ORIGINAL RESEARCH

ISSN (O): 2349-5332
CODEN: IRJPHY

AN ANALYSIS OF INJECTABLE BETA BLOCKER UTILIZATION IN MAJOR JORDANIAN ROYAL MEDICAL SERVICES HOSPITALS: A FOUR-YEAR INSIGHT.

Abeer Adel Jebreen;PH[1], Yasmeen Saed Al-Yasouri;PH[1], Mohammed Ali Mohammed Shawagfeh ;PH[1], Zaid Nazeeh Adel Abu Hammoor;PH[1].

[1]Pharmacist, Royal Medical Services, Jordan.

Submitted on: 27.02.2025; **Revised on:** 01.03.2025; **Accepted on:** 03.03.2025

ABSTRACT

1. Introduction: The Jordanian Royal Medical Services (JRMS) manages an extensive network of military hospitals and healthcare facilities, delivering vital medical services to the Jordanian population. Beta blockers, specifically injectable Propranolol and Metoprolol are key therapeutic medications used in the management of cardiovascular diseases. These drugs are crucial for managing many cardiovascular conditions, including hypertension, arrhythmias, and heart failure. Nonetheless, the dispensing quantities of these medications in different JRMS hospitals are inadequately examined, particularly regarding aspects such as patient demographics, facility specialization, and local healthcare requirements. Analyzing the distribution of these medications will yield significant information regarding prescribing practices, facility preferences, and budget allocation within the JRMS hospitals.

2. Objective: This study aims to analyze the dispensing behavior of two prevalent injectable beta blockers, Propranolol and Metoprolol, across four major hospitals within the JRMS network: King Hussein Medical Hospital, Queen Alia Heart Institute, Prince Rashid Ben Al-Hasan Military Hospital, and Queen Alia Military Hospital. The research seeks to establish trends in the yearly allocation of these pharmaceuticals from 2020 to 2023. This study will examine if the dispensing quantities correspond to the hospitals' specialty in managing cardiovascular illnesses, and will determine the potential causes affecting these patterns. The study will also examine discrepancies in medication utilization among institutions and evaluate if these variations correspond with particular treatment recommendations or clinical practices.

3. Methodology: The study will apply a quantitative methodology, leveraging data sourced from JRMS records including yearly data for the quantities of Propranolol and Metoprolol distributed to the designated hospitals from 2020 to 2023. Statistical approaches will be employed to evaluate the data and discern variations and patterns in dispensing quantities across each facility. The investigation will concentrate on annual fluctuations and hospital-specific dispensing tendencies. A comparative analysis will be performed to assess discrepancies in dispensing among the institutions, focusing on the impact of clinical specializations on medication utilization. The study will also examine external factors, including medication shortages and supply chain disruptions, that may influence dispensing habits. The findings will then be complemented within the broader healthcare landscape of the JRMS to assess their significance for resource management, clinical practices, and future pharmaceutical procurement plans.

KEYWORDS: Injectable beta blockers, Propranolol, Metoprolol, Jordanian Royal Medical Services, JRMS hospitals, medication dispensing trends, hospital supply chain, cardiovascular drug utilization, inventory management, pharmaceutical logistics.

Corresponding author: A. A. Jebreen
Email: jbreenaber@gmail.com,
Mobile No: +962 7 9970 3531

Indian Research Journal of Pharmacy and Science; 42(2025); 3235-3241
Journal Home Page: https://www.irjps.in

1. INTRODUCTION:

The Jordanian Royal Medical Services (JRMS) plays a pivotal role in the healthcare system of Jordan, especially for service members, their families, and other eligible recipients. The JRMS was founded with the objective of delivering exceptional healthcare services to this distinct population. It manages a comprehensive network of hospitals and medical facilities nationwide, guaranteeing that patients receive specialized medical care and access to essential medications [1]. Among the extensive array of medications available, injectable beta blockers, including Propranolol and Metoprolol, are crucial in the management of various cardiovascular conditions. The medications in question play a crucial role in the management of cardiovascular diseases, which are commonly observed within the population served by the JRMS.

