行政院國家科學委員會專題研究計畫 期末報告

台灣全民健康保險體系的低價藥品市場：現況、趨勢與對產業的影響(第 3 年)

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公 開 資 訊 ： 本計畫可公開查詢

中 華 民 國 102 年 10 月 31 日

中文摘要： 背景：世界各國藥品支出持續成長，費用抑制已成政府衛生政策重要目標之一。在台灣，雖然採取多次藥價調降措施，全民健康保險藥品支出漲勢依舊。

目的：分析台灣全民健康保險 2000 年至 2011 年藥品市場趨勢，特別著眼於高價藥品與低價藥品的支出差異情形。

方法：資料來源為台灣全民健保研究資料庫，包括特約藥局申報處方檔、門診處方檔與住院處方檔。為了便於比較，分析僅限於固態劑型的口服藥品。運用集中度曲線與集中度指數，測量藥品利用與藥價相關的不均情形，並供作趨勢比較之用。集中度曲線的製作，係以累積的開立口服藥粒數或累積的藥費佔率為 Y 軸，以累積的藥品品項數佔率為 X 軸，其中藥品品項從最低至最高單位價格依序排列。集中度指數的計算，則是集中度曲線與均等線之間的面積乘以二。集中度指數較高，則表示藥費分布較偏向高價藥品。

結果：全民健康保險口服藥品品項數從 2000 年的 7,896 增加至 2011 年的 8,735 項。雖然每年處方總數逐年減少（從 829.5 百萬至 781.0 百萬），總開立藥粒數卻從 10.8 十億增加至 13.8 十億，總藥費成長為 1.6 倍（從 45.2 十億至 74.3 十億新台幣）。單一藥品品項的單價從 0.06 元至 4,270 元不等。2000 年時，百分之六十的藥品品項之單價小於等於 3 元，此比例在 2011 年升至百分之七十三。研究的十二年間，開立藥粒數的集中度指數維持穩定約 0.075，藥費的集中度指數則從 0.619 升至 0.699。

結論：台灣全民健康保險裡，高價藥品在總藥品支出的佔率逐年增加。另一方面，長期低價藥品大量充斥的情形可能影響優良藥品的穩健供應。

中文關鍵詞： 藥品支出、集中度曲線、集中度指數、國家衛生計畫、台灣

英文摘要： Background: Because pharmaceutical expenditures continue to grow worldwide, cost containment has become one of the most important objectives of government health policy. In Taiwan, the growth of pharmaceutical expenditures within the National Health Insurance (NHI) program remained substantial despite several rounds of drug price adjustment. Objective: To analyze the trend of pharmaceutical market within Taiwan 's NHI with representative claims datasets from 2000 to 2011, with the focus on the expenditure differentials between expensive and cheap drugs.

Methods: The National Health Insurance Research Database in Taiwan supplied the datasets of prescriptions dispensed at independently contracted pharmacies, at clinics and outpatient departments of hospitals, and for inpatients in each year. For favorable comparisons, the analysis included only drugs with solid forms for oral use, i.e. tablets and capsules. The concentration curve and concentration index (CI) were applied to measure price-related inequality in drug utilization and to serve for trend comparison. The concentration curves were plotted for the distributions of cumulative prescribed pill counts and drug costs (on the y-axis) against the cumulative share of drug items ranked by unit price from the lowest to the highest (on the x-axis) in each year. A concentration index was calculated as twice the area between a concentration curve and the line of equality (the 45-degree line). A higher index denoted the distribution in favor of expensive drugs.
Results: The number of distinct drug items within the NHI increased from 7,896 in 2000 to 8,735 in 2011. Although the annual number of prescriptions decreased with time (from 829.5 to 781.0 million), the total prescribed pill counts rose from 10.8 to 13.8 billion and the total costs grew up 1.6 times from 45.2 to 74.3 billion New Taiwan dollars (NTD). The unit price of a drug item ranged from 0.06 to 4,270 NTD. Sixty percent of drug items in 2000 had a unite price less than or equal to 3 NTD (about 0.1 US dollar) and the proportion rose to 73% in 2011. While the CI of prescribed pill count remained stable (from 0.075 in 2000 to 0.075 in 2011), the CI of drug costs rose from 0.619 to 0.699.
Conclusions: Expensive drugs had an increasingly greater share of pharmaceutical expenditures within Taiwan 's NHI. On the other hand, the long-term existence of abundant cheap drugs might compromise a sound supply of pharmaceuticals.

