

Six-Sigma (DMAIC Methodology) Part I

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MHA623
Healthcare Quality

Lecture 7



Our Roadmap

Quality improvement
methodologies Overview

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planning tools

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Intended Objectives

1. Understand the principles of Six Sigma and the DMAIC methodology in healthcare quality improvement.
2. Identify key components of the Define and Measure phases and their role in process optimization.
3. Apply tools such as SIPOC, Pareto charts, and check sheets to assess and improve healthcare processes.
4. Analyze real-world healthcare challenges and formulate structured problem-solving approaches.

Chapter

DMAIC Methodology

1. Define (D)



DMAIC Methodology

➤ *Define Phase:*

- The purpose of the Define phase is to delineate the business problem and scope the project and process to be improved.

Define Phase

	Define Activities	Tools / Deliverables
1	Develop project charter	▪ Project charter ▪ SIPOC (Supplier – Inputs – Process – Output – Customer) ▪ High Level Process Map
2	Perform stakeholder analysis	▪ Stakeholder analysis definition ▪ Stakeholder commitment scale ▪ Communication planning worksheet
3	Perform initial Voice of the Customer (VOC) and identify Critical to Satisfaction (CTS)	▪ Critical to Satisfaction (CTS) summary
4	Select team and launch the project	▪ Responsibilities matrix ▪ Ground rules ▪ IFR (Items for Resolution)
5	Create project plan	▪ Work plan

Fig. 2.3 Define activities and tools/deliverables

Define Phase

1. Develop project charter:

- **Project Charter Components:**

- A. Problem Statement:**

- Clearly describe the business problem or challenge.
 - Specify the impacted process and its measurable effects.

- B. Customers/Stakeholders:**

- Identify internal and external customers and stakeholders affected by the problem or process.

Define Phase

■ **Project Charter Components:**

C. Critical to Satisfaction (CTS):

- **Define what is important to each customer/stakeholder group, focusing on:**
 - **Quality (CTQ):** Defects or quality issues.
 - **Delivery:** Timeliness.
 - **Cost:** Financial impact.

Define Phase

- **Project Charter Components:**

D. Quantifiable Goal: Define a measurable target for improvement, even if preliminary, specifying what will be measured and enhanced.

E. Scope Statement: Define the process to be improved, specifying what is included/excluded and the timeframe for activities and data collection.

F. Projected Benefits: Identify potential financial gains (savings, revenue growth, cost reduction, COPQ) and intangible benefits (e.g., morale improvement, waste elimination).

Define Phase

■ **Project Charter Components:**

G. Potential Risks: List possible risks impacting project success, assessing their likelihood (high, medium, low).

H. Project Resources:

- **Champion:** Director-level or above to remove barriers.
- **Finance:** Representative to validate financial benefits.
- **Team/Support:** Members providing data, information, or direct project support.

Define Phase

2. SIPOC (Suppliers-Input-Process-Output-Customer):

- SIPOC is a tool used in the Define phase to scope a project and understand a process. It maps the relationships between suppliers, inputs, process steps, outputs, and customers.
- **Key points:**
 - **Suppliers:** Provide inputs to the process.
 - **Inputs:** Resources or materials used in the process.
 - **Process:** 5-7 high-level steps that transform inputs into outputs.
 - **Outputs:** Results or products of the process.
 - **Customers:** Recipients of the outputs.

We have identified a process that will involve a patient, ward clerk and nurse...

Supplier	Input	Process	Output	Customer
Patient	Patient Information / Systems	• Triage/Reception • Patient Assessment • Assign bed & Admissions • Deliver Care	• Discharge Decision	Ward Clerk
Ward Clerk	Discharge Decision	• Discharge decision/activities	• Patient discharge papers	Nurse
Nurse	Patient Discharge Papers	• Patient discharge	• Discharge	Patient

Define Phase

3. Perform stakeholder analysis:

- **Identify Customers and Stakeholders:**

- Key to defining process quality, as quality is determined by meeting and exceeding their expectations.

Stakeholders include peers, subordinates, supervisors, internal groups, suppliers, and external customers.

- **Understand Their Impact and Concerns:**

- Analyze stakeholder groups, their roles, how they are affected by the process, and their specific concerns.

Define Phase

4. Perform Initial Voice of Customer (VOC) and Identify Critical to Satisfaction (CTS):

- Collect customer feedback through surveys, interviews, or research.
- Pick key quotes explaining why customers choose you.
- Group similar ideas and find common themes.
- Clarify unclear points by following up with customers.
- Identify what matters most to customers **(CTS)** from their feedback.
- Fill any missing information gaps.

