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A Benchmark of Supply Management Models for Pharmaceutical Products from Pharmacies in Public and Private Hospital Structures

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ABSTRACT

Introduction: The objective of this work is to study a certain number of criteria to meet the expectations of healthcare services seeking to improve the availability of pharmaceutical products.
Methods: Regarding the data collection method, we conducted a survey. The latter was intended for healthcare services. The questionnaire was validated by a team of hospital pharmacists and managers.
To develop our questionnaire, we used the Sphinx tool, and for the quantitative data, we processed it on a computer using SPSS software.
Results: The internal pharmacy management models of the two hospitals represent several differences but also several similarities. Two major differences can be noted, the first one is the supply model that is based on annual markets for AMSS hospitals versus negotiated and just-in-time purchases for private hospitals. The second one is the hospital central pharmacy healthcare service procurement model.
Conclusion: Following the multiple changes currently affecting the health care sector, hospital structures must optimize their management to reduce expenses while guaranteeing the safety and quality of care administered to patients.

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INTRODUCTION

Based on High Royal Instructions, the Kingdom of Morocco has drawn up a national health plan aimed at ensuring the autonomy and sovereignty of its national health system, especially with regard to certain pharmaceutical products and strategic services. Among other things, the plan aims to consolidate the healthcare system in general and hospital structures in particular (1).

The organization and development of hospital pharmacy is a major concern for hospitals. The overriding objective is to ensure the availability and accessibility of quality healthcare products within a general framework of good use (2, 3).

The pharmaceutical supply chain must make it possible to provide patients as efficiently as possible with the pharmaceutical products that will be administered to them, under conditions guaranteeing safety and traceability while respecting the numerous regulations surrounding pharmaceutical products and their dispensation (4).

In hospitals, whether public or private, the pharmaceutical product circuit covers two distinct but closely interconnected circuits: on the one hand the logistics circuit, that is to say the entire material process which goes from the purchase of health products to their provision for patients, and on the other hand the clinical circuit which is that of drug treatment for a hospitalized patient (5-7).

Medicines and medical devices are essential for proper patient care. The budget allocated to the purchase of these products represents a significant proportion of the budget of the Ministry of Health and healthcare facilities. The management of pharmaceutical products must therefore meet strict imperatives in order to make the best use of these increasingly scarce resources (8-10).

The efficiency of the pharmaceutical supply chain and logistics in the healthcare sector is essential to guarantee the availability, quality and safety of pharmaceutical products for patients. This encompasses several crucial aspects, such as inventory management and procurement, since optimized management avoids stock-outs and reduces overstocking costs, ensuring the timely availability of pharmaceutical products. Complete pharmaceutical product traceability, from manufacture to distribution, is also an important factor that reinforce health vigilance and facilitate the recall of defective products. We cite also quality control and transport conditions that guarantee appropriate storage and transport conditions, particularly for sensitive pharmaceutical products such as vaccines, which preserve their efficacy and safety. Another aspect to mention is cost optimization that reduce costs linked to management errors and delays, making pharmaceutical products more accessible while maintaining their quality. Furthermore, technology and digitalization using digital systems such as ERP (Enterprise Resource Planning) and traceability platforms to improve inventory management allow reducing human error and speed up distribution, without forgetting risk management and resilience that give the systems the ability to respond rapidly to crises, such as shortages or pandemics, which is essential to maintaining the continuity of healthcare services.

Finally, two other aspects are also very important in pharmaceutical supply chain and logistics efficiency, namely regulatory compliance by respecting local and international standards for the safety and distribution of pharmaceutical products, and collaboration with players in the value chain that implies smooth cooperation between manufacturers, distributors, pharmacies and hospitals, which is essential to respond rapidly to patients' needs (11-13).

METHOD

We used a questionnaire survey for the data collection method. The latter was intended for hospital care services (AMSS and private hospital); the questionnaire was validated by a team of hospital pharmacists and managers.

AMSS

AMSS hospitals (Autonomously Managed State Services) are public hospitals that have a certain financial autonomy which facilitates their management autonomy, but they do not have legal personality. They are subject to the subordination of the health administration (14).

Private hospital

A private hospital is a health establishment, which brings together a very large number of skills, enabling it to provide patients with a comprehensive and multidisciplinary management and continuity of care (15).