Taiwan

Research Article

Application of concentration indexes to analyze the widening expenditure divide between expensive and cheap drugs in Taiwan

INTRODUCTION

The pharmaceutical expenditures persistently grow up worldwide. Pharmaceutical cost containment becomes one of the most important objectives of government health policy.[1-3] The causes of growing drug expenditures can be decomposed to demand-side and supply-side. Influencing factors of demand-side include an increase in elderly populations, an increase in prevalence of chronic disease, and an increase in health expectation by patients, etc. On the other hands, the factors of supply-side include increase launch of new drugs (pharmaceutical innovation), broader coverage of reimbursed drug items, etc. All these factors result in the growth of pharmaceutical expenditure through two major elements, unit price of drug and prescription amount.[2,4,5]

Most of the previous surveys pay attention to total pharmaceutical expenditure compared with total health expenditures and gross domestic product.[6-8] Furthermore, most of them focus on the contribution of expensive drugs with the intention of cost control or generic substitution. However, these methods can not represent the utilization variation between different unit prices of drugs. The National Health Insurance (NHI) in Taiwan has offered a broad coverage of drug items, approximately 20,000 items all the time, since its launch in 1995.[9] Parallel to the growth of other sectors within the NHI, the drug expenditure has always accounted for 25% of the total NHI expenditure annually.[1] Despite going through several times drug price adjustment, the growing pharmaceutical expenditure is still an intolerable burden. The detail interactions between unit price and prescription volume remain unclear.

The concentration curve and related concentration index is a method commonly used to describe the income-related health inequalities,[10-12] but is rarely used to evaluate the drug utilization.[13] In current study, we applied the concentration curve and concentration index to analyze the trend of pharmaceutical market within NHI in Taiwan during 2000 to 2011. Using this convenient method, we can easy observe the variation in the prices and quantities of pharmaceuticals over time.

MATERIALS AND METHODS
Data source

The data sources came from the National Health Insurance Research Database (NHIRD), that merged the NHI's electronic claims datasets into a large computerized database for research purpose.[14,15] The single-payer NHI in Taiwan has covered almost all inhabitants (23,198,664 beneficiaries at the end of 2011, more than 99.9% of all population)[16]. The database contains original claims for reimbursement plus registration files of beneficiaries and healthcare facilities. The identification numbers

of persons and healthcare facilities in the datasets have been encrypted to protect privacy, but the encrypted identification numbers remain unique so that record-linking within datasets is feasible. All researchers who apply for use of the NHIRD are required to sign a written agreement declaring that they could not violate the privacy of patients or healthcare providers and should acknowledge the NHIRD on publication.

In the current study, we used three kinds of datasets:

(a) the systematic sampling files of ambulatory care expenditures by visits (CD), details of ambulatory care orders (OO), inpatient expenditures by admissions (DD) and details of inpatient orders (DO): The datasets of CD and OO represent 1/500 of the original claims datasets in each year and the datasets of DD and DO represent 1/20. Although the size of these datasets seems small in comparison with other kinds of available datasets such one-million cohort datasets, the systematic sampling datasets can well reflect the situation in each year.

(b) the complete datasets of expenditures for prescriptions dispensed at contracted pharmacies (GD) and details of prescriptions dispensed at contracted pharmacies (GO): After increasing division of prescribing and dispensing and intensive promotion of issuing the refill prescriptions for chronic illnesses within the NHI in recent years, the drug items dispensed outside the prescribing clinics, especially those in the second and third refills, can only be known from GD and GO datasets. The GD and GO datasets are indispensable complements to the prescribing datasets of CD and OO.