Cardiovascular disease (CVD) represents an important contributing factor to both morbidity and mortality on a global scale [2], and its impact is equally pronounced within military populations. The distinctive challenges encountered by individuals in military settings, including significant physical strain, harsh environmental conditions, and psychological pressures, may play a role in the development of cardiovascular disorders [3]. Moreover, military personnel frequently encounter risk factors such as hypertension, arrhythmias, and coronary artery disease at rates comparable to those observed in the general population. Effectively managing these conditions is crucial for preserving the health and operational readiness of military personnel. Consequently, medications such as beta blockers, which assist in alleviating the strain on the heart and regulating heart rhythm, are essential elements of the therapeutic options.

Beta blockers, such as Propranolol and Metoprolol, are extensively utilized in the management of cardiovascular disorders owing to their mechanism of inhibiting the effects of adrenaline on cardiac function. Beta blockers serve to reduce heart rate and blood pressure, thereby alleviating the strain on the heart [4]. This makes them particularly advantageous for patients experiencing conditions such as hypertension, arrhythmias, myocardial infarction, and congestive heart failure.

Propranolol functions as a non-selective beta blocker, indicating its influence on both beta-1 receptors located in the heart and beta-2 receptors found in various tissues, including the lungs and blood vessels [5]. This formulation demonstrates efficacy in addressing a wide array of conditions, encompassing hypertension, anxiety, thyroid disorders, as well as cardiovascular diseases. While Propranolol is widely utilized, its non-selective nature may lead to adverse effects, including bronchoconstriction, thereby restricting its application in individuals with respiratory disorders such as asthma [6]. Metoprolol is classified as a cardioselective beta blocker, indicating its primary action on beta-1 receptors located in the heart. The selective mechanism of Metoprolol renders it especially advantageous for individuals suffering from heart failure, arrhythmias, and myocardial infarction, as it offsets the likelihood of adverse effects, including respiratory complications, associated with non-selective beta blockers [7]. The targeted action of Metoprolol positions it as a preferred option in various clinical scenarios, especially for patients with pre-existing pulmonary conditions or those in need of long-term cardiovascular management [8]. The aforementioned characteristics render both medications essential within the clinical environments of the JRMS, particularly as patients frequently exhibit intricate cardiovascular health challenges. The choice between the two options is contingent upon various factors, including the particular cardiovascular condition, the presence of patient comorbidities, and the preferences of the prescribing physician.

The four hospitals included in this study (King Hussein Medical Hospital, Queen Alia Heart Institute, Prince Rashid Ben Al-Hasan Military Hospital, and Queen Alia Military Hospital) cater to unique populations, each presenting specific healthcare requirements [9]. The hospitals in question stand out in the provision of care for military personnel and their families, indicating that their patient demographics may vary significantly with respect to age, gender, and the specific health challenges encountered. For instance, King Hussein Medical Hospital and Queen Alia Heart Institute are likely to manage a greater number of cardiac patients owing to their specialized emphasis on heart-related diseases, which may contribute to the elevated prescribing and dispensing rates of Metoprolol. Prince Rashid Ben Al-Hasan Military Hospital and Queen Alia Military Hospital, conversely, are equipped to address a wider range of general medical cases, encompassing trauma, infections, and non-cardiac conditions. This may clarify the potential variations in the dispensing patterns of Propranolol, which is utilized for the management of conditions such as anxiety and thyroid-related disorders, alongside its application in cardiovascular diseases. Analyzing the dispensing trends of these medications across various hospital environments is essential for recognizing the changing preferences of healthcare professionals. Furthermore, monitoring these trends facilitates enhanced management of medication supply chains, ensuring that the appropriate medications are

accessible in sufficient quantities at each facility in accordance with patient demand.

