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Effect of Government Mediated Access Pricing on Availability and Pricing of Drugs in the Philippines

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Abstract

Introduction
The Philippines implemented Republic Act 9502, known as the "Cheaper Medicines Act of 2008" to improve access to cheap quality drugs. The government placed 5 drugs under maximum retail drug pricing and influenced pharmaceutical companies to reduce prices of 16 other drugs by half. This study compared the availability and price of selected drug molecules affected by the government-mediated access pricing (GMAP) in 2009 and 2011.
Methods
The study used data obtained from independent surveys conducted by IMS Health Philippines in 2009 and 2011 using a stratified sample of 600 drugstores each. Stratification was based on retail type (chain or independent) and location (Metro Manila, Luzon, Visayas and Mindanao). Three stock keeping units (SKUs) each for 11 drug molecules were selected: 1) product with highest sales volume; 2) highest-priced product competitor; and 3) cheapest generic counterpart available. Ten of 11 most saleable drugs were in the GMAP list. Drug availability and price data were obtained using a mystery shopper approach.
Results
Mean prices went down for all most saleable drugs, except for one drug not included in the GMAP list. Availability of these drugs generally did not significantly change. For competitors, marked decline in availability was observed for some, in particular, those that resisted price reduction. The availability of cheapest drug counterparts increased considerably while their mean prices all decreased.
Conclusion
Government mediated pricing can be effective in reducing drug prices. However, it can adversely affect availability of some drug products. Availability of generic drugs has evidently increased.

1. Introduction

Availability and access to quality medicines form an important component of a country's health service delivery. Many major diseases are treated effectively with drugs. However, access to cheap quality drugs has persisted as a big problem, especially among the poor (MDG Gap Task Force 2012). Low drug availability has been reported in the Philippines (Cameron et al. 2008, Dichosa 2010). Furthermore, medicine prices in the Philippines are considered too high compared to international reference price (Batangan 2005), making essential drugs less accessible to its poor population. Expenditure on drugs accounts for a substantial proportion of income of poor households (Batangan & Juban 2009). Even with social health insurance coverage, out-of pocket expenses, mostly on

purchased drugs, can amount to 10% of annual average income in a significant proportion (>=13%) of hospitalized patients in the Philippines (Tobe et al. 2012).

In 2008, Republic Act 9502, known as "The Universally Accessible and Quality Medicines Act of 2008" and also as the "Cheaper Medicines Act of 2008, was signed into law. This law was intended to promote and ensure access to affordable quality drugs and medicines to all Filipinos by encouraging full effective competition in their supply and demand, and in its failure, empowering the government to regulate their prices. After its enactment, the government set the maximum retail prices of 5 drug molecules with the intent to follow through with more. All drug products that carried these drug molecules were required to be sold at the maximum price set by the Philippine Department of Health. These were called drugs under maximum retail drug pricing (MDRP). A number of drug companies reacted by volunteering to reduce prices by half a list of 16 drugs. Counterpart drugs distributed by another company needed not follow the same pricing. These specified price-reduced drugs, together with the MDRP list, were collectively referred to as drugs under government-mediated access pricing (GMAP). Drug stores were required to post the reduced prices of these GMAP drugs in their premises for the information of their customers.

The public perception, however, apparently shows that the law has had minimal impact on improving access to drugs of the population (Ocampo 2012). The full impact of this law on the different stakeholders so far has yet to be assessed. This study is a part of a larger evaluation on the impact of the law on all Philippine stakeholders currently being conducted.

The study looked into the effect of the government mediated access pricing on drug availability and price. Specifically, this study compared the availability and price of selected drugs under the government-mediated access pricing in 2009 and 2011. The changes were also examined whether these varied according to location and type of drug store.

2. Methods

The study uses secondary data obtained from the surveys conducted by IMS Health Philippines (IMS) in 2009 and 2011. IMS was commissioned by the Philippines Department of Health to monitor the prices and availability of drugs as part of the monitoring of the implementation of the Cheaper Medicines Act of 2008. The 2009 survey represented baseline levels of drug availability and price while the 2011 survey was done to see changes in these after the implementation of the law. Permission to use data from IMS was covered in a memorandum of agreement between IMS Health and Rainiers Contract Research Services Inc to which the author is affiliated. The sampling and data collection procedures employed by IMS are described below.

