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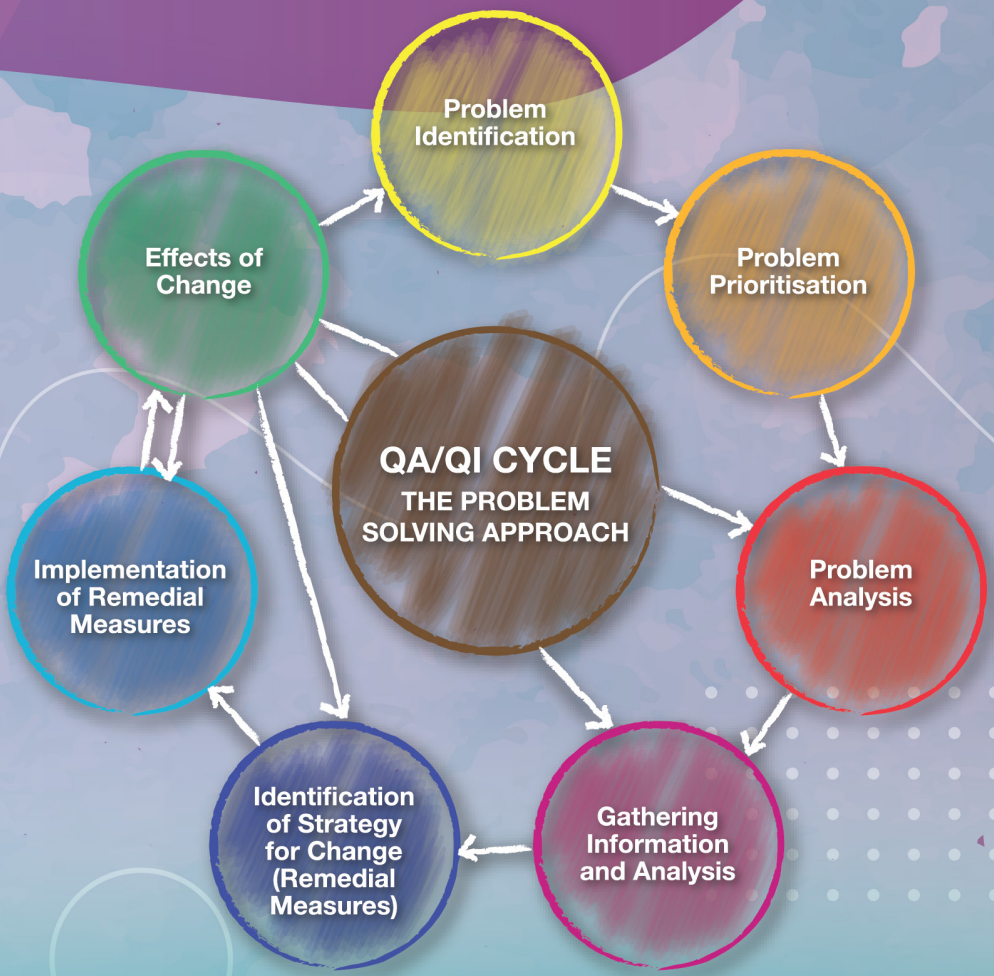
INSTITUTE FOR HEALTH SYSTEMS RESEARCH

QA/QI WORKBOOK

The Problem-Solving Approach

3rd Edition 2020

Best used as a Companion in QA/QI Workshop



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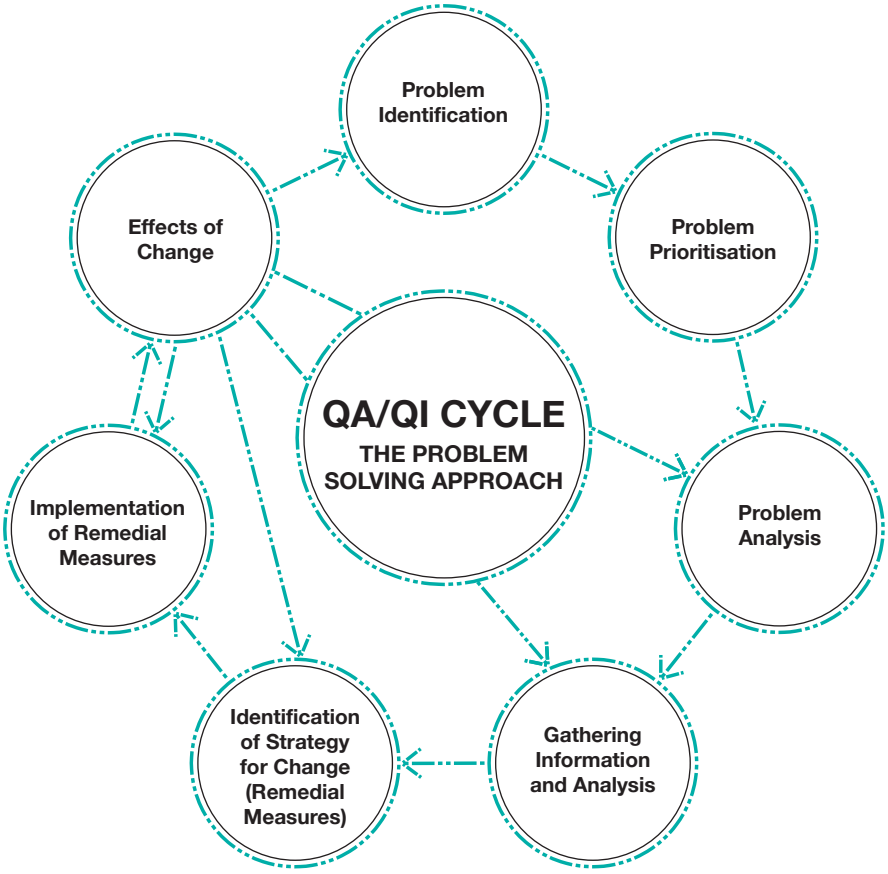

Best Used as a Companion in QA/QI Workshop

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WHAT THIS BOOK IS ABOUT

This workbook consists of compilations of QA/QI lecture notes, group work assignments, the Health Systems Research Training modules and other existing manuals. It is to be used in tandem with the module for Implementing Quality and Improving Performance, published by the Institute for Health Systems Research.

This edition was revised after taking into accounts valuable comments, feedback and new ideas from various sources including the previous users.

What is new in this edition?

- The QA/QI Cycle was revised based on feedback and discussion throughout years of QA/QI training
- A more comprehensive explanation of each topic
- A specific project was selected as an example and followed through in all of the exercises to enhance users' understanding
- Additional chapter on guidelines for writing a manuscript for QA/QI project
- A sample of a QA/QI project proposal, abstract and report and other useful references

We hope that this new edition will further simplify the training components during QA/QI workshops. We welcome any comments and suggestions from the users to further improve this workbook. Send us an email at ihsrqa@moh.gov.my.

THE AUTHORS, JUNE 2020

ABBREVIATIONS & ACRONYMS

A

ABNA = Achievable Benefit Not Achieved

C

CQI = Continuous Quality Improvement

H

HCQ = Health Care Quality

M

MOGC = Model of Good Care

N

NGT = Nominal Group Technique

Q

QA = Quality Assurance
QC = Quality Control
QI = Quality Improvement
QIR = Quality Improvement Report
QM = Quality Management

S

SQUIRE = Standards for Quality Improvement Reporting Excellence

T

TQM = Total Quality Management

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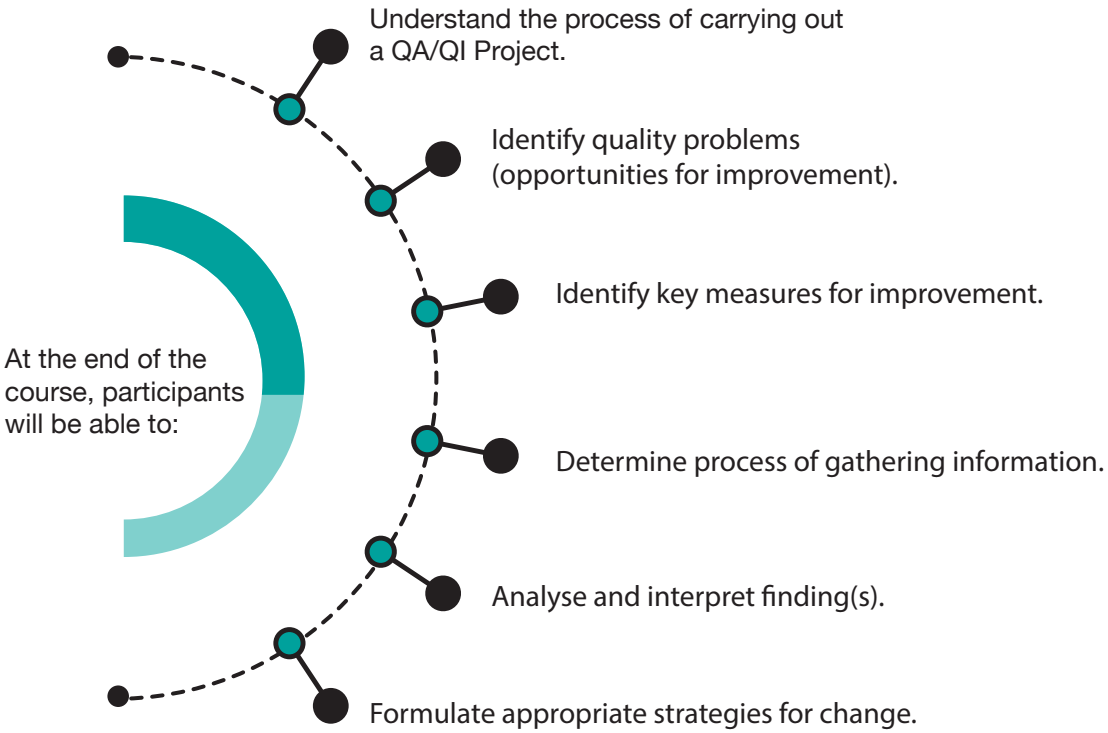
LEARNING OBJECTIVES



EXPECTED OUTCOMES

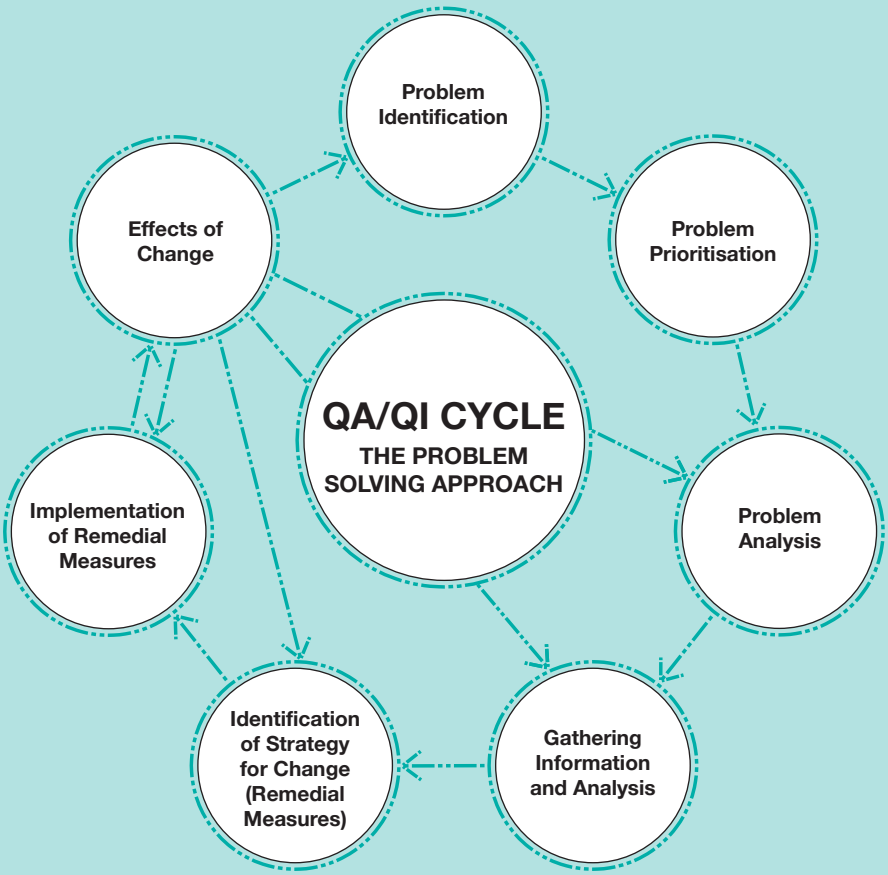
- A presentation of a proposal for a QA/QI Project
- A completed QA/QI Project, eventually.

Notes

CHAPTER 1:
OVERVIEW OF QUALITY

Chapter Objectives:

- Definition and terminology of quality
- ABNA concept
- Quality dimensions



" If you can't do great things,
do small things in a great way. "

Napoleon Hill

1.1 UNDERSTANDING QA

1.1.1 DEFINITION OF QUALITY IN HEALTHCARE

Quality in healthcare is defined differently by different people. Some of which are:

Source	Definition
Donabedian	Quality of care is a product of two factors; one is the science and technology of health care, and the second is the application of that science and technology in actual practice[1]
Institute of Medicine (IOM) and Agency for Healthcare Research and Quality (AHRQ)	Quality of care is the degree to which health services for individuals and population increase the likelihood of desired outcomes and are consistent with current professional knowledge[2]
World Health Organization (WHO)	Quality of care is the extent to which health care services provided to individuals and patient populations improve desired health outcomes. In order to achieve this, health care must be safe, effective, timely, efficient, equitable and people-centred[3]
Philip B. Crosby	Zero defects, conformance to requirements[4]
W. Edwards Deming	Good quality means a predictable degree of uniformity and dependability, with a quality standard suited to the customer[5]
Joseph M. Juran	Fitness for use[5]
Policy makers	• Access to service • Relevance of services • Efficiency of services • Acceptability & effectiveness of services
Health Care Professionals	• Technically sound • Outcome of treatment • Professionally ethical
Patients	Responsiveness to perceived care needs, level of communication, concern and courtesy, degree of symptom relief, level of functional improvement

1.1.2 TERMINOLOGY IN QUALITY

Terms	Definition
Quality Assurance (QA)	QA/QI involves identifying problems in the delivery of care and designing and implementing corrective steps to overcome those problems. QA/QI activities are often retrospective and reactive in nature. Within the context of QA, improvement efforts are focused on raising the level of quality to meet a predefined standard.[6]
Quality Control (QC)	QC refers to mechanisms, usually in industry, that intend to assure products meet specification or mechanisms that intend to prevent production of defects.
Quality Improvement (QI)	QI refers to actions that are taken systematically and proactively to continuously improve the processes involved in the delivery of care, based on data. QI strives to achieve the highest possible rather than reaching a predefined level of quality. Processes, rather than individuals are at the centre of QI so the activities are intrinsically focused on preventing errors rather than placing blame.[6]

1.1.3 THE 4 PRINCIPLES OF QUALITY ASSURANCE

- QA/QI is oriented toward meeting the needs and expectations of the patients/clients and the community i.e. stakeholders.
- QA/QI focuses on systems and process.
- QA/QI uses data to analyse service delivery process.
- QA/QI encourages a team approach to problem solving and quality improvement.

The requirement of the customer is always a consideration in defining quality.

1.1.4 DIMENSIONS OF QUALITY

There are various school of thoughts which outline different dimensions of quality. World Health Organization defines quality based on six dimensions[3]:

IOM / WHO / AHRQ Dimensions of Quality

Safe	Delivering health care that minimises risks and harm to service users, including avoiding preventable injuries and reducing medical errors.
Timely	Reducing delays in providing and receiving health care.
Effective	Providing services based on scientific knowledge and evidence-based guidelines.
Efficient	Delivering health care in a manner that maximises resource use and avoids waste.
Equitable	Delivering health care that does not differ in quality according to personal characteristics such as gender, race, ethnicity, geographical location or socioeconomic status.
Patient-centred	Providing care that takes into account the preferences and aspirations of individual service users and the culture of their community.

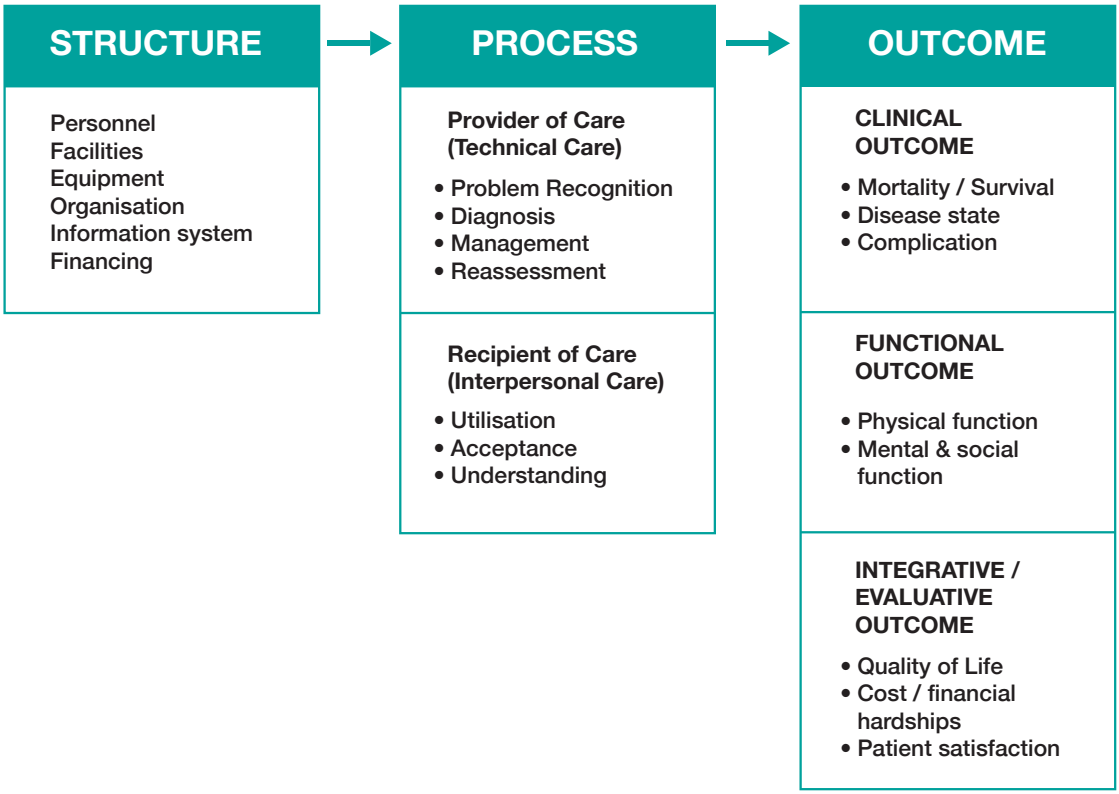
In Malaysian healthcare context, the definition of quality includes 7 domains (STEEEPA) as below:

Malaysia Health System Dimensions of Quality

Safe	Avoiding or minimising risk and harm during the process/delivery of healthcare for both patients and providers.
Timely	Reducing delays in providing and receiving health care.
Effective	Providing the best health care services through competent healthcare personnel on the best evidence developed and adopted.
Efficient	Delivering health care in a manner that make the best use of the resources and avoid waste
Equitable	Delivering health care that does not differ in quality according to personal characteristics such as gender, race, ethnicity, geographical location or socioeconomic status
People-centred	Providing care that is respectful of and responsive to individual patient preferences, needs and values, in partnership with and ensuring that patient values guide all clinical decisions.
Accessible	*Physical accessibility* - availability of good health services within reasonable reach of those who need them and of opening hours, appointment systems and other aspects of service organisation and delivery that allow people to obtain the services when they need them. *Economic accessibility or affordability* - ability to pay for services without financial hardship. It takes into account not only the price of the health services but also indirect and opportunity costs (e.g. the costs of transportation to and from facilities and of taking time away from work). *Information accessibility* - the right to seek, receive and impart information and ideas concerning health issues.

1.1.5 STRUCTURE, PROCESS, OUTCOME APPROACH (DONABEDIAN)[7]

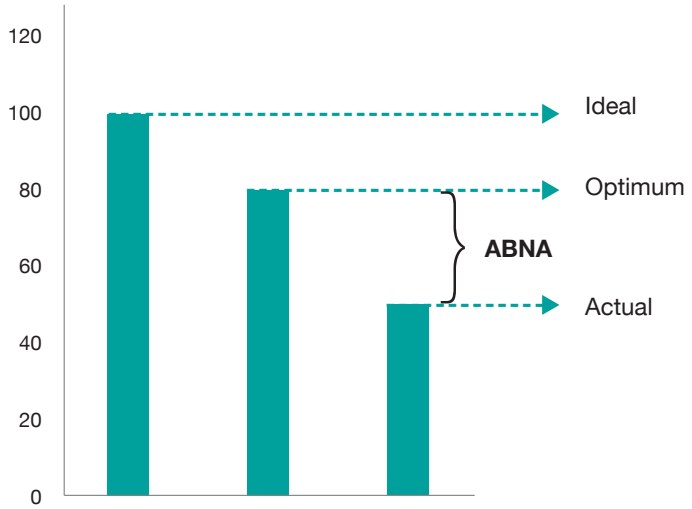
One of the approaches to assess quality is using the Donabedian's structure, process and outcome model.



(Adapted from Donabedian, 2003)

1.1.6 ABNA CONCEPT

ABNA (Achievable Benefit Not Achieved) = the difference between Optimum level and Actual level of achievement.



With Unlimited resources
- Ideal level of care

Optimal Achievable Level
- Targeted level within means

ABNA
- Difference between Optimum and Actual level achieved
- QA/QI aims at narrowing or eliminating the gap

Figure 1: ABNA Concept[8]

ABNA concept is applicable for rate based or proxy indicator, but may not be applicable in sentinel event indicator

1.1.7 WHY WE NEED QUALITY ASSURANCE

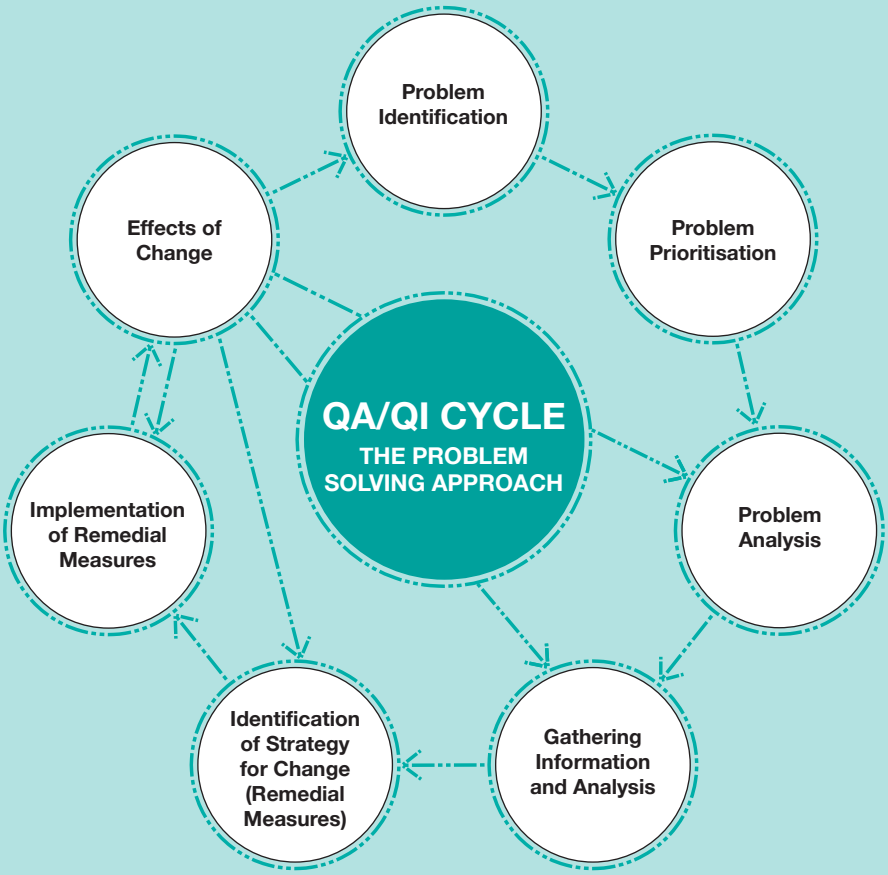
- Effectiveness
- Appropriateness
- Standardisation
- Cost-saving
- Benchmarking
- Accreditation, Certification etc.
- Report Cards
- Competition
- Professional Satisfaction
- Consumer pressure
- Continuous Improvement
- Ethical Consideration
- Peer Pressure
- Legal Requirement

Notes

CHAPTER 2: QA/QI CYCLE – THE PROBLEM-SOLVING APPROACH

Chapter Objectives:

- Able to understand components of the cycle
- Able to understand steps in doing QA/QI study



2.1 THE BASIC CYCLE

The Quality Assurance works based on The Model for Improvement (Figure 2), a most commonly used QI approach. This model combines the renowned Plan-Do-Study-Act (PDSA) Cycle[9] and three simple questions:

1) What are we trying to accomplish?
2) How will we know that a change is an improvement?
3) What changes can we make that will result in improvement?

