SIMULATING THE IMPACTS OF CLOSING A STATE MENTAL HOSPITAL

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ABSTRACT

The state of Missouri, suffering from lack of state and federal funds, is seeking to better manage available resources in order to continue to provide an acceptable level of service to the citizens of the state. The state Department of Mental Health (DMH), having experienced an overall shift in services during the last thirty years, wished to investigate the possible impacts of closing one of its five in patient mental hospitals. This impact is partially measured by a simulation model which models each of the five hospitals and details the expected impact on the patients within the hospital, the employees of the hospital, the community in which the hospital resides, the DMH, and the state of Missouri. The decision rules within the model may be varied to simulate different scenarios depending upon the economics and state policies occurring at the time of the shutdown of a hospital.

The purpose of the model is to provide information and input to the overall project team studying the total impact which in turn will provide information and input to the actual decision makers in state government.

INTRODUCTION

The state of Missouri has recently been suffering from many of the economic woes which are facing the nation at this time. The outlook for the next decade indicates that the present financial and budgetary constraints will continue. A large portion of these constraints on available funds will be felt in the public sector as both state and federal resources will be hard pressed to keep up with the rising costs of providing services. In order to better balance their budgets, governmental units will have to more effectively manage the funds available to them or they may be forced to reduce the level of services they are able to offer. One unit in Missouri, the Department of Mental Health (DMH), is now looking to better manage the state's mental health system in order not to be forced to reduce the services provided to the citizens of the state.

The DMH agency operates two types of facilities within the state. One type is the state mental hospital. These large facilities (there are five within the state) were built and maintained by the state when the mode of care for the mental health patient was long-term, inpatient care. However, over the past three decades, these long-term facilities have been shifting their services toward short-term care and even a substantial amount of outpatient treatment. The approach of permanently confining people to mental hospitals has given way to a more interactive approach with society whereby people with mental disorders are confined only if necessary and then only for as long as necessary.

This shift in services has helped to create the other major type of facility operated by the DMH. The trend toward short-term and outpatient treatment of the mental health patient has given rise to a smaller and more "local" treatment facility--the community-based mental health center. The DMH operates three such centers within the state. In addition to the state operated centers, there are eleven other non-publicly operated community mental health centers which specialize in comprehensive treatment of outpatients and short-term patients. These are financed through a mixture of federal, state, and community funds. There are also many private non-comprehensive treatment facilities throughout the state (such as geriatric nursing homes and private alcohol/drug abuse units), that offer more specialized services. This shift in patient care emphasis and growth of the community and state mental health centers has led the DMH to ask if one of the five long-term facilities may be permanently closed without adversely affecting or reducing total patient care within the state.

In the decision to study the possible effects of closing one of the mental hospitals the state

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government, and in particular the DMH, was very concerned that the entire impact of this decision be studied. This impact is a combination of the effects on the patients within the closed hospital, other state operated mental health facilities, private community-based facilities, the employees of the closed hospital, the communities in which a closed hospital is located, the DMH, and the state of Missouri.

To gain insight into the effects of closing a state mental hospital, the DMH funded a grant to the University of Missouri-Columbia to study and report on the expected impact resulting from the closing of each respective hospital. The investigators included a sociologist, an economist, an industrial engineer, and specialists in mental health care administration and hospital planning. This group decided that a computer model that examined the overall measurable effect of closing any one of the five hospitals under varying conditions and assumptions would be an effective way to examine the dollar impact on the mental health care system. The dollar impact was seen as an integral portion of the overall impact. Other components of the impact were to be analyzed outside the computer model.

It should be stressed that output from the group was not to be a recommendation on which hospital to close. The purpose was to place a large amount of information about the impact of possible choices (monetary, sociological, and political) into the hands of the decision-makers in state government.

In the following sections, the overall simulation model will be described through the different modules with which it is built. The logic of each module will be discussed along with the data requirements and availability and the decision criteria necessary for operation.

