THE RICE INSTITUTE

THE NURSING UNIT OF
THE GENERAL HOSPITAL

by

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# THE NURSING UNIT OF THE GENERAL HOSPITAL

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THE NURSING UNIT OF THE GENERAL HOSPITAL

PREFACE

The subject of this thesis is a presentation of research into the basic factors influencing the design of the nursing unit of the general hospital, and a study of the various components of the nursing unit. Conclusions have been set forth in general terms in the text and as diagramatic proposals and thus are adaptable to any particular design problem.

The material is based on library reference, interviews, and field studies in the Hermann Hospital, Methodist Hospital, and St. Luke's Episcopal Hospital, the three general hospitals of the Texas Medical Centre, Houston, Texas.

It is to be hoped that this thesis can be used as a methodological guide as to how all sections of the general hospital should be studied in order to understand and solve their special problems.

I have tried to avoid the illustration of nursing unit plans throughout the thesis because I feel that widespread publication of hospital plans and stock plans, although having illustrational value, have too often served as a tracing plate to the architect. This eclecticism has hindered progressive work in hospital design by the transplanting of hospital plans from one region to another without regard to orientation, topography, amenities, or actual needs. Stock plates retard hospital architecture,
and progressive research and advancement are strangled. Every new hospital, nursing unit, or even utility room must be looked upon as an individual project for a particular community, particular site, and particular problem. A hospital guide published recently that realizes this problem in the presentation of its material is A Guide to Hospital Building in Ontario.¹

I have not presented a revolutionary new hospital configuration just for the sake of originality. I feel this type of approach many times retards hospital design rather than advancing it. To quote Isadore Rosenfield, an American hospital consultant:²

"I have no ambition to create the spherical hospital, the cylindrical, spiral or diagonal hospital. The hospital architect's contribution is apt to be in new configurations of known forms rather than in the creation of new forms. The fact that the works of the great are usually small in magnitude and few in number and generally deal with well-known human problems such as the house, the hall, the workshop, shows how consuming creation is."

INTRODUCTION
Definitions

The word hospital encompasses a very large field and includes a great variety of types: General; Maternity; Eye, ear, nose, and throat; Diseases; Convalescent; Mental, and so forth. A hospital may be defined as an institution for the care of the sick and injured. Nursing care is the efficient, economical and amiable care of the patient, while hospitalization is the environmental provision for this nursing care.

To confine my thesis to the manageable boundaries of a single element in this vast field, I first narrowed the overall topic of hospital design to the most common form of hospitals today: The General Hospital; and from here, further defined my subject to the primary element of a general hospital: The Medical and Surgical Nursing Unit. The nursing unit is the starting point of the physical hospital design; the core of the hospital. It can be defined as that portion of the hospital where the patients are housed, fed, and attended to, plus the services and auxiliary areas which are necessary to expedite this nursing care. It is limited to a size that can be controlled by one group of nursing personnel. Everything within the unit must be designed for the welfare of the patient and the guide for the planning of the unit would be the medical requirements and programme of care. Throughout the nursing unit the comfort of the patient, efficiency
of operation, and economy of space are of primary importance.

Importance of Problem

Hospitals are the third largest welfare institutions in our country, exceeded only by schools and churches.¹ They have the welfare of our population in their hands and today are one of the outstanding building types requiring attention by the architectural profession. This attention must be immediate, for in our present time a hospital building boom is on and this boom will affect the quality of our hospitals for many years to come.

The nursing unit presents a series of problems that are quite different in their nature from those arising in other types of design problems. The differences result from the fact that accommodation must be provided for the treatment of a large number of heterogeneous human beings, under an infinite variety of conditions, both physical and mental, with each patient receiving one or more of a great number of varying treatments. Because of the complexity of the problem and the importance to keep abreast of all advances in medical and technical science, the problem of the design of a nursing unit is a team problem, with the leaders from the various branches affected contributing to the desired solution. This team should be composed of the administrator, doctor, nurse,

architect, engineer, and consultant. The hospital authorities must study and express themselves in all stages of the design and the architect and engineer must have a good understanding of the inner life of the nursing unit. This calls for personal field work.

Historical Consideration

The problem of hospitals is not a new one, for the recognition of the importance of medicine and nursing care dates back to the beginning of mankind. During the time of primitive man, this care was under the guidance of a group of respected men who, through the practice of supernatural arts and some logical thinking, cared for the health and well being of the members of their group. This can still be found today amongst the native tribes in isolated parts of our world.

The form of hospitals as we know them today can be said to have their beginning in the early Middle Ages when philanthropic individuals and religious orders began to set up small units for the care of the sick. ¹ A number of hospitals were built by the 15th century and by the time of the Renaissance many large and beautiful structures were erected, but there was little advancement in planning. ² As the number of patients increased the standards seemed to lower. Actually, the true renaissance of hos-

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HISTORIC STANDARD NURSING UNIT
BEDS PERPENDICULAR TO EXTERIOR WALL

NURSING UNIT - RIGS HOSPITAL
COPENHAGEN, DENMARK 1910
BEDS PARALLEL TO EXTERIOR WALL
CUBICLES, UTILITY RM., LARGE WINDOWS
pital design can be said to have arrived late in the 19th century. Since this date the progress in hospital design has been extremely rapid and I feel that the United States has done more for the advancement of hospital work with its progressive and leading building programmes than any other country. With the continued rapid advancement of medicine and surgery, hospital design must also keep up this pace in order to permit the application of these discoveries under the best possible conditions.

The nursing unit of today can almost be referred to as a small hospital in itself. This is a great step from the large open wards of the standard historical unit. In the open ward, the faults of cross infection, noise, lack of privacy, etc., are all immediately obvious to us. A major change in ward layout was introduced in 1910 by the Danes. This was at the Rigs Hospital in Copenhagen where the patients' beds were placed parallel to the outside wall in contrast to the traditional perpendicular position (see diagram 1). Today the nursing unit is composed of smaller, more personal wards and with continued medical advancement the auxiliary areas related to the ward are constantly expanding. The ideal size of these smaller wards, however, is still an important problem. We have gone beyond the medieval type of nursing unit and beyond the distortion of a unit to

fit a pre-conceived building form and are now producing the factorial type of unit which results after careful consideration of all the factors influencing its design.
FACTORS INFLUENCING THE DESIGN OF A NURSING UNIT

Social and Economic Factors

The neighborhood of the hospital has a definite influence on the design of a nursing unit. In the overall picture there is a difference in the social habits of various countries. This can be recognized by observing different customs and various types of home life; thus indicating that the national character should be reflected in the design of a nursing unit. While each country can gain by studying the characteristics and hospital methods in other parts of the world, it would be a mistake to try and find a common formula.

Similarly, within countries themselves there is a difference in the social aspect of various regions. The difference may be in economy, climate, ethnography, population trends, etc. Surveys must be made to establish this social picture before proceeding with the design. If the hospital is serving a general poor area, then an economical yet efficient form of hospitalization must be found - possibly a predominance of large wards; if serving a general rich area then possibly a predominance of private rooms. For nursing units in large civic hospitals, this is not so important, for the patients come from all parts of the city, although the particular neighborhood will still be felt and would certainly affect the outpatient department.

Today there are an increasing number of third party
organizations connected with hospitalization. They are such organizations as the government, labour groups, commercial insurance companies, Blue Cross, etc. These organizations became interested in a financial group plan in the late 1920's because the public could not afford the out-of-pocket cost of hospitalization, and more and more people were becoming patients in tax supported hospitals. Voluntary hospitals were going bankrupt even with the increasing number of people who required hospitalization. I feel in the future that this blanket prepaid hospitalization scheme will continue to take over the individual's financial connection with the hospital. The only danger with this is the dictatorial powers these organizations might have over the hospital, and the possible lowering of standards. This influence on nursing unit design can be felt today in many cases where hospital insurance groups have indirectly influenced hospitals to build largely two bed wards because the premium service that hospital insurance provides is for this unit. If their influence is always for the best then all is well and good, but we must guard against another strangle hold on progressive nursing unit design. Private competition is still required between hospitals to increase the efficiency and standards in the nursing units, but socialization is needed for expensive or special equipment and treat-

ment, and for progressive research in the large medical field. Socialization and free enterprise can and must work together for the health of the people.

We are today in an era when building costs are extremely high and there is strong temptation to lower the standards of planning in the interest of an assumed economy. We must constantly remind ourselves of the underlying principles of hospital planning and not be led astray by this false standard.

Hospital economy must be considered in the true sense of combining both initial construction costs and operating costs. It is completely wrong to divide the initial building cost from the operating or maintenance cost, and put such emphasis on this first figure as so many hospital committees do when estimates are higher than funds available. Economy in operation is by far more important in the long run than economy in construction. Certainly, the actual construction cost is of great importance to the building committee, but in a theoretical approach to nursing unit design, the mere construction cost cannot be accepted as the ruling factor. The main difference between the two costs is the type of budget available for each; an ordinary budget for operating and an extraordinary budget for building. The extraordinary budget is always the hardest to balance.

In the United States, forty percent of a building's costs remain as operating costs each year after the hos-
pital is built. In Sweden, a hospital that costs £5,000,000 to build has an annual operating cost of £1,000,000. Taking a mean between these two figures shows us that the operating cost of a hospital will equal the initial cost in about four years. It is quite evident that the problem of economy in the nursing unit lies in its practical design to cut this operating expense. It must be remembered that funds for hospital construction and hospital care will always be inadequate and the need for more hospital beds will never be filled. It is up to the architect as a member of the design team to present the best building available under limits of a reasonable economic minimum, and not to try to achieve an impossible number of beds for a cost that would sacrifice medical care in operation. From the planning and construction point of view, this means that there is no place for anything which is not strictly necessary for the proper function of the nursing unit if the maximum number of beds is to be obtained with the money available. One must remember, however, not to sacrifice the human element of hospital care.

Generally, a compact nursing unit is the cheapest to build and to operate, but extreme compactness and simplicity of design which disregard the demands of the

DIAGRAM 2.

HOSPITAL A.

- SALARIES: 61.7
- SUPPLIES & OTHER EXPENSES: 33.6
- DEPRECIATION: 4.7

HOSPITAL B.

- SALARIES: 59.4
- SUPPLIES & OTHER EXPENSES: 35.8
- DEPRECIATION: 4.8

HOSPITAL C.

- SALARIES: 59.0
- SUPPLIES & OTHER EXPENSES: 33.0
- DEPRECIATION: 8.0

COMPARISON OF SALARIES TO OTHER OVERHEAD EXPENSES
varied functions, ultimately defeat their own ends. When this minimum of elements is carried too far the nursing unit is forced to either live in a straightjacket or to expand after a few years of operation. The conditions of nursing must be carefully weighed when we have the economic utopia of having every cubic foot of construction give the maximum service. However, we must look at the design of the nursing unit as possibly more functional than any other kind of building unit. To quote Gustaf Birch-Lindgren, a leading Swedish hospital consultant

"Is it not in a way an injustice to humanity to deprive it of badly needed hospital beds by wasting money on architectural details which are not absolutely necessary? This close relation between the cost of the hospital building as a whole and the number of beds produced is generally not sufficiently observed, nor the fact that unnecessary space or decoration in the long run must affect the production of beds."

The largest part of the annual operating cost of a nursing unit is spent on employees salaries. This figure runs between 55 to 65% of the annual overhead. A comparison of the annual overhead expenses for the three general hospitals studied in my fieldwork can be seen in diagram 2. This clearly indicates the need for a unit which may reduce employee hours wherever practicable through better planning, labour saving devises, and the use of materials which will require a minimum of maintenance.

It is economical to spend $250 per bed for any item that saves the nurse one trip per bed per day figuring on a ten year amortization for equipment.\(^1\) This shows that certain facilities such as sinks, toilets, bed pan washers, etc., should be installed close to the beds (see diagram 21). Repeating facilities for fewer than four beds will not measurably increase the efficiency, except if these beds were in single rooms, as there is no further saving in travel distance. Based on the assumption that a nurse travels 3 feet per second\(^2\), every extra foot that she must travel costs the hospital about .016 cents.\(^3\) If, through proper planning, you can save one minute on a nursing routine that is performed daily on every patient the total annual saving is 6.1 hours per bed or approximately $100 per bed per 10 year amortization period. To be truly economical, however, this time saving must allow the nurse to give better nursing care or allow for a reduction in staff. Studies of all employees' movement in the nursing unit should be made in order to arrive at the most efficient plan.

It is often asked, "What is the best or the least expensive nursing unit?" This is impossible to answer for the least expensive to build would be one ward housing

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2. Ibid.
3. This figure is based on the salary of a registered nurse for Hospital B. $260 to $290 a month with 40 hr. week.
all patients plus a minimum of communal services; and
the most expensive to build would be separate rooms for
each patient plus individual services. The one room of
course would be contrary to good hygienic nursing and to
the welfare of the patient, and separate rooms for every
patient would be too expensive to achieve in our present
state of culture and economy. The costs of operation
are not as far apart as it may first seem, however, for
the inconvenience of the initial solution would raise
the operating cost and the convenience of the sub-utili-
ties in the second solution would lower the operating
cost. The answer lies in a compromise between the two
depending on the type of nursing unit and the community
it is serving. The cost of the nursing unit will vary
almost directly in proportion to the distribution of beds
by the type of accommodation, thus this division must be
given close study.

Functional Factors

Relation to General Plan of Hospital

The general hospital is an organic unit which can-
ot properly function unless all its departments perform
in harmony. This unity must prevail at all times even
though the specialized character of the various depart-
ments readily suggests the splitting of the hospital into
many different parts.

The nursing unit is the key to this group for it is
DIAGRAM 3.

RELATION OF NURSING UNIT TO GENERAL HOSPITAL
the home of the patient and is where he spends almost 100% of his time receiving nursing care. It is the main element which all other parts of the hospital ultimately serve (see diagram 3). It can be noted in studying the plans of various hospitals, that the marked difference between them is the location of the nursing units in relation to each other and to the other elements of the hospital.

The functional factors such as orientation, size, economy, use, etc., must be considered first for all elements of the hospital, and these factors must be respected as close as possible in designing the physical form to house them. However, the architect must realize the complex problem of combining these forms into a practical building group or unit. It is not possible to achieve complete perfection in every department but a certain compromise must exist in order of department priority, the top being the nursing unit. Danger must be recognized in carrying any compromise beyond a minimum level, for if emphasis is laid too heavily on one element, the resulting hospital may be ideal in only one section and not be satisfactory as a complete efficient building. This by no way suggests a defeatist attitude on behalf of the architect but instead presents a great challenge to him in putting his professional skill to work in order to arrive at the best possible solution. Every department head must co-operate to his utmost in the various depart-
ment decisions to preserve the total welfare of the hospital.

To maintain a working relation between the nursing unit and the hospital, the internal circulation of the nursing unit must continue on and link efficiently with the circulation of other units and with the overall circulation pattern of the general hospital. A minimum of travel is desirable and cross circulation must be avoided at all times. The random placing of departments throughout the hospital will result in bottlenecks in the flow of traffic. Direct patient circulation is required from the nursing unit to the operating suite, the x-ray department, and diagnostic department; and direct mechanical circulation is equally required from the unit to the pharmacy, central supplies, kitchen, and records. An articulated plan for a general hospital may look fine in the drawing state but great care must be taken that circulation does not become indirect and tediously long, while on the other hand a compact plan must be checked against complete entanglement of circulation.

Time-Motion Studies

As previously shown, the main cost of nursing unit operation consists of salaries, thus every effort must be made to reduce working hours or increase the efficiency per working hour. The time the nurse is away from the actual performance of duties, such as preparing medicine, administering aid, or encouraging the patients'
MOTION DIAGRAM
MEDICINE NURSE  8 HR SHIFT.
NURSES' STATION TO MEDICINE CABINET
NURSING UNIT C

SCALE
0 5 10 FEET

NO. TRIPS
0 30 60
morale, is completely wasted. Therefore, such items as travelling must be cut to a minimum, for it not only consumes professional time but reduces efficiency by tiring the nurse. The greatest saving can be effected on routines that are repeated with the most frequency (see diagram 4).

