THE APPLICATION OF EVIDENCE BASED DESIGN IN EMERGENCY ROOM OF PUBLIC HOSPITAL OF DR. R. SOSODORO DJATIKOESOEMO BOJONEGORO

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ABSTRACT

The Hospital facilities built under Evidence Based Design (EBD) will create a safe and comfortable environment, lower the *nosocomial* infection, quicken the patient recovery, lower the treatment cost, and improve staffs' performance. The emergency room of public hospital of Dr.R.Sosodoro Djatikoesoemo Bojonegoro needs to be redesigned because the existing design does not meet physical safety. The reparation should refer to Facilities and Safety Management (FMS), Indonesian regulation, EBD concept and benchmarking to RSCM Jakarta considered as an application sample. This research applies case study with descriptive single case study design. The result of the research shows that reparation should be done that includes site and location, building components, and rooms lay out. The width of the rooms should meet minimal standard. The placing of triage room and resuscitation should be in the front area. Sinks should be located near the entrance of every room. The isolation and decontamination rooms should be provided.

Keywords: Facilities and Management Safety (FMS); EBD; Benchmarking.

INTRODUCTION

The physical design based on the Evidence Based Design (EBD) creates a safe hospital, improving the patient recovering process, providing a better workplace for staffs (Ulrich et al, 2008). The setting of rooms and its accessories, such as location and design of sinks, bathrooms, and isolation room should consider the source, groove and transmission of infection to reduce infection caused by pathogen bacteria spreading through air and water such as the infection of *Tuberculosis* and *Aspergillosis* as well as *Legionellosis* (Noskin, 2008).

The facilities design may also reduce medical error incidents. The environment factors relating to medical errors include noise, lightening, adaptation sharpness, and single-patient room. The use of single-patient room may decrease the medical error sources such as discontinuity, communication between patients and staffs, and the decreasing noise level improves patient privacy that affects to the increasing sleep quality helping the recovery process, decreases the in-patient time in the hospital, and improves the patient satisfactory. Take advantage of the nature (nature view), light, and environment factor may decrease pain. A green park may reduce patients' stress. The sunlight effect and nature view may also lower patients' depression (Malenbaum, 2009) such

as by installing window facing outside the building (access to nature). Installing a wider bathroom, handrail, and setting up an appropriate lightening may avoid patients from falling (Ulrich et al, 2008).

Management design a good working environment also can improve the outcome of staff performance and reduce injury to staff. The staff at the hospital experienced a high accident risk either an infection or injury, especially musculoskeletal disorders. Placing workspace nurses decentralized manner will make an ergonomic working environment for the staff to work and will reduce the incidence of injury to staff (Cochrane et al, 2012). So that nurses will experience high job satisfaction that impact on the quality of service to patients and patient satisfaction (Saint, 2010).

Facility design and services that prioritizes the safety and interests of the patient and family is one indicator of the quality of hospital services. Instruments appraisal to improve the quality hospital in between Accreditation of Hospital, which at this time adapting the accreditation standards international ie Joint Commission International (JCI). One of the standard is about Facility Management and Safety (FMS). It is a system of management of the facility, building, yard, equipment, and staff (both clinicians and non-clinicians) which is an important factor in providing care to the patient, to be able to work safely

and ensure the safety of all occupants of the hospital. Facility Management and Safety consists of program leadership and planning, safety and security, hazardous materials, disaster preparedness, fire safety, medical equipment, and service support system and education staff.

Public hospital of Dr. R. Sosodoro Djatikoesoemo is a local government-owned hospitals Bojonegoro District currently planned will be relocating to the new building because of conditions that are now so full of patients. In the study a glimpse of the building from the entrance to the room service until the return process of the emergency services are not correspond so that should be redesigned in order to meet the physical safety. In order to realize the physical construction of the building that can support the flow, function and behavior of staff in the work then it must be structured and managed according to standard FMS. Facility Management and Safety implementation is organized by EBD and supported by government regulations on hospital facilities. So the purpose of this study is to conduct a study FMS implementation through review of appeals in hospitals that have been accredited by JCI, to evaluate the physical facilities at emergency department public hospital of Dr. R. Sosodoro Djatikoesoemo and develop a plan to repair the facility.

