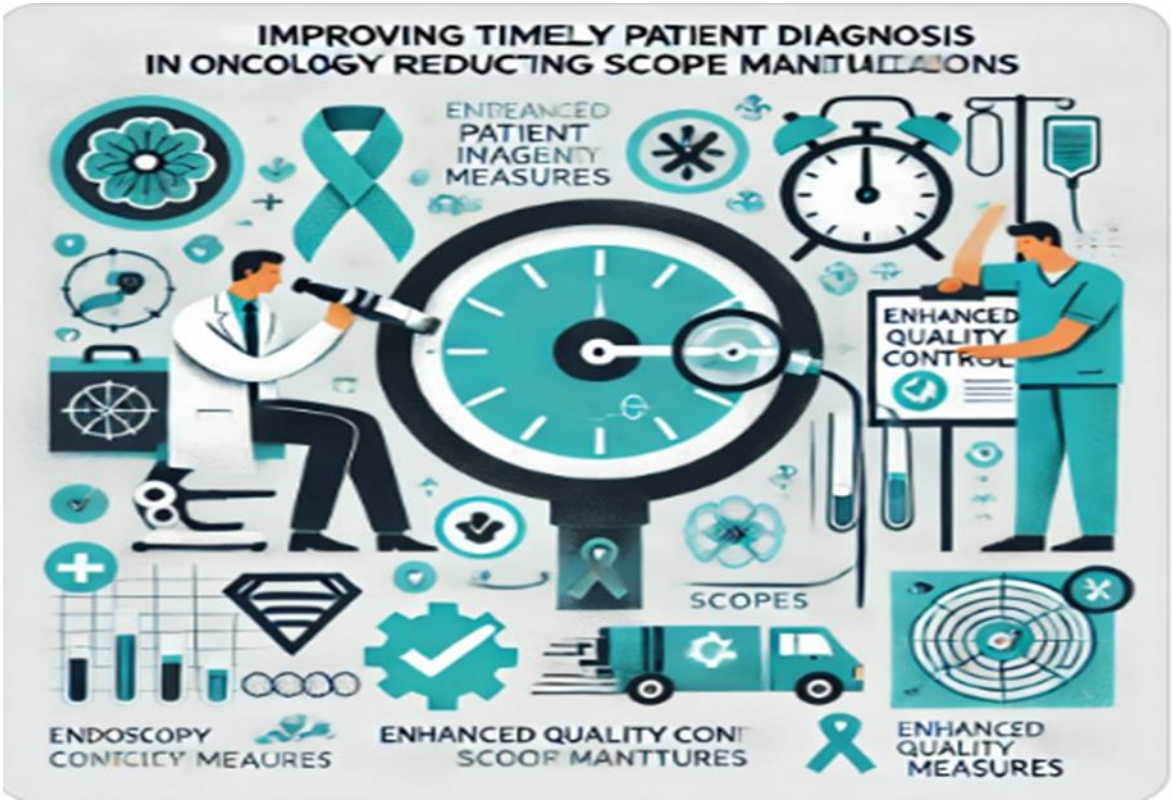
# Chapter 13: Improving Timely Patient Diagnosis in Oncology Setting Through Reducing Scope Malfunctions in Endoscopy Department.

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## Summary

This project aims to enhance the timely diagnosis of patients in an oncology setting by reducing the incidence of scope malfunctions, which are critical tools for endoscopic procedures. The research was conducted at the Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) in Muscat, Oman, focusing on identifying and addressing the root causes of scope malfunctions to improve the efficiency of the diagnostic process.