Until recent years, the architect has had to rely on past experience, opinions, and guesswork to plan the nursing unit. Opinions of the nursing unit staff are often misleading and the staff will tend to overemphasize their particular role and the importance of certain duties. To correct this uncertainty of a basis on which to plan, time and motion studies of the nursing unit can be a valuable factor in determining the final design. A sound basis can be established to provide a source of information. It is difficult to obtain an absolute time-motion study of nursing procedure for, unlike factory assembly lines where the same functions are repeated over and over again, the nurse's routine is constantly changing to meet her patients' demands. One study will not suffice but studies over a longer period would give the architect a sound reliable mean on which to base his conclusions. This extended recording period must be mandatory for all time and motion studies.

The studies can be divided into two sections, one to determine the best relation of the nursing unit elements and the other to determine the shape of these ele-
ments and their particular equipment arrangement (see diagrams 13 and 16). It is not important to know what the nursing duties are, for the architect must assume that all duties are for the benefit of the patient, but it is important to know how and where they are performed. The architect is only concerned with motion and not what takes place when the subject is at rest. The studies will show the value of having critically ill patients concentrated in one area and near the nursing station and utility room (see diagram 19). Efficiency is lost when these patients are spread throughout the unit.

Time and motion studies are also recommended after the nursing unit has been built and in operation for a year or so. A time-motion picture of that particular plan can then be seen and all jobs should be studied to determine whether an additional improvement in planning could effect a sufficient saving to justify the added cost necessary to make the physical change.

General Sizes and Areas

The following are the principal elements which comprise the size and mass of a nursing unit.¹

(1) proportion of private, semi-private, and ward beds
(2) space allowances for each patient
(3) number and size of auxiliary areas
(4) size of corridors

¹. cf. S. S. Goldwater, On Hospitals, p. 244.
Rules cannot be set as to the exact area or cubic content of a nursing unit. In practice it will depend upon climate, topography, orientation, etc., and the shape of the unit will vary in respect to the particular job. In cities, the multi-story block will usually offer better conditions for the patients and, in the case of additions to existing hospitals, the available land and orientation to these existing buildings will influence the shape. With the multi-story hospital, the outline of the vertical block is determined by the size and shape of the typical nursing floor. The size also depends on the condition of the patients, the length of patients’ stay, and the number of patients that can be assigned to each head nurse. Chronic cases require a much smaller proportion of services than acute cases. With the continual forward strides of medicine these relations are continuously changing. The exceedingly long patient stays of twenty years ago have now been cut down to approximately 8.3 days.¹

However, some reasonable standards for the nursing unit form will have to be established in the future after organized and continuous research by study teams. The criteria must not just establish one set unit that would not allow for variation or flexibility and thus become stagnant. There must be a reasonable range and the pros

¹ Hospitals, Administrators Guide Issue, vol. 29, p. 7. 8.3 is average for 1954 for a 300-499 bed hospital with 77.7% occupancy.
DIAGRAM 5.

DIAGRAM SHOWING VARIATION IN NURSING UNIT SHAPES
and cons of each variation carefully weighed by the architect in relation to his particular problem. This research must be continuously progressive in order not to destroy its own purpose.

This has already had its start in England in the research by the Nuffield Provincial Hospitals Trust. In the United States and Canada, the method to date has been to try all shapes, for one of them might be right. There have been square units, circular units, semi-circular units, double corridor, single corridor, V-shape, U-shape, T-shape, *ad infinitum* (see diagram 5). To force a plan into an original shape for the sake or originality of contemporary structure would be as wrong as forcing it into an ill-shaped neo-classic form.

These variations of form have certainly produced an interesting and abundant variety but this hit and miss method does not seem practical and today there is a definite need for detailed research into the problem. The private architect in practice is unable to do it. It is the responsibility of the government or hospital groups to develop a complete research programme and make the conclusions available to hospital authorities and architects. This research might possibly be done in conjunction with architectural schools throughout the country.

There is much to learn from a comparative analysis

of the existing hospitals in arriving at an acceptable size. In a comparison of relative areas, the services and circulation elements must be brought to a common relation.\(^1\) This area analysis should be done by the architect at the preliminary planning state and not after working drawings have started. It is imperative in hospital planning that a complete programme be drawn up before any working drawings are prepared. It will be well worth the time, for it only takes a few seconds to make a change but a few weeks to correct it in the working drawing because of the close interrelation of each section.

The 30 bed nursing unit is a historical development which has grown from nursing experience and not just an architect's idea.\(^2\) When units are divided according to type of accommodation it is common to have 20 bed units composed of single rooms, 20-30 bed units of two bed wards and 35 bed units of multi-bed wards. For comparison, in France the standard unit is 22 beds, in the United States 25-35 beds, and Finland 37 beds.\(^3\) The 30 bed unit is an attempt to solve the problem of the best size from the point of view of nursing and from the point of view of administration. It is a little too small for efficient administration and a little too large for nursing. However, with a rotating patient plan this size, with flexibility of ex-

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1. See below, Conclusions, p. 105.
4. See below, Conclusions, p. 105.
would be adequate

pension in time of emergency, for the requirements of nursing.

One solution that has been put forth is to develop a smaller nursing unit and group several of these into a larger administrative group. However, too many units will lead to poor supervision. It would be difficult to fill all the stations with head nurses capable of this extra responsibility above the normal call of duty, especially considering our constant shortage of nurses. A certain mediocrity of supervision would develop. For example, if a 280 bed hospital was divided into 20 bed units, then 14 head nurses would be required. It would be difficult to fill these 14 supervising positions for all shifts, however, with 35 bed units only 8 head nurses are required. It would be better to have the best nurses with supervisory qualities in key positions and increase the size of the unit. The limitation of the size of the unit, however, would depend on the number of staff that the head nurse could supervise.

No matter what the size of the unit is, there is a limit to the number of patients a registered nurse can handle. This means that for a larger unit, areas such as the nursing station will be made larger to look after this extra staff. Over the years the ratio of nursing hours per patient per 24 hours has averaged 4.2 hours. For every 30 patients, 15 nurses are needed over a 24 hour

2. Rochester Regional Hospital Council, Average Nursing Hours per Patient in Member Hospitals, p. 3, 1952.
A trend in nursing today is what is known as team-nursing. The teams are controlled by a professional nurse and come under the overall supervision of the head nurse. Care must be taken, however, that there is no lack of individual personal contact between the nurse and patient.

There is an argument today that the smaller the nursing unit the higher the quality of the nursing service. Actually, the size of the nursing unit has nothing to do with the quality of nursing. The patient in a small unit can be neglected just as easy by sub-standard nursing as in a large unit if the nurse-patient ratio is the same. This quality of nursing cannot be considered in the design of the unit for the architect must assume an equal standard of patient nursing performed by each professional nurse. If 5 nurses have an efficiency of 5e then 7 nurses have an efficiency of 7e. Therefore, the reduction of wasted time and motion are the primary considerations in determining the ultimate size.

Relation of Areas

Orientation is one of the major factors in the relation of areas. Favourable orientation has high hygienic value and should be a fundamental element in locating patients' rooms. The nursing unit should be oriented so

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1. In reference to nursing hours per patient in the general hospitals at the Texas Medical Centre: Hospital A—4.8 hrs - Hospital B—3.5 hrs - Hospital C—4.7 hrs
DIAGRAM 6

A.M.  NOON  P.M.
SHADOW DIAGRAM OF VARIOUS NURSING UNIT SHAPES
that the patients' rooms receive the sunlight, summer breezes, a protected exposure and attractive view.\(^1\)

This orientation of course will depend on regional factors. The importance of view for therapeutic value cannot be underestimated, in fact, in certain regions the location of rooms to take advantage of a pleasant view is better than the location for ideal sunshine.

Orientation of the nursing unit should be checked with respect to other buildings. Noisy or unpleasant activities should not be opposite a patient's window. A shadow study of the other buildings in the group should be carried out to see if the chosen orientation is not one which would place the exterior wall of the patient's room in shadow for most of the day (see diagram 6).

Certain factors pertaining to orientation are of questionable value for the critically ill. It is not until after the patient is out of any crisis does he start to recognize or have use for the amenities around him. Certainly large glass windows and bright light are the last thing he needs. The recommended environment for a critically ill patient is a quiet, restful area.

Besides striving for perfection in each separate element of the nursing unit, these elements should be related to each other so as to be most convenient for the staff, to eliminate unnecessary effort in the care of the

\(^1\) cf. Skidmore, Owings and Merrill, "Hospitals", *Architectural Forum*, vol. 96, p. 122, April 1952.
RELATION OF NURSING UNIT ELEMENTS TO PATIENTS BEDROOMS
patients, and to provide adequate supervision (see dia
gram 7). There must be no waste space in accomplishing
this, and the elements must be able to function without
outside interference. As shown in the time-motion studies,
compactness is important; there should be the shortest
practicable distance between the bed and related auxiliary areas, especially the sink, toilet and bed-pan unit. Some functional elements must be considered as being
used communally, such as the solarium, while others pri-
vately, such as the toilet. The relation of these areas
is one of the main factors controlling the economy of
operation. A significant contrast between various hospi-
tals is in the way interdependent departments are con-
veniently or inconveniently grouped.

Elements that group themselves around the nurses
station are the medicine room, utility room, treatment
room, doctors' office, and nurses' lounge. The nurses
station should be the centre of the nursing unit and have
closer relation to the critically ill than those patients
who are partially able to look after themselves. It
should have control over all corridors and also the stairs,
elevators, and the waiting room where visitors enter the
unit. The waiting room is best located adjacent to the
elevators.

If possible, the nurses lounge should be adjacent
to the nurses station and not off the hall. One of the
most important functions of the lounge is to give a needed
5 minute break to a nurse handling a difficult case when the patient's relatives are usually on the scene. It is impossible to explain to certain people the need of this break and the relatives resent seeing the nurse go into the lounge when their next-of-kin is lying critically ill. They do not understand how this needed 5 minute break will raise the efficiency of her nursing for the remainder of her shift.

The treatment room should be close to the utility room in order to shorten the transporting of any supplies. The clean and dirty utility sections should be related in the same area of the plan but separated by a partition for the sake of sanitation.

In relating these different elements the individual character of each must be recognized and the relation of each must not be carried to the extent of having dissimilar functions in the same room. However, such items as a medicine room could be merely an alcove off the nurses station. In this close relation of rooms the noise factor of each should be recognized and those with undesirable qualities that must be placed near the patient for convenience should be controlled by acoustic treatment. Noise is harmful to the patient's nervous system. Three ways to correct this noise disturbance is by absorbing it, isolating it, or diminishing the sound at the source.

It is the relation of areas within the nurses unit that determines the ultimate form of the unit. The same
principles of interrelation being used as for the design of the whole hospital. The relation of rooms should dictate the form; not the form dictate the relation of the rooms. Symmetry is not in itself essential in nursing unit design, but the convenient placing of the service units in the centre and patients' rooms on either side or around them, to cut down circulation, usually results in a symmetry of design. There should be a standard plan of equipment arrangement for every unit so a master plan of the entire nursing block can be made. This would save many hours wasted by new employees until they become familiar with the plan and equipment of the unit.

Circulation

The inner circulation of the nursing unit demands close study to obtain adequate separation where required and freedom of cross circulation in critical areas. The circulation must take care of both staff and services. The unity and economy of the unit are dependent on the routes of interior circulation. The shorter the circulation the better in respect to economy but if the corridors are reduced to a minimum then there is almost of necessity cross circulation through one area to reach another. In my opinion an example of this appears in the research plan put out by the Nuffield Provincial Hospitals Trust where actually part of the bedroom becomes

1. See above, page 15.
DIAGRAM 8

SEGREGATION OF ELEVATOR TRAFFIC

SCALE

0 5 10 FEET
corridor, which could cause disturbance to the patients who require rest.\textsuperscript{1} There should be only as much corridor area that is necessary for direct and efficient circulation and transportation of items such as carts, stretchers, and beds.

Visitor circulation from the elevator to waiting room should be away from the nursing corridor, and the patients' service elevator should be separate from public elevators (see diagram 8). Items such as bedpans must be separated from items such as foodtrays. As shown in previous sections the interior circulation of the nursing unit should tie in smoothly with the general hospital circulation so there is not a bottleneck at the unit's perimeter.

In some plans the working or nursing corridor serving the bedrooms is in the centre of the unit and separate from the two visitors' corridors running along the other sides of the bedrooms. This develops fine separation but the amount of added corridor to build, maintain, and control must be taken into consideration before accepting this. This is especially true when the only traffic using these two extra corridors is concentrated at a time of day when the main nursing corridor is comparatively free.

Circulation should be under the control or supervision of the head nurse and the planner must first consider the protection of the patient at all times. Indirect and uncontrolled traffic will disturb the patient and cause

\textsuperscript{1} Nuffield Provincial Hospitals Trust, \textit{Studies in the Function and Design of Hospitals}, p. 20.
RELATION OF NURSES’ STATION TO VERTICAL TRANSPORTATION
confused and inefficient care. Unwanted traffic will involve risk of contamination and hinder hygienic routine that is the key to healthy care. Cross infection through poor circulation must never even come close to occurring.

Mechanical aids can be of immeasurable help in unit circulation. Lifts or pneumatic tubes can afford the required direct circulation from the central supplies and pharmacy without any exterior interference. The location of such lifts should be placed so they can be easily reached, possibly in the utility room directly off the nurses' station or in a connecting wall. The circulation lifts in the nursing units under study were poorly located (see diagram 9). In Hospital B the nurse had to travel from the nurses station, across and partially down a hall and through the utility room to reach the lift whose buzzer was continuously making a noise that must have been disturbing to any adjacent critically ill patient. In Hospital C the lift was so far from the nurses' station that it was outside of the unit and completely useless as a convenience, and in Hospital A it was left out. Aids such as the electric eye can be used effectively for opening doors while moving beds, wheelchairs, and portable equipment, and even to help patients on crutches or aides carrying trays.

Communications

The economical saving of repetitive or needless
nurses' trips justifies the use of any communication system in the nursing unit. It will assist the nurse in caring for more patients without reducing the quality of nursing. The standard system has been the patient-nurse light system. This is being rapidly replaced by the patient-nurse vocal system. The vocal system enables the nurse to check what the patient wants without a needless trip. If anything is required, the nurse may pick it up on the way to the patient's room without backtracking. To speak to the nurse the patient does not have to move his head and the nurse can hear a quiet whisper. The ceiling mounted speaker above the bed functions much better than the wall-hung type. The receiver at the nurses' station should have a monophone receiver the same as a telephone. This permits private conversation with the patient to save him embarrassment and eliminates the noise factor of the nurse calling into the speaker box. The patient should always have the system thoroughly explained to him on his arrival to prevent any fear that may arise when he suddenly hears an unknown and sourceless voice.

Each patient's bed must be equipped with an emergency signal that will flash red outside his room and at the nurses' station. There should also be an emergency signal in his bathroom in case of trouble. The emergency light must only be extinguishable by a nurse going into the room.

Telephone, radio, and television service should be available in all patient areas. Telephone service however
should be controlled by the nurses station to prevent any disturbance of the patient. Telephone communication must be maintained from the nurses station to all parts of the general hospital. Communication between the nurses station and medical records can now be handled very efficiently by the installation of a pneumatic tube system. Tubes up to \( \frac{3}{4}'' \times 1\frac{1}{2}'' \) can very easily be used. The time of record communication is cut to a few seconds and the personnel previously required for this duty can now be used in a more profitable way.

