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Medicine pricing: Impact on accessibility and affordability of medicines vis a vis the product origin as pharmaco-economic drivers in Comoros

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This paper highlights the availability, pricing and affordability of popular medicines in Comoros. We used the standardized survey methodology developed by the World Health Organization and Health Action International to conduct a cross sectional survey for collecting data on availability and patient prices of medicines in public, private and mission sector medicines outlets from April 1 to June 30, 2014. Median availability of medicines in Comoros across all sectors was particularly low at 31.11% for all product types. The median price ratios of procurement prices for original brands, most sold generics and lowest-priced generics in the public sector, were 11.60, 4.74 and 3, respectively. These were 83 times higher than the international reference prices; and the median price ratios of retail prices to patients for lowest priced generics in the private sector were 29.49% higher than those in the public sector. For most of the population, the medicine prices are unaffordable particularly in the islands Ndzuwani and Mwali, where many people earn less 1$ per day. The survey revealed higher procurement prices and poor availability in the public sector. Various policy adjustments could increase the availability of essential medicines and reduce their prices for the low income population.

Key words: Affordability, availability, Comoros, islands, prices.

INTRODUCTION

Medicines accessibility and affordability depends on various factors that include purchaser variables such as individual, household, community, private insurer, national health system or international donor and even product specificities. Different approaches therefore have been employed to measure accessibility and affordability including benchmarking medicine prices against per capita gross national income (GNI), setting prices against "catastrophic" household health expenditure levels, or converting prices to working days based on government salaries as a proxy for average income (Cameron et al., 2009; Niens and Brouwer, 2009; Niens et al., 2010;

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Table 1. Facility sample distribution.

Island	Region	District	Public sector Hospital/Health Center	Private sector Pharmacies/retails	Mission sector/NGOs	Total
Ngazidja	North	Mitsamuhouli, Mbeni	2	4	0	6
	Central	Moroni, Mitsoudje	6	12	2	20
	South	Foumboni, Ouziouani	2	4	0	6
Ndzuwani	North	Domoni	1	2		3
	Central	Mutsamudou, Ouani	3	6	2	11
	South	Pomoni, Sima	2	2		4
Mwali	North	None selected				
	Central	Fomboni, Djando	3	5	2	10
	South	None selected				
Comoros	7	14	19	35	6	60

Wagstaff and van Doorslaer, 2003). These methods may however not account for all the widely varying levels of income inequality in different countries (Xu et al., 2003).

The Islamic Federal Republic of the Comoros is an insular, discontinued territory. The signing of the Fomboni Framework Agreement in 2001 for Reconciliation in the Comoros opened the way to the resolution of a number of crises and led to the creation of the Union of Comoros (François, 2008; Chrysantus, 2008; Thierry, 2007; Union of Comoros and United of Nations, 2007). Hence the ensuing constitution extends considerable autonomy to the three islands of Ngazidja (Grande Comore), Ndzuwani (Anjouan), and Mwali (Moheli), each having its own government. Collaboration between the central Government and the islands' local administration is difficult and jurisdiction is frequently disputed, including health delivery (WHO, 2014). Malaria is the leading cause of morbidity, the most vulnerable groups being children under five and pregnant women. The rate of HIV/AIDS prevalence is still low despite steady increase of the pandemic disease (WHO, 2014; Ouledi et al., 2012). Maternal and child mortality rates are alarming (Graham et al., 2013).

Despite efforts to develop national policies, delivery of health services is highly constrained: access to health facilities that are up to within 5 km varies from 45 to 74% from one island to the next, while use of health facilities varies between 9 and 20% (WHO, 2006). An encouraging increase in health staff has occurred but staff distribution is unequal and overall, motivation is rather poor (Ouledi et al., 2012). Qualified staff is insufficient, especially in the public sector; there is a general lack of mentoring, retraining and resources for management. A large proportion of staff is trained abroad and most do not return (WHO, 2002). Despite a national supply policy, shortage of essential drugs occurs frequently. There is no national quality control laboratory. Illegal markets are thriving and prices of drugs vary from one facility to another. The country lacks a coordinated and integrated system for health information collection, analysis, and use (Union of Comoros, 2005 and 2010). The private sector is expanding; however, it is uncontrolled, which adversely impacts quality of care and contributes to high and non-standardized costs of health care.

This paper reporting on the prices and availability of essential medicines in Comoros is one of the important initial baseline information summarizing the results of medicine price and availability surveys carried out around the globe using a standard survey methodology developed by the World Health Organization (WHO) and Health Action International (HAI) (WHO/HAI, 2009).

METHODOLOGY

A total of 20 medicines from the WHO/HAI core list of medicines were surveyed between the months of April 1 and June 30, 2014, selecting representation from the pre-set dosage forms, strengths and recommended pack sizes (WHO/HAI, 2003 and 2008; WHO, 2013). Prices and availability were recorded for the original/innovator brand product (OB) determined at the national level; and for both most sold (MSGs) and lowest priced generics (LPGs) equivalent which was determined at facilities in each of the three islands of Ngazidja (Grande Comore), Ndzuwani (Anjouan), and Mwali (Moheli). Data was collected from a total of 19 public sector facilities, 35 private pharmacies or private retail facilities and 6 Mission or Non-Governmental Organizations (NGO) across the Islands (Table 1). Pharmacies in government health facilities were surveyed for the availability of the selected medicines and frequency of utilization. In all three sectors, and in the three Islands surveyed, the medicine price data collection form was used to enter the price and availability of the medicines at the time of data collection.

Price information

As per the WHO/HAI survey methodology, prices were presented in

Table 2. Median percentage availability of all medicines on the day of survey across 3 sectors.

Product type	Mean availability (%)			Average product type for 3 sectors
	Public sector (N= 19 outlets)	Private sector (N=35 outlets)	Mission sectors (N=6)	
Original brand (n=20 medicines)	4.73	7.86	0	6.29
Most sold generic (n=20 medicines)	12.63	52.19	15	26.61
Lowest price generic (n=20 medicines)	54.21	49	55.83	53.01
Average of mean availability for all medicines on the day of the survey across three sectors				31.11

local currency and as median price ratios (MPR). The MPR was calculated by dividing the local price by an international reference price (converted to local currency). An MPR of 1 was regarded as the local price being equivalent to the reference price whereas an MPR of 2 means the local price is twice the reference price. To facilitate international comparisons, the international reference prices used for this study were taken from the Management Sciences for Health (MSH) reference prices - the International Drug Price Indicator Guide, 2013 (WHO, 2013).

Affordability

Affordability was calculated as the number of days the lowest paid unskilled government worker would have to work to pay for medicines for one month's treatment for medicines for a course of treatment for acute conditions. At the time of the survey, the lowest paid government worker earned KMF 1000 per day (equivalent to US$ 2.75 per day at the time of the survey) (The World Bank, 2013). Having to spend more than 1 day's income per month on family medical needs was considered to be unaffordable. All prices were converted to US dollars using the exchange rate (buying rate) of April 1st 2014, the first day of data collection that is, US$ 1 = 362.72783 KM. The cost of treatment and affordability for pre-selected clinical conditions was calculated in the public and the private sectors. Like many low income developing countries, a large proportion of the population in Comoros, earns less than the lowest paid government worker. It should be noted that nearly half the population (44.8%) live below the poverty line and have no access to essential medicines (MDGs Report, Comoros, 2013).