2.1. Sampling Procedures in the 2009 and 2011 Surveys

IMS Health Philippines maintains a proprietary Drugstore Distribution Database, an exhaustive database of drug stores that covers the whole country. Drugstores were categorized in this database according to retail type (chain or independent), location (Metro Manila, Luzon, Visayas and Mindanao) and volume of sales. From this database, a stratified sample of 600 drug stores was independently obtained each for 2009 and 2011. Stratification was based on location and retail type. The total sample size was allocated according to the size of population in each category created by the cross classification of the stratification variables. Data collectors were then assigned to obtain data on drug availability and price of selected drugs in the drug stores in the sample.

2.2. Selection of Drugs in the Study

For the 2009 survey, priority molecules were identified by IMS using a scoring system that considered the current sales value of molecules, the DOH morbidity and mortality data, Philippine Medical Data Index Prescription Counts and Philippine National Drug Formulary Classification. The 100 most saleable molecules were chosen as an initial step. Higher scores were each then given to higher ranking of molecules according to sales, morbidity and mortality of diseases associated with the use of the drug molecules and prescription counts. Different scores were also assigned according to whether or not drugs were included in the PNDF list of essential drugs. The total score was then obtained which became the basis for selection of 33 priority molecules from the list of 100.

Selection of priority molecules in the 2011 survey used a different criteria. Priority molecules included only those that were carried by drugs in the government-mediated access pricing (GMAP) list.

Several drug brands differing in form and strength (stock keeping units or SKUs) could carry a specific priority molecule. Three SKUs for one priority molecule were selected as follows. The first SKU was the brand product with highest volume based on actual units sold, i.e. the most saleable brand. Then the product counterpart from other pharmaceutical companies with the highest price was taken in, referred to as its competitor brand. In case the most saleable SKU was also the highest priced, then the next highest priced SKU was taken. The third SKU was the cheapest generic brand counterpart available in the sampled drug store.

Since change in drug availability and price was the subject of this paper, only those drug molecules that were present in both 2009 and 2011 surveys were included in this analysis. There were 11 drug molecules that met this requirement. These are presented in Table 1 with their respective most saleable brand and competitor brand. The table also indicated whether the drug was under MDRP or GMAP listing, wherein as such, these drugs were required to be sold at the government stipulated lower prices. The generic brand counterpart varied across drug stores depending on which brand was cheapest among the generic brands available in the drug store and thus is not identified in the table.

Table-1. List of Most Saleable and Competitor Brands for Each Drug Molecule

Drug Molecule	Most Saleable Brand	Competitor Brand
Atorvastatin 10 mg tablet	Lipitor (MDRP)	Atopitar (MDRP)
Glicazide 80 mg tablet	Diamicron (GMAP)	Clizid
Clopidrogel 75 mg tablet	Plavix (GMAP)	Clopivaz
Metronidazole 500 mg tablet	Flagyl	Patryl
Metronidazole 125 mg/5 ml suspension	Flagyl (GMAP)	Patryl
Ciprofloxacin 500 mg tablet	Ciprobay (GMAP)	Zalvos
Azithromycin 500 mg tablet	Zithromax (MDRP)	Azyth (MDRP)
Amlodipine 5 mg tablet	Norvasc (MDRP)	Asomex (MDRP)
Telmisartan 40 mg tablet	Micardis (GMAP)	Pritor
Losartan 50 mg tablet	Cozaar (GMAP)	Lifezar
Losartan + Hydrochlorothiazide 50 mg + 12.5 mg tablet	Hyzaar (GMAP)	Combizar

2.3. Data Collection

Information on drug availability and prices were obtained using a mystery shopper approach. A member of the survey team was assigned to visit a sample drug store and posed as a buyer of the drugs in the list.

2.4. Data Analysis

For drug availability, the percent of drug stores where each drug was available was obtained. Statistical significance of the changes in drug availability was assessed using Chi-square test or Fisher's exact test. The mean and median of the drug prices were derived. Differences in the mean prices between 2009 and 2011 were tested for significance using Student's t-test.

