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Easy cuts, easy rebound: Drug expenditures with massive price cuts in Korea

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ABSTRACT

Backgrounds: Since 2012, the Korean government has introduced 46.5% price cut for off-patent medicines in order to reign everescalating drug expenditure. This study sought to appraise the impact of the price cut measure (in the context of Korean National Health Insurance system).
Methods: We employed Korean National Health Insurance database from January 2007 until December 2016 for 120 month period. An interrupted time series analysis with segmented regression analysis was conducted to estimate the impact of price cut on overall drug spending.
Results: Drug spending significantly dropped with the price cut by 186.22 billlion Korean Won (KRW) ($p < 0.0001$) and the trend after the price cut has also significantly decreased by 1.33 billion KRW ($p = 0.002$). However, it was predicted that total expenditures showed an increasing trend and bounced back to the original level. Quantity prescribed had no significance with the price cut. Unit price had a substantial drop ($\beta = -41.68$, $p < 0.0001$) with the price-cut, but the trend after the intervention has increased ($\beta = 0.16$, $p = 0.656$) with no significance.
Conclusions: Although the price cut has successfully countered the everescalating pharmaceutical expenditures in Korea, the impact was temporary. A lack of demand-side measures resulted in an ineffectiveness and unsustainability of policy effect. Thus, more aggressive demand-side measures should be introduced in the Korean context,and both the demand and supply-sides should be balanced.

1. Introduction

In April 2012, the Korean government executed a new pricing measure, which was intended to cut prices of off-patent medicines by 46.5%. The basic mechanism was to cut the price of brand-named medicines by 46.45% when their patent expired, and generic medicines were to be priced at the same level of the originators, so-called equal medicine pricing (EMP) [1,2]. Of the total products, 40.1% (6505 over 13,814) were subject to this new pricing measure [3]. These were the most substantial price cuts ever implemented in Korea. Accordingly, the massive price cuts dramatically impacted overall drug spending. Total pharmaceutical expenditures dropped from USD 11,566 million (13.429 trillion Korean Won (KRW)) in 2011 to USD 11,260 million (13.074 trillion KRW) in 2012. Pharmaceuticals accounted for 29.6% of total health expenditures in 2009 but showed a decrease to 27.1% in 2012 due to the EMP [4]. However, the portion of pharmaceutical expenditures is still higher than 16.3% as of 2015, which was the average among OECD countries [5].

Price-cuts of listed prices are widely used as a supply-side measure to control drug expenditures [6]. It is known that the mid- to long-term impact of price-cuts on cost-containment is unclear and over time is often offset by volume increases [7,8]. However, this is a practical policy tool especially to prompt savings [8]. In practice, this measure has been implemented in many countries and its impact has been examined, and it has been concluded that such price cuts complement demand-side measures for controlling volume or consumption of medicines and more effectively control drug expenditures [3,9–15].

Currently, Korea has various cost-containment measures in place. However, most of them belong to supply-side measures such

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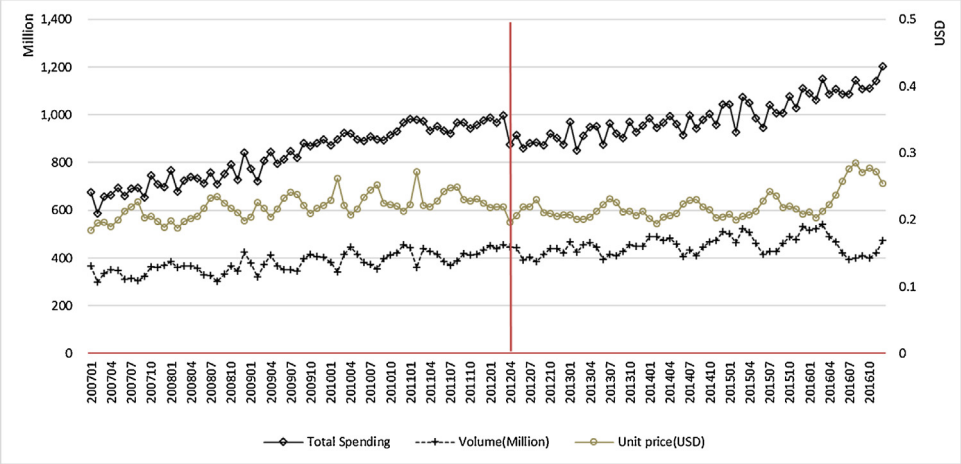

Fig. 1. Overall trend of total pharmaceutical expenditures, volume prescribed, and unit prices.

as price negotiations for new drugs, price adjustment for medicines listed in the Korean National Health Insurance. Some demand-side measures have been exercised including generic substitution by pharmacist, cost-sharing and drug utilization review. However, the effect was negligible since physicians mostly prescribe by the brand name and the NHI does not regulate nor incentivize generic substitution. Policies widely implemented in other countries such as INN (international non-proprietary name) prescribing, reference pricing and budgeting for pharmaceuticals have not been introduced.

