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Hospital Size and Efficiency

*Proceedings of the Ninth Annual Symposium on Hospital Affairs
December 1966*

Conducted by the Graduate Program in
Hospital Administration and Center for
Health Administration Studies, Graduate
School of Business, University of Chicago.

PUBLISHED BY

*Graduate Program in Hospital Administration and
Center for Health Administration Studies
Graduate School of Business, The University of Chicago*

Additional copies may be purchased
from Center for Health Administration Studies
5720 S. Woodlawn Avenue, Chicago, Illinois 60637

PRICE \$2.50

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Introduction

The next twenty-five years offer the greatest opportunity ever for a major reordering of general hospital beds. This opportunity comes about because of the projected large increase in population and its shifting distribution, rural, urban, and suburban. In 1960, 70 per cent of the population was urban, but the trend toward a larger proportion in cities has been in process for years. Hospital construction, now running over \$2 billion per year, will increase. Hospitals will be larger, and beds will follow population to the suburbs. Obsolescence will, at the same time, force renewal of central city hospitals.

Areawide planning for hospital facilities, on the increase in metropolitan areas throughout the country, is a reflection of the need to move effectively in the face of a heavy demand for more beds for an increasing population distributed quite differently. Interest in planning also has been stimulated by the expressed need of donors of capital funds, both government and private. Those providing capital funds for the large number of new hospitals being planned want efficiency, both in providing service to the public and in avoiding the unnecessary expense entailed in needless duplication of service.

While hospital construction has been one of the most popular charitable objectives, large donors need and have organized metropolitan-area agencies qualified to designate hospital-construction projects worthy of support.

The so-called modernization amendments to the Hill-Burton Act for the first time give priority to the need for replacement and reordering of beds in metropolitan areas. Also, additional major legislation aimed at that problem will undoubtedly be introduced in the Congress again this year.

Satisfactory administration of grants of capital funds depends on some designation of priorities for the sums made available within a metropolitan area.

Here again the areawide planning agency has a function.

Planning is easier said than done. One aspect of the effort to visualize and plan for the future hospital system is the need to develop consensus on guidelines which will shape plans. For example, a guide which has been debated and is still at issue is the number of general hospital beds needed per thousand population. Yet it is impossible to develop a citywide plan without decision on that point.

A second needed guideline is the best size for the metropolitan general hospital. Indeed, not only are the areawide planning agencies making decisions on the basis of their best judgment, but, since most hospitals are considering expansion, some judgment as to the best size influences present construction. There are other guidelines at issue, but it is this latter question of hospital size which we will discuss.

The general hospital has developed very much as a reflection of community need, particularly need as measured by local physicians evaluating the facilities that they require to treat their patients. The public has been concerned that adequate facilities be available and, with the advice of the profession, has proceeded to provide them. A unique aspect is that no other necessary utility has been so largely financed through philanthropy. Such financing has not been easy, nor has it provided adequate capital funds. The Hill-Burton Act for construction of hospitals is a demonstration of public concern with providing hospital beds. A major point to be made is that the hospital physical plant has, up to this time, been meagerly financed in spite of much effort and good intent.

To maintain the present ratio of approximately 3.5 beds per 1,000 in general hospitals with the projected population growth for the next fifteen years will re-

The Ninth Annual Symposium on Hospital Affairs, held at the Center for Continuing Education, The University of Chicago, Chicago, Illinois, on December 16 and 17, 1966, convened at 9:00 A.M. Charles R. Goulet, Superintendent, The University of Chicago Hospitals and Clinics, and Professor of Hospital Administration, Graduate School of Business, The University of Chicago, presided.

quire something like 150,000 general hospital beds. Coupling the cost of these beds and the cost for replacement of obsolete facilities guarantees a continued heavy demand for funds for construction.

There has been much discussion of whether other types of less-expensive institutional facilities will substitute for the general hospital bed or whether better-organized resources might permit care of a great number of the sick in their homes. Certainly interest in the use of such substitutes needs to be stimulated, and new methods of payment should encourage more use. However, there is little reason to expect a reduction in the demand for care in general hospitals. In fact, as seems likely, should the use of such hospitals measured in average days per thousand increase, more general hospital beds will be required.

This Symposium, in the face of much projected reordering of general hospital facilities, considers what may be the most efficient size for a metropolitan general hospital. Efficiency as here used has two dimensions, quality of service and economy of delivery. It is hoped that efficiency viewed in this broad perspective may be advanced by looking at the problem of general hospital size from a number of aspects.

This Symposium is directed toward examining the effect of the size of the general hospital upon efficiency in the delivery of care. The issue is unlikely to be settled; nor is there any expectation or desire that a specific size for the general hospital be set. Rather, it is an attempt to proportion the issue and assist the individual hospital and planning agency in evaluating this variable so vital for good planning.

Large Organization

THOMAS L. WHISLER, Ph.D.

Administrators, by and large, are interested in matters of organizational size and growth. Some are interested because they are working in large organizations and want to know if the problems that they face are peculiar to and inevitable in large organizations. These managers are also interested in developing an understanding of the advantages inherent in large size and in how to exploit these advantages.

On the other hand, administrators not now working in large organizations almost always expect that they will one day. They assume that their organizations are going to grow if they do their jobs properly. They want to know what dimensions of the organization must change with growth and what problems they must anticipate and, if possible, avoid.

I would like to comment on several theoretical aspects of organizational size and growth. I will focus on only a few aspects, because I think that our knowledge is quite limited. I am not even sure that what we know is true, but this is a matter that you will have to judge for yourself.

We need, first, to consider some problems of definition. What is a "large" organization? A "small" one? I find that people differ as to the definitions that they like and the measures that they apply. Some people measure organizational size in terms of the number of participants. Some measure it in terms of assets. I understand that in your industry you count beds. Other experts measure in terms of output—tons of steel, number of graduates, number of miles traveled, and so forth.

It is interesting to note that those who have made empirical studies on size measures find that, if one stays within an industry, the kinds of measures that we have mentioned all correlate highly. It does not matter which measure is used, provided one stays within the boundaries of a single industry.

However, these correlations among measures do not hold across industries. One reason is that technology differs among industries. So do other important factors. For example, product lines are different. Legal and social factors differ, the degree of competition differs, and so on.

Granted that there are different and interchangeable indexes of size, the problems of defining "large" and "small" still remain. These terms turn out to be relative ones—relative to a particular industry or

organizational class. What is large in one industry may be medium or small in another.

Those of us who theorize about organizations often wish that we had a definition that is industry-free, a generalized definition. We need to generalize. Consequently, we find ourselves, more often than not, using a people measure—a head-counting measure. We do this because we believe that differences in kind (if there are any) between little organizations and big organizations are associated with changes in the numbers of people rather than other things, like machinery, buildings, or assets.

Even with a people measure, we still do not find any uniform agreement on what is large and what is small. One authority asserts that a small organization is one characterized completely by face-to-face relationships. Such an organization (he says) would have between two and forty members.

A medium organization to this expert is one in which it is still possible for one member to get around to see all other members within some reasonable period of time and to interact with them. The membership would number between thirty and one thousand.

A large organization, says this authority, is one in which it really is not possible for any member to interact with everyone else in the organization. However, it is quite likely that most people in the organization still know who the key members are, even if they never see them. Such an organization (he is guessing) would run from around a thousand to ten thousand people.

Then he also has the category of "giant." This organization is so big that it is quite unlikely that everyone even knows who the key people are. The size runs from ten thousand people on up.

I am sure that other experts would quibble with these definitions. I prefer to avoid the issue, to consider instead the organizational changes that occur as an organization moves along the road toward bigness. I find it useful to speak of "small" and "large" as hypothetical and points on the size scale of organizations. I must leave it to you to decide where you lie on the scale.

I should also say, as a footnote, that the organizations that I will discuss are "hierarchies"—not the scientific and professional organizations with which

many of you are familiar and which usually are a key part of a hospital. I am going to talk about the hierarchy where authority is exercised, where levels exist, where departments are created, where efficiency is the watchword.

Let me take a few minutes to review what small and large organizations have in common before we ask ourselves how they differ:

1. They are *organizations*, both of them—multiperson cooperative systems—whether they are little or big.
2. They are characterized by the existence of a general common goal toward which all members work.
3. They exhibit specialization of effort—different people are doing different things at the same time.
4. They both have co-ordination problems.
5. They also have computation problems—figuring out the best way to get the jobs done.
6. They have problems of communication and control.
7. They have the problem of assuring that participants in the organization receive according to what they give.

Now, how do they differ?

It turns out that it is very hard to factor out what we would call "pure" size differences. Other things tend to change at the same time that size changes. For example, it is quite common that as organizations get larger they tend to spread out geographically. It is, however, possible to do one without the other, and the consequences differ.

Larger size may also be associated with a larger range of outputs, but these can be independent of one another. Age and size are also frequently related, although it is possible to get older without getting larger.

In my comments on size and growth I will try to keep these multiple causes separate, giving each its due, for it is size and size change in which we are primarily interested.

I have a modest list of dimensions along which I think change occurs as an organization grows from small to large:

1. One of these is *control structure*—the pattern of authority and control in organizations.
2. Another factor is *departmentalization*—the way in which activities are grouped into sections, divisions, departments, and so forth.
3. The degree of *task specialization*—how many different kinds of jobs there are in the organization.
4. The complexity of *computation problems*.
5. The complexity of the *communication system*.
6. The size of the *administrative component*—that chunk of the organization involved in administering.
7. The *span of control*—the number of people reporting to a supervisor. I am particularly interested in the span of control at the top-management level.
8. Last, we have the factor of *survival power*—the odds that the organization will still be here next year.

I would like to look at each of these factors briefly and make some comments and explanations.

In relation to the control factor, as organizations become larger, control structures become more decentralized, simply because they have to. There is absolutely no way of avoiding it. Communication and computation loads become overwhelming, if you try to maintain the same central control that you had when you were small. This decentralization can occur either by default, wherein you simply lose control through communication and decision overload, or it can result from systematic planning. Owners and managers do not like to decentralize, and, of course, I do not blame them. It is risky. Therefore, they will decentralize only to the extent that they find unavoidable.

Usually, if you are the top executive, you begin to decentralize by delegating cautiously, getting a trusted lieutenant or two to work with you. This partially explains the growth of the managerial group as organizations get bigger. But, even as you delegate, you seek to retain as much control as possible through the use of standard procedures and rules. These invisible monitors function as substitutes for face-to-face control but usually decline in effectiveness as the organization grows. In fact, they frequently tend to get in the way and are not enforced. So, in one way or another, as size increases, so does the degree of decentralization.

We now come to the matter of task specialization, the process of chopping up large tasks into smaller ones and making each smaller one a full-time job for someone. As very small organizations start growing, it pays dividends to fractionate tasks. As growth continues, at some point specialization gives way to replication; that is to say, we frequently begin adding more people to do the same thing that other people are already doing. We do not continue the specialization process forever because it does not pay off forever. The actual point of changeover depends chiefly on the nature of the technical equipment you use in your particular industry and the character of your client or customer markets.

There are factors affecting the degree of specialization other than simply size and growth, a particularly important one being the complexity of output—of goods or services. Increasing the complexity of output will probably increase organization size, but its primary effect will be to increase the degree of specialization.

Another factor that influences the degree of specialization is the amount of contracting-out that you do. As you can influence the size of your organization, you can likewise influence the variety and num-

ber of specialists that you have by contracting-out. Those of us who work with organization theory have perhaps taken too little account of managerial action of this kind, being more interested in merger than in spin-off or contracting-out.

Finally, I should also mention that specialization is a function of how dispersed you are geographically. If you spread out more and more as you grow, you get quite a retarding effect on specialization. Dispersion in and of itself tends to reduce the degree of specialization.

Referring to size once again, we will say that, if you can hold everything else equal (which is one of the hardest jobs in the world), you will find that at first you become more specialized as you grow but later on that process stops and, in some cases, may reverse.

I have been talking about specialization as a process of differentiating more jobs of individuals. But task specialization is also related to the way in which you departmentalize and to the way in which you aggregate tasks into departments, especially major departments.

At some point on the growth curve, however, we see the emergence of what we call "parallel departments." When this occurs, activities are arranged so that each department contains the same functions or most of the same functions as every other department. Typically, these parallel departments are oriented either to different kinds of output or to different client groups, or they are in a different geographical area. In the retailing industry, for example, you will find departmentalization by store (in the chains). Each store has essentially the same functions under its control as the next store. This is parallel departmentalization. This also happens now and then in other kinds of industries as they get larger and larger. You see the creation of parallel departments as a means for dealing with problems of communication and computation that are the curse of large size.

Now let us take a look at the administrative component—those in the organization who administer. They are often called "overhead" or "non-productive labor" by accountants. But they are always there, just the same.

There is a relationship between size and administrative component. As size increases, the administrative component naturally increases also. However, it does not increase proportionately; at least, it should not. If you have an organization of one hundred men, with seven of them engaged in administration, you should expect that the size of your organization could double without requiring the number of administrators to go to fourteen. Possibly it should be eight or nine. In other words, as you increase in

numerical size, the proportionate increase in the size of the administrative staff decreases.

Again we are assuming that only size changes—nothing else. It often happens, in the real world, that as you grow you spread out geographically or you expand your range of services. These changes cloud the picture. Research evidence indicates that dispersing geographically causes the administrative component to grow more than proportionately. The same result occurs if you begin to expand the range and variety of services that you offer. Thus size (or growth) affects the administrative component one way, geographical dispersion and complexity of output the opposite way.

We come now to the matter of span of control, which has been kicked around the organizational literature since many of you were children, maybe even longer. In other words, how many people should the top executive have reporting to him or how many does he have reporting to him?

Our research indicates that the span of control of top management increases with size. In other words, the larger your organization, the more people there will be reporting to you. This, of course, should not be too surprising if you recall earlier comments on size in relation to the administrative component and to decentralization. Span of control and decentralization are obviously related. The larger the span of control, the more decentralized you are.

While size affects the average span of control in an organization, so, too, do those familiar (by now) factors of output complexity and geographical dispersion. Our studies indicate that, once again, they work in the opposite direction; that is, an increase in output complexity or in geographical dispersion will tend to reduce the span of control. A manager who tries to estimate the effects of growth on the span of control will thus have his estimation efforts complicated if growth is accompanied by dispersal or by an expanding range of services.

The changes that I have been discussing are closely related to changes in computation and communication problems that occur as organizational size changes. By "computation" I mean simply figuring out the best way, or the quickest or cheapest way, to get something done (and then refiguring every time something unforeseen occurs). This is what many of you spend most of your time doing. Someday you may give a lot of this computation over to computers, but at the moment this is a prominent part of your daily activity.

The computation problem becomes an overwhelm-

ing one for the individual manager very early in the growth picture. The history of small businesses is replete with cases in which the individual who founded the business is unable to bring himself to shift from being the only computer in the organization to an arrangement whereby he shares the computation problem with others. He soon finds himself beyond his capacity. What started out as a great success can flounder and die. Successful solution of the computational-overload problem requires delegation to computational subcenters. A problem too big for one man becomes feasible for a group of managers.

Delegation, unfortunately, often introduces problems of goal conflicts; that is, the subcenter may solve its own part of the problem beautifully but not always in the best interests of the organization as a whole. It turns out that computation involves not only solution of problems but making an initial definition of them. This definition reflects the goals of the definers. Thus each organization faces the dilemma of having to delegate in order to overcome computational overload, but delegation itself introduces problems of goal conflict.

Communication systems in very small organizations are often what we call open-channel networks, where everyone can, if he wishes, communicate with everyone else. This open-channel communication helps to get the job done, as well as developing a feeling of belonging. The "unrestricted" network has great advantages.

The unrestricted network, unfortunately, becomes unfeasible as organization size increases. Information overload quickly develops at all receiving points, so filtering and priority systems are developed. Communication efficiency tends to fall because feedback loops are reduced. Messages are sent, but often the sender never knows whether they arrive and, if they arrive, whether they are understood. If feedback loops were not kept to a minimum, the channels would become overloaded. We would, in fact, be close to an open-channel, unrestricted network.

So, communications efficiency tends to dwindle as size increases. Furthermore, restricted networks can encourage game-playing. Information is power, and an individual seeking power can learn to manipulate information, relatively free from the probing finger of the feedback loop. If he occupies a key spot in the network, others in the organization find themselves vulnerable and dependent on him. Even if he plays openly and honestly, mistrust may develop. For example, it is my observation that nobody in a hierarchy ever feels that he gets as much information as he needs in order to get his job done. It does not seem to make any difference where he is in the organiza-

tion. If you talk to the janitor or to the machine operator, you soon find that he believes that nobody ever tells him anything. "They" do not tell him anything because he does not amount to anything in their eyes, he thinks. (In fact, he often believes that even his union does not tell him anything any more.)

The top executive seems to believe that, although he is responsible for everything in the organization, in reality he has very little idea of what is actually going on because nobody will ever tell him. A standard story concerns the president who arrived at the plant gate one morning in his Cadillac only to find a picket line announcing that the plant was on strike. Up to that point, he had not heard that anybody was unhappy. He was caught by surprise because of a communication failure.

And, if you talk to middle managers, you quickly find that they live in the worst of all worlds. Their subordinates never tell them anything, and neither do their superiors. They believe that they are trying to solve the really difficult problems of the organization without anyone's trying to keep them informed.

Perhaps all of us in large organizations feel that we are underinformed, at least about some things. It is impossible to tell everyone everything, but we have trouble accepting this. We feel vulnerable and uneasy. The introduction of computers will, I think, tend to increase the efficiency of both communications and computation. As a by-product they also tend to centralize control in organizations, given the basic bias of managers for not giving away any more authority than they have to. In this respect computers begin to make large organizations look a lot more like small ones.

The last item that I mentioned in my list of factors that change in the growth of little organizations to big ones has to do with survival power. Very small organizations are vulnerable to risk—they live in a risky world and tend either to get bigger or smaller, to grow or to die. Large organizations, more often than not, have sufficient resources and techniques to enable them to survive unexpected blows that would destroy the little organization. The small organization has the advantages of flexibility and tight internal control; it can move fast, shift fast. Its growth rate is almost certain to be higher than that of its bigger competitors, if something unexpected does not happen. If it does happen, and it is beneficent, growth is even more rapid. If the unexpected event is malignant, it is "curtains."

I would like now to say a few words about what I have found, in general, to be managerial attitudes toward growth.

My observation has been that most managers

want their organizations to grow. Growth becomes a mark of organizational effectiveness and of managerial effectiveness. Growth enhances survival power. Growth provides attractive career potential to outsiders that you might want to bring in. Growth attracts those who lend or give money. I am not talking about size but about growth. A manager will say, "This is a great organization." "How," you ask, "is it great?" More often than not he will cite its high growth rate. I believe that this attitude is consistent with the norms of our achieving society.

In this respect, I am not astounded by the fact that the federal government is becoming larger and larger. After all, the people who run it and spend their careers in it, I think, have the same motivations as anyone else in organizational work. They demonstrate effectiveness by seeking to become bigger.

I believe this managerial attitude toward growth to be pervasive. The other day I asked a manager from a large corporation who was visiting down here, "How are things going?" He replied, "We will know when the next annual report comes out." I then asked him what he looked for, and he replied, "Well, I hope that we will show at least a 2 per cent growth." My assumption has always been that a company is in business to make money. We always assume that to be the business goal. However, what this manager is striving for is growth. How often we see reports in the financial pages that a certain company experienced a growth in sales but, at the same time, a decline in profits. I sometimes wonder if managers buy growth even at the expense of profit.

