Mandala of Health
Vol.18, No.2, September 2025, Hal. 205-212
ISSN: 0216-3098
DOI: 10.20884/1.mandala.2025.18.2.17637

THE RELATIONSHIP BETWEEN PREVENTIVE ATTITUDES AND THE INCIDENCE OF EXTENDED SPECTRUM BETA-LACTAMASE (ESBL)-PRODUCING ENTEROBACTERIACEAE CARRIERS AMONG HEALTHCARE WORKERS IN HOSPITALS

Aulia Nuranisa[1], Rani Afifah Nur Hestiyani[2]*, Anriani Puspita Karunia Ning Widhi[2], Arfi Nurul Hidayah[3], Nia Krisniawati[2]
[1]Faculty of Medicine, Universitas Jenderal Soedirman, Purwokerto
[2]Department of Microbiology, Faculty of Medicine, Universitas Jenderal Soedirman, Purwokerto
[3]Department of Psychology, Faculty of Medicine, Universitas Jenderal Soedirman, Purwokerto

ABSTRACT

Infections caused by Extended Spectrum Beta-Lactamase (ESBL)-producing Enterobacteriaceae have become a serious health issue, particularly in hospital environments. Gram-negative bacteria such as *Escherichia coli* and *Klebsiella pneumoniae* are able to produce ESBL, making them resistant to various beta-lactam antibiotics and complicating infection treatment. The spread of ESBL-producing bacteria is often associated with suboptimal infection prevention practices in healthcare facilities, particularly among healthcare workers who may act as vectors in transmitting these pathogens. This study aimed to determine the relationship between attitudes and the incidence of ESBL-producing Enterobacteriaceae carriers among healthcare workers in hospitals. This research was conducted using secondary data. Data were analyzed using Fisher Exact test. The result showed no significant relationship between attitudes and the incidence of ESBL carriage, as indicated a p-value of 1.000. The conclusion there was no relationship between attitude and the incidence of ESBL-producing Enterobacteriaceae carriage among healthcare workers at RSI Banjarnegara.

Keywords: Attitude, Career, Enterobacteriaceae, Extended Spectrum Beta-Lactamase, Healthcare Workers

Correspondence author:

Rani Afifah Nur Hestiyani
Department of Microbiology, Faculty of Medicine, Jenderal Soedirman University
Jl. Dr. Gumbreg No. 1, Mersi, Purwokerto
Email: rani.hestiyanti@unsoed.ac.id

INTRODUCTION

Extended-spectrum beta-lactamases (ESBLs) are enzymes capable of hydrolyzing beta-lactam antibiotics such as penicillins and first-, second-, and third-generation cephalosporins (Rastuti et al., 2023). ESBLs are mainly produced by members of the Enterobacteriaceae family, particularly *Escherichia coli* and *Klebsiella pneumoniae*, and are responsible for resistance to antibiotics that normally act by inhibiting bacterial cell wall synthesis (Biutifasari, 2018).

Infections caused by ESBL-producing bacteria have emerged as major contributors to hospital-acquired infections, particularly in intensive care units, where aggressive antibiotic use increases the risk of colonization (Happy, 2020; Manuaba et al., 2021). Globally, the prevalence of ESBL-producing bacteria is high, reaching 45.6% in the Eastern Mediterranean, 32.9% in Southeast Asia, 32.4% in Africa, 24.1% in the Western Pacific, 4.9% in the Americas, and 13.8% in Europe (Bezabih et al., 2022).

In Indonesia, the prevalence is also alarming. A multicenter study in 24 hospitals reported an ESBL incidence of 70.75%, exceeding the 2024 Ministry of Health target of 52% (Ministry of Health, 2024). Previous studies found ESBL production in 42% of hospitalized patients (Saharman & Lestari, 2013), with *E. coli* and *K. pneumoniae* as the dominant isolates (Happy, 2020; Maharani et al., 2021). Local hospital-based data further emphasize this burden, including at RSI Banjarnegara, where urinary tract infection (UTI) cases reached 521 in 2021 and 622 in 2022 (RSI Banjarnegara, 2023).

