Reducing Claim Denials in US Healthcare RCM (Revenue Cycle Management)

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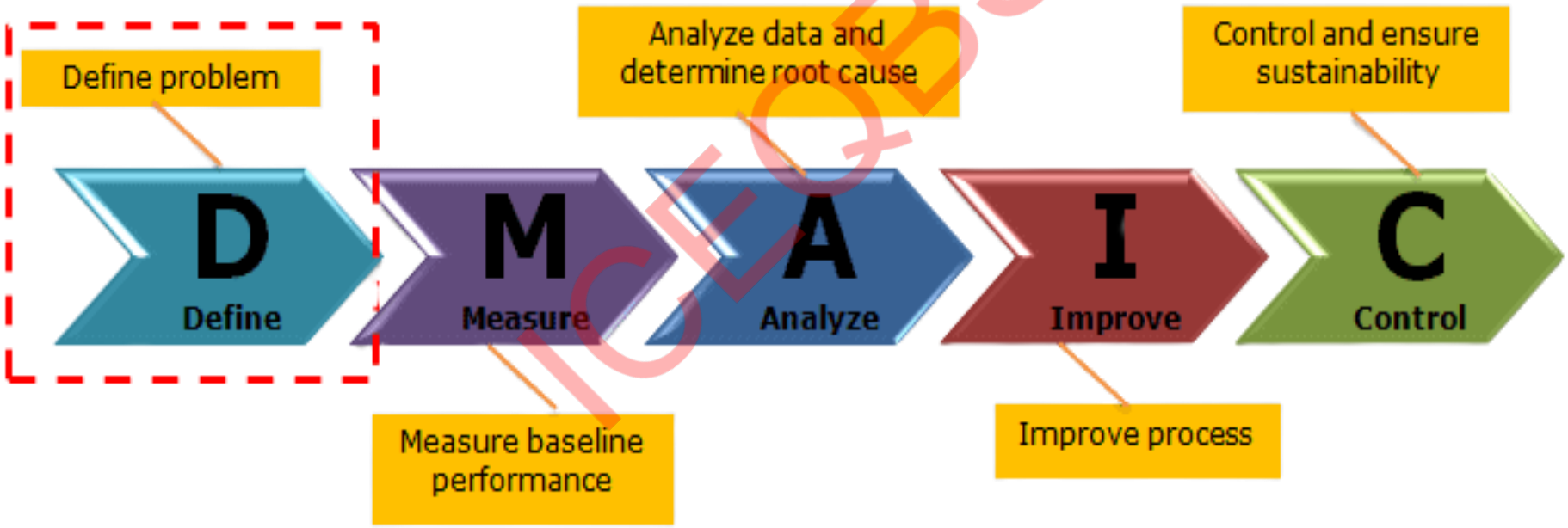
ROADMAP

OVERVIEW

Background

- The organization operates in a high-volume US Healthcare Revenue Cycle Management (RCM) BPO environment where first-pass claim acceptance is critical for cash flow and operational efficiency.
- Currently, the claim denial rate is 18.5%, significantly higher than the industry benchmark of ≤8%, resulting in delayed reimbursements, increased rework, higher administrative costs, and cash flow impact. Key contributors include gaps in coding accuracy, billing quality, and insurance eligibility verification.
- Reducing claim denials through a structured Lean Six Sigma approach will improve first-pass yield, accelerate cash realization, reduce rework and operating costs, and strengthen payer and customer relationships, leading to improved financial and operational performance.

DEFINE PHASE



VOC & CTQ

CTQ Tree :

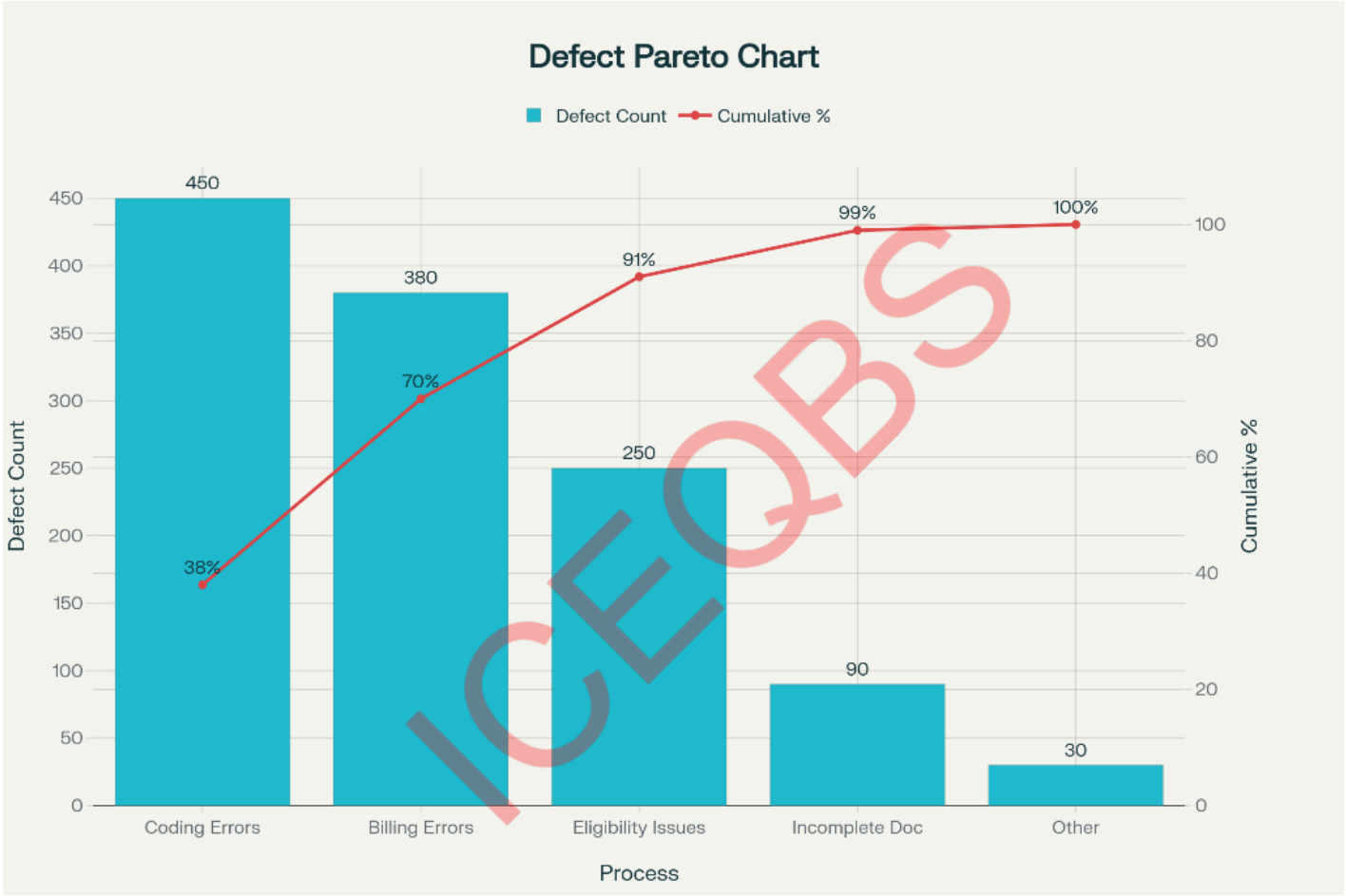
Voice of customer	Critical to X	Primary Metric for improvement
We expect accurate and timely claim approvals with minimal denials, faster resolution when issues occur, and clear, transparent communication on claim status	CTQ – Rejection rate	**Primary Metric -** Y = Claim Denial Rate (%) **Secondary Metric -** Productivity

Baseline Performance of Primary Metric (9 months data as Line chart)

Inference :

- Last 9 months data shows a significant variation and hence ideal problem to be taken up as a Six Sigma Project.

