Ind. J. Pharm. Edu. Res., 2025; 59(1s):s46-s51.
https://www.ijper.org

Review Article

Review of Existing Antibiotic Stewardship and Impact on Antimicrobial Resistance during COVID-19 in the Health Sector of the Emirate of Abu Dhabi, United Arab Emirates

Kanika Vats*, Kuldeep Singh

Department of Management, School of Commerce and Management, Om Sterling Global University, Hisar, Haryana, INDIA.

ABSTRACT

This study examined the present situation of Antimicrobial Resistance (AMR) and prevailing Antimicrobial Stewardship Programs (ASP), and its impact during COVID-19 globally and specifically in Abu Dhabi, UAE aiming to identify and define the problem(s) resulting in increasing trends of antibiotic resistance during COVID, potential impact factors, anticipated outcomes and provide a conclusion to aid our approach towards sustainable antimicrobial stewardship program and combat against antimicrobial resistance. The ongoing global AMR crisis is an escalating worldwide challenge and may have been intensified by the COVID-19 pandemic due to uncertainty surrounding COVID-19 treatment, which has resulted in a surge in antibiotic usage, interruptions in infection prevention and control measures within overburdened healthcare systems, and the diversion of both human and financial resources have been redirected from monitoring and addressing AMR threats. Consequently, there is a heightened urgency to emphasize actions aimed at containing AMR and enhancing the ability to swiftly detect, understand, and respond to emerging AMR threats. The Emirate of Abu Dhabi is not immune to this escalating challenge. With resources diverted from antimicrobial stewardship to meet urgent healthcare needs, and evidence of significant pre-emptive antibiotic use in COVID-19 patients potentially impacted levels of resistance and resulted in readmissions. Consequently, the threat of AMR remains substantial, leading to a reevaluation of an existing stewardship program in in-patient settings prompted by the pandemic. The review revealed a shortage of adequate data to determine the extent to which COVID-19 has impacted the current stewardship program in the Emirate of Abu Dhabi.

Keywords: In-patient, Antibiotic Stewardship, Antimicrobial Resistance, Hospitalized Patients, Readmissions.

Correspondence:
Dr. Kanika Vats
Department Management, School of Commerce and Management, Department of Management, Om Sterling Global University, Hisar, Haryana, INDIA.
Email: kanikamgt211@osgu.ac.in, vatskanika1987@yahoo.com

Received: 06-11-2023;
Revised: 10-04-2024;
Accepted: 07-10-2024.

INTRODUCTION

Antimicrobial Resistance (AMR) is a pressing global health issue, posing significant challenges to public health, clinical practice, and the effectiveness of antibiotics. The rise in AMR undermines the ability to treat common infectious diseases, leading to prolonged illness, higher mortality rates, and increased healthcare costs. Various factors contribute to this phenomenon, including overuse and misuse of antibiotics in human medicine and agriculture, lack of new antibiotics development, and inadequate infection prevention and control measures.

The COVID-19 pandemic has further complicated the AMR landscape. During the pandemic, there was widespread uncertainty regarding the management of COVID-19, especially in its early stages. This uncertainty often led to the pre-emptive use of antibiotics in COVID-19 patients, despite the fact that COVID-19 is caused by a virus, not bacteria. Consequently, this practice has likely contributed to increased antibiotic resistance.

Moreover, the pandemic has strained healthcare systems worldwide, leading to disruptions in routine healthcare services, including infection prevention and control practices. Resources, both human and financial, have been diverted to manage the immediate demands of the pandemic, thereby neglecting ongoing efforts to monitor and combat AMR. This diversion of resources has potentially exacerbated the AMR crisis, as routine surveillance and stewardship activities were deprioritized.

In Abu Dhabi, UAE, the impact of these global trends needs to be assessed that has likely influenced local AMR patterns, prompting concerns about the effectiveness of existing Antimicrobial Stewardship Programs (ASPs). The need to reassess and

DOI: 10.5530/ijper.20255637

strengthen these programs is critical to mitigate the growing threat of AMR in the post-pandemic era.

The review aimed to pinpoint the current status of AMR and delineate issues like how the COVID-19 pandemic has impacted antimicrobial resistance trends and the effectiveness of antimicrobial stewardship programs in Abu Dhabi, UAE, and what strategies can be implemented to enhance these programs to combat the rising threat of AMR post-pandemic.