The changes in drug availability and prices from 2009 to 2011 were also examined across locations (island groups - Luzon, Visayas, Mindanao and Metro Manila) and by retail type of drug store (chain or independent). To assess the differences of changes in drug availability by location and type of drug store, a logistic regression model incorporating an interaction term of these variables with year was employed. The likelihood ratio test (LRT) comparing to a nested model without interaction was used to assess statistical significance of the interaction. The odds ratios corresponding to the interaction terms were derived by getting the exponent of the estimates of the interaction term in the model. The interaction effects of location and type of drug store with year on drug prices were evaluated by performing an analysis of variance (ANOVA) that included the respective interaction terms. From the ANOVA, the variance of the interaction effects σ_{ab}^2 was estimated by the equation,

$$\hat{\sigma}_{ab}^2 = \frac{MS(AB) - MS(Error)}{\bar{n}_h}$$

where MS(AB)and MS(Error) are the respective mean squares of the interaction and error sources of variation and $\bar{n}_h$ is the harmonic mean of the sample sizes per cell. The square root of this variance was used to gauge the interaction effects. Area-specific and type-specific comparison of trends are described only for the statistically significant comparisons for the most saleable and competitor drugs in the results section due to space considerations.
Data analyses were generated using STATA Ver 10.1.

3. Results

3.1. Drug Availability

Table 2 shows the percent of drug stores that had the listed drugs in 2009 and 2011. For the most saleable drugs, the percent change in the availability in drug stores was not statistically significant (P>0.05) for 7 of the 11 drugs. One drug, Flagyl (metronidazole) 125 mg/5 ml suspension, had a decrease of 39%. Among the competitor drugs, only three had statistically significant changes (p>0.05). The actual magnitudes in reduction were relatively greater compared with the most saleable drugs. Four drugs had more than 30% reduction in availability in drug stores. These included 81.7% reduction for Clizid (gliclazide), 51.1% for Patryl (metronidazole) tablet and 34.5% for Patryl suspension and 37.4% for Asomex (amlodipine). The percent availability of cheaper generic counterparts significantly increased by 50% or higher for all drug molecules except telmisartan (p<0.001).

Table-2. Percent Availability of Drugs in Drug Stores (n=600)

	Most Saleable			Competitor			Cheapest Generic		
Drug molecule	2009	2011	Percent change	2009	2011	Percent change	2009	2011	Percent change
Amlodipine 5 mg tablet	75.3	68.0	-9.7	19.5	12.2	-37.4	15.3	58.5	282.4
Losartan 50 mg tablet	69.5	71.2	2.4	43.5	41.2	-5.3	4.5	44.5	888.9
Losartan + Hydrochlorothiazide 50 mg/12 mg tablet	59.5	70.0	17.6	36.7	34.0	-7.4	1.5	20.7	1280.0
Telmisartan 40 mg tablet	63.8	66.3	3.9	56.3	59.3	5.3	0.3	0.3	0.0
Atorvastatin 10 mg tablet	42.5	42.5	0.0	2.8	4.2	50.0	0.3	8.3	2676.7
Clopidrogel 75 mg tablet	52.0	46.2	-11.2	24.7	27.3	10.5	3.7	24.2	554.1
Gliclazide 80 mg tablet	71.2	71.2	0.0	26.3	4.8	-81.7	15.5	23.3	50.3
Azithromycin 500 mg tablet	46.5	48.7	4.7	35.5	39.5	11.3	0.3	13.8	4500.0
Ciprofloxacin 500 mg tablet	53.8	51.2	-4.8	6.0	5.5	-8.3	27.8	51.2	84.2
Metronidazole 500 mg tablet	61.0	61.0	0.0	8.8	4.3	-51.1	16.2	50.0	208.6
Metronidazole 125 mg/5ml suspension	59.8	36.5	-39.0	5.8	3.8	-34.5	15.3	33.8	120.9

The changes in the availability of the drugs from 2009 and 2011 were examined. Results are shown in Table 3. There were no significant differences in the trend for availability across regions for the most saleable drugs except for Combizar (losartan + hydrochlorothiazide) 50 mg + 12.5 mg tablet which showed significant increases in availability in drugs stores in Luzon (56.8% in 2009 vs 75.2% in 2011, χ^2=20.11, p<0.001) but no significant changes in the other areas ($\chi^2 \leq 1.17$,p>0.280) and for Lifezar (losartan) 50 mg tablet which registered increases in Metro Manila only (598% in 2009 vs 78.6% in 2011, χ^2=9.71, p<0.002; other areas p>0.0752).