(c) the registry for drug prescriptions (DRUG): These files have become available annually and can only make supplements to the master file (all-YYMM.b5) of reimbursed drugs within the NHI.

Study design

For favorable comparisons, the focus of current study was on oral drugs with solid forms, e.g. tablets and capsules. For each distinct drug item, we calculated how many times it had been prescribed in each year. The aggregate prescribed pill count and drug cost were also calculated. The data from the systematic sampling OO datasets multiplied with 500 add with the data from the systematic sampling DO datasets multiplied with 20, and then merged with the data from the complete GO datasets representing the drugs dispensed at outside pharmacies. Because unit prices of drugs might change during the year, we adopted the last approved price of each drug item at the end of each year in the analysis.

In present study, the drugs were grouped into lower unit price group (unit price <= 3 NTD) and higher unit price group (unit price > 3 NTD). The setting of threshold for low-priced drugs was based on the flat rate of payment for pharmaceuticals per day (daily rate), so-called "simplified forms", it is an optional claim billing method commonly used by practitioners at physician clinics. Each claim of simplified form is reimbursed 100 NTD for 3 days of prescription before 2002.[1] On average, every prescription contains 4 drugs which are taking three times a day. After calculation, each drug is reimbursed about 3 NTD. Three NTD is approximately equal 0.1 US dollar based on current exchange rate.

The concentration curve and related concentration index is a method commonly used to describe the income-related health inequalities. In current study, the concentration curves and concentration index were constructed to examine price-related inequality in drug utilization within NHI. The concentration curve plots the cumulative percentage of the health variable (on the y-axis) against the cumulative percentage of the sample (on the x-axis), ranked by the external variable which is the

subject of interest.[17] The concentration index is calculated in the same way as Gini index. It is defined as twice the area between the concentration curve and the line of equality (the 45-degree line).[18] When the concentration curve lies above the line of equality, the area is defined as a negative value.[19] On the contrary, the area is defined as a positive value. The concentration index is between -1 and +1. The positive value of concentration index indicates the distribution in favor of the higher variable groups. The negative value of concentration index indicates the distribution in favor of the lower variable groups.

In current study, we draw the concentration curve for distribution of cumulative share of the prescription numbers, prescribed pill counts and drug costs (on the y-axis) against the cumulative share of the drug items (on the x-axis), ranked by drug unit price from the lowest to the highest. The related concentration index of prescription numbers, prescribed pill counts and drug costs were also calculated.

Data processing and statistical analysis

The open-source software Perl (version 5.18.0) was used for computing. Statistical analyses were performed using the Statistical Analysis Systems, version 9.2 (SAS Institute, Cary, North Carolina, USA).

Descriptive statistics are presented as the percentage. Linear regression analysis was applied for the concentration index trends during the 12-year period of our inquiry; p-values < 0.05 were considered statistically significant.

RESULTS

The total item of oral drugs with solid form prescribed within the NHI in 2000 was 7896, which increased to 8735 in 2011. From 2000 to 2011, the aggregated pill counts rose from 10754.9 million to 13797.1 million, while the total prescription numbers decreased from 829.5 million times to 781.0 million times. However, the drug costs rapid grew up annually, from 45191.8 million New Taiwan dollars (NTD) to 81112.8 million NTD, during 12-year duration. The utilization and costs of oral drugs with solid form within the NHI in Taiwan during 2000-2011 are presented in Table 1.