After implemented the EMP with a substantial price cut in 2012, the Korean government has taken a lenient attitude toward controlling pharmaceutical expenditures, which has long been an easy target for healthcare cost containment policies. For examples, various measures to extend coverage for costly medicines, such as oncology or orphan drugs, have been introduced; namely, the "Benefit Enhancement Plan (BEP) for the four major conditions (cancers, cardiovascular & cerebrovascular diseases, and rare diseases)" and risk sharing agreements(in other words, "managed entry agreements") for costly drugs without alternatives have been in place since September 2013 and January 2014, respectively [16–19]. The BEP was implemented in accordance with the former President's pledge; specifically, it aims to reduce financial burden of patients suffering from the four major conditions by reducing patients' cost sharing and enhance the drugs' likelihood of being listed in the Korean NHI. Under the BEP, costly drugs with uncertain cost-effectiveness were more likely to be reimbursed [16,17], The RSA is an instrument increasingly employed in other countries to facilitate access to new medicines, especially anticancer or orphan drugs, in the context of uncertainty regarding the effectiveness and the high prices [20,21]. RSA is usually done through a non-disclosure agreement between payers and manufacturers While the risk sharing agreement is a contractual agreement between pharmaceutical company and the Korean National Health Insurance(NHI) and the contract is transient, the BEP addresses patients' cost sharing for four conditions and reimbursement decision of drugs indicated for those four conditions. These two policies have been implemented in order to enhance the coverage ratio of the Korean National Health Insurance(NHI), which could exacerbate the sustainability of the Korean NHI.

However, concerns have been raised recently regarding the rebounding trend of drug spending [22,23]. Park et al. [23] forecasted that, by 2025, total pharmaceutical expenditures would reach approximately 22,392 million USD (26 trillion KRW). Kwon et al. examined the effect of the EMP on the market competition of statin medication and concluded that the new pricing policy has not contributed to promoting market competition and was favorable to the originators even after the patent expired [3], yet few studies have systematically examined the impact of the EMP using the Korean NHI database. This study aimed to investigate the impact of the massive price cuts on overall drug spending in Korea and to suggest some implications for the future by recognizing the limitations of price cuts and the importance of demand-side measures.

2. Materials and methods

First, this study aimed to evaluate the impact of the EMP, implemented in April 2012, on overall pharmaceutical expenditures; to do so, we extracted datasets pertaining to monthly expenditures, quantities prescribed, and unit prices of pharmaceuticals from the National Health Insurance (NHI) claims data from January 2007 to December 2016 (Monthly data, 120 months), which was provided by the National Health Insurance Service (NHIS) of South Korea. The Korean NHI pharmaceutical prescription electronic claims data covers 97% of the population and 99% of the insurance claims [24].

An interrupted time series analysis with segmented regression analysis was conducted [25]. The model of segmented regression was $y = \alpha + \beta_1{}^* \text{Trend}_t + \beta_2{}^* \text{Intervention}_t + \beta_3{}^* \text{time\_after\_Intervention}_t + v_t$ where α = interception of the autoregression function for dependent variables prior to the EMP, β_1 = estimated change over time (slope) prior to the EMP, β_2 = change in interception of the autoregression function for dependent variables from the preintervention to the postintervention, β_3 = change in estimated change overtime (slope) from the pre- to the postintervention, and v_t = random error at observation t. Dependent variable y included total drug spending (1 USD = 1161.11 Korean Won (KRW) as of 2016), total volume prescribed (counted as the minimum unit i.e., tablet, capsule, vial), and unit price. The unit price was calculated by dividing total amount of spending by total volume prescribed, which was equivalent to average prices weighted by quantity prescribed. All statistical analyses were conducted using SAS version 9.4 (SAS Institute, Cary, NC, USA).

3. Ethical statements

This study was approved by the institutional review board of Seoul National University with the review exemption case for using the open data source (IRB No. E1706/001-001).

4. Results

The overall monthly trend of drug spending from January 2007 to December 2016 (120 months) is depicted in Fig. 1. Total pharma-

Table 1
Results of Segmented Linear Regression.

