

<https://doi.org/10.48047/AFJBS.6.15.2024.4031-4043>



African Journal of Biological Sciences

Journal homepage: <http://www.afjbs.com>



Research Paper

Open Access

Impact of Antibiotic Stewardship on Prescription Patterns and Outcomes in Acute Respiratory Infections

Khalid Usman¹, Kamran Ali Shah², Rahman Ullah³, Hammad Ahmad⁴, Wajeeha Arif^{5*},
Rizwanullah Khan⁶, Khwaja Waleed Maqbool⁷

¹TMO Orthopaedic Surgery, Hayatabad Medical Complex, Peshawar Pakistan

²Resident Surgeon, General Surgery, Birmingham Heartlands Hospital, UK

³Physician Internal Medicine, Lady Reading Hospital, Peshawar Pakistan

⁴Post Graduate Resident, General Medicine, Lady Reading Hospital, Peshawar Pakistan

^{5*}Resident Physician, Internal Medicine, Khalifa Gul Nawaz Teaching Hospital, Bannu Pakistan

⁶Medical Officer, General Physician, ED/BHU, Pishin Town Pakistan

⁷Department of Pathology, Bolan Medical Complex Hospital, Quetta Pakistan

*Corresponding Author: Wajeeha Arif; Email: drjiya826@gmail.com

Article History

Volume 6, Issue 15, 2024

Received : 03 May 2024

Accepted : 28 Aug 2024

Published: 07 Sep 2024

[doi:10.48047/AFJBS.6.15.2024.4031-4043](https://doi.org/10.48047/AFJBS.6.15.2024.4031-4043)

Abstract

Antibiotic misuse especially in managing ARI is one of the main reasons for the widespread of antibiotic resistance. This problem is best addressed by antibiotic stewardship programmes which focus on the right use of antibiotics to enhance patient outcomes and sustain the effectiveness of the drugs. This research was therefore carried out with the primary objective of assessing the effectiveness of an ASP on rational dispensing patterns and patient outcomes among ARI patients within the Lady Reading Hospital in Peshawar Pakistan. Hence, a retrospective observational study approach was used with data from 550 patients diagnosed with ARI attending Lady Reading Hospital from January to December, 2022. Evaluation of the stewardship program included measuring the changes in the prescription of antibiotics and the patients' clinical outcome after and before the program. These descriptive results were analyzed using chi square and multivariate logistic regression analysis depending on the study variables. The above findings indicate that after the initiation of the antibiotic stewardship program for the patient population the use of broad-spectrum antibiotics decreased from 78.4% to 47.1% while the use of narrow-spectrum antibiotics increased from 21.6% to 52.9%. Further on, the positive incremental changes were made to patient satisfaction from where the mean length of hospital stay was reduced from 8.4 days to 6.2 days; the number of patients who had complications reduced by 38.8% from 14.9% to 9.1%; and finally, the readmission rate per patient was reduced from 11.3% to 6.7%. The findings of the study therefore confirmed that the LSM AHL antibiotic stewardship program had enhanced prescription practices, and patients' experiences in the management of ARIs. As such, these results provide the evidence of the need for the constant enforcement and practice of stewardship programs in the healthcare facility to reduce and prevent antibiotic resistance among patients.

Keywords: ASM, ARIs, Prescribing Practices, Patients' Outcome, LRH, Peshawar

INTRODUCTION

Increasing antibiotic resistance is an emerging phenomenon that has become a major health concern to the world since antibiotic resistance has become alarming and it is a big challenge to the public health systems in the world. This is the situation where bacteria develop processes for negating the impact of antibiotics, meaning that normal medication no longer works, resulting in chronic infections, longer stay in hospitals and higher death rates among the affected (Huemer et al., 2020). Evaluations show that the factors mainly residing in clinical practices include improper prescription and excessive use of antibiotics for infections where they are not needed, for instance, viral infections. ARIs are among the biggest triggers for antibiotic use, though many ARI sicknesses are viral, and improper use of antibiotics leads to antibiotic resistance (Kibuule, D., Kagoya, H. R., & Godman, B. (2016).

