INSTITUTE FOR HEALTH SYSTEMS RESEARCH

MyLean Awareness Module

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In the name of Allah, the most Gracious the most Merciful.

Lean was introduced in Ministry of Health Malaysia as part of a Public Service Delivery Transformation (PSDT) initiative since 2013. Currently, 52 hospitals have implemented the Lean methodology, particularly at the Emergency Department (ED) and Medical Wards (MW) using the agile approach to reduce long waiting time and congestion. In 2018, Lean Healthcare expanded to 10 specialist hospitals for Orthopedics and Ophthalmology Clinics. Institute for Health System Research (IHSR) and Medical Development Division (MDD) contributed to the development and enrolment of these initiatives. Apart from that Lean has also expanded to other programs in MOH such as Pharmaceutical Services Division and Public Health Clinics.

As the number of Lean initiatives increases, it is going to be a challenge for the team to provide the support needed. Hence the Lean governance structure at MOH and state health office were established to monitor, and track the progress of its implementation and expansion. Apart from that, Lean sustainability model was developed through a collaborative effort between MOH, IHSR and UniKL MiTEC team as a guide for sustainability. The model consisted of three main construct namely Competency, Platform and Drivers model. `MyLean Awareness Module', product of the sustainability model serves as a guide to all MOH staff based on their level of understanding in Lean. This module provides an understanding on Lean thinking principles, wastes and tools in Lean. The module is divided into two sections: section 1: MyLean Awareness Basic;   section 2: MyLean Awareness Enhance.

With the successful development of this module, my heartiest congratulation goes to IHSR and MDD team who had contributed directly to this module. It is hope that this module will be useful as a guide in implementing Lean healthcare initiatives.

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As in the case of many developing countries, Malaysia is facing great challenges in providing better quality health care to its people. New challenges arise due to rapid population growth in the country and an increase in the aging population. This increase in population has led to overcrowding and congestion in public hospitals under the Ministry of Health. The increase in the aging population is associated with a rise in demand for care of chronic diseases.

A change for improvement in health care is necessary. As the famous quote by Albert Einstein goes, "Insanity is doing the same thing over and over again and expecting different results." Facing the challenge to do more with fewer resources, the Ministry of Health has turned to Lean Healthcare as a solution.

In health care facilities, problems in the patient flow process are found to result in long waiting times, delays and overcrowding. Lean has become a proven, practical approach to process improvement in manufacturing industry, and is increasingly being used in service industries including health care. Lean Principles have been applied in health systems of the United States, Canada, United Kingdom and Australia with much success. The application of Lean principles, tools and techniques help to improve patient flow and eliminate wastes in the work process.

Institute for Health Systems Research (IHSR), in collaboration with Lean change agents from University Kuala Lumpur (UniKL MiTEC) and Malaysian Productivity Cooperation (MPC), has embarked on a Lean healthcare journey since 2014 to train hospital personnel in Lean healthcare implementation. The participants were trained to utilise Lean tools and techniques to identify and eliminate waste in their work process. This has led to the production of the Lean Healthcare module, that serves as a comprehensive and practical guide for health care providers who are considering apply Lean approaches to improve work processes. In this module, we first introduce Lean concepts applied to healthcare followed by the application of Lean tools and techniques.

This module was put together with the understanding that each hospital is unique and might not be identical to one another. However, we believe that the patient flow and processes involved are similar across hospitals. Guided by this module, we hope that the Lean principles and tools could be understood and applied despite the differences to produce quality services and hospital work processes. Important to note here, although this Lean Healthcare module has gone through series of reviewing and refining, it should not be treated as a sole reference but rather as a guide to training and Lean implementation.

It is our sincere hope that you will find this MyLean Healthcare Awareness module to be useful in helping you to provide better quality healthcare delivery to patients. Just to tickle your state of mind, we shall leave this page with a few words of wisdom.

"Excellence is an art won by training and habituation. We do not act rightly because we have virtue or excellence, but we rather have those because we have acted rightly. We are what we repeatedly do. Excellence, then, is not an act but a habit…" (*Aristotle*: *a Greek philosopher and scientist; 384 BC - 322 BC)*

"Be a yardstick of quality. Some people aren't used to an environment where excellence is expected…" (*Steve Jobs*: *co-founder, chairman, and chief executive officer* (CEO) of *Apple Inc.; 1984)*

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This module is divided into two sections aimed for different level of staff understanding on Lean:

Section 1   : MyLean Awareness Basic

Section 2   : MyLean Awareness Enhance

- To promote Lean healthcare knowledge transfer
- To introduce and create awareness on the basic Lean principles
- To provide a guide to apply Lean principles and methodologies in improving the work process in health care
- To facilitate health personnel in Lean implementation

CHAPTER 1: INTRODUCTION

1.1 LEAN HEALTHCARE AND STRATEGIC DIRECTION IN MOH

Lean is an idea for transformation where services we deliver become more efficient with optimization of existing resources. Lean was first introduced to the Ministry of Health (MOH) in 2013 via Public Service Delivery Transformation (PSDT) with the aim to solve major issues in most public hospitals in Malaysia such as long waiting time.

With a vision to become a developed nation by the year 2020, the Government needs to improve its management by overcoming certain challenges such as silo and status quo.

1.2 PUBLIC SERVICE DELIVERY TRANSFORMATION (PSDT) IN HEALTHCARE

In order to become a developed nation by the year 2020, the Government has identified three major challenges:

1- The needs of `Public'
2- Rate of Urbanization
3- Increase population of senior citizens

If the need of the population is to be fulfilled, there will be funding gap created in the public service expenditure in the future. There are two options that can be taken up by the government in meeting the funding gap [1].

1. To cut the spending on public services to address the financial gap

   - By cutting number of services delivered, it is most likely that the government will have to face the angry and unsatisfied population.

2. To improve efficiency in delivering services

   - Efficiencies will help to save money without affecting the services people receive.

In view of the above scenario, Public Service Delivery Transformation (PSDT) was introduced to ensure the effectiveness and efficiency in the healthcare delivery system.

PSDT is about transforming and sustaining healthcare delivery system, together with a change in management addressing both technical & emotional aspects, and project management disciplines. There are seven steps in the transformative and sustainable PSDT framework which is divided in two different stages. Stage 1 is the basic framework while Stage 2 is the sustainability framework.
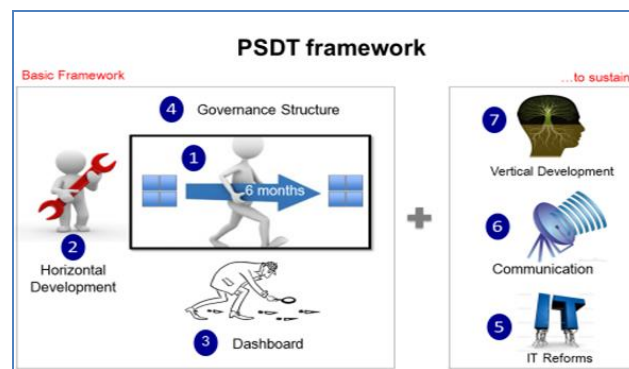
Figure 1: PSDT Framework [2]

Three levers on efficiency were introduced in PSDT consist of input, process and output.

PSDT introduced two tools for quality improvement which focus on process and non-process tools. In healthcare, Lean tool was selected by PSDT team as it is most suitable and most practical to improve efficiency in healthcare. (Figure2).
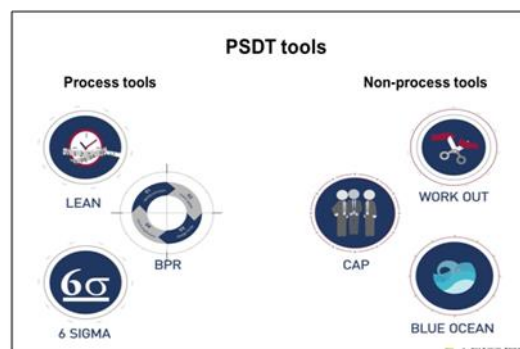
Figure 2: PSDT Tools [2]

The PSDT in MOH begin by looking at process change for quick improvement and gradually move to people change and later cultural change. To materialize the changes, it requires time, energy and support. (Figure3).
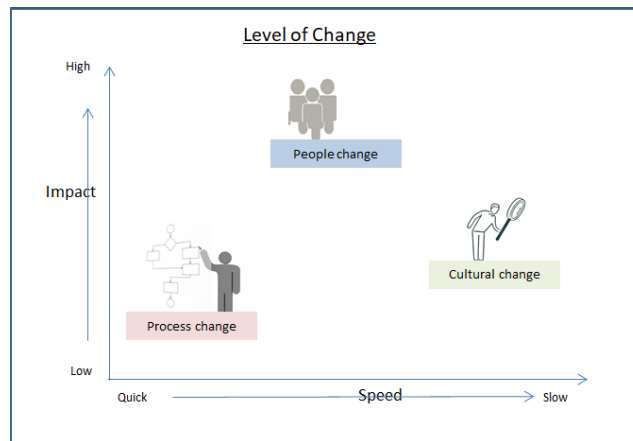
Figure 3: Beginning with Process Change

1.3 PSDT FRAMEWORK FOR HOSPITALS

The PSDT framework on operations management at the hospitals is looking at the functional aspects in improving the patient's journey process using Lean tools that meet clients/ patients need. The emotional needs of the clients/ patients were taken into account during the designing of the process as it will improve patient's experience of the service provided.
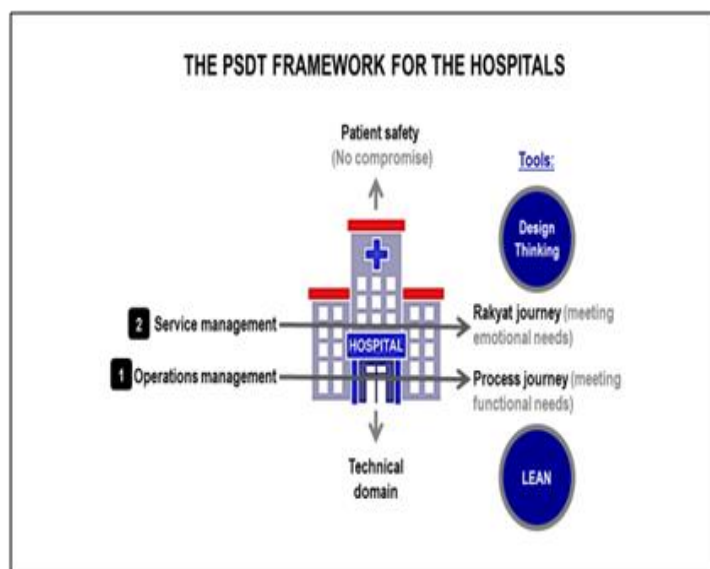
Figure 4: The PSDT Framework for the Hospitals [2]

1.4 LEAN HEALTHCARE INITIATIVES JOURNEY IN MOH MALAYSIA

MOH has embarked into quality initiatives since the 1970's through various activities to assure healthcare quality, safety, efficiency, effectiveness, equity and accessibility. With the introduction of Lean in 2013 to MOH hospitals and its philosophy on waste elimination and value creation, it would strengthen the various quality activities currently carried out. Lean Healthcare Initiative was introduced to MOH in view to have more patient-centered care by improving work processes, efficiency, and the patient's journey itself.

In the early implementation, the main focus of Lean Healthcare in MOH facilities was to reduce congestion and waiting time. The Lean journey started in October 2013 and Hospital Sultan Ismail, Johor Bahru (HSI) was chosen as the pioneer hospital for Lean Healthcare. Two projects were selected:

1) Improve waiting time (after being diagnosed) to start radical radiotherapy treatment of head and neck cancer after first consultation.

2) Improve waiting time of patients at Orthopedic Specialist clinic (who have been given appointments prior to radiological investigation) to meet the doctor for clinical examination

Following the success of Lean at HSI, in 2014, Lean was expanded to another five hospitals:

- Hospital Tengku Ampuan Afzan (HTAA), Pahang

- Hospital Sultanah Nur Zahirah (HSNZ), Terengganu

- Hospital Raja Perempuan Zainab II (HRPZ II), Kelantan

- Hospital Sultanah Aminah (HSA), JB

- Hospital Tengku Ampuan Rahimah, Klang (HTAR)
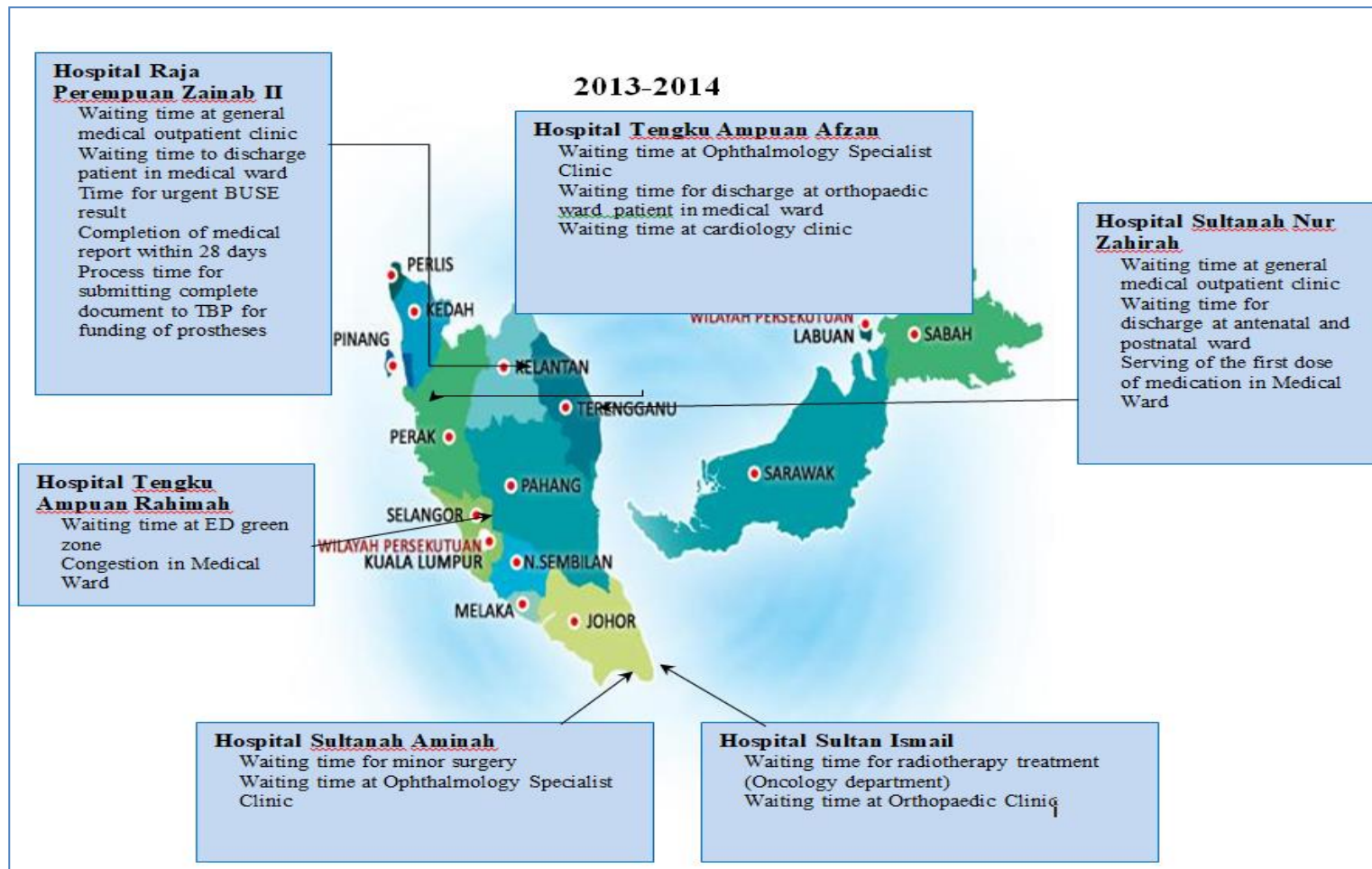
Figure 5: Lean Hospital Expansions in 2014

In 2015, the Lean Healthcare initiatives continue to expand to another 15 MOH hospitals (12 states hospitals and 3 major specialist hospitals) and 20 Hospitals in 2016. In total 52 MOH Hospitals, specifically ED and MW, have implemented Lean Healthcare since 2014 and 2017.

