Can systems analysis solve some of the complex problems that occur today in the provision of needed health services? The research presented in this paper indicates certain potentials and these are discussed.

A SYSTEMS ANALYSIS OF LOCAL PUBLIC HEALTH DEPARTMENTS

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It seems to be almost a truism now that some of the most difficult problems in local public health pertain to the factors that affect the delivery of health services. It is one thing to know what the best health practice is in a particular situation, but quite another to get people to apply or use it. This problem (or series of problems) applies not only to those for whom the services are intended, and the various public and private groups and organizations whose cooperation is essential, but also to the people who work in public health departments. The research being described here is concerned principally with the latter group; that is, its focus is the organizational and administrative conditions under which people in local public health departments can do their best work.

A number of disciplines and methods have developed in recent years that are concerned with these questions: disciplines and methods described variously as management science, operations research, planning, programing, budgeting systems, cost-benefit analysis, systems analysis, and the like. Some of these (management science, operations research) might be called disciplines; others are techniques for organizing, analyzing, and evaluating work. Systems analysis, as a conceptual device, has diverse meanings. It can be and has been used to connote a systematic way of arranging and organizing information so as to facilitate executive decision-making; thus, it frequently is used in conjunction with computerized information systems and data banks.[1] But it also can can be and has been used to connote a way of analyzing organizational behavior. It is this latter meaning that is used in the growing discipline called "organization theory."[2] This also is the meaning that is being used in this research project.

Using Systems Analysis

As a method for analyzing organizational behavior in local public health, systems analysis can provide a framework for answering many questions of interest to the health officer—questions such as: Will specialization of nurses, sanitarians, and inspectors improve the performance of this department? How important is it to try to decentralize this department? Is it important to try to hire highly professionalized people? Should I set up a system of formalized manuals and directives which everyone will follow? Should participation of my staff in decision-making be encouraged, including frequent group meetings, open communications channels, and the like?

Is it more important for me to try to focus upon developing community involvement rather than trying to promote efficiency and productivity among my personnel? Should records of job performance (number of visits made, number of cases handled, and so on) be used and emphasized in evaluating the performance of personnel?

Systems analysis provides a useful analytical framework for answering these kinds of questions. Using a systems approach, we can conceive of the local public health department as a "system" operating in an environment; and postulate that part of the performance of the system is a function of the environment, while part is a function of the internal organizational and administrative characteristics of the department.

There is a great deal that is known now about the relationship between various environmental characteristics and the administrative structure and performance of organizations. The British sociologists, Burns and Stalker, for example, found that organizations operating in more certain environments tend to be more formalized and centralized than those operating in more uncertain environments; and this work was supported by the research of Lawrence and Lorsch.[3] There also is a great deal of research knowledge concerning the relationship between various organizational variables. Hage and Aiken, for example, found that organizations that have wide participation in decision-making are also likely to have more rule observation, less specialization, less professional training, and less professional activity.[4] These are the kinds of questions that this research is exploring in local public health in the United States. Thus the organizational characteristics in which we are interested are:

1. Specialization
2. Centralization
3. Professionalization
4. Formalization
5. Styles of management
6. Role perception
7. Morale
8. Goal agreement

The principal objective is to find out how these things are related to performance of local public health departments; that is, whether decentralization is related to the performance of a department, how specialization is related to performance, and so on.

Measuring Performance

To answer these questions, it is necessary to measure performance of local public health departments. This is a difficult job, for it is difficult to get people to agree on what constitutes good and bad performance in public health. To express the difficulty in a better way, it is hard to measure how the things that are being done by local public health departments are related to the general objective of improving community health. In fact, it may rarely be possible to determine this directly; the most that may be possible is indirect measurement.

