THE RELATIONSHIP BETWEEN FIVE ELEMENTS AND NINE VARIABLES IN HOSPITAL PLANNING

Yahaya Hassan¹, Azli Yahya², Jasmy Yunus³, Sarajul Fikri⁴, Norhalimah Idris⁵, Husna Hamzah⁶

¹,²,³School of Biomedical Engineering & Health Sciences Faculty of Engineering, Universiti Teknologi Malaysia, Johor, Malaysia.

⁴Faculty of Built Environment (FAB), Universiti Teknologi Malaysia, Johor, Malaysia.

⁵School of Azman Hashim Business School, Universiti Teknologi Malaysia, Johor, Malaysia.

⁶Hospital Planning & Research, Damansara PMC Services Sdn Bhd, Kuala Lumpur, Malaysia.

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Abstract

Hospital is a place where the sick comes to seek for treatment from doctor. Hence, special attention and provisions must be given when designing and building the hospital which include assurance in terms of safety requirements, convenience, accessibility and functional for all stakeholders (patients, visitors and staffs). Designing an ideal hospital, which satisfies the above criteria, is challenging, but not entirely impossible. Extra efforts are required in ensuring a design not only functional but adheres to specific rules and regulations, especially incorporating latest technology. This paper discusses the initial stage of hospital planning and design, which incorporates all the necessary parameters (elements and variables) in hospital planning such as bed sizing, service area and locations, which are crucial for the mass users of population. Some analysis based on researcher’s professional judgement is applied in making projection of the present and future hospital capacity.

Keywords: Design, elements, hospital building, hospital planning, principles, variables.

I. Introduction

Malaysian hospitals are categorised into three levels, which are primary, secondary and tertiary. Since 1960s, Malaysian government mainly provides the first two levels, while the tertiary level is dominated by private sectors. Based on the 2016 Health Facts printed by Ministry of Health (MoH), there are 335 hospitals in...
Malaysia, which offers 58,050 beds in 2015 to accommodate Malaysia’s population of 30.485 million.

According to World Organization of Health (WHO), hospital bed is one of the indicators used to estimate the availability, accessibility and distribution of health services delivery to a population. This means that with higher number of hospital beds, more people can benefit inpatient services.

Table 1: STATISTIC OF BED RATIO BASED ON REGIONS

| Region          | Country   | Ratio of Hospital Bed : 1,000 population |
|-----------------|-----------|------------------------------------------|
| South East Asia | Malaysia  | 1.90 : 1,000 (2015)                       |
|                 | Indonesia | 0.9 : 1,000 (2012)                        |
|                 | Thailand  | 2.1 : 1,000 (2010)                        |
|                 | Singapore | 2.7 : 1,000 (2016)                        |
| Asia            | Korea     | 13.2 : 1,000                             |
|                 | Japan     | 13.7 : 1,000                             |
| US and Europe   | Australia | 3.9 : 1,000                              |
|                 | Germany   | 8.3 : 1,000                              |
|                 | United Kingdom | 3.0 : 1,000  |
|                 | United States |  : 1,000                      |

Source: 1. Asian Development Bank, 2. Department of Statistics Singapore, 3. Ministry of Health Malaysia

The Asian Development Bank (2016) provides compiled data on the ideal ratio of hospital beds as per 1,000 people in the world. Based on regions (refer to Table 1), Malaysia’s bed ratio is 1.90: 1,000, which is the second lowest in the ranking among countries. Meanwhile, more hospital beds are available to every 1,000 populations in Korea and Japan which are 13.2 and 13.7 beds respectively.