1.5 THE EXPANSION OF LEAN UNDER 11TH MALAYSIA PLAN (2016-2020)

Lean Healthcare initiatives will continue to expand under the 11th Malaysian Plan (2016-2020) to all 133 MOH hospitals in phases as mentioned in the newspaper cutting below to increase customer's satisfaction, staff morale, improve productivity, eliminate waste in hospital processes and improve quality of services delivered.

Figure 6: Chief Secretary: Lean Healthcare to Expand to 133 MOH Hospitals. (Source: Harian Metro 29th October 2014)

Lean Healthcare initiative's has become the Key Performance Indicator (KPI) for Minister of Health, Chief Secretary (KSU), Director General (KPK) and Medical Development Division. It is also listed as one of the MOH transformation initiatives evaluated through Star Rating Index [2]. In the early implementation of Lean healthcare at MOH, the KPI were targeted as below:

Table 1: Key Performance Indicator (KPI)

KPI Description:	Target:
Number of additional MOH Hospitals Implementing LEAN Healthcare- Reducing waiting time	10 hospitals per year until 2020

Reason for focus area
To reduce congestion and waiting time in hospitals by improving patient flow through application of LEAN methodology. This will reduce wastage in hospital processes hence improve efficiency, productivity and quality of services delivered resulting increased customer and staff satisfaction.

Initiatives:	
Improving patient flow in the green zone of Emergency Department and Medical Wards by focusing on: 1. Length of time from arrival to consultation (Door to consultation) 2. Length to stay (Door to door) 3. Bed Waiting Time 4. Call not attended (patient left unseen) 5. In-patient Discharge Cycle Time 6. Medical Ward Congestion (BOR)	**Health Minister Key Result Area (MKRA):** Optimizing Patient Flow Through LEAN Healthcare Initiatives to Improve Waiting Time

The Expected Benefits of Lean Healthcare Initiatives

The transformation journey of Lean healthcare in MOH is expected to yield following benefits:

- Deliver healthcare services that meets the public expectations

- Enable public hospitals to meet MOH obligations to the Public

- Support the Government in optimizing public spending

1.6 LEAN HISTORY

THE EVOLUTION OF LEAN FROM MANUFACTURING TO SERVICE INDUSTRIES

Lean manufacturing derives from the Toyota Production System (TPS) or Just-In-Time Production. The idea behind "Just-In-Time" is that, make only "what is needed, when it is needed and, in the amount, needed". Lean was developed in the Toyota car manufacturing field after the World War ll to optimize resources. Using Just-In-Time, Toyota is able to produce high quality products efficiently through the

elimination of wastes. Based on the basic philosophies of Jidoka (autonomation) and Just-In-Time, the TPS can efficiently and quickly produce products of sound quality, one at a time, that fully satisfy customer requirements. TPS became one of the key driving points for Lean Manufacturing in 1980's popularized by James Womack in a book entitled "The Machine That Changed the World: The Story of Lean Production – Toyota's Secret Weapon in the Global Car Wars That Is Now Revolutionizing World Industry". In this book, Womack introduced the Toyota Production System to American.

Lean has evolved from the Production System to Management System in US as seen in the Figure 8. In the 1990's to 2000's, the western countries adapted Lean and evolve from manufacturing sector into Services Industry including healthcare.
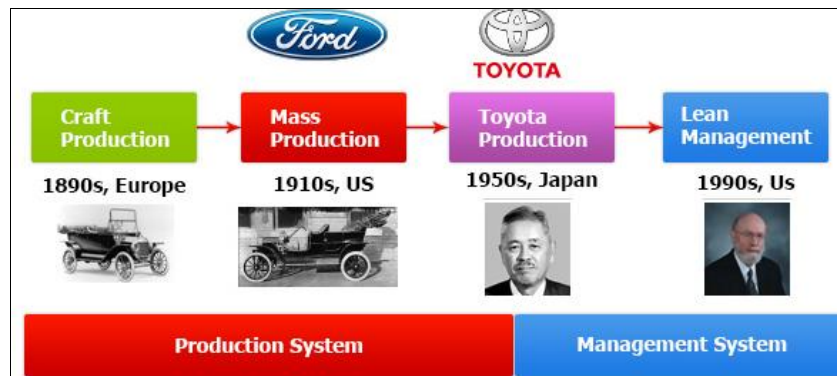
Figure 7: Evolution of Lean from Production System to Management System

(Source: Lean Management Institute of India; www.Leaninstitute.in)

In the healthcare industry, Lean is especially valuable where budgets are constrained and efficiency is vital. Lean not only provides a set of tools to use and procedures to follow, but a comprehensive and integrated thought process, culture and system benefits.

SECTION 1: MYLEAN AWARENESS BASIC

Topics covered:
- Lean thinking and principles
- Wastes in Lean

CHAPTER 2: CONCEPT

2.1 LEAN PHILOSOPHY & LEAN THINKING PRINCIPLES

LEARNING OBJECTIVES

- Understanding the Lean philosophy and how it applies to healthcare services
- Understanding the five steps in Lean Thinking principles

LEAN PHILOSOPHY

Lean philosophy is to improve workflow and eliminate waste, which translates as getting the right things to the right place, at the right time, in the right quantities, while minimizing waste and being flexible and open to change [3]. Lean can be applied to every process in all areas involving all levels of an organization. It helps to empower employees by allowing them to look for opportunities for improvement, actively look for ways to create efficiencies and make the necessary changes.

The healthcare delivery system needs to be of high quality and performance. There are many obstacles in the healthcare systems that interrupt them from achieving excellence in work. The goal of Lean healthcare is to identify and build the core competencies of every healthcare organization and training is a key part of it. This pertains to the front-line workers, the middle managers and top management as well. Adapting from Toyota Production System (TPS), the principle of Lean in Healthcare helps to create a maximum value for patients by reducing wastes and waits through healthcare staffs' involvement and continuous process improvement

Figure 8 : The Iceberg of Lean [(4)]

The iceberg of Lean model (Figure 8) explains why Lean in the public sector may be falling short of the mark. This model identifies the common and visible manifestations of Lean as being 'above the waterline '. These are tools, techniques and processes which are established and perceived as the Lean solutions. However, sustainable Lean requires the application of the less visible manifestations, the more difficult area which is believed to be the culture management system.

LEAN THINKING PRINCIPLES

James P. Womack, Daniel T. Jones and Daniel Roos first introduced the principles of Lean in the book 'The Machine That Changed the World". Lean Thinking is "The endless transformation of waste into value from the customer's perspective". The authors studied seven manufacturing systems and wrote the book based on their observations at Toyota[(5)]. There are 5 principles in Lean Thinking which focuses on non-value-added activities; the activities that do not add value for the customer. Some of these activities can be eliminated, and some can be simplified, improved or combined.

The 5 principles of Lean Thinking are summarized below:

1. Specify value from the customer or patient perspectives and express value in terms of a specific product.

   Three general rules to define value are:

   - The customer or patient is willing to pay for the activity

   - The activity must transform the product in some way (form, fit or function)

- Should be done correctly the first time and every time

2. Identify the value stream for each service, and remove the waste or non-value added activities that is unneeded, unwanted or involves excess effort.

    - Value stream map is a visual tool to map all the steps that allows us to see what is happening in the service provided. The value stream map includes details pertaining to customer value (i.e. process time, waiting time, percentage accuracy)

3. Make the process flow without interruptions from beginning to end.

    - The continuous uninterrupted movement of patients, information and equipment between departments, staff groups or organizations from end-to-end through the process as part of their care pathway.
    - Continuous flow instead of batch – and- queue

4. Pull from the customer.

    - As flow is introduced, let customers pull value from the next upstream activity. i.e. nothing is finished by the upstream process until the point when the downstream client signals the needs.

5. Head towards perfection - continuous improvement

    - Perform all principles again, and again with continuous improvement in all activities until a state of perfection is reached in which perfect value for the customer is created with complete elimination of waste.

Below are the examples of the 5 steps process of Lean Thinking applied to Healthcare: The Clinic Visit
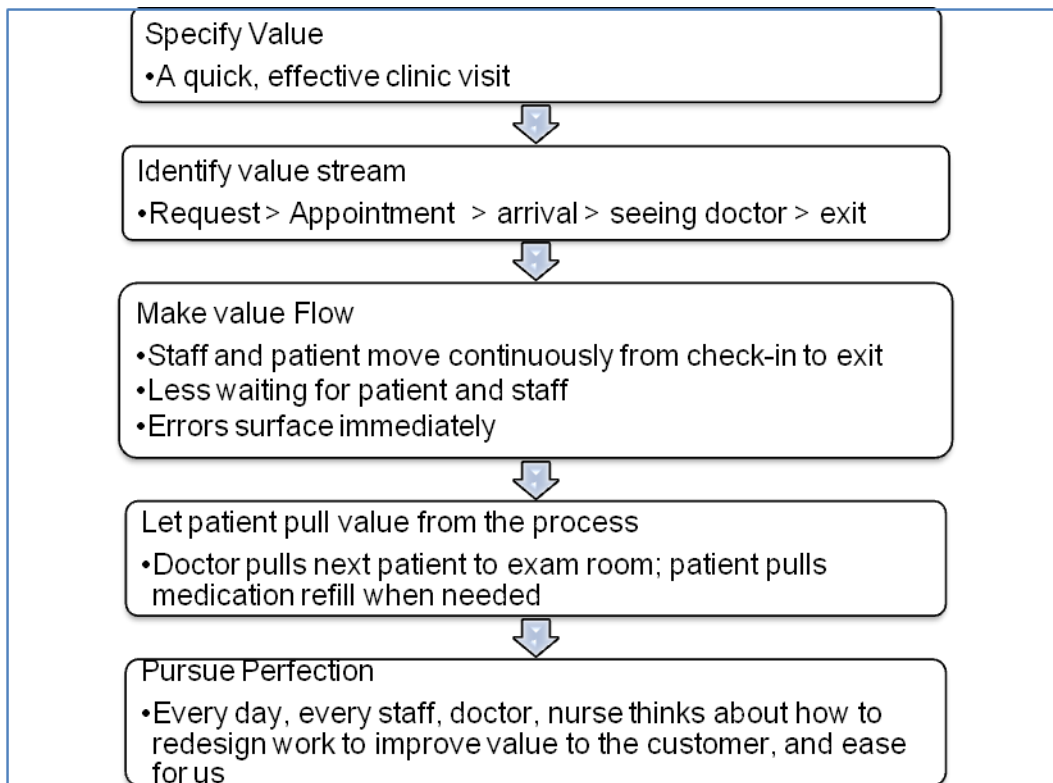
Figure 9: Example –using the 5 steps process of Lean Thinking Principles in the clinic visit

(Source: University of Michigan Health System)

2.2 LEAN CHALLENGES AND OBSTACLES - SILOS MANAGEMENT & STATUS QUO

Learning Objectives

- Understanding silos management practices that hindrance the implementation of Lean

- Demonstrate Lean leadership techniques to help organization make the cultural transition to Lean

- To provide understanding on status quo and how to manage it

- To discuss the appropriate way to overcome the status quo in workplace

Silo as defined by Cilliers and Greyvenstein (2012) states that silo is commonly used as a metaphor in organization as it refers to grain silos, as an example of how parts of organizations function in a manner disconnected from the others. It is further defined as group of employees that tend to work as autonomous units within an organization. They show a reluctance to integrate their efforts with employees in other functions of the organization [6].

OVERCOMING AND ELIMINATING THE SILO EFFECTS

Employees need to be consulted and given the opportunity to offer suggestions on how to eliminate the silos within their organization. Employees must be consulted so that they agree in principle with the definition of the silo problem. Employee dissent with components of the definition can cause unnecessary resistance to the process.

It is important that the formal definition is created with sufficient sensitivity to the integrity of individual employees and in-groups. This prevents employees from constructing defensive psychological barriers that inhibit the successful completion of the process. Such sensitivity can be achieved by constructing the definition in broad terms.

Once the problem is clearly defined, solutions must be carefully formulated around both the needs of the organization and its employees. It is very useful while thinking about solutions to define the points at which potential integration between silos could occur.

The most workable and practical solutions are then chosen from the list of options for adoption in the organization. These selected solutions must then be communicated to employees.

The level of employee buy-in to the process is a factor that either enhances the success of an intervention or undermines it. Solutions need to stand out to employee evaluation prior to being adopt. The likelihood and extent of adoption is based on the practical strength and usability of the solutions. In other words, the likelihood of the recommended solutions being accepted by employees is dependent on:

- employees' perception of the merit of the solution

- extent to which employees believe it impacts their interests
- logistics of implementation.