The reason that I emphasize this managerial attitude is that I think it explains the subject matter for this morning and for your meeting. In my research I have become more interested lately in the process of growth than in size as such. Most companies that I have studied either grow by expanding internally or by merger. There is a lot of merging going on in the organizational world today, probably because it is a quick way to grow.

The choice between internal expansion and merger has some interesting organizational implications. I am not going to talk about them this morning because, insofar as I know, you hospital people never merge. At least, you do not do very much of it, and I don't understand why. That is the fastest way to get big and, at the same time, one of the fastest ways to develop big organization problems. This is an interesting subject that we might discuss at another time.

Finally, I believe that managers find large organ-

izations more interesting and challenging places in which to work than small organizations. Not only is it more fun to make them grow, but it is more fun to be in them when they are big. Despite the fact that we often hear people say that they would like to be with a nice small organization, the small organization usually is not overwhelmed with topnotch people seeking to enter it. Where do our brightest graduates go? They go into large organizations. That is where the fun is—and the money.

I might conclude by saying a few words about managerial strategies for coping with large size. I have already mentioned some of these strategies. One is task specialization. Another is to develop parallel departments and to delegate substantial autonomy to them, while retaining some sort of key control—usually financial control in profit-seeking organizations. These efforts seek to substitute indirect for direct controls over people.

But, in these computer days we are beginning to see a reversal, a trend toward returning to more direct control by top-level management. Managers seek to achieve this control by investing in what they hope will turn out to be "sophisticated" computer-control systems. Installation of computers, unfortunately, produces a negative effect on attitudes. This effect tends to be localized in those who lose power in the process of computerization. One finds only the most positive attitudes in those who are designing computer systems to achieve more effective ways of running large organizations.

I suppose that if I were looking down the road toward what will happen in relation to strategies in the long run, it will be to use on-line computer systems to control day-to-day operations. Many of the things that managers spend time on now will be done by computers. Managerial attention will be shifted toward clients and customers. The result will be, I believe, an increase in the average size of organizations in the future in all fields of endeavor, including hospitals.

But in these large organizations with sophisticated control systems, there will be the ever present danger that the managing game will become so fascinating that the primary focus of serving the client and the customer will become blurred. Should this be allowed to happen, the large organization will become simply a large target for criticism and for regulation.

Well, I have not said anything that I am absolutely sure is true, and I am absolutely sure that I have not said anything new. I would, however, like to hear from you.

Economies of Scale

MILLARD F. LONG, Ph.D.

First of all, let me say that I am an economist and not terribly knowledgeable about the problems of hospitals. Therefore, my task, as I see it, is to give you a little background on today's problem, that is, "Economies of Scale," and also to express in economic terms the questions before this conference. Unfortunately, the information presently available is not sufficient to provide definitive answers to these questions. But, as one of our University of Chicago professors has said, "To state the question correctly is to be 50 per cent of the way to the answer." I shall try to state the questions correctly and will leave to other speakers the job of answering them.

The notion of economies of scale is not very complex. To illustrate what is at issue, consider Table 1.

TABLE 1

Inputs		Output		
Capital	Labor	1	2	3
100	100	100	100	100
200	200	190	200	210
300	300	270	300	330

Assume that 100 units of capital and 100 units of labor can be combined to produce 100 units of output, which may be hospital services or some other commodity. If inputs are doubled—that is, instead of using 100 units of capital and 100 units of labor, 200 units of capital and 200 units of labor are employed—what will happen to output? The second output column in Table 1 indicates one possible result—a doubling of output. This situation is called "constant return to scale." If, with the doubling of inputs, the increase in output is something less than 100 per cent, as indicated in the first output column, the economist would classify the process as one exhibiting diseconomies of scale. As shown in the third column, the output may rise more than proportionately with the increase in inputs; this would be called "economies of scale."

In a particular production process, economies of scale may prevail at first, only to be followed by diseconomies as size increases. Small hospitals may find that average costs fall as the hospital grows, then level off, and finally begin to rise as the hospital con-

tinues to expand. In hospitals, as in many production processes, there is probably a substantial range over which there are constant returns with the growth in output being proportionate to the growth in inputs.

While the notion of economies of scale is simple, its application to problems of hospitals is not so simple. Furthermore, the empirical studies that have attempted to measure economies or diseconomies of scale in hospitals have not provided unambiguous answers.

Thus far, I have talked only about hospital costs, but to the community whose interests are involved the relevant costs include more than hospital costs. For example, even if hospitals did have economies of scale and the quality of care increased with size, we would not suggest that for the city of Chicago there be only one hospital. Or, to make my example more extreme, we would not recommend one hospital to serve the whole United States. The reason the single hospital is not optional is that some of the relevant costs have not been taken into account. To find the correct solution, travel costs, and what I shall call "inconvenience costs," must also be taken into consideration to determine the optimal size of a unit. In fact, I hope to show that the optimal size of a unit will fluctuate, depending on density of population, available transportation, and other factors.

The studies done at the University of Pennsylvania indicate that, in respect to hospitals, travel costs are important, especially if we include not only the patients' and doctors' travel time but also the time of the people who visit the patients, the hospital staff, and so forth. In relation to travel costs, it is quite clear what happens as the average size of units is increased. As units become larger, costs rise. For example, if Chicago were to be served by half the present number of hospitals of doubled size, then, of necessity, travel costs would increase for, on an average, the hospital will be farther from the patients' homes, farther from the doctors' offices, and so forth. Travel increases with the size of units.

Now, there are other costs included in costs of care besides travel costs. What I am thinking about now is a little hard to see, especially in relation to how they vary with the size of unit, but they do vary. If you are interested in this, I can readily demonstrate it for you at the end of my talk. However, as of the

present time, I will merely ask that you take my word for this.

On the other hand, inconvenience costs—that is, the costs associated with a hospital's being full when a patient desires to enter—decrease with the size of units.¹ Now, when a hospital is full and must tell a patient that he must wait two weeks for accommodation or, if it is an emergency case, crowds facilities or dismisses a patient early, this is an inconvenience. Perhaps the worst kind of inconvenience would be if the hospital were forced to tell the patient to go to another institution because it was too crowded to care for him. The frequency with which this kind of phenomenon will occur depends upon the size of the hospital. In a community with 3,000 beds, it will happen least frequently if the beds are in a single unit; more often if there are two units of 1,500 beds; and still more often if there are six units of 500 beds.

All these costs are summarized in Figure 1. Travel costs per case rise as the average size of hospitals increases. On the other hand, the inconvenience costs about which I have just been talking fall as the size of the unit is increased. I do not know whether they offset each other. This is a problem of empirical measurement about which too little is known.

With regard to hospital costs, the evidence indicates that the cost per case rises in larger units. Does this really show diseconomies of scale in hospitals? The crude figures require correction in two ways.

1. Labor costs are a high proportion of total costs in any hospital. Larger hospitals tend to be in larger cities and to pay higher wages to nurses and other help. Therefore, these costs appear to be higher. If, instead of dollars, a physical measurement of input is employed, such as number of nurses per patient, this bias can be corrected.

2. While the main product of hospitals is patient care, they also produce other things. Specifically, some hospitals provide training and undertake research; these activities tend to be concentrated in larger hospitals. To get the correct measure of costs per case, we must eliminate the costs of training and research. As you know, hospital cost accounting is not so advanced that this is easily done. As the costs are mixed together, it is hard for the investigator to decide how to separate them. Even after this correction, studies have shown that larger hospitals have higher costs.

The remaining problem is that case mix differs by hospital size. Larger hospitals tend to have a larger proportion of more difficult and costly patients;

¹ That the frequency with which this occurs falls with size is a problem in statistics; instead of proving it here, I shall ask you to take my word for it.

smaller hospitals tend to treat problems that are relatively simple. Investigators have tried to deal with this problem in two different ways. One study of British hospitals introduced a vector of variables for case-mix differences. The results show that over the middle range of hospital sizes there is no discernible change in costs per case. In other words, the hospital cost curve is relatively flat. Had some of the extremely small hospitals and some of the very large hospitals not been removed from the sample, the results might have been different.

A much cruder procedure, but one used more extensively in connection with United States data, is to attempt to measure quality differences by looking not at output differences but at input. From the annual volume of *Hospitals*, the investigators took the number of services that the hospital was rendering: types of X-ray procedures, social services, and so forth.

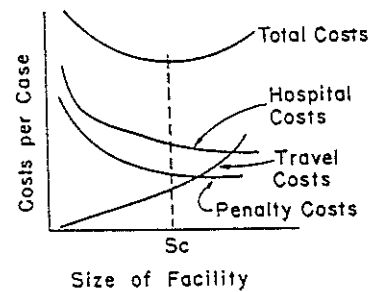


FIG. 1

When this is done, the diseconomies of scale apparent in the crude data disappear. On the other hand, it is difficult to judge whether hospital costs actually decline as size of unit increases. The safest position, at the moment, seems to be that, in hospitals, roughly constant costs prevail, at least in the middle range of sizes. For the extreme observations, that is, very large hospitals or very small hospitals, costs may well be higher than for hospitals in the middle range.

The hospital costs curve in Figure 1 reflects these considerations. I probably should have drawn the curve much flatter in the middle range. As unit size increases from some very low level, there is probably some falling in cost. For hospitals that are very large, costs probably rise. In the middle, the costs are more or less constant for a considerable range of sizes.

I would now like to integrate all my comments on costs. The optimal size hospital is the one that minimizes the average cost of service to the community—costs are defined to include, in addition to hospital costs, travel and inconvenience costs. In

Figure 1, this point is indicated as S_c ; of course, it would be very unlikely if this optimal unit size would be the same as the unit size which minimized hospital costs.

Travel costs depend upon density of population and adequacy of the transportation system and will differ by area of the country. So will the hospital and inconvenience-cost functions. This means, of course, that the optimal size hospital will also differ by region and that we should not expect that one size of hospital will be best in different regions. In fact, even

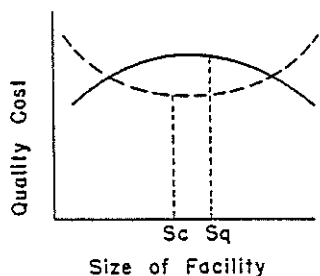


FIG. 2

within a region, such as Chicago, costs will probably be minimized by having different-sized units. Central city hospitals should be larger, for example, than suburban hospitals.

I would also like to raise the question of quality of care and how it might vary with the size of hospital. Again, I only wish to state the problem in an economic framework. The solid line in Figure 2 shows how quality might change with the size of hospital. If the unit is very small, the quality falls; if the hospital is very large, impersonal handling of patients may reduce quality. Again, as with costs, there may be a large size range over which quality is unaffected. In any case we can imagine the relationship between quality and size being much as I have drawn it.

The dotted line in Figure 2 represents the total cost curve from Figure 1. There is no reason to suspect that the size of unit which minimizes costs (S_c) will be the same as the size of unit which maximizes quality of care (S_q). It may well be that the size of hospital which maximizes quality of care is somewhat larger than the size of hospital which minimizes costs. Possibly the relationship will be the other way round. What I would like to point out is that they are not likely to be the same. In this situation we must recognize that to get higher quality we shall have to pay for it in terms of larger-sized units with higher costs.

But quality can always be improved if we are willing to pay for it. We can build better roads that will reduce the number of accidents; however, we may not judge it worth the cost. So it is with the hospitals. We shall have to judge, as we do now, whether the extra quality is worth the extra costs. The community should make this decision, depending on what they think is worth paying for. In fact, the decision may have to be made by hospital administrators, hospital boards, or regional planning agencies. But it is the solution to this joint problem of quality and costs which will determine the optimal size for hospital units.

Now, I want to tell you that I have merely tried to state for you some of the problems and some of the questions that economists have in relation to economies of scale and also, in turn, the problems that it raises for hospitals. The answers to these questions rest on some empirical measures which still have to be determined.

There is considerable study being done on these questions, and possibly ten years from now we will be able to specify the cost curves and point out to the community the alternatives that are open to it in the health field.

Hospital Size and Structure

DUNCAN NEUHAUSER*

The purpose of this paper is to develop a general theory of hospital size and internal structure.¹ This theory is simply stated as follows: Community characteristics, historical circumstances, and environmental characteristics define hospital size; size, in turn, defines the internal structure of the hospital, including such factors as division of labor, scope of services offered, costs, decentralization, the use of formal controls, and so on.

There are three distinctive size groups of hospitals with different structural characteristics:

1. Small hospitals, roughly from 0 to 100 beds, are characterized by uncertainty in the demand for their services, low division of labor, and few formal controls.
2. Medium-sized hospitals, centering around from 100 to 300 beds, are characterized by stability and what may be called, for the lack of a better term, "administrative ascendancy."²
3. Large hospitals, those of 300 beds or more, are characterized by "professional ascendancy."²

TABLE 1
CORRELATIONS BETWEEN VARIOUS MEASURES OF HOSPITAL SIZE*

Measure of Size	Average Daily Census	Total Expense	Total Personnel
Number of beds.....	+ .99	+ .95	+ .97
Average daily census.....		+ .96	+ .98
Total expense.....			+ .97

* Based on a sample of 350 United States hospitals chosen because they were participating in the Management Review and Hospital Administrative Services programs of the AHA at the end of 1965. Data are from the 1960 Guide Issue of *Hospitals*. All correlations are statistically significant. See also Wolf Heydebrand, "Bureaucracy in Hospitals: An Analysis of Complexity and Coordination in Formal Organizations" (unpublished Ph.D. dissertation, Department of Sociology, University of Chicago, 1965), p. 112.

A number of different measures of size, all highly interrelated, can be used, including beds, census employees, and total costs (see Table 1).

* The author is heavily indebted to the American Hospital Association and its Research Division for the use of their data and data-processing equipment. This research has been supported by USPHS Grant No. HM-00476.

¹ This paper, its tables, and graphs refer only to non-federal, short-term general and other special hospitals.

² The terms "administrative ascendancy" and "professional ascendancy" are recognized as having inherent emotional connotations. They are used here partly because they are descriptive of a set of size-related phenomena and partly for lack of better terms.

The Community and Hospital Size

Some correlations between community characteristics and hospital size are shown in Table 2.³

The first thing to note is the high correlation (+.98) between the population of the county in which the hospital is located and the total number of acute hospital beds in that county. This suggests that community size sets an upper limit on hospital size.

TABLE 2
COMMUNITY CHARACTERISTICS, HOSPITAL SIZE, AND THE TOTAL NUMBER OF HOSPITAL BEDS IN THE COMMUNITY*

Variable	Variable	Correlation (r)
Population.....	Total acute beds in community	+ .98
Population.....	Individual hospital size (beds)	+ .27
Per capita income.....	Individual hospital size (beds)	+ .45
Number of active M.D.'s in community.....	Individual hospital size (beds)	+ .26
Number of active G.P.'s in community.....	Individual hospital size (beds)	+ .24
Ratio of G.P.'s to total active M.D.'s.....	Individual hospital size (beds)	- .56
Hospital age.....	Individual hospital size (beds)	+ .50

* For same sample as in Table 1. Data from *Distribution of Physicians in the U.S. by State, Region, District, and County, 1965* (Department of Economics, Division of Socioeconomic Activities, American Medical Association, Chicago). The community refers to the county in which the hospital is located. All correlations are statistically significant.

This correlation sets the base line for the other correlations shown in Table 2 and indicates that the county is a reasonably good measure of the hospital catchment area for our purposes.

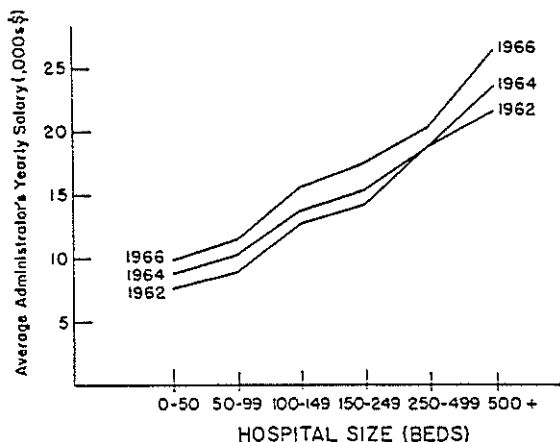
The correlation between community size and the size of any individual hospital is much lower (+.27) but still statistically significant. As community size increases, hospital size increases. Community size sets an upper limit on hospital size, and hospitals as a group expand to fill this upper limit. The size of an individual hospital is better explained by other characteristics, such as per capita income (+.45), hospi-

³ The data in Table 2, like those in Table 1, are drawn from approximately 350 acute hospitals, chosen because they participated in both the Management Review and Hospital Administrative Services of the American Hospital Association as of December, 1965. This is by no means a random sample.

tal age (+.50), or the ratio of G.P.'s to total active M.D.'s in the county (-.56). The absolute numbers of G.P.'s and M.D.'s are not good predictors of hospital size.⁴

The ratio of G.P.'s to total M.D.'s in the county is the best predictor of hospital size. This is partly due to the fact that G.P.'s are in small towns where the small hospitals are. That this is not the complete explanation is indicated by the much lower correlation between individual hospital size and community size (+.27). Another explanation is that the G.P.'s go where the specialists do not want to go. Specialists may gravitate to large hospitals in high per capita income communities.

GRAPH I
AVERAGE ADMINISTRATOR'S SALARY AND
HOSPITAL SIZE, ILLINOIS
(n = 155)



SOURCE.—Illinois Hospital Association, Report No. 35, February, 1966 (Mimeographed).

A third explanation is that the uncertain and fluctuating case loads of small hospitals call for the services of generalists. For example, consider a small hospital with two doctors. On one day there may be four deliveries and no surgery, and on another day there may be four surgical cases and no deliveries. If both these doctors were specialists, the obstetrician would be swamped one day and unemployed the next day. The surgeon would be unemployed the first day and overworked the next. On the other hand, two general practitioners could divide the work load between them and keep reasonably busy on both days.

It is, therefore, probably efficient for small hospitals to be staffed with G.P.'s. Larger hospitals can provide the specialized facilities and stabilized case load which make the use of specialists efficient. This reasoning leads us to expect to find a lack of special-

⁴ The absolute numbers of G.P.'s and total practicing M.D.'s are both highly correlated with community size.

ization within small hospitals. As Professor Whisler indicated, age is an important factor in explaining organizational size; older hospitals are bigger hospitals.

Hospital Size and Structure

It is well known that the scope of services provided by the hospital increases with size. The larger the hospital, the greater the number of patients who need these special services on a given day. At the same time, each type of service requires a minimal case load over which the costs can be spread.

The greater the scope of services the greater the division of labor, and the greater the complexity the harder it is to control the organization. This is reflected in the fact that the administrator's salary increases with hospital size (see Graph I). Administrators' salaries have been increasing over time, which

TABLE 3
HOSPITAL SIZE, OCCUPANCY RATE, AND
AVERAGE LENGTH OF STAY*

Bed Size	Occupancy Rate (Per Cent)	Average Length of Stay (Days)	No. Hospitals
0-49.....	68.50	6.58	90
50-74.....	77.59	6.68	128
75-99.....	76.95	7.02	71
100-149.....	79.25	6.79	146
150-199.....	84.30	6.97	71
200-299.....	85.38	7.60	109
300-399.....	86.24	7.92	80
400+.....	86.72	8.60	72

* Hospital Administrative Services, "Special Comparison National Size Groups" (American Hospital Association, September, 1965; Mimeographed). Based on data on 767 participating hospitals for the six-month period ending June 30, 1965.

is nice to know if you are or aspire to be an administrator.