Define Phase

5. Select Team and Launch the Project:

- **Select Team:** Choose members with process knowledge and commitment to the project.
- **Define Roles:** Clearly outline each member's responsibilities.
- **Establish Ground Rules:** Brainstorm and set behavioral expectations for team interaction.
- **Launch Project:** Ensure clarity on roles and rules from the start.

Define Phase

6. Generate the Project Plan:

- **Develop the Six-Sigma Project Plan:** Final step in the Define phase.
- **Plan Resources, Time, and Effort:** Allocate necessary resources and timelines.
- **Track Progress:** Use tools like Excel or Microsoft Project to monitor task completion.
- **Conduct Risk Analysis:** Identify potential risks to ensure project success.

Chapter

DMAIC Methodology

2. Measure (M)



Measure Phase

➤ *Measure Phase:*

- The purpose of the Measure phase is to understand and document the current state of the processes to be improved, collect the detailed voice of the Customer information, baseline the current state, and validate the measurement system.

Measure Phase

1. Measure Phase Activities & Tools:

1. **Define Detailed VOC:** Capture and document customer requirements and feedback.
2. **Define VOP & Current Performance:** Analyze and record current process metrics.
3. **Validate Measurement System:** Ensure data collection accuracy and reliability.
4. **Define COPQ:** Identify and quantify costs of poor quality or inefficiencies.

Measure Phase

1. Define Detailed Voice of Customer (VOC):

- **Definition:** VOC captures customer expectations and requirements.
- **Examples:**
 - **Responsiveness** (e.g., turnaround time).
 - **Error rates** (e.g., no errors in paychecks).
- **Data Collection Methods:**
 - Interviews, surveys, focus groups, complaint cards, warranty data, competitive shopping.

Measure Phase

➤ **Data Collection Plan:**

- **Purpose:** Ensure accurate measurement of Critical-to-Satisfaction (CTS) metrics.
- **Steps:**
 1. Define the **Critical to Satisfaction (CTS)**.
 2. Develop metrics.
 3. Identify data collection and analysis mechanisms.
 4. Develop sampling plans and instructions.

Critical to Satisfaction (CTS)	Metric	Data collection mechanism (survey, interview, focus group, etc.)	Analysis mechanism (statistics, statistical tests, etc.)	Sampling plan (sample size, sample frequency)	Sampling instructions (who, where, when, how)
Speed to market	Cycle time	Project management tool	Statistics (mean, variance); t-test	One year of projects	Collect data from project management system for last year
	Functionality delivered	Requirements traceability tool	Count	50 projects (30 development, 20 support)	Extract data based on sampling plan

Fig. 2.18 Data collection plan for software application development Six Sigma project

Measure Phase

2. Define VOP & Current Performance:

- **Purpose:** Assess current process performance.
- **Tools:** Pareto charts, benchmarking, check sheets, histograms, statistics.

Measure Phase

➤ **Operational Definition of Metrics:**

- **Purpose:** Ensure accurate measurement of **Critical-to-Satisfaction (CTS)** metrics.
- **Definition:** Clear description of how metrics are measured.
- **Key Points:**
 - Identifies what and how to measure.
 - Ensures consistency in measurement.

Measure Phase

A. Benchmarking:

- **Definition:** Review best practices to improve processes.
- **Key Points:**
 - Focus on processes, not just industry.
 - Ensure comparisons are "**apples to apples.**"

Measure Phase

B. Check Sheet:

- **Purpose:** Collect data on defects for root cause analysis.
- **Steps:**
 1. Choose a characteristic to track (e.g., defect types).
 2. Set up the check sheet.
 3. Collect data.

Defect Type	Tally	Total
Incorrect Case Name		5
Incorrect Docket Number		2
Incorrect Court Name		6
Incorrect Cite Segment		2
Incorrect Decided Date		7
Incorrect Segment Coding		2
Missing Text		10
Incorrect Primary Embedded Citations		2
Copyright Material Included		3

