

## **Exploration of Usability Issues in Malaysia Public Hospital Spatial Design: Pilot Study**

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### **Abstract**

*This paper explores the usability of healthcare spatial design in Malaysia public hospital as part of quality in-use evaluation. This study tries to understand of the complexity of end-users used facilities provided and to observe the patient feedback during journey experience in the hospital spatial design and it relationship. There are varieties of health-care evaluation either for the quality of design or service, as well as the impact of those factors to the patients but usability evaluation is appropriate in exploration of user experience. Usability approach is focusing on the method of collecting data, and it is based on the exploration of the user experience by knowing their perspective. It measured by three parameters; the effectiveness and efficiency of the design or facilities offered and user's satisfaction. The methods of collecting data in this study are using walkthrough observation and interviewing patients and visitors from three public hospitals. The study, identified variety of usability criteria contributes to the quality of architecture in-use. Later, all those issues will be used as evaluation criteria for a main case study.*

**Keywords:** Usability, Healthcare Spatial design, Evaluation, Quality in-use indicators.

### **1.0 Introduction**

This pilot study is small in comparison as a feasibility study; it to help added anything new or important to main study. Moreover, it had done to achieve all the objectives of the researcher tryout, such as improving data-collecting routines, and checking the appropriateness of usability evaluation; to explore current scenario and usability issues Malaysia public hospital. From a review of pilot study purpose, according to Prescott and Soeken (1989) in Hertzog (2008) pilot studies can serve many purposes included assessment of (a) feasibility, (b) adequacy of instrumentation, and (c) problems of data collection strategies and proposed methods. To these they added: (d) answering methodological questions and (e) planning a larger study. In a more recent article, and according to Jairath, Hogerney, and Parsons (2000) contributed a sixth potential use of a pilot study: (f) obtaining sufficient preliminary data to justify a main study. Furthermore, it can greatly reduce the number of unanticipated problems because we have an opportunity to redesign parts of the study to overcome difficulties that the pilot study reveals. Besides, in this pilot, the researcher had tried out a number of alternative measures and then selects those that produce the clearest results for the main study. Therefore, the requirements of the pilot study are essential to facilitate the assessment of the actual site.

### **2.0 Research background**

Currently, in Malaysia there are 136 public hospitals. The government hospitals in Malaysia are categorized into two types; regional or state and district hospital. The differences are in the provision of healthcare services, bed capacity and total of the number of medical specialist offered (Ministry of Health Malaysia, 2009). This study was conducted in a replacement hospital that had been choosing for the main case study. A replacement hospital is a new hospital built to replace the original hospital which had been closed or turned into the state health department or health clinic.

Meanwhile there are 10 replacement hospitals peninsular Malaysia and three different category hospitals have been selected, in which the hospital began operating in the year 2000 above and offered medical specialist- A, B & C (table1). This pilot study focuses on the northern region area, is due to lack of researcher focus on this area and spatial design. This pilot case study conducted on the selected main case studies as a preliminary study. It covered on the first floor area related to patient and visitors service.

**Table 1: list of replacement hospital in Peninsular Malaysia**

No.	Hospital	Year	Type of hospital	Size/beds	Patient/yr	Medical discipline (md)
1	A	2007	Referral / State Hospital /Total Hospital Information System'(THIS) /The Clinical Research Centre (CRC)	812	80%	22
2	B	2007	Secondary Hospital	550	72%	11
3	C	2001	District hospital	250	57%	6
4	D	1996	District Hospital without specialist	160	50%	Without specialist
5	E	1994	Secondary hospital	314	100%	10
6	F	1994	District Hospital With specialist	270	76.5 %	10
7*	G	1994	District Hospital Without specialist	90	51.9%	6 & 5 visit m d
8	H	2005	Secondary /Teaching Hospital	482	70.7%	14 specialist
9	I	2007	District Hospital	110	33.0%	Without specialist
10	J	2008	District Hospital	28	50%	Without specialist
			Northern area	*	South area	East area

