Sobraj Service

Improving Diagnosis for Patient Safety in An Oncology Setting: **Quality Initiatives**

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Foreword

In the ever-evolving field of oncology, the pursuit of patient safety and accurate diagnosis remains paramount. Each step in the diagnostic process, from the initial consultation to reporting critical results, is crucial in ensuring patients receive timely and effective care. The initiatives presented in this book, "Quality Initiatives: Enhancing Diagnosis for Patient Safety in Oncology Settings," reflect a comprehensive approach to improving the standards of diagnosis across various service areas at the Sultan Qaboos Comprehensive Cancer Care and Research Centre- University Medical City, Muscat, Oman.

This book is divided into four sections, each focusing on a different aspect of quality improvement initiatives within the oncology setting. The first section provides an introduction and background, setting the stage for understanding the vital role of quality initiatives in enhancing patient safety. Section Two delves into the intricacies of laboratory service quality initiatives, exploring strategies such as using a Risk Assessment Matrix (RAM) to minimize sample mix-ups, optimizing laboratory processes, improving proficiency tests, and enhancing critical lab results reporting. These initiatives underscore the critical importance of accuracy and efficiency in laboratory operations.

Section Three focuses on radiology service quality initiatives, including efforts to reduce biopsy sample mix-ups in the mammogram department, improve the timely reporting of critical radiology results, and enhance turnaround time in radiology and nuclear medicine departments using the PDCA methodology. These initiatives aim to streamline radiology services and support early and accurate diagnoses. In Section Four, the focus shifts to other quality initiatives within the oncology setting, including reducing the time to initiate diagnosis for newly referred patients, activating rapid response teams for emergency clinical situations, and enhancing early detection of high-risk conditions. The section also discusses strategies to improve the identification of psychological problems in oncology care, recognizing the holistic needs of patients and their families.

The final section provides a conclusion, summarizing the key findings and offering future directions for continued quality improvement. Each chapter of this book represents a step forward in the journey toward patient safety and excellence in oncology care. We hope this work serves as a valuable resource for healthcare professionals, administrators, and quality improvement specialists striving to enhance diagnostic accuracy and patient outcomes.

It is with great optimism and dedication to patient-centered care that we present this book. May it inspire innovation and progress in the ongoing efforts to provide the highest quality of care to oncology patients.

Section 1: Introduction and Background

Chapter 1: Introduction and Background

Diagnosis is the cornerstone of patient care, determining the course of treatment and management for a patient's condition. The process of diagnosing involves the synthesis of information gathered from patient interactions, clinical examinations, and diagnostic tests. Accurate diagnosis is vital for guiding appropriate interventions, preventing complications, and ensuring optimal health outcomes.

Yet, this process is complex and vulnerable to errors, which can have profound consequences. When diagnostic errors occur—whether they are delayed, incorrect, or missed—the impact can be devastating, leading to prolonged illness, unnecessary treatment, disability, or even death.

To emphasize the critical need for accurate and timely diagnosis in healthcare, the theme for World Patient Safety Day 2024 is "Get it right, make it safe!" This global campaign, which will be held on 17 September, aims to draw attention to the importance of diagnosis in patient safety and the need for collaborative efforts to minimize diagnostic errors. On this day, stakeholders—including patients, families, healthcare professionals, policymakers, and civil society—will come together to promote strategies and practices that ensure safer diagnostic processes.

Source: WHO 2024

Key Messages for World Patient Safety Day 2024 (WHO, 2024)

- **Correct and Timely Diagnosis: A Foundation for Patient Safety**

A correct and timely diagnosis is the first step towards effective prevention and treatment. However, diagnostic errors—such as missed, incorrect, delayed, or miscommunicated diagnoses—account for 16% of preventable patient harm in healthcare settings.

These errors often result from cognitive biases, insufficient communication, inadequate diagnostic tools, and complex patient presentations. They can worsen patient outcomes, lead to severe or prolonged illness, disability, and death, and increase healthcare costs. Reducing diagnostic errors is essential to improving patient safety and requires a systemic approach that addresses these multifaceted challenges.

- **Understanding the Diagnostic Process: Reducing Errors Through Clarity**

The diagnostic process is multifaceted and includes numerous iterative steps. It begins with the patient's initial presentation, followed by a detailed history-taking and physical examination. This is followed by ordering and interpreting diagnostic tests, communicating results, collaborating among healthcare team members, and developing a treatment plan.

Errors can occur at any point in this process due to factors such as inadequate information gathering, misinterpretation of data, poor communication, or insufficient follow-up. Understanding and clarifying each step in the diagnostic process are crucial for reducing errors and improving patient outcomes.

- **Addressing Diagnostic Errors: A Multi-Pronged Approach**

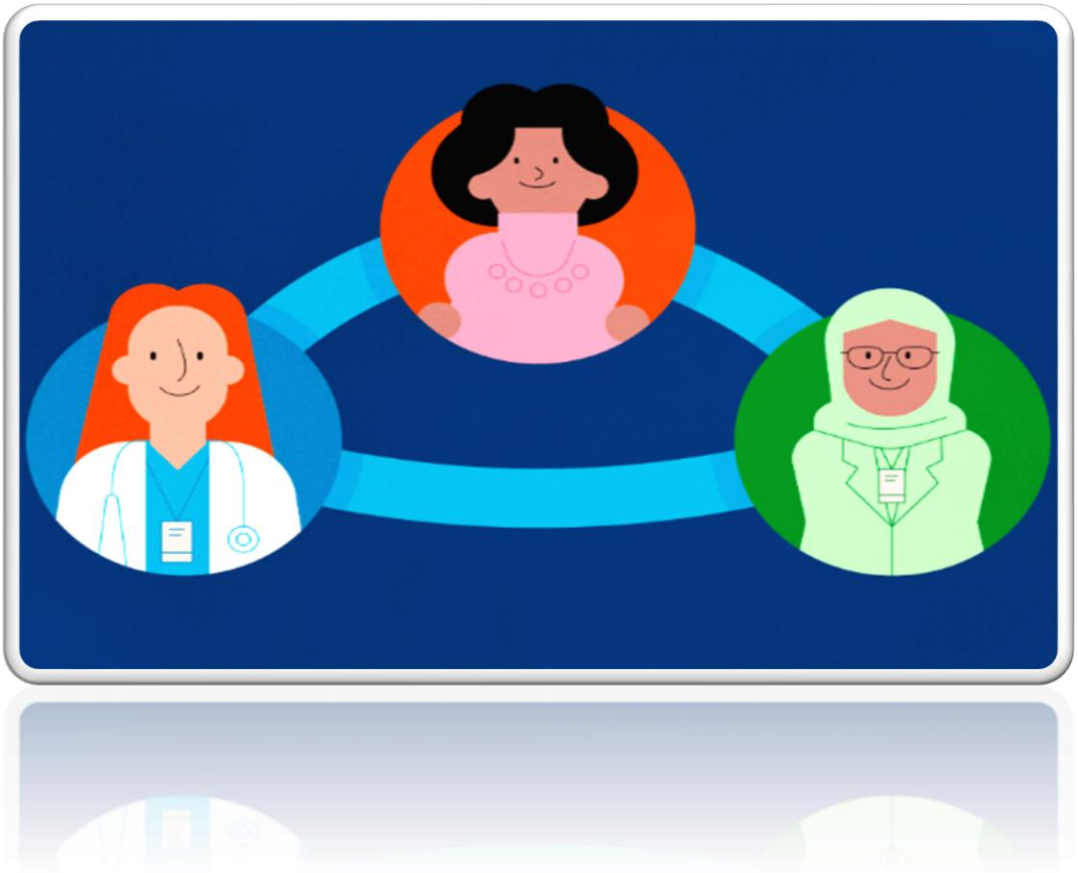
To address diagnostic errors, a multi-faceted strategy is required that engages all levels of the healthcare system. For policymakers and healthcare leaders, this includes fostering a positive workplace culture that encourages transparency, learning, and the use of quality diagnostic tools and technologies.

Healthcare workers should be supported in continuously developing their skills, utilizing evidence-based practices, and recognizing and mitigating unconscious biases. Patients and families should also be empowered to actively participate in the diagnostic process, ask questions, share their concerns, and seek second opinions when necessary. Establishing robust feedback and learning systems is essential to understanding errors when they occur and preventing their recurrence.

Source: WHO 2024

- **Diagnosis is a Team Effort: Collaborative Strategies for Safety**

  Diagnosis is not the responsibility of a single individual but a team effort that requires the active participation of all stakeholders—patients, families, caregivers, healthcare workers, leaders, and policymakers. Collaborative strategies should be promoted, such as regular team meetings to discuss complex cases, interdisciplinary training sessions, and the use of digital tools for better communication and data sharing. Effective teamwork and communication are critical in minimizing errors and improving diagnostic accuracy.



Source: WHO 2024

- **A Call to Action for Safer Diagnosis**

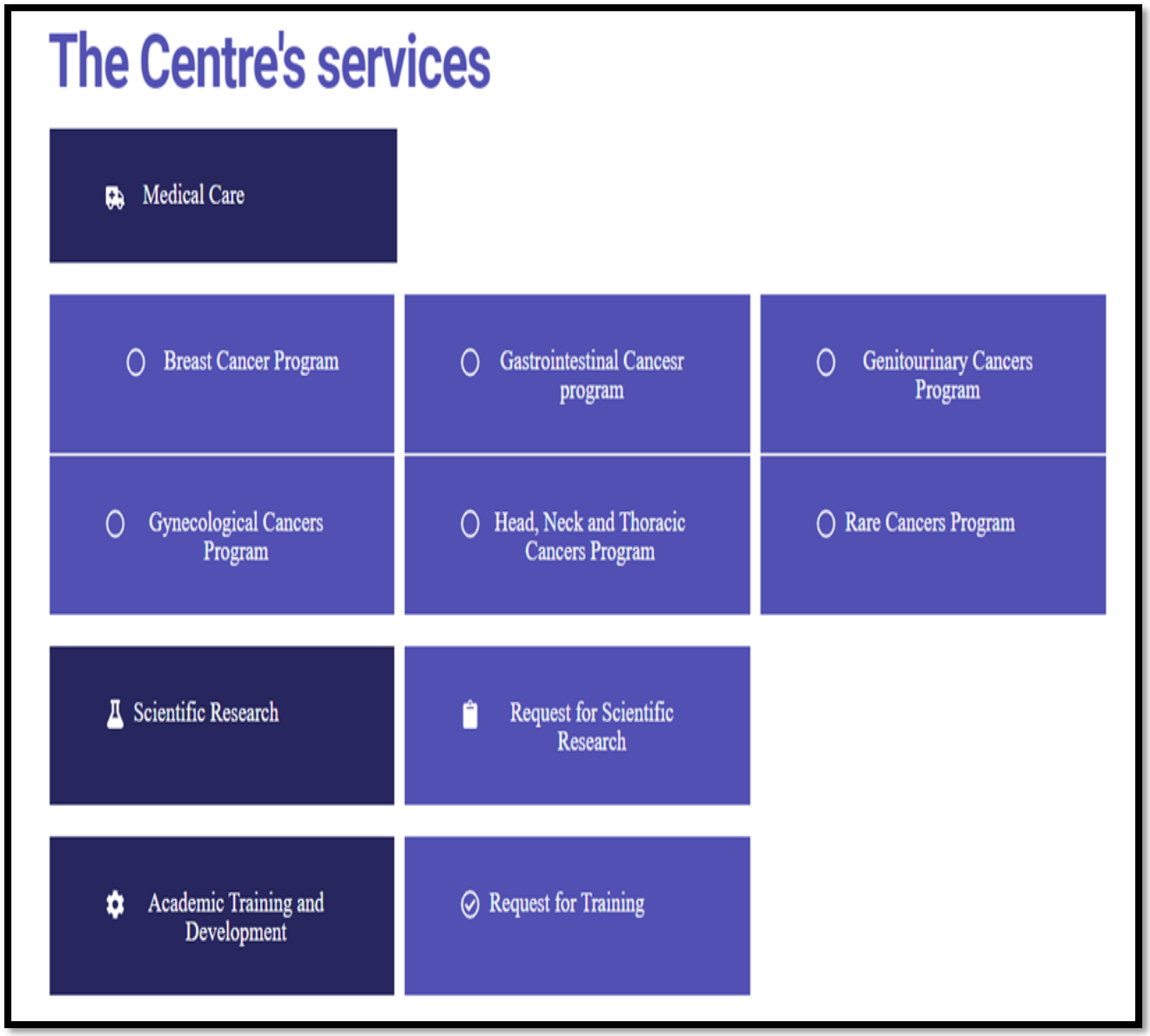
World Patient Safety Day 2024 serves as a call to action for all involved in healthcare to focus on improving diagnosis as a crucial element of patient safety. By understanding the diagnostic process, addressing potential errors, and fostering a culture of collaboration and transparency, we can significantly reduce preventable harm and ensure that every patient receives a timely and accurate diagnosis. As we prepare for this important day, it is vital to remember that getting the diagnosis right is not just a medical imperative but a shared responsibility that affects every aspect of healthcare delivery.

Quality Initiatives Setting.

Quality Initiatives were conducted at the Sultan Qaboos Comprehensive Cancer Care & Research Centre SQCCCRC (University Medical City). Muscat, Oman. SQCCCRC was the vision of His Majesty Sultan Qaboos bin Said, Oman. His directive was to establish a medical center that delivers comprehensive healthcare to cancer patients. The center provides healthcare through a leading multidisciplinary health professional staff with significant potential, expertise, and technical readiness. This includes modern medical equipment, advanced information systems, and a focus on the principle of "Patient First" as its priority.

The center provides the below services offered by the center, categorized into three main sections:

1. **Medical Care**: This section includes various cancer care programs, such as:
    - Breast Cancer Program
    - Gastrointestinal Cancer Program
    - Genitourinary Cancers Program
    - Gynecological Cancers Program
    - Head, Neck, and Thoracic Cancers Program
    - Rare Cancers Program
2. **Scientific Research**: This section covers:
    - General scientific research activities
    - A request option for scientific research
3. **Academic Training and Development**: This section includes:
    - General academic training and development services
    - A request option for training


The Centre's services
Medical Care
Breast Cancer Program
Gastrointestinal Cancesr program
Genitourinary Cancers Program
Gynecological Cancers Program
Head, Neck and Thoracic Cancers Program
Rare Cancers Program
Scientific Research
Request for Scientific Research
Academic Training and Development
Request for Training

Multidisciplinary Team

The multidisciplinary team includes the following specializations across the center's six clinical programs:

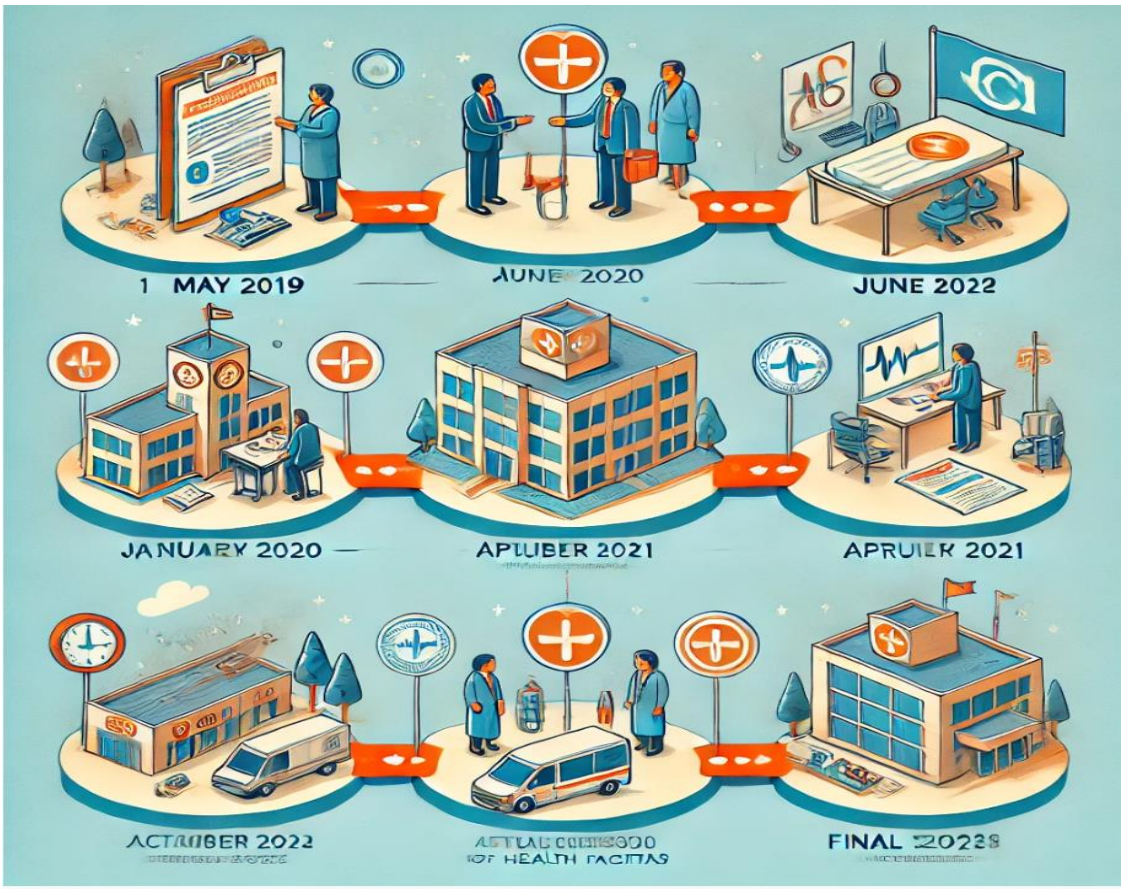
- Oncologists (Cancer Consultants): Specialists in medical, clinical, radiation, and surgical.
- Clinical Nurse Specialists: Coordinate various aspects of patient care and offer ongoing support to patients and their families in both inpatient and outpatient settings.
- Radiologists: Specialist doctors skilled in interpreting scans and X-rays to diagnose cancer.
- Geneticists: Specialists who consult with individuals who have a personal or family history that suggests an inherited cancer risk. They discuss genetic testing options and guide the interpretation of genetic information. Testing results can help guide future medical care.
- Pathologists/Histologists: Specialists who examine human cell samples under a microscope to determine if cancer is present.
- Dietitians: Provide counseling to patients and their families on dietary needs during and after cancer treatment. They offer evidence-based information on dietary modifications to

minimize the side effects of cancer treatments like chemotherapy. Early screening and nutritional interventions can help improve patient outcomes before, during, and after treatment.

- Physiotherapists: Focus on treating disease, injury, or deformity using physical methods such as massage, heat therapy, and exercise.
- Occupational Therapists: Enhance a person's ability to perform normal daily roles.
- The psychosocial team of psychiatrists, psychologists, and social workers offers essential mental and emotional support to cancer patients and their families. They address the challenges of a cancer diagnosis, aiming to enhance well-being and quality of life.
- Pharmacists: Assess, monitor, and collaborate with the multidisciplinary team to ensure medications are prescribed and administered safely and effectively. They educate patients and families about drug use and administration and coordinate with the team on drug therapy decisions to maximize efficacy and minimize side effects.
- Palliative and pain management team.

International accreditation certificate from the Joint Commission International (JCI):

The Sultan Qaboos Comprehensive Cancer Care & Research Centre obtained the international accreditation certificate from the Joint Commission International (JCI) in June 2023. It is one of the most prestigious international accreditation institutions working to enhance the quality of health care in the world. It is characterized by accurate, rigorous, and comprehensive evaluation procedures covering all clinical and administrative aspects, from the patient's admission into the health facility until the time of their discharge.



The Sultan Qaboos Comprehensive Cancer Care & Research Centre is the first governmental health institution in the Sultanate of Oman to obtain such international accreditation in such a short time frame among all the health institutions in the Sultanate of Oman, despite the strict standards enforced to by the Joint International Commission (JCI) for Accreditation of Health Institutions.

Section 2: Laboratory Service Quality Initiatives

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Chapter 2: Optimizing Laboratory Processes: A Path to Reduced Rejection and Improve Safety of Samples in Oncology Setting

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Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) - University Medical City

Summary

This project aimed to enhance the quality of laboratory processes at the Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) by reducing sample rejection and mislabeling rates. Using the FOCUS-PDCA framework, a systematic approach was implemented to identify critical areas for improvement, assemble a multidisciplinary team, clarify the causes of errors, and develop targeted interventions such as educational sessions, process modifications, and improved communication protocols. The interventions resulted in a substantial reduction in sample rejection rates from 20.85% to 6.05% and mislabeling rates from 1.68% to 0.25%, as confirmed by statistical analysis (ANOVA). These outcomes highlight the effectiveness of the applied strategies in optimizing laboratory practices, improving patient safety, and providing a model for other institutions aiming to enhance laboratory accuracy and reliability in oncology settings.

Key Points

- **The project achieved a significant reduction in sample rejection and mislabeling rates, demonstrating the effectiveness of targeted interventions.**
- **A systematic approach using the FOCUS-PDCA framework enabled continuous quality improvement in laboratory processes at SQCCCRC.**
- **Multidisciplinary collaboration among various healthcare professionals facilitated comprehensive problem-solving and effective intervention development.**
- **Educational sessions and process modifications were critical in enhancing staff competencies and reducing laboratory errors.**

Project Charter

	Details
Project Title	Enhancing Quality of Laboratory Processes at Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC)
Project Sponsor	Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC), Muscat, Oman
Project Start Date	Q2 2023
Project End Date	Q1 2024
Project Purpose	To enhance the quality of laboratory processes by reducing sample rejection and mislabeling rates, thereby improving patient safety and care standards in oncology setting.
Problem Statement	High rates of sample rejection (20.85%) and mislabeling (1.68%) are affecting diagnostic accuracy and patient safety at SQCCCRC. Errors are due to improper labeling, workflow inefficiencies, and communication barriers. A systematic approach using the FOCUS-PDCA framework was required to address these issues.
Project Goals and Objectives	1. Reduce sample rejection rate from 20.85% to below 10%. 2. Decrease sample mislabeling rate from 1.68% to below 0.5%. 3. Implement targeted interventions to improve staff training, workflow efficiency, and communication. 4. Establish a sustainable process for continuous quality improvement in laboratory practices.
Scope	Covers all laboratory processes related to sample collection, handling, labeling, transport, and processing at SQCCCRC. Includes interventions such as staff education, process modifications, and communication protocols. Excludes processes outside the laboratory domain.
Key Stakeholders	Oncologists, Nurses, Laboratory Technicians, Quality Management Experts, Informatics Staff
Resources Required	Budget for educational sessions, materials, process modifications; personnel from relevant departments; and data analysis tools (SPSS software).
Risks and Assumptions	**Risks:** Resistance to change, insufficient resources, potential implementation disruptions. **Assumptions:** Availability of necessary resources, stakeholder engagement, and consistent data collection for analysis.
Success Criteria	Achieving the targeted reduction in sample rejection and mislabeling rates, as confirmed by statistical analysis (ANOVA), and improved patient safety and care standards as evaluated through stakeholder feedback and audits.

Introduction

Laboratory sampling is a cornerstone in the field of medical diagnostics, forming the foundation for accurate patient diagnosis, treatment, and monitoring. The integrity and quality of samples are crucial, particularly in oncology, where timely and precise laboratory results significantly impact clinical decisions. Errors in the pre-analytical phase, which includes sample collection, handling, transport, and processing, can lead to significant adverse outcomes. Inaccurate sample handling contributes to misdiagnoses, inappropriate treatments, and delayed therapeutic interventions, ultimately affecting patient safety and care quality (McPherson & Pincus, 2021; Bolton-Maggs et al., 2015).

The pre-analytical phase is considered the most error-prone stage in laboratory medicine, accounting for approximately 60-70% of total laboratory errors (Plebani, 2010). These errors can result from a variety of factors, including improper sample collection, mislabeling, inadequate transport conditions, and incorrect handling procedures. Studies indicate that even minor errors in sample collection or labeling can have catastrophic consequences, particularly in oncology, where treatment decisions often rely on specific molecular and genetic markers (Raab & Grzybicki, 2010; Cadamuro et al., 2017).

At the Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) in Muscat, Oman, the issue of pre-analytical errors has been a persistent challenge. The high incidence of sample rejections and mislabeling incidents has highlighted the need for a systematic approach to enhance laboratory processes. In the last quarter of 2022, blood-related incidents constituted

40% of all reported incidents, underscoring the critical need for improvement in sample handling and management.

Addressing these issues is vital for improving patient safety, ensuring accurate diagnoses, and maintaining high standards of care. Various strategies, including education-based interventions, standardized protocols, and technological enhancements, have been proposed and implemented in different settings to reduce the prevalence of sampling errors (de Mel et al., 2017; Christian et al., 2021). This project, therefore, aimed to optimize laboratory processes at SQCCCRC through a comprehensive approach using the FOCUS-PDCA framework, targeting specific areas of concern to reduce the rate of sample rejection and mislabeling.

By employing a multidisciplinary approach involving oncologists, nurses, laboratory technicians, and quality management experts, this initiative sought to identify root causes, develop targeted interventions, and systematically evaluate their effectiveness. The project demonstrates the potential for significant improvements in laboratory accuracy and reliability through continuous quality improvement measures.

Problem Statement

In the realm of oncology, accurate and timely laboratory results are critical for effective patient management. However, the pre-analytical phase remains fraught with challenges, particularly in high-complexity settings like SQCCCRC, where errors in sample collection and handling can have severe consequences. Issues such as improper labeling, contamination, and delays in transport contribute to a high rate of sample rejections, leading to delays in diagnosis and treatment, increased costs, and potentially adverse patient outcomes.

Despite the crucial role of laboratory diagnostics in cancer care, there is often a lack of standardized protocols and adequate staff training to minimize these errors. This project aimed to address these gaps by implementing a structured, systematic approach to optimize the laboratory.

Methods

This project was conducted at the Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) in Muscat, Oman, from the second quarter of 2023 to the first quarter of 2024. A one-group pretest-posttest quasi-experimental design was employed to assess the impact of targeted interventions on sample rejection and mislabeling rates. The study included all samples processed during the designated timeframe, providing a comprehensive evaluation of the interventions 'effectiveness. The project utilized the FOCUS-PDCA methodology, a widely recognized framework for continuous quality improvement in healthcare settings

1. **Find**

   The initial phase involved identifying critical areas for improvement based on pre-intervention data. Analysis revealed a high rate of sample rejection (20.85 per 1000 samples) and mislabeling (1.68 per 1000 samples). These issues were primarily attributed to improper labeling, inefficient workflows, and communication barriers among staff.

2. **Organize**

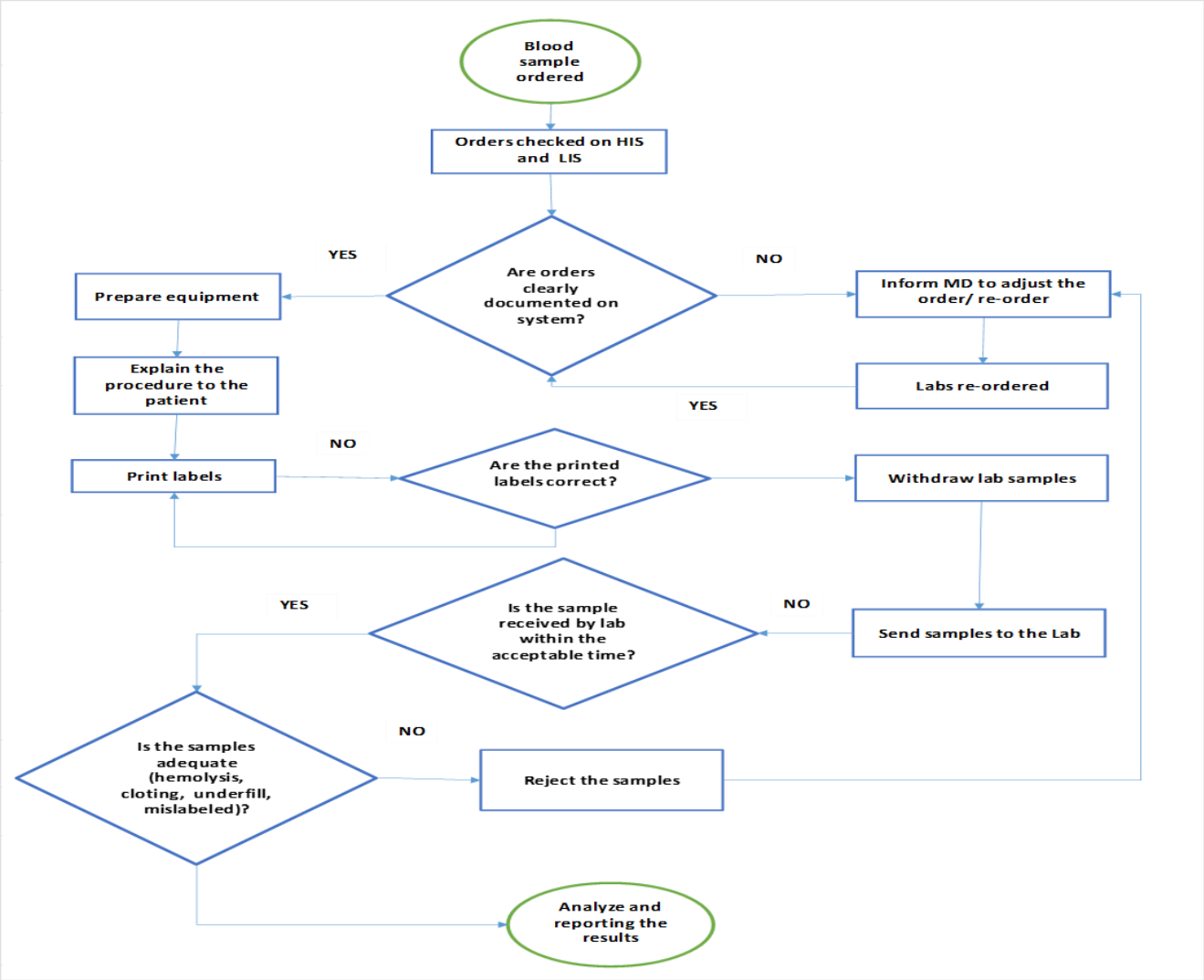
   A multidisciplinary team was assembled, comprising oncologists, nurses, laboratory technicians, quality management experts, and informatics staff. This team was responsible

for conducting a thorough review of current procedures and developing targeted interventions to address identified issues.

3. **Clarify**

Detailed process mapping was performed to analyze existing laboratory workflows, utilizing tools such as flowcharts, checklists, and quality rounds. This phase aimed to identify key barriers contributing to errors, such as improper identification protocols and labeling inaccuracies.

Figure 1: ***Blood Sampling Process***



4. **Understand**

A root cause analysis was conducted using the Fishbone (Ishikawa) diagram to identify the underlying causes of sample errors. This analysis revealed several critical factors, including inadequate staff training, lack of standardized procedures, and poor communication channels.

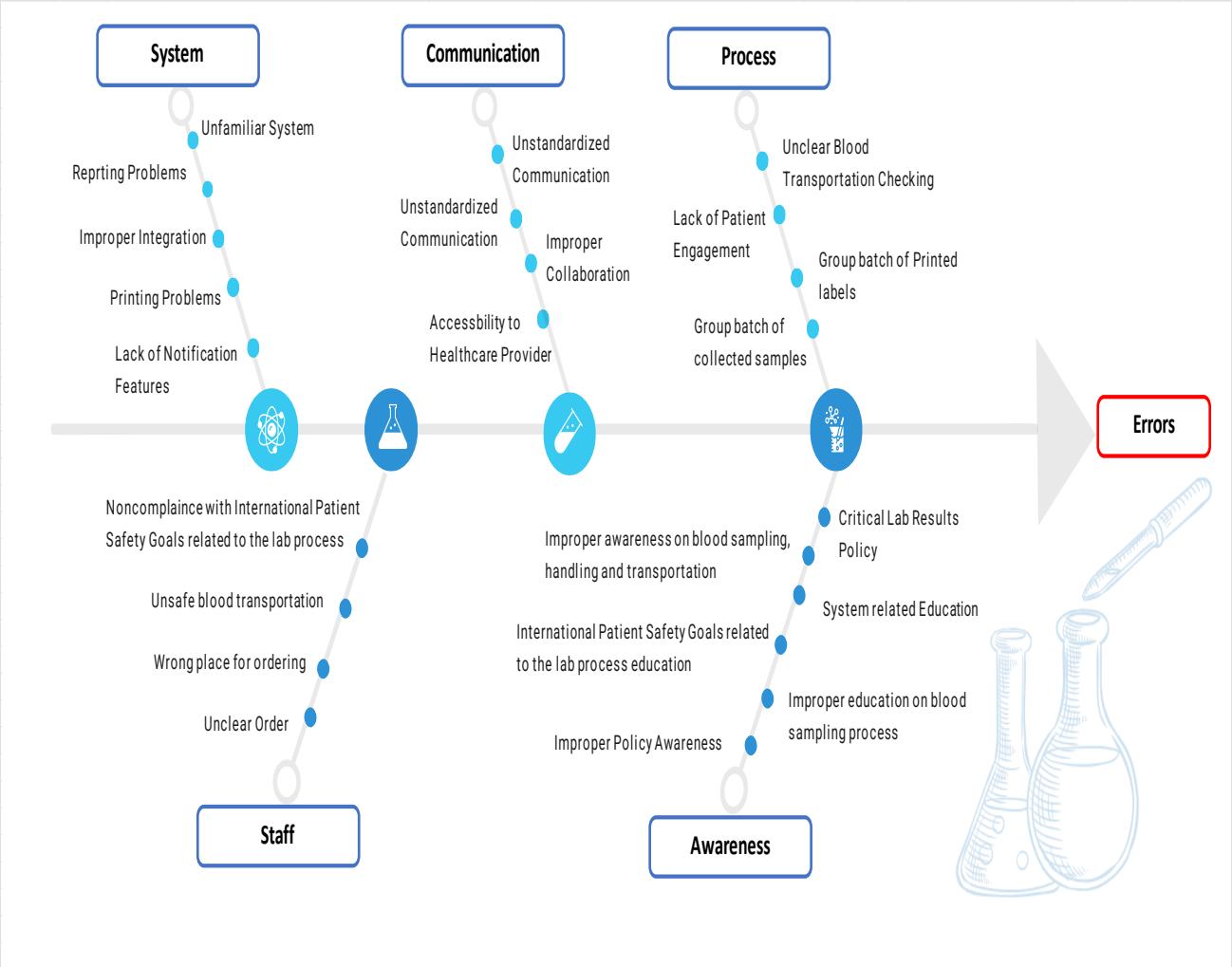


Figure 2: ***Fishbone***

5. **Select, Plan, and Do**

Based on the findings, specific areas for improvement were selected, and targeted action plans were developed (Table 1). Interventions included educational sessions for staff, process modifications, and the introduction of improved communication protocols. Key measures involved:

- **Ordering Process:** Conducted educational sessions to ensure proper placement of orders in the health information system, even during system downtimes. Features were added to the system to alert nurses about new or pending orders
- **Process Modifications:** Implemented a new protocol for printing labels for one patient at a time to reduce the risk of misidentification. Educational materials were developed to enhance staff competency in blood sampling and data collection
- **Labeling Process:** Developed an instruction manual for nurses detailing the types of tests, suitable vacutainers, and handling procedures. Introduced bedside labeling and double-bagging protocols for patients with suspected communicable diseases
- **Transport and Handling:** Trained medical orderlies on safe transportation criteria for lab samples. Implemented stricter documentation procedures at the laboratory reception to track sample receipts and ensure compliance. Ensured compliance during the transport of the samples through Pneumatic tube systems (PTS).
- **Auditing Process:** Regular audits were conducted by nurse managers and quality champions to monitor adherence to protocols and provide on-the-spot education to staff.