Table 1. Utilization patterns of oral drugs with solid form in Taiwan's National Health Insurance, 2000-2011

Year	No. of Items	Prescription Numbers (in millions)	Prescribed Pill Counts (in millions)	Drug Costs (NTD in millions)
2000	7896	829.5	10754.9	45191.8
2001	8044	812.1	11267.4	49040.4
2002	8206	801.6	11606.6	55072.5
2003	8227	784.2	11908.4	57566.8
2004	7832	826.7	12716.4	66256.8
2005	7911	798.2	12368.4	66693.5
2006	7373	687.3	11369.9	67264.8
2007	7366	701.4	11927.4	68134.0
2008	7650	698.7	12239.5	72391.6
2009	8002	715.5	12672.0	76186.7
2010	8566	738.3	13193.4	74277.6
2011	8735	781.0	13797.1	81112.8

In general, the vast majority of prescribed drugs are drugs with unit price less or equal than 3 NTD, about 0.1 US dollar, which accounted for 66% in 2000 and increased to 73% in 2011. During 12-year observation period, the prescription rates of drug with unit price less or equal than 3 NTD rose from 72% to 79%, and the prescribed pill counts increased from 63% to 69%. However, the costs of these cheaper drugs always accounted less the 20%. The distributions of drug utilization and drug costs with different unit price are showed in Figure 1.
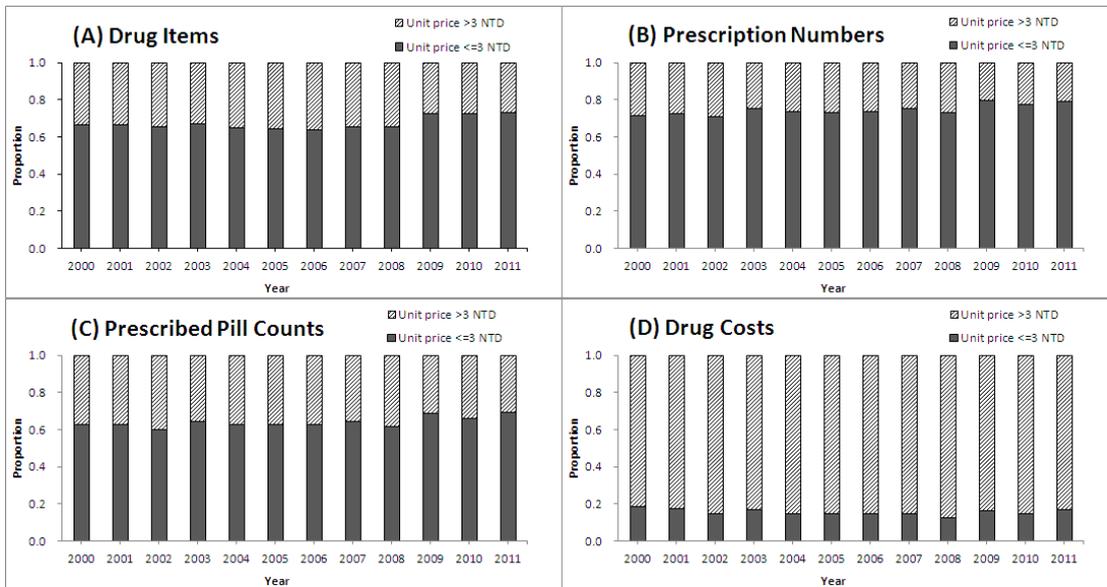

Figure 1. Utilization patterns of oral drugs with solid form in Taiwan's National Health Insurance, 2000-2011, stratified by unit price. (A) Drug items (B) Prescription numbers (C) Prescribed pill counts (D) Drug costs