International comparisons

In every WHO/HAI survey, data is collected on the same global list of medicines with the same dosage forms and strengths, which allows for comparisons to be made across countries. A list of 5 countries from the reference of African Low income countries (2013) were selected for international comparisons of availability, medicine prices ratio and affordability were then established in this survey. Countries were selected based on similarity in terms of economic wealth and development. Country data was extracted from the global database of survey results available on the HAI website.

Data collection

The participating institutions were selected based on geographical locations and population size. Ethical clearance/permission was granted and sought through the Pharmaceutical Association of Comoros from the Ministry of Health for the survey to be conducted. All survey personnel received training in the standard survey methodology and data collection /data entry procedures at a workshop held on March 10, 2014 to March 17, 2014. As part of the workshop, a data collection pilot test was conducted at public and private medicine outlets which did not form part of the survey sample. In Comoros, there is only one central purchasing medical store (CAMUC) which represents the public procurement agency following the bankruptcy and liquidation of the National Autonomous Pharmacy of Comoros (PNAC) in 2012. This provided the prices that the government pays to procure medicines and the public facilities. At private pharmacies, availability and the prices on the medicine strips/containers were surveyed at each selected facility.

Data analyses

For data analyses, the data entry was done by a single operator in the predesigned computerized WHO/HAI medicine prices workbook designed in the Microsoft Excel software and cross-checking done, with actual double data entry, on different dates. Descriptive statistics mainly in the form of percentages and mean (average) were used.

RESULTS

Availability of medicines in the public, private and mission sectors

In Comoros, the mean availability of surveyed medicines at all facilities in public, private and mission was 53.01, 26.61 and 6.29% for LPGs, MSGs and OBs, respectively with an overall percentage availability of surveyed medicines at 31.11% (Table 2). In the public sector, the median availability for all 20 medicines surveyed was 54.21 and 12.63% for both LPGs and MSGs, respectively, and only 4.73% of innovator brands were available in this sector. Six medicines: Clotrimazole, Co-trimoxazole, Erythromycin, Ibuprofen, Mebendazole and Paracetamol were available in public facilities as both innovator brands and generics equivalent. In the private sector, MSGs were the predominant product type available, with average availability at 52.19% for all medicines. For OBs, average availability was low at 7.86 and 49% for LPGs. The medicine availability was higher in private sector than that of the public sector. Availability in the mission sector for LPGs was higher at 55.83 and only 15% for MSGs. None of the OBs were available. The mean availability of surveyed medicines across sectors in Ngazidja, Ndzuwani and Mwali are depicted in Figure 1a. This Figure also shows the mean availability of surveyed

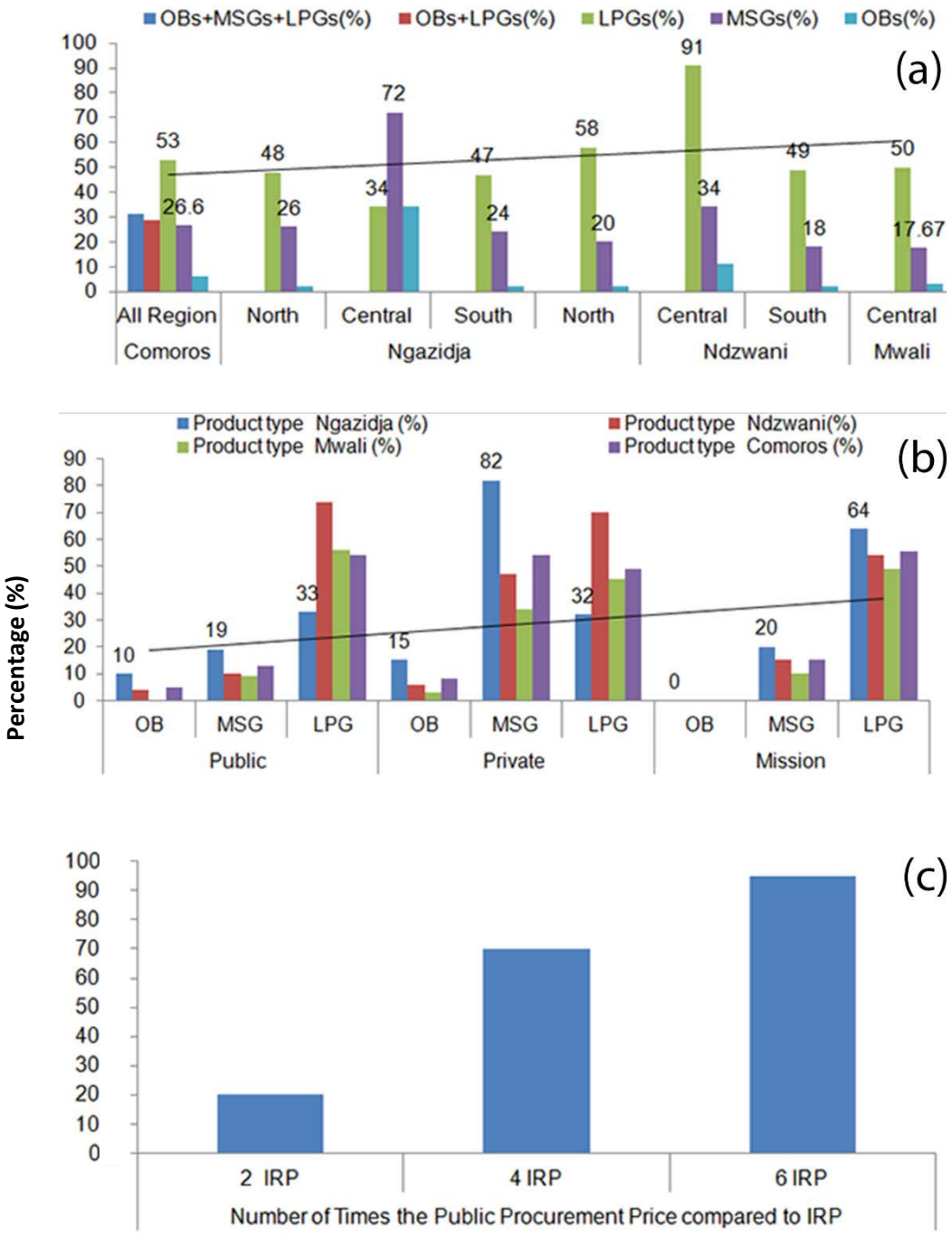

Figure 1. (a) Mean availability of surveyed medicines in various areas across 3 sectors; (b) Mean availability of any product type across 3 sectors and by Island; (c) Percentage availability of Medicines procured compared to the international reference prices (IRP).

medicines in 7 regions of Comoros across private, public and mission sectors in each Island.

