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ORIGINAL RESEARCH / *ÖZGÜN ARAŞTIRMA*

Analysis of Medication Inventory System for Intensive Care Unit: A Hospital Example

Yoğun Bakım Ünitesi İçin İlaç Envanter Sistemi Analizi: Bir Hastane Örneği

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ABSTRACT

Objective: Optimizing health benefits becomes essential given the limitations of universal healthcare resources. Therefore, this study aims to conduct an always, better, and control (ABC) and vital, essential, and desirable (VED) analysis of medications in the intensive care unit (ICU) of a tertiary care hospital. The primary objective is to enhance medication inventory management and control costs. The research will assess clinical and operational actions, examine research databases, and review published literature to achieve these objectives. Given that drug expenses constitute a significant portion (30-40%) of total medication costs in ICUs, this study will focus on evaluating selective inventory control techniques, including ABC, VED, and ABC-VED matrix analysis.

Materials and Methods: Examining 546 medications in 2020, 634 in 2021, and 662 in 2022, this study collected three years of data to conduct a comprehensive analysis. The applied methodologies included ABC, VED, and ABC-VEN matrix techniques.

Results: In 2020, Category I, comprising AV+AE+AD+BV+CV, had 79 drugs, constituting 74% of the total cost and representing 14% in variety. Category II (BE+CE+BD) included 259 drugs, accounting for 47% of the total cost and 47% of the total drug variety. In comparison, Category III (CD) comprised 208 drugs, representing 38% of the total cost and variety share. In 2021 and 2022, similar patterns were observed within the categories, with varying drug counts and percentages.

Conclusion: Given rising costs and the integration of expensive innovations in critical care, the study highlights the critical role of economic evaluations in the ICU. Implementing robust inventory control measures is crucial for effective medication management in ICUs, contributing to cost-effectiveness and improved resource utilization in healthcare systems.

Keywords: ICU, drug management, inventory management, ABC-VED analysis

ÖZ

Amaç: Bu çalışma, özellikle yoğun bakımda belirgin olan evrensel sağlık hizmetleri kaynak kıtlığı bağlamında, sınırlı kaynaklar dahilinde sağlık faydalarını optimize etme zorluğunu ele almaktadır. İlaç giderlerinin toplam ilaç maliyetlerinin %30-40'ını oluşturduğu üçüncü basamak bir hastanenin yoğun bakım ünitesine (YBÜ) odaklanan bu çalışmanın temel amacı, her zaman, daha iyi ve kontrol (ABC) ve hayati, temel ve arzu edilir (VED) ve ABC-VED matris analizi gibi seçici envanter kontrol tekniklerini değerlendirmektir.

Gereç ve Yöntem: 2020 yılında 546, 2021 yılında 634 ve 2022 yılında 662 ilacın incelendiği bu çalışmada, kapsamlı bir analiz yapmak için üç yıllık veri toplanmıştır. Uygulanan metodolojiler arasında ABC, VED ve ABC-VEN matris teknikleri yer almıştır.

Bulgular: 2020 yılında, AV+AE+AD+BV+CV'den oluşan Kategori I'de toplam maliyetin %74'ünü oluşturan ve çeşitlilik açısından %14'lük bir paya sahip olan 79 ilaç yer almıştır. Kategori II (BE+CE+BD) toplam maliyetin %47'sini oluşturan ve çeşitlilikte %47'lik bir paya sahip 259 ilaç içerirken, Kategori III (CD) toplam maliyetin %38'ini oluşturan ve çeşitlilikte %38'lik bir paya sahip 208 ilaç içermekteydi. 2021 ve 2022'de, ilaç sayıları ve yüzdeleri değişmekle birlikte, kategoriler içinde benzer modeller gözlenmiştir.

Sonuç: Artan maliyetler ve pahalı yeniliklerin kritik bakıma entegrasyonu göz önüne alındığında, bu çalışma YBÜ'de ekonomik değerlendirmelerin kritik rolünü vurgulamaktadır. Sağlam envanter kontrol önlemlerinin uygulanması, YBÜ'lerde etkili ilaç yönetimi için çok önemlidir ve sağlık sistemlerinde genel maliyet etkinliğine ve gelişmiş kaynak kullanımına katkıda bulunur.

