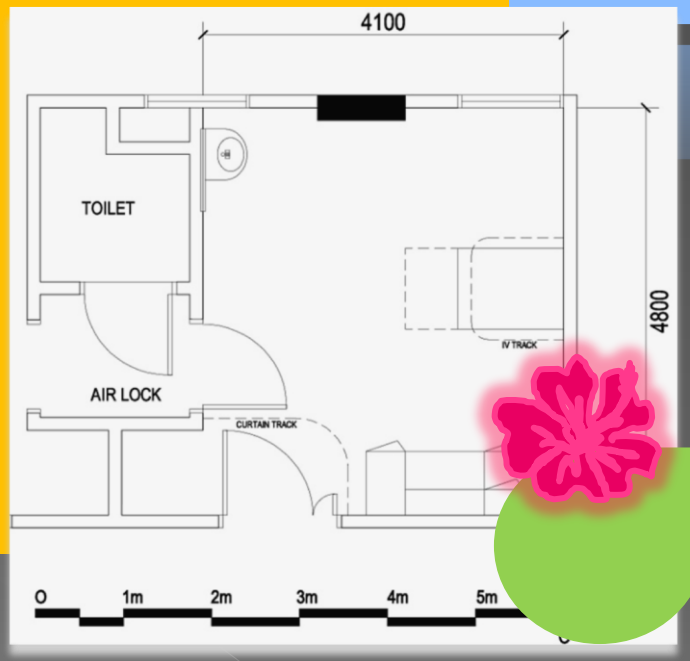
31st UIA-PHG Seminar, Tokyo, Japan 2-4October 2011

Shapes and sizes to safety:

labour delivery room design as case study of Malaysian hospitals.



Presented by
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International Islamic University Malaysia

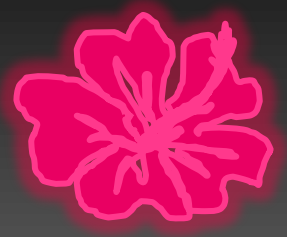
….on shapes and sizes

- Winston Churchill did say that

  ” We shape our building and the building shape us…”
- Kleeman in his book *The challenge of Interior Design* states, “ there are those who assert that essentially the design of an interior space and its location not only can communicate with those who enter it but also controls their behaviour”

Outline of Content

Issue of SPACE and SHAPE on Safety
Safety in healthcare environment
How we practice
Case Study and findings
Recommendation
Conclusion



….the issue

- Does the **shape and size** of the space produce affect safety?

…the issue

We pride ourselves on projects and design done but..

- Did designers ever ask oneself whether the projects and individual spaces derived through various decision making process is effective for the purported function once built ?
- Were there any re-visit or assessment or evaluation done on the handiwork as it is used?.

Research objectives

- To uncover whether **Shape** and **Size** in designing healthcare spaces effect Safety
- To provide recommendations as design guideline on critical dimension for better and safe design

Issue of SPACE, Shape and Sizes on Safety

Why Space, Shape and Size to safety

What Standards and Guidelines states…

Why Space, Shape and Size to safety?

- "Form and shape are areas or masses which define objects in space. Form and shape imply space; indeed they cannot exist without space. There are various ways to categorize form and shape. Form and shape can be thought of as either two dimensional or three dimensional. **Two dimensional form** has width and height. It can also create the illusion of three dimension objects. **Three dimensional shape** has depth as well as width and height. Form and shape can also be described as either **organic** or **geometric.**"

Ref: Jirousek. C.(1995). Form, Shape and Space.
http://char.txa.cornell.edu/language/element/form/form.htm

Why Space, Shape and Size to safety

- ."...architecture do not consist in the sum of width, length and height of structural elements which enclose space but the **void itself, the enclosed or** defined **space which man lives and moves.** No matter how beautiful the façades or walls of buildings are, they are merely containers**, the content is the internal space**" (Barry (1993) p24).

http://www.uia-public-health-group.org/Seminars/Istanbul_2005/presentaties/nawawi/The_Meaning_of_Spaces_in_Healthcare_Architecture_for.pdf

Why Space, Shape and Size to safety

- " ...spaces relate directly to body size, its acuity, range or motion and intentions- i.e. ergonomics, will eventually dictate how we move through space as well as interacts with its geometric forms and sensory stimuli. This movement defines our realm in specific environment or place.." Crisp (1998)

http://www.uia-public-health-group.org/Seminars/Istanbul_2005/presentaties/nawawi/The_Meaning_of_Spaces_in_Healthcare_Architecture_for.pdf

Why Space, Shape and Size to safety?

- Micro level
- Human scale, anthropometric
- Ergonomics
- Deals direct with Man (patient, staff, other) and the environment
- Point of use and contact
- Determinant of area for activity and related immediate activities
- Circulation
- Ventilation/Air borne
- Close proximity
- Controlled environment

What Standards and Guidelines states on healthcare spaces

- **Chapter 3: Accommodation for patients. Patient room size .**
- 63(1)where only 1 bed is intended to be placed in a room, there shall be at least 10 square metres of net usable floor space with no wall of the room being less than 3 metres long except for floor to ceiling height.
- 63(2where two or more beds are intended to be placed in a room or ward, the beds shall be arranged to allow spacing of beds at 1.5 metres clear space between beds and shall at least 0.9 metre from any wall.
- 63(3) not withstanding subregulation(2), the spaces between the head of the bed and wall may not be 0.9 metre if adequate space for services at the head of the bed is provided.
- 63(4)There shall be adequate space for movement of beds in and out of the room or ward.

Private Healthcare Facilities and Services Act and Regulations 2006. Part X, General Provisions For Standards of Private Healthcare Facilities or Services, p 190

What Standards and Guidelines states on healthcare spaces

- These findings were drawn from the variability of these standards with regards to situation in which (i) standards was judge as necessary to be established and (ii) being different between societies and cultures for both space standards and environmental standards.
- These differences also applies within the cultures themselves depending upon the social context in which the facility is used such as sizes of tread and risers for stairs for domestic, ceremonial, fire, etc. Rapoport, Watson (1972)

http://www.uia-public-health-group.org/Seminars/Istanbul_2005/presentaties/nawawi/The_Meaning_of_Spaces_in_Healthcare_Architecture_for.pdf

What Standards and Guidelines states on healthcare spaces

- Rapoport, Watson (1972) further stated that to some degree these standards have been derived from ergonomic and anthropometric studies carried out by building research organization in each country as well as unconsciously, through cultural processes.

http://www.uia-public-health-group.org/Seminars/Istanbul_2005/presentaties/nawawi/The_Meaning_of_Spaces_in_Healthcare_Architecture_for.pdf

Safety in healthcare environment

- The Concept of Safety in Healthcare Built Environment
- The concept of standardised space/room in architecture and healthcare

Concept of Safety in Healthcare Built Environment

- Reiling(2007)pg2 raised question in his book *Safe by Design* whether there is connection between **error and facility design**. In his discussion on James Reason and Lucian Leape's model of error, he concluded, that if the conditions causing human error are minimised or eliminated in health care, the result should be less human error, leading to fewer adverse events and preventable medical deaths, improved patients outcomes , and lower costs.

Concept of Safety in Healthcare Built Environment-2

- Reiling(2007),pg2 also discuss Architect Mau in his book *Massive Change* on importance of design where Mau states that ," for most of us, **design is invisible**. Until it fails…when system fail, we become temporarily conscious of the extraordinary force and **power of design**. Every accident provides a brief moment of awareness of real life, what is actually happening, and our dependence on the underlying systems of design"

Concept of Safety in Healthcare Built Environment-3

- Reiling(2007),pg3 summarised Reasons' **Cognitive Theory** of Errors in man as two types of mental functioning i.e.
  - ***Schemata*** – *established knowledge structures* based on past experiences that we use to unconsciously perform routine activities in our brain or one is **automatic and unconscious** , e.g. Brushing teeth, dressing and drive to work..it is done rapidly and effortless,
  - the other is **deliberate and conscious**, which is slow, sequential and laborious. These activities relate to problem solving ,assessments, or observed errors based on unconscious mental functioning.

Concept of Safety in Healthcare Built Environment-4

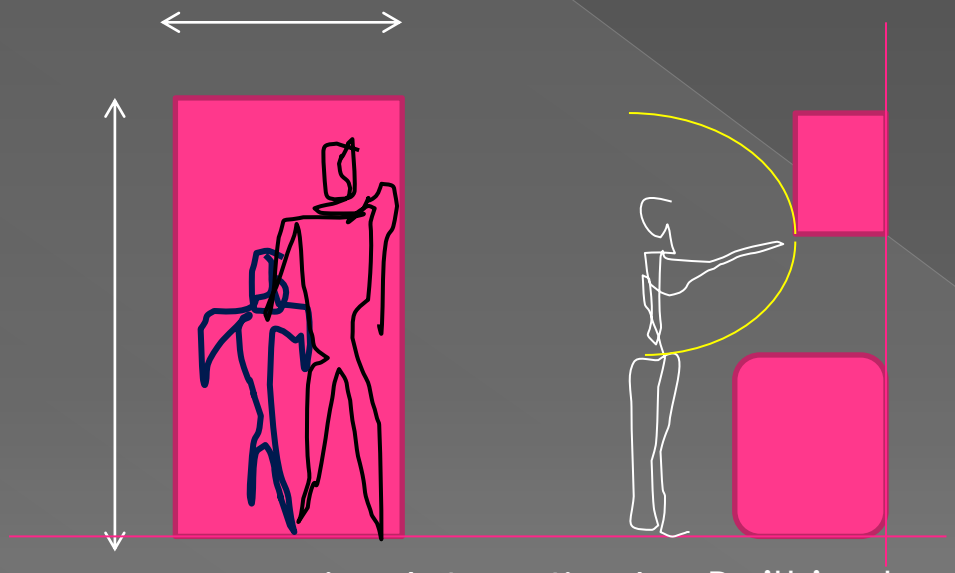
- Built environment that causes or lead to Man's error is classified as **"latent conditions"** as it lies dormant within the system for a long time and only becoming evident when they combine with other factors to breach the system's defense such as poorly designed facilities including their technology, equipment, noise, lack of standardisation, inadequate policies……. and poor safety culture.
- Errors made by physicians, nurses and other at point of service is classified as" **active failures".**

Concept of Safety in Healthcare Built Environment-5

- Under the Concept of Quality in Health Care as envisaged by former Director General of Health Malaysia, Tan Sri Datuk (Dr) Abdul Khalid bin Sahan, former Director General of Health Malaysia, Malaysian Medical Association (2002).*www.mma.org.my/info/4_quality_86.htm states that*
- "...Quality in health care is multi-dimensional, multi factorial and cannot to be judged out of context ... Safety is measured as relative risk and severity of an adverse outcome"

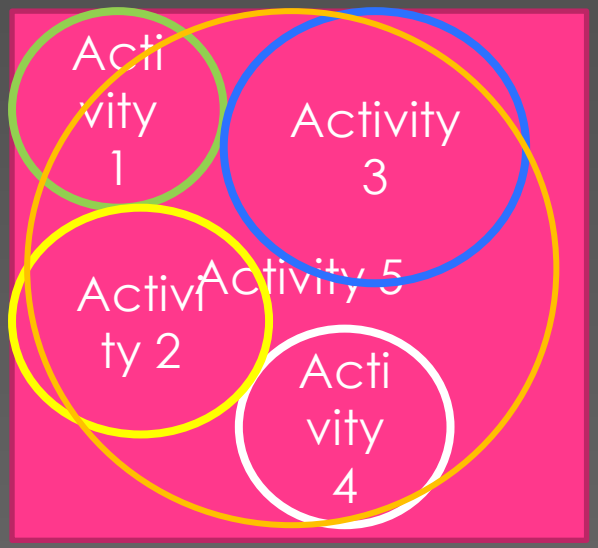
http://www.uia-public-health-group.org/Seminars/Istanbul_2005/presentaties/nawawi/The_Meaning_of_Spaces_in_Healthcare_Architecture_for.pdf

The concept of standardised space/room in architecture



Door size (elevation) Built ins location

Size and proportion are based on study of anthropometrics of man, women, age group, ethnic and others to fit the users