Source: Malaysia Ministry of Health (MOH) 2009

In this study, the usability evaluation criteria derived from Voordt 2005; 2009, seems it related to the assessment on healthcare architecture in-use. It is using nine dimensions,(1) Reach ability and parking facilities,(2) Accessibility,(3) Efficiency,(4) Flexibility,(5) Safety,(6) Spatial orientation,(7) Privacy, territoriality and social contact,(8) Health and physical well-being and ,(9) Sustainability. This evaluation adopted from NHS, Achieving Excellence Design Evaluation Toolkit (AEDET): its Post occupancy Evaluation (POE) Toolkit with the systematic questionnaire (Excel-based program) related to how building performed, provides three key areas; (1) functionality- use, access and space, (2) impact -character and innovation, form and materials, staff and patient environment, urban and social integration, and (3) build quality and standard performance, engineering and construction (AEDET evolution, NHS 2010)Voordt alteration on method of evaluation to suitable approach using observation and interview. In other to get the respondent more understand and in –depth study to the usability scenario.

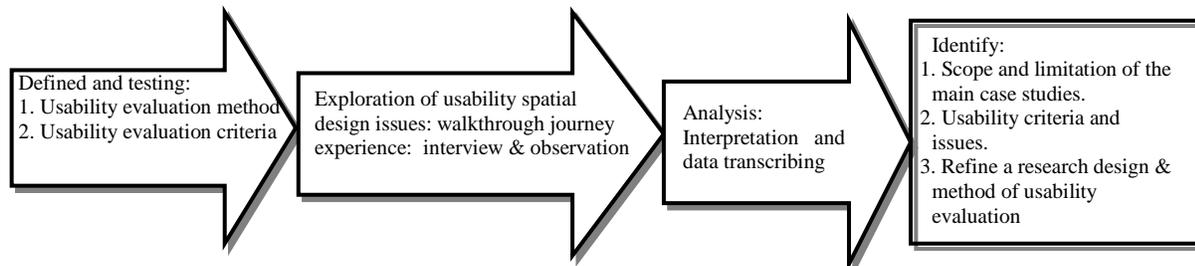
### 3.0 Aims of the pilot study

Purpose of this pilot is to achieve the main objective of this study is to explore the user experience of healthcare spatial design using usability evaluation criteria and to test methodology or procedure in gathering information. These pilot objectives are, such as;

- To observe the ease of use the hospital spatial design and explore usability issues and criteria that will support for the main case study.
- To obtain the feedback from testing the usability method and research design suitability for determining the assessment for quality in-use.
- To gather a perspective or view from hospital practice and consultant (medical planner, hospital support service) on the ability of design use by patients and visitors.

### 4.0 Methodology

Basically, this pilot explores and describes the situation or experiences of people with the three different type hospital environments, events and their relationships as a case study. Furthermore, this methodology is related the pilot study objective (figure 1).Moreover, according to Zainal 2007 case study research allows the exploration and understanding of complex issues and the life experience of a phenomenon for a person or group of people (Patton, 2002; Seamon, 2000; Yin, 2009). Consequently, the hospital is complex design and service to meet a variety of categories and type of end-users.



**Fig 1: The pilot study methodology**

In this pilot study, the usability evaluation is referred to process of collecting data as a proposed for main case study. It derived from usability research method; Systematic if Usability process by Sami Kärnä & Suvi Nenonen (2010) and from review of the usability methodology and research technique. Hence, it had been chosen as a reliable assessment method that thoroughly observes and explores the user's action from their experience the real thing (Haron & Yusof, 2011; 2011).

#### **4.1 Method of Data Collection**

There are several approaches in usability evaluation, and it is related to the method of data collection. It is concerned with the attraction, experience and expectation of end-users to a situation, design or product. There are several methods used and tested in this study.

##### **4.1.1 Document review**

Reviewing existing document, from the current and the previous report, healthcare design and facility guidelines, hospitals issue and finding from other researchers related to patient satisfaction also had been done to support the issues been highlighted in this study.

##### **4.1.2 Semi-structured interview**

This qualitative study was conducted using semi structured interviews involving patient, family members and friends as a hospital visitor's respondents. In the interview, they described a negative event from their own or friend/family member's experience. The walkthrough technique been used during journey and waiting experience, in which participants are asked to describe an event about an ability of use the design environment in which, in their perception that they had not expected, or that they found unusual or inappropriate or misuse. This technique helps to obtain rich contextual information, as it uncovers tacit knowledge by allowing participants to describe what their thought processes and actions were during the specific event. These interviews also involve hospital staff –doctors, nurses and administration and hospital support service: hospital consultant and medical planner. It's to get a feedback to the ability of design to patient and visitors. All interviews were recorded to allow for the verification and transcription for subsequent analysis. All interviews were conducted face to face on the interviewee's own premises. The length of an interview lasted between half hour to four hours during the walkthrough session and some interview take too long because waiting for the service takes time.

