



Distribution and Prevalence of Multidrug-Resistant Organisms (MDROs) Among MDRO-Positive Individuals at Dr. Kariadi Hospital

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ABSTRACT

Background: Multidrug-resistant organisms (MDRO) pose a significant challenge to healthcare facilities globally, impacting patient outcomes and healthcare costs. Understanding the distribution and prevalence of MDRO is crucial for effective infection control and prevention strategies. This study aimed to investigate the distribution and prevalence of MDROs, among MDRO-positive individuals at Dr. Kariadi Hospital.

Methods: A retrospective analysis of secondary data was conducted, encompassing a diverse range of MDROs, including ESBL, carbapenem-resistant Enterobacteriaceae (CRE), methicillin-resistant Staphylococcus aureus (MRSA), and vancomycin-resistant Staphylococcus aureus (VRSA). The study population consisted of individuals who tested positive for MDRO within the hospital.

Results: A total of 100 MDRO-positive cases were identified during the study period. The most prevalent MDRO identified was ESBL-producing organisms, accounting for 59% of all cases. Other significant findings included the presence of carbapenem-resistant Enterobacteriaceae (CRE) and MRSA, which constituted 4% and 3% of the MDRO-positive cases, respectively. Notably, a diverse range of MDRO species, such as MRCoNS (methicillin-resistant coagulase-negative Staphylococci), was also detected.

Conclusion: This study provides valuable insights into the distribution and prevalence of MDRO at Dr. Kariadi Hospital. The findings underscore the urgent need for robust infection control measures and targeted interventions to mitigate the spread of MDRO. Implementing effective surveillance, promoting antibiotic stewardship, and enhancing preventive strategies are crucial for controlling MDRO infections. Future research should focus on exploring the molecular characteristics and resistance mechanisms of the identified MDRO to inform tailored prevention and treatment approaches.

Keywords: multidrug-resistant organisms; distribution; prevalence; infection control; antibiotic stewardship.

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Introduction

Multidrug-resistant organisms (MDROs) have become a significant global public health concern, leading to increased morbidity, mortality, and healthcare costs^{1,2}. The emergence and spread of MDROs, characterized by resistance to multiple classes of antimicrobial agents, pose substantial challenges to healthcare systems worldwide^{3,4}. Effective infection control strategies and appropriate management of MDRO infections are crucial to mitigate their impact on patient outcomes and reduce the burden on healthcare resources^{5,6}.

Dr. Kariadi Hospital, located in Semarang, Indonesia, serves as a tertiary care facility and plays a vital role in providing healthcare services to a large population. However, like many healthcare institutions, Dr. Kariadi Hospital is not immune to the challenges posed by MDROs. Understanding the distribution and prevalence of MDROs among patients with MDRO infection within the hospital is essential for developing targeted interventions and optimizing infection control practices^{7,8}.

This study aimed to investigate the distribution and prevalence of MDROs among MDRO-positive individuals at Dr. Kariadi Hospital. The primary objective is to assess the occurrence and proportions of specific MDRO types, such as Extended-spectrum β -lactamase (ESBL)-producing organisms, Carbapenem-resistant Enterobacteriaceae (CRE), Methicillin-resistant *Staphylococcus aureus* (MRSA), and others^{9,10}. By gaining insights into the prevalence and distribution of MDROs, this study will contribute to the existing body of knowledge regarding MDRO epidemiology and aid in the development of evidence-based strategies for MDRO prevention and control^{11,12}.

Methods

This cross-sectional study was conducted at Dr. Kariadi Hospital, a tertiary care facility in Semarang, Indonesia. The study period spanned from 16 November, 2022 to 16 January, 2023.

Ethical approval was obtained from the Department of Education and Research, RSUP Dr. Kariadi prior to data collection. Strict adherence to patient confidentiality and data protection guidelines was maintained throughout the study. All data were anonymized and securely stored to preserve patient privacy.

The study population comprised individuals who tested positive for multidrug-resistant organisms (MDRO) infection within the hospital. Inclusion criteria consisted of patient's records with confirmed MDRO-positive test results. Patients who tested negative for MDRO or had missing or incomplete data were excluded from the study.