Where the solutions impose disadvantages for employees, these can be compensated by the introduction of new advantages from the process. This has to be worked out relative to the practical situation at each organization.

The problem needs to be carefully defined and solutions need to be formulated in ways that are sufficiently attractive to employees to propel them to embrace the process. Some solutions are likely to be simple, other may be more complex to implement. There is also a need to be flexible during implementation as unforeseen issues may arise that affect the silo elimination process. Therefore, progress must be continuously evaluated and modifications made if necessary.

MANAGEMENT LEVEL COMMITMENT AND LEADERSHIP

In order to eliminate the silo effect, the management has to show a commitment to address the negative effects of silos. The importance of the intended improvements needs to be communicated to and internalized by every member of the organization. Management needs to lead by example and processes need to be set up to demonstrate their commitment to eliminate silo effects.

COMMUNICATION

Effective communication of the problem and solutions by management to employees is a key to the success of the process. There must be consensus on the course of action to be followed and the ways in which it is to be communicated. Communication options include formal meetings, written notifications, training and individual teaching. Management needs to design the recommended behaviors and demonstrate their personal participation and commitment to the process. It is essential that sufficient resources within the organization be allocated to the process. It must be clear where responsibility for leading the initiative lies. Senior employees selected to head the initiative must be good teachers and managers, committed to the process and well respected by other employees. Employee's commitment may be compromised if management commitment is questioned.

RECOGNIZE ORGANISATION OBJECTIVE/COMMON GOALS

Within a department that offers various products and services, it is ideal that referrals to other components of the department are recognized within the appraisal process. Ideally financial incentives should be in place to facilitate this. The organization could work on a points system whereby points would be allocated for a referral such that points accrue as credits towards a more substantial incentive.

CULTURE CHANGES

In creating common ground, it may be desirable for an organization to embark on broad organizational culture changes and to break down some of the components of organizational sub-cultures that inhibit optimal communication between divisions. This needs to be evaluated and the correct interventions determined on a case-by-case basis.

Employees within a silo are only likely to accept solid solutions that solve the problem. These must be present for change to occur.

TASK ALLOCATION AND DELEGATION

Among the most effective ways of eliminating silos is the allocation of tasks across departments such that people from different parts of the organization are encouraged to interact and complement each other's skills on given projects or segments of work. Where possible, feedback into the performance appraisal system needs to be gathered from members of the organization who work outside a given employee's division, and have had exposure to his or her work. Formal meetings should ideally be set up across divisions with agendas of communal interest. This also allows employees to pool their skills and resources and identify the talent and competencies that other members of the organization have to offer them.

REINFORCEMENT AND CONFIRMATION

Success stories need to be marketed within the organization appropriately to encourage further participation and adoption. Incentive or reward systems can be powerful tools when tailored around the silo issue. Employees generally want recognition for their efforts. Positive feedback maintains employee commitment to the initiatives as they see and feel

improvements being made and experience personal recognition for their contributions and achievements.

2.2.2 CHALLENGING STATUS QUO

DEFINITION

Status quo tendency refers to the inclination of decision makers to continue with existing goals and plans beyond the point at which a neutral observer or a statistical model would recommend a change in course [7,8].

FACTORS ASSOCIATED WITH STATUS QUO

- Decision makers desire to appear competent

- Organization's norms supporting consistency

- Tendency to be in comfort zone and resist change

- No proper system to channel ideas

HOW TO CHALLENGE THE STATUS QUO:

- educate and create awareness
- encouraging teamwork
- encourage creative and innovative ideas
- accepting that anyone can make mistakes and make improvement

2.3 WASTE

LEARNING OBJECTIVES:

- To be able to understand and identify different types of waste at the workplace
- Able to understand the common cause of waste in the workplace

DEFINITION

1. Any activity that adds costs or time (extra resources) but does not add value to the customer.

2. Consuming more resources (time, money, space, etc.) than necessary to produce the goods or services that the customer wants

3. Divided into two:

   - Pure waste: actions that could be stopped without affecting the customer.

   - Incidental Waste (Business Requirement/Value Enabler/Necessary Non-Value Add): Action that need to be done based on how the current system operates but do not add value to the customer.

ROOT CAUSE OF WASTE

Muda (Waste)

- Non-valued added steps in any process
- Reactively avoid through elimination of waste in outcomes

Mura (Unevenness)

- Variation in customer demand or any process
- Proactively avoid by thorough preparation and planning

Muri (Overburden / Overdoing)

- Pushing people or equipment beyond their limits
- Proactively avoid through elimination of fluctuation in volume and quality of service or product.

EIGHT TYPES OF PURE WASTE

There are eight types of pure waste that should be eliminated to achieve process efficiency.

The summary as table below:

Table 2: Summary of waste and examples

TYPE OF WASTE	DEFINITION	EXAMPLES	COMMON CAUSES
1. DEFECT	Time spent doing something wrong, looking for errors and correcting errors	- Medications errors - Hospital acquired infections - Missing item from a surgical case cart - Wrong labeling of blood test tube	- Inadequate training - Incorrect method due to lack of standardization - Operator error - Excessive stocks (INVENTORY) - Material handling (TRANSPORTATION)
2. OVER - PRODUCTION	Doing more than what is needed by the patient or doing it sooner than needed	- Pre-print label - Sending blood samples in batches - Doing unnecessary diagnostic procedures	- Producing too much - Producing too soon - Batch processing - Over staffing - Over capacity
3. WAITING	Waiting for the next event to occur or the next work activity can eat up time and resources	- Patient waiting for next procedure, information and decision to be made - Staff waiting for the lab machine to warm up/cool down or to calibrate	- Unbalanced process - Unreliable process - As an implication of waste from OVER-PRODUCTION, MOTION, TRANSPORTATION

4. NON-UTILIZING TALENT	Failure to engage with the employees, listening to their ideas or supporting their careers	• Nurses doing clerk work • Doctors transporting patient for X-rays • Doctors performing ECG, giving IV antibiotics	• Failure to fully utilize the time and talent of people • Lack of training • No avenue for suggestions
5.TRANSPORTATION	Unnecessary movements of the product (patients, specimens, materials) in the system	• Moving patients/material/ specimen from one department/locati on to the next	• Excessive distance between operations (poor layout) • Extra inventory • Single skill focused operations
6. INVENTORY	Hospitals create waste when they incur excess inventory costs, storage and movement costs, spoilage and waste	• Medications ordered more than required • Complicated registration procedures causing long queue of patients	• Occurred when Lean principle of PULL is not practiced; Just in time production • Failure to observe first in first out – stagnant material
7. MOTION	Unnecessary movements by the staffs/employees in the system	• Nurses searching for missing supplies • Lab Technologies walking due to poor layout	• Poor workstation layout (excessive walking, bending & reaching) • Poor workplace organization • Large batch sizes
8. EXTRA PROCESSING	Effort that adds no value from the patients' viewpoint	• Re-work loops and workarounds • Unnecessary procedures • Redundant process steps	• No standardization of best techniques • Unclear specification/quality acceptance standards

WASTE MNEMONIC

D = **D**efects

O = **O**verproduction

W = **W**aiting

N = **N**on-utilized talent

T = **T**ransportation

I = **I**nventory

M = **M**otion

E = **E**xtra processing

2.4 VALUE

Learning Objective:

- To determine and analyses value added and non-value added in your working process

DEFINITION

- Value is defined by the customer

- Value is only meaningful when expressed in terms of a specific product or service which meets the customer needs at a specific price at a specific time

VALUE-ADDING ACTIVITIES (VA)

Any activity that fulfill all 3 criteria below:

1. Customer **must be willing to 'pay'** for it

2. Must **transform** the product or service change (form, fit and function)

3. Should be done correctly the **first time and every time**

NON-VALUE-ADDING ACTIVITIES (VE / NVA)

Consumption of resources but do not directly contribute to the product or services.

- **Incidental Waste** (Business Requirement / **Value Enabler** / Necessary Non-Value Add): Actions that need to be done based on how the current system operates but do not add value

- **Pure (Unnecessary) Waste**: Actions that could be stopped without affecting the customer

SECTION 2: MYLEAN AWARENESS ENHANCE

Topics covered:

- Lean tools and techniques

- Data collection

- Monitoring

LEARNING OBJECTIVES

- To be able to identify Lean tools and techniques especially the common ones.

- To implement Lean tools and techniques in your workplace.

There are many Lean tools but this chapter will only cover the more commonly used ones. Lean tools are divided into two which are:

- Tools to identify waste
- Tools to eliminate waste

TOOLS TO IDENTIFY WASTE

Spaghetti Diagram

A visual representation using a continuous flow line tracing the path of an item or activity through work process[9] . There are two lenses through which we can observe the process and work. First is activity of the product, which in healthcare setting means the patient. Second is activity of the employee where we can view the process with the perspective of the nurses, doctors and others. From this diagram, not only you draw out the activities but also you will have to measure the distance travelled and the time taken through the work processes.

This diagram enables team to:

1. Identify redundancies in the work flow
2. Identify opportunities to expedite work flow
3. Identify wasted movement and time among workers
4. Identify distance travelled that could be shortened.

What you need to have to get started:

- Overhead views of area or the floor plan of department

- Color pencils

- Measuring tape

- Stopwatch

- Team/operators impacted by the flow

- Actual, exact processes

Use different color for each different flow e.g. yellow for activity of employee, green for activity of patients or you can use separate map for each flow path for more clarity.

Benefit of the visual drawing is you can see major intersection points and areas of congestion within a workplace. Areas where many paths overlap contributes to delay, thus causes long waiting to customers and also unnecessary motion waste to staffs.

By using spaghetti diagram, wastes are easier to be identified and re-layout of workplace can be planned.

Before   After
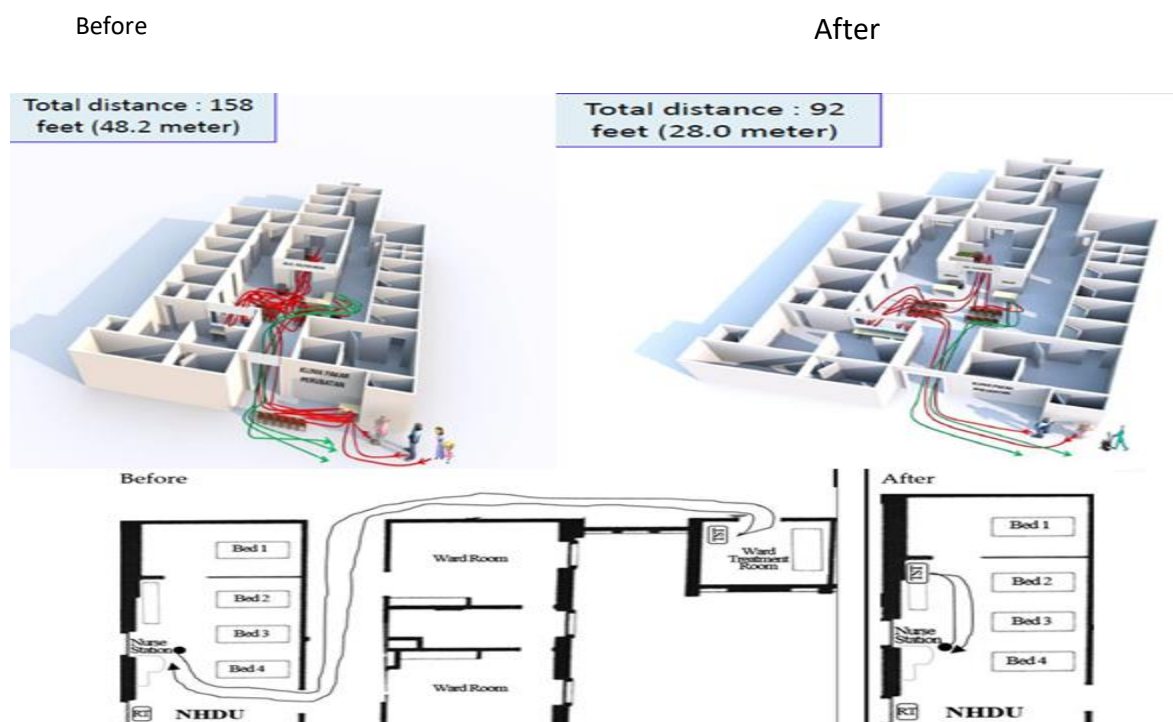
Figure 10: Visualization of spaghetti diagram at Medical clinic, HRPZII. Courtesy of Medical Department HRPZII

By utilizing spaghetti diagram, distance travel can be clearly visualized as seen in the above picture. This can help in changing layout of the workplace in order to reduce the distance travelled, thus reducing unnecessary movement of people.

Ishikawa Diagram

It was developed by Kaoru Ishikawa in 1968 and was also named as fishbone diagram due to its shape being similar to a fish.

