MDRO Risk Prediction Model to enable Early Intervention and Improve Patient Outcome

Dr. Sudip Roy
Ms. Debosmita Mallik Chakravarty

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Case Reports

Background

The Calcutta Medical Research Institute (CMRI) Hospital with 440 beds having a rich heritage spanning over 55 years, is recognized as the most trusted multi speciality tertiary care hospital of Eastern India. CMRI is recognized as one of the oldest corporate private hospitals in the region.

In today's healthcare landscape, Multi-Drug Resistant Organisms (MDROs) pose a significant threat to patient safety, particularly in high-risk areas like ICU. The rising prevalence of MDRO infection is associated with prolonged hospital stays, increased healthcare costs, and higher morbidity and mortality rates. CMRI is proactively addressing the challenge of MDRO with a comprehensive Infection Risk Assessment Process. This process focuses on identifying, mitigating, and managing the risk of MDRO transmission, particularly for patients moving from the Emergency Room (ER) to the ICU.

Distinctiveness of the Practice

A structured mechanism was created to guide clinical decisions and infection control practices, emphasizing the importance of early identification. The components included the following:

- **Systematic Risk Assessment**: A standardized scoring system, incorporated into the MDRO Risk Assessment Toolkit, was used upon admission to stratify patients based on their risk for MDRO colonization or infection. This toolkit considered factors such as recent hospitalizations, antibiotic exposure, prior MDRO history, and comorbidities. The screening was undertaken among the patients admitted in the emergency department. The resulting score categorized patients into risk levels (very high, high, moderate, low), triggering tailored interventions.
- **Implementing Tailored Preventive Measures:** Based on risk stratification, tailored preventive measures were implemented. This included cohorting patients with similar risk profiles to optimize infection control and resource allocation.
- **Laboratory Screening:** Systematic laboratory screenings were performed for prompt MDRO identification especially for high risk patients right at the point of admission in the ICU from ER.
- **Adherence to infection control management and antimicrobial stewardship program:**
  - Infection control management including contact precautions (hand hygiene, PPE use), enhanced environmental cleaning of patient areas, antimicrobial stewardship (appropriate antibiotic selection, dose, route, timing, and duration), continuous staff and family education on MDROs and prevention.
  - Antibiotic selection guided by culture results and patient-specific needs, ensuring appropriate dose and duration.
- **Continuous Surveillance and Communication Strategy:** Daily monitoring assesses infection control measures and facilitates care plan adjustments which include regular review of culture results to inform treatment, tailored antibiotic therapy based on patient response and infection control audits to evaluate protocol adherence. Effective communication regarding MDRO status during discharge or transfer, ensuring continuity of infection control was ensured.

In addition, Patient and family education on MDRO precautions, wound care, and medication adherence was provided to prevent reinfection or transmission.

- Early identification and intervention are prioritized to improve patient outcomes and minimize hospital-acquired infections.

This innovative approach aimed to significantly reduce hospital-acquired infections, enhance patient safety, and improve healthcare quality, reflecting a commitment to evidence-based practice and continuous improvement.

Risk Factor	Description	Points	Points Obtained
Age	< 40 years = 0 point	0-2	
	40-70 years = 1 points		
	> 70 years = 2 points		
Previous Hospitalization	No hospitalization in the past year = 0 points	0-2	
	Hospitalized once in the past year = 1 points		
	Hospitalized multiple times in the past year = 2 points		
Antibiotic Exposure	No antibiotics in the past 6 months = 0 points	0-4	
	Antibiotics for < 7 days in the past 6 months = 2 points		
	Antibiotics for > 7 days in the past 6 months = 4 points		
ICU Stay	No ICU stay = 0 points	0-4	
	ICU stay for < 5 days = 2 points		
	ICU stay for > 5 days = 4 points		
Comorbidities	No comorbidities = 0 points	0-4	
	1-2 comorbidities = 2 point		
	> 2 comorbidities = 4 points		
Presence of Invasive Devices	No device = 0 points	0-2	
	1 device = 1 point		
	> 1 devices = 2 points		
Prolonged Haemodialysis	< 3 Months = 0 point	0-2	
	> 3 Months = 2 points		

Total Points: Add the points for each risk factor to calculate the total MDRO Risk Score (Minimum Score: 0 || Maximum Score: 20)

Fig. 1 MDRO Risk Assessment Toolkit

Measured Effects

The implementation of the infection risk prediction model at CMRI Hospital yielded several positive results. These data were collected on over 150 patients since the program's inception, enabling ongoing analysis and refinement. The effects are as mentioned below:

- A decline in net mortality rates: from 1.39% in March, the rate dropped to 1.07% in June, with corresponding figures of 1.33% in April falling to 0.79% in July, and 1.28% in May decreasing

to 0.83% in August. This downward trend highlights the model's effectiveness in managing MDRO infections.

