyoke-Chicopee
4. Springfield
5. Westfield

REGION II

6. Fitchburg
7. Gardner-Athol
8. Blackstone Valley
9. South Central
10. Worcester

REGION III

11. Cambridge-Somerville
12. Concord
13. Lowell
14. Metropolitan-Beaverbrook
15. Mystic Valley

REGION IV

16. Danvers-Salem
17. Haverhill-Newburyport
18. Lawrence
19. Lynn
20. Tri-City
21. Eastern Middlesex
22. Cape Ann

REGION V

23. Medfield-Norwood
24. Newton-Wellesley-Weston
25. South Shore East
26. Greater Framingham
27. Marlborough-Westborough
28. South Shore West

REGION VI

29. Boston State Hospital
30. Boston University
31. Harbor
32. Mass. Mental Health Center
33. Tufts Mental Health Center

REGION VII

34. Cape Cod and the Islands
35. Brockton
36. Fall River
37. Attleboro
38. New Bedford
39. Plymouth
40. Taunton

affect mental illness, and depending on how the procedure is to be used. A clear danger here is that a procedure can be chosen on the basis of prejudgement about what its results should be and then used as "hard" evidence to support a priori conclusions. We resist strongly the notion that any of these procedures, our own included, are definitive. An attempt to use them as conclusive evidence of where the need for mental health service is would be misuse.

The procedures are not good for that much. Their utility lies in being able to indicate with a uniformly applied measure the relative expected mental health care requirements of a set of areas. The results can serve as a challenge to intuitive beliefs about areas, and as suggestions to look at some areas in greater depth. But these results can neither prove nor disprove the correctness of such beliefs.

We can find no compelling reason to favor strongly one of the five procedures outlined above over the others. There is a preference expressed here for the California, Newman, and demand analysis procedures because their results are metric and their workings straightforward and transparent. Not surprisingly, of these three we favor most the demand analysis that the OISEP staff has nursed into existence. This procedure attempts to model demand on the system - not simply admissions to it, and it controls for differential levels of service offered. Although in the final equation used, this control was statistically significant at only the $p < .3$ level, throughout the analysis, in a number of different equations, the relationship between utilization and expenditures on state hospitals remained consistently positive, and in other equations was more strongly significant than in the one finally

chosen.

The central problem of these procedures - and any analysis of mental health care need - is that they are groping in a cloud for a measure of psychiatric need or demand that is itself a very nebulous concept. This point is emphasized by the differences in table 12. The implications for resource allocation of these differences will depend on how decisions are made using these procedures. Perhaps being eighth rather than first on the list does not make a difference. In the first cut at setting target allocations for planning in DMH, this was the case; the procedure was used to place areas in quartiles. Whether it will be used to make finer discriminations at the regional level remains to be seen.

If, after all of the work involved in setting it up, the procedure is used only to draw the interquartile boundaries between areas, then there is a very real question about whether it is a wise investment of staff time to develop anything but a very simple ranking scheme. On this we concur with Mustian and See.⁵⁶ The compared priority systems used in six southern states to abbreviated priority systems using four or fewer indicators and found that a "simplified scheme provides adequate replication" of the more elaborate procedures.⁵⁷ Correlations between the simplified scheme and the complicated methods ranged from .59 to .95.⁵⁸ They conclude that unless an argument can be made for its superior validity, it is a waste of staff resources to develop an elaborate procedure when a more simplified approach could be used.

They add the comment that planning techniques such as the various priority systems they investigated can get perpetuated within an

organization when they should be replaced with less time consuming methods.

To this should be added another point on the perpetuation of techniques: not only might they be continued as inefficient uses of staff time, but also techniques might become ensconced to the point where more confidence is placed in their results than their validity warrants.

This is not to say that developing this procedure has been a useless exercise. Earlier results did encourage discussions about the match or mismatch between psychiatric problems in areas and the resources needed to service them. The procedure provides a means of making comparisons among areas along a common scale.

The problem of evaluating the validity of these procedures remains. The NIMH, 1974 DMH, and California procedures stand independent of any data but social indicators. There is nothing against which to evaluate them. On the other hand, the Newman procedure and ours depend on both social indicators and utilization data. This latter information provides a handle on how well these procedures perform. The multiple regression technique used for both procedures has associated with it a well developed set of statistics that describe goodness of fit and the strength of a relationship. But as we shall see in the next section, blind reliance on these statistics can yield misleading results.