Anahtar Kelimeler: YBÜ, ilaç yönetimi, envanter yönetimi, ABC-VED analizi

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Introduction

Intensive care involves a multidisciplinary team providing specialized, focused healthcare services to critically ill patients (1). The intensive care unit (ICU) is a specialized unit within a hospital equipped with advanced technology and a diverse team of experts, providing intensive care, including both invasive and non-invasive monitoring of the patient's physiological indicators for precise care adjustments (2). ICUs are characterized by a combination of unique features, including the severity of patients' clinical conditions, significant variability in length of stay, the potential for rapid deterioration of clinical conditions, a limited number of service beds, and strict policies against stockpiling medications (3).

ICUs are resource-intensive units within the healthcare system. Intensive care services are costly (4,5). ICU care requires intensive resources, including physicians, nurses, medical devices, medical supplies, and medications. In terms of hospital organization, ICUs account for one-third of the total service production costs (6,7). The high expenses associated with ICUs can be attributed to the aging patient population, the need for specialists from various fields, advanced medical devices, and the intensive and frequent use of medications. Patient lengths of stay in the ICU and personnel, medication, and material costs are fundamental factors that affect ICU costs. ICU medication expenses constitute approximately 30-40% of the total drug costs associated with hospital admissions, surpassing medication expenses in other departments (8). Moreover, the increase in medication costs in the ICU is nearly twice that of medication costs outside the ICU (8). Recognizing the significant role of medication usage in increasing overall ICU expenses and in effectively controlling costs is essential. Concerns arise due to factors such as the rising prices of commonly used ICU medications, the dominance of generic manufacturers, drug shortages, and regulatory changes, all of which contribute to the cost increases of ICU medications, constituting a significant portion of hospital drug budgets (9).

Inventory is a comprehensive record of an organization's assets, including items such as stocked goods, medications, and equipment (10). Managing medication inventory focuses on minimizing costs and increasing efficiency while maintaining exceptionally high service standards for each item. Medication inventory management emphasizes cost control and improved operational efficiency. Various inventory management strategies are employed to examine medication expenses. Some standard inventory management methods include always, better, and control (ABC) analysis, HML analysis, vital, essential, and desirable (VED) analysis, FSN analysis, SDE analysis, GOLF analysis, and SOS analysis (11,12). Two frequently used methods are ABC analysis (classifying medications based on budgetary consumption) and VED analysis (12,13). Among these methodologies, the ABC-VED analysis is widely preferred because it enables the evaluation of medication expenses while considering their impact on patient health and costs. The ABC analysis model provides an accurate and impartial depiction of budget distribution for inventory.

In contrast, VED analysis assists in prioritizing medications for supply and use within a medication supply system. Specifically, ABC, VED, and the ABC-VED matrix analysis are crucial for efficient resource allocation and cost-effective medication inventory management in hospitals and other healthcare organizations, balancing quality healthcare delivery and medication expenses. Existing literature contains numerous studies on medication inventory management in hospitals (14,15). Additionally, there are studies specific to ICUs (16).

This study aims to conduct an ABC-VED analysis of medications used in the ICU of a tertiary care hospital at the institutional level to enhance medication inventory management and control these medications to manage the increasing medication costs in the ICU. Additionally, it investigates clinical and operational actions, research databases, and published literature.

Materials And Methods

Compared to the traditional maximum-minimum system, the ABC system offers cost-effective benefits and enhances financial control, ultimately encouraging inventory management efficiency (17). The ABC classification technique, derived from the Pareto principle in inventory management, (18) prioritizes high-value, high-usage items over others. Approximately 20% of inventory items contribute to about 80% of the total sales value; the following 30% contribute to approximately 15%, and the remaining 50% contribute to approximately 5% (19-21).

Healthcare institutions may face budget constraints that hinder their ability to acquire all necessary medications, and VED analysis provides a systematic approach to prioritize medication procurement and inventory maintenance by categorizing medications into vital, essential, and desirable categories based on their importance from a healthcare perspective (22).

An ABC-VED matrix combines ABC and VED analyses to establish a prioritization management system divided into

three categories (I, II, and III). Category I includes AV, AE, AD, BV, and CV sub-items; Category II includes BE, CE, and BD sub-items; and Category III includes the remaining items in the CD sub-category. The first letter in these subcategories represents the classification in the ABC analysis, and the second letter represents the classification in the VED analysis (12,31).