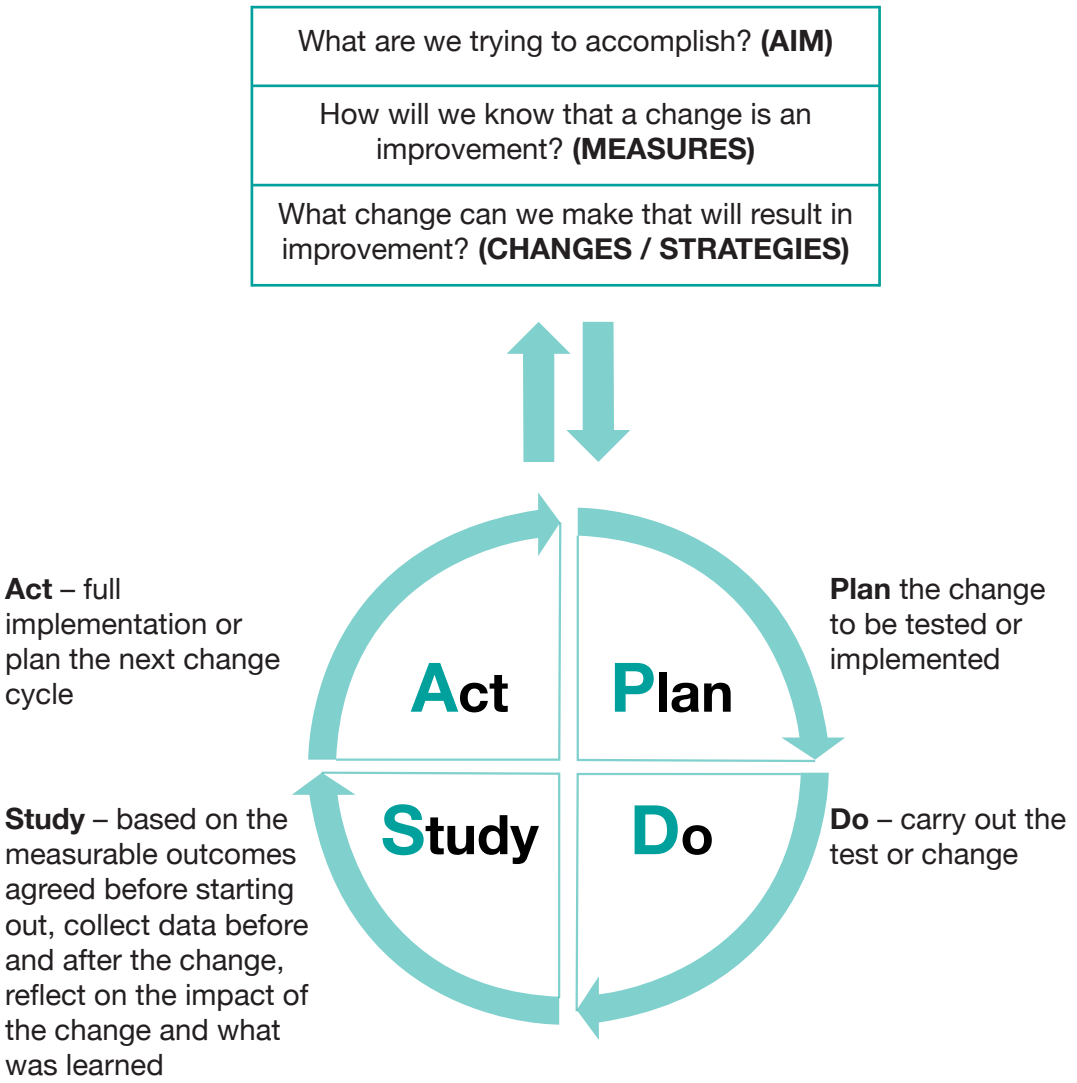


Figure 2: The Model for Improvement[9]

2.2 THE MALAYSIAN'S PROBLEM-SOLVING CYCLE

The Malaysian Quality Assurance Programme had adopted and adapted the PDSA Cycle to come up with Malaysian's QA/QI Cycle: The Problem-Solving Approach.

The main feature for this idea is, it is a continuous process that closes the loop and should occur in cycle.

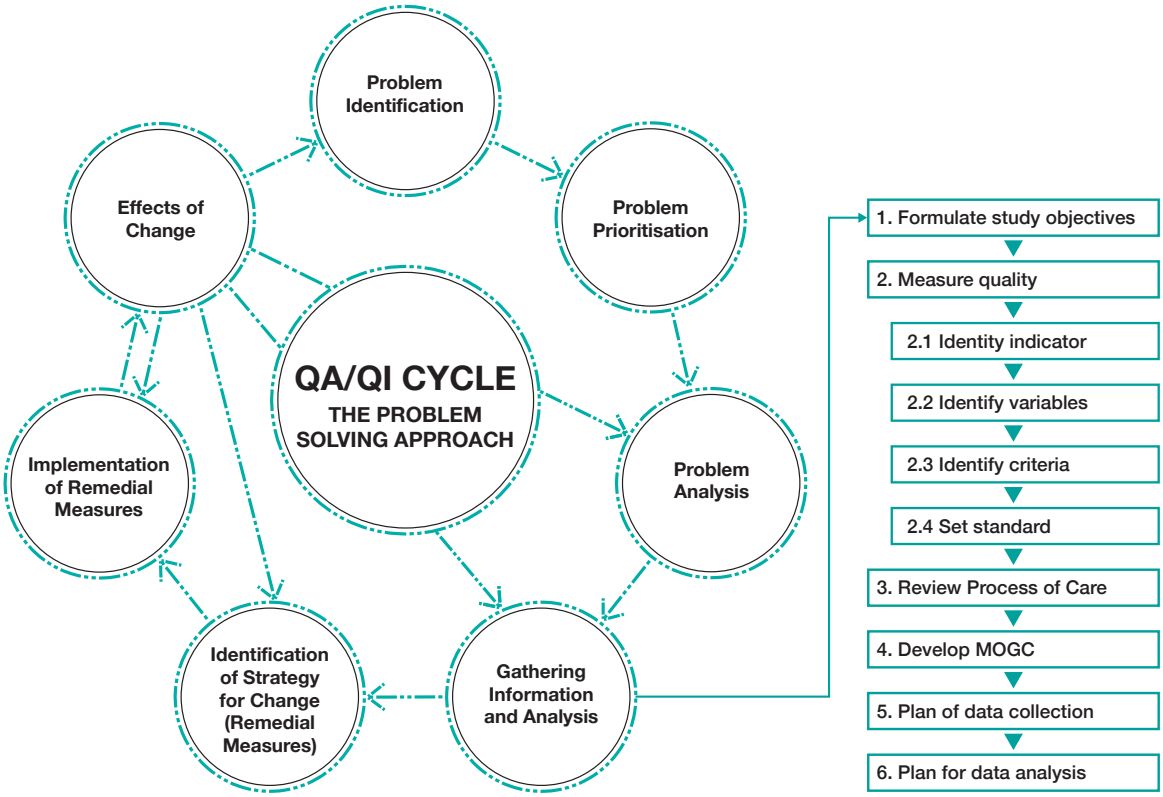


Figure 3: Malaysian QAP QA/QI Cycle: The Problem-Solving Cycle

2.3 DIFFERENCES BETWEEN QA/QI STUDY, CLINICAL AUDIT AND RESEARCH

The topic on the difference between quality assurance/improvement study or project, research and audit has been highly debated over the decades. The main reason why we need to distinguish between these three is because of the governance and ethical implication that comes with each.

Table 1 summarises the differences between QA/QI study, research and clinical audit, though this could be an oversimplified summary and more detail readings are welcomed. This summary may be applicable to Malaysia current context only.

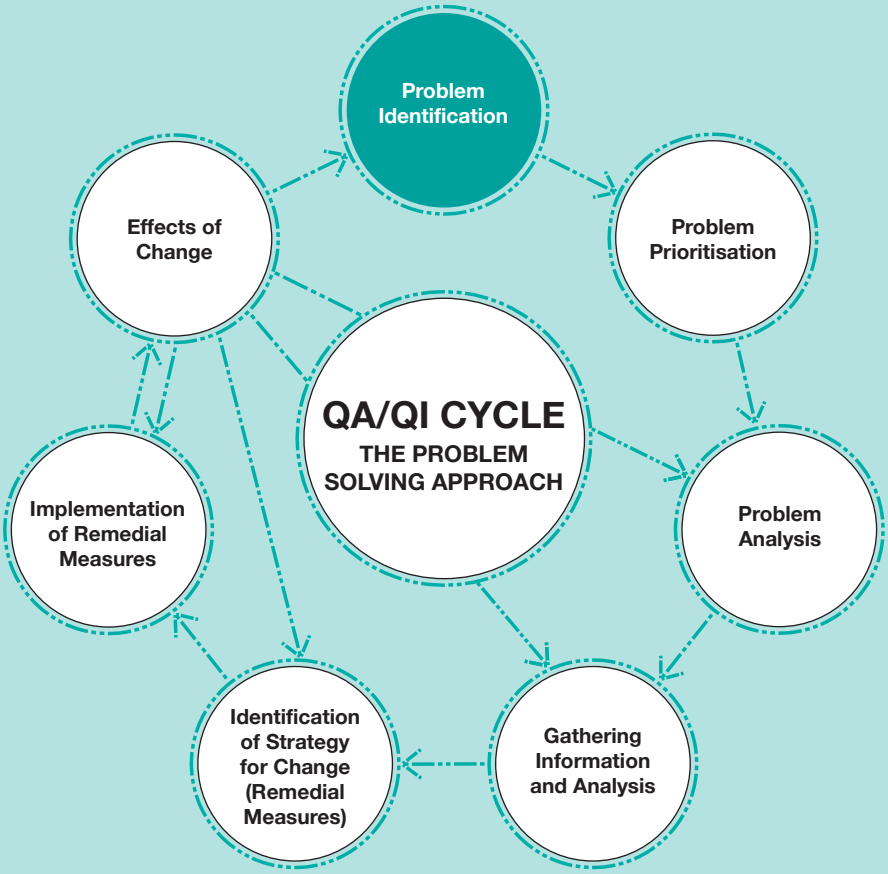
Table 1: Differences between QA/QI Study, Research and Clinical Audit – Malaysia Context.

Item	QA/QI Study	Research	Clinical Audit
Intention	To improve what we are currently doing	To generate scientific evidence / knowledge on what we should be doing	To find out whether we are doing what we should be doing
Design	Interventional in nature, cyclical changes of intervention, characteristically continuous	Various types of research design, for example, qualitative or quantitative study, cross sectional or interventional study, mixed method and etc.	Cross-sectional in nature, may complete one PDSA cycle
Scope of data / knowledge	Local / organisation specific	Aims to be generalisable	Local / organisation specific
Desired outcome	Aim to achieve a known desired outcome	Unknown desired outcome and starts with a scientific hypothesis	Comparing practices to a known desired outcome
Scope of intervention	Formulate intervention more holistically, involving the whole system and as many factors as feasible	Varies	Scope is usually confined to processes involved in the specific procedure not involving external factors
Statistical rigour	Simple statistics, just enough data	Complex statistics, all possible data, aims to be representative & generalisable	Simple statistics, just enough data
Team members	Usually consists of people who own the process	Need to include researcher from outside to avoid bias	Usually consists of people who own the process
Ethical approval	Not subjected to ethical approval	Ethical approval is mandatory	Not subjected to ethical approval

CHAPTER 3:
PROBLEM IDENTIFICATION (OPPORTUNITY FOR IMPROVEMENT)

Chapter Objective:

- Able to identify quality problems



" Problems are not stop signs, they are opportunities. "

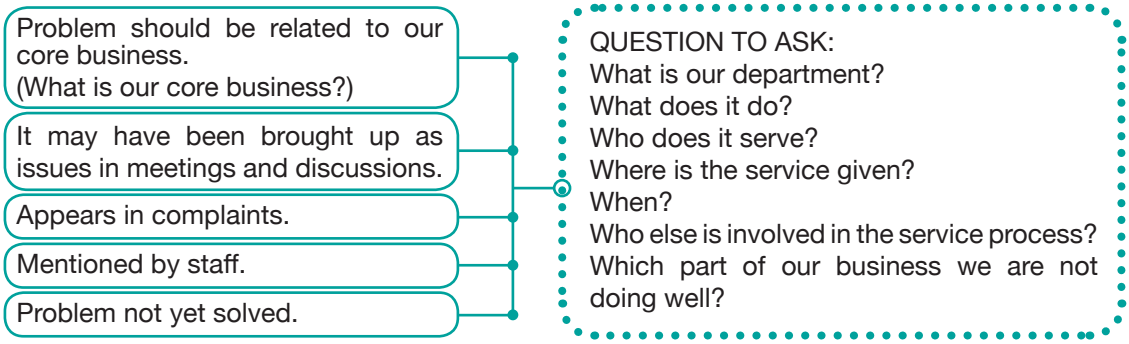
Unknown

3.1 GUIDE IN IDENTIFYING RELEVANT PROBLEMS

Quality problem occurs when quality aspects of a care or services becomes the centre of the problem. The important aspects of care that are commonly being given a quality priority are those that:

- **Occur frequently** – high volume, high risk or problem prone (e.g. surgical wound infection, thrombophlebitis), affects large number of patients
- **Place patients at risk** by not providing care correctly (e.g. wrong prescription, suboptimal management of diabetic patients in outpatient clinic), not providing care when indicated (e.g. need for transfusion) or providing care that is not indicated
- **Produce problem for patients or staff** (e.g. high stress level among mothers of NICU patients)
- **Causing wastage** of resources (high rejection rate of chest x-ray film)

HOW TO IDENTIFY QUALITY PROBLEM



3.2 EXAMPLE

Examples of quality problem:

No.	Example of Problem	Domain involved
1.	Inappropriate management of asthma in Clinic X	Effectiveness
2.	Low percentage of complete denture issued within 5-weeks from start of treatment	Efficiency
3.	Long-waiting time for endoscopy service causing low rate of gastrointestinal cancer detection	Timeliness/ Accessibility
4.	Low incidence of mother-baby skin-to-skin contact among premature babies in special care nursery (SCN)	Patient-centred/ Acceptable
5.	High incidence of in-patient fall in geriatric wards	Safety

Examples of problems not suitable for QA/QI Study:

- Poor restriction of visitors outside visiting-hour period
  → This is a managerial problem
- High occurrence of broken equipment in medical wards due to missed preventive maintenance schedule
  → This can be settled without performing QA/QI study

EXERCISE: PROBLEM IDENTIFICATION

a. What is your core business?

b. Who are your customers?

c. List down all problems at your workplace and decide whether it is a quality problem or not. State the reason why if it is not a quality problem.

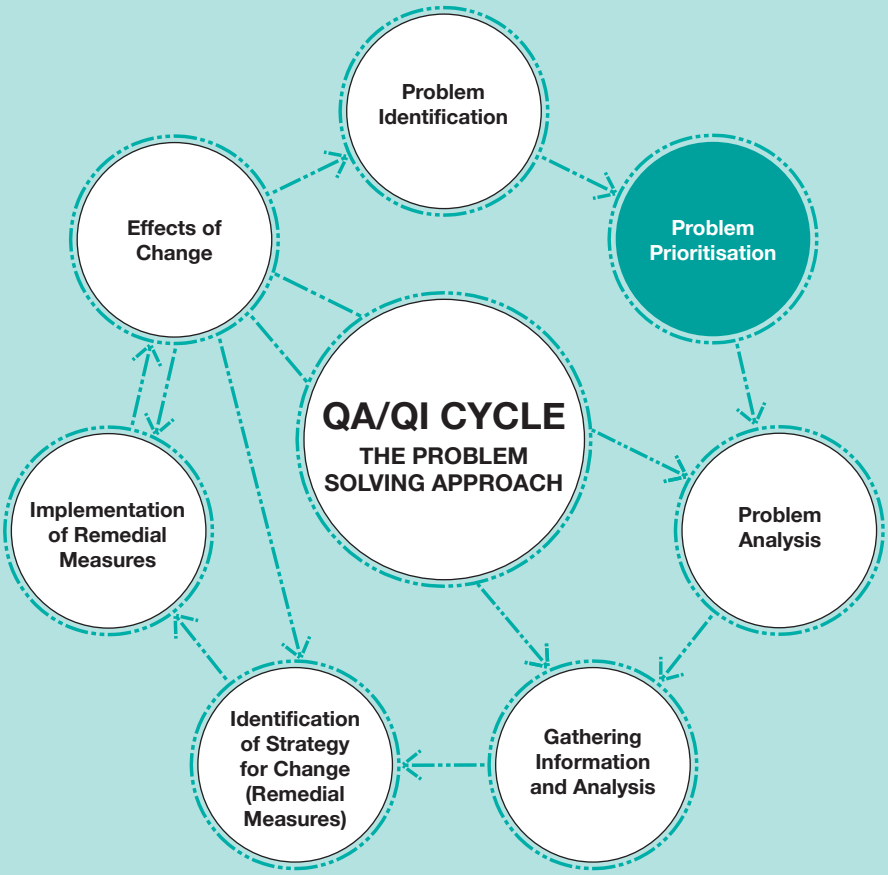
Problems	Is it a quality problem?		Reason if not a quality problem
	Yes	No	

Notes

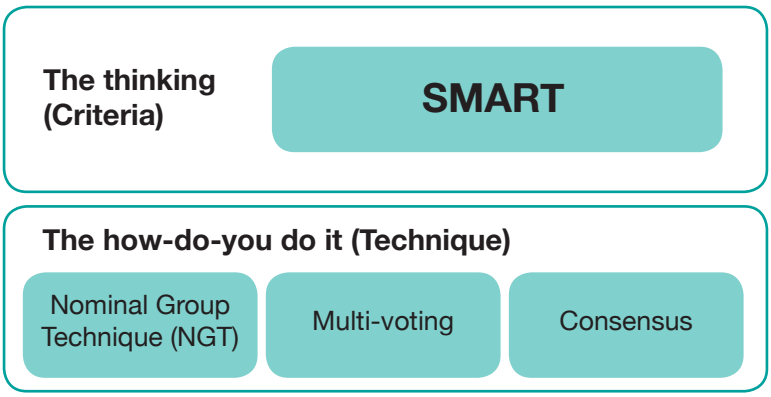
CHAPTER 4:
PROBLEM PRIORITISATION

Chapter Objective:

- Able to prioritise quality problems using appropriate technique



The basic **criteria** used in determining the priority of a problem is the SMART Criteria. Various **techniques** can be deployed in performing problems prioritisation.



4.1 SMART CRITERIA

Seriousness

- How important is this problem in relation to the quality of patient care?
- Is life at stake? Does it cause permanent disability, pain?
- Does it cause distress to patient, relatives?
- Does it have an impact on patient, society and hospital image?
- Does it have an impact on cost and resources?
- Frequent occurrence though not very serious.
- Is there room for improvement?
- How large is the ABNA - Is it worth studying?

Measurable

- The process of care is clearly defined with easily identifiable starting and ending points.
- The indicators are identifiable to the problems.
- Data related to the problem are available or can be obtained.

Appropriateness

- The process or project is related to core business and is consistent with the organisation goals and values.
- The proposed opportunity for improvement has direct impact on the customers and will likely result in an improvement in the quality of care.
- The cost of not solving this quality problem may be significant. This may be financial, legal or related to image of the organisation.
- Managers are concerned with this process, and agree that it is important to do a study and improve this process

Remediable

- Are solutions available? Are resources and expertise available to do the study or correct the situation?
- OR is solution too obvious? If the solution is very obvious, just solve it without doing a study.

Timeliness

- The study and remedial measures can be carried out within a reasonable period by the group.
- There are no current operational, financial or political issues which might affect the success of the project.

4.2 PRIORITISATION TECHNIQUE

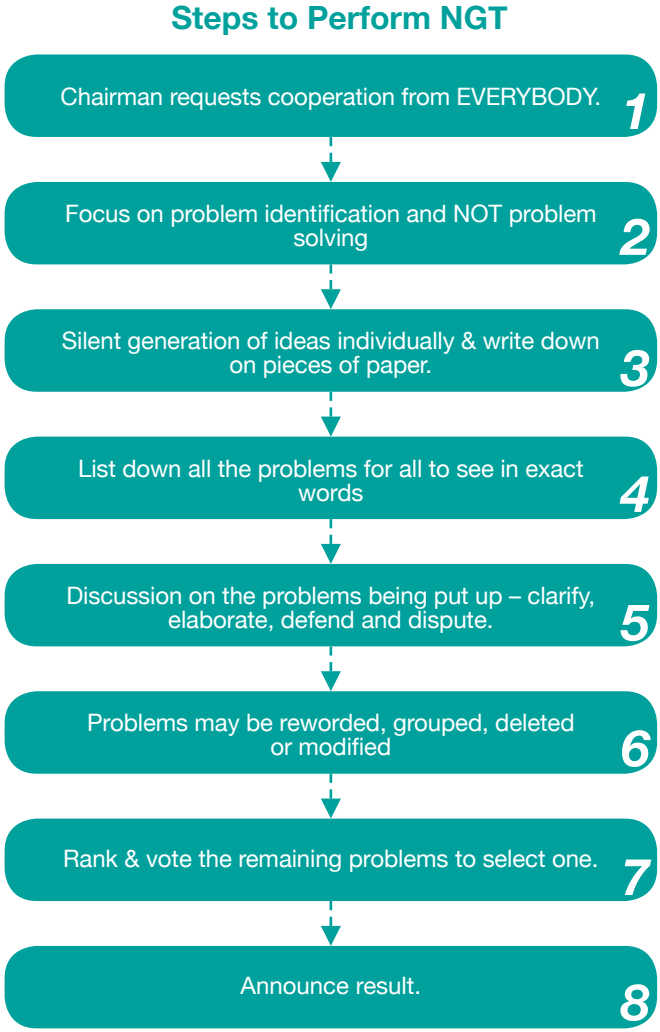
4.2.1 THE NOMINAL GROUP TECHNIQUE (NGT)

It is a weighted ranking technique that allows members of a team to prioritise a large number of issues without creating any winners or losers. Everyone in the group will have input into the problems, ideas which they feel have the most importance. The problems are ranked in order of importance individually by members of the group by casting votes. The problem which received the highest vote gets the priority.

NGT has a relatively low level of interaction. It is an effective technique when all or some group members are new to each other.

PREPARATION:

- The group must consist of 7-12 people with a common interest. (e.g. QI and the subject matter related to them)
  - o < 7 -- Inadequate expertise.
  - o > 12 -- Too many, creating unsatisfactory group dynamic
- Chairman should be a senior person with interest & authority.
- Final choice may need approval from people with financial & administrative authority.



4.2.1.1 VOTE TO PRIORITISE PROBLEMS

Process of voting:

1. Individuals need to prioritise and give highest point to the problem according to priority. Individuals can use or develop criteria to prioritise which problems they want to vote and give highest point.
2. Cumulative votes decide and prioritise problems for the group.
3. SMART criteria shall be used to decide if the problem is worth studying.

For each problem, a mark is given according to each criterion in SMART based on a rating scale for example;

1 – Low 2 – Medium 3 - High

This prioritisation by weightage can be done as a group or individual. Once a problem to be studied has been identified and prioritised by whichever technique, the whole committee must work together towards solving this problem. Other members can be co-opted at this point according to the nature and area of problem to be studied.

4.2.1.2 EXAMPLE

Example of Individual Voting

No.	Problems	S	M	A	R	T	Total
1.	High percentage of inappropriate time of medication administration among newly admitted patient	3	2	2	3	2	12
2.	High percentage of wrong dose of inotrope dilutions among ventilated patients in the general wards	2	2	2	2	2	10
3.	High percentage of health educations not given among in patients	2	1	2	2	2	9
4.	High percentage of in-patient fall	2	2	2	1	2	9
5.	Poor documentation of nursing assessment during admission	2	3	2	3	1	11

Weightage: 1 = Low, 2 = Medium, 3 = High

Example of Group Voting

No.	Problems	S	M	A	R	T	Total
1.	High percentage of inappropriate time of medication administration among newly admitted patient	9	8	8	9	9	43
2.	High percentage of wrong dose of inotrope dilutions among ventilated patients in the general wards	6	6	5	7	6	30
3.	High percentage of health educations not given among in-patients	4	5	5	6	5	25
4.	High percentage of in-patient fall	6	6	6	5	6	29
5.	Poor documentation of nursing assessment during admission	4	6	6	5	6	27

Weightage: 1 = Low, 2 = Medium, 3 = High

Voting performed by 3 group members

4.2.2 MULTI-VOTING

4.2.2.1 DEFINITION

Multi-voting is a group decision-making technique used to reduce a long list of items to a manageable number by means of a structured series of votes.

Brainstorming generates a long list of ideas which many are not realistic or feasible. The multi-voting activity allows a group to narrow their list or options into a manageable size for consideration or study. It will not help the group make a single decision but can help the group narrow a long list of ideas into a manageable number that can be discussed and explored. It allows all members of the group to be involved in the process and ultimately saves the group a lot of time by allowing them to focus energy on the ideas with the greatest potential. The result is a short list identifying what is important to the team.

4.2.2.2 MULTI-VOTING PROCEDURE

1. Brainstorm for a list of options.

Conduct the brainstorming activity to generate a list of ideas or options.

2. Review the list from the brainstorming activity.

Once you have completed the list, clarify ideas, merge similar ideas, and make sure everyone understands the options.

3. Participants vote for the ideas that are worthy of further discussion.

Each participant may vote for as many as they wish. Voting may be by show of hands or physically going to the list and marking their choices or placing a dot by their choices. Participants may vote for every item.