Secondary data were extracted from patient records using a standardized data collection form. The data variables included specific MDRO types (e.g., extended-spectrum β -lactamase [ESBL]-producing organisms, carbapenem-resistant Enterobacteriaceae [CRE], methicillin-resistant *Staphylococcus aureus* [MRSA]) identified through laboratory testing.

Descriptive statistics were employed to analyze the data and address the study objectives. Frequencies and proportions were calculated to determine the distribution and prevalence of different MDRO types among MDRO-positive patients.

Results

The distribution and prevalence of multidrug-resistant organisms (MDROs) among MDRO-positive individuals at Dr. Kariadi Hospital were analyzed. A total of 100 patients with MDRO infections were included in the study.

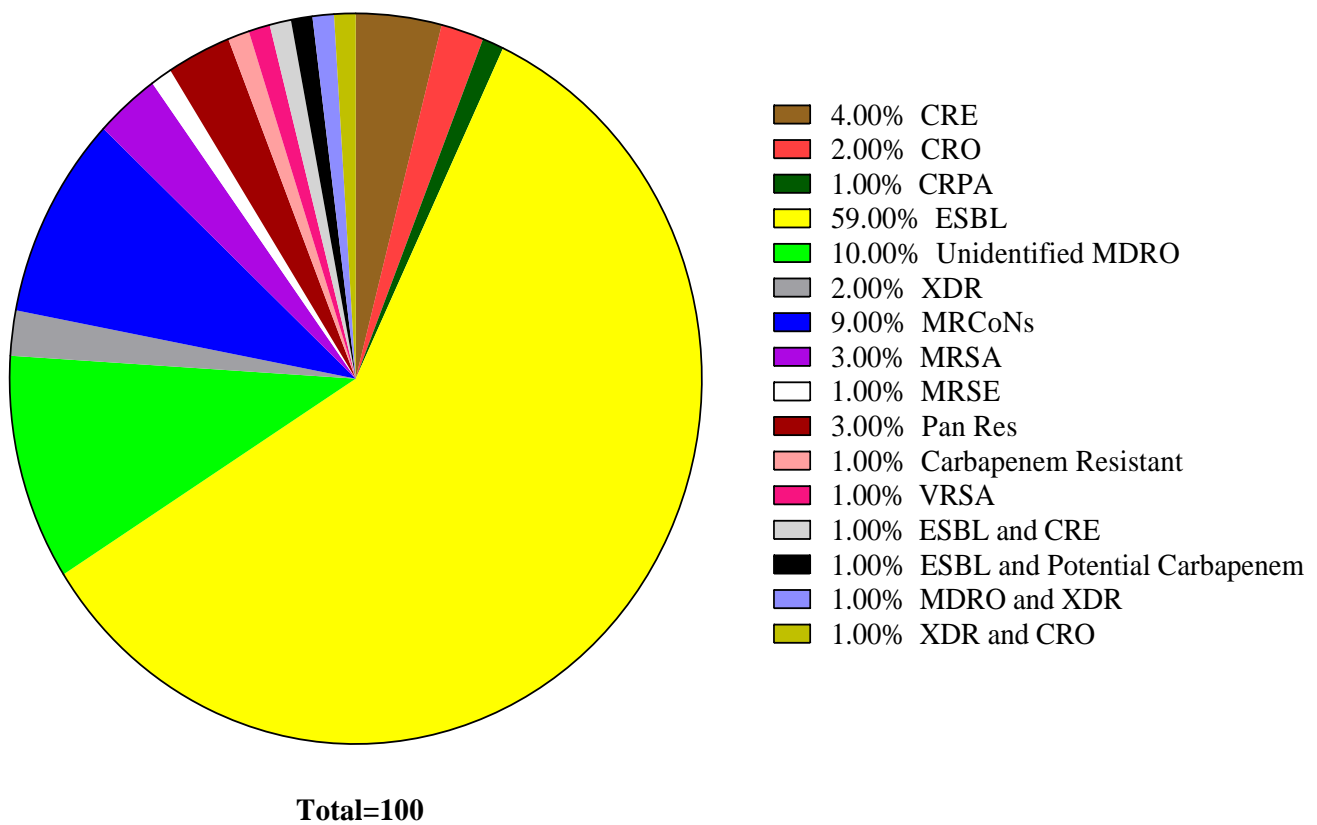


Figure 1: Distribution of MDROs in MDRO-positive patients at Dr. Kariadi Hospital, Semarang