Figure 2 shows the concentration curve for distribution of cumulative share of the prescription numbers, prescribed pill counts and drug costs (on the y-axis) against the cumulative share of the drug items (on the x-axis) when the drugs are ranked from the lowest to the highest price. There is significant inequality in the distribution of drug costs between different unit drug prices during study periods. The drugs with higher unit price shared higher drug costs, although their prescription counts and pill counts seems less inequality.
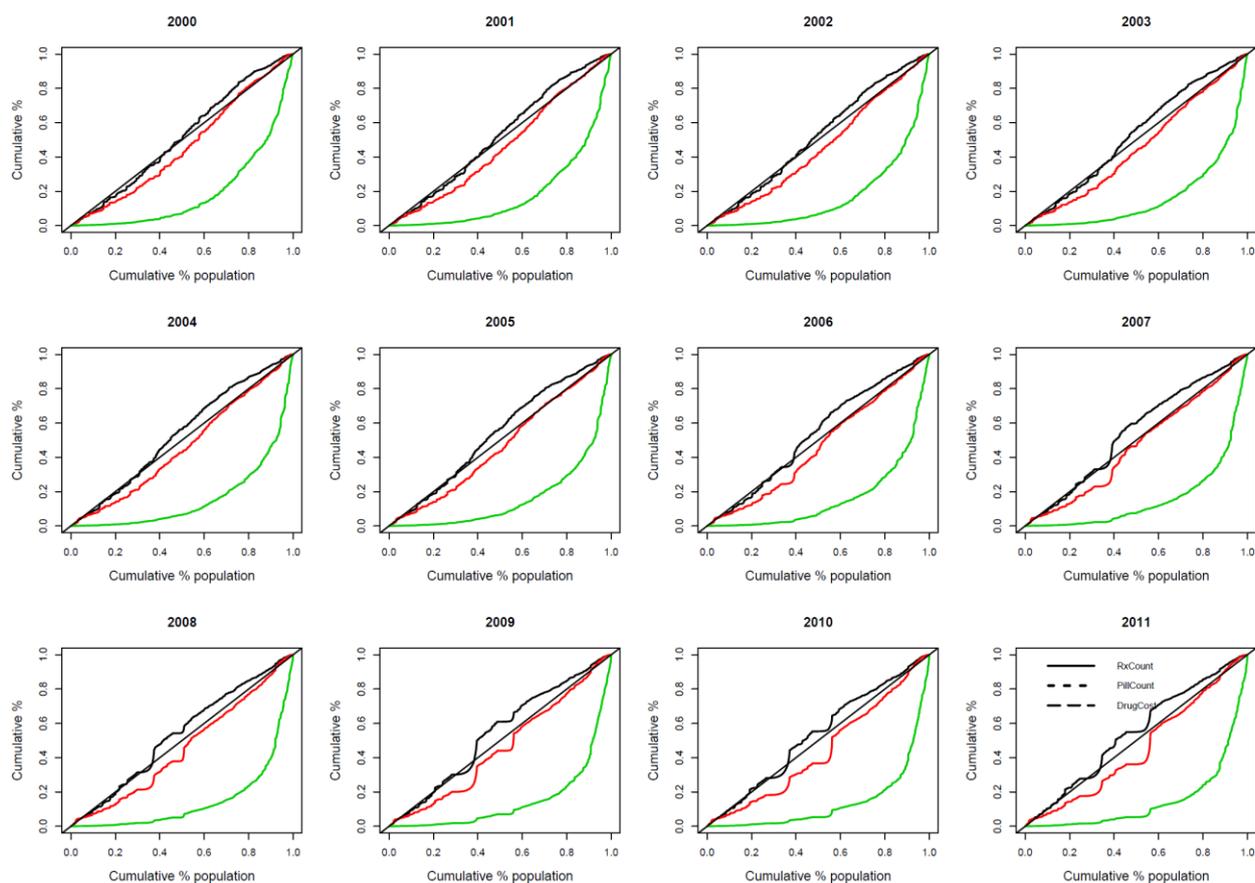
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Figure 2. Concentration curves for prescription numbers, prescribed pill counts and drug costs of oral drugs with solid form in Taiwan's National Health Insurance, 2000-2011.