MATERIALS AND METHODS

Comprehensive qualitative assessments were performed on a wide range of sources, including media reports, international guidelines, research papers, official documents, publications, surveillance reports, announcements, and industry standards. These sources were gathered using various search engines like Google Scholar and databases such as regulatory web portals. The review followed the scientific methodology outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, encompassing the stages of identification, selection, evaluation, amalgamation, and interpretation of findings. Figure 1 illustrates the review process.

LITERATURE REVIEW SUMMARY

As per the World Health Organization (WHO),[1] Antimicrobial Resistance (AMR) poses a global health and development challenge, demanding immediate, cross-sectoral efforts to attain the following Sustainable Development Goals (SDGs).

- AMR ranks among the ten most significant global public health challenges confronting humanity.
- The primary factors behind the rise of drug-resistant pathogens are the inappropriate and excessive use of antimicrobials.
- The absence of clean water, insufficient sanitation, and ineffective infection prevention and control measures facilitate the dissemination of microorganisms, including some that may resist antimicrobial treatment.
- The economic burden of AMR is substantial. Apart from the loss of lives and disabilities, extended periods of illness lead to lengthier hospital admissions, increased reliance on costly medications, and financial hardships for affected individuals.
- The effectiveness of advanced medicine in managing infections, including those associated with significant surgical procedures and cancer treatment, would face heightened jeopardy without effective antimicrobials.

Estimates suggest that more than 2.8 million antibiotic-resistant infections occur in the United States annually which can result in approximately 35,000 fatalities.[2]

Antibiotic Resistance Threats, Stewardship Programs, and Current Antibiotic Resistance Status

The reported antibiotic resistance threats[2] in the United States are listed below in Table 1.

Similar to any other drugs, antibiotics can lead to severe side effects, impacting approximately 20% of hospitalized patients who have been prescribed them. Those who receive antibiotics unnecessarily face these risks without gaining any benefits. Additionally, the inappropriate use of antibiotics has contributed significantly to the emergence of antibiotic resistance, a critical public health concern. This misuse of antibiotics can also negatively affect the well-being of individuals who are not directly administered these drugs, as it contributes to the spread of resistant microorganisms and the occurrence of *C. difficile* infections.[3]

The Core Elements of Hospital Antibiotic Stewardship Programs provide recommendations for managing antibiotic use within in-patient healthcare facilities. These guidelines are designed to aid healthcare professionals in enhancing clinical outcomes and reducing harm by optimizing the prescription of antibiotics.[3]

In 2014,[3] hospitals across the United States were urged to establish antibiotic stewardship programs, with the introduction of the Core Elements of Hospital Antibiotic Stewardship Programs (Core Elements) aimed at assisting hospitals in combating antimicrobial resistance. These Core Elements delineate the structural and procedural elements linked to the success of stewardship programs. Subsequently, in 2015, the United States set a target for implementing the Core Elements in all hospitals receiving federal funding as part of efforts to combat antibiotic-resistant bacteria.

Loria A Pollack and Arjun Srinivasan,[4] have further summarized the overview of these Core Elements of Hospital Antibiotic Stewardship Programs, outlining its structure and methodologies for collaborative, multidisciplinary programs aimed at enhancing antibiotic utilization and patient care in hospitals across the nation.

In 2015, guidelines were issued for every nursing home to improve antibiotic prescribing practices, and practical recommendations were provided for starting or expanding antibiotic stewardship initiatives in nursing homes.[5]

The Department of Health in Abu Dhabi provides assistance to healthcare institutions in the implementation of the "Antimicrobial Stewardship Programs" (ASP) guidelines. These guidelines are designed to support the implementation of the standard for Antimicrobial Stewardship Programs (ASP), which has the primary goal of enhancing the overall prescribing of antimicrobial agents, especially antibacterials. This is done to reduce the emergence and dissemination of antibiotic-resistant bacterial strains in both healthcare facilities and communities.[6]