THE SIMULATION MODEL

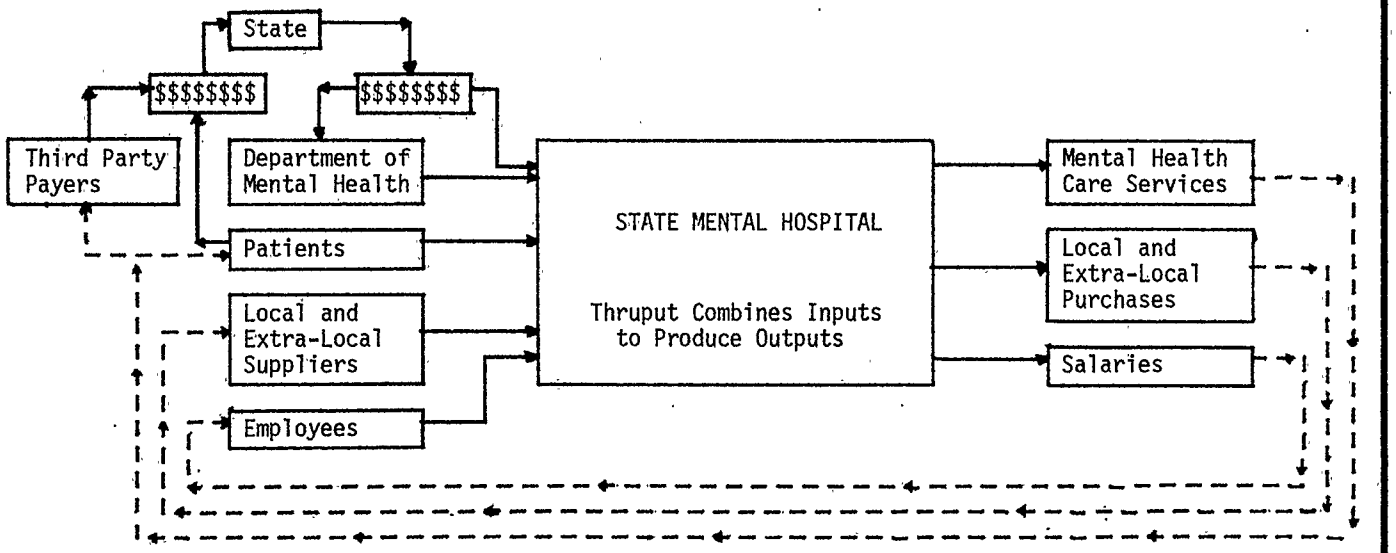
The simulation model is an attempt to quantitatively estimate the impacts, primarily economic ones, of closing a state mental hospital. The model is based on a view of state mental hospitals as open social systems. As such, they are in constant interaction with their environments. Open systems are characterized by cycles of activity revolving around importing resources from their environments (inputs), transforming these resources through some internal process or processes into some form of product or service (thruputs), and then exporting these products or services back to the environment (outputs) in exchange for further resources with which to begin the cycle again (see, for example, Bates and Harvey[1], Hall[2], Katz and Kahn[3], and Thompson[4]).

The open system model further views organizations as having boundaries that are open to their environments. These boundaries are permiable in both directions: they allow the organization to impact its environment, and they allow the environment to impact the organization. Whereas the thruput activities are most shielded from direct environmental influence, forming what Thompson[4] refers to as the technical core of the organization, input and output activities are the points of greatest direct contact and potential influence between organization and environment. To understand and assess the impact of closing a state mental hospital on its environment; then, one should focus on the hospital's input and output activities.

Figure 1 illustrates this approach to the concept of a mental hospital as an input-thruput-output open system. The inputs of money, materials, manpower, and patients are combined to produce outputs of mental health care, local and extra-local purchases, and salaries. The outputs are linked to the procuring of more inputs to

FIGURE 1

THE STATE MENTAL HOSPITAL AS AN INPUT-THRUPUT-OUTPUT OPEN SYSTEM



complete the input-thruput-output cycle.

Closure of a state hospital will eliminate its outputs which, in turn, has impacts on environmental units linked to these outputs. The elimination of care will impact patients and money generated to pay for care. The elimination of purchases of materials and supplies impacts local and extra-local suppliers, and the elimination of salaries impacts hospital employees.

Closure of a state hospital also eliminates the need for environmental inputs: patients to care for, employees to care for them, and money to run and maintain the hospital. These elements represent potential savings to the state; but these savings must be adjusted by subtracting the associated costs of caring for the closed hospital's patients at some other site. These costs represent termination and unemployment benefits for affected employees, loss of income tax and sales tax dollars, and the like.

Of course, the environmental units are also parts of other open social systems which in turn become impacted. Thus, employees and suppliers are part of community systems, and patients are part of a larger, more inclusive mental health care system. Patients must still be served, which draws other components of Missouri's mental health care system (other state and private mental health care providers) into the model. Lastly, the DMH receives money from the state (which received it from patients and third party payers in return for mental health care) to run the hospital. Thus, these units become part of the broader model as well.

Figure 2 outlines the major components of the model along with the major linkages between them. Note that this figure is no longer in a feedback form, but is in a recursive, causal hierarchical form. This is the form that is used in building the simulation model.

The major components of the model then, are the patients, the employees, the community in which the hospital is located, the DMH, and the state of Missouri. The decision was made early in the development of the model to design each of these components separately as semi-independent modules, and then to combine them at the end in the causally hierarchical order suggested by Figure 2.