Table 2: STATISTIC OF MALAYSIA POPULATION AND HOSPITALS IN YEAR 2015

| Total Population in Malaysia (2015) | 30.5 million |
|-------------------------------------|--------------|
| Hospital Type                      | Government   | Non-MoH | Private | Total   |
| No of Hospitals                    | 143          | 9       | 183     | 335     |
| No of Hospital Bed                 | 41,389       | 3,698   | 12,963  | 58,050  |
| No of Outpatient Attendances       | 58,883,654   | 2,162,307 | 3,932,361 | 64,978,322 |
| No of Inpatient Admission          | 2,526,205    | 150,832 | 1,064,718 | 3,741,755 |
| Conversion Outpatient to Inpatient | 4.29%        | 6.98%   | 27.08%  | 5.76%   |
| Ratio Bed No : Population          | 1.90 : 1,000 |

Source: Ministry of Health Malaysia

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MoH has set its future goal in providing 2.5 hospital beds available for every 1,000 population in Malaysia. In total, Malaysia requires 80,000 of hospital beds to support its current population of 32.0 million in year 2017.

In reference to the above Table 2, Malaysia is currently experiencing shortage of 22,000 beds from its target to achieve the hospital bed to population ratio of 2.5:1,000. Consequently, many developers have taken these opportunities to address the shortfall via intense development of hospitals, ambulatory care centres and other health facilities’ in Malaysia.

However, predicting an ideal bed number for each health facilities depends on the parameters and principals of hospital planning and design. Therefore, the following sections provides some findings from regression analysis on the parameters essential for hospital planning and design.

II. Main Results

Based on a thorough investigation on the development projects of more than 20 hospitals, the followings are the parameters, which are vital components, required in hospital planning. Elements are the components required to complete hospital planning, while variables are the parameters identified that affects the outcome of hospital planning. Therefore, incorporating these elements and variables, facilitates an optimum design of hospital building. Fig. 1: The Elements and Variables in Hospital Planning

\[ \text{Elements of Hospital Planning:} \]
- Components of Feasibility Study:
  - Location
  - Demography
  - Healthcare Scenario
  - Mortality Rate

\[ \text{Variables of Hospital Planning:} \]
- Type of Services
- Treatment Time
- Conversion Rate
- Outpatient \(\rightarrow\) Inpatient

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A. **Element 1, Variable 1**

Element 1 : Feasibility Study, and

Variable 1 : Type of Services

Feasibility study is one of MOH’s requirements for zoning hospital based on location. A feasibility study assesses the location, demography, healthcare scenario and mortality rate at the proposed site. This step is necessary, as normally MoH requires justification for the need in developing a new hospital at any location. MoH disapproves any application of new hospital proposal should there is nearby hospital that can be accessed easily.

From the feasibility study, a developer identifies the first variable, which is the type of services for the hospital. For example, if there are many factories at the nearby location, the proposed hospital could be a Centre of Excellence (CoE) for trauma, with focuses on treating industrial accidents and mishaps.

B. **Element 2, Variable 2-5**

Element 2: Questionnaires for Project Brief & Concept Design

Variable 2 – 5 : (i) Treatment Time,

(ii) Conversion Rate from Outpatient to Inpatient,

(iii) Length of Stay, and

(iv) Occupancy Rate

Subsequent to Variable 1, a developer identifies type of service as one of variables in hospital planning followed by answering the Element 2: The Questionnaires for Project Brief and Concept Design. In this stage, a developer’s vision of the hospital is queried in more detail. Examples of questions asked are the expected facilities to be delivered in the project such as number of clinic and medical equipment; and plans for future expansion.

Questions related to future expansion in Variables 2 – 5 are usually completed by hospital management and doctors. Feedbacks from the questionnaires provide some idea of overall hospital operation scenario, which include doctor’s competencies, availability of consultants, diagnostic and treatment facilities, severity of illnesses and patient’s financial abilities (these examples are from a private hospital case setting).

Variable 2: Treatment Time

Normal doctors at private hospital would attend on average, 20 minutes per patient for diagnostic and treatment of critical illness patient. Hence, in average of 5 hours per day in a clinic, a doctor attends 15 outpatients per day.

