



EXAMINING THE DISPENSING OF ORAL BETA BLOCKERS FROM THE JORDANIAN ROYAL MEDICAL SERVICES MAIN MEDICAL STORES TO QUEEN ALIA INSTITUTE FOR HEART DISEASES

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ABSTRACT

1. Introduction: Beta blockers are essential in the management of cardiovascular conditions, efficiently lowering heart rate, blood pressure, and myocardial oxygen demand. These drugs are essential for the treatment of chronic heart failure, atrial fibrillation, and ischemic heart disease, rendering their availability crucial for patient care. Queen Alia Institute for Heart Diseases (QAHI) is a leading cardiac care institution in Jordan, providing to a varied and extending patient demographic, therefore securing a consistent supply of beta blockers to QAHI is crucial for upholding superior care standards. This research paper analyzes the dispensing patterns of these pharmaceuticals from the Jordanian Royal Medical Services (JRMS) primary medical stores to QAHI from 2020 to 2023, emphasizing the problems and trends in medication supply and their implications for clinical and logistical operations.

2. Objective: The main objective of this study is to examine the variations in the distribution of beta blocker tablets to QAHI, identify causes that impact these variations, and provide practical recommendations for enhancing supply chain management. The study also seeks to link the impact of changing clinical standards and physician prescribing tendencies on these pharmaceuticals demand.

3. Methodology: The analysis will utilize data from the JRMS main medical stores records, concentrating on the average monthly amounts of oral beta blockers distributed to QAHI throughout the study duration. Quantitative analysis will be performed with the help of Excel spreadsheet software and visualized to determine trends among several oral medications available in JRMS stores, including Bisoprolol, Carvedilol, Metoprolol, and others. These observations will be contextualized with potential factors including stock shortages, procurement difficulties, and changes in medical practices.

KEYWORDS: Beta blockers, cardiovascular diseases, medication dispensing trends, Jordanian Royal Medical Services (JRMS), Queen Alia Institute for Heart Diseases (QAHI), Bisoprolol, Carvedilol, Propranolol, Metoprolol, Nebivolol, Atenolol, supply chain management, physician prescribing preferences, inventory management, healthcare logistics.

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1. INTRODUCTION:

Beta blockers are fundamental in the treatment of cardiovascular illnesses, commonly utilized for their efficacy in decreasing heart rate, blood pressure, and myocardial oxygen demand [1]. These pharmacological drugs primarily function by antagonizing beta-adrenergic receptors, therefore reducing sympathetic nervous system activity. This mechanism reduces cardiac workload and prevents unfavorable cardiac events in high-risk patients [2]. Their diverse advantages encompass decreasing arrhythmic risk, managing angina symptoms, and enhancing overall survival rates, especially in individuals with a history of myocardial infarction or chronic heart failure [1]. These outcomes have been thoroughly recorded in randomized clinical trials, meta-analyses, and long-term observational studies, reinforcing their essential significance in cardiovascular treatment [3,4].

Beta blockers provide diversity in therapeutic applications, enabling customized use across various patient populations. For individuals with early-stage cardiovascular illnesses, they offer effective symptom management and postpone disease progression. For individuals with severe heart failure or post-myocardial infarction, they constitute an essential element of multi-drug regimens designed to minimize illness deteriorating and reduce hospital readmissions [5]. Medications such as Bisoprolol, Carvedilol, and Metoprolol have become conventional treatments owing to their advantageous safety profiles, dose-dependent effectiveness, and capacity to enhance the quality of life in affected patients [1]. Carvedilol's dual alpha and beta-adrenergic inhibition provides enhanced advantages in diminishing peripheral vascular resistance, which is especially beneficial in the therapy of heart failure [1].

The Jordanian Royal Medical Services (JRMS) is a key organization in Jordan's healthcare structure, guaranteeing the accessibility of vital pharmaceuticals throughout its comprehensive network of hospitals and specialized facilities. This position is especially vital for drugs such as beta blockers, due to their extensive application and life-preserving capabilities [6]. The Queen Alia Institute for Heart Diseases (QAHI) is one of JRMS's premier institutions, acknowledged as a leading cardiac care institute in Jordan. QAHI offers extensive services, encompassing basic outpatient therapy of hypertension to intricate therapies for acute coronary syndromes and severe heart failure. The patient demographic encompasses individuals from many socioeconomic classes which require a

resilient supply chain to satisfy extensive and varied demands.

Securing a reliable supply of beta blockers for QAHI is essential, but it poses considerable logistical and operational difficulties. Dispensing pattern variations sometimes result from supply shortages, procurement delays, budgetary limitations, and changing procedures for treatment [7]. Furthermore, physician prescribing preferences, influenced by emerging research and revised clinical recommendations, can affect demand patterns. With the emergence of novel drugs featuring improved pharmacological profiles, medical professionals may alter their prescribing practices, resulting in heightened demand for certain treatments and diminished necessity for others [8,9].

