

Insights into Factors Influencing Pharmaceutical Tender Outcomes in Vietnamese Hospitals: Laying the Groundwork for Drug Management Efficiency Indices

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ABSTRACT

Background: Pharmaceutical tendering in hospitals is a crucial mechanism to ensure effective drug procurement and cost optimization. Despite recent reforms, tender outcomes remain significantly influenced by factors such as registered prices, the number of bidders, and bid values.

Objectives: This study aims to analyze the factors affecting pharmaceutical tender outcomes and provide a foundation for developing indices to evaluate the effectiveness of drug management in hospitals.

Methods: Data were collected from 646 tender records and 252 awarded contracts in Vietnam. Pearson correlation analysis and multivariate regression were employed to explore the relationships between registered prices, the number of bidders, bid values, and tender outcomes.

Results: The registered price was found to be the most significant determinant of bid and awarded prices across all drug groups. Higher-quality groups, such as Group 1 (European drugs) and Group 2, exhibited minimal price reductions, while Group 4 (domestic drugs) and Group 5 (other criteria drugs) showed higher levels of competition, with bid prices reduced by up to 22% from registered prices.

Conclusion: The findings serve as a basis for developing indices to evaluate drug management effectiveness in terms of economic efficiency and competitiveness. These indices can support policymakers in optimizing tendering policies and drug procurement management in hospitals.

Keywords: Pharmaceutical tendering, registered prices, drug management, economic efficiency

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1. Introduction

Pharmaceutical procurement is a cornerstone of healthcare policy, particularly in developing countries like Vietnam, where ensuring the availability of essential medicines depends on efficient resource allocation. Over recent years, Vietnam has implemented centralized procurement and national price negotiations to enhance drug availability and mitigate procurement inefficiencies [12,24]. However, despite these reforms, the tendering process remains complex and unpredictable, with varying outcomes influenced by factors such as the number of bidders, registered drug prices, and

procurement volumes. These challenges are not unique to Vietnam but are shared by many countries in the Asia-Pacific region, which struggle to manage pharmaceutical supply chains in an increasingly regulated market [13,21,27].

To streamline procurement and ensure transparency, Vietnam follows a structured regulatory framework that categorizes drugs into distinct groups for bidding. According to regulatory documents issued by the Ministry of Health, drugs are classified into five quality groups based on their origin, manufacturing standards, and certification. Group 1: European drugs;

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Group 2: European quality standards but produced in developing countries; Group 3: Equivalent standards (e.g., WHO-GMP) but produced outside EU/US; Group 4: Domestically produced drugs; Group 5: Other criteria drugs. These groups are designed to promote fair competition and prioritize essential drugs while supporting local manufacturing efforts.

These regulatory classifications, along with price-setting mechanisms implemented by the Drug Administration of Vietnam (DAV), are pivotal in shaping the procurement landscape. Yet, despite these regulations, significant variability remains in the tender outcomes, as the number of bidders, the registered prices, and procurement volumes can greatly influence the success of tenders. These regulatory frameworks are in place to ensure fair competition and equitable access to essential medicines, but the practical execution of these policies still faces challenges in terms of efficiency and cost control.

The pharmaceutical procurement process is inherently multi-faceted, involving several stages and criteria. On a global scale, research in other countries mirrors some of the challenges found in Kenya. For instance, in China, one study examined the impact of centralized drug procurement policies, finding that while such policies increased sales volume for pharmaceutical companies, they also resulted in short-term financial losses due to price reductions [27]. In the Philippines, a study identified inadequate procurement planning, geographical challenges, and a shift toward alternative procurement methods as major factors driving higher drug prices in national hospitals [4]. Similarly, a study on pharmaceutical procurement strategies identified procurement interventions, supplier relationships, pricing methods, and organizational structure as key elements influencing pharmaceutical procurement efficiency [6]. Other global research has pointed out significant statistical relationships between procurement management, drug quality, and supplier oversight [7], and the difficulties in procuring essential drugs in rural health centers due to inadequate funding and staff shortages [1]. These studies collectively show that issues such as funding, human resource shortages, legal constraints, and policy frameworks are critical factors influencing drug procurement in both developed and developing countries. Further research on factors influencing patient satisfaction with outpatient pharmaceutical services [23], human resources' impact on supply chain management [20], and socio-economic

factors affecting drug consumption [11], as well as electronic procurement behavior [8], contribute to a broad understanding of the complexities involved in pharmaceutical procurement across various contexts.