It is used to identify factors contributing to a problem. The relationship between problems and factors are clarified. Causes can be grouped as 5Ms:

- Machine

- Man

- Method

- Materials

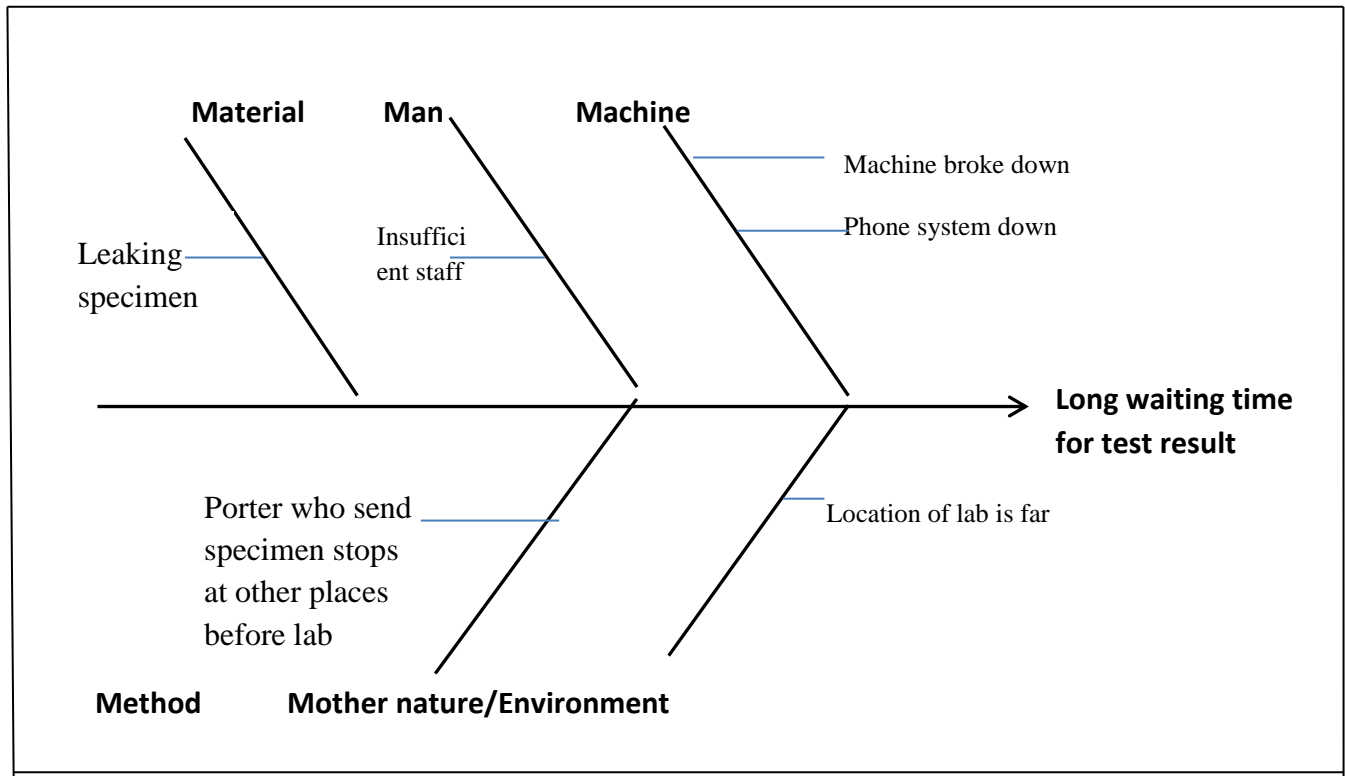- Mother nature/Environment

For example:

Figure 11: Ishikawa diagram

Value stream mapping

It is another tool to identify waste. It is a very important and powerful tool in Lean to identify and map out current process value stream, to review the process in order to identify area for improvement [10]. Time is the most common metric used in VSM. The unit can be second, minute and day. VSM's symbols are the icon of the activity in the process.
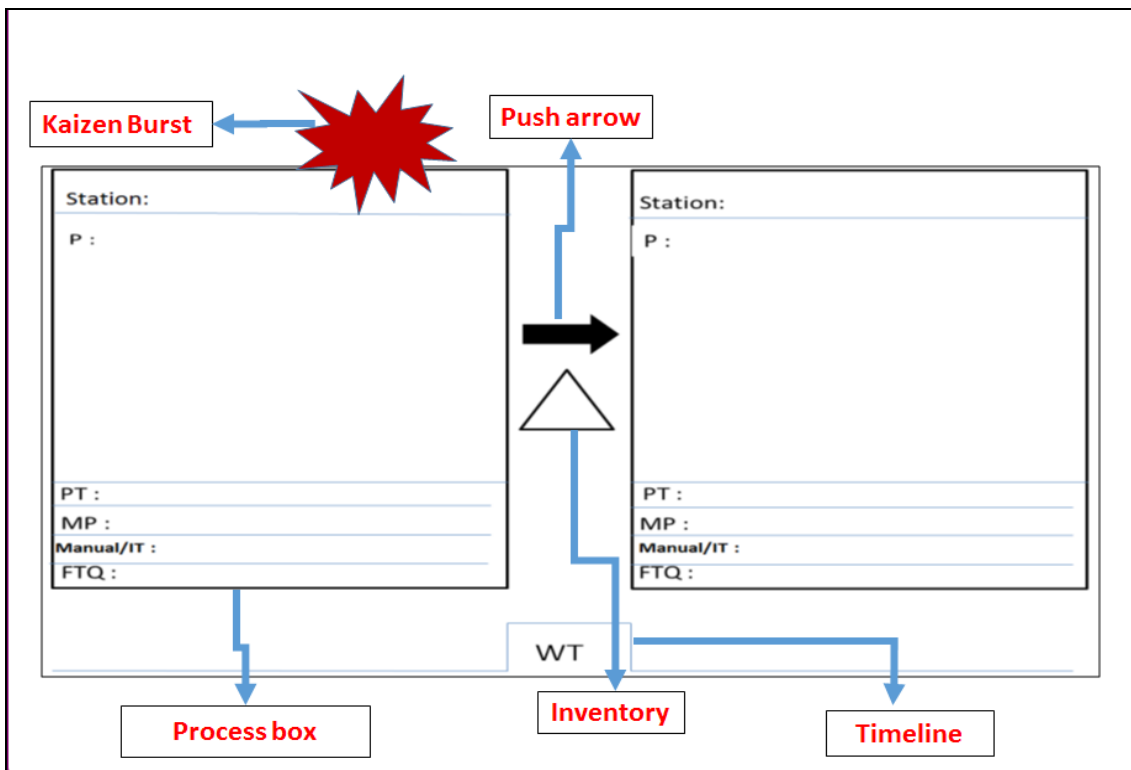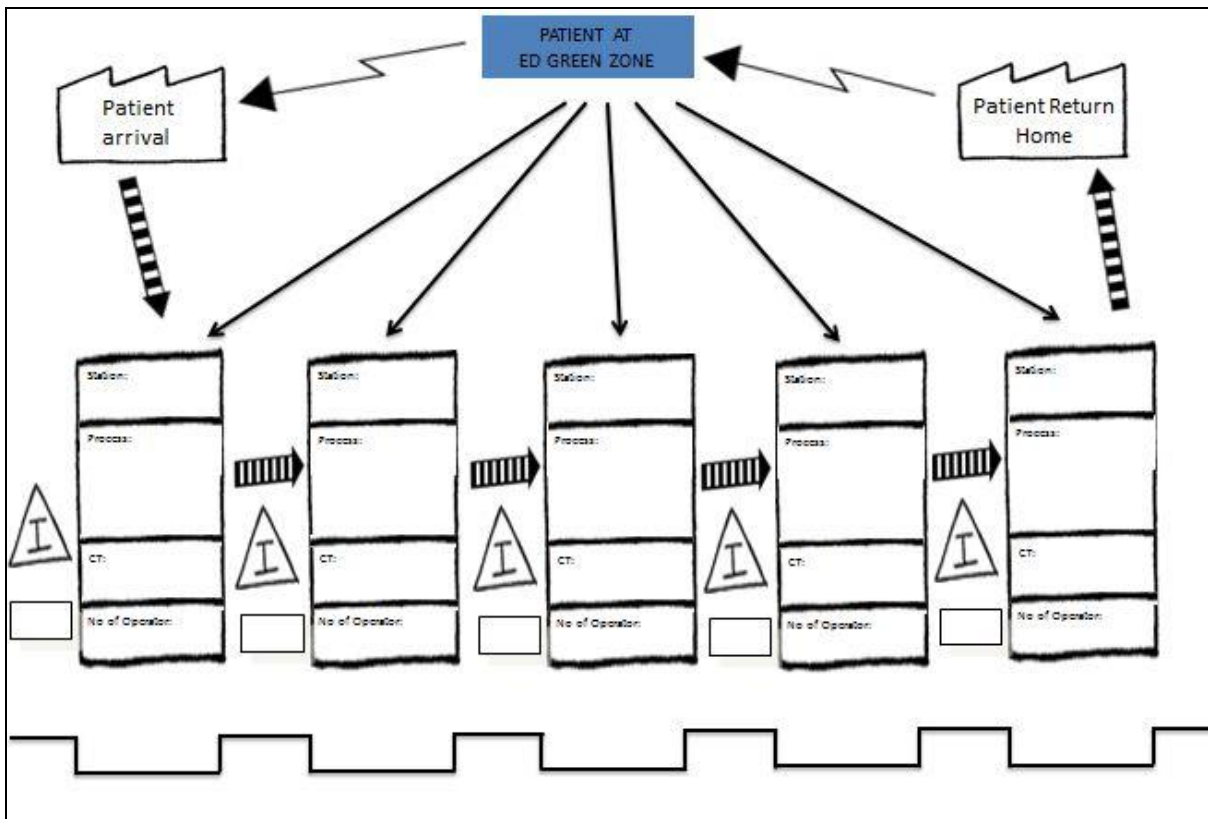
Figure 12: Example VSM Template

Lean Metrics	
PT Process Time	Time to conduct work in the process step
FTQ First Time Quality	The percentage of time that a task is completed accurately the first time it is worked on
Inventory	Number of patients waiting for subsequent process

Calculation

Lead time (LT) : Total Process Time (PT) + Total Waiting Time (WT)

Waiting Time (WT) : $\dfrac{\text{Inventory x subsequent Process Time(PT)}}{\text{Manpower}}$
(In between process)

Average FTQ : [(FTQ1/100) x (FTQ2/100) x(FTQ3/100)] X 100

Process efficiency : $\dfrac{\text{Process Time (PT)}}{\text{Lead Time (LT)}}$ X 100

STEPS IN VALUE STREAM MAPPING DEVELOPMENT

1. Create the map as a team

2. Describe the way the work is actually done NOW

3. Describe the task in the header box

4. Write out the process step

5. Identify who is performing the task

6. Any technology is required complete the task?

7. Estimates the Lean metrics data (PT; WT; FTQ)

8. Analyze the data

9. To do value analysis of each process

10. Plan kaizen (change for improvement)

Examples:

Figure 13 : VSM Outpatient Department Hospital Kinabatangan

Figure 14: VSM Outpatient Department

TOOLS TO ELIMINATE WASTE

5S in Lean Healthcare

5S is a Japanese methodology which helps in identifying and eliminating waste through improved workplace organization.

Primary goal is to prevent problems and to create work environment that allows people to provide the best patient care in the most effective way. It is not merely housekeeping!

DESCRIPTION OF 5S

Table 3: Description of 5S

Japan	English	Description
Seiri	Sort	• Sort out & remove unnecessary items. • If there is some question about items that might be needed, a *buffer zone* is set in the department.

Seiton	Store	• Arranging necessary items for easy and efficient access, and keep it that way. • Employees identify how frequent each item is used. The item used most often should be stored closest to the point of use, in good ergonomic zones, which is not too high or low.
Seiso	Sweep	• Keep workplace clean daily. • Opportunity to inspect area and equipment to ensure that they are maintained, as it should be.
Seiketsu	Standardize	• Ensure items are always organized and kept in defined locations. • Standardization can be done in a department or across departments. This can allow staffs from different departments to reorientate themselves easily, reducing time wasted to search for items.
Shitsuki	Sustain	• Education and communication to ensure everyone follows the 5S standards and maintain it. • Formal audit plan on a scheduled basis can be executed to maintain 5S.

Heijunka

Heijunka or "load leveling" is about intercepting batches of orders and then, smooth out the volume of demand. Heijunka or leveling is a balancing between demand and availability of

resources. Heijunka, when implemented correctly, it helps organizations meet demands while reducing waste. It is better achieved as a later-stage implementation in a Lean organization, after value streams have been identified, solidified and refined. It is generally used in combination with other Lean principles to stabilize value flow.

Examples include:

1. Creating staggered appointment whereby appointment date and time given was specified e.g. appointment at 8.00am, 9.00am and so on. Patient has to come according to specified date and time.

   - This way patient can plan their time and reduced waiting time to see doctor.
   - Reduce congestion in the clinic.
   - Leveling of patients load and manpower available.

2. Diverting patients from Green Zone Emergency Department (ED) to nearby health clinics with lower patients' attendance, thus reducing congestion at ED.

3. Creating a sub-ward by utilizing beds in low bed occupancy rate (BOR) wards to reduce congestion in high BOR wards.

Key Concepts in Heijunka:

- **Changeover time**: Efficiency of changeover is the fulcrum of heijunka; narrowing changeover time will help tighten value stream between flow and demand.

- **Takt time**: The time taken to finish a product in order to meet customer demand. It comes from the German word "takt" which means "pulse". Takt will help to deliver the right product at the right time and in right quantity.

$$\text{Takt time} = \frac{\text{Production time available}}{\text{Customer demand}}$$

Production time available = Total production time – breaks-shift changeover times-maintenance activities

Customer demand= Amounts of unit customer required

For example, in a ward the staffs are divided into 3 shifts; 7am- 2pm, 2pm-9pm, 9pm- 7am

Numbers of discharges are recorded according to shifts and days per week.

Shift	Mon	Tues	Wed	Thurs	Fri	Sat	Sun	Total
7am-2pm	5	6	7	5	6	3	2	34
2pm-9pm	3	4	3	4	2	2	2	20
9pm-7am	1	2	2	3	2	1	1	12
Total								66

Takt Time = $\dfrac{\text{Production Time (7days x 24 hours/day x 60 minutes/hour)}}{\text{66 Discharges}}$

$= \dfrac{10{,}080 \text{ minutes}}{66 \text{ Discharges}}$

= 152 minutes, equivalent to **2 hour and 32 minutes**

This is the time that patient should leave the ward after he was decided to be discharged.

Poka-Yoke (Error Proof)

The phrase originated from Japanese words that means "error-proofing". Error proofing can be defined as creation of devices or methods that either prevent defects or automatically inspect the outcomes of a process to determine if the quality is acceptable or defective.

The aim is for zero defects by preventing, correcting or drawing attention to human errors as they occur [11].

Applied Problem Solving (APS) methodology is an approach to build up poka-yoke, which consists of three step analysis of risk management:

- Identification of the need
- Identification of possible mistakes
- Management of mistakes before satisfying the need

Figure 16: Examples of poka-yoke

The above figures (Figure 16) show examples of devices or creation to prevent error:

- USB port which can only be entered in one direction

- The feet are labeled for operation, the right one labeled yes is the operation site.

- The oxygen and vacuum port have different shape of pins from one another, each with different colors.

Another poka-yoke approach is to make it obvious when errors have occurred. E.g. monitors and sensors that can automatically detect and signal anesthesiologist that patient was intubated incorrectly. Another example is infusion pump that will beep when the infusion flow is blocked or stopped.

Kanban System

The term is derived from Japanese word which means:

"Kan'= Card   "Ban"= Signal

This method was introduced by Taichii Ohno, an industrial engineer in Toyota. This method was developed in 1940's by looking at the process of supermarket stock shelves. The supermarket stocks just enough products to meet customer demand. By doing this, the supermarket was able to optimize and matched the flow, thus making it efficient in inventory management [12].

Following the success, Kanban was incorporated into manufacturing system in order to meet the high product demand and capacity loads with lower production time [13].