Pareto chart



Inference :

- Coding Errors contributes substantially and included in the scope of the project

Project Charter

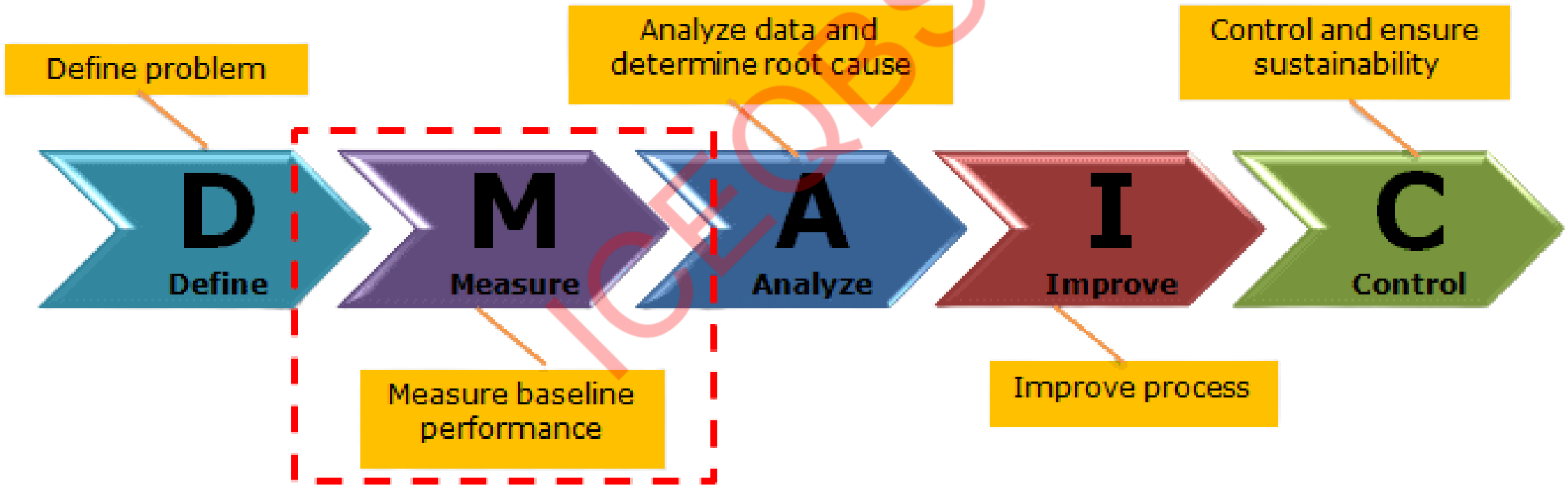
Project Title:	Reduction of Scrap% in Machining process from 3% to

Project Leader	Project Team Members:
Deepen Chakraborty	Meera Iyer Arjun Patel Deepen Chakraborty Nikhil Desai
Champion/Sponsors:	**Key Stake Holders**
Anjali Gupta	Coding Team (ICD, CPT coding) Billing Team Insurance Companies/Payers Patients
Problem Statement:	**Goal Statement:**
The current claim denial rate is 18.5%, which is significantly higher than the industry target of 8% or below.	Reduce the claim denial rate from 18.5% to 8% or below within 9 months through process improvements in coding, billing, and insurance eligibility verification.
Secondary Metric	**Assumptions Made:**
Productivity	Claim volume, payer mix, and staffing remain stable. No major payer policy or system changes during the project.

Project Charter

Tangible and Intangible Benefits:	Risk to Success:
Reduced rework and administrative costs Faster cash realization and improved cash flow Reduced revenue leakage due to fewer denials	Changes in payer policies or reimbursement rules during the project period. Inconsistent adherence to revised coding, billing, and eligibility processes.
In Scope:	**Out of Scope:**
Coding accuracy improvement Billing error reduction Insurance eligibility verification	Patient scheduling and clinical documentation Payer contract or policy changes Major IT system upgrades
Signatories:	**Project Timeline:**
Champion Sponsor	6 months

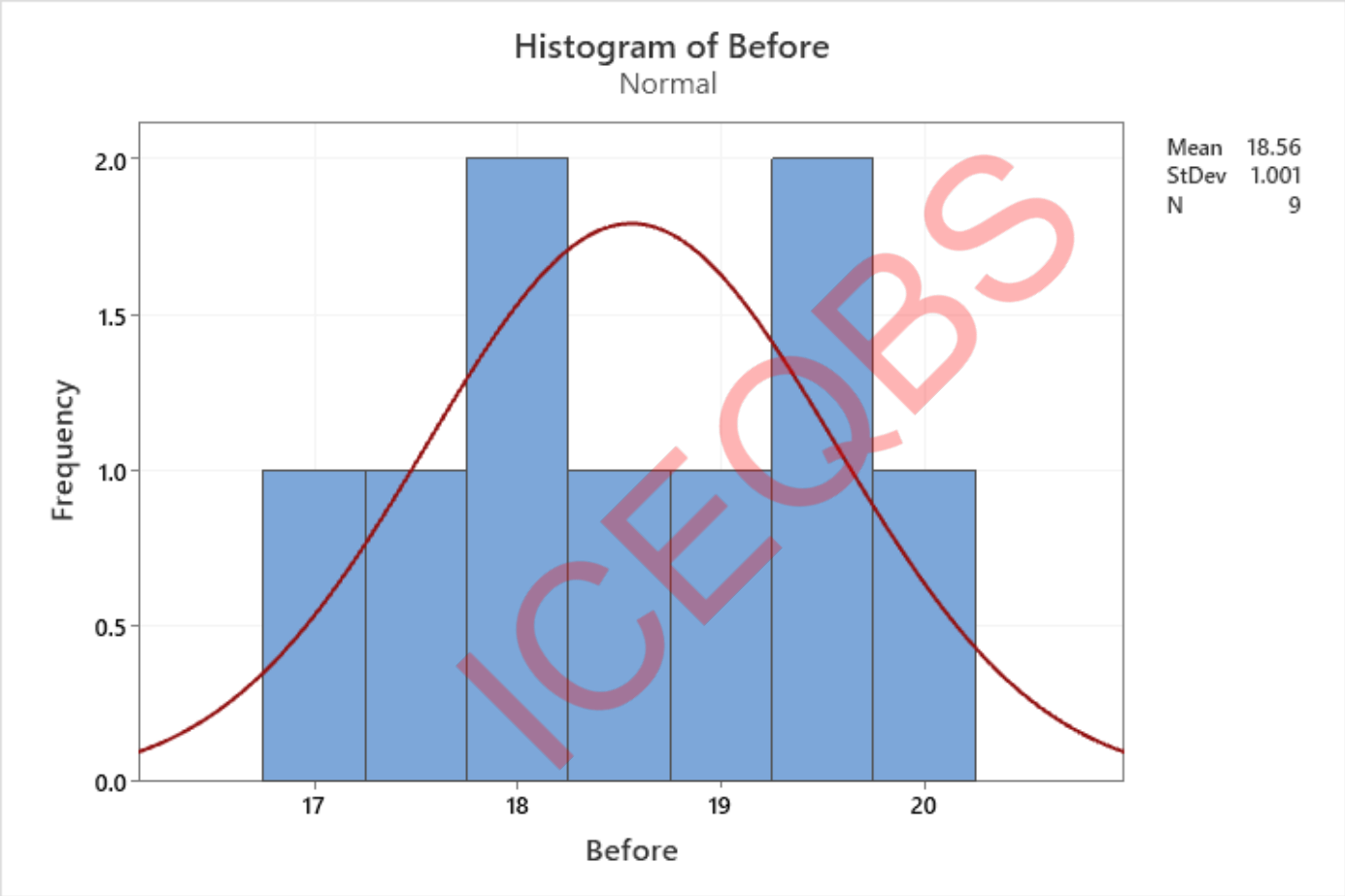
MEASURE PHASE



SIPOC

Suppliers	Inputs	Process Steps	Outputs	Customers
Healthcare Providers	Patient Demographic Data	1. Patient Registration	Complete Patient Data	Coding Team
Insurance Companies	Insurance Eligibility Info	2. Insurance Eligibility Verification	Verified Insurance Eligibility	Billing Team
Medical Coders	Medical Documentation & Reports	3. Medical Coding (ICD, CPT, HCPCS)	Accurate Coded Claims	Claims Processing Team
Billing Department	Coded Claims	4. Claim Submission to Insurance	Submitted Claims	Insurance Companies
IT Systems/Data Source	Billing & Claims Data	5. Claim Denial Analysis and Re-submission	Reduced Claim Denials	Patients, Revenue Cycle Management