Table-3. Assessment of effect of interaction of year with location and type of drug store on drug availability using logistic regression

	Location									Type of Drug Store								
	Most Saleable			Competitor			Cheapest Generic			Most Saleable			Competitor			Cheapest Generic		
Drug molecule	Range of Int (OR)[1]	Chi-square[2]	p-value[3]	Range of Int (OR)[1]	Chi-square[2]	p-value[3]	Range of Int (OR)[1]	Chi-square[2]	p-value[3]	Int (OR)[4]	Chi-square	p-value	Int (OR)[4]	Chi-square	p-value	Int (OR)[4]	Chi-square	p-value
Amlodipine 5 mg tablet	0.64-0.83	1.83	0.6085	1.02-1.67	1.43	0.6982	2.71-11.66	27.56	<0.0001	1.03	0.00	0.9718	0.73	0.65	0.4196	1.02	0.00	0.9586
Losartan 50 mg tablet	0.29-0.50	13.23	0.0042	0.57-1.25	4.03	0.2578	0.58-2.54	6.14	0.1052	2.76	2.18	0.1401	1.30	0.26	0.6080	1.23	0.18	0.6716
Losartan + Hydrochlorothiazide 50 mg/12 mg tablet	0.84-1.72	7.20	0.0659	0.52-0.95	3.18	0.3644	1.67-3.94	2.71	0.4382	0.67	0.40	0.5253	0.42	3.16	0.0753	2.03	0.61	0.4363
Telmisartan 40 mg tablet	0.81-0.91	0.25	0.9683	0.64-1.21	4.96	0.1748	-	-	-	0.74	0.11	0.7437	0.36	1.72	0.1896	-	-	-
Atorvastatin 10 mg tablet	0.98-2.08	5.40	0.1446	0.15-0.52	3.99	0.2667	-	-	-	0.36	3.48	0.0619	1.32	0.15	0.7016	9.41	1.96	0.1610
Clopidrogel 75 mg tablet	0.45-0.71	5.36	0.1470	0.37-0.91	6.29	0.0984	0.59-4.28	7.68	0.0531	0.92	0.02	0.8983	0.78	0.39	0.5330	2.22	2.52	0.1127
Gliclazide 80 mg tablet	0.42-0.63	6.23	0.1008	1.82-2.99	1.94	0.5851	1.67-3.59	7.94	0.0472	1.35	0.31	0.5769	3.78	7.60	0.0059	1.45	0.87	0.3514
Azithromycin 500 mg tablet	0.42-0.84	5.95	0.1138	0.64-1.47	4.55	0.2081	-	-	-	0.45	2.07	0.1499	0.34	4.24	0.0394	-	-	-
Ciprofloxacin 500 mg tablet	0.93-1.11	0.39	0.9423	0.45-0.86	1.43	0.6977	0.66-1.32	4.73	0.1929	0.99	0.00	0.9826	1.82	1.21	0.2723	0.63	1.88	0.1700
Metronidazole 500 mg tablet	0.59-1.07	2.76	0.4308	1.95-2.09	1.10	0.7780	0.67-11.72	27.77	<0.0001	2.57	1.87	0.1718	4.87	9.18	0.0024	1.62	1.82	0.1768
Metronidazole 125 mg/5ml suspension	0.91-1.44	2.08	0.5555	2.68-44.21	10.39	0.0155	0.95-1.49	1.78	0.6197	2.94	4.86	0.0275	2.68	2.72	0.0988	2.77	7.75	0.0005

[1] – Range of interaction OR: Three interaction terms are produced in the logistic regression with 4 levels of location (Metro Manila, Luzon, Visayas and Mindanao) and year (2009 and 2011). This column gives the lowest and highest odd ratios corresponding to each interaction term in the model by getting the exponential of this estimate.
[2] – Likelihood ratio test (LRT) comparing model with interaction and model without interaction.
[3] – p-value correspond to the LRT
[4] - Only one interaction term for type of drug store (chain and independent) and year.
Note: Blanks represent tables where there are zero cells. This occurs when there are very few drugs stores that sell a specific drug, for instance, in 2009, only innovator brands of telmisartan and atorvastatin were available in the drugs stores in the Philippines.