I believe the next major improvement in nursing unit communication will be in connection with television. In the near future the nurse will have visual as well as audible control over the patient's room. When the patient calls the nurse, the latter will be able to see and hear what the trouble is. For patients required to lie absolutely still the nurse will be able to check through the screen to see if the patient is moving or in danger of falling out of bed. This will help to allay the constant fears the nurse has when she is not in the room with the patient. At present various systems of wiring the bed are being devised to check on this undesired movement of the patient.

There is still the problem of doctor communication. The standard visual flashers have the disadvantage of not always being seen, especially when the doctor is working.

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1. This size is presently installed in M. D. Anderson Hospital and Tumor Institute, Texas Medical Centre.
for a length of time in an area where there is not a flasher. The traditional gongs or loudspeakers cause certain annoyance to the patients and I am sure over the years an undesirable psychological effect on the nursing staff. A unit must be developed where the telephone operator can call the doctor without disturbing anyone else. A system has been developed which I feel might be the answer to this. The equipment consists of a small receiver which the doctor carries and this is tuned into a radio circuit originating at the switchboard. The doctor would pick up the receiver at his call box upon entering the hospital. The main drawback for present use of course, is the expense, but with future development this will be greatly reduced the same as television. Two main faults I can see are, the need for the doctor to pass one particular spot on entering or leaving the hospital, and the possibility that the absent minded doctor will carry his receiver home.

Flexibility

The hospital that is continually growing shows the signs of a good hospital. With the continuous development in thinking, philosophy, technique, and demands, and the changing economic and social standards, it is impossible to design a perfect plan for future needs. The designer can only do his utmost in estimating the future

medical requirements and plan with flexibility in mind. Hospitals built today will be standing for many years and must lend themselves to changes or rapidly become obsolete. The rate of change and obsolescence in hospitals is matched somewhat by the rate of change in transportation. Examples can be found everywhere and the end is not in sight.

Obsolescence is one of the worst factors that can befall a nursing unit and it may destroy an otherwise structurally sound building. The plan of an area may have to be completely changed by the invention of new and better equipment. With this new equipment the established plan of an area is thrown completely out of balance. These changes become very difficult when you are dealing with materials such as steel, concrete and masonry.

A way of defeating this obsolescence must be found. Flexibility of design is the answer. The exterior shell or structure of the building is usually adequate; it is the interior areas and fenestration which become obsolete. A structural system that will permit maximum flexibility without imposing demands on today's functional needs is required. By using our present building materials to better advantage and encouraging the development of new products, we may develop a number of different structural

arrangements for the flexible nursing unit. For complete horizontal flexibility, a clear span from wall to wall, leaving the floor free from structural supports appears the best. Long span trusses might supply this answer. However, such items as stairs, elevators and lavatory plumbing give rigid inflexible points in this area. It would be best then to keep the stairs and elevators outside of this free area where possible. Pneumatic tubes would be far superior for handling pharmacy supplies than the rigid vertical dumb-waiter.

A good way to divide this free space would be by using prefabricated partitions. Partitions that can afford the same characteristics or better than traditional masonry walls and still have the advantage of being able to be moved in order to re-subdivide space with a minimum of noise, debris, confusion, and time. Here the metal partition has great merit and should be used more in hospitals. The main item that must be checked is the acoustic rating of these partitions. This problem can be handled by acoustic cores in the panelling but should be mechanically tested before application on the job. Psychologically the metal surface has a cold, institutional appearance but this can be remedied with colour, pattern, and fine texture.

Flexibility of the bedrooms is essential in a hospital. First, a certain basic number of medical and surgical beds, and single, double, or multiple rooms should
DIAGRAM 10.

4 BED WARD

2 DOUBLES

1 DOUBLE - 1 SINGLE

2 SINGLES

SCHEMATIC DIAGRAM SHOWING FLEXIBLE PATIENT'S ROOMS

SCALE: 1 5 10 FEET
be established according to prevailing social, economic, and medical factors. This cannot remain rigid but must have seasonal and preferential flexibility, and in addition, be able to fill the nursing unit to the absolute maximum. Through this flexibility, provision must be made to give the correct environment and special care for the critically ill, or correct surroundings and atmosphere for the improving convalescent patient and patients who are possibly only taking diagnostic tests. In these cases the folding partition has great merit. It is especially useful in dividing a semi-private ward into two private rooms, or a 4-bed ward into a semi-private and private room (see diagram 10).

Areas which receive heavy traffic will be in the need of re-surfacing after a number of years. The floor surface especially will receive heavy duty. Here, it is an advantage to have a flexible applied floor finish that can readily be changed rather than an integral finish that will be difficult to re-surface. The choice of this applied finish will also depend on other factors such as acoustics, appearance and economy.

Generous provision for future additions to circuits, vents, equipment, etc., should be made in the original plan, although to lay out mechanical services based on future needs is also practically impossible. Accessibility to the immediate system is imperative. Even if there is not to be a change, all mechanical systems have a
limited period of efficient operation after which there is the problem of maintenance and replacement. If services are grouped and located behind accessible and removable panels then this task is made much easier. Electric conduits, plumbing, oxygen and vacuum piping can all be handled in the thickness of a partition and be made readily accessible in this manner. The plan must be able to accommodate such innovations as the previously mentioned television ward control from the nurses' station.

Taking in the overall hospital plan, the nursing unit area must be designed for the easy and convenient expansion of a new nursing unit. This expansion must fit into the established working procedure without interruption and undue hardship on the present patients. Vertical and horizontal expansion are the two alternatives so structural allowances for the proposed method must be made.

Staff Training Programme

In order to fill the need for doctors and nurses which now exists in the medical profession, it is desirable to include a medical and nursing training programme in the nursing unit. Certain areas will have to be expanded in order to accommodate the extra student personnel.

The nurses' station will have to be large enough to allow for students to study patient charts without interfering with the registered nurse on duty. Such areas
as the medicine room and treatment room must be able to accommodate observation and training by the students, while personal rooms like the lounge must also be large enough for the extra influx.

For lectures, seminars, demonstrations, etc., it is advisable to have a room where the nurse and students can get away from the working area. It is not always convenient to go back to the main classrooms, so a section in the nursing unit should be set aside. This can very easily be accommodated in a multipurpose room which could also be used by the doctors and for conferences.¹ Certain required training aids should be stored in this room.

When planning the patient area this extra influx of interns and student nurses must be kept in mind. However, the main ward education of the student is by practical experience when he or she is assuming a position as one of the staff. Although the nursing unit is thus utilized for the training of students, this must not in any way interfere with the care and welfare of the patient.

Safety

The nursing unit has a greater safety responsibility than other types of buildings, or zones within buildings, in that the majority of its inhabitants are unable to save themselves in case of fire. The time of emergency evacuation is much longer, therefore, the protection against the outbreak and spreading of fire must be doubly investi-

¹ See below, Office and Seminar Room, p. 76.
gated and provided for by the planners.

Any outset of a fire must be quickly found and extinguished with convenient equipment. This fire fighting equipment must be of adequate size and number, and must be periodically checked by a member of the maintenance crew. The danger of fire spreading must also be reduced with proper planning, fire resistant construction, and horizontal and vertical fire doors. Every change or revision that is added to the nursing unit, once it is in use, must be closely checked for possible violation of the local fire codes. With fireproof construction and adequate protection against smoke and panic hazards, the fire danger of multi-story hospitals has been greatly reduced but the threat is always with us. An incident rate of fires in hospitals and similar institutions in the United States is about 1 a day.¹

Every nursing unit should have four types of fire protection inherent in the construction:

(1.) Automatic sprinkler system, especially in areas considered as hazards. Automatic sprinklers go into operation when the temperature at that point reaches a certain intensity. The initial expense of their installation is offset over the years by their effect on lowering insurance rates.

(2.) Enclosed vertical openings and horizontal

¹ Public Health Service, Design and Construction of General Hospitals, p. 94.
firedoors. Elevators, stairwells, dumbwaiters, ducts, chutes, etc., should be enclosed in fire resistant material as recommended by the local fire code. Horizontal fire doors should be used to help contain the fire in one area. If there are two nursing units on one floor then there should be provision to divide them by a fire door or if there is just one unit per floor, it should be similarly divided within the unit. With this fireproof division, it is possible to move patients from the danger area to other sections of the hospital when the fire is confined and not likely to spread. This has a great advantage in a hospital building, for it would cause great harm to move the more critically ill patients out of the building.

(3.) Exits. There must be sufficient enclosed exit stairs to allow all occupants to leave the unit quickly, and the stairs should be located in a manner that they afford escape from all sections of the building. All exits must be sufficiently marked and the maximum distance from a given point to the nearest exit will be determined by the local code, a good minimum being 100'. All exit doors

should be wide enough to accommodate patients on stretchers or mattresses. The door must be a self closing unit of fire protection material and open out into the landing. Panic hardware should be used on all exit doors.

(4.) Alarm signals. There are several types of alarm signals. First, the automatic fire detection type, which may be a separate system or part of the sprinkler system. Areas which are not used at night or used for storage should have such an alarm which will operate when high temperatures close an electric circuit. Second, the manual alarm type, which includes a telephone and manual alarm box. The manual alarms should not be connected to a general alarm bell which merely spreads fear throughout the hospital and which may possibly cause panic, but instead, should be connected to the switchboard, key personnel, and fire department. The third type is the personnel alerting system. This is usually controlled by the switchboard operator and is arranged so that she may alert off-duty personnel on the premises and give the approximate location of the fire.

All hospitals must maintain an efficient evacuation plan in case of any emergency.¹ The staff should have

¹ For detailed information see: Walter Downey, "Don't Shout Fire", Modern Hospital, vol. 77, p. 70, September 1951.
periodic fire drills under the supervision of the fire marshal.

Mechanical Services

The types and details of the various mechanical services will not be discussed in detail in this thesis because the mechanical equipment of buildings with such specialized medical equipment is a field of study in itself. Studies and advances are continuously taking place through the efforts of progressive mechanical engineers. The architect must realize the importance of these services in the functioning of the nursing unit and provide adequate and convenient areas for their efficient use. Mechanical engineers must be consulted for every project. This consultation should start at the initial stages of planning in order to arrive at a superior and well integrated solution.

The atmosphere of a nursing unit must be carefully scrutinized because of the danger of cross infection. In certain sections of the country a completely artificially controlled atmosphere is preferred while in other sections only interior and special areas require air-conditioning. The decision will depend on local temperature and humidity ranges and the quality of the air. It is uneconomical to spend money on elaborate air-conditioning systems unless there is a true need for it and its continued use is assured.

It used to be the practice in air-conditioning of hospitals to use 100% fresh air, whereas today with proper filter precaution, 75% is recirculated air. This reduces the size of the plant, cost of operation, and improves the quality of air by recirculating air from the cooler and dryer area. Such rooms as the treatment room, however, need special care. Here there is a danger from heavy air contamination. This must not be allowed to filter into the corridor or other areas and fresh air must be mechanically introduced to this section.

Natural ventilation combined with artificial ventilation for service areas is a very economical and direct solution. If the hospital is outside a region of excessive humidity and heat, or unpleasant odours, there must be due consideration given before turning to a completely air-conditioned interior. With proper designing the patient can be protected from any danger of drafts when using natural ventilation. Opening sash should be located so there is no direct draft on the patient's bed. Personally, I feel that natural ventilation creates a much more agreeable atmosphere to live in than artificial ventilation. A breeze from the landscaped courtyard outside the patient's window can do wonders for his morale when he is confined to clinical surroundings.

Hot water heating has become the standard form of

1. interview; Mr. R. Virtue, Building Superintendent for St. Luke's and Methodist Hospitals. These percentages were stated as typical during the course of the interview.
hospital heating today. Filtered forced air is passed over hot or cold water pipes, depending on the season, and then circulated throughout the room. The traditional unit fits below the window stool but since the filters and mechanism should be checked every 2 or 3 weeks, the problem arises of disturbing the patient. In order to keep uninterrupted maintenance, a system has been devised where the unit is installed in the suspended ceiling above the bathroom and thus is accessible from the corridor without patient disturbance.¹ This is fine for moderate climates but in cold areas is not enough to combat the cold surface on the exterior wall. The temperature for wards should be uniform with the average temperature for American nursing units being between 72-78⁰, with 4 air changes per hour.² This can be compared to England where the average temperature is between 65-67⁰ and with 3 air changes per hour.³

Radiant panel heating seems to be the answer to overall heating but it is still expensive to install compared to the traditional radiator and limits the flexibility of the unit. The best location for the panels would be in the floor or ceiling, thus leaving the partitions free. The floor panel seems to be better from the patients' standpoint for it keeps his feet warm when he

1. Interview; Ibid.
2. Interview; Ibid.
is up walking and yet makes it a bit cooler at breathing level or bed level. A fault with radiant heat is the inability to quickly adjust to abrupt temperature changes. If the weather suddenly changes from cold to warm then there is a certain time lag after the system has been lowered before the warmed building material loses its radiant heat.
SPECIAL FACTORS RELATING TO WELFARE AND COMFORT

Patient

The problem of patient welfare and comfort must be met and solved with the same conscientious study as purely functional problems. Three aspects of the problem of patient welfare are patient segregation, psychological considerations, and aesthetic considerations.

It is impossible to find a universal formula for the problem of patient segregation. The number of single, double and ward bedrooms recommended by hospital boards is a ratio of $1/3$ single, $1/3$ double, and $1/3$ four bed wards, but this will definitely depend on the country, province and community. The number of single rooms is the most debatable item. They should be mandatory, first for all patients requiring single rooms because of the nature of their illness and second for all patients who wish to pay extra for such accommodation. The single room gives greater flexibility in segregation of patients in respect to sex, disease, age and compatibility but the higher costs and lack of supervision are arguments against it.

The lack of supervision and problem of adequate nursing care is a serious argument that must be investigated. With a large number of single rooms to serve, it has become extremely difficult for the regular nursing staff to adequately attend to the critical patients in

these separate rooms. Special staff has to be called in to nurse the critical cases. With four or five such cases it is impossible to find enough nurses to fill the positions, thus resulting in a lack of nursing for certain deserving patients. A hospital which places a critical patient in a single room without immediate and constant supervision is assuming a great responsibility and the patient left alone runs a serious risk. For example, in an annual report for one particular nursing unit, there were forty patients found out of bed, with injury resulting to fourteen of these patients. Another five patients were injured while in bed.\(^1\) With a multi-bed ward, at least there is the protection of another patient in the room to call the nurse in case of emergency. Some system must be arranged in the unit where critical patients have the constant attention, required services, and privacy, even with the continual nursing shortage. Any arrangement devised must help to improve the nursing care and shorten the period of treatment.

In a survey of the Mount Sinai Hospital in New York, 500 patients were examined over a period of four months to find out the number requiring single rooms because of medical reasons.\(^2\) Costs were not considered, only the needs or conditions of the patients. The criterion used was as follows:

\(^1\) Modern Hospital, vol. 66, p. 61, May 1946.
\(^2\) S. S. Goldwater, On Hospitals, p. 288.
1. dangerously sick cases or cases where death is imminent.

2. mental and nervous diseases: delirium, psychosis, neurosis, insomnia.

3. special diseases: Grave's disease, acute chorea, pneumonia, severe hemorrhage.

4. communicable or suspected contagious disease, typhoid, erysipelas, malaria, gonorrheal diseases, tuberculosis, exanthems.

5. foul dressing and discharge cases, lung abscess, colostomies, incontinence, diarrheas.

6. disciplinary cases: bad habits, prisoners.

7. social reason cases: unusual sensitivity.

8. cases of uncontrollable pain.

9. cases of concentrated treatment: tracheotomy.

10. so-called absolute quiet cases in which light, heat and sound stimuli should be controlled.

11. early post operatives.

