

Post Occupancy Evaluation of Healthcare Facilities: a Case Study of a Medical Department in the UAE

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Abstract

The process of undertaking a comprehensive evaluation of a building after it has been occupied is defined as Post Occupancy Evaluation (POE). The purpose of such a study is to measure its users' satisfaction with its performance and determine whether or not the building fulfils its original design objectives. The main aim of the research work presented in this paper is to carry out a POE process to a single medical department/unit. The study is guided by a comprehensive literature review to identify the methods and techniques for implementing POE in general and for healthcare facility in Particular. A proposed criteria for POE is presented, which contain two main parts: technical evaluation, and occupants' perception measurement. The POE process commenced with the analysis of existing base plans, and a walkthrough observational technique to provide a closer investigation and to reveal aspects of interior design that could be further improved to serve the patients and other users better. It is expected that the result of this research project will raise awareness of integrating the concept of POE within the facility management processes of UAE healthcare projects and feed forward the positive and negative lessons learned into improving the design of current and future healthcare project in the UAE.

Keywords

Post Occupancy Evaluation (POE), Facility Management, Function Performance Specifications, Organizations, Healthcare Projects.

1. Introduction

Post Occupancy Evaluation is a tool that is used to assist in continuously improving the quality and performance of the facilities. This tool is particularly beneficial to organizations with recurring construction programs, or with a significant volume of facilities which requires remodeling (Preiser 1995). The term Post Occupancy Evaluation (POE) is defined as a process, which involves evaluating a buildings performance after it has been occupied by the target users. It provides feedback about the current status of the project and proposes solutions to the existing problems, in addition, it can provide a guideline principles and design criteria to improve similar future projects. POE looks at the requirements of the entire building not just the building as a structure. It is concerned with several issues such as: the health, safety, security, efficiency, comfort and many other requirements. According to Council (2001), POE has been seen as one of a number of practices aimed at understanding design criteria, predicting the effectiveness of emerging designs, reviewing completed designs, supporting building activation and facilities management, and linking user response to the performance of buildings. POE is evolving toward more process-oriented evaluations for planning,

programming, and capital asset management. According to Preiser (2002), POE generates overall beneficial changes and outcomes, including: Saving dollars and energy, improving the quality of facilities, involving stakeholders in the process of POE, and improving the satisfaction of building occupants.

The presented work in this paper is a part of an ongoing research project aiming at developing and implementing criteria for a POE of newly opened “In Vitro Fertilization” (IVF) Unit in Tawam hospital, AlAin City, UAE. This paper reports on the literature review stage and the implementation of the first part of the POE criteria, i.e. the technical evaluation. The paper starts with providing a background on the benefits, uses, and the methods and techniques of POE in general and for healthcare facility in Particular. The paper then presents the proposed criteria for the POE and the implementation of its technical part, which include: base plan analysis, and walkthrough observations. Finally, the paper ends with a conclusion and a plan for future work.

1.1 Benefits, and Uses of POEs

During the development of any project, the value delivery is the key goal of all stakeholders. Austin (2005) defined value as “the trade-off between what each stakeholder gets and what they have to give up.” All participants in the building delivery process should have a clear understanding of what type and level of performance should be achieved in a facility (Preiser 1995). After the delivery of the facility and its occupancy by the target users, facility managers can utilize the POE as a diagnostic tool to identify and evaluate critical aspects of building performance systematically. By comparing the performance criteria with the actual measures on ground, the outcomes of POE can benefit facility managers to maintain and improve their facilities and can also be documented as lesson learned with direct input into the next building cycle. Figure 1 illustrates the performance concept in the building delivery process as well as the basic outcomes of post occupancy evaluations from short- medium and long-term perspectives.