Table 1: Interventions

Process	Implemented action Plan
Ordering process	• 4 educational sessions to ensure. • proper placement for ordering lab samples in the health information system • the ordering process during downtime. • Adding features to alert nurses about new or pending orders in the health information system
Process	• Modifying the process: print the labels for one patient at a time and avoid collecting labels for more than one patient. • Educational sessions for nurses about the new process and best practices for data collection via spot education and educational video. • Developing and validating the blood sampling competency for all staff.
Labeling process	• Preparing an instruction manual for nurses that includes types of tests, suitable vacutainers, and the handling of different samples. • Encouraging the nurses to check the order before printing the label. • Labeling immediately after collection in the patient's bedside • Implement double bagging for patients suspected of having a communicable disease.
Transport and receiving the sample	• Educating the medical orderly about the criteria for safe transportation of lab samples. • Refusing unsafe samples and documenting incidents. • Lab reception staff will document the receiving of samples.
Auditing process	• Nurse manager/leader to perform regular rounds to monitor & educate about the process. • Nursing quality/champion to audit the entire process. • Lab quality will follow the endorsement process documentation for all received samples.

6. **Check and Act**

   The effectiveness of these interventions was evaluated through regular monitoring and data analysis. Adjustments were made as necessary to ensure continuous improvement in laboratory processes.

Data were analyzed using SPSS version 23, with pre and post-intervention data compared using ANOVA to assess the effectiveness of the interventions. Key performance indicators, such as sample rejection and mislabeling rates, were monitored throughout the study period to evaluate the impact of the implemented changes.

Results

The intervention resulted in a substantial decrease in rejected samples from 20.85% to 6.05% and in mislabeling rates from 1.68% to 0.25%. Statistical analysis using ANOVA demonstrated significant differences between the pre-and post-intervention phases for both rejection rates (F-value = 12.3458, p-value = 0.002) and mislabeling rates (F-value = 57.1875, p-value < 0.001) (Table 2). These findings indicate the effectiveness of the targeted interventions in optimizing laboratory processes and reducing errors.

Table 2: ***Quality Improvement Results***

Study Period	Quarter 2 2023	Quarter 3 2023	Quarter 4 2023	Quarter 1 2024	F (p-value)
Phase	Pre-intervention	Intervention	Post Intervention	Post Intervention	
Number of Samples	11974	18025	19628	23811	-
Rejected Samples rate	20.85	15	10.76	6.05	12.3458 (0.002)
Mislabeling rate	1.68	0.39	0.25	0.25	57.1875 (<.001)

Discussion

The application of the FOCUS-PDCA framework enabled a structured approach to identify and address critical issues in the laboratory processes at SQCCCRC. The significant reduction in sample rejection and mislabeling rates demonstrates the effectiveness of the interventions and highlights the importance of continuous quality improvement in healthcare settings (Plebani, 2010; Raab & Grzybicki, 2010).

Education-based interventions played a crucial role in reducing sampling errors by improving staff competency and adherence to standardized protocols (de Mel et al., 2017). Moreover, process modifications, such as bedside labeling and secure transport protocols, minimized the risk of mislabeling and contamination, enhancing the overall reliability of laboratory results (Cadamuro et al., 2017; Bolton-Maggs et al., 2015).

The success of this project underscores the importance of a multidisciplinary approach in tackling complex healthcare challenges. Involving various stakeholders, including laboratory technicians, oncologists, and quality management experts, facilitated a comprehensive understanding of the processes and enabled the development of robust solutions (Haroun et al., 2021; Saxena et al., 2004).

Additionally, this initiative provides a model for other institutions seeking to enhance their laboratory processes and improve patient safety. By demonstrating the impact of targeted interventions on reducing errors, the project highlights the potential for significant improvements in clinical outcomes through continuous quality improvement measures (Christian et al., 2021; Misganaw et al., 2019).

Ongoing monitoring and reassessment are essential to sustaining these improvements and ensuring the continued effectiveness of the implemented measures. Regular audits, staff training, and protocol updates should be integral parts of the risk management strategy to maintain high standards of care (Plebani, 2010; Raab & Grzybicki, 2010).

Conclusion

This project successfully optimized laboratory processes at SQCCCRC by significantly reducing sample rejection and mislabeling rates. The systematic approach, guided by the FOCUS-PDCA framework, demonstrates the importance of continuous quality improvement in enhancing laboratory accuracy and patient safety. These findings provide valuable insights for other healthcare institutions aiming to improve their laboratory practices and ensure high standards of care.

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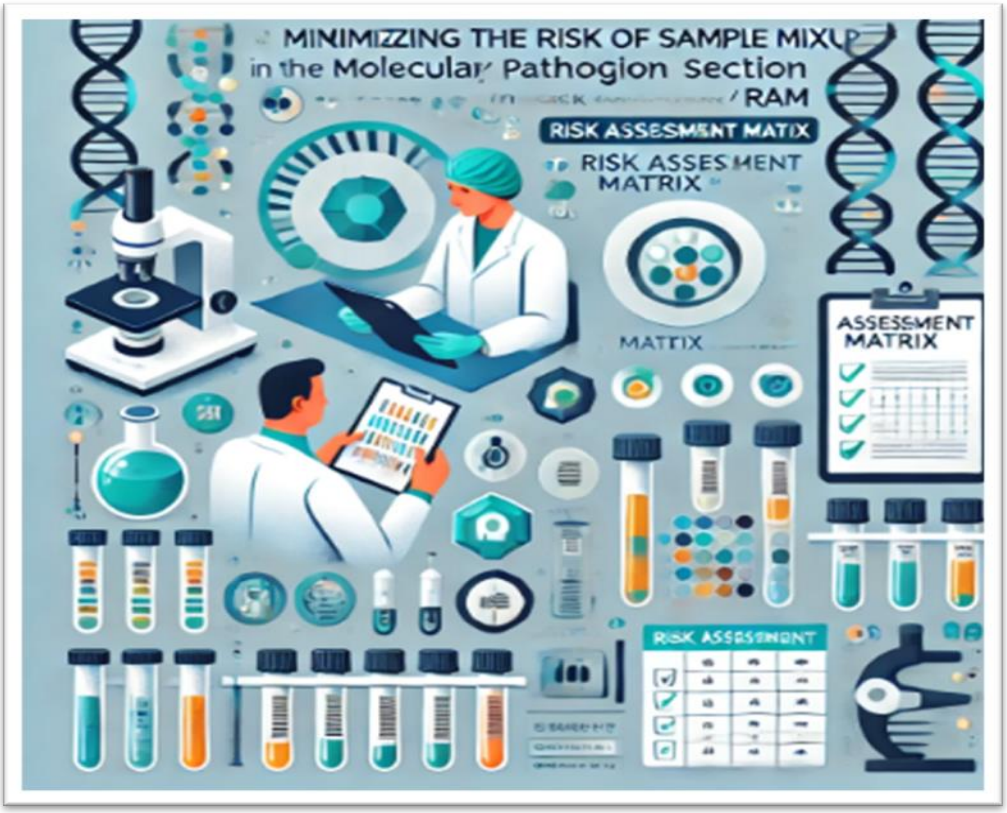
Chapter 3: Minimizing the risk of Sample Mix-ups in the Molecular Pathology Section in Oncology Center using Risk Assessment Matrix (RAM)



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Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) - University Medical City

Summary

This project aimed to minimize the risk of sample mix-ups in the Molecular Pathology section of the Sultan Qaboos Comprehensive Cancer Care and Research Centre by employing a Risk Assessment Matrix (RAM) to identify, evaluate, and mitigate potential risks. Through a systematic approach involving multidisciplinary collaboration, key risks such as incorrect labeling, unattended sample transport, and manual data entry errors were identified and addressed with targeted interventions, including electronic tracking systems, secure transport protocols, and standardized electronic data entry procedures. These measures resulted in a significant reduction in Risk Numbers (RNs), enhancing the accuracy and reliability of molecular diagnostics in oncology and establishing a model for improving safety and quality standards in molecular pathology laboratories.

Key Points

- Sample mix-ups pose significant risks in molecular pathology, potentially leading to misdiagnoses and inappropriate treatments.
- A systematic approach using the Risk Assessment Matrix (RAM) was applied to identify, evaluate, and mitigate risks related to sample handling.
- Key interventions included automated labeling, secure transport protocols, and enhanced staff training to reduce sample handling errors.
- The project successfully reduced risk levels and improved the accuracy and reliability of molecular diagnostics, enhancing patient safety and care quality.

Project Charter

Project Charter	Details
Project Title	Minimizing Sample Mix-Up Risks in the Molecular Pathology Section at Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC)
Project Sponsor	Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC), Muscat, Oman
Project Start Date	Q3 2023
Project End Date	Q2 2024
Project Purpose	To minimize the risk of sample mix-ups in the Molecular Pathology section, ensuring the accuracy and reliability of molecular diagnostics and enhancing patient safety through the use of a Risk Assessment Matrix (RAM) to identify, evaluate, and mitigate potential risks.
Problem Statement	The Molecular Pathology section faces significant risks related to sample mix-ups due to the high complexity and precision required in handling biological specimens. Errors such as mislabeling, incorrect data entry, and sample mismanagement can lead to severe consequences, including incorrect diagnoses and inappropriate treatments. A systematic approach using the Risk Assessment Matrix is needed to identify, evaluate, and address these risks effectively.
Project Goals and Objectives	1. Reduce the risk of sample mix-ups by 50% by the end of Q2 2024. 2. Implement electronic tracking systems and secure transport protocols to enhance sample handling accuracy. 3. Establish standardized electronic data entry procedures to minimize manual entry errors. 4. Develop and apply new policies for consistent labeling and secure handling of samples.
Scope	Covers all sample handling processes within the Molecular Pathology section, including collection, transport, analysis, and reporting. Involves developing and implementing interventions such as electronic tracking, secure transport protocols, and standardized data entry procedures. Excludes processes outside the Molecular Pathology section.
Key Stakeholders	Pathologists, Molecular Biologists, Laboratory Technicians, Quality Management Experts, IT Specialists
Resources Required	Budget for new equipment (e.g., electronic tracking systems, automated label printers), staff training, software for data management; personnel from various departments; and data analysis tools.
Risks and Assumptions	**Risks:** Resistance to change among staff, potential technical challenges with new systems, and insufficient resources. **Assumptions:** Availability of necessary resources, stakeholder engagement, and ongoing support from management for risk mitigation efforts.

Success Criteria	Achieving the targeted reduction in sample mix-up risks, as confirmed by the reduction in Risk Numbers (RNs) using the Risk Assessment Matrix, and demonstrating improved safety and quality standards in molecular diagnostics as evidenced by compliance with best practices.

Introduction

In oncology, the Molecular Pathology section is a cornerstone of cancer diagnosis and management, providing precise molecular diagnostics essential for identifying genetic mutations, guiding targeted therapies, and monitoring disease progression. Given the complexity and sensitivity of molecular testing, the risk of sample mix-ups is heightened, potentially leading to serious consequences such as misdiagnoses and inappropriate treatments. Accurate sample handling and processing are, therefore, critical to maintaining the reliability of these diagnostic procedures and ensuring patient safety (Duntsch et al., 2022).

Sample mix-ups in molecular pathology can occur at multiple points, including during collection, transportation, analysis, and reporting. Even minor errors, such as incorrect labeling or manual data entry mistakes, can have catastrophic effects by producing incorrect diagnostic outcomes. In the context of oncology, where timely and accurate diagnoses are crucial for effective treatment, these errors are particularly detrimental. They can lead to delayed or inappropriate therapy, increased patient anxiety, and potentially poorer clinical outcomes (Zhou et al., 2022).

To mitigate these risks, this project focused on minimizing the likelihood of sample mix-ups in the Molecular Pathology section of the oncology center at Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC). The project utilized a Risk Assessment Matrix (RAM) as the primary tool for identifying, evaluating, and addressing potential risks associated with the sample

handling process. The RAM method categorizes risks based on their severity and likelihood, enabling healthcare professionals to prioritize interventions for the most significant threats to patient safety and diagnostic accuracy.

The purpose of this initiative is to enhance the reliability of molecular diagnostics by implementing stringent controls and best practices. By conducting a thorough risk assessment and applying targeted interventions, the project aimed to reduce the incidence of sample mix-ups, thereby improving overall patient care quality. The successful application of the Risk Assessment Matrix serves as a model for improving safety and quality standards in molecular pathology laboratories, setting a benchmark for best practices in the field (Duntsch et al., 2022).

The findings of this project demonstrate that systematic risk management approaches, such as RAM, can effectively identify and mitigate key risks, leading to significant improvements in sample handling accuracy and reliability. This initiative underscores the importance of proactive risk management in specialized healthcare environments and provides valuable insights for other institutions seeking to enhance their molecular pathology services (Zhou et al., 2022).

Problem Statement

The Molecular Pathology section faces significant risks related to sample mix-ups due to the high complexity and precision required in handling biological specimens. Minor errors, such as mislabeling or incorrect data entry, can have severe consequences, including the delivery of incorrect patient results. These mistakes can occur at various stages, from sample collection and transportation to processing and reporting. Given the critical role of molecular diagnostics in oncology, where accurate and timely information is essential for guiding treatment decisions, any lapse in sample handling can adversely affect patient outcomes and safety (Duntsch et al., 2022).

Additionally, the absence of robust protocols and inadequate staff training further exacerbate the risk of errors. This environment presents a significant challenge for maintaining the reliability of molecular diagnostics, highlighting the need for a systematic and comprehensive approach to risk management. Without such an approach, the potential for catastrophic errors remains high, underscoring the urgency of addressing this issue through targeted interventions.

Methods

Setting:

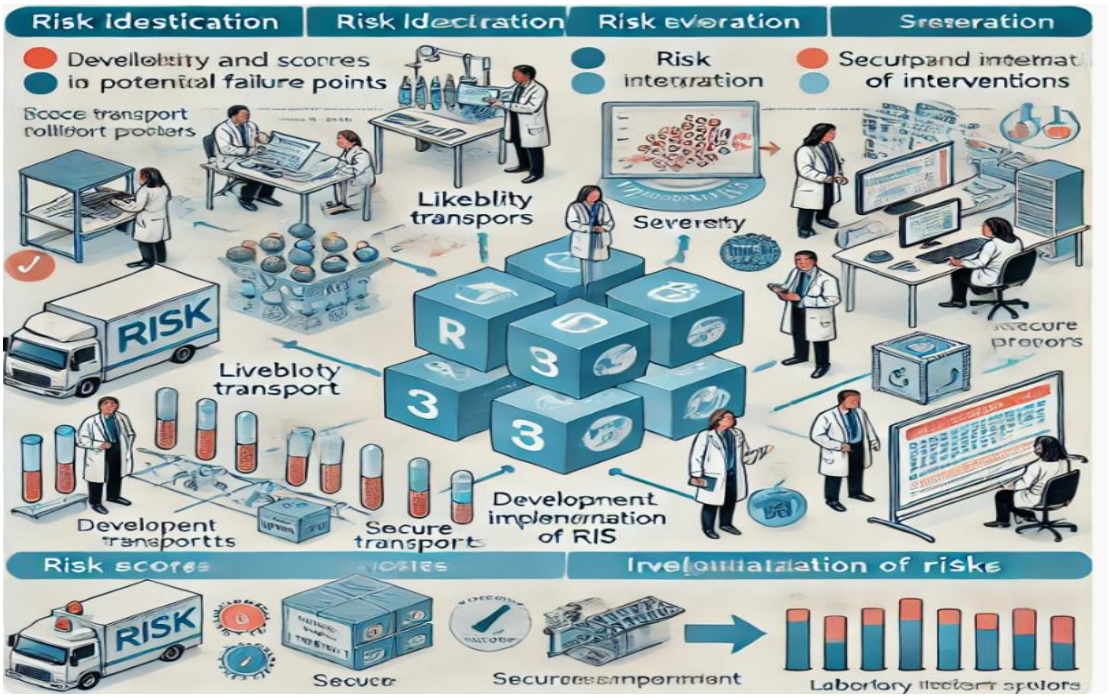
The study was conducted in the Molecular Pathology section of the Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC), University Medical City in Muscat, Oman. The study spanned from the third quarter of 2023 to the second quarter of 2024, focusing on improving the integrity and accuracy of sample handling processes to minimize the risk of mix-ups.

Design:

A one-group pretest-posttest design was utilized to evaluate the effectiveness of the interventions in reducing the risk of sample mix-ups. This design enabled a comparative analysis of key performance indicators, such as sample misidentification and labeling error rates, before and after implementing the interventions. The study included all samples processed during the designated timeframe to ensure a comprehensive evaluation of the interventions' impact (Getawa et al., 2023).

Risk Assessment Matrix (RAM):

The Risk Assessment Matrix (RAM) was employed as the primary tool for identifying and prioritizing risks associated with sample handling in the Molecular Pathology section. The RAM framework categorizes potential risks based on their likelihood of occurrence and the severity of their consequences, allowing for a structured approach to risk management.



The methodology involved several key steps:

- **Risk Identification:**

A multidisciplinary team, comprising pathologists, molecular biologists, laboratory technicians, quality management experts, nursing, and IT specialists, conducted a comprehensive review of existing sample handling processes to identify potential failure points. Key data sources included process flowcharts and staff interviews (Figure 1).

- **Risk Evaluation:**

Identified risks were assessed using the RAM, which involved assigning scores for the likelihood and severity of each risk. Likelihood scores ranged from 1 (rare) to 5 (almost certain), while severity scores ranged from 1 (insignificant) to 5 (catastrophic). The product of these scores provided a Risk Number (RN) for each identified risk, guiding the prioritization of mitigation efforts.

- **Development and Implementation of Interventions:**

Based on the RNs, the team developed targeted interventions to address the highest-priority risks. These included new policies for consistent labeling, secure transport protocols, eliminating Excel-based registrations, and introducing automated label printers integrated with the Laboratory Information System (LIS).

- **Re-evaluation of Risks:**

The team re-evaluated the risks post-intervention to assess the effectiveness of the actions taken, using the RAM framework to measure improvements in risk management

Figure 1: ***Flow Chart of Sample Handling Process in Molecular Pathology***

Results

The initial assessment identified several critical risks, such as the use of free labels, samples sent unattended, and manual data entry, all of which had high Risk Numbers (RNs). The application of the Risk Assessment Matrix (RAM) allowed for a structured evaluation of these risks, leading to targeted interventions that significantly reduced the RNs (Table 1). For example:

- **Printing Extra Labels Indicating Sending Samples:** The initial assessment showed a moderate risk with an RN of 6 (likelihood 3, severity 2). The intervention involved discontinuing the use of extra labels and replacing them with electronic tracking systems, reducing the risk to an RN of 2 (likelihood 2, severity 1).
- **Samples Sent Through PTS Unattended:** This risk was initially rated very high, with an RN of 16 (likelihood 4, severity 4). Implementing secure transport protocols, including tamper-evident containers and monitoring systems, reduced the RN to 6 (likelihood 2, severity 3).
- **Combining Samples from Different Locations with Free Labels:** Initially, this risk had an RN of 16 (likelihood 4, severity 4). Introducing separate handling and labeling for samples from different locations, along with an integrated Laboratory Information System (LIS), reduced the RN to 6 (likelihood 2, severity 3).
- **Registration in Excel and Handwriting Section Sample Numbers:** Initially rated with an RN of 16, this risk was addressed by transitioning to an LIS for all registration and labeling processes, effectively reducing the RN to 2 (likelihood 1, severity 2).

- **Manual Entry of Sample Details into LIS System:** The risk of manual data entry errors had an initial RN of 12. The intervention involved standardizing electronic data entry procedures and introducing double-checking and validation processes, reducing the RN to 4.
- **Handwriting Labels on All Tubes:** This practice had an initial RN of 12. Adopting automated label printers integrated with the LIS eliminated handwritten labels, reducing the risk to an RN of 2.
- **Nursing Non-compliance with ID Identification (Two Identifiers):** Initially, this risk had an RN of 16. Implementing strict adherence to ID policies, supported by education and disciplinary measures, reduced the risk to an RN of 6.
- **Loading/Unloading Samples Without Proper Witness:** Initially assessed with an RN of 6, implementing a formalized witness protocol reduced the risk to an RN of 2.
- **Incomplete Patient and Sample Location Data:** The initial RN was 9. Ensuring the LIS included mandatory fields for critical information reduced the risk to an RN of 2.

Overall, the interventions effectively lowered the risk priority numbers across all identified risks, reflecting significant improvements in managing and controlling sample handling processes within the molecular pathology section, and enhancing the accuracy and reliability of laboratory results (Zhou et al., 2022).

Table 1: ***RAM Results for Main Risks***

Main Risk	Likelihood (L)	Severity (S)	Initial RN (L*S)	Intervention	New Likelihood (L)	New Severity (S)	New RN (L*S)
Printing extra labels indicating sending samples	3	2	6	Discontinue the use of extra labels; replace them with electronic tracking systems.	2	1	2
Samples sent through PTS unattended	4	4	16	Implement secure transport protocols with tamper-evident containers and monitoring systems.	2	3	6
Combining samples from different sources with free labels	4	4	16	Ensure separate handling and labeling for samples; use an integrated LIS.	2	3	6
Registration in Excel and handwriting section sample numbers	4	4	16	Transition to LIS for all registration and labeling processes.	1	2	2
Manual entry of sample details into LIS system	3	4	12	Standardize electronic data entry; implement double-checking and validation processes.	2	2	4
Handwriting labels on all tubes	4	3	12	Use automated label printers integrated with LIS.	1	2	2
Nursing non-compliance with ID identification	4	4	16	Enforce strict adherence to ID policies with education and disciplinary actions.	2	3	6
Loading/unloading samples without proper witness	2	3	6	Establish a formalized witness protocol.	1	2	2
Incomplete patient and sample location data	3	3	9	Ensure LIS includes comprehensive patient and sample location information.	1	2	2
Inaccurate documentation in HIS/LIS	3	4	12	Enforce accurate documentation protocols; restrict unauthorized edits.	1	2	2

Discussion

The application of the Risk Assessment Matrix (RAM) in the Molecular Pathology section at SQCCCRC successfully identified and mitigated key risks associated with sample handling, demonstrating its effectiveness in enhancing the quality and safety of molecular diagnostics in oncology. The significant reduction in Risk Numbers (RNs) across all identified risks underscores the value of this systematic approach to risk management in healthcare settings (Zhou et al., 2022). By categorizing risks according to their likelihood and severity, the RAM method provided a structured framework for prioritizing interventions, enabling targeted and efficient responses to the most significant threats to patient safety.

The interventions implemented in response to the identified risks led to marked improvements in the accuracy and reliability of sample handling processes. For instance, the transition from manual data entry to electronic systems, the elimination of handwritten labels, and the introduction of secure transport protocols collectively reduced the potential for errors and mix-ups, thereby minimizing the risk of incorrect diagnoses and treatment plans (Duntsch et al., 2022). These results align with previous findings in similar healthcare contexts, where systematic risk management approaches have proven effective in reducing error rates and enhancing patient safety (Getawa et al., 2023).

Furthermore, the project highlights the importance of a multidisciplinary approach to risk management. By involving pathologists, molecular biologists, nurses, laboratory technicians, quality management experts, and IT specialists, the initiative benefited from a comprehensive understanding of the sample handling process, which facilitated the identification of vulnerabilities

and the development of robust solutions. This collaborative approach is essential in complex healthcare environments where multiple factors can contribute to errors, and diverse expertise is needed to address them effectively (Duntsch et al., 2022).

The findings also emphasize the need for continuous monitoring and reassessment to ensure sustained improvements in quality and safety standards. While the interventions led to significant reductions in risk levels, ongoing evaluation is necessary to identify any emerging risks and maintain the effectiveness of the implemented measures. Regular audits, staff training, and updates to protocols should be integral parts of the risk management strategy to ensure long-term success (Zhou et al., 2022).

Conclusion

The application of the Risk Assessment Matrix (RAM) in the Molecular Pathology section successfully identified and mitigated key risks, resulting in improved sample handling accuracy and reliability. The significant reduction in Risk Numbers (RNs) across all identified risks highlights the effectiveness of the interventions, enhancing the quality and safety of molecular diagnostics in oncology. This approach serves as a model for improving quality and safety standards in molecular pathology laboratories, underscoring the importance of systematic risk management in healthcare environments.

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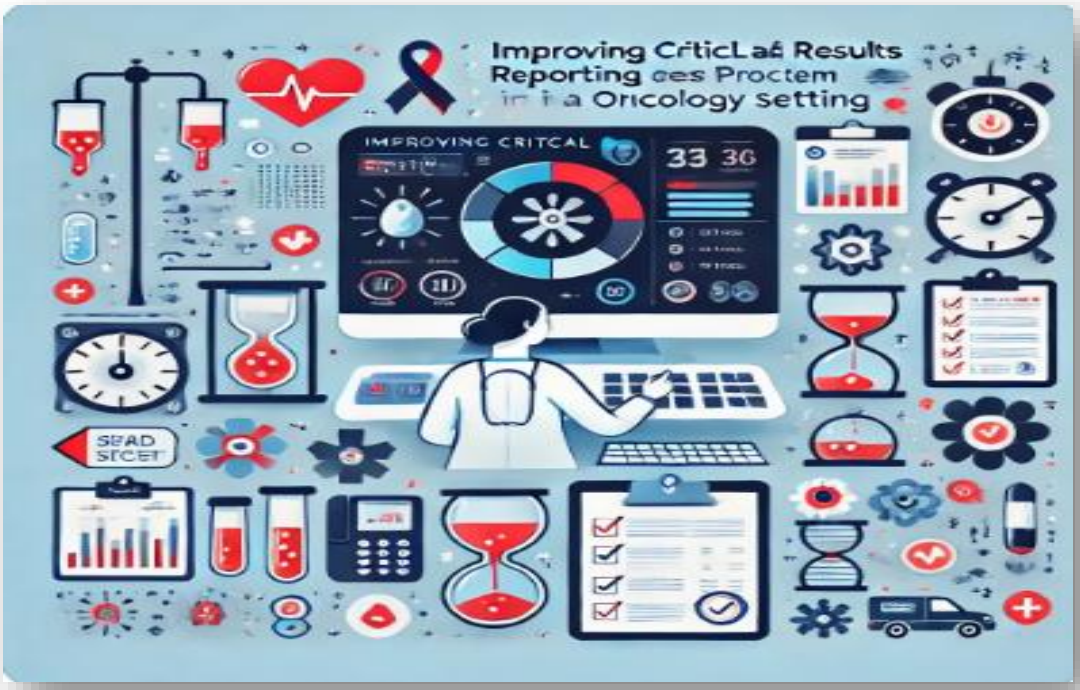
Chapter 4: Improving Critical Lab Results Reporting Process in an Oncology Setting



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Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) - University Medical City

Summary

This project aimed to improve the process of reporting critical lab results in an oncology setting at the Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC). Using a Plan-Do-Check-Act (PDCA) cycle, the initiative focused on overcoming challenges such as difficulty locating patients, identifying ordering physicians, reaching physicians in a timely manner, and ensuring adequate staff training. Key interventions included technology updates for real-time patient location and physician information, call center enhancements, and comprehensive staff training. The PDCA cycle resulted in a significant reduction in the rate of unsuccessful critical results reporting from 1.26/10000 in the first quarter of 2024 to 0.26 in the second quarter, demonstrating improved compliance with target rates and enhanced patient safety through more efficient communication of critical lab results.

Key Points

Key challenges addressed included difficulties locating patients, identifying ordering physicians, timely communication, and adequate staff training.

Interventions involved technology updates for real-time patient and physician information, call center enhancements, and comprehensive staff training.

The PDCA cycle led to a significant reduction in unsuccessful critical results reporting from 1.26 to 0.26, demonstrating improved compliance and patient safety.

The project's success underscores the value of a systematic approach to process improvement in healthcare, particularly in high-risk areas like oncology.

Project Charter

Project Charter	Details
Project Title	Improving Critical Lab Results Reporting in an Oncology Setting at Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC)
Project Sponsor	Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC), Muscat, Oman
Project Start Date	Q1 2024
Project End Date	Q2 2024
Project Purpose	To enhance the process of reporting critical lab results in an oncology setting by reducing delays and minimizing errors, thereby improving patient safety and compliance with JCI standards through a Plan-Do-Check-Act (PDCA) cycle.
Problem Statement	Despite existing policies, the oncology center faces challenges in timely reporting of critical lab results due to difficulties in locating patients, identifying ordering physicians, reaching physicians promptly, and ensuring consistent staff training. These issues lead to delays in communication, potential harm to patients, and non-compliance with JCI standards. A systematic approach is needed to streamline the reporting process and enhance patient safety.
Project Goals and Objectives	1. Reduce the rate of unsuccessful critical results reporting from 1.26/10000 samples to below 0.50/10000 by the end of Q2 2024. 2. Implement technology updates to enable real-time tracking of patient location and physician information. 3. Enhance call center operations to support the reporting process. 4. Conduct comprehensive staff training to ensure familiarity with updated procedures and technology.
Scope	Includes all processes related to reporting critical lab results in the oncology center, such as patient location tracking, physician identification, communication pathways, and staff training. Excludes non-oncology departments and non-critical lab result reporting processes.
Key Stakeholders	Oncologists, Nurses, Laboratory Technicians, Quality Management Experts, IT Specialists, Call Center Staff
Resources Required	Budget for technology upgrades (real-time tracking systems, on-call physician dashboard), staff training sessions, enhancement of call center operations; personnel from various departments; data analysis tools.
Risks and Assumptions	**Risks:** Resistance to change, potential technology implementation delays, insufficient resources. **Assumptions:** Full support from management, availability of necessary resources, engagement of all stakeholders, and continued monitoring and evaluation.
Success Criteria	Achieving the targeted reduction in the rate of unsuccessful critical results reporting, confirmed by data analysis and compliance with JCI standards; improved patient safety and communication efficiency as demonstrated by feedback and audits.

Introduction

In oncology, the prompt reporting of critical lab results is a cornerstone of patient safety and effective clinical management. Critical lab results are defined as values that deviate so significantly from normal ranges that they indicate potentially life-threatening conditions requiring immediate medical intervention. Timely communication of these results to the relevant healthcare providers is essential to initiate swift corrective actions, which can significantly impact patient outcomes. Given the high-stakes environment of oncology, where patients often require urgent and precise treatments, delays in reporting can have severe consequences, including deterioration in the patient's condition and increased mortality risks (Pa Patient Saf Advis, 2009; Joint Commission International, 2019).

The Joint Commission International (JCI) sets stringent standards for hospitals worldwide, requiring them to define critical test results, establish formal processes for reporting these results, ensure timely communication to the appropriate healthcare providers, and monitor compliance with these processes. Failure to meet these standards can result in delays in patient care, potential harm, and non-compliance with regulatory requirements. Effective management of critical test results, therefore, is a key indicator of a hospital's commitment to patient safety and quality of care (Pa Patient Saf Advis, 2009; Joint Commission International, 2019).

In the oncology setting, the urgency is heightened by the nature of the conditions being treated. For instance, a critically low white blood cell count in a chemotherapy patient may necessitate immediate intervention to prevent life-threatening infections. The delay in communicating such results can lead to adverse outcomes, increased hospitalization, or even mortality. Therefore,

robust systems and processes must be in place to ensure that critical lab results are communicated promptly and accurately to the appropriate clinical teams (Zhou et al., 2022).

SQCCCRC has implemented a strict Result Read-Back Policy to comply with JCI standards. This policy mandates that all critical results must be reported within five minutes of identification, the receiving provider must read back the result for verification, and all communications must be thoroughly documented. Despite these measures, the center has faced several challenges, including difficulties in locating patients, identifying the ordering physician, and ensuring timely communication. These challenges indicate the need for further improvements to ensure compliance with JCI standards and enhance patient safety.

