Study on the Effects of the Deregulation of Drug Price Control on Orphan Drug Price: Empirical Study with Big Data on Drug Price Data of 16 Provinces in China

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Abstract: Objective: To analyze the price changes of orphan drugs before and after the reform. To explore the impact of the abolition of drug price control and market liberalization on the price of orphan drugs. And to provide reference for the formulation of policies related to orphan drugs. Method: We used drug price data monitored by Beijing Municipal Bureau of Health from February 2014 to June 2017. 32 kinds of 12222 orphan drug data were extracted. Based on the interrupt time-series model and the accumulation of drug price differences frequency, this research analyzes and compares the price level of orphan drug before and after the deregulation. And the impact of reform on the price of orphan drugs were put forward. Results: After the deregulation, the orphan drug price level increased significantly (slope change amount $\beta_3=3.45\times10^{-1}$, $P<0.05$). In 2014, 1.77% of the orphan drugs were at high price differences, and 1.22% in 2015, compared with 2.57% in 2016 and 4.25% in 2017. Conclusion: After the deregulation, the Laspeyres index level of orphan drugs increased significantly, and the situation of high price differences drug became more serious. It is difficult to improve the accessibility of orphan drugs by market-oriented control measures alone. A better pricing mechanism needs to be introduced to protect the rights and interests of patients with rare diseases.

1 INTRODUCTION

The accessibility and affordability of drugs are the important attributes of drugs, and the drug price is of great significance for drug accessibility and affordability. Drug prices have always been one of the focus of medical and health undertakings. In recent years, China's drug expenses account for about 40% of the total health expenditure of (https ://www.who.int/medicines/publications/pharm_guid e_country_price_policy/en/.), which is at a high level compared with developed countries. Statistics from the Organization for Economic Cooperation and Development (OECD) (https://data.oecd.org/ healthres/ pharmaceutical-spending.html) show that the drug costs of most developed countries remain at 10% to 20% or less. Therefore, reasonable regulation of drug prices is very important to relieve the economic burden of individuals and even the country.

Government intervention is one of the main means of drug price control, the (Huang, 2005; Technology Information, 1997; China Pharmaceuticals, 1999). However, the drug price control system did not achieve the expected effect, but induced some adverse phenomena, such as high price differences (Shen, 2014), "Hu Piao effect" (Ruan, 2008) caused by drug manufacturers avoiding price reduction, excessive competition (Shi, 2014) manifested in anti-price competition. There is also the "exit effect" (Zhu, 2005), which makes too low prices drugs gradually disappear from the prescription.

In the case of the chronic failure of China's drug price control measures, on May 4, 2015, the National Development and Reform Commission, the Health and Family Planning Commission, the Food and Drug Administration and other departments issued the Opinions on Promoting the Drug Price Reform (F R ANCO, 2013). Since June 1, 2015, in addition to anesthetic drugs and type I psychotropic drugs, the regulation of drug price has been canceled, and the actual sales price of drugs has been formed by market competition, marking the prelude to a new round of drug price reform.

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Rare disease, also known as an orphan disease. The definition of rare diseases is not unified around the world, mainly with low prevalence, very low total population, life-threatening, difficult treatment, low enthusiasm for drug development and high treatment cost of (F R ANCO, 2013). Orphan drugs are drug for rare diseases, refer to the drug (Liu, 2019) used in the treatment, diagnosis, or prevention of specific rare diseases.

On May 11,2018, the National Health Commission, the National Drug Administration and other five departments jointly formulated China's First Batch of Rare Diseases List, clearly listing 121 rare diseases, aiming at safeguarding the health rights and interests of patients with rare diseases, which is a milestone in the management of rare diseases in China. However, there are few studies on the drug price of rare diseases in China. China's population base is large, and although the incidence of rare diseases is low, its patient population still cannot be ignored. This study is based on the drug price data from 16 provinces from 2014 to 2017. It aims to analyze the price changes of orphan drugs before and after the reform, explore the impact of abolishing price control and market liberalization on the price of orphan drugs, and provide a basis for the policy formulation related to orphan drugs.