Overview of the Modules

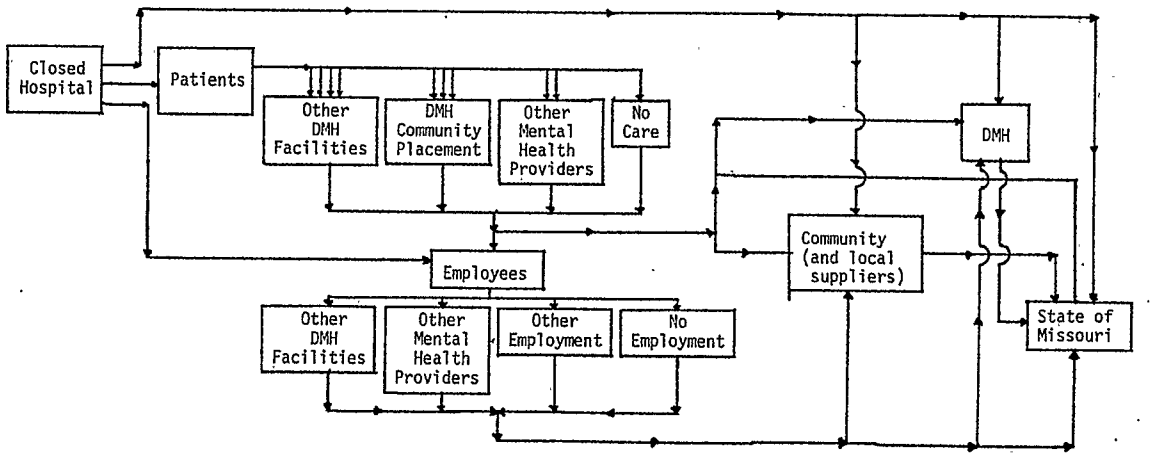
The patient module, which drives the simulation, requires as initial input a description of the patient profile expected at each state hospital and mental health center at the time the closure process begins. This profile includes information concerning the number of patients by the five hospital treatment programs (receiving and intensive care, adult general psychiatry, geriatrics, general medical and surgical, and children and youth), and the distribution of patients by age, sex, length of stay, and service area of residence. A description of staffing ratios and beds available by program at each facility is also required. From these descriptions and a set of decision criteria, the model simulates the resulting redistribution of patients following the closing of each hospital, in turn, under various sets of conditions and assumptions. Costs to transfer patients and resulting staffing requirements at remaining facilities following each simulated closing are also reported.

The patient module output serves as input into the employee module. Employees at a closed hospital are redistributed, by employment category (professional/managerial, paraprofessional/technical, and support staff), to other state mental facilities, private mental facilities, other employment, or unemployment. This re-distribution is implemented on the basis of staffing requirements resulting from the patient module and a set of decision rules internal to the employee module. The output from the employee module also includes estimates of the number of employees moving out of their communities for employment, the probable loss of salary to these employees, and the cost of unemployment and termination benefits to terminated employees.

The community module simulates the effect on the community in which a closed hospital is located. This effect, largely the result of a loss of employee salaries and the multiplied

FIGURE 2

COMPONENTS OF SIMULATION MODEL OF THE IMPACTS OF CLOSING A STATE MENTAL HOSPITAL



effect this loss would have on other sectors of the community, is dependent on the distributions resulting from the employee module. Other effects modeled include the loss of local tax dollars and the effect of the loss of local purchases by the hospital and patients.

The final module, the DMH and state module, accumulates the results of the preceding modules. Savings and costs associated with reducing administrative and physical plant overhead, employee reductions, patient transfers, loss of third party payments, loss of income and sales taxes, and the like are combined by the internal flow of this module.

In summary, the model results in estimates under varying sets of assumptions of the dollars to be saved or lost by the state of Missouri if it were to close one of its state mental hospitals. As intermediate steps, the model also reports the dollar figures saved or lost by caring for patients at other treatment sites, by hospital employees and their families, and by the communities in which hospitals are located and employees live.

Of course, there are many other non-economic impacts of closing a state mental hospital that are not measurable in dollars. These impacts will be analyzed outside of the boundaries of the model. This analysis, however, will use many of the resulting distributions from the patient, employee, and community modules in investigating these impacts. These latter impacts include increased travel distance to treatment sites for patients and their families, decreased interaction with friends and extended families for employees who move out of their communities, and the loss of a segment of a community's population as it affects the social and cultural life of the community.

Data Requirements

Data for the model came from several sources. Site visits to each of the state mental hospitals allowed project members to informally interview professional and administrative personnel at each facility concerning the flow of patients, employees, and money in and out of the institution. While at each site, interviews were also conducted with community leaders including representatives of local government (the mayor's office or city council), local businesses (through the Chamber of Commerce), and local services (the school system, for example). Many of the simulation model decision rules are based on these interviews, as well as on the expert opinion obtained from interviews with officials at the DMH's central office in Jefferson City, and with representatives of the private community mental health centers.

Government officials were interviewed to gain an in-depth understanding of the state merit (civil service) system, the flow of money from the state to the DMH to the hospitals, the operation of the state's mental health community placement program, and general administrative policies governing the operation of the state's mental health system. These officials were also consulted to determine permissible and non-permissible scenarios surrounding the closure of a hospital and the resulting redistribution of patients, employees, and state resources. This insured that the simulation model would be both realistic in terms of the operation of the state's public sector as well as relevant to the government officials and legislators who would need to make decisions concerning the closing of a state hospital.