Figure 1 The performance concept in the building delivery process

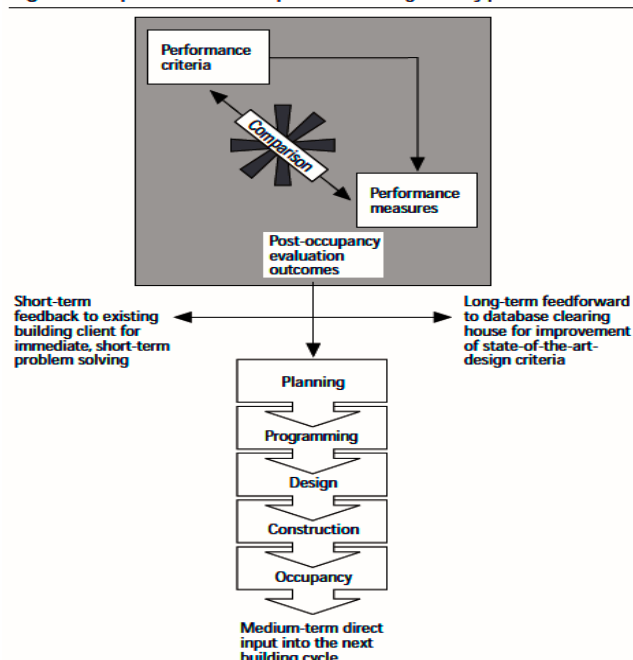


Figure 1: The performance concept in the building delivery process - Source: (Preiser 1995)

Several benefits can be obtained from performing POE. Preiser (2001) categorized the uses and benefits into short, medium, and long term. While the short term refers to immediate action; medium term include three to five year time frame, which is necessary for the development of new

construction projects; and the long-term time frame is ranging from 10 to 25 years, which is necessary for strategic planning, budgeting, and master planning of similar facilities.

In more details, the short-term benefits include the following:

- Identification of solutions to problems in the facilities.
- Proactive facility management responsive to building user values.
- Improved space utilization and feedback on the building performance.
- Improved attitudes of building occupants through active involvement in the evaluation process, understanding of the performance implications of changes dictated by budget cuts.
- Better-informed design decision-making and understanding of the consequences of design.

The medium-term benefits include:

- Built-in capacity for facility adaptation to organizational change and growth over time, including recycling of facilities into new uses.
- Significant cost savings in the building process and throughout the life cycle of a building.
- Accountability for building performance by design professionals and owners.

The long-term benefits include:

- Long-term improvements in building performance.
- Improvement of design databases, standards, criteria, and guidance literature.
- Improved measurement of building performance through quantification thorough improvements in the programming and planning of buildings.

Preiser (2001) and Other researchers (Whyte and Gann 2001, Preiser 2002, Zimring 2002, Preiser 2005, Hadjri and Crozier 2009) recounted in their research work almost the same benefits that was discussed earlier, and include: recommendations that are brought back to the client; re-modeling that is done to correct problems; lessons learned that influence design criteria for future buildings; providing information to the building industry about buildings in use; and finally positive influence upon the delivery of humane and appropriate environments for people.

1.2 Types, Techniques, and Methodologies of Post Occupancy Evaluation

According to Hadjri and Crozier (2009), there are numerous approaches to the concept of POE with a wide variety of methodologies that have been developed in order to address the specific approaches and outcomes of conducting POE. When reviewing the methodologies of POE, it is important to refer to the work of Zimring (1988); where they discussed the most common strategies of POE; in addition to, field studies, and the tends to maximize contextual realism. They described realism as the original of all techniques and methods used in POE's research.

According to Preiser (1995) and Council (2001), traditionally, POEs are conducted using questionnaire, interviews, site analysis, and observation of building users. Over time, more specific processes, levels of survey, and new technologies have been developed to better-fit stakeholder's objectives and budget. Currently, there are numerous methods and approaches to POE, depending on the contextual agenda and the required outcomes. In reviewing the research work of (Preiser 2001, 2002, 2005, Brooks and Viccars 2006), the POE can be analyze and arrange into three levels of typical process, defined as:

- Indicative Post Occupancy Evaluation, which give an indication of the major strengths and weaknesses of a particular building's performance.
- Diagnostic Post Occupancy Evaluation, which go into more deep objectives. Evaluation criteria are either explicitly stated in the functional program of a facility or have to be compiled from guidelines, performance standards, and published literature on a given building type.
- Investigative Post Occupancy Evaluation, which correlate physical environmental measures with subjective occupants' response measures, see Figure 2 for more details.