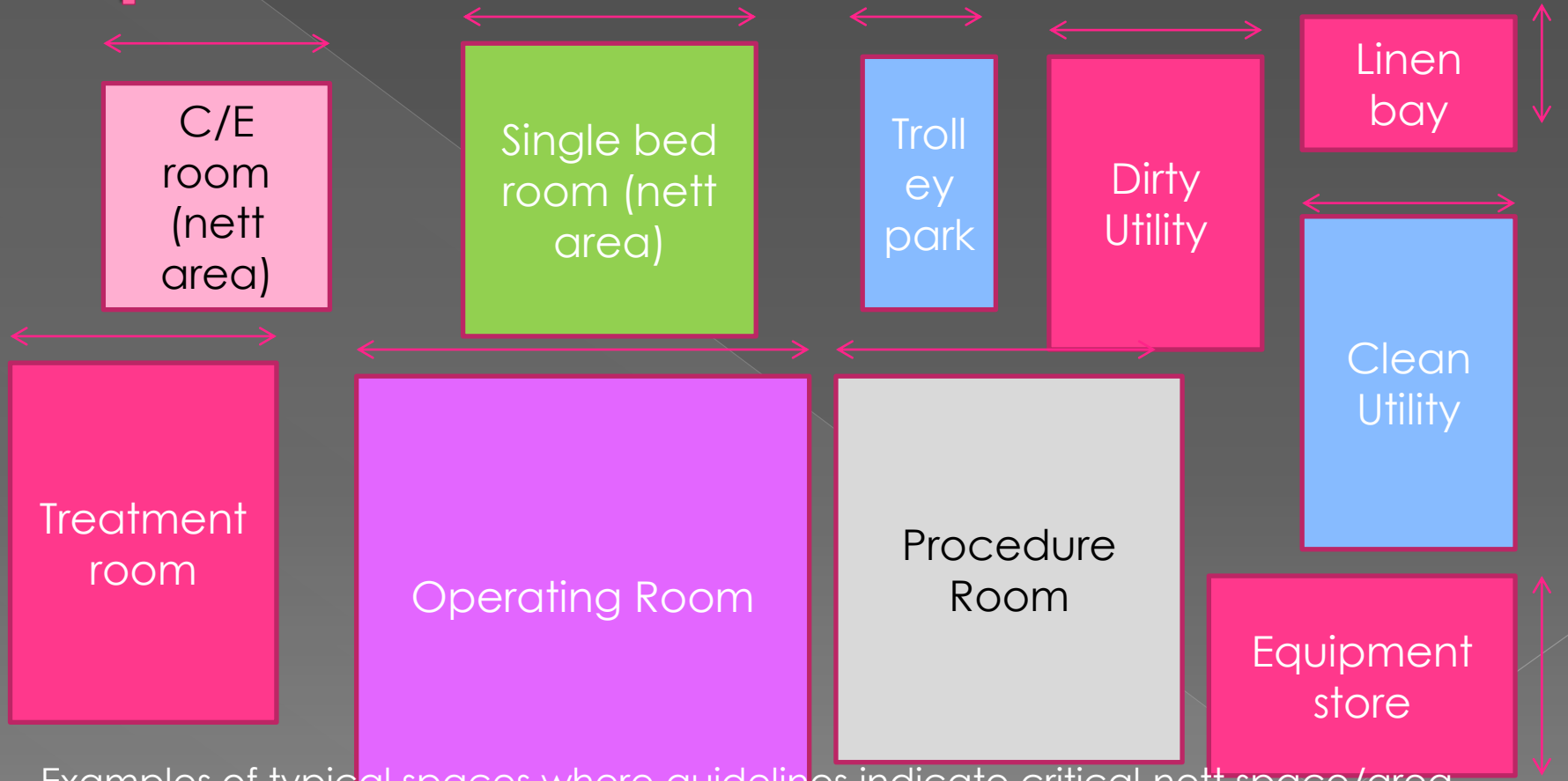


Space/Room size (Plan)

Space/room is based on an activity or related activities that take place sequentially or simultaneously with or without related tools, equipment, furniture, single or more users; and in control or natural environment..

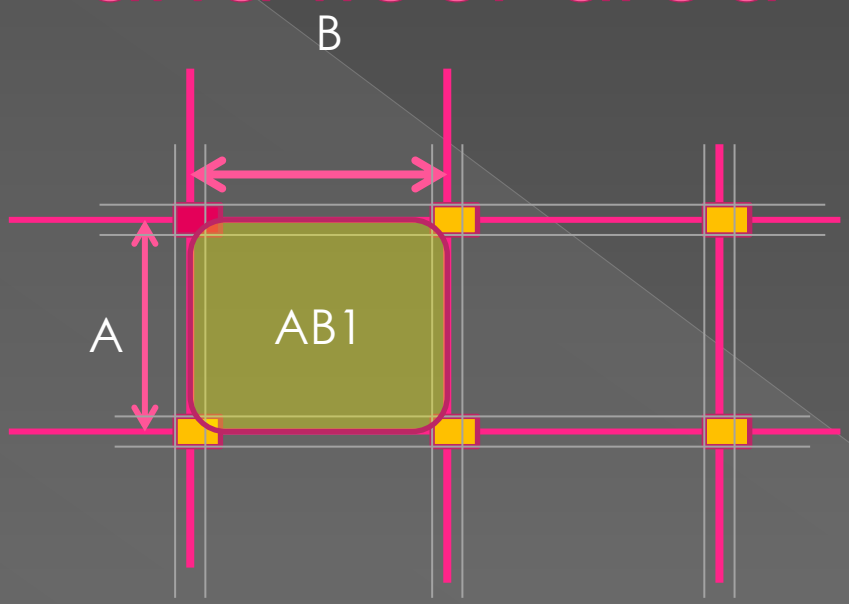
Clinical Space configuration consideration of single space

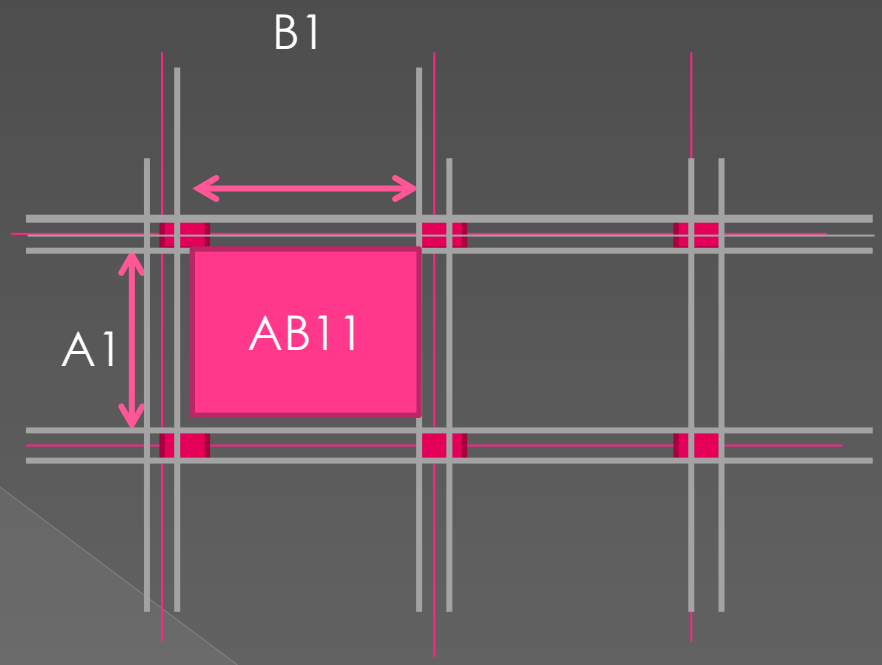
The concept of standardised space/room in healthcare



Examples of typical spaces where guidelines indicate critical nett space/area required and critical clear width dimension as mandatory provision. Safety in terms of infection control, adequate space circulation and environment are considered

Healthcare facility structural grid and floor area





Centre to centre (axis) dimension
Structural centred

Spatial area
A x B = AB1 –
Gross Area

Standard Grid
6.6 x 6.6
7.2 x 7.2
8.1 x 8.1

Clear dimension (outer skin of the wall)
Spatial centred

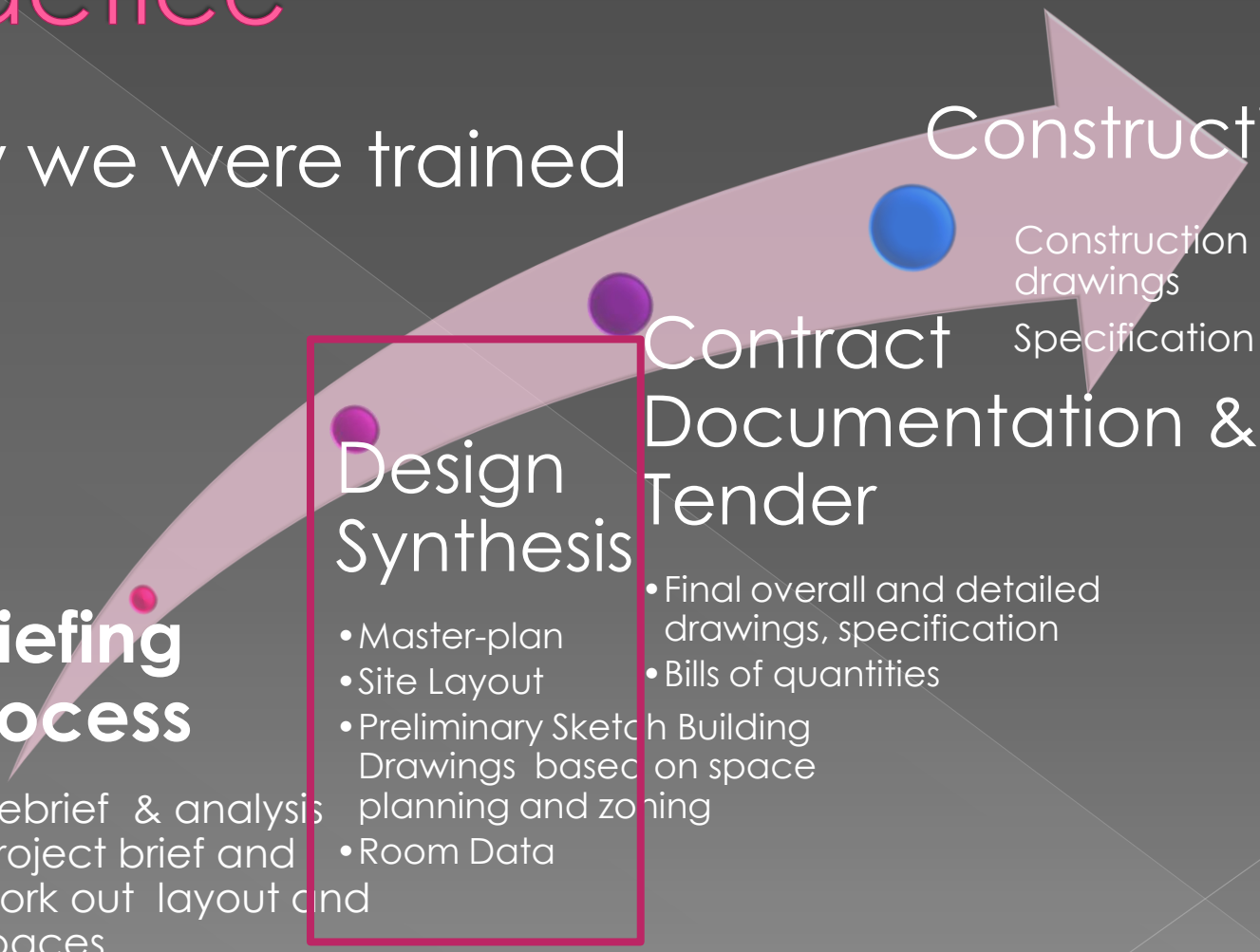
Spatial area
A 1 x B 1 = AB11 (smaller area then AB1) **Nett Usable Area**

How we practice

Retrospect the way we practice
Retrospect the way develop the design
Designers led /Traditional procurement
Contractor led/Other procurement
Design Outcomes