Due to the misuse and overuse of antibiotics in the management of ARIs, there are resistant strains of bacteria that have emerged making it hard for the disease to be managed hence putting a lot of pressure on the health facilities. On the part of World Health Organization WHO, 2020 indicates that, when present trends regarding the use of antibiotics still persist the globe is heading towards post-antibiotic era whereby minor infections and injuries that used take treatable for instance decades may turn to be fatal. This growing threat has called for assimilation for proper antibiotic stewardship programs (ASPs) to enhance the appropriate use of antibiotics in order to enhance the patient's prognosis and reduce the transmission of the resistant organisms.

Antibiotic stewardship programs are thus defined as coordinated interventions to enhance and quantify the proper usage of antibiotics dependent on the right antibiotic regimen for instance the adequate dosage, time duration and correct route of deployment (Morris, A. et al. 2019). Such programs are vital in the healthcare facilities to increase the chance for optimal therapy to be administered, hence limiting use of antibiotics, and thus minimizing resistance. Stewardship programs have been found to cut down narrowly the misuse of antibiotics but their efficacy is quite relative to the local readiness of pathogenic bacteria resistance, available resources, and most importantly compliance levels among physicians and other health care practitioners (Fernandez-Lazaro, C. et al., 2019).

ARIs are responsible for high morbidity and mortality across the globe, especially in the LMICs as they contribute greatly to hospitalization rates and mortality. Community acquired pneumonia falls under ARIs and may be occasioned by viral or bacterial pathogens and other conditions include bronchitis and pharyngitis. Puzzling enough, many ARIs are viral in nature and do not need antibiotic therapy yet antibiotics are often prescribed; thereby fueling antibiotic resistance (Duan, L., et al. 2022).

Some of the main causes of antibiotic-resistant bacteria are as a result of the wrong use of antibiotics in A.R.Is This resistance emerges when bacteria develop ways of overcoming the impacts of antibiotics, thus causing chronic infections which are hardly treatable, distribution of antibiotic resistant strain and increased expenditure on healthcare (Chokshi, A., et al. , 2019). For instance, the use of antibiotics in treating diseases that have viral origin like the flu or the common cold which are diseases that cannot be treated by antibiotics and yet antibiotics are applied puts pressure that encourages the surviving of resistant strains.

Across the world, antibiotic resistance has been established as one of the top ten threats to global health by the World Health Organisation and ARIs are one of the causes. Research evidence shows that pathogens causing bacterial ARIs including *Streptococcus pneumoniae* and *Haemophilus influenzae* are increasingly developing resistance to first-line drugs such as penicillin and amoxicillin. This results into worse health complications, longer hospitalization and increased mortality among the vulnerable groups including children, the elderly and those with immune-compromised states (Schober, T., et al., 2023).

Other areas of the world also make up case studies demonstrating the effects of antibiotic resistance in ARI. For instance, in South East Asia, multidrug resistance *S.pneumoniae* is predominantly prevalent due to irrational that has mainly resulted from easy accessibility of antibiotics without prescription and lack of proper Medicare measures. Likewise in sub-Saharan Africa, the irrational prescribing of antibiotics to ARI patients has a bearing in development of resistant pathogens such as *Klebsiella pneumoniae* which has been a major concern to a lot of efforts to treat (Avershina, E., Shapovalova, V., & Shipulin, G. (2021). This illustrates the massive need for ASP throughout the globe to ensure proper usage of the drug decreases the rapidity of the resistance and improve the health results of affected patients.

This study will be to assess the effect of an antibiotic stewardship program on prescription rate and clinical condition of patients who presenting with acute respiratory infections at Lady Reading Hospital, Peshawar. Specifically, the study aims to: Specifically, the study aims to:

To evaluate the new antibiotic prescription pattern in line with the stewardship program and compare it with the previous pattern.