2 DATA AND METHODS

2.1 Data Sources

The research data originated from the national drug price monitoring data of the Beijing Municipal Bureau of Health from February 2014 to June2017, and the cooperative research institution is the Peking University School of Pharmaceutical Sciences. In this study, 32 kinds of 12222 orphan drug data from 16 provinces including Gansu, Shandong, Heilongjiang, Shanghai, Jiangsu, Zhejiang, Hubei, Jilin, Liaoning, Inner Mongolia, Ningxia, Shandong, Shanxi, Sichuan, Yunnan and Chongqing were selected. The types of orphan drugs refer to the research of Liu Xin (Liu, 2019) on the status quo of orphan drugs in China. The drug data include the general name, specification, production unit, monitoring unit, sales volume, price and other data.

2.2 Data Analysis

This study used daily dose (DDD) as the unit of measurement to compare drugs of different manufacturers, dosage forms and specifications, with the total DDDs of each drug as the amount of drugs every two months. The DDD data for the drugs were obtained from the WHO Collaborating Centre for Drug Statistics Methodology (https://www.whocc.no/).

2.3 Drug Price Differences

The drug price differences is the ratio of the difference between the actual retail price and the factory price and the factory price, and its expression is as follows:

$$\text{Price Diference cs(PD)} = \frac{\text{Actual retail price} - \text{factory price}}{\text{factory price}} \times 100\%$$

According to Shen Hongtao's research (Shen, 2014) on drug price structure in many countries, he proposed that the factory price of less than or equal to 50% retail price is unreasonable, that is, the drug price is artificially high. More than 50% of the average evaluation price ratio is relatively reasonable, that is, the drug price is not artificially high. Therefore, drugs with a price differences above 100% were high price difference drug.

2.4 Laspeyres Index

Laspeyres index can measure the overall price level of a drug (Ye, 2016), that is, keep the weight of each drug unchanged, and compare the drug price level after the calculated period with the drug price of the base period. Collect drug prices for the calculated and base periods (P_0, P_1) and Basal usage (Q_0). The Laspeyres index was calculated using the following formula:

$$L = \frac{\sum P_1 Q_1}{\sum P_0 Q_0}$$

In this study, the drug price data from February 2014 was used as the base period data to calculate the pull price index of each period.

2.5 Interrupt Time Series Model

Interrupt time-series (ITS) design is designed to collect outcome data from multiple time points before and after the intervention, and evaluate the effect of the intervention with statistical models, including level changes and trend changes, which is mostly used to evaluate policy (Shao, 2015). Its nature is a linear regression (Lagarde, 2011) for a piecewise fit.

Set up X_1 For the time variable of the count, X_1= 1,2,3,…,n; X_2 Represents the intervention, and the

pre-intervention X_2=0. After the intervention X_2＝1; X_3 Represents the slope, and set X_3=0 represents the pre-intervention observations, X_3=X_1 Represents the observations after the intervention, and εt is a random error term. The fit level and slope change models were performed as follows:

Y_t＝β_0+β_1X_1+β_2X_2+β_3X_3+$\sum\beta_j\beta_j$+εt, $\sum\beta_jX_j$ Represents a set of covariates which is not considered here. Generation the variables X_1, X_2, and X_3 into the formula, the pre-intervention model is: Y_t＝β_0+β_1X_1+εt; The post-intervention model is: Y_t =β_0+β_1X_1+β_2X_2+β_3X_3+εt =β_0+β_1X_1+β_2×1+β_3X_3+εt =(β_0+β_2)+(β_1+β_3)X_1+εt =β_0^*+$\beta_1^*X_1$+ t; $\beta_0^*$and β_1^* are Called adjust parameters. β_1 is the slope of pre-intervention, β_2 is the amount of horizontal change, β_3 is the amount of slope change, (β_1+β_3) Is the slope after the intervention. The hypothesis test of the regression coefficient is the significance test of horizontal change and slope change. The interrupt point of this study was in June 2015. Analysis using the Durbin-Watson test found that there was autocorrelation in the pre-intervention regression equation. Use generalized least-squares estimation to solve the first-order autocorrelation bias (Shao, 2015).