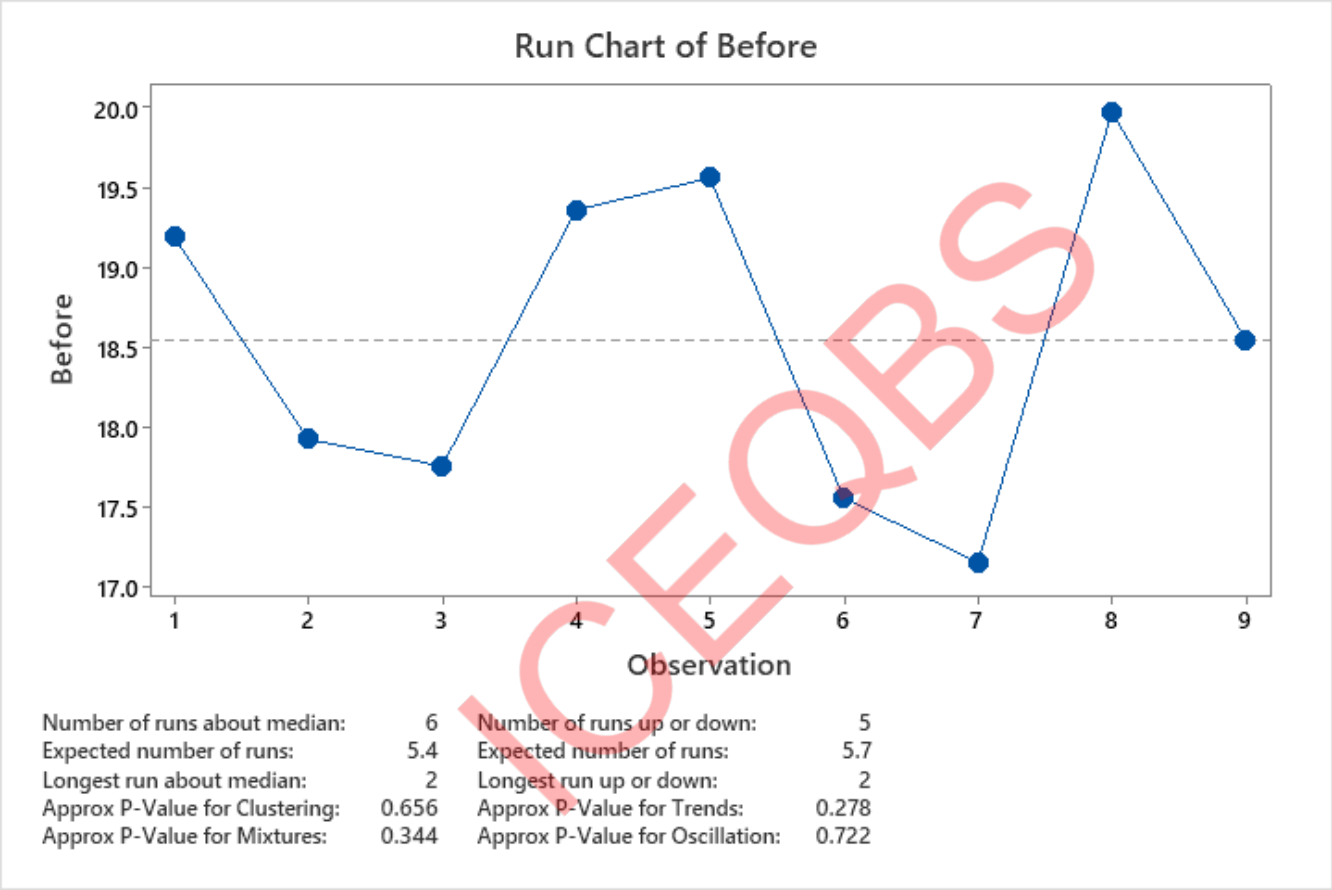
Data collection – Histogram (Before improvement)



Inference :

- Data is normally distributed over the mean

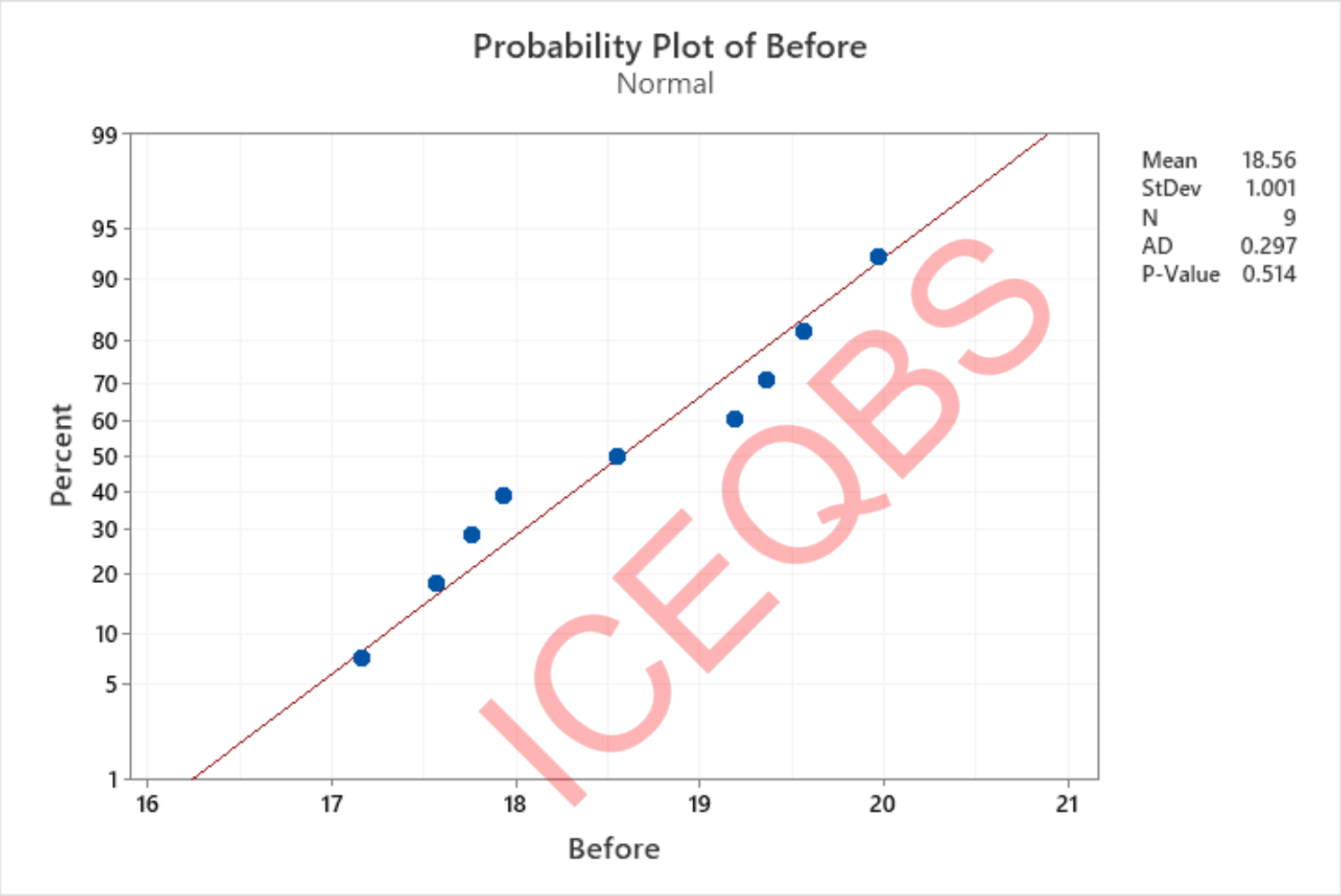
Data collection – Run Chart (Before improvement)



Inference :

P > 0.05 – No special causes in the process. Data can be used for further analysis