Transmission of ESBL-producing Enterobacteriaceae occurs mainly through healthcare-associated infections (HAIs), as these Gram-negative bacteria reside in the human gastrointestinal tract and can spread via direct contact with patients, inadequate hand hygiene, contaminated food, or unsterile medical equipment (Garamina et al., 2017). Such transmission underscores the important role of healthcare workers in either preventing or facilitating the spread of ESBL-producing bacteria.

Several international studies have highlighted healthcare workers' attitudes as a significant factor influencing ESBL transmission. Research in Lebanon and the United States demonstrated that poor attitudes toward infection prevention were associated with higher rates of ESBL infection (AbiGhosn et al., 2022). However, despite the increasing prevalence of ESBL-producing Enterobacteriaceae, research in Indonesia examining the role of healthcare workers' attitudes in ESBL carriage remains limited, particularly in Banjarnegara Islamic Hospital.

The findings of this study are expected to contribute to patient safety improvement efforts, especially infection prevention practices in daily healthcare services. Therefore, this study aimed to examine the relationship between healthcare workers' attitudes and the incidence of ESBL-producing Enterobacteriaceae carriage at Banjarnegara Islamic Hospital.

RESEARCH METHOD

This study was an analytical observational study with a cross-sectional approach. Measurements were conducted at a single point in time, with no follow-up assessments of the research variables. This study used secondary data obtained from a previous study involving healthcare workers at Banjarnegara Islamic Hospital. Respondents had been selected using a simple random sampling technique.

Materials (Data Source)

This study used secondary data obtained from a previous research project conducted at Banjarnegara Islamic Hospital. The dataset included information on healthcare workers, covering demographic characteristics, attitudes toward infection prevention, and the carriage status of ESBL-producing *Enterobacteriaceae*.

Procedures

The procedures of this study consisted of three steps. The first steps was the preparation stage, where the researcher searched for information regarding ESBL at Banjarnegara Islamic Hospital. The second steps was the implementation stage, which involved collecting secondary data from Banjarnegara Islamic Hospital. The third steps was the data processing and analysis stage, in which the data were entered into SPSS and analyzed.

Data Analysis

Based on the data obtained, a descriptive analysis was conducted to describe the characteristics of the subjects. Univariate analysis was carried out to describe the collected data without drawing conclusions applicable to the general population, including variables such as age, sex, educational level, profession, ward, work experience, and access to information (Sugiyono, 2016). Baseline data were tested using Fisher's Exact Test. Bivariate analysis was performed to determine whether there is a relationship between attitudes and the incidence of ESBL-producing Enterobacteriaceae carriers among healthcare workers at Banjarnegara Islamic Hospital.

The study was conducted in accordance with the approval of the Ethics Committee of the Faculty of Medicine, Jenderal Soedirman University, as evidenced by the ethical approval letter No. 079/KEPK/PE/VI/2023.

RESULT AND DISCUSSION

This study was an analytical observational research aimed at determining the relationship between attitudes and the incidence of Extended Spectrum Beta-Lactamase (ESBL)-producing Enterobacteriaceae carriers among healthcare workers in hospitals, using a cross-sectional study design. The study utilized secondary data and obtained responses from 64 healthcare workers who had completed informed consent and the distributed questionnaire. The number of respondents met the minimum required sample size, which was 63 healthcare workers. The general characteristics of the study respondents are presented in Table 1.

Table 1. Frequency Distribution of Respondent Characteristics

Respondent Characteristics	Frequency (n=64)	Precentage
Age		
24-34	55	87,3%
>35	8	12,7%
Gender		
Female	39	61,9%%

Male	24	38,1%
Profession		
Nurse	53	84,1%
Doctor	1	1,6%
Midwife	9	14,3%
Work Experience		
<1 year	2	3,2%
1-10 years	55	87,3%
10-20 years	5	7,9%
>20 years	1	1,6%
Access to Medical Information		
Yes	61	96,8%
No	2	3,2%
Main Source of Access to Medical Information		
Mass Media	55	87,3%
Training	8	12,7%
Educational Level		
D3	47	74,6%
D4	2	3,2%
Ners	5	7,9%
S1	8	12,7%
S2	1	1,6%
Work Location		
IGD	18	28,6%
VK	9	14,3%
Perinatology Unit	7	11,1%
Inpatient Ward	29	46%

Table 1 presents the characteristics of 63 respondents. The age group of the respondents was predominantly between 24–34 years old, totaling 55 healthcare workers (87.3%). The majority of respondents were female, with 39 healthcare workers (61.9%). Most of the respondents, 53 healthcare workers (84.1%), were nurses. In terms of work experience, the majority had 1–10 years of experience, with 55 respondents (87.3%).