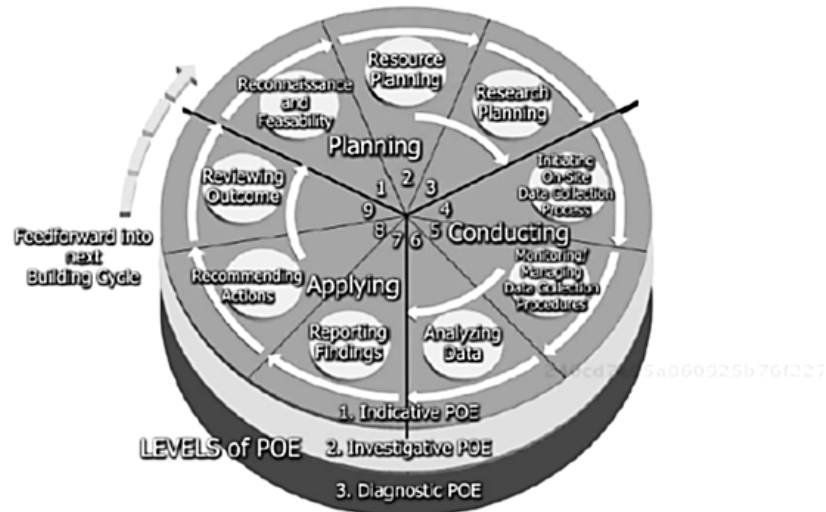


Figure 2: Post Occupancy Evaluation: evolving performance criteria source: (Preiser 2001)

Brooks and Viccars (2006), summarized the three levels of effort in the POE processes and their aims, methods and timescale for each, depending on the Preiser research work, which is shown in table 1. While in Table 2, the same authors summarized the advantages and the disadvantages of data collection techniques that have been used in POE.

Table 1: Level of POE and Methods - Source: (Brooks and Viccars 2006)

Level of POE	Aims	Methods	Timescale	Comments
Indicative	Assessment by experienced personnel to highlight POE issues	Walk through evaluation. Structured interviews? Group meetings with end-users? General inspection of building performance? Archival document evaluations?	Short inspection period	Quick, simple, not too intrusive/disruptive to daily operation of building. Judgemental and overview only?
Investigative	In-depth study of the building's performance and solutions to problems	Survey questionnaires and interviews. Results are compared with similar facilities. Report appropriate solutions to problems	From one week to several months	In-depth/useful results. Can be intrusive/time-consuming, depending on the number of personnel involved
Diagnostic	Show up any deficiencies (to rectify) and collect data for future design of similar facilities	Sophisticated data gathering and analysis techniques Questionnaires, surveys, interviews and physical measurements	From several months to several years	Greater value in usability of results. More time consuming

Table 2: Advantages and Disadvantages of Data Collection techniques- Source: (Brooks and Viccars 2006)

	Advantages	Disadvantages	Use in POE	Comments
1 Walk-through survey	Cheap and simple	Can be to judgemental and subjective	Yes	Essential, especially for technological review of systems
2 Diary analysis	Detailed data over time	Hard to administer. Respondents' response flags. Data intensive	Only if no alternative	
3 Focus group	Cost effective. Picks up detail left out of questionnaires	Needs skilled facilitator	Yes	Especially for design team review
4 Individual interviews	Excellent for senior management	Time consuming. Needs skilled interviewer. Note taking and write-up time burdensome	Yes	Essential for detail
5 Documentary analysis	Essential for building briefs	Jargon. Understanding context	?	
6 Plan analysis	Often excellent data source	Information overload	Yes	
7 Supplied data	Can be a cheap source of data	Can be in poor form or imprecise or hard to interpret without help	Yes	Good for energy data
8 Monitored data	Accurate. Quantitative	Cost. Sampling methods	?	
9 Questionnaire surveys	Comprehensive coverage. Quantitative and qualitative	Tend to miss out fine points and contexts	Yes	Essential for base data. Also extremely useful to involve as many people as affordable