Application

This research is a retrospective cross-sectional study covering the evaluation of medications used in the 37-bed Anesthesia and Internal Medicine ICUs of a 1005-bed university hospital in 2020, 2021, and 2022. The area where the study was conducted, the methods used, and the sources from which data were collected are components of the research that do not require ethical approval. The sample of this single-center quantitative research consists of 662 medications used in the ICU. This list covers all medications used in the Anesthesia and Internal Medicine ICUs generic drugs. Medications used in other ICUs in the hospital (surgical, coronary, pediatric, neonatal) were excluded. Data on the quantity of usage and purchase unit prices of medications used in the ICUs were obtained from the hospital's automation system. A structured data collection format adapted from Management Sciences for Health (MSH), as used by Jobira et al., (14) was used to collect the necessary data for the ABC analysis. A total of 27 vital medications that must be continuously available in intensive care were identified. Medications with a lower level of criticality for ICU patients and can be stocked in the hospital were categorized as essential. Medications with the lowest criticality, whose absence would not adversely affect the health of ICU patients, were categorized as desirable. Assigning a VED status to each medication was verified by the research group through discussion until a consensus was reached among the responsible intensivists. All medications in the ICU medication inventory were categorized into "V", "E", or "D" categories using a judgmental method (12).

Statistical Analysis

The information regarding the yearly consumption and expenses associated with each pharmaceutical item during the fiscal years 2020 to 2022 was gathered. These data were subsequently entered into a Microsoft Excel spreadsheet. Statistical analysis was conducted using the statistical functions available in Microsoft Excel.

For the ABC analysis, the total annual consumption of all medications was determined by multiplying the unit cost by the annual consumption. The obtained values were then ranked in order of monetary value. Subsequently, medications were categorized into A, B, and C groups with shares of 70%, 20%, and 10%, respectively, based on cumulative consumption (14,23).

For the VED analysis, medications were evaluated by the intensive care responsible physicians and categorized accordingly (14,24).

The data obtained from the ABC and VED analyses were organized into a matrix to classify medications types I, II, and III. With this consolidation, Category I includes items from the AV, AE, AD, BV, and CV subcategories; Category II includes items from the BE, CE, and BD subcategories; and Category III includes the remaining items in the CD subcategory (15,25).

ABC Analysis

The distribution of medications used in intensive care units for the years 2020, 2021, and 2022, according to the ABC analysis, is presented in Table 1. In 2020, there were 26 medications in intensive care in the A stock group, constituting 4.76% of the total medications. There were 43 medications in the B stock group, representing 7.88% of the total medications. The C stock group had 477 medications, making up 87.36%. Moving to 2021, there were 35 medications in the A stock group in intensive care units, representing 5.52% of the total medications. There were 53 medications in the B stock group, constituting 8.36% of the total medications. In the C stock group, there were 546 medications, making up 86.12% of the total medications. In 2022, there were 30 medications in the A stock group in intensive care, accounting for 4.53% of the total medications. There were 60 medications in the B stock group, representing 9.06% of the total medications. In the C stock group, there were 572 medications, comprising 86.40% of the total medications.

Regarding expenditures in 2020, A stock group materials accounted for ₺3,203,395.57, B stock group accounted for ₺915,559.60, and C stock group accounted for ₺456,761.41. The total expenditure for that year was ₺4,575,716.58. In 2021, the A stock group's share of total expenditure increased to ₺4,176,166.07, while the B and C groups accounted for ₺1,153,423.77 and ₺581,847.17, respectively. The total expenditure for that year was ₺5,911,437.01. In 2022, A stock group materials, amounted to ₺6,128,067.47, B stock group to ₺1,764,823.62, and C stock group to ₺860,459.70. The total expenditure for 2022 was ₺8,753,350.79.

VED Analysis

According to the VED analysis in Table 2 for the year 2020, when examining the drugs used, there were 62 drugs in the V category, representing 11% of the total drugs and accounting for 16% of the costs. The E category included 252 drugs, constituting 46% of total drugs and representing 57% of the costs. The D category included 232 drugs, constituting 42% of total drugs and accounting for 27% of the costs.

In 2021, there were 59 drugs in the V category, representing 9% of the total drugs and accounting for 15% of the costs. The E category included 303 drugs, constituting 48% of total drugs and representing 58% of the costs. The D category included 272 drugs, constituting 43% of total drugs and accounting for 26% of the costs.