From Figure 1a, it can be noted that the Central region for each Island had the highest mean availability of all medicines surveyed, indicating that some patients from other regions usually purchase their medicines in the Central Region. As shown in Table 3, in Ngazidja, the mean availability of both MSGs and LPGs was between 40.33 and 43% for all medicine surveyed. For OBs it was higher at 12.5% than in the other islands. The average availability of all medicine was 32% with the most available being MSGs and OBs than other the surveyed areas. In Ndzuwani, the mean availability of both MSGs and LPGs was between 24 and 66%. For OBs only 5%

Table 3. Mean availability of product type for all sector across Islands

Product type	Average mean availability (%)			
	Ngazidja	Ndzuwani	Mwali	Comoros
Original brand	12.5	5	3	6.3
Most sold generic	40.33	24	17.67	26.6
Lowest price generic	43	66	50	53
Average for all product type	32	32	24	31.11

Table 4. Mean availability across islands in public sector

Product type	Mean availability (%)		
	Ngazidja (Grande Comore)	Ndzuwani (Anjouan)	Mwali (Moheli)
Original brand	10	4	0
Most sold generic	19	10	9
Lowest price generic	33	74	56

Table 5. Mean availability across Islands in private sector.

Product type	Mean availability %		
	Ngazidja (Grande Comore)	Ndzuwani (Anjouan)	Mwali (Moheli)
Original brand	15	6	3
Most sold generic	82	47	34
Lowest price generic	32	70	45

mean availability was realized. Ndzuwani has the highest mean availability of LPGs than Ngazidja and Mwali. In Mwali, availability of both MSGs and LPGs was between 17.67 and 50%, with only 3% of innovator brands. In this Island, many patients often purchase medicines from other places, usually outside the Island.

Regional analysis

Comparison of availability in public sectors across the islands surveyed

As shown in Table 4, the mean availability of survey medicines in the public sector ranged from 33% in Ngazidja to 74% in Ndzuwani for LPGs equivalents. For MSGs, mean availability was lowest in Mwali (9%) and highest in Ngazidja (19%) while for OBs, mean availability was lowest in Mwali (0%) and highest in Ngazidja (10%).

Comparison of availability in private sectors across the islands surveyed

The mean availability of surveyed medicines in the private sector ranged from 32% in Ngazidja to 70% in Ndzuwani for the LPGs equivalents. For MSGs, mean availability was lowest in Mwali (34%) and highest in Ngazidja (82%) while for OBs, mean availability was lowest in Mwali (3%) and highest in Ngazidja (15%) (Table 5).

Comparison of availability in mission sectors across the islands surveyed

Mean availability of surveyed medicines in the Mission sector ranged from 49% in Mwali to 64 % in Ngazidja for the LPGs equivalents (Table 6). MSGs showed the lowest mean availability in Mwali (10%) and the highest in Ngazidja (20%). None of the OBs was found in the mission sector. The mission sector had predominantly LPGs as compared to other product types. As shown in this Fig.1b, in both public and private sector, Ndzuwani is procuring predominantly generic products and in Ngazidja both MSGs and OBs were substantially available.

Price information

The results from the survey were not presented in actual

Table 6. Mean availability across Islands in mission sector.

Product Type	Mean availability (%)		
	Ngazidja (Grande Comore)	Ndzuwani (Anjouan)	Mwali (Moheli)
Original brand	0	0	0
Most sold generic	20	15	10
Lowest price generic	64	54	49

Table 7. Summary of the mean of median price ratio in the public procurement sector for all medicines found

Product Type	MPR	25th percentile	75th percentile	Number of medicines found
Original brand	11.60	11.60	11.60	6
Most sold generic	4.74	4.74	4.74	9
Lowest price generic	3.83	3.83	3.83	18

N = 1 Public procurement; (n = 20 medicines).

Table 8. Summary of the Median Price Ratio (MPR) in the public sector patient prices for all medicines found.

Product Type	MPR	25th percentile	75th percentile	Number of medicines found
Original brand	13.69	13.23	14.40	6
Most sold generic	5.62	5.22	5.74	9
Lowest price generic	4.45	4.20	4.62	18

N= 19 facilities; (n = 20 medicines).

currency units but, rather, expressed as MPRs calculated using international reference prices.

MPR = median local unit price / reference unit price (both expressed in the same currency)

Public sector procurement prices

In the public sector, the national procurement agency CAMUC procures drugs through the public facilities and some local private sectors. All the regional hospitals and facilities are, in turn, expected to procure from their respective Regional CAMUC store. Public sector procurement prices were substantially higher than the international reference prices, for both MSGs and LPGs, the procurement prices were up to 4 and 5 times their IRP (Table 7). Only six (6) medicines of OBs were found in the public procurement with their prices about 12 times their IRP, indicating a poor level of purchasing efficiently. Only four (4) medicines (Metformin 500 mg, Mebendazole 100 mg, Ibuprofen 100 mg/5 ml, Cotrimoxazole 200 + 40 mg) were procured for less than twice the international reference price (Figure 1c).

Public sector patient price

At public sector facilities, patient prices for both LPGs and MSGs generic medicines were found to be 4 and 6 times their IRP, respectively. Patient prices ranged from 1.23 times (or 23% higher than) the IRP for Mebendazole to 13.27 times the IRP for Diclofenac. Six OBs were found and their generic equivalents were also found at lower prices. This is summarized in the Table 8.

Private sector patient prices

In the private sector, there is no procurement agency. Medicines are purchased by private wholesalers from importers and then wholesalers sell to pharmacies. Out of the 20 medicines surveyed, OBs were found for 14 of them in private retail pharmacies. At the private retail pharmacies, patient prices for both MSGs and LPGs were found to be 5.96 and 6.34 times higher than their IRP. And OBs in this sector are about 11.28 times higher than IRP (Table 6). When OBs are prescribed /dispensed in the private sector, patients pay about 111.23% more than they would for generics. Generic medicines were

Table 9. Summary of the MPR in the Private Sector for all medicines found.

Product Type	MPR	25th percentile	75th percentile	Number of medicines found
Original brand	11.28	11.16	12.02	14
Most sold generic	5.96	5.73	6.34	20
Lowest price generic	5.34	5.13	5.56	19

N= 35 retail pharmacies; (n = 20 medicines)

Table 10. Summary of the MPR in the Mission Sector for all medicines found.

Product type	MPR	25th percentile	75th percentile	Number of medicines found
Original brand	-	-	-	0
Most sold generic	4.31	4.23	4.38	7
Lowest priced generic	3.55	3.48	3.73	15

N= 6 Mission facilities; (n = 20 medicines).

Table 11. Comparison of the prices of original brands and generically equivalent products: MPRs for medicines found as both product types, in the case of public procurement

Product type (n = 5 medicines found)	MPR	25th percentile	75th percentile	Difference of OBs to LPGs (%)
Original brand	11.87	11.87	11.87	310.73
Lowest priced generic	2.89	2.89	2.89	

N=1 Public Procurement; (n= 20 medicines).

priced 20% higher in the private sector than in the public sector and 50 % higher in the private than in the mission sector. In the private sector, the prices patients are charged for medicines varied from pharmacy to pharmacy (Table 9).