To design our questionnaire, we based ourselves on the theoretical part, which enabled us to identify the nature of the questions and their content, while respecting certain rules of simplicity and clarity.
The questionnaire consists of 3 items, namely:

Placing orders (2 questions)
Delivery conditions (8 questions)
General opinion concerning the service (8 questions).

The entire questionnaire contains 18 questions divided as follows:
4: Single closed.
1: Multiple closed.
11: Close-ended ladder questions.
2: Texts.

Technical information

To develop our questionnaire, we used the Sphinx tool "Plus²" version because it allowed us to deal with all types of open "text" and closed "single, multiple, and scale" questions (16).
For the quantitative data, we processed it on computer support using SPSS software 13.0 (Statistical Package for the Social Sciences) in all stages of analysis of the results (17).

Regarding the method of collecting information, we chose the face-to-face method to assist respondents and ensure the relevance of the results.

The survey is a retrospective study, and the methodology adopted is based on a description of the sample studied. The results were expressed in numbers and percentages. The χ^2 test was used to search for possible associations, and a significance threshold was set a priori at 5% ($p<0,05$) (18).

Ethical Approval

This study was conducted in accordance with applicable ethical research principles, including maintaining data confidentiality and participant anonymity. All participants who responded to our validated questionnaire gave their consent to participate in our study. There were no direct intervention procedures involving human subjects, and all data were analyzed in aggregate for research purposes. The researchers ensured that this study did not violate the rights of research subjects.

RESULTS

The sample of our study consisted of 79 hospital departments, 52 of which were consulted at the AMSS "military hospital" level vs. 27 at the "Cheikh Zaïd" private hospital. The hospital services interviewed were services dedicated to hospitalization in medicine and surgery. The survey carried out allowed us to establish comparisons between the different pharmaceutical product management models.

Table 1. Summary of the statistics results of the survey

	State Services Managed Autonomously	**Private hospital**	**P-value**	**P-value**
Average order placement frequency	30.80%	74.10%	0.018	p<0,05
Order tracking	82.70%	77.80%	0.924	p>0,05
Respect of replenishment deadlines	40.40%	48.10%	0.865	p>0,05
Average time between order and receipt	36.50%	59.30%	<0.001	<0.001
Desired time between order and receipt	25.00%	66.70%	0.002	p<0,05
Stoppage of service activity due to supply delay	57.70%	51.90%	0.48	p>0,05
Product replenishment if necessary	32.70%	44.40%	0.358	p>0,05
Compliance of products ordered from the pharmacy	40.40%	59.30%	0.006	p<0,01

	State Services Managed Autonomously	Private hospital	P-value	P-value
Criterion of order conformity	82.70%	88.90%	0.5	p>0,05
Satisfaction with the service provided by the hospital pharmacy	48.10%	77.80%	0.938	p>0,05
Displacement to the pharmacy to solve problems	44.20%	44.40%	0.24	p>0,05

Concerning the comparison between the two hospital structures in relation to the results of the management indicators, delivery is done on a daily (74%) and individual basis for the Cheikh Zaïd hospital. Healthcare services order several times a day and by name for patients. For the military hospital, the healthcare services order for all patients hospitalized in the services to cover weekly (31%) and biweekly (27%) consumption. The difference between the two control modes is statistically significant (p=*0.018)*,

For the monitoring of orders by the healthcare services in the two hospital structures, monitoring is carried out in the same way and at the same frequency. Monitoring is still carried out in 83% for the services of the military hospital and 78% for the services of the Cheikh Zaïd hospital. The difference is not statistically significant (p=*0.924)*.

Compliance with replenishment deadlines is often achieved in 48% of cases for the care services of the Cheikh Zaïd hospital versus 39% of cases for the care services of the military hospital. The deadline is always respected in 21% of cases for the military hospital compared to 15% of cases for the healthcare services of the Cheikh Zaïd hospital. However, compliance with replenishment deadlines is achieved only in 40% of cases for the military hospital services compared to 37% of cases for the Cheikh Zaïd hospital services. The difference is statistically insignificant (p=*0.865)*,

There is however significant difference in the average time between ordering and receiving medications by healthcare services (p<*0.001)*. The healthcare services at Cheikh Zaïd Hospital receive medications between 1 and 4 hours after the order is placed in 59% of cases compared to 25% for the healthcare services at the military hospital. However, orders are received between 48 and 96 hours in 37% of cases for the military hospital services compared to 7% for the healthcare services of the Cheikh Zaïd hospital.