SPSS 25.0 statistical analysis software was used, and P <0.05 was set to indicate statistical significance.

3 RESULT

3.1 The Impact of Deregulation on the Price Level of Orphan Drugs

A total of 32 orphan drugs were included in this study, including 12,222 drug price data. Take the time as the horizontal coordinate and take the fixed Roche price index as the ordinate. Fig. 1 shows the impact of the deregulation on the overall price of orphan drugs.

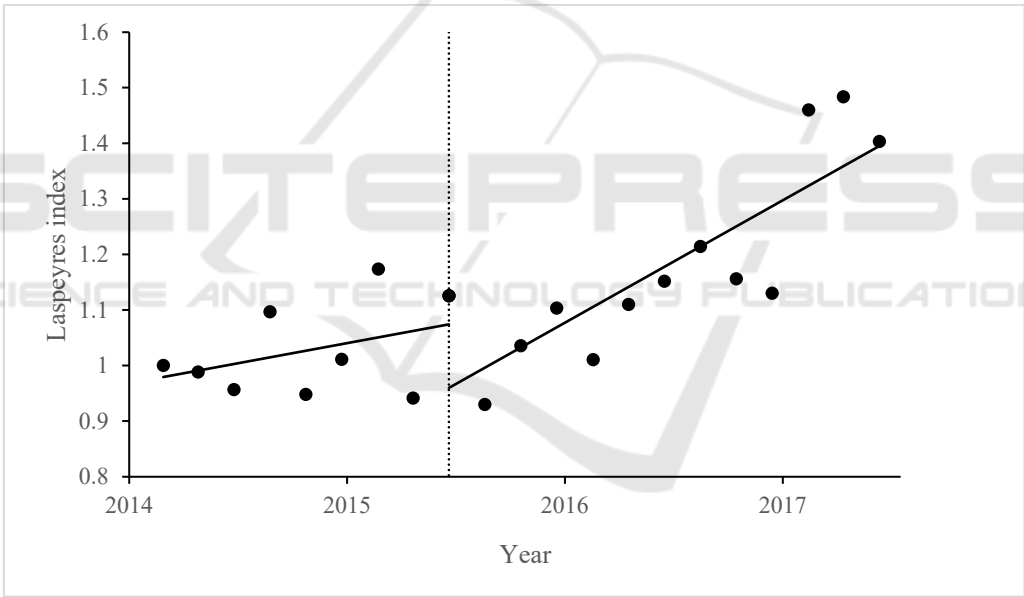

Figure 1: Effect of drug price deregulation on orphan drugs prices.

The slope (β_1) of the orphan drug price index before the deregulation is 0.006. The level change after the deregulation is -0.394 and the amount of slope change is 0.345 (P <0.05). The difference before and after was significant, indicating that the price level of orphan drugs increased significantly after the deregulation.

3.2 Drug Price Differences Before and After the Deregulation

The drug price increase rate was taken as the abscissa, and the cumulative frequency was taken as the ordinate for drawing.

In Fig. 2, when the drug price differences was at the highest price increase rate set by the government, the cumulative frequency curve increased almost vertical. After more than 15%, the growth rate slowed down, and the price differences of most drugs was