SECTION VI

SOME TECHNICAL NOTES

The social indicators used in the demand analysis were taken from the 1970 US census. Since detail in excess of that provided in published material was necessary, we had to look to more original sources. We were spared the trouble of having to process the notoriously difficult to handle census tapes by having access to the Social Ecology Archive, a dataset maintained at the Boston University Computation Center.⁵⁹ This dataset consists of several SPSS system files, and the software available to process these files made the job of aggregating data from 351 towns and 531 census tracts to 40 catchment areas less formidable a task than if it had been done using original census tapes.*

The basic aggregated file contained 79 indicators for each area, including (1) age, race, and sex breakdowns; (2) economic and employment characteristics; and (3) housing data. State hospital utilization data and budget allocations were added to the file before processing began.

The first step in processing was to select from the 79 indicators some subset for more intensive analysis. Based on earlier work with the data and some of the findings in the literature, 24 indicators were chosen. From these, an additional four indicators were constructed. The total of 28 indicators are listed in table 14.

Since four catchment areas** had alternatives to inpatient care that

* We are indebted to Yoishi Satow of Boston University who completed most of the work involved in this aggregation.

** Lowell, Harbor, MMCH, and Fall River areas.

TABLE 14: SOCIAL INDICATORS SELECTED FOR MULTIPLE REGRESSIONS

Total population
Black population
Spanish speaking population
Total youths
Black youths
Total aged
Black aged
Total families
Families with incomes less than \$8000
Families with incomes below poverty line
Total female headed households
Black female headed households
Widowed, separated, and divorced females, ages 20-34
Widowed, separated, and divorced males, ages 20-34
Widowed, separated, and divorced adults
Persons living alone
Blacks living alone
Persons in poverty, over 65, and living alone
Females in low status occupations
Males in low status occupations
Female household workers
Male household workers
Overcrowded housing units
Overcrowded units, black

CONSTRUCTED VARIABLES: (weighted by percent of families in poverty)

Total population
Families below poverty line
Overcrowded housing units
Persons living alone

reduced their dependence on state hospitals, the observed demand figures for those areas represent a situation markedly different from the other 36 areas. As such, these areas were eliminated from the multiple regression, but in the calculations for primary demand figures, they were included. The table below shows the difference this makes by giving the correlation coefficients between several variables and observed demand for all 40 areas and for the 36 excluding Lowell, Harbor, MMHC, and Fall River areas.

VARIABLES	R 40 AREAS	R 36 AREAS
Total population	.43	.61
Families below poverty line	.34	.63
Overcrowded housing units	.49	.76
Persons living alone	.37	.73

CORRELATION COEFFICIENTS OF OBSERVED DEMAND WITH EACH OF THE LEFT HAND VARIABLES FOR 40 AREAS AND FOR A SELECT 36

In performing a number of regressions of observed demand against the social indicators and state hospital expenditures, we were able to push the multiple R up to about .90, somewhat over Newman's multiple R of .82 for his procedure. But problems crept in.

One regression equation included six variables:

$$\begin{aligned} \text{DEMAND} &= .127 \times \text{OVERCROWDED HOUSING UNITS} \\ &\quad (\text{p} < .001) \\ &+ .040 \times \text{PERSONS LIVING ALONE} \\ &\quad (\text{p} < .001) \\ &+ .137 \times \text{FAMILIES BELOW POVERTY LINE} \\ &\quad (\text{p} < .25) \\ &+ 1.28 \times \text{FAMILIES BELOW POVERTY WEIGHTED BY PERCENT} \\ &\quad (\text{p} < .01) \quad \text{BELOW POVERTY} \\ &- .112 \times \text{POPULATION WEIGHTED BY PERCENT BELOW POVERTY} \\ &\quad (\text{p} < .05) \\ &+ .058 \times \text{STATE HOSPITAL EXPENDITURES IN THOUSANDS} \\ &\quad (\text{p} < .05) \\ &- 40.0 \end{aligned}$$

$$\text{MULTIPLE R} = .38$$

$$R^2 = .77$$

$$\text{F RATIO} = 16.45 \quad (\text{p} < .001 \text{ with } 6 \text{ and } 29 \text{ degrees of freedom})$$

By any standard measure, this equation has a good fit; its multiple R and its F ratio are solid, and all of the coefficients but one are significant at the .05 level. However, when we control for expenditure on state hospitals, and apply the formula to all 40 areas, some surprising results are found. The table below shows for three areas the percent of the state's total predicted primary demand attributable to each area.