Regarding the desired time for receipt of medications by the healthcare services, those at Cheikh Zaïd Hospital expressed the wish to receive medications in less than 2 hours in 67% of cases compared to 25% for the military hospital. However, this delay ranges between 6 and 12 hours in 23% of cases for the military hospital services compared to 7% for the Cheikh Zaïd hospital (*p=0.002*).

The delay in pharmaceutical products' supply does not stop the activity of healthcare services in 58% of situations for the military hospital compared to 48% for the Cheikh Zaïd hospital (p=*0.480)*. The latter's services see activity stop in 52% of cases when medications are not available in the hospital pharmacy.

The replenishment of orders is often done in 44% of cases for the healthcare services of the Cheikh Zaïd hospital compared to 33% for the services of the military hospital. On the other hand, replenishment is still done in 33% of cases for the military hospital services compared to 22% of cases for the Cheikh Zaïd hospital services. The difference is not statistically significant between the two hospitals (p=*0.358)*.

Concerning the compliance of the order with the request of the care services, the difference is significant for both hospital structures *(p=0.006)*. Compliance of orders with demand was always standing at 30% for Sheikh Zaid Hospital versus 15% for the Military Hospital, and often around 59% for Cheikh Zaïd Hospital versus 37% for the Military Hospital, and rarely around 40% for Cheikh Zaïd Hospital versus 7% for the Cheikh Zaïd Hospital. The criteria adopted to establish conformity of orders to deliveries did not differ between the two structures *(p=0.500)*, and were based on both qualitative and quantitative criteria.

The care departments of both the military and Cheikh Zaïd hospitals were fairly satisfied with the service provided by the hospital's central pharmacy (48% and 78% respectively). The difference was not statistically significant between the two structures (p=*0.938)*.

DISCUSSION

The in-house pharmacy management models of the two hospitals have a number of differences, but also a number of similarities. Two major differences can be noted, the first being the procurement model, which is based on

annual contracts for the Military Hospital versus negotiated purchases / just-in-time purchases for the Cheikh Zaïd Hospital. The second difference is the supply model for care departments where for the military hospital, departments request the majority of products on a bi-weekly and weekly basis. These departments store the medicines at their level and dispense them to patients during their hospital stay. However, at the Cheikh Zaïd Hospital HCZ, the departments request medicines on a daily basis for each patient. What's more, apart from the emergency carts available in all wards, the wards do not hold the large quantities of pharmaceutical products needed to provide care for their patients (19, 20).

These two major differences gave rise to some significant and some non-significant differences in the survey results (21).

Public hospitals' annual contracts have a direct impact on patient care, as they define resources, healthcare priorities, performance targets and patient flow management procedures. Effective management of these contracts can lead to improved quality of care and efficiency of services, while excessive cost pressure or insufficient funding can compromise the quality of patient care, especially in contexts of high demand. It is therefore essential that these contracts are well-balanced to meet patients' needs, while guaranteeing the sustainability and efficiency of public hospitals (22).

Annual contracts for public hospitals also have major implications for profitability and operational resilience. On the one hand, these contracts influence financial management, by encouraging better cost control and linking funding to performance, which can improve profitability while guaranteeing quality patient care. On the other hand, they strengthen the resilience of facilities by setting targets for crisis management, resource adaptability and infrastructure investment. If properly structured, these contracts enable public hospitals to operate efficiently, while being able to respond to unforeseen challenges at the same time. If properly structured, these contracts enable public hospitals to operate efficiently and respond to unforeseen challenges while maintaining a high level of service (23).

On the other hand, just-in-time procurement in private clinics offers advantages in terms of profitability, notably through reduced storage costs and optimized inventory management. However, this method requires rigorous management of demand forecasts, solid relationships with suppliers and constant monitoring of the supply chain. Its impact on patient care depends on the clinic's ability to maintain the availability of essential products while minimizing the risk of stock-outs. Finally, the operational resilience of private clinics in this model can be tested in the event of major disruptions, requiring proactive planning and robust risk management strategies to mitigate negative impacts (24).

The significant differences were mainly linked to deliveries made to the care departments from the central pharmacy, the time taken by the care departments to receive the order, the time required by the departments to receive the pharmaceutical products, and the conformity of the order to the needs expressed by the care departments (25, 26).