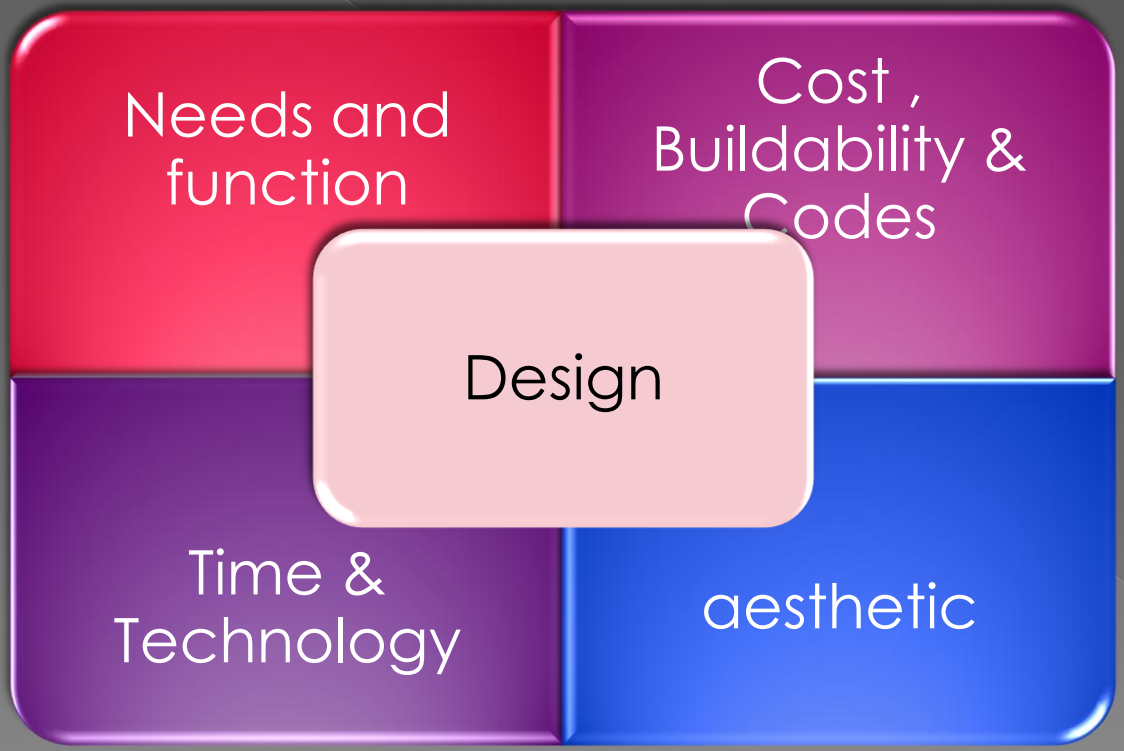
Retrospect The Way We practice

- How we were trained



Retrospect The Way We Develop the Design

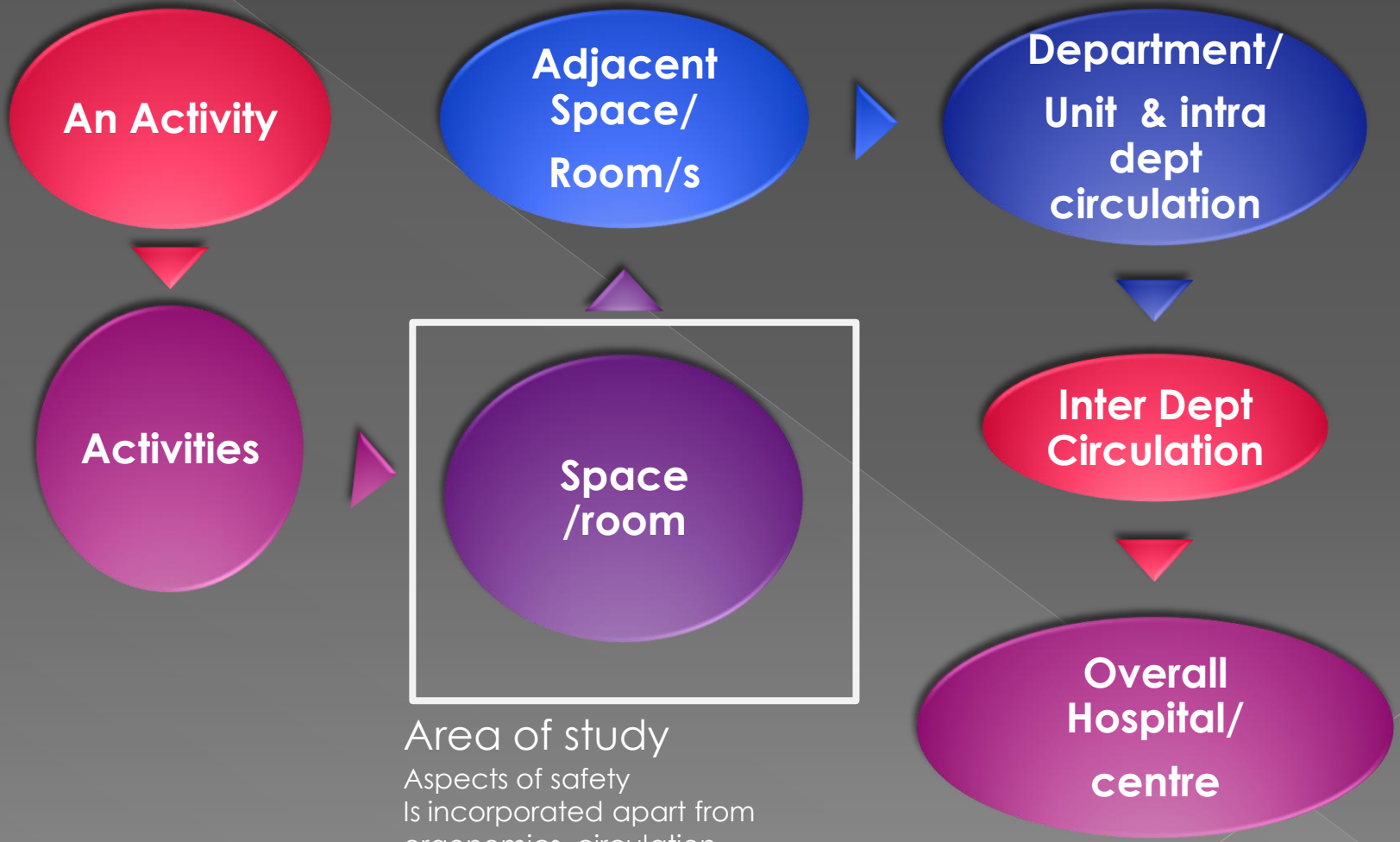
- Design objective matrix



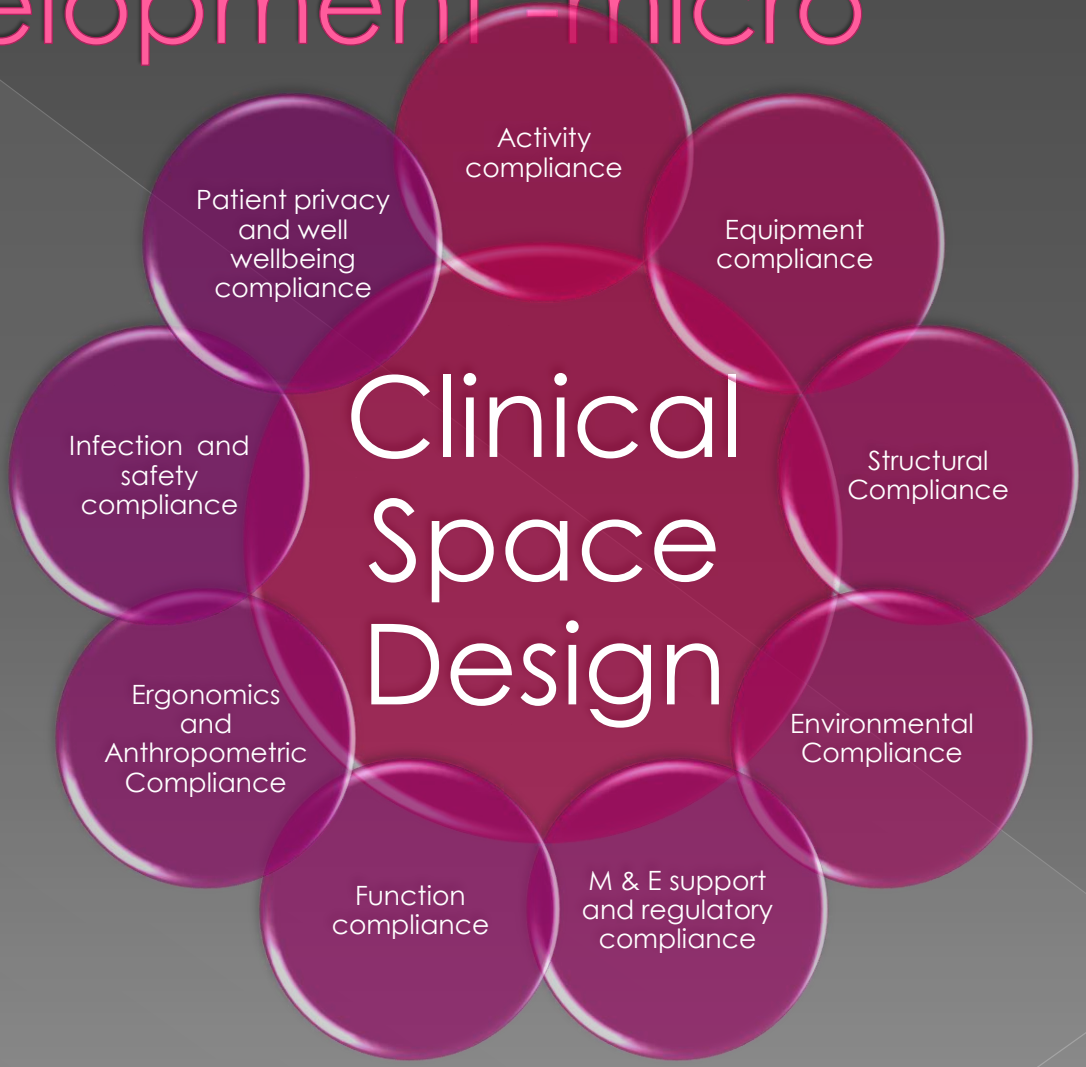
A fact

- Healthcare spaces, especially CRITICAL SPACES were initiated by FUNCTION first then form. Hence designers have to work back and forth putting the puzzles together to be hold by a structure before an overall building form can be realised.