There are, however, several kinds of objectives which most people might agree are desirable goals in public health management, although they are not necessarily directly related to the broad goal of improving community health. The related goals of productivity and economy, for example, are certainly desirable objectives; not simply in and of themselves, but also because, if things are done with as little expenditure of resources as possible, additional resources can be made available to do more things. Of course, productivity and economy are rather narrow goals. It is important to know more than whether a department is spinning its wheels at a rapid rate; one must also ask whether or not it is getting anywhere. This might be called the qualitative dimension of performance, and it presents a very thorny measurement problem. But it can be argued that the concept "innovation" is related to quality of per-

formance under the assumption that doing new things, or doing old things in new ways, at least reflects an attempt to improve quality. Thus, innovation might be used as one index of the quality of performance. And, finally, a department may be productive, economic, and innovating, but not be doing as many different things with its resources as it could. Thus another facet of performance that is measurable and being used in this research is the scope of services provided. In shorthand phrases, these are the performance measures being used here:

1. Productivity
2. Unit costs
3. Innovation
4. Scope

It should be emphasized that the purpose of using these measures is to try to determine if the organizational variables mentioned above are related to these performance measures. It is not being claimed that departments that score high on these four performance measures are also those that are doing the most toward the general objective of improving community health; although a case could be made that this is true.

Work on measuring these variables has been in progress for over two years. Several pretests have been made, and a pilot study of a national sample of 14 local public health agencies (drawn from a list of the 114 largest local public health agencies in the country) has also just been completed.

Findings of a Pilot Study

At this point, it will be interesting and instructive to consider some of the findings of the pilot study, although it should also be emphasized that these findings are tentative and should be taken with "a grain of salt." Table 1 shows that there is a tendency for the more centralized departments to be less productive; to have higher unit costs, less innovation, and a narrower scope of programs. Also, the more formalized the work procedures, and the more reliance that is placed upon records of personnel performance, the lower the productivity and innovation of a department. On the other hand, the more professionalized a department is, the higher the morale and productivity, the lower the unit costs, and the greater the amount of innovation. Specialization does not seem to be related to productivity, scope, or innovation; but the unit costs tend to be lower where there is more specialization. An unexpected result is the relationship between styles of management and productivity; the more participation by operating personnel in decision-making, the lower the productivity. Participatory styles of management do not seem to be related to scope or innovation. Finally, it might be noted that there is an inverse relationship between productivity and scope; and productivity does not seem to be related to innovation.

Since these are pilot study results, there is no need to dwell upon them in detail; they can be taken as suggestive rather than conclusive. Instead, let us focus for a moment on the content of some of the performance variables.

Unit costs measure the dollar costs of delivering one unit of output in each of five programs. These programs are: maternity, tuberculosis control, venereal disease control, dental health, and sanitation of eating and drinking places.[5] The cost that is being considered is strictly the cost of *personnel time*, not including equipment, supplies, travel, and the like. However, since 90 per cent of the amounts needed to provide services in each of these programs represents primarily man-hour costs, this appears to be an adequate measure, at least for our purposes. Cost is being measured by computing the number of man-hours that are devoted to each program, and multiplying this by the average departmen-

Table 1—Intercorrelations*

	PD	UC	SCOPE	INN	C	F	S	SC	SM	M	PF	GA_1	GA_2	GA_3	RC
PD		−.319	−.379	−.027	−.423	−.309	.088	.368	−.387	−.172	.319	.400	−.005	.385	.115
UC			.332	−.169	.108	.300	.335	.068	−.134	.082	.222	−.036	.524	.521	−.033
SCOPE				.508	.156	.562	.099	−.073	.033	.421	.253	.173	.755	.464	.183
INN					−.341	−.241	−.093	−.042	.048	.395	.372	−.005	.155	−.086	.299
C						.489	.291	.095	.068	−.168	−.327	−.041	.311	.059	.046
F							.102	−.074	.274	.251	−.096	.250	.659	.368	.041
S								.664	.220	.290	.368	.191	.363	.110	.096
SC									.193	.113	.046	.247	.221	.240	−.248
SM										.368	−.011	−.238	.133	−.305	.357
M											.579	−.175	.076	.082	.217
PF												.028	.089	.272	−.332
GA_1													.495	.493	.456
GA_2														.665	.300
GA_3															−.033
RC															