Kanban can be defined as an inventory control system that improves the process management by focusing on visual control of process. Referring to its name, it is actually a system which uses card containing all information required to be done at each stage along to its path to completion. To simplify, Kanban tells the worker what must be produced, what has been produced and how much.

The objectives of Kanban include:

- reducing cost by eliminating waste
- creating work place that can respond to change quickly
- facilitating the methods of achieving and assuring quality control
- designing workplace according to human capabilities to achieve maximum potential
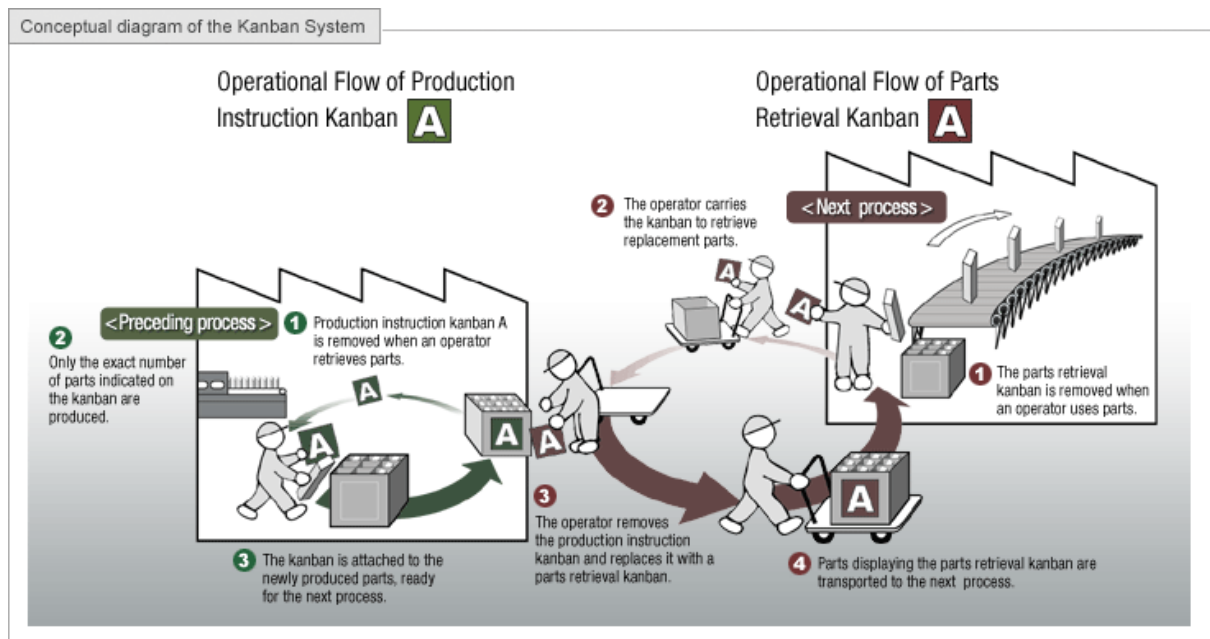
Figure 17: Kanban System

Visual management system must be easy to visualize, either hand written or printed. The purpose is to monitor and control any aspect of production. It should be placed in plain sight, nearest to the place where the actual work is done.

It should be frequently updated with latest results, and it should make the current work obvious at one glance.

Visual management helps reduce unnecessary movement of staffs to obtain certain information.

For example:

1. Visual display bed status in ward- easy visualization of bed availability
2. Visual display tracking sales in a manufacturing company
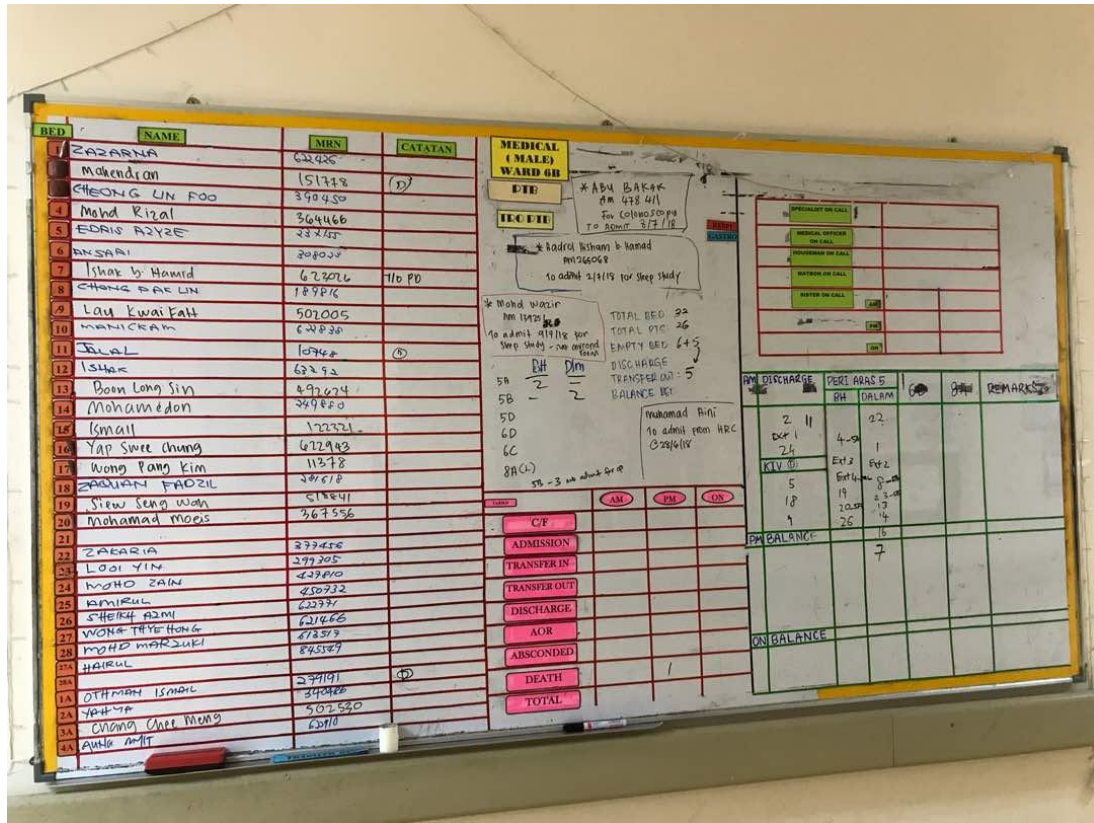
Figure 18 : Example of Visual board at Medical ward (Source: Medical Ward Hospital Ampang)

Kaizen means making changes for the better on a continual, never-ending basis involving everyone – top management, managers and workers. It is a Japanese term and was integrated into the Toyota Production System (TPS) after World War ll.

Kaizen is Lean process improvement philosophy to eliminate waste and makes the process more efficient, effective and adaptable [14].

Kaizen Event :

- Kaizen event is a short duration intervention with a specific aim for improvement.
- Focused on one particular part or area of the work flow process.
- Performed by a Kaizen team.
- Focus on step-by-step process
- From status Quo to `Ideal' state
- Collaborative problem solving

- Action Plan for immediate implementation

Steps in conducting a Kaizen Event:

Three separate sections of Kaizen event:

a) Before the event (when pre-kaizen-event planning occurs)

b) During the event (when you hold the kaizen event)

c) After the event (when you follow up on the kaizen event)
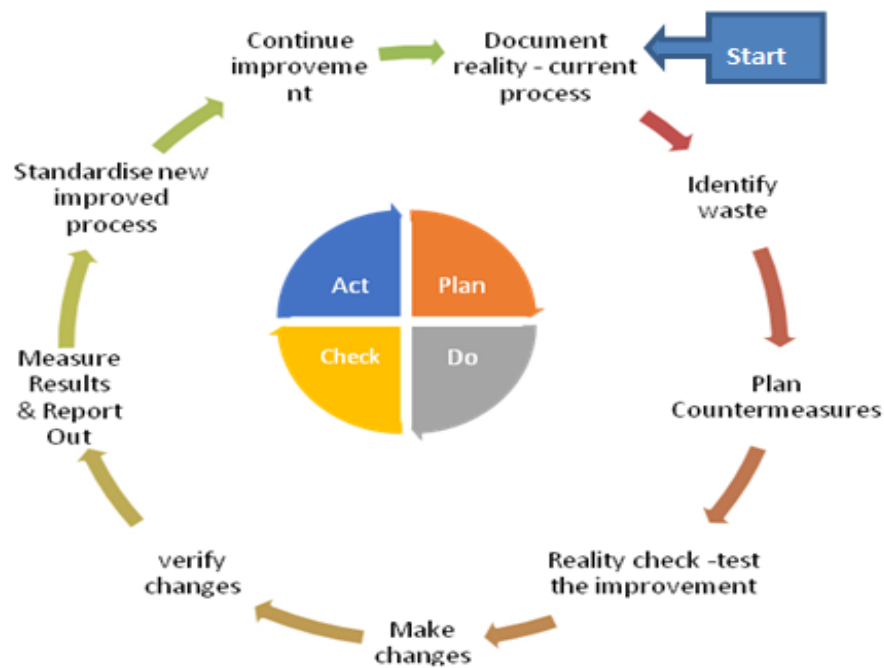
Figure 19: Stages of the kaizen event

a) Before Kaizen Event – Planning and Preparation

- Identify focus area/ scope to tackle on. Using tools to identify waste such as VSM, Spaghetti diagram and Root Cause Analysis (RCA), you will be able to identify the non-value added activities in work process which should be the focus area/scope

- Set Goals (measurable, realistic)

- Select Kaizen event team members assigned to tackle the problem.

- Collect baseline data to check reality of the current situation

- Develop plan to support the kaizen event

Root Cause Analysis (RCA)

It is a systematic way to identify breakdowns in processes and systems that contributed to the event and how to prevent future events.

There are several ways to do RCA:

I.   ISHIKAWA OR FISHBONE DIAGRAM (CAUSE AND EFFECT DIAGRAM)

- Tool that can help to perform a CAUSE AND EFFECT ANALYSIS for a problem and trying to solve the root cause of that problem.
- The fishbone diagram identifies many possible causes for an effect (problem) and used to structure a brainstorming session to immediately sorts ideas into useful categories.

II.   5 WHY'S

- By repeatedly asking the question "Why" (five is a good rule of thumb) on each factor, we can peel away the layers of symptoms which can lead to the root cause of a problem.
- The 5 Whys can be used individually or as a part of the fishbone method to support in exploring issues.

III.   AFFINITY DIAGRAM

- Tool that gathers ideas, opinions, issues and organizes them into groupings. This tool is used in combination with brainstorming. Unique features of the affinity diagram are:

a. Bringing out ideas silently.

The most effective way to work is to have everyone write out the ideas, without talking. This is a new experience for many people. It has two positive results: it encourages unconventional thinking (which is good), while it discourages battles (which are bad).

b. Go for gut reactions.

Encourage team members not to over think but to react quickly to what they see and think.

c. Handle disagreements simply.

The process provides a simple way to handle disagreements over the placement of ideas: If a team member doesn't like where an idea is grouped, he or she moves it. This creates an environment in which it is okay to disagree with people who have a different point of view. If consensus cannot be reached, make a duplicate of the idea and place one copy in each group.

How to create a cause and effect diagram & 5 why's

A cause and effect diagram can be created in seven steps

1. Draw Problem Statement

2. Draw Major Cause Categories

3. Brainstorm Causes - You can identify category of cause by using generic headings

- *Methods*
- *Machines (equipment)*
- *People (manpower)*
- *Materials*
- *Measurement*
- *Environment*
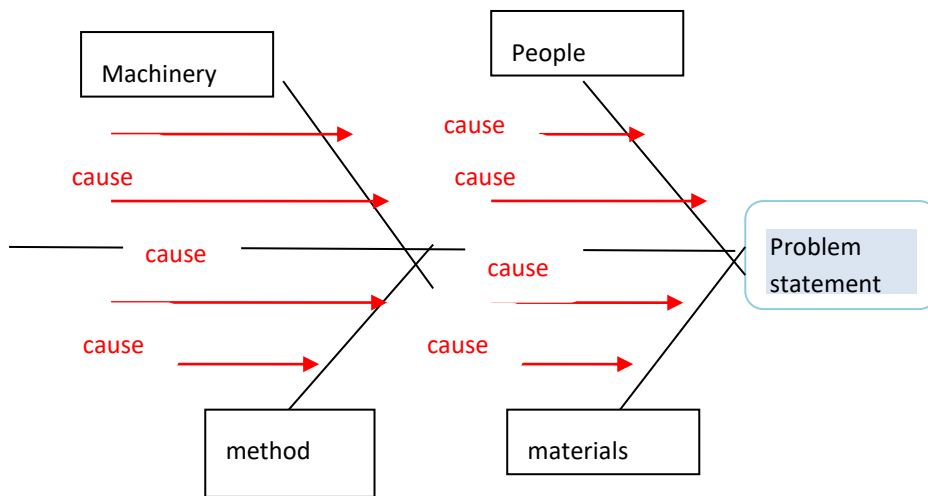
Example: Ishikawa Diagram - Categorize Causes

5. Determine Deeper Causes

- Again ask "why does this happen?" about each cause. Write sub–causes branching off the causes. Continue to ask "Why?" and generate deeper levels of causes. Layers of branches indicate causal relationships.
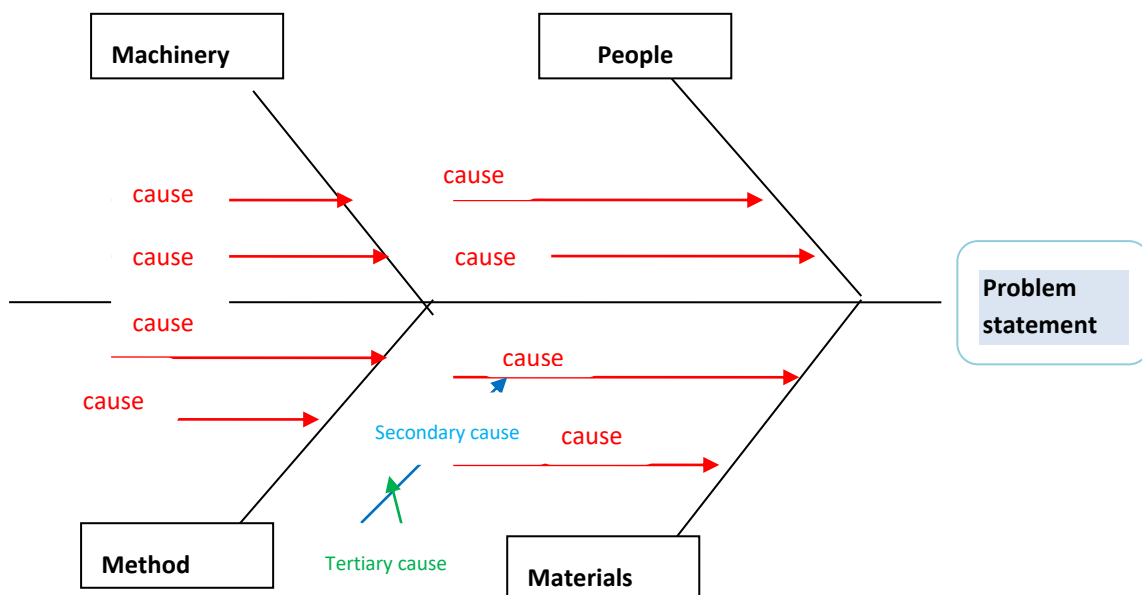
Example: Ishikawa Diagram - Deeper Causes

6. Identify Root Causes

7. Brainstorm all the possible causes of the problem using 5 WHY's technique

How to create affinity diagram ?