Source: BUS (1994)

1.3 The Pros and Cons of POE

According to Vischer (2001), one of the characteristics of POE activities is the discrepancy that exists between the reasons for doing POE (pros) and the difficulty of doing them (cons). The possible reasons of doing POE is discussed by Vischer (2001). The author stated that POE is a useful tool for improving buildings, increasing occupants' comfort, and managing costs, while the barriers to widespread adoption of POE are cost, defending professional territory, time, and skills (Vischer 2001). According to Brooks and Viccars (2006), one of the problems of the POE is the ownership. There are benefits to both the client and the designer, but who should pay for it? Customers may view their payment for the building as including any testing that needs to be undertaken to ensure everything is working in order. In contrast, the project team will not want to utilize all their profits by paying for an evaluation. As POE is not part of standard procurement procedures there is little incentive for the designer to differ from the standard approach. Despite the increasing climate for POE to work, there is still a reluctance to engage in any form of systematic evaluation process of those involved in the design and construction industry. It is likely that many clients and designers have not heard of POE yet. As a result the benefits of POE cannot be achieved and this will lead to future problems when using the facility.

In the same vein, (Council 2001) discussed barriers to widespread adoption of POE. The first identified obstacle is the cost, which may be expensive. The second barrier is professional territory, that is necessary for POE to be seen as useful for remote knowledge. Finally skills, where there are no specific skills or technique or even tools with POE studies which can lead to other problems when evaluating the buildings performance.

2. The Use of Post Occupancy Evaluation for Healthcare Facility

The use of POE in healthcare facilities is not new. According to Preiser (1995), POE was introduced in the 1960s in response to significant problems experienced in building performance with particular emphasis on the building occupant perspective. This was first noted in institutional care facilities, such as mental hospitals, nursing homes, and correctional facilities. Since then, POE has been introduced in a number of countries and in organizations ranging from small to very large governmental agencies.

Abu Samah *et al.* (2012), evaluated the interiors of a hospital outpatient unit in Malaysia. The main focus of the study was the interior designs characteristic including: space planning, ergonomics, accessibility, way finding, material and finishes, color, lighting, furniture, and safety. The study investigated the perception of the families and the patients to understand their expectations, experiences and preferences. A baseline analysis, occupancy survey and walkthrough observation methods were adapted. The main findings from the survey indicate that the facility performed moderate on all interior aspects. Likewise, in Sao Paulo, Brazil, a psychiatric facility was investigated by Ornstein *et al.* (2009). The implemented POE aimed at establishing adequate use and maintenance of the building. The main approaches of the study consisted of two basic performance features, namely, physical accessibility and fire safety. According to Ornstein *et al.* (2009), health care facilities have certain characteristics that are intrinsic to their type of use, and this fact requires careful planning if the pre-design evaluation (PDE) and the POE are to be applied correctly. Furthermore, besides the recurrent issues of the implementation of a POE, the characteristics of hospitals, which operate in shifts and must constantly deal with emergency cases, for example, give rise to a number of difficulties related to access and to unexpected reactions by users.