4. Identify items for next round of voting.

Count the votes for each item. Any item receiving votes from half the people voting is identified for the next round of voting. For example, if there are 12 people voting, any item receiving at least six votes is included in the next round. Signify the items for the next vote by circling or marking them with a symbol, i.e., all items with a star by the number will be voted on the next round.

5. Vote again.

Participants vote again, however this time they may only cast votes for half the items remaining on the list. In other words, if there are 20 items from the last round that are being voted on, a participant may only vote for ten items.

6. Repeat steps 4 and 5.

Participants continue voting and narrowing the options as outlined in steps 4 and 5 until there is an appropriate number of ideas for the group to analyse as a part of the decision-making or problem-solving process. Generally, groups need to have three to five options for further analysis.

7. Discuss the remaining ideas.

At this time the group engages in discussing the pros and cons of the remaining ideas. This may be done in small groups or the group as a whole.

8. Proceed with appropriate actions.

At this point the group goes to the next step. This might be making a choice of the best options or identifying the top priorities.

4.2.2.3 EXAMPLE

The team leader of QA/QI Team from Hospital A conducted a brainstorming session and first round of voting with the group members which produced the following list of problems:

I. Delay in completing discharge note for discharge patients
II. Over-crowding in medical wards during festive season
III. Increasing needle stick injuries among nurses
IV. Congestion of green zone in emergency department
V. Poor ventilation in wards with BOR > 100%
VI. High percentage of inappropriate time of medication administration among newly admitted patient
VII. Poor usage of non-pharmacological modalities during routine venepuncture in neonates
VIII. Increasing pressure ulcer incidence among stroke patients
IX. Delay in getting discharge medications after office hours
X. Lack of chairs in waiting area of emergency department
XI. Delay in initiation of breastfeeding among SVD mothers
XII. Delay in initiation of ambulation among post-caesarean mothers
XIII. Poor independence level among post amputation diabetic patients
XIV. Food wastage among inpatients
XV. Prescribing error in prescriptions received from medical wards
XVI. Increase incidence of fall among inpatients

The team used multi-voting to reduce this list to a manageable size by:

- Each of the 6 members of the team was allowed 8 votes (half of the number of problems)
- The votes were tallied, as shown in Viewgraph 1 and the top 8 problems (shaded) were carried forward to the second round
- In the second round, each member was allowed 4 votes (half the number of problems). The group chose to focus on the top 4 problems (shaded) as in Viewgraph 2.

First Round Tally		
No.	**Problems**	**No. of votes**
I.	Delay in completing discharge note for discharge patients	2
II.	Over-crowding in medical wards during festive season	1
III.	Increasing needle stick injuries among nurses	5
IV.	Congestion of green zone in emergency department	5
V.	Poor ventilation in wards with BOR > 100%	1
VI.	High percentage of inappropriate time of medication administration among newly admitted patient	6
VII.	Poor usage of non-pharmacological modalities during routine venepuncture in neonates	5
VIII.	Increasing pressure ulcer incidence among stroke patients	1
IX.	Delay in getting discharge medications after office hours	1
X.	Lack of chairs in waiting area of emergency department	1
XI.	Delay in initiation of breastfeeding among SVD mothers	5
XII.	Delay in initiation of ambulation among post-caesarean mothers	4
XIII.	Poor independence level among post amputation diabetic patients	4
XIV.	Food wastage among inpatients	1
XV.	Prescribing error in prescriptions received from medical wards	1
XVI.	Increase incidence of fall among inpatients	5

Viewgraph 1: Multi-voting Example - First Round Tally

Second Round Tally		
No.	**Problems**	**No. of votes**
III.	Increasing needle stick injuries among nurses	2
IV.	Congestion of green zone in emergency department	2
VI.	High percentage of inappropriate time of medication administration among newly admitted patient	1
VII.	Poor usage of non-pharmacological modalities during routine venepuncture in neonates	4
XI.	Delay in initiation of breastfeeding among SVD mothers	5
XII.	Delay in initiation of ambulation among post-caesarean mothers	4
XIII.	Poor independence level among post amputation diabetic patients	4
XIV.	Increase incidence of fall among inpatients	2

Viewgraph 2: Multi-voting Example - Second Round Tally

4.2.3 CONSENSUS

4.2.3.1 DEFINITION

Consensus decision making is a process used by groups seeking to generate widespread levels of participation and agreement. There are variations among different groups regarding the degree of agreement necessary to finalise a group decision. The process of group deliberation, however, has many common elements that are definitive of consensus decision making. These include:

Inclusive

As many stakeholders as possible are involved in group discussions.

Participatory

All participants are allowed a chance to contribute to the discussion.

Collaborative

The group constructs proposals with input from all interested group members. Any individual authorship of a proposal is subsumed as the group modifies it to include the concerns of all group members.

Agreement Seeking

The goal is to generate as much agreement as possible. Regardless of how much agreement is required to finalise a decision, a group using a consensus process makes a concerted attempt to reach full agreement.

Cooperative

Participants are encouraged to keep the good of the whole group in mind. Each individual's preferences should be voiced so that the group can incorporate all concerns into an emerging proposal. Individual preferences should not, however, obstructively impede the progress of the group.

4.2.3.2 PROCESS OF CONSENSUS

There are multiple stepwise models on how to make decisions by consensus

EXERCISE: PRIORITISATON TECHNIQUE

Based on the list of problems you have identified in page 16, prioritise your problems using the NGT.

No.	Problems	S	M	A	R	T	Total

4.3 PROBLEM VERIFICATION

4.3.1 What is Problem Verification?

Problem verification is the first step that needs to be done before analysing a problem. During this step, you will need to collect appropriate data to confirm that the problem exists.

Problem verification can be done just before problem analysis is performed, or at the very early stage of problems prioritisation if data is readily available.

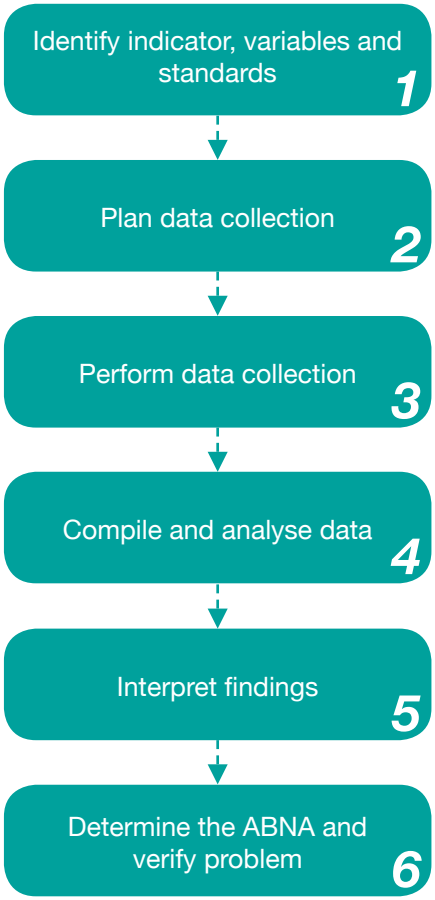
4.3.2 Why is it important?

Problem verification must be performed before further study conducted on the problem. This is because problem verification will:

- Confirm that a problem really exists or not.
- Provide pre-interventional or baseline data on current status of the problem i.e. magnitude of the problem
- Show achievement or non-achievement of certain standard of quality

4.3.3 How to perform problem verification?

Steps in performing problem verification:



It is best if past data is used to show the trend for problem verification. This will help the team to assess the magnitude of the problem more accurately. Findings from the problem verification will also answer your first specific objective of QA/QI Study (refer Section 6.1). Please refer to Section 6.4.3.1 for details in data collection for problem verification.

4.3.4 EXAMPLE

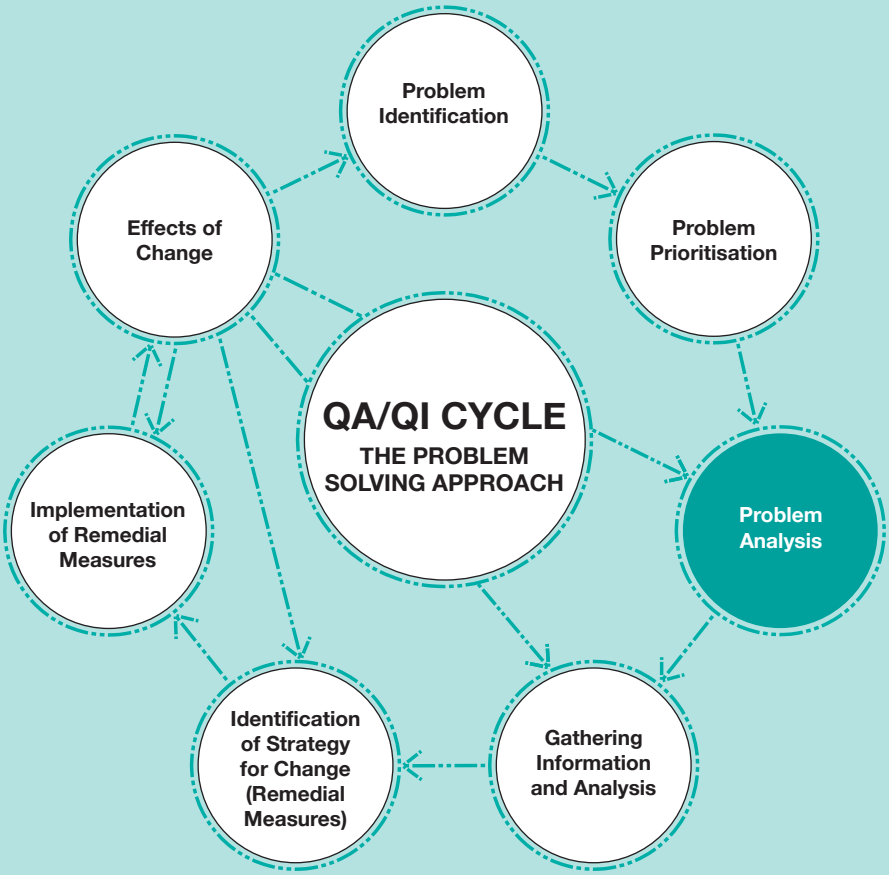
This is an example of problem verification that was made available at the early stage of problem prioritisation. This is possible if data for each problem is readily available.

No.	Problem	Problem verification
1.	Poor usage of non-pharmacological modalities during routine venepuncture in neonates	Only 15% of neonates underwent routine venepuncture with at least one type of non-pharmacological modality.
2.	Delay in initiation of breastfeeding among SVD mothers	40% of SVD mothers has initiated breastfeeding within 24 hours of delivery.
3.	Delay in initiation of ambulation among post-caesarean mothers	60% of post-caesarean mothers has initiated ambulation within 48 hours of delivery.
4.	Poor independence level among post amputation diabetic patients	80% of post-amputation diabetic patients has poor independence level at 6-month follow-up appointment.

CHAPTER 5:
PROBLEM ANALYSIS

Chapter Objectives:

- Able to analyse the selected QA/QI Problem using 5W + 1H
- Able to formulate a problem statement



5.1 INTRODUCTION

After identifying a problem to be studied, we need to analyse the problem and factors contributing to it. Problem analysis involves looking at:

- Process of care in the area concerned
- How it should be and what went wrong
- What are the possible/known causes
- What are the effects

In analysing a problem, we need to know the 5W + 1H:

What – **W**hat is the actual problem?

Where – **W**here does it occur?

You must be able to draw a process of care / flowchart (refer 5.2.1) that is related to the problem. The problem should be located somewhere in the process of care

When – **W**hen does it happen?

Who – **W**ho are involved in the process or affected?

Why – **W**hy the problem occurs?

This element identifies causes of the problem. You can use Problem Analysis Chart (5.2.2) or Ishikawa Chart (5.2.3) to illustrate why the problem occurs.

How – **H**ow does it happen?

You must be able to draw a process of care / flowchart (refer 5.2.1) that is related to the problem. The problem should be located somewhere in the process of care

Problem analysis should result in a statement that describes the problem (Problem Statement – Refer 5.3).

Example:

Problem – Low percentage of patients receiving Enteral Nutrition Product (ENP) as prescribed by dietitian within 24 hours.

What : Patient did not receive ENP as prescribed by dietitian
Where : Medical, surgical and orthopaedic wards in Hospital X
When : Everyday
Who : Personnel involved in the process: doctors, dietitian, nurses, hospital attendant, patients
Why : System and work process weaknesses, lack of awareness and inappropriate practices among staff
How : A written SOP is in place for prescription of ENP for patients but the percentage of patients receiving prescribed ENP within 24 hours remains low

5.2 QUALITY TOOLS FOR PROBLEM ANALYSIS

Some quality tools that can be used in analysing a problem are:

a. Problem Analysis Chart
b. Cause-effect Diagram (e.g. Ishikawa / Fishbone Diagram)
c. Process of care / Flowchart

5.2.1 PROBLEM ANALYSIS CHART (PAC)

Problem analysis chart shows the number of possible causes of a particular outcome and the relationship of each cause to the other.

Step by Step of PAC:

Step 1

Place the core problem at the centre of the page.

Step 2

Write all contributing factors that are perceived as causes of the problem. It is best if loose cards / sticky notes are used to allow brainstorming.

Step 3

Paste and organise the factors around the problem.

Step 4

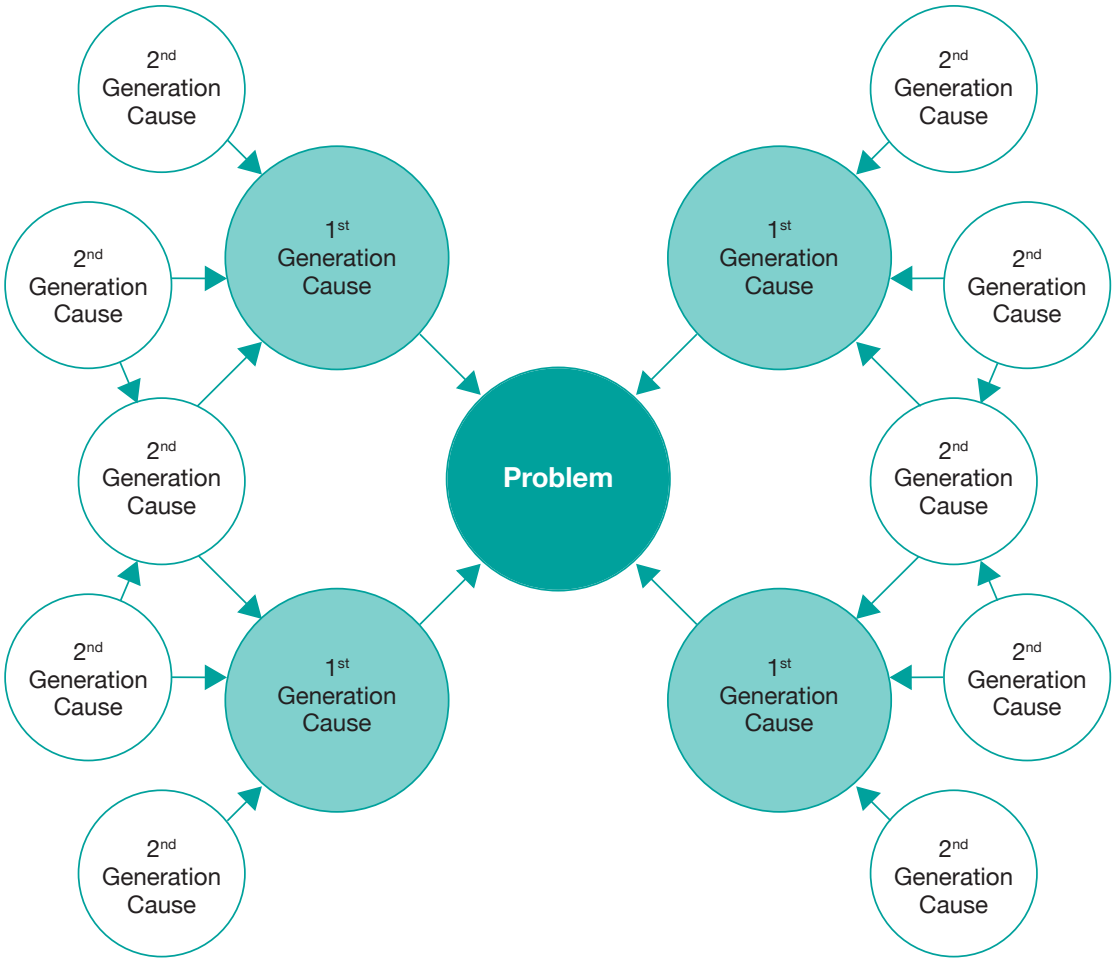
Indicate the relationships between factors and problem by using arrows. Determine which way the arrows should point between the various causes. The arrow should point inward, rather than outward, from "cause" to "effect".

Step 5

Analytically think and revise the diagram. Redraw, reorient the position of the causes if necessary.

Step 6

Finalise on agreed version of the team's PAC.


2nd Generation Cause
2nd Generation Cause
2nd Generation Cause
1st Generation Cause
2nd Generation Cause
2nd Generation Cause
1st Generation Cause
2nd Generation Cause
2nd Generation Cause
2nd Generation Cause
Problem
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1st Generation Cause
2nd Generation Cause
2nd Generation Cause

Example of Problem Analysis Chart:

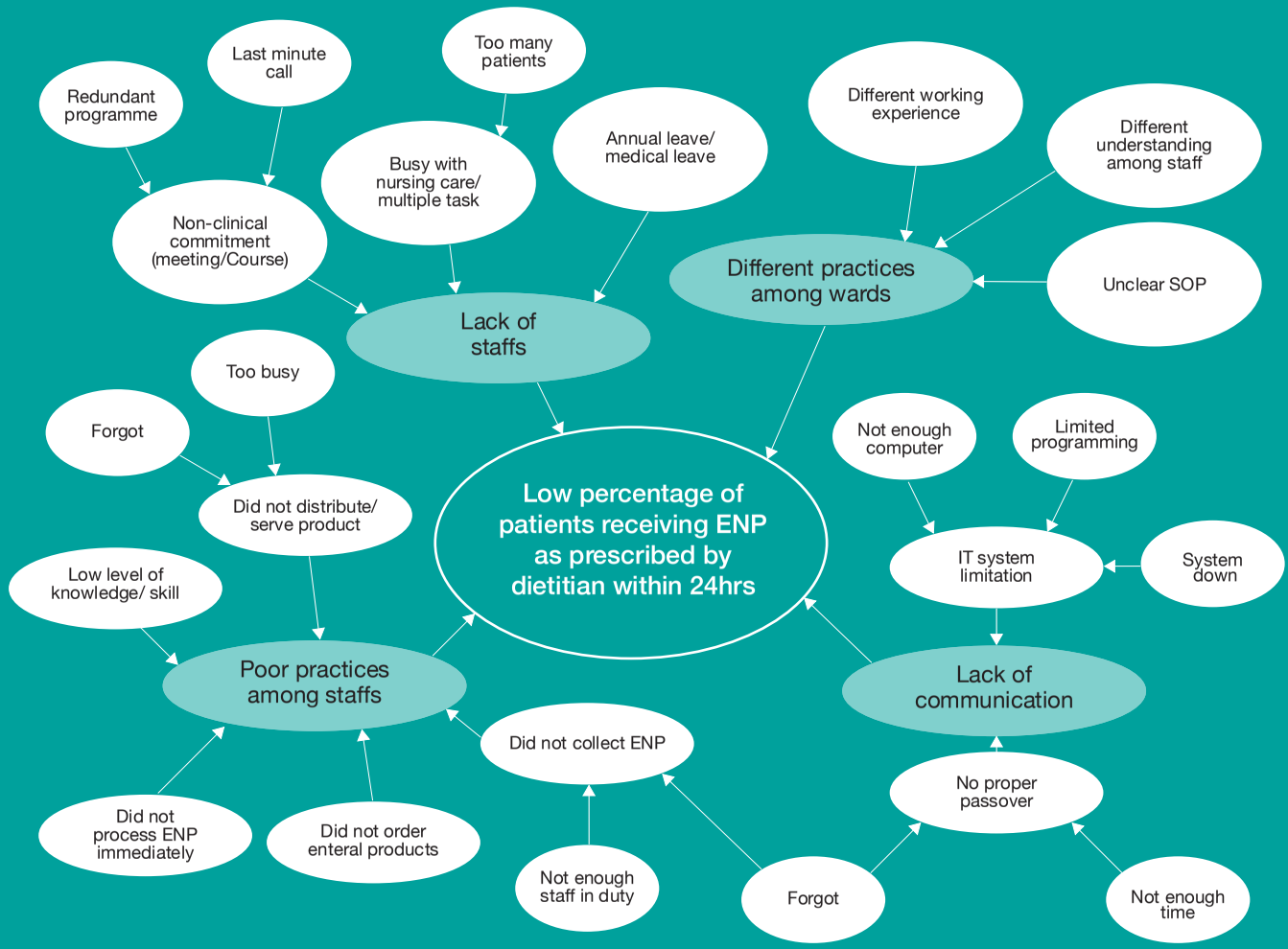


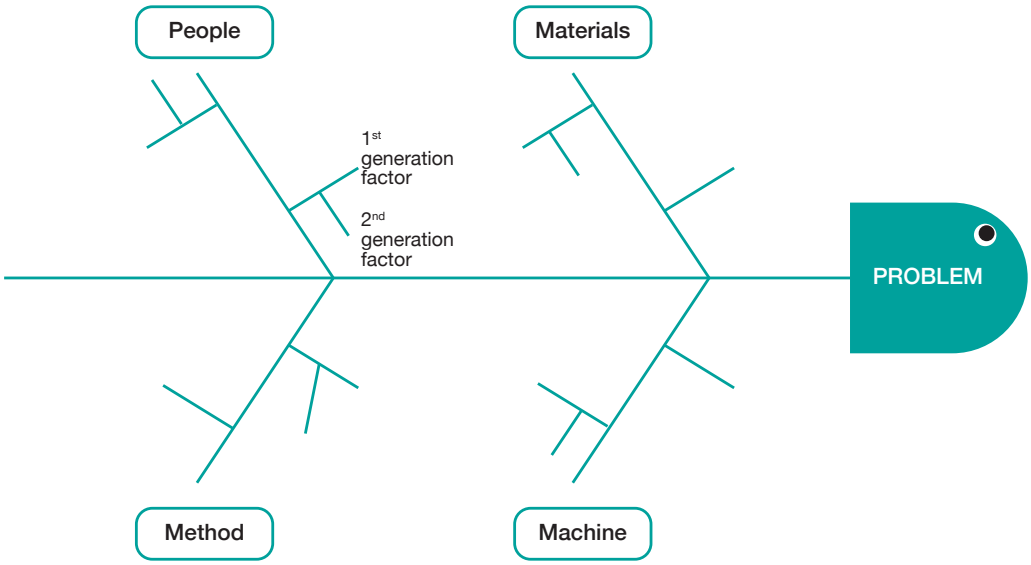
Figure 4: Problem Analysis Chart for Low Percentage of Patients Receiving ENP as Prescribed by Dietitian within 24 hours

5.2.2 CAUSE-EFFECT DIAGRAM (FISHBONE OR ISHIKAWA DIAGRAM)

A cause-effect diagram shows a large number of possible causes of a particular outcome. In Ishikawa Diagram, the causes are graphically organised into categories – People, Materials, Method, Machine (and Environment).

Step by step of Ishikawa Diagram:

1. Agree on the problem and write the problem/effect at the head of the fishbone. Be specific.
2. Brainstorm for causes and sort them into major branches. Add or drop categories as needed when generating causes.
3. Identify specific causes and fill into correct branch or sub-branches. If the idea fits in more than one branch, place it in both branches.
   Be sure that the causes as phrased have a direct, logical relationship to the problem.
4. Keep asking "Why?" and "Why else?" for each cause until a potential root cause has been identified.
5. Check the logic of the chain of causes. Make changes if necessary.