Other relevant findings include the positive correlation between the number of competitors in tendering processes and cost savings in drug procurement [21], the impact of electronic bidding on drug price stability [10], and the identification of key variables affecting the efficiency of procurement processes in public hospitals [19]. Furthermore, studies have explored customer decision-making in drug purchases, with therapeutic effects being the most influential factor [22], and the importance of monitoring, IT infrastructure, and human capital in ensuring supply chain efficiency [5]. Recent studies have also examined policy effects on drug usage and market competition [13], and how procurement planning and supplier selection influence the availability of essential medicines in public healthcare facilities [14].

While existing studies have primarily focused on price effectiveness or drug quality in pharmaceutical tendering, there is a lack of systematic approaches to evaluate the effectiveness of drug management through tender outcomes. Addressing this gap, this study aims to analyze the factors influencing pharmaceutical tender results in Vietnamese hospitals and establish a foundation for developing drug management effectiveness indices. These indices will be designed to assess economic efficiency, competitiveness, and support the optimization of hospital drug procurement policies.

2. Methodology

This study employs a quantitative research design to analyze the pharmaceutical procurement tenders conducted in Vietnam in 2016. The primary objective is to assess the influence of registered drug prices, the number of bidders, and the value of submitted bids on tender outcomes. Data was collected from official tender documents provided by healthcare facilities and DAV.

2.1. Data collection

The dataset for this study was drawn from:

- 162 tender dossiers from 72 healthcare facilities across 37 provinces, including both public hospitals and specialized medical institutions, covering the years 2014 to 2016.

- 107 financial statements submitted as part of the tender applications by bidders for generic drug packages during the same period.

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-Summary data on bidder rankings and the final contractor selection results from 2016, specifically from a Military Hospital.

In total, the dataset comprises 646 bid submissions and 252 awards from tenders for essential medicines. The variables collected include:

- Registered price of each drug as determined by DAV.
- Number of tenders received for each procurement.
- Bid value submitted by each participating bidder.

Final awarded prices for each successful bid. Additional variables include bidder experience, revenue, and number of past contracts to assess their potential influence on tender outcomes.

2.2. Analytical approach

a) Dependent variables:

Success rate of items: The success rate of tendered items is calculated as the ratio between the number of items awarded and the total number of items submitted by the bidder.

Tender value: The tender value is calculated as the ratio between the awarded value of the bidder and the total tender value.

Pricing decision: The pricing decision refers to the discount percentage of the bid price compared to the registered wholesale price approved by DAV.

b) Model to determine factors affecting tender outcomes: The regression analysis captures the influence of independent variables on the dependent outcomes using a multivariate regression equation with a determination coefficient (R^2) of 0.5 or higher:

$$y = \beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \beta_4x_4 + \beta_5x_5 + \dots + \beta_nx_n$$

Where: y represents the dependent variable (tender outcome), x_i : the independent variables, and β : are the coefficients of the variables.

The specific hypotheses tested include:

1. The success rate of tendered items is positively correlated with the number of participating items (x_1).
2. The success rate is positively correlated with the bid amount (x_2).
3. Bidders with higher revenue (x_3) will have a higher success rate.
4. Bidders with higher profits (x_4) will have a higher success rate.
5. A higher number of contracts (x_5) correlates with a higher awarded value.
6. Higher bid amounts (x_6) correlate with higher awarded values.