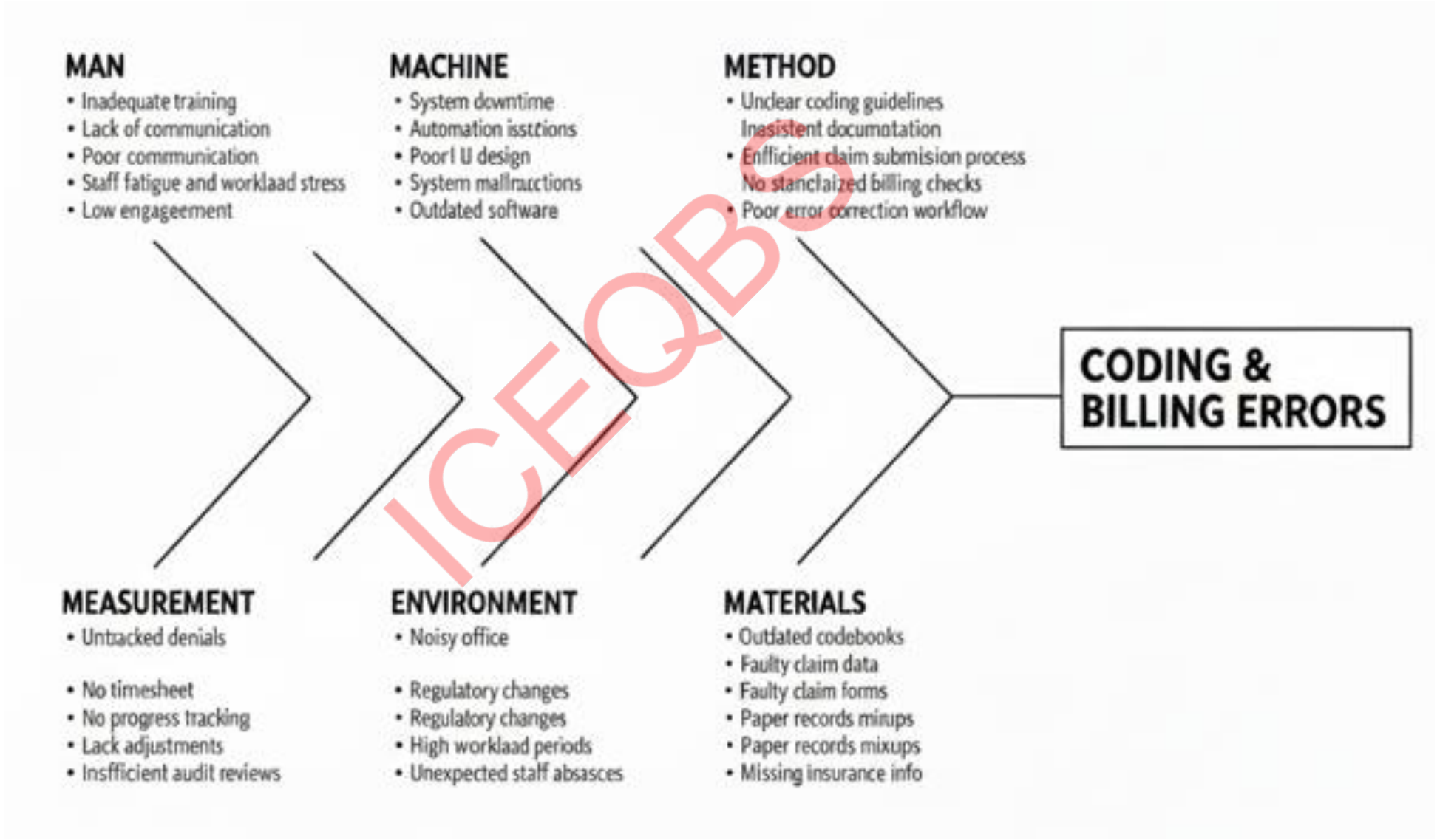
Data collection – Normality plot (Before improvement)



Inference :

- P > 0.05 in all scenarios, thus all the data is normally distributed

Fish Bone Diagram



Common Causes and Special Causes

Common Causes

- Unclear coding guidelines
- Inconsistent documentation
- Inefficient claim submission process
- No standardized billing checks
- Poor error correction workflow
- Inadequate training
- Lack of expertise
- Poor communication
- Staff fatigue and workload stress
- Low engagement
- Outdated codebooks
- Incomplete patient data

Special Causes

- Automation issues
- Untracked denials
- Regulatory changes
- Unexpected staff absences

3M Analysis for Waste

Muda (Waste)	Mura (Unevenness)	Muri (Overburden)
Duplicate entry of patient data	Big fluctuations in daily claim volumes	Staff working overtime to clear backlog
Reworking claims due to coding errors	Inconsistent review by different coders	Manual checking for claims under time pressure
Unused/obsolete documentation	Variation in insurance requirements	Coder handling excessive number of claim types

8 Wastes Analysis

Defects	Wrong procedure code entered on claim	Medical record documentation errors leading to denial
Overproduction	Generating duplicate claims for the same service	Printing multiple batches of billing statements
Waiting	Claims delayed awaiting physician signature	Coders waiting for missing patient information
Non-utilized Talent	Experienced coders spending hours on manual data entry	Billing staff performing repetitive administrative tasks
Transportation	Physically moving paper claims between departments	Sending paper forms to off-site billing vendor
Inventory	Unprocessed claims piling up in queue	Storing obsolete coding manuals in office
Motion	Staff repeatedly looking for codes in multiple systems	Coders frequently walking to supervisor for clarifications
Overprocessing	Double-checking already validated claims	Rechecking claims after multiple prior approvals

Action Plan for Low Hanging Fruits

Issue Type	Action Plan (Low Hanging Fruit)	Lean Tool	Expected Benefit
Special Causes	Automate tracking of denials and update coding workflow	Mistake-proofing, Standard Work	Immediate error reduction
	Create alerts for regulatory changes and staff absence	Visual Controls, Daily Huddles	Fewer unexpected disruptions
Muda (Waste)	Eliminate duplicate claim entry & unnecessary paperwork	5S, Value Stream Mapping	Higher efficiency, less rework
	Reduce waiting for approvals with electronic workflow	Kanban, Digital Checklist	Faster claim cycles
Mura (Unevenness)	Level claim volumes with load balancing among coders	Heijunka (Leveling)	Reduced daily stress
	Standardize review process for all coders	Standard Work	Consistent quality
Muri (Overburden)	Assign claims by complexity, not volume; rotate duties	Workload Balancing, Cross-training	Less stress, better accuracy
	Use automation for manual claim checks	Automation, Kaizen	Quick wins, lower manual load
8 Lean Wastes	Remove unneeded reports/forms; simplify steps	5S, Kaizen Events	Less motion & paperwork
	Train staff for best use of software tools	Training, One-point Lesson	Higher talent utilization

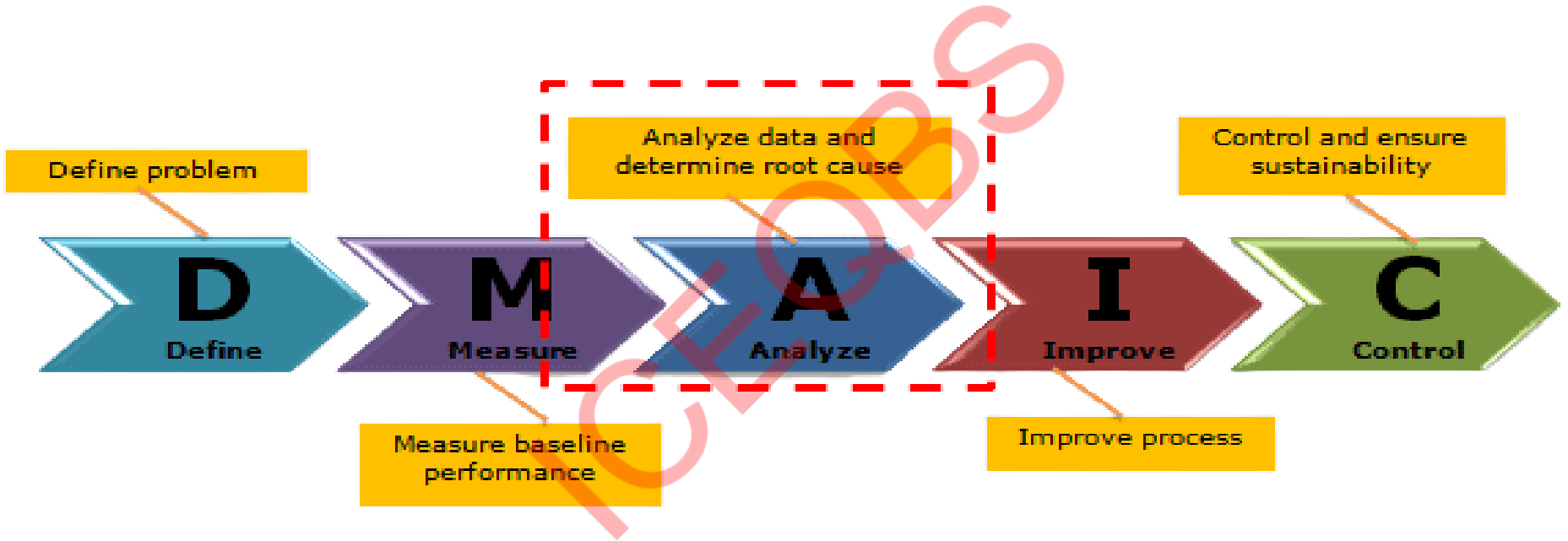
Top Prioritized Root Causes (Based on Net Score)