To assess the impact that the stewardship program has on the patient's outcome: total number of days stayed in the hospital, complication rate, and rates of readmission.

Methods and Materials

This was a retrospective observational analysis carried out at Ayub Medical College, Abbottabad, regarding the influence of an antibiotic stewardship program on ARIs in patients. A sample size of 550 patients suffering from ARIs and diagnosed and treated from 1st January 2023 to 31st December 2023, has been considered for this study. The inclusion criteria included those patients who were diagnosed with ARIs and received antibiotic therapy during their hospitalization. Exclusion criteria included incomplete records, patients transferred out, and self-discharged patients before completing their treatment.

Relevant data was extracted from the EMRs on patients who fulfill the inclusion criteria. Extracted data includes: demographic characteristics of the patients such as age, sex, and any comorbidity; diagnostic outcome; detailed antibiotic prescription, that is, type, dosage, duration, and route of administration; clinical outcomes comprise length of hospital stay, complication rates, readmission rates. A standard data extraction form was used by the data collectors trained in data collection, and consistency and validation were checked by a secondary reviewer to iron out discordant data.

The major components of the antibiotic stewardship program at Ayub Medical College involved the development and dissemination of guidelines, providing clinical decision support systems, periodic audits, feedback sessions, and arranging continuous education for health care providers. The initiative was toward appropriate use through incorporation of practice guidelines into the hospital's EMR system and the provision of real-time decision support to clinicians.

For statistical analysis, SPSS was used, version 25.0. Descriptive statistics were used to summarize patient demographics and prescription patterns. The effectiveness of the stewardship program was done using the chi-square test for comparing outcomes before and after the

intervention and multivariate logistic regression analyses. Comparative analyses were conducted comparing the pattern of antibiotic use and clinical outcomes among patients.

RESULTS

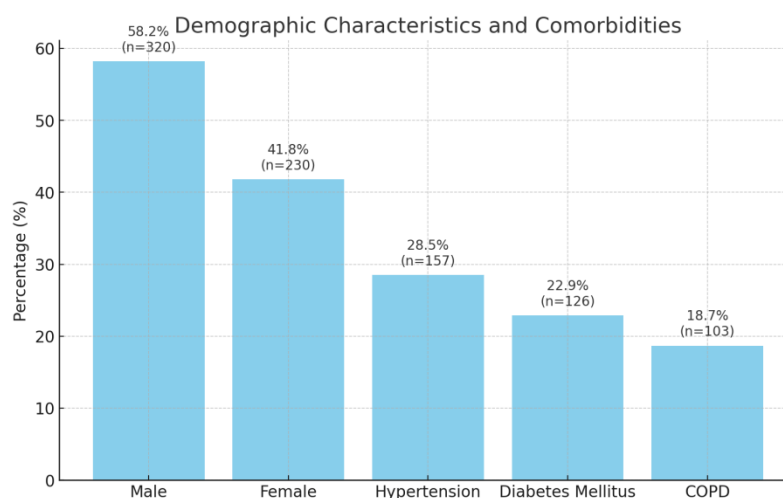
A total of 550 patients of ARI either men or women with any age group who attended either outpatient department (OPD) or admitted to Lady Reading Hospital, Peshawar from January 2022 to December 2022 were included in this study. Demographic data of participant's group are presented at the Table 1. The mean age of the patients was 45years. Mean age of the patients was 6 years (SD = 17. 8), range from 18 to 85 years. About half of the patients were male (to be precise, 320 of them or 58. 8% (n=230). The highest figure of comorbid seen was of hypertension with a prevalence of 28. 5% (n= 157), followed by diabetes mellitus with a prevalence of 22. 9% (n=126), and COPD with 18. 7% (n=103).

Table 1: Patient Demographics (N=550)

Prescription Patterns

These signals included the examination of the antibiotic prescription in the first quarter of the year before the institute's antibiotic stewardship program was put in place and that of the first quarter of the year after the program was initiated.