7. Registered prices with the DAV (x_7) are positively correlated with bid discounts.

8. The number of tender invitations (x_8) is negatively correlated with bid discounts.

9. The tender value (x_9) is negatively correlated with bid discounts.

If the model's R^2 value is less than 0.5, alternative models will be explored to assess the relationship between independent and dependent variables.

c) Steps

Data collection from tender ranking summaries and bidder selection outcomes in 2016 from a military hospital. Data processing using SPSS 20.

PEARSON correlation analysis is performed to establish relationships between variables. Correlation coefficients (r) are categorized as follows:

± 0.01 to ± 0.1 : Insignificant correlation.

± 0.2 to ± 0.3 : Low correlation.

± 0.4 to ± 0.5 : Medium correlation.

± 0.6 to ± 0.7 : High correlation.

± 0.8 and above: Very high correlation.

Regression analysis is then used to determine the significant factors influencing the tender outcomes.

2.3. Justification for methodology

The use of multivariate regression is well-suited to this analysis, as it allows for the isolation of individual factors and their impact on the dependent variable - namely, the final contract price. This approach provides policymakers with actionable insights into which factors most significantly affect tender outcomes, allowing for targeted improvements in the procurement process.

Given that pharmaceutical procurement in Vietnam, and the broader Asia-Pacific region, operates in a unique market environment characterized by imperfect competition and limited price transparency, this methodology offers a robust framework for identifying key determinants of successful bids. The study's findings are expected to inform future policy adjustments in the bidding process, ensuring more efficient and equitable access to essential medicines.

3. Results

3.1. Factors shaping pharmaceutical tender success

A correlation analysis was conducted to explore the relationships between the number of items submitted (x_1), bid value (x_2), revenue (x_3), and profit (x_4) with the success rate of tendered items (y).

3.1.1 Correlation and regression results of the winning rate of tendered items

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Table 1: Correlation results of the winning rate of tendered items

Indicator	No. submitted items	Bid value	Revenue	Profit	Winning rate
No. submitted items	1	.723**	.509**	.041	.823**
Bid value	.723**	1	.521**	.077	.750**
Revenue	.509**	.521**	1	.196	.333**
Profit	.041	.077	.196	1	-.014
Winning rate	.823**	.750**	.333**	-.014	1

Note: ** $p < 0.01$ (2-tailed)

The results indicate a significant relationship between the number of items submitted and the winning rate ($r = .823$, $p = .000$), showing a very high positive correlation. Similarly, the bid value is also highly correlated with the winning rate ($r = .750$, $p = .000$). The relationship between revenue and the success rate is moderately positive ($r = .333$, $p = .002$), while there is no significant correlation between profit and the winning rate ($r = -.014$, $p = .897$).

A very high positive correlation was found between the winning item rate and the number of items submitted ($r = 0.82$, $p = 0.00$), and a high positive correlation with bid value ($r = 0.75$, $p = 0.00$). The correlation between winning item rate and revenue was low but significant ($r = 0.33$, $p = 0.00$), while no correlation was observed with profit ($r = -0.01$, $p = 0.90$). Additionally, the number of items submitted showed a high correlation with bid value ($r = 0.72$, $p = 0.00$) and a moderate correlation with revenue ($r = 0.05$, $p = 0.00$), while the bid value correlated moderately with revenue ($r = 0.52$, $p = 0.00$).

Additional correlations: The number of items submitted and bid value show a strong positive correlation ($r = 0.72$, $p = 0.00$). The number of items submitted and revenue show a moderate correlation ($r = 0.05$, $p = 0.00$). The bid value and revenue also show a moderate positive correlation ($r = 0.52$, $p = 0.00$).

3.1.2 Regression equation for winning rate on number of tendered items

Based on the correlation analysis, two factors with significant correlations—number of items submitted and bid value—were further analyzed using regression modeling. The determination coefficient (R^2) was found to be 0.754, indicating that 75.4% of the variance in the success rate is explained by the independent variables ($F = 85.652$, $p = .000$). The regression results for winning item rate are shown in Table 2.