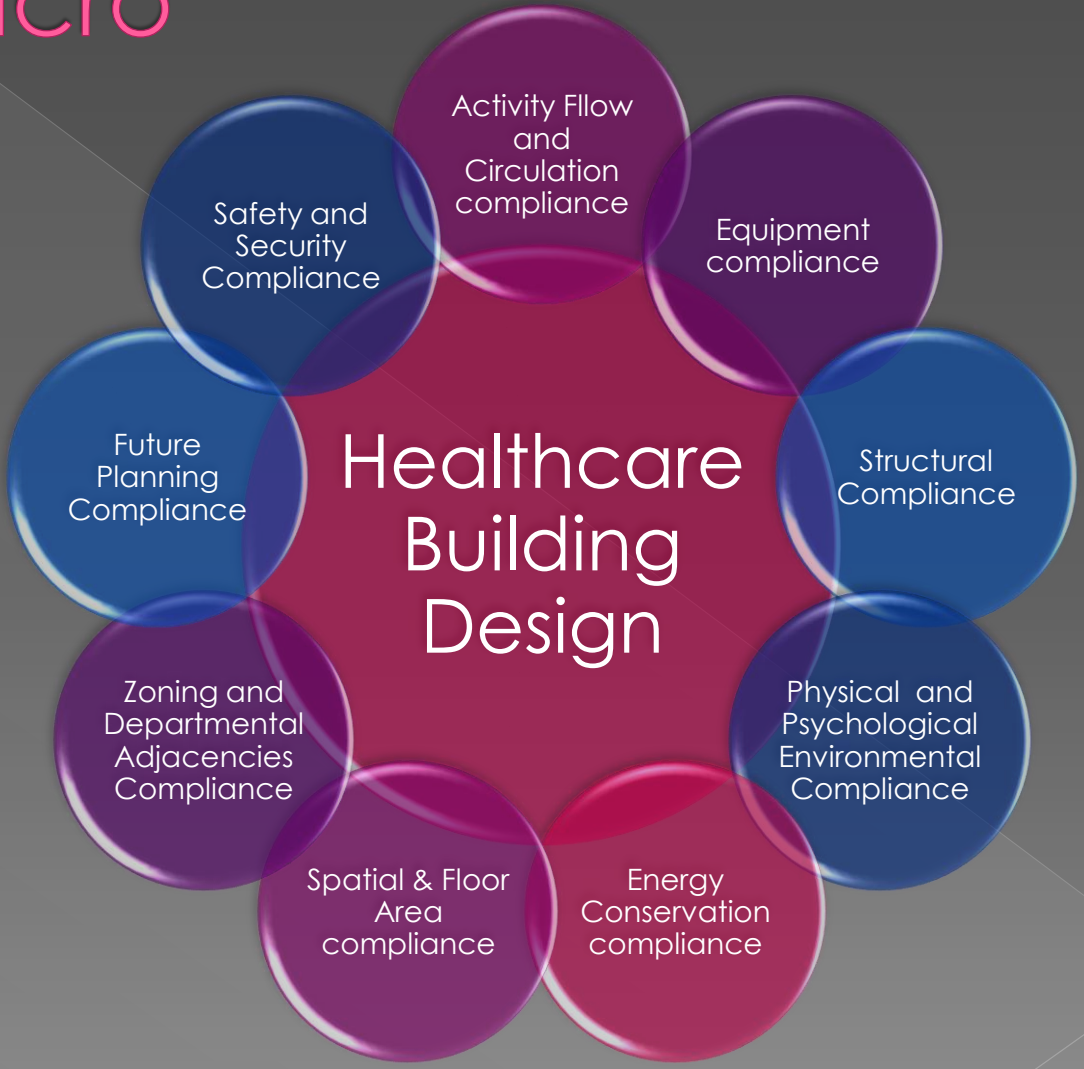
Design Activity Process



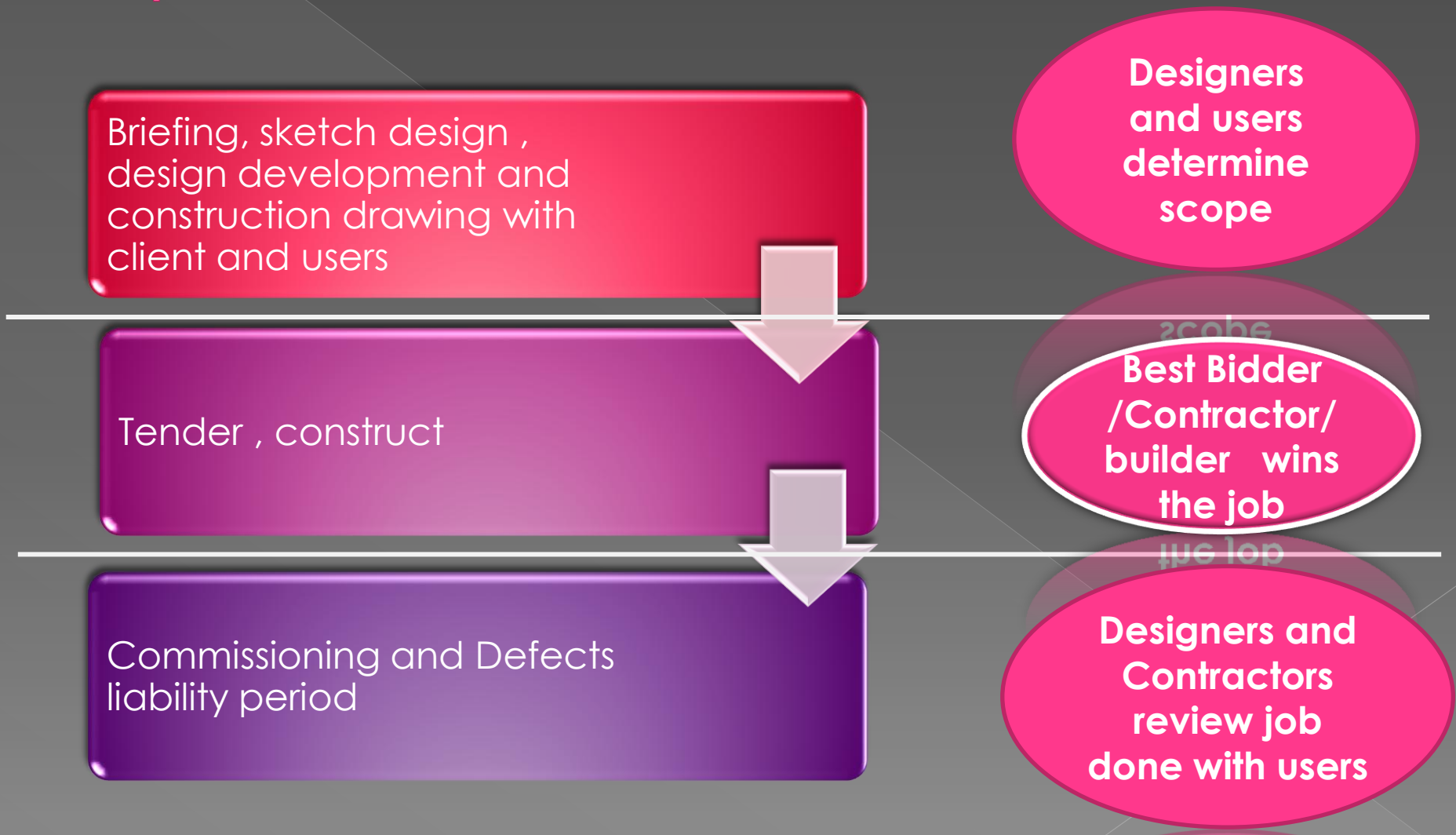
Matrix in design development -micro



Matrix in design development-macro

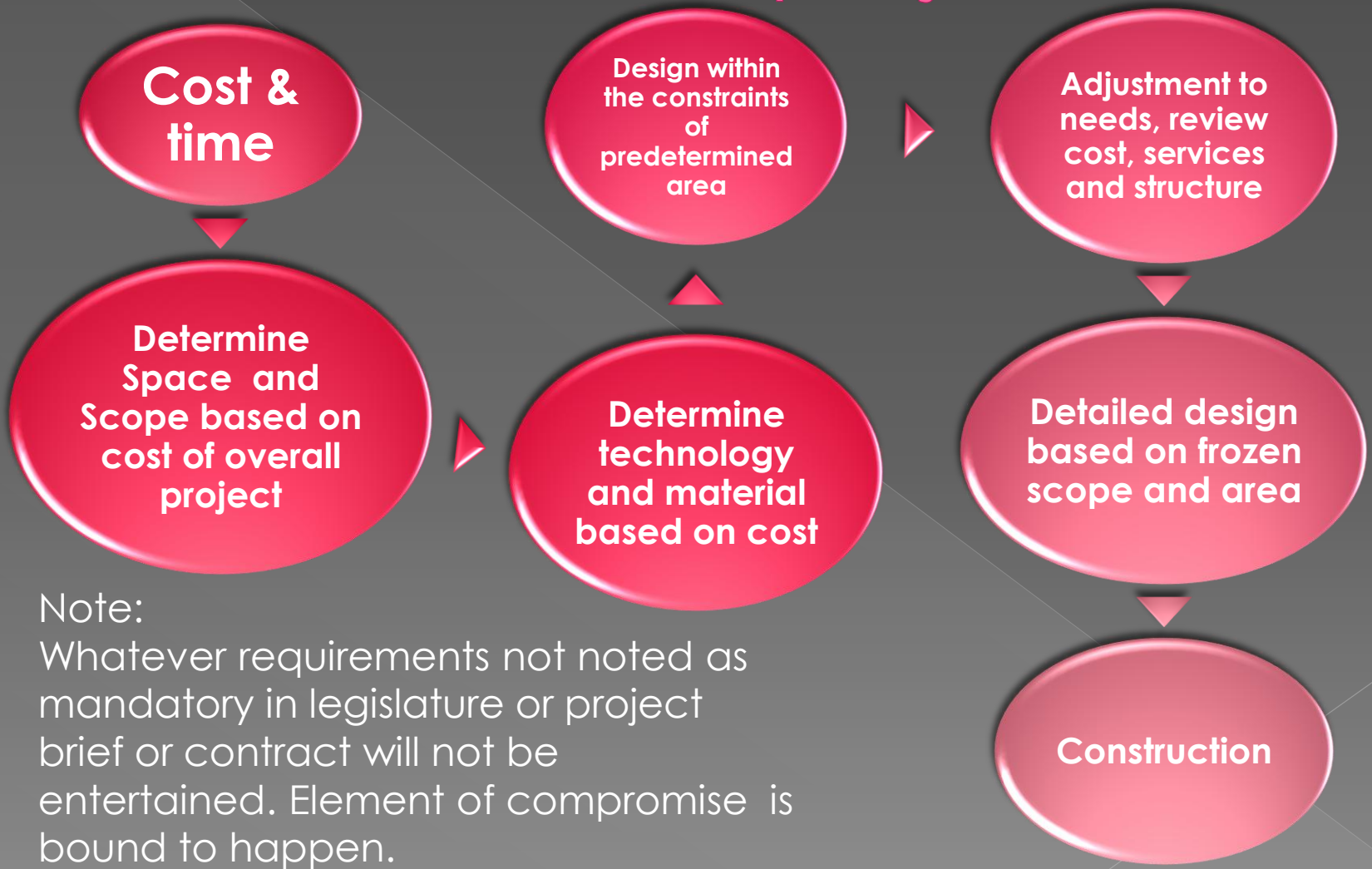


Designers led/ Traditional procurement method



Contractor led/ Other procurement method

Design process in Contractor-led projects



Note:
Whatever requirements not noted as mandatory in legislature or project brief or contract will not be entertained. Element of compromise is bound to happen.

Design outcome

- architects design spaces for proposed facilities based on
  - **schedule of accommodation** (SOA) accompanying the project brief , or
  - Drawings of **spaces done by others** on similar projects, or
  - **space standards illustrated in guidelines, or**
  - **through cumulative experiences** from past similar projects or
  - Intuitively through routine process

Design Outcomes

- Hence spaces were designed by decisions made based on
  - Overall estimated floor area to cost
  - Structural construct-ability to overall estimated area on defined footprint
  - Definite estimated volume of enclosure to cost and area

Without performing the design process of function before form that could give better estimate on spatial requirements including adequate circulation and support areas as well as adequate consideration to its site context

Design Outcome

- Various conglomeration of spaces and environment based on various predetermined constraints of cost, area and structure
  - Both comply and compromise spaces
  - Basically comply on minimum nett usable area but not necessarily on space configuration to activity

CASE STUDY AND FINDINGS

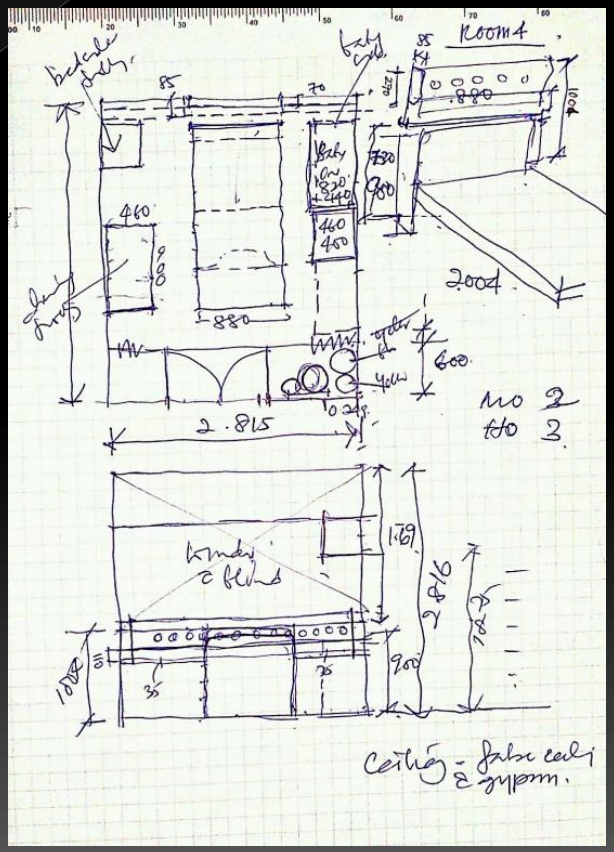
Identify scope /area of study

Design Process

Operational Policies

The Brief

Selected Sites and projects from public Hospitals of Malaysia

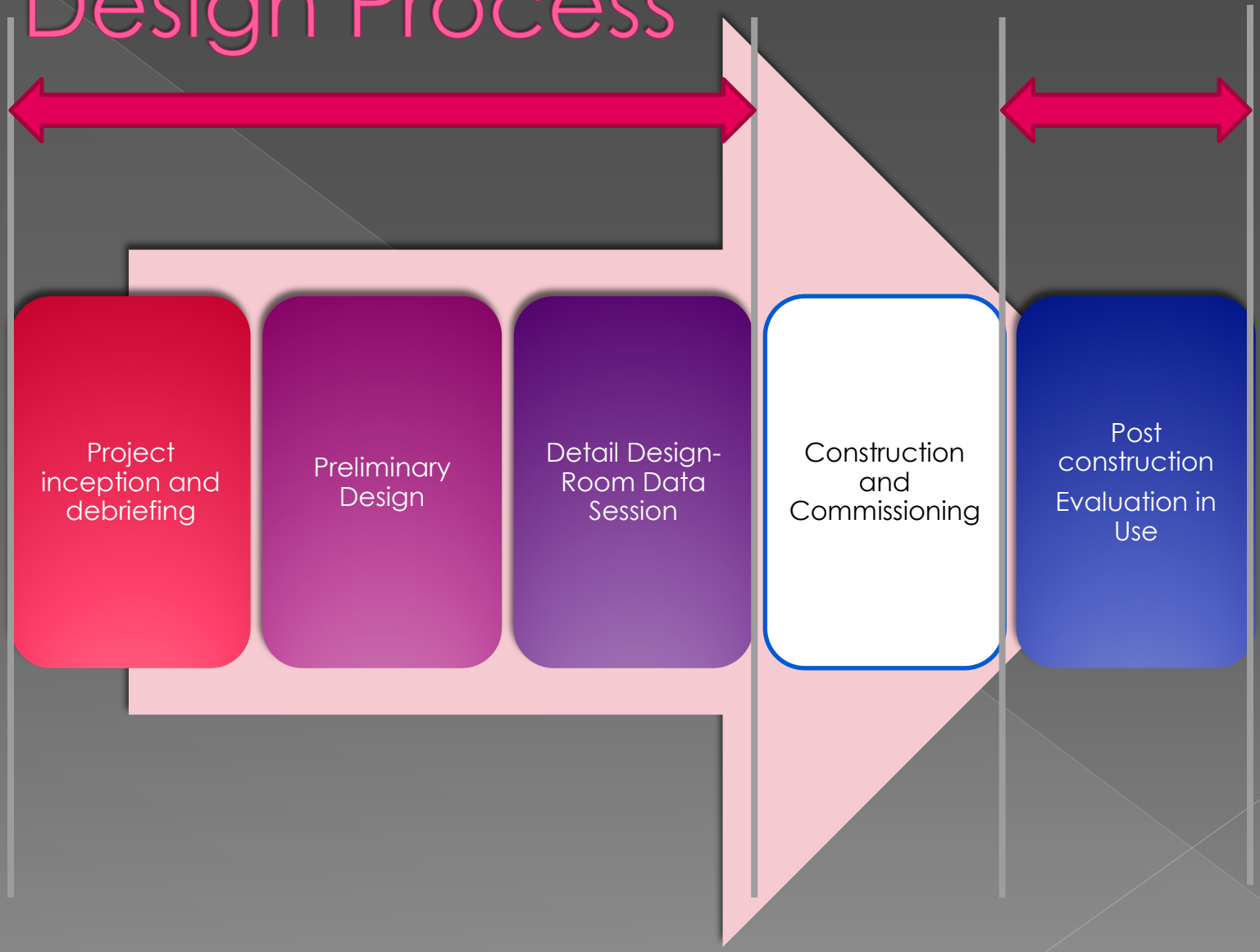


LABOUR DELIVERY ROOMS (LDR)

Scope of Study

- Eg. Labour Delivery Room (LDR) of a Labour Unit

Design Process



Operational policy (1990)

6.5.1 Individual room for patients are recommended for privacy. The assembly line concept is to be done away with for future planning.