* NOTE: The Spearman rank order coefficient was used because of the small sample. However, a check with the Pearson coefficient produced substantially the same results. An $r \geq .33$ is required for significance at the .05 level. The Spearman correlation coefficient can be interpreted the same way as the Pearson; that is, its range is between 0 and plus or minus 1. A zero indicates no linear relationship. A one indicates a perfect linear relationship. The closer the decimal approaches one, the stronger the relationship. A negative correlation indicates an inverse relationship. For example, the coefficient −.423 says that as centralization *increases*, productivity *decreases*. A positive correlation means that the variables move in the same direction. For example, the coefficient .332 tells us that, as the scope of activities increases, the unit costs also tend to increase.

CODE:

PD = Productivity
UC = Unit costs
SCOPE = Scope of Programs
INN = Innovation
C = Centralization
F = Formalization
S = Specialization
SC = Span of control
SM = Styles of management
M = Morale
PF = Professionalization
GA_1 = Goal agreement, treatment norms
GA_2 = Goal agreement, clinic norms
GA_3 = Goal agreement, orientation toward community
RC = Role conflict

tal salary paid to the category of person working in the program. For example, in maternity, the number of hours worked by clinicians, nurses, nutritionists (and other personnel who may work in maternity) is computed for a quarter of a year. To get the total man-hour costs put into maternity for the quarter, the hours of each type of personnel are multiplied by the department's average hourly salary paid to each. To obtain unit costs, the number of units of output are computed and divided into the total cost. Of course, to get comparable units of analysis, the output in maternity is broken down into component parts. Clinic visits are distinguished from home visits, and unit costs for clinic visits and home visits are computed separately. In maternity, a further distinction is made between first and repeat visits, and antepartum and postpartum visits.

The pilot study results did show that very nearly the same things are done for a first antepartum home visit by each department. Hence, it appears that the constancy requirement is being met. Distinctions similar to these are made in each of the programs for which we are measuring productivity. In tuberculosis, for example, distinctions are made between clinic visits for screening, clinic visits for diagnosis and treatment, field visits, and home visits. Finer distinctions also are being made as a means of getting down to a unit that is constant, and one which has approximately the same meaning in each department.

The pilot study results show that the mean cost of producing one maternity clinic visit for the 14 departments in the sample is $8.03, and the mean cost of providing one home visit is $12.15. There is some variation between departments for each of these activities. It appears that it costs some departments four to five times as much to complete a clinic visit as other departments. At this point we are working on the question of how much of this difference in costs is attributable to differences in the quality of the work, how much is due to differences in efficiency, and how much is due to measurement error. Some of the other average unit costs turned up by the pilot study are as follows: in dental health, the mean cost of restoring a tooth surface for the departments in the sample is $6.11; the mean cost for an inspection is $1.92; the mean cost for a cleaning operation is $3.04, and for an extraction the mean cost is $1.90.

Again, the tentative nature of these results should be stressed; there are still some problems to be ironed out before much confidence may be placed in the results. However, it is likely that the ranks of differences found, if not the magnitude, will remain the same when corrections are made; and thus the conclusions about the relationship of things like centralization to unit costs probably are not too far off.

Measuring Scope and Innovation

Through the method of self-recall, the number of hours devoted by each department to each of 33 programs is being measured. The mean per cent man-hour distribution of the 14 departments for the 33 programs is contained in Table 2. Since this is a random sample, it can be taken as a fairly good estimate of the universe of the 114 largest local public health departments in the United States. It shows how the "typical" department in the United States allocates its resources. More pertinent to the research project, it shows that the five programs for which productivity is being measured comprise 31.5 per cent of all the activity. For this reason, six additional programs are to be added so that productivity will be measured for about 55 to 60 per cent of a typical department's activity. The hours that each department devotes to these 33 programs shown in Table 2 can be used to measure the scope of activities of each department. A department that does more dif-

Table 2—Per cent of total man-hours divided by a "typical" department to various health programs