From 2000 to 2011, concentration index of drug costs rose from 0.62 to 0.70 (p<0.001), while the concentration index for prescription numbers dropped from -0.035 to -0.108 (p<0.001), and concentration index for prescribed pill counts was consistently around 0.076 (p=0.86). Overall, the trend of concentration index we examined over the 12-year period all involved statistically significant change except for prescribed pill counts. The 12-year trends of concentration index for prescription numbers, prescribed pill counts and drug costs are shown in Figure 3.
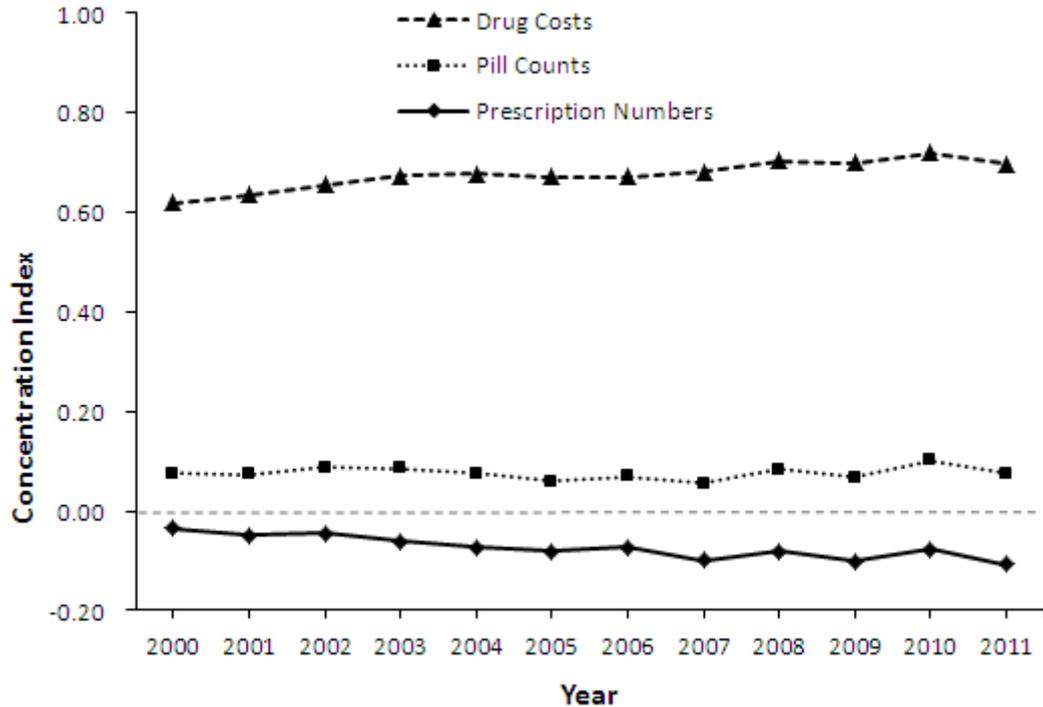
Figure 3. Concentration index for prescription numbers, prescribed pill counts and drug costs of oral drugs with solid form in Taiwan's National Health Insurance, 2000-2011.

DISCUSSION

Our results show that the pharmaceutical market within NHI in Taiwan was full of low-priced drugs throughout the 12-year observation period. Despite a small market share in terms of costs, the drugs cheaper than 3 NTD accounted for a large share in terms of volume (around 63%-69% of total prescribed pill count). Regarding price-related inequality in drug utilization, we found an interesting phenomenon. The drug costs were highly concentrated amongst the high-priced drugs, and there was a trend towards high-priced drugs years by years. Instead, the prescription number had a trend towards low-priced drugs years by years.

The discussions about the increasing drug expenditure usually focus on the aging of population, the change of disease patterns, and the innovation of drugs. The last item means the entry of more expensive drugs into the NHI and is constantly a matter of concerns to the NHI authority. For example, the Bureau of National Health Insurance routinely announces the top ranking list of drug ingredients and drug groups by expenditure. In 2009, the top 10 ingredients were amlodipine, atorvastatin, valsartan, factor VIII, clopidogrel, glimepiride, imatinib, rosuvastatin, pioglitazone, losartan.[20] Drug items belonging to the top ranking list are usually not cheap in term of unit price. That is, besides prescribed volume, the price might also play important role for those top ranked drugs that have the lion's share of the NHI drug expenditure. However, the usage and reimbursement of these expensive-drugs are always under strict restriction and utilization review. Most of them are reasonable used as needed. Besides, NHI authority introduced copayments and deductibles to decrease the expenditures of these high-priced drugs.