It was found that 14.4% of the 500 patients required separate rooms because of medical reasons. However, 210 of the total examined were convalescent or chronic patients. Subtracting these, 25% of the active cases required separate rooms or a certain degree of privacy that the large ward could not offer. This figure of course fluctuates with various hospitals and at various times of the year in the same nursing unit. In a spot check with the three medical units of the general hospitals of the Texas Medical Centre it was found that 44% required privacy. This variation makes it practically impossible to estimate the

1. Ibid, p. 288.
number of single rooms required for a given period and shows the importance of flexibility in accommodation. Regardless of the overall division there must always be single rooms for the isolation of patients with contagious diseases and those in need of quiet surroundings. These rooms should be available for other patients when not being used for the specialized purpose. Actually, every patient's bed should be treated as a general isolated area to obtain maximum aseptic technique.

The number of private rooms desired by patients on paying extra money must be added to the number of rooms required for medical reasons. I believe this desire for private rooms is instigated by the effort to escape from the undesirable patients in a multi-bed ward. With segregation according to the pre-mentioned criterion this figure would decrease. A nicely designed multi-bed ward without the annoyance of undesirable patients could be of help in passing the boredom of hospitalization by affording various interests and company.

The segregation between medical and surgical nursing units is still desirable because of the variation in nursing duties. However, one section of a nursing unit or an entire unit should have the flexibility of nursing staff and equipment to handle either surgical or medical cases depending on the capacity of each section. Approximately 60% of the beds in the nursing unit of general hospitals should be assigned to a particular clinical service
while 40% should be planned so they can be used by the service which is overcrowded at that time. Occupancy studies have indicated that the bed division of the various clinics is approximately 40-50% surgical, 20-25% medical, with the remainder obstetrical, pediatric or miscellaneous.¹

Flexibility is also required in respect to segregation of sex. A bi-sexual nursing unit has the advantage of even reduction of the patient waiting list because of the easier redistribution of beds. This flexibility can be accomplished through room segregation or in a large hospital through unit segregation with one nursing unit assigned to take both male and female patients. Wards of more than four beds should be capable of division to provide for this segregation.

The personal welfare of the patient must be recognized in his hospital care. He will react in varying degrees to the aesthetic values of his surroundings. When an adult enters the hospital he finds himself in an unfamiliar situation and becomes very uncomfortable and insecure. There is a fear of what the future holds for him. Some people still cling to the old idea that to enter a hospital means the last step. The word hospital has a strong emotional impact on us today and when an adult becomes a patient he emotionally becomes a child.² This

¹ Public Health Service, Design and Construction of General Hospitals, p. 23.
emotional content must be nursed along with his physical illness.

The psychological aspect of patient segregation must be considered before deciding on room divisions. With a single room there is the tendency for loneliness to develop, especially with patients who do not have the added benefit of many visitors. A sick person enjoys a certain amount of company after he is over his critical state. However, to put him into a double room might cause the patient greater hardship in personal adjustment to his roommate. The coincidence of personality maladjustment between two persons is quite high while in the case of 3 patients there is the tendency of two patients becoming friends and leaving the third patient out of this circle. Thus for psychological standards the best number of patients in a room would be one when the patient is critically ill and four when he is recuperating.

Every effort must be made to put the patient's mind at rest and thus help him to become susceptible to the nursing care. The unfamiliar, cold, institutional atmosphere must be tempered with such elements as light, furnishings and colour. If the patient is from a good home then he should feel that the unit is of a high standard comparable to his home. If he is from a poor home then he should feel that the unit is something better than he had known before and something which he will leave.

with better ideas. Although familiarity with the patient's daily life must be maintained, this homeliness must not be overdone. I believe that the concept of a hotel-like hospital is wrong. Isadore Rosenfield brought forth a good point when he said "...that most of mankind is less concerned about recovering in luxury than it is about paying its bills. I am convinced that a choice between fancy rooms and the best diagnostic and therapeutic facilities should always be resolved in favor of the facilities." The nursing staff have a job to do and frills cannot be allowed to hinder them.

The aesthetic amenities should become an integral part of the physical design. Colour, when intelligently selected can help the physical and emotional comfort of the patient and add to the efficiency of the staff. A little extra thought in selection of the furniture will add much pleasure to its future use. Today, manufacturers have recognized the aesthetic value of hospital furniture and are producing a high standard to choose from. With contemporary mechanical equipment and smaller rooms there is no need today for the barn-like atmosphere of the older units but rooms scaled to the size of the human patient can give him a feeling of familiarity with his room at home.

The public relations of a hospital is determined by the patient's attitude towards his particular nursing

The patients usually criticize the things they can control in their daily lives; food, beverages, noise, sights, smells, and so forth. However, they do not criticize things they cannot control; good medical and surgical care. Therefore, to have good public relations, the nursing unit must maintain a high standard of the controllable elements.

Staff

With so much attention focused on the patient there is a tendency to overlook the welfare and comfort of the staff. This must be checked, for without adequate and efficient staff many of our other considerations are completely useless. The working area, besides being functional from the economic standpoint, must cater to the personal element of the employee. Such areas as the utility room should be inviting to work in. Here again, scale, light, furnishings and colour can play an important role.

Hospitals should be designed not only to facilitate nursing but to increase the recruitment of nurses. With the population increase of today the needed additions to the nursing staff is becoming critical. Everything must be done to make the conditions as attractive as possible to help influence the enrollment of new nurses. A nurses' lounge on each unit floor is a necessity. It provides lockers, a rest room, and a haven for the nurses. It also

gives the special nurse, when off duty for a short period, somewhere to go besides adding to the crowd at the nursing station. Such amenities increase the efficiency of the personnel and result in better nursing care for the patients.

Lockers and a lounge should also be provided for the cleaning and maintenance staff. This area, however, will not be included in the nursing unit but would be in a central location serving the entire hospital.

Where possible, windows should be included in work rooms. Although the majority of the staff spend their time on the move and thus obtain the benefit of the patients' windows, it is worth the extra cost to provide this added amenity and source of light.
COMPONENTS OF THE NURSING UNIT

Patient Rooms

There are three typical sizes of patient rooms: single, 2 bed and 4 bed. It has been found advisable through previously discussed factors to limit the multi-bed room to 4 beds. All single rooms should be planned so that two beds can be accommodated in an emergency. The room should be wide enough to allow for the length of the bed plus a screening curtain and aisle. Typical of the varying hospital standards are the widths given for such a room; 10'-0", 10'-6", 11'-6" to 12'-0" and from a minimum area of 100 sq. ft. to 175 sq. ft. The standard given by the American Institute of Architects is from 140 sq. ft. to 150 sq. ft.\(^1\)

I believe the criterion for the size of a patient room should be the easy adaption of the private room to a double room. This will allow for flexibility during periods of overcrowding. A room of approximately 150 sq. ft. to 200 sq. ft. would be sufficient. It is much better to add this relatively extra cheap area at the construction state than to be completely lacking in space during any future overcrowding. To have the single rooms this size not only allows for flexibility in room division but allows enough area for any required equipment for critical patients and gives the paying private patient the advantage of extra space for a sitting area.

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\(^1\) The Hospital Building, p. 15.
However, if the nursing unit has a majority of single rooms this extra area may be too expensive and thus have to be reduced to a more economical size. An area of almost 200 sq. ft. can be assumed for double rooms and about 400 sq. ft. for 4 bed wards. All multi-bed rooms should have a lavatory and other equipment the same as a single room and each bed should be screened by a movable curtain. A comparison of the area per bed for the hospitals under study can be seen in diagram 23. The size of patients' rooms will be the major influence on the overall cubage and appearance of the nursing unit. In the design of a room the patient's bed is always the focal point and everything must serve this feature.

There is the question whether rooms for private patients should be included in voluntary general hospitals. This type of hospital is usually established for philanthropic purposes, so why allow for the paying patient? They should be included because, first, the paying patient helps to make the hospital self-supporting and, second, with pleasant contact by these patients and the hospital's service, the knowledge of the beneficent character of the hospital has led to needed donations for continued work.¹ It also helps the poorer patient to receive greater attention from doctors, for with paying patients scattered throughout the city the amount of time which the doctors could spend in a voluntary hospital

would be greatly reduced. The presence of exacting private patients also increases efforts to discover the best method of doing things regardless of cost, and in any hospital there is a tendency toward standardization of care thus benefiting the other patients.

The bedroom walls must be given careful study for they compose the main surface area of the room and thus have great influence on its character. The colour and texture of the wall material sets the complete tone. It has been a standard to make the colours a bit grayish or muted and thus be practical in resisting soiling and abuse.¹ The argument against this, however, is that walls should not hide dirt but make it noticeable so high sanitation can be developed with exacting maintenance. In my opinion, a correct clear colour is much more appealing than a dulled one. This colour must always be checked in both natural and artificial light because of the variations under each. The surfacing used for the wall can be one of many manufactured materials but must be at all times applicable to good maintenance.

In selecting the colour for patients' rooms, the emphasis should be placed on the type of occupancy rather than window exposure. Colour in the patient's room is more important than the majority of the other areas as the patient cannot move and is very susceptible to the

¹ Faber Birren, New Horizons in Color, p. 87.
colour's effect on his senses. Colour is one of the strongest therapeutic and psychological mediums that the nursing unit can use and can help the patient forget his fears and enjoy the pleasant surroundings. There should be no sharp contrasts as strong colour differences on various walls produce a restless feeling. However, if a different colour is to be used this can be successfully applied on the wall behind the head of the bed and thus outside of the immediate view of the patient. Cool, restful colours are required for critically ill patients and warm, more cheerful colours for convalescent patients. With the non-assigned bedroom arrangement in our hospitals today, this colour theory is impossible to achieve, for a room that houses a convalescent patient one day may have a very critically ill patient in it the next. The solution has been to try and find a happy medium; however, this does not meet perfected requirement for either situation.

Brightness or glare in a patient's room must be controlled through attention and understanding. Visual fatigue is caused by this glare and the continued adjustment from brightness to darkness. Patient reaction to this exposure can be noted in higher rate of blinking, reduced sensitivity on the retina, increased fatigue, and muscular and nervous tension.¹ The patient's eyes can adjust themselves alternately to moderately high and moderately low brightness, but are taxed to accommodate them

¹ cf. Faber Birren, "Color is More than Beauty", Modern Hospital, vol. 78, p. 58, January 1952.
simultaneously. Colour brightness, intensity and warmth tend to stimulate the human organism and the body processes are thus accelerated, while colour dimness, softness, and coolness tend to be relaxing and body processes are retarded.\textsuperscript{1} Thus the physiological benefits of a rightfully balanced colour scheme should be judged in conjunction with the aesthetic value.

The purpose of the window wall in the bedroom is to admit germicidal daylight, allow for a view, and admit fresh air. The presence of good light is vital to the functioning of the nursing unit and as a contribution to the morale and comfort of the patient. There is the problem of what size the window should be. If too small, then it darkens the room and gives a sharp, undesirable contrast to the rest of the wall, if too large, then it tends to admit too much sky glare for the critical patients. A critical patient requires a much smaller window area than a convalescent patient.

Whatever window division is employed it should be planned for flexibility. If single windows are used then the spacing must be planned to take care of any future changes and still have a window for each room, while if continuous windows are installed a module must be determined for a reasonable limit of partition divisions. Continuous windows present a greater problem of light control but this can be managed with blinds and drapes. Sky glare

\textsuperscript{1} cf. \textit{Ibid}, p. 58.
DIAGRAM II.

GLARE REDUCING GLASS

INTEGRAL SHADE

SOLID OR LOUVERED OVERHANG

AWNING

EXAMPLES OF EXTERIOR GLARE CONTROL
can be reduced by overhangs, awnings, or integral shields (see diagram 11). However, it is questionable if this control is rigid enough for the care of critically ill patients.

The large bedroom window helps to create interest in the room and give a bright, cheerful effect. This amenity can be obtained without great added costs. Based on existing hospital construction it has been found that strip windows with about 50% fixed glass are cheaper than the conventional masonry and window opening.\(^1\) The pattern of the opening windows should be arranged to allow for cleaning from the inside of the building. This is the most economical method, for then relatively unskilled labour can do the job and there is no added expense of exterior equipment.

The sill height of the window should be low enough so the patient can see part of the ground or some trees when lying on his hospital bed. This is especially important for patients on floors above the ground level. The height of the window sill will depend on the heating system to be installed, but even if radiators were used, there is no reason why part of the window could not extend to at least a foot off the floor between the heating units. The low sill would also allow reflective ground light to enter the bedroom.

The amount of window area does not directly indi-\(^1\) Isadore Rosenfield, "Rosenfield and His Hospitals", Architectural Forum, vol. 97, p. 132, September 1952.
cato the amount of light entering the room. Such items as screens must be considered, for these will reduce efficiency by approximately 20% while a dirty window will reduce efficiency up to 25%. The amount of light to penetrate the room also depends on the reflective value of the interior surfaces. This value is called the reflection factor and is the ratio of reflected light to the incident light. Values for various colours are as follows:

- flat white: 75-90%
- light yellow and blue: 60-70
- ivory and cream: 55-75
- light green and gray: 40-50
- medium gray: 15-30
- medium to dark brown: 15-30
- medium green: 15-30
- red and maroon: 5-15

The reflection factor for the walls should be around 60% while the floor should be around 25%.

The amount of artificial light required for a room depends on the various uses of the room. In a patient's room the problem arises of requiring three different lighting standards:

1. for medical and nursing care; high intensity; designed in a way that it can be focussed on the patient when required by the doctor or nurse.

2. for reading or other visual tasks; while the

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patient is lying in bed, sitting up in bed or seated in a chair. This requires sufficient light on the focal task and sufficient general lighting to avoid extreme contrasts. (3.) for evening when only a minimum of light is required.

First there must be a good bed lamp. This should be adjustable to suit the patient's needs both in quality and position. It should also be designed for use by the doctor; possibly a detachable unit that can be focussed on the part of the patient that is being examined. The general lighting of the room can be achieved with direct or indirect overhead fixtures, while floor lamps can be used when the patient is reading in a chair. To eliminate any possible glare from an overhead light the general lighting might be controlled with a proper arrangement of floor lamps. For night use there should be a light close to the floor to spread a soft light on the lower area of the room. This could possibly be installed in the base of the wall. For all sources of artificial light any possible glare must be eliminated. The actual lighting element should be out of the direct view of the patient.

The bedroom floor must be considered for its traffic, sanitation, safety, psychological, and aesthetic values. The selection of the floor material is particularly important for the large horizontal plane complements the room through its colour and reflective values. The floor should
be of a light colour to give good reflectivity and the surface should be durable and resilient and easy to keep clean. Joints such as where the floor meets the wall should be flush and devoid of all cracks.

The ceiling of the patient's room must be studied from the patient's view while lying in bed, for the ceiling becomes his wall and the wall behind the bed his ceiling. Thus the colour selected for the ceiling is what he will be looking at most of the time. It is recommended to paint this surface a slightly lighter shade than the colour of the walls. The ceiling is traditionally used as a sound absorber. Acoustic treatment in tile form is better than an integral finish because of the ease of replacement and accessibility to any suspended ceiling areas.

The ceilings of the smaller wards are much lower today than the historical units, thus creating a scale which the patient is familiar with. This has the added value of reducing the area of the enclosing walls, the size of area to be heated, and the temperature difference between the floor and ceiling levels.

The furniture in a patient's room consists of a standard hospital bed, tray stand, bedside table, chair, floor lamp and draperies, and such fixed equipment as a locker, nurses call box, telephone and radio, electric outlets, oxygen and vacuum pipes, and lighting fixtures. Closets should be provided for every bed, with two closets
included in the single rooms to allow for doubling in an emergency. All furniture should be arranged in respect to the patient's bed. It is important to blend the furniture, bedspread and draperies into the complete colour scheme of the bedroom. These elements give an excellent opportunity to introduce a colour accent to the room and add interest to the overall scheme.

A light, natural finish for the woodwork of doors and cabinets helps to eliminate the institutional feeling. The choice of colours for furniture should be made so that the units are interchangeable from one room to another without causing disharmony. The materials should be easy to maintain with possibly composition tops for the dresser and table. All furniture that can be kept off the floor is an aid to maintenance by thus eliminating any area under a unit that might be missed in cleaning.