	%		%
Home nursing service	3.24	Mental health	6.23
Homemaker-home health aide	.79	Occupational health	.41
Cancer control	1.10	Narcotic addiction control	.21
Heart disease control	.89	Air pollution control	1.48
Diabetes control	1.11	Eating and drinking inspections	9.76
Other adult health services	2.52	Milk control, all phases	4.04
Crippled children	2.89	All other food safety	2.40
Child health	13.81	Housing hygiene	.89
School-age child health	9.24	Radiation control	.30
Maternal health	8.26	Refuse and solid waste	1.58
Family planning	2.29	School and public building inspection	1.09
Tuberculosis	5.33	Sewage	1.60
Venereal disease	6.16	Swimming places	.21
Accident control	.59	Vector control	3.21
Alcoholism control	.38	Water systems	.83
Dental health	6.24	Barber and beauty shop inspections	.36
Enteric disease control	.37		
		Total	100%

ferent things, and that does more in each of the programs, can be said to have a wider scope. This can be computed easily by comparing the hour distribution of a particular department with the mean distribution for the 14 departments, and controlling for size.

Innovation is being measured by computing the per cent of total man-hour allocation that a department devotes to each of 12 new programs.[6] Of course, it might be said that innovation means more than just doing what is considered to be new programs; it also means doing old things in new ways. One way that this might be characterized is in terms of how much time a department is devoting to trying to organize community resources; particularly through getting people in the community involved in health programs. Measures of this are now being developed.

In addition to the organizational characteristics, the research project also postulates that performance will be related to the socioeconomic, demographic, and political characteristics of the communities in which the departments are located. Involved here are such things as the community's size and level of industrialization, and the social status, activity, and perception of councilmen and commissioners. Work is now in progress to develop measures of these variables. Among other things, it is postulated that these community characteristics may have a direct relationship with the amount of innovation and scope of services; while the organizational variables should relate directly to productivity and unit costs.

Systems analysis of this kind is not aimed at questions relating to how resources might best be allocated among competing alternatives in order to produce the largest payoff. Techniques like cost-benefit analysis—along with planning, programing and budgeting systems—are more suited to these questions. The objective of this research is more descriptive than normative; its aim is to describe the typical operation of a health department, and the organizational and community characteristics that relate to this. At the same time, however, it might be said that descriptive concerns are related to the more operational questions in that they pro-

vide a basis upon which more realistic operational research can be based.

Future Plans and Goals

The phasing of the project at the present time is as follows. In the early fall of next year, data on all of the variables mentioned above will be collected by the National Opinion Research Center of the University of Chicago. It is expected that these data will take about a year to be analyzed. The 135 local public health departments with 50 or more employees are to be included in the sample. Even though we are collecting a great deal of data in the project, it does not involve a tremendous amount of time on the part of the departments. The health officer and each of the principal division and program heads are to be interviewed, which takes about an hour and a half per person. A questionnaire will be distributed to a random sample of operating-level personnel. The questionnaire takes about an hour to complete. The rest of the data is to be collected by the interviewer through searching of records which can be supplied by the personnel people.

Those who bear the great responsibility of providing needed health services are faced with an enormous number of complex problems. This research does not claim that it will find answers to all of them; but it will provide rather precise answers to many of the more important administrative, organizational, and community problems usually faced by the local public health department. Of course, no technique, discipline, or mode of analysis can supplant the informed judgment of the health officer. The most that these things might do is to provide new information, or a new way of looking at old problems; and this can serve as the foundation upon which more effective decisions are made. That is what this research hopes to accomplish.

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5. Six additional programs are now being added: these are milk control, all other food safety, refuse and solid waste, swimming places, vector control, and child health. The reason for this is so that we can measure unit costs and productivity for the majority of the activities of most departments.
6. These are: cancer control, heart disease control, diabetes control, other adult health services, family planning, accident control, alcoholism control, dental health, mental health and mental illness, narcotic addiction control, air pollution control, and radiation control.

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