6.5.2 This room should be at least a minimum of 10 x 13 feet in size.

6.5.3 2 rooms will share one toilet facility.

6.5.4 There should be one room for every 600 deliveries.

6.5.5 The ideal maximum number of deliveries per hospital should be limited to 10,000 per year.

6.5.6 One room is to be reserved for special care of ill patients that requires close monitoring and use of ventillators.

6.5.7 A VIP room is to be allocated within the Labour Unit with individual toilet facilities, separate entrance and waiting room.

6.5.8 Assisted deliveries will be conducted in the same room as well.

Operational Policy (2010)

- ***Management at the labour ward is with specialist input (Std: 100%)***
  - **Standard** Procedures and activities in labour room / suite.
- **Intent of 9.2.2**
- Labour room / suite is a specialize area, taking care of mothers in labour. To ensure optimum patient care and safety to mothers and their babies, appropriate guidelines shall be followed for all procedures and activities.
- 1. During intrapartum period / postnatal period, refer to protocols :
- a. Management of normal delivery: 'Pengendalian Kelahiran'.
- b. Management of CTG: 'Pengendalian CTG'.
- c. Management of the placenta: 'Pengendalian Uri'.
- d. Vaginal examination: 'Proses pemeriksaan faraj'

Ref: Operation Policy In Obstetrics and Gynaecology Services. Medical Services Division.Ministry of Health Malaysia,2010

Operational Policy

- 2.8

To ensure that patient care in obstetrics and gynaecology ensures the highest order of **patient safety**, efficiency, justification for actions and meticulous treatment.

Ref: Operation Policy In Obstetrics and Gynaecology Services. Medical Services Division.Ministry of Health Malaysia,2010

The Project Brief -1

- **Labour/delivery room**
- **X delivery rooms** are required.
- The patient will be admitted into the room and go through the process of labour and delivery here. As much as possible, the room should have a non-clinical atmosphere and husband friendly so as to encourage the husband or a relative be with the patient during the entire delivery process.
-

The Project Brief -2

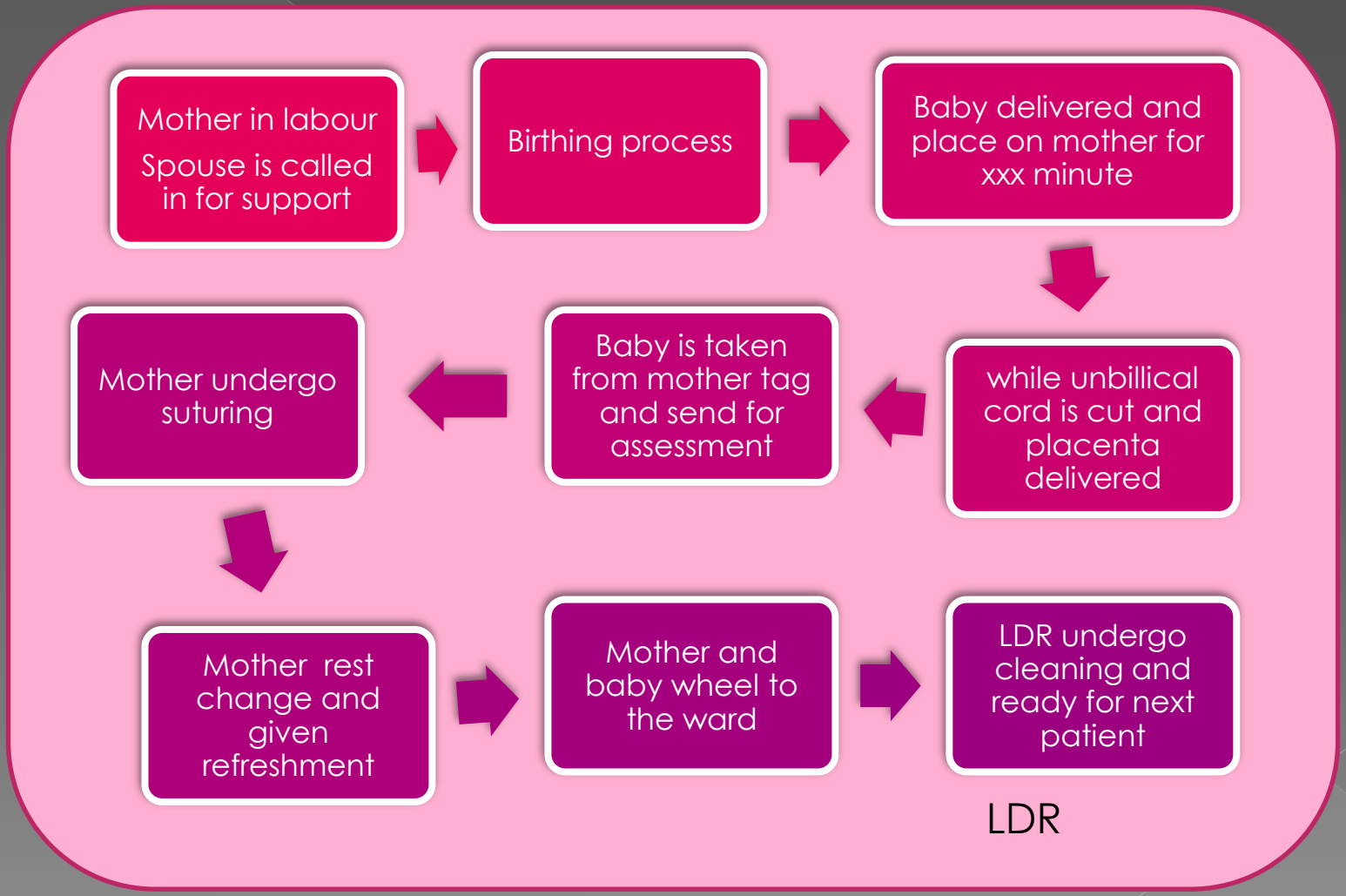
- The necessary clinical items for delivery should be kept on delivery trolley inside the room (one for each room). Two rooms shall be sharing an ensuite toilet. This toilet shall be used only by the patients. It shall have the vanity at the ante-lock and a 3-in-1 toilet/shower. Nurse call system shall be provided in the anteroom and toilet.

- Space should allow for at least 2 staff managing the delivery, a bassinet, a cardiotocograph, a maneuvering trolley and one visitor's chair. As well as resuscitation equipment in case of urgent resuscitation is required. Or else resuscitation is done at the resuscitation bay

Guidelines for LDR Space

Time Saver Standards	Australian (NSW HFG, Australasia, Victoria)	Malaysian Private Healthcare Facilities Act 1998	USA (96-97 HF)
Min 100sqft for LDR. 180 sq. ft for emergency. Min height 9ft (for obs light)	28 sq.m	Min 3.7m with min clear of at least 17sq.m exclusive of fixed or movable cupboard	Min clear 300sq.ft (27.87sq.m)
Clear 17ft 6in square (excluding equip/furniture)	Australasia 7x4.4 m (c/c),	For emergency 4.9m with at least 28 sq.m	For caesarian min clear 360sq.ft (33.45sq.m with min 16 ft (4.88) exld built ins etc.
Toilet/shower/dressing cubicle			Add 40sq.ft (3.72sq.m) for baby resus
Room door width 3ft 6in-4ft			

Understanding the Standard Operational procedure of LDR



Listing the standard equipments and furniture required in the LDR at various stages

GENERIC LIST

Delivery bed and accessories
Cardiac/overbed table
Baby crib, baby weigh and scale
Radiant heater
Monitor (where relevant)
CTG (when necessary)
Dressing trolley
Clinical wash basin
Medication cabinet(for disposables eg gloves, mask)
Visitor Chair (for spouse)
Writing table (for staff)
General Waste bin
Clinical bin
Sharps
other