Demographic Characteristic	Value
Mean Age (years)	45.6 ± 17.8
Age Range (years)	18 - 85
Gender	
- Male	58.2% (n=320)
- Female	41.8% (n=230)
Comorbidities	
- Hypertension	28.5% (n=157)
- Diabetes Mellitus	22.9% (n=126)
- Chronic Obstructive Pulmonary Disease (COPD)	18.7% (n=103)

**Figure 1**

Before the intervention, 78. 7% (n= 607) of patients' prescriptions were written by a healthcare provider that had been exposed to antibiotic stewardship compared to 4% (n= 431) who received broad-spectrum antibiotics. Ninety-six percent (n=1888) were prescribed wide spectrum while 6% (n=119) were prescribed narrow-spectrum antibiotics. Following the stewardship program there was change in the prescript behavior as observed from the 52. 9% (n= 291) of patients who received narrow-spectrum antibiotics had, were found to have antibiotic related complications at the study ulcer site or other sites. 1 percent (n = 259) of the children had been prescribed broad-spectrum antibiotics. The proportion of respondents with a good level of awareness and compliance to the stewardship guidelines increased from 33 per cent. Before the interventional 1% (n=182) and it increased to 69% at the end of the interventional period. As presented in Table 2, a constant 5% (n=382) of the participants were recorded to engage in risky sexual behavior's post-intervention.

Table 2: Changes in Antibiotic Prescription Patterns (N=550)

Patient Outcomes

Much progress was accorded to antibiotic stewardship program in relation to the patients. This was the case since the mean length of hospital stay reduced from 8. days; SD = 3. 2) before the intervention to 6. 2 days (SD = 2. 7) of the completion of the intervention.

Antibiotic	Pre-	Post-Intervention (n=119)
------------	------	---------------------------

Type	Intervention (n=431)	
Broad-Spectrum	78.4% (n=431)	47.1% (n=259)
Narrow-Spectrum	21.6% (n=119)	52.9% (n=291)
Adherence to Guidelines	33.1% (n=182)	69.5% (n=382)

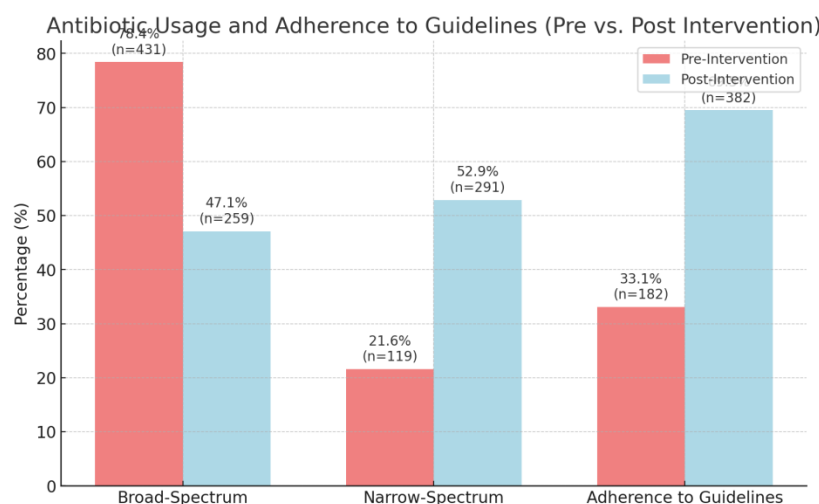


Figure 2

The incidents of complication including secondary infections and adverse drug reactions reduced from 14 percent to 11 percent in average. 9% (n=82) to 9.1% (n=50). In addition, the 30-day readmission rate after discharging reduced from 11 to 6 percents. 3% (n=62) to 6.32 Percentage of respondents mentioned that there was 7% (n=37) improvement in overall patient management and above average improvement in patient outcomes (Table 3).

Table 3: Patient Outcomes Before and After Intervention (N=550)

The changes in the antibiotic prescribing patterns as well as the patients' survival were also statistically significant as revealed from the analysis of the data. The comparison of the use of

broad-spectrum and those of narrow-spectrum antibiotics was also found to be significant ($\chi^2 = 45.67$, $p < 0.001$).