- Missing / Inconsistent Documentation.
- Missing insurance information.
- Unclear Coding guidelines.
- No standardized billing checks.
- Lack of coder training/expertise

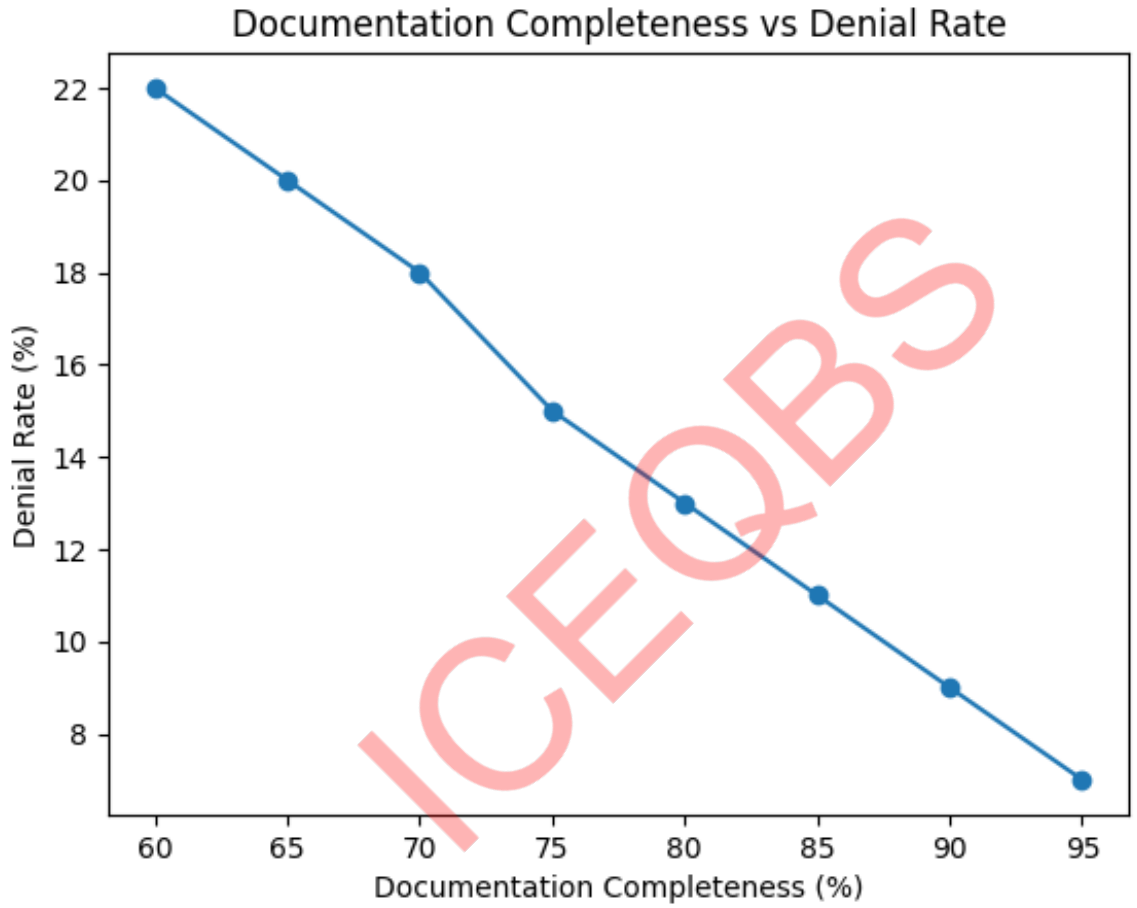
Data Collection Plan

Input (Root Cause)	Output 1: Claim Accuracy (10)	Output 2: Denial Rate (9)	Output 3: Cycle Time (8)	Output 4: Rework (7)	Output 5: Regulatory Compliance (6)	Net Score
Unclear coding guidelines	9	9	1	3	9	223
Inconsistent documentation	3	9	3	9	3	156
Inefficient claim submission	1	3	9	9	1	125
No standardized billing checks	9	9	3	9	9	246
Poor error correction workflow	3	9	3	9	3	156
Inadequate training (Man)	9	9	3	1	1	139
Lack of expertise (Man)	9	9	3	1	1	139
Poor communication (Man)	3	3	3	9	3	90
Staff fatigue/workload stress	3	3	3	9	3	90
Insufficient audit reviews	3	9	1	3	3	93
Noisy office (Environment)	3	3	3	1	1	61
Frequent interruptions	3	3	3	1	1	61
Regulatory changes (Environment)	9	9	1	3	9	223
High workload periods	3	3	3	1	1	61
Unexpected staff absences	3	3	3	1	1	61
Outdated codebooks (Materials)	9	3	9	9	9	199
Incomplete patient data	9	9	9	3	9	270
Faulty claim forms (Materials)	9	9	9	3	9	270

ANALYSE PHASE



Analyse – Hypothesis testing



Inference :

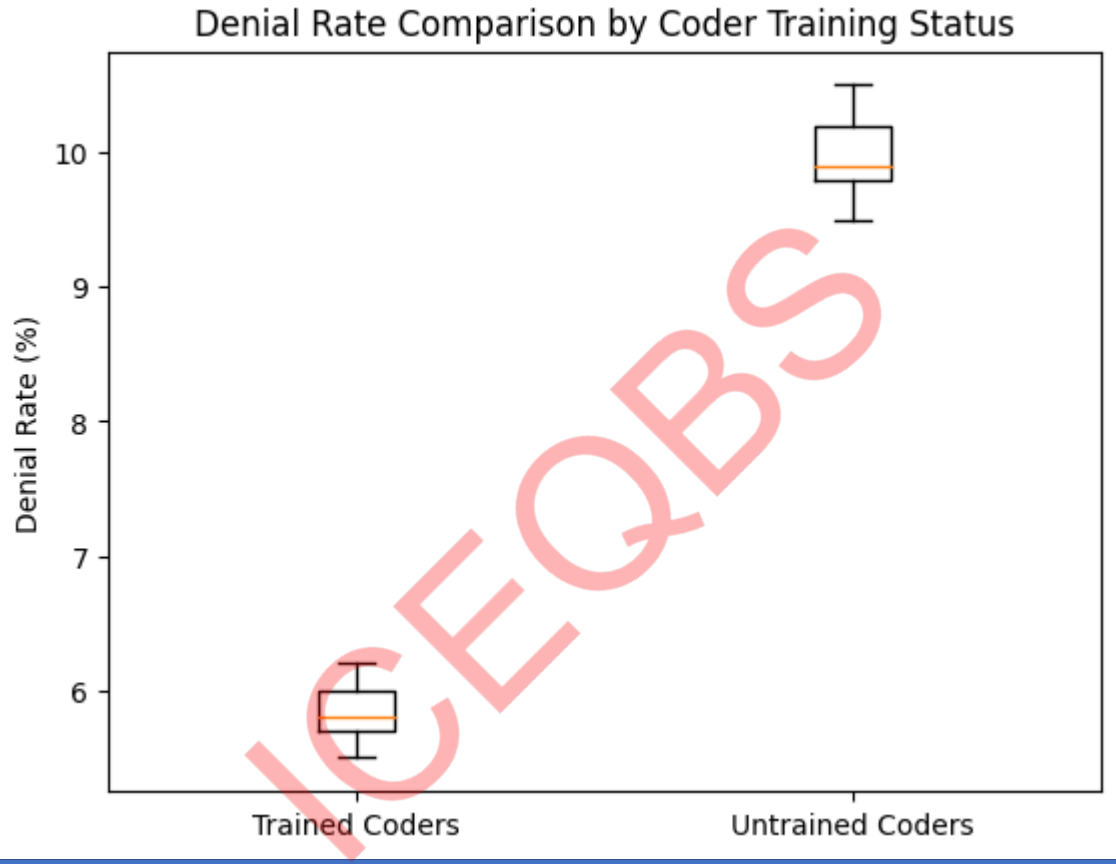
- As documentation completeness increases, the denial rate decreases, showing a **strong negative correlation**, supporting rejection of H_0 ($p < 0.05$).