For the competitor drugs, availability of Patryl (metronidazole) 125 mg/5 ml suspension decreased in all areas except for Mindanao where there was an apparent increase from only 0.9% in 2009 to 4.6% in 2011. Due to inadequate sample size, only the reduction in Metro Manila was statistically significant (6.8% in 2009 vs 0.9% in 2011, Fisher's exact p=0.035).

Trends in availability of the most saleable drugs did not differ significantly between independent and chain drug stores. The interaction term was significantly only for Flagyl 125 mg/5 ml suspension (χ^2=4.86, p=0.0275). Among the chain drug stores, the reduction in availability was from 94.4% in 2009 to 68.9% in 2011, compared to the decrease from 53.7% to 30.8% among the independent stores for the same years.

3.2. Drug Prices

The changes in the mean and median drug prices from 2009 to 2011 are shown in Table 4. Eight of the 11 most saleable drugs had price reduction between 30% to 50%. The reductions of these magnitudes in this group of drugs were expected by virtue of their inclusion in the GMAP list.

In the competitor set, the MDRP drugs (atorvastatin, amlodipine and azithromycin) had similar magnitudes of reduction as that of their most saleable counterparts. For the remaining drugs, most had significantly lowering of drug prices although these new prices seemed to settle near the GMAP prices. It should be noted that these competitor drugs had relatively lower prices in 2009 compared to the most saleable drugs, except for Lifezar (losartan) and Combizar (losartan with hydrochlorothiazide). Consequently, the price reductions of competitor drugs were of less degree compared to that seen for the most saleable drugs. It was the reverse for the losartan-based products, the most saleable drug products, Cozaar and Hyzaar, which were priced lower in 2009 had lower percent reductions, 9.7% and 12.0%, respectively, compared to the competitor 49.8% (Lifezar) and 48.2% (Combizar).

Mean prices for cheapest generic drugs also had significant percent reductions, ranging from 13% to 57.0%. All of these reductions were highly statistically significant (minimum t=3.23, p<0.0013), except for azithromycin and telmisartan. The non-statistical significance could be attributed to the fact that generic versions for the latter two drugs were rarely available in 2009, Only 2 drug stores were selling these generic products then.

The differences in the change of drug prices from 2009 to 2011 across locations and type of drug stores were assessed through the examination of both the statistical test for interaction and the estimate of σ_{ab}. Among the most saleable drugs, the trends in drug prices were not much different across regions. This can be gleaned from the estimates of σ_{ab}, which had a maximum of only 2.42 for Zithromax (azithromycin). The percent reduction in Zithromax price was smallest in 14.2% while the largest was not far at 16.9%. The variation in changes in other drug prices of the most saleable drugs across locations would be smaller than the difference for Zithromax.