This study aims to analyze the dispensing patterns of oral beta blockers from JRMS's main medical stores to QAHI throughout a four-year duration (2020-2023). By analyzing average monthly quantities issued, the study seeks to identify trends and fluctuations in dispensing patterns, evaluate potential causes for these variations, including logistical and clinical factors, and offer actionable recommendations for optimizing the supply chain to ensure the continuous availability of these essential medications. This investigation examines the influence of prescribing habits and treatment standards on pharmaceutical demand, alongside logistical barriers. Comprehending these dynamics is essential for synchronizing supply chain operations with clinical requirements, hence enhancing patient outcomes at QAHI. By integrating supply chain management with clinical practice this study supports the overarching objective of improving healthcare delivery within the JRMS framework

2. METHOD:

This research employed data from JRMS's main medical stores records, concentrating on the average monthly quantities of oral beta blockers distributed to QAHI. The averages have been calculated by dividing the total yearly quantities by 12 months to accommodate supply shortages during the time frame under consideration (2020-2023). This analysis encompasses the medications Bisoprolol, Carvedilol, Propranolol, Metoprolol, Nebivolol, and Atenolol in diverse dosages. The Excel spreadsheet software was utilized to carefully and systematically organize and critically analyze the data, facilitating the detection of patterns, variations, and notable alterations during the four-year span. The software's statistical tools enabled accurate estimations of percentage changes and comparison

analyses across different years and medication categories. This strategy guaranteed a clear depiction of dispensing patterns and established a solid basis for analyzing the results in relation to logistical and clinical factors.

3. RESULTS:

Table 1: The Percentage Changes Between Consecutive Years for Each Medication and Dosage Form

Year	2020-2021	2021-2022	2022-2023	2020-2023
Bisoprolol 10mg	43.40%	-25.70%	38.90%	48.1%
Bisoprolol 5mg	3.30%	-6.90%	-11.20%	-14.6%
Carvedilol 25mg	N/A	-45.50%	318.30%	N/A
Carvedilol 6.25mg	389.90%	-43.50%	166.90%	638.6%
Propranolol 10mg	-12.70%	25.00%	-17.50%	-10.0%
Propranolol 40mg	-40.30%	67.40%	-54.90%	-54.9%
Metoprolol 100mg	-5.50%	-4.20%	18.50%	7.4%
Nebivolol 5mg+HCT	466.20%	-62.80%	180.40%	490.0%
Nebivolol 5mg	397.10%	-49.90%	82.80%	355.4%
Atenolol 100mg	564.60%	-69.90%	83.30%	266.6%
Atenolol 50mg	74.70%	-61.80%	82.60%	21.7%

Patterns of bisoprolol utilization exhibited notable trends across various doses. The amounts of Bisoprolol 10 mg increased markedly from 23,981 in 2020 to 35,512 in 2023, reflecting a 48.1% increase during this period of time. This consistent increase indicates an escalating demand for higher-dose Bisoprolol. The 5 mg dosage quantities shown reasonable stability, reaching a peak of 28,136 in 2021, before decreasing to 23,276 in 2023. The reduction in subsequent years may suggest a transition in prescribing patterns towards increased dosages or alternative treatments.

Carvedilol exhibited substantial growth throughout its forms. The 25 mg dosage initially introduced in 2021, with quantities increasing to 54,455 that year and rising to 124,084 by 2023. The swift expansion signifies its escalating importance in therapeutic regimens. The 6.25 mg dosage surged significantly from 13,536 in 2020 to 99,975 in 2023, representing a 638.6% increase. This indicates an increasing acknowledgment of its efficacy in addressing particular conditions.

Propranolol exhibited diverse tendencies across various dosage categories. The distributed quantities of the 10 mg dosage varied, reaching a maximum level of 10,027 in 2022 before decreasing to 8,272 in 2023. This inconsistency may result from alterations in clinical preferences or the availability of alternative medications. The 40 mg dosage