Mission sector patient prices

In the non-governmental sector, the price charged to patient for LPGs was found to be 3.55 times than IRP. In the mission sector, no OBs was found. For both LPGs and MSGs generic medicines prices were found to be 3.55 and 4.31 times higher than their IRP, indicating a good level of purchasing efficiency compared to both public and private sectors. Generic medicines were priced 25.35 and 50.42% higher, respectively in the public and private sector than in the mission sector (Table 10).

Comparative median price ratio across sectors for a selection of interested medicines

The patient prices of some medicines across sectors for both MSGs and LPGs were, respectively exactly the same or almost the same in all sectors. Figure 2a illustrates this for 7 medicines. Interestingly a number of these medicines had a marked higher than average difference between patient's prices and procurement prices in public sector and lower than average difference of patient prices in mission sector.

Comparison of the prices of OBs and generically equivalent products

Only those medicines for which both the OBs and a generically equivalent products were available, were included in the analysis to allow for the comparison of prices between the two product types. Results showed that in the public procurement, OBs cost 310.73% more, on average, than their generic equivalents (Table 11). Table 12 shows those medicines for which both the innovator brand and a generically equivalent product were found, that were included in the analysis to allow for the comparison of price. Results showed that in the public sector patient prices, OBs cost 294.35% more, on average, than their generic equivalents. Table 13 shows the medicines for which both the OBs and generically equivalent products were found, allowing for the comparison of prices between the two product types. Results indicated that in the private sector, OBs cost 110.45% more, on average, than their generic equivalents. While public sector patient prices for LPGs were more than 20% the public procurement prices, the

Table 12. Comparison of the prices of original brands and generically equivalent products: MPRs for medicines found as both product types, in the case of Public sector patient prices

Product type (n = 5 medicines found)	MPR	25th percentile	75th percentile	Difference of OBs to LPGs (%)
Original brand	13.96	13.55	14.57	294.35
Lowest priced generic	3.54	3.38	3.65	

N= 19 Public facilities; (n = 20 medicines)

Table 13. Comparison of the prices of original brands and generically equivalent products: MPRs for medicines found as both product types, in the case of Private sector patient prices

Product type (n = 14 medicines found)	MPR	25th percentile	75th percentile	Difference of OBs to LPGs (%)
Original brand	11.28	11.15	12.02	110.45
Lowest priced generic	5.36	5.15	5.58	

N= 35 retail pharmacies; (n = 20 medicines).

Table 14. MPRs for medicines found in both public and private sectors.

Product type	MPR Public sector patient prices (n= 19 outlets)	MPR Private sector patient Prices (n=35 outlets)	Difference of private To public (%)
Original brand (n=3 medicines)	11.83	13.67	15.55
Most sold generic (n=9 medicines)	5.62	6.31	12.28
Lowest priced generic (n=17 medicines)	4.25	5.50	29.49

public sector patient price of some medicines was as much as 2 times the public procurement price; this may relate to items being sourced from the private sector instead of the public sector procurement sources. In the public sector, OBs were found to be 2.94 times more expensive than the LPGs (n=5) and in the private sector, OBs were found to be 1.1 times than the LPGs (n=14) (see Figure 2b).

Comparison of patient prices in the public and private sectors

In the Table 14, those medicines found in both public and private sector medicine outlets were compared in terms of prices between the two sectors. Results revealed that final patient prices charged in the private sector were 15.55% higher than in the public sector for originator/innovator brands. For both MSGs and LPGs patient prices charged in private sector was 12.28 and 29.49% higher than the public sector, respectively. On average in both sectors in Comoros, the patient prices in the private sector were generally 12% more than those in public sector, some medicines were up to 16 times more expensive than IRP; however most of MSGs medicines were the same or lower in both the public and private sector.

Regional analysis

Comparison of prices in public sectors across the islands surveyed

As shown in the Table 15, the MPR for OBs and generics in the public sector differed significantly across the 3 islands surveyed.

Comparison of prices in private sectors across the islands surveyed

The MPR for OBs in the private sector differed significantly across the 3 Islands surveyed (Table 16). This is explained by the fact that in Comoros most of the private licensed retail medicine outlets (Pharmacies) are located in Ngazidja and it is the highest medicines purchasing Island. However both MSGs and LPGs in the private sector seemed the same across the 3 Islands surveyed.

Comparison of MPR prices in mission sectors across the islands surveyed

As shown in the Table 17, the MPR for OBs and generics in the private sector differed significantly across the 3

Table 15: MPRs per survey area, public sector

Product type	Median MPR		
	Ngazidja (Grande Comore)	Ndzuwani (Anjouan)	Mwali (Moheli)
Originator brand	13.69 (n=6)	11.83 (n=3)	
Most sold generic	5.62 (n=9)	4.55 (n=5)	4.46 (n=4)
Lowest price generic	4.35 (n=19)	4.35 (n=19)	4.35 (n=19)

Table 16. MPRs across islands in private sector.

Product type	MPR		
	Ngazidja (Grande Comore)	Ndzuwani (Anjouan)	Mwali (Moheli)
Original brand	11.28 (n=14)	10.65 (n=10)	9.85 (n=5)
Most sold generic	5.96 (n=20)	4.96 (n=20)	5.45 (n=20)
Lowest priced generic	5.34 (n=19)	4.80 (n=19)	5.12 (n=19)

Table 17. MPRs across Islands in mission sector.

Product type	MPR		
	Ngazidja (Grande Comore)	Ndzuwani (Anjouan)	Mwali (Moheli)
Original brand	(n = 0)	(n = 0)	(n = 0)
Most sold generic	4.31 (n = 7)	4.44 (n = 5)	5.09 (n = 3)
Lowest priced generic	3.55 (n = 15)	3.55 (n =15)	3.55 (n =15)

Islands surveyed. The MPRs of product type (OBs, MSGs and LPGs) of selected individual medicines were compared across the 3 Islands. In the public sector, the average price were the same in all regions with little difference between Islands, across sectors, the median price of all medicines for all product type were highest in Ngazidja. This variation could be explained by several factors specific to Ngazidja.

Affordability of standard treatment regimens

The affordability of treatment for 11 common conditions (Table 18) was estimated as the number of days' wages of the lowest-paid unskilled government worker needed to purchase medicines prescribed at a standard dose. Table 18 illustrates how many days this worker would have to work to purchase various treatments.

Comparisons with other countries

Comparisons with other countries' public sector procurement

Results for basket of medicines in Figure 2c showed that government procurement prices in Comoros (2014) were higher than those in Burundi (August, 2013), Mauritius (2008), Mongolia (October, 2012), Sudan (February, 2013) and 7 other Africa low income countries (April, 2013). Moreover the Comoros' public sector appears to be purchasing medicines less efficiently than other countries.

Comparisons with other countries' private sector prices

From Figure 3a, the basket of medicines selected to make comparison between Comoros and other countries; Amoxicillin, Co-trimoxazole and Nystatin both OBs and LPGs prices in Comoros were higher than other countries. However the median MPR innovator brand of Glibenclamide was less in Comoros than others, but for LPG of Glibenclamide in Comoros was higher than in the other low income countries in Africa.