Radiant heater

Delivery bed

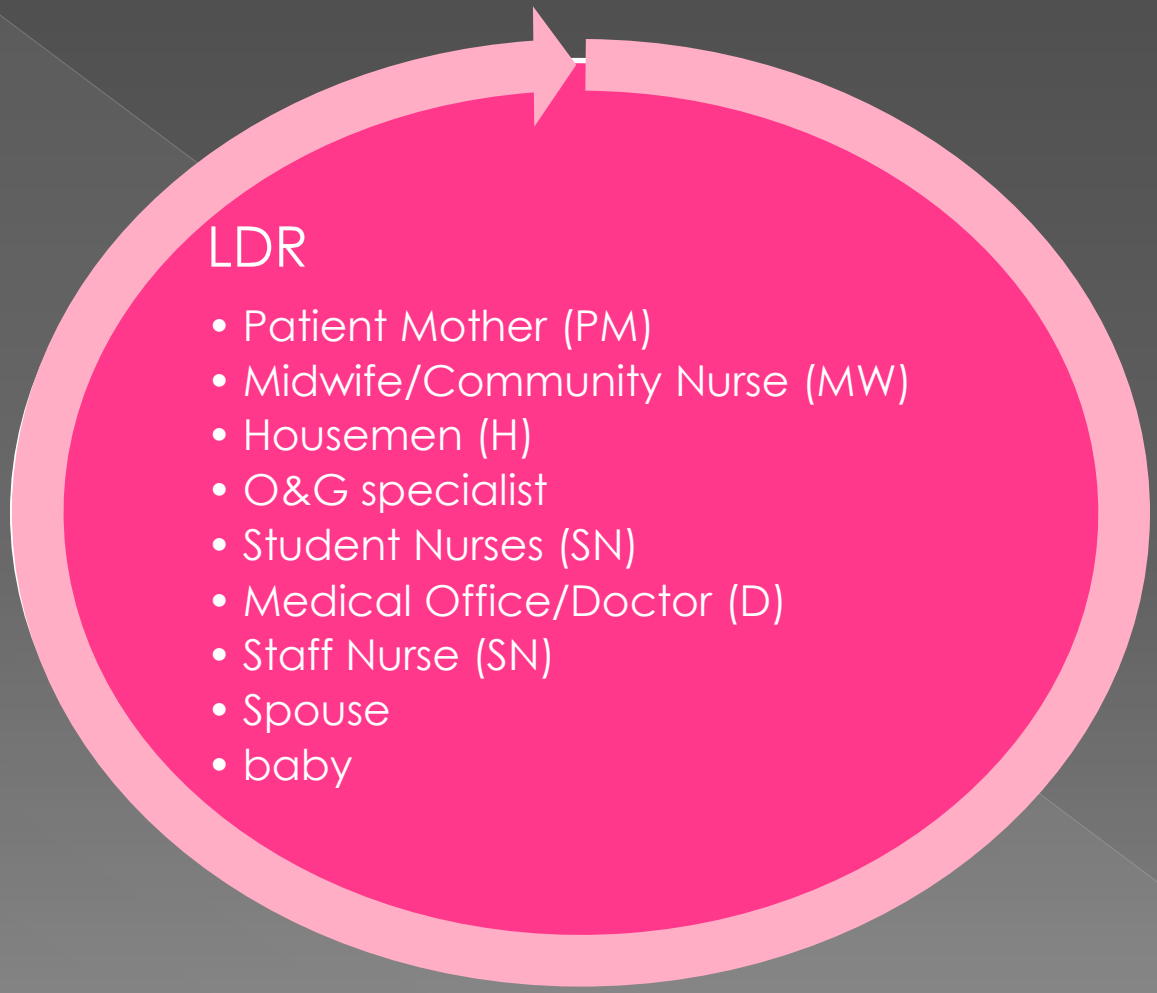
Overbed/ Cardiac trolley


Clinical bin


Medication cabinet

Dressing trollies and delivery sets

Identification of USERS of LDR

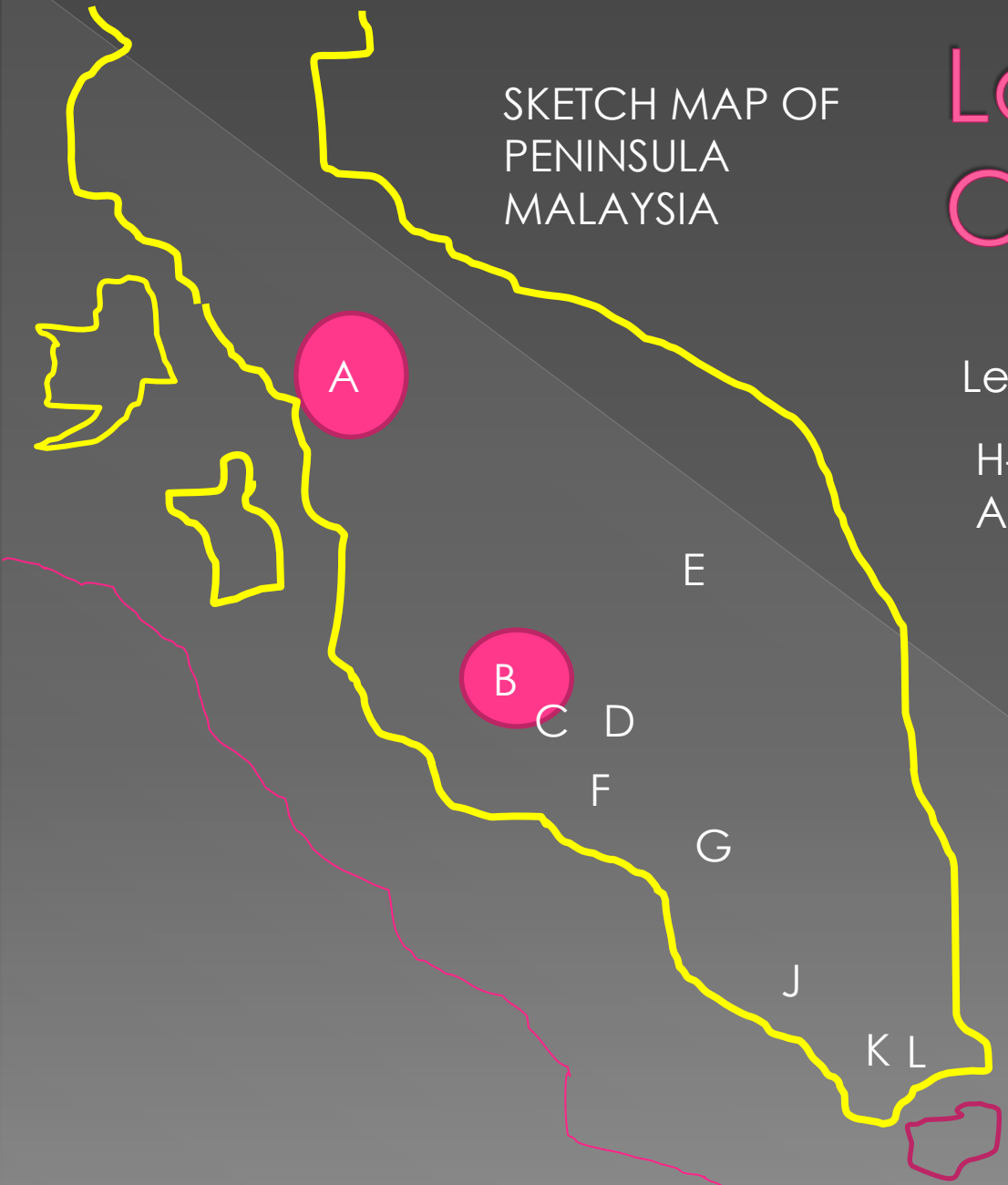


Framework & method of study

- For each hospital,
  - the physical measurement of LDR was conducted on all different designed rooms based on space configuration (L, B, Ht) + door size, window size, grid, ;
  - All equipments and built-ins in LDR were measured. Name of product were noted as well as the equipment/furniture were indicated by definite location on each drawing drawn.
  - observation of use (space utilisation factor) were based on cases available in the selected rooms at the time of visit ranging from 4-12 hrs of stay as well as mode of delivery – normal, forcep, vacuum. This include observation of circulation of various people involve in the process and the equipment use. The proceedings are captured by stages in sketches.
  - Interviews were conducted at random using guided questionnaire to staff and patient

- Safety issues are noted in the process based on observation and those related to standard practices.

Location of Case Studies



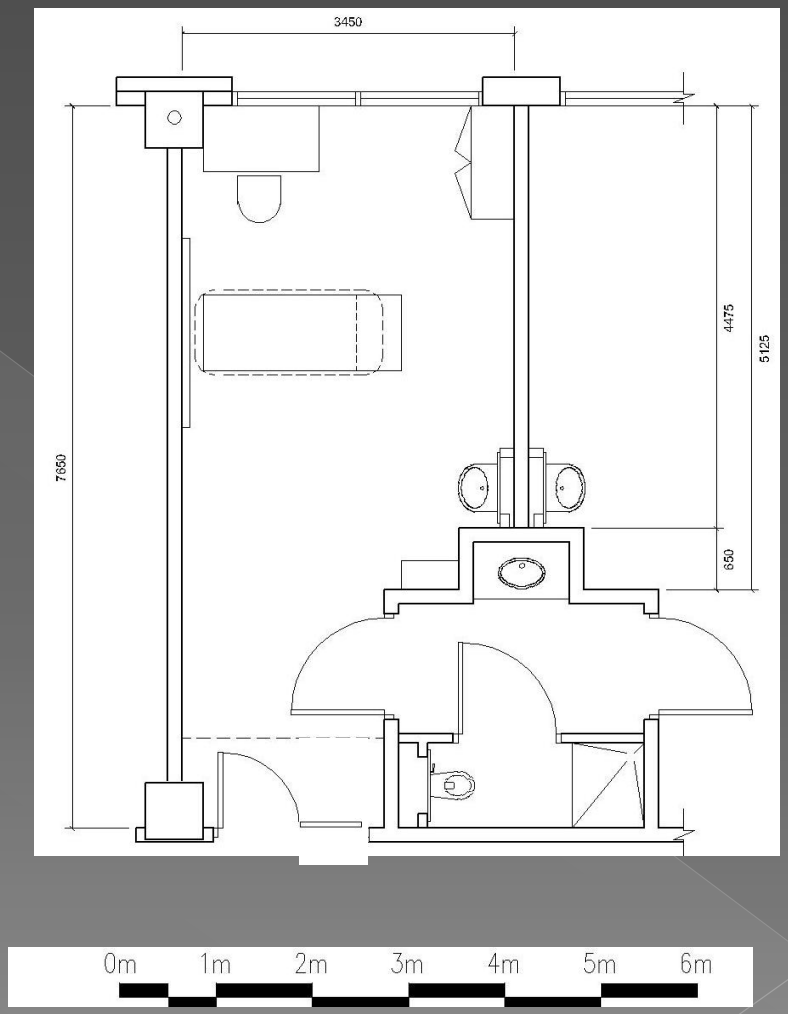
Legend

H- Hospital
A-L – Hospital code name

Background data of case studies

Hospital	Type	No of LDR
A,Kedah	Specialist (T)	14
B, Selangor	Specialist(R)	
C , Selangor	Specialist (R,T)	
D, Selangor	Specialist (R)	
E, Pahang	Specialist	10
F, Kuala lumpur	Specialist	20
G, Selangor	Specialist	18
J, Melaka	Specialist	
K, Johor	Specialist	
L, Johor		

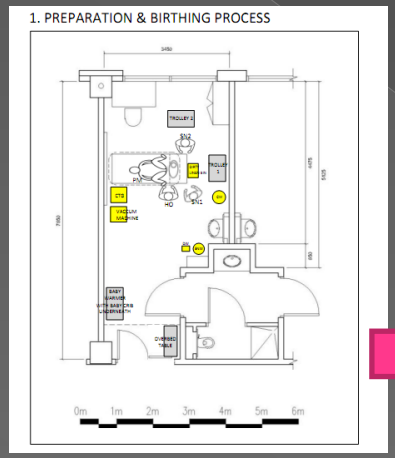
Labour Delivery Room-Hospital A

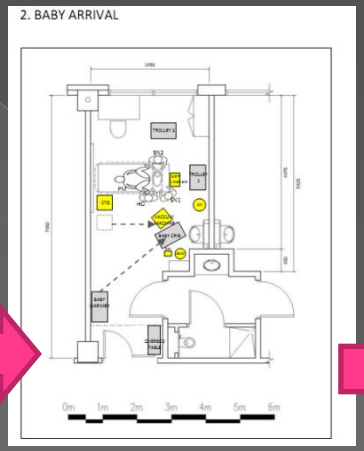


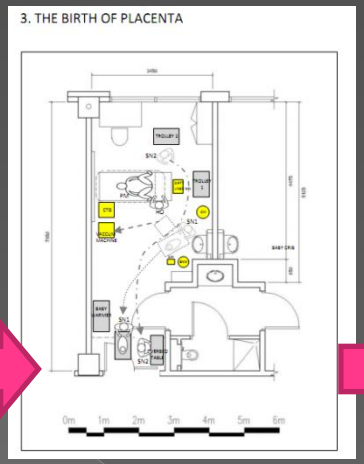
Views of typical Labour Room Hosp A

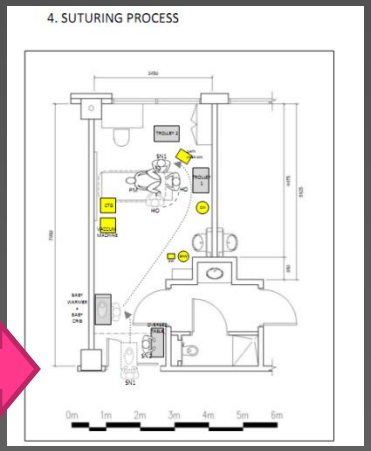
Room without windows (LDR)

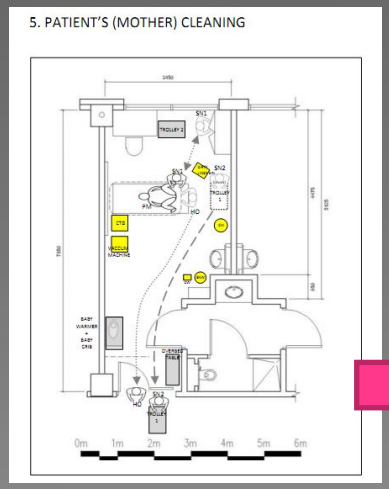
LDR A-room Observation on sequence of use during birthing