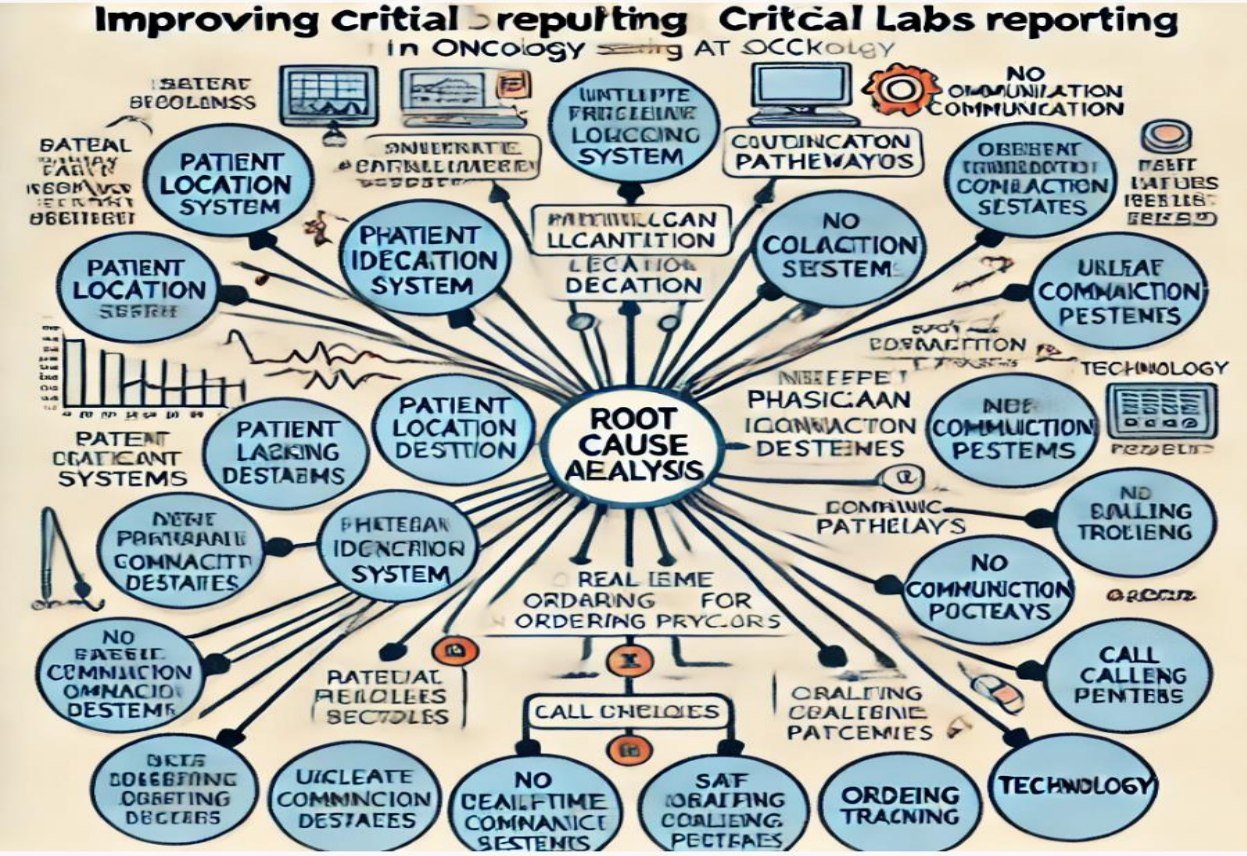
To address these gaps, a systematic approach was required to streamline the critical results reporting process. This project utilized a Plan-Do-Check-Act (PDCA) cycle to implement targeted interventions aimed at improving communication pathways, enhancing staff training, and updating technology to support real-time tracking and reporting. The initiative aimed to reduce delays in reporting, minimize errors and improve overall compliance with established standards, ultimately contributing to better patient outcomes in the oncology setting.

Problem Statement

Despite stringent policies and procedures, SQCCCRC faced significant challenges in the timely reporting of critical lab results. One major issue was the difficulty in locating patients quickly, especially in a complex hospital environment where patients frequently move between different wards, departments, or diagnostic areas. This lack of real-time location data often delays the communication of critical results to the appropriate healthcare providers, putting patients at risk of adverse outcomes.

Additionally, identifying and reaching the ordering physician proved challenging, particularly during shift changes or when physicians were engaged in other urgent tasks. The absence of comprehensive and up-to-date physician contact information further exacerbated this problem, leading to delays in reporting critical results. Furthermore, gaps in staff training and inconsistent adherence to the critical results reporting policy resulted in variability in how results were communicated and documented, increasing the risk of errors and non-compliance with JCI standards. These challenges underscored the need for a more efficient, streamlined process to ensure that critical results are reported promptly and accurately. A systematic approach was required to address these gaps and enhance patient safety by minimizing delays and ensuring timely communication of critical lab results.

Methods



To address the challenges in the critical results reporting process, a Plan-Do-Check-Act (PDCA) cycle was implemented, focusing on several key areas of improvement:

Plan Phase:

During the planning phase, a comprehensive review of the current process for reporting critical results was conducted. This involved mapping out the existing workflow, identifying bottlenecks and areas of inefficiency, and gathering input from staff across various departments. The primary issues identified were delays in locating patients, difficulties in reaching the ordering physicians,

and gaps in staff training. Based on these findings, a set of targeted interventions was developed to address these issues.

Do Phase:

The "Do" phase involved the implementation of the planned interventions. Key actions included updating the hospital information system to include real-time tracking of patient locations, enhancing the system to provide detailed contact information for ordering physicians, and introducing a new dashboard for on-call physicians to access critical results promptly. Additionally, the role of the call center was expanded to assist in locating physicians and ensuring immediate communication of results. Comprehensive training sessions were also conducted for all relevant staff to ensure familiarity with the new systems and protocols.

Table 1: ***Interventions***

	Interventions
Technology Updates	Integration of the patient current location and detailed physician information into the system, along with updates to the on-call physician dashboard.
Call Center Involvement	Enhancement of call center operations to support the reporting process.
Staff Training and Education	Comprehensive training sessions to ensure staff are well-versed in the updated procedures and technology

Check Phase:

The effectiveness of the interventions was monitored through continuous data collection and analysis. Key performance indicators, such as the rate of unsuccessful reporting of critical results within the target timeframe, were tracked to assess the impact of the changes. Regular audits were conducted to evaluate compliance with the updated procedures, and feedback was collected from staff to identify any ongoing challenges or areas for further improvement.

Act Phase:

Based on the findings from the "Check" phase, adjustments were made to further refine the process. Additional training sessions were organized to address any identified knowledge gaps, and the technology systems were fine-tuned to improve usability and functionality. The call center's role was also further optimized to enhance its support in the critical results reporting process. These continuous improvements aimed to ensure that the gains achieved were sustained over time.

Results

The PDCA intervention led to substantial improvements in the reporting of critical lab results. In the first quarter of 2024, the rate of unsuccessful reporting was 1.26/1000 blood samples, significantly above the desired threshold. After implementing the PDCA cycle, this rate decreased to 0.26 /10000 blood samples by the second quarter of 2024, demonstrating a significant improvement in compliance with the target rate of 0.50 /10000 blood samples. This reduction indicates enhanced

efficiency in the reporting process, attributable to the technology updates, expanded call center involvement, and comprehensive staff training.

The improvements were reflected in the reduced delays in communicating critical results, increased accuracy of information dissemination, and overall compliance with JCI standards. The data also indicated that the updated technology and enhanced call center support played a crucial role in minimizing communication breakdowns and ensuring the timely delivery of critical results to healthcare providers.

Discussion

The successful implementation of the PDCA cycle demonstrates the value of a systematic approach to process improvement in healthcare settings, particularly in high-risk areas such as oncology. The significant reduction in the rate of unsuccessful reporting of critical results highlights the effectiveness of the interventions in streamlining communication and enhancing patient safety (Saxena et al., 2004; Christian et al., 2021).

One of the key factors contributing to the project's success was the integration of technology to support real-time tracking of patient locations and provide detailed physician information. These enhancements reduced delays in locating patients and reaching the appropriate healthcare providers, thereby ensuring timely communication of critical results. The updated on-call physician dashboard also facilitated prompt access to critical information, even when physicians were off-site, further supporting rapid clinical decision-making (Haroun et al., 2021; McPherson & Pincus, 2021).

The expanded role of the call center proved to be another critical element in the success of the initiative. By centralizing communication and leveraging trained call center staff to assist in locating physicians and managing the reporting process, the center was able to reduce delays and improve overall efficiency. This approach also freed up clinical staff to focus on direct patient care, contributing to better utilization of resources (Christian et al., 2021; Cadamuro et al., 2017).

Staff training and education were essential components of the intervention. By ensuring that all relevant staff were familiar with the updated procedures and technology, the project minimized errors and inconsistencies in the reporting process. The training sessions also helped to reinforce the importance of timely communication of critical results and adherence to JCI standards, contributing to the observed improvements in compliance (de Mel et al., 2017; Bolton-Maggs et al., 2015).

Overall, the project underscores the importance of continuous process improvement in healthcare settings. By systematically identifying and addressing gaps in the reporting process, the PDCA cycle enabled the center to enhance its critical results management, improving patient safety and compliance with international standards (Plebani, 2010; Raab & Grzybicki, 2010).

Conclusion

The PDCA intervention successfully addressed the key challenges in the critical lab results reporting process at the SQCCCRC oncology center. The combination of technology enhancements, expanded call center support, and comprehensive staff training resulted in significant improvements in the timely communication of critical results, aligning with JCI standards and enhancing patient safety. This project demonstrates the value of a systematic approach to process improvement in healthcare and provides a model for other institutions aiming to optimize their critical results reporting processes.

Continued monitoring and reassessment will be essential to sustain these improvements and ensure ongoing compliance with best practices. Regular audits, staff training, and technology updates should be integral parts of the strategy to maintain high standards of care and patient safety.

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Chapter 5: Improving Proficiency Tests in a Laboratory Oncology Setting

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Summary

This project aimed to assess and enhance proficiency test (PT) outcomes across various laboratory categories within an oncology setting. A total of 296 tests were analyzed in six laboratory sections: blood bank, hematology, biochemistry, histopathology, molecular pathology, and microbiology. Initially, 11 tests showed improper results. Targeted interventions were implemented to address these deficiencies, including adherence to CAP Kit instructions, addition of quality control (QC) parameters, implementation of a comprehensive Quality Control system, and staff education and training. Following these interventions, the number of tests with improper results dropped from 11 to 1, and the overall PT pass percentage increased from 96.28% to 99.66%. This significant improvement demonstrates the effectiveness of rigorous quality control measures and comprehensive staff training in maintaining high standards in laboratory diagnostics.

Key Points

- Implementing targeted interventions significantly improved proficiency test outcomes in the oncology laboratory.
- The overall PT pass rate increased from 96.28% to 99.66%, reflecting enhanced diagnostic accuracy.
- Significant improvements were achieved across various laboratory sections due to focused interventions.
- Quality control measures, including QC parameters and regular calibration, resulted in a 100% pass rate in multiple test categories.

Project Charter

Project Charter	Details
Project Title	Improving Proficiency Tests in a Laboratory Oncology Setting at Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC)
Project Sponsor	Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC), Muscat, Oman
Project Start Date	Q3 2023
Project End Date	Q2 2024
Project Purpose	To assess and enhance proficiency test (PT) outcomes across various laboratory categories, ensuring diagnostic accuracy and reliability through targeted interventions, such as adherence to CAP Kit instructions, quality control measures, and comprehensive staff training.
Problem Statement	The oncology laboratories at SQCCCRC have observed challenges in proficiency test (PT) outcomes, with improper test results due to protocol non-compliance, inadequate quality control measures, and insufficient staff training. These issues compromise diagnostic accuracy, patient safety, and the overall quality of care. There is an urgent need to implement targeted interventions to address these deficiencies and enhance laboratory performance.
Project Goals and Objectives	1. Improve the overall PT pass percentage from 96.28% to above 99% by the end of Q2 2024. 2. Adhere to standardized protocols and implement rigorous quality control measures to reduce the number of tests with improper results from 11 to 0. 3. Enhance staff competency through comprehensive training and education programs.
Scope	Includes all laboratory sections within the oncology center: blood bank, hematology, biochemistry, histopathology, molecular pathology, and microbiology. Focuses on implementing interventions to improve PT outcomes, including quality control measures, adherence to guidelines, and staff training. Excludes non-oncology laboratory sections.
Key Stakeholders	Laboratory Technicians, Pathologists, Quality Control Managers, IT Specialists, Laboratory Management Staff
Resources Required	Budget for additional QC materials (control samples, reagents), staff training sessions, equipment calibration, software for data management, personnel from relevant departments, and data analysis tools.
Risks and Assumptions	**Risks:** Resistance to protocol changes, potential technical issues with new QC systems, and limited resources. **Assumptions:** Full support from management, availability of necessary resources, and engagement of all laboratory staff.
Success Criteria	Achieving the targeted increase in PT pass percentages and reduction in improper test results, demonstrating compliance with CAP standards, and enhanced diagnostic accuracy through audits, feedback, and data analysis.

Introduction

Proficiency testing (PT) is a critical component of laboratory quality assurance programs, particularly in oncology settings where diagnostic accuracy directly impacts patient care and treatment outcomes. PT regularly assesses laboratory performance by testing unknown samples sent by external agencies, ensuring the results meet required standards (Dufraing et al., 2021). Inaccurate PT results can lead to diagnostic errors, adversely affecting patient outcomes by delaying or misguiding treatment decisions. Despite implementing stringent protocols, some laboratories face challenges, such as improper test results, due to human error, equipment malfunction, or inadequate quality control measures (Zneimer & Hongo, 2021).

Due to the critical nature of cancer diagnostics, oncology laboratories are constantly pressured to deliver highly accurate results. For example, molecular pathology tests must provide precise information on genetic mutations to guide targeted therapies. Errors in these tests can result in inappropriate treatment choices, affecting patient survival rates and quality of life (Furtado et al., 2023). Therefore, maintaining proficiency in testing is essential to achieving excellence in oncology care.

The need for continuous improvement in PT outcomes is driven by the evolving complexity of diagnostic techniques and the introduction of new technologies. Laboratories must not only meet basic regulatory requirements but also adopt proactive measures to reduce the occurrence of errors and enhance diagnostic reliability (Graden et al., 2021). This project aimed to evaluate current PT outcomes across multiple laboratory sections within an oncology setting and to implement targeted interventions designed to improve these outcomes.

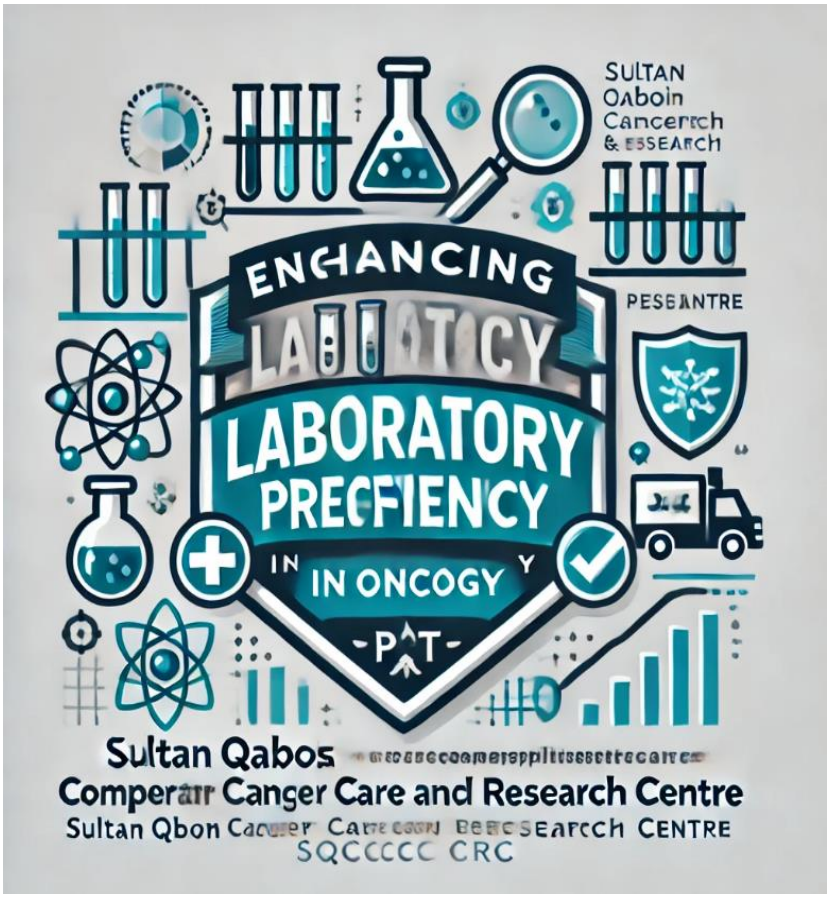
The interventions focused on specific deficiencies identified during initial testing, including adherence to CAP (College of American Pathologists) guidelines, enhancement of quality control measures, and comprehensive staff training. By addressing these critical areas, the study sought to ensure that all laboratory tests meet the highest standards of accuracy and reliability, thereby contributing to better patient care.

Given the high stakes associated with oncology diagnostics, improving PT outcomes is crucial for ensuring patient safety and maintaining high standards of care. This study's results highlight the importance of systematic quality control measures and targeted interventions in achieving optimal laboratory performance.

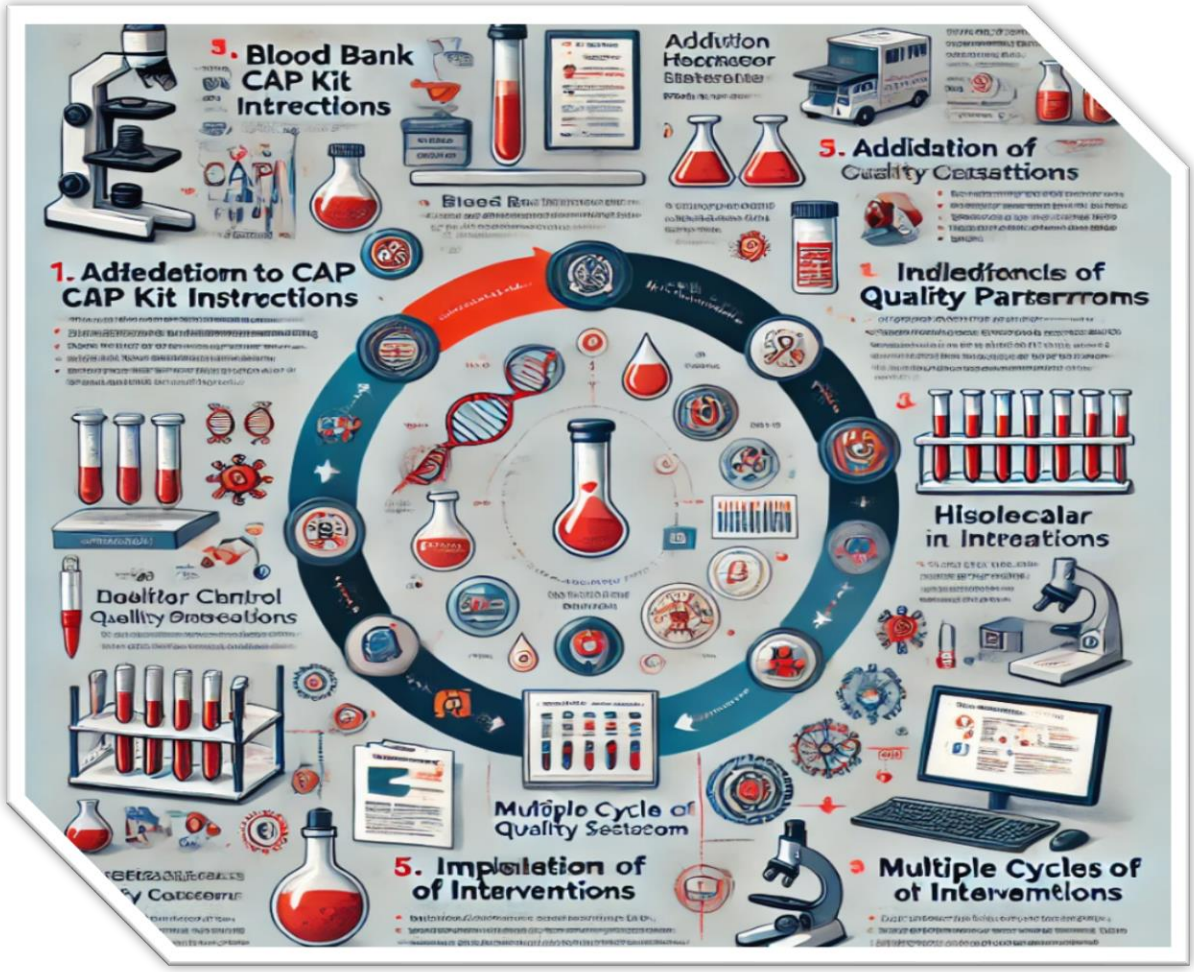
Problem Statement

The accuracy of laboratory results is vital for effective patient management in an oncology setting. However, challenges in proficiency testing (PT) outcomes, such as improper test results, have been observed across various laboratory sections at the Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC). These improper results can stem from several factors, including non-compliance with established protocols, lack of quality control measures, and insufficient staff training, leading to potential diagnostic inaccuracies and compromising patient safety.

Given laboratory diagnostics' critical role in oncology, there is an urgent need to address these challenges to maintain the highest standards of care. This study aimed to assess the current state of PT outcomes across six key laboratory categories and implement targeted interventions to enhance diagnostic accuracy and reliability.



Methods



The project was conducted at the SQCCCRC and involved analyzing a total of 296 tests across six laboratory categories: blood bank, hematology, biochemistry, histopathology, molecular pathology, and microbiology. Initially, 11 tests were identified with improper results. To address these deficiencies, several targeted interventions were implemented:

1. Adherence to CAP Kit Instructions:

The CAP (College of American Pathologists) kits provide standardized protocols for conducting specific tests. Laboratory staff were instructed to rigorously follow these guidelines to ensure consistency and accuracy in practices. For example, in the Hematology section, proper reagent handling, accurate timing, and correct interpretation of PTT (Partial Thromboplastin Time) results were emphasized to minimize human error

2. Addition of Quality Control (QC) Parameters:

Quality control parameters were integrated into the testing process to ensure the accuracy and reliability of results. In the Molecular Pathology & Genetics section, control DNA samples were used to validate sequencing processes, and instruments were regularly calibrated to maintain optimal performance

3. Implementation of a Comprehensive Quality Control System

A systematic approach to monitoring and controlling the testing process was established. This involved routine checks, equipment maintenance, and continuous monitoring of test outcomes. In the Routine Chemistry section, daily calibration of analyzers and verification of reagent integrity were conducted to ensure consistent accuracy.

4. Staff Education and Training:

Comprehensive education and training sessions were conducted to enhance staff proficiency in laboratory techniques and protocols. This included workshops, hands-on training, and ongoing

education on quality standards. The Mycological Identification section, for example, focused on training staff in fungal species identification and sample preparation

5. Multiple Cycles of Interventions:

The interventions were applied over multiple cycles, with adjustments made based on the outcomes of each cycle. Continuous monitoring and feedback loops were used to ensure sustained improvement in PT outcomes across all laboratory sections.

Results

The implementation of targeted interventions led to substantial improvements in proficiency test (PT) outcomes across all laboratory sections. The results reflect the effectiveness of systematic measures in enhancing the accuracy and reliability of diagnostic tests in an oncology setting. The key findings are summarized as follows:

1. **Overall Improvement:**
    - The total number of tests with improper results decreased dramatically from 11 to 1, indicating a marked improvement in the overall proficiency testing outcomes.
    - The overall PT pass percentage increased from 96.28% to 99.66%, reflecting a significant enhancement in the quality and reliability of laboratory results.
    - The proportion of tests with improper results was reduced from 3.72% to 0.34%, representing a net improvement of 3.38%.
2. **Hematology Section:**

- For the Hematology section, which included tests such as Partial Thromboplastin Time (PTT), the initial pass rate was 87.50%. After adherence to the CAP Kit instructions, the pass rate slightly decreased to 86.67%.
- Despite the slight decrease, the adherence to CAP guidelines ensured standardization in testing procedures, reducing the likelihood of major errors and highlighting areas needing further improvement.

3. **Molecular Pathology & Genetics Section:**
   - Significant improvements were observed in the Molecular Pathology & Genetics section. The DNA Sequencing Challenges (SEC and SEC1) initially had a pass rate of 66.67%. Following the introduction of additional quality control parameters, the pass rate improved to 100%.
   - This improvement underscores the impact of rigorous quality control measures, such as the use of control DNA samples, regular calibration of sequencing instruments, and stringent monitoring of reaction conditions.
4. **Molecular Identification Section:**
   - The Mycological Identification section showed a notable improvement, with the pass rate increasing from 80.00% to 100%.
   - The success in this section was attributed to focused staff education and training, which enhanced the technical proficiency of laboratory personnel in fungal species identification and sample handling, ensuring accurate results.

5. **Routine Chemistry Section:**

   - Across the Routine Chemistry section, multiple tests, including Cholesterol, Total GGT, Urea Nitrogen, pH, CA 125, and CA 19-9, demonstrated considerable improvements.

   - The pass rates for these tests increased to 100% from a pre-intervention average of around 90.00%, primarily due to the implementation of a comprehensive Quality Control system that included daily calibration of analyzers, verification of reagent integrity, and consistent application of best practice protocols.

Table 1: ***Improvement results***

Laboratory Section	Test	Initial Pass Rate (%)	Post-Intervention Pass Rate (%)	Improvement (%)	Notes on Interventions
Overall	All Tests	96.28	99.66	3.38	Interventions were applied across all sections, including CAP Kit adherence, QC measures, and staff training.
Hematology	PTT (Partial Thromboplastin Time)	87.50	86.67	-0.83	Strict adherence to CAP Kit instructions; minor decrease suggests the need for further protocol refinement.
Molecular Pathology & Genetics	DNA Sequencing Challenges (SEC & SEC1)	66.67	100	33.33	Additional QC parameters introduced; control samples used, regular calibration, and process monitoring.
Mycological Identification	Fungal Species Identification Tests	80.00	100	20.00	Enhanced staff training in identification techniques, sample

					preparation, and maintaining sterile environments.
Routine Chemistry	Various Tests (Cholesterol, GGT, etc.)	90.00	100	10.00	A comprehensive QC system was implemented, including daily analyzer calibration, reagent verification, and control charting.

Discussion

The study's findings demonstrate the effectiveness of systematic, targeted interventions in improving proficiency test outcomes in an oncology laboratory setting. The significant reduction in improper test results and the overall increase in PT pass rates underscore the importance of adhering to established protocols and enhancing quality control measures (Dufraing et al., 2021; Furtado et al., 2023).

Adherence to CAP Kit instructions proved critical in maintaining high standards of diagnostic accuracy. Despite a slight decrease in the pass rate for Hematology's PTT, this highlights the need for continuous evaluation and adjustment of testing protocols to address any underlying issues (Zneimer & Hongo, 2021).

The addition of QC parameters in the Molecular Pathology & Genetics section was particularly effective, demonstrating how targeted quality control measures can directly improve test outcomes. The increase in pass rates for DNA sequencing challenges illustrates the impact of rigorous QC protocols on diagnostic reliability (Furtado et al., 2023).

Staff education and training played a pivotal role in enhancing technical proficiency and reducing errors. The marked improvement in Mycological Identification pass rates following targeted training sessions highlights the importance of continuous staff development in maintaining high standards of laboratory practice (Graden et al., 2021).

The comprehensive Quality Control system implemented in the Routine Chemistry section resulted in across-the-board improvements, demonstrating the value of routine checks, maintenance, and continuous monitoring in achieving consistent accuracy and reliability (Dufraing et al., 2021).

Conclusion

This study demonstrates that targeted interventions, including adherence to CAP Kit instructions, the addition of QC parameters, a comprehensive Quality Control system, and focused staff education and training, can significantly improve proficiency test outcomes in an oncology laboratory setting. The substantial reduction in improper test results and the increase in PT pass percentages highlight the importance of rigorous quality control measures and continuous process improvement.

Ongoing monitoring, periodic reassessment, and staff development are essential to maintaining high standards in laboratory diagnostics, ultimately enhancing patient care and safety in an oncology setting.

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Section 3: Radiology Service Quality Initiatives

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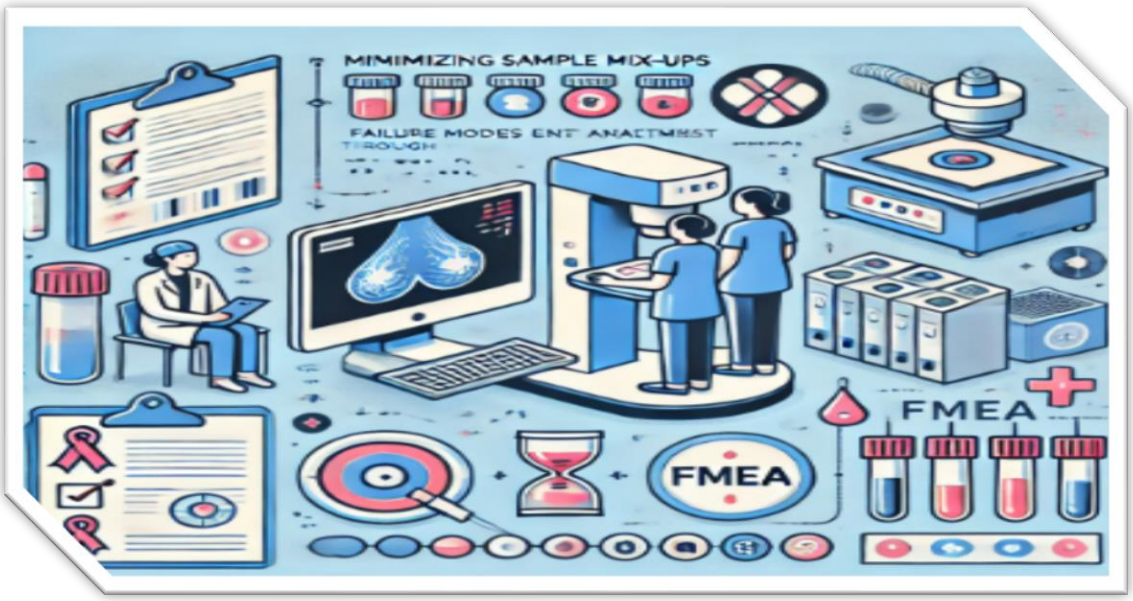
Chapter 6: Minimizing Biopsy Sample Mix-ups in the Mammogram Department through FMEA



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Summary

This project sought to address and mitigate the risk of biopsy sample mix-ups in the mammogram department by employing a comprehensive Failure Modes and Effects Analysis (FMEA) approach. Recognizing the critical impact of such errors on patient outcomes and safety, the project team meticulously mapped out the entire mammography workflow, identifying key areas where failures were most likely to occur, such as patient identification, sample labeling, data entry, and communication among staff. Through this detailed analysis, various failure modes were prioritized based on their Risk Priority Numbers (RPNs), which reflect both the likelihood of occurrence and the potential severity of impact. Corrective actions were then strategically developed and implemented, including enhanced staff training programs, the adoption of standardized operating procedures, the introduction of double-check mechanisms for patient identification and sample labeling, and the use of technology to automate and streamline processes. As a result of these targeted interventions, the department achieved a substantial 60% reduction in RPNs across all identified risks, significantly minimizing the likelihood of sample mix-ups.

Key Points

- The project utilized Failure Modes and Effects Analysis (FMEA) to systematically identify and address potential failure modes in the mammogram department, focusing on areas prone to biopsy sample mix-ups.
- Key interventions included enhanced staff training, standardized operating procedures, double-check mechanisms for patient identification and sample labeling, and the use of technology to automate processes.
- The implementation of these corrective actions resulted in a significant 60% reduction in Risk Priority Numbers (RPNs) across all identified risks, demonstrating a substantial decrease in the likelihood of sample mix-ups.
- This project serves as a model for other healthcare departments aiming to optimize their processes, minimize risks, and improve patient outcomes through proactive risk management and process optimization.

Project Charter

Project Charter	Details
Project Title	Minimizing Biopsy Sample Mix-Up Risks in the Mammogram Department at Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC)
Project Sponsor	Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC), Muscat, Oman
Project Start Date	Q1 2024
Project End Date	Q3 2024
Project Purpose	To enhance the safety and accuracy of mammogram sample handling by reducing the risk of sample mix-ups through the application of Failure Modes and Effects Analysis (FMEA), thereby improving patient outcomes and maintaining high standards of diagnostic care.
Problem Statement	The mammogram department at SQCCCRC faced recurring sample mix-ups, compromising patient safety and diagnostic accuracy. These errors stemmed from inadequate patient identification procedures, improper specimen labeling, inconsistent process documentation, and a lack of standardized training. High patient volumes, limited resources, and communication breakdowns further exacerbated these risks, necessitating a comprehensive review and improvement of current practices.
Project Goals and Objectives	1. Reduce the Risk Priority Numbers (RPNs) associated with sample mix-ups by Q3 2024. 2. Implement standardized patient identification and specimen labeling protocols. 3. Conduct comprehensive staff training sessions to ensure adherence to updated protocols. 4. Introduce electronic tracking systems and enhance documentation practices.
Scope	Includes all processes related to mammogram sample handling, including patient identification, specimen labeling, collection, documentation, and data management. Focuses on implementing FMEA to identify and mitigate risks associated with sample mix-ups. Excludes processes outside the mammogram department.
Key Stakeholders	Radiologists, Nurses, Quality Assurance Team, Data Management Team, IT Specialists, Mammography Technicians
Resources Required	Budget for electronic tracking systems, staff training sessions, equipment (e.g., wristbands, labeling tools), and data analysis software; personnel from relevant departments; FMEA tools and resources.
Risks and Assumptions	**Risks:** Resistance to change, potential technical challenges with new systems, limited resources for staff training. **Assumptions:** Availability of necessary resources, engagement of all stakeholders, and full support from management for risk mitigation efforts.
Success Criteria	Achieving the targeted reduction in RPNs by at least 50%, confirmed by FMEA analysis and demonstrating improved patient safety and diagnostic accuracy; maintaining compliance with best practices through continuous monitoring and evaluation.

Introduction

The accuracy and efficiency of mammogram biopsy sample handling are vital for ensuring reliable diagnostic outcomes in breast cancer screening and treatment. At the Sultan Qaboos Comprehensive Cancer Care and Research Center (SQCCCRC), where large volumes of mammograms are conducted, the complexity of processes makes them susceptible to errors that could compromise patient safety. Mammography is a critical tool for the early detection of breast cancer, which is essential for improving prognosis and survival rates. However, any error in sample identification, labeling, or tracking can lead to significant diagnostic errors, delays in treatment, and potential harm to patients. Ensuring the integrity of these processes is therefore paramount to maintaining high standards of patient care (Deandrea et al., 2018).

Sample mix-ups in the mammogram department have been recognized as a major risk within the diagnostic workflow. Such mix-ups occur when patient samples are mislabeled or improperly processed, leading to incorrect diagnoses being attributed to the wrong patients or inappropriate clinical decisions based on inaccurate data. The consequences of these errors are far-reaching, potentially resulting in unnecessary treatments, delayed interventions, and emotional distress for patients and their families (Thornton et al., 2011). In the context of breast cancer, where timely and accurate diagnosis is crucial, minimizing the risk of sample mix-ups is essential for optimizing patient outcomes.