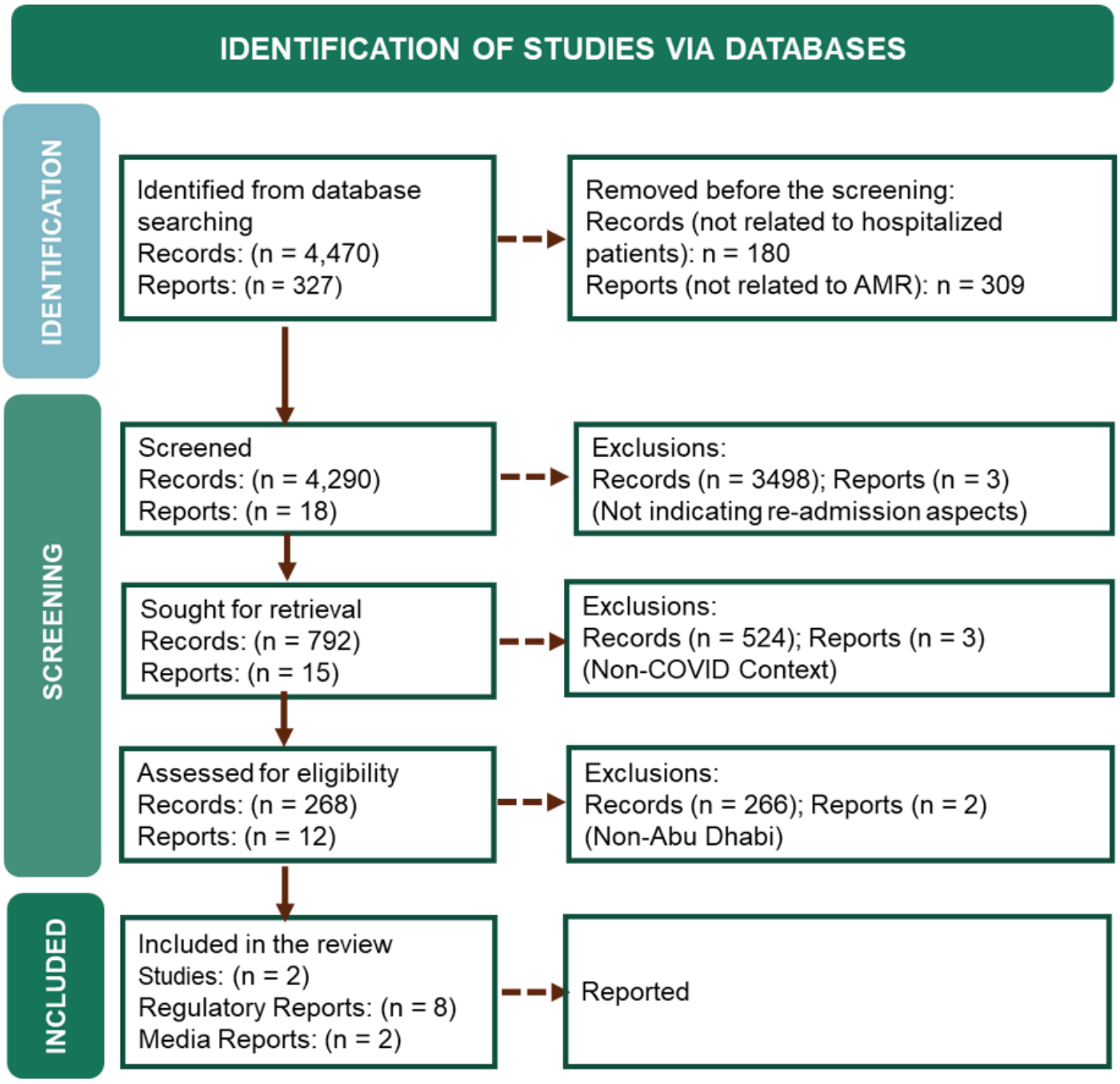

Figure 1: PRISMA Flow Chart Illustrating Study Method for the Review. (Source: Author's own property).

The national strategy[7] to combat antibiotic-resistant bacteria outlines a vision aimed at averting, identifying, and managing illnesses and fatalities resulting from infections sourced from bacteria resistant to antibiotics. This vision involves employing strategies to reduce the development and transmission of antibiotic resistance while safeguarding continued access to effective treatments for bacterial infections. In pursuit of this goal, specific objectives and an action plan[8] have been defined to combat antibiotic-resistant bacteria between 2020 and 2025.

Thomsen Jens and Abdulrazzaq Najiba,[9] emphasized the significance of national surveillance for Antimicrobial Resistance (AMR) as a critical public health function. This surveillance serves the purpose of delineating the epidemiology of AMR and identifying emerging resistance patterns. There is a notable scarcity of published national AMR surveillance data from countries in the Gulf region. The AMR Surveillance System was initiated in 2010 at the sub-national level, specifically within the Abu Dhabi Emirate in this region. In 2015, this system was extended to encompass the entire UAE at the national level. The key objectives of this program include the collection and analysis of national data related to AMR for common bacteria and fungi, the reporting of AMR levels and trends in the UAE,

Table 1: CDC Antibiotic Resistance Threats[2] (Source: CDC, Antibiotic Resistance Threats in The United States 2019).