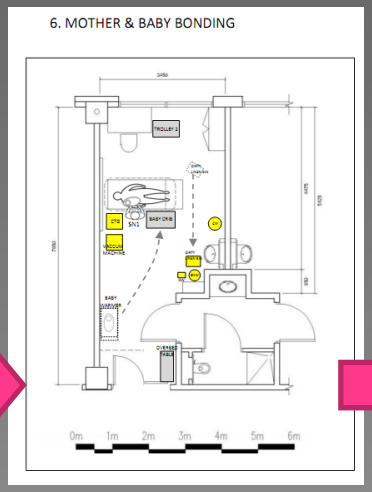


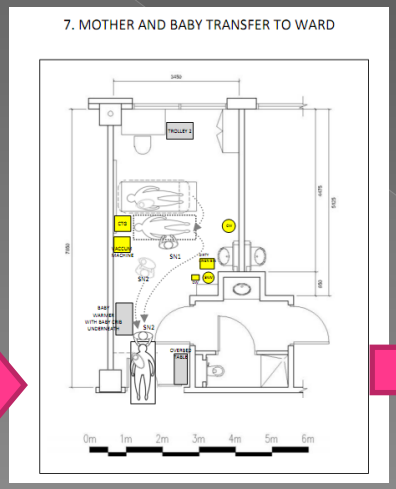


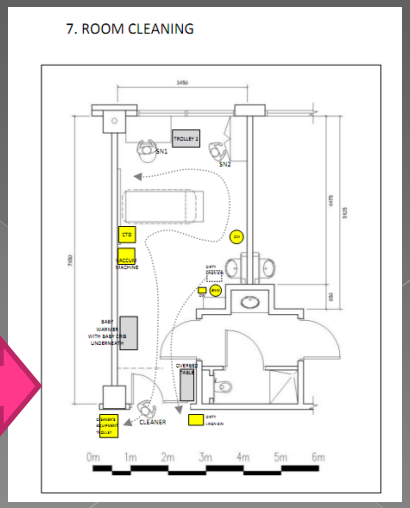




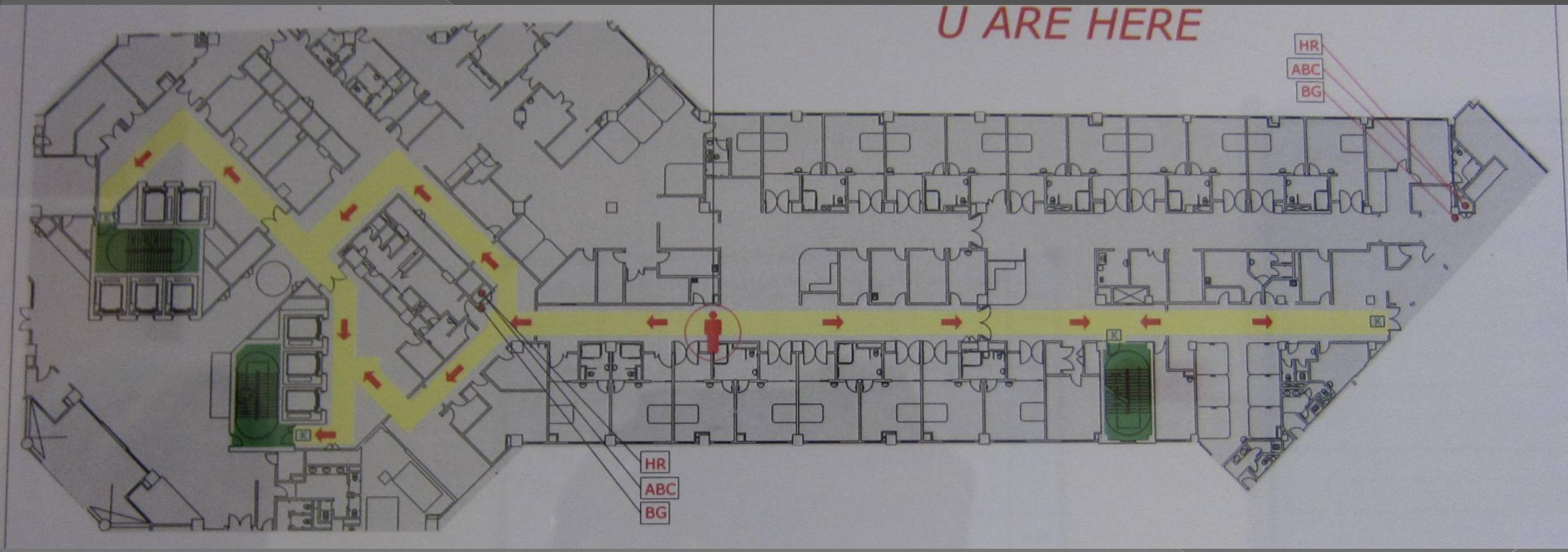




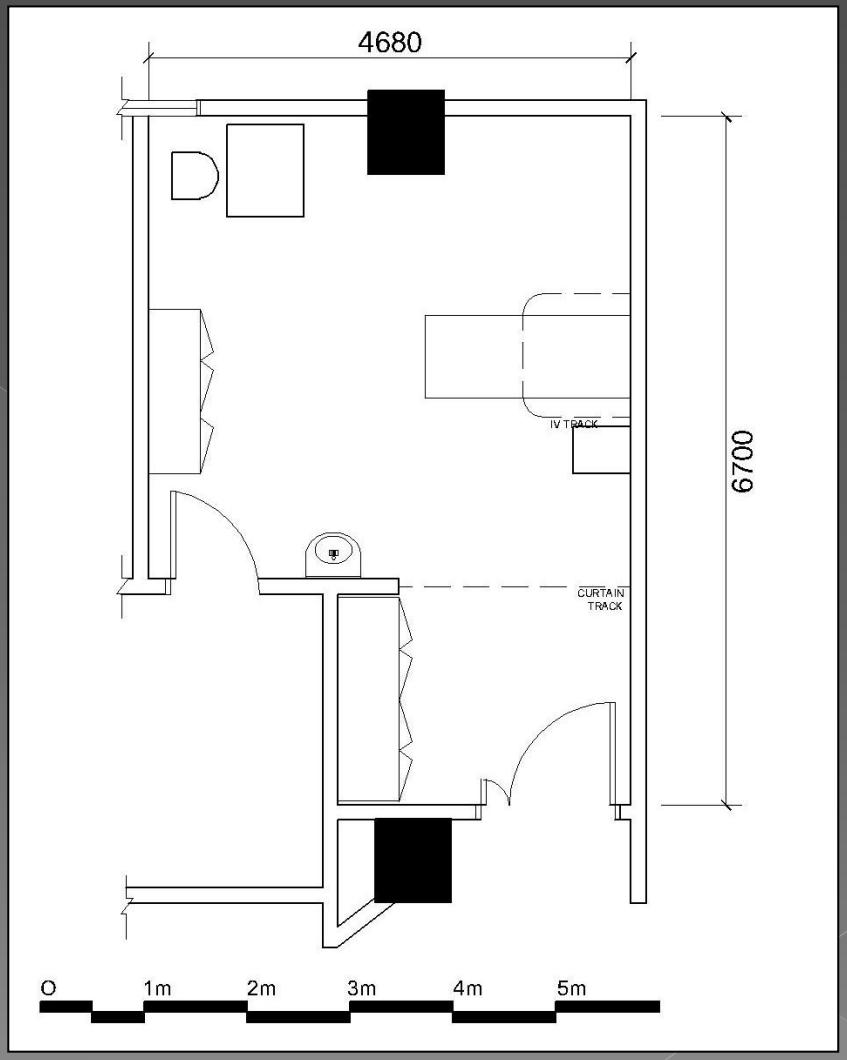




Hospital B – Labour Unit

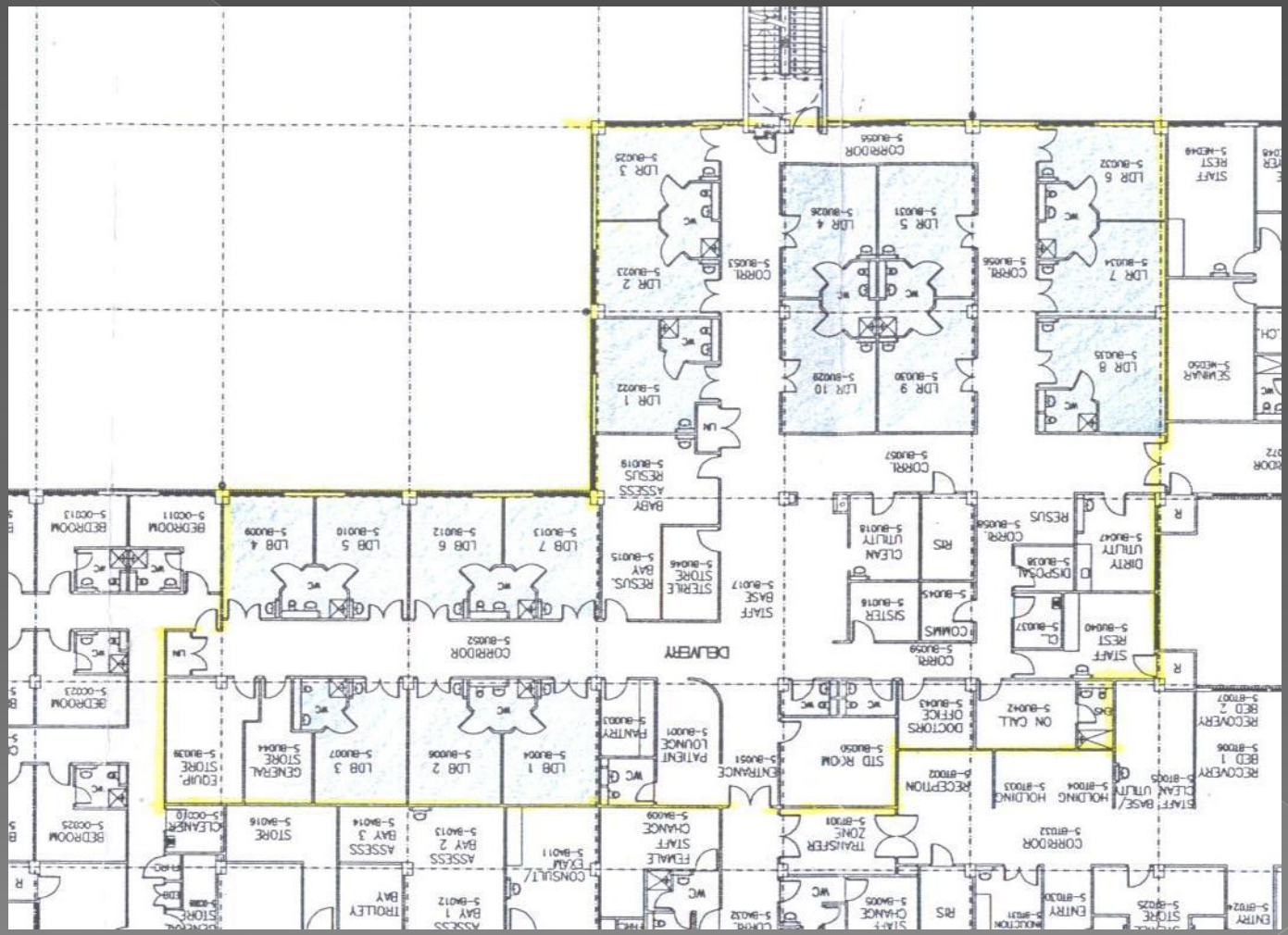


Labour Delivery Room-Hospital B

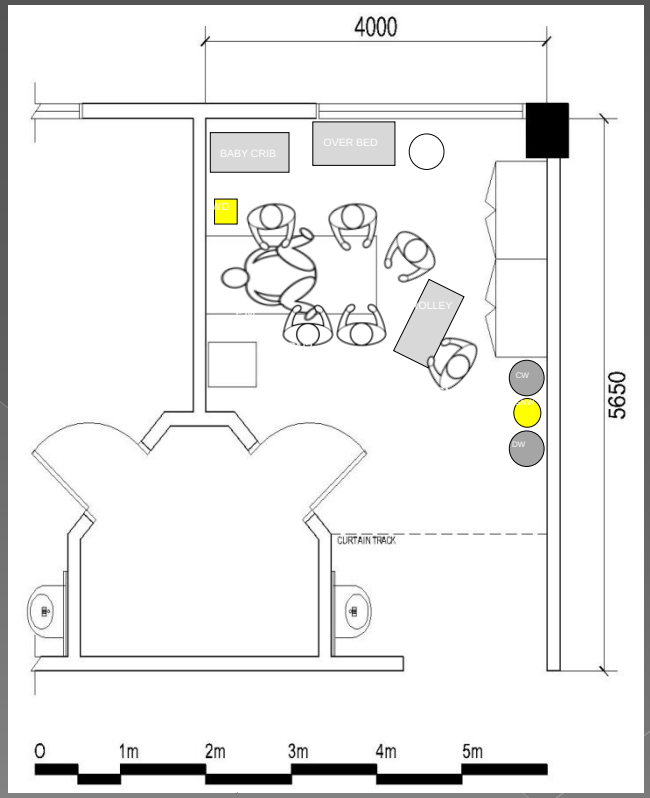


Views of typical Labour Room Hosp B

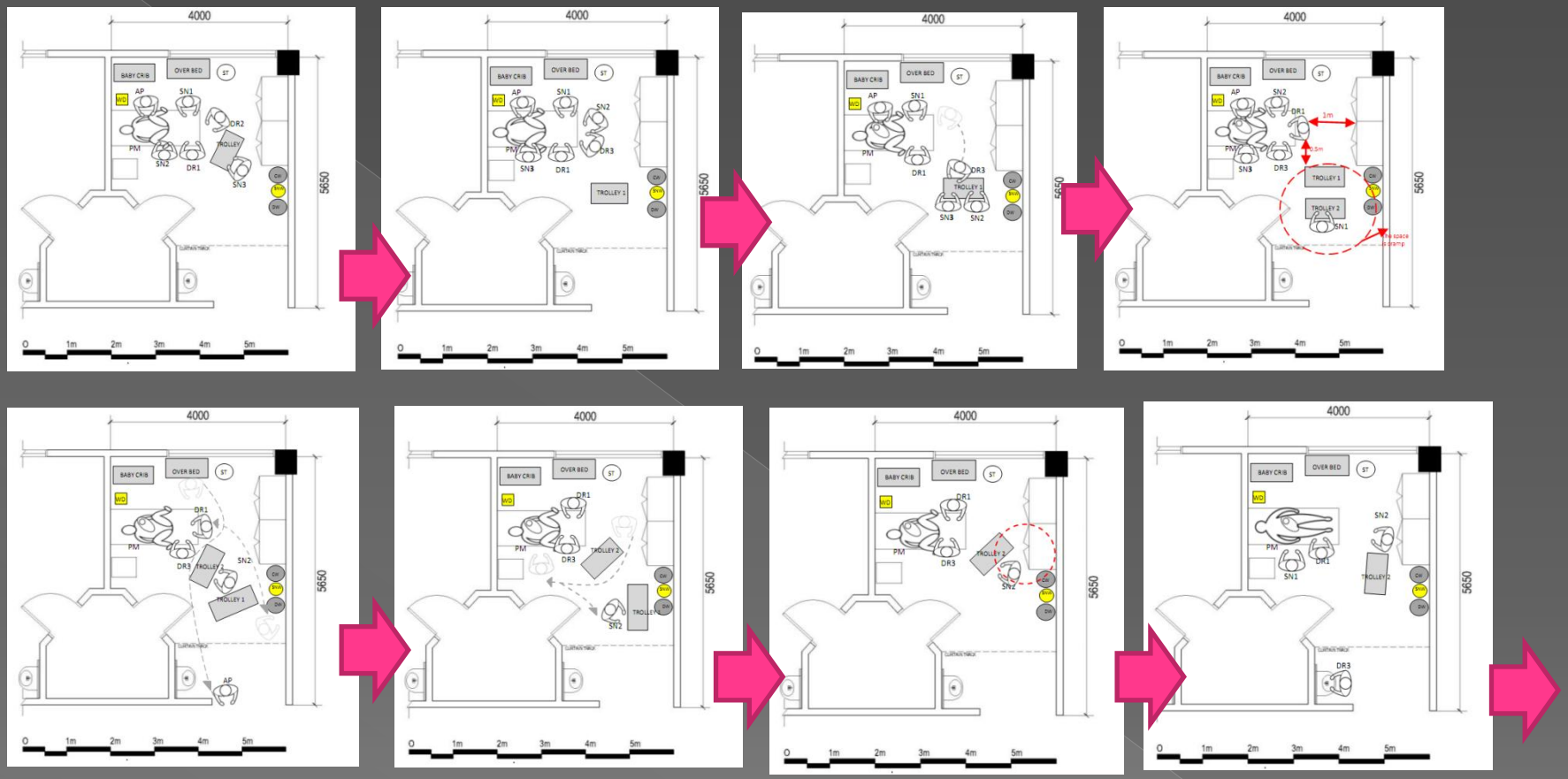
Hospital C – Labour Unit



Labour Delivery Room-Hospital C

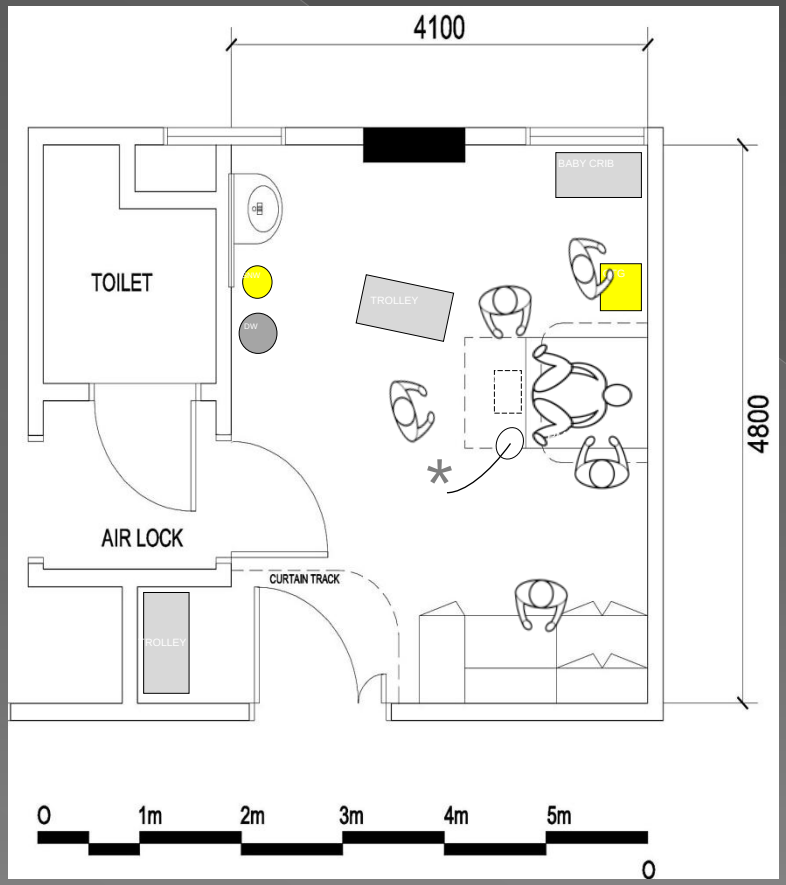


Observation process



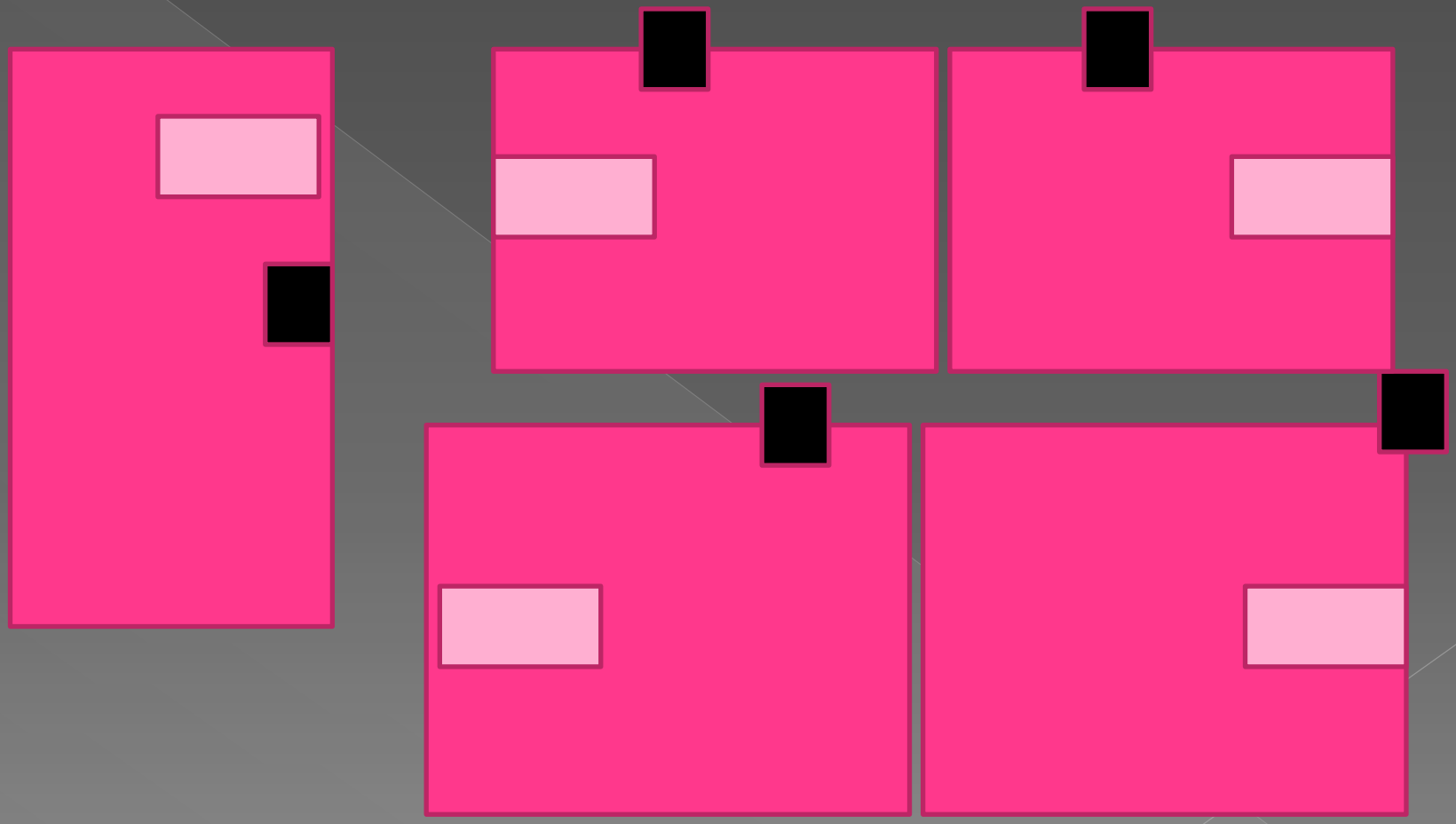
LDR Hospital K

Room 15



Room 10

Other LDRS observed



Shapes and Sizes of LDR

Hospital	LDR Shape	LDR Size
A,Kedah		18 sq m
B, Selangor		
C , Selangor		
D, Selangor		
E, Pahang		

Summary Findings

- Sizes vary accordingly by hospital
- Grid and column location determined size configuration and thence shape of the space
- Mirror image of spaces
- Location of equipment and fitting generally standard and typical in all rooms , mirror image room will mirror certain equipment but location of fittings are tried very much to be in unison to activity
- Location of column and size of column in the space affect positing of fittings and hence affect behaviour circulation
- Use of space varies by person
- Number of person involve varies if hospital is assigned as teaching when it was not designed to be for teaching and learning (space capacity)
- other

Findings

- Architects work backward from determined overall space to detail spaces and thus need to compromise configuration of certain spaces so as to fit in with the determined area
- Structural grid setting determined based on certain design criteria is taken cover overall and those results in compromising space area and affect its configuration

Ministry of Health Malaysia

- "There are many variations in the design, location, facilities, support services and the presence or absence of subspeciality services in the hospitals managed by the Ministry of Health. There are also variations in human resources managing the obstetric and gynaecological services located in these hospitals in terms of numbers, experience levels, training and capability. There are numerous factors accounting for these variations, many of which are beyond the control of the Ministry of Health. These variable facilities and resources dictate that the same practices cannot be carried out in all hospitals at the current time."