In 2022, there were 68 drugs in the V category, representing 10% of the total drugs and accounting for 16% of the costs. The E category included 311 drugs, constituting 47% of total drugs and representing 58% of the costs. The D category included 283 drugs, constituting 43% of total drugs and accounting for 27% of the costs.

ABC-VED Matrix Analysis

An ABC-VED matrix is formed by merging ABC and VED analyses to develop a prioritized management system into three categories (I, II, and III). Category I comprises AV, AE, AD, BV, and CV; Category II includes BE, CE, and BD. Category III encompasses the remaining items in the CD sub-category (Table 3). The first letter denotes the ABC classification, and the second indicates the VED classification. Based on the data for the year 2020, within Category I (AV+AE+AD+BV+CV),

Table 1. ABC analysis table

Year	Stock group	Item count	Item count percentage (%)	Total expenditure (₺)	Total expenditure percentage (%)
2020	A	26	4.76%	₺3,203,395.57	70.01%
	B	43	7.88%	₺915,559.60	20.01%
	C	477	87.36%	₺456,761.41	9.98%
	Total	546	100.00%	₺4,575,716.58	100.00%
2021	A	35	5.52%	₺4,176,166.07	70.65%
	B	53	8.36%	₺1,153,423.77	19.51%
	C	546	86.12%	₺581,847.17	9.84%
	Total	634	100.00%	₺5,911,437.01	100.00%
2022	A	30	4.53%	₺6,128,067.47	70.01%
	B	60	9.06%	₺1,764,823.62	20.16%
	C	572	86.40%	₺860,459.70	9.83%
	Total	662	100.00%	₺8,753,350.79	100.00%

Table 2. VED analysis table

Year	VED group	Count (number)	Amount (₺)	Count (%)	Amount (%)
2020	V group	62	₺743,205.28	11%	16%
	E group	252	₺2,594,302.34	46%	57%
	D group	232	₺1,238,208.96	42%	27%
	Total	546	₺4,575,716.58	100%	100%
2021	V group	59	₺914,319.77	9%	15%
	E group	303	₺3,433,294.78	48%	58%
	D group	272	₺1,563,822.46	43%	26%
	Total	634	₺5,911,437.01	100%	100%
2022	V group	68	₺1,383,492.49	10%	16%
	E group	311	₺5,039,423.24	47%	58%
	D group	283	₺2,330,435.06	43%	27%
	Total	662	₺8,753,350.79	100%	100%

Table 3. ABC-VED matrix analysis table					
Year	**ABC and VED matrix analysis**	**Count**	**Amount (₺)**	**Variety (%)**	**Cost (%)**
2022	Category I (AV+AE+ AD+BV+CV)	92	₺6,626,027.46	14%	76%
	Category II (BE+CE+BD)	320	₺1,811,117.56	48%	21%
	Category III (CD)	250	₺316,205.77	38%	4%
	Total	662	₺8,753,350.79	100%	100%
2021	Category I (AV+AE+ AD+BV+CV)	85	₺4,516,027.46	13%	76%
	Category II (BE+CE+BD)	311	₺1,097,203.78	49%	19%
	Category III (CD)	238	₺298,205.77	38%	5%
	Total	634	₺5,911,437.01	100%	100%
2020	Category I (AV+AE+ AD+BV+CV)	79	₺3,396,027.46	14%	74%
	Category II (BE+CE+BD)	259	₺953,483.35	47%	21%
	Category III (CD)	208	₺226,205.77	38%	5%
	Total	546	₺4,575,716.58	100%	100%

79 drugs account for 74% of the total cost and represent a 14% share in terms of variety. Category 1 drugs commonly used in the ICU according to their ATC names are albumin, amphotericin B, cefotaxime, and sodium chloride. These medications are essential for managing critical care patients' medical needs. Category II (BE+CE+BD) consists of 259 drugs and represents 47% of the total cost, with a 47% share in terms of variety. Category III (CD) is composed of 208 drugs, each representing 38% of the total cost and a 38% share in terms of variety.

In the data for the year 2021, within Category I (AV+AE+AD+BV+CV), 85 drugs account for 76% of the total cost and represent a 13% share in terms of variety. Category II (BE+CE+BD) consists of 311 drugs and represents 49% of both the total cost and variety. Category III (CD) is composed of 238 drugs, representing 38% of the total cost and 38% of the variety.