Example of Ishikawa Diagram:

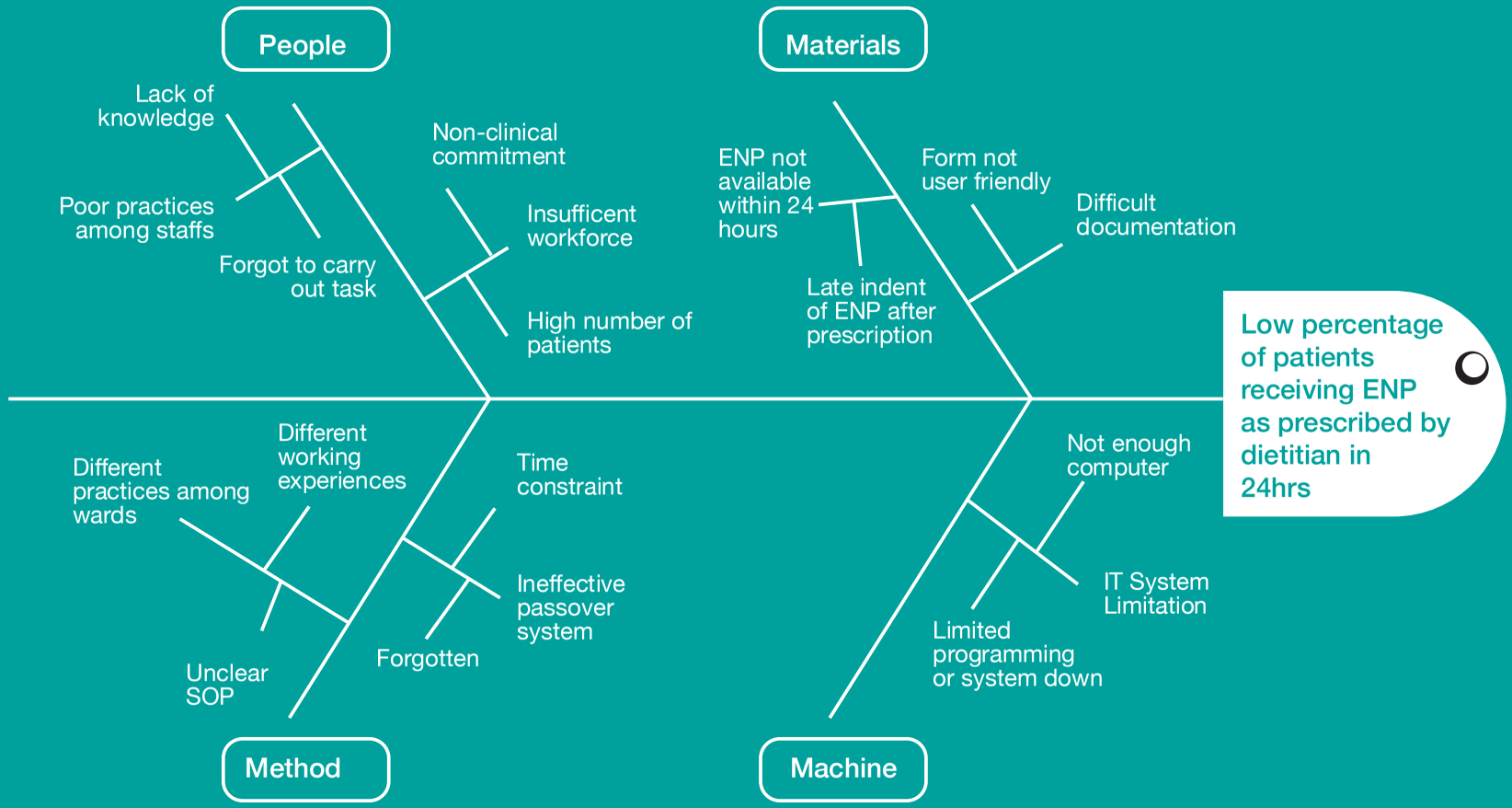
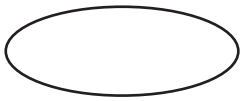


Figure 5: Ishikawa Diagram for Low Percentage of Patients Receiving ENP as Prescribed by Dietitian within 24 Hours

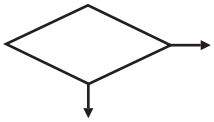
5.2.3 PROCESS OF CARE / FLOWCHART

A flowchart is a graphic presentation of how a process works, showing the step-by-step sequence of processes or sub processes.

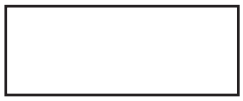
Common symbols used in flowchart:



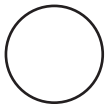
Start / Stop



Decision point



Task / Activity / Action / Step



Connector to another page / chart

Step by Step of Flowchart:

1. Agree on the purpose of the flowchart.
2. Determine and agree on the BEGINNING and END POINT of the process to be flowcharted
3. Identify the elements of the flowchart by asking:
   a. Who provides an input for a step? Who uses it?
   b. What is done with the input? What decisions are made while the input is being used?
   c. What is the output to this step? Who uses it to do what?
4. Review the first draft of the flowchart to see whether the steps are in logical order. Revise as necessary.

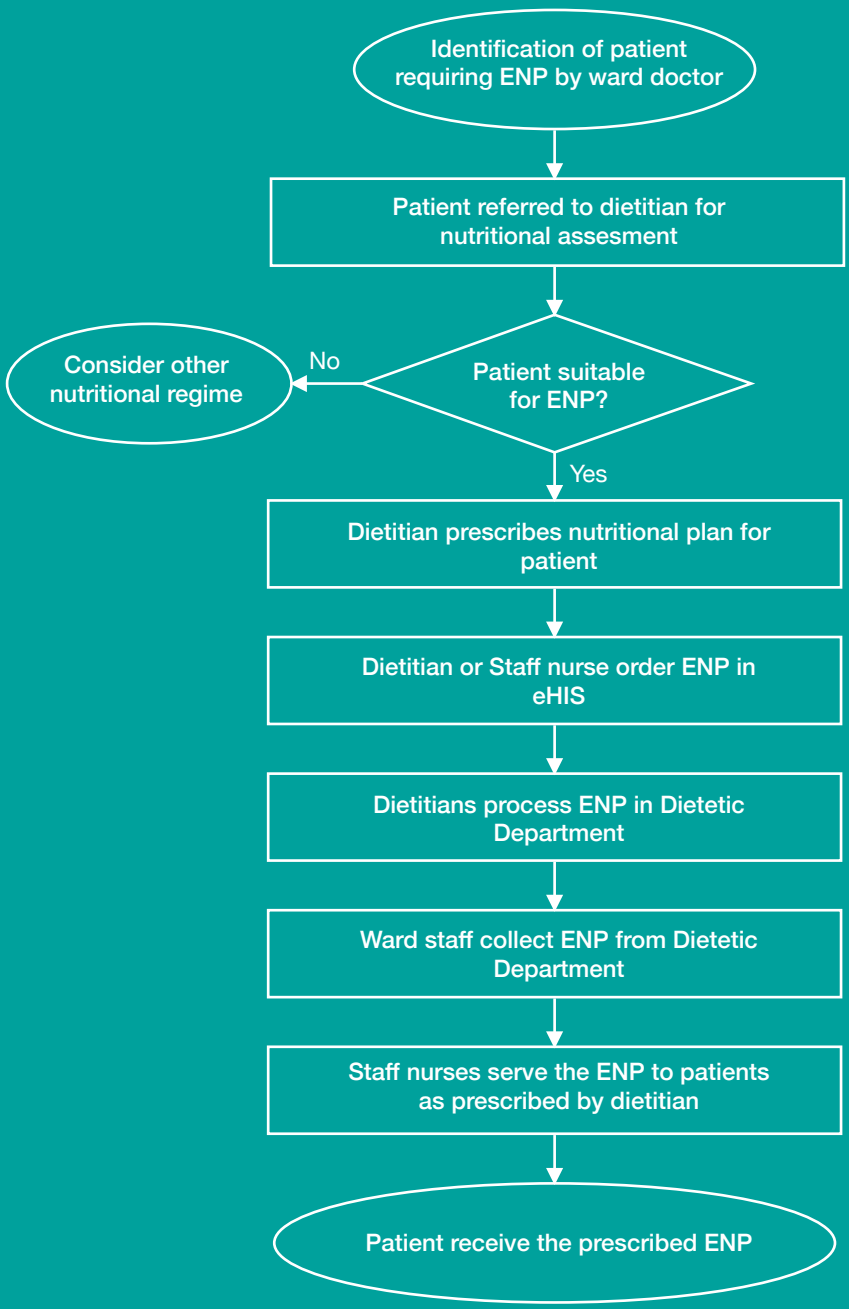


Figure 6: Example of a Flowchart – Processes Involved from Identification of Patients for ENP until ENP Received by Patient

EXERCISE: QUALITY TOOLS FOR PROBLEM ANALYSIS

1. Look at Figure 7.
   a) Can you identify any mistake?
   b) Explain why you think it is a mistake.
   c) Redraw the problem analysis chart based on your findings in a) and b)

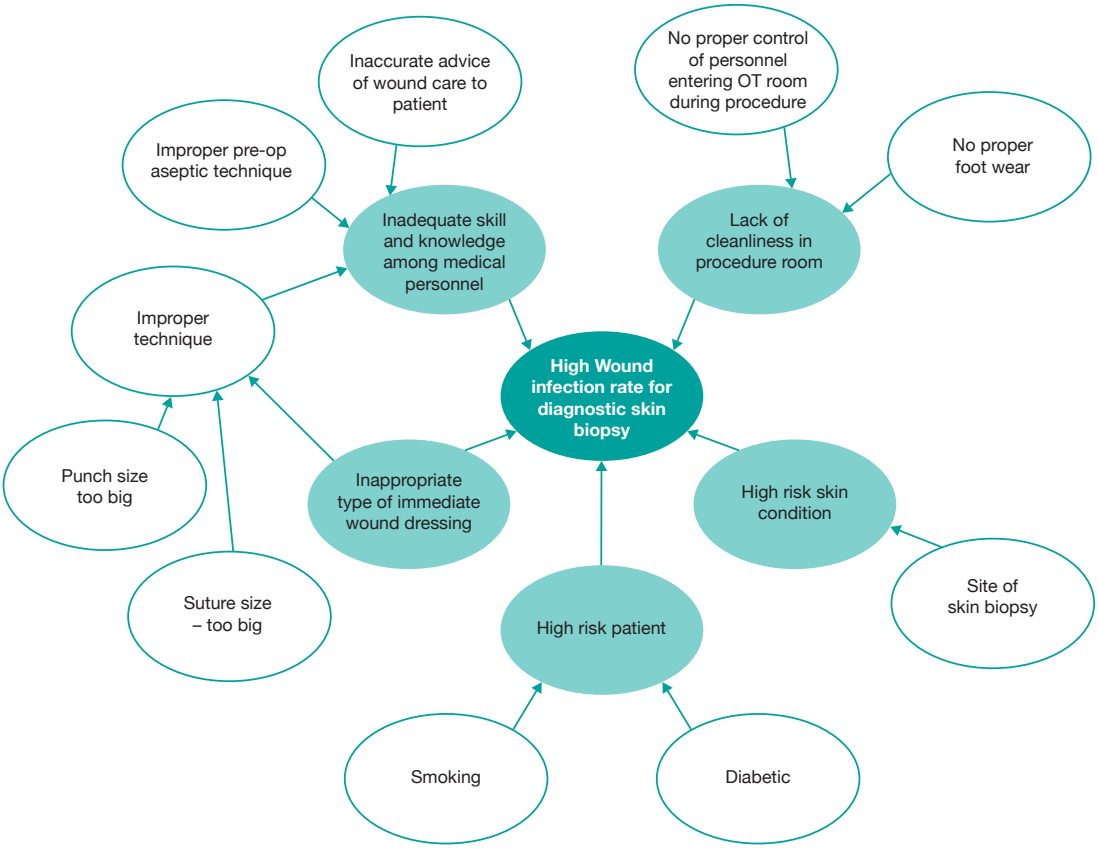


Figure 7: Exercise 1 for Problem Analysis Chart

You may refer to Appendix 1 for suggested answer.

2. Look at Figure 8.
   a) Can you identify any mistake?
   b) Explain why you think it is a mistake.
   c) Redraw the problem analysis chart based on your findings in a) and b)

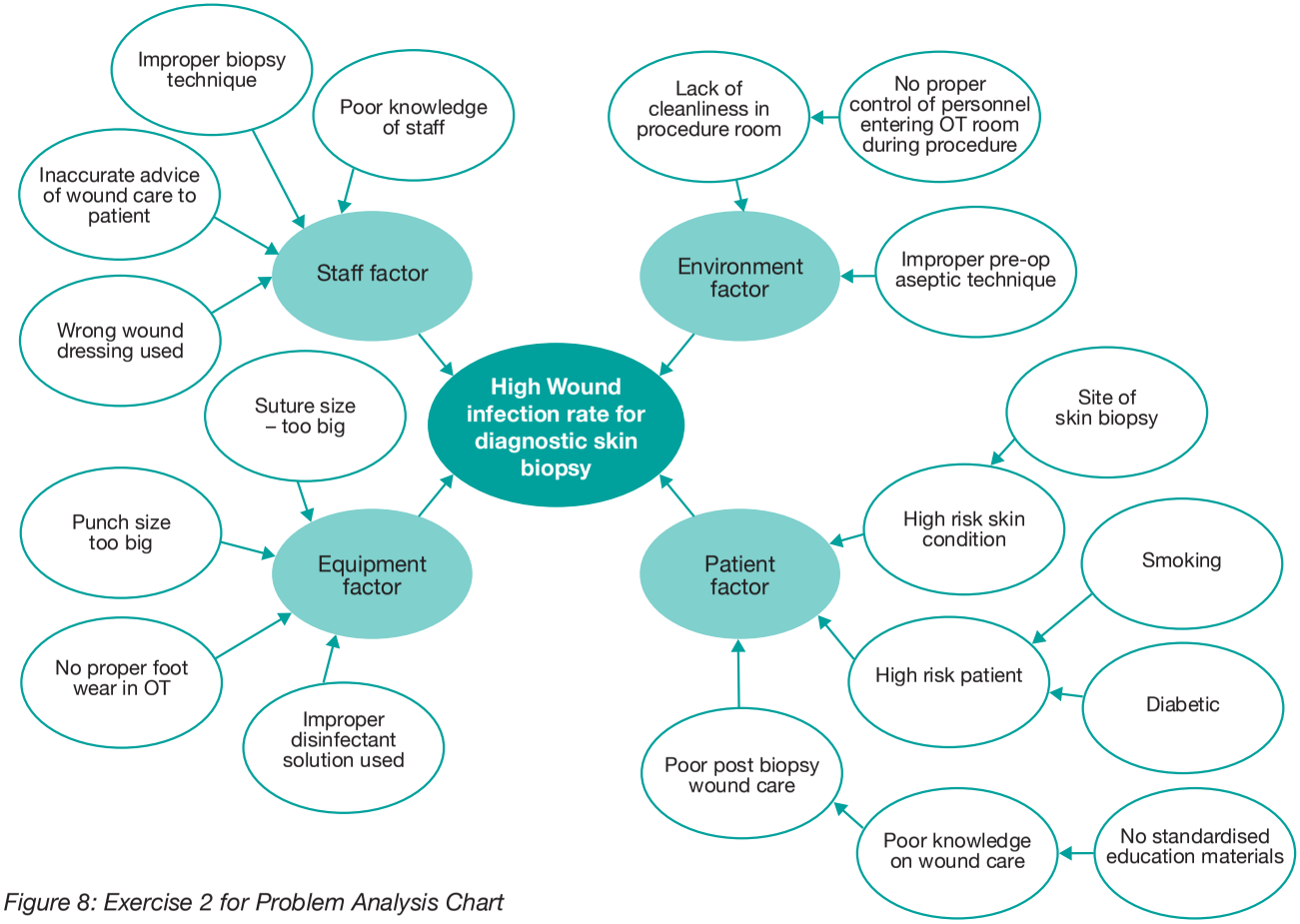


Figure 8: Exercise 2 for Problem Analysis Chart

5.3 FORMULATING THE PROBLEM STATEMENT

Problem statement is an opening statement of the project, more like a summary of why we want to start the project.

Purpose:
To justify why the study needs to be carried out. This will be the foundation for further development of study proposal and help in defining the scope of our study. In addition, by formulating problem statement it should tell us why this study should be carried out and what is expected from the results.

PROBLEM STATEMENT FORMULA:

- Explain what the problem is – supported by evidence, if any
- What are the consequences if the problem not solved?
- What are the possible causes of the problem?
- Why we want to do the study?

Example of Problem Statement:

PROBLEM	A survey conducted in February 2016 among 30 patients in 3 selected wards showed that only 56% of patients received ENP within 24 hours of dietitians' prescription
EFFECT	The delay will affect patient's nutrition status and slow clinical improvement as well as compromising total patient care.
POSSIBLE CAUSE	Multiple factors including manpower, information system limitation, attitude and current working culture contributed to this problem.
AIM OF STUDY	This study will improve the percentage of patients receive ENP as main nutrition support within 24 hours of dietitian's prescription.

The final problem statement will be:

A survey conducted in February 2016 among 30 patients in three selected wards showed that only 56% of patients received ENP within 24 hours of dietitians' prescription.

This delay will affect patient's nutrition status and slow clinical improvement as well as compromising total patient care.

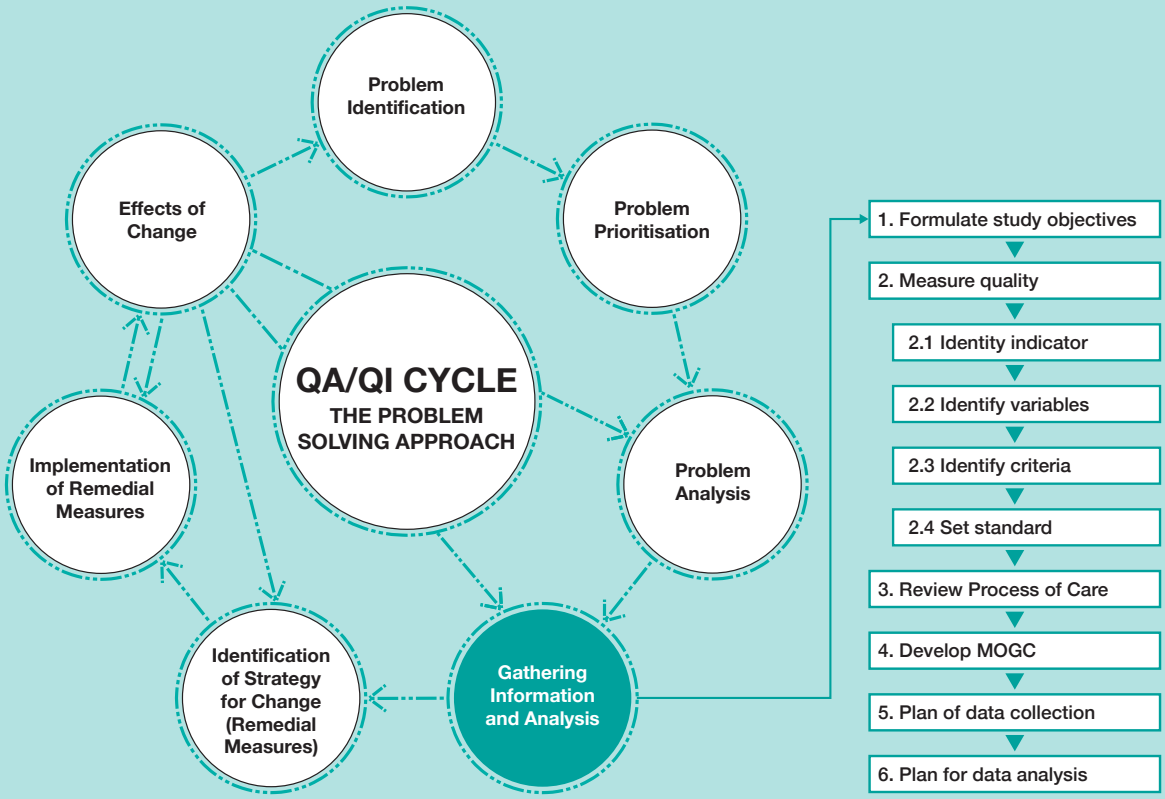
Multiple factors including manpower, information system limitation, attitude and current working culture may contribute to this problem.
This study aims to improve the percentage of patients who receive ENP as main nutrition support within 24 hours of dietitian's prescription.

Notes

CHAPTER 6:
GATHERING INFORMATION AND ANALYSIS

Chapter Objectives:

- Able to identify & formulate objectives, variables, indicators, criteria, standard and Model of Good Care (MOGC) for the various phases of the study.
- Able to plan for data collection.
- Able to analyse data obtained and draw conclusions from the findings.



" If you cannot measure the problem, you cannot manage/improve it "

Peter Drucker

6.1 FORMULATING STUDY OBJECTIVES

Study objective = what we want to achieve.

It can be divided into General and Specific objectives. General objective is the overall intention of the study. Specific objectives outline the steps we are going to take.

General objective:
Outline the final aim to be achieved in the study

Specific objectives

1. To determine the **existence of quality problem** / verify magnitude of the problem
2. To **identify factors contributing** to the problem
3. To **formulate and implement** appropriate remedial measures
4. To **evaluate the effectiveness** of remedial measures

◊ Objectives should be closely related to the problem statement
◊ Be realistic on what you want to achieve
◊ Avoid unnecessary collection of data

Example of general and specific objectives:

General Objective
Improving percentage of patients receiving ENP within 24 hours of dietitians' prescription in selected wards.

Specific Objective:

1. To verify the percentage of patients who do not receive ENP within 24 hours of dietitians' prescription.
2. To identify the contributing factors to low percentage of patients receiving ENP within 24 hours of dietitians' prescription.
3. To formulate and implement proper remedial action.
4. To evaluate the effectiveness of remedial action.

Exercise
a) Formulate general and specific objectives of your study

6.2 MEASURING QUALITY

Definitions of terms:

1. **Variable** is a characteristic/event that can take different value. It is measurable. This should be linked to your objectives (e.g. age, gender, weight, blood pressure, disease etc.)
2. **Standard** is a statement of expectation on quality of care for the inputs, processes or outcomes of the health system and made measurable by adding percentage, proportion, rate etc.
3. **Indicator** is a tool that measures a standard in assessing quality of care. It is a measurable form of the standard relating to structure, process or outcome.
4. **Threshold** is a value(s) included in the definition of the indicators to demarcate the level of acceptable quality of care

6.2.1 IDENTIFY INDICATORS

A good indicator should meet certain requirements:

- Specific
- Verifiable
- Comprehensive (covering all)
- Reliable (can get same result with anybody doing it)
- Valid (pertaining to quality of care)
- Feasible to get data
- Sensitive (able to differentiate good care from bad)
- Acceptable (to all concerned)

6.2.2 TYPES OF INDICATOR

There are different types of indicator which could be used for a given purpose.

Rate-based indicator

- Uses data about events that are expected to occur with some frequency.
- Can be expressed as percentage, proportions or rates (proportions within a given time period), ratios, or mean values for a sample population.
- Needs both numerator and denominator specifying the population at risk for an event and the period of time over which the event may take place.

Sentinel-event indicator

- Identifies individual event or phenomenon that are intrinsically undesirable, and occurrence of individual event always trigger further analysis and investigation.
- Sentinel-event indicator reports in terms of number of events occur, regardless its proportion to the population
- Sentinel event indicator does not need a numerator or denominator.

Structure, Process, or Outcome Indicator

Indicators can also be related to structure, process, or outcome of health care as illustrated in Section 1.1.5.

Structure:

- The attributes of the settings in which care occurs.
- This includes the attributes of material resources (such as facilities, equipment, and financing), of human resources (such as the number and qualifications of personnel), and of organisational structure (such as medical staff, organisation, methods of peer review, and methods of reimbursement).

Process:

- What is actually done in giving and receiving care
- Examples - the practitioner's activities in making a diagnosis, recommending or implementing treatment, or other interaction with the patient.

Outcome:

- Attempt to describe the effects of care on the health status of patients and populations.
- Examples – mortality rate, morbidity rate, health status, disease prevalence
- Improvements in the patient's knowledge and salutary changes in the patient's behaviour may be included under a broad definition of outcome, and so may represent the degree of the patient's satisfaction with care.

Examples of indicators:

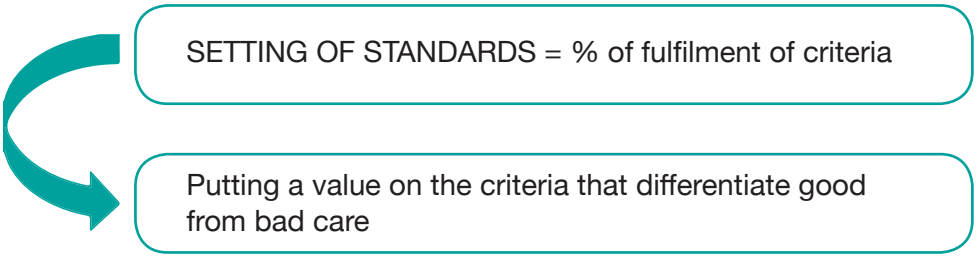
Type of Indicator	Structure	Process	Outcome
Rate-based indicator	• Doctors to population ratio • Bed occupancy rate • Percentage of hospitals with established Stroke Unit	• Percentage of lab samples with LTAT less than 60 minutes • Proportion of patients with myocardial infarction who received thrombolysis within 30 minutes of arrival at ED • Percentage of patients who was seen within 90 minutes in ED Green Zone • X-ray rejection rate	Clinical outcome: • Maternal mortality rate • Prevalence of Type 2 Diabetes • Wound infection rate post clean surgery • Hospital-acquired pneumonia among ventilated patients in ICU Functional outcome: • Mental or social function Evaluative outcome: • Patient reported outcome measures (PROMs) • Quality-adjusted life year (QALY)
Sentinel Event Indicator		• Number of medications wrongly administered to inpatient • Number of operations performed on wrong patient, wrong side of the body or wrong organ • Blood transfusion error • Retention of foreign objects after surgery	• Number of inpatient death due to suicide

Proxy indicator
Proxy indicator is an indicator that indirectly measures the problem. It is not very accurate because the problem itself is usually a result of many other factors, sometimes totally unrelated and beyond control. It is useful only as a flag to indicate that a problem may exist.

Example:
1. Myocardial infarction case fatality rate as a proxy indicator of medical management of acute myocardial infarction (AMI).
2. Death due to head injury as a proxy indicator of head injury management.
3. Acute respiratory infection (ARI) case fatality rate as a proxy indicator of paediatric management of respiratory infections.

6.2.3 SETTING AND COMMUNICATING STANDARDS

A standard will:
a. Decide if a problem exist (problem verification).
b. Decide if a contributing factor is responsible for the problem (second level standards).



Setting of standards in a study must involve all concerned with the process.

Example 1:
Problem:
Low percentage of patients receiving Enteral Nutrition Product (ENP) as prescribed by dietitian within 24 hours.