Table 2: Regression results for winning item rate

Variable symbol	Variable name	Coefficient (estimate)	p-value	VIF (Collinearity)
Constant		.825	.478	
x_1	Number of items submitted	.317	.000	2.206
x_2	Bid value (in 1000 VND)	1.574×10^{-6}	.000	2.244
x_3	Revenue (in 1000 VND)	-2.506×10^{-9}	.003	1.446
y	Winning item rate			

Determined coefficient for a significant regression model: $R^2 = 0.754$, ($F = 85.652$, $p = 0.000$). Regression equation: $\hat{y} = 0.32x_1 + 0.16 \times 10^{-6} x_2$

These results suggest that, if all other variables are constant, a 0.32 increase in the success rate is associated with every additional item submitted. Moreover, for every 1 billion VND increase in bid value, the success rate increases by 0.016.

The findings indicate that bidders submitting smaller bids (less than 1 billion VND) have about a 32% chance of success, suggesting a 1:3 competition ratio. While the success rate primarily depends on the number of submitted items, the bid value plays an important role in increasing the likelihood of success, especially for larger bids exceeding 1 billion VND.

3.2. Analysis results by drug quality group

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3.2.1 Correlation and regression results of the variables on drug quality group 1

The analysis for group 1, which includes high-quality European drugs, reveals a strong positive correlation between the registered price and the final contract price. As shown in **Table 3**, the correlation coefficient is $r = 0.75$ for submitted bids and $r = 0.78$ for awarded bids, indicating that higher registered prices lead to higher bid prices.

Table 3: Correlation results for drug quality group 1

Variable		Registered price		Number of tenders		Bid value	
		submission	award	submission	award	submission	award
Registered price	submission	1					
	award		1				
Number of tenders	submission	-.056		1		.258**	
	award		-.073		1		.506**
Bid value	submission	.091		.258**		1	
	award		-.014		.506**		1
Bid price decision (y)		.754**	.777**	-.066	-.089	.129*	-.018

Note: ** $p < 0.01$ (2-tail)

The regression analysis for group 1 indicates that the registered price is a significant predictor of both the bid and contract prices.

Table 4: Regression results for bid price reductions in group 1

Variable symbol	Variable name	Coefficient (estimate)		P-value		VIF (collinearity)	
		submission	award	submission	award	submission	award
Constant		9237.77	19626.612	.089	.049		
x ₁	Registered price	.107	.127	.000	.000	1.008	1.005
x ₂	Number of tenders		-.113		.525	1.008	1.005
x ₃	Bid value	3.009×10^{-5}		.078		1.008	
y	Bid price decision						

For submitted drug: determined coefficient for a significant regression model: $R^2 = 0.57$ ($F = 241$, $p = 0.00$). Regression equation: $\hat{y} = 0.11x_1$

For awarded drug: determined coefficient for a significant regression model: $R^2 = 0.61$, ($F = 116$, $p = 0.00$). Regression equation: $\hat{y} = 0.13x_1 + 19627$

This suggests that, on average, the bid price for group 1 drugs is 11% lower than the registered price, meaning that the average bid price is about 89% of the registered price. In other words, bidders tend to set their bid prices at around 89% of the registered price, and to increase the likelihood of winning, they often need to offer lower prices. This reflects the "necessity" and high value of Group 1 drugs, which are considered the highest quality drugs in the generic drug package. The 89% price level acts as a ceiling, ensuring a higher likelihood of winning the tender. This also suggests that the awarded price for group 1 drugs is, on average, 13% lower than the registered price, with an additional increase of 19,627 VND for higher-priced drugs. Thus, the average awarded price is 87% of the registered price.

For group 1 drugs in collected dataset, the difference between the bid price (11% lower) and the awarded price (13% lower) is minimal, indicating two key points: First, there is little competition in group 1, leading to similar bid and awarded prices. Second, the monopolistic nature and profitability of group 1 drugs lead to less price variation.

3.2.2 Correlation and regression results of the variables on drug quality group 2

For group 2, comprising mid-tier European drugs, the results are somewhat different. While the registered price remains an influential factor, the correlation with the final contract price is weaker than in group 1, as shown in **Table 5**.