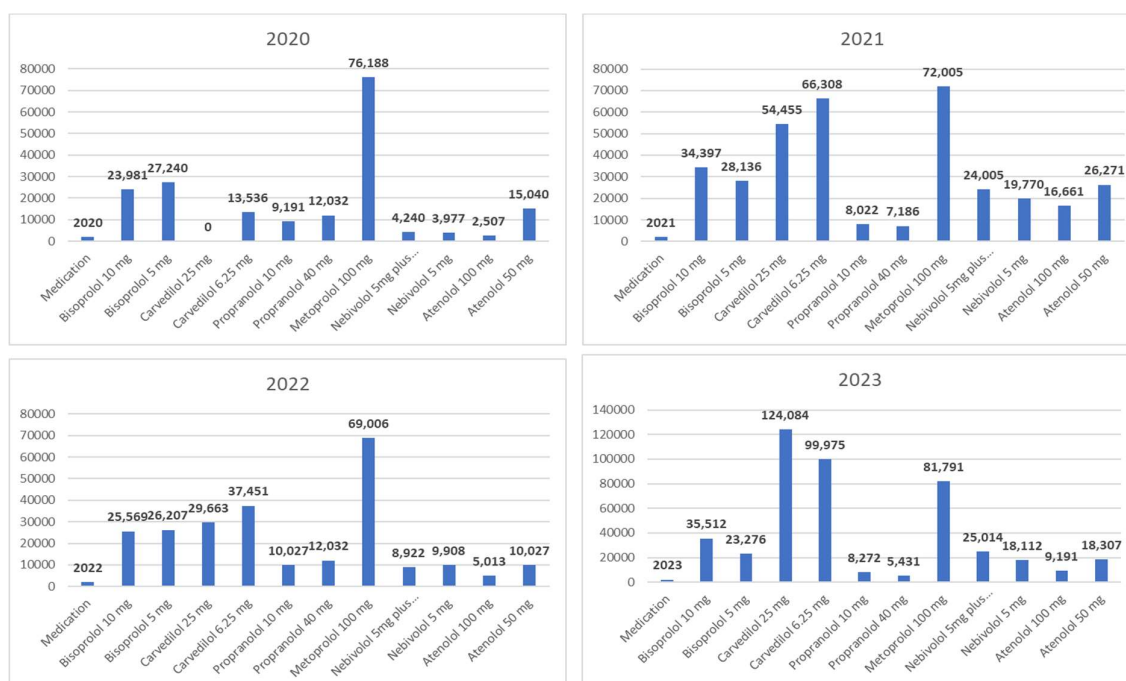
The subsequent table illustrates the percentage variations between successive years for each medicine and dose form. Positive values signify increases, and negative values signify decreases relative to the preceding year (table 1).

quantities decreased markedly from 12,032 in 2020 to 5,431 in 2023, reflecting a 54.9% reduction. This significant decrease may suggest a diminished dependence on elevated doses of Propranolol.

Metoprolol 100 mg exhibited consistent consumption trends, with amounts remaining stable and demonstrating a modest increase from 76,188 in 2020 to 81,791 in 2023. The uniformity in distribution indicates a stable demand.

Nebivolol exhibited significant growth in both its formulations. The 5 mg plus Hydrochlorothiazide combination experienced an increase in amounts from 4,240 in 2020 to 25,014 in 2023, indicating a six-fold elevation. The combination formulation may have acquired prominence due to its dual therapeutic properties. The typical 5 mg formulation exhibited significant increase, with volumes rising from 3,977 in 2020 to 18,112 in 2023. This increase may indicate a broader application in hypertension therapy.

The utilization of Atenolol has risen in both dosage strengths. The 100 mg dosage quantities shown a progressive rise, from 2,507 in 2020 to 9,191 in 2023, indicating a resurgence of interest or therapeutic preference for this dosage. The amounts of the 50 mg formulation increased from 15,040 in 2020 to 18,307 in 2023, signifying sustained demand growth.



The Dispensing Patterns of Oral Beta Blocker to QAHC Over the Study Period (2020-2023)

Figure 1: The frequency of perspiring Beta Blockers within the study period

4. DISCUSSION:

The findings indicate substantial insights on the dispensing patterns of beta blockers to QAH. The rise in amounts of Carvedilol and Nebivolol indicates their increasing significance in modern cardiac treatment, perhaps attributable to their observed effectiveness in managing heart failure and regulating blood pressure [1,2]. particular trends may also be affected by revisions in clinical guidelines, a growing patient demographic necessitating certain medicines, and physician prescribing opinions.

The prescribing preferences of physicians significantly impact these observed trends. Carvedilol experienced a significant surge in dispensing amounts following its initial unavailability in 2020. This corresponds with its widespread endorsement in heart failure care protocols, especially for patients with lowered ejection fraction. Carvedilol's dual alpha and beta-blocking characteristics render it very advantageous for the management of complicated cardiovascular disorders, providing benefits such as enhanced hemodynamic stability and decreased hospitalization rates [1,3]. Cardiologists at QAH may prioritize Carvedilol for patients need extensive heart failure medical care or those with concurrent hypertension, hence increasing its demand.

The increasing utilization of Nebivolol, both as monotherapy and in combination with Hydrochlorothiazide, underscores a transition towards beta blockers that have further pharmacological advantages, including nitric oxide-mediated vasodilation. Nebivolol is a compelling choice for those requiring efficient blood pressure management with minimal adverse effects. The combination with Hydrochlorothiazide fulfills many treatment requirements within a single regimen, hence improving patient adherence and clinical results [2,4]. The consistent increase in its dispensing indicates a wider trend in cardiology towards individualized and combination therapy.