AREA	% of Total State Primary Demand
Harbor	13%
Boston University	6%
MMHC	12%

The procedure gives the Harbor and MMHC areas a whopping 25% of total demand between them, but leaves the Boston University area,

widely thought to be the area of greatest need, only 6%. While the Harbor and MMHC areas contain the center of Boston and are beset with numerous social problems, these demand figures seem extraordinarily high, particularly when one considers that 28% of MMHC's population is in Brookline. The reason lies in the way the equation was estimated.

The Harbor and MMHC areas were two of the four excluded from the analysis because they offer alternatives to state mental hospitals. In estimating the equation's parameters, the multiple regression procedure was not able to take account of the fact that both of these areas had very high values for some of the indicators. Among all 40 areas, the Harbor area had the largest number of families in poverty (5598 compared with the next largest count of 4700 for the Boston University area), and MMHC had the largest number of persons living alone (25,501 compared with the next largest count of 17,803 for Cambridge - Somerville). To use the coefficients of an equation estimated using 36 areas for these is to make predictions beyond the range of the independent variable - a pitfall in any multiple regression application. The confidence interval for a dependent variable in multiple regression gets broader as the variables in the equation take on values further from their means. The values mentioned above are not simply far from their means; they are off the scale - beyond the range of values for which the equation is relevant.

A second problem with this equation is the negative coefficient for the population weighted by poverty. The literature says that the sign should be positive. The mathematics of multiple regression operates to produce the tightest fit possible between the dependent and independent

variables within the constraints of linear relationships. Its mechanistic operation assigned a negative sign to population weighted by poverty to correct for the over-estimate of the other indicators in the equation.

While this produces the better fit overall, the negative sign can misrepresent the situation in a specific catchment area. This is why the Boston University area shows up with only 6% of total demand. It has the highest value of any area for population weighted by poverty (23,423 compared with the Boston State area with the next highest at 17,033). This large value and the negative sign work in tandem to pull the expected demand for the Boston University area down. What is good for the fit of the equation as a whole is, in this case, a misrepresentation of the particulars of a catchment area.

The problem of the negative sign is compounded by the fact that the Boston University area's value for population weighted by poverty is the upper extreme of that indicator.

It is for these two reasons - values beyond the range of the regression and negative signs that make the model fit but misrepresent individual areas - that several equations were rejected as inappropriate.

The equation used for the demand analysis procedure is given on the next page. This equation was thought to be the best compromise when considering goodness of fit, significance of the parameters, and the proper signs of the coefficients.

The equation used in the demand analysis was:

$$\begin{aligned} \text{DEMAND} &= .00088 \times \text{TOTAL POPULATION} \\ &\quad (\text{p} < .05) \\ &+ .08282 \times \text{PERSONS LIVING ALONE WEIGHTED BY POVERTY} \\ &\quad (\text{p} < .001) \\ &+ .02922 \times \text{STATE HOSPITAL EXPENDITURE} \\ &\quad (\text{p} < .3) \\ &- 9.7 \\ \text{MULTIPLE R} &= .76 \\ \text{R}^2 &= .58 \\ \text{F RATIO} &= 14.48 \text{ (with 3 and 32 degrees of freedom, } \text{p} < .001) \end{aligned}$$

To estimate the primary demand for mental health services in each area, the state hospital expenditure term was simply dropped from the calculation. Since the primary demand was used only to determine the fair share allocations of resources, and hence was simply expressed as a percentage of total state primary demand, this is equivalent to setting state hospital expenditures proportional to the demand for services in an area.