In contrast to these high-priced drugs, the utilization of low-priced drug is usually

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overlooked. The large amount of low-priced drugs within the NHI raises some questions that should be seriously examined. Firstly, are these low-priced drugs used appropriately or over prescribed? For example, cheap antacids were prescribed in half of all prescriptions for outpatients in Taiwan in 2000; however, about 90% of these antacids were prescribed without claims diagnoses of gastrointestinal disorders.[21] To bend aforementioned squanders, Taiwan NHI terminated the reimbursement of antacids since October 2005.[22] We believe the issue of over-prescription of antacid is not just a corner of iceberg. Over-prescriptions also present in other cheap drugs. Prescribing unnecessary drugs not only result in medication waste, but also lead patients to suffering other medical adverse events. Thus, besides cutting down the unit price of drugs, NHI authority should propose strategies to regulate reasonable use of these cheap drugs. Out-of-pocket expense is one of the alternative measures to decrease demand of unnecessary drugs from patients.

Secondly, whether these drugs pricing too low? Our preliminary study found that there are a significant proportion of drugs with unit prices less than 1 NTD, approximately threepenny USD, within Taiwan NHI market. When the drugs are cheaper than a candy, can pharmaceutical firm get reasonable profit? Under the situation of lack reasonable profit, the first problem we facing is that brand name drug withdraw the market and no domestic pharmaceutical company willing to produce these cheap drugs. Furthermore, unfavorable low prices do not seem to guarantee the maintenance of quality, let alone more innovation, research and development.[23,24] Finally, the domestic pharmaceutical firm will become to produce generic drugs only. How is the sustainability of these domestic pharmaceutical firms in the long run? Moreover, in order to lessen the impact of low-price strategy from NHI, original international pharmaceutical companies postpone new drugs launched into Taiwan.[25] The policy of setting low prices might be detrimental to both the health of beneficiaries and the future development of the pharmaceutical industry in Taiwan.

Although the price mechanism plays a pivotal role of competition in the capitalist world, the situation is quite different in the quasi monopsony as the drug market within the NHI (note: the NHI is a payer instead of a direct buyer). The NHI only regulates the reimbursement prices, but not the acquisition prices. The difference between the reimbursement price and the acquisition price become the profit margin of the medical providers. The profit-seeking behavior of the medical providers resulted in some distortions. After squeezing the profit margin through cutting drug prices, the medical providers have financial incentives to substitute low-profit drugs by high-profit drugs.[26,27] These substitutes may be more expensive. Regardless efficacy, safety and cost, prescribing drugs only based on the profit is no benefit to the health of patients and reduction of total pharmaceutical expenditure.

Our study has several potential limitations. Firstly, current study was only focus on drugs with oral solid form, not whole dosage forms. The result may not truly reflect the real NHI pharmaceutical market. However, the range of prices within injectable drugs is broader than oral drugs. Price related structure variation should be more significant. In addition, the detail price-volume structure variation between different pharmacological group or specific ingredients need further investigation.

CONCLUSIONS

The drug market of the National Health Insurance in Taiwan was full of cheap drugs over years and resulted in some distortion effects. Besides cutting down the price of drugs, health policy makers need to propose more strategies to regulate the reasonable

use of drugs and to prevent financial incentives induced market chain reaction. The most important goal is to keep the balance between health benefits and the further development of pharmaceutical industry.

CONFLICTS OF INTEREST
The authors declare that they have no conflict of interests.