The door to the patient's room should be wide enough to permit the free passage of a stretcher or the patient's bed. Possibly two doors could be used, one approximately 2'-6" for daily use and the other 1'-6" which could be opened to give a clear 4'-0" clearance for the moving of equipment. The jambs should be protected against damage from the equipment that passes through the opening. The hardware should have friction hinges or other device to prevent slamming and hook down armpulls be installed to help the nurse when her hands are full.

Nurses' Station

The nurses' station should be located at the centre of the nursing unit and have control of all access to the patients' rooms. If possible, it should also have visual control of the elevators and visitors' waiting area. If a choice of location must be made then its functional position at the centre of the unit should overrule its policing action of the entrance. The distance between the station and patients' rooms and utilities should be cut to a minimum as the nurses' station is the start and finish of all activities. There should be easy access to any lifts from central supplies and pharmacy, and if a pneumatic tube system is used it should have a terminal directly in the nurses' station.

The station should contain ample desk area, drawers, movable or fixed chart rack, patient-nurse call system, telephone, storage file or cupboard, clock, bulletin board and medicine area. This must be designed for complete utilization with all extras eliminated. The final layout should be planned to give the ideal time-motion relationship.

The medicine area should include counter space, an acid resisting sink, drawers, cabinet, and lockable narcotics box. The medicine cabinet should be in easy view of the head nurse and an alarm light connected to the narcotics box. A good plan would be to separate the medicine area from the nurses' station with an alcove or a
light glass partition, thus allowing supervision and yet enabling the medicine nurse to make up the medicines and not be disturbed by the activity in the nurses' station. The cabinet should be directly adjacent to the nurses' station because of the heavy use of both areas by the medicine nurse.

The size of the nurses' station will vary according to the size of the nursing unit and its training program. It must accommodate the head nurse, registered nurses and practical nurses during routine work, and accommodate the entire unit's nursing staff during morning call. If there is no doctors' room provided then space must be allowed for the doctor to write his reports.

The walls of the nurses' station should have a light reflective surface to give maximum light to the area. If possible, a window should be included to not only increase the light but create a much better working environment for the staff. A window would be a great asset for good ventilation if the nursing unit is not totally air-conditioned. The nurses' station is a good area in the overall plan to obtain a little brightness and life with the use of colour. The counter front or the base of a glass partition is an excellent area for a colour accent. This could also be seen from the corridor, thus helping to add interest and to brighten the passages. More aggressive colour at this point will give the nurses a lift and help to promote more active work. Again, however,
excessive contrasts should be avoided to prevent any eyestrain on the part of the staff.

Sufficient light must be directed on the working surfaces to serve when writing charts and reports. This can be efficiently controlled by overhead lights with possibly a direct lamp attached to the medicine cabinet. Lighting for the nurses' station can be considered the same as for lighting an office and highly reflective working surfaces must be avoided to prevent eyestrain. The light signal from the patients' rooms should be placed in the most conspicuous place possible.

The floor material for the station must be particularly sturdy and still be comfortable to stand on. The floor receives more wear at this point that practically any other area in the unit. Thus, it is wise to use an applied surface and leave a colour break between the floor of the station and the corridor to facilitate replacements of the station floor without the noticeable difference that would occur if all the material was the same colour.

The nurses' station is one of the noisiest areas in the unit because of the concentration of so many duties. This calls for extreme acoustic control. All elements of noise such as telephones, metal furniture, call box, cupboard doors, etc., should be treated at the source. Most of the applied acoustic control will be confined to the ceiling area and the back wall of the station because of the openness of the plan. If complete surfacing is not
required the acoustic material could be worked into a wall pattern, thus adding a bit of interest to this focal centre of the nursing unit.

Utility Room

The utility room can be classified as the work room of the nursing unit and should be divided into two areas; a clean area and a soiled area. Small sub-utility units are sometimes used in relation to such areas as an isolation room. The two areas of the main utility room do not need complete division but a low partition could serve the purpose. The clean side is used for clean or sterile procedures while the soiled side is used for wash up and disposal.

The size of the areas vary according to the size of the nursing unit. In a comparison of utility areas of the three nursing units studied for field work, Unit B was the largest with 147 sq. ft. \(^1\) for the clean side and 88 sq. ft. for the soiled. Unit C had 86 sq. ft. \(^2\) for clean and 72 sq. ft. for soiled, Unit A, 80 sq. ft. and 38 sq. ft. The clean utility room of Unit C was also used as a medicine room. There is no standard size for a utility room and each problem must be solved individually.

The equipment in the clean area should include a sink, counter, cupboards, drawers, hot plate, drying rack,

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1. Figure includes dumbwaiter area.
2. Figure includes medicine cabinet.
portable sterilizer, small refrigerator, and possibly a
dumbwaiter from central supplies. The soiled area should
include a sink, counter, cupboards, specimen cabinet,
chute for soiled linen, and possibly a bedpan washer and
rack if bathroom units are not available for each room.
The utility room is one of the most mechanized areas in
the nursing unit and thus should be planned accordingly.
Items which are used most often should be closest to the
doors (see diagram 16) and any sequence of operation should
be planned to help the flow. The majority of the equip-
ment will be metal finished and all counters should be
also metal clad.

The utility room should be centrally located and
related to the nurses' station, treatment room, and
patients' rooms. The flow from the nurses' station to
the utility room should not cross the main flow of cor-
ridor traffic. The best arrangement would be direct
access from the nurses' station to the clean utility
room. There should also be small openings for passing
equipment from the clean and soiled utility areas to
the treatment room. This would eliminate any unneces-
sary transportation of equipment in the corridors.

The walls of the utility room should be of a smooth
surface which is very easy to maintain, preferably glazed
tile or equal. Irrespective of a unit's age it is the
condition of its surfaces which register obsolescence on
our senses, so therefore, all surfacing material, especi-
ally around service areas must be of first class material and selected for its cleaning properties and durability.

The colour in the work areas should be chosen to improve work performance, reduce fatigue, and eliminate hazards. The colour should be a light shade selected to give good reflective values. Dull walls and dark wainscoting around the utility area should be avoided because of their psychological effect in reducing personnel efficiency. Artificial lighting can be adequately handled by general fixtures in the ceiling. Ventilation must be especially good to maintain a clean, fresh atmosphere in the work area. If windows can be introduced they would be invaluable in adding to the lighting and providing natural ventilation. They would also make what is usually a dull work space a much more interesting area to work in.

As the utility room is a fairly noisy area the walls, ceiling and floor should be acoustically constructed to reduce this undesirable noise. The floor must be resistant to heavy wear and capable of being scrubbed without showing marks of abrasion. The doors to both areas should be at least 3'-4" wide and have small glass panels to eliminate any danger of two-way traffic and to allow visibility without entering the room. The door hardware should be similar to that used for patient room doors.

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A small laboratory is sometimes included in conjunction with the clean utility room or treatment room. It would be used to conduct minor investigations in respect to clinical work of the nursing unit. The inclusion of such an area would depend on the general laboratory policy of the hospital and a study of this area should be carried out in relation to the central laboratory.

Treatment Room

The treatment room is an area in the nursing unit where the patient may be wheeled from his room and treated or examined in privacy. It has the added advantage of having all the required equipment centralized and provides a more suitable area in which to treat the patient than around a cramped and sometimes unsuitable screened off bed. It not only aids the doctor but removes any unpleasant or painful treatment from other patients in the ward. The room should be centrally located and close to the utility room.

The treatment room should be large enough to give the doctor ample room around the examining table and provide enough accommodation for a number of medical students. The area must be planned for when the equipment is in use and when it is stored against the wall. The equipment consists of an examining table, service table, special lighting unit, waste container, instrument and scrub-up sink with goose neck spout and elbow controls, liquid soap
dispenser, cabinets, x-ray viewing plate, clock, and bulletin board. This equipment should be repeated in the treatment room on every floor and be laid out as a minor operating room; everything being convenient when the examining table is in use.

The colour of the room should create a uniform visual condition for the entire area, thus a colour like blue-green would be much better than white. The blue-green also directly complements the red of human tissue thus helping the doctor's examination. A window in the treatment room is an asset for it would admit the desired germicidal benefits of daylight when the room is not in operation. As the atmosphere is highly contaminated after each treatment the artificial ventilating system must be especially designed to remove this danger as quickly as possible. The walls of the area should be of glazed tile and all surfacing material should be easily washable.

General lighting can be handled by ceiling fixtures but a special lamp must be provided to assist the doctor's examination. A light capable of directing a focussed, bright beam is required. This can either be fixed to the ceiling and be movable or attached to a lamp stand. Back lighting will be required for x-ray viewing. The acoustic problem is not so demanding in the treatment room so it

1. Faber Birren, "Colour is More than Beauty", Modern Hospital, vol. 78, p. 58, January 1952.
would be better to have a smoother ceiling rather than introduce any surface that might harbor bacteria. The door will again be similar to patient room doors.

Lavatories

Early ambulation increases the need for lavatories in the nursing unit. The most desirable condition is to have one lavatory adjoining every bedroom for the convenience of the patient and to increase nursing efficiency. In order to reduce costs a lavatory could be located between two single rooms. This would adequately serve both rooms but would lose a certain amount of privacy. Each patient's lavatory should have a toilet, bedpan washer, basin, shelf and mirror and safety bar to assist the patient at the toilet. The lavatory units in multi-story blocks should be located above each other to reduce plumbing costs and help centralize the equipment for easy maintenance. The lavatories are usually located in the interior of the unit to leave the exterior wall free for bedroom windows but this adds an extra load to the artificial ventilation. Sufficient duct area must be planned to handle all service piping and allow room for this extra ventilating. All lavatory fixtures should be attached to walls to provide clear area for cleaning the floor.

Very few bathtubs and showers are required as most of the patients are bathed in bed and surgical cases
usually leave by the time they are able to bathe themselves in a bathtub. Showers should always be separate units and never combined with a bathtub in order to reduce any possible danger of the patient slipping. The tub should be raised about a foot from the floor and be free on both sides to allow the nurse to assist the patient. This would also allow for ease of cleaning. A safety bar should be attached to the wall beside the bathtub for the aid of the patient.

If there is not an adjacent lavatory, there should at least be a basin in every room to assist the duties of the staff and for the use of the patient. This convenience helps to promote good hygienic technique on the part of the doctor, nurse, and patient. The basin should have a combination faucet with elbow control and an open drain with strainer. The spout should be high enough above the rim of the basin to be convenient for filling a pitcher with water.

Toilets for both men and women should be provided near the waiting room for public use. A minimum area would be sufficient. Facilities must also be available at the nurses' station and should include a toilet, basin and mirror.

The surfacing material of lavatories should be resistant to moisture. A light colour should be used to add apparent size to the small area and should complement the bedroom it is serving rather than be treated as an isolated unit. This interrelation of areas of colour should be considered for all sections of the
nursing unit. A particular room may have a good colour scheme in itself but it might be completely ruined by the relation to an adjoining room whose door is left open most of the time. Coloured fixtures could also be considered besides the traditional white, but care must be taken not to create a bizarre appearance.

With the use of light coloured walls, one lighting fixture is sufficient; possibly a wall unit by the mirror. The lavatory is one of the noisier areas of the unit and the closest to the patient's room. The toilet should be selected for its noiseless quality and the area should be structurally insulated from the bedroom. Acoustic treatment of the ceiling would be sufficient for applied control of such a small area.

Floor Kitchen

Food preparation and serving will not be discussed with any detail in this thesis for it directly relates to the policy of the general hospital regarding overall food service. The kitchen area in the nursing unit will depend on whether the hospital has a central kitchen or divided kitchens, a public or private cafeteria, a coffee shop, canteens, or other services. These should be investigated by a separate study of the service factors for the entire hospital and a detailed analysis of institutional kitchens and equipment.

There are two types of nursing unit food service. One is where the food is prepared, cooked and served on
each floor, and the other is where there is a complete tray service from the central hospital kitchen and a small pantry is provided on each floor. In the three nursing units studied, Unit C had the pantry and Units A and B the divided kitchens. Hospitals B and C had the exact opposite systems and patient reports were favourable for both. However, with the use of the central kitchen it is more economical in respect to staff, for the help from the main cafeteria can easily transfer during the tray assembly rush in the main kitchen.

If the divided kitchens are to be used then a complete kitchen for each floor should be equipped for independent operation. It should be large enough to allow for efficient movement during the peak meal hours and be centrally located between two nursing units. If the central kitchen is used then the floor pantry may be very simple, containing only a sink, counter, cupboard and drawers for utensils, gas plate, toaster, tray rack, clock, bulletin board, and disposal unit. It is mainly used to supplement the central kitchen. Both types should be near the service elevator for direct access. Flow from the main kitchen to pantry should never interfere with any public area.

The kitchen walls should be surfaced with glazed tile to a minimum height of five feet, preferably up to door height. Colour selection must adhere to all previously discussed qualities of a pleasant working area and should harmonize with the characteristic colours of food. As much
window area as possible should be introduced to improve the light on the working surfaces. Overhead lighting should be designed to give maximum coverage of the essential work areas with perhaps an added light over the sinks. The kitchen must be kept as neat and clean as possible for obvious sanitary reasons and should be a show place for hygienic standards.

Ventilation for the kitchen should be controlled by a separate unit to eliminate the strong food smells. Odours must not be allowed to penetrate into the corridor. The ventilation for the small pantry can be controlled by direct fan and duct to the exterior. The unit kitchen presents a greater acoustic problem than the pantry. The kitchen should be isolated from the bedroom section by other rooms, while the noise from the pantry can easily be controlled by acoustic treatment. Any applied acoustic material should be susceptible to easy cleaning because of the staining nature of the cooking food and steam. All safety and code regulations pertaining to large kitchens must be applied and constantly checked.

Office and Seminar Room

A room near the nurses' station that could be used for doctors' meetings, seminars, consultations or conferences would be a valuable addition to the nursing unit. It would provide space where doctors and medical students could confer and use patient records without interrupting the work at the nurses' station. With the trend towards
greater specialization, teamwork between physicians will become compulsory and a private area close to the patient's room will be essential. Head nurses could use this area for private meetings with the staff or patient. Floor seminars could also be held and be completely free from the working flow of the unit. At night the room might possibly be used by relatives who are spending the night to be close to critically ill patients.

The room would be a combined office, meeting room and classroom. It should be equipped with a desk, chairs, bookcase, telephone, blackboard and storage cupboard for extra folding chairs, supplies, and training aids. The area should be large enough to accommodate a small group of nurses seated around a blackboard. The room could have overhead lighting for seminars while a desk lamp should be available for individual work. Materials such as wood panelling could be used in this area and patterned window drapes could add interest to the room. The decorating will generally be the same as for a private office. Possibly the blackboard could be a sliding type that is covered when not in use and thus not dominate the room.

Nurses' Lounge

The nurses' lounge should be adjacent to the nurses' station and provide a resting area for tired nurses. It is definitely required for the welfare of the staff and in the long run to help increase their efficiency. It must be large enough to comfortably accommodate three or
four nurses. If it is possible the room should have exterior light and afford a nice view. It should contain easy chairs, a couch, coffee table, lamps, ash trays, and possibly a coat closet if one is not included near the nurses' station. A nurse-patient light signal should be installed on the wall to aid the special nurse in checking her assigned room during her rest period.

The colour and furnishings must be selected to provide a pleasant and restful atmosphere. The wall colour and surface could be enhanced with a painting and the floor possibly covered with a carpet. Lighting can be satisfactorily controlled with the lamps connected to the main switch. The whole purpose of the lounge is to give the nurse a break from her routine duties.