This can be demonstrated mathematically. Let y be predicted demand, z be state hospital expenditures, and x_1 and x_2 be the other two indicators in the equation. The regression equation has the form:

$$y = a_1x_1 + a_2x_2 + a_3z + c$$

where the subscripted a 's are the coefficients and c is the constant. To set the level of expenditure proportional to demand in each area,

let

$$z = ky$$

where k is a constant. The regression equation now becomes

$$y = a_1x_1 + a_2x_2 + a_3(ky) + c$$

putting the y 's on one side:

$$y = \frac{a_1x_1 + a_2x_2 + c}{(1-a_3k)}$$

The $(1 - a_3k)$ in the denominator effectively multiplies the right hand side of the equation by a constant:

$$y = j(a_1x_1 + a_2x_2 + c)$$

where $j = 1/(1 - a_3k)$. In taking the sum of the predicted demands, y , and expressing the demand of each area as a fraction of the total, the j 's cancel out, making irrelevant the level of service chosen, as long as it is proportional to demand. For convenience, we set the proportionality constant equal to zero.

In summary, we assembled an original dataset with 79 indicators drawn from the 1970 US census and selected from it 24 indicators that were used in finding a multiple regression equation to model inpatient

demand. To these 24 we added four indicators constructed from the others. In estimating the multiple regression equation, four catchment areas were excluded from the analysis because the data reported from them represented a kind of mental health care delivery qualitatively different from the other 36 areas.

In performing the regressions, we found that the standard statistical tests of significance and goodness of fit can be misleading unless one looks behind the summary statistics to check the distributions of the variables involved.

We wanted to estimate the expected demand for mental health services in each area while controlling for the level of service offered. This was done by setting state hospital expenditures to zero for each area.

SECTION VII

SUMMARY AND CONCLUSIONS

We set out to develop a procedure to aid in making resource allocation decisions in the Massachusetts Department of Mental Health. The procedure deals with but one aspect of DMH resource allocation policy - that of providing each catchment area with funds commensurate with its primary demand for mental health services. Though this side of DMH policy is the limited scope with which this thesis deals, it cannot be divorced from considerations of the type of services offered in areas, of the effectiveness of these services, and of the long-term contributions that different services make to the mental integrity of the population.

The formal decision-making structure of DMH puts the decisions about specific services at the catchment area level, to be decided by area boards and directors. The central office has assumed the role of redressing the inequities of present funding patterns by directing new and unencumbered funds to areas falling short of an equitable share of mental health resources. In basing decisions on an equity criterion alone, and in deferring decisions about how these funds are to be spent to the regions, and through the regions to the catchment areas, the central office begs the question of whether the funds go toward meeting the mental health care needs of the state. These needs will be met only to the extent that catchment area administrations can assess the service-specific needs of their clients, and then direct resources toward these needs.

Section IV demonstrated the inequitable geographical distribution of mental health resources, based on the primary demand calculated by the procedure developed here. The procedure showed all of region I to be receiving only 65% of its equitable allocation, and the Tri-City area (Everett, Medford, and Malden) receives only 60%. At the other side of equity, Greater Framingham gets 1.43 times its fair share; the Tufts area receives about half again what it should. The catchment area of Lynn receives 1.89 times its equitable allocation, and Concord comes out on top at 2.41 times its share.

This work only points to these apparent inequities; the response of DMH to this will determine how quickly these inequities will be redressed. A procedure similar to the one developed here was used to set target allocations for FY '78 planning and budget-making around an expected \$6 to \$8 million increment. During the meetings to discuss these allocations, it was clear that the concept of equity had to sit side-by-side with political considerations. The decision-makers took it as given that all areas had to receive some money, even if they were overfunded to begin with. The procedure describing the state of equity in the system was used only to establish which areas were to be allocated more than others.

The target allocations for the areas were summed to regional totals, and these totals are to be reallocated to the areas by the regional administrators. We do not know how the administrators will reallocate these totals. There is no guarantee that the final distribution of funds will further departmental goals; it may exacerbate inequities in the system.

The funds up for allocation are only 4% to 6% of the expected mental health care budget for FY '78. Though small in comparison to a total of \$135 million, the \$6 to \$8 million to be allocated represents nearly all of the funds over which DMH has some choice. The rest of the budget is bound by existing commitments - both state hospitals and community programs - that command automatic budget increments, or that require increasing state funding with a declining share of federal expenditure on community mental health centers.

The planning staff of DMH took budgetary inertia as a given, probably a wise thing to do in view of the short four months between the beginning of the planning effort and the first decisions of the budget process. But without the pressing need for an allocation criterion for the budget increment, and with a first cut at priority setting already finished, the planning staff should turn its attention to a more penetrating analysis of the budget process, both its official and informal components.

