

Drug Market with Volume Purchase(VP)

Wenxuan Liu^a, Ge Qi^b, Yibing Li^{c,*}

School of International Medicine Business, China Pharmaceutical University, Nanjing, 211198, China
^a1628407604@qq.com, ^b2974742793@qq.com, ^c1019861191@cpu.edu.cn

*Corresponding author

Abstract: The new round of medical and health system reform launched in China takes "drug reform" first, and is committed to breaking the mechanism of "supporting doctors with drugs" and alleviating the problem of "difficult and expensive medical treatment". For more than ten years since the implementation of centralized drug procurement, the effect of controlling medical expenses is not significant. The phenomenon of falsely high drug prices still exists, and medical expenses continue to rise. The reason is that there are some problems in centralized drug procurement, such as imperfect laws and regulations, dislocation of procurement subjects, separation of bidding and procurement, and non linkage between quantity and price. Therefore, it is imperative to reform the method of drug procurement. Based on this, this paper discusses and analyzes the impact of volume procurement on the drug market, and puts forward corresponding optimization suggestions. Through investigation and interview with relevant government departments, medical institutions, drug enterprises and their relevant personnel, this paper investigates the comparison of bid winning prices and price reduction before and after the implementation of volume procurement policy in a city, as well as the division statistics of area A and B of the second batch of volume procurement. The results show that, Compared with the previous round, the bid price of the three batches of drugs purchased in the city decreased by an average of 56%, while the average decrease of the third batch of drugs purchased in the city was only 43%, which was significantly narrowed compared with the first two batches. The highest single product decreased by 93% and the lowest by only 2%. There were great individual differences in drugs; The second batch of two districts with volume procurement in the city calculate the quantity of agreed procurement targets respectively, and the bidding drug manufacturers will conduct bidding respectively to reduce the possibility of exclusive bid winning, one dominating the market and maliciously excluding other products. The VP mode has positive significance both in theory and practice.

Keywords: Volume Procurement, Procurement, Drug Market, Impact

1. Introduction

As a new mode of centralized drug procurement, drug volume procurement is an important measure of medical system reform in the new era. In the bidding stage of volume procurement, it is necessary to determine the procurement quantity, and clearly set up the mechanism that the capital exchange and circulation between medical institutions, drug circulation enterprises and medical insurance and drug procurement centers must be carried out through special accounts. At the same time, the allocated funds are from the overall planning part of the medical insurance fund for urban employees. Furthermore, the medical insurance payment method of settlement under the control of the total amount of advance appropriation has been fully realized in the region. Yes, the price of medical products included in medical insurance tends to be stable, so as to prevent the proportion of "disease without medicine" from happening. Because the policy is novel, the relevant research mainly focuses on the multi-dimensional evaluation of the policy, including the analysis of value and impact.

Many scholars at home and abroad have studied the impact of volume procurement on the drug market. Kim G developed silicone copolymer hydrogel contact lenses containing various functional monomers for the transport of hydroxypropyl methylcellulose, and hydrogel prepared under physiological pH exhibited different swelling reactions. Therefore, the mathematical parameters were calculated to better understand the drug release mechanism of hydrogels. By evaluating these parameters, the main limiting factor [1] of silicon hydrogel contact lens was determined under the pH value. Haruka used single source data for some tea based beverages, including purchase data before and after package changes. Using these data, packaging changes and product redesign were divided

into three types, and the impact of each type on consumers' purchase of redesigned products was measured. The results show that the change of packaging will affect consumers' purchase, and the change of packaging will be different due to the change of design elements [2].

This paper introduces the motivation for the implementation of volume procurement policy, and comprehensively introduces the policy complementarity and the necessity of policy implementation of volume procurement for the traditional centralized drug procurement mode. This paper discusses the impact of VP on the drug market, puts forward corresponding optimization suggestions, investigates and interviews relevant government departments, medical institutions, drug enterprises and their relevant personnel, understands more real situations, grasps a large number of first-hand materials, verifies the feasibility of VP, and can reflect the actual situation of the implementation of the current medical insurance drug VP policy [3-4].

2. Influence of VP on Drug Market and Optimization Suggestions

2.1 Concept of VP

VP is a model innovation and the reengineering of drug purchase process. It is a change behavior, which needs to be recognized by members of the organization and those who accept the change. The biggest change in the drug purchase mode is that the hospital no longer obtains the "benefits" of selling drugs, including the sales bonus allowed by the policy and various implicit rebates. Therefore, the hospital is the one who accepts the change. From the perspective of drug supply chain, organization members should include all relevant members in the supply chain, especially drug manufacturers.