The main objective of this study is to analyze the dispensing practices of Propranolol and Metoprolol within JRMS hospitals, concentrating on four significant institutions: King Hussein Medical Hospital, Queen Alia Heart Institute, Prince Rashid Ben Al-Hasan Military Hospital, and Queen Alia Military Hospital. This investigation will examine the annual and monthly dispensing quantities from 2020 to 2023, aiming to discern any significant trends or changes in medication utilization across various hospitals and time frames. Furthermore, the study will examine medication preferences by evaluating which hospitals exhibit a preference for one beta blocker compared to another, while also investigating the underlying reasons for these choices. This study aims to investigate the impact of specific cardiovascular diseases treated at a designated hospital on the selection between Propranolol and Metoprolol. A critical area of emphasis will be the evaluation of supply chain and logistical efficiency. Through a thorough evaluation of consumption patterns, this study also aims to identify specific areas where inventory management can be enhanced to more effectively align with the demands of hospital operations. The analysis will also investigate the relationships between dispensing trends, potential drug shortages, and changes in clinical practice. The study ultimately seeks to offer valuable insights that will aid in the strategic planning of healthcare initiatives within JRMS. Comprehending the medications that exhibit the highest demand, along with the underlying factors influencing their utilization, is essential for guiding decisions related to inventory management, procurement, and distribution strategies. This approach ensures the efficient allocation of resources and the optimization of patient care.

The dispensing patterns of injectable beta blockers serve as a significant indicator for comprehending the wider healthcare requirements and treatment approaches within the JRMS system. This investigation into these trends yields valuable insights regarding medication consumption and the dynamic evolution of healthcare delivery in the military context. As clinical guidelines progress, preferences regarding medications may change. Recognizing these changes enables healthcare providers to proactively address patient needs and guarantee the timely availability of appropriate medications. Furthermore, the results of this study hold significant practical implications for enhancing healthcare delivery within the JRMS, especially concerning the management of the supply chain for essential medications. Comprehending the demand for specific medications, the variability of their usage across different healthcare facilities, and the evolution of these trends over time will facilitate more effective resource allocation, improved logistical strategies, and superior patient care outcomes [10]. This study is of considerable importance in a wider context, as it adds to the scarce body of research regarding the dispensing patterns of essential medications in military healthcare systems. This presents a valuable opportunity to analyze the differing strategies employed by civilian and military healthcare systems in the field of medication management, while also pinpointing potential avenues for enhancement.

The research will concentrate on the distribution of Propranolol and Metoprolol from the JRMS medical warehouses to the four designated hospitals over a four-year timeframe, spanning from 2020 to 2023. it excludes the consideration of other medications or treatments, thereby ensuring a concentrated analysis of these two particular beta blockers and their significance in the management of cardiovascular diseases within the JRMS. The study will conduct a thorough analysis of the data derived from annual dispensing quantities, facilitating a comprehensive examination of trends observed over the four-year period. This comprehensive analysis aims to deliver practical insights regarding the dispensing practices of these two medications, along with their implications for clinical treatment strategies and operational efficiencies within the JRMS hospitals.

2. METHOD:

The data utilized in this study was sourced from the JRMS medical warehouse records, which document the average monthly quantities of two injectable beta blockers, Propranolol Ampules and Metoprolol Ampules, dispensed across four hospitals over a four-year timeframe, spanning from 2020 to 2023. This dataset provided the annual total quantities of each medication dispensed to each hospital, which were subsequently divided by twelve to ascertain the average monthly dispensed quantity, thereby facilitating an understanding of potential shortages or stockouts that could have influenced availability. The research utilized a descriptive analysis approach to investigate dispensing trends throughout the duration of the study. The annual analysis of dispensing data facilitated the recognition of trends and variations in the utilization of Propranolol and Metoprolol. The investigation further examined the data on a hospital-by-hospital basis, evaluating the preferences for specific medications and the temporal changes in these preferences. The study further analyzed total dispensing to ascertain any notable fluctuations in the consumption of these medications across designated years. The analysis also aimed to investigate the preferences of physicians within each hospital by taking into account various factors, including patient volume,

modifications in clinical practice, and the demands of regional healthcare, all of which may have impacted medication selection. The analysis employed fundamental statistical techniques to discern trends and patterns in medication dispensing, while qualitative insights derived from clinical practices were integrated to enhance contextual understanding.