##### **4.1.3 Observation Method**

As mentioned before, we use walkthrough observation to user behavior activities been done by watching people use their environment and activities related to spatial-relationship and surrounding to determine the usability variables (Haron, 2010). It has done by analyses of the space and movements "tour" of the building assessing different qualities of functions of environment. In the same time Interviews had used to support humans without disturbing their activities, and it took place in a personally meeting, according to the expressed wishes of respondents. In addition, interviews useful to support behavior reaction, and we will know in-depth information around the topic and related issue. Moreover, it is an effort to describe what is going on in a given environment or situation. The action and reaction will be captured by video and photograph and sometime keeping the interview to direct observation to allow them more freedom to say what they think. Those methods being used to know the expected uses, new uses and misuses of design, recognized needs by getting the story behind a participant's experiences.

#### **5.0 Sampling strategy and size**

In obtaining feedback on the usability criteria, 12 respondents consisting of patient, visitors, family and friends been interviewed. 10 respondents were selected on a voluntary basis from Healthcare practice or staff participants (where holding a variety of positions) - doctors, nurses and administration and hospital consultant;

medical planner, engineer and hospital support service to gather a perspective on usable of design according to patient need and expectation. The value of involving patients' and family members' voices in the dialogue about healthcare facility environments is immense if society's goal is to meet people's needs. Reports from The Picker Institute and The Center for Health Design these ultimate end consumers about what matters to them in the built environment, and about what supports their healthcare experience with considering consumers' needs and expectation. It by measuring their satisfaction, as well as the result will provide important information to the best practices for healthcare planners, managers, architects, and interior designers who strive to create caring and supportive healthcare environments (Stern, 2003).

As previously mentioned, pilot studies are carried out with fewer subjects than will be employed in the main study. From the body of literature the various factors affecting the size of sampling. However, there is no easy answer to the question of what are the appropriate number and specific recommendations or size of sample should be in the qualitative study (Burns and Grove 2005, Polit and Beck 2004, Johanson, 2009). The factors which influence the size of the sample will include of these factors, according to Treece and Treece 1982 in Johnson (2009) and Nieswiadomy (2008), recommend obtaining approximately 10% of the project study total sample size. It is recommended that a minimum 12 subject per group or observations in constructing a confidence interval be considered for pilot studies (Van Belle 2002; Julious 2005). Specific sample size depended on the nature of the decision based on the estimate, with samples as small as 10–15 per group sometimes being sufficient (Hertzog, 2008). It same goes to Kieser and Wassmer (1996) indicate 10–20 participants per group would be sufficient to implement to size of sampling. Nevertheless, for exploratory studies according to Isaac and Michael 1995 and Hill 1998 in Johanson (2009) suggested for pilot studies are between 10 and 30 have many practical advantages", including simplicity, easy calculation, and the ability to test hypotheses, yet "overlook weak treatment effects. In addition, according to Marshall (1996) that everyone has an equal chance of being selected as a member of the sample. As well as for phenomenology study according to Creswell (1998), 5 to 25 are sufficient.

Moreover, in qualitative studies size is not mattered, but the key point is our sample must be big enough to assure that we are likely to hear most or all the perceptions that might be important (DePaulo.P 2000). Moreover, each respondent has the same chance of being included and the main is the objectives of the study is achieved (DePaulo.P 2000). In addition according to Yin (2009), generalization of results from case studies, from either single or multiple designs, stems on theory rather than on populations. In other words, as this pilot is a case study method, it is a unique way of observing any natural phenomenon, which exists in a set of data (Yin, 2009). Consequently, different respondent may have diverse perceptions. Therefore, the smaller the sample size, the narrower the range of perceptions we may hear and explore from the answer. On the positive side, the larger the sample size, the less likely it is that we would fail to discover a perception that we would have wanted to know (DePaulo.P 2000). In addition, it also influenced by level of accuracy required and constraints affecting the investigation such as cost and time constraints as well as by size and variability of the population (Hertzog, 2008).