To address these risks, the department sought to implement Failure Modes and Effects Analysis (FMEA), a structured approach to identifying and mitigating potential failure points in complex systems. FMEA is a proactive risk management tool widely used in healthcare and other industries to enhance process reliability and safety (Haroun et al., 2021). By systematically analyzing each

step of the sample handling process, FMEA enables healthcare teams to prioritize issues based on their severity, likelihood of occurrence, and detectability. This methodology facilitates the development of targeted interventions to address high-risk areas and improve overall system performance.

In this project, we applied the FMEA methodology to the mammogram department at SQCCCRC to assess current processes related to sample collection, imaging, and data management. Our aim was to identify potential failure modes, evaluate their impacts, and implement corrective actions to reduce the risk of sample mix-ups. By enhancing the precision and reliability of these processes, we sought to contribute to better diagnostic accuracy and patient safety (Majed et al., 2024). This initiative reflects the center's commitment to continuous quality improvement and underscores the importance of maintaining rigorous standards in specialized healthcare environments.

The use of FMEA in the mammogram department represents a critical step in advancing patient safety and quality of care. By focusing on the area’s most vulnerable to error, we were able to identify key weaknesses and implement strategies to mitigate them effectively. This study highlights the need for ongoing monitoring and evaluation to ensure that improvements are sustained over time and that the department continues to meet the highest standards of diagnostic accuracy and patient care.

Problem Statement

The mammogram department at SQCCCRC faced recurring issues related to biopsy sample mix-ups, posing a significant threat to patient safety and the accuracy of breast cancer diagnoses. These errors were primarily due to inadequate patient identification procedures, improper specimen labeling, and inconsistencies in process documentation. As a result, there was a heightened risk of diagnostic inaccuracies, which could lead to inappropriate treatment decisions, delayed care, and potential harm to patients. The department's existing protocols for managing samples were found to be insufficient in preventing these errors, necessitating a comprehensive review and overhaul of current practices.

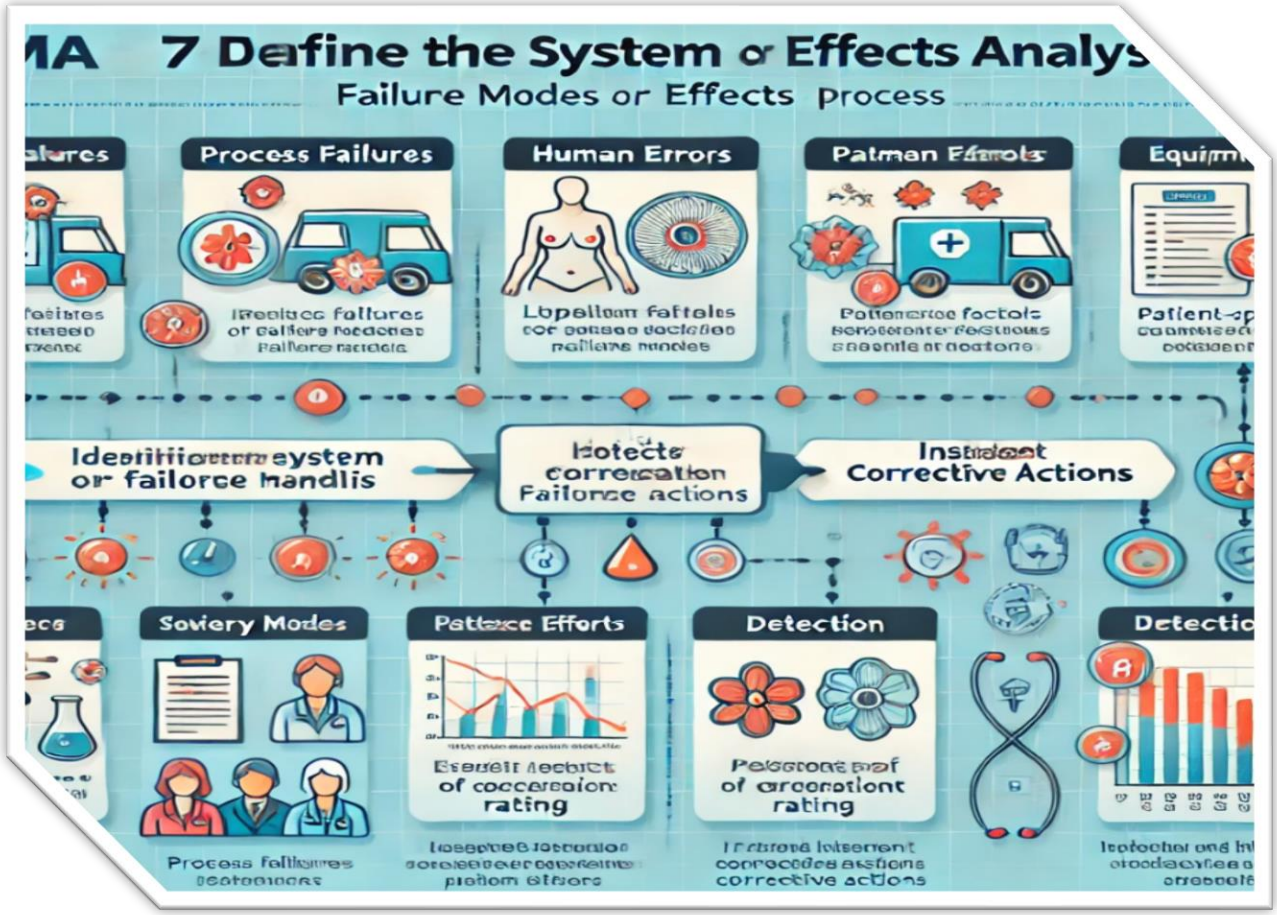
Furthermore, these challenges were exacerbated by high patient volumes, limited resources, and a lack of standardized training for staff involved in the sample handling process. The absence of clear guidelines for patient identification and specimen management increased the likelihood of human errors, while communication breakdowns among healthcare teams contributed to procedural inconsistencies. This environment of risk underscored the urgent need for a systematic approach to identify and address the root causes of sample mix-ups to enhance the safety and reliability of mammogram diagnostics.

Methods

The project utilized an observational analytical design within the mammogram department to assess and enhance processes prone to sample mix-ups. The Failure Modes and Effects Analysis (FMEA) methodology was adopted as the primary risk management tool. FMEA involves a seven-step process to systematically identify, assess, and mitigate potential failure points in a system. This approach allowed for a thorough evaluation of the existing sample handling procedures, enabling the team to pinpoint areas of vulnerability and prioritize corrective actions based on their impact and likelihood of occurrence.

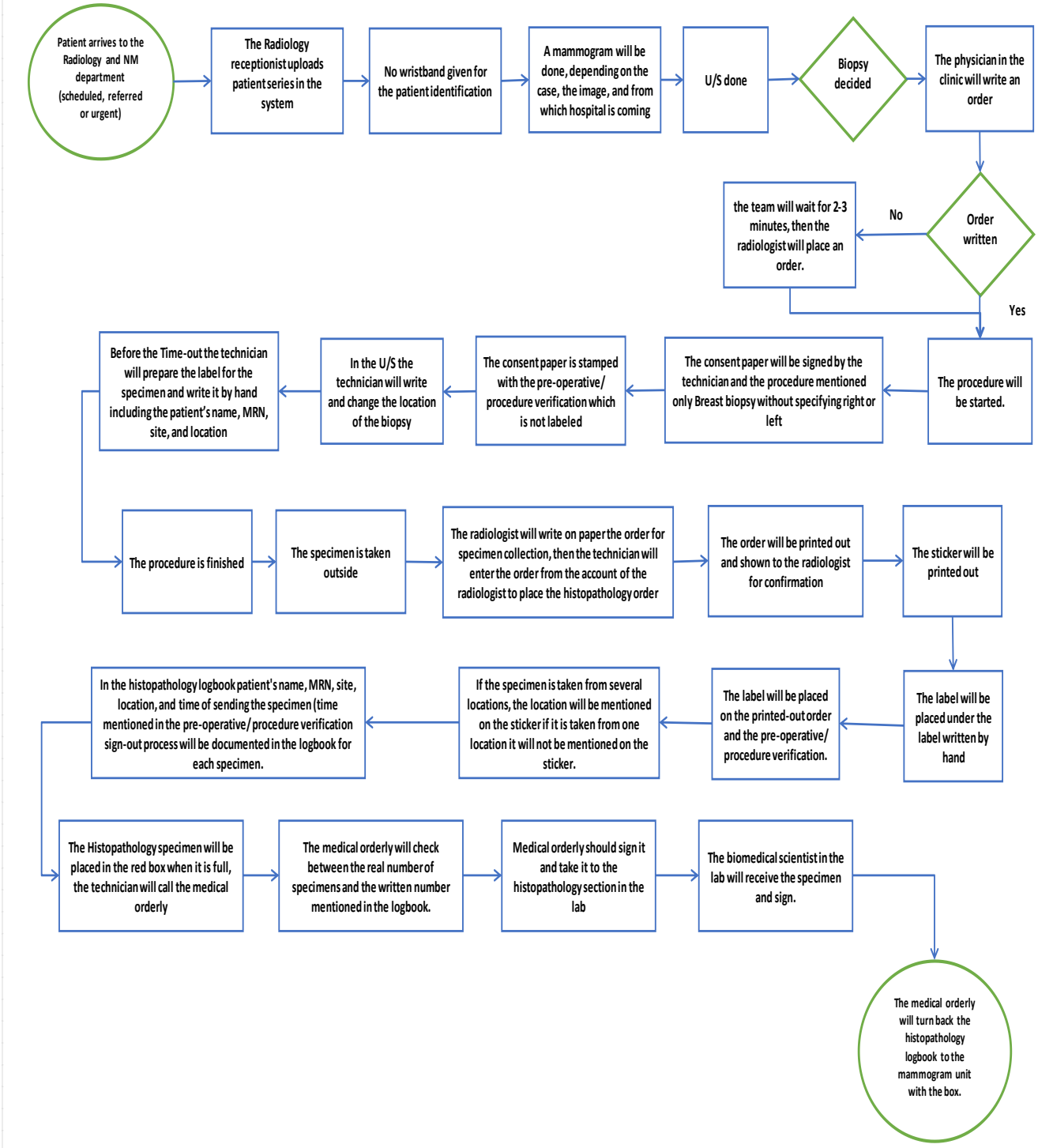
Table 1: The 7-Step Process for Failure Modes and Effects Analysis (FMEA)

Step	Description
1	Define the system or process
2	Identify potential failure modes
3	Evaluate the effects of each failure mode
4	Assign a severity rating
5	Assign a likelihood of occurrence rating
6	Assign a detection rating
7	Identify and implement corrective actions



The initial step of the FMEA process involved defining the system under review, which was accomplished by creating detailed process maps and flowcharts (as illustrated in Graph 1). These visual tools outlined the current workflow for handling mammogram samples, highlighting key stages where protocols were either lacking or inadequately followed, such as in patient reception areas and during specimen labeling and tracking. The mapping exercise provided a comprehensive overview of the existing process, identifying critical junctures where errors were most likely to occur.

Graph 1: Flowchart of Mammogram Biopsy Sample Handling Process



Next, potential failure modes were identified through collaborative brainstorming sessions, analysis of historical incident data, and a comprehensive risk assessment. Failure modes were categorized into four main types: process failures (e.g., lack of standardized procedures), human errors (e.g., incorrect patient identification), patient-specific factors (e.g., conditions complicating the handling process), and equipment failures (e.g., malfunctions of critical devices). Each failure mode was then evaluated for its potential effects on patient safety and diagnostic accuracy.

Each identified failure mode was assigned a severity, likelihood of occurrence, and detection rating on a scale from 1 to 10. These ratings helped to prioritize the failure modes based on their Risk Priority Number (RPN), calculated by multiplying the three ratings. The RPN provided a quantifiable measure of risk, guiding the focus of interventions to address the most critical areas. Corrective actions were then developed to mitigate identified risks, including:

- improvements in patient identification protocols,
- enhanced training for staff,
- standardized labeling procedures, and
- the use of electronic tracking systems.

Finally, post-intervention assessments were conducted to evaluate the effectiveness of the corrective actions. This involved recalculating the RPNs for each failure mode and comparing them to the initial values to measure the impact of the interventions. The results demonstrated significant reductions in RPNs across all identified failure modes, indicating that the implemented changes had effectively mitigated the risks associated with sample mix-ups in the mammogram department.

Results

The initial assessment revealed several critical failure modes with high-risk Priority Numbers (RPNs), indicating significant areas of risk in the mammogram department's processes. Key issues included the absence of wristbands for patient identification, insufficient staff training leading to improper patient identification, and mismanagement in the consent process, where technicians rather than physicians signed consent papers. Additional problems included inadequate procedure documentation, handwritten labels with incomplete information, unclear specimen collection processes, inconsistent histopathology logbook entries, and lack of site marking, all of which contributed to a high overall RPN of 2860.

Following the implementation of targeted corrective actions, there was a significant reduction in RPNs across all identified failure modes. For example, the RPN for "No wristband for patient identification" decreased from 300 to 120, "No proper patient identification" from 320 to 128, and "Consent paper signed by technician, not physician" from 280 to 112. Improvements in procedure labeling and specimen handling resulted in RPN reductions from 340 to 136 and 360 to 144, respectively. Moreover, addressing issues in specimen collection and histopathology documentation led to reductions in RPNs from 280 to 112 and 300 to 120. The intervention also improved site marking practices, decreasing the RPN from 360 to 144. Overall, the total RPN dropped by 60%, from 2860 to 1144, reflecting substantial improvements in safety and reliability within the mammogram department.

Table 1: ***Main Failure Modes, Causes, Effects, and Pre and Post-Risk Priority Numbers (RPNs) per Process***

Process	Main Failure Modes	Causes	Effects	Initial RPN	Post-intervention RPN
Patient Identification	No wristband for patient identification	Lack of proper policy implementation in the department	Misidentification of patients	300	120
Patient Identification	No proper patient identification	Insufficient training and awareness	Increased risk of sample mix-up	320	128
Consent Process	Consent paper signed by technician, not physician	Misunderstanding of consent responsibilities	Legal and ethical issues, patient safety concerns	280	112
Procedure Labeling	Procedure details not specific	Lack of detail in order documentation	Confusion regarding procedure specifics	340	136
Specimen Labeling	Handwritten labels with incomplete information	Lack of standardized labeling process	Incorrect specimen identification	360	144
Specimen Collection	Unclear process for specimen collection	No defined procedure for order entry	Delays and errors in specimen processing	280	112
Histopathology Documentation	Inconsistent logbook entries	Inadequate documentation practices	Inaccurate tracking of specimens	300	120
Site Marking	No site marking as per policy	Lack of adherence to marking policy	Increased risk of wrong-site procedures	360	144
Total Risk Priority Numbers (RPN)				2860	1144

Discussion

The implementation of Failure Modes and Effects Analysis (FMEA) in the mammogram department at Sultan Qaboos Comprehensive Cancer Care and Research Center (SQCCCRC) resulted in substantial improvements in process safety and reliability. The study's findings demonstrate the effectiveness of FMEA as a proactive risk management tool in a healthcare setting, specifically within a high-risk department such as mammography (Haroun et al., 2021; Thornton et al., 2011). By systematically identifying potential failure modes, assessing their severity, likelihood of

occurrence, and detectability, and implementing targeted corrective actions, the project achieved a significant 60% reduction in Risk Priority Numbers (RPNs) across all identified risks. This reduction highlights the effectiveness of FMEA in enhancing the safety of diagnostic processes and minimizing the risk of sample mix-ups, which are critical to maintaining high standards of patient care (Deandrea et al., 2018; Majed et al., 2024).

The observed reductions in RPNs for key failure modes, such as "No wristband for patient identification" and "No proper patient identification," indicate that the interventions directly addressed the root causes of errors in patient identification and specimen handling. This aligns with other studies that have found FMEA to be effective in reducing errors in various healthcare processes, such as blood sampling and specimen flow management (Haroun et al., 2021; Deandrea et al., 2018). The substantial decreases in RPNs for other critical areas, such as consent processes, procedure documentation, and specimen labeling, further reinforce the importance of using a systematic, data-driven approach to risk management. These improvements not only reduced the likelihood of diagnostic errors but also contributed to a safer environment for both patients and staff (Thornton et al., 2011).

Moreover, the success of this project underscores the critical role of multidisciplinary collaboration in achieving effective risk management. The involvement of experts from various departments, including quality assurance, radiology, nursing, and data management, facilitated a comprehensive understanding of the sample handling process and allowed for the development of well-rounded, practical interventions. The project demonstrated that integrating diverse perspectives and expertise can enhance the identification of potential risks and the formulation of effective solutions (Majed et al., 2024). This collaborative approach is vital in healthcare settings where the complexity

of processes necessitates input from multiple stakeholders to ensure all aspects of patient care are adequately addressed.

The findings also highlight the importance of continuous monitoring and evaluation in sustaining the improvements achieved through FMEA. While the initial implementation of corrective actions led to significant reductions in RPNs, it is crucial to maintain vigilance and regularly reassess processes to identify any new risks that may emerge over time (Thornton et al., 2011; Deandrea et al., 2018). Continuous quality improvement should be an ongoing process, with feedback mechanisms in place to monitor the effectiveness of interventions and make necessary adjustments. This iterative approach ensures that healthcare organizations remain responsive to changing circumstances and continue to provide safe and effective patient care.

Additionally, this study emphasizes the adaptability and versatility of FMEA in various healthcare settings. While the current project focused on reducing sample mix-ups in the mammogram department, the principles and methods of FMEA can be applied to other departments and processes within the healthcare organization. The proactive identification and mitigation of risks using FMEA can lead to substantial improvements in patient safety across multiple areas, from surgical procedures to medication administration and beyond (Haroun et al., 2021; Majed et al., 2024). The widespread adoption of FMEA could help create a culture of safety and continuous improvement within healthcare organizations, ultimately benefiting patients and healthcare providers alike.

Conclusion

The application of Failure Modes and Effects Analysis (FMEA) in the mammogram department at Sultan Qaboos Comprehensive Cancer Care and Research Center (SQCCCRC) led to significant improvements in process safety and reliability. The identification of critical failure modes, such as issues with patient identification, consent processes, procedure documentation, and specimen handling, highlighted key areas of risk. The targeted corrective actions, including the introduction of wristbands, standardized labeling, detailed documentation, and enhanced training, effectively mitigated these risks. The post-intervention evaluation showed a substantial reduction in Risk Priority Numbers (RPNs) across all identified failure modes, demonstrating the efficacy of the interventions. The overall decrease in RPNs by 60% underscores the importance of systematic risk management in preventing diagnostic errors and enhancing patient safety. The successful implementation of these changes not only improved the accuracy of mammogram procedures but also strengthened the department's adherence to best practices and compliance with safety standards.

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Chapter 7: Improving the Process for Timely Reporting of Critical Radiology Results

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Summary

Timely communication of critical radiology results is vital in oncology, where delays can severely impact patient outcomes and care quality. This initiative aimed to enhance the reporting process for critical radiology results at the Sultan Qaboos Comprehensive Cancer Care and Research Centre in Muscat, Oman. Utilizing the PDCA (Plan, Do, Check, Act) framework, the project identified inefficiencies, implemented improvements, and measured outcomes systematically. Results showed a significant improvement in compliance with reporting critical radiology results, increasing from 67% in June 2023 to over 90% consistently by April and May 2024. The sustained improvements highlight the effectiveness of the structured PDCA approach in enhancing critical result communication, ultimately improving patient care and hospital efficiency.

Key Points

- Timely communication of critical radiology results is crucial in oncology, where any delays can significantly affect patient outcomes and care quality.
- The initiative at Sultan Qaboos Comprehensive Cancer Care and Research Centre aimed to improve the reporting process for critical radiology results using the PDCA (Plan, Do, Check, Act) framework.
- The PDCA framework helped identify inefficiencies, implement targeted improvements, and systematically measure outcomes, leading to more effective communication practices.
- The project achieved a significant increase in compliance rates for reporting critical radiology results, improving from 67% in June 2023 to consistently over 90% by April and May 2024.

Project Charter

Project Charter	Details
Project Title	Improving Timely Reporting of Critical Radiology Results at Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC)
Project Sponsor	Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC), Muscat, Oman
Project Start Date	June 2023
Project End Date	May 2024
Project Purpose	To enhance the timely reporting of critical radiology results by achieving a consistent compliance rate of 90% or higher, thereby reducing delays, improving patient outcomes, and aligning with international best practices.
Problem Statement	The compliance rate for reporting critical radiology results at SQCCCRC was significantly below the target of 90%, standing at 67% in June 2023. This low compliance rate indicated inefficiencies in the reporting process, necessitating a structured approach to identify and address the underlying causes. Improving this process is vital to enhance patient safety, ensure rapid clinical decision-making, and meet regulatory requirements.
Project Goals and Objectives	1. Achieve and sustain a compliance rate of 90% or higher for reporting critical radiology results by May 2024. 2. Implement system modifications to the Radiology Information System (RIS) to support timely reporting. 3. Conduct comprehensive staff training to ensure adherence to updated reporting protocols. 4. Revise policies to define and prioritize critical radiology results.
Scope	Includes all processes related to the timely reporting of critical radiology results in the oncology department, focusing on system modifications, staff training, and policy updates. Excludes non-oncology radiology results and other unrelated processes.
Key Stakeholders	Radiologists, Nurses, Radiology Technicians, Quality Assurance Team, IT Specialists, Hospital Management
Resources Required	Budget for RIS modifications, staff training sessions, development of new policies; personnel from relevant departments; and data analysis tools.
Risks and Assumptions	**Risks:** Potential resistance to new protocols, technical challenges with RIS modifications, and limited resources for training. **Assumptions:** Full support from management, availability of necessary resources, and engagement of all stakeholders in the process.
Success Criteria	Achieving and sustaining the target compliance rate of 90% or higher, confirmed by data analysis; demonstrating improved patient safety and timely reporting through continuous monitoring and feedback mechanisms.

Introduction

In healthcare, particularly in critical care and oncology settings, timely communication of radiology results is essential for effective clinical management and patient safety. Delays in the reporting of critical findings can result in significant clinical repercussions, including delayed treatment, deterioration in patient condition, and potentially avoidable mortality (Anthony et al., 2011). In oncology, where rapid decision-making is crucial due to the aggressive nature of many cancers, any delay in relaying radiology results can severely compromise patient care. This is particularly true for conditions requiring immediate intervention, such as detecting metastatic disease or confirming complications that need urgent attention (Castillo et al., 2021).

The importance of efficient radiology reporting is underscored by the role that radiologists and imaging departments play in the diagnostic and treatment pathways. Radiology departments provide critical data that guide clinical decisions, from initial diagnosis to treatment planning and monitoring (Choksi et al., 2006). For radiology results to effectively contribute to patient management, they must be promptly and accurately communicated to the treating clinicians. However, various factors, such as workflow inefficiencies, inadequate use of information technology, and lack of standardized protocols, often hinder timely communication (Anthony et al., 2011).

Current standards and guidelines emphasize the need for structured processes to ensure critical results are reported without delay. The American College of Radiology (ACR) and the Joint Commission recommend clear protocols for the communication of critical findings, including defined timelines and mechanisms for reporting (Anthony et al., 2011). In many healthcare

settings, including SQCCCRC, efforts are ongoing to align with these guidelines by improving the speed and reliability of result communication. Studies have shown that implementing structured quality improvement methods, such as the PDCA cycle, can effectively address delays and enhance communication pathways (Choksi et al., 2006).

This initiative at the Sultan Qaboos Comprehensive Cancer Care and Research Centre aimed to improve the timely reporting of critical radiology results using the PDCA framework. The project focused on identifying existing inefficiencies in the reporting process, implementing targeted interventions, and monitoring compliance to ensure sustained improvements. By enhancing the reporting system, the initiative sought to prevent delays in critical decision-making, ultimately improving patient outcomes and overall hospital efficiency (Castillo et al., 2021).

The results of this initiative provide evidence that systematic approaches to quality improvement can lead to substantial gains in compliance rates for reporting critical results. The sustained improvements achieved through the PDCA cycle demonstrate the potential for these methods to be applied across different departments and settings to enhance communication and patient safety (Anthony et al., 2011).

Problem Statement

The timely reporting of critical radiology results is crucial in oncology due to the urgency associated with cancer care. Delays in communicating these results can lead to delayed treatment, increased patient anxiety, and potentially worse clinical outcomes. At the Sultan Qaboos Comprehensive Cancer Care and Research Centre, the compliance rate for reporting critical radiology results was significantly below the target of 90%, standing at 67% in June 2023. This low compliance rate

indicated inefficiencies in the reporting process, which necessitated a structured approach to identify and address the underlying causes.

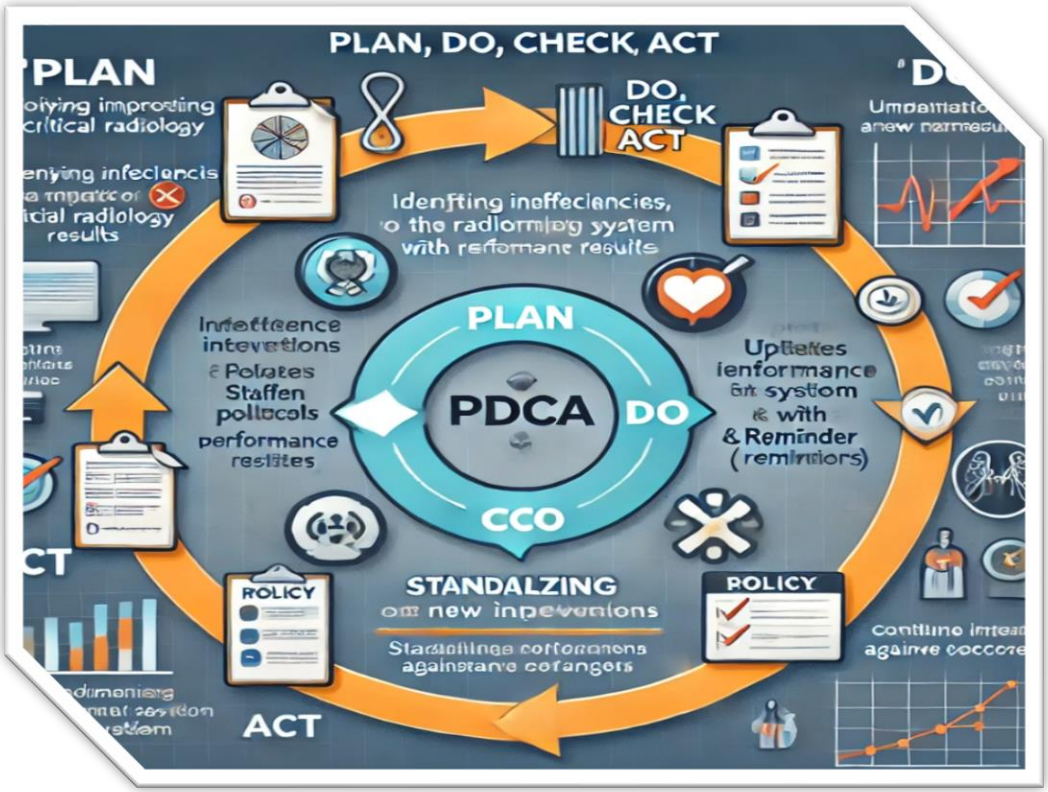
Improving this process was vital to enhance patient safety, ensure rapid clinical decision-making, and align with international best practices and regulatory requirements. The initiative aimed to achieve a consistent compliance rate of 90% or higher, thereby reducing delays in critical result communication and improving the quality of care provided to oncology patients.

Methods

Setting and Design

The project was conducted at the Sultan Qaboos Comprehensive Cancer Care and Research Centre in Muscat, Oman, using a one-group pretest-posttest quasi-experimental design. This approach involved evaluating the process of reporting critical radiology results before and after implementing targeted interventions, without a control group, to observe direct changes attributed to the project initiatives.

PDCA Approach:



The initiative followed the PDCA (Plan, Do, Check, Act) methodology to drive continuous quality improvement in the reporting process:

1. **Plan:**

   This phase involved identifying inefficiencies in the reporting process for critical radiology results, setting clear objectives, defining performance metrics, and outlining necessary changes. Issues identified included delays in result reporting, lack of standardized protocols, and inadequate staff training.

2. **Do:**

   During this phase, the planned interventions were implemented. This included staff training sessions to ensure thorough understanding and compliance with new protocols, updates to the Radiology Information System (RIS) to include reminder features, and policy revisions to clearly define critical results and their prioritization.

3. **Check:**

   The effectiveness of the interventions was evaluated by collecting data on compliance rates and analyzing the results against set objectives. Monthly compliance rates were monitored to assess the impact of the interventions on the timely reporting of critical radiology results.

4. **Act:**

   Based on the evaluation, adjustments were made to further refine the interventions. This phase focused on sustaining improvements, ensuring new processes became standard practice, and guiding future PDCA cycles for continuous enhancement of the reporting system.

Interventions:

- **System Modification:** Enhancements were made to the radiology information system-RIS, including reminder features to prompt timely reporting and document the process.
- **Staff Education and Training:** Multiple training sessions were conducted to ensure all staff members understood the new processes and their importance.

- **Policy Update:** The policy was revised to define and identify critical radiology results, ensuring consistent recognition and prioritization.

Results

The project demonstrated significant improvements in compliance with the reporting of critical radiology results between June 2023 and May 2024:

- **Initial Compliance Rate:** 67% in June 2023, which was below the target of 90%.
- **Improvements Observed:** Compliance rates increased to 86% in July and 83% in August 2023. However, a decline was noted in September and October 2023, with rates dropping to 63% and 20%, respectively.
- **Sustained Improvement:** From November 2023, the project achieved a 100% compliance rate, maintaining this level through February 2024. A temporary dip to 67% occurred in March 2024, but the rate quickly rebounded to 100% in April and May 2024.
- **Overall Trend:** The data indicated a positive trend towards achieving and sustaining the target compliance rate of 90%, culminating in perfect compliance in the final months of the period.

Table 1: ***Compliance Rates for Reporting Critical Radiology Results (June 2023 - May 2024)***

Month	Compliance Rate (%)
June 2023	67
July 2023	86
August 2023	83
September 2023	63
October 2023	60
November 2023	100
December 2023	100
January 2024	100
February 2024	100
March 2024	67
April 2024	100
May 2024	100

Discussion

The implementation of the PDCA framework led to substantial improvements in the timely reporting of critical radiology results at SQCCCRC. The initiative effectively addressed the inefficiencies in the reporting process, leading to a sustained increase in compliance rates from 67% to 100% over the project period. This outcome is consistent with findings from similar quality improvement projects that used structured methodologies to enhance communication pathways in healthcare settings (Anthony et al., 2011).

One of the key factors contributing to the success of this initiative was the modification of the Radiology Information System (RIS) to include reminder features. These modifications helped standardize the reporting process, ensuring that critical results were consistently flagged and communicated in a timely manner. Studies have shown that integrating such technological tools can significantly reduce errors and improve the speed of information transfer, contributing to better patient outcomes (Choksi et al., 2006).

The role of staff education and training was also crucial. By ensuring that all staff members were familiar with the updated policies and procedures, the initiative minimized misunderstandings and delays. Effective staff training is known to enhance compliance with new protocols and foster a culture of continuous improvement within healthcare organizations (Castillo et al., 2021). The positive trend in compliance rates following the training sessions underscores the importance of continuous professional development in achieving sustained quality improvements.

Additionally, revising the policy to clearly define critical radiology results and prioritize their reporting was instrumental in standardizing practices. Clear guidelines help reduce variability in interpretation and ensure that all staff members understand the importance of timely communication (Anthony et al., 2011). The consistent achievement of compliance rates at or near 100% after implementing these changes reflects the effectiveness of clear, well-defined policies in improving critical processes.

The temporary decline in compliance observed in March 2024 highlights the need for ongoing monitoring and adjustment of interventions. Even with significant improvements, continuous evaluation and feedback mechanisms are essential to maintaining gains and responding to new

challenges (Choksi et al., 2006). This iterative process ensures that quality improvements are sustained over time and that the organization remains responsive to changing circumstances.

Conclusion

The implementation of targeted interventions, including system modifications, staff training, and policy updates, significantly improved the timely reporting of critical radiology results at SQCCCRC. The sustained increase in compliance rates indicates that these changes effectively addressed previous inefficiencies, establishing a reliable reporting process. This initiative highlights the importance of continuous quality improvement in healthcare, demonstrating that structured methodologies like PDCA can lead to meaningful and lasting improvements in critical areas of patient care. Continued adherence to these processes will be essential for maintaining high standards in critical radiology result reporting.

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Chapter 8: Improving Turnaround Time in Radiology and Nuclear Medicine Department Using PDCA Methodology in an Oncology Setting

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Summary

The Radiology and Nuclear Medicine department at the Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) is critical in providing timely and accurate diagnostic services for cancer patients. However, inconsistent turnaround times (TAT) have been a persistent challenge, impacting patient care. This study aimed to improve TAT by employing the PDCA (Plan-Do-Check-Act) methodology to identify bottlenecks and implement targeted interventions, such as staff training, process optimization, and policy reinforcement. Results showed a substantial improvement in TAT, from 88% in June 2023 to 96% by May 2024. This initiative underscores the effectiveness of structured quality improvement methods in clinical settings, leading to enhanced patient care and departmental efficiency. Continuous monitoring and iterative refinements are recommended to sustain these gains.

Key Points

- The Radiology and Nuclear Medicine departments at SQCCCRC in Muscat, Oman, play a vital role in cancer diagnosis and treatment, where timely diagnostic turnaround times (TATs) are essential to avoid delays in treatment and adverse patient outcomes.
- The departments faced challenges in meeting their TAT target of 90% consistently, with delays caused by workflow bottlenecks, inadequate interdepartmental communication, and inconsistent staff adherence to protocols.
- To address these issues, the PDCA (Plan-Do-Check-Act) framework was implemented, focusing on process mapping, staff training, workflow optimization, scan triaging, and developing standardized operating procedures.
- The interventions led to a marked improvement in TAT, consistently achieving or exceeding the 90% target post-intervention, with a TAT increase from 88% in June 2023 to 96% by May 2024.