3. RESULTS:

The examination of dispensing data for Propranolol and Metoprolol across four hospitals (King Hussein Medical Hospital, Queen Alia Heart Institute, Prince Rashid Ben Al-Hasan Military Hospital, and Queen Alia Military Hospital) uncovers notable trends and distinct preferences for these two medications throughout the four-year span from 2020 to 2023 (table 1).

Table 1: Trends of using Propranolol Ampules and Metoprolol Ampules in the study hospitals during the study period

Year	Medication	King Hussein Medical Hospital	Queen Alia Heart Institute	Prince Rashid Ben Al-Hasan Military Hospital	Queen Alia Military Hospital
2020	Propranolol Ampules	18	21	30	4
	Metoprolol Ampules	32	13	9	5
2021	Propranolol Ampules	46	13	21	6
	Metoprolol Ampules	5	8	4	2
2022	Propranolol Ampules	35	25	10	7
	Metoprolol Ampules	75	27	60	16
2023	Propranolol Ampules	19	17	2	9
	Metoprolol Ampules	79	17	44	31

Propranolol Dispensing Trends: The dispensing quantities of propranolol exhibit significant variations over the years. For example, King Hussein Medical Hospital has consistently been allocated greater quantities of Propranolol Ampules in comparison to other hospitals. In the year 2020, this hospital was allocated 18 ampules on a monthly basis. This figure grew to 35 in 2022, followed by a slight decrease to 19 in 2023. This may indicate a consistent demand for Propranolol. The Queen Alia Heart Institute, conversely, exhibited a modest decline in the dispensing of Propranolol from the year 2020 to 2023. Initially, there were 21 ampules distributed monthly in 2020, which subsequently reduced to 17 by 2023. This decline may indicate a change in treatment preferences or the institution's increasing dependence on Metoprolol for the management of heart disease, particularly given the hospital's specialization in cardiovascular care. The consistent dispensing observed at Prince Rashid Ben Al-Hasan Military Hospital and Queen Alia Military Hospital further supports this notion. In both hospitals, the utilization of Propranolol remained consistently low, exhibiting minimal fluctuations from year to year. This suggests that additional factors may play a role in influencing the consumption of this medication. In 2023, Prince Rashid dispensed a total of only 2 ampules monthly, while Queen Alia Military Hospital reported a dispensing rate of 9 ampules. These figures are notably low when compared to the dispensing numbers recorded by King Hussein.

Metoprolol Dispensing Trends: The dispensing patterns of Metoprolol Ampules reveal a notable trend that underscores the preferences of healthcare providers for this medication, particularly within hospitals specializing in cardiovascular treatments. King Hussein Medical Hospital, despite exhibiting fairly modest numbers in 2020 and 2021, experienced a notable increase in the dispensing of Metoprolol, rising from a monthly total of 5 ampules in 2021 to 79 ampules in 2023. The observed increase in Metoprolol utilization indicates a heightened dependence on this more cardioselective agent, potentially driven by evolving clinical guidelines or a rising patient population necessitating cardiovascular interventions, such as post-myocardial infarction management or heart failure treatment. At Queen Alia Heart Institute, the utilization of Metoprolol exhibited a consistent trend from 2020 to 2023, maintaining levels that were reliably higher than those observed for Propranolol. In the year 2022, a total of 27 ampules were dispensed on a monthly basis, which subsequently declined to 17 in the year 2023. The observed reduction may be linked to modifications in treatment protocols or potentially influenced by