Based on the above factors, there's no specific target number of sampling (N), course of cost and time constrain, also associated to the hospital with a complex design and difficulty. The data collection process takes a long time (walkthrough journey experience, interview and observation). Moreover, the size or number of sampling influence by due to repeated result, which is same issues or usability criteria raised out during the interview process, and due to the data had achieved the objective of study.

## **6.0 Preliminary Finding**

The results are divided based on the objectives of the pilot study.

### **6.1 To explore the ease of use the hospital spatial design and usability issues /criteria**

From this pilot, many patients reported problems related to an ability of design from their experiences and find it, the usability issues related to the effectiveness hospital offering either facility or design. Based on the observations and interviews, there are few factors reflect patient's satisfaction:

- The frequency of the patient and visitor visit to the hospital frequency of patients and visitors coming-effectiveness -familiarity of the place and space: (a) visits the hospital infrequently and is quite uneasy there. (b) Visits hospital fairly regularly and is irritated by the long waiting time and (c) visits the hospital and is frequently extremely bored and feeling not comfortable.
- Patient satisfaction is just not associated with long of waiting times, but it is related to the activities, atmosphere, environment and facilities offered during the waiting process.

- Related to the fulfillment of the needs and expectation from the patient’s family members and friends.
- The familiarity factors are influence by the frequent patient/visitors visit an experienced with the buildings.
- Associated with, the effectiveness and the efficiency of spatial designs offered in other to meet the patient and visitors or family member’s expectations, needs and goals.
- The facilities offered meet or suitable and able to use for every category of patients and visitors and family members, which come from various age, physical conditions and health.

**6.1.1 Usability criteria**

From this pilot analysis found, in order to assess these usability parameters; effectiveness, efficiency and satisfaction there are few usability criteria explain those parameters by identifying the usability issues.

**Observation result:**

According to Voordt 2005; 2009, seems it related to the assessment on healthcare architecture in-use. It is Using 9 Dimensions and from observation and interviews only eight items touched by patients and visitors in addition to aspects of sustainability. Aspects 1 to 4 are related mainly to the user value of the building (table2).

**Table 2: Summary of observation –reaction to usability spatial design**

Usability criteria	Usability issues /problems	Case Study			
a. Reach ability & parking facilities	The bus-stop location is away from the main hospital lobby. It was difficult for patients and visitors to reach the hospital, especially for disable or physical difficulty.	B			
	In addition there is insufficient parking space-not enough parking.	A,C			
b. Accessibility	There is a difficulty on using the staircase to reach the upper floor, especially for respondent with physical difficulty and using the wheelchair.	A,C			
	There is a difficulty happens to a patient related to designing application such as position of public phones that are unsuitable for disabled people, material selection for doors difficult for disabling to access.	B			
c. Efficiency	Because patients and visitors had through the long journey made them tired and bored. From the observation, most of the issues influence by the patient and visitor with the physical ability, age and health condition factors.	A,B			
d. Flexibility	From the observation, there is lacking of an area for kids to play. Most of the area without complete equipment/facilities.	A,B,C			
	Besides that the respondent also needs the multifunctional activities or able or suitable facility while waiting for service. They can do something else to eliminate the feeling bored and tired. These include the provision of reading materials, wireless facilities, and beverage facilities and to see surrounding (more open space) rather than just watching television. Not only that, the facilities should be adaptable to every type or category group of respondents.	A,B,C			
e. Safety	There are few sitting units is damaged to invite danger to visitors and patients. Similarly, the use of multilevel space to reach the specialist clinic also invited danger to use the staircase, especially to the patients and visitor with physical difficulty, elderly people and to the children.	B,C			
	Although there are lifts close, but it was in the lobby and inpatient area, and most of the respondent came direct from the outpatient entrance, causing them forget or not know that there is a lift to the upper level.	A			
f. Spatial orientation	There is a lack of signs, and it was too small to notice, and illogical placements of services only add to the confusion and make orientation difficult and sources of frustrating and stress to the respondent. The participants were confusing and access routes difficult to understand, they look tired and bored to find the service. There are lacking on orientation and way finding coded such as signs and landmarks, which is any design that brought different, variations or unique, rather than repeated design. It made the area easy to identify and to learn as well as the orientation became more user-friendly. The observation most often, participants would note that everything looks the same and confuse in identify the space.	A,B,C			
g. Privacy, territoriality and social contact	Waiting area too crowded-uncomfortable waiting areas. There are visitors or patients who switch seats, so they prefer to chat with each other in a comfortable position. There were also among those who are not sitting, course having to watch the children plays. From here we can conclude that the layout of space and furniture, especially seats play an important role in the optimum comfort to the patient members and visitors.	A,B,C			
Health and physical well-being	Most of the respondent, do not feel comfortable when sitting for too long as a seat material is too hard and unsuitable for them. There is also a respondent of patients waiting outside the examination room because the room was closed and lack of activities for him. In addition, some of the spaces or area lack of natural lighting made them feel uncomfortable.	B,C			
A	Referral/state hospital	B	Small district hospital	C	Large district hospital