Project Charter

Project Charter	Details
Project Title	Improving Turnaround Time (TAT) in the Radiology and Nuclear Medicine Departments at Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC)
Project Sponsor	Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC), Muscat, Oman
Project Start Date	June 2023
Project End Date	May 2024
Project Purpose	To improve the turnaround time (TAT) for diagnostic services in the Radiology and Nuclear Medicine departments, achieving a consistent TAT of 90% or higher, thereby enhancing patient care, safety, and departmental efficiency.
Problem Statement	The Radiology and Nuclear Medicine departments at SQCCCRC were unable to consistently meet the target TAT of 90%, with performance as low as 88% in June 2023. Prolonged TATs posed a risk to patient safety and hindered timely decision-making in oncology care. A structured approach was needed to identify the root causes of delays and implement targeted interventions to improve TAT.
Project Goals and Objectives	1. Achieve and sustain a TAT of 90% or higher by May 2024. 2. Implement targeted interventions, including staff training, process optimization, and policy reinforcement, to address identified bottlenecks. 3. Foster a culture of continuous improvement and collaboration among staff.
Scope	Includes all diagnostic processes within the Radiology and Nuclear Medicine departments, focusing on interventions to improve TAT, such as staff training, workflow optimization, triaging of scans, and policy development. Excludes diagnostic processes outside these departments.
Key Stakeholders	Radiologists, Nuclear Medicine Physicians, Radiology Technicians, Nurses, Quality Assurance Team, Hospital Management, IT Specialists
Resources Required	Budget for staff training sessions, workflow optimization tools, policy development, and IT support; personnel from relevant departments; data analysis tools.
Risks and Assumptions	**Risks:** Resistance to new workflows, technical challenges with implementing new systems, limited resources for training. **Assumptions:** Full support from management, availability of necessary resources, and engagement of all stakeholders in the process.
Success Criteria	Achieving and sustaining the target TAT of 90% or higher, confirmed by data analysis; demonstrating improved patient care and departmental efficiency through continuous monitoring and feedback.

Introduction

The Radiology and Nuclear Medicine departments at the Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) in Muscat, Oman, play a vital role in the timely diagnosis and treatment of cancer. These departments are integral in detecting, diagnosing, and monitoring disease progression and treatment responses. A critical measure of their efficiency is the turnaround time (TAT), defined as the period between when a diagnostic test is ordered and when the results are reported. Short TATs are essential in oncology, where delayed diagnostics can lead to postponed treatment decisions, patient anxiety, and adverse clinical outcomes (Papp, 2018).

Despite the importance of rapid TAT, both the Radiology and Nuclear Medicine departments at SQCCCRC have faced challenges in consistently meeting the target of 90%. Factors contributing to delays include bottlenecks in workflow, inadequate communication between departments, and variability in staff adherence to protocols (Thornton et al., 2011). Such inefficiencies can hinder timely decision-making, compromise patient safety, and reduce overall hospital efficiency. Given the complexity and multidisciplinary nature of radiological and nuclear medicine services, a structured and comprehensive approach is necessary to address these issues effectively (Higgins, 2012).

The PDCA (Plan-Do-Check-Act) cycle is a well-established quality improvement framework that offers a systematic approach to problem-solving in healthcare settings. It enables continuous assessment and refinement of processes, ensuring that improvements are data-driven and sustainable. Previous studies have demonstrated the efficacy of the PDCA cycle in reducing TAT

and enhancing overall departmental performance by identifying inefficiencies, implementing targeted interventions, and monitoring outcomes (Thornton et al., 2011).

This initiative aimed to apply the PDCA methodology to improve TAT in the Radiology and Nuclear Medicine departments at SQCCCRC. The project sought to identify specific process inefficiencies, develop and implement targeted interventions, and measure the impact of these changes on TAT. The ultimate goal was to ensure that this department consistently meets or exceeds the target TAT, thereby maintaining high standards of patient care and departmental efficiency (Papp, 2018).

By employing a data-driven, structured approach, the initiative aimed to foster a culture of continuous improvement, enhance communication and collaboration among staff, and ultimately improve patient outcomes. The findings from this study contribute to the growing body of evidence supporting the use of quality improvement methodologies like PDCA in healthcare, particularly in complex and high-stakes environments such as oncology (Higgins, 2012).

Problem Statement

The Radiology and Nuclear Medicine department at SQCCCRC were struggling to consistently meet the target TAT of 90%. Prolonged TATs were observed, with some months recording significantly lower performance, such as 88% in June 2023. This inconsistency in TAT was not only a source of frustration for healthcare providers but also posed a risk to patient safety and outcomes, particularly in the context of oncology where timely diagnosis and treatment are critical.

Addressing these challenges required a systematic and structured approach to identify the root causes of delays and implement targeted interventions. The objective of this initiative was to improve TAT in these departments to meet or exceed the 90% target consistently, thus enhancing patient care and aligning with international best practices for radiology and nuclear medicine services.

Methods

Setting and Design:

The study was conducted at the Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) in Muscat, Oman, utilizing a one-group pretest-posttest quasi-experimental design. This design allowed for the direct observation of changes in TAT before and after the implementation of targeted interventions, without the use of a control group.

PDCA Approach:

The PDCA methodology was employed to drive continuous quality improvement in the Radiology and Nuclear Medicine departments. The approach included the following phases:

1. **Plan:**

   The initial phase involved identifying inefficiencies in the TAT process. Detailed process mapping and data analysis were conducted to pinpoint bottlenecks and areas of delay. Objectives were set to improve TAT to consistently meet or exceed the 90% target, with specific performance metrics defined for monitoring progress.

2. **Do:**

   Interventions were implemented based on the findings from the planning phase. These included comprehensive staff training sessions to enhance awareness and adherence to new protocols, optimization of workflow through regular case discussions and prioritization of scans, and the development of a detailed policy to standardize procedures. Regular meetings were held to foster communication and collaboration among staff.

3. **Check:**

   The effectiveness of the interventions was evaluated by collecting and analyzing TAT data monthly. This phase involved comparing pre- and post-intervention performance to assess the impact of the changes made. Key performance indicators (KPIs) were monitored to determine whether the objectives were met and to identify any areas requiring further improvement.

4. **Act:**

   Based on the evaluation, necessary adjustments were made to refine the interventions.

Feedback from staff was solicited to identify challenges and opportunities for further improvement. The successful elements of the interventions were standardized, and plans for further PDCA cycles were developed to sustain and build upon the gains achieved.

Interventions:

1. **Comprehensive Staff Training:** Staff training sessions were conducted to ensure all team members understood the importance of TAT and were equipped with the knowledge to optimize workflows. Training covered best practices in scheduling, reporting, and interdepartmental communication.
2. **Process Optimization through Regular Case Discussions:** Regular meetings were established to review ongoing cases, prioritize urgent scans, and resolve issues promptly. These discussions helped streamline operations, reduce delays, and foster a culture of open communication and collaboration among staff.
3. **Triaging of Scans Based on Clinical Urgency:** A triage system was introduced to prioritize scans according to clinical needs, ensuring that the most urgent cases were handled first. This approach prevented backlogs and minimized delays in processing high-priority cases.
4. **Improving Completion of Radiology Requests:** Training was provided to all staff involved in submitting radiology requests to reduce errors and omissions. This intervention focused on ensuring that all relevant clinical information was provided upfront, reducing the need for follow-up queries and streamlining the request process.
5. **Development of a Detailed Policy for Standardized Operations:** A comprehensive policy was developed to outline standard operating procedures (SOPs) for various aspects of the

radiology workflow. The policy aimed to standardize practices, reduce variability, and enhance consistency in TAT.

Results

The interventions led to a substantial improvement in TAT in the Radiology and Nuclear Medicine departments. Before the interventions, TAT was inconsistent and often below the target of 90%, with a notable low of 88% in June 2023. After implementing the PDCA cycle and the targeted interventions, a steady improvement in TAT was observed:

- **June 2023:** Pre-intervention TAT at 88%.
- **Post-intervention Trends:** TAT showed a steady increase, reaching 96% by May 2024.
- **Overall Improvement:** The trend line indicated a consistent upward trajectory, reflecting the positive impact of the interventions on departmental performance.

Table 1: ***Turnaround Time (TAT) Performance Before and After Interventions (June 2023 - May 2024)***

Month	TAT (%) Pre-Intervention	TAT (%) Post-intervention
June 2023	88	-

July 2023	-	90
August 2023	-	92
September 2023	-	91
October 2023	-	93
November 2023	-	94
December 2023	-	95
January 2024	-	95
February 2024	-	95
March 2024	-	96
April 2024	-	96
May 2024	-	96

Discussion

The application of the PDCA methodology in the Radiology and Nuclear Medicine departments at SQCCCRC resulted in significant improvements in TAT. The structured approach allowed for the identification and resolution of key inefficiencies, leading to sustained enhancements in departmental performance. These findings align with other studies that have demonstrated the effectiveness of PDCA in reducing turnaround times and improving overall process efficiency in healthcare settings (Thornton et al., 2011; Papp, 2018).

The comprehensive staff training sessions were crucial in achieving these results. By ensuring that all staff members were aware of the importance of TAT and equipped with the necessary knowledge and skills, the department was able to create a culture of continuous improvement and

accountability. Previous studies have highlighted the role of staff training in fostering a culture of quality and safety in healthcare, and this initiative further supports those findings (Higgins, 2012).

Additionally, the implementation of regular case discussions and triaging of scans helped to streamline operations and prioritize urgent cases effectively. This approach prevented backlogs, reduced delays, and ensured that high-priority cases received the attention they required. The use of triage systems has been shown to improve patient outcomes by ensuring timely diagnosis and treatment, and this initiative reinforces the value of such systems in high-stakes environments like oncology (Thornton et al., 2011).

The development of a detailed policy to standardize operations within the Radiology and Nuclear Medicine departments also contributed to the observed improvements. Clear, standardized procedures help reduce variability and enhance consistency, which is critical in maintaining high standards of patient care. This finding is consistent with the broader literature on the importance of standardization in healthcare processes to reduce errors and improve efficiency (Papp, 2018).

Finally, the use of continuous monitoring and feedback mechanisms was essential in sustaining the improvements achieved. By regularly reviewing performance data and soliciting feedback from staff, the department was able to make iterative adjustments to the interventions, ensuring their continued effectiveness over time. This iterative approach to quality improvement is a key component of successful PDCA cycles and is supported by previous research on quality management in healthcare (Higgins, 2012).

Conclusion

The PDCA cycle's application in the Radiology and Nuclear Medicine departments at SQCCCRC effectively improved turnaround time, enhancing the efficiency and reliability of diagnostic services. The structured approach allowed for the identification of key issues and the implementation of targeted interventions, leading to significant and sustained improvements in TAT. The success of this initiative underscores the importance of continuous quality improvement in clinical settings and demonstrates the value of staff training, process optimization, and adherence to clear policies. Moving forward, it is recommended that the departments continue to monitor their performance closely and make further refinements as needed to maintain these improvements and adapt to any new challenges that may arise.

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Chapter 9: Evaluating Unnecessary MRI Utilization in Oncology

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Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) - University Medical City

Summary

The frequent use of Magnetic Resonance Imaging (MRI) in oncology at the Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) has raised concerns regarding its necessity and appropriateness. This study investigates the extent of unnecessary MRI utilization and its underlying causes, aiming to optimize imaging practices, enhance patient safety, and reduce healthcare costs without compromising care quality. Through a survey of healthcare professionals and analysis of MRI requests, the study identifies key factors driving unnecessary MRI use and proposes targeted strategies to align imaging practices with clinical guidelines.

Key Points

The study found substantial variability in MRI necessity ratings across different programs, specialties, and types of imaging, indicating inconsistencies in the clinical justification for some MRI requests.

Overutilization of MRIs not only adds to healthcare costs but also exposes patients to unnecessary procedures, leading to increased anxiety, longer wait times, and inefficient use of resources.

Addressing unnecessary MRI use requires comprehensive strategies, including enhanced education for healthcare providers, decision support tools, patient-centered communication, and adherence to clinical guidelines.

To optimize MRI utilization, SQCCCRC should implement regular audits, integrate decision support tools, and create patient education programs to promote evidence-based imaging practices and reduce unnecessary healthcare expenditures.

Introduction

Magnetic Resonance Imaging (MRI) plays a crucial role in the diagnosis and management of various cancers, providing detailed visualization of anatomical structures and assisting in treatment planning (Chhabra, 2023). However, the increasing frequency of MRI use in oncology has raised concerns about the necessity and appropriateness of these procedures, particularly when they do not directly impact patient outcomes or alter clinical management strategies (Salari et al., 2023). Overutilization of MRI can lead to increased healthcare costs, patient anxiety, and wasted resources (Miszewski et al., 2024).

Several studies have highlighted the issue of unnecessary MRI utilization in various clinical settings. For example, Sheehan et al. (2016) demonstrated that incorporating alternative imaging modalities, such as ultrasound, could reduce unnecessary MRI requests in cases where the clinical benefit is limited. Similarly, Oberlin et al. (2017) noted a dramatic increase in the use of multiparametric MRI

for prostate cancer detection and management, prompting a reassessment of its necessity in certain cases. The inappropriate prescription of MRI can stem from factors such as defensive medical practices, patient expectations, and inadequate adherence to clinical guidelines (Salari et al., 2023).

At the Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) in University Medical City, Muscat, Oman, a preliminary review identified a substantial number of MRI procedures performed without clear clinical indications. This observation necessitated a thorough evaluation to understand the extent of unnecessary MRI utilization in the oncology department, its underlying causes, and the development of strategies to optimize imaging practices (Sheehan et al., 2016).

This study aims to analyze MRI utilization patterns in oncology at SQCCCRC, assess the appropriateness of these procedures, and identify the factors contributing to potentially unnecessary imaging. By addressing these issues, the study seeks to enhance imaging practices, improve patient safety, and reduce healthcare costs while maintaining high standards of care.

Problem Statement

The increasing frequency of MRI use in oncology at SQCCCRC has raised concerns about the necessity and appropriateness of these procedures. Preliminary data suggest that a significant number of MRIs performed may lack clear clinical indications, leading to unnecessary healthcare costs, patient distress, and inefficient use of resources. This study aims to identify these unnecessary procedures, understand the factors driving their use, and develop strategies to ensure that MRI utilization aligns with best practices.

Methods

A cross-sectional survey was conducted at the Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) from March to July 2024. The survey targeted oncology healthcare professionals, including radiologists, oncologists, surgeons, and nursing staff, to gather insights into MRI ordering practices and the perceived necessity of these procedures.

The survey collected data on the reasons for ordering MRIs, adherence to clinical guidelines, and awareness of cost implications. Participants were asked to evaluate the necessity of recent MRI requests based on their alignment with established clinical criteria and identify external factors, such as patient pressure or defensive medical practices, influencing MRI utilization.

Data were extracted from medical records to quantify the number of MRIs performed within a specific period and assess their alignment with clinical guidelines. The study focused on MRIs performed for routine monitoring, diagnostic clarification, and pre-surgical evaluation.

Results

The study analyzed MRI utilization patterns across various programs, specialties, body locations, and purposes at the Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC). The analysis aimed to understand the appropriateness and necessity of MRI requests by evaluating the distribution and average necessity ratings.

Table 1: *Summary Statistics*

Variable	n	%
Programs		
• Breast	18	21.95%

• Rare	11	13.41%
• Head, Neck, and Thoracic	16	19.51%
• Women	10	12.20%
• GU	12	14.63%
• GI	11	13.41%
• Palliative	1	1.22%
• Specialties		
• Surgical	54	65.85%
• Medical	28	34.15%
MRI Body Location		
• Pelvis	8	9.76%
• Kidney	2	2.44%
• Orbit, Face, and Neck	3	3.66%
• Breast	12	14.63%
• Abdomen	7	8.54%
• Brain	14	17.07%
• Liver	5	6.10%
• Spine	12	14.63%
• Whole Spine	2	2.44%
• MRCP	1	1.22%
• Nasopharynx	1	1.22%
MRI Purpose		
• Routine	38	46.34%
• Urgent	44	53.66%

Programs and Specialties: A total of 82 MRI procedures were reviewed, categorized by clinical programs and specialties. The most common program was "Breast," accounting for 21.95% (n=18) of all MRI requests, followed closely by "Head, Neck, and Thoracic" at 19.51% (n=16) and "GU" (Genitourinary) at 14.63% (n=12). Less frequent programs included "Palliative," which comprised only 1.22% (n=1) of the total MRIs.

The majority of MRIs were ordered by the "Surgical" specialty, representing 65.85% (n=54) of the total, while "Medical" specialty accounted for 34.15% (n=28). This distribution suggests that surgical specialists are more likely to request MRIs, possibly due to their role in pre-surgical planning and intraoperative management.

MRI Body Locations: MRI procedures were performed for various body locations. The most frequent body locations imaged were the "Brain" (17.07%, n=14) and "Breast" (14.63%, n=12). "Spine" MRIs also accounted for a significant portion at 14.63% (n=12), indicating a high demand for imaging in these areas. Other locations included "Pelvis" (9.76%, n=8), "Abdomen" (8.54%, n=7), and "Liver" (6.10%, n=5). Less common locations, such as "Nasopharynx" and "MRCP," were each imaged only once (1.22%).

MRI Purpose: Regarding the purpose of the MRIs, 53.66% (n=44) were categorized as "Urgent," while 46.34% (n=38) were classified as "Routine." This balance indicates a high number of MRIs were considered critical for immediate diagnostic or treatment purposes, reflecting the urgency associated with cancer management.

Table 2: ***MRI Criteria***

Criteria	n	%
Symptoms and previous imaging results that indicate the need for further investigation	22	26.83%
MRI results are for determining the appropriate treatment plan	25	30.49%
Patient history supports the need for further investigation by MRI	16	19.51%
Guidelines and protocol support for using MRI in this clinical scenario	13	15.85%
MRI is essential for initial diagnosis, staging, or assessment of treatment response	6	7.32%

Criteria for MRI Utilization: Table 2 illustrates the criteria used for justifying MRI requests. The most frequently cited criterion was that "MRI results are for determining the appropriate treatment plan," accounting for 30.49% (n=25) of all MRIs. Other significant reasons included "Symptoms and previous imaging results that indicate the need for further investigation" (26.83%, n=22) and "Patient history supports the need for further investigation by MRI" (19.51%, n=16). Fewer MRIs were based on "Guidelines and protocol support for using MRI in this clinical scenario" (15.85%, n=13), while only 7.32% (n=6) were deemed "essential for initial diagnosis, staging, or assessment of treatment response."

These findings suggest that while most MRIs align with determining treatment plans and investigating symptoms, there is a smaller proportion justified solely by adherence to guidelines or the necessity for initial diagnosis, staging, or assessment, which could indicate potential areas of overutilization.

Table 3: ***Average MRI Necessity Ratings***

Category	Mean	SD
Overall Average	**8.45**	**2.13**
Program		
Breast	**9.11**	**0.94**
Rare	**8.75**	**1.48**
Head, Neck, and Thoracic	**9.15**	**1.07**
Women	**8.90**	**1.22**
GU	**8.00**	**2.07**
GI	**7.50**	**2.53**
Palliative	**8.00**	**0.00**
Specialty		
Surgical	**8.89**	**1.85**
Medical	**7.92**	**2.41**
MRI Body Location		
Pelvis	**8.67**	**1.15**
Kidney	**8.50**	**0.71**
Orbit, Face, and Neck	**9.00**	**0.00**
Breast	**9.33**	**0.82**
Abdomen	**7.71**	**2.06**
Brain	**9.00**	**1.00**
Liver	**6.80**	**2.17**
Spine	**8.75**	**1.39**
Whole Spine	**9.50**	**0.71**
MRCP	**6.00**	**0.00**
Nasopharynx	**10.00**	**0.00**
MRI Purpose		
Routine	**7.88**	**2.34**
Urgent	**9.15**	**1.05**

Overall and Program-Specific Necessity Ratings: The overall average MRI necessity rating was 8.45 (SD 2.13), indicating a generally high perceived necessity across all MRIs. However, there were notable variations between different programs. "Head, Neck, and Thoracic" had the highest average necessity rating at 9.15 (SD 1.07), followed closely by "Breast" at 9.11 (SD 0.94). "GI" (Gastrointestinal) MRIs had a relatively lower necessity rating of 7.50 (SD 2.53), suggesting potential overuse in certain cases within this program.

Specialty-Specific Necessity Ratings: When broken down by specialty, MRIs requested by "Surgical" specialties had a higher average necessity rating of 8.89 (SD 1.85) compared to those requested by "Medical" specialties, which averaged 7.92 (SD 2.41). This difference could reflect the perceived importance of imaging in surgical decision-making and planning versus non-surgical management.

Body Location-Specific Necessity Ratings: MRIs targeting different body locations also exhibited variability in their necessity ratings. "Nasopharynx" and "Whole Spine" MRIs had the highest average ratings of 10.00 (SD 0.00) and 9.50 (SD 0.71), respectively, indicating that these scans were deemed highly necessary. Conversely, MRIs of the "Liver" and "MRCP" had the lowest average ratings of 6.80 (SD 2.17) and 6.00 (SD 0.00), respectively, suggesting they were less consistently perceived as necessary.

MRI Purpose-Specific Necessity Ratings: MRIs categorized as "Urgent" had a significantly higher average necessity rating of 9.15 (SD 1.05) compared to "Routine" MRIs, which had an average rating of 7.88 (SD 2.34). This finding underscores the greater perceived necessity of MRIs that are classified as urgent, highlighting the importance of appropriate classification in justifying imaging use. The results indicate that while the overall necessity for MRIs is considered high, there are notable discrepancies across different programs, specialties, and MRI types. The high variability in necessity ratings suggests that some MRI requests may not be fully justified by clinical criteria, particularly in routine or non-urgent cases. This points to potential overuse in specific programs or specialties, underscoring the need for improved adherence to clinical guidelines and decision-making protocols to ensure appropriate imaging utilization.

Discussion

The findings indicate a substantial proportion of MRI requests in oncology at SQCCCRC do not meet established clinical criteria, suggesting overutilization and unnecessary imaging. This overuse appears driven by multiple factors, including defensive medicine practices, where healthcare providers order MRIs to rule out even minimal diagnostic uncertainties due to fear of litigation (Salari et al., 2023). Additionally, patient expectations for thorough imaging often pressure clinicians into ordering MRIs, even when alternative modalities could suffice (Miszewski et al., 2024).

The lack of adherence to clinical guidelines was another critical factor contributing to unnecessary MRI use. Some clinicians may not be fully aware of current standards, while others may choose to deviate based on clinical judgment or perceived patient preferences (Chhabra, 2023). To improve adherence, healthcare institutions must enhance training and provide decision-support tools that guide imaging practices toward evidence-based protocols (Sheehan et al., 2016).

Moreover, overutilization of MRI is not only a financial burden but also increases patient exposure to prolonged and potentially unnecessary diagnostic procedures. This can lead to heightened anxiety, increased waiting times, and inefficient use of healthcare resources (Oberlin et al., 2017). Addressing these issues through strategic interventions can improve the efficiency of oncology care and reduce unnecessary healthcare costs.

Educational initiatives that target both healthcare providers and patients are crucial. For healthcare providers, continuing medical education on the appropriate use of MRI and the integration of clinical decision-support tools in electronic health records can encourage adherence

to guidelines (Miszewski et al., 2024). For patients, informed discussions about the necessity and risks of MRI can help manage expectations and reduce demand for unnecessary imaging (Oberlin et al., 2017).

Conclusion

The study reveals a significant proportion of MRIs performed in oncology at SQCCCRC may not be clinically necessary, driven by defensive practices, patient expectations, and lack of guideline adherence. Addressing these issues requires a comprehensive approach involving enhanced education, decision support tools, and patient-centered communication strategies to optimize MRI utilization, reduce costs, and improve care quality.

Recommendations

1. **Enhanced Training and Education**: Regular training sessions for healthcare professionals on the latest clinical guidelines and the appropriate use of MRIs in oncology.
2. **Decision Support Tools**: Integrate decision support tools in electronic health records to prompt adherence to imaging guidelines.
3. **Patient Education**: Develop patient education programs to clarify when MRIs are necessary and address common misconceptions about imaging.
4. **Audit and Feedback**: Implement regular audits of MRI requests and provide feedback to healthcare providers to identify patterns of unnecessary use and promote best practices.
5. **Guideline Adherence**: Create institutional policies to ensure strict adherence to evidence-based guidelines and promote the use of alternative imaging modalities when appropriate.

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Section 3:
Multidisciplinary Areas Quality Initiatives

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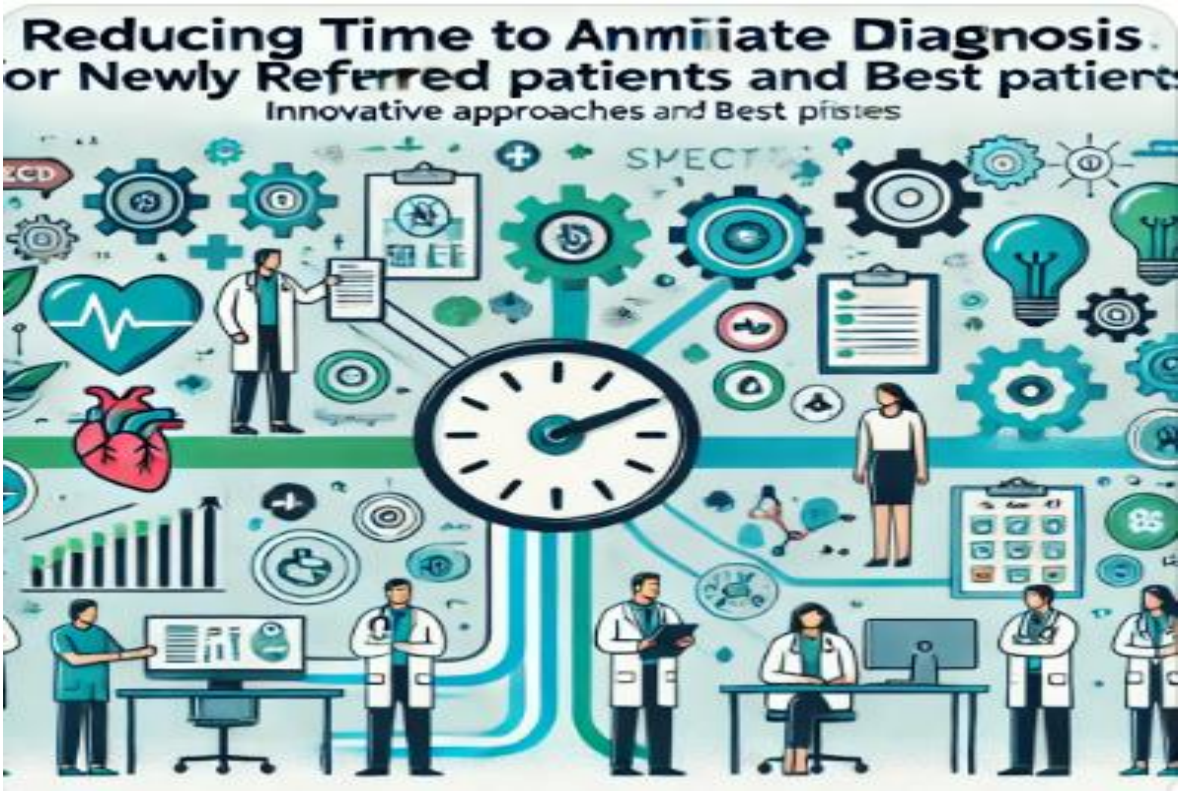
Chapter 10: Reducing Time to Initiate Diagnosis for Newly Referred Patients: Innovative Approaches and Best Practices



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Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) - University Medical City

Summary

Timely diagnosis and treatment initiation are essential in oncology, where delays can significantly impact patient outcomes. At the Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) in Muscat, Oman, inefficiencies in the referral system caused delays in accepting new patients and scheduling their first appointments. This project aimed to enhance patient care by streamlining the referral process using technological enhancements, process optimizations, and patient engagement strategies. Utilizing the FOCUS PDCA (Find, Organize, Clarify, Understand, Select, Plan, Do, Check, Act) framework, the project achieved a significant reduction in the average days for patient acceptance from 4.3 to 1.3 days and a decrease in time from acceptance to the first appointment from 8.6 to 4 days. These statistically significant improvements demonstrate the effectiveness of a comprehensive, data-driven approach to optimizing patient care.

Key points

- Timely diagnosis and treatment are crucial in oncology, where delays can negatively impact patient outcomes, making a streamlined referral process essential.
- Inefficiencies in the referral system at SQCCCRC, such as delays in patient acceptance and appointment scheduling, were identified as key barriers to timely care, necessitating a comprehensive approach to improvement.
- The FOCUS PDCA framework was effectively utilized to implement technological enhancements, process optimizations, and patient engagement strategies, resulting in a significant reduction in patient acceptance time from 4.3 to 1.3 days and appointment scheduling time from 8.6 to 4 days.
- Technological upgrades, including a new referral management system and standardized policies, reduced administrative delays, ensured clear communication between entities, and enhanced overall efficiency in patient care.

Project Charter

Project Charter	Details
Project Title	Improving the Referral Process in Oncology 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	3Q 2022
Project End Date	3Q 2023
Project Purpose	To enhance the efficiency and timeliness of the referral process at SQCCCRC by reducing delays in patient acceptance and scheduling of initial diagnostic appointments. The project aims to optimize patient care by streamlining the referral system through technological advancements, process standardization, policy updates, and patient engagement initiatives.
Problem Statement	Inefficiencies in the referral process at SQCCCRC have resulted in delays in patient acceptance and scheduling of initial diagnostic appointments, with an average time for patient acceptance of 4.3 days and a time from acceptance to the first appointment of 8.6 days. These delays negatively impact patient satisfaction, care quality, and outcomes, especially in oncology where timely diagnosis and treatment initiation are critical.
Project Goals and Objectives	1. Reduce the average time for patient acceptance from 4.3 days to less than 2 days. 2. Decrease the time from patient acceptance to the first appointment from 8.6 days to 4 days or less. 3. Implement a comprehensive referral system with enhanced accessibility and user-friendly orientation materials. 4. Standardize the referral process to ensure consistency, reduce variability, and improve coordination. 5. Engage patients in the referral process to improve satisfaction and trust.
Scope	Includes all aspects of the referral process for new patients at SQCCCRC, from external referrals to internal scheduling and acceptance procedures. The project focuses on reducing delays, optimizing communication, and improving patient engagement.
Key Stakeholders	Admission Discharge Transfer Office, Nursing Staff, Quality and Accreditation Department, Informatics and Cybersecurity Team, Physicians, Patients, Hospital Management
Resources Required	Budget for technology development, staff training, and patient education materials; personnel from relevant departments; IT infrastructure for the referral system; data analytics tools.
Risks and Assumptions	**Risks:** Resistance to new processes, limited resources for technology development and training, challenges in patient engagement. **Assumptions:** Full support from management, availability of necessary resources, active participation of all stakeholders, and effective communication across departments.
Success Criteria	Achieving a reduction in average patient acceptance time to less than 2 days and time to the first appointment to 4 days or less; successful

	implementation and utilization of the comprehensive referral system; improved patient satisfaction and streamlined processes as indicated by performance metrics.

Introduction

The referral process in healthcare is critical in determining how quickly patients can begin their diagnostic and treatment journeys. According to the World Health Organization (WHO), referral is a systematic process in which a healthcare provider seeks assistance from a more specialized facility due to limited resources or expertise (WHO, 2019). In oncology, this process is particularly important because cancer care often requires specialized, multidisciplinary teams and timely interventions to improve patient outcomes (Deandrea et al., 2018). A well-organized referral system ensures rapid access to specialized services, which is crucial for minimizing delays in diagnosis and treatment initiation (Majed et al., 2024).

At the Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) in Muscat, Oman, inefficiencies in the referral system were identified as significant barriers to intiate timely patient care. Common delays in patient acceptance and scheduling of initial appointments led to increased anxiety for patients, potential deterioration in their condition, and overall dissatisfaction with the care process. This situation necessitated a comprehensive review and redesign of the referral system to align with best practices in healthcare delivery and quality management (Haroun et al., 2021).

The study utilized the FOCUS PDCA (Find, Organize, Clarify, Understand, Select, Plan, Do, Check, Act) framework, a proven model for continuous quality improvement in healthcare settings (Thornton et al., 2011). This approach combines a focused analysis of current processes with

iterative cycles of planning, implementing, and evaluating interventions, ensuring that changes are data-driven and effectively address identified inefficiencies (Majed et al., 2024).

Optimizing the referral process is crucial for several reasons. Firstly, it enhances patient satisfaction by reducing waiting times and improving communication with healthcare providers (WHO, 2019). Secondly, it prevents unnecessary duplication of tests and treatments, reducing healthcare costs and optimizing resource utilization. Thirdly, timely diagnosis and treatment initiation are associated with better clinical outcomes, especially in oncology, where early intervention can significantly impact survival rates (Haroun et al., 2021).