Comparisons with other countries' public sector availability

Results for basket medicines in Figure 3b indicate that the availability of OBs of all medicines was less in Comoros than other countries. However the median

Table 18. Number of days' wages of the lowest paid government worker needed to purchase standard treatments.

Disease condition and 'standard' treatment			Day's wages to pay for treatment					
Condition	Drug name, strength, dosage form	Treatment schedule	Public patient prices			Private patient prices		
			OB	MSG	LPG	OB	MSG	LPG
Asthma duration = 30 days Number of units per treatment = 60	Salbutamol 0.5 mg/ml ampoule	1 ampoule×2×30 days=60	-	12.66	7.08	21.20	12.46	11.85
Diabetes duration = 30 days Number of units per treatment = 60	Glibenclamide 5 mg Cap/tab	1 cap/tab×2×30 days=60	-	-	0.73	1.78	0.81	0.78
Diabetes duration = 30 days Number of units per treatment = 90 days	Metformin 500 mg cap/tab	1 cap/tab×3×30 days=90 days	-	-	1.23	8.76	2.82	2.45
Hypertension duration = 30 days Number of units per treatment = 60	Nifedipine 20 mg cap/tab	1 cap/tab×2×30 days=60	-	-	1.96	5.86	2.89	2.83
Adult.Resp.infection duration = 7 days number of units per treatment =21	Mebendazole 100 mg tab-cap	1 cap/tab×3×7days=21	6.52	1.71	0.67	6.95	2.38	1.32
Adult.Resp.infection duration = 7 days Number of units per treatment=21	Amoxicillin 500 mg cap/tab	1 cap/tab×3 for7days=21	-	1.26	1.25	3.18	1.56	1.45
Paediatric.Resp.infection duration = 7 days Number of units per treatment =70	Co-trimoxazole (200+40 mg/5 ml) suspension	5 ml×2 for 7 days=70	9.42	-	2.72	9.21	4.11	2.64
Paediatric.Resp.infection Duration = 7 days Number of units per treatment =105	Erythromycin125 mg/5 ml suspension	5 ml×3 for 7 days = 105	29.15	-	9.22	-	11.91	10.90
Arthritis duration = 30 days number of units per treatment = 60	Diclofenac 25 mg cap/tab	1 cap/tab×2×30 days= 60	-	1.64	1.56	1.88	1.75	1.68
Arthritis duration = 4 days number of units per treatment = 60	Ibuprofen 100mg/5ml suspension	5 ml×3×4days=60	12.01	-	1.76	15.05	5.20	4.98
Pain/inflammation duration = 3 days Number of units per treatment= 45	Paracetamol 500 mg, 50 ml vial	5 ml ×3×3 days=45	10.01	-	3.42	-	4.43	3.76
Pyelonephritis duration = 10 days number of units per treatment = 40	Ampicillin 500 mg cap/tab	2 cap/tab×2×10 days= 40	-	2.39	1.96	4.79	2.52	2.23
Anxiety duration = 7 days Number of units per treatment = 7	Diazepam 5mg cap/tab	1 cap/tab×1×7 days=7	-	0.1	0.09	0.20	0.10	0.1

Table 18. Cont'd

Gastro intestinal health duration = 7 days Number of units per treatment = 21	Metoclopramide Hcl 10 mg tab-cap	1 cap/tab×3×7 days=21	-	0.26	0.23	-	0.25	0.22
Tropical fungal infection Duration = 7 days Number of units per treatment =21	Clotrimazole 1% cream	1 g ×3 times × for 7 days=21	0.61	-	0.18	-	0.25	0.21

availability of LPGs of Amoxicillin, Co-trimoxazole, Diazepam and Nystatin was higher than African low income countries. The LPGs of Glibenclamide and Nifedipine were less in Comoros than in other African low income countries and Sudan.

Comparisons with other countries' private sector availability

Results for basket medicines in Figure 3c showed that the availability of OBs of all the basket medicines was lower in Comoros than the other countries. The LPGs of Amoxicillin, Co-trimoxazole, Glibenclamide and Nifedipine, the median availability was lower in Comoros than in Africa low income countries and most of other countries under study. LPGs of Metformin had a median availability that was lower in Comoros than in Sudan and Mauritius and higher than in Mongolia and Burundi. The LPGs of Nystatin availability was lower in Comoros than in Burundi and Mauritius and almost the same in African low income countries.

Comparisons with other countries' public and private sector affordability

Comparisons of chronic medical condition treatment across public and private sector in terms of affordability: Figure 4a and b illustrate that in the selected countries, treatment of diabetes using Glibenclamide costs between 0.4 and 1.1 days' wages when LPGs are purchased from both private and public sector. In Comoros, the lowest paid government worker would need to spend 0.73 or 0.78 days wages to purchase the LPGs in both sectors, which shows a better affordability compared with Burundi but less affordability with other countries. When the OB is purchased, the affordability ranges from 1.3 to 6.7days' wages across the selected countries in both sectors.

Comparisons of acute medical condition treatment across public and private sector in term of affordability: Figure 4c and 5a indicate that in the selected countries, treatment of adult respiratory infection using Amoxicillin costs between 0.3 and 1.45 days' wages when LPGs are purchased from both the private and public sectors. In Comoros, the lowest paid government worker would need to spend 1.25 or 1.45 days' wages to purchase the LPGs in both sectors, which shows a lower affordability compared with other the countries. When the OBs are purchased, the affordability ranges from 1.7 to 3.18 days' wages across the selected countries in both sectors.

DISCUSSION

The present survey was done in Comoros according to the methodology described in the WHO/HAI manual for measuring medicine price. The provision for supplementary medicines allowed local morbidity patterns to be better presented. A total of 20 medicines were surveyed for the price and availability in the public, private and mission sectors in Comoros. The results of this study can be compared with a previous survey performed in Comoros (2001) in order to obtain a more precise evaluation of the availability of medicines before the reconciliation (Fomboni Agreement, 2001). This study chiefly compared the prices, availability and affordability of medicines, and also aggregated selected medicines for valid comparisons. One particularly important aspect of this study is that it included a comparison analysis of the health situation before the political conflict between Islands and the markup cost from the old procurement prices and the new one to health facilities in public sector.