Table 5: Correlation results for drug quality group 2

Variable		Registered price		Number of tenders		Bid value	
		submission	award	submission	award	submission	award
Registered price	submission	1					
	award		1				
Number of tenders	submission	-.049		1		.664**	
	award		-.120		1		.483**
Bid value	submission	.210**		.664**		1	
	award		.165		.483**		1

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Variable	Registered price		Number of tenders		Bid value	
	submission	award	submission	award	submission	award
Bid price decision (y)	.431**	.949**	-.062	-.127	.086	.131

Note: ** $p < 0.01$ (2-tailed)

The correlation between the bid price decision and the registered price set by the DAV for submitted drugs is moderate ($r = 0.43$, $p = 0.00$), while the correlation for awarded drugs is very strong ($r = 0.95$, $p = 0.00$), indicating a strong positive relationship in both cases.

Table 6: Regression results for bid price decision for drug quality group 2

Variable symbol	Variable name	Coefficient (estimate)	P-value	VIF (collinearity)
Constant		3060.044	.566	
x_1	Registered price	.174	.000	1.000
y	Price reduction from registration			

Determined coefficient for a significant regression model: $R^2 = 0.90$ ($F = 741$ and $p = 0.00$). Regression equation: $\hat{y} = 0.17x_1$

Details of regression result was presented in **Table 6**. This suggests that, on average, the bid price for group 2 drugs is 17% lower than the registered price, meaning that the average bid price is about 83% of the registered price. In other words, bidders tend to set their bid prices at around 83% of the registered price, and to increase the likelihood of winning, they often need to offer lower prices. The 83% bid price level reflects the confidence of bidders in group 2 drugs, due to the limited direct competition from other bidders with similar active ingredients.

3.2.3 Correlation and regression results of the variables on drug quality group 4

For group 4, which includes domestically produced drugs, the results indicate a higher level of competition, as reflected by the stronger correlation between the number of tenders and the bid value. **Table 7** shows the detailed correlation results for this group.

Table 7: Correlation results for drug quality group 4

Variable		Registered price		Number of tenders		Bid value	
		submission	award	submission	award	submission	award
Registered price	submission award	1		-.046		.183**	
			1		-.141		.036
Number of tenders	submission award	-.046		1		.229**	
			-.141		1		.525**
Bid value	submission award	.183**		.229**		1	
			.036		.525**		1
Bid price decision (y)		.732**	.904**	-.087*	.130*	.299**	.072

Note: ** $p < 0.01$ (2-tailed)

Table 8: Regression results for bid price decision for drug quality group 4

Variable symbol	Variable name	Coefficient	p-value	VIF
Constant		836.27	-.075	.014
x_1	Registered price	.180	.245	.000
x_2	Number of tenders	.001	.009	.937
x_3	Bid value	-	.026	1.44

For submitted bids: determination coefficient R^2 : 0.54 ($F = 250$, $p = .000$). The regression equation is: $\hat{y} = 0.18x_1$.
 For awarded bids: determination coefficient R^2 : 0.82 ($F = 564$, $p = 0.000$). The regression equation: $\hat{y} = 0.25x_1 - 1716$.

For submitted bids, data in **Table 8** indicates that, on average, the bid price is reduced by 18%

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compared to the registered price for domestic pharmaceuticals in drug quality group 4. For awarded bids, analysis data suggests that, on average, awarded prices are 25% lower than the registered prices, with an additional reduction of 1,716 VND for high-priced drugs.

These findings demonstrate that domestic pharmaceutical bidders typically set their bid prices at 82% of their registered prices, while to secure an award, they often need to lower their prices to 75% of the registered prices.

3.2.4 Correlation and regression results of the variables on drug quality group 5

Group 5, which includes drugs meeting other criteria, also shows a high level of competition. The correlations between number of tenders and bid value are stronger than in group 4, as shown in **Table 9**.