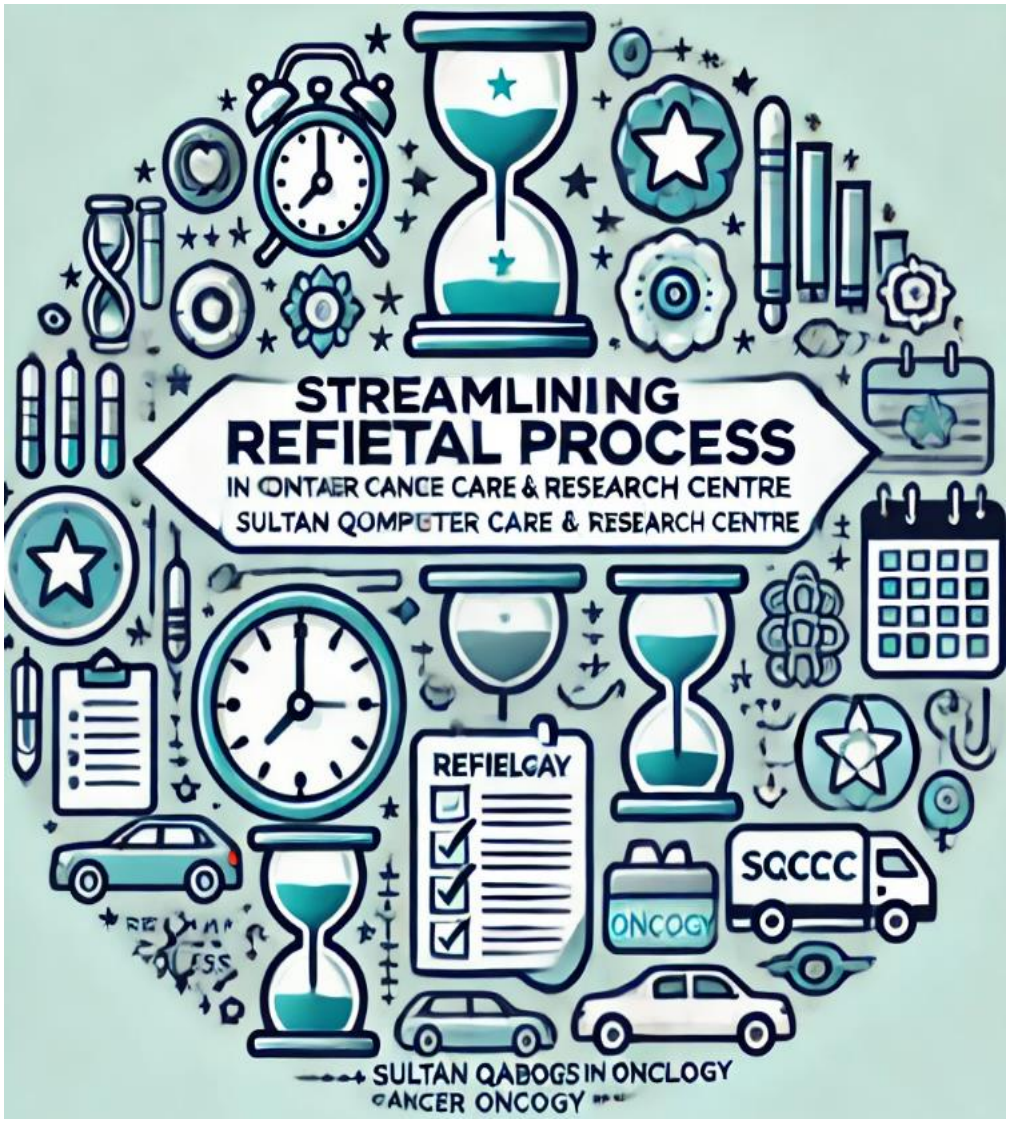
This study aimed to reduce the time required to start diagnosis for newly referred patients at SQCCCRC by implementing a comprehensive set of interventions, including technological upgrades, process optimization, and patient engagement initiatives. The objective was to streamline the referral system, minimize delays, and enhance overall patient care through a structured, evidence-based approach.

Problem Statement

Inefficiencies in the referral process at SQCCCRC resulted in prolonged delays in patient acceptance and scheduling of initial diagnostic appointments. The average time for patient acceptance was 4.3 days, and the time from acceptance to the first appointment was 8.6 days. These delays negatively affected patient satisfaction, outcomes, and overall care quality, especially in oncology setting, where timely diagnosis and treatment initiation are critical.

To address these challenges, a comprehensive approach was required to identify the root causes of delays and implement targeted interventions. The study's goal was to improve the efficiency of

the referral process, thereby reducing waiting times for newly referred patients and enhancing their overall care experience.



Methods

Setting: The study was conducted at the Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) in Muscat, Oman, from the third quarter of 2022 to the third quarter of 2023.

Design: A one-group pretest-posttest quasi-experimental design was used to assess the impact of the interventions on key performance indicators within the oncology referral process. This design allowed for the evaluation of changes without a separate control group, focusing on the average days for patient acceptance and the time between acceptance and the first appointment. Data were collected from patient records and analyzed by the quality and accreditation department.

FOCUS PDCA Approach: The project followed the FOCUS PDCA methodology, which involves the following phases:

1. **Find Phase**: Identified key areas for improvement, such as reducing the average days for new patient acceptance (4.3 days) and the delay between acceptance and the first appointment (8.6 days).
2. **Organize Phase**: A multidisciplinary team was formed, including members from the patient flow office, nursing, quality and accreditation, informatics and cybersecurity, and physicians.
3. **Clarify Phase**: Developed a flowchart of the current referral process, identifying barriers and inefficiencies such as delays in registration and appointment scheduling (see Figure 1).

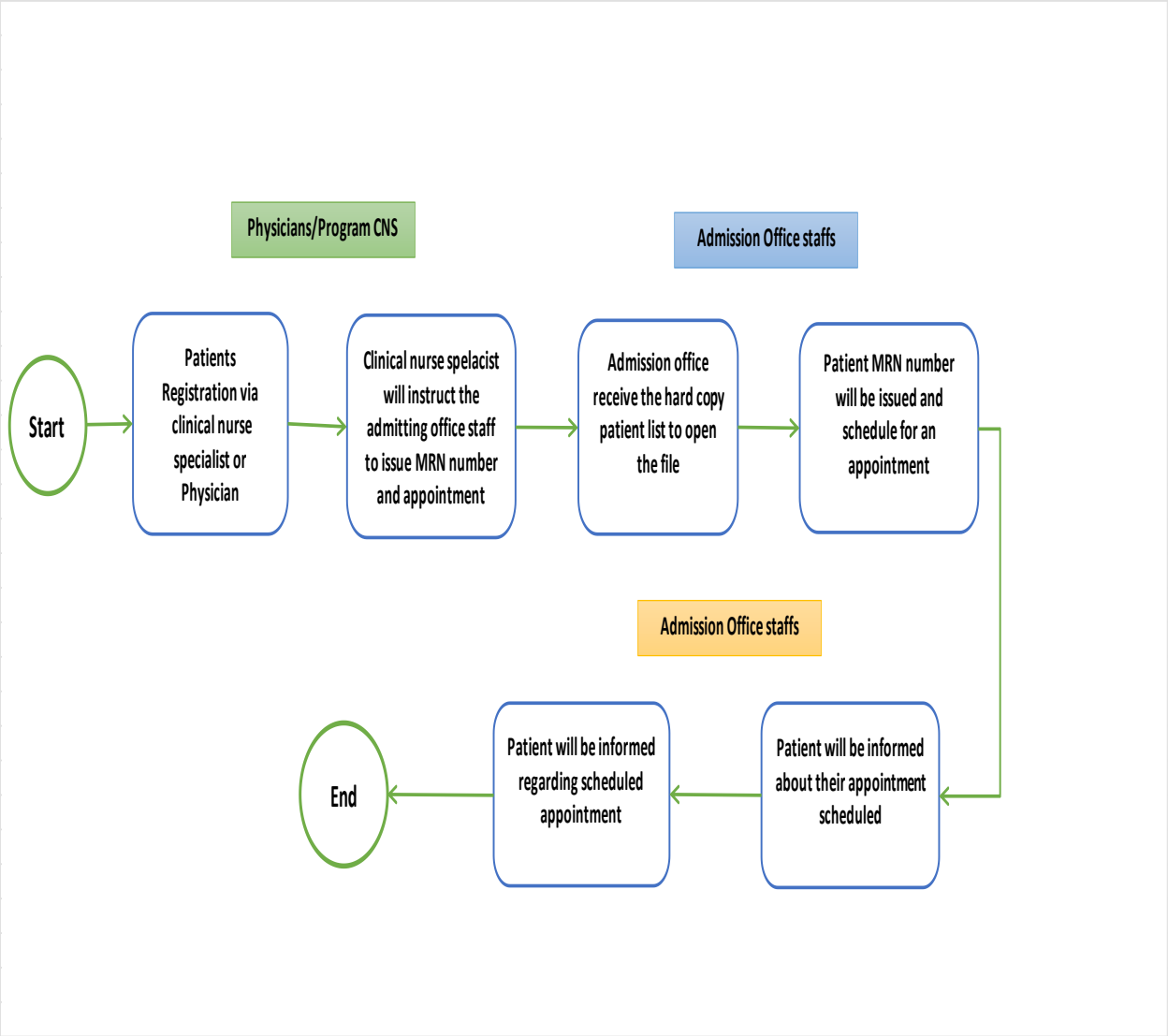


Figure 1: ***Previous Practice For New Patient Referral Appointment***

4. **Understand Phase**: Used Fishbone (Ishikawa) diagrams and brainstorming techniques to identify the root causes of these barriers (Figure 2).

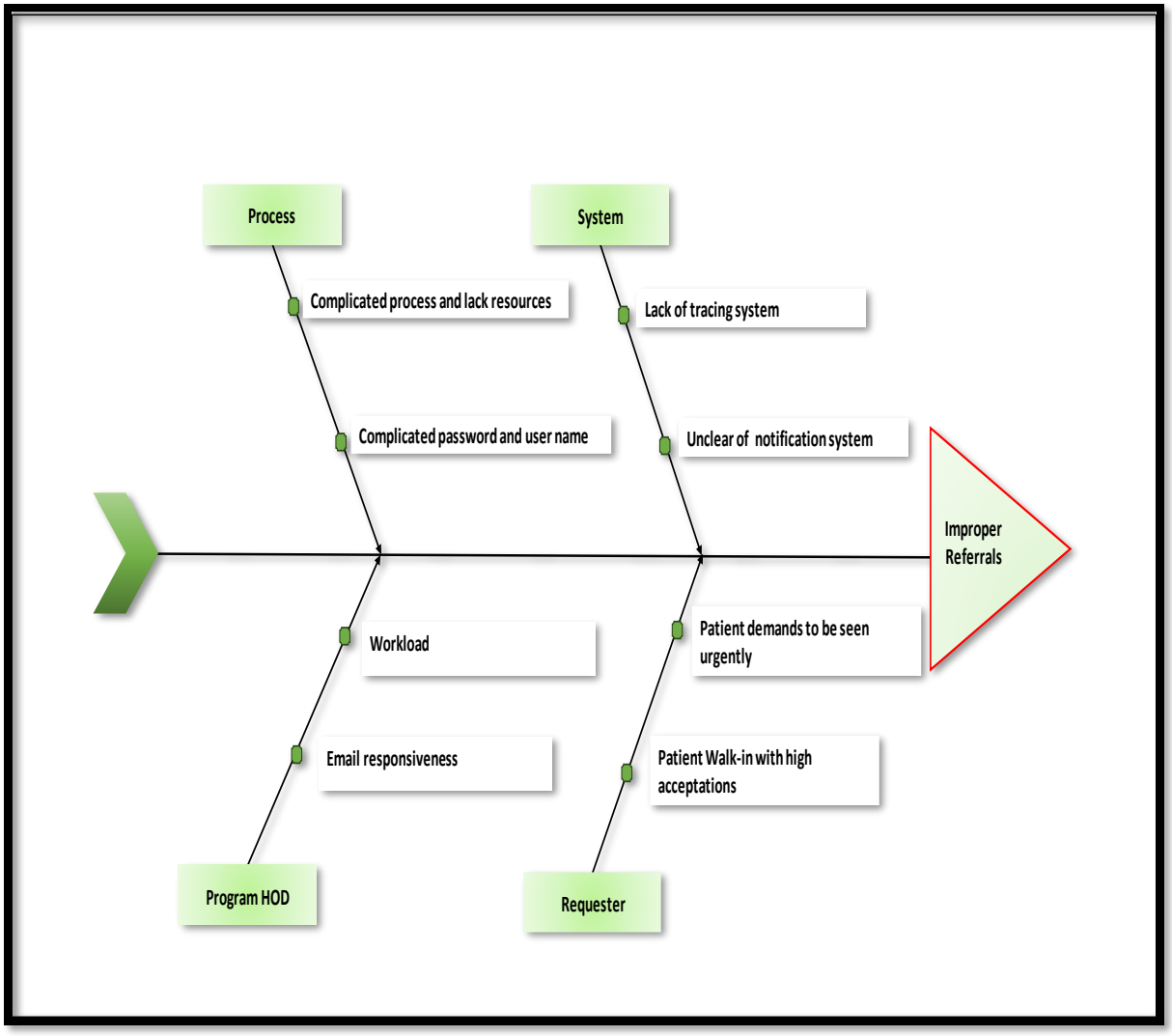


Figure 2: ***Cause-Effect Analysis For Improper Referral Appointments For New Patients***

5. **Select Phase**: Choose areas for improvement based on previous findings and literature, focusing on technology development, process and system modifications, and patient involvement.

PDCA Cycle Implementation: Operational plans were developed with leadership support and stakeholders. PDCA cycles were conducted from the fourth quarter of 2022 to the second quarter of 2023, with monthly follow-ups and discussions to monitor progress (Table 1).

Table 1: Improvement areas and Operational plans for the quality Improvement	
Main Area of Improvement	**Plans**
Technology	1. Technology Development: Creation of a comprehensive referral system addressing both external (referred organization) and internal (acceptance process) dimensions.
	2. Enhanced Accessibility: Publishing the referral system link across all relevant facilities and organization websites, ensuring convenient access for external parties.
	3. Orientation Materials: Development of informative and user-friendly orientation materials on the organization's website, providing clear guidance on navigating the referral system.
	4. Internal Training: Implementation of internal staff education initiatives to effectively educate and empower team members about utilizing the referral system adeptly.
Process	Standardize the profess of referral (internal and external process) Figure 3
System and policy management	1. Policy Formulation: Develop a comprehensive referral policy that outlines the objectives, scope, and principles guiding the acceptance process for patients.
	2. Criteria Definition: Define clear and specific criteria for patient acceptance based on the various programs and specialties offered. These criteria could include medical condition severity, treatment availability, and program suitability.
	3. Specialty Programs Criteria: Tailor the criteria for acceptance to the specific specialty programs available. Different programs may have unique requirements, ensuring that patients are directed to the most appropriate care setting.
Patient involvement	Develop awareness campaigns to educate patients about the referral process, including transportation options available to them.

Process Modifications: A new referral process was introduced, starting with an external link managed by the admission office and assigned to the appropriate program team for assessment. A continuous feedback loop was established to maintain communication and transparency among all parties (Figure 3).

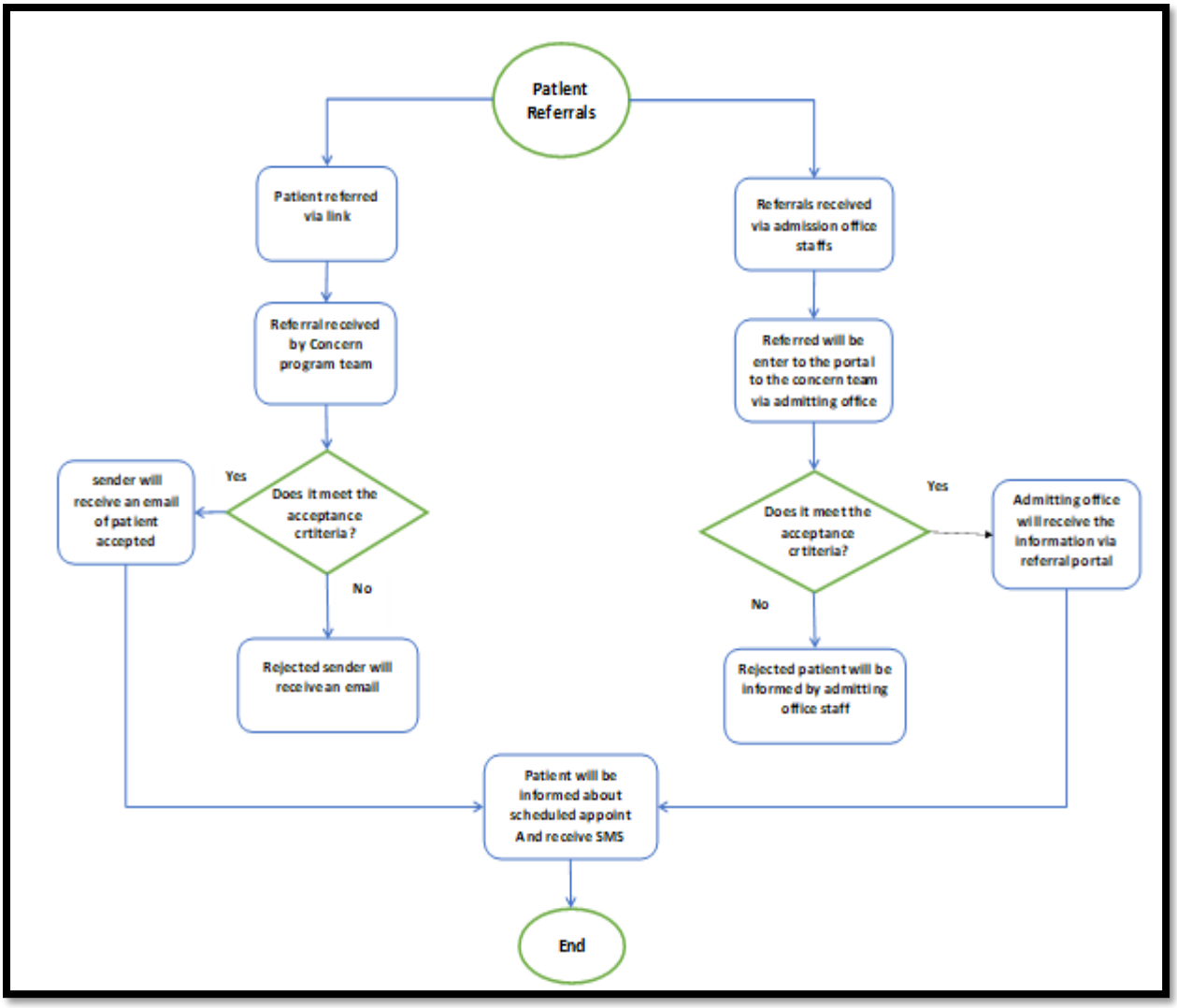


Figure 3: ***New Practice For New Patient Referral Appointment***

Referral Tracking System: A comprehensive system was developed to manage external and internal referrals, supported by training for internal staff and educational materials for external entities.

Policy Development and Acceptance Criteria: A standardized framework for referral acceptance and rejection was established, promoting fairness and consistency. Acceptance and rejection criteria were refined based on medical condition severity and treatment availability.

Data Analysis: Data were analyzed using SPSS version 23, with ANOVA and p-values calculated to assess the significance of observed changes.

Results

The intervention led to a significant reduction in the average days for new patient acceptance, from 4.3 days pre-intervention to between 1.3 and 1.6 days post-intervention. This improvement was statistically significant (F-value = 46.25, $p < .0001$). Additionally, the average time from patient acceptance to the first appointment decreased from 8.6 days to as low as 4 days, also showing significant improvement (F-value = 6.29, $p < .01$) (Table 2).

Table 2: ***Result Differences Pre and Post Interventions***

		Month	Mean	F	p value
Average number of days for the acceptance of new patients	Pre-data	Jul-22	4.3	46.25	0001.>
	Post intervention	Oct-22	1.3		
		Nov-22	1.3		
		Dec-22	1.6		
		Jan-23	1.6		
		Feb-23	1.4		
		Mar-23	1.3		
Average days between the patient acceptance and first visit appointment	Pre-data	Sep-22	8.6	6.29	0.002
	Post intervention	Oct-22	6.4		
		Nov-22	6.9		
		Dec-22	7		
		Jan-23	5		
		Feb-23	4		
		Mar-23	4		

Discussion

The findings of this study underscore the importance of a systematic approach to improving the referral process in oncology settings. By utilizing the FOCUS PDCA framework, the project was able to identify critical areas for improvement and implement targeted interventions that significantly reduced the time required for patient acceptance and the scheduling of initial appointments. This result is particularly significant in oncology, where delays in diagnosis and treatment can have profound effects on patient outcomes, including decreased survival rates and poorer quality of life (Deandrea et al., 2018).

The reduction in average days for patient acceptance from 4.3 to 1.3 days and in time to the first appointment from 8.6 to 4 days indicates that the interventions were highly effective in addressing the inefficiencies in the referral process. These improvements can be attributed to the comprehensive approach taken, which included technological enhancements, process optimization, policy updates, and patient engagement initiatives. The integration of technology, such as the development of a comprehensive referral system, played a crucial role in streamlining communication between referring entities and the receiving department, reducing administrative delays, and ensuring that critical information was readily available (Haroun et al., 2021).

Furthermore, policy updates and process standardization were essential in creating a consistent framework for managing referrals. Clear criteria for patient acceptance and rejection, tailored to specific specialty programs, ensured that all staff members were aligned in their understanding and execution of the referral process. This consistency reduced variability and errors, leading to faster decision-making and improved coordination across departments. The success of these strategies

is supported by previous research, which highlights the benefits of standardizing procedures to improve efficiency and reduce delays in healthcare settings (Majed et al., 2024).

Patient involvement was another key factor contributing to the success of the interventions. By educating patients about the referral process and available transportation options, the project empowered them to actively participate in their care, enhancing satisfaction and trust in the healthcare system. This aligns with studies showing that patient education and engagement are critical components in improving health outcomes and service delivery (Thornton et al., 2011).

Continuous monitoring and evaluation were critical to sustaining the improvements achieved. The use of data analytics to track performance allowed for timely identification of any emerging issues and enabled quick adjustments to the interventions as needed. This iterative process of assessment and modification is a core tenet of the PDCA methodology and is vital for ensuring that quality improvements are maintained over time (WHO, 2019).

Lastly, the study's focus on multidisciplinary collaboration was crucial for its success. By involving a range of stakeholders—from the patient flow office to nursing, quality management, informatics, and physicians—the project leveraged diverse expertise to develop well-rounded and practical solutions. This approach facilitated the identification of potential barriers and the creation of tailored interventions that addressed the specific needs of each department involved in the referral process (Haroun et al., 2021). The collaboration also fostered a culture of continuous improvement, where staff members were encouraged to contribute ideas and feedback, further enhancing the overall effectiveness of the initiative.

Conclusion

The results of this study highlight the effectiveness of a comprehensive, structured approach to improving the referral process in an oncology setting. The significant reduction in waiting times for newly referred patients demonstrates that the FOCUS PDCA framework, combined with technological enhancements, policy updates, and patient engagement initiatives, can lead to meaningful improvements in healthcare delivery. Moving forward, it is essential to continue monitoring these processes to ensure sustained gains and address any new challenges that may arise. The study provides a valuable model for other healthcare organizations seeking to optimize their referral systems and improve patient care outcomes.

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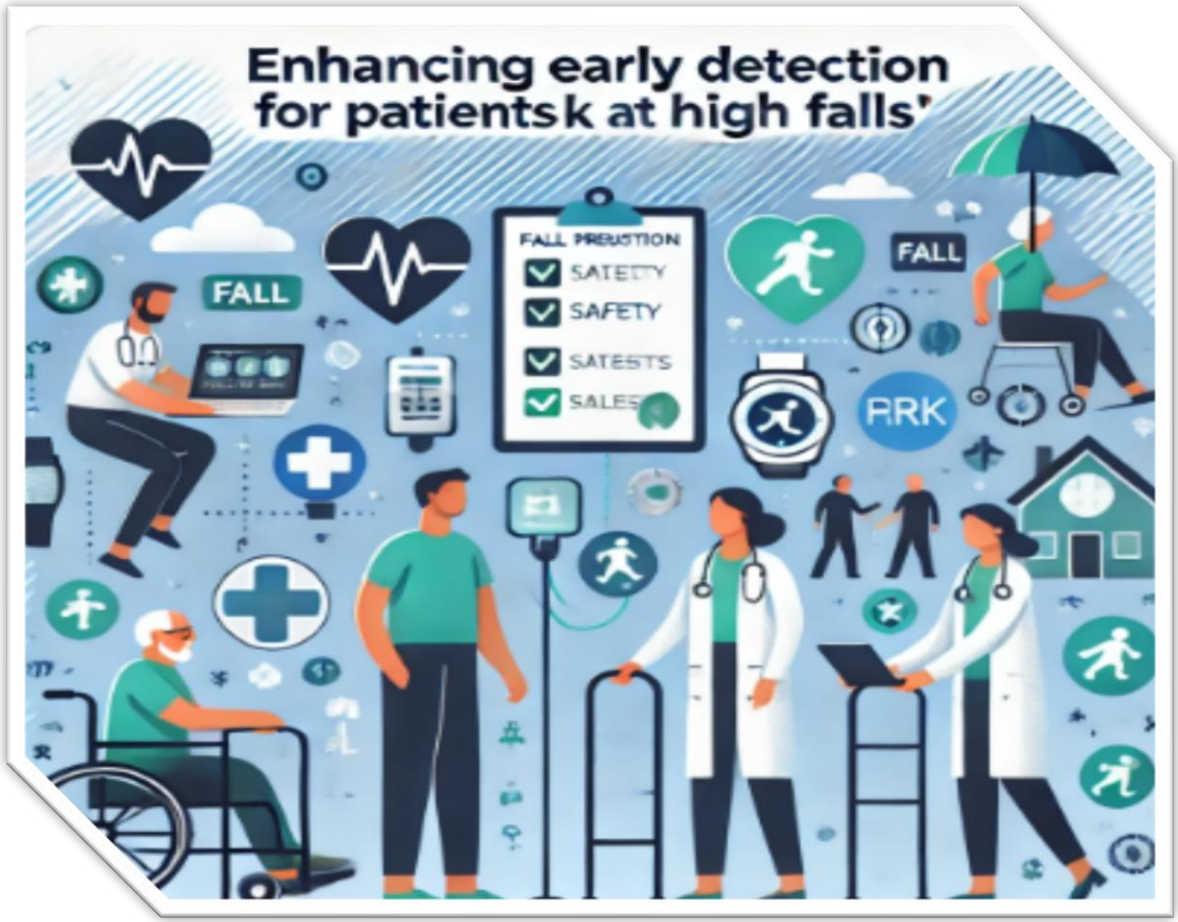
Chapter 11: Enhancing Early Detection for Patients at High Risk for Falls



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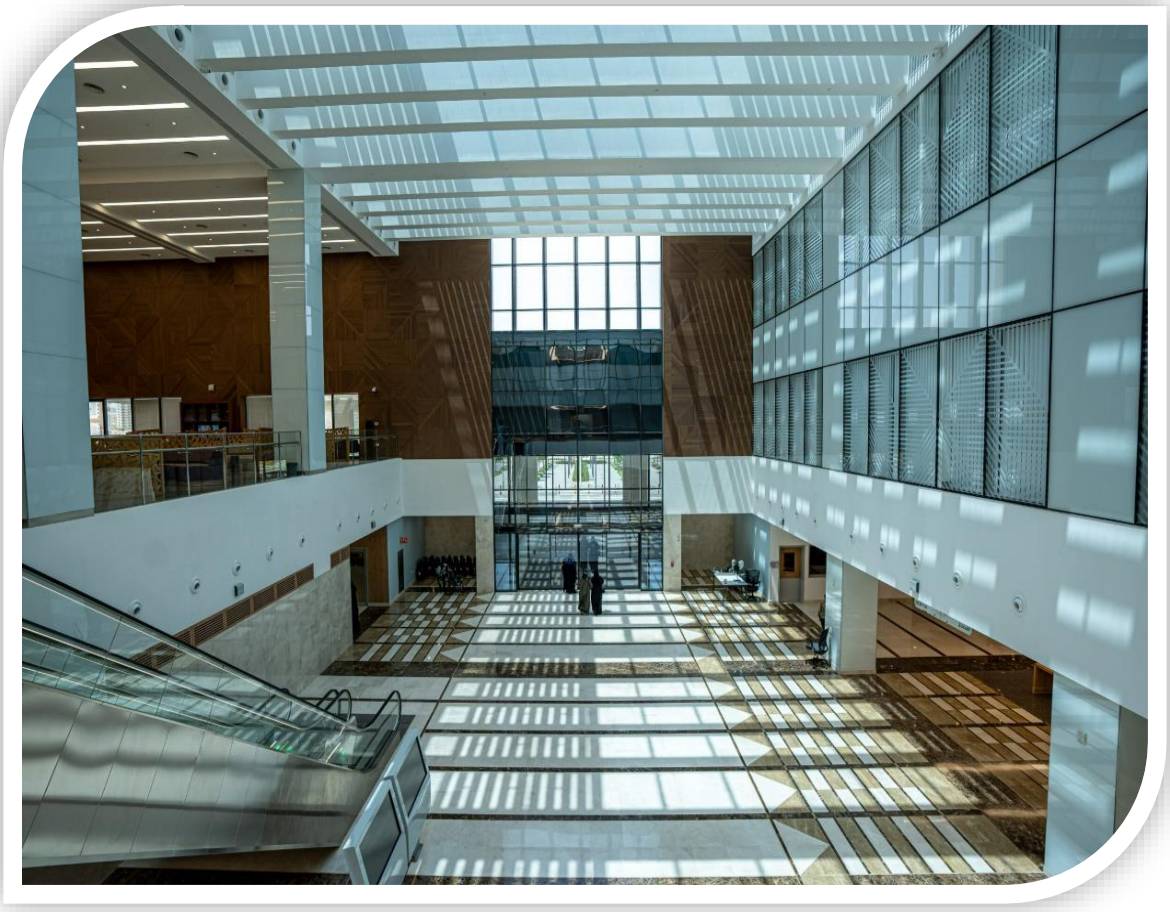
Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) - University Medical City

Summary

This project aimed to enhance patient safety by optimizing fall risk management for oncology patients using Failure Modes and Effects Analysis (FMEA) within outpatient settings at the Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC), University Medical City. Interventions targeted at improving fall risk assessment and preventive measures were applied, resulting in significant reductions in Risk Priority Numbers (RPNs) across various failure modes, demonstrating the effectiveness of FMEA in minimizing fall risks and enhancing patient safety.



Key Points

The project applied Failure Modes and Effects Analysis (FMEA) to identify and mitigate potential failures in the fall risk assessment process at SQCCCRC, focusing on outpatient settings.

Targeted interventions, including the use of the Modified Morse Fall Scale, electronic tracking, staff training, and policy updates, resulted in a 62% reduction in Risk Priority Numbers (RPNs) across identified failure modes.

The findings underscore the effectiveness of FMEA in proactively enhancing fall risk management by improving the accuracy of assessments, clarifying responsibilities, and ensuring timely preventive actions.

While the study achieved significant improvements, continuous monitoring, technological integration, and iterative policy updates are essential for sustaining gains and further reducing fall risks in outpatient oncology care.

Project Charter

Project Charter	Details
Project Title	Enhancing Fall Risk Management in Outpatient Oncology Settings 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	Third Quarter 2023
Project Purpose	To improve patient safety by reducing the incidence of falls in outpatient oncology settings at SQCCCRC through the identification and mitigation of risks associated with patient falls, using the Failure Modes and Effects Analysis (FMEA) methodology to standardize fall risk assessments, enhance staff training, and implement technological solutions.
Problem Statement	Current fall prevention practices in outpatient oncology settings at SQCCCRC are inadequate due to a lack of standardized protocols, insufficient staff training, and limited technological tools, leading to preventable falls that adversely impact patient safety and care quality. A systematic approach is needed to improve the early detection of fall risks and implement effective interventions.
Project Goals and Objectives	1. Reduce the incidence of falls by 50% within the outpatient oncology settings. 2. Implement the Morse Fall Scale to standardize fall risk assessments across all relevant areas. 3. Enhance staff knowledge and skills through targeted training programs. 4. Develop and integrate an electronic tracking system for real-time monitoring of fall risk assessments. 5. Update fall prevention policies to ensure clarity and consistency in responsibilities and procedures.
Scope	Includes all outpatient settings at SQCCCRC, such as clinics, daycare, radiology, radiotherapy, and rehabilitation facilities. The project focuses on standardizing fall risk assessments, enhancing staff training, updating policies, and implementing technological tools for real-time monitoring. Excludes inpatient settings and non-oncology departments.
Key Stakeholders	Outpatient Clinic Staff, Nursing Staff, Quality and Accreditation Department, Rehabilitation Team, Radiology Department, Informatics Team, Patients, Hospital Management
Resources Required	Budget for technology development, staff training, and policy updates; personnel from relevant departments; IT infrastructure for electronic tracking systems; data analytics tools.
Risks and Assumptions	**Risks:** Resistance to new protocols, limited availability of resources for technology and training, challenges in maintaining consistent application of new procedures.

	Assumptions: Full support from hospital management, adequate funding and resources, active participation and cooperation of all stakeholders, and effective communication across departments.
Success Criteria	Achieving a 50% reduction in fall incidence in outpatient settings; successful implementation and use of the Morse Fall Scale and electronic tracking system; improved staff compliance with new protocols and positive feedback from stakeholders; demonstrated improvement in patient safety metrics.

Introduction

Patient falls are a significant safety concern in healthcare settings, often leading to severe consequences ranging from minor injuries to major trauma and even death (Ha et al., 2021). The risk of falls is particularly high in oncology settings due to factors like physical weakness, fatigue, cognitive impairments, and sensory deficits resulting from cancer treatments such as chemotherapy (Oliver et al., 2004; Christiansen et al., 2020). These impairments can substantially affect a patient's balance, coordination, and cognitive function, further increasing the likelihood of falls (Yamamoto et al., 2020).

Cancer patients face not only the physical and medical challenges associated with their condition but also the emotional and psychological impacts of falls. Injuries from falls can delay recovery, interrupt treatment schedules, and significantly reduce the quality of life due to increased fear and anxiety (Fulton et al., 2019; Sattar et al., 2021). Falls are a growing concern in outpatient oncology settings, where continuous follow-up care is necessary, and patients frequently navigate environments that may not always be optimized for safety (Mehta et al., 2021; Abdelbasset et al., 2021).

The outpatient nature of oncology services, combined with frequent appointments and the complex needs of cancer patients, creates unique challenges in fall prevention. Many outpatient

facilities lack the resources or comprehensive systems necessary to conduct thorough fall risk assessments, leading to missed opportunities for intervention (Smebye et al., 2014; Yulistiani et al., 2023).

This project employed the Failure Modes and Effects Analysis (FMEA), a proactive, systematic approach to identify and mitigate risks associated with patient falls, by analyzing potential failures in the fall risk assessment process and implementing targeted interventions (Haroun et al., 2021; Filz et al., 2021). Conducted at the Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC), the project aimed to optimize fall risk management in outpatient oncology settings, reducing fall incidents and improving patient safety outcomes.

Problem Statement

Falls pose a substantial risk to oncology patients in outpatient settings due to their inherent vulnerabilities and the outpatient context's unique challenges. Despite efforts to manage these risks, significant gaps in fall prevention remain, leading to preventable incidents that adversely affect patient safety and quality of care. This project addresses the need for a more robust and systematic approach to fall risk management to enhance early detection and intervention.