Indicator:
Percentage of patients receiving ENP within 24 hours as prescribed by dietitians

Numerator:
Total number of patients who received ENP within 24 hours

Denominator:
Total number of patients prescribed for ENP by the dietitians

Formula:

$$\frac{\text{Total number of patients who received ENP within 24 hours of dietitian prescription}}{\text{Total number of patients prescribed for ENP by the dietitians}} \times 100$$

Standard:
The standard for the indicator is at least 90% based on expert consensus

Threshold:
24 hours

Example 2:
Problem:
High wound infection rate among patients who underwent diagnostic skin biosy

Indicator:
Percentage of patients who developed wound infection post diagnostic skin biopsy

Numerator:
Number of patients who developed wound infection

Denominator:
Total number of patients who underwent diagnostic skin biopsy

Formula:

$$\frac{\text{Number of patients who developed wound infection}}{\text{Total number of patients who underwent diagnostic skin biopsy}} \times 100$$

Standard:
The standard for the indicator is wound infection rate for diagnostic skin biopsy should be less than 2%

Exercise

a) Formulate an indicator for the identified problem including name of the indicator, numerator, denominator, and threshold if applicable.

b) Set the standard for your quality problem.

6.3 MODEL OF GOOD CARE (MOGC)

MOGC is a process of care that is thought to fulfil the standard set. The standards are values that distinguished good from bad care.

- MOGC is the process of care with a 'good design'.
- `GOOD' is based on the 'specifications' considered optimum and achievable.
- `GOOD' is defined by Criteria and Standards.
- The good steps can be adopted from the professionally accepted standard or normal, SOP, guidelines, circulars, CPG, etc.
- It may also be innovations thought of by the group.
- MOGC can change with time.
- Not all steps in process of care should be included in the MOGC. Only the critical steps from the process should be included in the MOGC.
- Critical steps are steps that should be accomplished within the set criteria and standard.
- If the critical steps not followed, it might cause a 'multiplying effect of failure' in the series of care.

During the process of developing MOGC, it is advisable to put Process of Care and MOGC side-by-side. Refer Chapter 5.2.3 of this workbook for POC.

Example:

Model of Good Care from Prescription of ENP Until ENP Served to Patient

No.	CRITICAL STEP	CRITERIA	STANDARD
1.	Dietitian prescribes ENP in patient's nutritional plan	a. Nutritional plan prescribed by dietitian documented in case note	100%
		b. ENP prescription communicated to ward nurses via verbal, notes or eHIS within one hour of prescription.	100%
2.	Dietitian or ward nurse order ENP in eHIS	a. Ensure Right patient and Right ENP ordered	100%
		b. Order or indent in the system was done within 8 hours of prescription	100%
3.	Dietitians process and prepare the ordered ENP	a. Countercheck Right patient and Right ENP, and correct any error if detected	100%
		b. Order processed through system or manual form if system not available within 8 hours of order	100%
4.	Collection of ENP from dietetic department by ward staff	a. Completion of ENP processed must be informed to ward staff within one hour of completion	100%
		b. Ward staff collect ENP from dietetic department within 3 hours of notification	100%
5.	Ward nurses to serve ENP to patient	a. Ward nurses to serve ENP to patients within 3 hours of ENP collection from dietetic department	90%
		b. Date, time and amount of ENP served charted in input-output charting	100%

If we compare the MOGC with the POC (refer page 40), the first 3 steps in POC were not included in the MOGC. This is because, looking at the problem that is being studied in this example, the timing starts from prescription of ENP by dietitian until ENP received by patient. Therefore, the first 3 steps were not considered as critical steps in this study, albeit its criticalness in the whole patient care is undeniable.

Exercise:
From process of care that you developed in Chapter 5, identify the critical steps and develop Model of Good Care for your process.

No.	Critical Step	Criteria	Standard*

(*) refers to Standard of EACH Process of Care, not the main indicator

6.4 DATA COLLECTION (PROCESS OF GATHERING INFORMATION)

6.4.1 STUDY DESIGN

This section briefly explains general overview of study design not limited to QA/QI study.

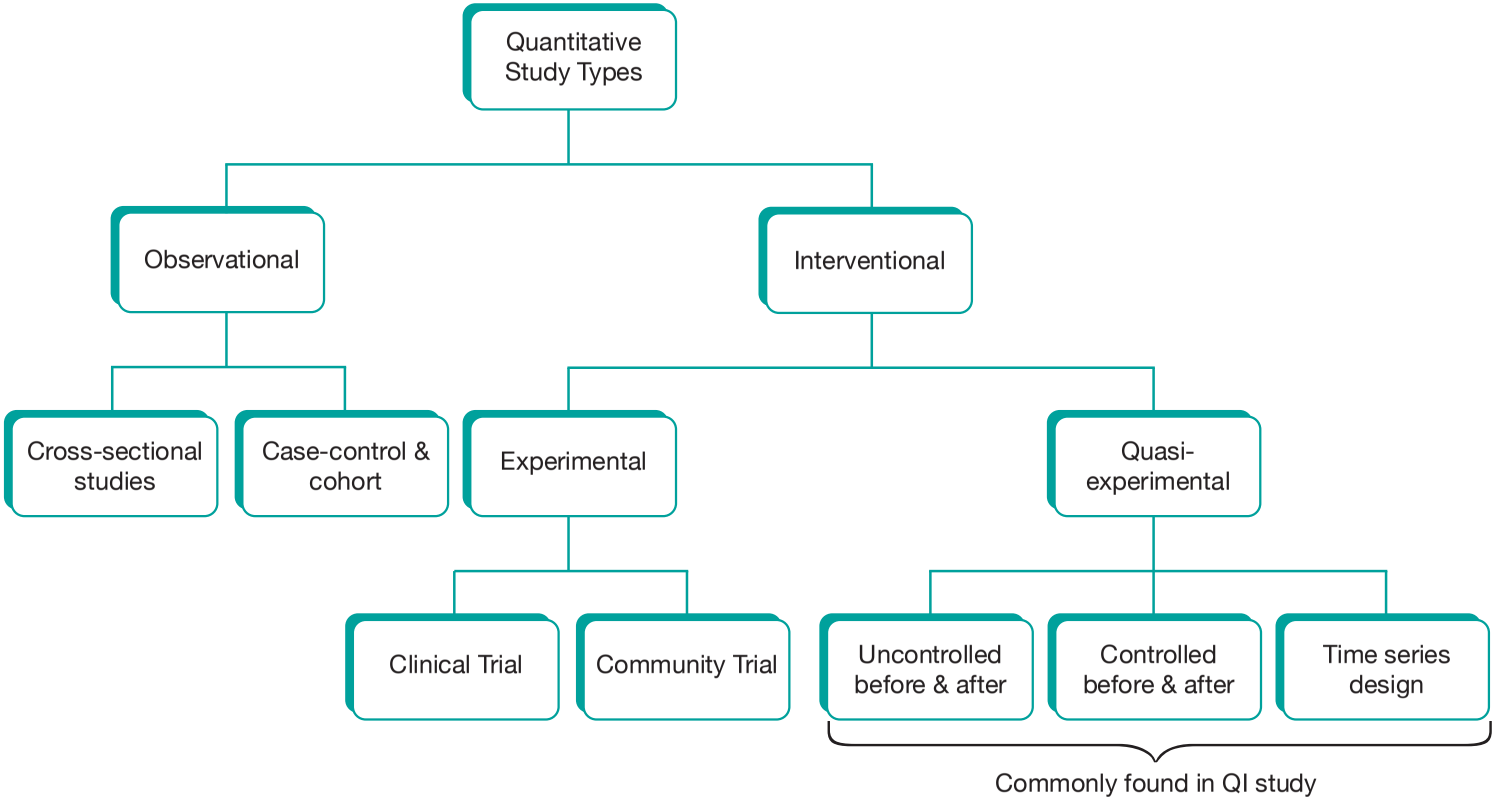


Figure 9: Schematic Overview of Quantitative Study Type[11,12]

Cross-sectional Studies

Cross-sectional study is a type of observational study where data is collected at a specific time and involves single or several variables. This type of study is conducted to give a clear picture of a particular situation, that is, to tell us The Picture Today for example prevalence of a disease or severity of a problem.

Cross-sectional Studies

In case-control studies, a group of people with a particular disease (the cases) are compared with a group of people without the disease (the controls). The purpose of the comparison is to determine whether in the past, the cases have been exposed more (or less) often to a specific factor than controls.

Cohort Studies

Cohort (or follow-up) studies are those in which people are identified and grouped with respect to whether or not they have been exposed to a specific factor. The groups are followed-up over time to determine whether the incidence of a particular disease is any greater (or less) in the exposed group than in the non-exposed group.

Interventional studies

Interventional studies may be experimental (where all 3 elements exist – randomisation, control group and interventional) or quasi-experimental (one of or both elements are missing – randomisation or control group)

Three commonly used quasi-experimental study types in QI studies are[12]:

- **Uncontrolled before and after studies**: These studies involve the measurement of the target of the QI intervention before and after the intervention in same study sites with the assumption that any differences are due to the intervention, without comparing with any control group.
- **Controlled before and after studies**: This type of study use before and after observations across control and intervention sites. This allows the comparison of rates of change in both groups over time, known as the "difference in difference" method.
- **Time series design**: Multiple points before the intervention are measured to assess any underlying trends, whereas multiple points are measured after the intervention to evaluate the effect of the intervention accounting for the underlying secular trends.

6.4.2 SAMPLING

Sampling Technique

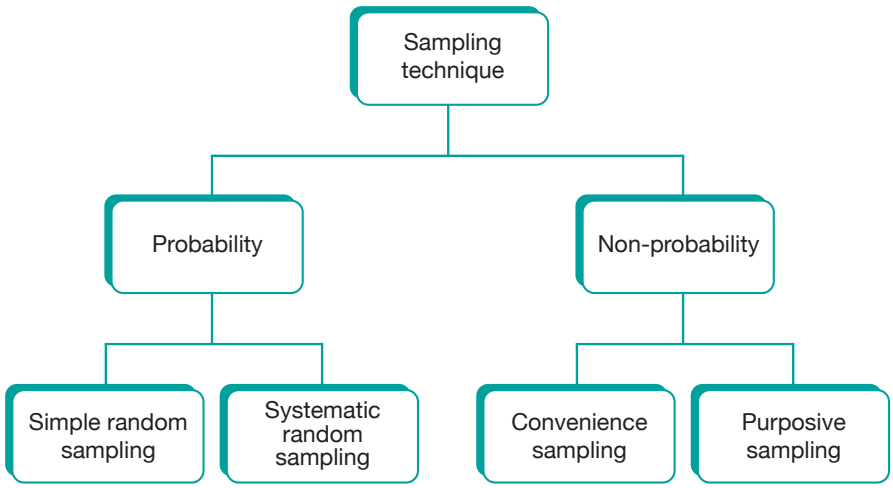


Figure 10: Schematic Overview on Different Types of Sampling Technique

Sample Size

Guideline on determining sample size:

1. Determine these 3 key items:
   a. The proportion / mean of the main variable of interest (outcome variable). Determine this from available literature or expert opinion.
   b. The power of the study (i.e. how reliable the sample size is to answer the objective). This is usually set at a minimum of 80%.
   c. The level of significance (the p value). This is usually set at 0.05
2. Impute these items to a sample size calculator e.g. Raosoft, EpiCalc 2000 etc.
3. The sample size calculated above is the minimum sample size required. You would need to increase the calculated sample size by 10-20% to ensure the minimum sample size is still achieved after drop-outs, non-response, missing records etc. This then becomes the required sample size.

This is a general guideline on calculation of sample size. In QA/QI study, it may not be always possible to achieve minimum sample size depending on feasibility and availability of resources. You may need to lower the power of the study to accept a smaller sample size.

6.4.3 DATA COLLECTION PROCESS

There are various data that need to be collected throughout different phases of the study. Data collected must be able to answer your study objectives at different phases.

6.4.3.1 Phase 1: Problem verification phase

The purpose of collecting data in this phase is to verify that the problem exists and determine severity of the problem.

Data that need to be collected in this phase is related to the indicator chosen; that is, variables for numerator and denominator of the indicator (refer Section 6.2).

Example (from Section 6.2.3 – Example 1):

Problem	Low percentage of patients receiving Enteral Nutrition Product (ENP) as prescribed by dietitian within 24 hours.
Indicator	Percentage of patients receiving ENP within 24 hours as prescribed by Dietitians
Numerator	Total number of patients who receive ENP within 24 hours
Denominator	Total number of patients prescribed for ENP by the dietitians
Standard	At least 90% based on expert consensus
Variables need to be collected	1. Number of patients prescribed with ENP by dietitian 2. Date and time of ENP prescription of each patient 3. Date and time of ENP received by patient 4. Total duration between ENP prescription started until ENP received by patient
Data collection tool	1. Patient medical record 2. Data collection sheet

If the data indicates that standard is not achieved, more data need to be collected to identify the factors contributing to the problem.

6.4.3.2 Phase 2: Determining factors contributing to the problem

The purpose of collecting data in this phase is to determine factors contributing to the problem.

Data that needs to be collected in this phase is related to the factors identified in problem analysis chart (refer Section 5.2.1 and 5.2.2). All important factors identified should be verified by collecting appropriate data. You may use Pareto Chart (refer Section 6.5.3.5) to identify the most important factor(s).

Example (based on example from 5.2.1: Figure 3 or 5.2.2: Figure 4):

Problem	Low percentage of patients receiving Enteral Nutrition Product (ENP) as prescribed by dietitian within 24 hours.		
Factors identified	Staff knowledge and awareness	Critical points in process of ENP prescription until patient received ENP	Adherence to SOP
Variables need to be collected	1. Level of awareness on SOP for ENP prescription for patients 2. Level of knowledge on importance of ENP for patients	1. Time taken to complete each step 2. Number of staff and workload in each step	1. Percentage of adherence to SOP in each case of ENP prescription
Data collection tool	1. Questionnaire 2. Audit checklist	1. Time-motion database	1. Audit form 2. Patient medical record

6.4.3.3 Phase 3: Post-remedial measures

The purpose of collecting data in this phase is to evaluate the effectiveness of remedial measures by determining magnitude of the problem after remedial measures were implemented.

Data that needs to be collected in this phase is similar to data collected in Phase 1.

Data on contributing factors (Phase 2) should also be collected to see if the factors have changed in the post-remedial phase.

If the problem was not solved, the data on factors may indicate why this has happened. You may need to look at other factors that has not been studied.

6.4.3.4 IDENTIFYING CRITERIA

Criteria in simple terms mean prerequisites or definitions. This can be applied to indicators, variables (data) or MOGC.

Inclusion criteria:
Used to define the sample eligible to be included in the study which is not in the main definition of the study.

Exclusion criteria:
Defines the features of the potential study participants who meet the inclusion criteria but present with additional characteristics that could interfere with the success of the study or increase their risk for an unfavourable outcome.

Exclusion criteria are not merely the negative of inclusion criteria. The best way to formulate exclusion criteria is by asking question: Among those who are included (according to the inclusion criteria), who should we exclude?

Example 1:
Inclusion criterion – All new admission or transfer-in patients in all medical wards
Exclusion criterion – Unstable new patients who are on ventilators
NOT an exclusion criterion – Existing patients in all medical wards

Example 2:
Inclusion criterion – Medications prescribed for new patients
Exclusion criterion – STAT medications
NOT an exclusion criterion – Medications prescribed for existing patients

6.4.3.5 VARIOUS DATA COLLECTION TECHNIQUES

In any QA/QI study, a variety of data techniques can be used for one study. For each technique you must have at least one tool.

3 major data collection techniques commonly used in QA/QI Study are explained briefly below. You may use other techniques in your study if necessary.

Techniques	Explanation	Tool
Review of recorded sources	A technique that involves retrieving information from recorded sources and documents e.g. census data, patient medical records, attendance records etc.	A checklist of all data to be collected that will answer your study objectives.
Observation	Systematic selection, watching and recording of behaviour and characteristics of living beings, objects and phenomena. For example: Observing procedures e.g CPR, LSCS, wound dressing, POP cast application etc.	i. Eye, ear or camera / audio to capture data ii. Checklist or data collection form to record data
Interview or self-administered questionnaire	An interview is a data collection technique that involves verbal questioning of respondents. A written questionnaire (also referred as self-administered questionnaire) is a data collection technique where respondents write down their answers to written questions.	i. Interview schedule / checklist ii. Questionnaire iii. Audio-recording device In designing a questionnaire, you need to consider: i. its content (set of questions that will answer your objectives) ii. the format iii. its reliability and validity Pre-test your questionnaire before using it for the study.

Remember to collect only relevant data.

6.4.3.6 MASTER SHEET AND GANTT CHART

Master sheet

Master sheet compiles all data (variables) collected in a study. Master sheet will help in providing overview of results available from a study, and provide a working base for data analysis.

Example of master sheet:

No.	Patient ID	Ward staff in charge	Dietitian in charge	Age	Gender	Type of ENP prescribed	Time taken for Step 1	Time taken for Step 2	Time taken for Step 3	Total time taken

Gantt chart

A Gantt chart helps map out the study activities, by-person and time-frame. It offers a plan for the entire QA/QI project and facilitates monitoring on progress of the study.

Example of Gantt chart for a QA/QI Project:

Time	Person in-charge	Jan 2016	Feb 2016	Mac 2016	Apr 2016	May 2016	Jun 2016	Jul 2016	Aug 2016	Sep 2016	Oct 2016	Nov 2016	Dec 2016	Jan 2017	Feb 2017	Mac 2017
Committee establishment	Person A															
Brainstorming and problem selection	All team members															
Verification study & problem analysis	Person A & B															
Remedial action implementation	All team members															
Re-evaluation (Cycle 1)	Person A & B															
Discussion and Remedial Action Cycle 2	All team members															
Re-evaluation (Cycle 2)	Person A															
Discussion/ Sharing session / Presentation	All team members															

Planned

Actual

6.5 DATA ANALYSIS AND INTERPRETATION

The purpose of analysing data is to:

- Look at rates or percentages
- Look at relationships (cause-effect)
- Derive conclusions and answer your objectives

6.5.1 Steps in planning for data analysis

1. Compile, check, label and store your data

- Compile and check for completeness or errors in data
- Label all data with unique identifiers, batch number, date etc. This will help to trace origin of data if problem arises later during data analysis.
- Store your data systematically

2. Design database for your data entry

- This could be as simple as an excel sheet.
- Test the database created with a few entries to detect problems or errors.
- Modify if necessary

3. Enter data into the database

- Train staff for data entry and do spot checks for quality of data entered.
- Ensure all data has been entered.

4. Clean the data

- Perform data cleaning after all data has been entered.
- Run frequency counts and key cross-tabulation to look for completeness of data, abnormal or illogical values or inconsistencies (e.g. male with PAP smear).

5. Plan for data interpretation

- Examine the objectives and apply relevant descriptive statistics or statistical tests that can be used to best answer your objectives.
- A dummy table developed prior to the study conducted will be helpful.
- Choose appropriate data display tools to present your key findings.

6.5.2 Dummy table

It is helpful to prepare dummy tables while designing the study. Dummy tables are blank tables that clearly show what data will be collected and how comparisons will be made. Dummy tables are very much similar to what you will expect in your result section.

Dummy tables help to:

- Ensure that the data you will collect will answer objectives of the study
- Prepares you for the result section

Example of dummy table:

Percentage of patients in Ward A-C receiving ENP within 24-hours

Ward	Number of patients	Number of patients on ENP, (N)	Number of patients receiving ENP within 24-hours, (n)	Percentage of patients receiving ENP within 24-hours (%)
Ward A				
Ward B				
Ward C				

6.5.3 Data display tools

Example of some common data display tools are as below:

6.5.3.1 Problem analysis chart (refer Section 5.2.1 and 5.2.2)

6.5.3.2 Flow chart (refer Section 5.2.3)

6.5.3.3 Pie chart

Pie charts are used to visualise the difference between several parts of a whole. Pie charts are used to show relative proportions of various items in making up the whole "pie". Pie charts can be used in place of bar charts.

Example:

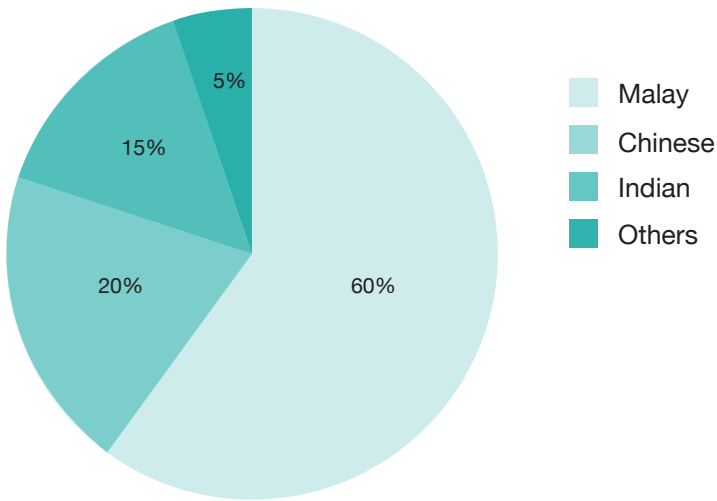


Figure 11: Pie Chart - Percentage of Outpatient Visit in Clinic A According to Ethnicity

6.5.3.4 Bar chart

Bar charts are used to compare sizes, amounts or proportions of various items or groupings of items. The data presentation can be similar to the pie chart but more variables can be presented in bar charts by using stacked or grouped bar charts.

3 types of bar charts are:

- Simple bar charts
- Grouped bar charts
- Stacked bar charts

Example:

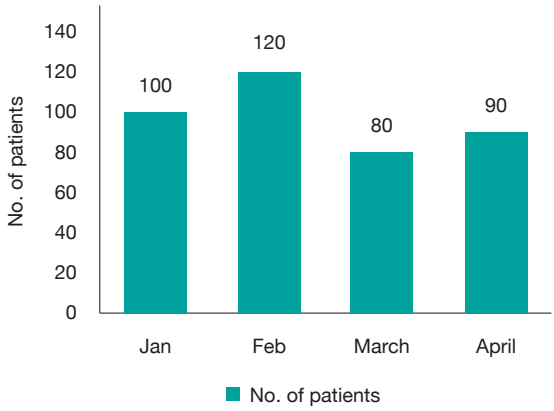


Figure 12: Simple Bar Chart – Number of Patients in Clinic A from January until April

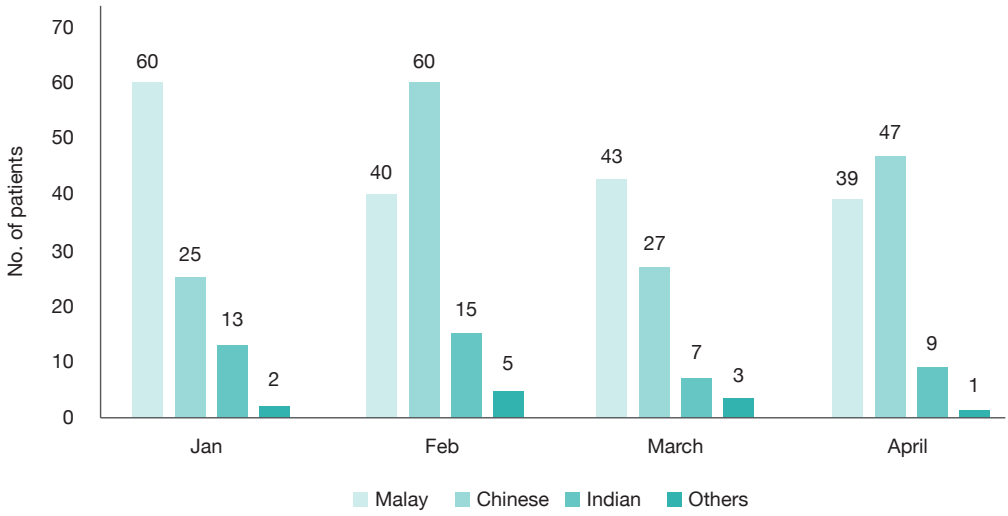


Figure 13: Grouped Bar Chart – Number of Patients According to Ethnicity in Clinic A from January until April

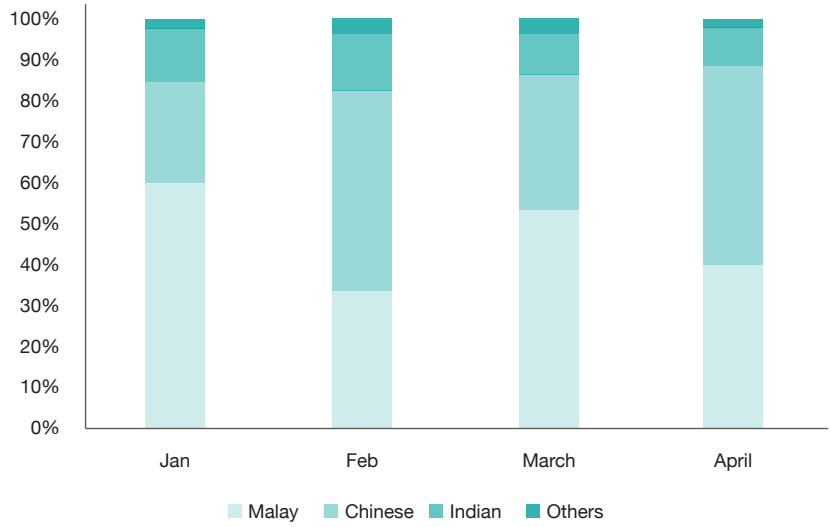


Figure 14: Stacked Bar Chart – Percentage of Patients According to Ethnicity in Clinic A from January until April

6.5.3.5 Pareto chart

Pareto chart is a special form of vertical bar chart that puts items in descending order, to show the relative importance of various problems or causes of problems. Pareto principle describes that when several factors affect a situation, a few factors will account for most of the impact.