Kotzer *et al.* (2011) conducted a research for Pre- and Post-Occupancy of the Children's Hospital in the USA. Its main objective was to evaluate and compare the impact of an existing and newly built hospital environment on family and staff satisfaction in relation to light, noise, temperature, aesthetics, and amenities, as well as safety, security, and privacy. Using a pre-post survey design, all nursing, social work, therapy staff, and families on selected inpatient units were invited to participate. Family and staff satisfaction surveys were also developed and administered pre- and post-occupancy of the new facility. Pre/post mean scores for staff satisfaction improved on all survey subscales with

statistically significant improvement in most areas. The most improvement was seen with the layout of the patient room, natural light, storage, and comfort and appeal. Family satisfaction demonstrated significant improvement in natural light, quiet space, parking, and the child's room as a healing environment. According to Kotzer et al. (2011), Study results will be used to guide future architectural design decisions, attract and retain staff at a world-class facility, and create the most effective healing environments.

In another study, the Healing Environment of a pediatric wards in Malaysia was assessed by Ghazali and Abbas (2012). A POE studies were conducted upon pediatric wards in eight hospitals. The used POE methodology for data collection adopted UK's NHS AEDET and ASPECT Evaluation toolkits, which evaluated the physical qualities and staff & patients' satisfaction levels respectively. Those involved 215 nurses and 217 patient's questionnaires respondents, personal on-site observations, and photographic documentations as supplementary evidences. According to Ghazali and Abbas (2012), the analysis of received data demonstrate that the overall physical qualities and design trend of the wards over the last three decades seemed to be positive towards the creation of the healing environment. The trend however, seemed not to correspond with the satisfaction levels of the end users. In terms of the physical design of newer wards, the authors suggested that, apart from understanding the behavioral needs of the end users, there should be inclusion of the other additional therapies- art, music, pet and aromatherapy in the design brief.

3. Criteria for Post Occupancy Evaluation of the IVF Unit

The aim of the presented research in this paper is to test whether the selected IVF Unit is providing its users with spaces that fulfil their needs, and enable them to perform their work effectively during patient visits and procedures. The proposed POE criteria have two main parts: 1) Technical evaluation and 2) Occupants' perceptions. The first part, the technical evaluation, involves the analysis of existing base plans and available documentation's; and a walkthrough observational technique to investigate the possible POE problems/issues and take photos and measurements, if needed. In the second part, to obtain occupants perceptions for facility performance; a semi structure interviews/group meeting, with medical staff, nursing, and admin, will be utilized to investigate possible problem/issues.

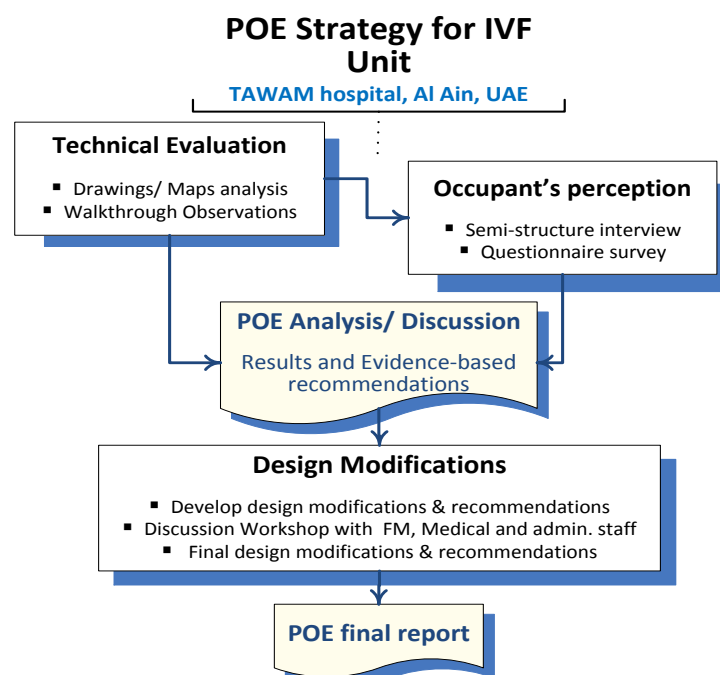


Figure 3: The POE Methodology

Based on the above, a questionnaire survey will be developed and conducted to measure the perception of patients/visitors and employees (including the medical staff, nursing, admin, and technician). The target areas to be examined and evaluated by the questionnaire will include: (1) Quality of interior, (2) Safety & Security, (3) Access and approach, (4) Corridor and circulation, (5) Aesthetics, (6) Medical Equipment, (7) Comfort, (8) Noise, and finally (9) Material and finishes. Figure 3 illustrates the proposed POE criteria. Based on the analysis of received POE data, a proposal for design modifications and recommendations to improve facility performance will be developed and discussed with FM, Medical and administration Staff. A Final design modifications & recommendations will be then developed and a report to document POE process will be established. The implementation of the first part of the POE criteria, i.e. the technical evaluation is described in the following sections.