- The average length of stay for patients has decreased. For instance, average length of stay improved from 5.43 days (March) to 4.88 days (July).

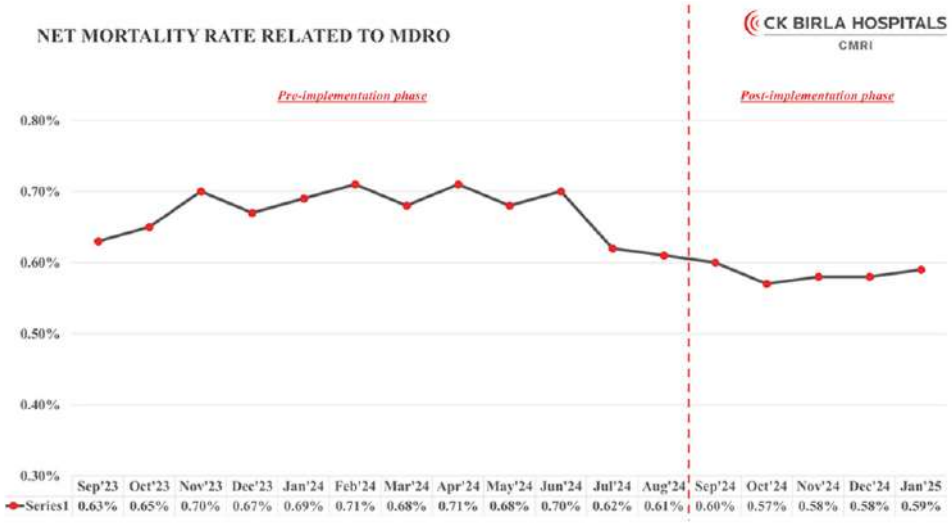

Fig. 2 KPIs to monitor & track improvements due to implementation of the tool

These results and shared experiences demonstrated the model's success in facilitating early interventions, reducing mortality, shortening hospital stays, and fostering a more proactive and collaborative approach to infection control.

Challenges

The implementation of the MDRO Infection Risk Prediction Model encountered several challenges, requiring strategic interventions to ensure effective adoption and sustainability. These are listed below:

- One of the primary challenges was the integration of the risk assessment toolkit into clinical workflows. Staff initially faced difficulties in adapting to the systematic risk stratification process upon patient admission. Additionally, the need for real-time risk stratification created an additional burden on healthcare providers, especially during peak admission hours.
- Another significant challenge was staff adherence to tailored preventive measures, particularly patient cohorting. Space constraints in the hospital made it difficult to segregate high-risk patients effectively, leading to occasional cross-exposure risks. Furthermore, laboratory screenings for early MDRO identification required additional resources and coordination, which initially led to delays in screening high-risk patients admitted through the emergency room.
- Compliance with infection control protocols was another concern. While strict measures such as hand hygiene, PPE use, enhanced environmental cleaning, and antimicrobial stewardship were established, ensuring consistent adherence among all healthcare workers proved challenging. Some staff members showed resistance to change, requiring continuous education and reinforcement of best practices.
- The effective communication of MDRO status between departments and during patient discharge was another implementation hurdle. Ensuring seamless information transfer about MDRO-positive patients to prevent reinfection or transmission required strengthening communication protocols. Similarly, educating patients and families on MDRO precautions was met with some resistance, as misconceptions about antibiotic use and infection control persisted.
- Lastly, resource allocation posed a challenge, particularly in maintaining adequate staffing for infection control audits, laboratory screenings, and training sessions. The hospital leadership had to secure funding and allocate personnel to sustain the program effectively.