## Key Points

**Endoscopic procedures are essential in oncology for early diagnosis, monitoring, and treatment, but their efficacy depends heavily on the functionality of the equipment, particularly endoscopes.**

**A root cause analysis identified factors such as improper handling, inadequate maintenance, environmental issues, and a lack of supervision as significant contributors to scope malfunctions.**

**Targeted interventions, including environmental reorganization, enhanced staff training, improved supervision, and optimized equipment management, were implemented to address these issues, resulting in a reduction of scope malfunctions to 0.00% by Q1 2023.**

**These results underscore the need for a structured, evidence-based approach to equipment management in oncology, highlighting the importance of continuous monitoring, staff training, and process optimization to sustain improvements in patient care and operational efficiency.**

## Project Charter

| Project Charter | Details |
|---|---|
| **Project Title** | Improving Timely Patient Diagnosis Through Reducing Scope Malfunctions in endoscopy at Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) |
| **Project Sponsor** | Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC), University Medical City, Muscat, Oman |
| **Project Start Date** | Third Quarter 2022 |
| **Project End Date** | Second Quarter 2023 |
| **Project Purpose** | To enhance the timely diagnosis of patients in an oncology setting by reducing the incidence of scope malfunctions, thereby improving procedural efficiency and patient outcomes. The project aims to identify the root causes of scope malfunctions and implement targeted interventions to minimize these incidents, ensuring optimal equipment performance and reducing delays in patient diagnosis. |
| **Problem Statement** | The frequent malfunctions of scopes in the endoscopy unit at SQCCCRC, with a malfunction rate of 1.68% per performed procedure, have led to procedural delays, increased healthcare costs, and potentially compromised patient safety. This project seeks to identify the root causes of these malfunctions and develop interventions to reduce their frequency, thereby improving the timeliness of patient diagnosis and overall care quality. |
| **Project Goals and Objectives** | 1. Reduce the scope malfunction rate from 1.68% to 0.5% or less by the second quarter of 2023.<br>2. Improve the reliability and efficiency of endoscopic procedures to ensure timely patient diagnosis.<br>3. Implement a comprehensive equipment management plan, including staff training, environmental reorganization, and enhanced supervision.<br>4. Optimize the storage and handling of scopes to prevent damage and prolong equipment lifespan. |
| **Scope** | Includes all activities related to scope management and maintenance within the endoscopy unit at SQCCCRC, covering equipment handling, storage, reprocessing, and staff training. The project focuses on reducing scope malfunctions, improving workflow efficiency, and enhancing patient safety. Excludes non-endoscopic equipment and procedures outside the oncology department. |
| **Key Stakeholders** | Endoscopy Unit Staff, Biomedical Engineering Team, Quality and Accreditation Department, Nursing Staff, Hospital Management, Patients |
| **Resources Required** | Budget for training programs, equipment upgrades, and storage modifications; personnel from relevant departments; IT infrastructure for data management and monitoring; materials for educational sessions and guideline development. |
| **Risks and Assumptions** | **Risks:** Resistance to new processes, limited resources for equipment upgrades and training, and challenges in implementing environmental |

| | |
|---|---|
| | changes.<br>**Assumptions:** Full support from hospital management, availability of necessary resources, active participation of all stakeholders, and effective communication across departments. |
| **Success Criteria** | Achieving a reduction in scope malfunction rate to 0.5% or less; demonstrated improvement in the timeliness of patient diagnosis; successful implementation of interventions, including staff training and environmental reorganization; positive feedback from staff and patients; sustained adherence to equipment management best practices. |

## Introduction

Endoscopic procedures are a cornerstone of modern oncological care, offering minimally invasive techniques that facilitate early diagnosis, monitoring, and therapeutic interventions for cancer patients (Zhai, 2024). These procedures rely heavily on sophisticated equipment, such as endoscopes, which allow direct visualization of internal organs, biopsy collection, and targeted treatment delivery. Endoscopes have transformed patient care by enabling precise diagnostic and therapeutic interventions with minimal patient discomfort, reduced recovery times, and lower risks of complications compared to conventional surgical approaches (Paracchini et al., 2021; He et al., 2023).