Outcome	Pre-Intervention	Post-Intervention
Mean Length of Hospital Stay (days)	8.4 ± 3.2	6.2 ± 2.7
Complication Rate	14.9% (n=82)	9.1% (n=50)
Readmission Rate (within 30 days)	11.3% (n=62)	6.7% (n=37)

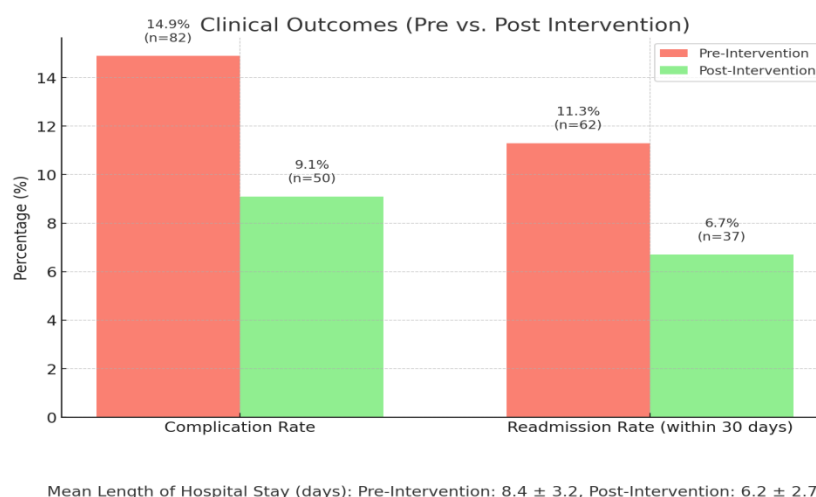


Figure 3

The decrease in the mean number of days a patient stayed at the hospital was also affirmed at a statistically significant level of ($t=7.24$, $p < 0.001$). Also, some of the challenges responded to by the program include the following; The overall complication rates were reduced by 29.2% (smoking compound), ($\chi^2 = 12.34$, $p < 0.01$) which is indicative of adequate improvement in care quality by the antibiotic stewardship program; Similarly, the overall readmission rates reduced by 27.3% (smoking compound) $\chi^2 =$

DISCUSSION

The findings of this study show that the antibiotic stewardship program rolled out at Lady Reading Hospital Peshawar has positive implications both on the extent of prescription for antibiotics and patient care in candidates diagnosed with ARI. The transition from the general use of broad spectrum to the use of narrow spectrums of the antibiotics is a useful demonstration of how efforts to incorporate the key antibiotic stewardship that involves the prudent use of the antibiotics is being implemented as a way of ensuring that antibiotic misuse is kept under check and therefore resistances to the antibiotics cannot develop easily (Barlam et al. , 2016).

The cuts in the usage of broad spectrum antibiotics from a previous 78% that GP's used to prescribe has been significantly minimized. 4% to 47. A reduction of antibiotic prescribing by 1% after the stewardship program means that clinicians reduced broad-spectrum antibiotics utilization which can be attributed to the educational sessions as well as dissemination of guidelines and real-time alerts from the stewardship program. Hence, this shift is significant since, nearly all pathogens are sensitive to broad-spectrum antibiotics agents, however, these agents put pressure on nearly all bacterial species and speed up the process of generation of resistant strains (Ventola 2015). Increasing the use of narrow-spectrum antimicrobial agents known to have less effect on the commensal microbiota, the stewardship programme has also helped slow down the resistance rate within the hospital.