Variable	Intercept	Trend	Policy effect	Interaction	DW	R^2
Total Drug Spending(Billion KRW)	745.88** (10.26)	6.84** (0.28)	−186.22** (14.73)	−1.33* (0.43)	2.02	0.93
Quantity Prescribed (Million)	3271** (138.08)	16.50** (3.68)	−18.06 (183.40)	-8.98 (5.84)	2.01	0.75
Unit price(KRW)	232.04** (8.54)	0.67* (0.22)	−41.68** (10.50)	0.16 (0.36)	2.01	0.66

Note: DW, Durbin-Watson; KRW, Korean Won(1USD=1.161.11 KRW as of 2016).
**p<0.0001, *p<0.05.

ceutical expenditures have shown an increasing trend ($p < 0.0001$, Table 1) in spite of a drop in April 2012. Total volume prescribed showed a steady trend while unit price tended to slowly increase.

Table 1 represents the results of segmented linear analysis with interrupted time series. Total drug spending has dropped with the EMP by 186.22 (billion KRW, $p < 0.0001$) and the trend after the EMP has significantly decreased by 1.33 (billion KRW, $p = 0.002$). However, quantity prescribed had no significance in the intercept ($\beta = -18.06$, $p = 0.922$) and trend ($\beta = -8.98$, $p = 0.127$) with the EMP. Unit price had a substantial drop ($\beta = -41.68$, $p < 0.0001$) with the EMP, but the trend after the intervention has increased ($\beta = 0.16$, $p = 0.656$) with no significance.

Fig. 2 represents the estimation of segmented regression analysis. The following model estimates total drug spending at time t. Total drug spending = 745.88 + 6.84*$time_t$ − 186.22*$intervention_t$ + −1.33*$time\_after\_intervention_t$. With this model, the predicted drug expenditures can be calculated and presented by lines in Fig. 2. The predicted values were consistent with what we observed in the raw data. It was found that, despite massive price cuts, total expenditures and prices showed an increasing trend. Interestingly, the trend of volume prescribed was affected by the EMP, demonstrating a slow-down slope after the EMP, unlike the previous steep increasing trend.

5. Discussion

This study examined the impact of the recently implemented measure of massive price cuts on Korean drug spending. We observed total drug spending, volume prescribed, and unit price based on 120 months of observations from the National Health Insurance claims data and suggested that, although the price cut has successfully countered the ever-escalating pharmaceutical expenditures in Korea, the impact was temporary, and it almost bounced back to the original level. Specifically, we demonstrated that the impact of the EMP on pharmaceutical expenditures was statistically significant right after its implementation, yet its impact on the quantity prescribed was not, and the unit price per product actually increased, although not significantly. Since unit prices represented the weighted average prices, the increase in prices implies that costly medicines have been prescribed within the same ingredient after the EMP. This was revealed that after the EMP, brand-named drugs were more likely prescribed than generic medicines which were subject to price cuts after the EMP [3]. These findings indicate that the reduced pharmaceutical expenditure was attributable to the massive price cut per se, and if patients or health care providers (physicians or pharmacists) do not change their utilization behavior, then pharmaceutical expenditures would bounce back. Namely, the impact of price cuts is transient, if not complemented with other demand-side measures. Godman and colleagues reached similar conclusions, suggesting that the supply-side measures resulted in limited savings and emphasized the importance of the multiple demand-side measures [26]. Kwon et al. also demonstrated that, in the example of statin medication, price control (supply-side) had a limited impact on the growth of pharmaceutical expenditures when the number of patients was increasing and the use of expensive drugs was prevalent [12].

In the face of ever-escalating pharmaceutical expenditures, the Korean government has introduced various policies geared toward the supply-side (pharmaceutical industry), such as price adjustments for off-patent drugs, price negotiations for new drugs, cost-effectiveness analyses of already listed medications, and so on, without demand-side measures which were commonly used in other countries, such as INN (international nonproprietary name) prescribing, reference pricing systems, or mandatory generic substitution. Most physicians prescribe drugs by product name, and generic substitution is not illegal but is very limited in Korea, which means the drug utilization and market share of generic medicines is mainly determined by physicians.

The Korean NHI is paying providers for their health services on the basis of fee-for-service payment, which is known to encourage more visits, services, and overuse of medicines; so-called supplier induced demand (SID) [27,28]; and the first ranked growth among OECD countries of current health care expenditures (6.8%) from 2005 to 2015, which was almost 3 times higher than the average OECD growth rate (2.1%) [29]. In addition, it is obvious that Korea will soon face a substantial increase in healthcare costs due to its aged society. Thus, effective and efficient cost containment measures need to be considered. For example, global payments can be considered as a solution to slow down the growth of health care expenditures [30,31].

Similarly, for pharmaceuticals, a lack of demand-side measures resulted in an ineffectiveness and unsustainability of policy effects [2,12,26,32–34]. In the Korean context, lessons learned from previous policy implementations have suggested that more aggressive demand-side measures, such as generic substitution, reference pricing systems, or fixed budgets for pharmaceuticals [7,9,35] be introduced and that both the demand- and supply-sides be balanced [2,3,12].