However, the efficacy of endoscopic procedures is highly dependent on the reliability and functionality of the scopes used. Frequent malfunctions of these instruments can lead to significant challenges, including procedural delays, increased healthcare costs, and compromised patient safety (Vargo & Jang, 2021). Malfunctions may arise due to various reasons such as mechanical wear and tear, improper handling, environmental factors, or inadequate maintenance practices (Badger et al., 2022). These issues can result in incomplete or inaccurate diagnostic outcomes, increased procedure time, and, in severe cases, potential harm to the patient.

In oncology settings, where time is often a critical factor, the delay caused by scope malfunctions can directly impact patient outcomes. For instance, delays in diagnosis or treatment initiation can lead to disease progression, reduced treatment efficacy, and increased patient anxiety (Zhai, 2024). Additionally, scope malfunctions contribute to higher operational costs due to equipment repair, replacement, and the need for repeat procedures, further straining healthcare resources (Paracchini et al., 2021).

The Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) in Muscat, Oman, has encountered multiple incidents of scope malfunctions within its endoscopy unit. These malfunctions, with a recorded rate of 1.68% per performed procedures between April and July 2022, disrupted the workflow and increased both the time to diagnosis and the financial burden on the healthcare system. Understanding and addressing the root causes of these malfunctions is essential for improving patient care and optimizing operational efficiency.

This project aims to investigate the causes of scope malfunctions at SQCCCRC and develop strategic interventions to minimize these incidents, thereby improving the timeliness of patient diagnosis and enhancing overall care quality in the oncology setting.

## Problem Statement

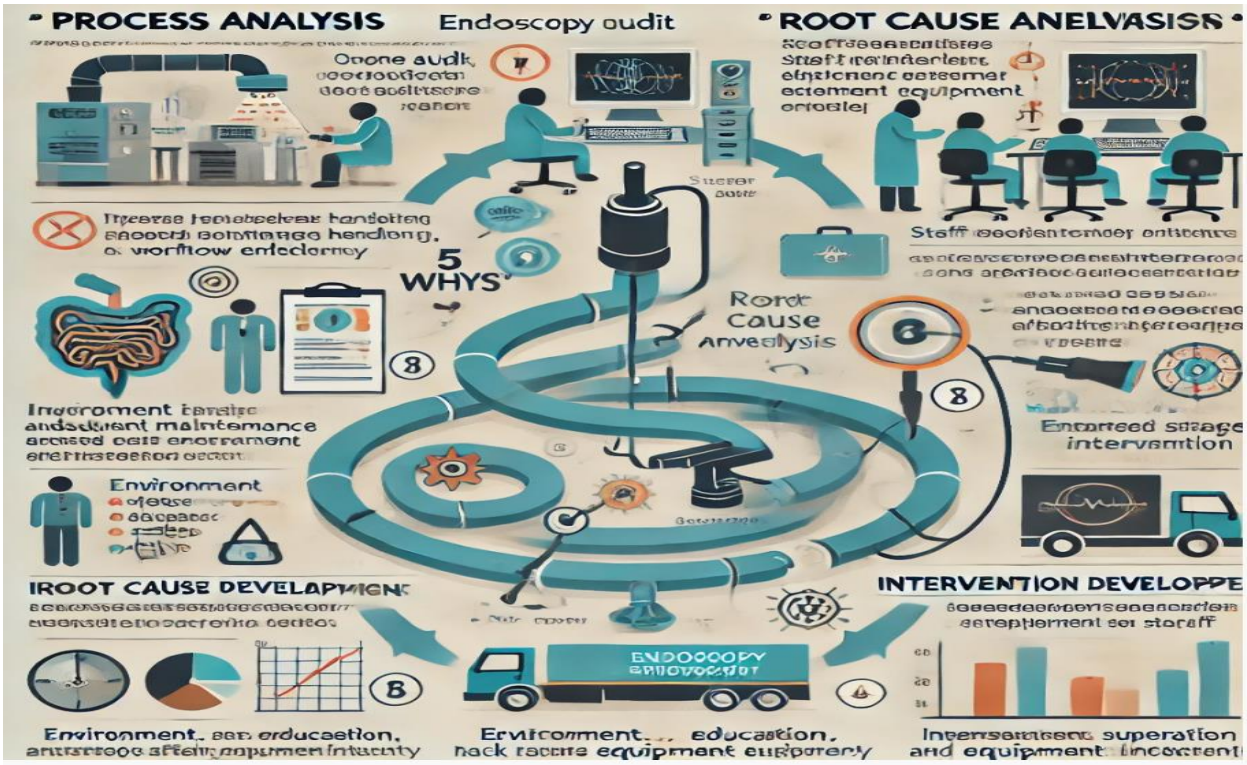
Scope malfunctions in oncology settings present a significant challenge, leading to procedural delays, increased healthcare costs, and potentially compromised patient safety. At SQCCCRC, the malfunction rate of 1.68% per performed procedure indicates systemic issues within the endoscopy unit. This project seeks to identify the root causes of these malfunctions and implement targeted interventions to reduce their frequency, ultimately improving diagnostic timeliness and patient outcomes.