Drug volume procurement is a brand-new centralized drug procurement policy officially issued by the State Council through the overall Deepening Reform Commission of China's Central Committee and according to the general idea of national organization, alliance procurement and platform operation. Its name is derived from the characteristics of linking the agreed procurement quantity and quantity price when determining the drug procurement in the catalogue. As an innovative measure introduced by China in the process of China's medical reform in response to the falsely high drug prices, its procurement method is similar to and different from China's traditional drug procurement. The similarity is that the executive organization of drug bidding procurement is designated by the government, while the difference is that the traditional drug procurement is independently purchased by regional governments, and the new policy of volume procurement is to form a National Alliance for collective procurement, In order to solve the problems of decoupling between quantity and price in traditional drug procurement, the state has also issued a number of supporting measures for drug quality, drug consumption, drug enterprise funds and other aspects.

Before the reform of national institutions, the procurement bidding of medical products was exercised in a decentralized manner by the National Health Commission, the Ministry of medicine and the Ministry of finance. After the reform of national institutions, the state medical security administration, which undertakes the functions of centralized drug procurement examination and approval, bidding, supervision and management, etc., made overall arrangements for relevant activities and assumed the responsibility of the government[5-6].

2.2 Impact of VP on Drug Market

China's centralized drug procurement has not achieved "volume price linkage" and "volume procurement", that is, the price of China's centralized drug procurement will not decrease with the increase of procurement volume, because China's centralized drug procurement does not publish the procurement demand. For drug suppliers, if the purchase with quantity is implemented, the production enterprise can organize mass production according to the variety and quantity to be supplied, so as to reasonably reduce the bidding price; Although the price has decreased, it can obtain the growth of sales volume, and through the improvement of sales volume, it can reduce the production and operation cost and obtain a certain profit space, so as to achieve the business goal of profit by volume. For drug purchasers, batch procurement can reduce procurement costs and transaction costs, and realize procurement efficiency and benefits. It can be seen that volume procurement is based on this most basic economic principle[7].

The main reason why drug manufacturers are unwilling to participate in VP is that the price of VP is too low and affects the prices of other provinces and even the whole country. The national health and

Family Planning Commission has established the "national drug supply guarantee comprehensive management information platform" and requires the provincial drug procurement platforms of all provinces to realize docking and interworking with it, which means that the bid winning price of provincial drug centralized procurement in all provinces will be collected by all provinces in the country on the national management platform. However, in the centralized procurement of drugs at the provincial level, the bid winning products did not obtain the commitment of the bid inviter.

Control the unreasonable growth of drug costs through centralized drug procurement. China's implementation of centralized drug procurement with the province as the unit can better concentrate the wisdom of experts in the province to select high-quality drugs, which is conducive to saving the human, material and financial resources of the government, hospitals and enterprises, and giving full play to the scale effect of centralized procurement, so as to reduce the purchase price and purchase cost.

2.3 Optimization Suggestions for VP

To establish a benefit sharing mechanism and mobilize the enthusiasm of all participants, it is necessary to optimize the management of the drug supply chain, such as procurement plan, inventory management, etc., and also be responsible for the collection management of the hospital; The hospital is the actual user of drugs, and because the hospital monopolizes the prescription right of drugs, it can decide whether to use and how much to use; The government is the leader of drug procurement. The bid winning price of volume procurement is "real price". Based on different bidding procurement policies, the bid winning price of volume procurement should be treated differently from the general provincial bid winning price. Therefore, the recommendations are as follows:

(1) In the final bid winning result, only the total transaction price will be published, and the specific transaction unit price of the product will not be published. The bid winning varieties purchased with quantity are checked separately every month in the hospital, so it is convenient in specific operation. As other provinces have not really implemented volume procurement, but since the interconnection between the national drug control platform and the national provincial platform, more than 20 provinces have implemented the price linkage mechanism, and the local bid winning price is dynamically adjusted according to the latest bid winning price of other provinces. If the specific transaction unit price of the product is not published, the national drug control platform will not reflect it, so other provinces can not refer to it. Therefore, the price of other provinces will not be affected in the short term, and at least the concerns and concerns of manufacturers about price linkage can be eliminated temporarily[8-9].

(2) Provide more additional services for production enterprises. At present, the sunshine platform is not open to production enterprises. Therefore, production enterprises cannot obtain the detailed order information of products from the platform, and it is more difficult to grasp the phased changes of hospital terminal sales and market share of products. The bid winning varieties purchased with quantity are purchased online through the sunshine platform, and the sunshine platform also has more detailed data, such as hospital list, purchase amount, purchase quantity and product distribution. If these data can be provided to production enterprises, it will help production enterprises analyze the market, find sales growth points and provide better after-sales service. In addition, it can be considered to give priority to the bid winning enterprises of volume procurement to handle matters related to bidding and networking on the sunshine platform, so as to improve the efficiency of the bid winning enterprises in handling daily matters.