Urgent Threats	
Carbapenem-resistant Acinetobacter	Candida auris
Clostridioides difficile	Carbapenem-resistant Enterobacteriaceae
Drug-resistant *Neisseria gonorrhoeae*	
Serious Threats	
Drug-resistant Campylobacter	Drug-resistant Candida
Extended-spectrum beta-lactamase producing Enterobacteriaceae	Vancomycin-resistant *Enterococci*
Multidrug-resistant *Pseudomonas aeruginosa*	Drug-resistant nontyphoidal *Salmonella*
Drug-resistant *Salmonella serotype Typhi*	Drug-resistant *Shigella*
Methicillin-resistant *Staphylococcus aureus*	Drug-resistant *Streptococcus pneumoniae*
Drug-resistant Tuberculosis	
Concerning Threats	
Erythromycin-resistant group A *Streptococcus*	Clindamycin-resistant group B *Streptococcus*
Watch List	
Azole-resistant *Aspergillus fumigatus*	Drug-resistant *Mycoplasma genitalium*
Drug-resistant *Bordetella pertussis*	

the reinforcement of local capacity for AMR surveillance, and the provision of support for AMR prevention and control strategies in the UAE.

The United Arab Emirates (UAE) reported its initial case of the novel coronavirus on January 29, 2020.[10] Subsequently, on March 11, 2020, COVID-19 officially declared a pandemic.[11]

Impact of COVID-19 on existing AMR

PAHO (Pan American Health Organization) has highlighted the concerning and escalating impact of COVID-19 on AMR. The pandemic has led to a rise in infections caused by multidrug-resistant pathogens, which are directly linked to unfavorable clinical outcomes, extended hospitalizations, higher mortality rates, and an increasing strain on healthcare infrastructure, resulting in elevated costs. The increased usage of antibiotics has expedited the diminished effectiveness of standard treatment drugs like carbapenems, a class of highly potent antibiotics typically used to manage severe or high-risk bacterial infections. It has also impacted alternative medications like colistin, which is considered a treatment option used as a last resort for multidrug-resistant Gram-negative infections. The economic toll of AMR on national economies and healthcare systems is substantial, affecting the productivity of patients and caregivers due to prolonged hospital stays and the necessity for costly and intensive care.[12]

RESULTS

Based on the literature review, below are the results addressing research questions to some extent, as the review revealed a shortage of adequate data to determine the extent to which COVID-19 has markedly influenced the existing stewardship program in Abu Dhabi's Emirate.

Current Status

It is evident that AMR is recognized by WHO as a major global health challenge, exacerbated by inappropriate and excessive use of antimicrobials, inadequate sanitation, and poor infection prevention and control measures. In the UAE, AMR surveillance was expanded from Abu Dhabi to the national level in 2015, focusing on common bacteria and fungi to monitor resistance trends and inform prevention strategies. AMR imposes a substantial economic burden due to prolonged illnesses, extended hospital stays, and increased healthcare costs. This impact extends to productivity losses among patients and caregivers.

Impact of COVID-19 on AMR Trends

The COVID-19 pandemic has led to a surge in the use of antibiotics, including those critical for treating severe infections. This increase has accelerated the emergence of drug-resistant pathogens. Infections caused by multidrug-resistant organisms have risen, resulting in worse clinical outcomes, longer hospital stays, higher mortality rates, and increased healthcare costs.

The pandemic has strained healthcare systems, making it challenging to maintain effective Antimicrobial Stewardship Programs (ASPs). The focus on managing COVID-19 cases has diverted resources from ASPs, potentially undermining efforts to control AMR.

Effectiveness of Antimicrobial Stewardship Programs (ASPs)

The Department of Health in Abu Dhabi supports ASP implementation in healthcare institutions to improve antimicrobial prescribing practices and reduce the spread of resistant bacteria. Core Elements of Hospital Antibiotic Stewardship Programs, developed in the US, provide a framework that could be adapted to enhance ASPs in Abu Dhabi.