4. The Implementation of Post Occupancy Evaluation Criteria: The Technical Part

4.1 Base Plan Analysis

The IVF Unit was selected as a medical department case study to measure its users' satisfactions towards its spaces' functionality and appropriateness of design as well as to establish conformance

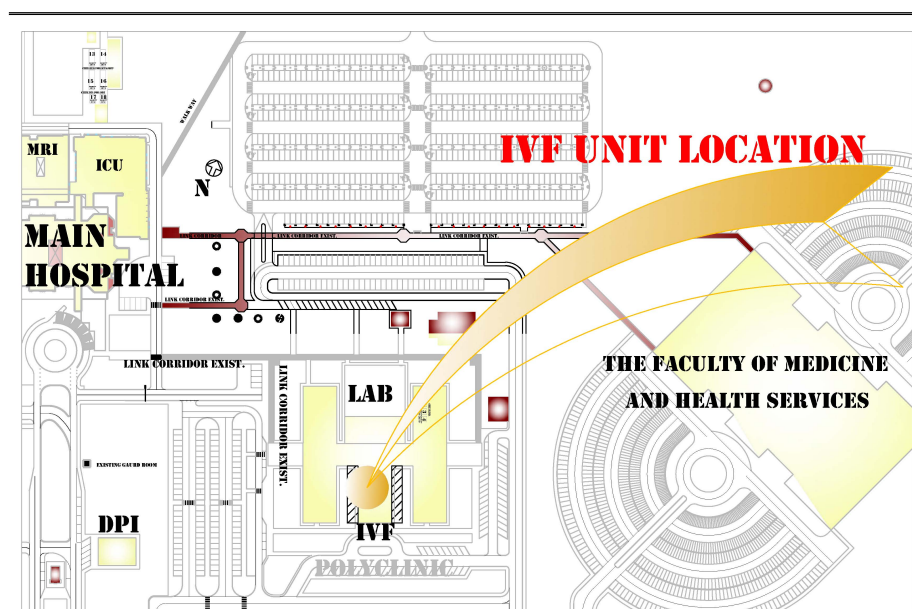


Figure 4: IVF Unit Location Map

with performance requirements as stated in the functional diagram. The new IVF Unit was opened 3 years ago. It is located in Tawam hospital campus, between the medical college and main hospital building where there is a shaded walkway corridor between both buildings, as shown in Figure 4. The IVF unit is attached to outpatient clinics building. The total built up area of the IVF unit is about 1000 square meter. It consists of four main functional zones, their detailed spaces are described in the following:

4.1.1 Head of Department Zone (Manager Office & Secretary Room): contains admin office and meeting room.

4.1.2 Public Zone:

- Main Reception: with main function being to register patients and respond to customers' phone calls. It is connected to an adjacent filing room.
- Waiting rooms: for male and female patients and visitors
- Vital Sign Room: to check and record the vital signs for patients.
- An Assessment Room: where nurses meet the new assessment couple and do the needed assessment and file their records to the unit data system.

- Male Sample Room: for male patients to collect the semen sample.

4.1.3 Clinic Zone:

- Four Clinics: for consultation and diagnostic examinations.
- Two Ultra Sound Rooms
- Nurse Station: to register all patients coming for appointments, and assist patients with any inquiries they may have.
- Sanitizer Area: to sanitize and packet medical equipment.
- Staff room with staff toilets and a changing room (male/female)
- Storage Room: to store all the consumables needed for the entire department.
- Medication and counselling room: to educate patients how to take needed injections by themselves.