(3) For distribution enterprises: provide certain subsidies or preferential policies

Distribution enterprises are an important link to ensure drug supply. In reality, there is often the last kilometer, that is, in some remote areas, old, young, border and poor areas, no distribution enterprises are willing to distribute drugs. This is mainly based on the consideration of distribution cost. Although the distribution fee is paid by the production enterprise to the distribution enterprise, from the perspective of business, the distribution behavior is that the distribution enterprise performs its obligations to the production enterprise; However, from the perspective of public management, drug distribution involves the establishment of drug supply security system and the supply of public medical and health services. Centralized and unified distribution is implemented for drugs purchased with quantity, with large distribution radius and high distribution cost in remote areas; Moreover, after the pharmacy orders in batches, the goods are kept by the distribution enterprise on behalf of the medical institution, and the distribution enterprise also needs to bear the inventory management cost. It is suggested that the government provide certain subsidies or preferential policies for distribution

enterprises, such as allowing payment collection taking a certain time or undertaking pharmaceutical services in some hospitals, so as to encourage and improve the enthusiasm of distribution enterprises to participate[10-11].

(4) For hospitals: establish a compensation mechanism as soon as possible and give opportunities to participate in the procurement process

Formulate the medical insurance payment standard of drugs as soon as possible, and allow the hospital to obtain the difference between the actual sales price of winning drugs and the medical insurance payment standard, so as to improve the motivation of hospitals to use drugs with lower winning prices. Due to the large price reduction of the bid winning varieties purchased with quantity, according to the current policy, the hospital can only obtain the sales plus part allowed by the policy. When the demand for drugs is relatively stable, the more the hospital uses to purchase the bid winning varieties, the greater the economic loss of the hospital. When the compensation measures are not in place, the hospital may face business difficulties. Therefore, to encourage hospital participation, its economic interests must be taken into account. The advantage of Shanghai's medical insurance department leading volume procurement is that it can coordinate the linkage between medicine and medical insurance, introduce medical insurance payment standards as soon as possible, and use the medical insurance payment incentive mechanism to promote hospitals to actively use the winning varieties of volume procurement.

In the selection link of the catalogue of products purchased with quantity, medical experts can participate in relevant discussions and put forward selection suggestions from the perspective of clinical medication, so that hospitals and doctors can feel that the purpose of purchasing with quantity is to meet the needs of clinical medication and provide them with drugs with high quality and appropriate cost performance. Based on the characteristics of asymmetric information and prescription monopoly in the medical service market, hospitals and doctors have an absolute voice in the use of drugs. Relatively speaking, doctors have a better understanding of the differences, advantages and disadvantages of the efficacy and safety of different brands of drugs. In the process of continuing to gradually promote the pilot of volume procurement, it is particularly important to select which categories as the pilot are easier to obtain the expected policy effect. Clinical medical experts are invited to participate in the selection of pilot varieties, so as to increase varieties[12].

3. Analysis of Drug Price Strategy

According to the definition of the relationship between demand function and price, let the drug demand function be $q = R - GQ$, where $r > 0$ and $G > 0$, indicating that demand is inversely proportional to price Q ; $K = a - bq$, where $a > 0$, $B < 0$; In the optimal price decision of pharmaceutical enterprises, the optimal price is $q' = \frac{a - k_n}{b}$, and the maximum profit is as shown in formula (1)

$$E\pi^* = \left[-H \frac{(a - K_n)}{b^2} + \frac{(r + Hc)(a - K_n)}{b} - rC \right] (0.5G + 0.4M + 0.3L) \quad (1)$$

The optimal price is $q_* = \frac{r + HC}{2G}$, and the maximum profit value is as shown in formula (2)

$$E\pi^* = \left[\frac{(r + GC)^2}{4G} - rC \right] (0.5G + 0.4H + 0.3L) \quad (2)$$

According to the above analysis, only when the unit cost of pharmaceutical enterprises is $C < \frac{r}{H}$, can they agree to the price reduction requirements. Otherwise, pharmaceutical enterprises need to consider strategies such as participating in external market competition, enterprise transformation and merger.

When meeting the cost $C < \frac{r}{H}$, the quotation of pharmaceutical enterprises shall be combined with the influence coefficient of price on demand and government utility, and the optimal price strategy shall be determined according to the actual level of their own cost.