Why is there such inertia? Why is there an unquestioning assumption of inertia among DMH decision-makers? Who are the key actors in the process? Where do they impact the budget? At what points can DMH administration intervene more effectively to produce useful changes in the process?

A clear understanding of the budget process goes only part of the way toward increasing the effectiveness of DMH administration in providing mental health care.

Just as important as process issues are issues of budget substance. What kinds of services and programs should be funded, and at what

levels? DMH is in the embarrassing position of being unable to answer this question. We do not know how different services impact the outcome of mental health care, their relationship to one another, and their cost effectiveness. The move toward community-based care has been undertaken largely uninformed by a careful look at these factors. Better decision-making demands an investigation of them.

What of the validity of the procedure we developed? It is a disappointing note to end on, but one which is nonetheless inescapable. We must conclude that social indicator approaches to determining mental health care need are not definitive; in fact, different procedures based on social indicators can lead to very different results.

Yet there remains the undeniable relationship between social indicators and mental illness. The thought behind a social indicator approach to determining psychiatric need or demand is that this relationship can be used to make distinctions among catchment areas with respect to requirements for mental health care. We feel this thought remains valid. The poor, people living alone, families in overcrowded housing, broken homes, divorced couples, and other specific populations often cited as high-risk groups experience daily the pressures of their state in life. Without the financial means or social support to deflect these pressures or to mitigate their consequences, these people become consumers of mental health care at rates far above the population average. Part of the problem of allocating mental health resources is to take account of this differential in service requirements. The procedure developed here was an attempt to do this in a way that represents an improvement over past methods. The attempt was only

marginally successful.

Can the procedure be improved? Probably, if improvement is measured by making a better model of mental health care demand. More information on admissions policies and other service characteristics, better client demand data than simply first admissions and average length of stay, and a less biased data base than state psychiatric hospitals might yield higher multiple R's, more significant coefficients, and the correct signs. But there is still the fundamental problem of evaluating the results - there is nothing tangible to compare them with.

Even if a better procedure were found, it is not clear how much of an impact on budget decisions it would have. The original procedure had only a mild impact on allocating resources equitably; other considerations imposed constraints on the decisions. But there is another facet of its effect; it confronted decision-makers with two sides of mental health care delivery - both the demand for services and the resources devoted to serving that demand. The efficient allocation of resources requires that both of these aspects be considered.

The political constraints of decision-making limited the use of the procedure. A more quantitatively sophisticated approach would undoubtedly meet with these same constraints; its marginal impact beyond that of the earlier procedure would be quite small. Nor would a more sophisticated approach heighten the decision-makers' awareness of the gaps between demand and resources. They have been shown this in the aggregate. What is needed now is a clearer picture of the nature of the discrepancies, and a procedure of the sort used here will not be very informative in this regard.

We conclude that more intensive efforts to describe the equity of the mental health system will not be very productive in aiding budget decisions until there is a more thorough understanding of the budget process, of the configuration of services and programs in place, and of their effectiveness.

APPENDIX A

NOTE ON THE STATISTICS
USED IN THIS THESIS

A reader unfamiliar with basic statistics might find some of the quantitative material in this thesis unintelligible. But this need not be the case. An understanding of a few concepts in statistics will provide the necessary background.

The work here leans heavily on multiple regression, a general statistical technique used to analyze the relationships between a dependent variable and a set of independent variables by examining a number of real world observations. In the application of multiple regression shown here, the dependent variable is the demand for inpatient care. We analyzed the relationships between this and the independent variables, a set of social indicators and data on expenditures of state hospitals. The analysis was based on observations from 36 mental health catchment areas in Massachusetts.

The mathematics of multiple regression finds the linear combination of the independent variables that most closely reproduces or predicts the values of the dependent variable. The independent variables cannot reproduce perfectly the dependent variable, and so the equation that multiple regression estimates misses the mark, sometimes overshooting the dependent variable, sometimes underestimating it. The difference between the observed dependent variable and its predicted value is called the residual. In estimating the equation, multiple regression minimizes the sum of the squared residuals.

The example below will clarify this. It will also serve to demonstrate the statistics that describe how well the regression equation fits the observations and that indicate the confidence one can have in the equation. DEMAND for inpatient psychiatric service is the dependent variable; only one independent variable - TOTAL POPULATION - is used for illustrative purposes. The comments made about this simple case apply as well to situations where there is more than one independent variable.