METHOD

The study uses case study design with descriptive single case study, describing phenomena by using various data sources in a single analysis unit, namely is emergency room layout. The strategy applied is reference analysis to Cipto Mangunkusumo (RSCM) Hospital Jakarta in five phases, such as preparation phase includes building a team, creating checklist instrument, and delivering proposal to RSCM. The instruments include program implementation of Facilities and Safety Management. The second phase implementation phase includes data collection through interview, discussion, site visit to photo documentation and facilities. The third is analysis done by comparing the research object hospital and the referral analysis hospital. The gap performance between the research object hospital and the referral analysis hospital are recorded and then analyzed by creating reparation plan for the research object hospital.

RESULTS

The implementation of FMK standard in the best practice EBD referral hospital is good enough.

RSCM conducts the program comprehensively and evaluation monitoring in form of weekly inspection to the working unit periodically. Creating a risk area map of harmful-prone area for all people in the hospital, the risk area is a part of the implementation of risk management. To ensure the FMS program is implemented during the service from the hospital manager, it is creating a Person in Charge in every building. Beside that, there is a policy of management cycle run by Management on Duty (MOD) functioning as an unofficial management. The disaster management implementation is applied by creating search and rescue team. The team conducted a simulation exercise fire management, emergency, disaster and plague once a year to all the inhabitants of the hospital. Support systems such as water, electricity, gas, medical and other support function tests and load tests and monitoring its buffer stock, the risk of disturbance can be avoided. Meanwhile, to ensure the safety of medical equipment, each tool does inventory, calibration, test the implementation of new tools along with training function and no recall system tools when damaged. Analysis of the case and take corrective action on FMS is a Plan Do Check Act (PDCA) cycle so that compliance to the safety facility will always proceeds.

Differences in the design of facilities and safety in the emergency department RSCM and public hospital of Dr. R. Sosodoro Djatikoesoemo can be found in some cases ie the location and design of buildings, building construction components and layout of the room.

Spatial structure emergency department in Hospital Dr. R. Sosodoro Djatikoesoemo not open plan, many doors corridor and massive bulkhead. Extent of rooms is also not qualify as well as the layout of the rooms.

In addition the design of room not meet the requirements, there is also a significant but not yet available, namely room of decontamination and isolation. The location of this room should be in the front area or near areas of decreased patient of the ambulance. There is a separate sewer to the tank.

To reduce the transmission of the disease in the ER then there must be isolation room. Spacious room minimum of 9 m². Access to this room should have its own entrance, its construction in the form of a closed room. Air pressure be made negative. Is available hand-washing facilities and equipment of its own?

DISCUSSION

The result of the comparative study to RSCM regarding the implementation of FMS standards in

Table 1. Implementation of FMS standards in RSCM Jakarta

Standard	Examples of Implementations	
The hospital manages risk management facilities
	Make a map of the area that is potentially risky, given the mark.	Declining path, created slope $\pm 7^\circ$, given the handrail and textured floor
Hospital planning and implementing safety programs and safety of the physical environment
	Exit doors use fingerprint and guarded by security	Surveillance with CCTV monitoring
The hospital prepare emergency management and disaster programs
	Evacuation route map and directions	The place gather center a secure
The hospital plan and implement fire safety program
	Emergency stairs toward evacuation route	Disaster management room and facilities

Emergency Room provides sufficient information of how to implement evaluation element and physical facilities design that support safety although there are some aspects need to improve. This is in line with the success key in comparative study that there is a

transformation and progress, establishing what efforts to maximize to get the maximum results (Benchmarking, 2008).