The lack of standardized protocols, insufficient staff training, and limited use of technological tools for monitoring and documentation contribute to the inadequacies in current fall risk management practices (Dehnavieh et al., 2014; Jain, 2017). To mitigate these risks, the project aimed to apply the FMEA methodology to identify critical failure modes and implement corrective actions, thereby improving the consistency and effectiveness of fall risk management practices in outpatient oncology settings.

Methods

Setting and Design

The project was conducted at the Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) in Oman, focusing on outpatient clinics, daycare, radiology, radiotherapy, and rehabilitation facilities. An observational analytical design was used to assess the fall risk assessment process pre and post-interventions, commonly employed in health sciences to explore causal relationships (Social Research Methodology, 2020).

FMEA Methodology

A 7-step Failure Modes and Effects Analysis (FMEA) was implemented, involving:

1. **Defining the System or Process:** Created process maps to define the fall risk assessment system, identifying gaps at reception and other key areas.

2. **Identifying Potential Failure Modes:** Identified failure modes such as process failures, human errors, patient-specific factors, and equipment failures.

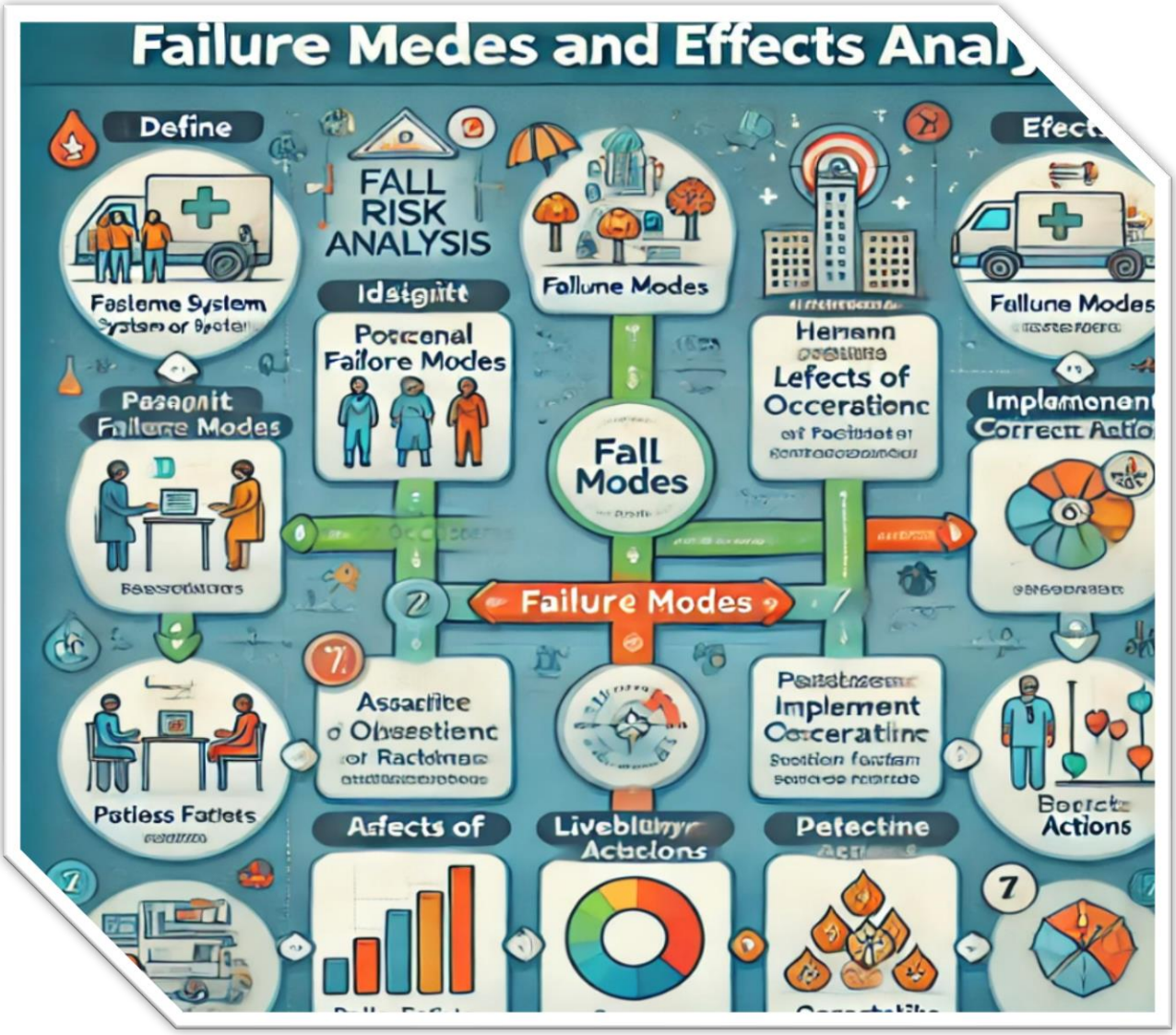
3. **Evaluating the Effects of Each Failure Mode:** Analyzed impacts of identified failures on patient safety and service delivery.

4. **Assigning Severity Ratings:** Rated each failure mode on a scale of 1 to 10 for severity.

5. **Assigning Likelihood of Occurrence Ratings:** Rated the likelihood of occurrence for each failure mode.

6. **Assigning Detection Ratings:** Rated the detectability of each failure mode.

7. **Identifying and Implementing Corrective Actions:** Developed and implemented targeted interventions to address identified failure modes.



Interventions

1. **Scale Modification:** Introduction of the Modified Morse Fall Scale to standardize assessments (Agency for Healthcare Research and Quality, 2013).

2. **Process and Responsibility Modifications:** Clear definition of responsibilities for conducting fall risk assessments.

3. **Resource and Information Technology Utilization:** Implementation of an electronic tracking system to monitor assessments in real-time (Huang et al., 2021).
4. **Policy Update:** Comprehensive policy updates incorporating new assessment procedures.
5. **Staff Education and Training:** Training programs for healthcare professionals on fall risk prevention strategies.

Results

The project identified several significant failure modes in the fall risk assessment process, each associated with high RPNs, indicating critical risk levels. Key issues included inaccurate assessments due to inadequate staff education, complex risk assessment scales, and unclear responsibilities for conducting fall assessments. These failures led to missed opportunities for timely intervention and prevention.

Main Failure Modes, Causes, Effects, and Pre and Post Risk Priority Numbers (RPNs) per Process

Process	Main Failure Modes	Causes	Effects	Initial RPN	Post intervention RPN	Difference (%)
Fall screening	Wrong assessment	Improper staff education	Lack of knowledge to screen the patients.	256	110	57%
		Complex risk assessment scale	Unable to assess patients periodically due to complex scale	288	105	63%
Fall screening	Missed fall assessment	Unclear process and responsibility for fall assessment	Premature process led to knowledge deficit and no proper patient screening for fall	360	72	80%
		Improper staff education	Lack of knowledge to screen the patients.	256	110	57%
		Complex risk assessment scale	Unable to assess patients periodically due to complex scale	288	105	63%
Fall risk precaution measures	Missed Fall risk precaution measures for high risk	Improper staff education	Lack of knowledge to implement fall precaution measures	256	110	57%
		Unclear fall precaution measures-responsibilities	No proper distribution of responsibilities	360	72	80%
		Missed bracelets for high risk	Absence of implementing precaution measurement for fall	256	110	57%
Fall risk precaution measures	Insufficient measures	Improper staff education	Lack of knowledge to implement fall precaution measures	256	110	57%
		Lack of proper distribution and available equipment	Unable to implement fall precaution measures	192	110	43%
Fall risk precaution measures	Un-documented intervention	No clear process (responsibilities)	No proper distribution of responsibilities	360	110	69%
		Unaware of the documentation requirement	Lack of fall precaution measures documentation	192	110	43%
Patient Education	No/improper education	Improper staff education	Lack of patient awareness	256	110	57%
		Unuse of educational material and resources	Absence of patient education	243	110	55%

Following the interventions, the project observed substantial reductions in RPNs across all identified failure modes, with an overall decrease of 62%. Significant improvements were noted in the accuracy of fall risk assessments, clarity of responsibilities, and implementation of preventive measures. For instance, the failure mode "Missed Fall Assessment" saw an 80% reduction in RPN, highlighting the effectiveness of the interventions.

Discussion

The results of this project demonstrate the effectiveness of FMEA as a tool for enhancing fall risk management in outpatient oncology settings. By systematically identifying potential failure modes and implementing targeted interventions, the project achieved substantial reductions in RPNs across various domains of fall risk management (Yamamoto et al., 2020; Sattar et al., 2021). The introduction of the modified Morse Fall Scale simplified and standardized assessments, addressing one of the key failure modes—complexity and inconsistency in risk assessment processes (Agency for Healthcare Research and Quality, 2013).

The success of the interventions can be attributed to several factors. The use of an electronic tracking system ensured real-time monitoring and documentation, allowing healthcare providers to promptly initiate fall precautions and communicate effectively across care teams (Huang et al., 2021). Additionally, the comprehensive policy updates and staff training programs helped improve awareness and adherence to best practices, reducing the likelihood of human errors (Filz et al., 2021).

However, challenges remain in ensuring consistent application of protocols and addressing resource limitations. Continuous monitoring and iterative improvements are necessary to sustain the gains achieved and further reduce fall risks (Fulton et al., 2019). Future studies should explore

the integration of advanced technologies, such as artificial intelligence and machine learning, to predict and prevent falls more effectively (Abdelbasset et al., 2021).

Conclusion

FMEA proved to be an effective tool for enhancing fall risk management in outpatient oncology settings at SQCCCRC. The project's proactive approach resulted in substantial improvements in the accuracy and effectiveness of fall risk assessments and interventions. The findings highlight the importance of continuous monitoring, staff training, and policy updates to maintain high standards of patient safety. While challenges remain, particularly in ensuring consistent application of protocols and addressing resource limitations, the project provides a valuable model for improving fall risk management and enhancing patient safety in outpatient oncology care.

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Chapter 12: Interventions to Improve the Timely and Accurate Identification of Psychological Problems in Oncology Care

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Summary

The initiative aimed to enhance the identification and management of psychological problems among oncology patients at the Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) by using the Plan-Do-Check-Act (PDCA) framework. Through standardized assessment tools, staff augmentation, technology integration, and continuous monitoring, the project significantly improved screening rates, timeliness, and accuracy of psychological interventions, ultimately enhancing patient care and staff satisfaction.

Key Points

Psychological well-being is crucial in cancer care, but many oncology centers struggle with inconsistent screening, inadequate resources, and a lack of standardized protocols, resulting in missed opportunities for early intervention.

The use of standardized psychological assessment tools like HADS and PHQ-9, along with the expansion of the mental health team and integration of tools into the Health Information System, significantly improved screening rates and the timeliness of interventions.

The project achieved notable improvements, including a 24% increase in psychological screenings and a rise in the proportion of patients receiving timely psychological interventions from 80% to 86%.

While the PDCA framework proved effective, ongoing efforts are needed to maintain staff engagement, adapt to technological changes, and continuously refine the approach to further enhance psychological care in oncology settings.

Project Charter

Project Charter	Details

Project Title	Improving the Timely and Accurate Identification of Psychological Problems in Oncology Care 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	January 2024
Project End Date	June 2024
Project Purpose	To enhance the identification and management of psychological problems among oncology patients at SQCCCRC by implementing a structured approach using the PDCA framework. The project aims to standardize psychological assessments, augment mental health resources, integrate technology, and ensure continuous monitoring to improve screening rates, diagnostic accuracy, and timeliness of interventions.
Problem Statement	Despite the high prevalence of psychological issues among oncology patients, the timely and accurate identification of these problems remains suboptimal at SQCCCRC. Inconsistent screening practices, limited staffing, and inadequate integration of technology result in delayed interventions, negatively impacting patient outcomes and quality of life. A structured approach is needed to improve early detection and management of psychological problems in oncology care.
Project Goals and Objectives	1. Increase psychological screening rates by 20% by June 2024. 2. Ensure 90% of patients receive psychological screenings within three working days of admission. 3. Improve the accuracy and timeliness of psychological interventions, with 90% of patients receiving interventions within 48 hours of need identification. 4. Standardize the use of evidence-based assessment tools across the department. 5. Enhance staff training and expand the mental health team to meet patient needs.
Scope	Includes all psychological care activities for oncology patients at SQCCCRC, covering outpatient and inpatient settings. The project focuses on standardizing psychological assessments, increasing staffing, integrating technology into the Health Information System (HIS), and enhancing staff training. Excludes non-oncology departments and non-psychological interventions.
Key Stakeholders	Oncology Department Staff, Mental Health Team, Quality and Accreditation Department, Nursing Staff, Health Information System (HIS) Team, Patients, Hospital Management
Resources Required	Budget for staff training, technology integration, and mental health team expansion; personnel from relevant departments; IT infrastructure for HIS upgrades; data analytics tools.
Risks and Assumptions	**Risks:** Resistance to new protocols, limited availability of qualified mental health professionals, challenges in integrating new tools into the HIS.

	Assumptions: Full support from hospital management, adequate funding and resources, active participation of all stakeholders, and effective communication across departments.
Success Criteria	Achieving a 20% increase in psychological screening rates; 90% of patients screened within three working days of admission; 90% of patients receiving interventions within 48 hours of need identification; successful integration of assessment tools into HIS; positive feedback from staff and patients; demonstrated improvement in psychological care metrics.

Introduction

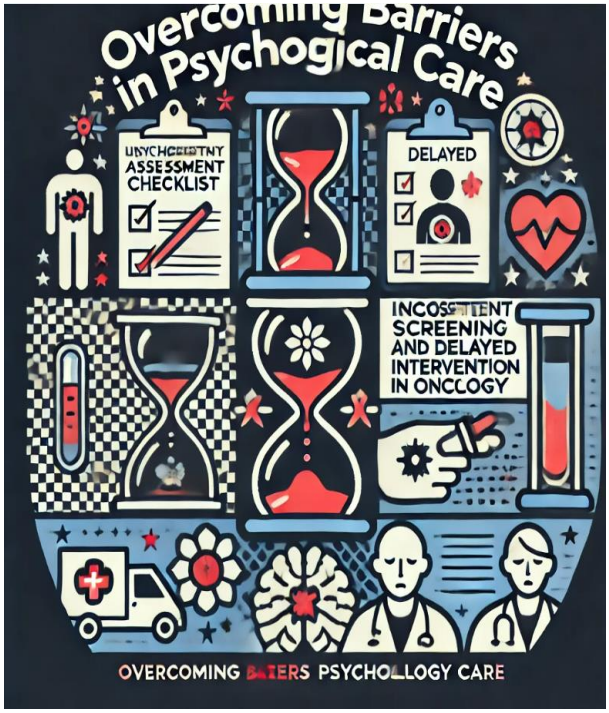
Psychological well-being is a crucial component of comprehensive cancer care, profoundly impacting treatment outcomes and quality of life for patients. Cancer diagnosis and treatment are often accompanied by emotional and psychological challenges that can interfere with recovery and decrease treatment efficacy (Zimmermann et al., 2023; Wang et al., 2024). Despite the importance of addressing these psychological issues, many oncology centers face difficulties, such as inconsistent screening practices, inadequate resources, and a lack of standardized protocols for psychological care (Xie et al., 2024). These gaps can result in delayed or missed opportunities for early intervention, further complicating patient outcomes.

To improve psychological care, our oncology center implemented a targeted initiative to address the identified barriers. The initiative focused on standardizing psychological assessments, augmenting the mental health team, and integrating tools into the Health Information System (HIS) to enhance the efficiency and accuracy of the screening process (Doyle et al., 2024). By employing the PDCA cycle, we aimed to achieve continuous quality improvement in the timely and accurate identification of psychological problems, thereby providing more effective and comprehensive patient care.

The adoption of the PDCA framework enabled a structured approach to identifying existing gaps and implementing effective interventions. Key steps included standardizing evidence-based tools like the Hospital Anxiety and Depression Scale (HADS) and the Patient Health Questionnaire (PHQ-9), expanding mental health resources, integrating technology to facilitate screenings, and enhancing staff training to ensure consistency in care delivery (Wang et al., 2024). This comprehensive strategy was intended to improve screening rates, diagnostic accuracy, and the timeliness of interventions.

Problem Statement

Despite the known psychological challenges faced by oncology patients, timely and accurate identification of these issues remains suboptimal due to inconsistent screening practices, limited staffing, and inadequate integration of technology in care processes. These shortcomings often result in delayed interventions and compromised patient outcomes. To address these critical gaps, a targeted initiative using the PDCA framework was launched to improve the early detection and management of psychological problems in oncology care.



The initiative focused on overcoming existing barriers by standardizing assessment protocols, increasing staffing, and leveraging technology to facilitate efficient psychological screening and intervention processes. The primary objective was to enhance patient care by ensuring timely and

accurate identification of psychological issues, thereby improving overall treatment outcomes and quality of life.

Methods

Plan:

1. **Comprehensive Assessment:** Conducted an in-depth evaluation of current psychological screening and intervention practices at SQCCCRC to identify key areas for improvement.
2. **Gap Analysis:** Identified inconsistencies in assessment tools, insufficient staffing levels, and a lack of technology integration as major areas needing attention.
3. **Goal Setting:** Set clear objectives to increase psychological screening rates, enhance diagnostic accuracy, and ensure timely interventions for identified psychological issues.

Do:

1. **Standardization of Assessment Tools:** Implemented evidence-based psychological assessment tools, such as HADS and PHQ-9, consistently across the department.
2. **Staff Augmentation:** Expanded the mental health team to include more social workers, clinical psychologists, and psychiatrists to meet the increased demand for psychological support.
3. **Technology Integration:** Integrated screening tools and related documentation into the Health Information System (HIS) to streamline data management and facilitate prompt follow-up.
4. **Comprehensive Training:** Provided training to all relevant staff on the new protocols, tools, and processes to ensure consistent and high-quality care.

Check:

1. **Key Performance Indicators (KPIs):** Established KPIs to monitor the effectiveness of the interventions, focusing on screening rates, diagnostic accuracy, and timeliness of interventions.
2. **Data Analysis and Feedback:** Conducted regular data analysis and feedback sessions to evaluate progress, identify challenges, and inform subsequent improvements.

Act:

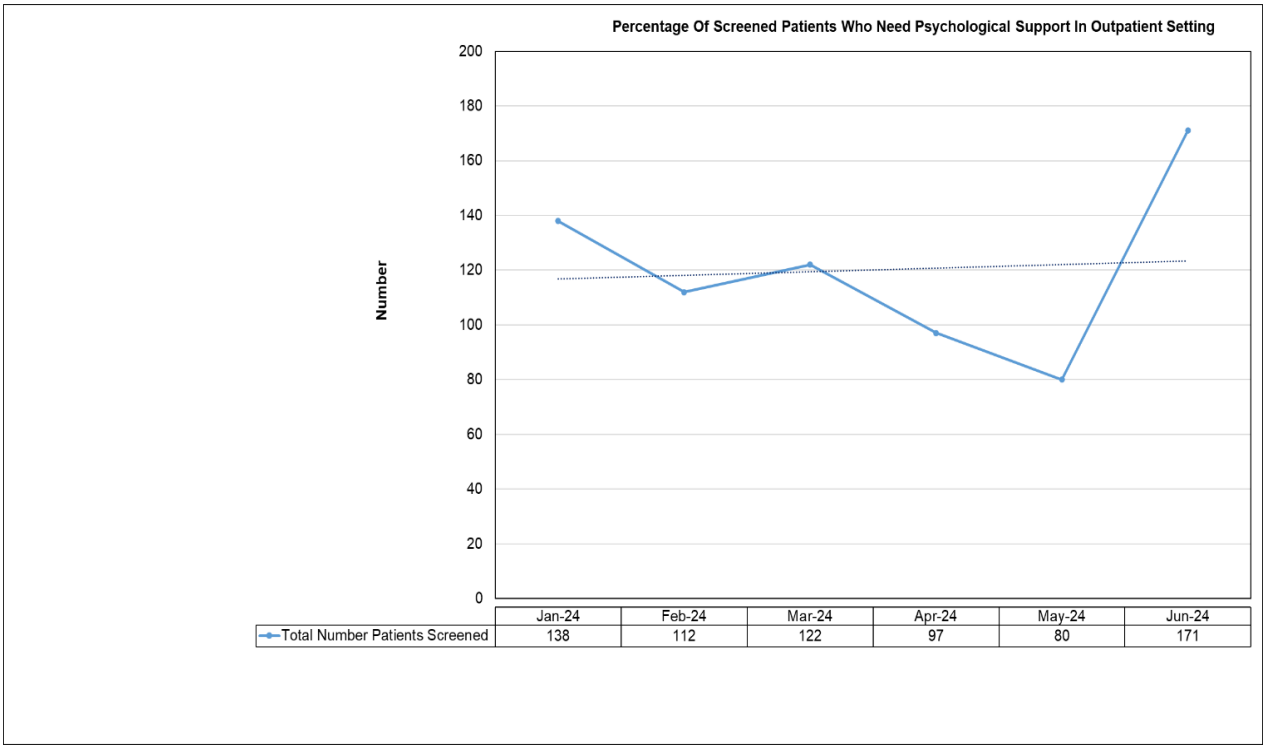
1. **Continuous Improvement:** Made targeted adjustments to intervention strategies based on data analysis and feedback, including refining staff training, optimizing staffing levels, and enhancing HIS functionality to support psychological care processes.

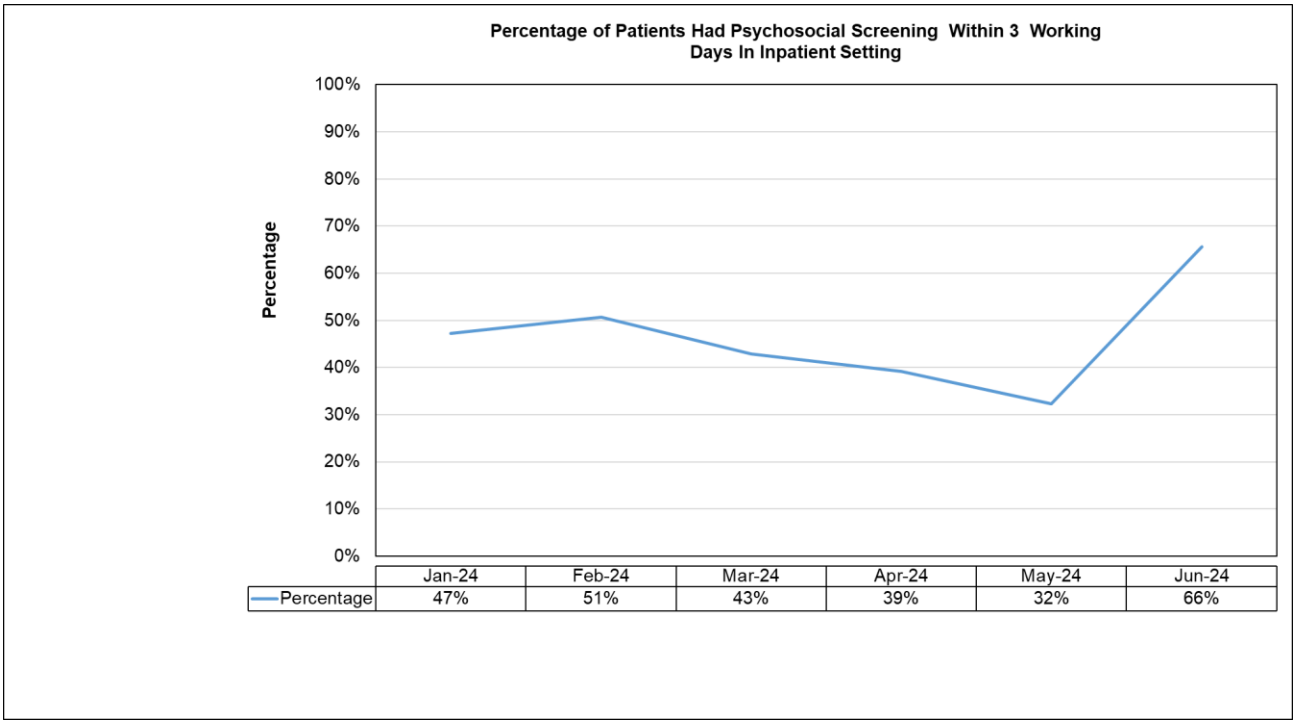
Results

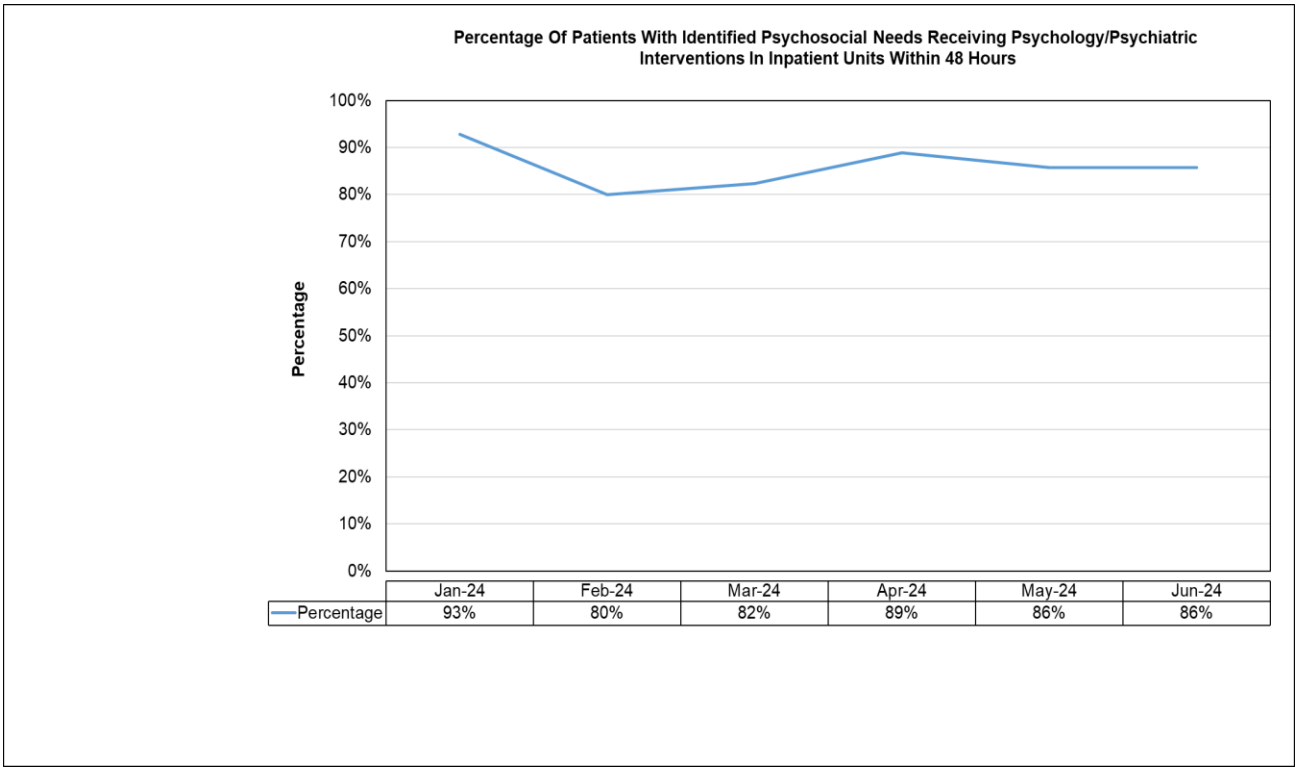
The implementation of the PDCA cycle yielded substantial improvements in the psychological care provided to oncology patients.

1. **Increased Screening Rates:** Psychological screening rates rose from 138 patients in January 2024 to 171 in June 2024, attributed to the standardized use of evidence-based tools and HIS integration
2. **Improved Timeliness of Screenings:** The percentage of patients receiving screenings within three working days of admission improved from 47% in January 2024 to 66% in June 2024, reflecting enhanced staff training, increased personnel, and systematic process improvements
3. **Enhanced Accuracy and Timeliness of Interventions:** The proportion of patients receiving psychological interventions within 48 hours of need identification rose from 80%

in February 2024 to 86% in June 2024, due to early referrals by social workers to psychologists or psychiatrists for all positive cases




Percentage of Patients Had Psychosocial Screening Within 3 Working Days In Inpatient Setting
Percentage
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Jan-24 Feb-24 Mar-24 Apr-24 May-24 Jun-24
Percentage 47% 51% 43% 39% 32% 66%


Percentage Of Patients With Identified Psychosocial Needs Receiving Psychology/Psychiatric Interventions In Inpatient Units Within 48 Hours
Percentage
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Jan-24 Feb-24 Mar-24 Apr-24 May-24 Jun-24
Percentage 93% 80% 82% 89% 86% 86%

Discussion

The initiative's success underscores the effectiveness of the PDCA framework in enhancing the timely and accurate identification of psychological problems in oncology care. By standardizing the use of evidence-based assessment tools and integrating them into the Health Information System, the initiative addressed key barriers to psychological care, such as inconsistent screening practices and inadequate resources (Zimmermann et al., 2023; Xie et al., 2024). The increase in screening rates and improved timeliness of interventions demonstrate the importance of systematic approaches to quality improvement in oncology settings (Wang et al., 2024).

Moreover, the expansion of the mental health team and comprehensive staff training were critical to meeting the increased demand for psychological support and maintaining high standards of care. This approach aligns with findings from other studies that emphasize the need for adequate staffing and training to ensure effective psychological care (Doyle et al., 2024). The integration of screening tools into the Health Information System facilitated more efficient data management and timely follow-up, enhancing both diagnostic accuracy and patient outcomes (Xie et al., 2024).

However, ongoing challenges, such as maintaining staff engagement and adapting to technological changes, must be addressed to sustain these improvements. Future initiatives should focus on further refining the PDCA framework, incorporating feedback from staff and patients, and exploring additional technological solutions to enhance care delivery (Wang et al., 2024; Zimmermann et al., 2023).

Conclusion

The PDCA framework proved to be an effective strategy for improving the timely and accurate identification of psychological problems among oncology patients. The structured approach led to significant improvements in screening rates, diagnostic accuracy, and timely interventions, demonstrating the value of continuous quality improvement in enhancing psychological care. Continued refinement of these processes is essential to sustain gains and address ongoing challenges in delivering comprehensive oncology care.

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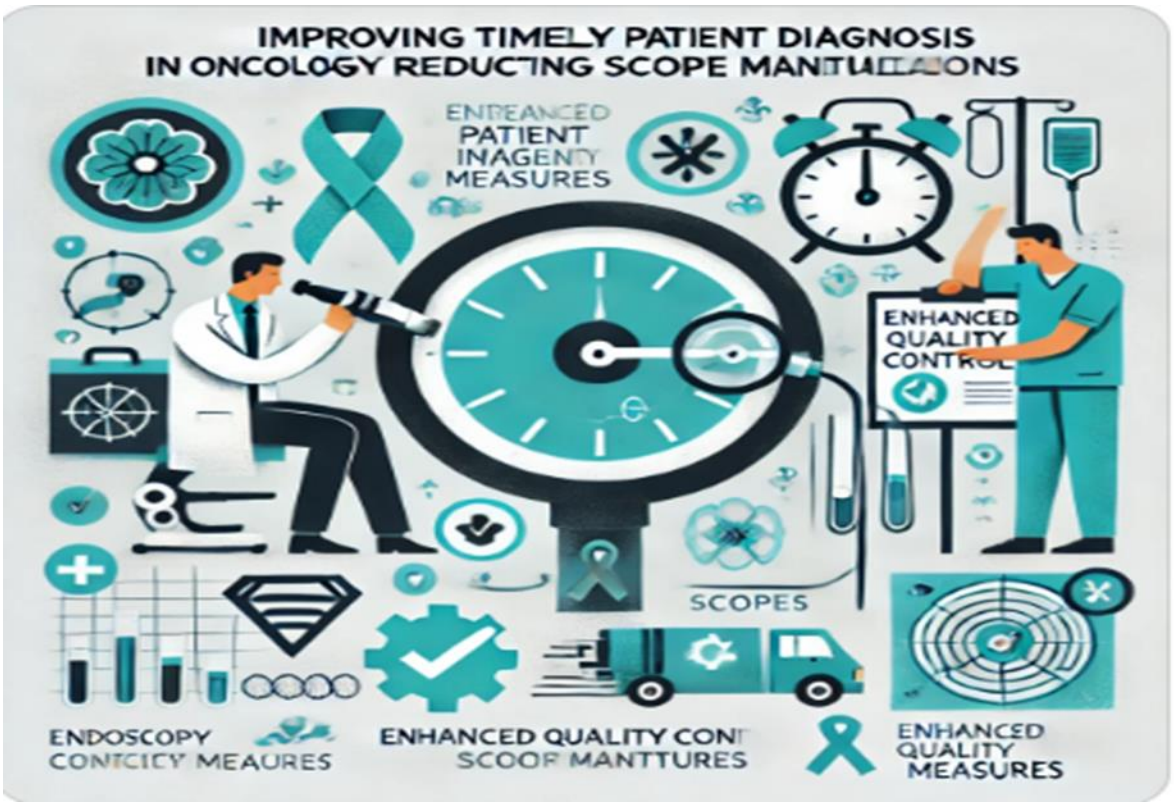
Chapter 13: Improving Timely Patient Diagnosis in Oncology Setting Through Reducing Scope Malfunctions in Endoscopy Department.