1. Generate ideas on post-its. The rest of the steps in the Affinity process will be easier if these ideas are written on post-its.
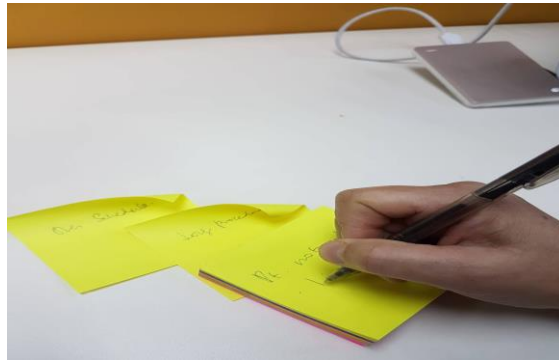
2. Display the ideas. Post the ideas on a chart pack, a wall, or a table in a random manner
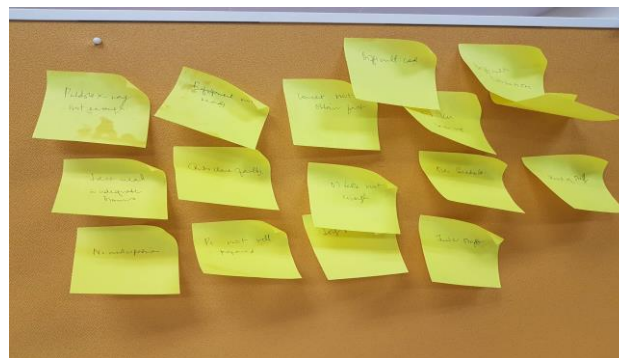
3. Sort the ideas into related groups. The team members physically sort the notes into groupings. Look for other ideas that are related to each other and establish new groups. This process is repeated until the team has placed all of the ideas in groups

4. Create header cards for the groups.
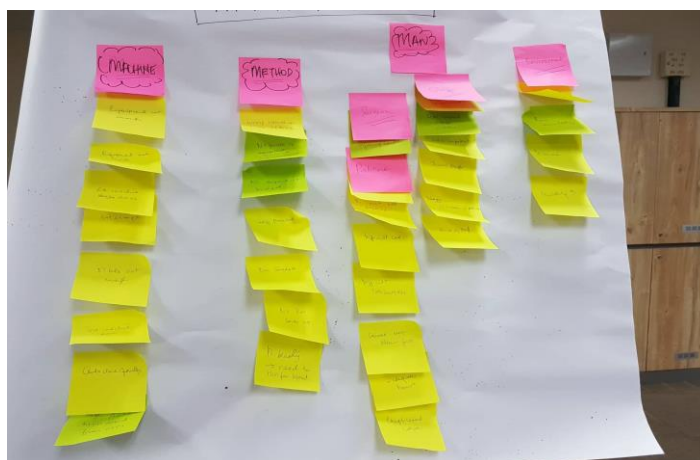
5. Draw the finished Affinity Diagram. Make sure you write the problem statement on top of the diagram

Impact/Effort analysis

The next step after the team has conducted RCA is to find factors which leads to a problem and the countermeasure actions (kaizen). Choosing which kaizens to implement first is very crucial to the start of Lean implementation as the kaizens chosen will determine the Lean journey in the department.

When making the selection, several things need to be considered are:

- Cost- choose kaizen with the least/minimal cost needed first
- Human resource- to review if there is non-utilized talent among staffs.
- Space- is enough space available?

Method that can be used to assess feasibility of the kaizens is by conducting Impact/Effort Analysis. Impact/Effort Analysis was done by applying the Impact/Effort matrix which is designed specifically to choose which solutions to implement. It helps to decide which solutions/kaizen is easiest to do but gives most effects.

Steps in conducting Impact/Effort Analysis:

1. Retrieve the kaizens that you have come up with.
2. Construct the diagram with impact at one axis and effort/difficulty at another axis. Divide the area into 4 quadrants. It does not matter whether you want to put impact at horizontal or vertical axis etc. Put scale from 0-10 or 0-5 etc. whichever preferred. For example, 0 being not difficult, no impact; 1 least effort, least impact and 10 being very impactful, high effort needed.
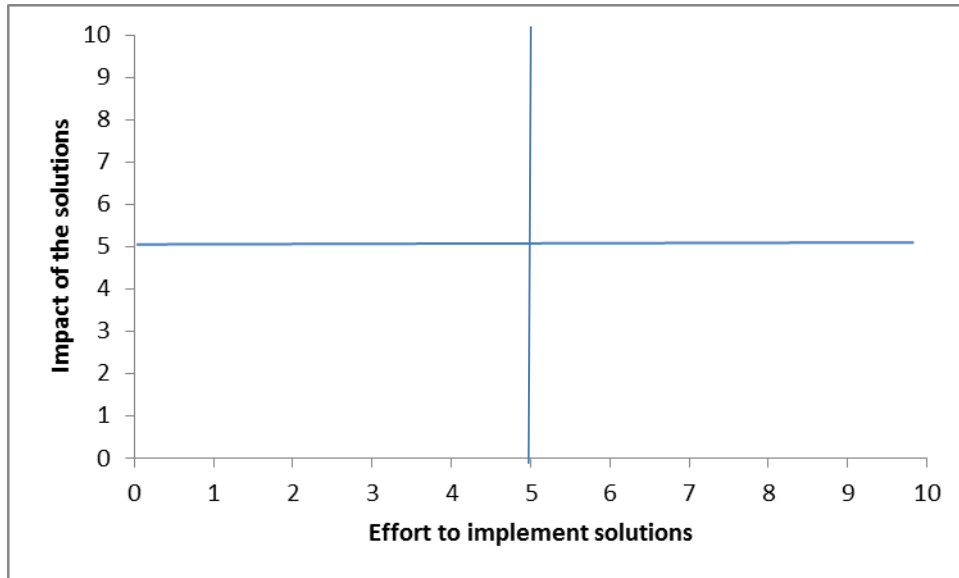
Figure 20: Impact/Effort Analysis Diagram

3. Write the kaizens in sticky notes or can also label each solution with different colors or code. Assess the impact and effort for each solution among team members.

E.g. Create discharge lounge: Impact 9, effort 7

Create discharge trolley: Impact 7, effort 2

4. Place the kaizens on the diagram according to the assessments given.
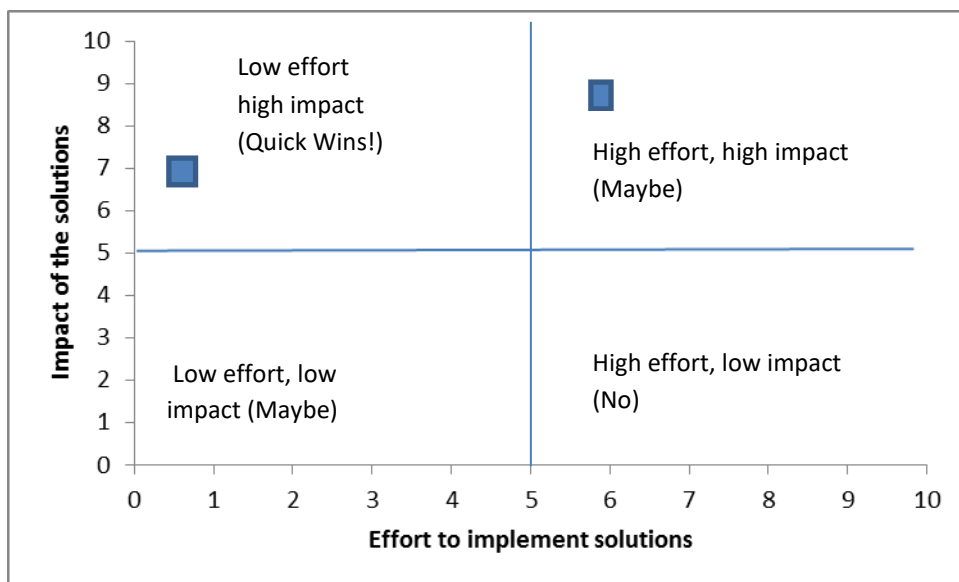
Figure 21: Low effort and high impact matrix

Kaizens on the upper left quadrant which is low effort and high impact should be considered first as it brings the most impact but low effort needed. It is also known as quick wins or 'low-hanging fruit'. Start with the quick wins first until successfully

implemented. Once you have successfully executed the quick-win kaizens and ensure its sustainability, you can proceed with other kaizens which are high impact, high effort and low effort, low impact.

b) During Kaizen Event

Utilize the tools to eliminate waste to support your kaizen event e.g.

- Poka yoke
- Heijunka
- Visual management
- 5S
- Kanban

Hold progress meetings frequently to check and monitor the kaizen implementation.

For each kaizen, elect a person in charge (PIC) to make it easier to track the progress of the kaizen implementation.

c) Post Kaizen Event

- Observation- the new process in action
- Evaluation (use Lean metrics; KPIs) by collecting post implementation data for effect confirmation.
- Monitoring

Learning Objective

- To share example of kaizens using Lean tools

MEDICAL WARD

Tool: Visual management

improve bed waiting time

Visual Display Bedboard color coding

enables better visual control of real time bed status for coordinated care.

Tool: Heijunka

improve bed waiting time

Improve ward congestion (BOR)

Discharge Lounge

improves bed clearance and free beds for new incoming admissions.
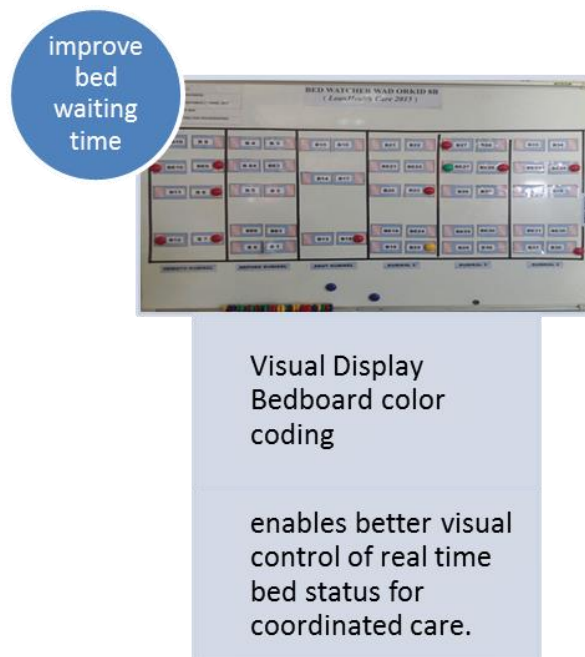
Tool: Kanban

improve bed turnaround time

improve waiting and motion

Online result tracing – LIS (Lab Informative System)

house officers can now trace results from the ward by using the Lab Informative System. This greatly reduces the motion wastage and hence improves the tracing of lab investigation results.

Tool: Heijunka

improve bed turnaround time

establish subward for medical ward

By utilizing the daycare ward to accomodate uprising dengue cases during outbreak, we optimized usage of space where a temporary dengue ward is created during dengue outbreak season. Now all stable dengue cases are admitted to the dengue ward. This greatly reduces the general medical ward congestion as well as bed waiting time.

Tool: Kanban/Spaghetti diagram

Improve discharge time

Discharge Trolley

All the commonly used discharge documents such as discharge note, prescrition script, medical certificate et cetera are available immediately. .

EMERGENCY DEPARTMENT

Tool: Poka yoke/Visual management

Reduce waiting

Implement a different barcode colour label for blood specimens from ED

Blood investigations from ED are easy to recognize and blood investigations are prioritized and processed faster

Tool: 5S
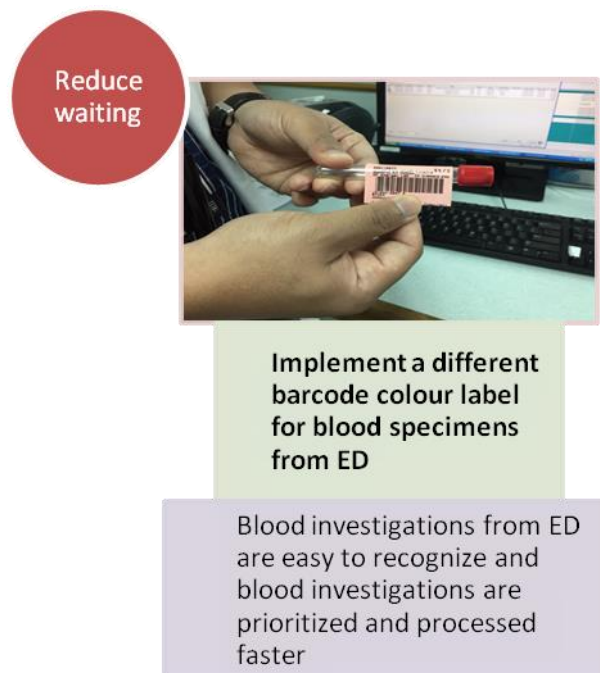
Shorter Time

Create a pit stop for stretchers outside the yellow zone

AMO just took a strecther that is readily available next to yellow zone to shorthen the time they spent inside

Reduce Patient Waiting

Fast Track Consultation And Discharge

Cold cases patients that do not need specific investigation can be seen and assess by designated MO and discharged. This will reduce waiting time.