Step by Step of Pareto Chart:

1. Determine list of causes to the problem.
2. Develop a standard measure for comparing each of the causes; e.g. frequency, cost or time
3. Collect the data in a given time frame; or use available data.
4. Tally each item based on the frequency (or cost or time). Add all amount to get total frequency of the problem. Calculate the individual and cumulative percent frequency for each of the causes.
5. List the causes in decreasing order of frequency; from the most to the least frequent.
6. List the items on the horizontal axis of a graph from highest to lowest. Label the left vertical axis as frequency, and the right vertical axis as cumulative percentage.

Pareto Principle: 80% of variation observed in everyday processes can be explained by a mere 20% of the causes of that variation.

$$\text{Individual frequency percentage} = \frac{\text{Frequency (n)}}{\text{Total frequency (N)}} \times 100$$

$$\text{Cumulative frequency percentage} = \frac{\text{Cumulative Frequency}}{\text{Total frequency (N)}} \times 100$$

Example of Pareto Chart:

Table 2: Frequency and Cumulative Frequency of Different Causes of Blood Transfusion Error (n=165)

Causes of blood transfusion error	Frequency, n	Percentage	Cumulative frequency	Cumulative Percentage
Request error	64	38.8%	64	38.8%
Wrong labelling	47	28.5%	111	67.3%
Incorrect (bedside) patient identification	22	13.3%	133	80.6%
Transcription error	15	9.1%	148	89.7%
Technical error	9	5.5%	157	95.2%
Switching sample	6	3.6%	163	98.8%
Administration	1	0.6%	164	99.4%
Issuing error	1	0.6%	165	100.0%

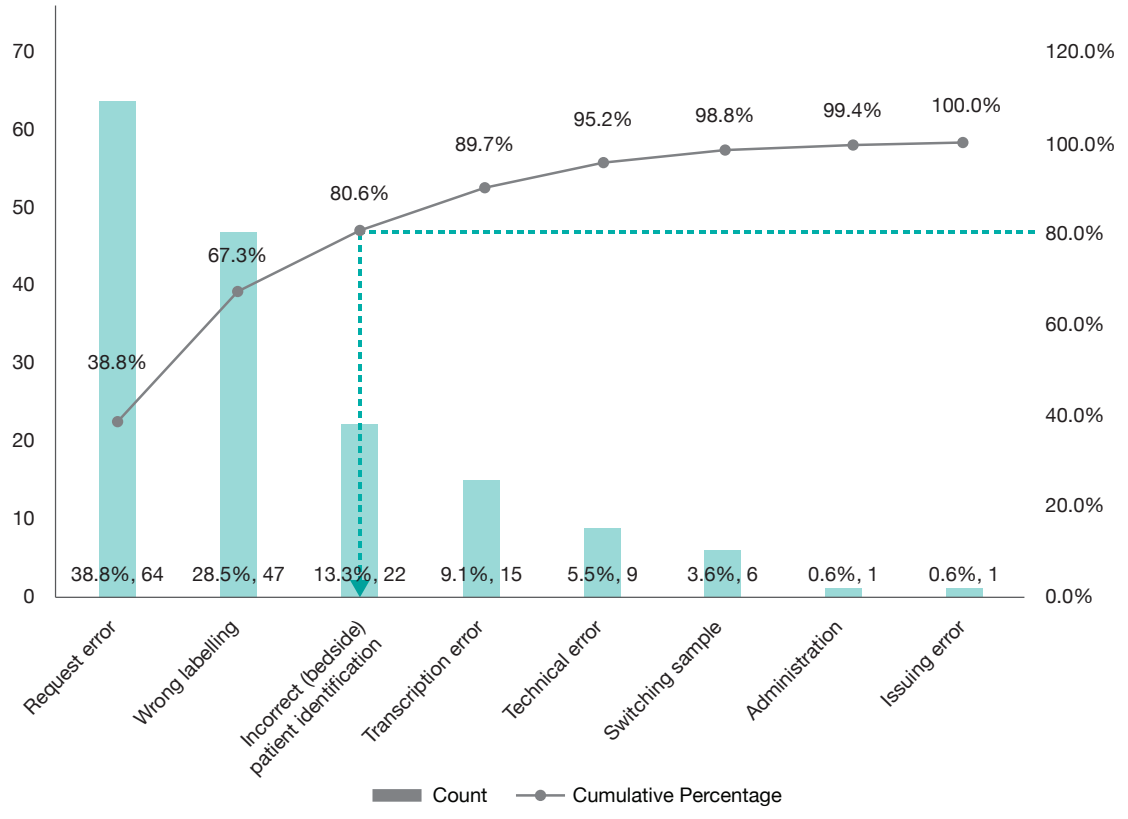


Figure 15: Pareto Chart - Causes of Blood Transfusion Errors (n=165)

From this example, it can be concluded that the first 3 factors (request error, wrong labelling and incorrect bedside patient identification) contributed to 80% of the problem. Formulation of strategies for change should focus on overcoming these 3 factors.

6.5.3.6 Histogram

A histogram displays a single variable in a bar form to indicate how often some event is likely to occur by showing the pattern of data distribution. Histograms can only be constructed by using continuous data, for example, weight, temperature, time and etc.

Example of histogram:

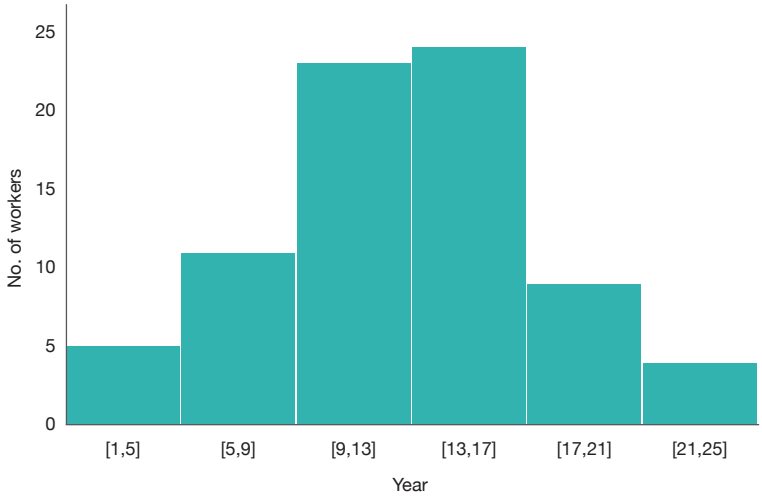


Figure 16: Histogram – Working Experience (years) of Workers in Hospital A.

6.5.3.7 Run chart

Run chart is plotting of points on a graph to show level of performance over time. A run chart gives a picture of a variation in some process over time and helps detect special causes of that variation, shows trends or other non-random variation of the process. It is useful to identify trends, analyse performance data, monitor actions taken to improve performance and predict future performance.

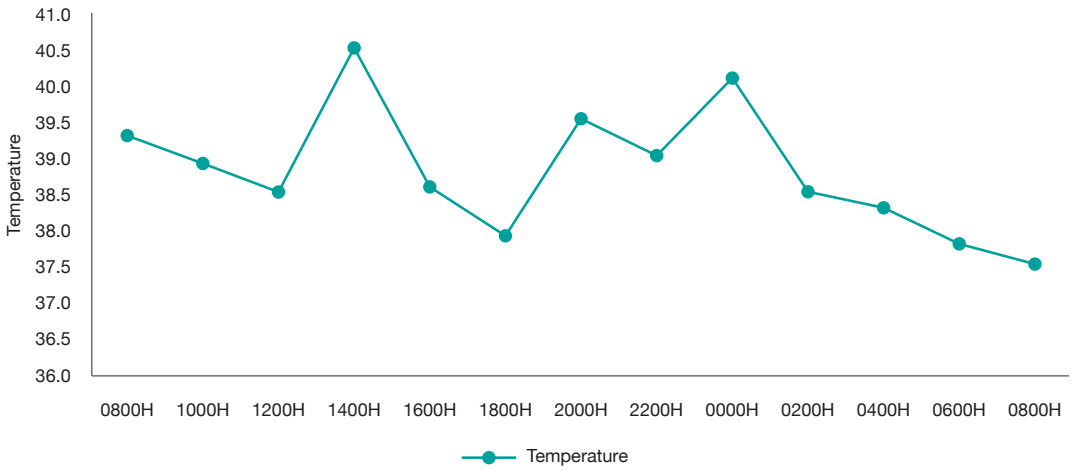
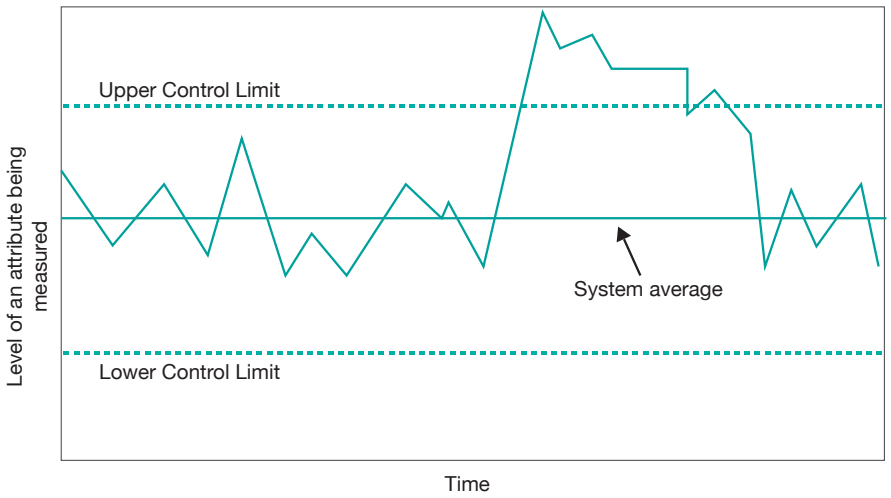


Figure 17: Run Chart – Body Temperature of Patient X in ICU Ward A

6.5.3.8 Control Chart

Control chart is basically a run chart with upper and lower control limit on either side of the averages. The limits are to state whether the process is statistically in control but not saying if the process is running at the desired level or not. The features of a control chart are as in diagram below:



Some ways to tell that a problem may be arising by using a control chart are:

- One point is more than 3 standard deviations from the mean (that is beyond the upper or lower control limit)
- 8 or more points are in a row on the same side of the mean even though they are still within the upper or lower control limit
- 6 or more points in a row are continually increasing (or decreasing)
- 8 or more points in a row alternate in direction, increasing then decreasing

EXERCISE: GATHERING INFORMATION & ANALYSIS

1. Outline a plan for data collection to:
   i. Verify that the problem exists.
   ii. Verify factors identified as contributing to the problem.

Variable (What to Collect?)	Where to Collect?	Who?	When?	How?

2. Plot a Gantt chart for your study.

3. Draw master sheet for data collection.

4. Draw dummy tables for data to be collected.

5. Review your pre-remedial results and summarise your findings.

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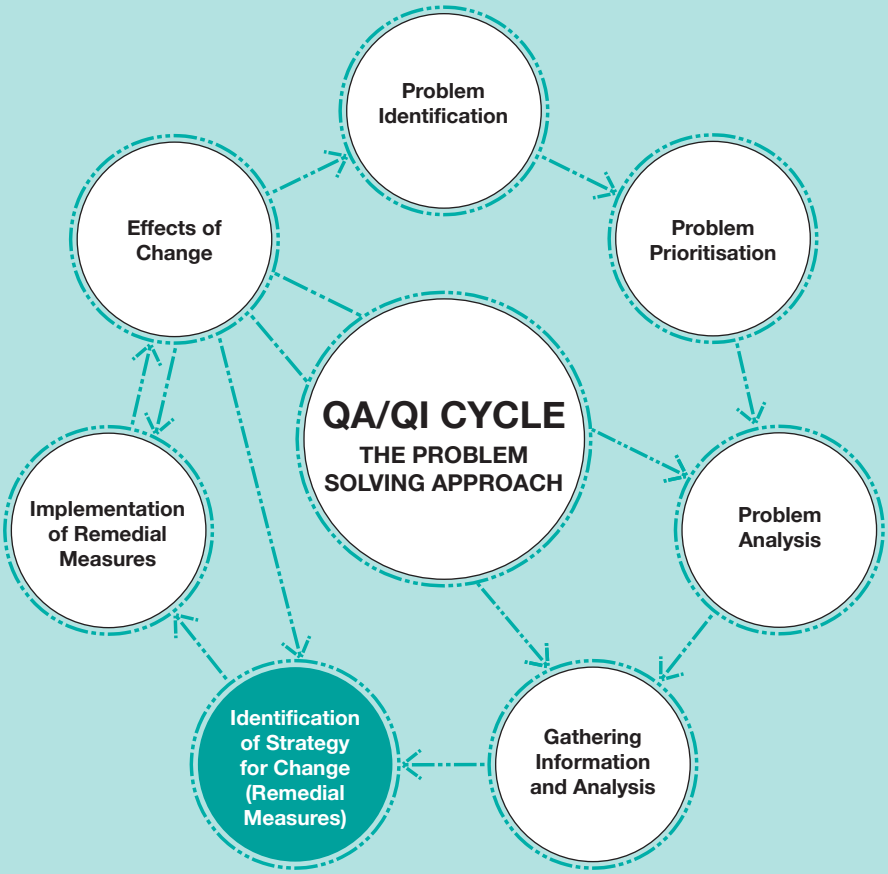
Notes

CHAPTER 7:
STRATEGY FOR CHANGE

Chapter Objectives:

- Able to formulate innovative strategy for change based on contributing factors identified.
- Able to plan and implement strategies for change / remedial measures.



" Small deeds done are better than great deeds planned. "

Peter Marshall

7.1 TIPS IN IMPLEMENTING REMEDIAL MEASURES

- Discuss QA study findings and proposed remedial measures with all those involved.
- Suggest & discuss remedial measures for each factor identified to have contributed to the problem.
- Report can be submitted to local QA Committee for interdepartmental changes / implementation.
- Simple measures can be carried out immediately.
- Go for sustainable measures.
- Advice from peers may help prevent confrontation.
- Discuss difficult ones with the proper groups. Is it feasible and will the outcome be worth the investment?
- May require co-opting people with influence and interest into the group to get effective implementation.

7.2. TYPE OF CHANGES THAT MAY BE REQUIRED

As Donabedian put it, good structure and good process will produce good outcome. In formulating changes required to make improvement, it is helpful to think along the line of improving the structure and process in order to achieve a better outcome.

Example of remedial actions related to specific problems are as follow:

STRUCTURE RELATED REMEDIAL MEASURES:

1. PEOPLE
   - Knowledge Problem
     - Organisation of in-service training
     - Improvement on orientation program
     - Feedback session on past results
     - Provision of references, guidelines, manuals, protocols, or written policies
   - Attitude or Behaviour Problems
     - Counselling (formal and informal)
     - Performance feedback on past results
     - Rewards and sanctions
     - Reassignment of duties
     - Supervision
     - Transfer or dismissal
   - Lack of manpower problem
     - Reassignment / rescheduling of duties
     - Empowerment of underutilised personnel

2. EQUIPMENT AND BUDGET
   - This is rarely within the scope of QA/QI study. However, data and evidence gathered from the study can be used to justify the need for extra budget allocation or new equipment

When recommending remedial actions:

- **Do not imply that any party is negligent**
- **Do not be punitive**
- **Be practical and realistic**
- **Be sustainable**
- **Be cost-effective**
- **Provide some flexibility**

PROCESS RELATED REMEDIAL MEASURES:

1. Improving communication channels, policies and procedures
2. Focus on critical steps, remove unnecessary / redundant process
3. Identification of suboptimal process and removing wastages
4. Technological advancement
5. Changes in physical environment
6. More often than not the system is usually at fault rather than the individual. A change in the system may also change the attitude.

EXERCISE: STRATEGY FOR CHANGE

1. Based on findings from problem analysis, plan strategy for change (remedial measures).

Study findings	What needs to change	How	Who	When

2. Note other findings that you may have discovered during data collection / analysis phase.

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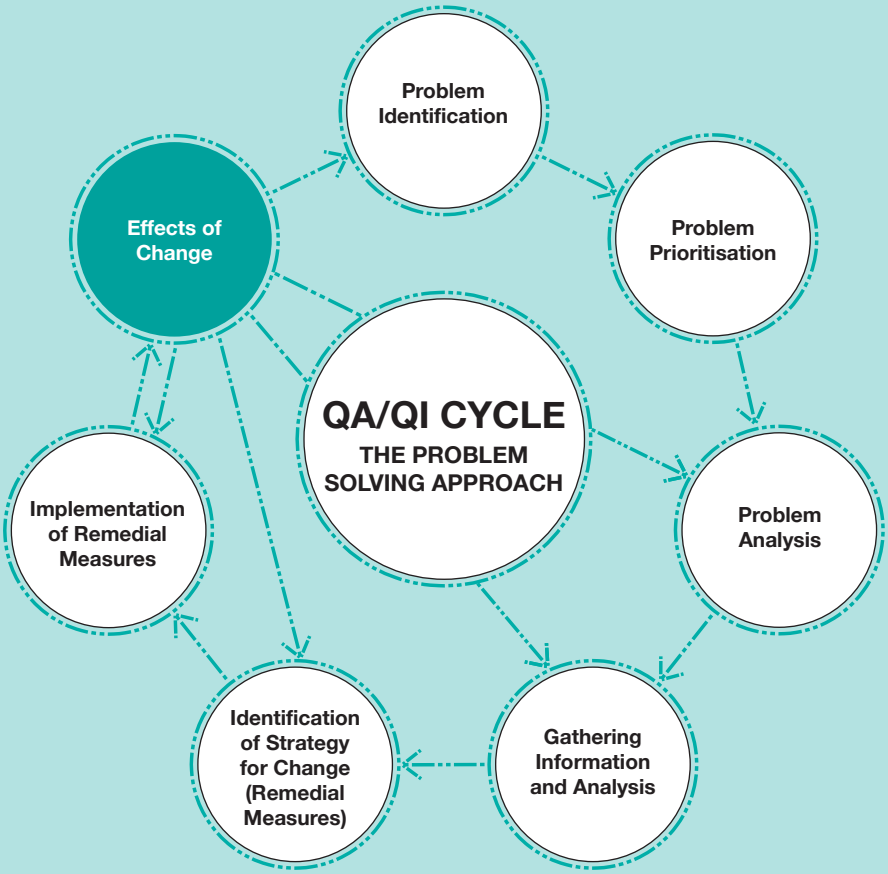
CHAPTER 8:
EFFECTS OF CHANGE

Chapter Objectives:

- Able to ensure remedial measures are carried out
- Able to plan data collection for re-evaluation of the problem
- Able to plan monitoring process



8.1 EVALUATING THE EFFECTS OF CHANGE

WHY EVALUATE?

- To evaluate the effectiveness of the remedial measures carried out.
- To assess the progress of the implemented remedial measures.
- To provide evidence to further modify or improve the remedial measures if necessary.

WHAT DO WE WANT TO EVALUATE?

- The effect of changes on contributing factors
- The success of remedial measures implementation in solving the problem

Prior to evaluating changes that has taken place, it is important to monitor the changes by keeping a record / checklist of changes that has been done.

It is important to make a comparison of different variables between pre-remedial and post-remedial phase. It is helpful to put the result side by side to see the effect of changes.

Example:

Factor addressed	Strategy	When strategy was performed	Pre-remedial result	Post remedial result
Factor 1				
Factor 2				
Factor 3				

It is also important to see the effect of changes on ABNA.

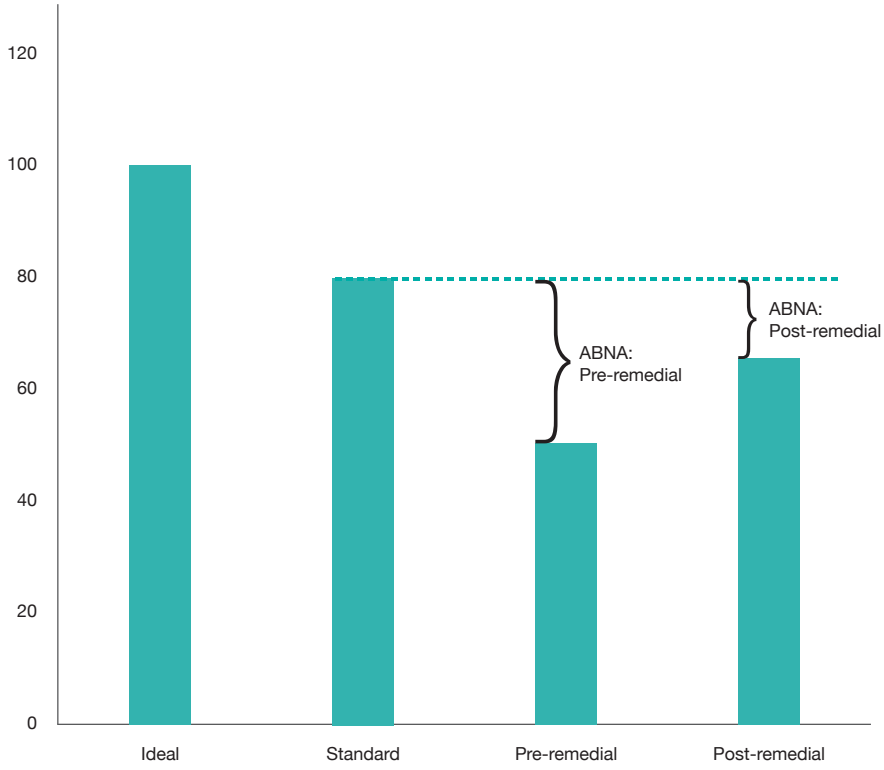


Figure 18: Effect of Changes on ABNA

The effect of changes can be summarised as:

> The ABNA has reduced from X% *(pre-remedial value)* to Y% *(post-remedial value)*.

8.2 LESSONS LEARNT & THE NEXT STEP

Reflect on the lessons you learnt from the project, its limitations and the next step:

- What are the strengths of the project?
- What are your project's limitations?
- If you were to repeat the study, what will you do differently?
- How will you take this project forward?

8.3 CONCLUSION

The Objective – Conclusion Relationship
The conclusion must answer all the specific objectives.

Example:

No.	Objective	Conclusion
1.	To verify the percentage of patients who do not receive ENP within 24 hours of dietitians' prescription.	Pre-remedial data showed that 40.7% patients did not receive ENP within 24 hours of dietitian prescription.
2.	To identify the contributing factors to low percentage of patients receiving ENP within 24 hours of dietitians' prescription.	The main contributing factor to this problem is ENP not served to patients after collected from dietetic department. Other factors include delay in ordering ENP in system, no clear SOP in ward and poor awareness among staffs on the importance of timely serving of ENP to patients.
3.	To formulate and implement proper remedial action.	Strategies formulated include introduction of dietetic chart in patients' record, display of diet board, establishment of ENP SOP in ward and continuous training to staff.
4.	To evaluate the effectiveness of remedial action.	Post-remedial, percentage of patients receiving ENP within 24 hours increased from 40.9% to 97.1%.

EXERCISE: EFFECTS OF CHANGE

1. Review your study objectives and answer them using study findings.

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CHAPTER 9:
PRESENTING A QA/QI PROPOSAL

Chapter Objective:

- Able to present a proposal to improve quality

SECTION	EXPLANATION
Selection of opportunities for improvement	• What is the quality problem? • Brief description of context (Description of the physical work process, etc. where relevant, to introduce the project) • Why is the problem chosen? • What are you trying to accomplish? (Study objective)
Literature review	• Any evidence to support that the above problem exist • Summarise the findings from the other studies • Justify why the study needs to be done
Key measures for improvement	• What would constitute improvement? • How did you measure/assess the opportunity for improvement? (How did you measure/assess the problem?) • Evidence to support choice of the measures
Process of gathering information	Methods and tools used to collect data to assess the problem. Include here: • Timeline of the study • Study type • Sampling techniques • Inclusion / Exclusion criteria • Definitions • Data collection tool & technique
Appendices	This section should include: • Flowchart of process of care • Model of good care table • Problem analysis chart or Ishikawa chart • Data collection tool / formats (including questionnaire, checklist)

CHAPTER 10:
WRITING A QA/QI REPORT

Chapter Objective:

- Able to write a QA/QI report based on appropriate format

Following the completion of a study, a report should be prepared. The format below is recommended in general. An example of a write-up is as in Appendix 4.