As hospital size increases, occupancy rates and average length of stay increase (see Table 3). The low occupancy rates of small hospitals reflect fluctuating and uncertain demand for their services. The longer average length of stay reflects the more complex care provided in larger hospitals. Quality of care, as measured by accreditation, increases with size, at least up to a point. This is shown in Table 4. Non-accredited hospitals are, on the average, much smaller than accredited hospitals.

Expense and revenue per patient day both increase with size, reflecting, in part, the increased complexity of care provided in large hospitals. Some indication of the relationship between efficiency and size can be seen by looking at the difference between expense and revenue by size.

Table 5 shows the absolute and percentage differ-

ence between expense and revenue per patient day. The smallest hospitals cannot obtain enough revenues to cover their costs. Medium-sized hospitals (150-399 beds) take in considerably more revenue than expenses. The largest hospitals do not have this large a margin.

Undoubtedly, if a hospital is to survive and grow in a time of inflation and rapidly changing technology, it must have revenues greater than expenses. The deficit shown for small hospitals implies that these small hospitals must get much larger, fold up, or be subsidized. Medium-sized hospitals will prosper, having the funds to rebuild, expand, and add new technological innovations. These medium-sized hospitals provide a service which people are both willing and able to pay for.

The uncertain and fluctuating demand for small-hospital services is reflected in their uncertain financial position. Medium-sized hospitals have skilled and trained full-time management, and per-

TABLE 4
ACCREDITATION (QUALITY) AND HOSPITAL SIZE

	Size of Accredited Hospital (Beds)	Size of Non-accredited Hospital (Beds)
Mean size.....	182	41
Median size.....	153	40

SOURCE.—1961 Guide Issue of *Hospitals*, p. 385. For all short-term general and other special hospitals. Students of Professor Thompson at Yale found a correlation of $-.59$ between hospital size and a quality index based on the scope of facilities and educational programs offered by the hospital (D. J. Magid and M. C. Quadland, "A Study of Cost Variation among the Thirty-five Short Term General Hospitals in Connecticut" (June, 1966; Mimeographed)). In my sample of 350 hospitals the correlation between bed size and scope of services offered is $+.72$ (1960 data).

haps this is reflected in their sound financial position. In large hospitals the demands of the professionals for education, research, and charity patients for teaching use up the excess revenue, presumably in order to enhance the quality of care. It is possible that these large hospitals do not provide the amenities and patient comforts found in medium-sized hospitals—amenities which patients are willing to pay for.⁵

⁵ It has been argued that hospitals with excess revenues are not serving the public to the extent that they could, while hospitals which run a deficit are doing a particularly good job. If considerations of efficiency are excluded, this may well be true at the present point in time. In the long run, the outcome may be different. If the hospital with excess revenues plows back the surplus into improvements which will affect patient care in the future, and the hospital with a deficit goes bankrupt and closes, then, in the long run, the former is doing a better job than the latter. The voluntary hospital which does not plow back excess revenues into improving patient care, but lets it accumulate indefinitely in "reserves for contingencies," is undoubtedly doing a disservice to its community.

Hospital Size and Departmental Costs

The relative importance of different hospital department changes with hospital size, as indicated by the varying percentages of total operating expenses devoted to the major departments (see Table 6). First, note that the relative size of the administrative component declines with size. In the smallest hospitals, administration accounts for 12.1 per cent of costs, while in the largest hospitals it accounts for only 9.6 per cent. One reason that small hospitals have relatively larger administrative costs is that the administrator in the small hospital carries out tasks which are not ordinarily considered as "administra-

TABLE 5
HOSPITAL REVENUE AND EXPENSE PER PATIENT DAY

Hospital Size (Beds)	Revenue*	Expense†	Difference	Differences as a Per Cent of Revenue	No. Hospitals in Sample
0-49...	\$32.94	\$33.37	\$-0.43	-1.3%	90
50-74...	34.59	33.94	0.65	1.9	128
75-99...	36.31	35.89	0.42	1.2	71
100-149...	38.01	37.54	0.47	1.2	146
150-199...	39.76	38.52	1.24	3.1	71
200-299...	41.45	39.46	1.99	4.8	109
300-399...	44.22	42.14	2.08	4.7	80
400+.....	43.49	43.06	0.43	1.0	72

* Revenue is adjusted patient revenue per patient day. It excludes tuition, sales to non-patients, various fees, and income from investments, gift shops, vending machines, etc.

† Expense is total operating expense per patient day, including depreciation.

SOURCE.—Hospital Administrative Services, "Special Comparison National Size Groups" (September, 1965; Mimeographed). Based on data from 767 hospitals participating in HAS for the six-month period ending June 30, 1965. Other studies have shown that costs per patient day increase with size. See Walter J. McNeerney et al., *Hospital and Medical Economics* (Chicago: Hospital Research and Educational Trust, 1962), chap. xlii, and Joan H. Hayes, *Factors Affecting the Costs of Hospital Care*, Vol. 1: *Financing Hospital Care in the United States* (New York: Blakiston Press, 1964), chap. vi.

tion," such as care, admitting patients, order-patient ing supplies, direct supervision, and perhaps even sweeping the floors.⁶ The small-hospital administrator has to be a Jack-of-all-trades and a generalist.

The largest change in relative department costs occurs in "nursing" and "medical and surgical" costs, which go from 33.3 per cent in the smallest hospitals to 24.7 per cent in the largest hospitals. As the hospital increases in size, more and more work of the "generalist" nurse is taken over by "specialists," such as dieticians, social workers, laboratory technicians, therapists, interns, residents, OR and delivery-room personnel. Ancillary costs thus tend to increase with hospital size.⁷

⁶ See D. E. Saathoff and R. A. Kurtz, "What Administrators of Small Hospitals Do," *Modern Hospital*, August, 1962.

⁷ This problem of substitution between hospital departments causes severe problems in making departmental cost

To summarize, the small hospital is the home of the generalist—the generalist-administrator, the nurse, and the general practitioner. The use of generalized tasks is one good way of coping with fluctuation and uncertainty in the demand for services. As hospitals increase in size, the generalist becomes less important and there is increasing division of labor.

Hospital Size and Survival

What happens to hospitals, by size, through time? To attempt an answer to this question, we looked at all 57 acute hospitals in metropolitan Chicago in existence in 1945 and traced their histories over a

TABLE 6
DEPARTMENTAL OPERATING EXPENSE AS A PER CENT
OF TOTAL OPERATING EXPENSE PER PATIENT
DAY BY HOSPITAL SIZE

Department	Small Size (0-50 Beds) (n=90)	Medium Size (150-199 Beds) (n=71)	Large Size (400+ Beds) (n=72)
Administrative and General.....	12.1%	9.9%	9.6%
Dietary.....	11.1	10.1	10.1
Housekeeping, Laundry, Plant.....	12.7	11.9	11.6
Nursing, Medical and Surgical.....	33.3	27.5	24.7
Pharmacy.....	5.3	4.7	4.2
OR, Delivery, Anesthesia.....	1.7	7.4	7.0
Radiology.....	7.2	6.5	5.7
Lab.....	5.6	7.1	6.4
Interns and Residents.....		1.7	2.5
EW, OPD.....			1.8
Depreciation.....	5.1	4.6	4.7
Other.....	5.9	8.6	11.8
Total.....	100.0%	100.0%	100.0%
Operating expense per patient day.....	\$33.37	\$38.52	\$43.06

SOURCE.—Hospital Administrative Services, "Special Comparison: National Size Groups." AHA. Excluded are direct costs associated with nursing education, maintenance of personnel, research, or other miscellaneous non-operating expenses. Dollar figures based on total operating expense per patient day. Part of these differences may be due to differences in definitions. For cost breakdowns of other size groups see the original source.

twenty-year period of 1965.³ Hospitals started after 1945 were not included. Because this is an urban area, these findings may not be generalized to rural areas. By choosing an urban area, we obtained a group of hospitals which are close enough together to be somewhat in competition with one another for patients, personnel, and funds. Assuming "survival

comparisons between hospitals. Because this substitution varies systematically with size, it is difficult to study departmental economies of scale.

³ I am indebted to the assistance of Mrs. Joanna Kravits of the Center for Health Administration Studies for her help in the preparation of these data.

of the fittest," this might indicate something about optimal size.

The columns in Graph II refer to the size of the hospitals in 1945. In 1945 there were three hospitals with 50 beds or less in Chicago. Of these, one closed (33½ per cent of the total) and two grew to be bigger than 50 beds. Of these two surviving hospitals, their average growth was 126 beds, or 467 per cent over this twenty-year period. There were twelve hospitals of 51-100 beds in 1945. Of these, four closed (33½ per cent of the total), two remained the same, and six grew. Of the eight surviving hospitals (50 per cent of the total), the average growth was 35 beds, or 43 per cent, over this twenty-year period. The other columns can be interpreted in the same way.⁴

By our definition (see note to Graph II), only two hospitals decreased in size. These two hospitals were the largest in the 1945 sample and are unique enough to require special comment. The largest hospital in Chicago, both in 1945 and today, is Cook County Hospital. In 1945 it had 3,400 beds; today it has 2,747 beds, a decline of over 650 beds. Is this an indication that very large hospitals are inefficient? Perhaps, but it is hard to prove from one example. It is doubtful that the quality of care provided by Cook County Hospital is any better than that provided in many other Chicago hospitals of much smaller size.

The other hospital that decreased in size between 1945 and 1965 is also unique, because it is the result of a merger. In 1945 Presbyterian Hospital and St. Luke's Hospital were two separate entities, having 522 and 432 beds, respectively. They merged in 1957 and went from an original combined total of 954 beds in 1945 to 839 beds in 1965.

A summary of the information in Graph II disclosed the following facts: The smallest hospitals have the highest "death" rate. One-third of all hospitals of less than 100 beds closed their doors. Those hospitals having from 0 to 50 beds which survived grew enormously, by 467 per cent. It seems that small city hospitals must grow enormously or disappear. Since 1945 other small hospitals have sprung up to take their place. These small hospitals probably serve a distinctive group of doctors who cannot get staff privileges elsewhere.

Medium-sized hospitals were the most likely to

⁴ Two problems with these data should be noted. First, the 1945 size figures are probably not completely accurate. They were often listed in round numbers, such as 100 or 200 beds. For this reason the size classifications used here are slightly different from those used in the other tables. This means that several size changes from, say, 200 beds to 195 beds, are counted as "same" rather than "decreased" in size. I believe that this size-classification system provides the most accurate description of what happened.

remain the same size and are the most stable. Note that one 251-300-bed hospital closed its doors. This can be explained by the fact that the neighborhood became blighted and the hospital could not find enough patients to remain solvent. Perhaps another explanation is that this hospital did not make the transition from medium-sized community to large-sized teaching hospital. It was situated next to a teaching hospital which has prospered during this time, which indicates that the changing neighborhood may not have been the only factor.¹⁰

The larger hospitals (301-650 beds) all grew, and both of the largest hospitals, as has already been indicated, decreased in size.¹¹

Hospital Management and Size

Information about the educational experience of the hospital administrator is shown in Table 7. Two

¹⁰ More detailed analysis of hospital growth patterns should be done before reliable conclusions can be drawn. Another factor which should be considered is the location of these hospitals, although the Chicago data can be explained without reference to location.

sources are used because they classify the information in somewhat different fashions. The upper half of this table uses information obtained from the 1960 Guide Issue of *Hospitals*. The lower half of the table uses information from the State of Illinois in 1966.

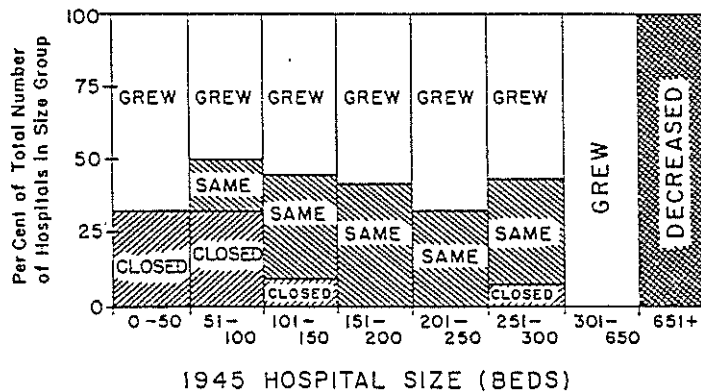
The small hospital is usually administered by an R.N., M.D., or non-college graduate. Small hospitals cannot afford the services of specialists in administration but rely more often on R.N.'s and M.D.'s who are undoubtedly also involved in patient-care activities. This is another indication of the use of generalists in small hospitals. Medium-sized hospitals are most frequently run by graduates with a Master's

¹¹ [EDITOR'S NOTE.—At this point, some discussion took place and Mr. Pierre deVise pointed out that the bed figure for Cook County Hospital in 1945 was an estimate. Cook County Hospital actually started counting its bed capacity only a dozen years ago. He suggested that this is one reason why it might have decreased in size. Professor Herbert Klarman said that other very large municipal hospitals have been declining in size and that he suspected this would be true also for Cook County Hospital.]

GRAPH II

ALL HOSPITALS IN THE CITY OF CHICAGO EXISTING IN 1949 BY SIZE GROUP AND CHANGE IN SIZE FROM 1945 TO 1965

% Growth	467%	43%	61%	40%	30%	25%	34%	-18%	} SURVIVING HOSPITALS ONLY
Avg. Growth 1945-65	126	35	77	69	69	69	168	-384	
Number of Hospitals in Size Group	3	12	11	12	6	7	5	2	TOTAL 57 HOSPITALS



SOURCE.—1945, 1965 Guide Issues of *Hospitals*. This is based on the 57 hospitals in the metropolitan Chicago area in existence in 1945. The ten hospitals starting operation after 1945 are excluded. Those hospitals defined as "grew" had a large enough increase to move them from one 50-bed size classification to another. Those hospitals defined as "same" did not change their size enough to move them out of their original 50-bed size classification. If the hospital became smaller, so that it moved into a smaller 50-bed size classification, it "decreased" in size.

For example, a hospital which went from 125 beds to 175 beds "grew," while a hospital which went from 125 to 135 beds stayed the "same." Although the larger hospitals have been aggregated in Graph III (301-650 beds and 651 beds), the same definition based on 50-bed size groups is in effect.

The two largest hospitals which decreased in size are (1) Cook County Hospital, which went from 3,400 to 2,747 beds, and (2) Presbyterian-St. Luke's. In 1945 these hospitals were separate; St. Luke's had 432 beds and Presbyterian had 522 beds. They merged in 1957 and shrank from a 1945 total of 954 to 839 beds by 1965.

Metropolitan Chicago was chosen in order to compare a group of hospitals whose proximity to one another would tend to put them into competition. Because of the small number of hospitals involved, it would be unwise to infer statistical significance to the figures shown in Graph II.

degree, and the physician-administrator is most frequently found in the largest hospitals. In large hospitals physicians are more likely to be employed as directors of medical education or as full-time chiefs of service. The nature of these positions involves them in managerial decision-making.

It is interesting to note the relationship between the amount of "excess revenue" shown in Table 5 and the per cent of hospitals administered by Master's program graduates. It is my hypothesis that program graduates are more oriented toward fiscal

TABLE 7
EDUCATION OF THE ADMINISTRATOR
BY SIZE OF HOSPITAL
UNITED STATES, 1959 (n=370)*

Education of Administrator	0-99 Beds	100-199 Beds	200-299 Beds	300-399 Beds	400+ Beds
R.N.....	23%	18%	7%	4%	4%
M.D.....	4	3	3	4	27
Other.....	73	79	90	92	69
Total.....	100%	100%	100%	100%	100%
No. hospitals.	147	101	58	28	26

ILLINOIS, 1966 (n=155)†

Education of Administrator	0-49 Beds	50-99 Beds	100-149 Beds	150-249 Beds	250-499 Beds	500+ Beds
Master in hospital administration..	18%	34%	65%	56%	63%	38%
Other academic degree..	36	37	16	38	30	54
R.N. or no degree..	46	29	19	6	7	8
Total..	100%	100%	100%	100%	100%	100%

* SOURCE.—1960 Guide Issue of Hospitals for same sample as in Table 1.
† SOURCE.—Illinois Hospital Association, *op. cit.*

responsibility and solvency. This is part of what was meant by "administrative ascendancy."

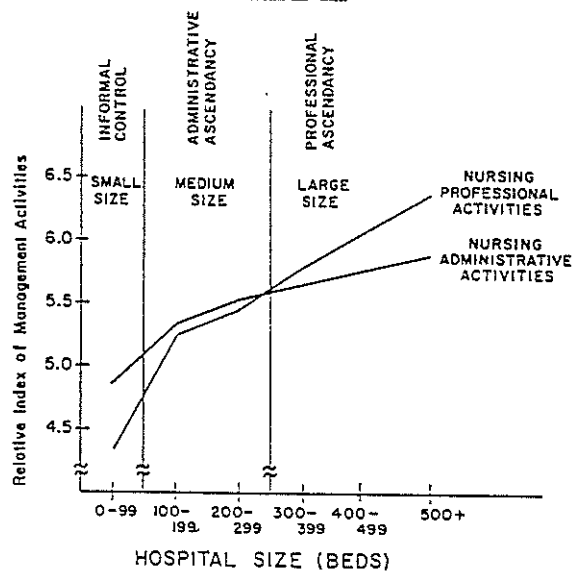
As organizations increase in size, they increasingly rely on formal policies, rules, and regulations to control the organization and to hold it together. The use of formal management activities or controls in hospital by size is shown in Graph III.

Two types of activities indices are shown—professional and administrative. Administrative activities are defined as those relating to cost control and are in the form of written rules, such as "There is a policy manual which says how to order supplies and equipment," "There is a formalized staffing plan,"

and so on. The professional activities include both education or patient-care activities and are carried out by a group, such as "There is a committee to evaluate the quality of care," "There are regular staff meetings for all R.N.'s," and "There is a regular on-going education program for graduate nurses."

Graph III shows that both types of formal activities increase with size. Small hospitals are very low on both types of formal controls. There is a general feeling that formal preprogrammed written rules do not work well under conditions of uncertainty. In both small and medium-sized hospitals there are relatively more administrative controls than professional controls. In the largest hospitals there are relatively more professional activities. This is consistent with

GRAPH III



Data from 245 hospitals participating in both HAS and Management Review programs as of December, 1965. Activity scores are based on indices of nursing activities in the Management Review questionnaires. These two indices are relative to each other in that the mean index numbers are set equal to each other.

Professional activities are defined as (1) committee or group participation in decision-making, (2) related to educational activities, or (3) quality of care. Administrative activities are defined as (1) written rules and regulations and (2) related to cost control and efficiency.

Only questionnaires completed by the administrator himself are used here. There is probably some tendency for small hospitals to exaggerate their responses in order to "look good." Nursing has been used because it is the single largest hospital department.

the concept of decentralization in large organizations. Decentralization is reflected in the increasing importance of decision-making at lower organizational levels and professional responsibility.