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國科會補助計畫衍生研發成果推廣資料表

國科會補助計畫	計畫名稱: 台灣全民健康保險體系的低價藥品市場：現況、趨勢與對產業的影響
	計畫主持人: 周麗芳
	計畫編號: 99-2410-H-004-029-MY3　　　學門領域: 醫務管理

無研發成果推廣資料

99 年度專題研究計畫研究成果彙整表

計畫主持人：周麗芳　　　　計畫編號：99-2410-H-004-029-MY3

計畫名稱：台灣全民健康保險體系的低價藥品市場：現況、趨勢與對產業的影響

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<tr><td rowspan="4">參與計畫人力（本國籍）</td><td>碩士生</td><td>4</td><td>0</td><td>100%</td><td rowspan="4">人次</td><td></td></tr>
<tr><td>博士生</td><td>0</td><td>0</td><td>100%</td><td></td></tr>
<tr><td>博士後研究員</td><td>0</td><td>0</td><td>100%</td><td></td></tr>
<tr><td>專任助理</td><td>2</td><td>0</td><td>100%</td><td></td></tr>
<tr><td rowspan="12">國外</td><td rowspan="4">論文著作</td><td>期刊論文</td><td>0</td><td>0</td><td>100%</td><td rowspan="3">篇</td><td></td></tr>
<tr><td>研究報告/技術報告</td><td>0</td><td>0</td><td>100%</td><td></td></tr>
<tr><td>研討會論文</td><td>0</td><td>0</td><td>100%</td><td></td></tr>
<tr><td>專書</td><td>0</td><td>0</td><td>100%</td><td>章/本</td><td></td></tr>
<tr><td rowspan="2">專利</td><td>申請中件數</td><td>0</td><td>0</td><td>100%</td><td rowspan="2">件</td><td></td></tr>
<tr><td>已獲得件數</td><td>0</td><td>0</td><td>100%</td><td></td></tr>
<tr><td rowspan="2">技術移轉</td><td>件數</td><td>0</td><td>0</td><td>100%</td><td>件</td><td></td></tr>
<tr><td>權利金</td><td>0</td><td>0</td><td>100%</td><td>千元</td><td></td></tr>
<tr><td rowspan="4">參與計畫人力（外國籍）</td><td>碩士生</td><td>0</td><td>0</td><td>100%</td><td rowspan="4">人次</td><td></td></tr>
<tr><td>博士生</td><td>0</td><td>0</td><td>100%</td><td></td></tr>
<tr><td>博士後研究員</td><td>0</td><td>0</td><td>100%</td><td></td></tr>
<tr><td>專任助理</td><td>0</td><td>0</td><td>100%</td><td></td></tr>
</table>

	其他成果 (無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等，請以文字敘述填列。)	無

	成果項目	量化	名稱或內容性質簡述
科教處計畫加填項目	測驗工具(含質性與量性)	0	
	課程/模組	0	
	電腦及網路系統或工具	0	
	教材	0	
	舉辦之活動/競賽	0	
	研討會/工作坊	0	
	電子報、網站	0	
	計畫成果推廣之參與（閱聽）人數	0	

國科會補助專題研究計畫成果報告自評表

請就研究內容與原計畫相符程度、達成預期目標情況、研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）、是否適合在學術期刊發表或申請專利、主要發現或其他有關價值等，作一綜合評估。

1. 請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估 ■達成目標 □未達成目標（請說明，以 100 字為限） 　　　□實驗失敗 　　　□因故實驗中斷 　　　□其他原因 　說明：
2. 研究成果在學術期刊發表或申請專利等情形： 論文：□已發表 ■未發表之文稿 □撰寫中 □無 專利：□已獲得 □申請中 ■無 技轉：□已技轉 □洽談中 ■無 其他：（以 100 字為限） 投稿審查中
3. 請依學術成就、技術創新、社會影響等方面，評估研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）（以 500 字為限） 在研究計畫補助下，多年來持續運用全民健保資料庫進行醫療利用與藥品經濟學領域的研究。本研究計畫本年度亦已依進度按部就班執行計畫。本研究計畫成果內容，與原計畫相符，亦達成預期目標。已針對標的期刊所要求的格式完成英文論文初稿（如期末報告內容），編修後將於近期內投稿。將再陸續就相關衍生課題內容寫就論文。