A survey of a randomly selected sample of employees at each of the state mental hospitals was conducted in order to establish a data base consisting of employee household demographic, economic, and employment characteristics. The survey also investigated employee attitudes toward closure of their hospital, employment experience and job skills, probable future employment plans if their hospital were to close, spending patterns, and ties to community and family. A computer tape of selected elements of the DMH's employee data file allowed the validation of portions of the sample survey as well as the estimation of both employee salaries by community of residence and current staffing levels by program at each state mental hospital.

Data obtained from the DMH's patient census data file, reflecting the patient profile at each facility on the last day of each quarter for all of 1980 and 1981 and through the first half of 1982, supplied information to derive the required description of expected patient profiles at the time the closure process begins. Additional data from this file documenting daily patient census in each treatment program unit at each facility during the months of March and June, 1982, permitted the estimation of the number of beds required to accommodate the average daily patient levels expected at the remaining state facilities following the closure of one hospital. A final special run from this data file resulted in information concerning the distribution of patient lengths of stay in each program at each facility. This information was necessary to allow estimates of the number of patients who would have to be physically transferred from a closed hospital to a remaining open receiving institution.

Several special data runs were performed on other DMH data files (community placement, accounting and budgeting, and financial management and control). These runs were made to obtain information concerning the unit cost of providing inpatient care at the various state facilities as well as in community placements, the amount of local and non-local purchases made by each hospital, and the cost of maintaining and operating each hospital.

Lastly, monthly and annual statistical reports routinely published by the DMH as well as available special studies recently conducted by the department's staff were used. One very central study concerned the determination of appropriate treatment settings and was useful in simulating the expected redistribution of patients following a hospital's closure.

The next several sections of this paper further describe and document the logic, decision rules, and output of each of the model's component

modules. Final sections discuss the combination of the modules into the overall DMH and state impact and the general implications of the model and of this approach to aiding governmental decision making.

The Patient Module

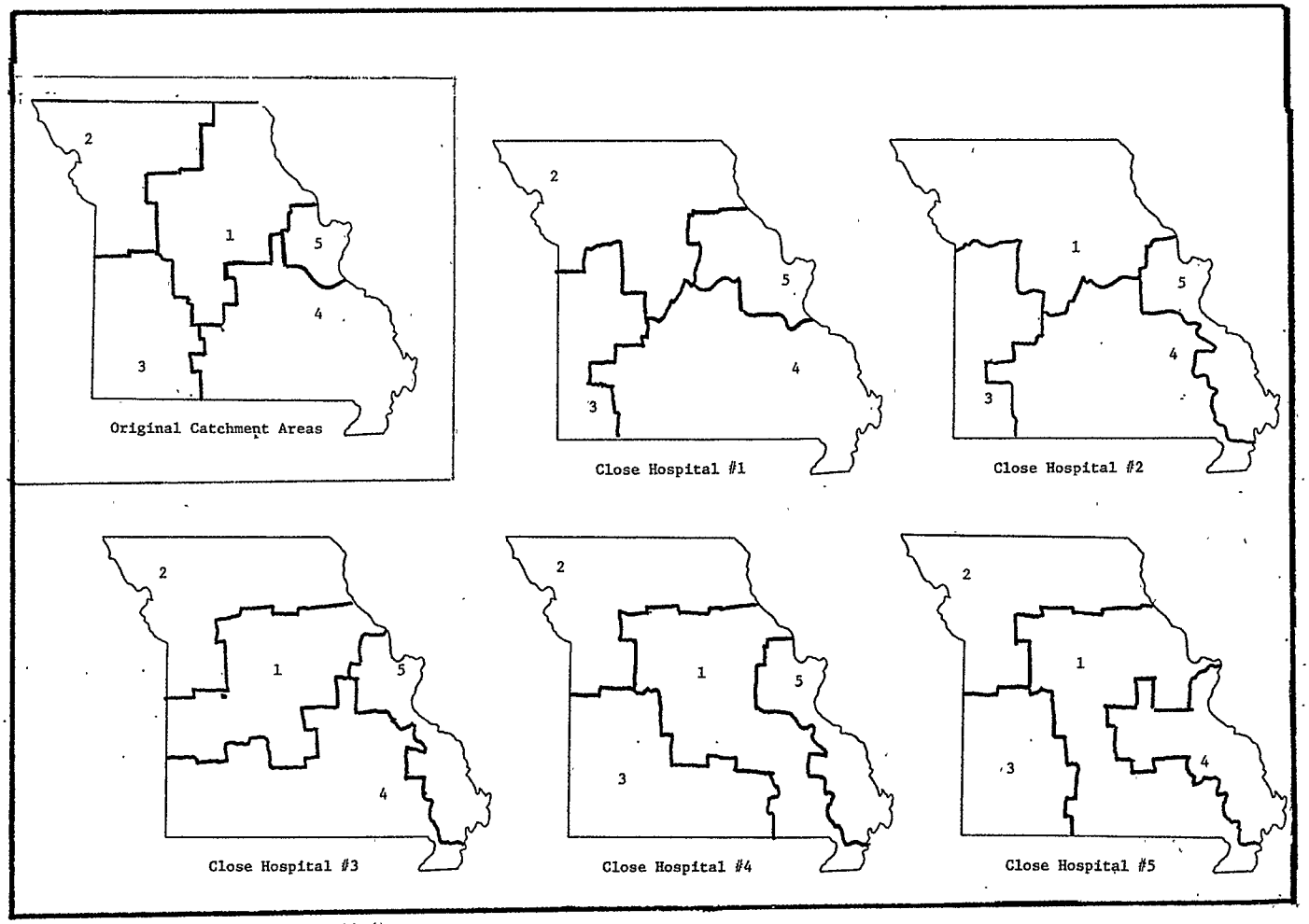
The patient module is the most complex and detailed module within the model. This detail is due to the importance the DMH places on the patient as the department insists that the level of patient care should not be reduced. In order to reflect this policy, there was careful analysis of each individual hospital's costs, capacities, employee levels, and expected patient population. The data from this analysis, along with the analysis of alternative patient care systems, was input into the model to accurately reflect system conditions and capabilities so a clear picture of the impact of closing a hospital on the total system could be observed.