Why is there a lag in the development and use of professional activities as size increases? Hospital-administrative-service cost data indicate that pro-

professional activities are costly to maintain in small hospitals. For example, maintaining an elaborate training program for graduate nurses in small hospitals is expensive and relatively few small hospitals have such a training program. Large hospitals can spread the cost of such a program over a bigger patient load.

Summary

The theoretical framework used here can be restated as follows:

1. Small hospitals (0-100 beds) are characterized by uncertainty both in numbers and types of patients demanding service. This uncertainty is also reflected in low survival rates and fiscal insolvency. This uncertainty calls for generalized tasks and a reliance on informal controls. As measured by accreditation, small hospitals provide, on the average, a poor quality of care.

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2. Medium-sized hospitals (100-300 beds) are stable, fiscally solvent, and have skilled administrators. Cost- and efficiency-related managerial activities are relatively more important.

3. Large hospitals (300+ beds) have the greatest degree of specialization and professional orientation. Physicians are more frequently involved in management, and fiscal soundness is sacrificed to the demands of teaching and research. There is decentralization of responsibility, and professionals are brought into the decision-making process through the use of committees.

This is one way of looking at hospitals. There has been some evidence presented to suggest that hospitals can be too small or too large, but the evidence presented here should not be considered conclusive.

Hospital Size and Capital Costs

AUGUST HOENACK

The optimum size of a hospital has always been a good subject for lively discussion. It is doubtful that anyone has spoken the last word on the subject, and it probably will not be heard for some time to come.

Each discipline involved or in some way connected with the hospital judges it from its particular viewpoint. The public also has its particular viewpoint, frequently based upon limited experience and superficial knowledge. A hospital can be evaluated with respect to any of its many individual services or departments or to its economy of operation or as to its photogenic quality. Somehow we have not been able to come up with a composite value representing the quality of the facility as a whole.

This difficulty extends itself to comparing various sized hospitals from the standpoint of initial capital cost. It would be difficult to find a large hospital and a small one each with exactly the same service and departments only at a different scale. If one could be found, there probably would be other variables involved in the cost precluding an accurate comparison.

This is why the subject "Hospital Size and Capital Costs" is not as simple as it would first appear. It is really quite complex and not a matter of simply comparing cost figures.

We have found in the Hill-Burton program that small hospitals generally were designed with fewer square feet per bed than large hospitals providing approximately the same services but on a larger scale. This was partly because of the lower budget afforded by rural communities and the lower tempo of activities permitting proportionally smaller spaces and in some instances the dual use of space. On the other hand, a 300-bed hospital in a suburban area may have to contain many services which the same size hospital in an urban area would not need because large medical centers would most likely provide these services. This would make a difference in the amount of space needed for each of these hospitals with a corresponding difference in construction cost.

Data on construction costs of projects constructed under the Hill-Burton program have been maintained since the beginning of the program. "Representative Construction Costs of Hill-Burton Hospitals and Related Health Facilities" provides cost information to architects so that they may more accurately estimate the costs of proposed projects. This material lists for each project the date of bid opening, number

of beds in the facility, the number of square feet per bed, cost per square foot, and so forth, as well as a brief outline of the main construction characteristics. Chart I shows examples of the kind of information provided. Because the date of bid opening is given for each project listed, an architect can relate the information to the latest cost index, as well as other data that he may have, to arrive at a unit cost suitable for the section of the country in which the proposed project is being built. The brief description also will assist the architect to compare his project with those listed to help in estimating costs.

The data accumulated in "Representative Construction Costs of Hill-Burton Hospitals and Related Health Facilities" were used to develop the information in Tables 1, 2, and 3. The time of construction shown in Table 4 was taken from other data.

It may be of interest to review some of the factors that affect construction costs and how their effect may vary with the size of the facility. Some of these factors can be controlled to some extent by the designers or the sponsor through the selection of materials, system of construction, selection of site, or similar kinds of decisions.

One factor is the cost of materials for the basic structure. The architects and engineers must consider function, cost, and availability in a particular area in selecting structural materials for the building—such as steel or reinforced concrete for framing. Large hospitals have problems in relation to such factors as structural and fire safety. The structural frame and the envelope could have a unit cost considerably more for a high-rise facility in an urban area than for a small rural hospital which could utilize wall-bearing construction.

The cost of labor, union contracts, availability of mechanics, transportation, and living expenses are other factors. Here again the more complex large hospitals tend to require a higher percentage of costly types of labor for their more complex mechanical plants. This labor, often buried in contracts for large equipment, may be a factor which contributes to a higher construction cost for the large hospital.

Another factor is the contractor's overhead, expenses, profit, and the cost of insurance and performance and payment bonds. Large institutions with considerable financial resources can self-insure and assume their own bond, thus providing their

own protection against fire, bankruptcy, or non-payment for labor and materials on the part of the contractor. Occasionally, substantial sums can be saved by the large hospital in this way. Because the contractor's overhead and profit are usually a percentage of the bid included in the bid, lower bids will reduce this item.

The specified time of completion may also affect the cost. If it is necessary to build a hospital within a relatively short period of time, overtime may be required, and sophisticated and expensive construction equipment may be necessary to do the job faster.

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cause he knows better what he is bidding on—he does not have to guess. Also, the contractor may not have as much justification for many change orders, which can be costly and can add to the cost of the job.

The architect should be given sufficient time to prepare complete plans and specifications. Too many people think about the building of the hospital for ten years and then, when they finally obtain financing, want to start building within six months.

CHART I
GENERAL HOSPITAL: NEW BUILDING

STATE AND CITY	PROJ. No.	BID OPENING DATE		No. Beds	GROSS FLOOR AREA		BLDG. & FIXED EQTIP.			PROJECT COST			
		Mo.	Yr.		Total Sq. Ft.	Sq. Ft. per Bed	Total	Per Sq. Ft.	Per Bed	Total	Per Sq. Ft.	Per Bed	
COLORADO Fairplay	G095	08	65	20	12,800	640	\$286,710	\$22.39	\$14,335	\$329,258	\$25.72	\$116.462	
		BASEMENT: None STORIES: One ELEVATORS: None DUMBWAITERS: None FOUND.: Rein. Conc. FRAME: Wall Bearing FIRE ALARM SYSTEM: Yes LAUNDRY: Yes AIR COND.: No EXT. WALLS: Brick and Blk.						ROOF: Flat, B.U., Wood Dk. FLOOR FINISH: Vinyl Tile FLOORS: Slab on Gr. PARTITIONS: Conc. Blk., Wood Stud. WALL FINISHES: Plaster CEILING FINISHES: Plas., Acoustical Tile BOILER PLANT: New, Not Separate Bldg. HEATING SYSTEM: Water TYPE AIR COND.:					
IDAHO Coeur d' Alene	0061	04	65	92	65,071	707	\$1,570,905	\$24.13	\$17,066	\$1,851,172	\$28.45	\$20,121	
		BASEMENT: Part. STORIES: One ELEVATORS: None DUMBWAITERS: None FOUND.: Reinf. Conc. FRAME: Reinforced Conc. FIRE ALARM SYSTEM: Yes LAUNDRY: Yes AIR COND.: Partial EXT. WALLS: Brick and Blk.						ROOF: Pitched, Shingles, Wood Dk., Met. Dk. FLOOR FINISH: Asphalt Tile FLOORS: Slab on Gr., Conc. Slab. PARTITIONS: Conc. Blk., Met. Stud. WALL FINISHES: Plas., Vinyl Fab. CEILING FINISHES: Plas., Ac. Pl., Ac. T. BOILER PLANT: New, Separate Bldg. HEATING SYSTEM: Water, Gas TYPE OF AIR COND.:					

Getting at the job in a large urban area with limited site or other buildings on the site may be expensive to the contractor, whereas, if he has a lot of space around a small hospital in a rural area, his problems in getting the material on site and scheduling his work will be minimal.

The quality of plans and specifications can materially affect the cost of hospital construction. This is an extremely important consideration in getting good bids in any size job. However, it is particularly important in connection with a large hospital, where a great deal of correlation between architectural, structural, and complex mechanical and electrical services is necessary. If the drawings are complete and clear, the contractor can give a better price be-

Often this is not enough time to have a good set of plans completed, particularly for a large hospital.

There should also be good performance specifications for the quality of materials and workmanship and for the built-in equipment. If you have good performance specifications, you can get good competition, resulting in lower cost. The use of only single brand names in specifying usually leads to higher costs, whether the project is large or small. There is considerable evidence that a great deal of mechanical equipment—laundry equipment, kitchen equipment, casework, and all of this—can be bid competitively and a good-quality job can be obtained at less cost.

Another big factor involved in cost is the interest of contractors in bidding. Of course, this is something

over which we have little control. Perhaps, the only possible control is to withhold placing a project on the market until the amount of construction work in the area lessens. This situation very often works against the large hospitals. There are not always many contractors in an area who have the financial backing and technical organization to build a large hospital. This applies not only to the general contractor but also to the mechanical, electrical, and other subcontractors. In many areas of the country, the contractors have so much work that they do not wish to take on more because of financial or bonding limitations. Those who can undertake additional work may bid quite a bit higher than they otherwise would. The reverse, of course, can also be true, resulting in more competition and better bids. However, we have seen very little of this situation in recent years.

Although the Hill-Burton program requires com-

total construction cost, they represent one of a number of such items of additional cost which can accumulate.

One of the problems that architects find in their practice, both in connection with hospital building and with other building types, is the introduction of new materials on the market. Some of these hold tremendous promise from the standpoint of maintenance, improved function, and aesthetics. Frequently, experimentation with these materials goes on in the large facility and can contribute to some higher cost. Often, particularly in modernization projects, utilizing new equipment or materials is the only reasonable solution to a problem in design. This experimentation contributes to the advancement of the building field and hospital design. This can also lead to lower costs in many instances. The utilization of sprayed ceramic and other types of synthetic wall finishes is an example.

TABLE 1
COST DATA FOR NEW GENERAL HOSPITALS IN THE HILL-BURTON PROGRAM—BY CALENDAR YEAR

CALENDAR YEAR	CONSTRUCTION AND FIXED-EQUIPMENT COSTS				PROJECT COSTS*	
	Average No. Beds	Average Sq. Ft. per Bed	Average Cost per Sq. Ft.	Average Cost per Bed	Average Cost per Sq. Ft.	Average Cost per Bed
1948.....	43.21	598.53	\$16.93	\$10.116	\$20.02	\$11.987
1952.....	64.84	664.09	21.49	14.273	25.49	16.933
1957.....	42.71	650.12	23.39	15.209	27.30	17.750
1961.....	75.76	763.00	23.97	18.290	28.29	21.579
1965.....	96.00	884.00	29.06	25.684	33.32	29.886
Per cent increase between 1948 and 1965	122%	49%	72%	154%	69%	149%

* This includes movable equipment, some fixed equipment not in the contract, and fees but not the site.

petitive bidding for all its construction, selective bidding is permitted. The owner may select at least three contractors to bid on each contract. We believe that this is desirable from the standpoint of obtaining quality construction, especially on larger projects. The owner should select only those contractors who he knows have good reputations for quality construction and who have had experience with hospital construction.

Another factor involved in construction cost is the quality of materials and finishes. Usually in large hospitals finish materials of better quality are used. Some small hospitals find it necessary to economize by using inexpensive materials which may require expensive maintenance. However, for large-hospital projects with experienced administrators, consultants, architects, and engineers, the long-term value of better materials is recognized. Although the materials and finishes are a relatively small part of the

Various labor-saving devices, environmental controls, and comfort features are in the development stage. Ventilation and air conditioning, which no hospital today would be without, are much more complex than an air-conditioning plant in the department store or in an apartment house. These systems can either be a tremendous boon to a hospital or a tremendous problem, particularly in terms of infection control, if they are not designed properly. Many studies are presently going on with respect to proper filtration and methods for introducing air into critical hospital areas.

Various material-distribution systems, communication systems, and information systems need much study. These systems are rapidly becoming essential elements of hospitals. However, much must be learned about these devices in order to fit them into the hospital system to obtain maximum utilization and to understand problems with respect to their

maintenance. As labor costs increase, the high cost of these labor-saving devices appears to be less formidable. In fact, some of them now look quite reasonable, and someday they will become necessities, just as air conditioning is at the present time. It appears that we are the victims of our own technology. There is no turning back, and our only recourse is to make these many systems work, because on them may depend how efficiently and economically our large hospitals work in the future.

There is no doubt that one of the most important factors in getting the best facility for the construction funds expended is the quality of the programing done by the sponsors before the design is begun. This applies to any size hospital but is much more important as the facility increases in size and complex-

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ity. Only after adequate definition of needs is established in a program by the sponsor can the architect and engineer contribute their interpretation of the program in terms of space, environment, and equipment.

Table 1 shows the variation between square footage per bed, the average cost per square foot, and how this affects the cost per bed. It is interesting to note that between 1948 and 1965, the number of square feet per bed increased about 49 per cent. This reflects the expanded program requirements which took place during that time.

In that same period, the cost per square foot increased 72 per cent. This figure has little to do with

TABLE 2
DATA ON NEW GENERAL HOSPITALS IN THE HILL-BURTON PROGRAM,
BY YEAR AND SIZE

SIZE OF PROJECTS	NO. PROJECTS IN SURVEY	AV. SQ. FT. PER BED	AVERAGE CONST. & FIXED EQUIPMENT COSTS		AVERAGE PROJECT COSTS	
			Per Sq. Ft.	Per Bed	Per Sq. Ft.	Per Bed
1962						
Up to 25 beds.	6	703	\$25.27	\$17,748	\$30.29	\$21,280
26-50 beds...	25	665	23.97	15,824	28.63	18,902
51-100 beds..	13	757	24.23	18,341	28.91	21,884
101-200 beds..	7	744	28.54	20,940	32.92	24,153
Over 200 beds.	5	823	23.72	19,631	27.96	23,142
1963						
Up to 25 beds.	15	712	\$23.20	\$16,526	\$23.18	\$20,074
26-50 beds...	21	744	24.75	18,422	29.52	21,975
51-100 beds..	17	808	26.41	21,365	31.15	25,200
101-200 beds..	7	778	26.14	20,349	31.06	24,180
201-300 beds..	4	806	28.67	23,116	33.80	27,246
Over 300 beds.	3	802	29.86	23,956	35.13	28,180
1964						
Up to 25 beds.	5	724	\$25.09	\$18,169	\$26.04	\$22,213
26-50 beds...	19	707	27.00	19,086	30.82	21,783
51-100 beds..	16	708	27.93	19,780	33.31	23,592
101-200 beds..	10	723	27.33	19,716	33.33	24,047
201-300 beds..	6	926	27.93	25,869	33.21	30,761
Over 300 beds.	3	925	25.95	23,988	30.72	28,404
1965						
Up to 25 beds.	6	670	\$25.89	\$17,336	\$31.59	\$21,156
26-50 beds...	15	836	24.87	20,788	29.06	24,285
51-100 beds..	14	810	28.01	22,683	33.32	26,980
101-200 beds..	7	903	30.38	27,450	34.89	31,520
201-300 beds..	6	947	29.07	26,577	32.50	30,766
Over 300 beds.	1	1,041	35.38	36,000	40.63	42,329

TABLE 3
PER CENT BREAKDOWN OF CONSTRUCTION CONTRACTS OF NEW GENERAL HOSPITALS

Per Cent Total Constr. Contracts	Per Cent Gen. Constr. Cost	Per Cent Mech. Cost	Per Cent Elect. Cost	Per Cent Elev. Cost	Per Cent Group I Equip. Cost	Per Cent Total Mechelec. Cost
Bid in 1960						
50-100 Beds (5 Projects)						
100.....	58	24	10	3	5	37
100-200 Beds (4 Projects)						
100.....	57	25	10	4	4	39
200 Beds and Up (3 Projects)						
100.....	54	26	9	5	6	40
Bid in 1963						
50-100 Beds (6 Projects)						
100.....	51	30	12	3	4	45
100-200 Beds (5 Projects)						
100.....	50	30	11	4	5	45
200 Beds and Up (4 Projects)						
100.....	49	27	12	5	7	44
Bid in 1966						
25-50 Beds (4 Projects)						
100.....	48	34	11	3	4	48
50-100 Beds (5 Projects)						
100.....	48	33	12	3	4	48
100-200 Beds (6 Projects)						
100.....	49	32	12	3	4	47

programs or with the size of the hospital. It simply reflects the increase in the cost of putting brick, mortar, and materials together with a certain amount of labor. The square-foot cost is the basis for the various cost indices for other types of buildings. This is the only way in which we can compare the cost of hospitals with the cost of other types of facilities.

The cost per bed increased 154 per cent between 1948 and 1965. This is a result of the increase in both the square-foot cost and the increase in square feet per bed. This could be considered a valid cost unit for a hospital except that the number of square feet per bed varies between hospitals because of variations in the kinds and extent of hospital services.

Area requirements have been increasing somewhat more rapidly for large hospitals than for small hospitals, as shown in Table 2. This is apparently because new services, as they are needed in the community, are provided by the larger hospital, which already has more complete backup services. To cite an example, in the first few years of the Hill-Burton

TABLE 4
SPECIFIED TIME OF COMPLETION OF NEW GENERAL HOSPITALS—HILL-BURTON PROGRAM

No. Projects in Survey	No. Beds	Specified Time of Completion (Construction Contracts) in Calendar Days	Time Required for Project Completion in Calendar Days
12	20-25	373	446
19	26-50	380	450
17	51-100	455	565
16	101-200	557	720
4	201-300	746	750

program few hospitals included space for physical therapy, although Public Health Service guide material recommended the inclusion of this service. Today, few hospitals are without it.

Although the samples are small, nevertheless there is a certain consistency in the data that indicates a trend which will probably continue.

Table 3 is a percentage breakdown of the various kinds of construction contracts by size and categories of hospitals. It shows the percentage of the cost for general construction, mechanical plants, electrical systems, elevators, and Group I equipment. Although the samples are small because there were relatively few projects where separate prime contracts were let for the mechanical and electrical work, these data do indicate a trend of increasing mechanical and electrical costs. There is also some indication that the increase is greater for larger facilities. The use of mechanical distribution and more complex communi-

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cation systems in large hospitals will accelerate this rise in cost.

Table 4 shows the time specified for completion and the actual time required for completing the construction for various sizes of hospitals. For small hospitals the time required to complete the construction was approximately 450 days. On the other hand, a 200-300-bed hospital can be built in 750 days. This certainly indicates that large-hospital-construction projects benefit from better organization as well as better construction equipment.