The table also shows that 61 healthcare workers (96.8%) had access to media information. The main source of information was mass media, cited by 55 respondents (87.3%). Regarding educational background, most respondents held a Diploma 3 (D3) degree, with 47 respondents (74.6%), followed by Bachelor's degree (S1) at 12.7%, Professional Nurse (Ners) at 7.9%, Diploma 4 (D4) at 3.2%, and Master's degree (S2) at 1.6%. In terms of work units, 29 respondents (46%) worked in the inpatient ward, followed by 19 (28.6%) in the Emergency Room (ER), 9 (14.3%) in the delivery room (Verlos Kamer/VK), and 7 (11.1%) in the perinatology unit.

Table 2. Characteristics of Attitude Scores and ESBL Carrier Status

Characteristics	Total	Precentage (%)
Attitude		
Good (52-85)	58	92,1%
Poor (17-51)	5	7,9%

Total	63	100%
ESBL Carrier		
Carrier	8	12,7%
Non-Carrier	55	87,3%
Total	63	100%

Based on Table 2, the attitude characteristics of the respondents showed that the majority had a positive attitude, with scores ranging from 52 to 85, represented by 59 healthcare workers (92.1%). Meanwhile, 5 healthcare workers (7.9%) demonstrated a negative attitude, with scores between 17 and 51. In terms of ESBL carrier status, the majority of respondents—55 healthcare workers (87.3%)—were non-carriers, while 8 healthcare workers (12.7%) were identified as ESBL carriers.

Table 3. ESBL Isolates Found in Carriers

Species	Frequency	Precentage
Escherichia coli	5	62,5%
Klebsiella pneumoniae	2	25%
Acinetobacter baumanii	1	12,5%

Based on Table 3, the most common ESBL isolates found were *Escherichia coli* (62.5%), followed by *Klebsiella pneumoniae* (25%), and *Acinetobacter baumannii* (12.5%).

Table 4. Relationship Between Attitudes and ESBL Carrier Status

Level of Attitude	ESBL Carrier Incidence				Total		P Value
	Positive		Negative				
	N	%	N	%	F	%	**1,000***
Good	8	13,8%	50	86,2%	58	100	
Poor	0	0%	5	100%	5	100	
Total	8		55		63	100	

**Fisher's Exact test*

Based on the results from the study, it was found that 8 healthcare workers (13.8%) with a positive attitude were ESBL carriers, while 50 healthcare workers (86.2%) with a positive attitude were non-carriers. On the other hand, none of the healthcare workers with a negative attitude were ESBL carriers (0%), and all 5 healthcare workers with a negative attitude were non-carriers (100%).

Table 4 indicates that the Chi-square test could not be used due to the presence of cells with expected frequencies <5, so Fisher's Exact Test was employed. Fisher's Exact Test yielded a P-value of 1.000. Since the P-value is greater than 0.05, it suggests that there is no significant relationship between attitudes and the occurrence of ESBL carriers.

The findings of this study revealed no significant association between preventive attitudes and the incidence of ESBL-producing Enterobacteriaceae carriers among

healthcare workers. This result contrasts with previous studies conducted in Lebanon and the United States, which reported that poor preventive attitudes were significantly associated with higher ESBL colonization rates (AbiGhosn et al., 2022). The discrepancy may be attributed to contextual differences in healthcare systems, infection control resources, and variations in compliance monitoring across different settings. In this study, although most respondents demonstrated positive attitudes, other unmeasured factors such as workload, institutional culture, and availability of facilities might have played a greater role in determining ESBL carriage status.

Similarly, a study by Kamate (2020) reported a significant association between attitudes and clinical behaviors such as proper hand hygiene and the correct use of personal protective equipment. Based on data from 450 participants in India, the study revealed a significant positive linear relationship ($r = 1.0$, $p \leq 0.01$) between attitudes and clinical behaviors. Positive attitudes toward hygiene and the use of personal protective equipment were shown to enhance compliance with infection control protocols, which are essential to preventing the spread of healthcare-associated infections (HAIs), including those caused by ESBL-producing bacteria (Kamate et al., 2020).