Availability of all medicines survey across the sector

Results indicate that in the public sector, the procurement of medicines is inefficient, as shown by purchase prices being higher than international reference prices. By the time these medicines are sold to patients, prices have increased by 18% as a result of add on costs in the public sector distribution chain. Availability of generic medicines in public sector is noted to be poor. The average availability across all surveyed medicines was

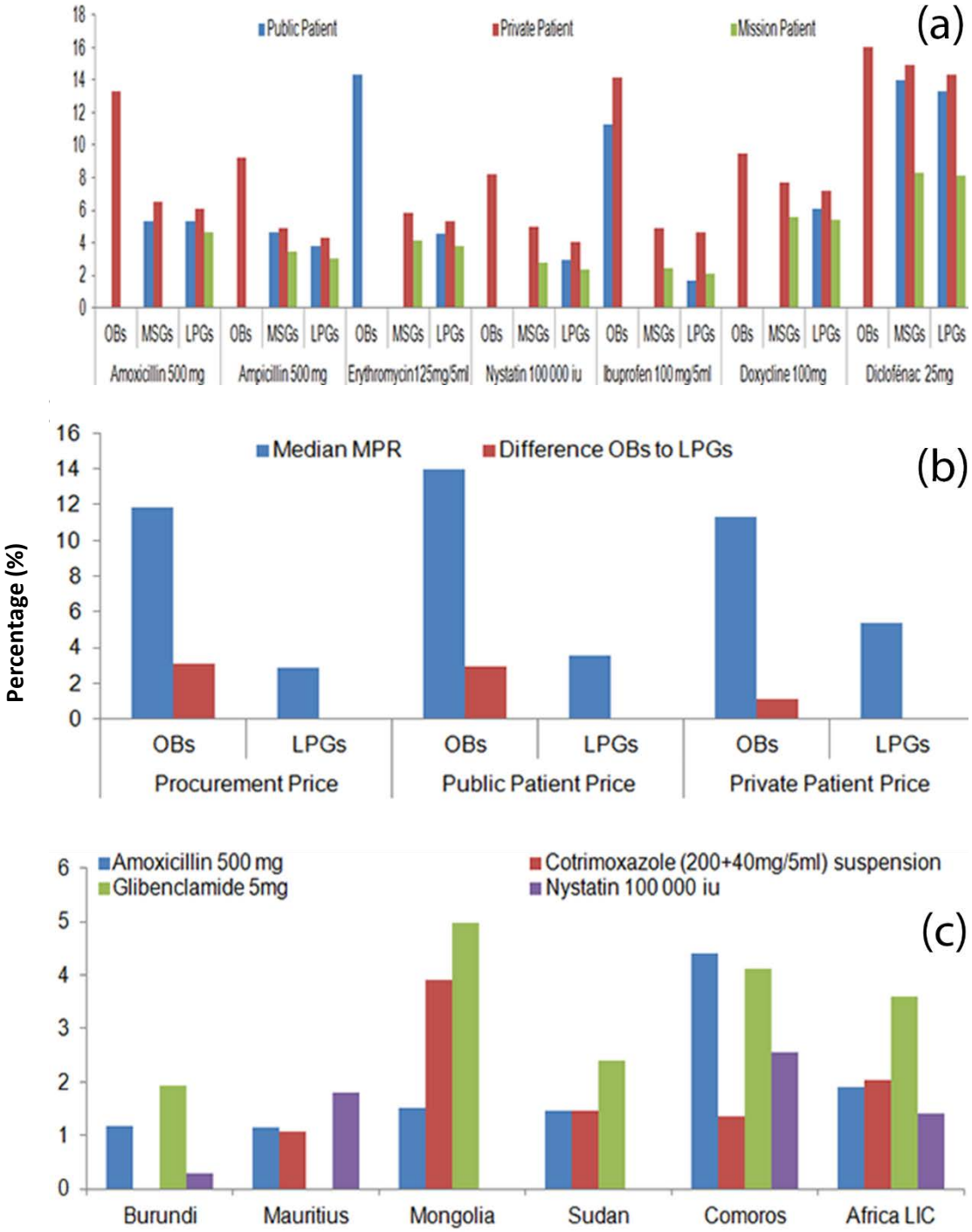

Figure 2. (a) Comparison of medicine product types MPR prices across 3 Sectors; (b) Comparison of both originator/innovator brands and generically equivalent MPR across public and private patient prices; (c) MPR comparison of a basket of medicines in Comoros and others selected countries for the public procurement price.

31.11%. The availability of the LPGs was mostly available in public sector, and the mean availability was 54.21%. Given this median availability of medicines in public sector, it can be concluded that many patients have to purchase medicines from the private sector. This difference of availability could be explained by many reasons but the most important is financial constraints. It should be noted that the availability of both MSGs and OBs medicines are rarely or not available in the public sector, with an average availability, respectively 12.63 and

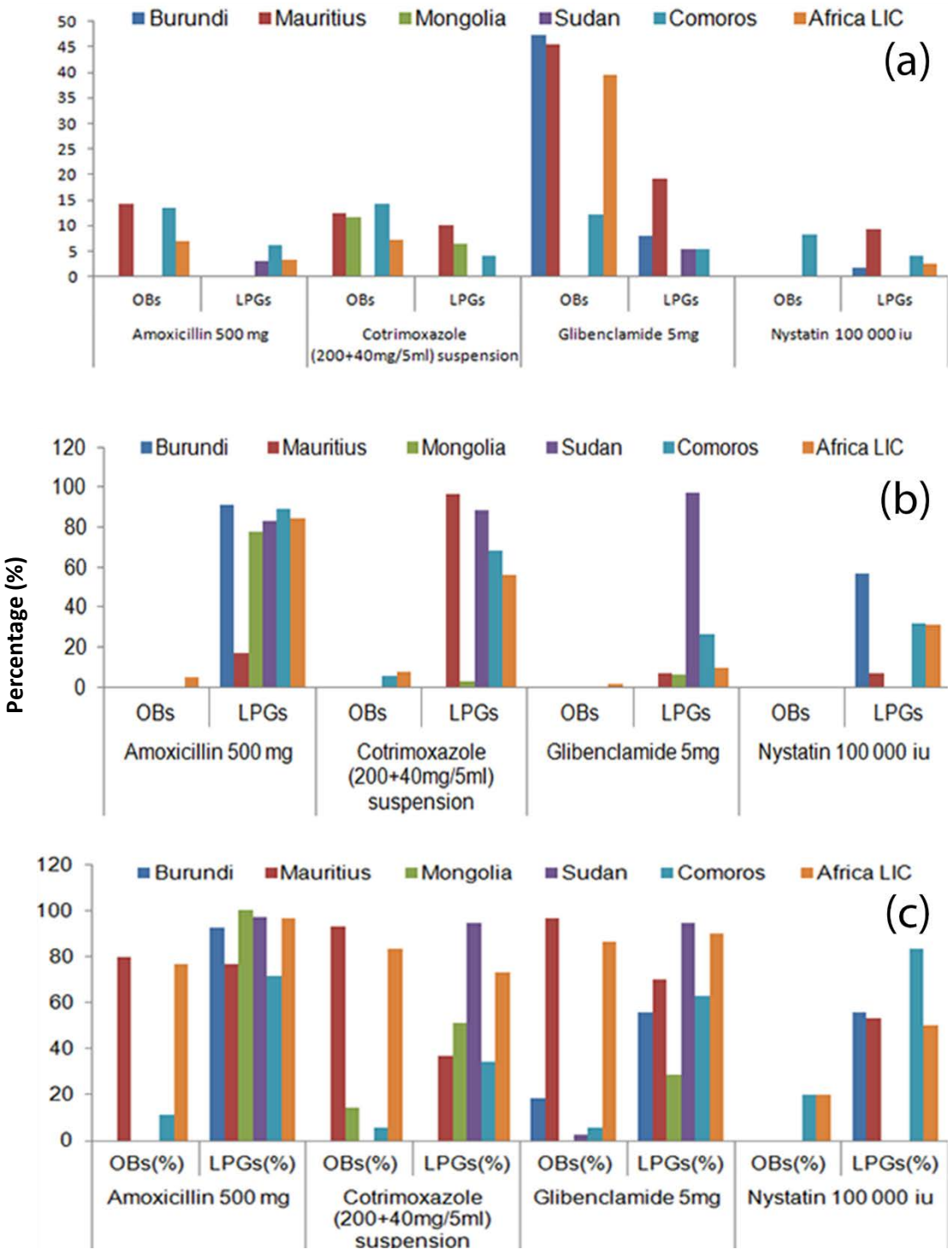

Figure 3. (a) MPR Comparison of private sector prices of a basket Medicines in Comoros and other selected countries; (b) Mean (%) Availability of basket of Medicines in Comoros in the Public Sector in Comparison with Other selected Countries; (c) Mean (%) Availability of a basket of Medicines in the Private Sector in Comoros in comparison with other Countries.