Table 5 gives estimates of space needs and costs in

TABLE 5
SPACE PER BED, COST PER SQUARE FOOT, AND PERCENTAGE DISTRIBUTION OF COST, BY COST CATEGORY
188-BED GENERAL HOSPITAL

Department	Sq. Ft. per Bed	Per Cent of Total Area	Construction Cost (Sq. Ft.)
Total hospital	765.08	100.00	\$29.61
Administration	48.44	6.33	24.36
Adjunct facilities	47.76	6.24	34.04
Laboratory	19.94	2.61	33.69
Pharmacy	3.10	0.40	46.62
Nursing departments	297.10	38.83	34.68
Inpatient units	245.94	32.15	29.84
Operating facility	23.96	3.78	64.38
Operating suite	20.17	2.63	57.78
Operating rooms	8.78	1.15	79.32
Emergency	5.11	0.67	37.56
Service departments	125.27	16.37	39.53
Dietary	56.37	7.37	46.79
Main kitchen	16.54	2.16	68.00
Housekeeping	3.18	0.42	52.00
Outpatient Department	23.00	3.01	26.69
All other space			
General circulation	34.34	11.03	19.06
Mechanical	71.43	9.34	20.57
Exterior walls	63.84	8.34	13.23

From "Estimating Space Needs and Costs in General Hospital Construction," by James J. Souder, of the American Hospital Association, Chicago, Illinois, 1963.

connection with general hospital construction. The data were taken from "Estimating Space Needs and Costs in General Hospital Construction." This publication is a valuable guide for designers in preparing cost estimates for modernization of old hospitals because it provides cost data for various departments of a hospital. This is extremely important in connection with modernization, because not all departments are involved in such a project. If a new wing containing predominantly diagnostic or surgical services is to be built, the average cost per square foot does not reflect the actual cost of the wing because the square-foot cost of the space for these departments is higher than the average. This study, published by the

American Hospital Association, shows factors which may be applied to current average square-foot costs to approximate the square-foot costs of the various departments.

The utilization of this kind of cost data for estimating the cost of construction for additions to hospitals and modernization projects is essential. It is also important to apply to large facilities where a larger proportion of the square-foot area is utilized for diagnostic and treatment services than is utilized in a small hospital. Additional services of this kind can make a radical difference in the average square-foot cost figures.

From the foregoing Hill-Burton data it is evident that large hospitals in the past have generally involved higher capital costs than small hospitals. There are trends, although not at this time backed by statistics, which indicate that large facilities will continue to involve higher costs. The demand for versatility in structure and in mechanical and electrical

plants as well as the ability to revise space arrangement will add to capital cost. The concept of concentrating related services and programs in large-hospital facilities in the community so that they can in turn serve the small facilities may gradually affect the construction costs accordingly. Extended care, rehabilitation, mental health programs, and central laboratory facilities are examples of this trend. The efforts of the many areawide planning groups will ultimately be felt in the communities, so that essential health services will be provided where needed. It is possible that all hospitals will not necessarily provide all services, but only those with which they can best serve the community. In this situation the significant concern would be not so much whether large facilities cost more or less than small facilities but that the community obtains its total health-facility needs at the lowest capital cost consistent with good design.

Hospital Size and Quality

LEONARD ROSENFELD, M.D.

I was pleased to be invited to discuss this subject. It is central to important issues in planning health facilities and services. In speculating on an approach to the subject, the cadence of the title, "Size and Quality," brought to mind the song "Love and Marriage." I could not carry the analogy very far, however, because, as you may recall, the song goes on, "Love and marriage go together like a horse and carriage . . . you can't have one without the other." In the case of size and quality, neither the variables nor their relationship is that simple.

There was a good bit of discussion yesterday about the relationship of the size of the institution and of various characteristics of operation, and, as one would expect, there were few sharp lines and beacons to follow. Only in recent years have we begun to focus on some of these questions in any systematic way. Out of accumulating experience, observations are emerging that may be useful to the administrator and to the planner. There are also emerging a great number of new questions that we had not really thought about before.

I would like to spend a couple of minutes talking about what we mean by size and what is implied by quality. These terms mean different things to different people.

Traditionally, when one mentions size in connection with hospital care, or institutional care of any sort, we immediately think of beds. More and more, however, as the system of health services extends to encompass broader areas of service and as they become focused around institutional settings, we have to think of size in other dimensions as well. Ambulatory care—a service provided by many institutions—has not received the attention of planning and regulating agencies that has been accorded to inpatient services.

Ambulatory care is now becoming an essential part of the system of health services, and the size of the ambulatory facility must also be taken into consideration. It too has an effect on some of the questions at issue.

An ambulatory facility can contribute very substantially to the utilization of certain of the services that are essential to inpatient services. A hospital with a well-organized and large ambulatory facility can afford to support and justify a much broader

spectrum of diagnostic services than a hospital of equal size with primarily inpatient service.

The question of size is important in designing diagnostic facilities per se. Some of you may be familiar with the work going on in California under the aegis of the Kaiser Foundation toward development of a multiple-screening technique. The men employed in this project are working and thinking very hard on the relationship of size and quality and economy and now feel that they can pinpoint these relationships very specifically in terms of their range of services. It seems important to take a broader view of hospital function in considering the relationship of size and quality.

We are all familiar with some of the factors that influence size. I would like to refer to some of these very briefly and then go on.

Population base and scatter, of course, are basic. In a highly rural area, such as the Great Plains areas in the United States and in Canada, which are very sparsely populated, we see very small facilities. These are essential because of distances involved, even though they may not be entirely justified in terms of economy and quality of service alone. Therefore, the functions of those institutions are different and must be considered in that light.

The teaching responsibility of an institution has an important relationship to size. As medicine has gone on to greater and greater specialization, as training and research have become more specialized, there is a continuing need for a concentration of the various resources and facilities essential in training in highly specialized disciplines. This is often possible only in a large institution.

Finally, our policies of financing of service have an influence on size and on the quality of care. There are certain ranges of costs per unit of service of various sorts which the public finds acceptable. Costs and charges outside this range come under very careful public scrutiny. There is thus a strong incentive for institutions to operate within certain norms. This is forcing the issue of size in many cases, particularly in the cities, insofar as it makes possible economies and maintenance of standards. The facilities available to an institution are, to a large extent, a function of size, a function of the financial base, and a function of the cost of providing the particular service.

Each year, in the Guide Issue of the American Hospital Association there is published a distribution of facilities according to various hospital characteristics. Examination of data in the current issue indicates that, while there are certain services that are available in virtually all institutions, such as clinical laboratory facilities, there are other services that are not as generally distributed. For example, intensive care (which, for a patient who is desperately ill, can be very important) is found in 13 per cent of the hospitals from 50 to 99 beds in size, in 72 per cent in the group from 300 to 399 beds, and in 90 per cent in the group of over 500 beds. Intensive care is a relatively recent development in hospital care, and I am sure that, as we go along, this service will become more widely available.¹

Home care, which is predominantly featured in the recent legislation, is very scattered in its availability and distribution around the country. According to the Guide Issue, 1 per cent of the smaller hospitals have home-care programs; 15 per cent of the 300-bed class, and 32 per cent of the hospitals of 500 beds and over. There are many questions at issue in the development of home care. One of the important questions is how to make these services that are now available as a matter of national policy actually available in communities throughout the country.

The accompanying tabulation shows the relation-

	50-99 Beds	300-399 Beds	500 Beds and Over
Blood bank.....	61%	90%	95%
Pathology.....	47	100	100
Pharmacy.....	49	100	100
Premature nursery.....	56	38	93
Social service.....	4	60	85
X-ray therapy.....	17	95	100

ships between size of hospital and availability of other selected facilities and services. The range of facilities and services that may be needed by patients at any time in the course of illness and management is of critical importance to the physician and the patient. The provision of these facilities is a matter of concern to the administrator, the planner, and the public. However, I think that it is also important to recognize that the availability of facilities alone is not sufficient. The availability of facilities can be a double-edged sword. There is another important consideration—the way in which that facility is used and the way in which the service is rendered.

A while back there was a report by the American Hospital Association of a survey conducted in 1961

¹ American Hospital Association, Guide Issue, *Hospitals*, XL (August, 1966).

of open-heart surgical facilities in hospitals. At that time 327 hospitals with facilities for open-heart surgery were identified. Of these, some 37 had never been used. The case fatality rates among the several hospitals were inversely proportional to the utilization of the service, to the efficiency with which the open-heart facility and the surgical team were used. This is an important consideration in planning and to the administration and the board of any institution.

There are a great many pressures on institutions to move into more and more specialized facilities and services. This is often true regardless of what is already available and without sufficient consideration given to the prospect of volume of demand for the service, which would make it possible to maintain adequate standards. Because of the rapid expansion in residency training, young men who are very well trained in some of the surgical subspecialties find themselves in the position of having the training and equipment without the demand for their services. This presents a question of considerable importance in the whole system of manpower planning and development.

It seems clear that we cannot look at facilities alone in estimating the relationship between quality and size. What was said about open-heart surgery applied, in varying degrees, to the whole range of other highly specialized services.

Up to this point, we have considered the relationship of size to quality. I would now like to focus for a moment on what we mean by quality of care. This likewise is an evolving concept. The more that we pursue it, the more new modalities of care that develop, the more the concept will expand. However, of research that has been undertaken, most of the effort has been directed at exploring and studying three dimensions of quality of care.

One of these has to do with the facilities, those elements necessary in order to provide service. The American College of Surgeons and the Joint Commission have looked at this very carefully, and there are even earlier examples of this. The earliest formal effort of that sort was started by Florence Nightingale in the course of the Crimean War.

A second method of studying quality is examination of the process. In other words, is what is being done consistent with currently accepted standards of good medical practice?

Finally, there have been several interesting studies of end result. If we could pick any one method as theoretically the ideal, this would be the one we would choose. However, it is a very complex problem

to study and lends itself to use only in selected situations.

Out of the various experiences, out of the literature, and out of the discussions that have gone forward, quality of care emerges more as a profile than as a single index. It is a profile made up of several elements. One of these is obviously the availability of essential service in accordance with patient needs. A second essential is the quality of professional judgment that is brought to the case in the use of facilities and the mixtures of the various modalities that are brought to the patient's problem.

A third essential, which is more speculative, has not been as clearly defined. It has, however, been featured in speeches and papers throughout the country and the world. This is the continuity of care. Do the various services rendered over a period of time fall into a pattern that is relevant to the patient's needs? Many people attach a good deal of importance to the question of continuity of medical responsibility and continuity of relationship between an individual physician and an individual patient. What part does this have in the spectrum of quality of care, and what implications does it have with regard to the planning of facilities and their size?

Finally, an element which also has been looked at, but to a lesser degree, is the patient's understanding, acceptance, and intelligent participation in the process of medical care.

All these elements are affected by the size of the facility and the size of the environment in which the medical process is carried out. The important question is how to reconcile the needs for availability, quality, and economy of service in order to do the best with available and potential resources. I think that it is this rather than any absolute standard of quality of care that we must reach for.

Looking at it another way, the factors that influence quality of care seem self-evident. They are in the first place, the qualitative and quantitative adequacy of staff—the training, experience, attitude, and the attributes of personal responsibility of not only the medical staff but all the paramedical personnel.

The second factor is facilities—their adequacy and use. To what extent are privacy, identity, and dignity of patients insured? If the patient is to participate responsibly and intelligently in the process, maintaining a sense of personal identity must be considered.

The third factor is organization. This point need not be labored in a forum of hospital administrators. The continuing function of delineation of responsibility; recruitment and assignment of suitable and ap-

propriate personnel; the process of policy formulation, co-ordination, and communication; and the continuing accountability that is built into the process of hospital organization—all of this becomes an essential part of the maintenance of quality in an institution no matter what the size.

However, the question that we must consider is what or how does size relate to these various factors? Obviously, in an institution that is so small that the administrator must double and triple in various capacities, as well as everybody down the line, it is not possible to bring about the amount of administrative specialization that is necessary to deal with many of the complex problems and issues in hospital organizations. There is a relationship between organization and quality, and there is likewise a relationship between organizational resources and size of facilities.

Organization may be looked at from another point of view. It is obviously impossible now, and probably always will be impossible, for all institutions to provide all services that might be needed in the course of care of the community. The question has been at issue in this country for at least thirty-five years of developing regional systems of relationships among institutions so that effective use can be made of the various specialized services and to assure that they are made available by other institutions if they cannot be provided in the home institutions. Deficiencies in facilities and services at one institution often can be made up by effective working relationships among several institutions.

Other elements that are pertinent to the issue are financing and, finally, public understanding and expectation. This probably has more of a bearing on the quality of our medical services than we are often likely to think. The years since the war have brought a good deal of migration and provided some interesting natural experiments which would be worth observing. We have seen examples of men who have come from countries where medical training is quite indifferent and who have an opportunity to work in a good, well-organized medical environment. Their standard of care tends to come up. The converse has also been observed of people who have come out of centers of excellent medical training and gone to a setting of low expectation in another culture, another community, where it is difficult to maintain standards. The constant pressure of public expectation is evident.

Studies have been done that shed light on many of these issues. However, in the aggregate, the evidence

so far is fragmentary. Judging from reports of the results of the inspections and observations of the Joint Commission, there is a well-established relationship between hospital size and the likelihood of its being accredited. Among the 25-49-bed hospitals, 34 per cent are accredited; in the 50-59-bed group, 78 per cent are accredited; in the 100-199-bed group, 95 per cent are accredited; and in the group having over 200 beds, 99 per cent are accredited.

The system of accreditation examines several of the elements that were mentioned as affecting the quality of care. For example, it examines staffing, facilities, organization, and policies, and it also takes a careful look at the system of accountability set up within the institution. Therefore, this is one measure that has been carried forward on a regular, institutionalized basis for a number of years.

There is evidence all around us that there is a relationship between size of facility, volume of service, and the degree of specialization that can be provided within the institution. There have been a number of studies that have focused on the question of relationship between specialization and quality of care. Only brief reference will be made to several of these.

For example, there are the studies that were done in New York relating the perinatal mortality experience to the source of care and the degree of specialization of the physician.² They found a clear relationship.

There have been several case fatality studies done in England and in Canada. A series of studies carried out by Lee and Morris, based on data coming out of the British National Health Service, indicates a clear relationship between the place in which a person has his problems cared for and the likelihood of his surviving the encounter. This series compares the experience of teaching hospitals, which are large hospitals and specialized institutions, and all other hospitals in England and Wales. In a series of diagnostic and surgical categories, they found a lower case fatality rate among the teaching hospitals, which is no more than a documentation of a reasonably sound hypothesis.³ The question is not only size but the multiplicity of factors going into these observations. We can speculate fairly easily with regard to some of these factors.

² Sam Shapiro, L. Weiner, and P. M. Densen, "Comparison of Prematurity and Perinatal Mortality in a General Population and in the Population of a Pre-paid Group Practice, Medical Care Plan," *A.J.P.H.*, XLVIII (February, 1968), 170-87.

³ L. Lipworth, J. A. H. Lee, and J. N. Morris, "Case Fatality in Teaching and Non-teaching Hospitals, 1956-1959," *Medical Care* (April-June, 1963), 71-76.

A similar study was carried out by Roemer in Saskatchewan. He made two interesting observations. First of all, he observed the differences in case fatality rates in selected surgical procedures carried out in different settings. The fatality rate was lower in the larger institutions. In Saskatchewan, in referring to a large institution, one talks of a hospital of 100 beds or more. He also looked into the extent to which certain procedures and services are centralized in the larger institution as compared to the smaller institution. He found a clear relationship between the order of difficulty and risk in surgical procedures and the size of the hospital in which the procedure was performed. Through the joint effort of the physician and the patient, a higher proportion of the more difficult procedures ended up in the larger centers in the cities than did others. On the other hand, appendectomies, for example, occurred relatively more frequently in the smaller institutions.⁴ Studies using methods of clinical assessment of standards of care in Boston and in New York provide further evidence of the relationship between institutional size—and factors associated with size, such as degree of staff specialization and range of facilities—and quality of care according to current standards.⁵

A question has been raised concerning the implications of the drive toward medical specialization on hospital staffs on the quality of care in the community as a whole. What is the effect on quality of care of the sequestering, to an ever increasing degree, of the non-specialized physician from hospital-staff association? This is a question which has not been squarely faced or rationalized in any urban community. It is a question which the individual institution cannot resolve on its own. Its approach requires formulation of community policy and review of corresponding trends and policies by the various professional organizations and the various voluntary and governmental licensing and accrediting authorities.

Other studies have examined the relationship of quality care as related to the size of facilities. A series of studies has been undertaken by the New York City Health Department of the quality of laboratory services given in laboratories throughout the city, in both hospital and independent laboratories, to attempt to assess the validity of finding an adequacy of procedures. Schaeffer recently reported his findings at a meeting of the APHA Program Area

⁴ Milton I. Roemer, "Is Surgery Safer in Larger Hospitals?" *Hospital Management* (January, 1959).

⁵ L. S. Rosenfeld, "Quality of Medical Care in Hospitals," *A.J.P.H.*, XLVII (July, 1953), 556-65, and M. A. Morehead, *A Study of the Quality of Hospital Care Secured by a Sample of Teamster Family Members in New York City* (New York: Columbia University School of Public Health, 1964).

Committee on Medical Care Administration. These demonstrate a relationship between the volume of laboratory procedures, such as biochemistry and bacteriology, and the reliability of these results. Other findings indicate that with a larger volume it is possible to justify the employment of full-time specialized personnel.⁶ Again we see the relationship between adequate staffing, size, and quality.

It would appear that one of the modal points in the relationship of age and quality is at the point at which volume of service in a specialized service is large enough to merit appointment of a full-time person. Experience indicates that, other things being equal, full-time responsibility represents a higher level of responsibility to an institution or to a service than does the equivalent time of two or more part-time persons. There is an understandably greater identification of the full-time person with the institution or service than is usual among part-time personnel.

Relatively little study has yet been given to another parameter of quality of care, the question of continuity of care. This is an intriguing area. From the results of the studies thus far it would appear that we have a long way to go in achieving what might be considered an approach to the ideal. We have a long way to go in defining this area of quality.

Other studies have been done relating to the patient's understanding and attitude toward the process of medical care. One study was done by Koos in New York State. In his book, *The Health of Regionville*, findings on interviews with families concerning their sources of medical care and the reasons for various forms of medical behavior are reported.⁷ This was an intensive study. It is obvious that the intelligence of patient behavior and the responsibility with which the patient pursues his part of the medical regimen are important in the final outcome of the joint effort.

George Reader and his group at Cornell did another study in which effort was made to assess the level of patient understanding after a visit with a physician. In general, the results are disappointing in terms of the patient's understanding after an encounter with a physician, with a clinic, and with a hospital.⁸

These are important considerations and almost basic to some of the things that we are trying to do.

⁶ M. Schaeffer, *An Appraisal of the Clinical Laboratories in New York City* (New York: Bureau of Laboratories, Department of Health, November, 1966).

⁷ Earl L. Koos, *The Health of Regionville* (New York: Columbia University Press, 1954).

⁸ L. Pratt, A. Seligman, and G. Reader, "Physicians' Views on the Level of Medical Information among Patients," *A.J.P.H.*, XLVII (1957), 277.

If we think of the aims of medical care as not merely the provision of services but in terms of maintaining the effectiveness and competence of individuals, then these are some of the questions that must be looked at and ultimately brought into our concept of quality of care.

There is need for continuing research. The country now spends some \$36 billion on medical services. Approximately 3 per cent goes into medical research generally, and of that a very small part goes into studies of the organization and delivery of patient care. The question is, of course, how much is enough? Manpower constitutes one of the problems in expanding research in this field.

