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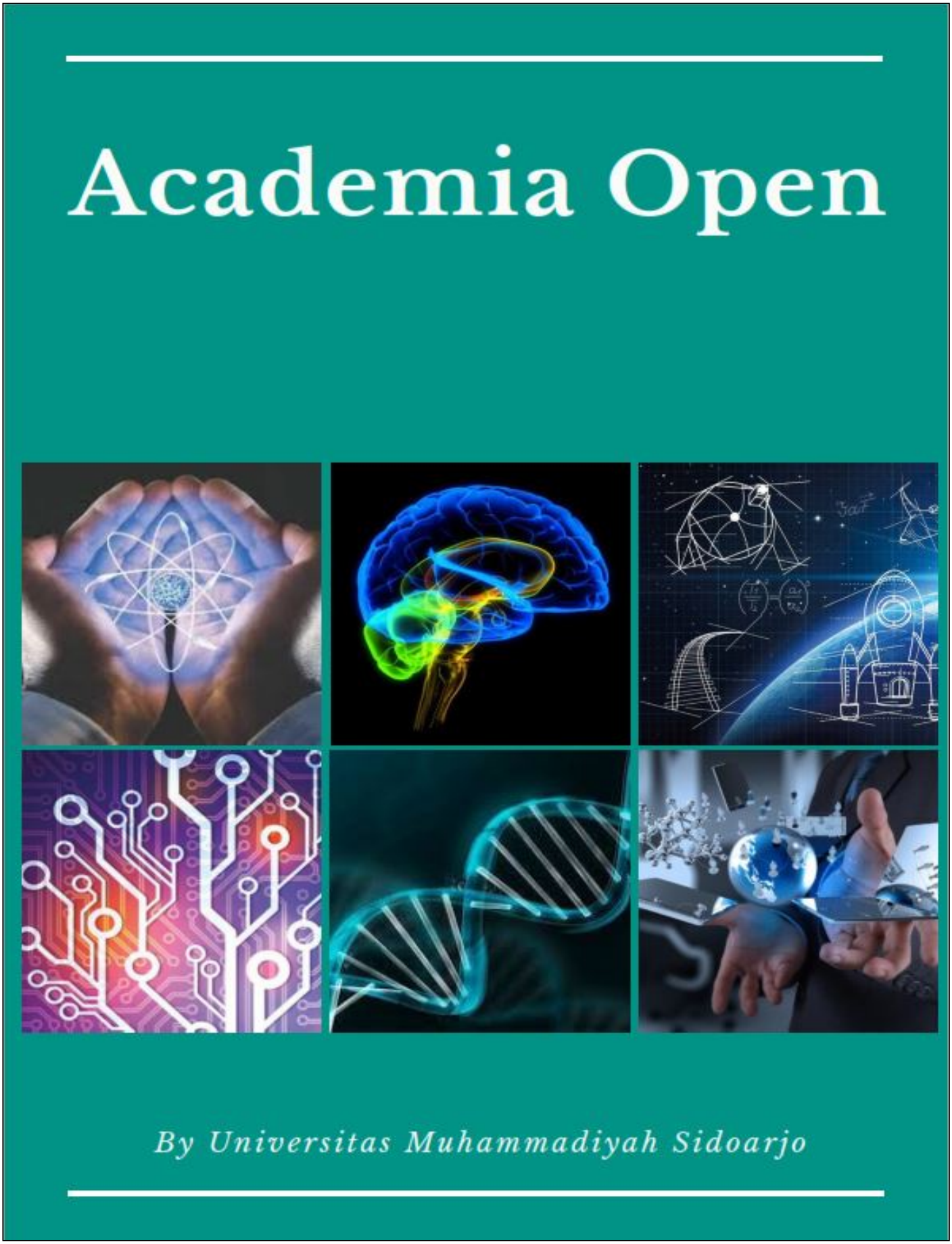

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Multidrug Resistant Bacteria Isolated From Some Basrah Hospitals