According to the data for the year 2022, within Category I (AV+AE+AD+BV+CV), 92 drugs account for 76% of the total cost and represent a 14% share in terms of variety. Category II (BE+CE+BD) consists of 320 drugs and represents 48% of the total cost, with a 48% share in terms of count. Category III (CD) is composed of 250 drugs, representing 38% of the total cost and having a 38% share in terms of variety.

Results

The analysis of the medication inventory system in the ICU, combining ABC, VED, and ABC-VED matrix analyses, highlights critical patterns in drug usage and expenditure from 2020 to 2022. The ABC analysis demonstrates that while the C stock group consistently includes the highest number of medications each year (over 86%), its financial impact remains minimal compared to the A stock group, which, despite having the lowest item count, contributes the highest share of total expenditures. Over the three years, expenditures for A group medications rose significantly from ₺3.2 million in 2020 to ₺6.1 million in 2022, reflecting the high costs associated with essential ICU drugs. This trend underscores the importance of stringent management strategies for high-cost items to optimize resource allocation and reduce financial strain in critical care settings.

The VED analysis further reveals that vital (V) and essential (E) medications dominate the expenditure landscape, emphasizing their crucial role in patient care. The ABC-VED matrix analysis offers a comprehensive view by integrating cost significance and clinical importance, categorizing medications into three priority levels. Category I drugs, including high-cost and critical medications, consistently accounted for over 74% of total costs across all years, highlighting their indispensability in ICU operations. Effective inventory management, particularly for Category I medications, is essential for ensuring cost-efficiency, uninterrupted supply, and enhanced healthcare outcomes in ICUs. This study reinforces the need for continuous monitoring, precise demand forecasting, and strategic procurement practices to manage ICU medication inventories effectively.

Discussion

This research evaluates the inventory management of drugs used in intensive care units through ABC-VED analysis.

Ensuring rapid access to essential resources, including drugs, is crucial for effective healthcare delivery in ICU settings. Conducting ABC or VEN analysis independently has certain limitations. ABC analysis disregards the importance of drugs, while VED analysis overlooks the cost dimension of drugs (26). Therefore, ABC-VEN matrix analysis is essential to harness the advantages of both approaches and identify items requiring strict control (13,27). In healthcare services, using scientifically sound techniques for drug inventory management is imperative to enhance the efficiency and effectiveness of healthcare service delivery (28). Given that limited resources and increasing demand characterize the healthcare environment, healthcare institutions must prioritize the efficient allocation of resources to minimize errors and maximize benefits (15). In a healthcare setting, inventory must be managed to ensure continuity of essential patient care services while achieving optimal inventory levels with minimal working capital utilization (15).

Based on the ABC analysis conducted in the current study, drugs classified as Class A represented 4.76% of the total quantity supplied in 2020, 5.52% in 2021, and 4.53% in 2022. In Class A, the number of item categories has increased each year. Classes B and C seem to have experienced fewer fluctuations in the number of item categories. The total expenditure in 2020 is approximately ₺4.6 million. Despite having less than 10% of the total expenditure, Class C leads in the number and variety of item categories. In 2021 and 2022, the total expenditure amounted to ₺5.9 million and ₺8.7 million, respectively. Class C had more item categories in both years than the other groups (22,16). Although they have limited quantities, the proper management of Class A drugs is essential because their neglect can lead to increased hospital expenditures and, consequently, affect the overall provision of healthcare services (29,15). Class A drugs require stringent monitoring, data-based accurate demand forecasting, strict budget control, minimum safety stock, regular inventory checks, and well-defined regulation and control protocols (14).

Regarding V Group drugs, there were 62 in 2020, 59 in 2021, and 68 in 2022. This indicates that the number of items classified as critical has increased. 13 For E Group items, there were 252 in 2020, 303 in 2021, and 311 in 2022. These data generally show that the number of essential items has increased and is significant for healthcare services. The number of D Group items was 232 in 2020, 272 in 2021, and 283 in 2022. This suggests that the number of desired items remains relatively stable. Focusing on 2022, the number of V Group items has increased, while the number of items in the E and D Groups has remained relatively constant. This indicates an increasing importance of critical items and the need for greater attention to the inventory management of such items. Regarding expenditure percentage, V Group items represented 16% of total expenditures in 2020, 15% in 2021, and 16% in 2022. This emphasizes the significance of these items significance in terms of quantity and cost. E Group items represented 57% of total expenditures in 2020 and 58% in both 2021 and 2022 (12). This accounts for a significant portion of the cost and remains relatively constant. D Group items represented 27% of total expenditures in 2020, 26% in 2021, and 27% in 2022. This group has a lower cost share and a relatively stable share (22).