Among the different MDRO types identified, the most prevalent was extended-spectrum β -lactamase (ESBL)-producing organisms, accounting for 59 cases (59%). This highlights the significant burden of ESBL infections within the hospital setting.

Carbapenem-resistant Enterobacteriaceae (CRE) was found in 4 cases (4%), indicating the presence of organisms with reduced susceptibility to carbapenem antibiotics. Additionally, carbapenem-resistant *Pseudomonas aeruginosa* (CRPA) was detected in 1 case (1%), further emphasizing the emergence of resistance in this nosocomial pathogen.

The presence of methicillin-resistant *Staphylococcus aureus* (MRSA) was observed in

3 cases (3%), indicating the persistence of this important antibiotic-resistant pathogen in the hospital. Methicillin-resistant coagulase-negative staphylococci (MRCoNS) were identified in 9 cases (9%), underscoring the relevance of these organisms as potential sources of healthcare-associated infections.

Other MDRO types identified included carbapenem-resistant organisms (CRO) in 2 cases (2%), extensively drug-resistant (XDR) organisms in 2 cases (2%), methicillin-resistant *Staphylococcus epidermidis* (MRSE) in 1 case (1%), vancomycin-resistant *Staphylococcus aureus* (VRSA) in 1 case (1%), and pan-resistant organisms in 3 cases (3%).

The lack of specific MDRO types identified in 10% of the individuals may be

attributed to limitations in laboratory methods, the presence of emerging or novel MDROs, false-negative results, or the heterogeneity of MDROs in the study population.

These findings provide valuable insight into the distribution and prevalence of specific MDRO types at Dr. Kariadi Hospital. The high prevalence of ESBL-producing organisms highlights the urgent need for infection control measures and antimicrobial stewardship programs to mitigate their spread. The presence of CRE and CRPA signifies the importance of vigilant surveillance and appropriate infection control strategies to prevent the emergence and dissemination of these highly resistant pathogens.

Furthermore, the persistence of MRSA, MRCoNS, and other resistant organisms emphasizes the ongoing challenges in managing and controlling healthcare-associated infections.

Discussion

The distribution and prevalence of multidrug-resistant organisms (MDRO) among MDRO-positive individuals at Dr. Kariadi Hospital were assessed in this study. The results revealed several important findings that have implications for infection control and antimicrobial stewardship strategies.

The high prevalence of extended-spectrum β -lactamase (ESBL)-producing organisms, accounting for 59% of MDRO cases, is consistent with previous studies conducted in hospital settings^{13,14}. ESBL-producing organisms pose a significant challenge in healthcare facilities due to their resistance to multiple classes of β -lactam antibiotics, limiting treatment options and increasing the risk of treatment failure¹⁵. The observed high prevalence underscores the urgent need for robust infection control practices, including hand hygiene, isolation precautions, and antimicrobial stewardship programs¹⁶.

Carbapenem-resistant Enterobacteriaceae (CRE) were identified in 4% of the cases, indicating the presence of organisms with reduced susceptibility to carbapenem antibiotics.

This finding is consistent with the global emergence of CRE as a major public health concern¹⁷. The rise of CRE infections is associated with significant morbidity, mortality, and healthcare costs, highlighting the need for enhanced surveillance, strict infection control measures, and judicious use of carbapenems¹⁸.

The detection of carbapenem-resistant *Pseudomonas aeruginosa* (CRPA) in 1% of the cases is consistent with reports of increasing resistance in this nosocomial pathogen¹⁹. CRPA infections are particularly problematic due to limited treatment options and a propensity for outbreaks in healthcare settings²⁰. Strict adherence to infection control protocols, including environmental cleaning, disinfection, and source control, is crucial to prevent the spread of CRPA²¹.