The example is:

$$\text{DEMAND (in patient-months)} = .00114 \times \text{TOTAL POPULATION} \\ (p < .001)$$

$$- 3.88$$

$$\text{MULTIPLE R} = .61$$

$$R^2 = .37$$

$$\text{F RATIO} = 20.20 \text{ (with 1 and 34 degrees of freedom, } p < .001)$$

Overall, how well does this equation fit the observations? The answer is provided by the multiple R, the multiple correlation coefficient. A multiple R of one implies a perfect fit; values less than one - as they inevitably will be - show how imperfect the equation is. The example's multiple R is .61. In social science work, multiples R's are typically between .50 and .80; those above .80 are usually considered high.

The multiple R is simply the correlation between the observed and predicted values of the dependent variable. Theoretically, it can range from negative one (showing that the equation has the poorest possible

fit to the observations) to positive one, indicating perfect concordance between the predictions and the observations. In practice, the multiple R is almost always positive; if it is not, there could well be something wrong with the data.

The meaning of the multiple R can be understood better by looking at R^2 , the square of the multiple R. R^2 is sometimes called the explanation or the coefficient of determination. R^2 is the ratio of the variance accounted for by the regression to the total variance in the dependent variable. Put another way, the set of values for the dependent variable has a certain amount of variance about the variable's mean; the regression predicts some of this variance, but cannot account for the rest. The R^2 of .37 in the example indicates that the equation predicts 37% of the variance, leaving 63% unexplained.

The F ratio is a statistic from which one can infer whether the observed multiple R is the result of a genuine relationship between the dependent and independent variables, or simply a coincidental artifact of randomness in the variables. The inference is made after looking up the F ratio in a table. (F tables are published in many statistics books.) Making the inference requires two additional pieces of information - the degrees of freedom for the F ratio. The first value for degrees of freedom is associated with the numerator of the ratio (1 in this case) and the second value is associated with the denominator (34 in the example). The degrees of freedom are derived from the number of variables included and the number of observations used.

Looking up the example's F ratio of 20.20 in a table in the column

and row corresponding to one degree of freedom in the numerator and 34 in the denominator provides the value of a probability, p . In this case, $p < .001$. The value of p is the probability of an F ratio as large as the one observed occurring by random coincidence. In this example, the chance of an F ratio of 20.20 (and hence the chance of the observed multiple R of .61) occurring where there is no relationship is less than one in a thousand.

This is usually called the test of the null hypothesis - a test of whether no relationship exists. Hypothesis testing is where statistics is shown to have neither the power to prove nor to disprove anything. The statistics indicate that there is a very small chance that no relationship exists, so we infer that the equation expresses a real relationship.

Similar reasoning applies to the value of p given below the coefficient of TOTAL POPULATION. It says that the probability of observing a coefficient as large as .00142 when the "true" coefficient should be zero is less than .001.

For a thorough treatment of the statistics used here, the reader should consult any standard statistical text.

APPENDIX B

AREA CHARACTERISTICS

Following are the values of the social indicators used in the demand analysis for each of the 40 catchment areas. All data are from the 1970 US census.

Area #	Area	Total population	Persons living alone weighted by poverty	Expenditure on state hospitals
1.	Berkshire	149,402	525	969
2.	Franklin-Hampshire	134,830	412	1094
3.	Holyoke-Chicopee	193,101	709	1529
4.	Springfield	209,120	1068	1726
5.	Westfield	94,430	215	806
6.	Fitchburg	154,709	454	1246
7.	Gardner-Athol	74,834	253	1420
8.	Blackstone Valley	128,948	219	1608
9.	South Central	86,523	241	1042
10.	Worcester	245,693	884	3198
11.	Cambridge-Somerville	189,140	1433	1825
12.	Concord	76,394	53	933
13.	Lowell	214,152	577	0
14.	Metropolitan-Beaverbrook	129,174	290	1508
15.	Mystic Valley	184,167	229	1033
16.	Danvers-Salem	140,126	351	951
17.	Haverhill-Newburyport	105,541	396	908
18.	Lawrence	142,350	576	991
19.	Lynn	143,927	644	1067
20.	Tri-City	163,009	519	1266
21.	Eastern Middlesex	113,110	148	354
22.	Cape Ann	105,943	320	759
23.	Medfield-Norwood	159,815	156	1434
24.	Newton-Wellesley-Weston	159,735	150	818
25.	South Shore East	150,189	203	1017
26.	Greater Framingham	156,842	181	1964
27.	Marlborough-Westborough	71,630	116	1079
28.	South Shore West	153,966	313	1015
29.	Boston State Hospital	207,934	861	3506
30.	Boston University	115,853	3227	740
31.	Harbor	174,297	1332	63
32.	Mass. Mental Health Center	208,542	1845	0
33.	Tufts Mental Health Center	87,450	976	504
34.	Cape Cod and the Islands	106,464	601	1171
35.	Brockton	198,346	464	1891
36.	Fall River	141,687	804	1076
37.	Attleboro	75,951	178	1197
38.	New Bedford	165,987	1161	1767
39.	Plymouth	83,093	167	876
40.	Taunton	92,766	243	1104