Ref: Operation Policy In Obstetrics and Gynaecology Services. Medical Services Division.Ministry of Health Malaysia,2010

Recommendations

- Matrix of checklist on each stages of design as safety filter
- Reorganise traditional design process by integrating safety culture as mandatory part of facility design process

The Agency for Healthcare Research and Quality: **10 Patient Safety Tips for Hospitals**

- **No.7: Use good hospital design principles.**
- Follow evidence based principles for hospital design to improve patient safety and quality.
- Prevent patient falls by providing well-designed patient rooms and bathrooms and creating decentralized nurses' stations that allow easy access to patients.
- Reduce infections by offering single bed rooms, improving air filtration systems, and providing multiple convenient locations for hand washing.
- Prevent medication errors by offering pharmacists well-lit, quiet, private spaces so they can fill prescriptions without distractions.

Citation: 10 Patient Safety Tips for Hospitals. AHRQ Publication No. 08-P003. Revised December 2009. Rockville, MD, Agency for Healthcare Research and Quality. http://www.ahrq.gov/qual/10tips.htm.

Conclusion

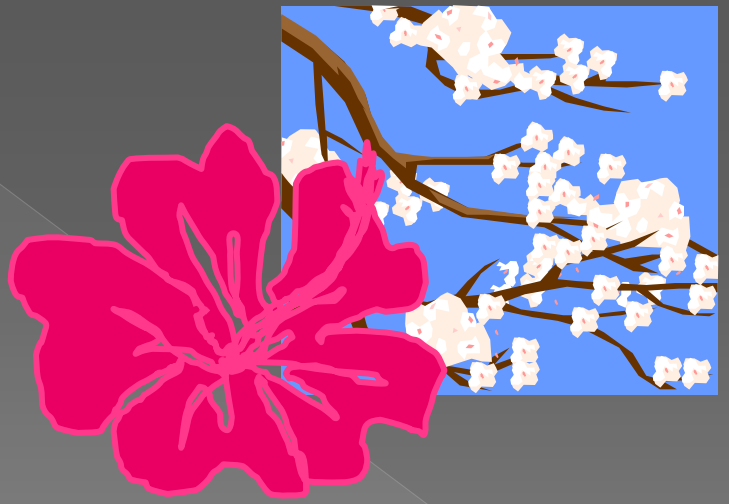
- Healthcare facilities as part of the built environment and very much part of healthcare services are expected to provide CARE and not to HARM those laid in their lair. Although to "Err is Human…" at all cost it should be avoided.
- Latent failures only unearth when reacted with other failures or errors.. and thus we need to keep abreast with POE studies to be relevant in making spaces in the healthcare built environment SAFE.

Conclusion

- Reiling (2007) p16 &21, quote James Reasons in *Managing the Risks of Organisational Accidents*, Aldershot, UK, Algate Publishing 1997,p 25, states , "We cannot change the human condition, but we can change conditions under which people work"

Thank You

Arigato Kuzaimas



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