Basically, construction and lay out design is affected by patients and staffs flow, the function of the

Table 2. Location and design of Emergency Department

Standard	Implementation in RSCM	Implementation in RSUD
<ul style="list-style-type: none">- Easily accessible,near highway.- Located on the ground floor.- Location in the front area of hospital.- Have its own street- Emergency department room is connected with other units- Zone droff out freeway	<p>The location of the building ED RSCM from the highway.</p>	<p>The location of building ED from the direction of highway.</p>
	<p>Zone dropped out emergency department RSCM</p>	<p>Zone Drop out as a vehicle crossing to the Ward Inpatient</p>
	<p>Room open plan</p>	<p>Space much partition, no open plan</p>

rooms and staffs attitude in providing services. For example, the patients' path entering the ER of RSCM is distinguished between the infectious patients and non-infectious ones. The air circulation is also made separately. Additionally, the floor and wall construction are designed to protect from bacteria transmission. The floor is made of vinyl with *antifatigue* mats motif as a sign or direction to certain rooms or spots. Based on the research conducted by Lankford et al (2006) who studied various kinds of

floor cover, vinyl is an easy cleaned-material. The *Antifatigue mats* affect to more directed and easy work mobilization. For example in front of the resuscitation, room is decorated with certain motif to ease the staffs to drive the bran cart recognizing and entering the room. Likewise, when it will enter the room X-Ray with different color marking will signify the area alert to the danger of radiation. An experimental study found that hospitals that make wayfinding system, then the patient will have faster

Table 3. Components and building construction emergency department

Standard	Implementation in RSCM	Implementation in RSUD
Floor: bright colors, waterproof, easy to clean.
	The coatings of vinyl, hospital Plint and not be the transmission of germs	The coatings of ceramic, no hospital plint
Walls: Strong, bright, easy to clean, between the walls is not angled, plugged handrail.
	Plugged the handrail which serves to prevent patient falls and protect the walls from collision	Not Plugged the handrail and wallcoverings not of material that is easy to clean.
The door: Strong Materials, main doors in the form of swing, Open into, minimum width of 120cm, the height difference be avoided.
	The main door is distinguished entrance and exit	The main of Door less width and the slope of floor are not ramps
Corridor: Width 2.40 m, space for officers, brancard and tools trolleys move freely
	Corridor width > 2.40 m, not for storage of equipment	The corridor was very narrow, not allowing 2 brancard intersects
The sink: There is in every room, near the entrance, designs is not shallow, anti splashback faucet.
	The sink is equipped with soap and dryer	The sink lot is located near the bathroom door

Table 4. Components and building construction emergency department

Standard	Implementation in RSCM	Implementation in RSUD
Triage space: minimum area of 25 m ² . The location should be at the very front, near the entrance to the ER.	There is triage 1 and 2, extensive	There is in the middle area of the ER, extensive 4.5 m x 3 m
Resuscitation room: minimum area of 36 m ² , easily accessible from the entrance and room staff, ensuring access procedures 360° rotating action to all parts of the patient.	Being in the area, form of open space with an area of 12.6 x 6.7 m.	Being in the area, enclosed room, spacious 4.5 x 4.5.
Laboratory: floors, walls and work desks covered with chemical resistant and vibration, and not easily cracked.	Floors, walls and table is made of the granite stone	Floors, walls and table is made of the ceramic
Nurse station: located in between room, direction view of staff to patients is not blocked.	Nurse Station in the form of lobbying, there is an enclosed space to consult	Nurse Station is a closed room, not in between room
Operating room: minimum size of 7m x 6m x 3m. There sterile equipment room, equipment and soiled linen, scrub room, room of preparation and recovery	The size of 6.3m x 6m x 3m, the space requirement is fulfilled	Size 6m x 4m x 3m, the need for space still not enough
Delivery room: minimum area of 12 m ² / bed, there is scrubs room and baby room	Baby room with the door fingerprint lock	 There is no baby room.

Gambar 1. Layout Ruang IGD RSUD Dr. R. Sosodoro Djatikoesoemo

Gambar 2. Facilities should be provided shower and sink

Gambar 3. Floors and walls are easy to clean

Gambar 4. Equipped Personal Protective Equipment for officers

Gambar 5. Isolation room door Emergency room RSCM made double as a function of the airlock area

access to the destination, much less ask, and report lower stress levels (Carpman, Grant & Simmons, 1984).

Between the floors with walls is made curved so it is not easy to keep dust and easy to clean. To support the safety facility then on the wall mounted handrail along the corridor wall emergency room to helps patients to keep from falling. It also can serve as a safety wall of collision brancard/trolley (Ulrich et al, 2008).