The purpose of the patient module is to simulate the moving of patients from the hospital selected for closure and the placing of them in locations designated by input decision rules. These decision rules reflect current or expected conditions and indicate the proportion of patients by their program classification that are placed in other DMH hospitals, in state mental health centers, in state-paid community placements, or to private mental health care facilities. It should be noted that leaving the system of state-supported care does not necessarily mean that these patients are not receiving any care, but rather their care is no longer being paid for by the state. As previously mentioned, the model considers five service or program classifications for the patients. There is also a sixth program as one forensic unit exists within the state. However, this unit is so unique that the impact of the possible movement of this service is examined outside of the computer model. The remaining services exist in at least three of the hospitals.

The patient module has the capability of adjusting patient populations within the remaining hospitals, and accumulating costs of moving and caring for patients at the receiving hospital or center.

The patients within the hospital selected for closure are placed in their alternative care facility in two distinct phases. The first phase deals with a patient move that does not have a cost impact to the DMH or to the State. During the time between the announcement of closure and the actual closing of the selected hospital, there will be a phase-down period during which no new admissions or readmissions will be permitted to the selected hospital. These expected admissions will be directed instead to the appropriate hospital serving the newly drawn "patient catchment areas".

The catchment area defines the geographic area served by each of the hospitals. Figure 3 shows the current catchment area for each hospital and how the catchment areas change according to



which hospital is to be closed. The new catchments were calculated by assuming that all patients come from the population centroid of each county and then using the expected demand of DMH hospital services from each county, the total patient miles were minimized. This objective allows the majority of new or readmitted patients to travel the least amount of distance for care. The resulting catchment areas where then slightly modified to take into account additional administrative constraints.

Once the initial movement of patients is complete, the second phase of patient placement begins. By input decision rules there are proportions of each of the five service classifications possible within each hospital allocated to either:

a. Other DMH hospitals and mental health centers.
The majority of the patients remaining in the hospital will be transferred to another DMH facility. This move will be paid for by the DMH and the patients will be transferred to the appropriate hospital within the new catchment areas.

b. Community placement.
These placements are within non-state operated, community-based facilities for which the DMH will provide the cost for the care of the patients.

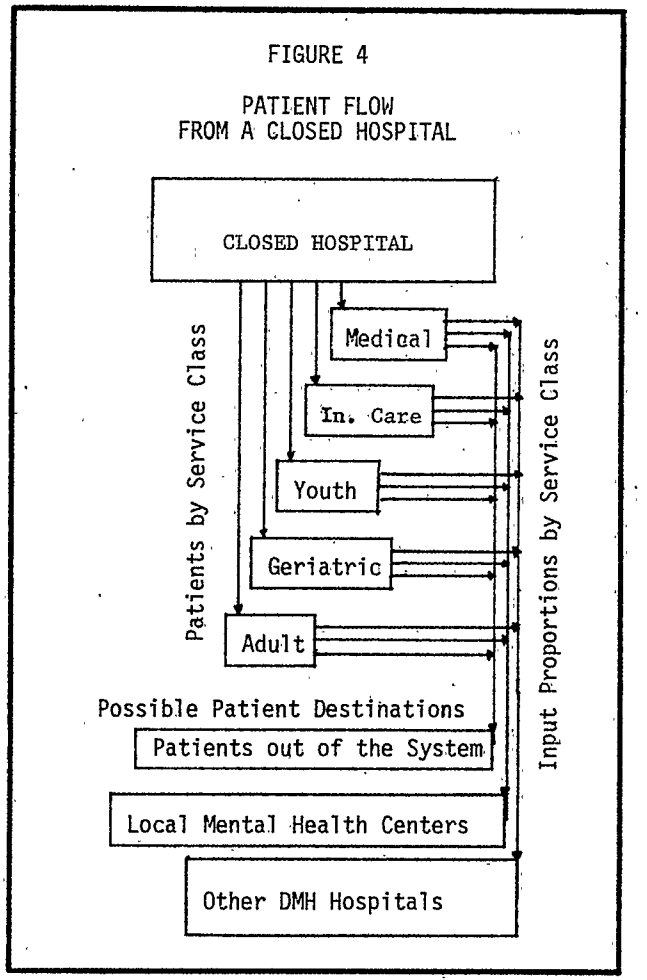
c. Out of the DMH system.
There may be some patients who will receive care from a mental health care facility but who create no impact upon the state or the DMH. It is also possible, however, that some of these patients will "fall between the cracks" and not receive care from any facility.