Waiting Room

The waiting room is designed specifically for the public and is the only other room besides the patient's room where visitors have prolonged contact. Therefore, it will make an immediate impression on the visitor and influence his thoughts about the nursing unit. These visitors will in the future be patients and this personal contact will have influence on their choice of hospital. Thus the waiting room should not be neglected because it is not directly serving the patient but must be designed to cater to the outside visitor. If possible, the room should have a good view, preferably looking over a landscaped area.
The waiting room is usually open to the corridor and located where it is under visual control of the nurses' station. If there are two nursing units on one floor, one waiting room could easily serve both. It should be close to the public elevators and away from the working corridor. Public telephones and lavatories should be provided. The furniture consists of easy chairs, coffee table, smoking stands, magazine rack and reading lamps.

Stronger colours and a greater freedom may be used in the waiting room than in the nursing section. Texture may be employed to a greater extent but the fundamentals of good housekeeping must be kept in mind. Indirect wall lighting may provide the general illumination while the lamps would be designed specifically for reading. The furnishings should all be chosen to blend in with this cordial atmosphere. If open phones or a television set are installed then centralized acoustic control must be applied to prevent noise from entering the corridors.

Storage

Linen

The size of the linen storage will depend on the number of beds in the unit and the routine of laundry distribution. Some hospitals have adopted the system of delivering the linen directly from central linen supply to the patient rooms to reduce handling. However, if this system is used some storage space to cover emergencies and
periods when the central supply is closed will still be required. The linen closet should be central to the nursing unit and open off the corridor. For soiled linen a laundry chute is usually used and then only a small area in the utility room for a soiled linen hamper will be required. If no chute is provided, a separate room should be planned for dirty linen.

The linen storage area should be the walk-in type and large enough to hold a linen truck. A counter and shelves should be attached to the wall. The counter should be approximately 2'-0" wide and be around 3'-0" off the floor with shelving below for blankets.\textsuperscript{1} The main shelving for linen should be of varying widths with a minimum of 12" and have the top shelf within reach of the nurse. To help ventilation the shelves should be composed of slats and be kept away from the wall surface to facilitate cleaning. Outside light and ventilation should be introduced if possible and a vent installed in the door. The area should have a light, bright colour to improve visibility and add colour to the corridor when the door is open.

Cleaners' Supplies

The cleaners' closet should be large enough to hold a sink, shelving, mop truck, floor polisher and vacuum cleaner. The sink should be set into the floor and project a minimum of 6" above the floor. This is to facili-

\textsuperscript{1} Isadore Rosenfield, \textit{Hospitals-Integrated Design}, p. 63.
tate easy drainage of the scrub trucks. There should be at least 2 or 3 shelves to hold pails and supplies. A hook strip is required above the sink to hang mops and allow them to drain into the sink. A heavily braced water spout is essential and should be designed to hold a pail while it is being filled.

The flooring and wainscot should be of tile or terrazzo as protection against the water. The room must be well ventilated and have a grill in the bottom section of the door. The door should be wide enough to permit both scrub truck and janitor to enter. A vacuum duct outlet for cleaning dust mops is desirable.

Stretcher and Wheelchair

The stretcher and wheelchairs should be stored in an area near the nurses' station. A large closet would be best but an alcove could also serve the purpose. The closet should have 2 or 3 shelves for supplies with the bottom shelf not less than 4'-0" from the floor. A bumper protection is required along the walls to prevent damage or marking by the equipment. The door jambs should also be suitably protected.

Flower Room

A flower room is required for receiving, cutting, arranging flowers and plants, refilling vases, and night or cleaning period storage. The hospital officials hold

a high regard for the therapeutic value of flowers so a
definite area should be designed to look after them.\footnote{1}
There should be a flower room in each nursing unit be¬
sides a receiving room in the basement of the hospital.
A sink and counter is needed for arranging the flowers
and shelving for the storage of vases. A small refriger¬
at or would be an asset but is not necessary.

Laundry and Waste Chute

The laundry chute is best located in the soiled
utility room. It should be at least 20" in diameter,
preferably 24", and with an 18" throat sloped away from
the door.\footnote{2} The chute will drop directly to a central
soiled linen room in the basement. The use of chutes
eliminates the employment of extra personnel to pick
up soiled linen from the nursing units and then carry
it back through the corridors to the laundry room.

Aluminum is the best available material for the
chute at present but in the future this might be re¬
placed with plastic. The door should be self-closing
and self-latching with a rubber gasket. At the bottom
of the chute there should be a self-closing door with
a fusible link. The top of the chute should have a
hot and cold water ring for cleaning purposes with a
drain at the bottom. The base of the chute must be
well anchored.

\footnote{1} "Flower Rooms for Therapeutic Purposes", \textit{Hospitals},
vol. 26, p. 68, October 1952.
\footnote{2} Isadore Rosenfield, \textit{Hospitals-Integrated Design}, p. 64.
The waste chute is of similar material and construction as the laundry chute and should be located in the cleaners' closet. The use of a waste chute has been a controversy for some time but they are now being generally accepted. The chute should open into a separate waste room in the basement.

The problem of noise and fire are the two main objections of the chutes. The waste chute especially is very noisy and must be well insulated. Because of this noise factor the chutes should never open off the corridor but be in an auxiliary room. The fire danger usually arises from someone throwing a cigarette butt into the chute. This can be partially eliminated by having locks put on the waste chute with only the required people having keys. All safety precautions previously discussed must be strictly adhered to. It is desirable to have the doors of the chutes flush with the wall rather than projecting into the room and possibly causing an accident.

Solarium

A solarium is required for the ambulant or movable patients to give them a change of scenery and atmosphere from their particular room. Early ambulation might be greatly encouraged if the patient had some interesting place to walk to. It is a great psychological factor in raising the spirits of the patient and hastening recovery. The size will vary with the size of the nursing unit and

1. see above; Safety. p 37
the nature of its occupancy. There should be space to accommodate a patient's bed and still leave ample room for card games, checkers, or a sitting area. A minimum allowance would be approximately 25 sq. ft. per ambulant patient.¹

The solarium is usually located either at the end of the corridor or near the elevator lobby. The position near the elevator is convenient for outsiders to visit the patient without having to walk through the corridor, however, the room takes up valuable central space which might be better used for functional service areas. If the solarium is at the end of the nursing unit then care must be taken not to completely eliminate any daylight from entering the corridor. The area should be either open to the corridor or have glazed doors.

The solarium should be glazed and heated, although this often leads to its misuse as a patient's room. In an emergency it is acceptable to put patients in the solarium for a short period of time but continued use of it as a bedroom, such as in Unit B of the field study, is wrong. Especially in this particular case where there are no adjoining toilet facilities. This is not only depriving the other patients of a needed amenity but is lowering the standard of hospitalization for the patients housed in the solarium.

The orientation of the solarium should be towards the sun and have large windows overlooking a pleasant view. A variety of colours can be introduced to create interest and pleasure. The equipment required consists of easy and straight back chairs, tables, bookshelves, smoking stands, book and magazine stand, radio, reading lamps, and storage cabinets for games and other items. The floor could be covered with a tightly woven carpet. Acoustic material should be used for ceiling control of the noise that might arise from the patients' games. The problem of subduing the institutional atmosphere must be constantly remembered when selecting materials and furnishings for the solarium.

Roof Deck and Balconies

A paved roof deck for the patients is a desirable addition to the nursing unit. One deck can serve the entire block of units. The surface should be resistant against the exterior elements and present a non-slip area that can be easily washed and drained. The area may be used for ambulatory patients in conjunction with the solarium. At least 1/3 of the area should be sheltered and at least 1/2 shaded from the sun. However, if too much of the roof is covered it loses its primary purpose of an outdoor area for patients. The shelter could have sliding glazed walls that would be opened in the summer.

A lavatory and storage area for chairs, etc., must be provided, possibly beside the elevator penthouse.

The parapets should be kept low to enable the occupants of the roof deck to take the best advantage of the view. Approximately one foot to one foot and a half with an open fence around it would be a desired height. The small parapet helps to protect the patient from drafts when lying in a deck chair and the open protective fence above it allows the patient a view. A holiday atmosphere can be created by using bright colours on surfaces such as the penthouse and deck chairs. The conventional dull roof can be turned into a resort for the patients.

Balconies on each floor can be an added and convenient amenity but are not considered a necessity. They might be incorporated with the solarium or placed at another location on the building to provide two pleasant areas. It is doubtful if balconies for each room are worth the additional cost and maintenance. They would certainly not all be used. Possibly private balconies could be planned for only the luxury suites. The advantage of a change of scenery when moving the patient from his room to another section of the nursing unit is another argument for not providing individual balconies.

To be of utmost use the balconies should receive sun during some part of the day. They should not, however, block the sunlight from entering the bedrooms. They
must be large enough to allow for moving wheelchairs
and be protected by a metal railing. The surfacing ma-
terial should be slip proof and capable of good drain-
age and maintenance the same as the roof deck. The
colour of the balconies has more effect on the exterior
than the interior appearance of the nursing unit, hence
the colours should be chosen in consideration of the
overall colour scheme of the hospital. The balconies
can become accents of colour in the exterior design.

Corridors

The corridor is the main artery of the nursing
unit. It is not only the working route of the staff but
is in constant use by the patients. The patient uses
the corridor on his initial entrance to the nursing
unit as he is shown to his room by the head nurse.
He makes contact again when being taken to the diagnostic department or as he is wheeled to the operating
room. After his crisis, his first outing will be to
the corridor and then along it to the solarium. When
he has improved, the corridor will serve as his sidewalk for a stroll and it is the last part of the unit
he has contact with before leaving. Therefore, the corridor must be designed with the patient in mind. It is
very important that hygienic and aesthetic values are
not stopped at the door of the patient's room but con-
tinue out into the corridor. The corridor should be in-
viting, wide, colourful, light, quiet, odourless and neat.
The traffic in the corridor is very heavy during certain periods of the day, thus adequate room is required for ease of passing. The minimum width is 7'-6" with a preferred width of 8'-0" while a greater dimension is required at the elevator entrances. The ceilings should be approximately 9'-6" although a reduced height may be allowed to give sufficient space for mechanical services above the finished ceiling. All steps or ramps should be eliminated within the unit but if a ramp is required to connect with an existing building then it should not exceed a 5% grade. Surface protection against wear is essential and must be considered when choosing flooring and wall materials. The material should be chosen for toughness, acoustic values, and maintenance properties. The flooring material should have a good finish but not create a slippery surface that would endanger both patients and staff.

Natural light and ventilation should be allowed to enter the corridor wherever it is possible. It is essential that the disagreeable odours are quickly cleared from this area and not allowed to remain and make the corridor uninviting. However, a great deal of window area is impossible to obtain in a central corridor; so colour and artificial lighting must make up for it. The colour should give a sunny appearance and thus provide contrast to the

2. Ibid, p. 17.
cooler tones of the patients' rooms. The corridor should have adequate light for day work and give a fresh, cool restful atmosphere at night. It must give a feeling of hospitality to the visitor. The temperature of the corridor should be the same as the patient rooms to prevent any chill when the patient is brought out of his bedroom.

Good lighting, although not necessarily high illumination, is essential to help prevent accidents, show any dirt, and to contribute to the morale and comfort of the employees, thus increasing the efficiency of the maintenance. Incandescent or fluorescent fixtures designed to give a uniform illumination should be recessed in the ceiling to eliminate any glare. Fluorescent light gives a low intensity at the fixture and could be mounted across the corridor to reduce the apparent length of the passage. Night lighting can be managed with recessed units near the floor in a similar manner as in patient rooms. All lighting fixtures should be of simple design to minimize maintenance costs. Sufficient outlets for maintenance should also be provided.

The corridor is a source of noise because of the continual staff activity and it is also a medium of noise conveyance from one area to another. Therefore, extra acoustic control is required. The ceiling alone may not be sufficient for this control and the acoustic material will have to be applied to the surface of the walls. A common solution to the problem is a wainscoting of protective material and then
acoustic treatment for the remainder of the wall and ceiling. To produce a uniform and clean line the wainscoting should align with the top of the doors.

The corridor is also the main path for horizontal mechanical services. As corridors run to practically all rooms a convenient duct space is above the suspended ceiling. Here, the pipes can be hung from the structure and be made accessible at various points along the corridor. The ceiling itself should be of applied tiles so it can be removed for complete access if a major planning change is made. All corridors should be free from projections to reduce the possibility of accidents. Items such as water coolers and fire extinguishers are best recessed in an alcove.

Elevators

The efficient operation of a multi-story block of nursing units will depend on proper elevator service. To be adequate, the system must be individually planned. The number of nursing units, staff, visitors, etc., must all be considered. A multi-story hospital up to 125 beds will require a minimum of two elevators and a unit up to 200 beds will require 3 elevators. If vertical expansion of the nursing unit is planned then sufficient shafts and rough fittings should be installed during initial construction to prevent a future additional cost due to in-

1. Ibid, p. 88.
convenience of installation.

The elevators can be classified as carrying either passenger traffic or vehicular traffic. The passenger traffic would include doctors, nurses, technicians, ambulatory patients, aides, and visitors, while vehicular traffic would include stretchers, beds, wheelchairs, food carts, service carts, and transporting dollies. The elevators should be planned so the patient can be transported from his room to the operating room with a minimum of exposure. Separate patient, freight, and public elevators would be ideal. As the mixed traffic is normally concentrated at different peaks during the day, one of the elevators may be able to serve two types of traffic by having doors at both ends, one opening to a service corridor during certain hours and the other opening to the public during other hours. In the future, the speed, control, and efficiency of the elevator should increase, and the number of elevators required in a large hospital will decrease. Less area will be required but the economic saving will not be great because of the added cost of extra superior equipment.

The elevators should be located at the entrance to the nursing unit and be designed as a single economical block. In locating this transportation core, consideration must be given to the overall traffic flow of the hospital. It is advisable that the elevators do not open directly into a nursing unit corridor but an ele-
vator lobby is recommended.

The elevator car must be large enough to hold a bed or iron lung plus attendants. A minimum of 5'-8" x 8'-0" is required but there is a trend toward larger sizes which carry more passengers. Service elevators are recommended to be larger in order to permit greater loads and therefore fewer trips. The doors should be as large as possible with 3'-10" x 7'-0" being a minimum. The cars should be as automatic as possible to reduce the number of personnel required and thus reduce operating cost. This will also help to insure good elevator service for the entire 24 hours whether operators are available or not. However, operators are required during busy periods.

The noise of the elevator and machinery must be reduced by adequate isolation from the patient rooms. Structural acoustic treatment of the shaft is advisable. The isolated shaft required for fire protection also helps this acoustic problem. The doors should be of the silent-acting type and the floor a tough resilient material. The interior finish should be selected for a minimum of upkeep, painting and cleaning, with possibly stainless metal sides. The colour should be a neutral shade, perhaps a blue-green. A metal bumper is required along the wall for protection from damage.

by the stretchers and service trucks. A floor indicator and corridor lights are required. The general car lighting can be controlled by an overhead fixture with the switch at the operator's box. An indirect light would be preferable to eliminate direct glare when the patient is being transported on a stretcher. It is desirable to have a telephone connection in the car for any emergency. Maintenance for the machinery will not usually be carried out by the nursing unit staff but regular inspections will be arranged by contract with the elevator service organization.

Stairs

Stairs are not used to a great extent in comparison to the number of employees. The number, size and location are usually determined by the local building and fire codes rather than traffic demand. For emergencies they should be easy and wide and lead directly to the outside. The structure must be of completely fireproof material and compose a complete vertical shaft. The minimum width of stairs is 3'-8" with sufficient width at the landings to turn a stretcher. Standard treads and risers without winders should be used with a continuous handrail at a minimum height of 3½". The stairs should be made of non-slip material; possibly rubber treads with metal nosings and abrasive

2. Ibid.
inserts. Openings to the stairwell opposite a patient's door are a source of annoyance to the patient and should be avoided.