Having spent longer time spent on a patient indicates the more severity of the illness and longer time spent in using investigative and treatment facilities available in a hospital.
Variable 3: Conversion Rate from Outpatient to Inpatient

According to MoH’s Health Facts (2016), the conversion rate from outpatient to inpatient at a private hospital is 27.08%, whereas 11.33% as stated in 2015 KPJ Bhd’s Annual Report.

The conversion rate shows the severity of patient’s illness and financial ability (whether a patient pays using their savings or insurance coverage) which enables one gets admission for further medical treatment.

Variable 4: Length of Stay

The average length of stay in a private hospital is 2.5 days per admission, with an exception for very severe cases. This shows that hospital has competent doctors and good investigative and treatment facilities, which allow patients to be discharged earlier.

Variable 5: Occupancy Rate

Most private hospitals’ occupancy rate is in a range of 70% - 75%, which reflects patients have strong financial abilities where payment can be either using their own saving or via insurance coverage.

Based on the above information, it can be concluded that a hospital is thriving and has good investigative and treatment facilities, which attracts many patients apart from individual’s financial ability to be treated.

Findings from the questionnaires help to generate the project or design brief of the hospital.

C. Element 3, Variable 6-7

Element 3 : Project / Design Brief

Variable 6 – 7 : (i) Hospital Bed

(ii) Hospital Size

The questionnaires can determine an ideal size of a hospital and number of beds. For example, if a developer wants 20 clinics in a hospital, assumptions in variables 2-5 are the basis of estimating the hospital size and beds number.
Fig. 2: Example if the number of clinic is 20,

From the above calculation, the ideal number of hospital beds is 150.

By assuming that a hospital has 20 clinics with 150 hospital beds, information on expected services is available, estimation of the hospital size can be obtained after incorporating the size of gross floor area (GFA) at each sections and services. At this stage, a developer would decide whether to develop the hospital in one go, or by phases.

D. Element 4, Variable 8-9

Element 4: Schedule of Facilities (SoF) & Schedule of Areas (SoA)

Variable 8 – 9 : (i) Type of Services & Discipline

(ii) Medical Equipment Required

Schedule of Facilities (SoF) and Schedule of Areas (SoA) are detailed in Project/Design Brief of Element 3 which derived from Questionnaires earlier. SoF provides information on facilities such as services and disciplines which are available at every floors of a hospital. Thus, number of medical equipment required for each service can be estimated.
In a meanwhile, SoA indicates size or dimension of services that adhere to MoH’s guidelines. Normally, a planner prepares SoA according to the guidelines in order for architects to prepare the 5th Element: Massing Drawings.

E. Element 5

Element 5 : Massing Drawings

Information gathered from Element 4 and Variable 8–9 are used in developing Massing Drawings. These drawings show the positioning and allocation of each services with respective medical equipment at each floor of a hospital. At the same time, architects need to ensure services’ flows are in accordance to the MoH’s guidelines. For example, the Accidents and Emergency (A&E) Department must be next to or easily accessible to the Diagnostic Imaging Services and Pharmacy. This is important as to ensure patient receives immediate investigation and treatment.

The information from the Elements and Variables, with an exception for Element 2 and Variable 2-5 are sent to MoH for further approval. After this stage, a developer further details out the hospital building using the principles in the design of hospital building, which serve as the basis of design considerations, while accommodating to any latest technology available in the design of a hospital building.

III. Conclusion

In summary, it is undeniable that Malaysia is experiencing shortages of hospital beds when compared to the targeted hospital bed to population ratio of 2.5:1,000. This resulting to rapid development of hospitals in Malaysia.

Therefore, it is essential to identify elements and variables in hospital planning in order to contribute to produce optimum design, which projects the present and future needs of the hospital capacity.

On another note, information from the feasibility study and variables 2–5 can also be used to indicate the healthcare scenario in a country. If the information shows unfavourable condition, it means that the country’s healthcare requires improvement in terms of developing competent healthcare personnel, improving facilities and hospital environment and increasing awareness among public about critical disease and illness.

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