Corridor in the ER room there is a narrow, corridor including the maternity ward with an operating room < 200 cm. This resulted in the area, trolley, brancart, or bed patients can not move freely. Whereas the mobilization of officers and patients is very high, ie in patients who would be abnormal labor action and will be in operation. In this corridor is also a trajectory corridor for patients in the ER PONEK to go to the room laboratory/BDRS as well to the radiology room. Based on the study concluded that the observation level of security and comfort to the patient transfer process is considered bad (Soesanto, 2012).

Gambar 6. The entrance to the isolation room separate of the the main door of Emergency room RSCM

Gambar 7. Ventilation systems and HEPA filters separate isolation rooms Emergency room RSCM

Figure 8. Wayfinding example to reduce confusion

The placement nine of fourteen sink at ER room public hospital of Dr. R. Sosodoro Djatikoesoemo near the bathroom door. This is due to the builders are looking for convenience and minimize the cost of making water sink drain combined with the drain water from bathroom. For example, the location of the sink in the room birth preparedness causing officers who will conduct the examination or action must walk long distances to the sink.

Use of the bathtub should be observed in the design of bathroom. Bathtub reduces space bathroom, and flexibility patients and caregivers as well as wheelchair users. Bath-tub requires cleaning every day, because the patient is a carrier of the infection source. Use water that has been used by previous patients contaminate the water in the bathtub so that the disease transmission media (Angenent et al, 2005; Conger et al, 2004; Mineshita et al, 2005).

Pattern or workflow in ER as recommended is "radial layout" which work station is located in the middle (Burns et al, 2004). This will minimize the movement because the patient area closer to work area and all of room can be seen (Burns et al, 2004). The nurse's room must be between room action and main observations. This room in the form of an open lobby that can freely observe the patient's condition

and surroundings. Where possible, the nurses station room is made with a higher floor height so that the sitting position, nurses can see patients without having too frequent mobility.

Designing of room ER public hospital of Dr. R. Sosodoro Djatikoesoemo has a garden in the middle of building. Many large windows that provide ventilation effect and lighting into the ER room and the natural scenery of the park that can be enjoyed. The effect is very beneficial to the healing process of the patient. Nature view (natural scenery such as trees, parks, and water), daylight, and other environmental factors can reduce pain by generating positive emotions, reduce stress, and interfere with the patient focus on their pain (Malenbaum et al, 2009). Another effect is help improve the sleep of patients, lower levels of depression, shorten the length of stay of patients in hospitals and improves patient satisfaction. As for the hospital staff can reduce stress levels and increase satisfaction.

The placement room triage and resuscitation room also needs to be changed. Triage room is a room to sort through the level of emergency patients in order to determine the next action so that this room should be right in front of the entrance to ER. From this visual triage it may need to be sorted if the general emergency room, emergency room for Ponak, isolation room or decontamination room. In patients who require resuscitation then from the entrance should be directly to the resuscitation room. Resuscitation room because the nature of the emergency on the first level (speed of action should be performed by a medical team in 0 minutes) then this room should be in the front area. In practice, resuscitation room away from the entrance will increase the response time for resuscitation. In addition to far from the entrance, to achieve the resuscitation room in the ER also must pass a three-door (the main door and two-door Emergency room corridor) with wide doors and corridors that are not standard. To this it must be done on site redesign and size of the area of room required that a minimum of 36 m² and is located in an area near the entrance.

The operation room of the ER is not too spacious. The wall and floor's covers are not made of recommended material. The door design was not made automatic or it is not an automatic door closer and can not be opened by elbow but hand. Considering the operation room is a sterilized room, so there should be a limited contact with stuffs may transmit the disease. The supporting rooms for operation room are also not provided with sterilized channel and scrub up. The door leads to the utilities room is dirty.

CONCLUSION AND SUGGESTION

The ER rooms in public hospital of Dr. R. Sosodoro Djatikoesoemo needs to be repaired. The reparation plan should meet physical safety. Therefore the management of the hospital needs to improve their understanding about FMS and EBD based Emergency Room. To implement the idea into design, the management should consult to a professional architect who understands the standard requirements for building a hospital.

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