Measure Phase

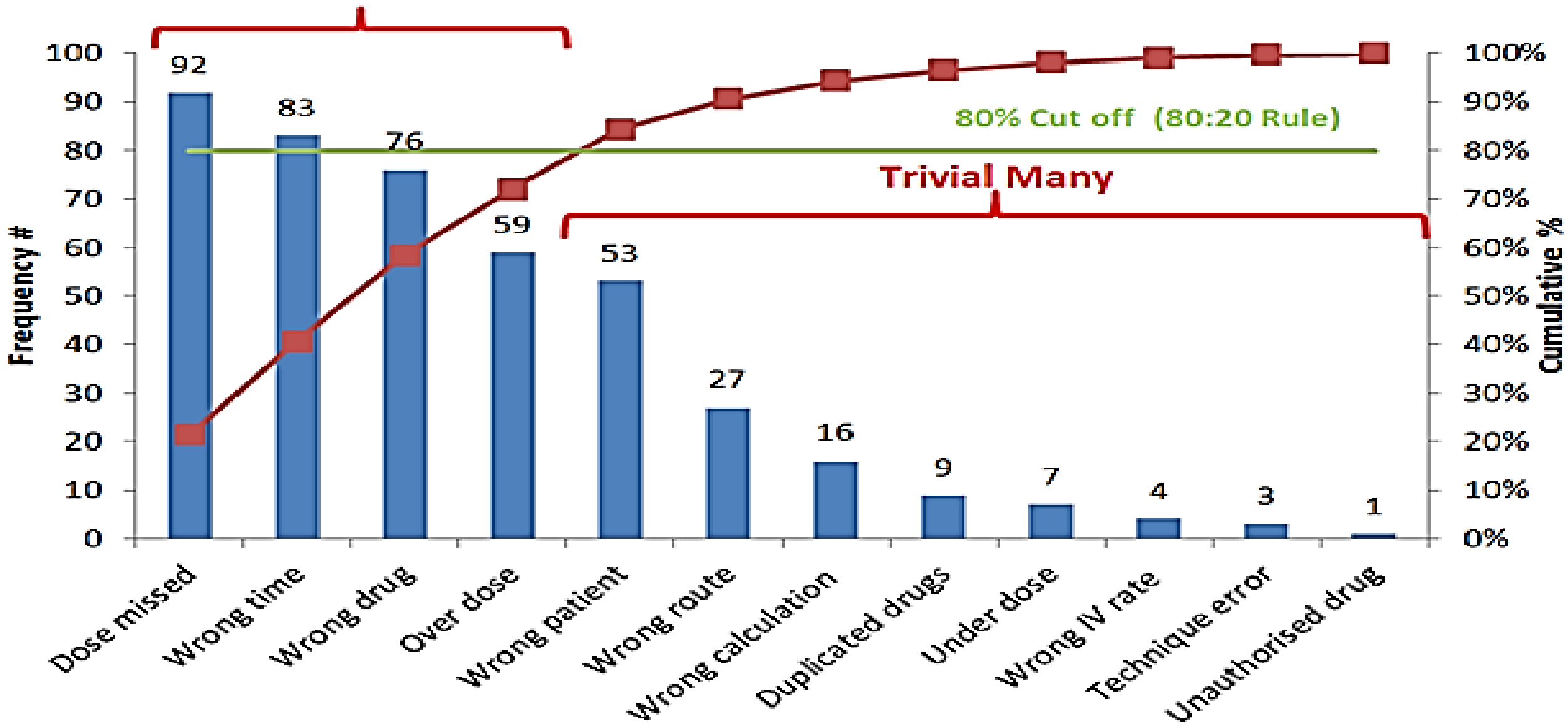
C. Pareto Chart:

- **Purpose:** Identify critical areas causing most problems (80/20 rule).
- **Steps:**
 1. Define data categories.
 2. Determine relative importance (e.g., dollars, occurrences).
 3. Collect data and compute cumulative frequency.
 4. Plot bar graph in descending order.

Medication Error Type	Frequency	Cumulative Frequency	Cumulative Percentage (%)
Dose missed	92	92	21.4%
Wrong time	83	175	40.7%
Wrong drug	76	251	58.4%
Overdose	59	310	72.1%
Wrong patient	53	363	84.4%
Wrong route	27	390	90.7%
Wrong calculation	16	406	94.4%
Duplicated drugs	9	415	96.5%
Underdose	7	422	98.1%
Wrong IV rate	4	426	99.1%
Technique error	3	429	99.8%
Unauthorized drug	1	430	100%

Pareto Chart - Types of Medication Errors (n=430)