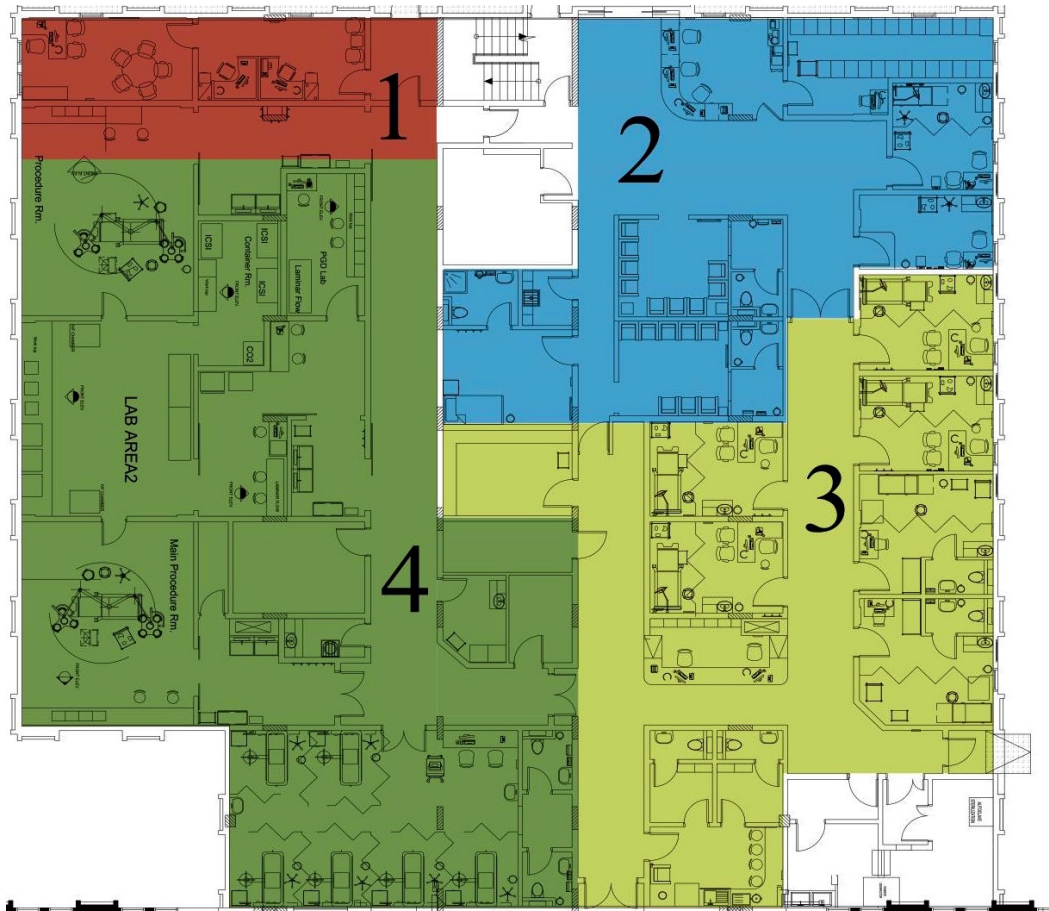


Figure 5: Functional Floor Plan Layout

4.1.4 Procedures Zone:





- Procedure Theatres: to accommodate all fertility procedures, that needs general anesthesia, and any other procedures that does not need anesthesia.
- Laboratory Area: to do all the lab tests and procedures related to fertility.
- Recovery Room: to prepare patients prior to planned procedure and to receive patients post procedures and observe them until they are fully recovered.



From reviewing the detail function plan of the IVF unit, it can be observed that the area of the entrance lobby is small and the location of the reception desk is considered an obstacle to the flow of visitors. In addition, it was noticed that the female waiting room opening is facing the main entrance which does not provide the level of privacy culturally required in the UAE. Furthermore, it was noticed that the door from the main hospital building to the IVF Unit has no control in regard to patients or visitors moving from outpatient building to IVF unit.