Bakteri Resistan Multiobat Diisolasi Dari Beberapa Rumah Sakit Di Basrah

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Abstract

General Background: Antibiotic resistance is a significant and growing public health concern, especially in hospital settings, where intensive care units (ICUs) often harbor multidrug-resistant organisms. **Specific Background:** Antimicrobial resistance in ICUs is a significant issue, necessitating a thorough assessment of bacterial susceptibility patterns to develop effective treatment protocols. **Knowledge Gap:** Despite the increasing concern, comprehensive studies focusing on bacterial resistance patterns in ICUs, particularly in diverse hospital settings, remain limited. **Aims:** The study aimed to assess the resistance patterns of bacterial isolates from blood, urine, and ICU surfaces to various antibiotics and identify the most resistant species. **Results:** Thirty blood, twenty urine, and fifty-six environmental samples were collected and cultured. Staphylococcus spp. exhibited 75% resistance to erythromycin, while Klebsiella spp., Pantoea spp., and E. coli showed 100% resistance to multiple antibiotics, including Ticarcillin, Piperacillin, and Cefixime. Confirmatory bacterial identification was performed using the Vitek 2 compact system, and resistance was measured across 25 antibiotics from various classes. **Novelty:** The study highlights the alarming 100% antibiotic resistance in various ICU-associated bacterial species, emphasizing the urgent need for revised antibiotic stewardship programs. **Implications:** The study underscores the importance of monitoring AMR patterns in hospitals and adjusting antibiotic therapies to combat rising resistance, particularly in ICUs, highlighting the need for robust surveillance.

Highlights:

1. 100% resistance: Klebsiella, Pantoea, E. coli resist multiple antibiotics in ICU.
2. ICU risk: Multidrug-resistant bacteria prevalent in intensive care units.
3. Urgent need: Update antibiotic protocols, enhance AMR surveillance in hospitals.

Keywords: Antibiotic resistance, ICU, bacterial susceptibility, multidrug-resistant organisms, hospital infections

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Introduction

ICUs, or intensive care units, seem to have an effect on patient outcomes.One of the main causes of morbidity and death is still infections with Gram-negative germs [1]. The underlying sickness of the patient, the intensity of their condition, the kind of intensive care unit (ICU) they are in, how long they stay there, and the quantity, kind, and duration of intrusive equipment and treatments are all intricately interacting to cause this.In [2,22] Antibiotic resistance in hospitals, particularly is a major worldwide concern in the critical care unit (ICU). It is well known that the emergence of drug-resistant organisms in the critical care unit is correlated with the widespread use of antibiotics. Compared to a typical hospital context, the ICU has a multifold greater risk of antibiotic resistance. Numerous monitoring initiatives have brought this phenomena to light[3, 4]. The most frequent isolates found in clinical specimens in Canadian intensive care units (ICUs) are P. aeruginosa, Staphylococcus aureus, Haemophilus influenzae, Enterococcus spp., Staphylococcus pneumoniae, and K. pneumoniae, according to research conducted in Canada by Zanel et al. in 2006[5]. In addition, P. aeruginosa is the most common phenotype that is resistant to several drugs, meaning that it can withstand the effects of a minimum of three antibiotics, including ciprofloxacin, amikacin or gentamicin, meropenem, cefepime, and piperacillin-tazobactam. In Thailand, resistance to imipenem P. aeruginosa, resistant to ceftazidime Third-generation cephalosporin-resistant K. pneumoniae, Acinetobacter baumannii, and quinolone-resistant The most frequent cause of infection in intensive care units was E. Coli. [6]. Many resistant Gram-positive bacteria (GPB) have either decreased or stayed relatively steady in prevalence. In addition, methicillin-resistant Staphylococcus aureus (MRSA) has started to become less common in a few nations recently[7]. Gram-negative bacteria (GNB) are more dangerous than GPB because AMR levels have risen in China in a number of significant pathogens, such as Escherichia coli, Pseudomonas aeruginosa, Acinetobacter baumannii, and Klebsiella pneumoniae [8]. According to Akhtar 2010[9], the respiratory and urinary systems are the most likely organs to become infected. Pseudomonas aeruginosa, Klebsiella pneumonia, Escherichia coli, and Candida spp. are the most common pathogens associated with these diseases

Methods

Thirty blood sample were collected from hospitalized patient, A sterile disposable syringe was used to draw five millilitres of blood. Twenty urine specimens were collected in a sterile plastic container made of polyethylene. Twenty millilitres of urine were collected from inpatients and outpatients suffering from UTIs who presented at six different hospitals. Fifty-six sterile swabs, saturated with sterile normal saline, were taken from tables, beds, walls, and various equipment and instruments in the ICU. all samples cultured on nutrient agar ,manitol agar and macConke agar and incubated at 37° C for 24 h. and then subcultured on nutrient agar to have a pure colonies . then all the isolates stained by Gram stain. All bacterial isolates were stained by Gram-stain, then examined under light microscope.catalse and oxidase teat were done and Confirmatory Identification of bactria spp. by Vitek 2 compact. Antibiotics discussed in the present study listed