NOTES

1. Massachusetts Department of Public Health, 1974 Health Data Annual, Vol. I, p. 65.
2. Jane Kreamer, "Standards and Criteria for Psychiatric Bed Need," unpublished discussion paper for the Massachusetts Transition Project, 25 March 1976, appendix.
3. Mary Walker, a DMH OISEP staff member, assembled the department's list of facilities.
4. 1976 estimates of inpatient census were prepared by Will Van Horne and Cindy Fisher of DMH OISEP.
5. United Community Planning Corporation (1974), Community Mental Health and the Mental Hospital, p. 11.
6. The US Joint Commission on Mental Illness and Health, Action for Mental Health (1961 report to Congress).
7. Information of the various community mental health services comes from two sources: United Community Planning Corporation (1975), Developing Community Mental Health Programs, pp. 1-3, and United Community Planning Corporation (1974), op. cit., pp. 19-23.
8. United Community Planning Corporation (1974), op. cit., p. 21.
9. Memorandum from DMH Commissioner Robert L. Okin to Governor Michael S. Dukakis, 24 December 1975.
10. National Institute of Mental Health, Division of Mental Health Service Programs, "Guidelines for the Preparation fo State Plans for Comprehensive Mental Health Services," 17 February 1976 draft, p. 27.
11. Memorandum from DMH Commissioner Robert L. Okin, "Instructions for the Preparation of FY '78 Area Plans," 26 April 1976.
12. Ibid.
13. National Institute of Mental Health, op. cit.
14. United Community Planning Corporation (1974), op. cit., p. 70.
15. Ibid., calculated from data on pp. 80-84.
16. Personal communication (February 1976) with Jake Getson, Director, Massachusetts Office of Comprehensive Health Planning.

17. Edwin Newman in United Community Planning Corporation (1974), op. cit., p. 107.
18. The Comprehensiveness Assessment Scale was developed by Mark McGrath, Mark Peterson, and Will Van Horne of DMH OISEP.
19. August Hollingshead and Fredrick Redlich, Social Class and Mental Illness: A Community Study, p. 11.
20. Cited in Leona Bachrack, "Psychiatric Bed Needs: An Analytic Review," National Institute of Mental Health, Mental Health Statistics, report series D, #2, 1975.
21. Jane Kreamer, op. cit., p. 7.
22. Massachusetts Office of State Planning, Standard Population Projections.
23. Jane Kreamer, op. cit., appendix.
24. Charles Gore, et. al., "Needs and Beds: A Regional Census of Psychiatric Hospital Patients," Lancet, 29 August 1964, pp. 457-460.
25. Three community surveys for identifying mental illness are often cited: Commission on Chronic Illness, Chronic Illness in the United States, Vol. IV, Chronic Illness in a Large City; L. Srole, et. al., Mental Health in the Metropolis: The Midtown Manhattan Study; and D.C. Leighton, et. al., The Stirling County Study of Psychiatric Disorder and Socio-Cultural Environment, Vol. III, The Character of Danger: Psychiatric Symptoms in Selected Communities.
26. Al Sorkin, et. al., "The Use of Social Indicators in Allocating State Mental Health Funds," paper presented at the Urban and Regional Information Systems Association Conference in Atlantic City, New Jersey, 30 August 1973, p. 8.
27. M. Harvey Brenner, Mental Illness and the Economy, p. 9. In making this statement, Brenner cites 13 studies between 1934 and 1960 to back his position.
28. Thomas Langner and Stanley Michael, Life Stress and Mental Health: The Midtown Manhattan Study, Vol. II, p. 394, cited in Brenner, op. cit., p. 9.
29. Jane Kreamer, op. cit., appendix.
30. Will Van Horne and Elizabeth Markson, both of DMH OISEP, calculated average length of stay figures from highly disaggregated data on client treatment.