Table 9: Correlation results for drug quality group 5

Variable		Registered price		Number of tenders		Bid value	
		submis sion	awa rd	submis sion	awar d	submis sion	awar d
Registered price	submis sion	1		-.046		.183**	
	award		1		-.120		.165
Number of tenders	submis sion	-.046		1		.229**	
	award		-.120		1		.525**
Bid value	submis sion	.183**		.229**		1	
	award		.165		.525**		1
Bid price decision		.936**	.238*	-.044	-.163	.157**	-.111

Note: ** $p < 0.01$ (2-tailed)

The correlation between the bid price decision and the registered price for submitted drugs is very strong and positive ($r = 0.936$, $p = 0.00$). Data in Table 9 indicating that as the registered price increases, the bid price also increases. However, for awarded drugs in group 5 (other criteria drugs), there is no significant correlation between the bid price decision and factors such as the registered price, the number of tenders, or the bid value.

Table 10: Regression results for bid price decision

Variable symbol	Variable name	Coefficient (estimate)	P-value	VIF(collinearity)
Constant		6002.913	.286	
x ₁	Registered price	.223	.000	1.035
x ₃	Bid value	-2.535×10^{-5}	.393	1.035
y	Bid price decision			

Determined coefficient: $R^2 = 0.88$, with $F = 1354$, and $p = 0.000$, indicating a significant regression model.

Regression equation is: $\hat{y} = 0,22x_1$

Table 10 shows that, on average, the bid price for group 5 drugs is 22% lower than the registered price, meaning that the average bid price is about 78% of the registered price. In other words, bidders tend to set their bid prices at around 78% of the registered price, and to increase the likelihood of winning, they often need to offer lower prices.

3.3 Analysis of non-conforming variables

The study examines the impact of factors such as similar contracts, years of experience, revenue, post-tax profit, and the bid ratio on overall performance.

Table 11: Correlation results for non-conforming variables

Variable	Similar contracts	Years of experience	Revenue	Profit	Bid ratio 1	Bid ratio 2
Similar contracts	1	.117	-.047	.122	-.013	.063
Years of experience	.117	1	-.036	.120	.009	.088
Revenue	-.047	-.036	1	.320*	.526*	.502*
Profit	.122	.120	.320**	1	.086	.013
Bid ratio 1 (quantity)	-.013	.009	.526**	.086	1	.681*
Bid ratio 2 (value)	.063	.088	.502**	.013	.681*	1

Note: ** $p < 0.01$ (2-tailed)

Despite the importance of variables like **bidder experience**, **revenue**, and **number of similar contracts** in other procurement sectors, these variables did not have

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a significant impact on tender outcomes in the pharmaceutical sector, as shown in **Table 10**. The correlation between **bidder experience** and tender success was low ($r = 0.117, p > 0.05$), and similar trends were observed for the number of similar contracts ($r = 0.06, p > 0.05$).

3.4. Summary of results:

The analysis focuses on the impact of key variables, including registered drug prices, number of bidders, and bid values, on pharmaceutical procurement outcomes in Vietnam. The 2016 tender data reveals that the registered price determined by the DAV plays a dominant role in shaping both the bid price and the final awarded price. Additional factors such as the number of bidders and bid values contribute to the tender outcomes, although their influence varies across different drug quality groups.

Multivariate regression analysis highlights a strong relationship between the registered price and the final awarded price, particularly for higher-quality drug groups. The results show that competitive pressures are most pronounced in group 4 and group 5, where significant reductions in the bid prices from the registered prices were observed.

4. Discussion

While significant research has been conducted on procurement in other sectors, relatively few studies have examined the distinctive challenges of the pharmaceutical market [1,21]. Legal and regulatory factors play a critical role in shaping pharmaceutical tender outcomes. The findings of this study highlight the centrality of registered prices as a ceiling for bid submissions, significantly influencing tender efficiency across all drug groups. For high-quality European drugs (Group 1), the relationship between registered prices and awarded prices was notably strong ($r = 0.75$ for bid submissions and $r = 0.78$ for awarded prices; **Table 3**). Regression analysis further revealed that bid prices in this group were only 11% lower than registered prices, demonstrating limited pricing flexibility (**Table 4**). Similar trends were observed in mid-tier European drugs (Group 2), where bid prices were reduced by 17% on average (**Table 6**). These findings align with prior research emphasizing the monopolistic nature of high-value drug categories and the regulatory constraints in Vietnam's pharmaceutical market [3,18]. Introducing more flexible mechanisms for setting registered prices, such as periodic adjustments based on market trends, could enhance competitiveness and reduce costs. One

approach could involve allowing periodic price adjustments based on market conditions or incentivizing price reductions through negotiated tenders [13,27].