With regard to deliveries of pharmaceutical products from the central pharmacy to the care departments, it was explained that the pharmacy at Cheikh Zaïd Hospital makes several deliveries a day to the care departments, as the departments place daily and nominative orders. The hospital's information system is based on nominative invoicing of drug and medical device consumption, a task performed by the hospital's pharmacy staff. In contrast to this management system, the military hospital orders fairly large quantities on a weekly basis for the care of its in-patients. It should also be noted that this mode of management is strongly affected by the way pharmaceutical products are selected, which differs between the two structures. The military hospital bases its selection on a predefined nomenclature, whereas the therapeutic booklet drawn up by the Cheikh Zaïd Hospital contains a much broader nomenclature that changes on an ongoing basis (27, 28).

The same applies to the actual delivery times and the times requested by the departments. The fact that the care departments at the Cheikh Zaïd Hospital do not have large quantities of pharmaceutical products at their disposal encourages them to order and insist on rapid deliveries for patient care. The case is different for the care departments of the military hospital, which have the necessary pharmaceutical products at their disposal and can therefore tolerate a little more time to receive these products (29).

With regard to the compliance of deliveries with orders, it appears that orders delivered by the central pharmacy of the Cheikh Zaïd Hospital are more compliant than those delivered by the central pharmacy of the military hospital, mainly in relation to the number of references available and in relation to the method of procurement of pharmaceutical products (procurement by annual calls for tender in accordance with the regulations in force for the Mohamed V Military Hospital requiring a series of steps, versus direct purchases for the Cheikh Zaïd Hospital) (30).

In comparison with similar studies, the compliance of pharmaceutical products ordered from the hospital pharmacy is globally satisfactory when the supply of services is ensured according to an allocation, on average every two days, via a system of mobile cabinets (31-33).

In addition, the monitoring of orders by care departments, compliance with department resupply deadlines by the central pharmacy, the impact of stock-outs on the activity of care departments, the replenishment of quantities ordered by departments, and the management methods introduced by the hospital structures generally show comparable results between the two structures studied.

International supply chain disruptions, such as global pharmaceutical shortages and pandemics, have a significant impact on the procurement strategies of hospitals in Morocco. They lead to supply difficulties, cost increases, and operational disruptions that affect the quality of care and profitability of healthcare facilities. To mitigate these effects, it is crucial to adopt resilient supply strategies, such as diversifying sources of supply, strengthening local production, and integrating technology for inventory and risk management (34).

The hospital supply chain presents subtleties related to the diversity of products and services involved, stringent quality and compliance requirements, risk management, and the impact of new technologies. Challenges lie in coordination between players, cost optimization, crisis resilience, and critical inventory management. To improve the efficiency of this chain, hospitals must invest in supply chain management technologies, diversify their sources of supply, and develop a greater capacity to respond to health crises (35, 36).

Morocco and some regions of Africa face similar healthcare infrastructure challenges, sharing many of the same challenges in managing their pharmaceutical supply chains. These include shortages of pharmaceutical products, logistical difficulties, and dependence on imports (37). However, Morocco stands out for the gradual digitization of its inventory management systems and efforts to stimulate local production. Nevertheless, common challenges remain, particularly in terms of inventory management and resilience in times of crisis. It is essential that Morocco and other similar countries continue to strengthen collaboration between public and private players and invest in local solutions to make the pharmaceutical supply chain more sustainable and resilient.

The regulatory influences on hospital supply chains are vast, and have profound implications for inventory management, quality of care, and hospital profitability. Hospitals must navigate a complex environment of standards and regulations to ensure that pharmaceutical products are available safely, efficiently, and in the best conditions for patients. However, these regulations also present challenges, particularly in terms of flexibility, cost and responsiveness to external disruptions. Hospitals must therefore constantly adapt their procurement strategies to remain compliant with regulations, while optimizing their operations (38).

Economic and macro-economic factors exert constant pressure on hospital supply chains, affecting inventory management, purchasing strategy and continuity of care. Inflation, exchange rate fluctuations, economic growth, and increased demand for healthcare require continuous adjustments in hospital supply models. Hospitals must navigate this economic landscape by adopting flexible and innovative strategies to guarantee access to care while controlling costs (39).

Technological advances are radically transforming hospital supply chains, improving inventory management, traceability, needs forecasting, product safety and process efficiency. By enabling more proactive, faster and more transparent management, these systems help to guarantee continuity of care, reduce costs and improve the quality of medical services. To maximize the benefits of these technologies, hospitals need to invest in appropriate infrastructures, staff training, and the integration of these systems throughout the supply chain (40).