Methicillin-resistant *Staphylococcus aureus* (MRSA) was found in 3% of the cases, indicating the persistence of this important antibiotic-resistant pathogen. MRSA infections are associated with increased morbidity, mortality, and healthcare costs²². The implementation of comprehensive infection control measures, such as active surveillance, contact precautions, and decolonization strategies, is crucial to mitigate the transmission of MRSA²³.

Methicillin-resistant coagulase-negative staphylococci (MRCoNS) were identified in 9% of the cases. While often considered as commensal organisms, MRCoNS have the potential to cause healthcare-associated infections, especially in immunocompromised individuals²⁴. Proper infection control measures, including device-associated infection prevention and catheter management, are essential to minimize the risk of MRCoNS-related infections²⁵.

The absence of specific multidrug-resistant organism (MDRO) types among 10% of the individuals in this study raises several considerations. Several factors may contribute to this finding. First, it is possible that the laboratory testing methods employed in this study had limitations in detecting or identifying specific MDRO types¹³. Second, the presence of

emerging or novel MDROs that were not included or characterized in this study could account for the lack of specific MDRO types in these individuals¹⁴. Third, false-negative results could contribute to the absence of specific MDRO types. Laboratory tests may fail to detect MDROs due to factors such as low bacterial load, inadequate sampling, or technical errors in the testing process¹⁵. Lastly, the heterogeneity of MDROs should be considered. MDROs encompass a wide range of bacterial species and resistance mechanisms. The 10% of individuals in this study may represent a diverse group with different MDRO types that were not individually captured or reported in the results⁶.

The presence of other MDRO types, such as carbapenem-resistant organisms (CRO), extensively drug-resistant (XDR) organisms, vancomycin-resistant *Staphylococcus aureus* (VISA), and pan-resistant organisms, highlights the complexity of MDRO infections at Dr. Kariadi Hospital. These findings underscore the need for multifaceted approaches, including antimicrobial stewardship, surveillance, and infection control interventions, to address the challenge of these highly resistant pathogens.

Study Limitations : Despite the valuable insights obtained from this study, there are certain limitations that should be acknowledged. Firstly, the study relied on secondary data, which may have inherent limitations such as missing or incomplete information. The accuracy and reliability of the data are dependent on the quality of documentation and recording practices at Dr. Kariadi Hospital. Secondly, the study design was cross-sectional, which only provides a snapshot of the MDRO distribution and prevalence at a specific point in time. Longitudinal studies would be beneficial to assess temporal trends and changes in MDRO patterns. Additionally, the study was conducted at a single hospital, which limits the generalizability of the findings to other healthcare settings. Further research involving multiple hospitals or a larger patient population would enhance the external validity of the results. Lastly, the study did not investigate the underlying factors contributing to MDRO

acquisition or the association between MDRO infections and patient outcomes, which could provide valuable insights into the clinical implications of MDRO prevalence.

Conclusions

In conclusion, this study sheds light on the distribution and prevalence of MDROs among MDRO-positive individuals at Dr. Kariadi Hospital. The findings underscore the high prevalence of ESBL-producing organisms, highlighting the urgent need for robust infection control practices and antimicrobial stewardship programs. The presence of carbapenem-resistant Enterobacteriaceae, carbapenem-resistant *Pseudomonas aeruginosa*, methicillin-resistant *Staphylococcus aureus*, and methicillin-resistant coagulase-negative staphylococci further emphasizes the complexity of MDRO infections and the importance of comprehensive infection control measures. The study findings provide valuable information for healthcare professionals and policymakers in developing targeted interventions to combat the spread of MDRO and improve patient outcomes. Future research should focus on addressing the limitations of this study and exploring additional factors influencing MDRO acquisition and transmission in healthcare settings. By implementing multifaceted approaches that integrate surveillance, antimicrobial stewardship, and infection control interventions, healthcare facilities can effectively address the challenge posed by these highly resistant pathogens and safeguard patient safety.

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