Tool: Kaizen

Tool: Heijunka

4.1 PERFORMANCE METRICS AND DATA COLLECTION METHOD

Learning Objectives:

- To understand the importance of data collection
- To be able to develop performance metrics measurements in Lean Healthcare

Definition and Importance of Data Collection

Data collection can be defined as the process in collecting information in an organized manner based on specific question or problem.

Data collection is deemed important while doing any research or project because:

- Data collection may help in identifying and solving the problem provided the data and method is correct
- Proper data collection will ensure an accurate and appropriate result for the integrity of the research.
- Data collection helps to provide baseline in order to measure improvement.
- Accurate data collection method can help in addressing the problem to higher authorities to support the result and provide better outcome.

Consequences for improper data collection include:

- Waste of resources and wrong data collected.
- Misleading other researcher who decide to follow the same method
- Compromise the decision for public policy (for research that relates to policy making)
- Unable to validate the result which cause the study to be repeated
- Unable to answer specific questions and finding solution to solve problems

In Lean Healthcare, data collection is important because performance is measured through results of performance metrics. Without the result, we cannot compare before and after improvement has taken place. It also act as a concrete evidence for stakeholders and higher

authorities foe decision-making. Thus, a clear and standardized definition of each performance metrics should be provided as a guide to avoid any mistakes.

EXAMPLES OF PERFORMANCE METRIC

Emergency department and medical ward have been selected as sites for Lean healthcare implementation. Seven performance metrics were developed to assess and monitor the performance. Four measurements for emergency department and three measurements for medical ward were developed. A standard definition must be used to allow a valid comparison of performance between hospitals implementing Lean.

Performance metrics of Emergency department
- Arrival to Consultation (ATC)
- Throughput for arrival time to consultation
- Length of Stay (LOS)
- Throughput for length of stay
- Bed Waiting Time (BWT)
- Call Not Attended

Performance metrics of Medical ward
- Discharge Time (DT)
- Bed Turnaround Time (BTT)
- Bed Occupancy Rate (BOR)
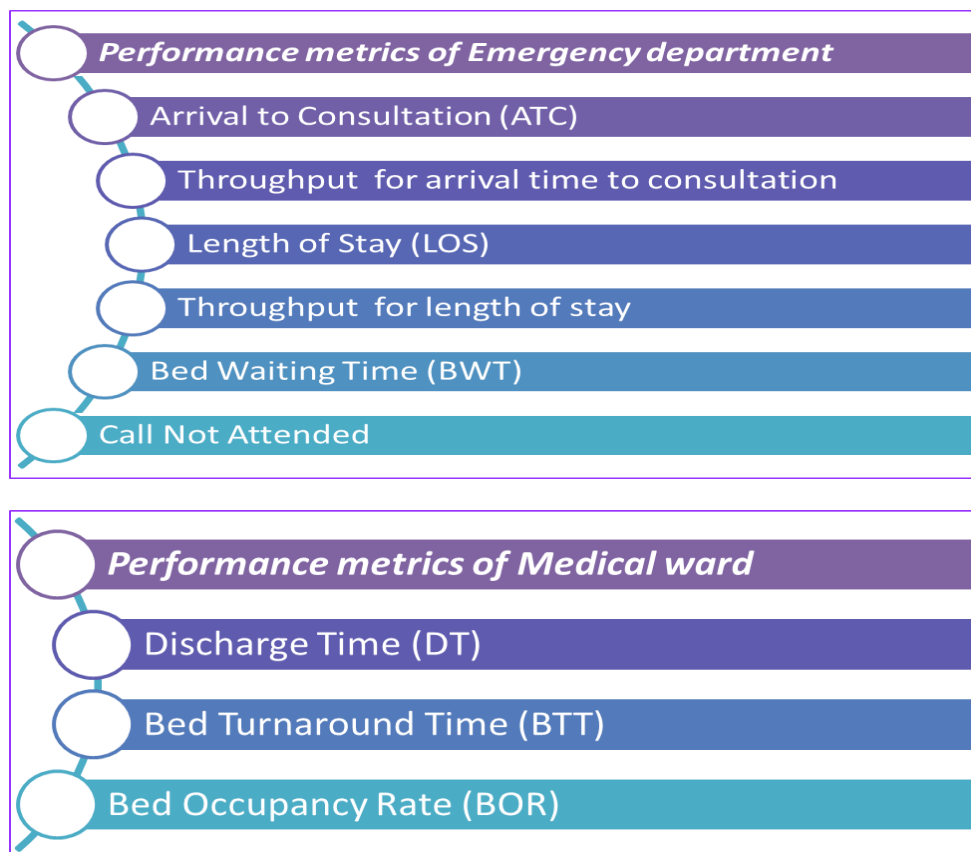
Figure 22: Performance metrics for Emergency Department and Medical Ward

EMERGENCY DEPARTMENT

Emergency department performance is determined by four performance metrics which are Arrival to Consultation (ATC), Length of Stay (LOS), Call Not Attended (CNA) and Bed Waiting

Time (BWT). However, Bed Waiting Time involved both emergency department and medical ward.

Table 4 : Performance metrics for Emergency Department

Performance Metrics	Definition	Responsible person (Data collector)	ED Zone
Arrival to Consultation (ATC)	The time taken by patient from his/her arrival (i.e. primary triage/drop zone) until patient sees the doctor (i. e time enter the consultation room)	i) Paramedic/medical assistant at primary triage/drop zone ii) Doctor in consultation room	GREEN
Length of Stay (LOS)	The time taken by patient from his/her arrival ((i.e. primary triage/drop zone) until he/she exits ED (discharge/sent to pharmacy/admit to ward/refer to other specialty)	i) Paramedic/medical assistant at primary triage/drop zone ii) Doctor in consultation room	GREEN
Bed Waiting Time (BWT)	The time taken upon decision made by ED physician: i) To ADMIT patient to MW until the time	i) Doctor in consultation room ii) Nurse in medical Ward	ALL ZONE

| | patient arrives on his/her bed in MW

OR

ii) To REFER to MEDICAL team until the time patient arrives on his/her bed in MW			
Call Not Attended	Patient left ED before completing his/her treatment process including absconded (left without being seen by doctor)	Doctor in Consultation room	GREEN

MEDICAL WARD

Medical ward performance is determined by three performance metrics which are Discharge Time (DT), Bed Turnaround Time (BTT) and Bed Occupancy Rate (BOR). In Medical Ward, the aim of Lean implementation is to improve discharge process. Patient treatment and care is not affected by this implementation.

Table 5 : Performance metrics for Medical ward

Performance Metrics	Definition	Responsible person (Data collector)
Discharge time (DT)	The time taken from doctor's decision to discharge patient until patient leaves the bed (going home/discharge lounge/referred to other ward)	i) Doctor/Nurse on duty in MW ii) Nurse on duty in MW
Bed Turnaround Time (BTT)	The time taken from when patient leaves the bed (going home/discharge lounge/referred to other ward) until bed ready for next patient.	Nurse on duty/ Support staff i.e. Radicare
Bed Occupancy Rate (BOR)	The percentage of beds occupied by patients in medical ward at 12 am and 2pm	Nurse on duty

DATA COLLECTION POINTS
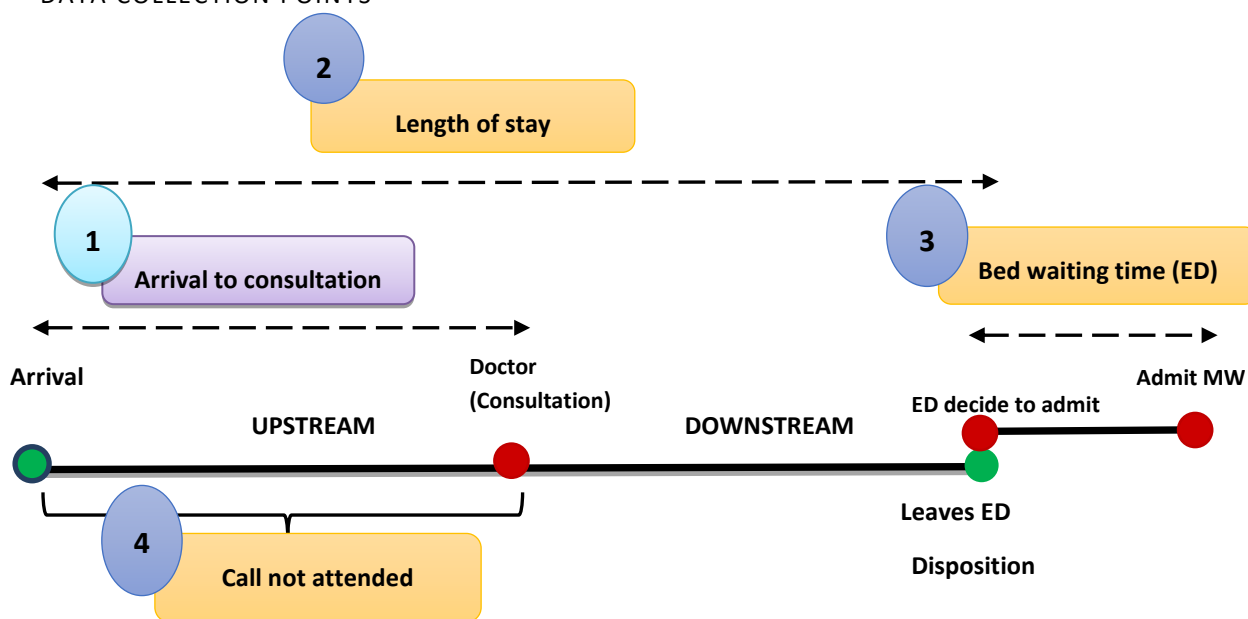
Figure 23: The data collection points for Emergency Department
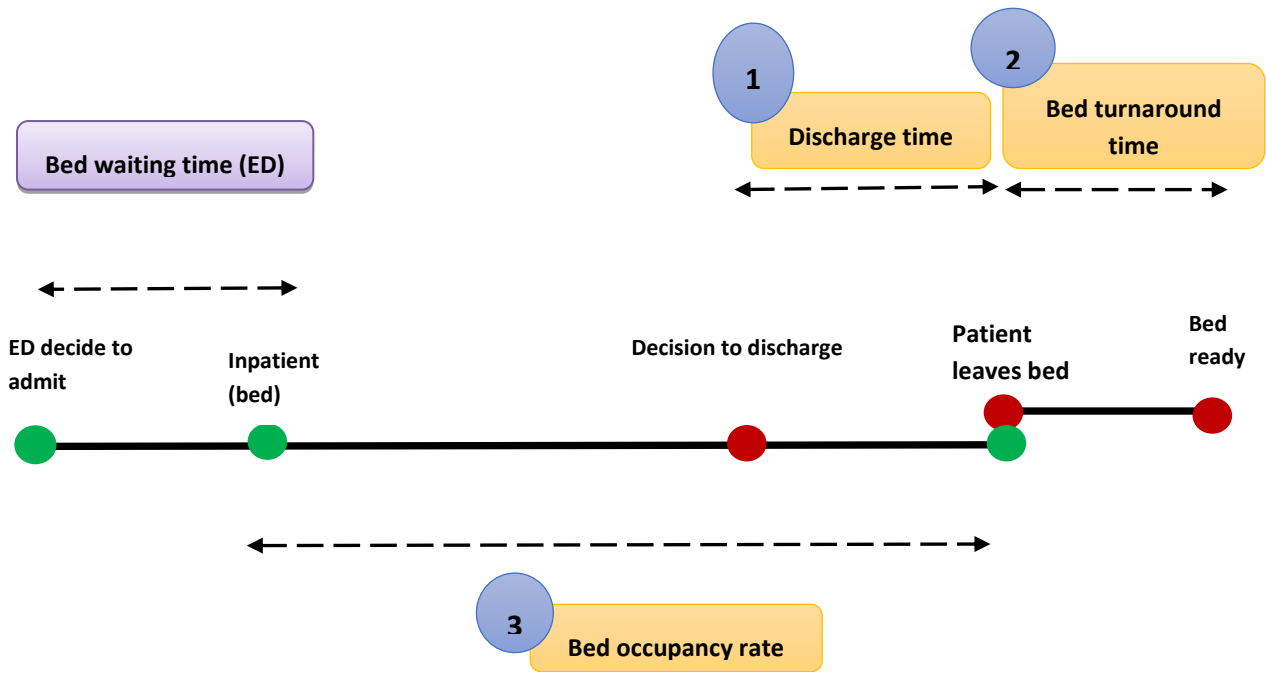
Figure 24 : The data collection points for Medical ward

During Lean implementation, data collection forms have been introduced as a tool to collect data for performance measure. In this form, each data collection points collection were given description in order to ease the process of collecting information.

A   B

Figure 25 : Emergency department data collection form. A: front page, B: back page

It is advisable to conduct baseline data collection for one week (including both weekdays and weekend) for 24 hours to capture patients waiting time and load before Lean implementation. The data collection should be done at least twice within period of six months (pre/baseline and post Lean implementation) so that the result is comparable and improvement can be seen clearly.

What?	When?	Duration?
Pre/baseline data collection	after training session	One week (including both weekend & weekdays) I.e. Monday to Sunday
Post data collection	after 6 months of implementation	One week (including both weekend & weekdays) I.e. Monday to Sunday

Medical ward team is advised to collect data for at least one week (including weekdays and weekend) to show pattern of patient discharge time and bed turnaround time in ward. The process should be done twice i.e. pre and post so that the result is comparable and reflect true situation.

Figure 26: Medical Ward data collection form

Another performance measure under medical ward is Bed Occupancy Rate (BOR) which is measured by each ward at hospital every day. For Lean implementation, it is advisable to collect BOR in the same week as discharge time data collection. Form for BOR data collection including its calculation can be seen in Figure 27. The data collector should use the number of gazetted bed reported to Ministry of Health as denominator and number of patients registered under medical ward as the nominator. If the number of patients exceeds the number of gazetted beds available, the ward can be said to have a capacity issue.

Figure 27 : Sample of Bed Occupancy Rate data collection form

Data entry and reporting can be done using Microsoft Excel template provided. Snapshot of the template is as in Figure 28.

Figure 28 : Snapshot of Microsoft Excel template for data entry

This snapshot shows the data entry template for Medical ward, however, Emergency department can use the same template with few adjustments on the points of data collection. Format of date and time is crucial because it will affect analysis later.