## Methods

**Setting and Design:**

The project was conducted at the Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) in Muscat, Oman, from the third quarter of 2022 to the second quarter of 2023. A quasi-experimental design was employed to evaluate the impact of targeted interventions on reducing scope malfunctions. The project involved a multidisciplinary team, including

members from Biomedical Engineering, Quality and Accreditation, Endoscopy, and Nursing departments.




**Process Analysis:**

An onsite audit of the endoscopy unit was carried out, evaluating equipment layout, staff roles, workflow efficiency, and the physical environment. Maintenance records, procedure manuals, and incident reports were reviewed to identify patterns in malfunction occurrences. Staff interviews provided insights into operational challenges and areas needing improvement.

**Root Cause Analysis:**

A "5 Whys" technique was used to conduct a root cause analysis, identifying key issues such as improper handling, inadequate maintenance, lack of supervision, and environmental factors affecting equipment integrity. The analysis highlighted deficiencies in education, equipment management, and storage practices as significant contributors to the malfunctions (table 1).

**Table 1:** ***Summary of Process and Root Causes Analyses Results***

| Domain | Root Causes |
|---|---|
| Environment | • Reprocessing and storage environment is not appropriate (sink, many types of equipment, machines) |
| | • Uncontrolled access areas |
| | • Different types of equipment and utilities are obstructing the Main CSSD and Endoscopy process workflow (doors, chairs, tables,) |
| Education, Guidance, and references | • Missed Reprocessing and Disinfection Guidelines in Main CSSD |
| | • Lack of awareness about the Endoscopy Reprocessing and Disinfection Guidelines |
| | • Scopes manuals are not available in the CSSD |
| | • Lack of Senior Endoscopy CSSD staff |
| | • No Evidence of proper education (Competencies-checklist) in Endoscopy and Main CSSD |
| Supervision | • Lack of proper direct expert supervision of the sterilization process and proper staff utilization in the Endoscopy and Main CSSD |
| Storage | • Congested storage area in Endoscopy |
| | • Improper distribution of scopes among cabinet in Endoscopy |
| | • No Segregation of low utilized scopes in the storage area in Endoscopy |
| Equipment | • Lack of protective and supportive equipment for important areas in the scopes |
| Staff | • Junior staff with limited experience in CSSD-endoscopy |
| | • Staff number is low |
| | • Improper handling of scope during the washing, sterilization, and transfer |
| Quality check | • Infrequent audit from the quality team and infection control |
| | • Lack of audit from the unit supervisor |
| | • Unstandardized (un-documented) quality check during the scope's workflow, including before the usage |

**Intervention Development:**

Based on the findings, targeted interventions were developed, focusing on:

- **Environmental Reorganization:** Optimizing the reprocessing and storage environment to prevent equipment damage.
- **Staff Training:** Implementing regular training sessions on proper scope handling, maintenance, and safety protocols.
- **Enhanced Supervision:** Strengthening oversight of reprocessing and sterilization practices by assigning dedicated supervisors.
- **Improved Storage Management:** Segregating low-utilized scopes and optimizing storage areas to prevent damage (see Table 2).