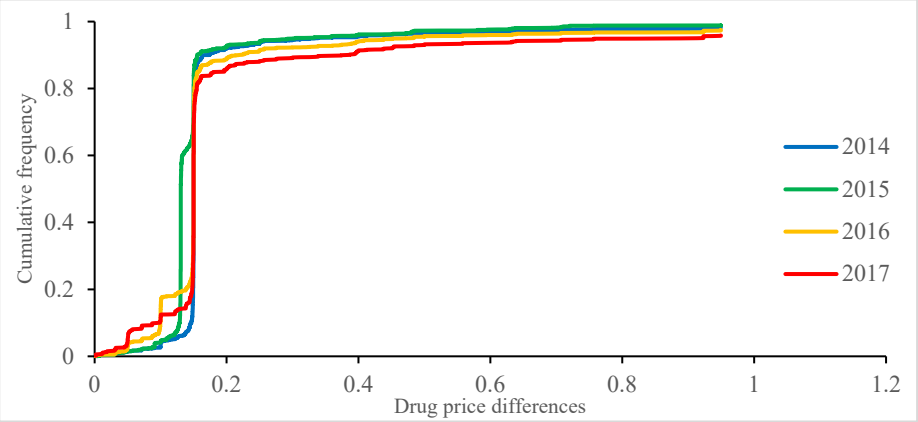

Figure 2: Cumulative frequency of orphan drug price increase rate from 2014 to 2017.

within 100%. In 2014,1.77% were high-priced drugs, 1.22% were high prices in 2015, compared with 2.57% in 2016 and 4.25% in 2017.

4 DISCUSSION

4.1 The Effect of Drug Price Control Policy Reform Has Both Advantages and Disadvantages

Fig. 1 results show that after the deregulation, the price level of orphan drug rose significantly, and the Laspeyres index rose sharply in 2017. Combined with the results of Fig. 2, in 2016 and 2017, when the price control was abolished, the proportion of high price difference drugs increased year by year, indicating that the problem of the inflated price of orphan drugs is becoming more and more prominent, and the role of the completely competitive market in leading the price change is not obvious. Yang mingchun (Yang, 2018) believes that after the abolition of control, in order to see from the production period, the drug price will generally increase by in order to gain more benefits. Through empirical research, Jiang Zaiduo (Jiang, 2016) found that the drug price was still inflated and the existed after the policy reform. This study confirms these two conclusions that the abolition of government pricing can not curb the problem of inflated drug prices.

As can be seen in the previous section of the chart, the proportion of drugs with low price differences in 2016 and 2017 also increased significantly, which has certain benefits to its own sustainable development. The regulation of the "zero margin" of essential drugs is too extreme. In the absence of government health spending, zero margin blocks hospitals' income when using essential drugs, but causes medical institutions to try to circumvent price controls. The same is true for low-priced drugs in orphan drugs. The reform is of great significance to the price rise of low-priced drugs. Most low-priced drugs are still low-priced drugs after experiencing price increases. The price increase effectively alleviates the "dead standard" situation of some low-priced drugs, guarantees the supply of low-priced drugs, protects the interests of low-priced drug manufacturers, and enables the market to develop (Wang, 2020) healthily. At the same time, for patients with rare diseases, the accessibility of low-cost orphan drugs can also be guaranteed to reduce the economic pressure of patients.

4.2 The Effect of Policy Reform Still Needs to Be Long-Term Evaluation

The reform of government pricing is aimed to establish a market-led price formation mechanism. Considering the operation of the market and the lag of the reform and the emergence of volume procurement policy, the subsequent effect remains to be further observed.

4.3 The Letter of Drug Price Formation Mechanism Needs to Be Improved

The previous drug price customization mechanism is defective, and the laws and regulations are also

imperfect. Due to policy support and monopoly, there is an unreasonable price gap between patented drugs and generic drugs, while products with significantly better quality and efficacy are allowed to be priced separately. However, due to the differences in manufacturers, brands, and geographical location, the price difference between the same drugs is also very large (Ruan, 2008). At the same time, the government pricing of drugs is mainly the cost price increase, and the lack of consideration of the circulation cost is also one of the reasons for the inflated price of (Liu, 2006).

China's population base is large, and although the incidence of rare diseases is low, its patient population still cannot be ignored. Orphan drugs are very important in the treatment of rare diseases, so the price change and inflated price of orphan drugs should be paid more attention. At present our orphan drug accessibility is compared with developed countries still has a certain gap (Liu, 2019), for orphan drugs and all the long-term benign development of drug prices, suggest a more perfect pricing mechanism, medical and health undertakings, pharmaceutical enterprises, medical institutions, patients and other interests, fully consider drugs in addition to the production cost of circulation, storage, and sales costs, to achieve a more reasonable balance.