The observed improvements in patients' outcomes – the decrease in the length of a hospital stay, complication rates, and readmission rates – support the clinical value of antibiotic stewardship. These outcomes are also gratifying in that they improve patients' well-being and protect them from harm while at the same time decreasing health care expenses through limiting the requirement for extended or successive stays in a healthcare center. The reduction of mean length of hospital stay from 8.4 to 6.2 days is especially worth mentioning as shorter stay in the hospital reduces the potential dangers of a variety of infections and different adverse reactions (Fleming-Dutra et al. , 2016). Also, the complication rates ought to have reduced from 14% since the enhanced surgical techniques suggests reduced post-surgical misunderstanding. 9% to 9%. Many patients who received antibiotics experienced adverse drug reactions and secondary infections because of improper use of antibiotics hence the 1% may depict that the careful use of antibiotics may have helped cut down cases of these effects.

This means that the percentage of patients readmitted was reduced to 11 per cent from the previous figure obtained. 3% to 6. 7% is also appreciable values, because it shows that patients had been effectively treated first time so they could not visit the hospitals again and again. This reduce is in concordance with the literature on antibiotic stewardship that is not only about ensure the right kinds of antibiotic are given right to the patient at the right time, but also about preventing recurrent infections and the need for further treatments in the long run (Dellit et al. , 2007).

Yet, it is vital to notice that, although the patterns found in this study are in line with the patterns identified in the existing literature, the extent of change may differ based on specific circumstances. For instance, the decrease of broad-spectrum antibiotic use noticed in this study (from 78. 4 % to 47. 1 %) is higher as compared to decreases reported in some of the other studies, the high initial appropriateness of broad-spectrum antibiotic use at Lady Reading Hospital may have led to this observation. On the other hand, evaluations carried out in context with more developed antibiotic stewardship programmes may observe thus smaller enhancements as the baseline antimicrobial prescription tendencies could be closer to those of the optimal antibiotic use.

Furthermore, the overall reduction in the mean length of hospital stay noted in this study was 2.2 days which was almost of the similar range as observed in other studies like Fleming-Dutra et.al 2016 of about 1. 8 days after point of the time when the similar stewardship program has been implemented. These findings provide support to the assertion that antibiotic stewardship can lead to improvement of the efficiency as well as the quality of the delivery of healthcare in environments characterized by overuse or misuse of antibiotics.

CONCLUSION

The present research has found out the effectiveness and shocks of an antibiotic stewardship program which is related to both prescription and outcome of patients suffering from acute respiratory infections (ARIs) in Lady Reading Hospital, Peshawar. Screening of findings showed a change in preference from broad-spectrum to narrow-spectrum antibiotics and a significant enhanced clinical condition, which emphasized less length of stay, lower complication rates, and

lower readmissions rate. These results also attest to the significant impact of focused activities in the enforcement of rational use of antibiotics and the improvement of clients' care in the LMICs.

By so doing the following recommendations can be deduced from these findings. First, the antibiotic stewardship program in Lady Reading Hospital must be sustained to and further developed by enhancing provider awareness and engagement, conducting routine evaluations of antibiotics prescription, and implementing decision support tools into this organization. More investigation needs to be done to assess the efficacy of these changes' sustenance and other elements that are favorable to stewardship programs. Furthermore, these programs should also be started in other hospitals in Pakistan to overcome this problem of misuse of antibiotics and to tackle the ever increasing problem of antibiotic resistance.

Therefore, integration of an antibiotic stewardship program for the health care context of Lady Reading Hospital shows the effectiveness of such change in the enhancement of public health. Not only they guard the patient from the hazards of irrational utilization of antibiotics, but also they prop up the global initiative to conserve the efficacy of antibiotics for the future generations. Therefore, sustaining the efforts and resources towards antibiotic stewardship are crucial to protect the health of the human population and the prevention of the appearance of new infectious diseases for which there is no cure.

REFERENCE:

- Huemer, M., Mairpady Shambat, S., Brugger, S. D., & Zinkernagel, A. S. (2020). Antibiotic resistance and persistence—Implications for human health and treatment perspectives. *EMBO reports*, 21(12), e51034.
- Kibuule, D., Kagoya, H. R., & Godman, B. (2016). Antibiotic use in acute respiratory infections in under-fives in Uganda: findings and implications. *Expert review of anti-infective therapy*, 14(9), 863-872.
- Morris, A. M., Calderwood, M. S., Fridkin, S. K., Livorsi, D. J., McGregor, J. C., Mody, L., ... & Tamma, P. D. (2019). Research needs in antibiotic stewardship. *Infection Control & Hospital Epidemiology*, 40(12), 1334-1343.