Policy interventions in healthcare supply chain management are essential to ensure the availability, quality and sustainability of care. They require a holistic approach, combining centralized purchasing, inventory management, technological innovation, crisis resilience and compliance with environmental and quality standards. However, their effective implementation relies on good coordination between public and private players, as well as investment in training and logistics infrastructure (41).

Recommendations

In light of the discussion of the results of our study, which aims to contribute to the optimization of the pharmaceutical supply chain, we propose a number of recommendations for improving the logistics management of healthcare products. These proposals for improvement, drawn up in consultation with a team of pharmacists, do not

claim to solve all the problems, but we feel that their application would enable improvements to be made at organizational level.

The recommendations for private clinics and public hospitals are all aimed at improving efficiency, cost-effectiveness and continuity of care by optimizing supply chain management. Although private clinics generally benefit from greater flexibility in their processes, they still need to adopt modern practices to ensure efficiency. Public hospitals, on the other hand, have to overcome the challenges of limited resources and bureaucratic processes, but can take advantage of pooled procurement solutions and technological innovations to better manage their supply chain.

In addition, encouraging local production of pharmaceutical products through public-private partnerships would provide a long-term competitive advantage to strengthen the resilience of the supply chain.

For better inventory management, we recommend the application of two theories: Lean Supply Chain and the Bullwhip Effect. Applying these concepts in the healthcare sector would enable better inventory management, cost reduction and improved continuity of patient care, while guaranteeing optimum responsiveness to fluctuations in demand.

The Lean Supply Chain theory is based on the idea of reducing waste and optimizing process efficiency throughout the supply chain. In the pharmaceutical context, this includes pharmaceutical supply management, inventory management, and the distribution of products to healthcare facilities. The Lean Supply Chain aims to:

Reducing waste: Lean supply chains seek to eliminate waste in various forms, such as excess inventory, unnecessary waiting times, processing errors and unnecessary product movements.

Inventory optimization: By applying lean principles, pharmaceutical companies aim to keep inventories to a minimum, thereby reducing inventory management costs and the risk of pharmaceutical products expiring. It also frees up resources for other needs.

Pull System: In a lean supply chain, procurement is based on a "pull" system, where production and delivery are adjusted according to actual demand. This avoids overproduction and excess inventory, a principle particularly relevant to pharmaceutical logistics, where pharmaceutical products need to be available in sufficient quantities, but also avoid losses due to expiry.

Reducing cycle times: The aim is to reduce cycle times, ensuring that pharmaceutical products are delivered to hospitals and pharmacies with a high degree of responsiveness, thus minimizing the risk of stock-outs. Reducing supply lead times can improve patient satisfaction by ensuring continuity of care (42, 43).

The Bullwhip Effect theory refers to the amplified variation in demand in the supply chain as one moves away from the point of consumption (the end customer). This means that small fluctuations in consumer demand can lead to large fluctuations in orders placed with suppliers, creating excess inventory or stock-outs.

Causes of the Bullwhip Effect: In pharmaceutical logistics, the bullwhip effect can be particularly problematic due to uncertain demand and long lead times for certain pharmaceutical products. The main causes of the Bullwhip Effect include: 1) Inaccurate forecasts: When demand forecasts are poorly made, they lead to over- or under-ordering. 2) Batch ordering policies: Ordering in large quantities to obtain price reductions can cause variations in orders. 3) Replenishment lead times: Long lead times between order and delivery can lead to an overestimation of demand, creating peaks in orders.

Ineffective communication: A lack of real-time information between supply chain players amplifies forecasting.

Consequences of the Bullwhip Effect on pharmaceutical logistics: 1) Stock-outs: Hospitals and pharmacies may run out of pharmaceutical products, adversely affecting care. 2) Additional costs: Managing excess inventory to meet anticipated demand can lead to unnecessary costs (storage, perishability of pharmaceutical products). 3) Supply chain disruption: The Bullwhip Effect can make the supply chain less responsive and more vulnerable to crises (e.g. pandemics or outbreaks).

Measures to mitigate the Bullwhip Effect: Theories to mitigate the Bullwhip Effect in pharmaceutical logistics include: 1) Improving communication and information sharing: Using information technology to monitor demand in real time and adjust orders. 2) Reduced replenishment lead times: Improving logistics efficiency to reduce the time between order and delivery of pharmaceutical products. 3) Collaborative forecasting: The various links in the supply chain need to work together to finetune forecasts and reduce over-reactions to variations in demand (44).