Lessons Learned

The implementation of the MDRO Infection Risk Prediction Model at CMRI Hospital yielded valuable lessons for improving patient outcomes and healthcare practices. Key takeaways include:

- Prompt identification of at-risk patients enables timely interventions, significantly improving survival rates and reducing complications.
- Engaging all stakeholders—clinicians, nursing staff, infection control specialists, and administrators—ensures practical and relevant protocols, fostering shared responsibility.
- Thorough and ongoing training equips staff with the knowledge and confidence to effectively manage at-risk patients and adhere to protocols.
- Continuous data collection and analysis enable timely adjustments and refinement of the model, ensuring its effectiveness against evolving MDRO challenges.
- Early and consistent engagement with all stakeholders is crucial for successful implementation and long-term sustainability.
- Being open to modifying protocols and practices based on feedback and new information is essential for optimal outcomes.
- Identifying and addressing potential resource limitations proactively prevents disruptions and ensures smooth implementation.
- Regular evaluation and refinement are necessary to sustain improvements and adapt to new challenges.

- Open communication among all staff levels facilitates feedback, addresses concerns, and reinforces best practices.
- Keeping the focus on patient safety and quality of care guides all aspects of the initiative.

These lessons emphasize the importance of a collaborative, data-driven, and patient-centered approach to infection control, offering valuable insights for other healthcare institutions seeking to enhance their practices.

Sustainability of Practice

The long-term sustainability of CMRI Hospital's MDRO risk assessment practice is ensured through several key mechanisms. These focus on integration, continuous improvement, and stakeholder engagement.

- Strong leadership support ensures resource allocation and prioritizes the practice. Interdisciplinary collaboration among departments (emergency services, nursing, infection control, housekeeping) ensures comprehensive infection risk management.
- Dedicated sustainability committees provide oversight and drive continuous improvement. Regular feedback sessions encourage open communication and continuous learning.
- Efforts are underway to integrate the MDRO risk assessment toolkit directly into the hospital's Electronic Health Record (EHR) system. This EHR integration will streamline the screening process, enhance data collection, and improve access to patient information for healthcare providers, making the risk assessment a natural part of the clinical workflow.
- The MDRO risk assessment protocols are formally embedded within hospital infection control policies and admission protocols, becoming standard procedure. Detailed Standard Operating Procedures (SOPs) guide staff in using the toolkit and implementing infection control measures, ensuring consistent practice.
- The ongoing training programs keep staff updated on protocols and reinforce best practices. A robust monitoring system, including regular audits, data collection, and performance metrics, allows for timely adjustments.
- Benchmarking against national and international standards ensures alignment with best practices.

Conclusion

The adaptability and replicability of the MDRO risk assessment tool at CMRI Hospital were key factors that contributed to its long-term success and impact. By allowing customization, integrating feedback, and providing standardized frameworks, the tool can be effectively implemented in various healthcare settings. The MDRO infection risk assessment tool provided a range of tangible benefits, including improved patient outcomes, cost savings, and reduced infection rates. Additionally, it offered intangible benefits such as enhanced patient trust, improved staff morale, and a strengthened culture of safety. Together, these benefits contributed to a more effective and patient-centered healthcare environment.

MDRO Risk Prediction Model to enable Early Intervention and Improve Patient Outcome

1

Target Population

Patient in the High-risk areas especially Intensive care unit.

2

Phenomenon of Interest

Implementation of an MDRO risk prediction model at CMRI Hospital to enable early identification, targeted interventions, and improved infection control measures.

3

Context

High Prevalence of MDRO-related mortality, hospital-acquired infections, and longer length of stay.

Conclusion

The MDRO risk prediction model at CMRI Hospital has significantly improved patient outcomes, reduced hospital-acquired infections, and fostered a proactive, data-driven approach to infection control.

Key Findings

1

Decreased Length of Hospital Stay

The average length of stay improved from 5.43 days in March to 4.88 days in July, demonstrating the model's effectiveness in reducing infection-related complications and accelerating recovery.

2

Reduction in MDRO-Related Mortality

The implementation of the MDRO risk prediction model led to a decline in net mortality rates, dropping from 1.39% in March to 1.07% in June and continuing to decrease in subsequent months.

3

Enhanced Infection Control and Staff Engagement

The initiative strengthened a culture of safety, improving adherence to infection control protocols increasing staff confidence in managing at-risk patients, and enhancing communication between departments.