For final reporting, every hospital should include all seven metrics stated below:

Table 6: Performance metrics of Emergency department and Medical ward

Location	Performance metrics	Key performance indicator in Lean Healthcare
Emergency department	Average time for arrival to consultation	Less than 60 minutes
	Throughput for arrival time to consultation	80% within 90 minutes
	Average time for length of stay	Less than 120 minutes
	Throughput for length of stay	80% within 120 minutes
	Call Not Attended	Less than 1%
	Average time for bed waiting time	Less than 120 minutes
Medical department	Average discharge time	Less than 240 minutes
	Average bed turnaround time	Less than 30 minutes
	Average bed occupancy rate	Less than 85%

Below is the example on reporting done by each hospital as depicted in Figure 29

	EMERGENCY						MEDICAL			
HOSPITAL	AVERAGE ATC	T. ATC (%)	AVERAGE LOS	T. LOS (%)	BWT	CALL NOT AROUND	DISCHARGE TIME	T.DISCHARGE (%)	BOR	BTT
H1	85	58.8	112	58.3	0	8	200	67.4	88.87	40
H2	49	88.7	93	69.8	0	25	126	88.2	86.16	28
H3	49	86.9	132	54.5	0	31	286	40.6	93.33	58
H4	33	97.9	68	85	25	TIADA MAKLUMAT	185	62.5	83.9	22
H5	39	98.5	81	88	0	3	244	62.9	68.86	48
H6	87	60.3	124	56	120	8	125	83.3	136.46	22
H7	45	92.2	105	71.4	0	3	135	93.9	96.96	29
H8	54	84.3	111	63.5	0	15	280	44.6	115.83	32
H9	69	71.6	256	41.5	25	23	185	66.1	91.33	51
H10	77	76.4	119	61.2	0	27	275	39.1	142.84	27
H11	77	67.2	144	51.8	637	5	241	50	79.33	84
H12	64	86.4	112	62.3	89	9	174	80.1	91.75	31
H13	55	86	63	78.3	24	15	121	87.3	100.33	60
H14	37	93.6	69	88	0	15	242	44.3	94.67	38
H15	75	64.4	125	54.8	0	32	168	75.5	92.42	29

Figure 29 : Sample reporting of the seven performances metrics of ED and MW by hospital

Learning Objectives

- To learn the basic format of A3 report to document improvement project in Lean healthcare Initiatives

- To produce an A3 report for selected Kaizen

DEFINITION

A3 refers to a simple communication tool for problem-solving technique. A Lean tool used to systematically think through the Plan-Do-Check-Act (PDCA) that lead to effective countermeasures based on facts. It is named A3 report because of its size equivalent to normal A3 paper. The A3 format is used by Toyota as the template for three different types of reports [15].
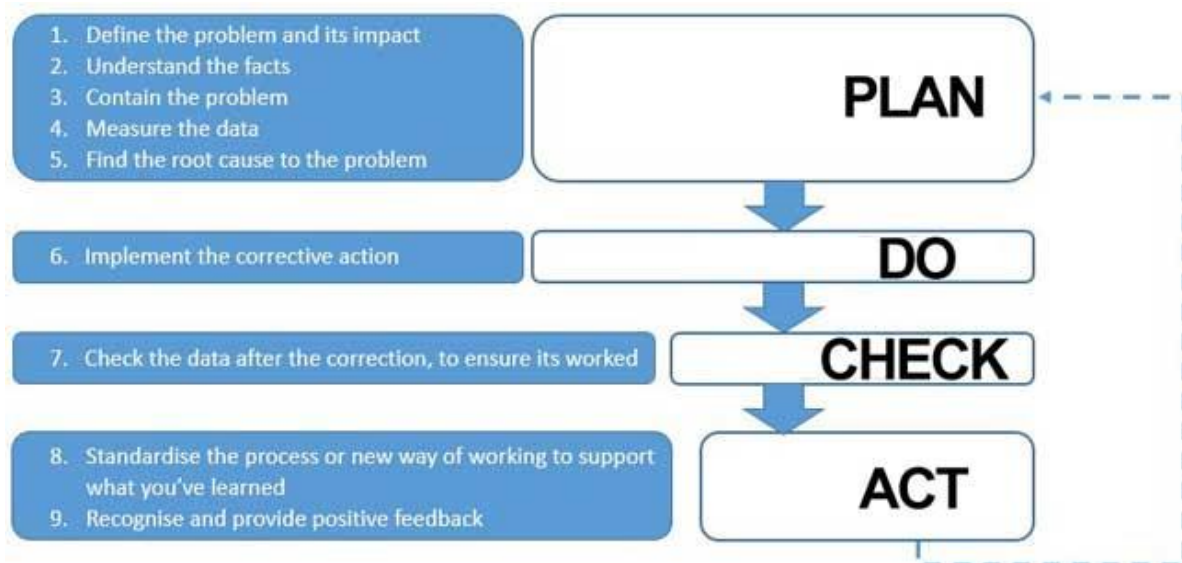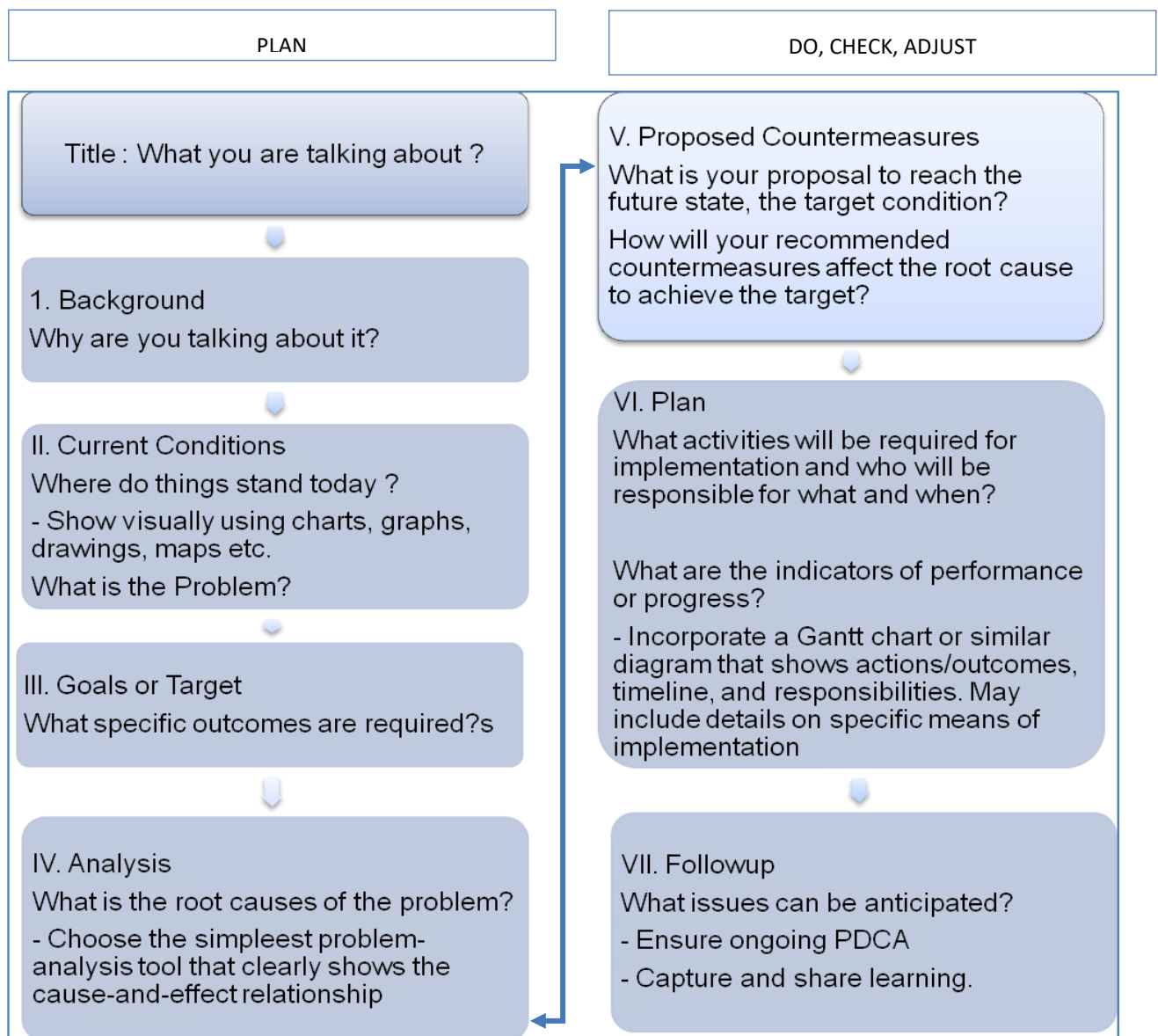
PLAN-DO-CHECK-ACT (PDCA) CYCLE

Figure 30: PDCA Cycle

Title : What you are talking about ?

1. Background

Why are you talking about it?

II. Current Conditions

Where do things stand today ?

- Show visually using charts, graphs, drawings, maps etc.

What is the Problem?

III. Goals or Target

What specific outcomes are required?s

IV. Analysis

What is the root causes of the problem?

- Choose the simpleest problem-analysis tool that clearly shows the cause-and-effect relationship

V. Proposed Countermeasures

What is your proposal to reach the future state, the target condition?

How will your recommended countermeasures affect the root cause to achieve the target?

VI. Plan

What activities will be required for implementation and who will be responsible for what and when?

What are the indicators of performance or progress?

- Incorporate a Gantt chart or similar diagram that shows actions/outcomes, timeline, and responsibilities. May include details on specific means of implementation

VII. Followup

What issues can be anticipated?

- Ensure ongoing PDCA

- Capture and share learning.

Figure 31: A3 Template

These are the basic steps in producing A3 report:

- Identify the problem or need

- Understand the current situation/state

- Develop the goal statement – develop the target state

- Perform root cause analysis

- Brainstorm/determine countermeasures

- Create a countermeasures implementation plan

- Check results – confirm the effect

- Keep the plan in place

The A3 helps spread a scientific method that forces Individuals to observe reality, present data, propose a working countermeasure designed to achieve the stated goal, and follow up with a process of checking and adjusting for actual results.

Figure 32: Problem Solving (Source: University of Michigan,USA)

5.1: LEAN HEALTHCARE INITIATIVES IN MALAYSIA

RADIOTHERAPY AND ONCOLOGY DEPARTMENTS, HOSPITAL SULTAN ISMAIL (HSI), JOHOR BHARU.

Being a leading referral center for cancer treatment for southern region especially in Johor, Radiotherapy and Oncology Department in HSI was facing a problem of long waiting time for the patients to receive their first radical radiotherapy after being consulted by the oncologists. Realizing the delay in receiving treatment could affect the prognosis of the cancer patients, a method to tackle this issue was sought. When Lean was first introduced to MOH, HSI took the chance to embrace Lean as a solution to their problem.

Lean Healthcare was carried out within a period of six months from October 2013 until March 2014. On-going Kaizen activities generated from the project enhances the deliverables of the project. At the end of the project, the department was able to bring down the waiting time from average of 16 weeks to 8 weeks giving a 50% improvement [16].

By adopting Lean in healthcare, it was realized that there are many opportunities for service delivery improvement within our healthcare setting that do not necessarily require high investments. Transformation of mindset towards Lean thinking and challenging the process is the key to PSDT success.

Figure 33 : Hospital Sultan Ismail, JB 2013- PILOT (Source: YouTube.com)

The encouraging evidences of success from Lean Healthcare at HSI had prompted MOH to apply Lean methodology at HTAR. Being one of the most congested hospitals in Malaysia, Emergency Department and Medical Ward at HTAR participated in Lean Healthcare pilot project in early 2014. The pilot project focused on the Green Zone (non-critical) area at Emergency Department aiming to reduce waiting time and congestion. In September 2014, HTAR projects have shown positive improvement by increasing the percentage of patient discharged within 2 hours in ED from 18% to 70%, while in the medical ward, Bed Occupancy Rates (BOR) have reduced to 83% from 145% and inpatient discharge cycle time increased to 83% without compromising patient's safety and care [17,18].

The improvement initiatives at Medical Ward (MW) of Hospital Tengku Ampuan Rahimah, Klang (HTAR) to reduce congestion in the ward:
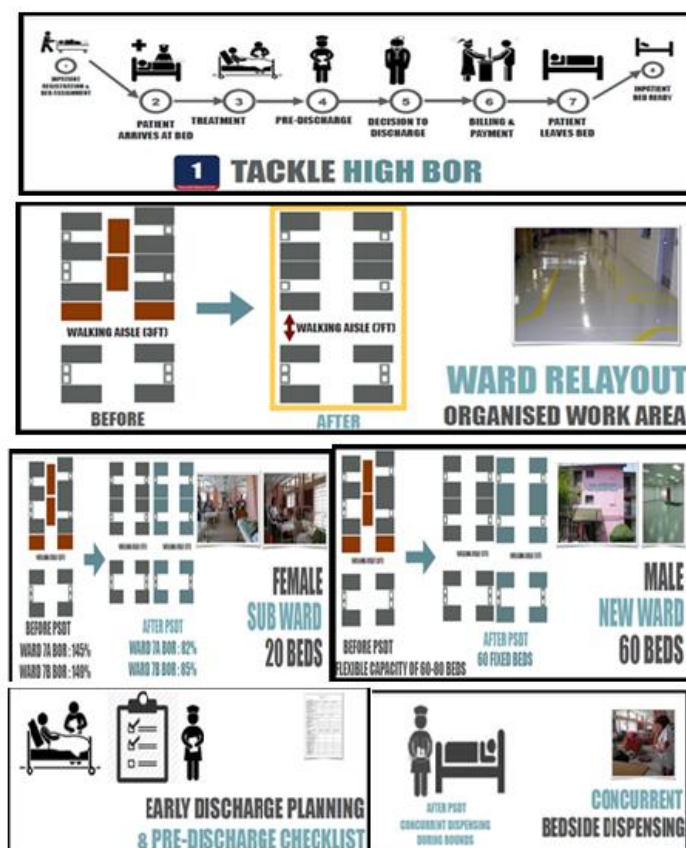

Figure 34 : Examples of Medical Ward Kaizen – Tackle High BOR and Improve Discharge Process

The Bed Watcher System is another Kaizen created by the Emergency Department staff.

Figure 35 : Example of Kaizen – Bed Watcher System in HTAR

Examples of Kaizen at Emergency and Trauma Department, HTAR as below:

Figure 36 : The Operating Hours of 5 Clinics Before and After

Figure 37: Facilities Upgraded for Pathology Lab and X-Ray Room

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