5 CONCLUSION

After the abolition of drug government pricing, the Laspeyres index of orphan drugs increased significantly, and the inflated price of drug became more and more serious. The proportion of drugs with high price increase rate increased from 1.77% in 2014 to 4.25% in 2017. It is difficult to improve the accessibility of orphan drugs by market-oriented control measures alone, and a better pricing mechanism needs to be introduced to protect the rights and interests of patients with rare diseases.

REFERENCES

F R ANCO. P Orphan drugs: the regulatory environment J. Drug Discov Today, 2013, 18(3-4):163-172.

Huang Zhiyong, “On the research of Chinese governmental regulation problem in pharmaceutical Industry, D. National University of Defense Science and technology, 2005.

Jiang Zaiduo, Song Qiong, Liu Jing, Xiang Yan, Tan Rongjun, “A fter the opening price, the purchase of drugs and medical institution in Hubei Provinc e and the use of the status quo a nalysis and Countermeasures,” J. Pharmaceutical Analysis, 2016,11 (06): 25-28.

Lagarde M. How to do (or not to do) ...Assessing the impact of a policy change with routine longitudinal data J. Health Policy Plan, 2011,27(1):76-83.

Liu Xin, L i Jian-tao, Z hang Peng-xiao, K ong Jian, M ei Dan, Z hang Bo. Current Status of Orphan Drugs in China and Comparative Analysis with Foreign Countries J. Chinese Pharmaceutical Journal ,2019,54(10):839-846.

Liu Hua, “Analysis and thinking on the problem of inflated drug prices,” J. Chinese Health Resources, 2006(04): 151-152.

OECD , Pharmaceutical spending , EB/OL https://data.oecd.org/healthres/pharmaceutical-spending.html .

Ruan Jing, “Study on the government control regulation system of d rug p rice,” D. Soochow University, 2008.

Shao Hua, Wang Qiqi, Hu Yuehua. Interrupt time-series analysis and its application in public health J. Chinese Journal of Epidemiology, 2015, 36(9): 1015-1017.

Shen Hongtao, “Research on the pharmaceutical price regulation in China,” D. Harbin Institute of Technology, 2014.

Shen Hongtao, “Research on the pharmaceutical price regulation in China,” D. Harbin Institute of Technology, 2014.

Shi HongYang, Zhou Jie, “Excessive competition, inflated drug prices and drug price regulation,” J. Journal of Jiangxi Open University, 2014 (03): 66-70.

“T h e National Planning Commission issued the Interim Measures on the Administration of Drug Prices,” J. Technology Information, 1997.

“The National Planning Commission has issued a new regulation on drug price management: standardize the order of drug prices to stop artificially high pricing and high discounts.” J. China Pharmaceuticals, 1999, 008 (001): 10-10.

Wang Nuoning, Han Sheng, Fan Di, Shi Shuwen, Chen Jing, “Study on the effect of the deregulation of drug price control on drug price,” J. Chin a Pharmacy, 2020, 31 (03): 257-260.

WHO. WHO Guideline on country pharmaceutical pricing policies EB/OL. https ://www.who.int/medicines/publications/pharm_guide_country_price_policy/en/.

WHO Collaborating Centre for Drug Statistics Methodology EB/OL. https://www.whocc.no/.

Yang Mingchun, Tian Ye, Zou Yujie, Han Sheng, Shi Xiuwen, Guan Xiaodong, “Effect of government regulation and deregulation on drug prices —— takes digestive drugs as an example,” J. China Journal of Health Policy, 2018, 11 (09): 53-58.

Ye Rendao, Liu Gan, Xue Jie. Statistics M. Xidian University Press, 2016: 225-226.

Zhu Xiaofa, “Explore the root cause of the inflated drug price and its governance countermeasures,” J. Price Theory and Practice, 2005 (07): 18-19.