The dynamics of ordering and inventory management emerged as another critical determinant of tender efficiency. Stronger competition was observed among domestic pharmaceuticals (Group 4), where bid prices were reduced by 18% and awarded prices by an additional 25% (**Tables 7 and 8**). These reductions reflect the aggressive pricing strategies employed by domestic suppliers to secure contracts. Similar trends were observed for essential drugs (Group 5), where bid prices were approximately 17% lower than registered prices (**Table 9**). This evidence highlights the importance of optimizing procurement cycles to balance supply and demand effectively, particularly in high-competition categories. Policies tracking the frequency of ordering and price reductions in these groups could further enhance supply chain efficiency and cost savings, as suggested by a recent study [25].

The study also identified key trends in improving access to essential medicines. Domestic manufacturers played a significant role in increasing access by offering competitive prices for essential and generic drugs, particularly in Groups 4 and 5. However, disparities in competition levels between high-quality imported drugs and domestic drugs highlight gaps in procurement practices, especially in underserved areas. Group 4 suppliers typically set bid prices at 82% of registered prices but reduced these to 75% to secure awards, showcasing their contribution to affordability (**Table 8**). These findings are consistent with previous studies advocating for policies that prioritize essential medicines to address common chronic illnesses in Vietnam [9,16]. Future research could focus on developing a *clinical relevance index* that links procurement data to the national disease burden. Such an index would support more informed decision-making, ensuring equitable access to priority medicines and potentially advancing recently proposed initiatives for greater transparency in drug pricing [2].

Competitive dynamics also revealed significant implications for tender governance. Variables such as the number of participating bidders and bid value were more predictive of tender outcomes than bidder experience or past contracts (**Table 11**). The correlation between the number of bidders and winning rates ($r = 0.823$; **Table 1**) highlights the importance of transparent and inclusive tendering processes. This finding aligns with

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recommendations for streamlining qualification criteria and adopting digital platforms to reduce administrative burdens and corruption risks [17,26]. Establishing a *competitiveness index* to monitor bidder participation and pricing trends could provide policymakers with valuable insights to improve governance in tendering processes. Such an index would also strengthen the State's role in Vietnam's pharmaceutical industry, contributing to a sustainable development approach that ensures human health security [15].

Finally, these insights highlight the potential for a *comprehensive drug management index* to optimize procurement practices. Such an index could integrate metrics related to economic efficiency, competitiveness, and clinical relevance, similar to frameworks implemented in countries like Malaysia and Indonesia [16,25]. For Vietnam, tailoring this index to include flexibility in price ceilings, tracking of ordering cycles, and prioritization of essential medicines would provide a robust foundation for improving tender outcomes and healthcare delivery.

5. Conclusion

This study highlights the central role of registered prices in shaping pharmaceutical tender outcomes in Vietnam, particularly for high-value imported drugs, where pricing flexibility and competition are limited. Conversely, domestic and essential drugs exhibited stronger competitive dynamics, with significant cost reductions, suggesting the importance of supporting local manufacturers and prioritizing essential medicines to enhance affordability and access.

To optimize tendering processes, the findings advocate for greater flexibility in price regulation, enhanced governance through transparency measures, and the development of a *comprehensive drug management index*. Such an index should integrate legal, economic, and clinical metrics to align procurement with national healthcare priorities, ensuring equitable and sustainable access to medicines. Future research should expand to underserved regions and consider additional factors such as workforce capabilities and policy compliance.

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