The model is general enough to handle different patient proportions depending upon the service and the hospital. The module is also capable of changing these proportions in order to reflect optimistic and pessimistic views. For example, the DMH would like to minimize the number of patients that fall under category "c" above. However, this may not be possible at the actual time of closure and this possible impact upon the patients and the system should be explored. Figure 4 shows a representation of this flow of patients.

Once the patients have been transferred to the appropriate location of care, the cost and the impact of this additional load on the facilities that have an effect upon the state or the DMH is calculated. The state operated mental health centers are analyzed within the module in order to measure the total number of patients that will be added to their load and estimating the cost of these patients and additional staffing to the DMH and the state.

FIGURE 4

PATIENT FLOW
FROM A CLOSED HOSPITAL



The combination of the four mental hospitals remaining open must accept a large proportion of the patients from the hospital to be closed. This acceptance of additional patients is not without impact and costs. The hospitals have certain standards that must be met for accreditation -- number of patients per patient-care employee, number of square feet allotted per patient, and the number of patients per room, to mention a few. These regulations, coupled with the existing physical plant layout at each hospital may create problems. For instance, an open hospital may not be able to accept additional patients without extensive remodeling or even the construction of new buildings.

The patient module has, for each hospital, four levels of acceptance of patients according to their program classification:

a. Ready beds.
Ready beds are those beds that are available and meet the accreditation standards. The model places patients into these ready beds until they are all filled.

b. Remodeled beds.
Several of the hospitals have existing wards or wings of buildings in use that are not being used for patient care but that could be remodeled to bring them to accreditable patient care standards.

The model will accumulate the one-time remodeling cost that is estimated for each hospital when patients are initially placed in this category.

c. Renovation beds.
Several of the hospitals also have existing buildings that are not in use. The renovation of these buildings will cost much more than the remodeling of space in buildings already in use. The model will place patients in this space when the previous two categories are filled and accumulate the one time cost.

d. Overflow.
Due to the number of patients that will be released from the closed hospital and the condition of the physical plants of all the hospitals, there exists a high probability that one or more of the remaining hospitals may not be able to accommodate all the patients assigned to it. When this occurs, the overflow of patients is documented and the cost of this construction is computed within the model by using a capitalization cost per patient.

Each hospital accepting patients will incur the cost of additional patient care. This cost is accumulated at the expected cost per day per patient at the receiving hospital by the appropriate program cost. The hospital also must hire employees to care for and provide service to the additional patients. These employees, the three classifications of which are explained below, are added to the receiving hospital at the rate of the existing employee/patient ratio or at the accreditation rate, whichever is less. The cost of the additional employees is also added to the hospital.

All the information on the movement of patients and the costs associated with transferring patients is printed out as intermediate results of the model. This information is used in later modules.

The Employee Module

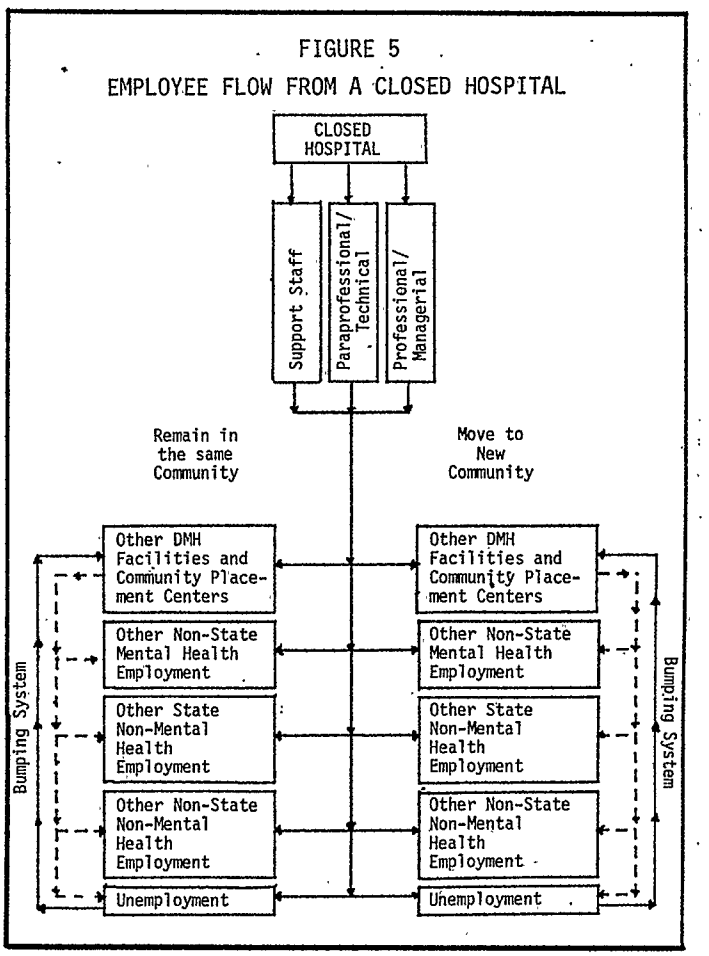
When a hospital closes, employees working there lose their jobs. However, when the hospital is a state mental hospital that is part of a more inclusive state employment and mental health care system, the impact of the closure goes beyond that one hospital and its employees. As was modeled in the patient module, closing a state mental hospital has a ripple effect on employees throughout the entire mental health care system, affecting both state and non-state components. In addition, the employee module must simulate the effect of a hospital closure on other DMH employees who are part of the state's merit (civil service) system and who are therefore subject to being "bumped" by terminated hospital employees who have greater seniority than they. This "bumping" is dependent upon general guidelines set by the personnel division of the state's Office of Administration located within the Governor's Office.