NO.	Antibiotic class	Symbol
1	Cefoxitin Screen	FOX
2	Benzylpenicillin	BEZ
3	Oxacillin	OXA
4	Gentamicin	GEN
5	Tobramycin	TOB
6	Levofloxacin	LVX
7	Moxifloxacin	MXF
8	Clindamycin	CIN
9	+Azithromycin	AZM
10	Erythromycin	ERY
11	Clindamycin	CLI
12	Linezolid	LZD
13	Teicoplanin	TIC
14	Vancomycin	VAN
15	Tetracycline	TET
16	Tigecycline	TGC
17	Nitrofurantoin	NIT
18	Rifampicin	RIF
19	rimethoprim/Sulfamethoxazole	TMP
20	Cefepime	CPM
21	Cefixime	CFM

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22	Imipenem	IPM
23	Meropenem	MEM
24	Piperacillin	PEP
25	Ticarcillin	TIC

Table 1.

Result and Discussion

According to the results of antimicrobial susceptibility test figure 8 showed that (75%) Staphylococcus SPP. was resistant to Erythromycin followed by Clindamycin with percentage (50%) ,Trimethoprim/Sulfamethoxazole (35.50%) , Gentamicin (25%),Tobramycin (25%) ,Tetracycline (25%), Rifampicin(25%), Levofloxacin(18.75%), Moxifloxacin(18.75%), Teicoplanin(12.50%), Vancomycin (12.50%), Nitrofurantoin(6.25%).On the other hand most Enterobacter spp showed (13.33%) percentage of resistance to antibiotics followed by Ticarcillin , Ticarcillin/Clavulanic Acid, Piperacillin and Piperacillin/Tazobactam (6.66%) as showed in figure (9), Pseudomonas spp showed low percentage of resistance to Ticarcillin (14.28%) and Piperacillin(14.28%) and show no resistance to the other antibiotics used as showed in figure (10), Klebsiella spp showed high resistance to Ticarcillin,Piperacillin,Cefixime,Ceftazidime,Cefepime,Minocyclin,Trimethoprim/Sulfamethoxazole and Aztreonam with percentage of (100%) while, Imipenem, Meropenem, Amikacin, Gentamicin Tobramycin, Ciprofloxacin and Levofloxacin(50%) as showed in figure (11), pantoea spp exhibited (100%) resistant to antibiotics Ampicillin, Amox, Cefoxitin, Cefixime, Cefpodoxime (100%) and 50% for Ticarcillin, Piperacillin/Tazobactam and Ceftriaxone Aztreonam, ,Piperacillin, Tobramycin, Ciprofloxacin, Gatifloxacin, Levofloxacin, Moxifloxacin, Ofloxacin, Minocycline, Trimethoprim. Trimethoprim/ Sulfamethoxazole as showed in figure (12), Escherichia coli showed highly resistant(100%) to Ticarcilli , Piperacillin, Piperacillin/ Tazobactam, Cefixime, Ceftazidime, Ceftriaxone Cefepime, Aztreonam and Trimethoprim/ Sulfamethoxazole as showed in tables (2,3.4).

No	Antibiotics	*S.lentus* N=5				*S.haemolyticus* N=2				*S.aureus* N=1				*S.xylosus* N=2				*S.saprophyticus* N=4				*S.vitulinus* N=1				*S.epidermidis* N=1			
		S		R		S		R		S		R		S		R		S		R		S		R		S		R	
		No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
1	GEN	3	60	2	40	2	100	0	0	0	0	1	100	2	100	0	0	3	75	1	25	1	100	0	0	1	100	0	0
2	TOP	5	100	0	0	0	0	2	100	0	0	1	100	1	50	1	50	4	100	0	0	0	0	1	100	1	100	0	0
3	CIP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	LVX	5	100	0	0	0	0	2	100	0	0	1	100	2	100	0	0	4	100	0	0	1	100	0	0	1	0	0	0
5	ERY	5	100	0	0	2	100	0	0	0	0	1	100	0	0	2	100	4	100	0	0	0	0	1	100	0	0	0	0
6	CLN	3	60	2	40	2	100	0	0	0	0	1	100	2	100	0	0	4	100	0	0	1	100	0	0	1	100	0	0
7	TEC	5	100	0	0	2	100	0	0	0	0	1	100	2	100	0	0	4	100	0	0	1	100	0	0	0	0	1	100
8	VAN	5	100	0	0	2	100	0	0	0	0	1	100	0	0	2	100	4	100	0	0	1	100	0	0	0	0	1	100
9	TET	5	100	0	0	0	0	2	100	0	0	1	100	0	0	2	100	4	100	0	0	1	100	0	0	1	100	0	0
10	TS	5	100	0	0	2	100	0	0	0	0	1	100	0	0	2	100	0	0	4	100	1	100	0	0	1	100	0	0