Table-4. Mean and median prices of drugs, 2009 and 2011

	Most Saleable						Competitor						Cheapest Generic					
	Mean			Median			Mean			Median			Mean			Median		
Drug molecule	2009	2011	Percent change	2009	2011	Percent change	2009	2011	Percent change	2009	2011	Percent change	2009	2011	Percent change	2009	2011	Percent change
Amlodipine 5 mg tablet	43.1	23.3	-46.0	44.5	22.9	-48.7	26.6	26.1	-1.9	26.0	26.0	0.0	12.8	7.8	-38.9	11.0	7.0	-36.4
Losartan 50 mg tablet	24.3	22.0	-9.7	24.0	21.5	-10.4	42.9	22.2	-48.2	43.0	21.5	-50.0	16.5	11.8	-28.8	15.0	12.0	-20.0
Losartan + Hydrochlorothiazide 50 mg/12 mg tablet	25.1	22.1	-12.0	25.0	21.5	-14.0	46.9	23.9	-49.2	47.5	23.8	-50.0	18.5	13.3	-28.1	22.0	13.0	-40.9
Telmisartan 40 mg tablet	50.4	25.7	-49.1	50.0	25.0	-50.0	50.4	25.5	-49.3	50.6	25.0	-50.6	25.1	13.6	-45.6	25.1	13.6	-45.6
Atorvastatin 10 mg tablet	62.4	34.1	-45.4	62.5	34.4	-45.0	50.0	29.3	-41.3	51.5	29.0	-43.6	44.4	19.1	-57.0	44.4	18.9	-57.5
Clopidrogel 75 mg tablet	119.9	60.6	-49.4	119.9	61.8	-48.5	45.0	34.5	-23.2	44.5	36.3	-18.5	57.7	25.7	-55.4	63.5	26.5	-58.3
Gliclazide 80 mg tablet	14.7	9.8	-32.8	14.8	9.8	-33.9	9.6	9.1	-5.4	9.6	9.0	-6.3	6.1	5.2	-13.4	6.0	5.0	-16.7
Azithromycin 500 mg tablet	297.2	151.5	-49.0	298.8	151.3	-49.4	180.6	141.5	-21.6	184.3	144.0	-21.9	130.8	109.8	-16.1	130.8	113.0	-13.6
Ciprofloxacin 500 mg tablet	77.9	42.0	-46.1	79.2	41.9	-47.1	64.0	55.8	-12.8	61.6	60.0	-2.6	20.6	12.3	-40.4	19.0	10.0	-47.4
Metronidazole 500 mg tablet	23.0	23.0	0.0	22.8	23.0	0.7	10.2	15.7	53.2	9.0	12.0	34.1	6.9	5.5	-19.5	5.0	5.0	0.0
Metronidazole 125 mg/5ml suspension	133.8	66.8	-50.1	132.2	65.5	-50.5	92.4	67.1	-27.5	85.0	63.9	-24.8	55.5	40.3	-27.4	49.9	35.0	-29.8

Among the competitor drugs, the differences in price trend across locations were both statistical significant and substantial (i.e. $\hat{\sigma}_{ab}$>3.0) only for Zalvos and Patryl tablet. The mean price of Zalvos went up in the Visayas from P58.63 in 2009 to P65.81 in 2011 (t=1.78, p=0.0941). The opposite trend was seen in Luzon and Mindanao. In Luzon, the mean price of Zalvos decreased from P67.44 in 2009 to P51.31 in 2011 (t=2.51, p=0.0182) while it similarly declined to P49.00 in 2011 from P61.83 in 2009 (t=3.15, p=0.0084). In Metro Manila, the change in price was not statistically significant (P73.50 in 2009 vs P66.69 in 2011, t=0.29, p=0.7855). The mean price of Patryl tablet significantly increased in Metro Manila (P8.46 in 2009 vs P13.73 in 2011, t=2.77, p=0.0170) and Luzon (P10.21 in 2009 vs P18.10 in 2011, t=4.84, p<0.0001) but not in Visayas (P11.99 in 2009 vs P10.41 in 2011, t=-0.87, p=0.3976). There were very few stores (n=3) in Mindanao that sell this product.

The largest interaction effect of year and type of drug store, maximum $\hat{\sigma}_{ab}$, was only P1.49 for Norvasc among the most saleable drugs. In the chain drug stores, the mean prices were P45.23 and P22.96, respectively, for 2009 and 2011. The corresponding mean prices were P42.55 and P23.34, respectively, among the independent drug stores. Clearly this was a small difference in price trends between the types of stores. Since other $\hat{\sigma}_{ab}$'s for the competitor drugs were smaller than that for Norvasc, this indicated that the trends in prices of these drugs were also similar for independent and chain drug stores.

The interaction effects of year and type of retail store were considerable only for Patryl tablet and suspension among the competitor drugs. In chain drug stores, there were only minimal changes in mean price of Patryl tablets, P9.95 in 2009 to P9.74 in 2011, while a relatively large increase was observed among independent outlets, (P10.75 in 2009 vs P18.81 in 2011, t=4.60, p=0.0001). For Patryl suspension, there were reduction in prices, but it was again considerably greater in independent stores (P107.11 in 2009 vs P64.80 in 2011, t=4.60, p=0.0001) than in the chain stores (P87.36 in 2009 vs P68.80 in 2011, t=5.14, p<0.0001).