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Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) - University Medical City

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. 2. Improve the reliability and efficiency of endoscopic procedures to ensure timely patient diagnosis. 3. Implement a comprehensive equipment management plan, including staff training, environmental reorganization, and enhanced supervision. 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. **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

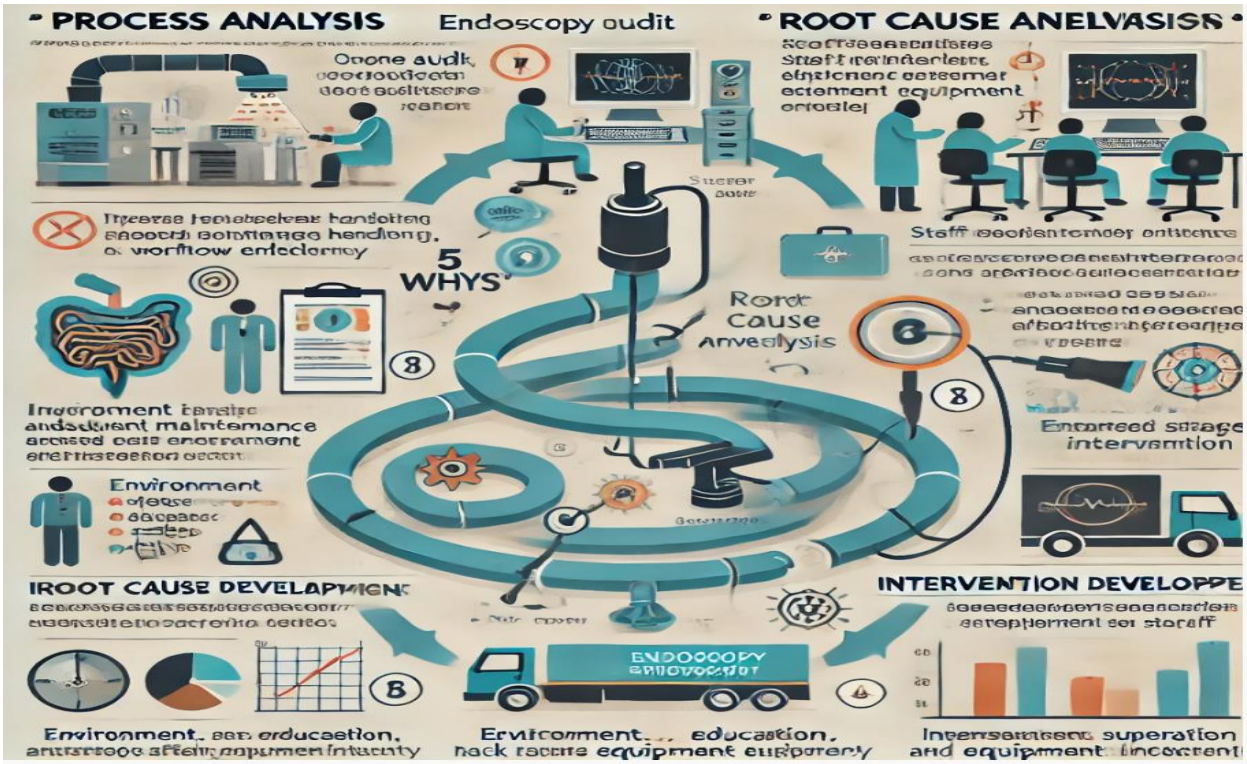
Scope malfunctions in oncology settings present a significant challenge, leading to procedural delays, increased healthcare costs, and potentially compromised patient safety. At SQCCCRC, the malfunction rate of 1.68% per performed procedure indicates systemic issues within the endoscopy unit. This project 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***

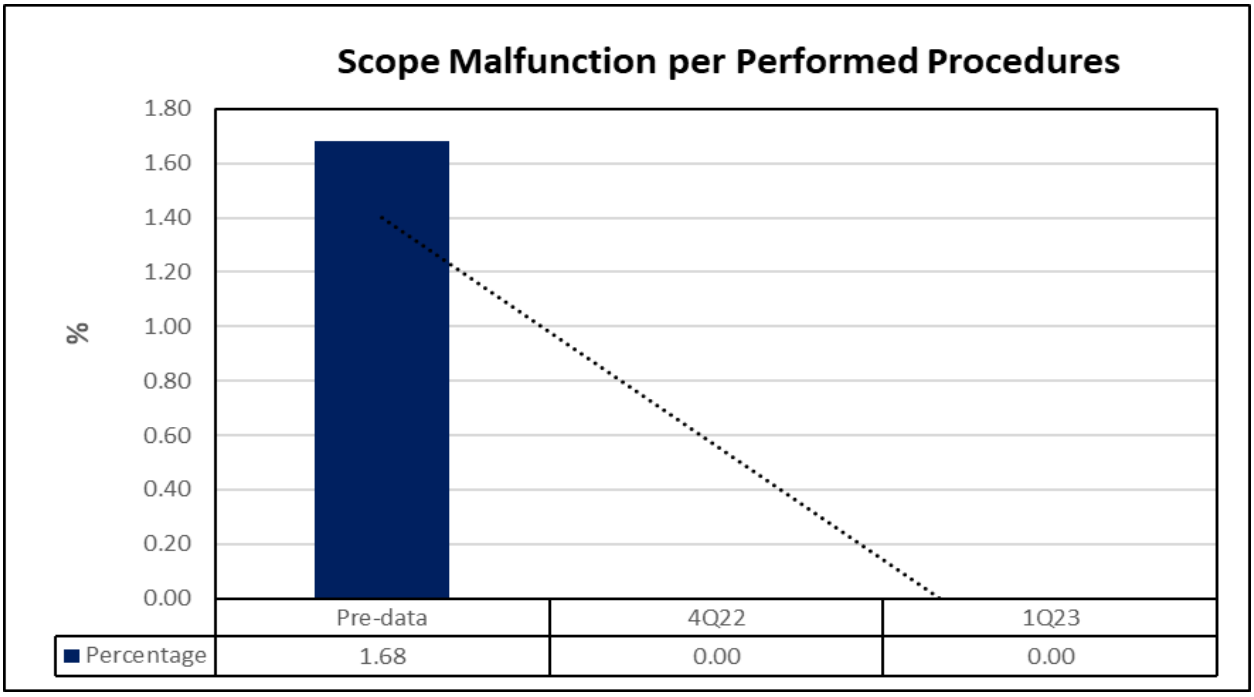
Domain	**Action**
Environment	- Organize the environment to optimize reprocessing and scope workflow, reducing incidents of breakage and falls
	- Implement a control-access system for all endoscopy unit doors, including the CSSD reprocessing area, to limit access to authorized staff
Education, Guidance, 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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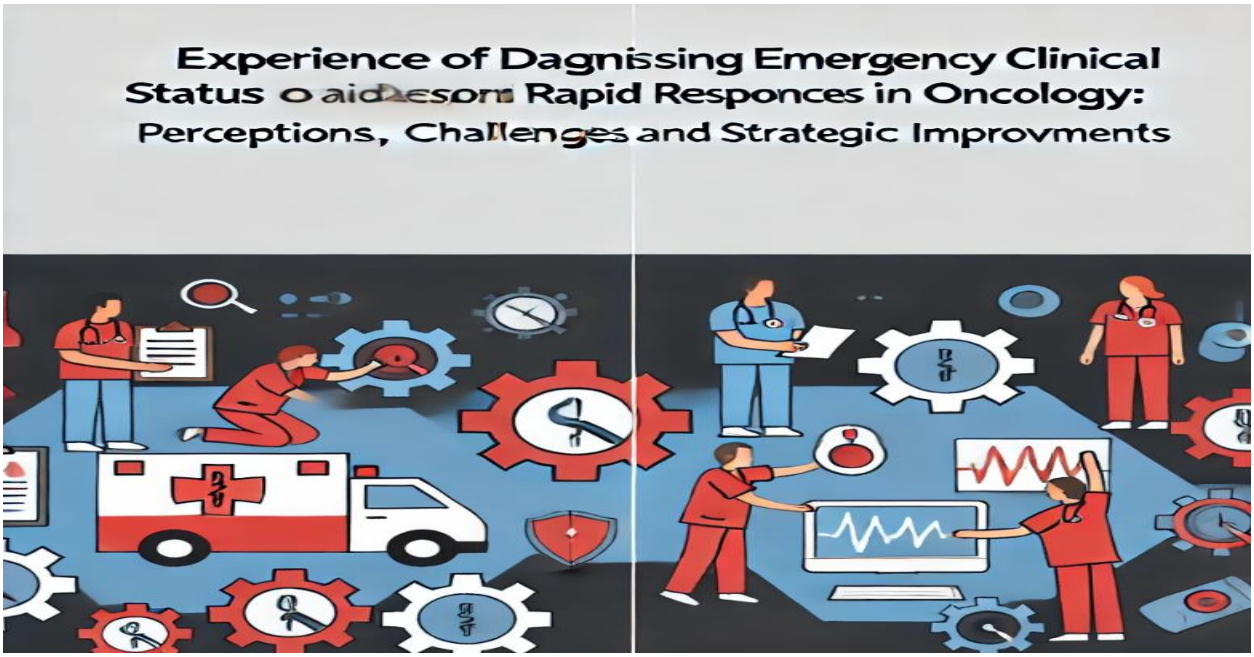
Chapter 14: Experience of Diagnosing Emergency Clinical Status to Activate Rapid Response Teams in Oncology: Perceptions, Challenges, and Strategic Improvements



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Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) - University Medical City

Summary

This project explored the challenges and barriers to effective Rapid Response Team (RRT) activation in an oncology setting at the Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC). It identified key issues, including communication breakdowns, resource shortages, inadequate team coordination, and improper handover processes, which contribute to delayed responses and suboptimal patient outcomes. Through a mixed-methods approach, the project highlighted the need for targeted interventions, such as enhanced communication protocols, standardized handover processes, improved resource management, and ongoing education and simulation training. Implementing these strategies can optimize RRT performance, ensure timely and accurate responses to clinical emergencies, and ultimately improve patient safety and care quality in oncology.

Key Points

Improved Communication Protocols are essential to reduce misunderstandings and delays during Rapid Response Team (RRT) activations, ensuring timely and effective responses in high-stress situations.

Enhanced Resource Availability and appropriate staffing levels are critical for preventing burnout and supporting efficient emergency responses, especially during peak times or high-risk periods.

Standardizing Handover Processes with tools like checklists and digital updates ensures seamless communication of critical patient information, reducing errors during shift changes or unit transfers.

Ongoing Education and Simulation Training tailored to the unique challenges of oncology settings can strengthen team preparedness, adherence to updated protocols, and overall RRT effectiveness.

Introduction

Rapid Response Teams (RRTs) are essential in providing immediate medical attention to patients showing early signs of clinical deterioration, thereby averting potential adverse outcomes (Samuel, 2023; Azie, 2024). In oncology settings, where patients often face complex and rapidly evolving health conditions, the effective and timely activation of RRTs is critical. Despite their importance, several barriers, such as communication breakdowns, resource shortages, and inadequate coordination among team members, can hinder the optimal performance of RRTs (Longstreth et al., 2023; Egozcue et al., 2023).

Previous studies have indicated that a lack of standardized processes and insufficient staff training contributes to improper RRT activations, leading to delayed responses and potentially worsening patient outcomes (Rajwani et al., 2023). Furthermore, the unique challenges of oncology, such as patients' critical conditions and complex treatment regimens, necessitate tailored strategies for RRTs to function effectively (Longstreth et al., 2023; Egozcue et al., 2023). This project aims to explore the experiences and perceptions of healthcare staff and RRT members in diagnosing emergency clinical status, identifying barriers to effective RRT activation, and proposing strategic improvements for optimizing RRT processes in an oncology setting.

Problem Statement

The effectiveness of Rapid Response Teams (RRTs) in oncology settings is often compromised by multiple challenges, including communication gaps, lack of standardized protocols, resource limitations, and inadequate team coordination. These issues lead to improper activations, delayed responses, and suboptimal patient outcomes. This project seeks to identify the key barriers and

challenges faced during RRT activation and assess the effectiveness of current practices to propose targeted improvements.

Methods

Project Design:

A cross-sectional study using a mixed-methods approach was conducted to assess the experiences of healthcare staff and RRT members in activating RRTs for emergency clinical situations in an oncology setting. The project involved two surveys: one for general healthcare staff (103 respondents) and another for RRT-specific team members (44 respondents). These surveys aimed to capture demographic information, perceived barriers to RRT activation, challenges faced by RRT members, and suggestions for improvements.

Data Collection:

The surveys were complemented by the analysis of quality statistics related to RRT activation outcomes over two years. This included the percentage of improper activations, the number of patient transfers to critical care, and cases stabilized within the unit.

Data Analysis:

The data collected from the surveys and quality statistics were analyzed to identify key barriers and challenges, quantify improper activation rates, and assess patient outcomes following RRT activations. The project employed descriptive statistics to summarize the data, and thematic analysis was used to interpret the qualitative responses.

Results

Demographics and Workforce Characteristics:

The majority of general staff participants were female (57%), aged between 31-40 years (58%), and held a bachelor's degree (71%). Staff nurses constituted the largest group (64%), with a significant portion having 10-15 years of professional experience (34%). Among the RRT-specific team members, staff nurses also made up the majority (52%), with most members aged between 31-40 years (75%) and holding either a bachelor's (61%) or a master's degree (39%).

Barriers to RRT Activation:

- **Communication Breakdown:** As reported by 11% of RRT members, communication issues between the responsible physician and the RRT were significant barriers, leading to delays in decision-making and unclear roles during emergencies (Samuel, 2023; Azie, 2024).
- **DNR-Related Issues:** The absence of clear Do Not Resuscitate (DNR) code decisions was identified as a major challenge by 18% of RRT members, resulting in uncertainty and delays in appropriate interventions (Azie, 2024).
- **Improper Handover:** Improper handover of patient information was cited by 12% of RRT members and 11% of general staff, especially problematic during unit transfers or shift changes, leading to incomplete communication of critical information (Longstreth et al., 2023).
- **Resource Challenges:** Resource shortages were reported by 23% of RRT members, including insufficient tools, equipment, and human resources (Egozcue et al., 2023).

Challenges Faced by RRT Members:

- **Resource Shortages:** Frequent resource shortages, including physical tools and human resources, were identified by 23% of respondents as major challenges.
- **Increased Workload in the ICU:** The increased workload in the ICU, coupled with RRT responsibilities, led to burnout and decreased efficiency in managing RRT calls, as reported by 13% of team members.
- **Coordination Issues:** Poor coordination among team members during RRT activations was reported by 13% of the RRT team, attributed to unclear roles and inadequate communication (Longstreth et al., 2023).

RRT Activation Outcomes (Quality Statistics):

- **Improper Activation Processes:** Improper activations peaked at 17% in July 2022 and May 2023, exceeding the target of 5%. Despite improvements, certain months continued to show high rates of improper activations, indicating the need for ongoing education and process refinement (Azie, 2024).
- **Patient Transfer to Critical Care:** Patient transfers to critical care showed variability, with peaks in May 2023 (16 cases) and April 2024 (14 cases), reflecting challenges in early intervention and stabilization within the unit.
- **Stabilization in Unit:** The number of cases where patients were stabilized within the unit increased, peaking at 18 cases in May 2023, suggesting improvements in managing patients effectively without needing transfer to critical care.

Discussion

The project findings highlight significant barriers to the effective activation of RRTs in oncology settings, including communication breakdowns, resource shortages, and inadequate team coordination. Communication issues, cited by 11% of RRT members, are consistent with previous research emphasizing the need for clear, structured communication to ensure effective RRT activation (Samuel, 2023; Egozcue et al., 2023). The absence of clear DNR decisions, reported by 18% of respondents, further complicates RRT activation, leading to delays in decision-making (Azie, 2024).

Resource shortages, identified by 23% of respondents, align with other studies highlighting the critical role of adequate resources in the effectiveness of RRTs (Egozcue et al., 2023). Addressing these shortages, along with improving coordination among team members, is crucial to enhancing RRT effectiveness (Rajwani et al., 2023). The findings also suggest that ongoing education and simulation-based training could reduce improper activations, bolster staff confidence, and improve team coordination, consistent with recommendations from existing literature (Longstreth et al., 2023; Azie, 2024).

Improper activation rates remained high in certain months, highlighting the need for continued process refinement and staff training. Simulation-based training could help reduce these rates by providing healthcare providers with opportunities to practice RRT protocols in a controlled environment, thereby improving decision-making skills and response times (Egozcue et al., 2023).

Conclusion

This project identifies significant challenges in diagnosing emergency clinical status for RRT activation in an oncology setting, including communication issues, resource limitations, and poor team coordination. To improve RRT effectiveness, targeted interventions, such as enhanced communication practices, better resource management, and ongoing education and training, are essential. By addressing these barriers, oncology centers can strengthen their rapid response capabilities, ensuring timely and accurate responses to clinical emergencies and ultimately enhancing patient safety and care quality.

Recommendations

Based on the findings of this project, the following recommendations are proposed to enhance the effectiveness of Rapid Response Teams (RRTs) in oncology settings:

1. **Improve Communication Protocols:**
    - Implement standardized communication protocols, such as the Situation-Background-Assessment-Recommendation (SBAR) tool, to ensure clear and concise communication between healthcare providers during RRT activations. This approach can help reduce misunderstandings and delays in decision-making, particularly in high-stress situations.
    - Conduct regular communication workshops and simulation exercises to reinforce effective communication practices among all team members, including physicians, nurses, and support staff.
2. **Enhance Resource Availability:**

- Ensure that necessary equipment and tools are readily available during RRT activations. This includes maintaining a well-stocked emergency cart and ensuring that critical supplies are accessible.
- Review staffing levels and allocate additional personnel as needed during peak times or high-risk periods to prevent burnout and ensure efficient emergency response.

3. **Standardize Handover Processes:**
    - Develop and implement standardized handover protocols, such as checklists, to ensure all critical patient information is accurately communicated during shift changes or unit transfers.
    - Use digital tools, such as electronic health record (EHR) systems with real-time updates, to facilitate seamless information exchange and reduce errors during handovers.
4. **Strengthen Team Coordination and Role Clarity:**
    - Clearly define the roles and responsibilities of each RRT member to minimize confusion and ensure all team members understand their duties during activations.
    - Conduct regular team-building exercises and multidisciplinary training sessions to foster a culture of collaboration and enhance team dynamics.
5. **Implement Ongoing Education and Simulation Training:**
    - Regularly schedule education sessions and simulation-based training for all RRT members to keep them updated on the latest protocols and practice coordination in a controlled environment.

- Include scenario-based training that reflects the unique challenges of oncology settings to improve team preparedness for emergencies.

6. **Regular Monitoring and Feedback:**
    - Establish a system for continuous monitoring of RRT performance, including tracking key performance indicators (KPIs) related to response times, activation accuracy, and patient outcomes.
    - Implement feedback mechanisms where RRT members and general staff can provide input on challenges faced during activations, allowing for iterative improvements to processes and protocols.
7. **Enhance Decision-Making Support:**
    - Develop decision-support tools to aid healthcare providers in recognizing early signs of clinical deterioration and activating the RRT more promptly.
    - Incorporate real-time data analytics and alert systems within the EHR to support timely decision-making and facilitate early intervention.
8. **Encourage a Culture of Safety:**
    - Foster an organizational culture that encourages reporting of near-misses and errors without fear of punitive action. This will help identify and address systemic issues contributing to improper RRT activations.
    - Promote open dialogue and learning from past incidents to continuously improve RRT activation processes and patient care.
9. **Integrating the early warning score in the nurses' workflow.**
10. **Utilizing technology to calculate the EWS.**
11. **Creating a clear process for doctors to consult ICU doctors.**

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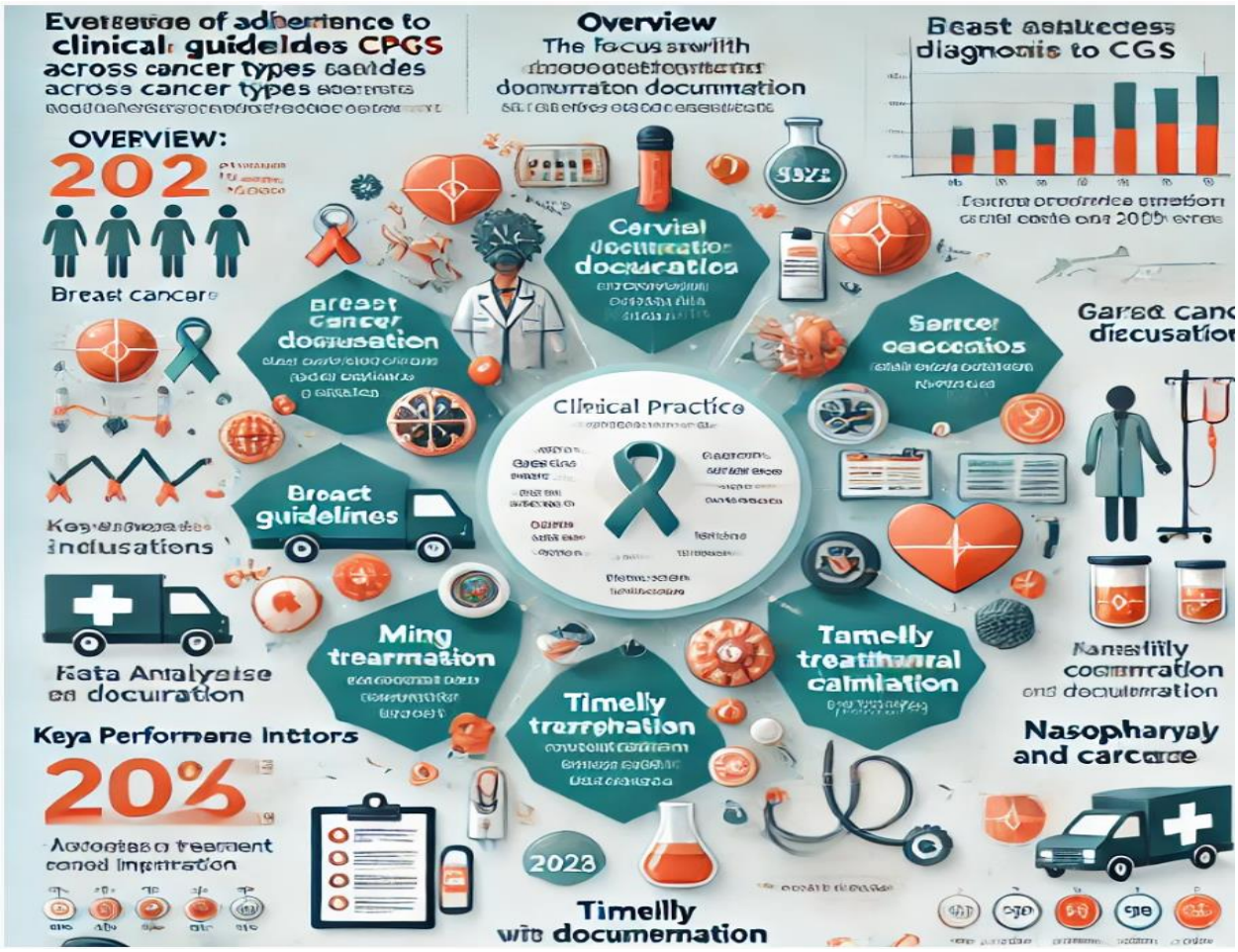
Chapter 15: Adherence to Clinical Practice Guidelines in Oncology and Impact on Patient Diagnosis



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Summary

This report evaluates the adherence to clinical practice guidelines (CPGs) across multiple cancer types and assesses their impact on patient diagnosis. The focus is on key performance indicators (KPIs) such as multidisciplinary team (MDT) discussions, compliance with documentation standards, timely treatment initiation, and other diagnostic and treatment-related practices. The analysis covers data from July to December 2022 and compares it with 2023 targets to identify gaps and areas for improvement. The report highlights the successes and challenges in adhering to CPGs for breast cancer, cervical cancer, Ewing sarcoma, gastric cancer, nasopharyngeal carcinoma, and prostate cancer, and discusses the implications for patient diagnosis and care outcomes.

Key Points

MDT Discussions: Ensure all cases undergo multidisciplinary team discussions to improve diagnostic accuracy and comprehensive treatment planning, especially for cancers with currently low compliance rates.

Timely Treatment Initiation: Address delays in treatment initiation for cancers like gastric and nasopharyngeal carcinoma to enhance early intervention and patient outcomes.

Documentation Compliance: Improve adherence to documentation standards, particularly in cervical cancer pathology reports, to support accurate diagnosis and effective care delivery.

Screening and Referral Protocols: Maintain high compliance with screening and referral practices to ensure early detection, comprehensive assessment, and appropriate management of cancer patients.

Introduction

Clinical practice guidelines (CPGs) are essential tools designed to standardize care delivery, improve patient outcomes, and reduce variability in healthcare practices. In oncology, adhering to these guidelines is particularly crucial due to the complexity of patient conditions and the rapid progression of many cancers. CPGs provide evidence-based recommendations for the diagnosis, treatment, and management of various cancers, aiming to optimize care and ensure timely and accurate patient diagnoses.

This project evaluates the adherence to CPGs for multiple cancer types, including breast cancer, cervical cancer, Ewing sarcoma, gastric cancer, nasopharyngeal carcinoma, and prostate cancer. The focus is on the impact of adherence on diagnostic processes and patient outcomes. Key performance indicators (KPIs) such as multidisciplinary team (MDT) discussions, compliance with documentation standards, timely treatment initiation, and adherence to diagnostic and therapeutic protocols are analyzed. The project aims to identify gaps in adherence, understand contributing factors, and propose recommendations for enhancing compliance and improving diagnostic accuracy across these cancer types.

Methods

A retrospective project was conducted to assess the adherence to clinical practice guidelines (CPGs) for six types of cancer from July to December 2022, with comparative targets set for 2023. The project utilized clinical records, MDT meeting logs, treatment initiation timelines, and documentation compliance rates to evaluate the performance of various oncology programs. The key metrics assessed included:

- **MDT Discussions:** Participation and compliance with guidelines for discussing cases in multidisciplinary team meetings before treatment initiation, which directly impacts diagnostic accuracy and comprehensive care planning.
- **Timely Treatment Initiation:** The percentage of patients starting treatment within specified timeframes post-referral, critical for managing cancer progression effectively.
- **Screening and Referral Protocols:** Compliance with required screenings (e.g., dental, nutritional) and referral practices (e.g., physiotherapy) to support accurate diagnosis and tailored treatment strategies.

Data were collected from institutional databases, patient management systems, and departmental records. Descriptive statistics were used to calculate percentages and compare them against target values. Trends over time were also examined to assess the impact of any interventions implemented to improve adherence to CPGs and enhance diagnostic accuracy.

Results

The following table summarizes the key findings from the analysis of adherence to clinical practice guidelines and their impact on patient diagnosis across various cancer types:

Cancer Type	Metric	2022/ 2023	Target	Findings
Breast Cancer	Patients with MDT discussion before treatment initiation	99.4%	95%	Exceeded target; high compliance with MDT discussions, positively impacting diagnostic accuracy.
	Patients with breast surgery within 8 weeks of the last neoadjuvant chemotherapy	98%	80%	Exceeded target; effective coordination for timely surgeries, improving outcomes.
Cervical Cancer	Compliance with MDT discussion	100%	95%	Exceeded target; all cases were discussed in MDTs,

				enhancing diagnostic accuracy.
Ewing Sarcoma	Adherence to guidelines	100%	80%	Exceeded target; strong adherence supports accurate diagnosis and effective treatment planning.
	Timely treatment initiation within 28 days	100%	90%	Exceeded target; consistent with expected timelines for treatment initiation, supporting early diagnosis.
Gastric Cancer	MDT compliance before starting therapy	100%	95%	Exceeded target; all eligible cases underwent MDT discussions, enhancing diagnostic accuracy.
	Treatment initiation within four weeks post-referral	70%	90%	Below the target, delays in starting treatment affect early intervention and diagnostic processes.
Nasopharyngeal Carcinoma	Dental and nutritional screening compliance	100%	90%	Exceeded target; strong adherence supports comprehensive diagnostic assessments.
Prostate Cancer	Physiotherapy referral compliance	100%	90%	Exceeded target; all eligible patients were referred for physiotherapy, supporting comprehensive care.
	MDT discussion compliance	70%	90%	The below target needs improvement to ensure thorough diagnostic evaluations.

Conclusion

The project reveals varying levels of adherence to clinical practice guidelines across different cancer types and their impact on patient diagnosis. High compliance was observed in areas such as MDT discussions for breast and cervical cancer cases and screening protocols in nasopharyngeal carcinoma, leading to improved diagnostic accuracy and comprehensive care planning. However, significant gaps remain, particularly in documentation practices for cervical cancer and MDT discussions for nasopharyngeal and prostate cancers, which may negatively impact patient diagnosis and treatment outcomes.

To enhance adherence to CPGs and improve diagnostic accuracy, targeted interventions are necessary:

1. **Enhancing Training and Communication:** Regular training sessions and improved communication among healthcare providers are crucial to ensuring all cases undergo MDT discussions and proper documentation practices are maintained.
2. **Streamlining Processes:** Developing more efficient referral and treatment initiation processes, particularly for gastric cancer, reduces delays and supports timely diagnoses.
3. **Implementing Robust Monitoring Systems:** Continuous monitoring and feedback mechanisms are needed to identify deviations from guidelines promptly and implement corrective actions.

Section 4: Conclusion

Chapter 16: Conclusion, Recommendation, Future Implication

Conclusion

This book underscores the vital importance of enhancing diagnostic practices to ensure patient safety in oncology settings. The comprehensive quality initiatives implemented at the Sultan Qaboos Comprehensive Cancer Care and Research Centre (SQCCCRC) demonstrate a commitment to improving diagnostic accuracy, reducing delays, and fostering a culture of continuous improvement. By focusing on key areas such as laboratory and radiology services, as well as multidisciplinary approaches, this work highlights the multifaceted nature of achieving excellence in patient safety.

The quality initiatives presented illustrate the necessity of optimizing laboratory processes to minimize sample rejection rates and improve safety in oncology. The development of risk

assessment tools and standardized protocols in the molecular pathology and mammogram departments has proven effective in reducing the risk of sample mix-ups and ensuring critical results are reported promptly. These steps have reinforced the importance of a robust quality management framework in maintaining high standards of patient care.

In radiology, the implementation of structured methodologies, such as Failure Mode and Effect Analysis (FMEA) and Plan-Do-Check-Act (PDCA) cycles, has significantly enhanced the accuracy and timeliness of diagnostic imaging. By refining processes, reducing turnaround times, and evaluating unnecessary MRI utilization, these efforts have directly contributed to more accurate and efficient diagnostic practices. The integration of these strategies within the oncology setting underscores their value in improving patient outcomes.

Moreover, the focus on multidisciplinary quality initiatives, such as enhancing early detection for high-risk patients and improving psychological assessments, demonstrates the center's holistic approach to patient safety. The strategic improvements in activating Rapid Response Teams and reducing diagnostic initiation times for newly referred patients further illustrate the comprehensive nature of these quality efforts. These initiatives serve as a model for other healthcare organizations aiming to enhance their diagnostic capabilities.

The book reveal that achieving excellence in oncology diagnostics requires a multifaceted strategy, including collaboration, innovation, and continuous process evaluation. By integrating advanced technologies, adopting best practices, and promoting multidisciplinary teamwork, healthcare institutions can create an environment where timely and accurate diagnosis is a fundamental aspect of patient care. The strategies implemented at SQCCCRC have proven to be effective, establishing a benchmark for quality in oncology settings.

Overall, the experiences and outcomes described in this book highlight the crucial role of diagnostic quality in ensuring patient safety. They demonstrate that by focusing on key areas of improvement, from laboratory services to multidisciplinary care, institutions can drive meaningful changes in their diagnostic processes. The book underscores the importance of ongoing evaluation and adaptation to maintain high standards of care in an ever-evolving healthcare environment.

The recommendations provided emphasize the need for a proactive approach to diagnosis, with a focus on reducing unnecessary procedures, improving communication, and enhancing the use of

technology. These strategies are vital for fostering a patient-centered care model that prioritizes safety, accuracy, and efficiency in oncology diagnostics. By implementing these recommendations, the SQCCCRC aims to maintain its commitment to excellence and set a standard for other institutions to follow.

In conclusion, the quality initiatives detailed in this book have demonstrated the effectiveness of a comprehensive approach to improving diagnostic practices in oncology settings. The lessons learned from these initiatives are valuable not only for SQCCCRC but for any healthcare institution seeking to enhance its diagnostic capabilities and ensure the highest levels of patient safety. The commitment to continuous improvement and the pursuit of excellence in diagnostic accuracy will continue to guide the center's efforts in the future.

Recommendations

1. **Enhance Multidisciplinary Collaboration:** Encourage regular meetings and discussions among different specialties to ensure comprehensive decision-making and reduce diagnostic errors.
2. **Implement Advanced Data Analytics:** Use data analytics tools to predict diagnostic outcomes and identify potential delays or errors, improving overall diagnostic accuracy.
3. **Strengthen Communication Protocols:** Develop and enforce standardized communication protocols to enhance the clarity and accuracy of information sharing among healthcare professionals.
4. **Expand Training Programs:** Regularly update training modules to cover new diagnostic technologies and methodologies, ensuring all staff are equipped with the latest knowledge and skills.

5. **Utilize Digital Health Tools:** Incorporate telemedicine and digital platforms to facilitate real-time consultations and data sharing, reducing delays in obtaining expert opinions.
6. **Optimize Resource Allocation:** Conduct periodic reviews to assess resource needs and ensure that necessary diagnostic tools and personnel are readily available.
7. **Develop Patient-Centric Pathways:** Create diagnostic pathways tailored to individual patient needs, ensuring timely and appropriate access to necessary diagnostic tests.
8. **Implement Continuous Quality Improvement (CQI):** Regularly review diagnostic processes and use data-driven insights to make necessary adjustments and improve overall efficiency.
9. **Enhance Patient Education:** Provide clear information to patients about diagnostic processes, helping them understand their options and encouraging adherence to recommended tests.
10. **Monitor Diagnostic Performance:** Establish a framework to monitor key diagnostic performance metrics and make ongoing adjustments to improve quality and efficiency.

Future Implications

The implementation of these recommendations at the Sultan Qaboos Comprehensive Cancer Care and Research Centre sets a precedent for improving diagnostic practices in oncology. By focusing on multidisciplinary collaboration, advanced data analytics, and patient-centered approaches, the center can continue to enhance its diagnostic capabilities and patient outcomes. Future efforts should explore the integration of artificial intelligence and genomics into diagnostic pathways, further personalizing care and improving accuracy.

Investing in digital health infrastructure and continuous staff education will be essential to maintaining these advancements and addressing new challenges as they arise. By adopting these strategies, the SQCCCRC can solidify its role as a leader in oncology care and serve as a model for other institutions looking to improve their diagnostic processes.

The future of oncology diagnostics lies in the ongoing commitment to excellence, innovation, and patient-centered care, ensuring that every patient receives the most accurate and timely diagnosis possible.

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