4.73%. The results of this survey indicate that the mean availability differed in public sector from Island to Island. It will be noted that in the big Island Ngazidja, most of public facilities presented all product types in contrast to

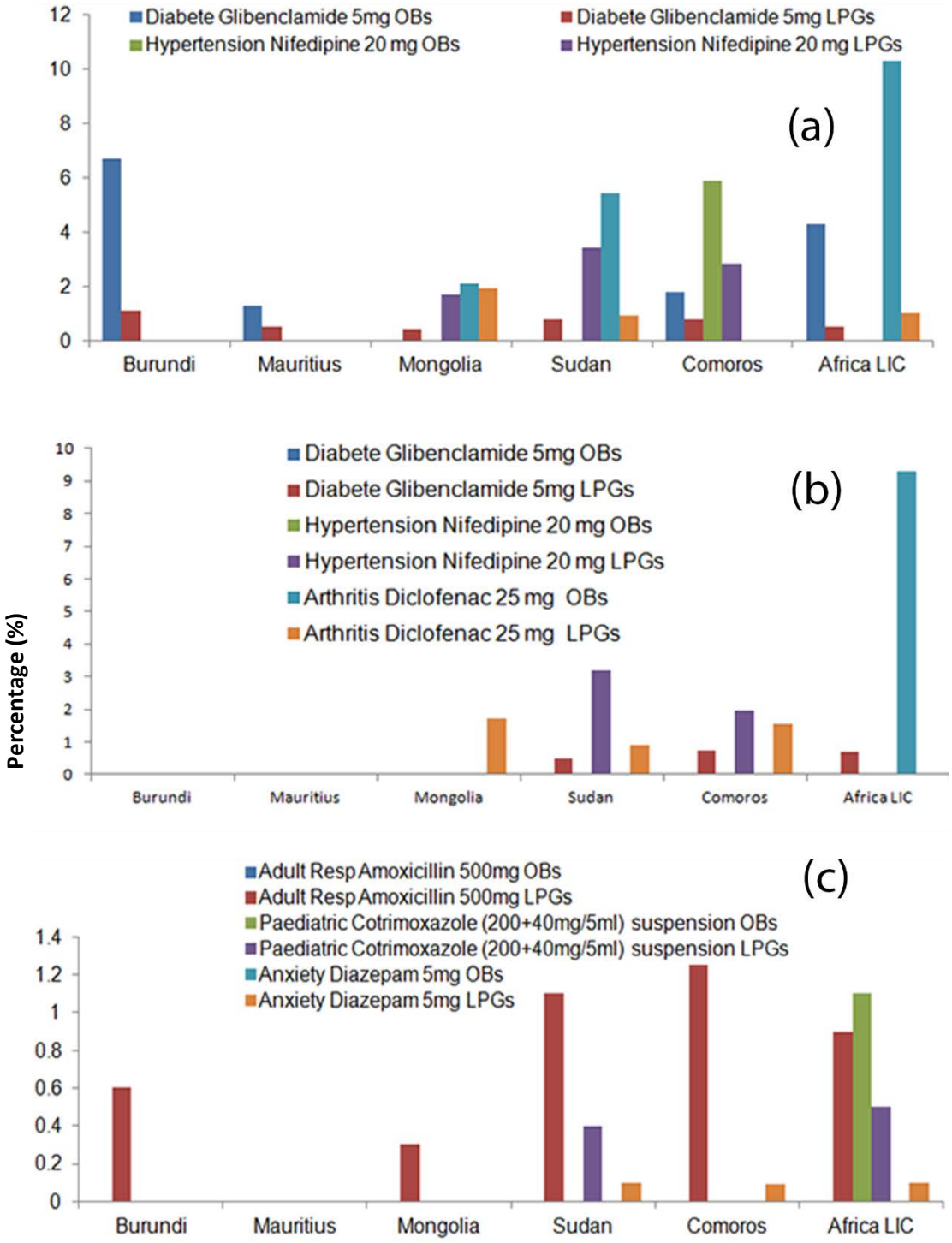

Figure 4. (a) Private Sector affordability Comparison of Chronic conditions in Comoros and other countries; (b) Public sector affordability Comparison of Chronic condition in Comoros and others countries; (c) Public sector affordability Comparison of Acute conditions in Comoros and others countries.

the smallest Island Mwali where only two kind of product type were found. In Ndzuwani, the mean availability of LPGs was higher than others. This situation of low availability of medicines in Mwali public facilities forces many patients to seek treatment from other Islands.

In the private sector, generic equivalents were the predominant product type found. Mean availability in the private sector for MSGs and LPGs was 52.19 and 49%,