Analyse – Hypothesis testing

Inference :

Higher coding error rates are associated with higher denial rates, indicating a **strong positive correlation**, confirming coding errors as a critical root cause ($p < 0.05$).

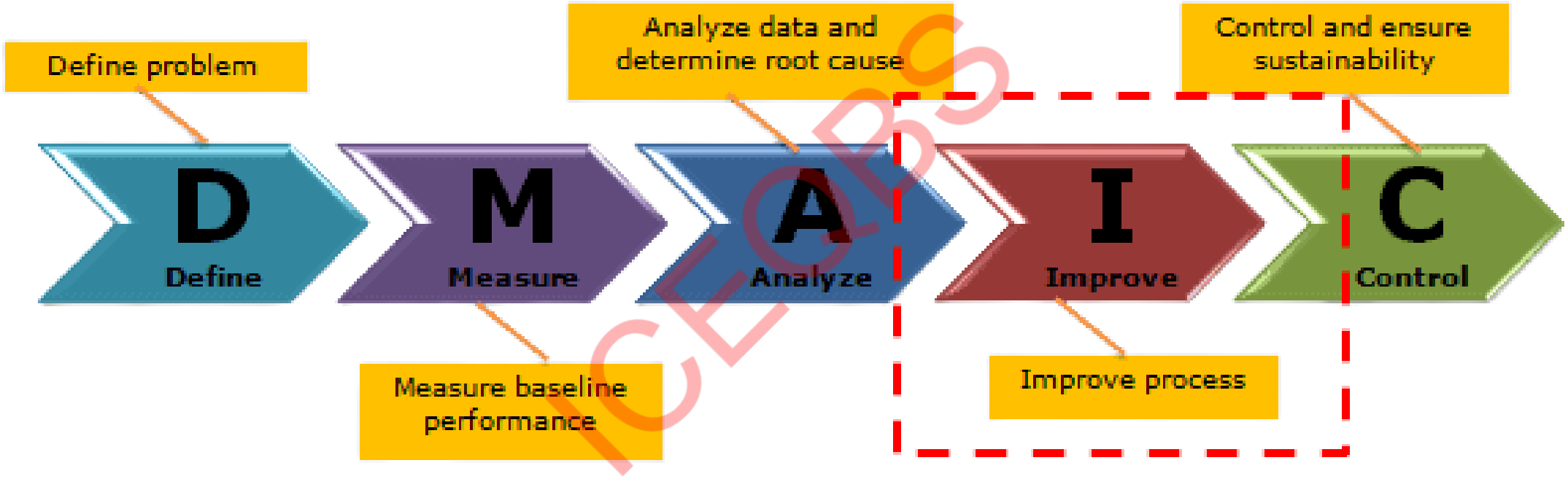
Analyse – Hypothesis testing



Inference :

Trained coders show a significantly lower denial rate compared to untrained coders, indicating a **statistically significant difference**, leading to rejection of H_0 ($p < 0.05$).

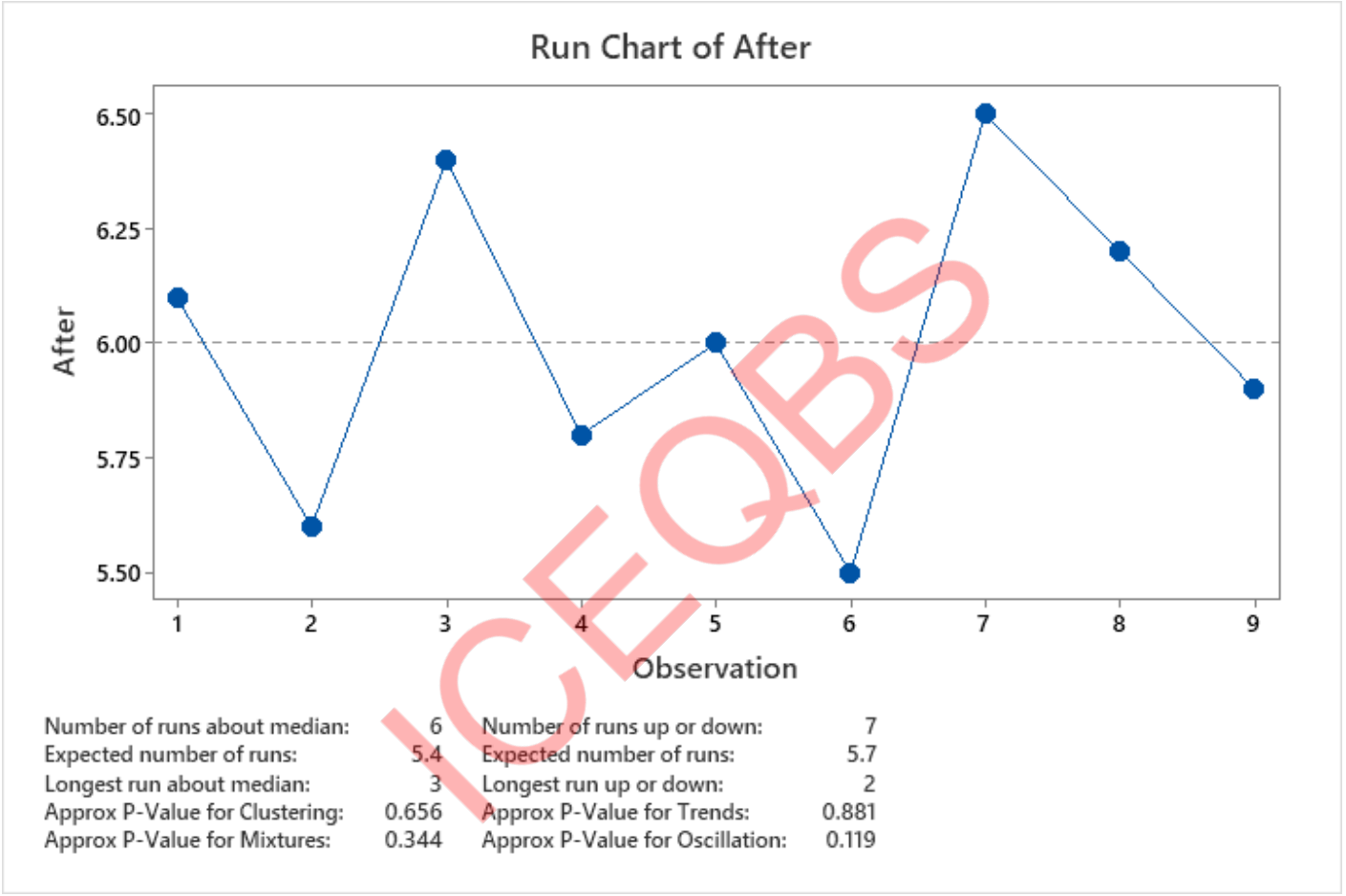
IMPROVE PHASE



Improve

Critical Root Cause	Improvement Action	Tool / Method	Owner	Timeline
Documentation Completeness	Create a standard documentation checklist mapped to payer-specific requirements	Standard Work, Checklist	RCM Ops Manager	2 weeks
Documentation Completeness	Implement pre-bill documentation audit for high-risk claim types	Pre-Bill Audit	Quality	3 weeks
Unclear Coding Guidelines	Develop a single source of truth coding playbook (CPT/ICD/HCPCS)	Knowledge Management	Coding Lead	3 weeks
Unclear Coding Guidelines	Conduct monthly coding clarification huddles with audit feedback	Feedback Loop	Coding Lead	Monthly
Unclear Coding Guidelines	Deploy payer-specific coding rules matrix	Standardization	Quality	4 weeks
Coder Training Status	Mandatory role-based coding certification for all coders	Training Matrix	HR / Coding Lead	6 weeks
All three causes	Implement real-time denial analytics dashboard	Visual Management	Analytics	4 weeks

Improve



•The run chart indicates a **stable and controlled process with no significant trend or special-cause variation after improvement**.