Gaps and Areas for Improvement

There is a need for more robust national AMR surveillance data and improved reporting mechanisms in the Gulf region, including the UAE. The pandemic highlighted the necessity for

resilient healthcare infrastructure capable of sustaining ASPs even during crises. Therefore, it is crucial to reassess the health facility's existing antimicrobial stewardship program, which may have been influenced by the overall strain on the healthcare system during the COVID-19 pandemic.

DISCUSSION

The COVID-19 pandemic has presented significant obstacles for antimicrobial stewardship programs globally, potentially impacting programs in the Emirate of Abu Dhabi as well. Inadequate antimicrobial stewardship during this crisis may have resulted in several notable outcomes. For instance, the increased use of antibiotics, frequently for prophylactic purposes in COVID-19 patients, may have heightened the risk of antibiotic resistance, mirroring trends observed elsewhere around the world. This trend poses a risk of worsening the global health impact of Antimicrobial Resistance (AMR), potentially reducing the effectiveness of current treatments against common bacterial infections.

Moreover, the redirection of healthcare resources from antimicrobial stewardship to prioritizing COVID-19 care has impeded the regular surveillance and monitoring of AMR patterns. This lack of oversight could lead to delayed identification of emerging resistance trends and slower adoption of necessary interventions, which could complicate efforts to manage AMR.

Furthermore, the extended hospitalizations and intensive care needed for severe COVID-19 cases have increased the likelihood of Healthcare-Associated Infections (HAIs), frequently caused by multidrug-resistant organisms. Poor stewardship practices might have exacerbated the persistence and transmission of these infections within healthcare settings, posing risks to both patients and healthcare workers.

Strategies to Enhance ASPs Post-Pandemic

Given the insights from the literature review and practical clinical experience with antimicrobial stewardship in Abu Dhabi, which was not fully developed before COVID-19, and acknowledging the pandemic's potential impact, it is essential to implement effective strategies to tackle these challenges. Some proposed strategies may include:

Strengthening Surveillance and Reporting

Enhance national AMR surveillance systems to ensure timely and accurate data collection and reporting. This will help in identifying emerging resistance patterns and guiding targeted interventions.

Education and Training

Implement regular training programs for healthcare professionals on proper antimicrobial use and stewardship principles. Highlight the importance of adhering to guidelines, even during healthcare crises, which are often neglected.

Policy and Regulatory Measures

Implement stricter regulations on antimicrobial prescribing and dispensing. Ensure compliance through regular audits and feedback mechanisms. Develop and enforce policies that support the integration of ASPs into routine healthcare practices, with clear accountability structures.

Public Awareness Campaigns

Launch public awareness campaigns to educate the community about the dangers of AMR and the importance of responsible antibiotic use. Engage the public in stewardship efforts by promoting behavioral changes that reduce infection transmission.

Research and Innovation

Invest in research to develop new antimicrobials and alternative therapies. Encourage innovation in diagnostic tools that can rapidly identify infections and guide precise antimicrobial therapy. Conduct retrospective research to examine the impact COVID-19 has had on healthcare systems, particularly in relation to deviations from established stewardship practices.

By implementing these strategies, Abu Dhabi could potentially enhance its antimicrobial stewardship programs, mitigate the impact of AMR, and ensure the continued effectiveness of antimicrobials in treating infections post-pandemic.

CONCLUSION

In conclusion, addressing the consequences of inadequate antimicrobial stewardship during the COVID-19 pandemic requires concerted efforts from healthcare stakeholders. By implementing proactive strategies and fostering a culture of stewardship, we can mitigate the risks posed by AMR and safeguard the effectiveness of antibiotics for future generations.

Therefore, this review underscores the importance of assessing the prescribing practices of clinicians both before and during the COVID-19 pandemic, aligning them with the established ASP guidelines. It also calls for an examination of the status of antibiotic stewardship programs before the onset of COVID-19 and their influence during the pandemic in in-patient settings. Additionally, it urges an analysis of the overall strain on the healthcare system resulting from adverse events, prolonged hospitalizations, or readmissions.

Accordingly, a subsequent study, characterized by its correlation, observational nature, and retrospective approach, will be conducted in an Abu Dhabi, UAE inpatient healthcare setting. This study shall aim to assess the prescription patterns of antimicrobial drugs before and during the COVID-19 pandemic, analyze the pandemic's effects on antibiotic stewardship programs

within in-patient settings, and analyze any potential impact on the healthcare system's burden.