factors such as medication shortages or variations in patient demographics that have impacted the demand for beta blockers. The Prince Rashid Ben Al-Hasan Military Hospital observed a notable rise in the utilization of Metoprolol, dispensing a total of 60 ampules on a monthly basis throughout the year 2022. However, by the year 2023, the figure decreased to 44. This indicates that the clinical demands of the hospital and the needs of patients may exhibit greater variability and unpredictability, particularly in light of the year-to-year data fluctuations observed. Lastly, Queen Alia Military Hospital demonstrated a consistent and moderate dispensing of Metoprolol, showing a gradual increase from 5 ampules per month in 2020 to 31 ampules in 2023. This trend may indicate an increasing acknowledgment of Metoprolol's advantages in managing cardiovascular conditions; however, the hospital's emphasis on broader healthcare requirements suggests that this medication continues to be a secondary consideration compared to more general treatment options.

Comparing Yearly Dispensing Across Hospitals: Upon analyzing the data over the years, it is clear that there has been a significant rise in the dispensing of Metoprolol from 2020 to 2023, especially within King Hussein Medical Hospital. This may indicate a wider trend towards the utilization of cardio-selective beta blockers, driven by an increasing patient demographic presenting with more complicated cardiovascular conditions. In contrast, the dispensing of Propranolol exhibited relative stability or even a decline in certain hospitals, thereby underscoring the preference for Metoprolol in specialized cardiovascular care (Figure 1).

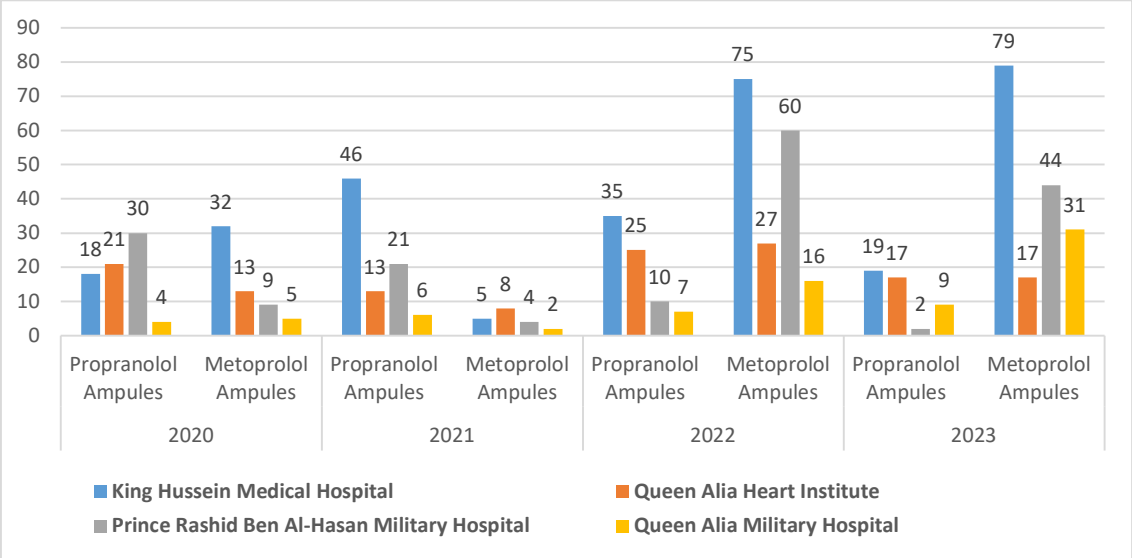

Figure 1: frequency and distribution of Propranolol Ampules and Metoprolol Ampules per year in the study hospitals