4. Discussion

Five years after the implementation of Republic Act 9502, or the "The Universally Accessible and Quality Medicines Act of 2008", an evaluation of its overall impact is wanting. The law itself provides for the necessity of this evaluation. One of the most visible interventions related to this

implementation was the government-mediated pricing of drugs. At the time of the study, there were 22 drugs in the list. However, the study included only 11 for which data on availability and pricing was contained in the IMS Health Philippines surveys in 2009 and 2011.

There are two major results shown in this study. Prices of market leaders, i.e. most saleable brands and their competitors, decreased after GMAP implementation drugs. Generic drugs availability increased significantly in 2011 compared to 2009 levels. These trends of availability drug prices tended to be similar across locations and type of drug stores for most of the drugs.

Table-5. Assessment of effect of interaction of year with location and type of drug store on drug price using analysis of variance (ANOVA)

	Location									Type of drug store								
	Most Saleable			Competitor			Cheapest Generic			Most Saleable			Competitor			Cheapest Generic		
Drug molecule	$\hat{\sigma}_{ab}$[1]	F-test[2]	p-value[3]	$\hat{\sigma}_{ab}$[1]	F-test[2]	p-value[3]	$\hat{\sigma}_{ab}$[1]	F-test[2]	p-value[3]	$\hat{\sigma}_{ab}$[1]	F-test[2]	p-value[3]	$\hat{\sigma}_{ab}$[1]	F-test[2]	p-value[3]	$\hat{\sigma}_{ab}$[1]	F-test[2]	p-value[3]
Amlodipine 5 mg tablet	1.32	11.35	<0.0001	0.29	1.39	0.2464	0.63	1.78	0.1498	1.49	20.34	<0.0001	0.56	3.84	0.0515	1.08	6.89	0.0090
Losartan 50 mg tablet	0.00	0.64	0.5864	0.00	0.97	0.4047	0.00	0.21	0.8914	0.00	0.35	0.5537	0.42	3.89	0.0492	1.47	5.88	0.0159
Losartan + Hydrochlorothiazide 50 mg/12 mg tablet	0.13	1.42	0.2369	0.00	0.53	0.6601	2.78	2.54	0.0594	0.00	0.03	0.8566	0.26	2.02	0.1563	0.00	0.00	0.9962
Telmisartan 40 mg tablet	0.00	0.84	0.4705	0.26	1.75	0.1545	-	-	-	0.11	1.39	0.2384	0.69	10.01	0.0016	-	-	-
Atorvastatin 10 mg tablet	0.00	0.78	0.5083	6.58	2.36	0.0884	-	-	-	0.00	0.13	0.7155	3.51	1.90	0.1762	10.79	3.30	0.0756
Clopidrogel 75 mg tablet	0.00	0.30	0.8249	1.33	3.67	0.0126	2.38	2.25	0.0842	0.91	3.90	0.0489	1.22	5.98	0.0151	6.83	28.20	<0.0001
Gliclazide 80 mg tablet	0.00	0.05	0.9852	0.48	2.83	0.0399	0.00	0.52	0.6699	0.29	11.80	0.0006	0.44	5.48	0.0203	0.50	5.56	0.0192
Azithromycin 500 mg tablet	2.42	3.46	0.0163	3.17	5.40	0.0012	-	-	-	0.43	1.14	0.2857	2.12	4.55	0.0334	-	-	-
Ciprofloxacin 500 mg tablet	0.24	1.17	0.3216	6.36	2.04	0.1171	2.05	3.76	0.0109	0.00	1.00	0.3181	0.00	0.26	0.6113	3.90	15.66	0.0001
Metronidazole 500 mg tablet	0.20	2.28	0.0776	4.92	5.38	0.0021	1.33	3.49	0.0159	0.04	1.10	0.2949	3.99	15.43	0.0002	0.00	0.16	0.6920
Metronidazole 125 mg/5ml suspension	0.66	1.58	0.1928	4.78	1.45	0.2387	6.92	5.87	0.0007	0.37	1.77	0.1842	11.15	8.49	0.0052	4.68	5.27	0.0224

[1] – $\hat{\sigma}_{ab}$ is used as the estimate of the estimate of the interaction effects. Calculation of this estimate is described in data analysis part of the methods section.