Figure 1. *Antimicrobial susceptibility of staphylococcus spp*

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No	Antibiotics	*E.aerogenes N=1*				*E.cloacae N=19*				*P.stutzeri N=5*				*P.luteola N=1*				*P.alcaligenes N=1*			
		S		R		S		R		S		R		S		R		S		R	
		No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
1	TIC	1	100	0	0	18	94.7	1	5.3	4	80	1	20	1	100	0	0	1	100	0	0
2	PIP	1	100	0	0	18	94.7	1	5.3	4	80	1	20	1	100	0	0	1	100	0	0
3	CFM	1	100	0	0	18	94.7	1	5.3	5	100	0	0	1	100	0	0	1	100	0	0
4	CAZ	1	100	0	0	18	94.7	1	5.3	5	100	0	0	1	100	0	0	1	100	0	0
5	CRO	1	100	0	0	18	94.7	1	5.3	5	100	0	0	1	100	0	0	1	100	0	0
6	CEF	1	100	0	0	18	94.7	1	5.3	5	100	0	0	1	100	0	0	1	100	0	0
7	AZT	1	100	0	0	16	84.2	3	15.8	5	100	0	0	1	100	0	0	1	100	0	0
8	IPM	1	100	0	0	18	94.7	1	5.3	5	100	0	0	1	100	0	0	1	100	0	0
9	MEM	1	100	0	0	16	84.2	3	15.8	5	100	0	0	1	100	0	0	1	100	0	0
10	AMK	1	100	0	0	19	100	0	0	5	100	0	0	1	100	0	0	1	100	0	0
11	GEN	1	100	0	0	18	94.7	1	5.3	5	100	0	0	1	100	0	0	1	100	0	0
12	TOP	1	100	0	0	17	89.5	2	10.52	5	100	0	0	1	100	0	0	1	100	0	0
13	CIP	1	100	0	0	17	89.5	2	10.52	5	100	0	0	1	100	0	0	1	100	0	0
14	TS	1	100	0	0	18	94.7	1	5.3	5	100	0	0	1	100	0	0	1	100	0	0

Figure 2. *Antimicrobial susceptibility of Enterobacter*

No	Antibiotics	*K.pneumoniae N=2*				*Pantoea N=1*				*E.coli N=1*			
		S		R		S		R		S		R	
		No	%	No	%	No	%	No	%	No	%	No	%
1	TIC	0	0	2	100	0	0	1	100	0	0	1	100
2	PIP	0	0	2	100	0	0	1	100	0	0	1	100
3	CFM	0	0	2	100	0	0	1	100	0	0	1	100
4	CAZ	2	100	0	0	0	0	1	100	1	100	0	0
5	CRO	0	0	2	100	1	100	0	0	1	100	0	0
6	CEF	0	0	2	100	0	0	1	100	0	0	1	100
7	AZT	0	0	2	100	0	0	1	100	0	0	1	100
8	IPM	1	50	1	50	0	0	1	100	0	0	1	100
9	MEM	1	50	1	50	0	0	1	100	1	100	0	0
10	AMK	2	100	0	0	0	0	1	100	0	0	1	100
11	GEN	1	50	1	50	0	0	1	100	0	0	1	100
12	TOP	1	50	1	50	0	0	1	100	0	0	1	100
13	CIP	1	50	1	50	0	0	1	100	0	0	1	100
14	TS	0	0	2	100	0	0	1	100	0	0	1	100

Figure 3. *Antimicrobial susceptibility of Klebsiella spp, Escherichia coli spp and Pantoea spp*