Potential Factors Influencing Dispensing Trends: The observed dispensing trends may be associated to a variety of influencing factors. Recent clinical guidelines seem to have shifted in favor of Metoprolol, attributed to its more specific action on cardiac function and a reduced incidence of respiratory side effects when compared to Propranolol. Furthermore, medical institutions that focus on specialized cardiac care, including King Hussein Medical Hospital and Queen Alia Heart Institute, may prefer Metoprolol owing to its advantageous safety profile for patients with comorbid conditions such as asthma [8]. In contrast, the extensive therapeutic range of Propranolol may render it a more favorable option in clinical scenarios where it is indicated for a diverse array of conditions, extending beyond merely cardiovascular concerns [6]. The variations in dispensing practices among hospitals indicate that treatment preferences and patient demographics significantly influence medication utilization. For example, healthcare facilities that manage a higher volume of patients with heart failure, arrhythmias, or myocardial infarction may prefer the utilization of Metoprolol, given its proven efficacy in these clinical scenarios. Conversely, hospitals that serve a diverse array of patient populations may exhibit significant variability in their dispensing practices, influenced by the spectrum of medical conditions they address. Ultimately, logistical considerations, including medication shortages, budgetary allocations within JRMS, and supplier preferences, can significantly

impact the quantities of Propranolol and Metoprolol dispensed at various points. This is particularly important in hospital settings where stock levels and financial limitations may vary over time.

The findings indicate distinct variations in the dispensing practices of Propranolol and Metoprolol among the four JRMS hospitals. The data indicates that King Hussein Medical Hospital and Queen Alia Heart Institute demonstrated a higher and more consistent utilization of Metoprolol, implying a preference for this cardioselective beta-blocker. In the interim, the application of Propranolol exhibited greater variability and was generally lower overall, with the exception of King Hussein Medical Hospital. This observation may indicate its wider applicability in the management of both cardiovascular and non-cardiovascular conditions. The analysis highlights the necessity for customized inventory management and supply strategies, considering the changing preferences and demands for particular medications.

4. DISCUSSION:

The findings indicate a notable preference for Metoprolol among the majority of JRMS hospitals. The observed shift can be attributed to multiple factors, notably the rising incidence of cardiovascular diseases within the military demographic and the demand for more targeted therapeutic alternatives [10]. Metoprolol is classified as a cardio-selective beta-blocker, which indicates its primary action on the heart. This characteristic renders it particularly suitable for the management of conditions such as heart failure, arrhythmias, and various other cardiovascular disorders. This observation clarifies the preference exhibited by hospitals such as King Hussein Medical Hospital and Prince Rashid Ben Al-Hasan Military Hospital, which likely manage a greater influx of patients with cardiovascular conditions, for Metoprolol in comparison to Propranolol. Furthermore, the increasing utilization of Metoprolol may indicate a wider shift in clinical practices towards therapies that specifically address cardiovascular conditions, as opposed to nonselective treatments such as Propranolol.

The notable decrease in Propranolol dispensing at Prince Rashid Ben Al-Hasan Military Hospital may indicate alterations in patient demographics or a transition in clinical guidelines that prioritize Metoprolol for the management of cardiovascular conditions. Furthermore, the reduction in Propranolol dispensing at various healthcare facilities, including Queen Alia Military Hospital, may suggest a shift towards the utilization of more targeted therapeutic options. Nonetheless, in light of these changes, Propranolol continues to be a vital therapeutic agent within the JRMS hospitals. The observed decrease in usage may be linked to evolving prescribing practices or the emergence of alternative therapeutic options. Additionally, the rise in dispensing at King Hussein Medical Hospital could be linked to an increased patient volume or a greater number of specialized cases which requires the unique characteristics of Metoprolol. The variations in dispensed quantities across regions are indicative of the distinct healthcare requirements and practices prevalent in each hospital setting.

5. CONCLUSIONS:

This study underscores notable changes in the dispensing practices of injectable beta blockers within the JRMS hospitals during the 2020-2023 timeframe. The tendency towards Metoprolol, especially within King Hussein Medical Hospital and Prince Rashid Ben Al-Hasan Military Hospital, reflects an increasing trend in the adoption of more cardio-selective therapies for the management of cardiovascular diseases. The observed reduction in Propranolol dispensing within numerous hospitals indicates a shift towards the adoption of more targeted therapeutic options. The findings further emphasize the critical need to comprehend medication consumption patterns to enhance supply chain management within healthcare systems. Through the careful monitoring of these trends, the JRMS can effectively maintain sufficient inventories of essential medications and adapt supply levels to align with the changing clinical requirements of its patient population.