ACKNOWLEDGEMENT

The Author(s) express their appreciation to Burjeel Holdings and the Department of Health, Abu Dhabi, for granting ethical approvals for the upcoming correlational, observational, and retrospective study in inpatient settings within Abu Dhabi, UAE.

CONFLICT OF INTEREST

The author declares that there is no conflict of interest.

ABBREVIATIONS

AMR: Antimicrobial Resistance; **ASP:** Antimicrobial Stewardship Program; **UAE:** United Arab Emirates; **WHO:** World Health Organization; **SDGs:** Sustainable Development Goals; **CDC:** Centers for Disease Control and Prevention; **PAHO:** Pan American Health Organization.

SUMMARY

The impact of COVID-19 on antibiotic resistance is an intricate and evolving area of research. Several factors associated with the COVID-19 pandemic may have contributed to the dynamics of antibiotic resistance i.e., increased use of antibiotics, disruption of healthcare systems and supply chain, and decreased surveillance and reporting due to overwhelming COVID-19 cases, hence it is crucial for public health agencies, healthcare professionals, and policymakers to review, collect data and address the potential impact of the COVID-19 pandemic on antibiotic stewardship activities and change in antibiotic resistance trends, especially in in-patient settings to ensure the continued effectiveness of these essential medications.

REFERENCES

1. World Health Organization. Newsroom, fact sheet, detail, antimicrobial resistance [cited Jun 25, 2022]. Available from: https://www.who.int/news-room/fact-sheets/detail/antimicrobial-resistance.
2. CDC. Antibiotic resistance threats in the United States, 2019. Atlanta: United States Department of Health and Human Services, Centers for Disease Control and Prevention (US); 2019 [cited Jun 25, 2022]. DOI: http://dx.doi.org/10.15620/cdc:82532. Available from: https://www.cdc.gov/drugresistance/pdf/threats-report/2019-ar-threats-report-508.pdf.
3. CDC. Core elements of hospital antibiotic stewardship programs. Atlanta: United States Department of Health and Human Services, Centers for Disease Control and Prevention (US); 2019. Available from: https://www.cdc.gov/antibiotic-use/core-elements/hospital.html.
4. Pollack LA, Srinivasan A. Core elements of hospital antibiotic stewardship programs from the Centers for Disease Control and Prevention. Clin Infect Dis. 2014;59(S3):S97-100. doi: 10.1093/cid/ciu542, PMID 25261548.
5. CDC. The Core Elements of Antibiotic Stewardship for Nursing Homes. Atlanta, GA: US Department of Health and Human Services, CDC; 2015. Available from: http://www.cdc.gov/longtermcare/prevention/antibiotic-stewardship.html.
6. Department of Health. Abu Dhabi. Guidelines for antimicrobial stewardship programs (DOH/ASP/GL/1.0) [cited Jun 25 2022]. Available from: https://www.doh.gov.ae//media/D3F36B0B85FB4546B74CA47B4506DDB7.ashx.
7. CDC. National strategy for combating antibiotic-resistant bacteria; 2014 [cited Aug 21 2022]. Available from: https://www.cdc.gov/drugresistance/us-activities/national-strategy.html.
8. CDC. National action plan for combating antibiotic-resistant bacteria; 2020 [cited Aug 21 2022]. Available from: https://www.hhs.gov/sites/default/files/carb-national-action-plan-2020-2025.pdf.
9. Jens T, Najiba A. Proceedings of the European Society of Clinical Microbiology and Infectious Diseases (ESCMID), 29th ECCMID; 2019, UAE; 2019.
10. Organization WAM, Emirates News Agency. UAE announces first case of new coronavirus; 2020 [cited Jun 26 2022]. Available from: https://wam.ae/en/details/1395302819532.
11. Organization WHO, Home. WHO characterizes COVID-19 as a pandemic. Diseases/Coronavirus disease (COVID-19)/Events as they happen. 2020.
12. PAHO, Pan American Health Organization. Antimicrobial resistance, fueled by the COVID-19 pandemic. Policy Brief. 2019;November [publication] (PAHO/CDE/AMR. COVID-19/22-0006).

Cite this article: Vats K, Singh K. Review of Existing Antibiotic Stewardship and Impact on Antimicrobial Resistance during COVID-19 in the Health Sector of the Emirate of Abu Dhabi, United Arab Emirates. Indian J of Pharmaceutical Education and Research. 2025;59(1s):s46-s51.