Although there were only 9 isolates of Staphylococcus aureus overall, the percentage of meticillin-resistant Staphylococcus aureus (MRSA) among all Staphylococcus aureus was 44.4%, making it difficult to make firm conclusions. Pseudomonas aeruginosa, as opposed to MRSA, was the main pathogen recovered from sick patients in Greece, Morocco, and Saudi Arabia [10, 11, 12, 20]. Maksum et al. discovered that K. pneumoniae was similarly multidrug resistant to quinolone and third-generation cephalosporin medicines. Cephalexin (86.5%), ceftriaxone (75.7%), ceftazidime (73.0%), cefpirome (73.0%), and cefotaxime (67.9%) were all highly resistant to K. pneumoniae. Similar findings to our investigation showed that ceftazidime-resistant K. pneumoniae and P. aeruginosa were isolated from ICU patients in 96%–100% of cases[13,21]. P. aeruginosa, resistance to amikacin, gentamicin, ciprofloxacin, and levofloxacin decreased over time, while resistance to ticarcillin/clavulanic acid, cefoperazone/sulbactam, cefepime, imipenem, and meropenem increased over time in both the ICUs and the entire hospital. Regarding A. baumannii, resistance to amikacin, gentamicin, tobramycin, piperacillin/tazobactam,

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ciprofloxacin, imipenem, and tigecycline decreased with time in the ICUs, whereas resistance to cefoperazone/sulbactam increased in the ICUs as well as across the hospital. Accordingly, [15,18] made the point that insufficient data regarding the prevalence of bacteria and their pattern of resistance to antibiotics may allow for the prescription of multiple antibiotics in a row. This type of antibiotic prescription not only has no therapeutic benefit but may also cause side effects in patients, such as diarrhoea brought on by Clostridium difficile that arises from the indiscriminate use of antibiotics[15, 16,23]. The new antibiotic management strategy, which was introduced by the MOH in May 2011 with the goal of standardising antibiotic consumption and reducing antibiotic abuse, may be the cause of the current reduced proportion of antimicrobial usage.[17,19, 24].

Conclusion

Most bacteria isolated from intensive care units in hospitals showed varying resistance to the antibiotics that were used to test their susceptibility.

References

1. . J. L. Vincent, D. J. Bihari, P. M. Suter, H. A. Bruining, J. White, M. H. Nicolas-Chanoin, et al., "The prevalence of nosocomial infection in intensive care units in Europe: Results of the European Prevalence of Infection in Intensive Care (EPIC) Study," JAMA, vol. 274, pp. 639–644, 1995.
2. . J. Vaqué, J. Rossello, A. Trilla, V. Monge, J. Garcia-Caballero, J. L. Arribas, et al., "Nosocomial infections in Spain: Results of five nationwide serial prevalence surveys (EPINE project, 1990 to 1994)," Infection Control and Hospital Epidemiology, vol. 17, pp. 293–297, 1996.
3. . M. E. Jones, D. C. Draghi, C. Thornsberry, J. A. Karlowsky, D. F. Sahm, and R. P. Wenzel, "Emerging resistance among bacterial pathogens in the intensive care unit: A European and North American surveillance study (2000-2002)," Annals of Clinical Microbiology and Antimicrobials, vol. 3, p. 14, 2004, doi: 10.1186/1476-0711-3-14.
4. . U. Hadi, D. O. Duerink, E. S. Lestari, N. J. Nagelkerke, M. Keuter, D. Huis in't Veld, et al., "Audit of antibiotic prescribing in two governmental teaching hospitals in Indonesia," Clinical Microbiology and Infection, vol. 14, pp. 698–707, 2008.
5. . G. G. Zanel, M. DeCorby, N. Laing, B. Weshnoweski, R. Vashisht, F. Tailor, et al., "Antimicrobial-resistant pathogens in intensive care units in Canada: Results of the Canadian National Intensive Care Unit (CAN-ICU) study, 2005-2006," Antimicrobial Agents and Chemotherapy, vol. 52, no. 4, pp. 1430–1437, 2008.
6. . S. K. Fridkin, "Increasing prevalence of antimicrobial resistance in intensive care units," Critical Care Medicine, vol. 29, pp. 64–68, 2001.
7. . O. Denis, C. Nonhoff, and M. J. Dowzicky, "Antimicrobial susceptibility among gram-positive and gram-negative isolates collected in Europe between 2004 and 2010," Journal of Global Antimicrobial Resistance, vol. 2, no. 3, pp. 155–161, 2014, doi: 10.1016/j.jgar.2014.05.001.
8. . Z. Zong, A. Wu, and B. Hu, "Infection control in the era of antimicrobial resistance in China: Progress, challenges, and opportunities," Clinical Infectious Diseases, vol. 71, suppl. 4, pp. S372–S378, 2020, doi: 10.1093/cid/ciaa1514.
9. . N. Akhtar, "Hospital-acquired infections in a medical intensive care unit," Journal of the College of Physicians and Surgeons Pakistan, vol. 20, pp. 386–390, 2010.
10. . A. Gikas, J. Pediaditis, J. A. Papadakis, J. Starakis, S. Levidiotou, P. Nikolaides, et al., "Prevalence study of hospital-acquired infections in 14 Greek hospitals: Planning from the local to the national surveillance level," Journal of Hospital Infection, vol. 50, pp. 269–275, 2002, doi: 10.1053/jhin.2002.1181.
11. . I. Jroundi, I. Khoudri, A. Azzouzi, A. A. Zeggwagh, N. F. Benbrahim, F. Hassouni, et al., "Prevalence of hospital-acquired infection in a Moroccan university hospital," American Journal of Infection Control, vol. 35, pp. 412–416, 2007, doi: 10.1016/j.ajic.2006.06.010.
12. . T. A. Madani, N. A. Al-Abdullah, A. A. Al-Sanousi, T. M. Ghabrah, S. Z. Afandi, and H. A. Bajunid, "Methicillin-resistant Staphylococcus aureus in two tertiary-care centers in Jeddah, Saudi Arabia," Infection Control and Hospital Epidemiology, vol. 22, pp. 211–216, 2001, doi: 10.1086/501891.
13. . M. Radji, S. Fauziah, and N. Aribinuko, "Antibiotic sensitivity pattern of bacterial pathogens in the intensive care unit of Fatmawati Hospital, Indonesia," Asian Pacific Journal of Tropical Biomedicine, vol. 1, no. 1, pp. 39–42, Jan. 2011.
14. . L. Tian, Z. Zhang, and Z. Sun, "Antimicrobial resistance trends in bloodstream infections at a large teaching hospital in China: A 20-year surveillance study (1998-2017)," Antimicrobial Resistance and Infection Control, vol. 8, p. 86, 2019, doi: 10.1186/s13756-019-0545-z.
15. . S. M. Al Johani, J. Akhter, H. Balkhy, A. El-Saed, M. Younan, and Z. Memish, "Prevalence of antimicrobial resistance among gram-negative isolates in an adult intensive care unit at a tertiary care center in Saudi Arabia," Annals of Saudi Medicine, vol. 30, pp. 364–369, 2010.
16. . L. D. Bobo and E. R. Dubberke, "Recognition and prevention of hospital-associated enteric infections in the intensive care unit," Critical Care Medicine, vol. 38, suppl. S324–334, 2010.
17. . "Policy of clinical application of antimicrobial drug use," Ministry of Health of the People's Republic of China, 2011. [Online]. Available: http://www.moh.gov.cn/mohyzs/s3586/201203/54251.shtml. Accessed Apr. 15, 2016. (in Chinese).