Natural light should be introduced to the stairs wherever possible to improve visibility. Light colour on the walls would help this. The tread nosings should be well marked. Artificial lighting will be required and should be directed on the stairs. Heating and ventilation of the stairwell is required and if the nursing unit is to be air-conditioned this should also include the stairwell to prevent it from becoming a heat trap.
CONCLUSIONS

Observations and Recommendations based on Field Study

The motion diagrams of the three nursing units under study were made by recording the movements of one registered nurse for each unit for a complete eight hour tour of duty. The motion diagrams are presented as a guide to show how all employees' movements may be traced and related according to priority of duty in order to obtain a complete motion study of the particular nursing unit under observation.

Interviews were conducted with the administrators, nurses, aides, and maintenance staff. The study was concentrated on a typical medical nursing unit for each of the three general hospitals. Each unit reported a slack period at the time the studies were made but the results give the desired relation of the flow of the various elements of the unit.

The registered nurse for Unit A was on duty from 7:00 A.M. till 3:00 P.M. For Unit B, the motion diagram combines the duty of two nurses. This was necessary because of the division of the nursing duties employed at that unit. One was a registered nurse, on duty from 7:00 A.M. till 3:00 P.M., and the other a student nurse, on duty from 7:00 A.M. till 12:10 P.M. The registered nurse for Unit C was on duty from 7:00 A.M. till 3:00 P.M. The nurses for Units B and C were in charge of medicine distribution and the nurse for Unit A was a
DIAGRAM 15.

MOTION DIAGRAM = GENERAL NURSE

4½ HOURS 7:00 TO 11:30 A.M.
ACTUAL ROUTE

NURSING UNIT A
SCALE = ___  = 16 FEET
DIAGRAM 16.

MOTION DIAGRAM
RELATION OF ELEMENTS TO
UTILITY ROOM DOORS

NURSING UNIT B
general duty nurse.

The motion diagrams for the various units emphasize the concentration of motion at the nurses' station and the dispersal of the nurse's movements from this point to the various elements (see diagrams 12, 13 and 14). This is graphic proof that the nurses' station is the core of the unit and is rightly placed at the centre. Diagram 15 shows the actual path of the nurse in a single line study while diagrams 12, 13 and 14 are in a simplified form to give a clear picture of the volume of the nurse's entire movements. The initial single line study is required to give a true picture of the bed to bed movements of the nurse.

The motion diagram of a nursing unit enables one to chart the best relationship of areas in a working plan and thus give a basis on which to design an improved unit. In many cases the diagrams will show how the plans of the existing unit can be improved without any major structural changes. In this respect, I believe that the diagram for Unit C illustrates a good example of how the unit could be improved in respect to the motion of the particular nurse under observation. The motion study emphatically showed the needless time and effort spent by the medical nurse because of the existing location of the medicine cabinet. The nurse was constantly moving back and forth from the medicine cabinet, narcotics box, and nurses' station. In many instances
 DIAGRAM 17.

MOTION DIAGRAM OF EXISTING PLAN
MEDICINE NURSE

MOTION DIAGRAM OF REVISED PLAN
MEDICINE NURSE
RELOCATION OF MEDICINE CABINET

NURSING UNIT C

SCALE: 0 30 60
NO. TRIPS
FEET
DIAGRAM 18.

EXISTING LOCATION OF UTILITY ROOM

REVISED LOCATION OF UTILITY ROOM
IMPROVED RELATION BETWEEN NURSES STATION AND UTILITY ROOM (LIFT)

NURSING UNIT B
it was just to speak to someone. The problem could easily be solved by moving the wardrobe to another location and putting the medicine cabinet in its place (see diagram 17). There is adequate space for a counter and shelves. While not absolutely necessary, it would be desirable to separate this area from the nurses' station by means of a glazed, lightweight partition. The distance which the medicine nurse has to walk is then drastically reduced and vocal contact with the nurses' station is possible.

In Unit B, the distance from the nurses' station to the utility room and dumbwaiter is too far for convenience and to reach this area the nurse must cross the main flow of corridor traffic (see diagram 13). The buzzer indicating the arrival of the dumbwaiter continually disturbs the patients while the nurse makes this trip to open the door. It would have been better to have combined the utility room and nurses' station in one corner block, thus improving the access between the two rooms and yet leave the doors to the utility room in relatively the same position in the overall plan (see diagram 18). The problem of accessibility of the dumbwaiter would be solved and the medicine cabinet would also have more area. However, this change cannot be fairly considered without first knowing the relation of this area to the other elements in the hospital. These other elements may have been the controlling reason
REVISED PLAN NURSING UNIT C

MOTION
DIAGRAM: 1 TRIP FROM BEDROOMS TO BEDPAN ROOM
TOTAL DISTANCE = 242 FEET
for the existing plan, but it must always be kept in mind that the nursing unit is of prime importance in a good hospital.

The same cross corridor traffic to the utility room occurs in Unit A, but the access is much more direct (see diagram 12). The added problem of attending to the dumbwaiter is avoided by simply eliminating this necessary vertical transportation.

The motion diagrams also show the need for a concentration of critical patients. The amount of time and motion to be conserved can easily be seen in the comparison of the existing patient division for Unit C to a revised plan of relocating five critical patients (see diagrams 14 and 19). A solution to this problem of concentrated care of critical patients is brought forth in the second part of my conclusions.

An interesting comparison of the extra trips required for the single task of attending to the bedpans for twelve bedrooms without toilets and with toilets can be made from diagrams 20 and 21. In the revised plan lavatories were installed between each room. This diagram illustrates the importance of having adjacent lavatory facilities for each bedroom.

An important factor that impressed me during my visits to the various units was the amount of time the registered nurse spent on non-patient duties. Only 20% of the nurse's time was actually spent on the ward floor
while 68% was time spent in the nurses' station. In relation to the number of occupied beds the nurse for Unit B spent 5.1 minutes per bed outside the nurses station, Unit C, 4.5 minutes, and Unit A, 4.1 minutes. The figure for Unit C was a bit above its normal because of the introduction of a surgical amputation case from the operating room during the study. It must be pointed out that a great amount of the nurses' time at the nurses' station is spent in direct duty on behalf of the patient, such as preparing medicines and charting, however, the rest of the time she was doing non-professional duties. These non-professional duties could very easily be done by a semi-skilled employee. This would then allow the nurse more time to give better nursing care to the patients.

In Unit A, the task of answering the telephone

1. Division of nurses' time for each unit:

<table>
<thead>
<tr>
<th>Unit</th>
<th>Floor Duty</th>
<th>Station Duty</th>
<th>Lunch and Coffee</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit A</td>
<td>1:39 1/2 hrs</td>
<td>5:58 1/2 hrs</td>
<td>1:02 hrs</td>
<td>8:30 hrs</td>
</tr>
<tr>
<td>Unit B</td>
<td>1:15 hrs</td>
<td>5:47 hrs</td>
<td>1:58 hrs</td>
<td>8:00 hrs</td>
</tr>
<tr>
<td>Unit C</td>
<td>2:11 1/2 hrs</td>
<td>4:46 1/2 hrs</td>
<td>2:58 hrs</td>
<td>8:00 hrs</td>
</tr>
</tbody>
</table>

Division of time for the two nurses in Unit B:

<table>
<thead>
<tr>
<th>R.N.</th>
<th>Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floor duty</td>
<td>1:07 1/2 hrs</td>
</tr>
<tr>
<td>Station duty</td>
<td>5:54 1/2 hrs</td>
</tr>
<tr>
<td>Lunch and coffee</td>
<td>1:58 hrs</td>
</tr>
<tr>
<td>Total</td>
<td>8:00 hrs</td>
</tr>
</tbody>
</table>
DIAGRAM 22.

UNIT A

UNIT B

UNIT C

DIAGRAM SHOWING AREA DIVISION FOR EACH NURSING UNIT
made the nurse a busy receptionist and message-taker. Two of the nurses' longest trips were to look for someone who was wanted on the telephone. Other similar duties such as recording and looking after communications could be handled by a unit secretary located in the nurses' station. There is a definite need for such a person to attend to the numerous extra duties. With the education of nurses becoming more extensive, it is uneconomical to use the nurse for these tasks. In Unit B, there was such a ward secretary on duty during the main shift. The administration is very satisfied with the results of this arrangement. It is interesting to note that the nurse in Unit B was able to spend approximately a minute more per patient on floor duty. This figure is not as high as it probably could be and care must be taken that the nurse spends her free time in direct contact with patient duties. In my opinion, the unit secretary is essential for complete and efficient organization of the nursing unit.

A comparison of the various areas of the three plans gives us a basis on which to judge the efficient use of space for each unit. In such a comparison it is only possible to relate areas which are common to each unit. Diagram 25 lists the complete service facilities for each unit and diagram 22 illustrates the arrangement of areas within the unit. The areas that can be compared are such rooms as the bedrooms, nurses' station, corridors,
DIAGRAM 23.

BEDROOMS
UNIT A: 4092
UNIT B: 4874
UNIT C: 4038

CORRIDORS
UNIT A: 1715
UNIT B: 1657
UNIT C: 2362

LAVATORIES
UNIT A: 967
UNIT B: 568
UNIT C: 437

UTILITIES
UNIT A: 128
UNIT B: 263
UNIT C: 182

NURSES STATION
UNIT A: 100
UNIT B: 165
UNIT C: 172

STORAGE
UNIT A: 47
UNIT B: 37
UNIT C: 173

COMPARISON OF AREAS IN SQ.FT.
utility room, lavatories, waiting room and storage rooms (see diagram 23). In comparing the totals for the above mentioned areas it was found that Unit A was the smallest with 7,212 sq. ft. and Unit C next with 7,473 sq. ft. and Unit B the largest with 7,672 sq. ft.

However, to obtain a true area relation, the bed capacity of the units must be taken into consideration. The amount of total area required to serve each bed would be a better measure. The capacity for Unit A was 29 beds. The bed count for the entire floor which included three nursing units was 82 beds. These units shared certain communal facilities such as elevators, waiting room, treatment room, and so forth. Unit B had 27 beds with an entire floor count of 58 beds divided into two units. Two of the beds in Unit B were permanently stationed in the solarium. Unit C had 31 beds with an entire floor count of 62 beds divided into two units. In comparing the above mentioned areas in relation to the number of beds for each unit it was found that Unit C was the smallest with 241 sq. ft. per bed, Unit A next with 249 sq. ft. and Unit B the largest with 284 sq. ft. The amount of actual bedroom area allowed for each bed, however, was 130 sq. ft. for Unit C, 141 sq. ft. for Unit A, and 181 sq. ft. for Unit B.

These figure comparisons do not immediately rank Unit C as the more economical plan for the area allowed for the beds in comparison to the other major area of
## Diagram 24

### Scale

0 10 20 30 40 50 60 Feet

### Nurses Station

<table>
<thead>
<tr>
<th>Unit</th>
<th>Distance (Feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>36.5</td>
</tr>
<tr>
<td>B</td>
<td>42</td>
</tr>
<tr>
<td>C</td>
<td>33.5</td>
</tr>
</tbody>
</table>

### Utility

<table>
<thead>
<tr>
<th>Unit</th>
<th>Distance (Feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>40</td>
</tr>
<tr>
<td>B</td>
<td>48.5</td>
</tr>
<tr>
<td>C</td>
<td>41</td>
</tr>
</tbody>
</table>

### Linen Storage

<table>
<thead>
<tr>
<th>Unit</th>
<th>Distance (Feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>43</td>
</tr>
<tr>
<td>B</td>
<td>59</td>
</tr>
<tr>
<td>C</td>
<td>36</td>
</tr>
</tbody>
</table>

**Average Distance from Service Areas to Patient's Room in Feet**
the unit, the corridor, was considerably higher for Unit C than Unit A or B. Unit C required approximately 17 sq. ft. more corridor area per bed than Unit A. Thus the shape of Unit A allows for the most economical corridor plan of the three units. Again, however, the smallness of the corridor area is not the only factor to be considered for an economical corridor. To be truly efficient the corridor must give a short circulation distance between the beds and the essential service elements. For example, let us take the average distance between the nurses' station and the door of the patient's room. For Unit C the average distance was 33.5 ft., for Unit A, 36.3 ft., and for Unit B, 41.9 ft. In comparing these figures one may ask if this average saving of 3 feet per bed for Unit C over Unit A justifies the extra 17 sq. ft. of corridor area per bed. See diagram 24 for circulation distance from the utility room and linen storage.

It must always be remembered that the smaller area will not automatically be the best. The most efficient space should be designed to serve a particular plan concept and would justify certain variation from other plans. If the differences are exceedingly great, however, then a reappraisal should be made of the original concept.

The amount of nursing hours per patient has a

1. This can be defined as the average hours of nursing care given to each patient. It is computed by dividing the personnel hours by the patient census. If the nursing hours per patient ratio was 4 hrs and there were 20 patients, then 4 \times 20 or 80 hrs of nursing would be required. This would entail 10 nurses over a 24 hour period.
bearing on the efficiency of the unit operation. This can only be concluded if the quality of nursing care is considered equal for each unit. This is a factor that the architect must accept when working on the theoretical problem. The figure obviously depends upon the percentage of beds occupied by the patients. An extremely high percentage may put an extra load on the available nurses and thus reduce the figure. A comparison of last year's figures for the three hospitals is as follows:

Hospital B, 93%, Hospital A, 90%, and Hospital C, 60%.

The large variation in Hospital C is because it is the newest hospital of the three and still has one floor unoccupied. Hospital C opened in 1954, Hospital B in 1951, and Hospital A in 1949. The relation of occupancy for the particular units studied was 96% for Unit B, 93.5% for Unit C, and 79% for Unit A. In comparison of nursing hours per patient for the three hospitals, Hospital B had the lowest ratio of 3.5 hrs., with Hospital C 4.7 hrs., and Hospital A 4.8 hrs. The figure of 3.5 hrs for Hospital B again reflects the value of a unit secretary.

It is much easier to find faults in a design than to point out the good features, especially when concentrating on one particular section of a large, complex hospital. However, lessons can be learned from mistakes as well as the good features of a building. I have followed the easier path and in the following list I shall point out a few errors in planning which I have observed.
<table>
<thead>
<tr>
<th>6th floor Hermann Hospital</th>
<th>6th floor Methodist Hospital</th>
<th>6th floor St. Luke's Episcopal Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 nursing units</td>
<td>2 nursing units</td>
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<tr>
<td>4 stairways</td>
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<td>5 elevators</td>
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<td>4 elevators</td>
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<tr>
<td>3 small utility rooms</td>
<td>1 nurses' lounge</td>
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</tr>
<tr>
<td>3 nurses' station</td>
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<tr>
<td>1 kitchen</td>
<td>1 sub-utility</td>
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<td>2 bathrooms</td>
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</tr>
<tr>
<td>1 waiting room</td>
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<td>2 janitor closets</td>
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<td>2 bedpan rooms</td>
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<td>1 janitor closet</td>
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<td>1 laboratory</td>
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<tr>
<td>Secretary office</td>
<td>Housekeeper</td>
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<td>2 wheelchair alcoves</td>
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<tr>
<td></td>
<td></td>
<td>2 solariums</td>
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I shall also suggest the inclusion of some elements which have been omitted from some of the units which I studied. These suggestions may be a useful guide if there is a new addition to be built in the future.

Observations of Field Study:

Hospital A

Work space in nurses' station was too small (see diagram 23).
There was no privacy for the doctors at the nurses' station.
A solarium is required.
A conference room is required.
A nurses' lounge is required.
No laundry or waste chutes.
No stretcher storage.
No patient-nurse vocal inter communications.
Not enough light at medicine cabinet.
The drinking fountain projects into the corridor.
No communication equipment between the nurses' station and pharmacy or central supplies.
The corridor lacked colour.
Not an ideal relation between utility and nurses' station.
No unit secretary.
The air-conditioner caused a draft in the nurses' station.