4.2 Walkthrough Observations

Walkthrough observations were conducted for one day, recorded using a note pad and a digital camera. Observations and commentaries of the facility are summarized in table 3.

Table 3: Walkthrough Observations

View of Area	Walkthrough Observations
	<p><u>Main Reception Area:</u> This is the area where male and female patients register, make appointments and wait to be seen by doctors. It includes two separate waiting areas for both males and females.</p> <p><u>Observed Problems</u></p> <ul style="list-style-type: none"> • The automatic door is too close to the reception desk causing a lot of noise when patients are merely standing to the reception desk. • Lack of shelving space for daily appointment files. The reception desk itself is made of a poor covered wood, also on top of the wood is a surface covered with fixed glass, which is difficult to clean under.
	<p><u>Male & Female waiting areas:</u> This is the area where patients wait for checking or for a doctor's consultation.</p> <p><u>Observation Problems:</u></p> <ul style="list-style-type: none"> • Female waiting room is facing the main entrance which does not provide the level of privacy culturally required in the UAE.
	<p><u>Head of Department Office and its Secretary:</u> Admin Office and meeting room for the unit.</p> <p><u>Observation Problems:</u></p> <ul style="list-style-type: none"> • Meetings are being held while patients are being transferred from recovery room to a procedure and vice versa. • Clean corridor is being used by admin many times throughout the workday.
	<p><u>Procedure Theatres:</u> Where fertility procedures are carried out</p> <p><u>Observation Problems:</u></p> <ul style="list-style-type: none"> • The users of the procedure room feel that it's larger than required. As seen in the furniture layout.

	<p><u>Recovery Room:</u> The area where patients are prepared prior to a procedure or post procedure. Patient normally is under observation until they are fully recovered and discharged. A relatives is allowed to be there for a certain time during the day.</p> <p><u>Observation Problems:</u></p> <ul style="list-style-type: none"> • Cubical curtain divisions offer less/no privacy. However, patients don't feel comfortable as reported by medical staff during the walkthrough.
	<p><u>Laboratory Area:</u> To do all the lab procedures/tests related to fertility.</p> <p><u>Observation Problems:</u> Lab Area lacks an office for technicians to document and update patient procedures.</p>

5. Conclusion and Future Work

Post Occupancy Evaluation is a comprehensive assessment of a building/facility after it has been occupied by its target users. It is concerned with feedback obtained from building end-users. POE has a wide variety of methodologies that vary in nature, size, and level of interaction. Decisions regarding POE use need to take into account the purpose of the study or the organizational benefits that can be derived from the results of POE. By using the POE, several benefits can be gained such as: improved space utilization and feedback on the building performance; recommendations that are brought back to the client; lessons learned that influence design criteria for future buildings; and finally positive influence upon the delivery of humane and appropriate environments for people.

The presented work in this paper is a part of an ongoing research work aiming at developing and implementing criteria for a POE for the IVF Unit, in TAWAM Hospital to determine the performance of the built facility based on its users' satisfaction and experiences. A proposed criteria for the POE is presented with two main parts: technical evaluation, and occupants' perceptions. The technical evaluation part is presented in this paper, and commenced with the analysis of existing base plans and available documentation's; and a walkthrough observational technique to provide a closer investigation and to reveal aspects of interior design that could be further examined and evaluated.

The future work will focus on obtaining occupants perceptions for the facility performance. A semi structure interviews/group meetings, with medical, nursing, and admin staff will be utilized to investigate possible problems/issues in using the facility. Based on the above, a questionnaire survey will be developed and conducted to measure the perception of patients/visitors and employee for facility performance. Based on the analysis of received POE date, a proposal for design modifications and recommendations to improve facility performance will be developed and discussed with FM, Medical and administration Staff.

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