**Table 2:** ***Intervention phase results***

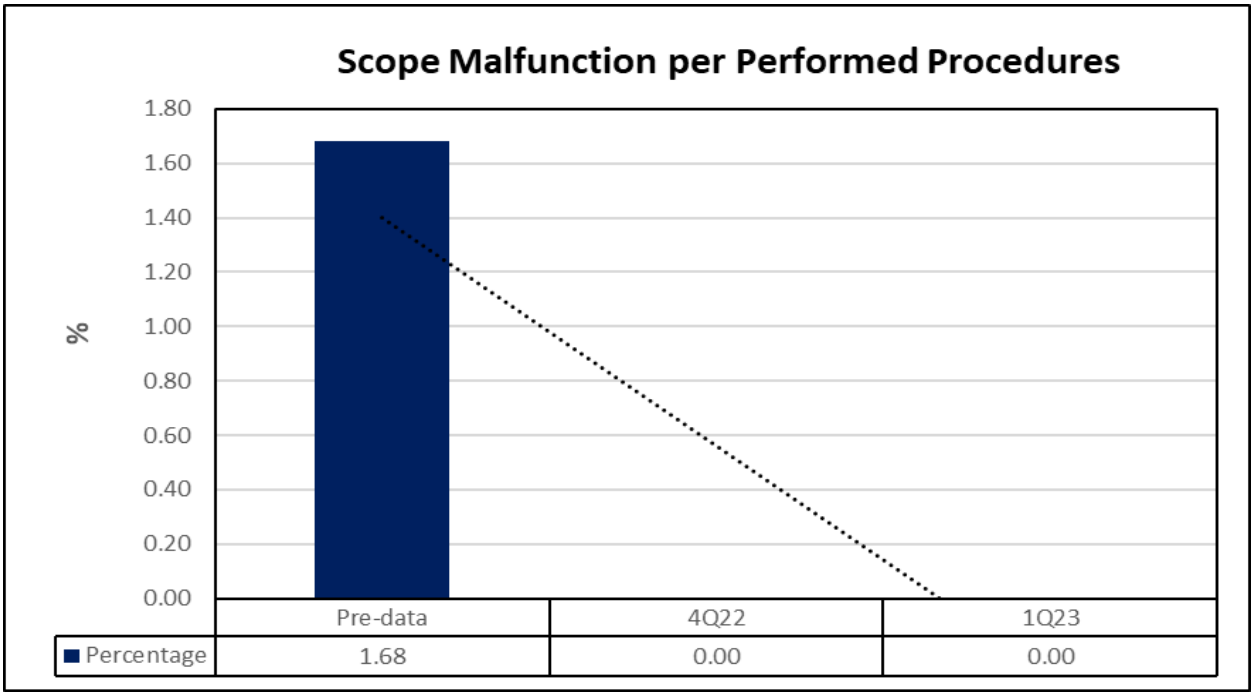
| **Domain** | **Action** |
|---|---|
| Environment | - Organize the environment to optimize reprocessing and scope workflow, reducing incidents of breakage and falls |
| | - Implement a control-access system for all endoscopy unit doors, including the CSSD reprocessing area, to limit access to authorized staff |
| Education, Guidance, references, and Staff Handling | - Develop evidence-based guidelines for sterilizing scopes in the main CSSD |
| | - Conduct staff education sessions on adhering to Endoscopy-CSSD guidelines |
| | - Enhance communication among staff regarding proper scope usage through case review discussions |
| | - Implement competency checklists for scope users based on evidence-based practice |
| Supervision | - Ensure direct expert supervision of the sterilization process and staff utilization |
| | - Separate Endoscopy CSSD staff from the main CSSD |
| | - Establish permanent supervision for Endoscopy CSSD Technicians, including education, competencies, performance evaluation, and leave management |
| Storage | - Optimize storage areas by segregating scopes based on usage and organizing cabinets |
| Equipment | - Ensure availability and proper use of protective equipment for critical areas in scopes |