Limitations of the Study: The study offers significant insights into the dispensing patterns of Propranolol and Metoprolol; however, it is essential to acknowledge several limitations that warrant consideration. Initially, it is important to note that the data does not accurately represent actual usage rates, indicating that elevated dispensing numbers may not directly correlate with the true consumption patterns of patients. Furthermore, the study does not consider external variables, including alterations in clinical practice guidelines, the introduction of new pharmaceuticals, or changes in patient demographics, all of which could have impacted medication prescribing patterns. Moreover, the analysis is confined to four hospitals within the JRMS, which may not comprehensively reflect the wider trends present across all JRMS medical facilities. The study does not explore the underlying reasons for particular prescribing decisions, including physician preferences or patient-specific considerations, which could offer further context.

REFERENCES:

1. Nazer, L. H., & Tuffaha, H. (2017). Health care and pharmacy practice in Jordan. *The Canadian journal of hospital pharmacy*, *70*(2), 150.
2. Butler, J., Young, J. B., Abraham, W. T., Bourge, R. C., Adams, K. F., Clare, R., ... & ESCAPE Investigators. (2006). Beta-blocker use and outcomes among hospitalized heart failure patients. *Journal of the American College of Cardiology*, *47*(12), 2462-2469.
3. Adirim, T. (2019). A military health system for the twenty-first century. *Health Affairs*, *38*(8), 1268-1273.
4. Sezai, A., & Shiono, M. (2014). The role of β-blockers in cardiac perioperative management. *Annals of Thoracic and Cardiovascular Surgery*, *20*(4), 261-266.
5. Srinivasan, A. V. (2019). Propranolol: A 50-year historical perspective. *Annals of Indian academy of neurology*, *22*(1), 21-26.
6. Nies, A. S., & Shand, D. G. (1975). Clinical pharmacology of propranolol. *Circulation*, *52*(1), 6-15.
7. Zamir, A., Hussain, I., ur Rehman, A., Ashraf, W., Imran, I., Saeed, H., ... & Rasool, M. F. (2022). Clinical pharmacokinetics of metoprolol: a systematic review. *Clinical Pharmacokinetics*, *61*(8), 1095-1114.
8. Salpeter, S. R., Ormiston, T. M., Salpeter, E. E., Wood-Baker, R., & Cochrane Airways Group. (1996). Cardioselective beta-blockers for reversible airway disease. *Cochrane Database of Systematic Reviews*, *2011*(11).
9. Oweis, R., Al-Widyan, M., & Al-Limoon, O. (2005). Medical waste management in Jordan: A study at the King Hussein Medical Center. *Waste management*, *25*(6), 622-625.
10. Ringel, J. S., Hosek, S. D., Vollaard, B. A., & Mahnovski, S. (2002). The elasticity of demand for health care a review of the literature and its application to the military health system. *RAND-PUBLICATIONS-MR-ALL SERIES-*.
11. DiNicolantonio, J. J., Lavie, C. J., Fares, H., Menezes, A. R., & O'Keefe, J. H. (2013). Meta-analysis of carvedilol versus beta 1 selective beta-blockers (atenolol, bisoprolol, metoprolol, and nebivolol). *The American journal of cardiology*, *111*(5), 765-769.
12. Shireman, T. I., Mahnken, J. D., Phadnis, M. A., & Ellerbeck, E. F. (2016). Effectiveness comparison of cardio-selective to non-selective β-blockers and their association with mortality and morbidity in end-stage renal disease: a retrospective cohort study. *BMC cardiovascular disorders*, *16*, 1-10.

CONFLICT OF INTEREST REPORTED: NIL; SOURCE OF FUNDING: NONE REPORTED