31. Ibid., It should be noted that part of the reason for the average length of stay in inpatient units ranging from 1.12 to 3.97 months is that some catchment areas have alternative services that accommodate clients needing acute inpatient treatment, and use state hospitals (the facilities to which these figures apply) only for longer term care. If the average length of stay were computed on the basis of all inpatient treatment, we suspect that this difference would be smaller.

32. L. Srole, et. al., op. cit., pp. 352-353.

33. Hollingshead and Redlich, op. cit.

34. L. Srole, et. al., op. cit.

35. Hollingshead and Redlich, op. cit., p. 23. The breakdown of the treatment agencies reporting for the study is:

Treatment agency	Number who	
	cooperated	refused
State hospitals	6	0
Veterans hospitals	5	0
Private hospitals	11	0
Clinics	7	0
Private practitioners	46	20
TOTAL	<u>75</u>	<u>20</u>

36. This variation in length of stay could be due to a number of factors. See note 31 above.

37. National Institute of Mental Health, op. cit.

38. Massachusetts Department of Mental Health, "Addendum to State Plan," April 1974.

39. Sorkin, et. al., op. cit.

40. Edwin Newman, memorandum to DMH, 4 June 1974.

41. National Institute of Mental Health, op. cit.

42. Harold Goldsmith and Elizabeth Unger, "Demographic Structure of Mental Health Catchment Areas: Principle Component Factor Analysis with Varimax Rotation to 18 Factors," working paper draft, National Institute of Mental Health, 16 December 1975.

43. National Institute of Mental Health, op. cit., p. 52.

44. Data were supplied by the National Institute of Mental Health, Division of Biometry and Epidemiology, through the Mental Health Demographic Profile System.

45. The way we made the NIMH procedure compatible with the others by multiplying the final scores by the inverse of the population is not perfectly analogous to the way NIMH intended the procedure to be used. Our apologies are extended to NIMH if their work is misrepresented by doing this.

46. Where estimates had to be made for variables in the DMH procedure because catchment area boundaries were changed, they were made by prorating according to population.

47. Sorkin, et. al., op. cit., p. 5.

48. The authors cite Commission on Chronic Illness, op. cit.; L. Srole, et. al., op. cit.; and D.C. Leighton, et. al., op. cit.

49. Data on juvenile and adult delinquents, on suicides, and on the number of sex offenders came from Sourcebook of Criminal Justice Statistics 1973. The number of alcoholics and special education problems came from Massachusetts Department of Public Health, op. cit., Vol. II.

50. Since catchment area boundaries have changed since Newman did his analysis, some adjustments to the figures he provided had to be made. Any changes were prorated on the basis of population.

51. For a good basic discussion of this problem of parameter bias, see T. Wonnacott and R. Wonnacott, Introductory Statistics for Business and Economics, chapter 13.

52. The expected rate of decline for inpatient census in state hospitals for 1975 - 1976 ranges from 42% for Boston State Hospital to 0% for Medfield. These figures were estimated by Will Van Horne and Cindy Fisher of DMH OISEP.

53. Calculated from figures provided in Massachusetts Department of Public Health, op. cit.; figures in another source, United Community Planning Corporation (1974), op. cit., would put the average cost for state hospitals at \$23.98 per day.

54. United Community Planning Corporation (1974), op. cit., pp. 29-30.

55. Hollingshead and Redlich, op. cit., pp 214-216, shows that lower status individuals are likely to remain under treatment longer than those from higher status groups.

56. R. Mustian and Joel See, "Indicators of Mental Health Need: An Empirical and Pragmatic Evaluation," Journal of Health and Social Behavior, March 1973, pp. 23-27.

57. Ibid., p. 27.

58. Ibid., p. 26.

59. The Social Ecology Archive was developed by Prof. Frank Sweetser of Boston University; some of the work was done under a contract with

DMH in 1974. Prof. Sweetser provided some assistance in abstracting the necessary information from the Archive for our analysis.

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