Improve

The probability plot shows the **post-improvement data follows a normal distribution** (p-value = 0.97), confirming **process stability and suitability for further statistical analysis**.

Improve

Two-Sample T-Test and CI: Before, After

μ_1: population mean of Before
μ_2: population mean of After
Difference: $\mu_1 - \mu_2$

Equal variances are not assumed for this analysis.

Descriptive Statistics

Sample	N	Mean	StDev	SE Mean
Before	9	18.56	1.00	0.33
After	9	6.000	0.339	0.11

Estimation for Difference

Difference	95% CI for Difference
12.560	(11.763, 13.357)

Test

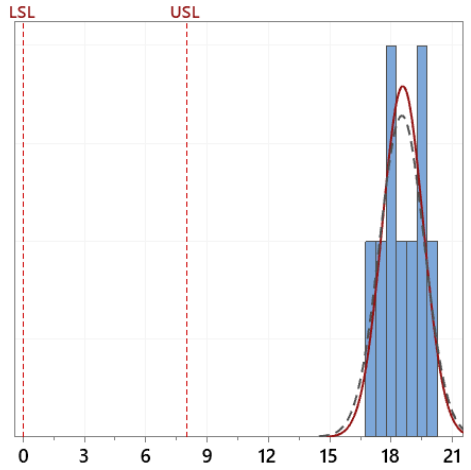
Null hypothesis $H_0: \mu_1 - \mu_2 = 0$
Alternative hypothesis $H_1: \mu_1 - \mu_2 \neq 0$

T-Value	DF	P-Value
35.64	9	0.000

Inference:
The two-sample t-test confirms a **statistically significant reduction after improvement** (mean reduced from 18.56 to 6.00, $p < 0.001$), demonstrating the **Lean Six Sigma intervention was effective**.

Improve – Process capability

Process Capability Report for Before



Process Data

LSL	0
Target	*
USL	8
Sample Mean	18.56
Sample N	9
StDev(Overall)	1.00137
StDev(Within)	1.09264

Overall
Within

Overall Capability

Pp	1.33
PPL	6.18
PPU	-3.52
Ppk	-3.52
Cpm	*

Potential (Within) Capability

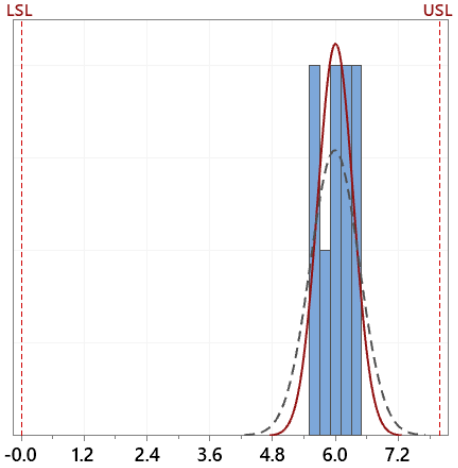
Cp	1.22
CPL	5.66
CPU	-3.22
Cpk	-3.22

Performance

	Observed	Expected Overall	Expected Within
PPM < LSL	0.00	0.00	0.00
PPM > USL	1000000.00	1000000.00	1000000.00
PPM Total	1000000.00	1000000.00	1000000.00

The actual process spread is represented by 6 sigma.

Process Capability Report for After



Process Data

LSL	0
Target	*
USL	8
Sample Mean	6
Sample N	9
StDev(Overall)	0.339116
StDev(Within)	0.465426

Overall
Within

Overall Capability

Pp	3.93
PPL	5.90
PPU	1.97
Ppk	1.97
Cpm	*

Potential (Within) Capability

Cp	2.86
CPL	4.30
CPU	1.43
Cpk	1.43

Performance

	Observed	Expected Overall	Expected Within
PPM < LSL	0.00	0.00	0.00
PPM > USL	0.00	0.00	8.65
PPM Total	0.00	0.00	8.65

The actual process spread is represented by 6 sigma.

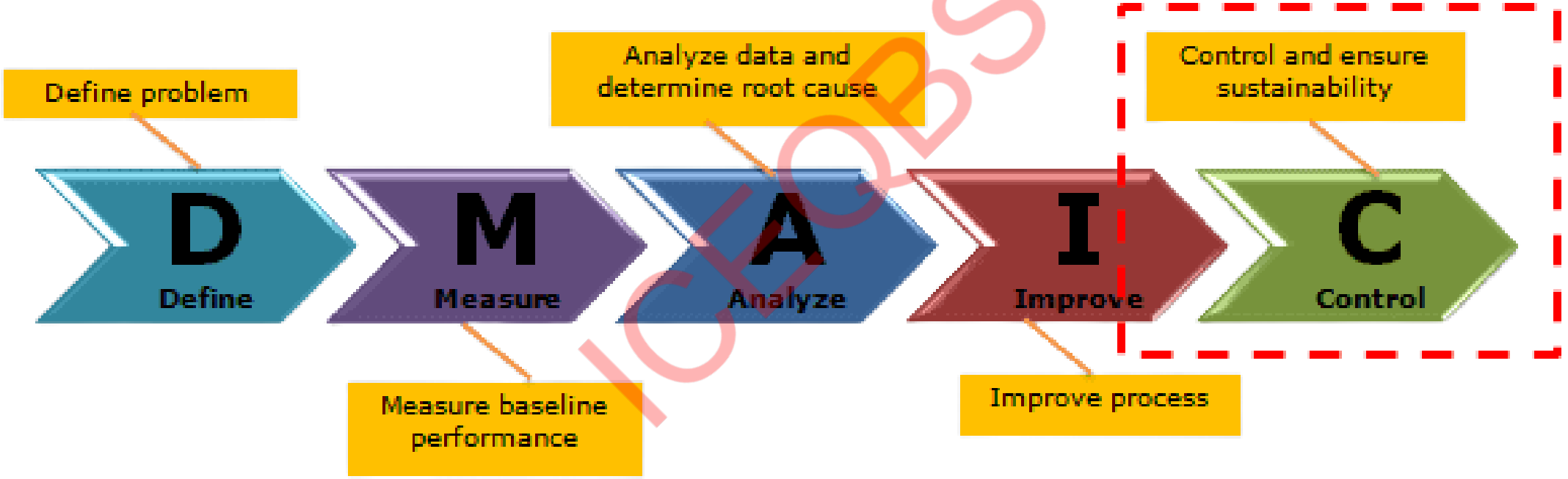
Inference :

Process capability improved significantly after implementation, with **Cpk moving from unacceptable to acceptable levels and defects reduced to near zero**, confirming the process is now capable