According to the results of the analysis, it is evident that specific categories are important in drug consumption for the years 2020, 2021, and 2022. Firstly, the drugs within Category I (AV+AE+AD+BV+CV) represented a significant portion of the total cost, accounting for 74%, 76%, and 76% in the respective years (14,29). This category has a high-cost impact and makes up a substantial portion of hospital drug expenditures, while having a lower share in terms of variety, with percentages of 14%, 13%, and 14% noted for specific sub-categories (22,16). This highlights the need for intensive care unit managers to monitor these drugs and continually review them for cost-effectiveness.

Category II (BE+CE+BD) is more significant and notable in cost and variety than other categories. This category represented 47%, 49%, and 48% of the total cost in 2020, 2021, and 2022, respectively. It also had a share of 47%, 49%, and 48% in variety during these years. This reflects the diversity of hospital inventory and suggests that drug costs are distributed more evenly. These drugs play a significant role in the daily operation of the hospital (30).

Category III (CD) has a more balanced structure in terms of cost and variety. It represents 5% of the total cost in all three years and has a 38% share in terms of variety. These drugs can be supplied annually or semi-annually, reducing order costs, maintaining a reasonable holding cost, and preventing the blocking of a significant amount of capital (24).

Moreover, the evolving significance of specific drug categories over the years underscores the importance of closely monitoring consumption patterns and expenditure distribution. Category I drugs consistently contribute a substantial portion of total costs, highlighting the need for intensive care unit managers to continually review these drugs for cost-effectiveness. Category II drugs play a significant role in daily hospital operations, reflecting the diversity of hospital

inventory. In contrast, Category III drugs exhibit a more balanced structure in terms of cost and variety, allowing for efficient supply management.

In conclusion, the comprehensive analysis conducted in this study emphasizes the critical role of ABC-VED analysis in optimizing drug inventory management within ICU settings. By closely monitoring consumption patterns and expenditure distribution, healthcare institutions can make informed decisions to enhance resource utilization, ensuring the continuity of essential patient care services while maximizing cost-effectiveness.

Conclusion

In conclusion, this study underscores the importance of conducting an ABC-VED analysis of drugs in ICUs. The implementation of ABC-VED analysis has provided valuable insights into medication consumption patterns and expenditure distribution, highlighting critical areas for effective inventory management.

Category I drugs (AV, AE, AD, BV, CV) have emerged as significant contributors to total medication costs across all three years despite representing a limited variety. These drugs' meticulous monitoring and continual assessment are essential for achieving cost-effectiveness and optimal resource allocation within the ICU.

Category II drugs (BE, CE, BD) exhibit a notable presence in terms of both cost and variety, reflecting the diverse inventory requirements of the hospital. Careful management of these drugs is necessary to ensure efficient utilization of resources.

Category III drugs (CD) demonstrate a more balanced structure in terms of cost and variety, which is crucial in maintaining adequate inventory levels while minimizing costs.

In conclusion, the findings emphasize the importance of adopting comprehensive inventory management strategies, such as ABC-VED analysis, to optimize medication inventory management and control costs effectively in ICU settings. By closely monitoring medication consumption patterns and expenditure distribution, healthcare institutions can make informed decisions to enhance resource utilization and ensure the continuity of essential patient care services while maximizing cost-effectiveness.

Furthermore, sharing inventory classification and analysis results with pharmacy managers has influenced decisions regarding the intensive care unit's procurement, storage, and continuous monitoring of inventory items. This research is a valuable tool for healthcare institutions seeking to optimize their drug inventory management, streamline operations, and allocate resources efficiently in the ever-evolving healthcare landscape.

Ethics

Ethics Committee Approval: The area where the study was conducted, the methods used, and the sources from which data were collected are components of the research that do not require ethical approval.

Informed Consent: The sample of this single-center quantitative research consists of 662 medications used in the ICU.

Footnotes

Authorship Contributions

Surgical and Medical Practices: A.D., A.N.G., Concept: A.D., A.N.G., Design: A.D., Ö.Ö., A.N.G., Data Collection or Processing: A.D., Ö.Ö., Analysis or Interpretation: A.D., Ö.Ö., A.N.G., Literature Search: A.D., Ö.Ö., Writing: A.D., A.N.G.

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