Section	Explanation	Related Chapter(s)
Cover page	Should include: • Title • Names of authors and affiliation	None
Abstract	Your abstract should follow the sub-headings of the report / write-up: • Selection of opportunities for improvement • Key measures for improvement • Process of gathering information • Analysis and interpretation • Strategy for change • Effect of change • The Next Step • Value added features (for NIA projects only)	Chapter 10
Selection of opportunities for improvement	• What is the quality problem? • Why is the problem chosen? • Brief description of context (Description of the physical work process, possible factors etc. where relevant, to introduce the project) • What are you trying to accomplish? (Study objective)	Chapter 3 Chapter 4 Chapter 6.1
Process of gathering information	• What would constitute improvement? • How did you measure/assess the opportunity for improvement? (How did you measure/assess the problem?) • Evidence to support choice of the measures	Chapter 6.2
Key measures for improvement	Methods and tools used to collect data to assess the problem. Include here: • Timeline of the study • Study type • Sampling techniques • Inclusion / Exclusion criteria • Definitions • Data collection tool & technique	Chapter 6.4
Analysis & interpretation	• What are the perceived factors that could contribute to the problem? • What were the results? • What did the results tell you of the problem?	Chapter 6.5

Section	Explanation	Related Chapter(s)
Strategy for change	• What actual changes and/or innovation were made? • How were these changes and/or innovation implemented? • Who was or were involved in the change and/or innovation process?	Chapter 7
Effects of change	• How did the changes and/or innovation lead to improvement? • How did you know that improvement had taken place? • What have you achieved? • What have you learned?	Chapter 8
The Next Step	• How will you take this forward?	Chapter 8
Value added features	• This is applicable for NIA-related projects only • Specific creativities and innovations in data collection, analysis and strategies for change	None
Appendices	Should include relevant diagrams or figure such as: • Problem analysis chart or Ishikawa diagram • Gantt chart • Forms used in data collection • New formats • Relevant circular • Sample data • Pictures, if necessary	None

Another format is used for publication submission purpose. Submission of manuscript of QA/QI Project to be considered for publication in Q bulletin should follow this format:

Guideline for Authors – Q Bulletin	
Subheading	**Description**
Title	Indicate that the article concerns an initiative to improve healthcare.
Abstract	This is a summary of your work and is the most important section to attract a reader's attention. Please ensure you include: a) A brief background to the problem, b) The method for your quality improvement project, c) The overall results and d) The conclusion Keep it succinct and factual. Please include 3 – 5 appropriate keywords for your manuscript.
Problem	Summarise your problem and the focus of your project. Give some details about your local context including; a) The type of organisation you work in, b) The size of your organisation, c) Details about the staff members who work there and d) Perhaps a little bit about your local patient population. Include here the SMART aim of your project (for example; the aim was to reduce medication errors from 15% to 5% across six elderly care wards in three months).
Background	This section gives the reader background information about the problem and provides up-to-date, research and knowledge from the literature. Summarise the literature you have found on the background to your problem here. a) What existing evidence is there that this problem exists? b) What existing evidence is there on the factors contributing to the problem? c) What evidence is there that other people have tried to solve this problem in the past? d) Is there any evidence for what works and what doesn't to solve your problem?
Measurement	Describe which measures you selected for studying processes and the outcomes of the intervention(s), including: a) Rationale for choosing them, b) Their operational definitions, c) Inclusion and exclusion criteria, d) The standard and how you determine it Describe how you planned to collect this data throughout your project and how frequently. Include here the results of your baseline measurement (verification study).

Subheading	Description
Initial assessment of the problem	Describe what processes are involved in your problem including the critical steps in the processes that will contribute to the achievement of your final goal. Describe on the perceived factors that could contribute to the problem and how you quantify them. Include here the results of the study that you conducted to identify the contributing factors to the problem.
Strategy	In this section you should explain your strategy for improvement to the reader and discuss how you implemented your improvement cycles. In most cases you will have tried a number of progressive improvement cycles, some of which will not have been successful. It is important that you also share these to help others avoid similar difficulties. Remember that data should be collected continuously throughout your project. This is a difficult section to document and will contain a lot of information. For each PDSA cycle you should describe your aim, your change hypothesis and strategy for change. a) Describe how you implemented the change and the data you collected. b) Describe your key learning from each cycle of change, and discuss how this learning impacted on your change process. c) How well did your predictions of what change was needed match your outcomes? d) What worked more effectively than anticipated and what had less effect than predicted?
Results	Provide a summary of your results using appropriate chart or diagram. a) Describe the variation in your data. b) Were the interventions you made responsible for any improvements? c) Describe how contextual elements interacted with the intervention(s) and affected your results. d) Compare your results to your baseline measurement. Comment on how you assessed whether the data was complete and accurate- was there any missing data? Please comment on whether there were any unintended consequences such as unexpected benefits, problems, failures or costs associated with the intervention(s).

Subheading	Description
Lessons and Limitations	In this section, discuss the lessons you learnt from the project and its limitations. Comment on the strengths of the project. Describe any problems you faced and how you navigated these. If you were to undertake this project again, what would you do differently? Reflect on your project's limitations. For example, did you realise as the project was implemented that your results would be affected by unforeseen factors such as a small sample size or the turnaround of patients or staff? Comment on the limits of generalisability. Describe whether chance, bias, or confounding have affected your results and whether there was any imprecision in the design or analysis of the project. Are more data points required? Were efforts made to minimize/adjust for any limitations? Although we accept publications using different improvement approaches, we would expect you to have modified your intervention as it was implemented and undergone a process of continuous improvement, measurement and learning. If your project does not fit with this approach then we would like to see reflections and learning here about how you could have incorporated continuous improvement and measurement approaches in your project.
Conclusion and the next steps	You should reflect on your background research, noting what is already known on this topic and what your project adds. You should refer back to your aims statement – did your project achieve its aims? Did you adjust your aims as you went along? Was it a useful project? Were your measures appropriate and did you use balancing measures? Think about what your senior sponsor would like to see as an output of your work and what can help others to make the case for undertaking a similar piece of work – or for doing something differently if your project was not successful. Please describe your cost analysis here, were there any financial savings that your project made? Being able to demonstrate that your intervention delivered savings really helps to add value. Give an assessment of whether you think your project is sustainable – do you have enough data? What have you done to try to ensure that your work continues? Comment on how you would spread your project and whether it could be replicated elsewhere. Discuss what your next steps will be and whether further study in the field is required. The point of the conclusion is not to rewrite the whole project, but to give an overview of how the whole project was conducted, what it achieved, and some personal reflections.

Subheading	Description
References	In this section you should record any references to published material that you refer to elsewhere in your project. This is particularly likely to include material from background reading or from your conclusions. Use the Vancouver style for referencing.
Acknowledgements	Please include here the names of anyone who is not on the author list but whose input you wish to acknowledge.
Conflict of Interest	Please declare any conflict of interest, if any.
Funding	Please declare any source of funding, if any.

Notes

CHAPTER 11: PRESENTING A QA/QI PROJECT

Chapter Objective:

- To assist in the preparation of the oral or poster presentation of the project.

11.1 Oral Presentation

Section	Explanation	No of slide(s) recommended (total of 25 slides)
Title & Authors	• Read title. • Do not read author's names, affiliation etc.	1
Introduction	Outline the reason why the problem is important. (Why you did this QA/QI study?)	1
Content	1. Selection of opportunities for improvement (Outline of Problem): • What is the quality problem? • Brief description of context (Description of the physical work process, etc. where relevant, to introduce the project) • Why is this problem chosen? • What are you trying to accomplish? (Study objective) • Problem statement • Background (evidence from literature review to support)	2-3
	2. Key Measures • What would constitute improvement? • How did you measure/assess the problem? • Evidence to support choice of the measures	1-2
	3. Process of gathering information • Methods and tools used to assess the problem	3-4
	4. Analysis and interpretation • What are the perceived factors that could contribute to the existence of this problem? • What were the results? • What did the results tell you of the problem?	3-4
	5. Strategy for change • What actual changes and/or innovation were made? • How were these changes and/or innovation implemented? • Who was or were involved in the change and/or innovation process?	2-3

Section	Explanation	No of slide(s) recommended (total of 25 slides)
	6. Effects of change • How did the changes and/or innovation lead to improvement? • How did you know that improvement had taken place? • What have you achieved? • What have you learned?	3-4
	7. The next step • How will you take this forward?	1
	8. Value added features (only for NIA project) • Specific creativities and innovations in data collection, analysis and strategies for change	1-2
References	• Listed but not read out.	1
Acknowledgement	• Listed but not read out.	1

SECTION	TIPS
Slides	• Slides should be self-explanatory, easily understood, appropriate graphic, colour scheme and font size, smooth and logical flow of presentation etc. Construct all slides in "landscape" orientation. • It is advisable to construct slides in your presentation with black text (and • black illustrations) on a white background. Adjust font size so that that approximately 10 words fit horizontally (24 • point is usually a good size), and line spacing so that only 10 lines would fit per slide. • Use appropriate graph design to show your findings • Your audience will read 100% of the text on a slide, so delete any text that is not essential. • Use italics instead of underlining. • Avoid using strings of all capital letters in slide titles (and elsewhere). • Do not include repeated banners, logos, or backgrounds on your slides. They are often pretentious, always distracting. • Do not use transition fades, bouncing text, or swooshing noises
Presentation	• Clarity and ability of the presenter to demonstrate good understanding about the project (including the ability to respond to questions posed by the judges). • Test your presentation in the room where you will give the presentation • When verbally referring to a specific portion of a slide, use a pointer to orient the audience. • If you must use a laser pointer, do not blind people by directing the beam in their eyes. • Do not put your hands in your pockets. • Do not draw more attention to bad slides by apologizing for them. • Minimise your use of the crutches, "OK," "like," "um,""er," "sort of," "you know," and "kind of." • Adjust your speed. Attempt a response to all questions even when you think there is an audience member who might be able to field it better than you.

11.2 Poster Presentation

SECTION	TIPS
Content	Please refer Appendix 1
General	• Understand the objectives of the presentation. • Know your subject well as to be able to answer questions when asked. • Ensure the size of poster and technical requirement follow guideline given by the organiser. • Posters with 500-800 words or less are ideal. • Select appropriate font style for title, headings and body text that is easy to read. Avoid using dark backgrounds. • Use italics instead of underlining your word as it will draw more attention to the word. • Select colour for poster diligently. As a general rule, limit your choice to 3 colours only per poster. • Use a larger font size for headers, with a simple "bolded" format to demarcate sections. • Make sure all font sizes are readable within 6-feet distance. • Try to keep 40% of the poster area empty of text and images, that is, the poster is not too cramped. This allows the readers to "breathe" in between sections and helps to maintain readers' focus. • The poster must be self-explanatory.
Title	• The title should be at the top centre, the key position. • Use the largest text and usually in a bold font. • Use smaller fonts for authors and affiliations.
Graphic	• Label all graphics. • Never display two-dimensional data in 3-D as it tends to obscure true difference among bar heights. • Make sure that details on graphs and photographs can be comfortably viewed from 6 feet away. Axes labels, figure legends, and numbers on axes are not exempted from font-size guidelines. • Use a high-quality image to avoid blurred images on printed poster. • Add a thin gray or black border (but not overly thick line) to a photograph to make it more visually appealing.
Printing	• Determine the type of poster paper that you want to use. • Ensure you have size and dimension right. • Plan when to print and allow sufficient time for printing to ensure your poster is ready on time.
References	• List references used at the end of the poster. You may use smaller font for references.
Acknowledgement	• State acknowledgement at the end of the poster. You may use smaller font for acknowledgement.

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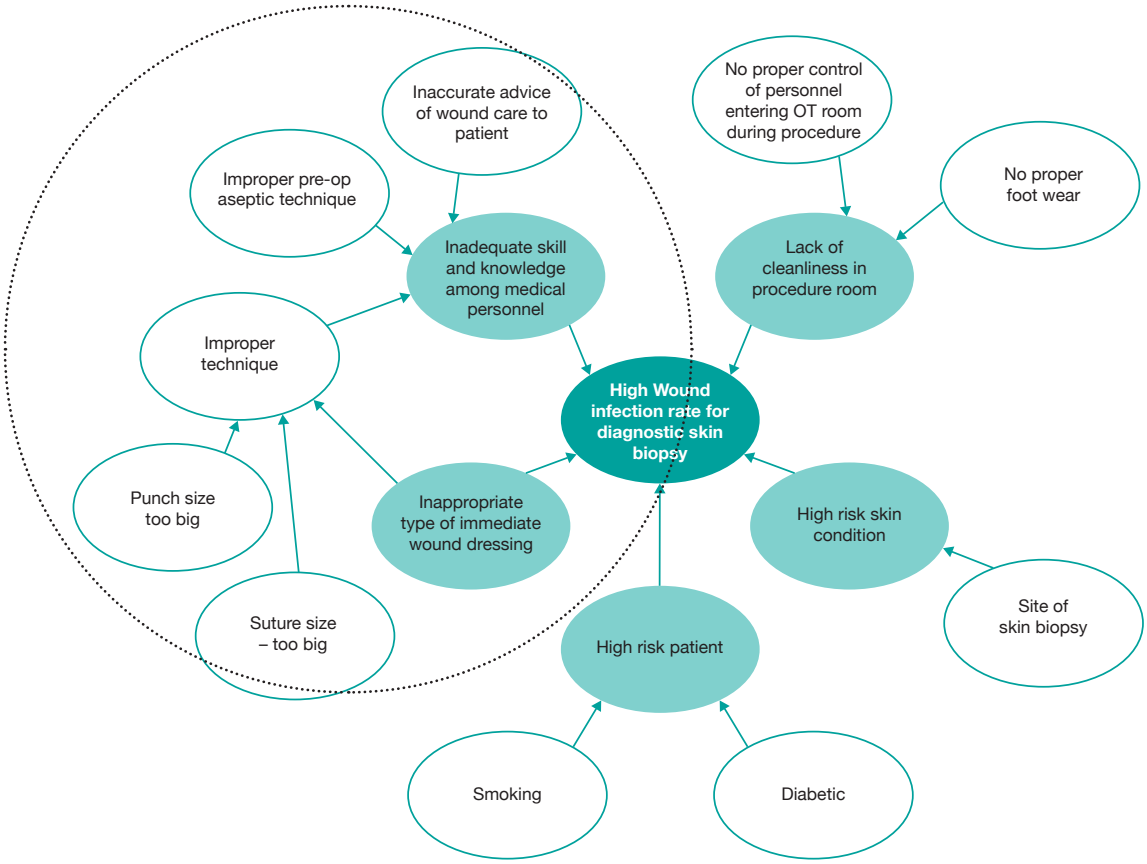
Appendix 1: Suggested Answer for Exercises

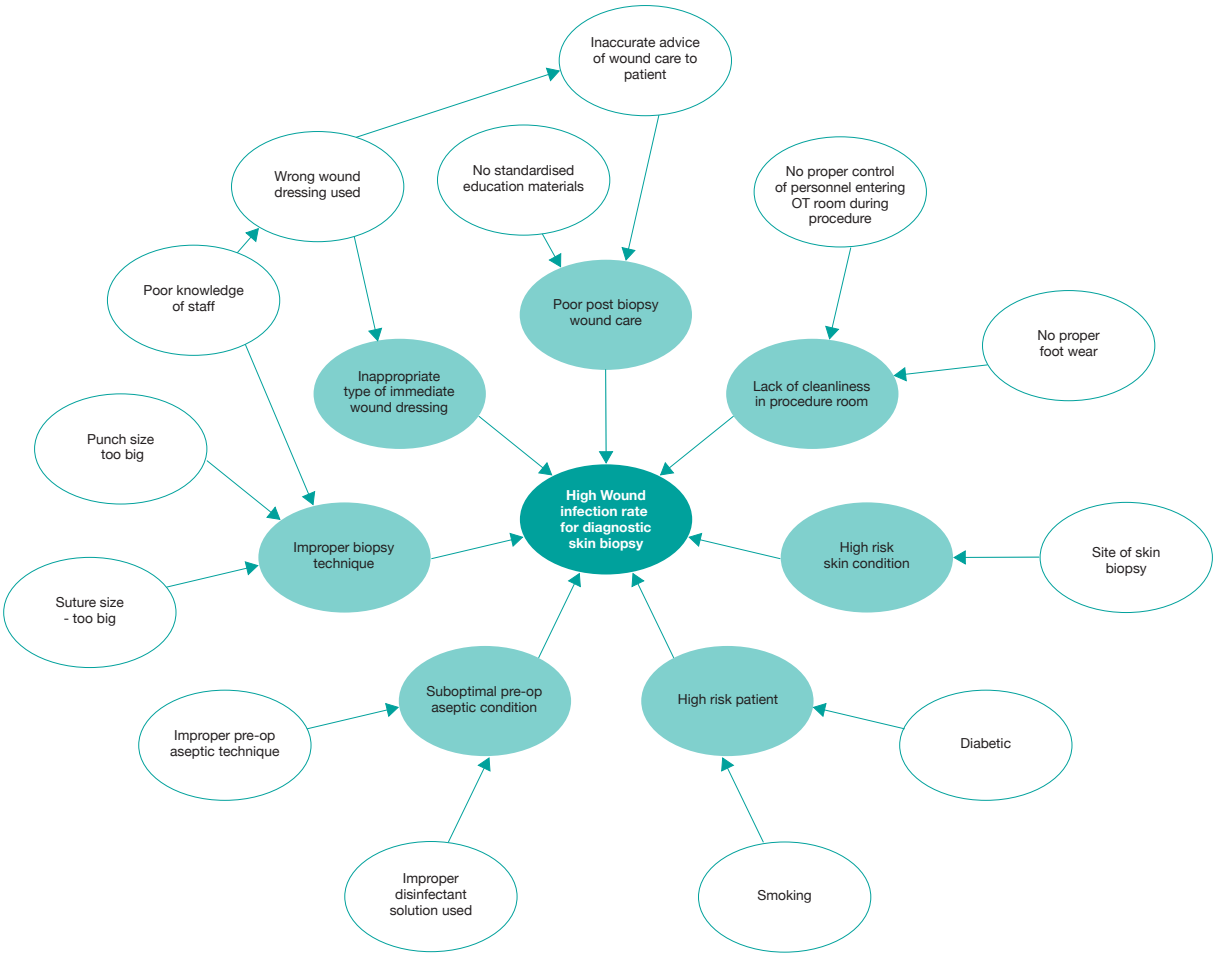
5.2.5 Exercise 1



The circled area is incorrect because:

i. Wrong direction between "inadequate skill and knowledge…" and "inaccurate advice…" and "improper pre-op aseptic…".
ii. "Inadequate skill and knowledge…" should be 2nd generation bubble instead of 1st generation bubble.
iii. Factor in 1st generation bubble should not cause factor in 2nd generation bubble.

Suggested revised PAC is as below:



5.2.5 Exercise 2:

If factors are arranged according to group, Ishikawa diagram should be used instead of PAC. Refer Section 5.2.2 for example of Ishikawa diagram.

Appendix 2: Judging Criteria Used in MOH National QA Convention (Oral & Poster)

No.	Elemen yang dihakimi ***Elements to be judged***	Panduan pembahagian markah ***Guide to mark allocation***	Markah ***Marks*** *(HSA/DSA)*	Markah ***Marks*** *(NIA)*
A. ELEMEN BAGI ISI KANDUNGAN TEKNIKAL *ELEMENTS OF TECHNICAL CONTENTS (80 marks)*				
1.	Pemilihan Peluang untuk Penambahbaikan (Masalah yang digariskan) *Selection of opportunities for improvement (Outline of Problem)*	Apakah peluang penambahbaikan? (Apakah masalah kualiti itu?) *What are the opportunities for improvement? (What is the quality problem?)*	5	5
		Penerangan ringkas konteks kajian (Penerangan proses kerja dsb, yang mana berkenaan bagi memperkenalkan projek) *Brief description of context (Description of the physical work process, etc. where relevant, to introduce the project)*		
		Mengapa peluang penambahbaikan itu dipilih? (Mengapa masalah itu dipilih?) *Why is this opportunity for improvement chosen? (Why is this problem chosen?)*		
		Apakah yang cuba dicapai? *What are you trying to accomplish?*		
2.	Pengukuran Utama Penambahbaikan *Key Measures for improvement*	Apakah yang terkandung dalam penambahbaikan? *What would constitute improvement?*	5	0
		Bagaimana anda mengukur/menilai peluang penambahbaikan? (Bagaimana anda mengukur/menilai masalah?) *How did you measure/assess the opportunity for improvement? (How did you measure/assess the problem?)*		
		Bukti-bukti bagi menyokong pemilihan pengukuran utama *Evidence to support choice of the measures*		

No.	Elemen yang dihakimi ***Elements to be judged***	Panduan pembahagian markah ***Guide to mark allocation***	Markah ***Marks*** *(HSA/DSA)*	Markah ***Marks*** *(NIA)*
3.	Proses pengumpulan maklumat *Process of gathering information*	Kaedah dan alat yang digunakan untuk mengukur peluang penambahbaikan (Kaedah dan alat yang digunakan untuk menilai masalah) *Methods and tools used to assess the opportunity for improvement* *(Methods and tools used to assess the problem)*	15	15
4.	Analisis dan Interpretasi *Analysis and interpretation*	Apakah faktor-faktor yang dianggap dapat menyumbang kepada peluang penambahbaikan? (Apakah faktor-faktor yang dianggap mungkin boleh menyumbang kepada wujudnya masalah ini?) *What are the perceived factors that could contribute to opportunity for improvement?* *(What are the perceived factors that might have contributed to the existence of this problem?)*	15	15
		Apakah keputusannya? *What were the results?*		
		Apakah yang ditunjukkan oleh keputusan berkenaan peluang penambahbaikan? (Apakah yang ditunjukkan oleh keputusan berkenaan masalah?) *What did the results tell you of the opportunity for improvement?* *(What did the results tell you of the problem?)*		

No.	Elemen yang dihakimi ***Elements to be judged***	Panduan pembahagian markah ***Guide to mark allocation***	Markah ***Marks*** *(HSA/DSA)*	Markah ***Marks*** *(NIA)*
5.	Strategi penambahbaikan *Strategy for change*	Apakah perubahan sebenar dan/ atau inovasi yang diadakan? *What actual changes and/or innovation were made?*	16	16
		Bagaimanakah perubahan dan/atau inovasi diadakan? *How were these changes and/or innovation implemented?*		
		Siapakah yang terlibat dalam perubahan dan/atau proses inovasi tersebut? *Who was or were involved in the change and/or innovation process?*		
6.	Kesan Penambahbaikan *Effects of change*	Bagaimana perubahan dan/atau inovasi tersebut membawa ke arah penambahbaikan, termasuk penjimatan kos? *How did the changes and/or innovation lead to improvement, including cost saving?*	17	17
		Bagaimana anda tahu bahawa penambahbaikan telah berlaku? *How did you know that improvement had taken place?*		
		Apakah yang telah anda capai? *What have you achieved?*		
		Apakah yang telah anda pelajari? *What have you learned?*		
7.	Langkah seterusnya *The next step*	Bagaimana anda akan membawa projek ini ke depan? *How will you take this forward?*	7	7
8.	Ciri-ciri bagi nilai tambahan (bagi projek NIA) *Value added features (only for NIA project)*	Kreativiti dan invasi spesifik dalam pengumpulan data, analisis dan strategi untuk perubahan *Specific creativities and innovations in data collection, analysis and strategies for change*	0	5
JUMLAH MARKAH BAGI ISI KANDUNGAN TEKNIKAL ***TOTAL MARKS FOR TECHNICAL CONTENT***			**80**	**80**

No.	Elemen yang dihakimi ***Elements to be judged***	Panduan pembahagian markah ***Guide to mark allocation***	Markah ***Marks*** *(HSA/DSA)*	Markah ***Marks*** *(NIA)*
B. TEKNIK PEMBENTANGAN ***PRESENTATION TECHNIQUE (20 marks)***				
1.	Slaid/Poster *Slides/Poster*	Boleh difahami dengan sendiri, grafik, skim warna, saiz huruf yang sesuai dan aliran pembentangan yang teratur dan logik. *Self-explanatory, easily understood, appropriateness of graphic colour scheme and font size, smooth and logical flow of presentation etc.*	15	15
2.	Pembentangan *Presentation*	Pembentangan yang jelas dan keupayaan pembentang dalam menunjukkan tahap pemahaman yang bagus tentang projek. (termasuk keupayaan menjawab soalan yang dikemukan oleh hakim-hakim). *Clarity and ability of the presenter to demonstrate good understanding about the project (including the ability to respond to questions posed by the judges)*	5	15
JUMLAH MARKAH BAGI TEKNIK PEMBENTANGAN ***TOTAL MARKS FOR PRESENTATION TECHNIQUE***			**20**	**20**

Appendix 3: Example of An Abstract Using QIR Format

Improving Percentage of Patients Receiving Enteral Nutrition Product Within 24 Hours of Dietitian Prescription in Selected Wards of Hospital Serdang

Category of study: Hospital Specific Approach

Irne J[1], Siah PJ[1], Siti Zafirah MR[1], Nurliyana N[2], Halimatun Saadiah S[1], Roslinda MS[1], Normawati AW[1], Fatimah S[1]
[1] Serdang Hospital, Selangor, Malaysia
[2] University of Putra Malaysia, Selangor, Malaysia

SELECTION OF OPPORTUNITIES FOR IMPROVEMENT:
Dietitians prescribe Enteral Nutrition Product (ENP) to ensure critically ill patients receive sufficient nutrient intake and reduce disease complications, mortality and length of hospital stay. Verification study showed only 59.3% of patients received ENP within 24 hours of dietitian prescriptions. Delay in initiating ENP will lead to poor nutritional status and worsening clinical outcome.

KEY MEASURES FOR IMPROVEMENT:
The key indicator for improvement was measured using the percentage of patients receiving ENP within 24 hours of dietitian's prescription. The standard is 90% based on consensus in Dietetic Clinical Meeting.

PROCESS OF GATHERING INFORMATION:
A cross-sectional study was conducted using universal sampling in three selected wards with 140 subjects in two consecutive phases. Data to identify contributing factors was collected by using an audit form of patients who meet the inclusion criteria.

