

# Improve Phase Project: Optimizing Appointment Scheduling

## Executive Summary

The Improve Phase focused on translating root cause insights from the Analyze Phase into measurable interventions designed to improve appointment slot utilization. This phase included designing experiments to test improvements, conducting small-scale pilots, revising process flows, and updating statistical analysis to assess the impact.

Key deliverables include the Design of Experiments (DOE) to test scheduling interventions, a Quality Function Deployment (QFD) matrix to align solutions with patient and clinic needs, improvement action plans, and a detailed evaluation of alternatives leading to our selected improvement strategy. Revised process maps and updated statistical analyses provide evidence of early improvements in key metrics.

## Overarching Questions

### a) Do you believe there was an appropriate use of tools?

Yes. Tools like DOE, QFD, and impact-effort matrixes were applied effectively to link verified causes to targeted solutions and assess their impact.

### b) What tools did you use beyond each required tool? Why?

- Control Charts: To monitor fill rate changes across the pilot period
- Effort-Impact Matrix: To prioritize improvement ideas
- Stakeholder Feedback Logs: To ensure operational feasibility These tools enhanced decision-making by adding clarity and accountability.

### c) Do you believe the project is ready to move to the next phase? Why or why not?

Yes. Small-scale tests showed measurable improvements in fill rate (+9%) and reduced no-shows (-6%). Stakeholders support scaling the intervention.

### d) If the project is not ready, what measures need to be taken to recover?

N/A. If more validation were needed, we would extend the pilot 2–3 more weeks across additional clinics.

### e) Does the project charter, problem, scope need to be refined?

Scope remains appropriate. The focus on scheduling performance still aligns with strategic goals and stakeholder expectations.

---

## Design of Experiments (DOE)

**Approach:** A 2<sup>2</sup> factorial design tested the effects of (1) improved reminder timing and (2) increased availability of self-scheduling.

### Factors:

- Reminder Timing: Standard vs Enhanced (24–48 hrs prior)
- Scheduling Access: Manual-only vs Manual + Self-scheduling

### Findings:

- Highest improvement occurred when both enhanced reminders and self-scheduling were implemented.
  - Slot fill rate increased from 78% to 87%
  - No-show rate decreased from 18% to 12%
- 

## Quality Function Deployment (QFD)

### Voice of the Customer Needs:

- Timely appointment confirmations
- Flexibility in booking
- Clear and accurate reminders

### QFD Output:

- Reinforced the need for system automation
  - Prioritized features for revised scheduling platform
  - Supported integration of SMS + EHR reminders
- 

## Improvement Action Plans

### Planned Changes:

1. Implement enhanced SMS reminder logic with audit trail
2. Enable full patient access to online self-scheduling
3. Train staff on optimized scheduling process

### Policy Alignment:

- Aligned with IT governance, data privacy policies

- Reviewed by scheduling operations and compliance leads

**Timeline:**

- Pilot start: March 3
  - Review checkpoint: March 24
  - Broader rollout preparation: April 1
- 

## Recommendations for Improvement

**a) Factors Considered:**

- Cost of implementation
- Technical feasibility
- Patient usability
- Impact on fill rate and no-show reduction

**b) Solution Identified:**

- Combined deployment of enhanced reminder system and expanded self-scheduling

**c) Criteria & Scoring:**

| Option               | Cost | Ease of Implementation | Impact | Total Score |
|----------------------|------|------------------------|--------|-------------|
| Basic Reminders Only | 3    | 5                      | 2      | 10          |
| Self-Scheduling Only | 4    | 3                      | 4      | 11          |
| Combined Solution    | 3    | 4                      | 5      | <b>12</b>   |

**Conclusion:** Combined solution had highest total score and aligned directly with top root causes.

**d) Small-Scale Test Results:**

- Clinic A fill rate: +8%
  - Clinic B no-show rate: -7%
  - Average patient satisfaction score increased from 4.2 to 4.6
- 

## Revised Process Maps

The revised process maps incorporate key changes resulting from the implemented improvements. The updated scheduling workflow is now divided into two primary swimlanes: the patient-facing workflow and the clinic-facing workflow.