**Interview feedback:**

Most of the interview finds that the usability criteria were related to an ability of healthcare spatial design issues to a patient and visitor’s (table 3). Moreover, it related to usability parameters; effectiveness if the facilities, design and service provided; ease of learning, ease of use and efficiency if the facilities, design or service provided is easy to use and take less of effort/ time to solve a task or to reach a goal.

**Table 3: Summary of interview -the usability criteria**

Usability criteria	Usability issues and problems	Hospital			
Accessibility	Insufficient parking area. <ul style="list-style-type: none"> <li>Not enough car parks provided.</li> <li>Lack of a signage and info board.</li> </ul>	A			
	<ul style="list-style-type: none"> <li>There are no covered walkways from parking area to main entrance.</li> </ul>	C			
	<ul style="list-style-type: none"> <li>Lack on landscaping area creating shading and more rest areas out of the building.</li> </ul>	AB			
Reach ability	Facility provided especially against the appropriate baseline for the function of space. <ul style="list-style-type: none"> <li>Lack on social area – Just a space but lack on activities and facilities</li> <li>Problem to place the children when the parents meet the doctor.</li> <li>Insufficient area- some of the area is close to public.</li> <li>Limited shops with limited choices.</li> </ul>	ABC			
Spatial orientation	<u>Wayfinding:</u> <ul style="list-style-type: none"> <li>Signage design or systems area confusing.</li> <li>The directional clarity from the spatial characteristic and access a route are not related to each other’s.</li> <li>Small signage or symbol to show the name of area or building</li> <li>Alternative wayfinding system for who could not read or not understand the language.</li> </ul>	ABC			
	<u>Learn ability and memorability:</u> <ul style="list-style-type: none"> <li>Recognizable functional units, tracking by a landmark for space and design and all are showing their own identity or image, so that it is easy to remember.</li> <li>Confusing direction and layout, especially for systems in walkways to the main area.</li> </ul>	C			
	<u>Efficiency</u> <ul style="list-style-type: none"> <li>Long distance and wayfinding issue will cause the patient tired and no pit stop area for rest especially for disable and elders people.</li> </ul>	ABC			
	<ul style="list-style-type: none"> <li>Wastage of space and the lengthy corridor.</li> </ul>	C			
Aesthetic elements	<u>Emotional comfort</u> <ul style="list-style-type: none"> <li>The interior environment not livelier and enjoy.</li> <li>There’s no window can view the external of the building.</li> </ul>	ABC			
	<u>Physical comfort</u> <ul style="list-style-type: none"> <li>The selection of furniture not comfortable–not suitable for long use.</li> </ul>	ABC			
	<u>Social comfort</u> <ul style="list-style-type: none"> <li>The users concern on separation sitting area for men and women in waiting area</li> <li>Lack of natural lighting at waiting area</li> <li>The sitting arrangement – easy for communicate and interaction.</li> </ul>	C			
Comfort & Well being		AC			
Flexibility in design	<ul style="list-style-type: none"> <li>Lack of multi-function activities in waiting area.</li> <li>The area provided can’t fully utilized by the various categories of users.</li> </ul>	B			
Safety aspect		C			
	Lighting not efficient –especially in closed area and walk way.	ABC			
	There was broken furniture, inviting the danger to the end users	BC			
	Separate area for men and woman – woman feel safer and comfort.				
A	Referral/state hospital	B	Small district hospital	C	Large district hospital