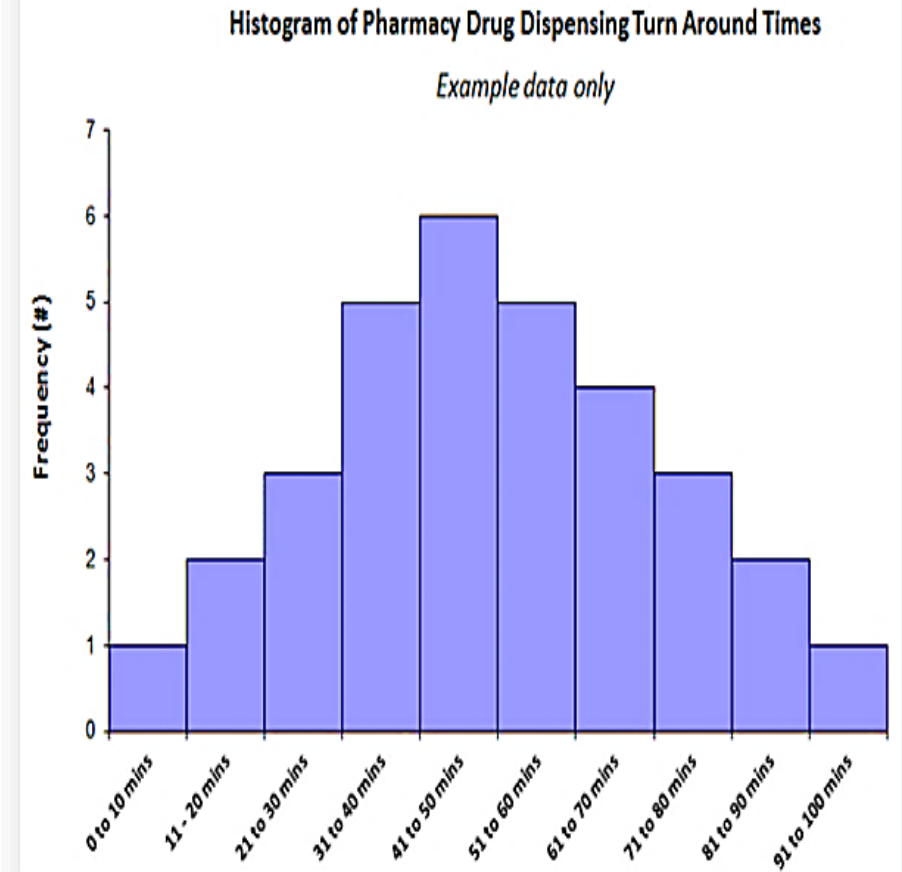
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Measure Phase

C. Histogram:

- **Purpose:** Visualize data distribution (centering, shape, variance).
- **Key Point:** First step in understanding data distribution.



Measure Phase

D. Statistics:

- **Purpose:** Assess VOP using statistical metrics.
- **Key Metrics:**
 - Mean (average).
 - Standard deviation (variation).
 - **Normal Distribution:** 99.997% of data within Six Sigma.

Measure Phase

3. Define COPQ (Cost of Poor Quality):

- **Purpose:** Identify and quantify costs of inefficiencies or defects.
- **Key Areas:**
 - Internal failures.
 - External failures.
 - Prevention costs.

Practical Example

Reducing Medication Errors in Inpatient Wards

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1. Define Phase:

- **Problem Statement:** High rate of medication errors during administration.
- **Stakeholders:** Patients, nurses, pharmacists, hospital management.
- **Critical-to-Satisfaction (CTS):** Ensure accurate medication dispensing and administration.

Practical Example

Reducing Medication Errors in Inpatient Wards

2. Measure Phase:

▪ Data Collection Methods:

- Review incident reports on medication errors.
- Conduct direct observations of medication administration.
- Use electronic health records (EHR) to track prescription discrepancies.

Practical Example

Reducing Medication Errors in Inpatient Wards

2. Measure Phase:

▪ Key Metrics to Measure:

- Frequency of errors (e.g., wrong drug, wrong dose, wrong time, wrong patient).
- Percentage of medication errors per total administered doses.
- Average time spent on medication administration per patient.

Practical Example

Reducing Medication Errors in Inpatient Wards

2. Measure Phase:

▪ Tools Used:

- **Check Sheets:** Track medication errors by type, shift, and department.
- **Pareto Charts:** Identify the most common causes (e.g., unclear prescriptions, look-alike drugs).
- **Histogram:** Visualize trends in medication errors over time.

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Wrap Up

1. Six Sigma DMAIC methodology is a structured approach to healthcare process improvement.
2. The Define phase focuses on problem identification, stakeholder analysis, and goal setting.
3. The Measure phase ensures accurate data collection to assess current performance.
4. Tools like SIPOC, Pareto charts, and check sheets help visualize and analyze process inefficiencies.

Wrap Up

5. Identifying Critical-to-Satisfaction (CTS) factors aligns improvements with stakeholder needs.
6. Root cause analysis is essential for designing effective, sustainable interventions.
7. Continuous monitoring and evaluation are key to maintaining process improvements.
8. Implementing Six Sigma in healthcare enhances patient safety, efficiency, and quality outcomes.



Thank You