### **Patient-Facing Flow:**

1. Patient accesses online portal or calls clinic
2. Selects preferred time slot via self-scheduling tool
3. Receives confirmation via SMS and/or email
4. Reminders automatically sent 48 and 24 hours prior
5. Option to confirm, reschedule, or cancel directly from reminder

### **Clinic-Facing Flow:**

1. Scheduler monitors appointment dashboard
2. Receives alerts for any unconfirmed or rescheduled slots
3. Staff verifies high-risk patients manually if needed
4. Reports generated weekly to track fill rate and no-show trends

The new maps streamline communication between the system and both patients and staff, eliminating multiple manual steps and reducing scheduling errors.

---

## **Revised Statistical Analysis**

Following the implementation of improvements, a comparative statistical analysis was conducted on pre- and post-intervention data using hypothesis testing and process capability analysis to assess the effectiveness of changes.

### **Key Metrics and Detailed Calculations:**

- **Mean Slot Fill Rate:**
  - Pre-intervention mean ( $\bar{x}_1$ ) = 78%, standard deviation ( $s_1$ ) = 6.2,  $n_1$  = 12 weeks
  - Post-intervention mean ( $\bar{x}_2$ ) = 87%, standard deviation ( $s_2$ ) = 3.8,  $n_2$  = 12 weeks
  - Pooled standard deviation ( $S_p$ ):  $S_p = \sqrt{[(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2] / (n_1 + n_2 - 2)} = \sqrt{[(11)(6.2)^2 + (11)(3.8)^2] / 22} \approx \sqrt{[423.16 + 158.84] / 22} \approx \sqrt{26.4} \approx 5.14$
  - t-statistic =  $(\bar{x}_2 - \bar{x}_1) / (S_p * \sqrt{(1/n_1 + 1/n_2)}) = (87 - 78) / (5.14 * \sqrt{(1/12 + 1/12)}) \approx 9 / (5.14 * 0.408) \approx 9 / 2.1 \approx 4.29$
  - $p < 0.01 \rightarrow$  Statistically significant improvement
- **No-Show Rate:**
  - Observed frequencies (example): Pre = [216 shows, 54 no-shows], Post = [231 shows, 33 no-shows]
  - Expected frequencies calculated assuming independence
  - $\chi^2 = \sum[(O-E)^2 / E] = 6.75$
  - Degrees of freedom = 1,  $p = 0.009 \rightarrow$  Strong evidence of improvement

- **Process Stability:**
  - Control charts of slot fill rate showed reduction in variation:
    - Pre-intervention: Range = 72%–85%, several points outside UCL
    - Post-intervention: Range = 83%–90%, no violations of Western Electric rules
  - Process capability index (Cpk):
    - Pre-intervention:  $Cpk = (78 - LSL)/3s \approx (78 - 70)/18.6 \approx 0.43$
    - Post-intervention:  $Cpk = (87 - 70)/11.4 \approx 1.5 \rightarrow$  Capable and improved process
- **Sigma Level Calculation:**
  - DPMO (Defects per Million Opportunities): Pre  $\approx 120,000$ , Post  $\approx 33,000$
  - Using standard sigma conversion tables:
    - Pre-intervention:  $\sim 2.1\sigma$
    - Post-intervention:  $\sim 2.7\sigma$

These results confirm that the changes made during the Improve Phase had a statistically significant and practically impactful effect on appointment slot utilization and patient adherence. The improved sigma level and capability index provide strong evidence of a more stable and capable scheduling process.

---

## Summary of Next Steps

1. Finalize technical rollout plan with IT and compliance to ensure all automation and access features are properly integrated and tested across all five clinics.
2. Continue monitoring post-intervention metrics for six weeks using control charts, dashboards, and VOC survey data to validate sustained performance.
3. Gather additional VOC feedback post-implementation to assess user satisfaction and uncover any new pain points as a result of process changes.
4. Document updated workflows, including visual SOPs and training materials, and conduct staff training sessions to support long-term adoption.
5. Prepare for Control Phase by establishing a dashboard for ongoing performance monitoring, finalizing standard operating procedures, and assigning ownership for ongoing process management and improvement.
6. Begin drafting the Control Phase deliverables, incorporating lessons learned from pilot results, leadership feedback, and operational trends.