The results of the patient module estimates additional staffing requirements at the remaining state hospitals, the state mental health centers, and the state community placement offices resulting from a hospital's closure under varying sets of assumptions. This becomes a major input into the employee module, along with expected probabilities of the closed hospital's employees (by professional/managerial, paraprofessional, and support staff employment categories) moving or remaining in their communities; looking for re-employment in another state facility, a non-state mental health setting, other state or private setting; or remaining unemployed. These probabilities are based on an analysis of the employee sample survey and estimates of projected employment requirements by job category and industry in Missouri (based on Federal and state documents), present and expected future salary/wage levels by employee category, and normal employee turnover rates at each state facility.

Utilizing all of this input, the simulator in this module redistributes the employees of a closed hospital, by employment category, into other state and non-state employment or assigns them into an unemployed pool. Employees in this latter pool are then allowed to "bump" low seniority employees at other state facilities and also fill in expected vacancies (based on staff turnover rates). Any employees remaining in the unemployment pool, along with "bumped" employees joining that pool, are considered lost from the active workforce. Figure 5 illustrates this redistribution of employees.

FIGURE 5

EMPLOYEE FLOW FROM A CLOSED HOSPITAL



The output of this module includes the resulting distribution of employees, expected resulting salary levels adjusted by cost of living differences by community for those employees expected to move for employment reasons. The output will also indicate the amount of salary removed from the DMH budget, the state budget, and the community in which the closed hospital is located, and the impact of "bumping" on employees of other state facilities. A general profile of employees in each redistribution category will also be passed as input into the subsequent community, DMH, and state modules.

The Community Module

The community module consists primarily of economic multiplier matrices into which information from prior modules and financial information are input as data. This approach permits the modeling of both direct and indirect economic impacts. The direct impact is the actual dollar loss resulting from a hospital closure: lost salaries, lost local purchases made by the hospital, and lost local purchases made by the hospital's patients (or, more frequently, made by the hospital on behalf of its patients, using the patient's money). The indirect impact is the result of what economists refer to as the multiplier effect. This effect occurs due to a proportion of a given dollar of local expenditure being re-spent in a given local economy. The economic impact on the local economy from the elimination of that original dollar is greater than its face value; that is, greater than one dollar. The total impact is equal to the direct one dollar loss plus the indirect (multiplier effect) portions of that dollar as it is re-spent several times within the local economy.

The estimates of the multiplier effect used in this module are based on the work of Floyd Harmston[5-6]. His approach uses a multiplier matrix keyed to the dollar value of economic transactions between various sectors of a local economy, rather than a single multiplier to represent an entire local economy.

Input into the multiplier matrix are dollar estimates of total salary loss from a closed hospital (adjusted to reflect the proportion of that total salary spent in the local economy), total hospital local expenditure loss, and total patient local purchases loss. These total losses are each first broken down into components which are removed from specific sectors of the local economy (for example, X% of total employee salary removed from the food/grocery sector, and Y% of total hospital local expenditures removed from the public utility sector). Each community (defined as the county or Standard Metropolitan Statistical Area (SMSA) if the county is in an SMSA) in which a state hospital is located has a unique matrix multiplier based on the pattern of inter-sector transactions occurring in its local economy. Output from the multiplier matrix analysis are estimates of the direct and indirect dollar loss to a given community of having its hospital closed.

Once again, as in the patient and employee modules, the community module also must model a system more complex than a single hospital in which closure is simulated. That hospital is part of a larger mental health care system which must shift and adapt to the closure. Increases in patient census at other state mental facilities to accommodate patients from the closed hospital, along with concommitant increases in employee staffs at those facilities, all have impacts on the communities in which those facilities are located. Proportional increases in total adjusted employee salaries, patient purchases, and hospital expenditures added to these communities are input into the respective multiplier matrices for these communities, and direct and indirect dollar additions to these local economies are calculated and reported as output from this module. The net impact on state revenue from sales taxes (estimated as the total direct and indirect losses in the community in which a hospital closes, offset by additions in the communities in which state facilities remain and grow) is passed to the DMH and state impact module.