Hospital B

Poor relation between nurses' station and the utility room and dumbwaiter.
No stretcher storage.
No window in corridor.
Medicine area too small.
Solarium used exclusively as a bedroom; no adjoining lavatory facilities.
There was no privacy for the doctors at the nurses' station.
Only minor control of the two bedrooms near the waiting area.
No patient call light in the nurses' lounge.
Hospital C

No toilets adjoining the majority of bedrooms. Very poor relation between the nurses' station and dumbwaiter.
Nurses' lounge too small.
No call light in nurses' lounge.
The waste chute should not open off the corridor. Waste and laundry chutes should not be side by side. Worse still is the fact that they open into the same area in the basement.
Certain amount of waste area along the centre strip of the unit.
The drinking fountain projects into the corridor.
No control of entrance.
There is a certain amount of noise from the patient-nurse call box.
No unit secretary.
No solarium.

Rotating Patient Theory

A solution is required to correct the faults found in our present day nursing units. As an answer to many of these undesirable elements I believe that a design based on a rotating patient theory has great merit, and I present the following as a conclusion after consideration of the factors influencing the design of a nursing unit.

The rotating patient theory would be a natural development from the present sequence of operating room, to post-operative recovery room, to nursing ward. Previously, the patient's life was endangered by being directly transferred from the operating room to the nursing unit. Then it was discovered that supervision and aid to the recovering patient could best be given in a concentrated area, where all post-operative patients rested while com-
ing out of the anaesthetic. The patient could be supervised by specially trained personnel and the doctor or professional anaesthetist could readily be summoned in any emergency. Special equipment could be made available in this area as required. From this initial progressive step, it seems only logical that during the patient's crisis he would also benefit by being housed in a special section designed for critical cases rather than being scattered in with the other patients in various states of health. Surgical and medical patients would both be treated similarly in their respective units. However, the medical section would not have the same extreme critical classification as the surgical section.

It does not seem humane to house patients who are critically ill with patients who are recuperating or are nervously waiting for an operation: a patient waiting for an unfamiliar examination beside a dying patient; a sensitive, high strung patient beside a noisy, odourous, or delirious patient. These patients have very little in common and should not be housed together. It is not hospitalization in its truest sense of serving the complete human being; both mind and body. There must be some division between the recuperating patient and the critical patient. This is more important to the patient's welfare than any of the other added amenities such as a good view or pleasant surroundings.

The following sequence would then follow: operat-
DIAGRAM 26

OPERATING ROOM

RECOVERY ROOM

CRITICAL SECTION

RECUPERATING AREA

ROTATING PATIENT THEORY
### Diagram 27.

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<td>12/31</td>
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36% of acutely ill patients have RN's on private duty
42% of critically ill patients have RN's on private duty
22% of convalescent patients have RN's on private duty
ing room, to post-operative recovery section, to critical section, to recuperation section (see diagram 26). The patient's welfare and comfort must be kept in mind at all times and the cold mass production atmosphere not be allowed to enter. The previously discussed amenities of colour, light, furnishings, etc., must all be adhered to. When the patient is in the critical section he receives the personal attention of a specially trained nurse and special equipment, and after leaving this section he enjoys the company of other improved patients. The saving of the patient from inhumane patient mixing improves his psychological welfare and hence certainly justifies this amount of specialization.

The critical patient should be nursed in an area where there is equipment to adequately meet all his needs and there is constant supervision by the nursing staff. The danger of leaving critical patients unattended has been previously stressed. Today, there is a tendency in the United States and Canada to solve this problem by providing special nurses to look after the critical patients (see diagram 27). This is a large added expense that the patient must pay. A special nurse would cost approximately forty dollars a day. In many cases the added expense is impossible for patients to pay. Besides this point, even if everyone could af-

1. see above, Special Factors Relating to Welfare and Comfort of the Patient
ford such required service it would be impossible to find enough nurses with our present personnel limitations to serve every deserving patient. In the future, even with the decreased hospitalization due to medical advances, the probable continued increase of the ratio of hospitalized patients over new graduate nurses is going to make it even more difficult. Some system where the critical patient has constant supervision, right surroundings, and immediate accessibility to equipment, without adding to the number of nurses required or increasing hospital costs must be devised.

There have been experiments in which nurses exclusively look after a given number of patients: one nurse in charge of a group of four 2-bed wards or single wards connected by an interior corridor.¹ I feel this, when applied to a rotating patient theory, is the basis for a solution to our problem. One professional nurse would be in charge of a small number of critical patients. This would eliminate the need for a special nurse for each single room. The exact number of critical beds per section would have to be worked out with consultation of the doctor, nurse, administrator, architect and engineer. The number of sections per nursing unit would depend on the type of unit, neighbourhood, and other such factors.

DIAGRAM SHOWING A 4-BED CRITICAL SECTION IN NURSING UNIT

RECOVERING AREA DESIGNED AS FLEXIBLE BEDROOMS
DIAGRAM 30.

SCHEMATIC VIEW OF A 4 BED CRITICAL SECTION
In my diagramatic presentation I have shown one solution with a 4 bed critical section and the other with a 4 bed and 5 bed section (see diagrams 28 and 29). This latter solution could be used to serve two adjoining nursing units.

The patients can be accommodated in one section divided into private areas by floor to ceiling partitions (see diagram 30). The partitions should have the upper part glazed, permitting cross-vision by the nurse in charge. The glazing would have to incorporate a sound proofing detail similar to that used for the control booths of broadcasting studios. Each cubicle should be capable of being closed with a sliding door as required. A work area should be arranged parallel to these cubicles and should contain the nurses' sub-station and required utilities. Each cubicle could be adequately soundproofed to prevent any annoyance to the next patient. Special ventilation controls should be installed for each enclosed cubicle, thus if any objectionable odour was connected with the injury it could be easily exhausted by adjusting the individual control. Special equipment required for various treatments could then be concentrated in this particular section. There would be a considerable saving in not having to install and maintain such equipment to every bed in the nursing unit. For the medical unit, however, it would still be advisable to pipe oxygen to the private rooms but it would not be required for
surgical units. Toilets would not have to be supplied in such large numbers, but one could serve the critical section and one could serve each multi-bed recuperating ward.

It would then be much easier to obtain the correct psychological atmosphere for each room. No longer would there be the problem of what colour to paint a room that would alternately be occupied by critical and recuperating patients. The colour of the critical area could then be selected to give the desired cool, restful atmosphere. The recuperating patients could enjoy a more cheerful and aggressive atmosphere without the danger of the critical patient having to suffer a hardship. Television and radios would no longer torture the patient in need of quietness. The windows of the critical area could be designed for the particular job and shaded accordingly. A view would not be such an important factor for the critical patient as it would for the recuperating patient. The recuperating patient could then take full advantage of the view by having the exterior wall glazed and also obtain the benefit of a lighter and more open room. It would not be as imperative that this large window be capable of complete darkening with expensive, heavy drapes as is the case in a room with mixed occupancy. This individual window design would influence the exterior elevation of the nursing unit. This could easily be an advantage by the architect and might even add interest
to an otherwise monotonous exterior pattern.

With the rotating patient theory controlling the design of the nursing unit, the economy and efficiency of nursing would be excellent. Where 4 registered nurses plus sufficient nurses aides would be required for 4 separate bedrooms, now only one registered nurse could take charge with assistance from the nurses aides when required. The problem of the nursing shortage would be relieved. The nurse would have the required equipment and sub-utility area at her immediate disposal and thus reduce the distance she would have to travel in a normal plan. This would then allow her opportunity to give adequate nursing service to the critical patients. The nurse would not be interrupted by outside interference but she would be free to concentrate her attention on her patients.

Professional nurses would then be doing the job they are trained to do and not, as today, where they are often involved in time-consuming tasks that are a complete waste of their talents. The areas where the recuperating patient is housed can then be attended to by staff with less training or even by patients themselves in some cases. The nurses aides would not need the extreme professional training required of a registered nurse and it would be much easier to fill such vacancies. This would help give adequate supervision to each patient in

1. See above, Observation of Field Study, p. 99.
the recuperating area without increasing the number of registered nurses.

The patients would remain in the critical section until they are well enough to be moved to the recuperating area. This decision would be made by the doctor in charge of the patient. The bed and clothes locker could be designed as an easy, movable unit and would be moved with the patient without the trouble of changing him to a new bed. The free bed and closet unit would then be wheeled into the vacant area to receive the next critical patient.

This introduces the problem of administration difficulties. When should the patient be moved to a less expensive area? How is the move to be kept on records? What will be the financial charges for each section? First, I feel that the patient's doctor will have to assume the responsibility in his decision of moving the patient. He will certainly be basing his decision on medical grounds and the move will rightly rest on the welfare of the patient and not be swayed by economic reasons.

The ward secretary\(^1\) could easily be responsible for the recording of the change which would then be quickly recorded on the master records through the use of pneumatic tube communication. Even in our nursing

\(^1\) See above, *Recommendations of Field Study*, p. 100.
units today, there is a surprising number of moves being constantly made from the public to semi-private to private, and from private back to semi-private. These changes are being adequately handled by the standard detached administrative system, so I see no problem when there is the extra secretarial help in each specific unit.

The problem in respect to the financial charges to be made for various types of accommodations is a major one. The ideal theoretical solution would be to merge the cost of the critical section into the general hospital fee structure and divide it equally among all patients in that unit. This would increase the cost of each bedroom but the saving of personnel and equipment would help bring this increase down to manageable terms. However, the personal charge that the patient must now pay for this required nursing care would be greatly reduced. This would make it possible for patients who could not afford a private nurse to then receive the quality of nursing that they deserve. The only way a true cost of analysis can be made is to record the results of an experimental unit. Here is where a government sponsored research division could be readily employed.

This theoretical financial solution might not be practical in our present hospital scale of charges. There is also the added problem that not all patients would require this critical section and those that do would remain there for different lengths of time, so why
should everyone be charged a higher rate because of certain critical patients.

It would be desirable to charge only the patients who use the critical section. This could be managed in the same way as the post-operative recovery room is today. That is, the patient is charged an hourly rate for the amount of time he is in this particular section. The ward secretary would have a scale of rates and charge the patients accordingly. When the doctor felt that his patient no longer required the benefit of the critical area then he would sign a transfer slip and the extra charge would be stopped. The patient would then be transferred to the recuperating area.

This immediately raises the question; what if there is not a bed available in the recuperating section? The patient would then remain in his private cubicle until one is free. However, with the continual rotation of patients this wait would not be long, if at all. The patient would pay the same rate as if he were in the recuperating area as soon as the doctor ordered his transfer. This would not cause any problem in the fee structure of the critical section for over the year, a certain mean would be established on which to base the next year's rates. This variation then would be covered by the hourly charge for each critical section cubicle.

The multi-bed wards of the recuperating area should be designed for complete flexibility of occupancy (see
diagrams 10 and 28). The problem of moving the patients who rotate from the critical section to the general nursing area could be much more readily solved. The flexibility also gives the unit the opportunity to adjust itself to the fluctuating demands of seasonal occupancy. The plan in diagram 28 is adaptable to accommodate from 25 patients up to 34. With the maximum figure, the 4 bed ward would predominate thus helping the nursing staff to give adequate supervision to each patient in the recuperating area without increasing the staff.

A certain number of private rooms, however, will still be required. These would be for contagious isolation cases, problem cases who are not critically ill, and private paying patients. The number would depend on previously discussed factors.¹

For very large hospitals, it might be feasible to make an entire wing a concentrated critical area, the same as the critical section in the nursing unit. The problem of circulation arises, however, for the horizontal transfer of beds would be much easier than the vertical transfer.

The rotating patient theory might be carried further by placing the patients who have been in the nursing unit for a considerable time and actually require

¹. See above, General Sizes and Areas, p. 118.
little attention other than medicine or occasional check, in an amiable, roomy area in one section of the unit. The progression would then be from operating room to recovery room, to critical area, to recuperating section, and then to convalescence section.
BIBLIOGRAPHY

Books


Field, Minna, *Patients are People*, New York, Columbia University Press, 1953


Holmes, Christian R., *The Planning of a Modern Hospital*, Detroit, National Hospital Record Publishing Co., 1911


Sloan, Raymond P., *Hospital Color and Decoration*, Chicago, Physicians Record Co., 1944

Bulletins


*Average Nursing Hours per Patient in Member Hospitals*, Rochester, Rochester Regional Hospital Council, 1952

General Standards of Hospital Construction, Ottawa, Department of National Health and Welfare, 1948


Plans for Canada's Rural Health, edited by H. G. Hughes, Department of National Health and Welfare, 1947


Study of Nursing Functions in Twelve Hospitals in the State of New York, School of Nurse Education, New York, New York University, 1952

The Hospital Building, edited by W. A. Taylor, Washington, Edwards Brothers Inc., 1948

Architectural Periodicals

Architectural Record

"Building Types", vol 113, pp 165-88, February 1953
"Building Types", vol 115, pp 159-90, March 1954
"Building Types", vol 117, pp 177-203, March 1955
"Building Types", vol 118, pp 199-219, November 1955

Architectural Forum

"Hospitals in California", vol 94, pp 92-9, February 1951
"Hospitals", vol 96, pp 120-9, April 1952
"Expanding Hospital", vol 97, pp 152-7, July 1952
"Rosenfield and His Hospitals", vol 97, pp 128-35 September 1952
"Parallel Block Hospital", vol 97, pp 112-15, November 1952
"Houston Hospitals", vol 101, pp 141-5 December 1954
"New Kind of Teaching Hospital", vol 102, pp 150-3, March 1955
"Single Room Plan", vol 104, pp 146-7, April 1956
Progressive Architecture
"Hospital-New York", vol 32, pp 15-16, July 1951
"Hospital Design and Construction", vol. 34, pp 77-103, November 1953


Medical Periodicals
Canadian Hospital, "Economy in Planning and Construction", vol 30, pp 52-3, September 1953

Hospitals
"Hospital Care", vol 23, p. 62, April 1952
"Philosophy of Planning", vol 24, pp 66-8, July 1952
"Flower Distribution", vol 24, p 68, October 1952
"Patient Inconveniences", vol 25, pp 58-60, June 1953
"Trends in Planning", vol 26, pp 80-2, October 1953
"Construction", vol 27, pp 53-9, January 1954
"Plan for Mobility", vol 28, pp 78-80, July 1954
"Care for the Critical Case", vol 28, pp 65-6, September 1954
"Hospital Planning", vol 29, pp 69-72, March 1955

Hospital Management
"Noise Eliminating Insulation", vol 75, pp 37-9 March 1953
"Decoration and Color", vol 76, pp 33-5, December 1953
"Elevator Service", vol 78, pp 49-55, September 1954

Hospital Progress
"Patients Privacy", vol 33, pp 58-9, September 1952
"Human Relation to Management", vol 37, pp 51-4, December 1954

Modern Hospital
"Measuring Quality of Nursing Care", vol 66, pp 50-55, April 1946
"Measuring Quality of Nursing Care", vol 66, pp 59-62, May 1946
"What a Head Nurse does with her Time", vol 77, pp 59-62, November 1951
"Private-in Shared Accommodations", vol 77, pp 55-7, October 1951
"Fire", vol 77, p 75, December 1951
"Color", vol 77, pp 58-60, December 1951
"Building Obsolescence out of the Building", vol 78, p. 122, June 1952
"Patient Safety", vol 79, p 83, September 1952
"Efficiency Centres on the Corridors", vol 82, pp 61-72, March 1954
"Metal Partitions", vol 83, pp 116-8, August 1954
"Psychological Study of the Hospital Patient", vol 83, pp 51-4, September 1954
"Color in the Modern Hospital", vol 84, pp 65-72, April 1955
"Patient Report", vol 85, pp 71-4, August 1955

Source of Photographs
Standard open ward - Billings J. S., Description of The John Hopkins Hospital, plate 24, Press of Isaac Friedenwald, Baltimore, 1890

Nursing unit, Rigs Hospital - Nuffield Provincial Hospitals Trust, Studies in the Functions and Design of Hospitals, fig. 1, p. 3, Oxford University Press, London, 1955