The level of compliance among healthcare workers with infection control protocols, such as regular handwashing, the use of personal protective equipment (PPE), and proper sterilization procedures, greatly influences the spread of ESBL-producing bacteria. Non-compliance or negligence in following these protocols can increase the risk of infection or colonization. Healthcare workers who do not adhere to antibiotic therapy guidelines or who often prescribe antibiotics improperly, such as the overuse of broad-spectrum antibiotics, may contribute to the selection of resistant bacteria, including ESBL-producing strains (WHO, 2023).

Stress and fatigue from high workloads can reduce healthcare workers' vigilance regarding infection prevention protocols. When healthcare workers are rushed or exhausted, they may be more likely to overlook basic prevention steps, such as hand hygiene or appropriate use of PPE. Inadequate resources or facilities—such as proper sterilization tools, sufficient isolation rooms, or appropriate protective equipment—can also affect how healthcare workers handle patients with ESBL infections or colonization. This can lead to broader bacterial spread in hospital or healthcare settings (WHO, 2023).

The attitudes and habits within the hospital culture significantly influence healthcare workers' actions. If a hospital culture does not fully support infection control or prudent antibiotic use, the occurrence of ESBL carriers among healthcare workers may increase. Support from the medical team and hospital policies that promote infection control are crucial in reducing these risks (David, 2008).

Healthcare workers who receive continuous training and education on infection control and responsible antibiotic use tend to have better attitudes toward preventing the spread of ESBL. Without ongoing education, healthcare workers may not be aware of the latest developments in infection control or effective antibiotic therapy. The attitudes of healthcare workers toward infection control are also influenced by social and professional factors, such as professional norms within the medical team, peer communication, and perceptions of the importance of infection prevention. A positive attitude toward cleanliness and infection control is likely to reduce the risk of becoming an ESBL carrier (David, 2008).

Several limitations should be acknowledged in this study. First, the sample size was relatively small and limited to a single hospital, which may affect the generalizability of the findings. Second, the study relied on self-reported questionnaires to measure attitudes, which could be subject to social desirability bias and may not accurately reflect actual behavior in clinical practice. Third, potential confounding factors such as hand hygiene compliance, antibiotic usage, and the presence of underlying medical conditions were not assessed, although these may have influenced ESBL carriage.

Despite these limitations, the study highlights the importance of continuous infection control education and monitoring in hospital settings. While attitudes alone were not statistically linked to ESBL carriage in this population, fostering a supportive hospital culture, improving resource availability, and implementing stricter adherence to infection prevention protocols remain essential. Future studies with larger, multi-center samples and the inclusion of behavioral and microbiological data are recommended to better understand the multifactorial determinants of ESBL colonization among healthcare workers

Although the results of this study did not show a significant relationship between preventive attitudes and the occurrence of ESBL carriers, hospitals still need to improve education and infection control policies to reduce the spread of ESBL in the workplace. Without a proper understanding of how ESBL develops and spreads, healthcare workers may not implement prudent antibiotic use policies, which can increase the risk of colonization or infection.

CONCLUSION

Based on the results of the study, it can be concluded that there is no significant relationship between attitudes and the occurrence of ESBL-producing Enterobacteriaceae carriers among healthcare workers at RSI Banjarnegara. Recommendations for future research include investigating other factors that may influence the occurrence of ESBL carriers, such as compliance with hand hygiene practices, antibiotic use, or hospital infection control policies.

REFERENCE

Abi Ghosn, J. *et al.* 2022. The Effect of Infection Precautions on Extended-Spectrum Beta-Lactamase Enterobacteriaceae Colonization Among Nurses in Three Beirut Hospitals. *Cureus*. 2022(4): 1-11.

Bezabih, Y. M., Bezabih, A., Dion, M., Batard, E., Teka, S., Obole, A., Dessalegn, N., Enyew, A., *et al*. 2022. Comparasion of The Global Prevalence and Trend of Human Intestinal Carriage of ESBL-Producing *Escherichia coli* Between Healthcare and Community Settings: a Systematic Review and Meta-Analysis. *JAC Antimicrobial Resistant*. 4(3): 1-12.