Obviously, the administrator and the planner, on the basis of evidence and of assumptions and hypotheses where evidence is lacking, must take a position because the day-to-day decisions must go on and time presses upon all of us. The positions that have been taken are evident in the actions of various hospitals and various planning bodies throughout the country. Progress will be measured by the extent to which sound theory can be substituted for assumptions and unexamined experience. The size of an institution is the result of consideration of a number of countervailing factors that go into making the final decision. Quality and economy of service are factors of critical importance to the institution and to the community. In recent years, hospital-planning councils have adopted minimum standards regarding size of general hospitals. In New York the Hospital Review and Planning Council of Southern New York, Inc., has adopted a minimum capacity of 400 beds as a guiding principle. Furthermore, it recommends that such facilities constitute the nucleus of a "Medical Service Center," equipped to provide the full range of related services.⁹ This, it is felt, would assure the greatest return for investment in terms of quality and efficiency. It is unlikely that many new 400-bed hospitals will be built. Movement toward this standard will probably result from the amalgamation of small, older institutions.

Experience among hospital-based group-practice prepayment programs providing comprehensive medical coverage for identified groups indicates that a much lower level of utilization of hospital services is required than in the community at large. This pattern of organization of service makes possible the

⁹ Hospital Review and Planning Council of Southern New York, Inc., *Guidelines and Criteria for Planning Hospital and Related Health Services in New York City* (New York, June, 1966).

maintenance and efficient utilization of a full range of diagnostic services at a center with fewer beds than in the traditional community hospital. It would seem possible to justify smaller inpatient facilities in urban areas in the framework of comprehensive pre-paid services.

In different settings, of course, different conclusions may be reached on the basis of what is best. How can one use the available resources most effectively? In a low-density population area an institution must be as large as possible and still be available within some reasonable time span to the people whom it is serving. Although a hospital of twenty-five beds is frowned upon, there are places where, to maintain a hospital of twenty-five beds, one must encompass an area of several thousand square miles. One cannot expect these people to travel inordinate distances to receive medical attention. Therefore, distance is a factor.

There is increasing recognition of the differences between inpatient and outpatient facilities with regard to criteria of availability. Whereas in the past ambulatory clinic facilities were almost always planned on the same site as the hospital, the concept of decentralization of these facilities and services is now gaining wider acceptance. In the last fifteen to twenty years, group-practice prepayment programs have developed small neighborhood clinics for providing personal health care, articulated with larger, more specialized clinics located at a general hospital. This pattern of facilities and services has been developed by the Kaiser Permanente programs in

California and Oregon, by the Group Health Cooperative in Seattle, by the Group Health Association in Washington, D.C., and by the Metropolitan Hospital of Detroit.

This principle of planning clinic services is being adopted in urban communities, in part, in response to the stimulus of O.E.O. and funds under Title II of the Social Security Amendments.

The principle appears sound in that it recognizes the greater importance of accessibility of ambulatory as compared with inpatient facilities. While the population at large uses ambulatory medical services on an average of four to five times per person per year, the incidence of in-hospital care is about one person in ten per year. By articulating neighborhood clinics to larger central facilities, the value of size in maintaining standards and economy is assured, while, at the same time, maximizing accessibility.

In highly developed urban communities, with high population densities, the question "How big is too big?" has been raised. Much less consideration has been given to the question of maximum size than to minimum. The danger of loss of identity of both physician and patient and the concomitant dilution of responsibility in very large institutions must be considered. We must work toward a balance among the basic attributes of service—availability, efficiency, and quality. The balance struck in each community reflects the wisdom, knowledge, values, and judgment behind the day-to-day decisions about organization of facilities and services.

The Size of the Hospital of the Future: A Panel Discussion

GEORGE BUGBEE, Moderator

MR. BUGBEE: There is a distinguished group of panelists who have been kind enough to accept the assignment of discussing this subject. Several of you mentioned that you would like to have more specificity on hospital size. We will try to accomplish this in this panel discussion.

Now, realistically, I think you know that what we have been doing in this day and a half is viewing the variables that have some bearing on size, not to produce a specific answer for any given setting but, rather, looking at these variables in such a fashion that they may have meaning in your own particular settings.

Let me introduce the panel. First we have Bob Holloway, who is a relatively new addition to the campus. He is a member of the faculty in sociology and on the staff of the Center for Industrial Relations. He received both his Bachelor's and Master's degrees at Oregon and his Doctor's degree in sociology and anthropology at Michigan State University. He is involved in an interesting study of hospital organization.

Sitting next to Bob is Walter McNeerney. I am sure that you all know Walt and his outstanding accomplishments in many capacities in graduate education for hospital administration. He is at this time President of the Blue Cross Association.

Next to Dr. Rosenfeld, the previous speaker, is Dr. Richard Manegold, Director, Department of Hospital and Medical Facilities, American Medical Association. He works with Dr. Charles Edwards in the department, which is concerned with the social and economic aspects of medicine. Dick's responsibilities are particularly in hospital and medical facilities. He is an internist, receiving his Bachelor's degree from Harvard Medical School and his medical degree from Temple University. We appreciate his willingness to participate on the panel. We have been working Dick fairly hard this week. We have just completed a four-day session for the staffs of area-wide hospital planning agencies. The AMA was one of the sponsoring organizations, together with the American Hospital Association and the Public Health

Service, and he attended all sessions and presided at one.

Next to him is James W. Stephan, Director, Graduate Program in Hospital Administration, University of Minnesota. He is an alumnus of the Graduate Program in Hospital Administration of The University of Chicago, though, of course, he has other claims to fame. He has been very much involved in hospital administration and then with graduate education in hospital administration at Minnesota. He has unique and desirable experience as a consultant, visiting many hospitals, and he is a most appropriate member of this panel.

Next we have Richard Stull, Executive Vice President, American College of Hospital Administrators. Dick went through the program at Duke University a few years back. Chuck mentioned that we were quite proud of the fact that Chicago is the oldest degree program. However, we have to qualify this by saying that it is the oldest graduate program in hospital administration. I was informed a while ago that the program at Duke was actually established a little earlier, so Duke has the honors.

As I indicated, Dick took the Duke course a few years ago and then became involved in hospital administration and consulting. He organized a new program in hospital administration at the University of California in Berkeley and then became Vice President for Administration and supervised the building of several medical schools and other university health facilities. He has now been doing remarkable things in his present assignment.

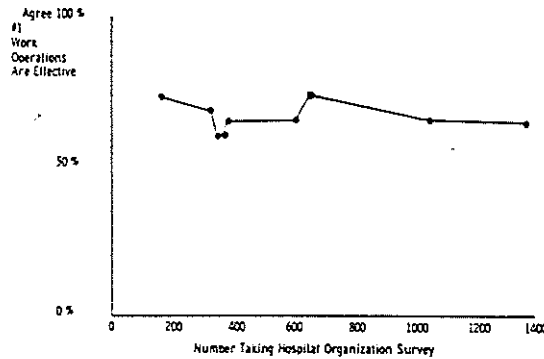
MR. ROBERT HOLLOWAY: I am always dubious about being introduced as a sociologist. I am sure that many of you have heard the definition of a sociologist—a person who gives you a dim view of the obvious. However, this platform has been shared with economist and organizational theorists whom, I think, I might group under a similar definition, namely, men who argue that a water glass is either half-full (our economist) or half-empty (our organizational theorist), when, in fact, the water level may be

measured half-way up the glass. We have had some of that type of speculation today in wrestling with a few of the problems of the optimum size of hospitals.

My thought here today is to give you just one or two reflections on the nature of this conference as an outsider and then to relate this to some data that we have which you may be interested in.

It seems to me that what we have experienced today are attempts to arrive at some guidelines on the basis of some general thoughts regarding what is

CHART I
RELATIONSHIP BETWEEN SIZE OF HOSPITAL ORGANIZATION SURVEY STAFF AND WORK ORGANIZATION



related to the optimum hospital size. One might be concerned with such a title for the panel as "Sizing the Hospital of the Future." Many men have fallen along the wayside trying to speculate about facts and then to project on the basis of the speculation. The path of people trying to project into the future has been extremely rocky for some. Daniel Webster, in an inspiring speech on the floor of Congress, did not think the land west of the Mississippi was worth twenty-five cents. The eminent scientist Vannevar Bush, in 1940, held the view that the intercontinental ballistic missile was technically impossible in the near future, only five years before Von Braun launched a rocket from Germany to England. It is a risky practice because we very often do not have the facts at hand. Unfortunately, the dilemma of a manager or administrator facing a relatively complex and real problem is that he often cannot afford to wait until all the facts are in—he must make his judgments without having facts based on the data available. Even though all the facts may not be in, it seems likely that fewer errors in judgment will be made if we expand the number of factors to be considered in making any given decision.

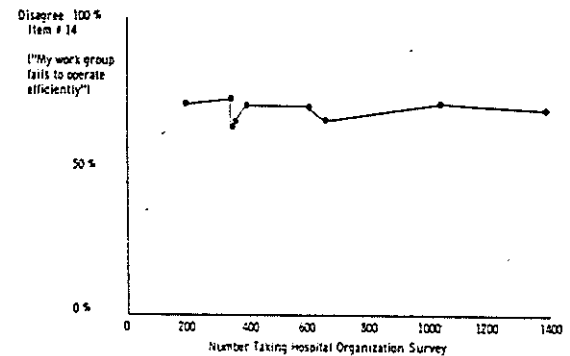
As I look at this conference, I see a void in the kind of facts that have been discussed concerning the

relationship between efficiency and effectiveness and the optimum size of the hospital. We have been talking about what I would call the four "B's"—beds, budgets, beautiful care (or quality), and the bigger environment of the hospital (the neighborhood, population growth, etc.). However, I think that we have left out an extremely important fifth "B."

If we are going to consider the effectiveness and the efficiency of a hospital, then we certainly have to be concerned with the *behavior* of those for whom we at least nominally have managerial, administrative, or supervisory responsibility and who must ultimately achieve this efficiency or effectiveness.

My staff at the Industrial Relations Center has just conducted a very modest survey of fifteen hospitals and is in the process of comparing these results with about 40,000 industrial cases. We have about 10,000 hospital employees analyzed, and these data on the board represent nine hospitals and 5,000 employees for just a few of the eighty-five variables

CHART II
RELATIONSHIP BETWEEN SIZE OF HOSPITAL ORGANIZATION SURVEY STAFF AND ITEM 14 ("MY WORK GROUP FAILS TO OPERATE EFFICIENTLY")



that we have measured to date. If we are going to consider the behavior of subordinates, we have to consider, in part, their attitude toward how effectively they perform on the job and likewise their concern with how well their managers and supervisors organize the work that they are to perform. We also have to be concerned with whether they know *what* to do and with creating opportunities for improving their behavior on that job.

The data in Chart I represent statements on the part of hospital employees as to how efficiently and effectively they feel they are operating. What we are dealing with here, as we plot our variables, are attitudes toward work, and the kind of distribution that you see here is a typical one. In other words, there

is no relationship between the size of hospital (plotted on the X axis) and employee statements about work-operations effectiveness (Chart I), work-group efficiency (Chart II), quality of work in the department (Chart III), waste of time (Chart IV), and organization of the work group (Chart V). Plotted on the Y axes is the percentage of employees in each hospital who responded either "agree" or "disagree" with each question. This pattern runs throughout our data, variable after variable, and all that we have done is plotted a few samples for you.

It is not really very puzzling when you think of it. You see, in this conference we have been concentrating on what a top manager is concerned with (point-

THE SIZE OF THE HOSPITAL OF THE FUTURE

behavior of *the employee* from the economic standpoint, his behavior is only a very small part of the combinational factors that go into the total economic contribution for an organization.

CHART III

RELATIONSHIP BETWEEN SIZE OF HOSPITAL ORGANIZATION SURVEY STAFF AND ITEM 43 ("THE QUALITY OF WORK DONE IN MY DEPARTMENT IS EXCELLENT")

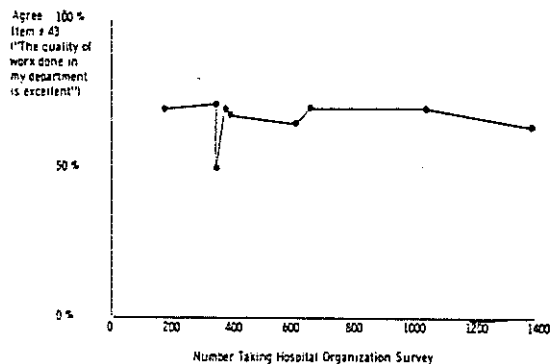


CHART IV

RELATIONSHIP BETWEEN SIZE OF HOSPITAL ORGANIZATION SURVEY STAFF AND THE STATEMENT, "IN MY OPINION TOO MUCH TIME IS WASTED AROUND HERE"

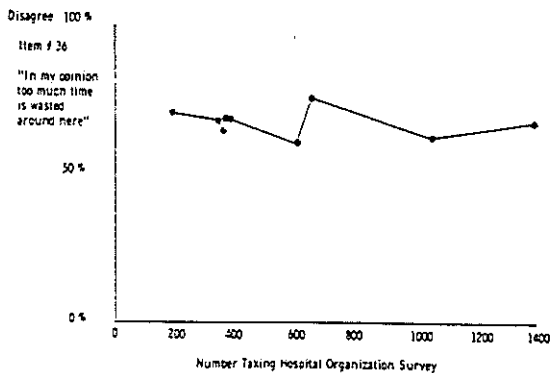
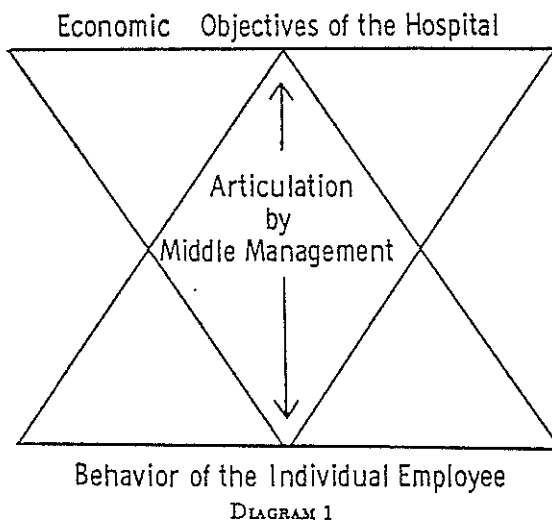
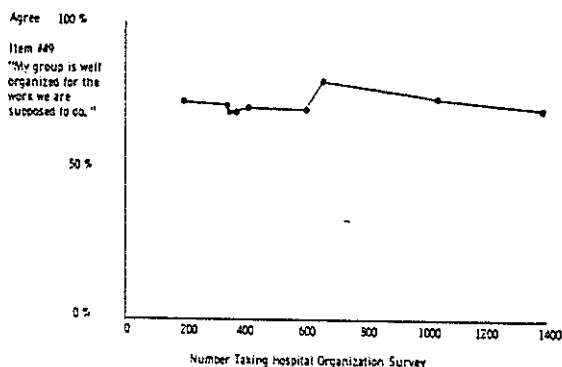


CHART V

RELATIONSHIP BETWEEN SIZE OF HOSPITAL ORGANIZATION SURVEY STAFF AND THE STATEMENT, "MY GROUP IS WELL ORGANIZED FOR THE WORK WE ARE SUPPOSED TO DO"



Now, if we reverse this diagram and think in terms of behavior (pointing to the bottom of Diagram 1), a top administrator has very little knowledge about or little influence over the behavior of each employee in the organization. Therefore, the resolution of the problem, of this dilemma, must occur at the first-line and middle-management levels, because this is where the direct influences on the behavior, and hence the effectiveness of employees, are felt.

What I am suggesting is that the nature of the

ing to the top of Diagram 1), namely, the economics of managing an organization. The economics of managing an organization are quite broad in perspective and cover many areas. However, when we look at the

relationships between first-line supervisors and employees, the work groups, does not vary by size of the organization. You are just as likely to find a cost-conscious supervisor in a small hospital as in a large hospital. You are just as likely to find a paternalistic patriarch or laissez faire manager in a small hospital as in a large one. Further, you are just as likely to find each type of manager in a hospital as in an industry. On the whole, we find very little difference between corporations as an industry and hospitals as an industry on these kinds of measures.

So, if administrators are to concern themselves with improving the "internal economy" of their organizations, they must be concerned with developing the proper perspective of middle management where, in fact, they do have considerable influence, so as to develop the proper attitudes and knowledge and to create the experience opportunities of subordinates in order to begin to make some progress in terms of the economic problems facing the organization.

In summary, all I can say is that, even though there may be economies of scale (and I am not sure that at this conference we have determined that as a *fact*) or there may be higher quality of care in the larger-sized organizations, on the basis of the data that we have on hand, I think that, at least from a behavioral standpoint, the size of the organization is not a critical factor and that the nature of the relationship between managers and employees can be the same in a small or large hospital. Whether it is effective or efficient depends upon the enlightenment of the management system of that hospital in being able to create the proper attitude climate to impart knowledge and to develop the learning opportunities for all to perform their roles efficiently and effectively.

MR. BUGBEE: We could easily talk for an hour and a half on this presentation, and it is unfortunate not to be able to do so. Hopefully, you will have a chance to interact with Bob on some other occasion. We ought to move along with the panel. We will come back to the subject if there is time.

Jim, you are an alumnus, so why don't you talk a little about construction from your own experience. I did put on the board some figures from Mr. Hoenack's report yesterday which I thought might put this problem in perspective. I do not know whether it will or not, but I took a look at the figures that he gave us from 1948 to 1965 and the kind of projects that Hill-Burton was working on in those years; as far as I can tell, these were all new hospitals.

MR. JAMES W. STEPHAN: With reference to Gus Hoenack's statistics on new general hospitals, 1948-65, we started off in 1948 with an average size, as to number of beds, of 43 and we ended up in 1965 with 96. This meant that we increased the bed size by 123 per cent.

Now, if you look at the square feet per bed, this went up from 598 to 884, or an increase of 49 per cent. On the other hand, if we look at the square foot per project, we find that it went from 25,800 to 88,400, or 242 per cent.

The only conclusion that I could draw from that was that the square footage in hospitals being built did not necessarily represent a straight-line projection of bed increases.

Other things have come into this during this twenty-year period, and to a very remarkable degree. In other words, if it had remained constant and we had talked primarily in terms of beds, we would not have increased the project cost or the project size any more than we increased the bed size. Well, this is an oversimplification of statistics, but I do think that it indicates to you what is happening.

The major thing that is happening, in my estimation, is a change and a very basic change in what we call hospitals. Our consideration today has to be in terms of sizing the hospital for the future, so we must recognize that this is the kind of thing that is going to be increasing and that we are going to be dealing with facilities in which the bed portion will, in my estimation, be a minor section of the hospital.

We also have to look very hard at other measures of size than beds. One of the groups to whom we must turn in this relation is economists and sociologists. They can help us find the right kinds of criteria to use for this because, at the moment, I am sure that our criteria are not correct.

Mr. Bugbee asked me to talk a bit about construction, and I cannot do this without talking about what I think the trends are that are occurring in the development of hospitals. I am going to try to keep this as short as I can.

I think that we are talking about at least four different trends coming to the fore at the present moment in the development of our facilities.

One of these is the effort to create an optimum environment for patient care, both inpatient and outpatient care. This means not only the aesthetics of the building and the development of surroundings in which care can be enhanced and in which we have a chance of doing a better job, but it also means a much heavier emphasis on the privacy of the individual. I think that we are moving away from the multiple-bed room into a private-room concept. Of

course. I do not know that everybody agrees with me, but I feel strongly that this is the way we will go in this country. I think that we have been constrained from going to an all-private-room hospital by the financing system. This has been the constraint, not the needs of patients.