18. . A. A. Maher, "Knowledge of nursing college students on preventive measures for irritable bowel syndrome: Pre-experimental study," International Journal of Integrative and Modern Medicine, vol. 2, no. 3, pp. 16–24, 2024.
19. . M. Atiyah, "Nurses' knowledge regarding management of hypovolemic shock: A cross-sectional study," Academia Open, vol. 9, no. 2, p. 10-21070, May 2024.
20. . S. S. Hamid, W. D. Ali, and M. A. Atiyah, "Assessing nursing students' knowledge of sleeve gastrectomy effects," Academia Open, vol. 9, no. 2, p. 10-21070, Jun. 2024.
21. . A. M. Tiryag, M. A. Atiyah, and A. S. Khudhair, "Nurses' knowledge and attitudes toward thyroidectomy: A cross-sectional study," Health Education and Health Promotion, vol. 10, no. 3, pp. 459–465, Jul. 2022.
22. . H. H. Abdul-Ra'aoof, M. A. Akber, F. A. Jassim, A. M. Tiryag, S. S. Issa, M. A. Atiyah, et al., "The psychological impact of violence on emergency department and intensive care unit nurses: A cross-sectional study," Research Journal of Trauma and Disability Studies, vol. 3, no. 4, pp. 228–233, Apr. 2024.
23. . M. A. Atiyah and M. F. Hasan, "Assessment of pharmacy staff knowledge towards prevention of osteoporosis in adolescent girls," Age, vol. 20, no. 6, pp. 30–39.
24. . W. D. Ali, D. R. Hashoosh, H. S. Mishet, S. H. Sabri, and M. A. Atiyah, "Assessing nurses' knowledge on medication to reduce errors in Iraq," Academia Open, vol. 9, no. 2, p. 10-21070, Sep. 2024.

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