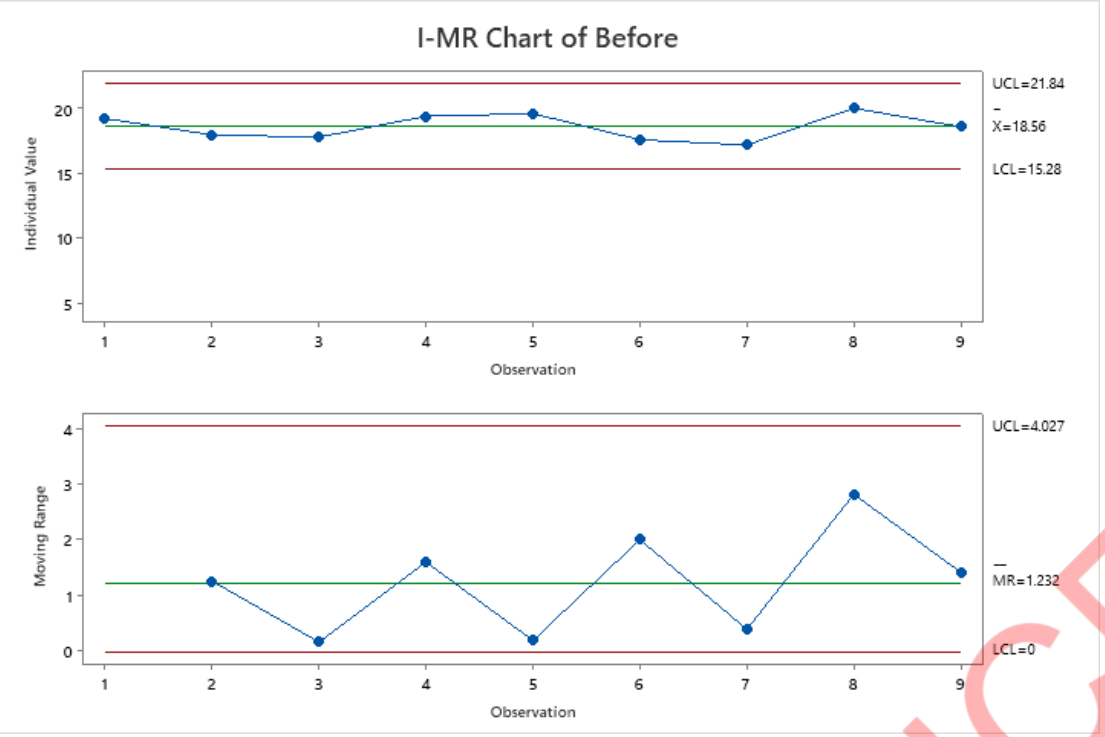
FMEA

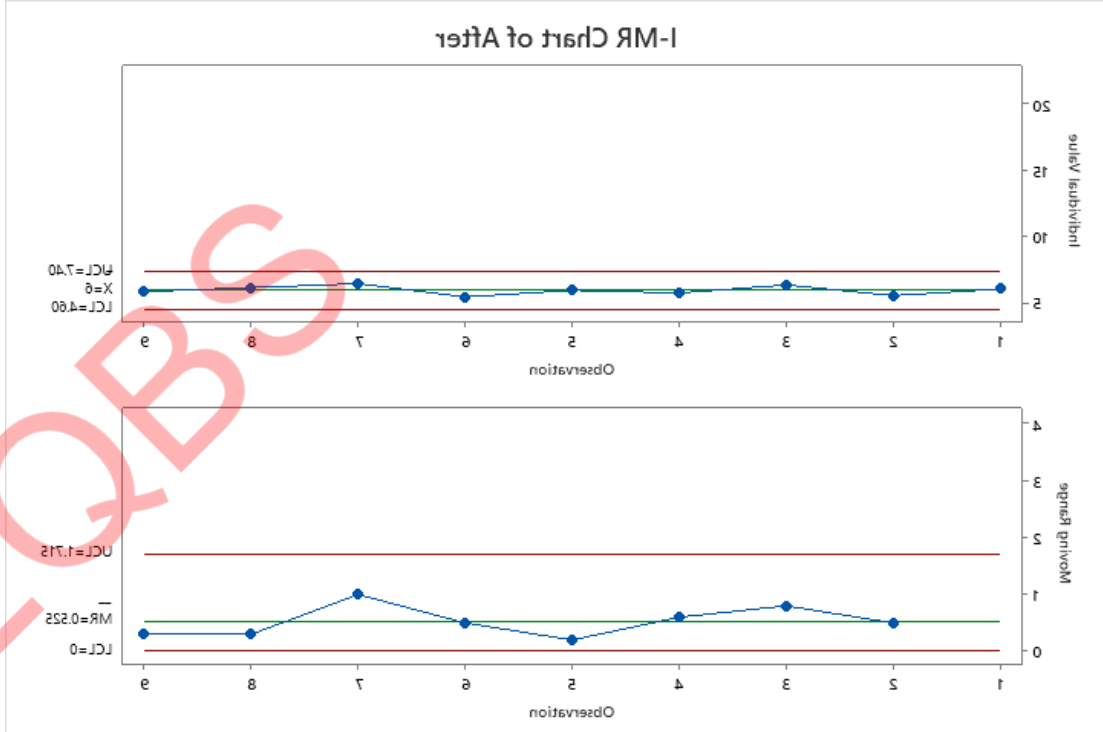
Process Step / Changea	Potential Failure Mode	Potential Effect(s)	S	Potential Cause(s)	O	Current Controls	D	RPN	Recommended Proactive Action	Owner	Target Date	Post-Action S / O / D	Post RPN
1. Documentation checklist rollout	Checklist not used consistently	Missing docs → denials persist	9	Manual process, workload pressure	6	SOP issued	6	324	Make checklist system-embedded & mandatory before claim moves	IT / Ops	3 weeks	9 / 3 / 2	54
2. Pre-bill documentation audit	Audit skipped during peak volume	High-risk claims submitted unchecked	8	Staffing shortage	5	Supervisor oversight	6	240	Risk-based audit (only top denial CPTs); audit auto-flag	Quality	2 weeks	8 / 3 / 3	72
3. EHR mandatory fields	Hard stops incorrectly configured	Processing delays / workarounds	7	Poor rule design	4	User feedback	6	168	Pilot hard stops with 10% claims; refine rules	IT	4 weeks	7 / 2 / 3	42
4. Coding playbook creation	Outdated or conflicting guidance	Wrong codes applied	9	No ownership	5	Email updates	7	315	Assign Coding Governance Owner; version control	Coding Lead	2 weeks	9 / 2 / 3	54
5. Coding guideline usage	Coders continue using old references	Coding variance & rework	8	Habit, ease of access	6	Training session	6	288	Disable access to obsolete files; central repository only	IT / Coding	3 weeks	8 / 3 / 2	48
6. Coder training rollout	Training incomplete / not absorbed	Errors continue	8	No assessment	5	Attendance record	6	240	Add mandatory competency test & certification	HR / Coding	4 weeks	8 / 2 / 3	48

CONTROL PHASE



Control Plan





The I-MR charts show that **process variation and mean have reduced after improvement**, with all points within control limits, indicating a **stable and well-controlled process post-implementation**.

Control Plan

5S Pillar	Mechanism	What to Implement	Sustaining Benefit
Sort	Denial root-cause segregation	Separate denial types (documentation, coding, insurance) into distinct digital folders / queues	Focused action, faster learning
Sort	Archive obsolete coding guidelines	Remove outdated CPT/ICD/payer rules from active access	Prevents wrong guideline usage
Set in Order	Standard claim intake checklist	Single standardized checklist mapped to payer requirements	Improves documentation completeness
Set in Order	Coding playbook structure	One master folder with payer-wise coding rules	Single source of truth
Set in Order	Skill-based work queues	Separate queues for low, medium, high complexity claims	Matches skill to work
Shine	Weekly denial hygiene review	Clean up incorrect mappings, duplicate rules, outdated edits	Reduces systemic errors
Standardize	SOP for claim submission	One-page SOP with screenshots & examples	Reduces variation
Standardize	Coding decision tree	Visual flow for common coding scenarios	Faster, consistent decisions
Sustain	5S digital audit	Monthly audit score for checklist usage & SOP adherence	Discipline & visibility
Failure Risk	Poka-Yoke Mechanism	How It Works	Type
Missing documents	Mandatory field validation	Claim cannot move forward unless required documents are attached	Prevention
Inconsistent documentation	Auto cross-check rules	System flags mismatch between diagnosis, procedure, notes	Detection
Wrong document version	Version control lock	Only latest approved templates allowed	Prevention

Control Plan

Failure Risk	Poka-Yoke Mechanism	How It Works	Type
Wrong CPT/ICD selection	Coding suggestion engine	System suggests codes based on diagnosis	Prevention
Payer-specific rule miss	Payer rules pop-up	Auto alert when payer has special coding rule	Detection
Use of outdated guideline	Time-stamped guideline	Old guidelines auto-expire	Prevention
Wrong CPT/ICD selection	Coding suggestion engine	System suggests codes based on diagnosis	Prevention
Payer-specific rule miss	Payer rules pop-up	Auto alert when payer has special coding rule	Detection
Use of outdated guideline	Time-stamped guideline	Old guidelines auto-expire	Prevention

Conclusion

Results after improvement

- This project successfully reduced claim denials through standardized, error-proofed RCM processes, delivering sustainable improvements in cash flow, operational efficiency, and customer satisfaction.