Our analysis is the first attempt to systematically analyze the impact of EMP on pharmaceutical spending, volume, and unit price using Korean NHI data in the past 10 years, yet our study has the following limitations. First, our interrupted time-series analysis assumed ceteris paribus except the introduction of the EMP in April 2012; yet other policies, such as the introduction of the benefit enhancement plan (BEP) for the four major conditions (cancers, cardiovascular & cerebrovascular diseases, and rare diseases) in September 2013 and the risk sharing agreements (RSA) in January 2014 for high priced cancer drugs without alternatives, could stimulate pharmaceutical utilizations [16]. Second, in order to measure the volume of the drugs prescribed in the Korean NHI, our analyses employed “quantity prescribed” unit, not WHO’s defined daily dose (DDD) (https://www.whocc.no/atc_ddd_index) because this has not been adopted yet in the Korean Database for pharmaceuticals.

Despite these limitations, our findings reconfirmed that price cuts, though massively cutting down prices, showed a transient effect and cannot be the best alternative to consistently and efficiently control drug spending in the future. The stress was placed on demand-side measures that were still lacking in Korea. Fixed budgeting for pharmaceuticals can be considered as an alternative for controlling both demand- and supply-side.

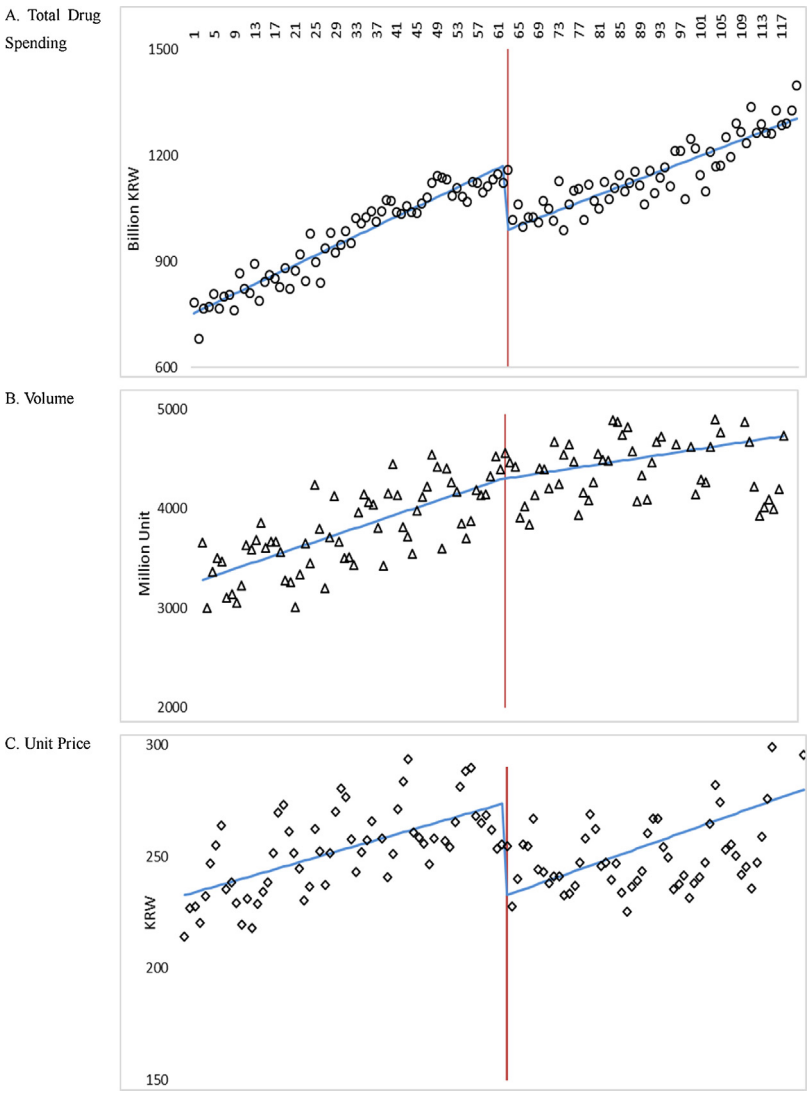

Fig. 2. Estimation of Segmented regression.

Authors' contributions

HYK and SJB conceived the concept of this work and developed the article. HYK performed the data collection and analysis and drafted the manuscript. SEC, SP and SMP revised the manuscript critically and contributed to the interpretation of the data. JHK and EKL supervised the findings and implications of this work. All authors discussed the results and contributed to the final manuscript.

Conflict of interest

All authors declared no conflict of interest.

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