4. Experimental Analysis on the Influence of VP on Drug market

In order to investigate the impact of VP on the drug market, this paper investigates the comparison of bid winning prices and price reduction range before and after the implementation of VP policy in a city. The survey results are shown in Table 1 and figure 1.

Table 1: Comparison of bid winning prices before and after the implementation of volume procurement

batch	Common name	Bid winning price (yuan)	Bid winning price of last round (yuan)	price cut percentage
First batch	Amoxicillin	1.89	5.9	-73%
	enalapril	2.5	10.3	-82%
Second batch	Lisinopril Tabelets	2.62	16.31	-84%
	Dirithromycin enteric coated slice	17.93	51.06	-65%
	Valaciclovir hydrochloride slice	9.9	46.99	-79%
Third batch	Aniracetam tablets	4.38	24.3	-82%
	Aripiprazole Tablets	67.19	67.24	-50%
	Clarithromycin tablets	2.6	4.22	-38%
	Simvastatin tablets	2.75	3.44	-20%
	Zopiclone tablets	22.8	24	-5%



Figure 1: Comparison of bid winning price before and after the implementation of VP policy

It can be seen from the data in the above chart that the bid price of three batches of volume procurement in the city has an average decrease of 56% compared with the bid price of the previous round, the maximum decrease of a single variety is 93%, and a total of 24 product specifications have decreased by more than 50%, accounting for 67% of the total number of product specifications. Most of the winning drugs are domestic generic drugs with obvious advantages. It is worth noting that the bid winning price of the first and second batch of volume procurement in the city has an average decrease of 78% and 72% compared with the bid winning price in the previous round. At the same time, the median decline rates of the two batches of drugs were 73% and 76% respectively, with little deviation compared with the average decline rate, and the decline rate was relatively stable. The average decline in the third batch of drugs purchased in the city was only 43%, which was significantly narrowed compared with the first two batches. In addition, the highest single product decreased by 93% and the lowest by only 2%. There were great individual differences in drugs.

In order to avoid the dominance of the bid winning products, the city was divided into two areas a

and B during bidding. The division statistics of area a and area B of the second batch of belt procurement in the city are shown in Figure 2

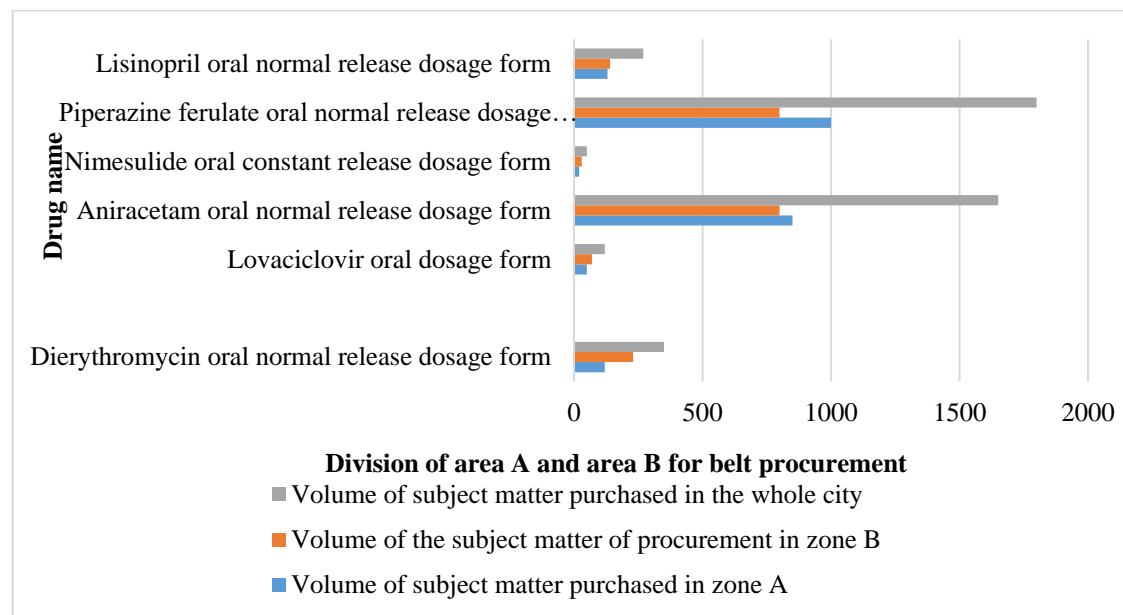


Figure 2: Division of area a and area B for belt procurement

According to the analysis of the above figure, the two districts of the second batch of volume procurement in the city calculate the quantity of agreed procurement targets respectively, and the bidding drug manufacturers conduct bidding and bidding respectively. The common name, specification, dosage form and packaging of the same bidding drugs are different. Bidding enterprises can bid and bid separately according to the operation conditions of different districts, or they can bid and bid separately for different specifications and packages of the same drug in the same district. The second batch of procurement with volume increases the difference of drug bidding in the design of bidding rules, reduces the possibility of exclusive bid winning, one dominating the market and maliciously crowding out other products.