There has also been a trend toward maximizing the use of human resources, and this we have to continue at all costs. One of the ways in which I see this showing up is that we are more concerned now with medically oriented facilities and the operation of a medically oriented facility than the operation of a number of services that somebody else can do better than we can do ourselves. This means that we do not have to get involved with the operation of a laundry; we can contract out housekeeping and maintenance services; we can combine facilities; we can utilize one laboratory to serve a number of facilities; we do not have to prepare all our food, since we can easily get some of this prepackaged and prepared for us. I think that we would be wise if we, as administrators, tried to cut free of all the things that we do not have competence in and stay within the areas of our maximum competence. This relates to the medically oriented facilities.

Along with this is what you have heard from the previous speakers—the trend toward comprehensive care or continuity of care. Certainly we see this in the university teaching hospitals with the centering of their facilities around clinical investigation units. There is also the tying-in of the basic scientist, the clinical scientist as well as all of the other professions that we are bringing into the hospital. We are bringing in many professions that had no relationship, or maybe just a tangential relationship, to hospitals in the past.

We are also concerned with minimum construction costs, and I see a trend toward an attempt to gain them. This means different kinds of designs than we have used in the past. Along with this is the great fear on the part of everyone that we are building a very substantial concrete and granite facility that nobody can change easily and that will last a long time. I would be hopeful that someday we can come up with a disposable hospital.

There are some things that designers can do. For example, they can make a much wider span, so that we can change room walls. We do not have to have as many columns as we used to have. We can develop other forms along this line which, in turn, will give us flexibility of space.

Do we need flexibility of space? I am sure that you are all agreed that this is what we have to have. It is a very complex problem for designers, probably as

complex as any problem that the designer can come across. Part of the reason for its complexity is that nobody has taken the time to define the goals that we are trying to establish with our structure. The poor architect or designer gets one set of criteria from the board, another set from the administrator, and, if he has the patience, he can get a third set from the patient. All of these, of course, have to be meshed together, but at the moment we clearly lack definitive goals that we can give him.

In general, we end up with a compromise and with an attempt on the part of the designer to give us something that will meet the continual changes. One thing that we know is that any hospital built ten years ago is obsolete at this time. It usually takes about five years between the time that we get ideas of building a hospital and the time of construction of the hospital, and we know that it is obsolete by the time it gets to the construction phase.

There are attempts in some of the foreign countries to build much more quickly, by the use of prefabricated hospitals, than we do; this, I think, may have an effect upon us.

MR. BUGBEE: Everything that you say is interesting, Jim. Now, Dick Manegold, are there any comments that you want to make in relation to the subject? We would like to hear comments with regard to quality and the interaction of physicians in the hospital, as related to size.

DR. RICHARD MANEGOLD: Several aspects of economy of scale impressed me as warranting your consideration as I was listening to the talks yesterday and today. They pertain to goal conflicts that require compromise of synthesis. They involve the validity of the goals of subgroups versus those of primary groups versus those of the extended group.

If you view economy of scale as a community problem, there are different concerns than if you view it as an institutional problem. Dr. Rosenfeld this morning viewed it as a community problem. I think, on the other hand, that as an institution you would be very unhappy to put a less-than-qualified physician on your staff. Obviously, each institution is going to be oriented toward excellence. The way to achieve that is to get the best men that you can. How, then, do we compromise or integrate the oft-time conflicting yet, when separately viewed, quite valid goals of the extended group—the community—with those of the primary group—the institution?

Similarly, there are problems in considering econ-

omy of scale with reference to a particular subgroup—a hospital medical staff. Again there are dual goals, quality and efficiency. The quality of medical care, of course, resides primarily with the physician. Growing specialism is the pursuit of quality in a field that is getting increasingly complex. This results in further subdivision—"fragmentation of care"—and attendant parochialism. Do we, at some point, witness diminishing returns with optimization of quality and efficiency at a secondary level, resulting in deterioration at the primary level?

I had training in a city hospital where I would guess the staff was too large. The hospital became a federation of services; we had some that were excellent but others that were substandard. We had pride in our own service, but we really did not care about the institution as a whole, and, further, no thought was given to the responsibility for other services. This would be somewhat like this morning's comment about the large institution in which nobody knew who the boss was.

Somewhere there is an ideal staff size, where the staff does take institutional pride and is an integral part of the whole institution. Possibly this may be at 200-300 beds. Beds, however, may not be the concern; rather, the number of services that the hospital supplies may be.

How large or small a medical staff should be depends upon the composition of the staff in relation to the institutional mission. At what size do we assure a full range of skills and keep vital in terms of advances in medicine? Mention was made of the Baltimore study on cardiac surgery which revealed that not enough surgery was done in several hospitals to sustain the competence of the surgical team. At the other pole, there is the input-overload problem in some places, where understaffing results from the volume of work. For example, the Edens Expressway here in Chicago is a misnomer at around five o'clock. You can do better with a horse on a cowpath than on Edens Expressway during the rush hour.

These are my reflections as I examine economy of scale in relation to the quality problem and the medical staff.

MR. BUGBEE: I think that the question of what size medical staff is optimum is fundamental. I would also guess that this applies to the mix of the staff.

Dick Stull, do you want to talk a little about administration with regard to size?

MR. RICHARD J. STULL: Well, if you make the administration a broad umbrella, I will be glad to talk about it.

I would like to clear up one thing. There is no problem, at least in my mind, of the size of the hospital of the future. In other words, it should be one room, performing all services, and with a qualified general-duty nurse assigned to my bedside during my stay. I will not go into the reasons for that. To me it seems only worthy as an academic exercise to discuss sizing the hospital for the future based on beds and information derived from traditional concepts of hospital operation and environments of clinical practice—some of which reflect reported experience from facilities which are recognized as outmoded and inadequate for today's and tomorrow's programs of medical practice and institutional care and in terms of current thinking regarding the hospital's role in comprehensive and continuing care.

Perhaps a by-product of these mental gymnastics of the last few days and this collection of figures is the identification or development of some "yardsticks" which may be applied to a defined set of circumstances for measuring performance against certain goals.

Let me attempt to illustrate, with apologies for using some industrial terminology.

What we are involved in primarily is the marketing of medical services, in the total sense of bringing to the public the maximum benefits of all our scientific and medical "know-how" and all there is of its application—diagnostic, therapeutic, rehabilitative, preventative, extended care, and so forth.

Today, and in the future, in my opinion—recognizing full well the hospital as a social institution or an institution of public service—the hospital is and will be more of an assembly, production, distribution, and customer-service center for marketing medical services. It also serves as a catalyst to, and in some instances provides the environment for, the conduct of education and research programs.

As such an enterprise, it must be evaluated at least by the following:

1. Quality of medical product dispensed and customer service rendered in relation to the need of the segment and aspects of the market being served.
2. Maximum return in service rendered for dollars invested in capital and operating funds.
3. Capacity for serving its designated part of the market—services referenced earlier can include teaching and research as well as patient service.
4. Customer convenience and accessibility for use by the professional talents available.

If this be true, at least in part, then it seems that the size of the customer-service center must have some relationship to:

- a) Its role as an operational and distribution center.
- b) The professional and supportive capacity available or

which can reasonably be acquired and employed effectively in the enterprise.

- c) The magnitude and scope of the market that it serves.
- d) The nature and scope of its functions.

All of this means that we must start with purposes and programs—medical practice and customer service, teaching, research, and so forth—and consider how these best can be organized and implemented, applying all modern techniques of management, communication, transportation, clinical practice, and so on. All of this will be a factor of effectiveness in capacity to render service, which affects design, size, layout, staffing.

Don't start with beds—start with a program.

We should be mindful of the fact that such a customer-service center could have a collection or perhaps a series of environmental settings designed to render customer service for specific needs and segments of the market, backed up by the operational functions essential to support them. A total market—nation, state, or region—could be well serviced by a group of varying customer-service centers, varying in services rendered and with limitations on their intended capacity to provide such services.

Our real problem is to define what kind of customer service or distribution unit or units that we need for specific market segments and how to size these to serve the market with the products that we can reasonably produce.

MR. BUGBEE: Thank you very much, Dick.

Walter, you have been around in Michigan and elsewhere, and I believe that you represent an organization that purchases a little hospital care. Are there any comments you want to make on this?

MR. WALTER McNERNEY: I am going to start as a purchaser first and say, having paid Stull's bill, that I have the distinct feeling he did have a nurse.

I am going to rise above the professors and not put any facts on the board; I would like to talk about loftier notions. This, of course, means that I do not know the answer to the problem of hospital size and efficiency.

I do not think that it can be said too often that size, from the point of view of the individual institution or the point of view of the community, is only one of a series of important elements to consider.

Size is one thing if you perceive it from the point of view of the individual institution. The role of the individual hospital may be perceived by that hospital to be one of giving comprehensive care to as many people as possible and, hopefully, to provide alternate ways of doing that more economically. When one

looks at it from the point of view of the community, one faces up to the problem of size as among institutions. It would be possible, for example, to have five efficient hospitals but two of them superfluous. I think, therefore, that we must take the broader view, that is, look at the individual institution but also at institutions as well, which has been stated in various ways.

Let us hold other matters constant for a moment and focus on size. Let us assume that we can agree on the role of the hospital and that there are the right number of beds in the community. I will say that in the future we will need larger hospitals, on the average. I say it conceptually. There is a scarcity of manpower, and it has to be husbanded more judiciously than we have done to date. Also, lesser skills have to be given more responsibility.

We need a better opportunity to allocate overhead intelligently and to use systems instead of intuition. We need a better brand of regionalization, part of which comes with size. A large enough institution, pervasive in an area, regionalizes within itself.

In terms of the community, assuming that we can agree on size of the individual institutions, I think that conceptually we have to, in a product-analysis way, put the patient where he belongs, on a continuity basis, whether it is inoculation, or education, or whatever it is. There is, of course, great room for improvement there.

Is all of this theory? No. We can see that the larger institutions—assuming that we are holding the other things constant for a moment—have better accounting and better personnel policies; are more apt to be accredited; have greater specialization (which relates to quality); are more apt to avoid underuse (which is likewise a quality factor); are less apt to have drug errors; and, even though they might have colder food, are more likely to have more nutritious food relevant to the patients' needs.

We can see qualitative factors, which suggest that this is not all theory.

On the quantitative side, there is not much reliable information on the individual institution. There are so many differences among hospitals (even in terms of role) that it is hard to make a generalization. However, when you move to the framework of the community, you can see some very hard economic facts; namely, where there is a group-practice setting which comprehensively sits on top of the full span of medical activity, you can see dramatic results in some instances. See, for example, admission rates under selected diagnoses for FEP (federal employees);

those rates under group-practice situations are half what they are for Blue Cross and Blue Shield plans.

This makes the point that until you take a broad control view toward the problem efficiency remains an elusive thing.

What are the main deterrents to getting larger institutions and better continuity of care? They are cultural. A given town, for example, wants a facility because it fears being too far from such a facility. The doctor wants his own workshop, and he would rather be more broadly privileged in it than less privileged in a more highly organized shop. Another impediment, I think, is management's attitude. With regard to size, the average administrator has a fixed attitude which he has grown with and refuses to see that a larger unit is a workable unit. This is a matter of inertia.

I list these only to make this point. None of them convinces me as being very important. Of these resistances, none has much economic weight.

I think that what we are going to see emerging is the middle ground that was referred to, the health-campus concept, where there is a tying-together of institutions (hospitals, nursing homes, ambulatory facilities, health departments) to achieve size—tied together by common use of certain facilities and tied together by much better computation (with record information available through negative pressure, perhaps, leading to all points along the way), even though one unit might be on a private-fee basis and the other on an institutional basis. I think that we are going to see a greater balance achieved through this campus concept (campus in the sense of being in one common geographical area).

Now, will this happen in fact, or is this just a figment of the National Commission on Community Health Services, which came out rather strongly for this middle-ground position? I say "Yes" to the former. I say "Yes" because of the economic pressures that are now on our system. In other words, it is beyond the point of speculation whether this type of thing, or something more radical, is going to take place.

The increase in health-care costs cannot, over a protracted period of time, exceed earnings in the population or else, ultimately, 100 per cent of the gross national product will be spent on health. I think that there is some cause to believe that probably will not happen, and the only way we can get out of the dilemma is to change the slope of one or both of those curves.

Wages and earnings are pretty tough to move up in any dramatic scale. It is almost inevitable that the

medical curve has to come down, and it will come down through attention on the part of a better-educated community to such factors as size and continuity and the control framework, such as I mentioned, within which care will be rendered, heightened by a growing lack of manpower that will make it impossible to continue on the paths that we are now on.

Therefore, looking to the future, somewhat puckishly, and returning to the original question, I see optimum size as something from 200 to 2,000 beds—this lesser consideration than that of how these beds relate to the facilities around them and the allied programs of home care, preventive care, and the organization of medical practice.

MR. BUGBEE: Well, let us try this with the panel. Walt said from 200 to 2,000.

MR. McNERNEY: Sometimes I get more general than that.

MR. BUGBEE: Well, Len, if you had to pick out of the air a desired size for a hospital in a metropolitan area and give a top and bottom, what would you pick out, granting that it has no general application but as you think of it in your mind? In other words, you have 400 as the floor in New York, and what do you think is the ceiling?

DR. ROSENFELD: Well, I think most of the discussion has been about floors in this field and very little consideration given to ceilings. In a metropolitan community I would like to see 400-bed hospitals. I think that at that size you have the maximum reasonable efficiency which can be achieved in connection with most services, except, of course, for the most highly specialized, which might be concentrated in a few institutions. At the same time, institutions of this size could be distributed in a manner to assure reasonable geographic accessibility.

There is more difficulty in achieving and maintaining the personalization of service and the personal identity of the physician, of other personnel, and of the patient as size increases.

MR. BUGBEE: I do not think that 400 is too large for that. However, are you standing on 400 to get the range of services?

DR. ROSENFELD: Yes. I think that we have all had the experience of visiting a very small hospital where there is a remarkably high level of morale—the staff is dedicated, the patients love the place, and so on. With proper leadership and environment, this may

be more easily achieved in a small institution than in a large one or even in a 400-bed unit.

On the other hand, there are certain obvious disadvantages and obvious inefficiencies in terms of modern medical practice built into the very small facility as an independent unit.

In the larger metropolitan areas we have seen very large institutions built. We have also seen state hospital systems with very large institutions. We have probably seen the largest institution of that sort built that probably ever will be built. Pilgrim State Hospital, I think, is up to about 12,000 beds. This frightens me when I think about it. The trend, however, is now in the other direction in mental-health planning. There is now some discussion of the eventual elimination of state hospital systems by incorporating psychiatric care in the general hospitals.

At any rate, I think that the underlying issue is similar. If we use past experience, if we evaluate it, this is going to teach us some lessons. In general hospital care, for example, there are some institutions as large as 2,000 and 3,000 beds.

With sufficient support and with a topflight organization, I believe that it should be possible to devise a system whereby the patient, the physician, and the other people are not lost within that context; on the other hand, it is much more difficult to do. Setting a ceiling on size becomes a question of balancing factors. To assure a good level of personal identity and staff responsibilities, I would hope that hospitals would not be expanded any more beyond the 400-bed level than may be essential to meet the needs of the community and of the program.

MR. BUGBEE: Walt, do you want to take a shot at this bottom and top?

MR. McNERNEY: Not particularly. I will stay with my range, nothing under 200. I can also see 2,000 as a very optimal situation in certain urban areas.

MR. STEPHAN: You are talking about urban areas?

MR. BUGBEE: The question was phrased in connection with a metropolitan area.

MR. McNERNEY: I would say that 200 would also apply to rural areas—maybe 150, but it does not make much difference.

I just want to underscore one point; that is that convenience, comfort, the easier living that often goes with smaller work groups (whether you are

talking about medical staff or the other) has to be balanced against economic consideration. With the more (not less) complicated equipment and procedures coming up, requiring greater experience to administer, we will see greater pressure put on the second.

Also, I would like to make this statement about the 2,000-bed institution: I do not think that there is anything intrinsically limiting about this size. I believe that it is a management challenge that can be met with better management. The real limitations lie in ability of management, and we are not making use of the limited number of managers that we now have.

MR. BUGBEE: I am now conscious of two things. I have some pressure from the floor for questions but also a realization that time is running out.

Before closing, I would like to make a few comments. We have been talking about the organization that in some way gives the optimum delivery of medical care. If we were to bring in eight thousand graduates of medical schools this year and give them some form of talent test, I think that we would have to agree that there would be a variation from the best 5 per cent to the least. I do not know what the variation is. Maybe it is inconsequential.

I was also impressed when one of the members of the Business School faculty, an economist who lives in a suburb nearby, said to me, "I know that the ablest members of the profession are not settling in our suburb. I think that they are probably up on the North Shore." Well, I do not know what that means except that he possibly had a feeling that there was a variation in performance. I think that almost everything that we have been able to see indicates that there is a variation in performance.

In the hospital, we are not talking about beds as the magic dimension; we are talking about an organization which can improve quality in the delivery of medical care by the physician and those that work with him. How much variation in human talent, in educational preparation, in training can be hedged by better organization has threaded through our discussion. This is not a measurable variation. There is variation in control through organization which has some relationship to size. Large size brings difficulties in smooth delivery of care and obviously increases the range of technical resources and special skills in the medical staff and elsewhere.

We should now close this meeting. I first want to thank the panel and express appreciation for their

willingness to come here today. I also apologize to the group that there has not been more time for discussion. We are not today going to settle hospital size, as I am sure all of you knew when you arrived.

Let me say, by way of adjourning the meeting, that I am a little more relaxed in this Symposium than I was the first time that I tried to put one to-

gether that would be of interest to all of you. I now look forward to them with great pleasure. The speakers have produced a most interesting day and a half. The presentations on their program have been outstanding.

[Whereupon, at twelve o'clock noon, the meeting adjourned sine die.]

Hospital Size: A Selected Annotated Bibliography

DUNCAN NEUHAUSER

The literature in this general area is too vast to undertake an exhaustive listing here. Instead, a limited number of key books and articles are included. They relate to organizations in general and to hospitals in particular.¹

This bibliography is divided into a number of sections by topic and according to whether the work refers to organizations in general or specifically to hospitals. Many of the works cited here have their own bibliographies, which can be used to obtain further references.

I. Organizations: General

A few basic books on organizations that include some discussion of size follow:

1. BLAU, PETER and SCOTT, W. RICHARD. *Formal Organizations*. San Francisco: Chandler Publishing Company, 1962.
2. KNIGHT, FRANK H. *The Economic Organization*. New York: Kelley, 1957.
3. MARCH, JAMES G. *Handbook of Organizations*. Chicago: Rand McNally and Co., 1965.
4. THOMPSON, VICTOR A. *Modern Organization*. New York: Alfred A. Knopf, 1965.

II. Sources of General Information on Hospital Size and Costs

1. The Annual Guide Issues of the *Journal of the American Hospital Association*, particularly the statistical summary.
2. BROWN, RAY. "The Nature of Hospital Costs," *Hospitals*, XXX, No. 7 (April, 1956), 36-41.
3. COMMISSION ON FINANCING OF HOSPITAL CARE. *Factors Affecting the Costs of Hospital Care, Vol. I: Financing Hospital Care in the United States*. New York: Blakiston Co., 1954.
4. COMMISSION ON HOSPITAL CARE. *Hospital Care in the United States*. Cambridge, Mass.: Harvard University Press, 1957.
5. HOSPITAL ADMINISTRATIVE SERVICES. "Special Comparison, National Size Group" (American Hospital Association, Chicago, Illinois; Mimeographed, September, 1965, and November, 1966.)