The reduction in Propranolol dispensing, especially the 40 mg dosage, indicates a transition from traditional, non-selective beta blockers to newer medications with more specific mechanisms of action. This tendency aligns with modern cardiology approaches that emphasize drugs with enhanced safety profiles and less central nervous system-related adverse effects. Propranolol's contemporary application is primarily confined to specialized indications, such as certain arrhythmias or anxiety-induced cardiovascular symptoms, rather than standard cardiac treatment [1,2].

The consistent distribution of Metoprolol and the gradual increase of Bisoprolol highlight their

persistent significance in cardiovascular treatment. Both drugs are essential for the management of heart failure and ischemic heart disease, esteemed for their beta-1 selectivity and recognized for their prolonged action [2]. The physicians' expertise and familiarity with these drugs further enhance their persistent demand [10].

The renewed popularity of Atenolol, evidenced by the rise in dispensing volumes for both 50 mg and 100 mg dosages, indicates its ongoing significance in particular patient demographics. The cost-effectiveness, straightforward dosing, and performance of atenolol in managing blood pressure render it a suitable option, especially in resource-limited environments or for people with simple hypertension [11].

Stock shortages and procurement difficulties undoubtedly contributed to the observed changes [12], especially for Carvedilol, which was unavailable in 2020 but had significant rises in the following years. This highlights the significance of effective supply chain management to avert disruptions in pharmaceutical availability. Resolving these difficulties necessitates tight cooperation between JRMS and QAHI to forecast demand, optimize procurement procedures, and alleviate the effects of supply interruptions since maintaining a reliable supply of beta blockers is essential for QAHI to provide superior cardiac care to its patients.

The data indicate that prescribing patterns at QAHI may have changed during the study period, driven by improvements in pharmacological research, physician preferences, and patient-specific factors. Modifications in clinical guidelines likely compelled clinicians to embrace novel drugs or modify dose protocols for current meds [9,13]. Revised heart failure treatment protocols highlighting the advantages of Carvedilol may have contributed to its heightened utilization. The increasing tendency towards combination therapy may have influenced the heightened demand for Nebivolol in conjunction with Hydrochlorothiazide.

These findings underscore the dynamic interaction between clinical practice and supply chain logistics. Proactive planning and adaptation are crucial to guarantee the continuous availability of beta blockers. This entails integrating physician feedback into procurement strategies, overseeing guideline revisions, and utilizing data analytics to forecast demand trends. By synchronizing supply chain management with clinical requirements, JRMS and QAHI can augment their ability to address the changing needs of cardiac care.

5. CONCLUSIONS:

The study emphasizes the changing patterns in the distribution of beta blockers to QAHI from JRMS main medical stores. During the four-year period analyzed, notable alterations in the volumes and varieties of beta blockers dispensed were detected, indicating modifications in clinical recommendations and the growing preferences of physicians. These changes highlight the imperative for adaptive inventory management techniques that not only respond to fluctuating demands but also foresee future requirements based on clinical progress and population health trends.

The vital role of beta blockers in cardiovascular treatment underscores the necessity of ensuring their continuous availability. Supply shortages or delays might impede patient care and potentially result in negative health outcomes. The study's findings indicate that JRMS and QAHI should prioritize improved forecasting techniques to better correctly predict demand. This may entail utilizing data analytics and past dispensing trends to optimize procurement and inventory levels in accordance with clinical needs. Furthermore, efficient cooperation between JRMS and QAHI is crucial for tackling potential supply chain difficulties. Consistent communication and collaborative planning sessions can assist in recognizing and alleviating risks such as procurement delays, financial limitations, and logistical constraints. Moreover, formulating contingency plans, including the maintenance of buffer inventories for high-demand drugs such as Carvedilol and Metoprolol, might enhance protection against supply disruptions.

The research underscores the necessity for flexibility in inventory management. With the emergence of new beta blockers exhibiting enhanced efficacy and tolerability, with the changing landscape of treatment guidelines, JRMS and QAHI must be flexible to modify their procurement strategy accordingly. This entails remaining updated on new clinical information and interacting with healthcare providers to comprehend changes in prescribing practices. Ultimately, cultivating a feedback mechanism between clinicians and supply chain managers can improve the system's responsiveness. By incorporating insights from prescribing trends and patient outcomes, JRMS can enhance its inventory procedures to more effectively cater to QAHI's varied and expanding patient demographic. These preemptive steps are crucial for guaranteeing that beta blockers, as a fundamental component of

cardiovascular therapy, remain available to those in need.

Limitations of the Study: The research exclusively utilizes secondary data and fails to consider

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