A number of recommendations and suggestions for improvement can also be made, focusing on the following areas: 1) Inventory management based on actual demand: Use accurate forecasts and just-in-time systems to avoid stock-outs and surpluses. 2) Optimize supplier relations: Develop strategic partnerships and diversify suppliers to ensure continuity of supply and optimize related costs. 3) Improve inventory visibility and traceability: Use digital inventory management systems such as ERP systems and collaborative platforms to manage inventory more accurately and avoid errors. 4) Reduced replenishment lead times: Optimize distribution logistics and reduce order lead times to better respond to variations in demand. 6) Proactive risk management: Identify vulnerabilities and develop continuity plans to cope with crises or disruptions in the supply chain. 7) Cold chain management: Ensure continuous temperature monitoring and use specialized packaging and enclosures for heat-sensitive products. 8) Ongoing staff training: Regularly train staff in inventory management, pharmaceutical product safety and good distribution practices. 9) Transport optimization: Choose the right modes of transport and favor collaborative transport to reduce costs and improve distribution efficiency (45).

Limitations

At the end of our study, it is worth pointing out certain limitations we faced in carrying out our research, and which other future work should anticipate in order to provide more information on the theme addressed, starting with the confidentiality of data from the various hospitals involved in this study, as well as the complexity of the field of intervention (concerning hundreds of pharmaceutical products).

Also, given that the data are declarative on the part of the participants, the answers obtained are sometimes subjective, as they depend on the degree of understanding of the various questionnaire items. Indeed, the use of a retrospective survey method introduces a recall bias, as the study does not sufficiently take into account potential biases related to respondents' perception of purchasing effectiveness.

Similarly, due to the authorization required from hospital management to administer questionnaires in other hospitals, we were unable to target a large sample. As a result, we opted for one public and one private hospital, as public hospitals operate on a broadly comparable basis, and the same applies to private clinics. Nonetheless, this remains one of the main methodological limitations of our study, due to its use of a questionnaire survey of only two hospital structures, which limits the generalizability of the results.

In addition, the unbalanced distribution of the sample of departments is justified by the larger number of care departments in public hospitals compared with private clinics.

Finally, the statistical approach we have adopted is straightforward, using descriptive statistics and chi-square tests, but does not explore more advanced analytical techniques likely to strengthen causal interpretations. The integration of qualitative interviews or case studies could have shed more light on the subtleties of hospital supply chain challenges.

CONCLUSION

The healthcare sector is currently undergoing constant transformation to adapt to a complex and changing environment. The hospital service environment has experienced multiple changes in recent years: growth in health spending, aging of the population, integration of increasingly sophisticated and increasingly expensive technologies, and other changes (46, 47). In such a context, hospital structures must optimize their management to reduce their expenses while guaranteeing quality and safety of care for the patient. It is therefore interesting to identify the most important cost items to estimate possible gains (48).

Inefficiencies in the pharmaceutical supply chain undermine the availability of pharmaceutical products, impacting on the quality of care, incurring additional costs and affecting patient confidence. Inefficiencies in the pharmaceutical supply chain can lead to stock-outs and delays in treatment, undermining patient compliance and worsening health outcomes. To improve this situation, it is essential to optimize inventory management, strengthen the reliability of the supply chain and ensure continuity of care (49).

These inefficiencies also affect hospital performance, increasing operational costs, disrupting workflows, and compromising quality of care. To improve performance, hospitals need to invest in efficient logistics management, better coordination of chain actors and the use of inventory management technologies (50).

Improving hospital supply chain management requires a combined approach between public policy and managerial management. Public policy can create a favorable framework for innovation, standardization, and inter-

hospital collaboration, while managerial practices focused on efficiency, communication and agility can optimize logistics operations and ensure optimal patient care (51).

The goal of the study was to meet the expectations of healthcare services seeking to improve the availability of pharmaceutical products. The objective was not limited to making an observation concerning the availability or not of these products but aimed mainly at the management process in the public and private sector, in order to identify the elements which, have a negative influence on the availability of these products.

AUTHORS' CONTRIBUTION STATEMENT

The work reported was significantly enhanced by the contributions of all authors, who took part in the drafting, revising, or critical review of the article, and approved the final version of the manuscript.

CONFLICTS OF INTEREST

The authors declare no conflict of interest associated with this research.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The authors declare that they did not use Generative AI or AI-Assisted Technologies during the writing of this manuscript.

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