Biutifasari, V. 2018. Extended Spectrum Beta-Lactamase (ESBL). *Oceana Biomedicina Journal*. 1(1): 1–11.

David, L. H. 2008. *Control of Communicable Diseases*, 19th Edition. Washington DC, American Public Health Association.

Departemen Kesehatan RI. 2019. Waspada Infeksi Saluran Kemih. Jakarta, Depkes RI.

Garamina, H., Warganegara, E. & Sumekar, D. 2017. Analisis Perbandingan Uji Sensitivitas Antibiotik dan Keberadaan *Extended Spectrum Beta Lactamase* (ESBL) pada *Escherichia coli* dari Feses Tenaga Medis di Ruang Rawat Inap Dewasa dan Ruang Rawat Inap Anak RSUD Dr. H. Abdul Moeloek Provinsi Lampung. *Jurnal Agromed Unila*. 4(2): 275–282.

Happy, T. 2020. *Perbandingan Escherichia coli Penghasil ESBL pada Usia Neonatal Dini dan Pasca Neonatal di Wilayah Surabaya Utara*. Surabaya, Thesis Universitas Airlangga.

Inggas, Made Agus M., et al. Biokimia, Biologi Molekuler dan Aplikasinya Dalam Bidang Kesehatan. Mafy Media Literasi Indonesia Publisher, 2024, doi:10.1112/kakinaan1132.

Kamate, S., Gautam, N. & Sharma, S. 2020. Knowledge, Attitude and Practices Regarding Infection Control Measures Among Health Care Professional Students In A Teritiary Care Centre In India. *International Journal of Infectious Diseases*. 101(1): 280–281.

Kementerian Kesehatan Tepublik Indonesia. 2024. *Waspada Bakteri Kebal Antibiotik*.

Maharani, Y., Yuniarti, N. & Puspitasari, I. 2021. Prevalensi Bakteri *Extended-Spectrum Beta Lactamase* dan Evaluasi Kesesuaian Antibiotik Definitif pada Pasien Rawat Inap di RSUP dr Soeradji Tirtonegoro Klaten. *Majalah Farmaseutik*. 17(2): 157–165.

Manuaba, I., Iswari, I. & Pinatih, K. 2021. Prevalensi Bekteri *Escherichia coli* dan *Klebsiella pneumoniae* Penghasil *Extended Spectrum Beta Lactamase* (ESBL) yang Diisolasi dari Pasien Pneumonia di RSUP Sanglah Periode Tahun 2019-2020. *Jurnal Medika Udayana*. 10(12): 51–57.

Muhajir, A., Purwono, P. & Handayani, S. 2016. Gambaran Terapi dan Luaran Infeksi Saluran Kemih oleh Bakteri Penghasil *Extended Spectrum Beta Lactamase* pada Anak di RSUD Dr. Soetomo Surabaya. *Sari Pediatri*. 18(2): 1-11.

Nuswantoro, Ari, et al. Imunologi Dasar: Memahami Sistem Pertahanan Tubuh Manusia. Penerbit Mafy Media Literasi Indonesia, 2024, doi:10.1112/kakinaan1112.

Rastuti, M.R., Budayanti, N.N.S., Dwija, I.B.N.P. 2023. Various Types of Extended Spectrum β-Lactamases: a literature review. *Journal of Clinical Microbiology and Infectious Disease.* 3(2): 29-34.

Rumah Sakit Islam Banjarnegara. 2023. Data Primer RSI Banjarnegara Tahun 2023: Sepuluh Besar Penyakit Rawat Inap.

Saharman, Y. R., Lestari, D.C. 2013. Phenotype Characterization of Beta-Lactamase Producing Enterobacteriaceae in the Intensive Care Unit (ICU) of Cipto Mangunkusumo Hospital in 2011. *Acta Medica Indonesiana*. 45(1): 11-16.

Sugiyono.2016. *Metode Penelitian*. Bandung, Alfabeta.

World Health Organization. 2023. *Antimicrobial Resistance: Global Repost on Surveillance.*