Hospital Activities Service has a number of Mimeographed reports on size and various cost classifications in their "Spotlight Series," available through the American Hospital Association.

6. MAGID, DENNIS J., and QUADLAND, MICHAEL C. "A Study of Cost Variation among the Thirty-five Short

¹ I am indebted to August Hoenack, Millard Long, Dr. Leonard Rosenfeld, Thomas Whisler, and David Starkweather for their advice and suggestions.

Term General Hospitals in Connecticut. (Yale University Hospital Administration Program, June 2, 1966; Mimeographed.) (This includes a large number of correlations and a discussion of quality of care and size.)

7. McNERNEY, WALTER J., et al. *Hospital and Medical Economics*. Chicago: Hospital Research and Educational Trust, 1962.
8. PINKER, ROBERT. *English Hospital Statistics 1861-1938*. London: Heinemann, 1966. (A careful look at English hospital data in the last century. The original source material leaves something to be desired. Good bibliography.)

Other general articles on hospital size follow:

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2. BURGOON, DAVID F. "Effect of Bed Size on Surgical Work Load in Short-Term General Hospitals," *Hospitals*, January, 1967, pp. 63-66.
3. COWAN, PETER. "The Size of Hospitals," *Medical Care*, I, No. 1 (January-March, 1963), 1-9. (An international comparison of the distribution of hospitals by size and type.)
4. KREEGER, M. D. "Determining Optimal Size of Urban and Rural Hospitals," *Canadian Hospitals*, November, 1963.
5. SIBLEY, H. "Size of a Hospital," *Hospitals*, December 16, 1962.
6. TIBBITTS, S. J. "It's Not Size but Service That Counts," *Modern Hospital*, September, 1962.

III. General Studies of Organizational Growth and Size

1. BOULDING, KENNETH E. "Toward a General Theory of Growth," *Canadian Journal of Economics and Political Science*, XIX (1953), 326-40.
2. CAPLOW, THEODORE. "Organizational Size," *Administrative Science Quarterly*, I (1957), 484-505.
3. HAIRE, MASON. "Biological Modes and Empirical Histories of the Growth of Organizations," in *Modern Organization Theory*. Edited by MASON HAIRE. New York: John Wiley & Sons, 1959.
4. HART, P. E. "The Size and Growth of Firms," *Economica*, February, 1962.
5. HYMER, STEPHEN, and PASHIGIAN, PETER. "Firm Size and Rate of Growth," *Journal of Political Economy*, LXX, No. 6 (December, 1962), 555-69.
6. LITTERER, JOSEPH A. *The Analysis of Organizations*. New York: John Wiley & Sons, 1965. See esp. chap. xx on "Growth and Structure of Organizations."
7. PENROSE, EDITH TILTON. *The Theory of the Growth of the Firm*. New York: John Wiley & Sons, 1959.
8. SMITH, RICHARD AUSTIN. *Corporations in Crisis*. New York: Anchor Books, Doubleday & Co., 1966. See esp. chap. 1, "Olin Mathieson: A Crisis of Growth." (The other chapters in this book make good reading on the subject of organizational growth, survival, and decay.)

9. STARBUCK, WILLIAM H. "Organizational Growth and Development," in JAMES G. MARCHE. *Handbook of Organizations*. Chicago: Rand McNally & Co., 1965, pp. 451-533. (Includes a lengthy bibliography.)
10. WEISLER, THOMAS L. "Organizational Aspects of Corporate Growth," in WILLIAM W. ALBERTS and JOEL E. SEGALL, *The Corporate Merger*. Chicago: University of Chicago Press, 1966. Pp. 183-201.

IV. Changes in Internal Organizational Structure Which Relate to Size

Some general studies under this category are the following:

1. GRAICUNAS, V. A. "Relationship in Organization," in *Papers on the Science of Administration*. New York: Institute of Public Administration, Columbia University, 1937. Pp. 183-87. Also see HENRY H. ALBERS, *Organized Executive Action*. New York: John Wiley & Sons, 1961. Pp. 75-77. (As organization size increases, the theoretical number of personal interactions increases exponentially.)
2. HALL, RICHARD H., and TITTLE, CHARLES R. "A Note on Bureaucracy and Its Correlates," *American Journal of Sociology*, LXXII, No. 3 (November, 1966), 267-72.
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9. HEYDEBRAND, WOLF. *Bureaucracy in Hospitals: An Analysis of Complexity and Coordination in Formal Organizations*. Unpublished Ph.D. dissertation, Department of Sociology, University of Chicago, June, 1965.
10. SAATHOFF, D. E., and KURTZ, R. A. "What Administrators of Small Hospitals Do," *Modern Hospital*, XCIX, No. 2 (August, 1962), 85.

V. Merger

General studies on merger:

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2. LITTLE, ARTHUR D., INC. *Mergers and Acquisitions: Planning and Action*. Cambridge, Mass.: Prepared for Financial Executives Research Foundation, 1963. (Bibliography.)
3. NELSON, RALPH. *Merger Movements in American Indus-*

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4. SMITH, RANDALL, and BROOKS, DENNIS. *Mergers Past and Present*. The Acton Society Trust, England, 1963. (Extensive references.)
5. U.S. Federal Trade Commission. *Report on Corporate Mergers and Acquisitions*. Washington, D.C.: U.S. Government Printing Office, 1955.
6. U.S. Federal Trade Commission. *Report on the Merger Movement*. Washington, D.C.: U.S. Government Printing Office, 1955.
7. WESTON, J. F. *The Role of Mergers in the Growth of Large Firms*. Berkeley: University of California Press, 1953.

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2. DEWING, A. S. "A Statistical Test of the Success of Consolidations," *Quarterly Journal of Economics*, 1921.
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5. MARKHAM, J. "Survey of the Evidence and Findings on Mergers," in National Bureau of Economic Research, *Business Concentration and Price Policy*. Princeton: Princeton University Press, 1955.
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Descriptions of hospital merger:

1. "Special Report on Hospital Mergers," *Modern Hospital*, CVII, No. 1 (July, 1966), 83-101.

Also see the American Hospital Association, *Cumulative Index of Hospital Literature*, under "Hospital and Health Facilities—Merger," for articles and descriptions of specific mergers.

2. BENT, JOHN P., and KLICKA, KARL S. "Merger Was the Best Solution," *Hospitals*, XXXI (June, 1957), 30. (On Presbyterian and St. Luke's merger in Chicago.)
3. CANNON, NORMAN L. "The Case for Hospital Merger," *Delaware Medical Journal*, XXXIII, No. 10 (October, 1961), 281-94.
4. LANG, H. J. "The Human Factor in Mergers and Acquisitions," *Management Record*, XXV (January, 1963), 16-18.
5. "Large City-University Hospital Indicates It May 'Unmerge' To Solve Unique Expansion Problems," *The Modern Hospital*, CVII (July, 1966), 176. (A brief note on the Palo Alto-Stanford Hospital.)
6. MCKELLOP, WILLIAM. "Three Hospitals Merge To Create New Medical Center," *Hospitals*, Vol. XL (February, 1966). (On Wilmington, Delaware, merger.)
7. Tufts—*New England Medical Center News*, Vol. II, February, 1965: May, 1965. (Special issues on Tufts—New England Medical Center merger.)

VI. Hospital Survival and Closure

See American Hospital Association's *Cumulative Index of Hospital Literature*, under "Hospitals and Health Facilities—Discontinuance."

Some good case histories can be found in the following articles:

1. FRIEDMAN, JAY W., and WEINER, TESS. "A Small Proprietary Hospital Closes Its Doors," *Hospitals*, XL (August, 1966), 46-51.
2. "Closing the Small Hospitals," *The Hospital*, LVIII (November, 1962), 737.
3. "'S Per Centers' in the Hospital Field," *Hospitals*, Vol. XXXVII (March 1, 1963). (Special Report, pp. 17-22; Editorial, p. 47.)

VII. Quality of Care and Hospital Size

1. BUREAU OF PUBLIC HEALTH ECONOMICS. "Medical Care Chart Book." 2d ed., School of Public Health, The University of Michigan, 1964. Mimeographed. (See Part G. "Quality of Care" and Chart F-19 for a graphic summary of several studies of quality of care.)
2. CIOTTO, A., HUNT, G. H., and ALTMAN, I. "Statistics on Clinical Services to New Patients in Medical Groups," *Public Health Reports*, LXV (January, 1950), 99-115.
3. COLUMBIA UNIVERSITY SCHOOL OF PUBLIC HEALTH AND ADMINISTRATIVE MEDICINE. *Prepayment for Medical and Dental Care in New York State*. (Trussel Report.) See chap. vii in Part D. (This study says that [large] teaching hospitals provide better care than [small] proprietary hospitals.)
4. DONABEDIAN, AVEDIS. "The Hospital Administrator and Assessment of the Quality of Medical Care," in *Applications of Studies in Health Administration*. Proceedings of the Eighth Annual Symposium on Hospital Affairs, December, 1965, Center for Health Administration Studies, University of Chicago.
5. GEORGOPOULOS, BASIL S., and MANN, FLOYD C. *The Community General Hospital*. New York: Macmillan Co., 1962. (See esp. pp. 376-79.)
6. KOOS, EARL L. *The Health of Regionville*. New York: Columbia University Press, 1954.
7. LEE, J. A. H., MORRISON, S. L., and MORRIS, J. N. "Fatality from Three Common Surgical Conditions in Teaching and Non-teaching Hospitals," *Lancet*, October, 1957, pp. 785-90.
8. LIPWORTH, L., LEE, J. A. H., and MORRIS, J. N. "Case Fatality in Teaching and Non-teaching Hospitals, 1956-1959," *Medical Care*, April-June, 1963, pp. 71-76.
9. NEW YORK ACADEMY OF MEDICINE. *Maternal Mortality in New York City*. New York: The Commonwealth Fund, 1933.
10. ROEMER, MILTON I. "Is Surgery Safer in Larger Hospitals?" *Hospital Management*, LXXXVII (January, 1959), 35 ff.
11. ROSENFELD, LEONARD S. "Quality of Medical Care in Hospitals." *American Journal of Public Health*, XLVII (July, 1958), 856-65.
12. SCHAEFFER, M. *An Appraisal of the Clinical Laboratories in New York City*. New York: Bureau of Laboratories, Department of Health, November, 1966.
13. SHAPIRO, SAM, WEINER, L., and DENSEN, P. M. "Comparison of Prematurity and Perinatal Mortality in the General Population and in the Population of a Prepaid Group Practice. Medical Care Plan," *American Journal of Public Health*, XLVIII (February, 1958), 170-57.

VIII. Construction, Capital Costs, and Hospital Size

Published information on this subject is scarce. See the American Hospital Association's *Index of Hospital Literature* under "Construction, Costs."

1. CALIFORNIA STATE DEPARTMENT OF PUBLIC HEALTH BUREAU OF HOSPITALS. "Cost Estimating Procedures for Part I," July, 1957. (Mimeographed.)
2. "Hospital Costs." *Engineering News Record*, June 16, 1966, and March 21, 1963.
3. "Hospital Departmental Area Studies." *Journal of the American Institute of Architects*, May, July, August, 1957.
4. *Representative Construction Costs of Hill-Burton Hospitals and Related Health Facilities*, July-December, 1966. Washington, D.C.: Division of Hospital and Medical Facilities, U.S. Public Health Service. (This lists costs, size, and a description of each hospital-construction project approved under the Hill-Burton Program. This report has been issued three times yearly for the last several years.)
5. SONDER, JAMES J. *Estimating Space Needs and Costs in General Hospital Construction*. Chicago: American Hospital Association, 1963.
6. "What Is It Costing To Build Hospitals?" *Hospital Administration and Construction*, II (September, 1960), 33-35.
7. "Where Hospital Construction Dollar Goes." *The Modern Hospital*, XCIX, No. 5 (November, 1962), 109-16.

IX. Hospital Size, Utilization, and Occupancy

Of the innumerable articles on this subject we have selected only a few.

1. BLUMBERG, MARK. "The Effects of Size and Specialism on Utilization of Urban Hospitals," *Hospitals*, May 16, 1965.
2. GOLDSTEIN, M. S., and WOOLSEY, T. D. *Hospital Utilization in Saskatchewan with Special Reference to Variations by Size of Hospital*. Washington, D.C.: U.S.P.H.S., Division of Public Health Methods, 1955.
3. LONDON, M., and SIGMUND, R. M. "Small Specialized Bed Units Lower Occupancy," *Modern Hospital*, May, 1961.
4. LONG, MILLARD F. "Efficient Use of Hospitals," in *The Economics of Health and Medical Care*. Ann Arbor: Bureau of Public Health Economics and Department of Economics, University of Michigan, 1964.

For a bibliography on this topic see:

5. DETLOFF, VIRGINIA, DROSNES, DANIEL L., and RIBAK, NANCY. *Utilization of Health Facilities and Services, 1950-1963: An Annotated Bibliography*. Sacramento: Department of Public Health, State of California, 1964.

X. Economies of Scale

For a general introduction to the concept of economies of scale see any basic economic textbook, for example:

1. LEFTWICH, RICHARD H. *The Price System and Resource Allocation*. Rev. ed. New York: Holt, Rinehart, & Winston, 1962. Chap. viii.

2. MARSHALL, ALFRED. *Principles of Economics*. 8th ed. New York: Macmillan Co., 1948. Pp. 240-322.
3. ROBINSON, E. A. G. *The Structure of Competitive Industry*. Chicago: University of Chicago Press, 1958.
4. STIGLER, GEORGE J. *The Theory of Price*. Rev. ed. New York: Macmillan Co., 1963. Chaps. vii-viii.

The following economic studies go into more detail on economies of scale in industry:

1. ADELMAN, MORRIS A. "Measurement of Industrial Concentration," *Review of Economics and Statistics*, November, 1951, p. 269. Reprinted in *Business Organization and Public Policy*, ed. HARVEY J. LEVIN. New York: Rinehart and Co., 1958. (A good discussion of the measurement of organization size.)
2. BAIN, JOE S. "Advantages of the Large Firm," *Journal of Marketing*, April, 1956.
3. ROSENBLUTH, GIDEON. "Measures of Concentration," in National Bureau of Economic Research, *Business Concentration and Price Policy*. Princeton: Princeton University Press, 1955. Pp. 89-92.
4. STIGLER, GEORGE J. "The Economies of Scale," *Journal of Law and Economics*, October, 1958. (The use of changing share of the market and the survivor technique to measure optimal firm size.)

The general conclusion from studies of economic size and efficiency in industry is that the range of optimum sizes is generally wide.

5. SMITH, CALEB A. "Survey of the Empirical Evidence on Economies of Scale," in National Bureau of Economic Research, *Business Concentration and Price Policy*. Princeton: Princeton University Press, 1955, pp. 213-38.

Also see:

6. KOONTZ, H., and O'DONNELL, C. "Diseconomic Size," in *Principles of Management*. New York: McGraw-Hill, 1964.
7. SAVING, T. "Estimation of Optimal Size of Plant by the Survivor Method," *Quarterly Journal of Economics*, November, 1961.
8. WEISS, L. "The Survivor Technique and the Extent of Suboptimal Capacity," *Journal of Political Economy*, June, 1964.

A number of studies of economies of scale in hospitals have been carried out. Several of these with somewhat contradictory results are reviewed in the following:

1. KLARMAN, HERBERT E. *The Economics of Health*. New York: Columbia University Press, 1965. Pp. 106-8. (Klarman says, "There may be a range of optimum sizes, rather than a single optimum size" (pp. 107-8). This book includes a lengthy bibliography.)

Another excellent review of several cost studies is:

2. LAVE, JUDITH R. "A Review of the Methods Used To Study Hospital Costs," *Inquiry*, III, No. 2 (May, 1966), 57-81.

Also see the Berry, Ro, and Martin Feldstein doctoral dissertations in the list below for reviews of the literature and lengthy bibliographies.

Empirical studies of economies of scale in hospitals:²

1. BERRY, RALPH E. "Competition and Efficiency in the Market of Hospital Services: The Structure of the American Hospital Industry." Unpublished Ph.D. dissertation, Harvard University, 1965. (Berry compared groups of hospitals all having the same scope of services as listed in the Guide Issue in *Hospitals*. In most cases he found economies of scale.)
2. CARR, JOHN W., and FELDSTEIN, PAUL J. "The Relationship of Cost to Hospital Size." (Mimeographed; February, 1966.) (Using 1963 AHA data on over 3,000 hospitals and controlling for scope of services, they found strong evidence for economies of scale. In hospitals providing the largest number of services, there was a curvilinear relationship between costs and size. Optimal size varies with the scope of services offered. This curvilinear relationship was also found for all hospitals with an optimal size at about 200 average daily census.)
3. FELDSTEIN, MARTIN S. "Economic Analysis for Health Service Efficiency: Econometric Studies of the British National Health Service." Unpublished Ph.D. dissertation, Oxford University, May, 1966. (Mimeographed.) (Martin Feldstein controlled for case mix in a sample of English hospitals and found that size had no significant influence on cost per case. He excluded small hospitals and larger teaching hospitals from his sample. This work includes a lengthy bibliography of European studies. For a description of his case-mix variable see his "Hospital Cost Variation and Case Mix Differences," *Medical Care*, April-June, 1965.)
4. FELDSTEIN, PAUL J. *An Empirical Investigation of the Marginal Cost of Hospital Services*. ("Graduate Program in Hospital Administration Research Series." University of Chicago, Chicago, 1961.) (In this early study of 60 hospitals Feldstein found evidence for economies of scale.)
5. FITZPATRICK, THOMAS, GOTTLIEB, SYMOND, and WIRICK, GROVER. "The Nature of Hospital Costs." Unpublished manuscript, University of Michigan Program in Hospital Administration, Ann Arbor, 1964. (With a sample of 30 Buffalo hospitals using multiple-regression techniques and controlling for various factors, they found evidence for economies of scale.)
6. INGBAR, MARY LEE. "Statistical Study of Differences in Hospital Costs." Harvard University, 1965. (Mimeographed.) (With a sample of 72 Massachusetts hospitals controlling for various factors, such as radiological, surgical, educational, and ambulatory activities, Ingar found that size had no significant effect on per unit costs.)
7. INGBAR, MARY LEE, WHITNEY, BARBARA J., and TAYLOR, LESTER D. "Differences in the Costs of Nursing Service: A Statistical Study of Community Hospitals in Massachusetts." *American Journal of Public Health*, LVI, No. 10 (October, 1966), 1699-1715. (They conclude that variations in hospital size do not explain differences in nursing costs per available bed day.)

² By economies of scale we mean that cost per patient day or cost per case declines with size. By diseconomies of scale we mean that these per unit costs increase with size. None of these brief descriptions can do justice to these studies and the interested reader is urged to refer to the original documents. In fairness, it should be noted that these researchers have tackled an exceedingly difficult problem with many pitfalls. Their attempts at solutions are often ingenious. Faced with almost insurmountable problems and their use of different techniques, it should not be too surprising that their findings differ.