ANALYSIS AND INTERPRETATION:
Pre-remedial study showed 40.7% patients did not receive ENP within 24 hours of dietitian prescription. The causes included the product not being served to patients (27.3%), ENP not indented (9.3%), product not collected from dietetic department (2.1%), indent not being processed (1.4%) and wrongly indented by staff (0.7%).

STRATEGIES FOR CHANGE:
The strategies were establishment of dietetic chart, provision of formatted dietetic board, updating standard of work procedure and conducting continuous nursing education. More strategies were updating formatted nursing report, encouraging hospital attendant to prepare the ENP, conducting bedside teaching for nurses and providing bedside tagging.

EFFECT OF CHANGE:
The percentage was increased from 40.7% to 85.4% in cycle 1, then improved to 95.0% in cycle 2. Achievable benefit not achieved was improved from 30.7% to 4.6% and finally -5%. We successfully reduced the mean duration from 34 hours to 20 hours and maintain low percentage of complication rate and mortality among patients.

THE NEXT STEP:
This study was expanded to all wards in the hospital and has been replicated in Selangor government hospitals. We plan to expand the study to national level.

297 words

Appendix 4: Example of A Project Write-up Using QIR Format

Improving Percentage of Patients Receiving Enteral Nutrition Product (ENP) Within 24 Hours of Dietitian Prescription in Selected Wards of Hospital Serdang

Irne J[1], Siah PJ[1], Siti Zafirah MR[1], Nurliyana N[2], Halimatun Saadiah S[1], Roslinda MS[1], Normawati AW[1], Fatimah S[1]
[1] Hospital Serdang
[2] Universiti Putra Malaysia

SELECTION OF OPPORTUNITIES FOR IMPROVEMENT

During brain storming, five (5) quality problems were identified by team members related to dietetic services in Hospital Serdang. The quality problems were low percentage of patients attending outpatient dietetic clinic appointment, low percentage of patients receiving enteral nutrition product (ENP) as prescribed by dietitian within 24 hours prescription, poor number of patients without caregiver receive oral nutritional supplement (ONS) as prescribed by dietitian, delay of bedside referral done by doctor/ ward staff and no dietetic referral letter done by doctor. Based on SMART criteria (seriousness, measurable, appropriateness, remediable and timeliness), the second problem was prioritised highest therefore chosen to be studied.

Nutrition support therapy should be initiated within 24-48 hours following hospitalisation in patients who are unable to maintain oral nutritional intake (Eugene R et al 2017). From study, 40% of hospitalised patients are having malnutrition (Heyland DK et. al., JPEN 2003) and there is significant relationship between mortality (29.1%) with the average total calorie received in hospitalised patient (Alberda C et al, 2009). A meta-analysis on the effectiveness of using oral nutritional supplements in malnourished patients suggested that clinical complications associated with malnutrition can be decreased by as much as 70% and mortality reduced by around 40%. (Stratton RJ, Elia M 2005).

Enteral nutrition is any method of feeding that uses the gastrointestinal tract to deliver part or all of a person's caloric requirements, either oral or tube feeding (American College of Gastroenterology, 2011). Enteral nutrition product (ENP) is product intended for ingestion that contains a dietary ingredient intended to add further nutritional value to the diet (FDA, US Food and Drug Administration). Dietitian is a professional trained in translating the science of food, nutrition and medical nutrition therapy to meet the needs of individual or target groups whether in disease or health (Malaysian Dietitian Association, 2004).

Dietitians prescribed ENP to ensure patients receive sufficient nutrient intake. A short survey was conducted in early of February 2016 in selected wards to get overview of this problem. The result showed only 56.4% of the patients received ENP within 24 hours of dietitians' prescription. The problem occurred mostly in Medical, Surgical and Orthopaedic Ward. This study involved dietitians, Pembantu Operasi (PO) and ward staff including medical officers, nurses and Pembantu Perawatan Kesihatan (PPK).

KEY MEASURES FOR IMPROVEMENT

We analysed the contributing factors to this problem using a problem analysis chart as in (Example) Figure 1. After excluding factors which were beyond our control such as lack of staff and IT system limitation, we identified the main contributing factors were improper practices among staff, lack of communication and ineffective Standard Operating Procedure (SOP).

The current process of care was reviewed and we identified the critical steps for improvement as shown in (Example) Figure 2. This study objective is mainly to improve percentage of patients receiving the ENP within 24 hours of dietitians' prescription. The specific objectives are to verify the prevalence of patients who do not receive ENP within 24 hours of dietitians' prescription, to identify the contributing factors to low percentage of patients receiving ENP within 24 hours of dietitians' prescription, to formulate and implement proper remedial action and to evaluate the effectiveness of remedial action.

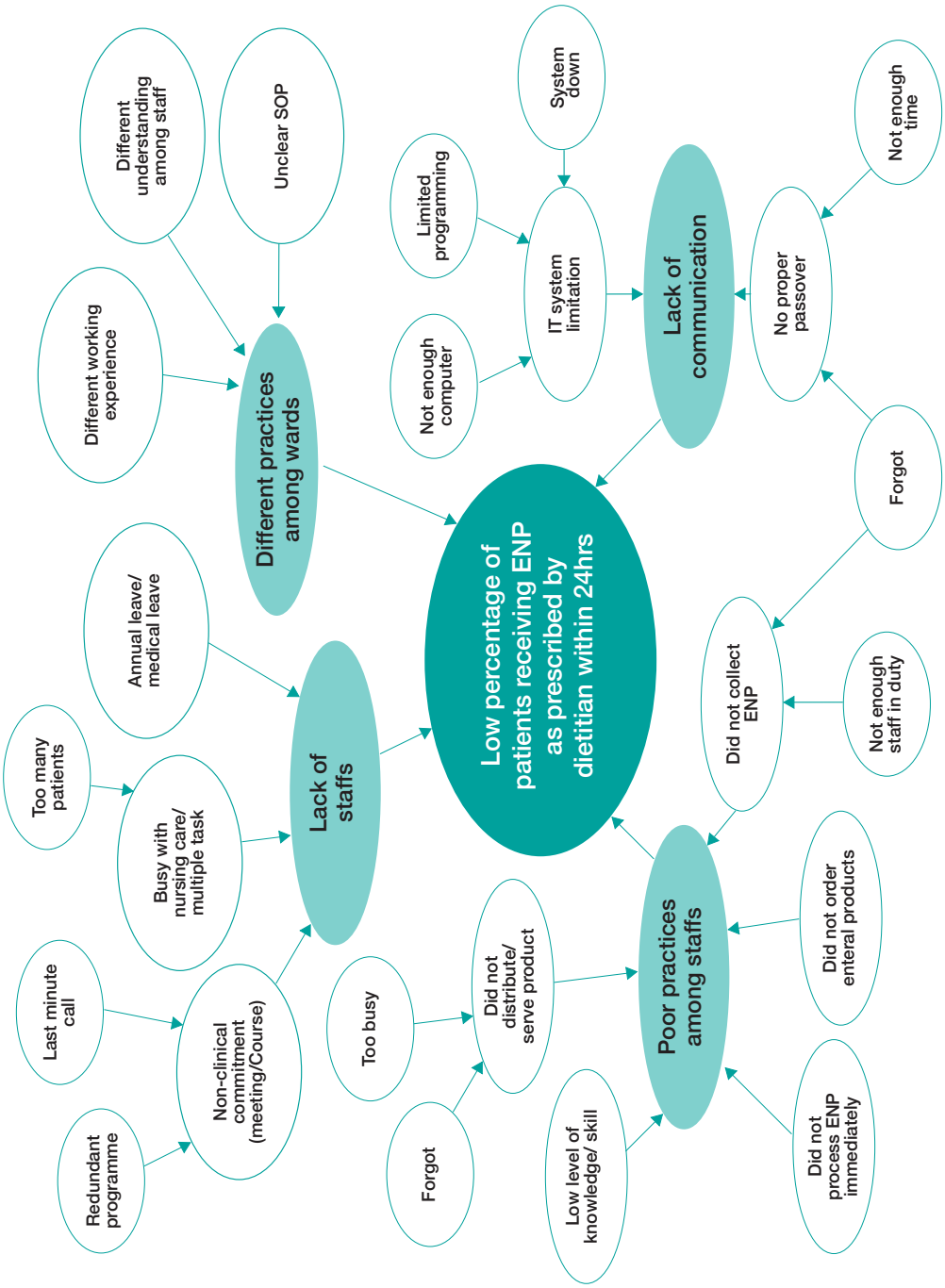
The key indicator for improvement was measured using the percentage of patients receiving ENP within 24 hours of dietitians' prescription. Percentage of patients receiving ENP within 24 hours as prescribed by dietitians calculated from total number of patients receiving ENP within 24 hours divided by total number of patients prescribed for ENP by the dietitians. The standard is 90% as agreed in Clinical Dietetic Department Meeting.

PROCESS OF GATHERING INFORMATION

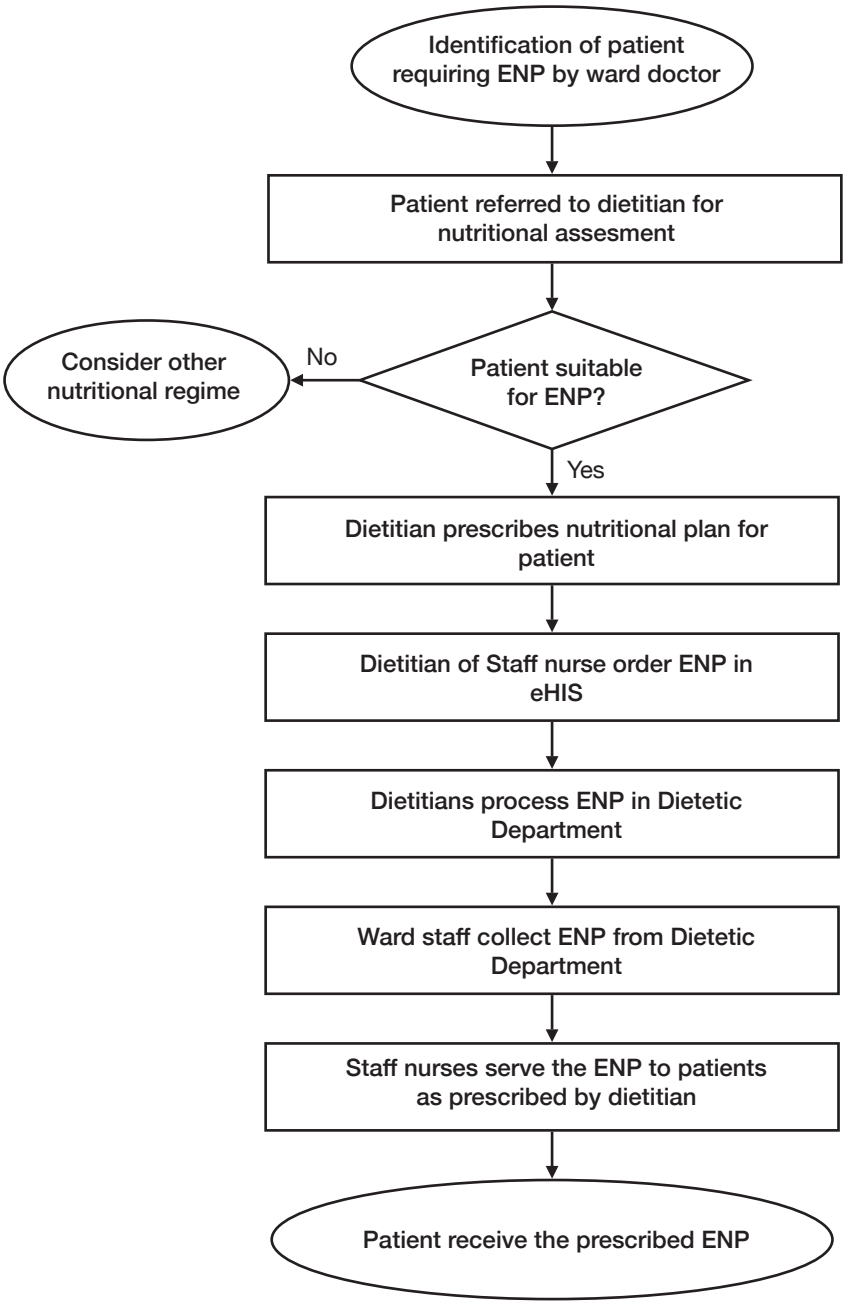
A cross sectional study was carried out using universal sampling technique. All patients who had been prescribed for enteral nutrition product (ENP) by dietitians and met the inclusion criteria were included in this study. Patients who were nil by mouth (NBM), refused to take the ENP, who had the ENP by their own, or who were discharged before getting the ENP within 24 hours of dietitians' prescription were excluded from the study.

Hospital Serdang is using total hospital information system (THIS). The system is outsourced by the government (MOH) to IT vendor. The nurses need to indent the product through IT system. All the orderable data will be captured by system only at 7.30am and 1.30pm daily. The dietitian will process the product in a timely manner tailored to the IT system. Ward staffs need to collect the product from the dietetic department during the store counter operational time period at 10.00am -12.00pm and 3.00-4.30pm. Then, the nurses must serve the product as soon as possible to patients, by referring to the feeding regiment which had been prescribed by the dietitian.

ENP given to patients could be easily monitored during regular dietitian review (ward round) and audited by the dietitian through system and manual form. Remedial action could be implemented to improve the work process with multidisciplinary approach.



(Example) Figure 1: Problem analysis chart for low percentage of patients receiving ENP as prescribed by dietitian within 24-hours.



(Example) Figure 2: Process of care for prescription until patient receive ENP

Minimum study sample for each phase was 140 based on the scientific study calculation. The whole study in three selected wards of Hospital Serdang had been carried out in 2016 and 2017. The verification study was carried out from March to June 2016. Remedial measures were implemented in July and August 2016. During the month of September to December 2016, first cycle study was conducted. After more remedial actions had been initiated in February to April 2017, second cycle study was conducted from May to August 2017.

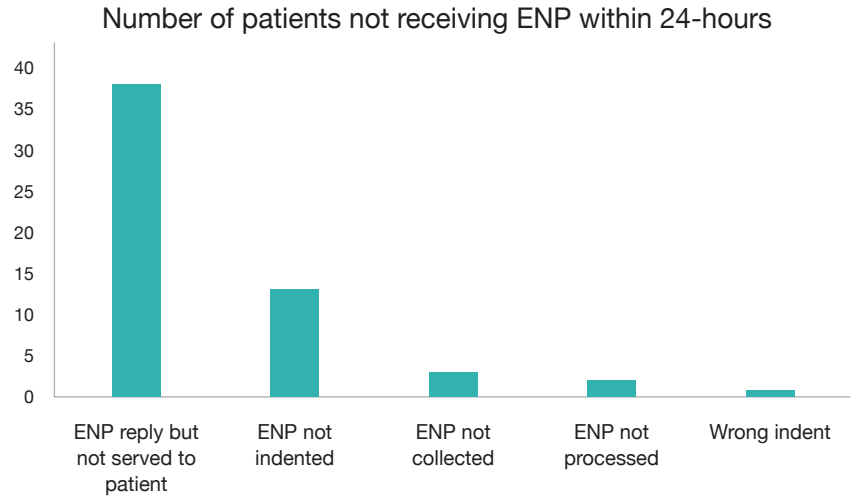
IT documentation and related monitoring form were used to collect the data. All data were collected by dietitians and compiled in excel format before analysed using SPSS version 16.0.

ANALYSIS AND INTERPRETATION

Results in verification study showed 59 patients (41.0%) did not received ENP within 24 hours of dietitians' prescription, 98 (68.1%) were taking the ENP as an oral nutrition supplement and the other 46 (31.9%) received the ENP through Ryle's tube feeding. Most of the patients were from surgical ward, 78 (54.2%), followed by medical ward, 55 (38.2%) and finally orthopaedic ward, 11 (7.6%).

The contributing factors for patients not receiving ENP within 24 hours were the products not being served to patients (64.4%, n= 38), not indented accordingly (25.4.%, n= 15), not collected from dietetic department (5.1%, n= 3), not being processed (3.4%, n=2) and wrongly indented by staff (1.7% n= 1) as shown in . The first two factors contributed to almost 90% of the problem.

Concurrently, we conducted knowledge survey consisting of ten questions related to ENP management among the staff nurses. We found out the knowledge level can be considered as good with rating of 8/10 point. They knew the purpose of ENP prescription, and were able to differentiate variety of ENP's category as well as how to indent and order the ENP in IT system.



(Example) Figure 3: Causes of patient not receiving ENP within 24-hours dietitian prescription (n=59)

STRATEGIES FOR CHANGE

A few strategies had been developed involving management level, wards and dietetic services itself. The remedial actions implementation was divided into two phases - four strategies in cycle one and another four strategies in cycle two.

Firstly, the establishment of dietetic chart to ensure the product was served according to feeding plan as shown in (Example) Figure 4. The dietetic chart contained patient's details, feeding's regiment, date and time of prescription with the stamp and signature of dietitian in-charge. Then, the nurses needed to update the date, time and initial sign each time when feeding was provided to patient. This dietetic chart also allows monitoring of patient's feeding progress.

Secondly, we improved non-standardised diet board to standardised and formatted ones. Diet board was used by ward staff to refer whenever to indent diet or enteral nutrition product in IT system. Previous diet board only mentioned patient's name, bed number and diet type. By modifying the diet board, we added extra column of enteral nutrition product (ENP), order frequency and remarks. Therefore, the ward staff especially nurses would not miss the ordered ENP.

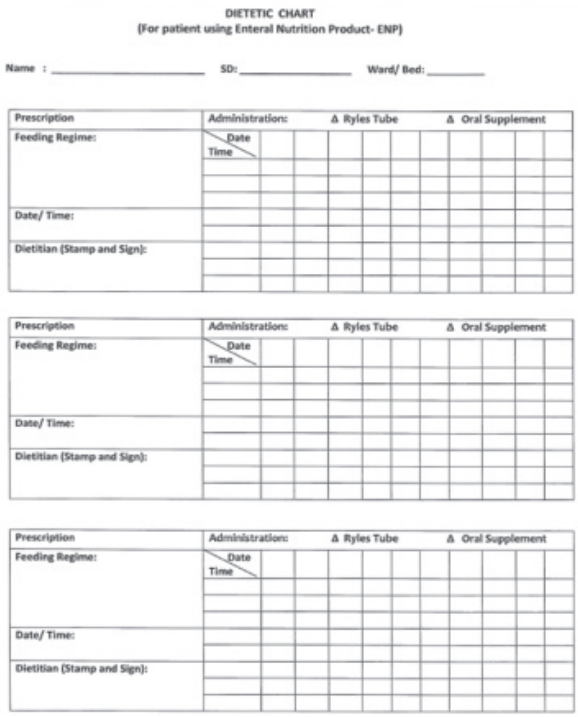
Thirdly, we reviewed and updated standard of procedure (SOP) on related work process. Previously, nurses indented the ENP in IT system after being prescribed by dietitians. In the new SOP, the dietitian carries out the first indent of the ENP to ensure a more efficient work flow and also to ensure a correct ENP was indented from the beginning. The new SOP had been acknowledged by Hospital Director and had been distributed to all wards and clinical department.

In addition to that, we conducted continuing nursing education (CNE) as our fourth remedial action. Three CNE sessions were given by the dietitians to the nurses in the three wards. In view of good rating of knowledge among staff nurse, the aim of CNE was to create awareness of the study and empowerment/ enforcement of delivering efficient services especially regarding ENP.

More strategies were initiated in cycle two. The fifth strategy was to update the nursing report format with nutrition element. The nursing unit practices ISBAR checklist as their pass-over report format to ensure complete information. It consists of introduction/ identification, situation, background, assessment and recommendation/ risk. Previously, nursing report was free text report. By adding the nutrition part in the format, they will be reminded to key in the feeding prescription.

Sixth strategy was encouraging Pembantu Perawatan Kesihatan (PPK) to assist in preparing the ENP. Prior to this, PPK only collected the ENP from dietetic department and place it at the nursing counter. In this study, we modified the SOP by allowing PPK to prepare and serve the ENP to patients. We re-enforced the nurses in the seventh strategy by providing bedside teaching to them. We managed to approach 43 nurses in two months. After each dietitian review, we briefed the nurse in-charge on dietetic chart usage and mentioned the diet board to be referred regularly.

Finally, we put bedside tagging to all patients who had been prescribed for ENP. The bedside tagging was prepared by dietitians and they put or hang the signage of gentle reminder at patient's bed. Everyone including patient and their family member can notice the tag and might ask or request the ward staff if they do not receive the ENP



DIETETIC CHART
(For patient using Enteral Nutrition Product- ENP)

Name : _____ SD: _____ Ward/ Bed: _____

Prescription	Administration:			Δ Ryles Tube			Δ Oral Supplement			
Feeding Regime:	Date / Time									
Date/ Time:										
Dietitian (Stamp and Sign):										

Prescription	Administration:			Δ Ryles Tube			Δ Oral Supplement			
Feeding Regime:	Date / Time									
Date/ Time:										
Dietitian (Stamp and Sign):										

Prescription	Administration:			Δ Ryles Tube			Δ Oral Supplement			
Feeding Regime:	Date / Time									
Date/ Time:										
Dietitian (Stamp and Sign):										

(Example) Figure 4: New Dietetic Chart

EFFECTS OF CHANGE

Upon implementation of the above strategies, the percentage of patients received enteral nutrition product (ENP) was increased to 85.4% in cycle one. In cycle two, the result showed increment to 95.0%. Most of the subjects were from surgical ward and received the ENP as oral nutrition supplement. We successfully reduced the ABNA from 30.7% to 4.6% in the first cycle. The ABNA in second cycle improved to -5% which was better than our standard of 90%.

From this study, we managed to reduce duration of work process from the mean of 34 hours to 20 hours as our effort to ensure patients receiving the ENP within 24 hours of dietitian prescription as can be seen in improvement of critical steps implementation as in (Example) Figure 5. Through awareness and spirit of teamwork, we see encouraging changes among staff as they prioritize their clients and provide efficient services.

Another important effect of change was lower rate of medical complications among patients who received ENP within 24 hours. 60.2% of patients who did not receive their ENP within 24 hours had developed complications, the rate was only 42.5% among those who received ENP in 24 hours (p= 0.04). Out of patients that have complications, 73.6% of them had infection, 6.6% wound breakdown, others were hospital acquired pneumonia, aspiration pneumonia, acute kidney injury etc. There is significant association between mortality and received ENP within 24 hours of dietitian prescription (p=0.02). We can see that the proportion of patients discharged/ survived were higher in patient who received the ENP within 24hours (76.6%) compared to patients who received the ENP after 24 hours prescription (23.3%).

There was an increase in paper cost due to provision of dietetic chart and bedside tagging but it is still cost effective compared to managing complications. We conclude that our key changes in work process could help in delivering efficient services and thus improve patient outcomes. Cooperation from multidisciplinary staffs and team work are crucial to provide the excellent services.

Critical Steps	Criteria	Standard		Verification		Cycle 1		Cycle 2	
		%	Time	%	Time	%	Time	%	Time
Dietitian prescribes the nutritional plan	Dietitian must inform nurses either through verbal, notes or eHIS	100%	≤ 1 hour	100%	1 hour	100%	1 hour	100%	1 hour
Dietitians/ Staff nurses order/ indent diet/ENP in eHIS	Ensure 2R: - Right patient - Right ENP	100% 100%	≤ 8 hours	100% 99.3%	10 hours	100% 100%	4 hours	100% 100%	4 hours
Dietitians process the ordered ENP	- Dietitians must process order through system or manual form. - Countercheck 2R and correct errors detected.	100% 100%	≤ 8 hours	98.6% 100%	8 hours	99.3% 100%	8 hours	100% 100%	8 hours
Ward staffs collect the ENP from Dietetic Department	- Ward staffs should collect the ENP from JDS. - Reminder: Call/ Whatsapps/ Telegram/ SMS - Receipt slip	100% 100% 100%	≤ 4 hours	80% 100% 100%	7 hours	90.9% 100% 100%	5 hours	100% 100% 100%	5 hours
Staff nurses/ PPK serve the ENP as prescribed by dietitians	- Staff nurses/ PPK serve the ENP to patients - Input - Output charting	90% 100%	≤ 3 hours	59.3% 91.7%	8 hours	85.4% 100%	3 hours	95% 100%	2 hours
All entire process	Patient receive the ENP	90%	≤ 24 hours	59.3%	34 hours	85.4%	21 hours	95%	20 hours

(Example) Table 1: Improvement in implementation of critical steps in Cycle 1 and Cycle 2

THE NEXT STEP

This study has been expanded to all wards in Hospital Serdang. Hospital Serdang achieved excellent result of 97.1 % (136 out of 140 subjects received the ENP within stipulated time period). The duration of ENP delivery was successfully minimized to only 12 hours. The study has been replicated in all Selangor government hospitals in 2018 with full support from Selangor State Health Department. Results showed an improvement from pre-intervention phase of 85.0% to 91.9% post implementation of strategies at the state level. The strategies implemented are now being continued in all Selangor hospitals.

As a team, we will continue to monitor the work process and ensure it is done efficiently through regular education, enforcement and regular audit until this becomes a culture in the hospital. At the same time, we will improve charting system and practices among medical staff.

We plan to share our remedial actions and experiences with other hospitals in the country and to expand the study to national level. Briefing to head of services has been initiated. Discussion regarding this study and promoting the remedial action will be conducted through meetings and seminar. We also encourage dietitians from other states to conduct study on enteral nutrition support.

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