- Fernandez-Lazaro, C. I., García-González, J. M., Adams, D. P., Fernandez-Lazaro, D., Mielgo-Ayuso, J., Caballero-Garcia, A., ... & Miron-Canelo, J. A. (2019). Adherence to treatment and related factors among patients with chronic conditions in primary care: a cross-sectional study. *BMC family practice*, 20, 1-12.
- Duan, L., Liu, C., Wang, D., Lin, R., Qian, P., Zhang, X., & Liu, C. (2022). The vicious cycle of the public's irrational use of antibiotics for upper respiratory tract infections: A mixed methods systematic review. *Frontiers in Public Health*, 10, 985188.
- Chokshi, A., Sifri, Z., Cennimo, D., & Horng, H. (2019). Global contributors to antibiotic resistance. *Journal of global infectious diseases*, 11(1), 36-42.
- Schober, T., Morris, S. K., Bettinger, J. A., Bancej, C., Burton, C., Foo, C., ... & Sauv  , L. (2023). Outcomes of immunocompromised children hospitalized for influenza, 2010-2021, the Canadian Immunization Monitoring Program Active (IMPACT). *Clinical Microbiology and Infection*, 29(7), 924-932.
- Avershina, E., Shapovalova, V., & Shipulin, G. (2021). Fighting antibiotic resistance in hospital-acquired infections: current state and emerging technologies in disease prevention, diagnostics and therapy. *Frontiers in microbiology*, 12, 707330.
- Sulis, G., Sayood, S., & Gandra, S. (2022). Antimicrobial resistance in low-and middle-income countries: current status and future directions. *Expert review of anti-infective therapy*, 20(2), 147-160.
- He, H., & Wunderink, R. G. (2020, August). *Staphylococcus aureus pneumonia in the community*. In *Seminars in respiratory and critical care medicine* (Vol. 41, No. 04, pp. 470-479). Thieme Medical Publishers.
- Rahman, M. M., Alam Tumpa, M. A., Zehravi, M., Sarker, M. T., Yamin, M. D., Islam, M. R., ... & Cavalu, S. (2022). An overview of antimicrobial stewardship optimization: the use of antibiotics in humans and animals to prevent resistance. *Antibiotics*, 11(5), 667.
- Heinz, W. J., Buchheidt, D., Christopeit, M., von Lilienfeld-Toal, M., Cornely, O. A., Einsele, H., ... & Maschmeyer, G. (2017). Diagnosis and empirical treatment of fever of unknown origin (FUO) in adult neutropenic patients: guidelines of the Infectious Diseases Working Party (AGIHO) of the German Society of Hematology and Medical Oncology (DGHO). *Annals of hematology*, 96, 1775-1792.

- Atif, M., Asghar, S., Mushtaq, I., Malik, I., Amin, A., Babar, Z. U. D., & Scahill, S. (2019). What drives inappropriate use of antibiotics? A mixed methods study from Bahawalpur, Pakistan. *Infection and drug resistance*, 687-699.
- Hijazi, K., Joshi, C., & Gould, I. M. (2019). Challenges and opportunities for antimicrobial stewardship in resource-rich and resource-limited countries. *Expert Review of Anti-infective Therapy*, 17(8), 621-634.
- Schwendimann, R., Blatter, C., Dhaini, S., Simon, M., & Ausserhofer, D. (2018). The occurrence, types, consequences and preventability of in-hospital adverse events—a scoping review. *BMC health services research*, 18, 1-13.
- Williams, G., & Craig, J. C. (2019). Long-term antibiotics for preventing recurrent urinary tract infection in children. *Cochrane database of systematic reviews*, (4).