The DMH and State Module

This last module, the DMH and state, is an accumulation of costs from the previous modules along with some additional impact associated with these final levels. In addition to this accumulation of costs, the economic dollar benefits from the closing of one of the five hospitals are introduced into the model.

The impact on the DMH includes the one-time costs of necessary renovation and construction within the physical plants of the remaining hospitals and the patient moving charges. Also included are continuous costs associated with the additional patient and physical plant load on the remaining hospitals and state mental health centers, the additional employees necessary for these patients, and the cost to DMH of patients in community placement facilities. The savings to the DMH introduced in this module include reduced physical plant operations at the closed hospital, some reduction in patient-care costs and the overall reduction of employees. The DMH will also have some reduction in funds flow from the state and may have some reduction in personnel at the state level.

The total impact from the closing of one of the mental health hospitals cannot be measured through the analysis of the DMH impact alone as the DMH also has an impact upon the state. The state will absorb the one-time and continuous cost impact from the DMH; but it will also have continuous revenue reduction from the loss of income and sales taxes and third party payers. The state will also pay some unemployment benefits and any earned or vested employee benefits caused by laying off employees from the closed hospital. The state will, however, reduce its funds flow to the DMH to reflect the changes in DMH when a hospital is closed.

The total impact on the state is the "bottom line" in the economic impact of the model. But just as important to the state government, including DMH, is the impact upon the DMH and the patients, employees and community affected by the closure of a hospital.

VALIDATION

The validation of this model was accomplished at three levels. The first level included the validation of the data used within the model. The employee survey was validated through the use of DMH records. The patient data was available for the previous ten quarters and this provided information for forecasting the patient populations. Cost data was accumulated at each hospital and cross-checked through DMH records. Data on hospital physical plants and the ability to accept patients at the different levels was received from the hospitals and checked through on-site visits by the project team and through the DMH central office. Data on the community was obtained by the project team from the individual communities involved and also through state and federal records.

The interactions of the mental health system which led to the building of the logic of the model and the linkages between the modules within the model was obtained through observations by the project team. The team also interviewed the administrators in the DMH to better understand the system and to find out if any future changes were planned for the system. This helped the model adapt to probable changes in the system.

The second level of validation involved the decision rules employed by the model. These decision rules were received from mental health hospital administrators, DMH administrators, and verified by experts on the project team, applicable literature, special studies, and additional experts in mental health and hospital administration. These decision rules, governing patient and employee status and, therefore, the majority of the resulting costs of closure, in effect determine the outcome of the model. The relevant ranges of these decision rules and the integration and interactions of the effects of these decision rules are extremely important. Therefore, different scenarios of rational mixtures of decision rules will be submitted to the DMH as a portion of the project.

The last level was a "structured walk-through" of each module individually and then again with interactions between modules. This exercise was done both during the design and testing phase of the program with the participation of the programmer, the analyst, members of the project group, and DMH administrators. This intensive verification of the model was necessary to ensure that the DMH was aware of the model's capabilities and assumptions and the project team was more keenly aware of the mental health system in the state of Missouri.

STATUS AND CONCLUSIONS

The model is, at present, in the final stages of programming. The most complex module, the patient module is programmed, tested and debugged. The employee module is programmed and is in the process of testing; the community module has been designed and is in the process of programming; and the DMH and state module has, for the most part, been accumulated through the previous modules. The additions of the benefits into the logic of the module and the assimilation and reporting of the total results remain to be programed within the DMH and state module. The final report to the DMH on the possible consequences of closing any one of the hospitals under different decision rules is due and will be completed by the last of September, 1982.

The type of simulation model presented here is very timely. Economic and budgetary restrictions are a part of life today in the world of service, business, and government and the feasibility of consolidating and not reducing services will be explored in all these areas. The described model will explore many possible outcomes under different economic and administrative conditions. It will provide important input to the decision makers in state government. The impact on the patients and employees of the hospitals and the affected communities is of economic and political importance. This model is specifically designed and applied to the mental health field, but the shifting of the model to the field of general health care should not be too difficult. The further generalization of the model to the delivery of many types of services is another important step and is being considered at this time.

Bibliography

1. Bates, Frederick L, and Clyde C. Harvey, The Structure of Social Systems. New York: Gorden Press, 1975.

2. Hall, Richard H., Organizations: Structure and Process. Englewood Cliffs, N. J.: Prentice-Hall, 1972.

3. Katz, Daniel, and Robert L. Kahn, The Social Psychology of Organizations. New York: Wiley, 1966.

4. Thompson, James D., Organizations in Action. New York: McGraw-Hill, 1967.

5. Harmston, Floyd, "An Inter-Sectoral Analysis of the Missouri Economy." Columbia, MO: Research Center, School of Business and Public Administration, University of Missouri-Columbia, 1963.

6. Harmston, Floyd, "An Input-Output Model of the St. Louis Region." St. Louis: St. Louis Regional Commerce and Growth Association, 1972.