5. Conclusions

At this stage, the phenomenon of falsely high and falsely low drug purchase prices coexist, and the deviation of purchase prices from the reasonable price range has become a prominent problem in the field of medical and health care. Drug procurement by volume is an important measure to improve the centralized drug procurement system, explore the linkage between drug procurement volume and price, ensure drug supply in the market and scientifically evaluate drug quality. It is of great significance for the evaluation and Research on the implementation of drug procurement policy. Therefore, this paper discusses the impact of VP on the drug market, puts forward corresponding optimization suggestions, and achieves certain results; However, due to the influence of objective factors, there are still some deficiencies. Due to the limited theoretical knowledge, the combination of theory in this paper is still insufficient; Due to the limitation of time and working conditions, the implementation evaluation of medical insurance drug with quantity procurement is not deep enough. In the future, we will further strengthen theoretical study and carry out comprehensive and in-depth investigation and Research on all links of medical insurance drug volume procurement through theoretical guidance and practice, so as to provide more scientific guidance for medical insurance drug volume procurement.

Acknowledgement

This study is supported by Jiangsu Postgraduate Research and Practice Innovation Program Project "Research on the Influence of Chinese Government Regulation on the Technological Innovation of Pharmaceutical Industry", Project No. KYCX21_0690,2021-2022.

References

- [1] Kim G, Kim H J, Noh H. *Influence of Solution pH on Drug Release from Ionic Hydrogel Lens. Macromolecular Research*, 2019, 27(2):191-197.
- [2] Haruka, Kozuka. *Effects of Package Changes and Product Redesign on Purchase. Japan Marketing Journal*, 2019, 38(3):95-110.
- [3] Raza S A, Mansoor M, Iraqi K M. *Influence of Investor Sentiments on Stock Market Capitalization of Different Economic Sectors in a Developing Economy: Evidence from Pakistan. Journal of Finance & Economic Research*, 2019, 4(1):31-43.
- [4] Aditya A R, Alversia Y. *The Influence of Online Review on Consumers' Purchase Intention. GATR Journal of Management and Marketing Review*, 2019, 4(3):194-201.
- [5] Patel S, Kumthekar A. *Psoriatic Arthritis: The Influence of Co-morbidities on Drug Choice. Rheumatology and Therapy*, 2021, 9(1):49-71.
- [6] Tang M, He J, Chen M, et al. "4+7" City Drug Volume-Based Purchasing And Using Pilot Program in China and its Impact. *Drug Discoveries & Therapeutics*, 2019, 13(6):365-369.
- [7] Broyaka A. *Influence of Socio-Economic Factors on Consumer Demand Formation. Economy Finances Management Topical Issues of Science And Practical Activity*, 2019(6 (46)):27-38.
- [8] Ran M, Tang Z, Chen W. *The Influence of Trading Volume, Market Trend, and Monetary Policy on Characteristics of the Chinese Stock Exchange: An Econophysics Perspective. Open Physics*, 2019, 17(1):985-998.
- [9] Kabanov M A, N. A. Ivantsova, Kuzin E , et al. *Evaluation of the Influence of Drug Complex Formation on the Efficiency of Water Conditioning with Reagents for Tetracycline. Pharmaceutical Chemistry Journal*, 2022, 55(11):1245-1249.
- [10] Kozowska M, Garbacz P, Wesoowski M. *Influence of co-crystallization on bioavailability of drug substances. Farmacja Polska*, 2019, 75(7):396-402.
- [11] Korkmazov M, Korkmazov A, Dubinets I, et al. *Influence of Non-Drug Therapy on Rehabilitation Time and Skeet Shooting after Rhinosurgical Interventions. Human Sport Medicine*, 2020, 20(S1): 136-144.
- [12] B E F A, C M M H, A A A, et al. *The Influence of Polymorphisms in the Drug Transporter, ABCB1 on the Toxicity of Glucocorticoids in Saudi Children with Acute Lymphoblastic Leukaemia. Pharmacological Reports*, 2019, 71(1):90-95.