[2] – F-test for the interaction effect in the ANOVA with interaction model.

[3] – p-value corresponding to the interaction effect in the ANOVA.

Note: Blanks represent tables where there are zero cells. This occurs when there are very few drugs stores that sell a specific drug, for instance, in 2009, only innovator brands of telmisartan and atorvastatin were available in the drugs stores in the Philippines.

Except for metronidazole 500 mg tablet, all drugs that were most saleable were under MDRP/GMAP. Almost all drugs submitted for GMAP reduced their prices by half. Thus the results showing substantial reduction in mean prices of the most saleable drugs were expected. The government was rather strict on the compliance of drug stores on the policy, not only in terms of pricing but in informing consumers of these prices. In the Philippines, almost all drug stores display the list of GMAP drugs in a conspicuously located part of the drug store.

The availability of market leaders in the drug stores were apparently not adversely affected. However, since these market leaders were the GMAP-listed drugs in the study, it was not possible to determine availability of the leading brands would be affected had they not been under GMAP. Only one drug, Flagyl 500 mg tablet, was market leader but not in the GMAP list. There was no change in availability in the drug stores for this drug from 2009 to 2011.

The results reflecting the behaviour of prices of the competitor drugs were those expected due to competition. Prices of the competitor drugs, though not required by law to follow GMAP levels, also went down albeit in a lower degree, since most of them were already priced lower in 2009. These drugs were compelled to sell at prices below their most saleable counterparts to maintain hold or improve their market positions. For the competitor brands that did not reduce their prices in the same degree, their availability in the drug stores can be severely negatively affected. This was observed from the results for Clizid, Patryl tablet and Asomex, which experienced reductions of 81.7%, 51.1% and 37.4%, respectively. Possible explanations could be that supply of these drugs might have also decreased or drug stores were finding these brands moving slower at their non-competitive prices thus were less willing to procure them.There is evidently a rapidly growing market for the generic drug industry based on the results of the study. A report by Frost and Sullivan in 2010 stated the generic drug market was small and accounted for only 19.6% in the Philippines. This study demonstrated large increases in the availability of generic drugs in the drug stores, reaching up 4,500% increase. For older drugs in the market, such as metronidazole, ciprofloxacin and amlodipine, availability was 50% or higher in the drug stores. These results corroborates a more recent report that the generic drug sales in the country have grown significantly in the past years albeit it still lags behind branded medicines (Business Mirror 2013). As possible reason to this is that the imposition of the GMAP

makes the more expensive leading brands less attractive for the drug stores. With a ceiling on prices, drug stores cannot mark up the prices of these drugs to attain more profit. Thus, this might force them to procure and sell more generic drugs where there could be better profit potential.The study also showed that the prices of the cheapest available generic drugs in the drug stores were getting lower. The use of our study results to explain these trends in pricing of generic drugs is limited. The data collected for our study only determined the presence and price of the lowest generic drug regardless of its source. It was ambiguous as to whether the prices of specific generic brands were also getting lower due to the competition from the lowering price of the more popular brands or a reflection of a growing number of generic brands introduced at lower prices as expected.

There are limitations of the study that could be addressed with additional information collected. The study did not collect data on the actual sales of the listed drug brands in the drug stores. This would inform of the effect of GMAP on the actual volume and sales of drugs. Another component of this larger impact evaluation will be able to address this issue.

5. Conclusion

This study showed that availability of most saleable brands generally did not significantly changed after implementation of the GMAP. Mean prices of these drugs significantly decreased by as low as 9.7% to as high as 50.1% from 2009 to 2011. The reduction in their prices was expected due to compliance since almost all of these drugs were included in the GMAP list. Mean prices of the other competitor drugs also tended to follow the decreasing trend. For those that did resisted price reduction in the same degree as the leading counterparts, there were significant decline in the availability in drug stores of these competitor drugs. The availability of generic drugs all went up significantly except for telmisartan. Mean prices of the cheapest generic drugs in drug stores all went down. The implementation of the GMAP has resulted in a lowering of drug prices and an increasing availability of generic drugs.

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