**Post-Intervention Evaluation:**

The effectiveness of the interventions was evaluated by comparing pre-and post-intervention data on scope malfunction rates, procedural delays, and patient outcomes. Continuous monitoring and data collection were carried out throughout the project period.

## Results

The project observed a substantial reduction in the incidence of scope malfunctions following the implementation of targeted interventions at the Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC). The scope malfunction rate decreased from 1.68% per performed procedures before the interventions to 0.00% by the end of Q1 2023. This represents a complete elimination of malfunctions within the monitored period.



## Discussion

The reduction in scope malfunctions from 1.68% to 0.00% reflects the effectiveness of a structured, multifaceted approach to improving equipment management and operational efficiency in oncology settings. The results indicate that the targeted interventions directly addressed the underlying causes of scope malfunctions, leading to substantial improvements in both procedural reliability and patient outcomes.

The reorganization of the reprocessing and storage environment was critical to the success of the intervention. By optimizing the layout and introducing controlled access, the project minimized the risk of accidental damage to scopes, which was previously a significant issue (Badger et al., 2022). The restructured environment also streamlined the workflow, reducing congestion and ensuring that all equipment was properly stored and handled, which is essential in preventing mechanical wear and tear (Zhai, 2024).

Comprehensive staff training played a pivotal role in reducing malfunctions. The project demonstrated that targeted education on equipment handling, maintenance, and safety protocols could significantly enhance the competency and confidence of healthcare professionals, leading to better adherence to best practices (He et al., 2023). Training programs that included practical demonstrations, case reviews, and competency assessments helped reinforce knowledge and skills, contributing to the observed reduction in malfunction rates (Paracchini et al., 2021).

The introduction of direct expert supervision and regular performance evaluations created a culture of accountability and continuous improvement. Supervision ensured that all procedures were performed correctly and consistently, reducing the variability in practices that can lead to equipment damage (Vargo & Jang, 2021). By establishing clear roles and responsibilities and fostering an environment of continuous learning, the project reinforced the importance of high standards in equipment management and patient care.

Improving the storage conditions for scopes was another key intervention that directly impacted the malfunction rate. Proper segregation of scopes based on usage frequency and the availability of protective equipment reduced the risk of damage during storage and retrieval (Zhai, 2024). This intervention not only extended the lifespan of the equipment but also contributed to a more efficient and organized workflow within the endoscopy unit.

While the project demonstrated significant short-term success, maintaining these improvements will require ongoing efforts. Regular audits, continued education and training, and periodic evaluations of equipment and storage conditions are essential to sustain the gains achieved (Vargo & Jang, 2021). Moreover, integrating advanced technologies for equipment monitoring and maintenance can further enhance the reliability and safety of endoscopic procedures (Ji et al., 2021).

The findings underscore the need for healthcare institutions to adopt a proactive approach to equipment management, particularly in high-stakes environments such as oncology. By

continuously monitoring and refining processes, institutions can minimize risks, reduce costs, and improve patient outcomes.

## Conclusion

The implementation of targeted interventions, including environmental reorganization, enhanced staff training, improved supervision, and optimized equipment management, led to a complete elimination of scope malfunctions in the oncology setting at SQCCCRC. These results highlight the importance of a structured, evidence-based approach to equipment management and operational efficiency. Continued efforts to maintain these improvements will be crucial in sustaining high standards of patient care.

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