Source: Haron SN, Hamid MY & Talib A ( 2011)

**6.1.2 Test of Methodology Evaluation:**

As mentioned earlier, this pilot is to test the sequenced of method proposed before applying it to main case study. From this pilot, find it walkthrough journey experience suitable to use course hospital is the complex building and multilevel floor and a lot of space and area that must be experiencing by the end-user. Moreover, these methods served useful in identifying issues in the evaluation methodology for the ability to complete tasks especially related to spatial orientation. Besides that, there’s needed improvement on the data collection and analysis for the main case study.

- Use the layout plan as identification of respondent location and usability issues.

- Use of mapping techniques for analysis of space or detect usability issues, and it is important especially related to the spatial relationship/orientation and efficiency factors.
- Use of user’s expectation checklist, to help the interviewer to know the patients/visitors expectation and needs and target for walkthrough process step (figure 2).Consequently, it will be a guide for a main study in the data collection framework.

What patients need to know and expectation to the situation – outpatient service?								
Patient stage - outpatient service								
First service	Notification the step	registration	Waiting - experience	Appointment	Physical journey to clinic	Waiting - experience	Appointment & follow up	Finish
<b>What Patients need to know and expectation</b>								
Accessibility and reach ability aspect before enter? Where to go & referred?	How its work – How easy to find & familiar, how long it takes to reach?	where ,how,	What to do/ When be calling? How long?	When , where ,how, what expectation	How to get there? What expected?	What to do/ How long? What can I kids/ elderly / young people do? The environment and the condition	instruction & action	What should I do next ?after / next appointment Where to go?
Patient stage to specialist clinic /service by appointment workflows								

What visitors need to know and expectation to the situation								
visitors stage- inpatient area / wards workflow								
First service	Notification the step	Registration	Physical journey experience	Waiting - experience	Physical journey experience	Alternative activities – another area	Physical journey experience	Target area experience
<b>What visitors need to know and expectation</b>								
Accessibility & reach ability aspect before enter? Where to go.	How its work – Familiar of the space, how long it takes to reach? How far? What can my kids do?	When ,where ,how, How to get there? What expected?	Instruction & action. Spatial design/ environment and ambient	When will be called? How long it takes? What can I kids/ elderly etc do? The environment and the condition	Instruction & action. Spatial design/ environment and ambient	How to go? How far?	Instruction & action. Spatial design/ environment and ambient	What should I do next? After / next appointment - Where to go?

Fig 2: The process of patient and visitors experience  
 Source: Haron SN, Hamid MY & Talib A ( 2011)

**6.1.3 Feedback from Hospital staff (doctors, nurses and administration) and hospital consultant (medical planner and hospital support service).**

There a loop between the practice and patient feedback, most of them satisfied to what the hospital offered and what had been design. From the feedback, Hospital staff, more concerns on patient satisfaction regarding to the treatment and service offered. In addition, there are some usability issues, raised, and mostly for the benefit to the two parties –patients and staff; less of parking area, cleanliness issues and not enough of a cafeteria. Besides that from the interviews with the medical planners and architect explained, most of the hospital design is repetition from the previous hospital design.

**7.0 Discussion**

In summary, from the experience, walkthrough with interview and observation methods are a suitable method in collecting data dealing with human needs. Especially when touched on field experience and reflection of experience. Otherwise from this pilot, we explore that usability is related to human action. It is a reaction between the applications or provision of service provided to the user, whether it is good or not. Based on the results and findings, it appears that the usability method of evaluation and applying usability criteria and recommendations could identify more usability problems in the main case study. However, from the usability issues show the component of layouts, and facilities provided plays an important role in measuring the performance of healthcare spatial design.

Mainly, it involves with identifying the component of the spatial and facilities available by optimizing the usability of the design. Moreover, from that usability issues, we can conclude there are several factors of users experience and expectation affecting that usability criteria, especially on patient satisfaction. Which, it will be achieved if the respondent's can complete the task in the easiest solution and the design/facilities offered meet their expectation.

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