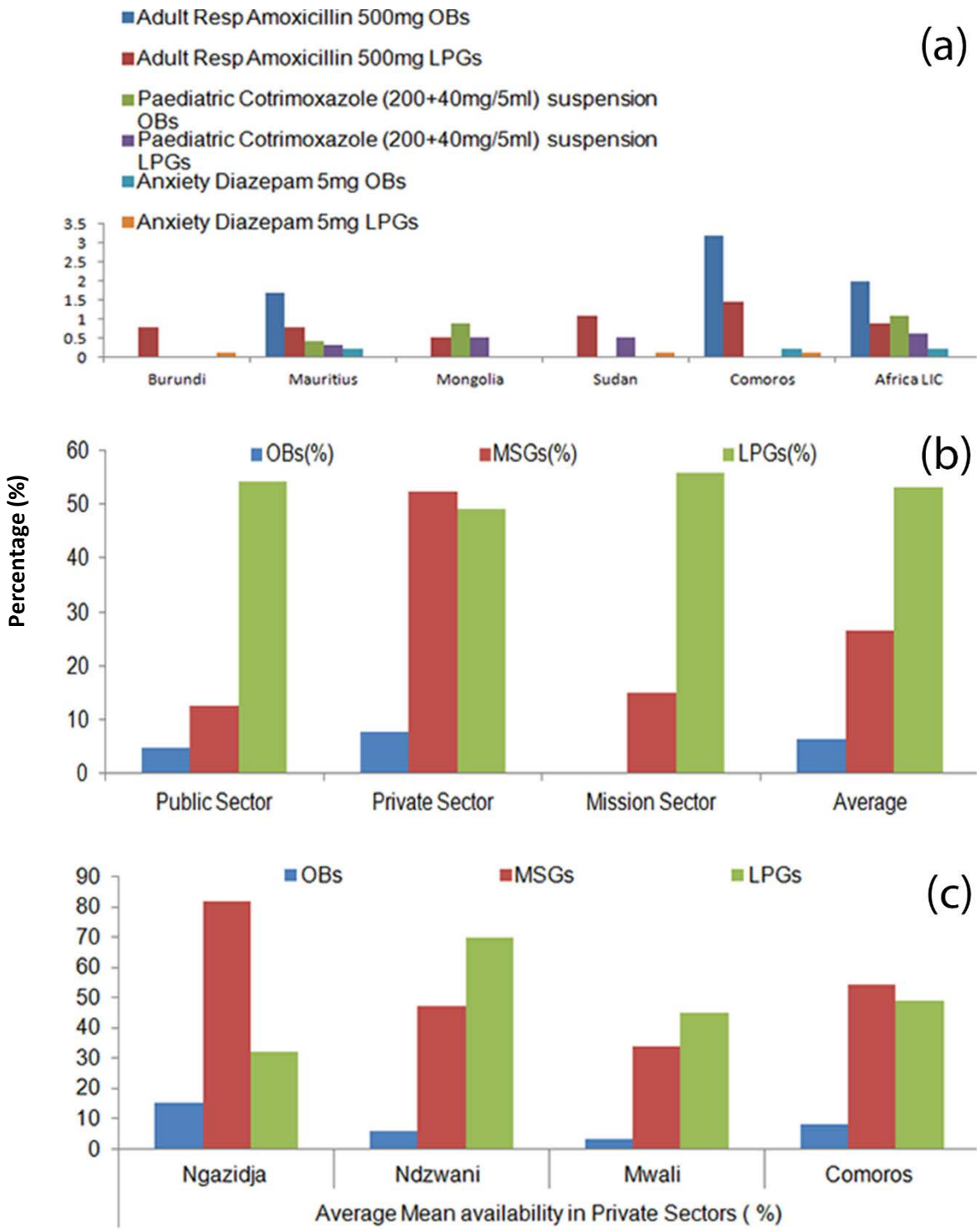

Figure 5. (a) Private sector affordability comparison of acute conditions in Comoros and others countries; (b) Mean (%) Availability Comparison of a basket medicine in Comoros and others countries; (c) Mean (%) Availability Comparison per surveyed areas in public sector.

respectively. For the OBs, mean availability in private sector was 7.86%. The mean availability however differed from island to island. Availability of medicines in private sector was higher in the three Islands for both OBs and generic equivalents (Figures 5 and 6).

In conclusion in both public and private sectors in Comoros, availability of medicines remained low. And this low availability created many disparities and inequalities

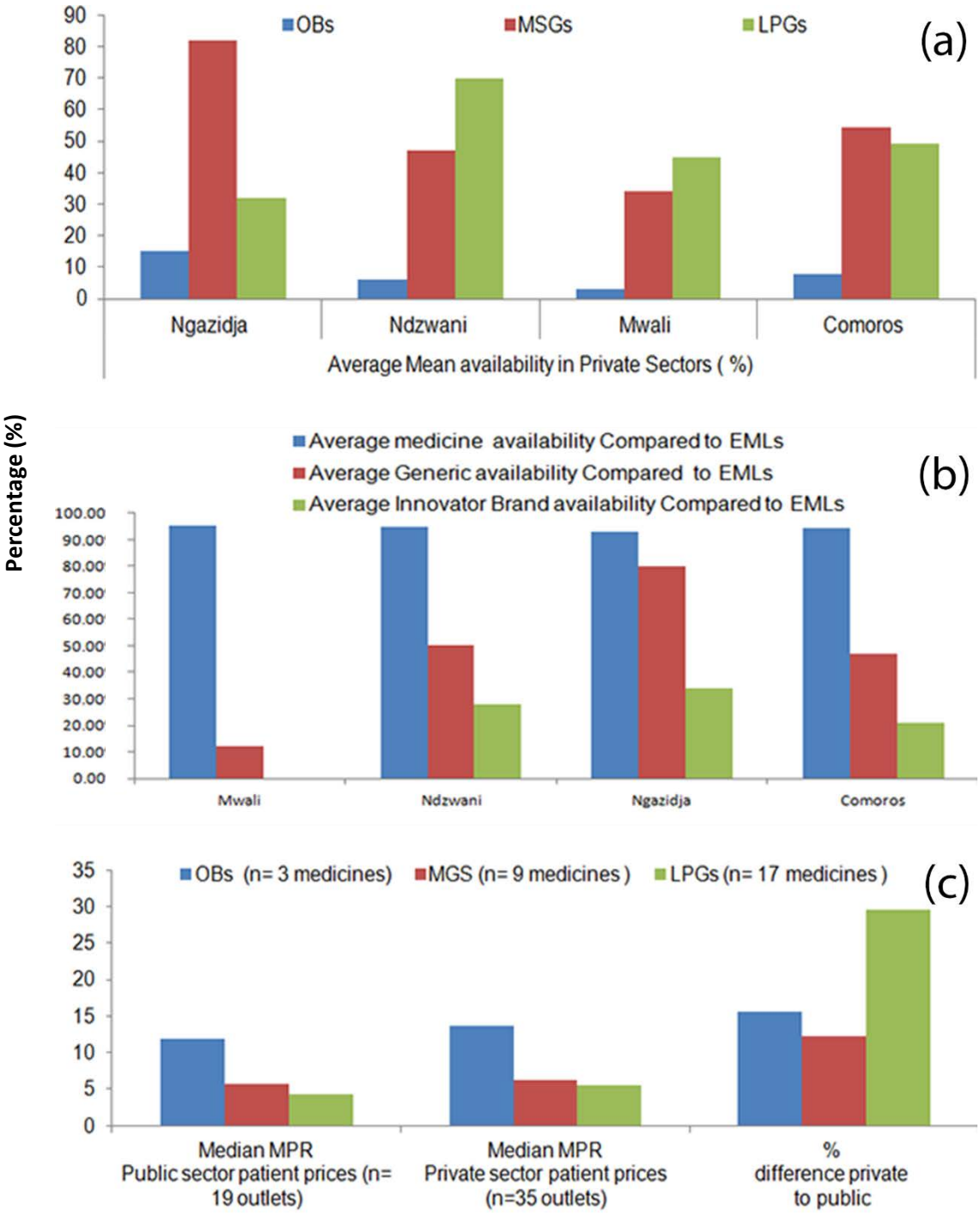

Figure 6. (a) Mean (%) availability per surveyed areas in private sector; (b) Mean Availability (%) per surveyed areas in public sector 2001; (c) Comparison of Medicine price in both private and public sectors.

between islands and also between districts. Comparing to the previous surveys conducted by the Ministry of Health and financed by World Health Organization (projet santé III, October 2001) in Comoros, the differences of availability could be explained by the political disputes and jurisdiction issues on health matters between the central government and the regional administration resulting immediately after adoption of Fomboni (2001) Union des Comores and United of Nations. (2008).

This study noted an improvement in that more than94% of most of the medicines recommended in the Essential Medicines List (EML) was now available in the health

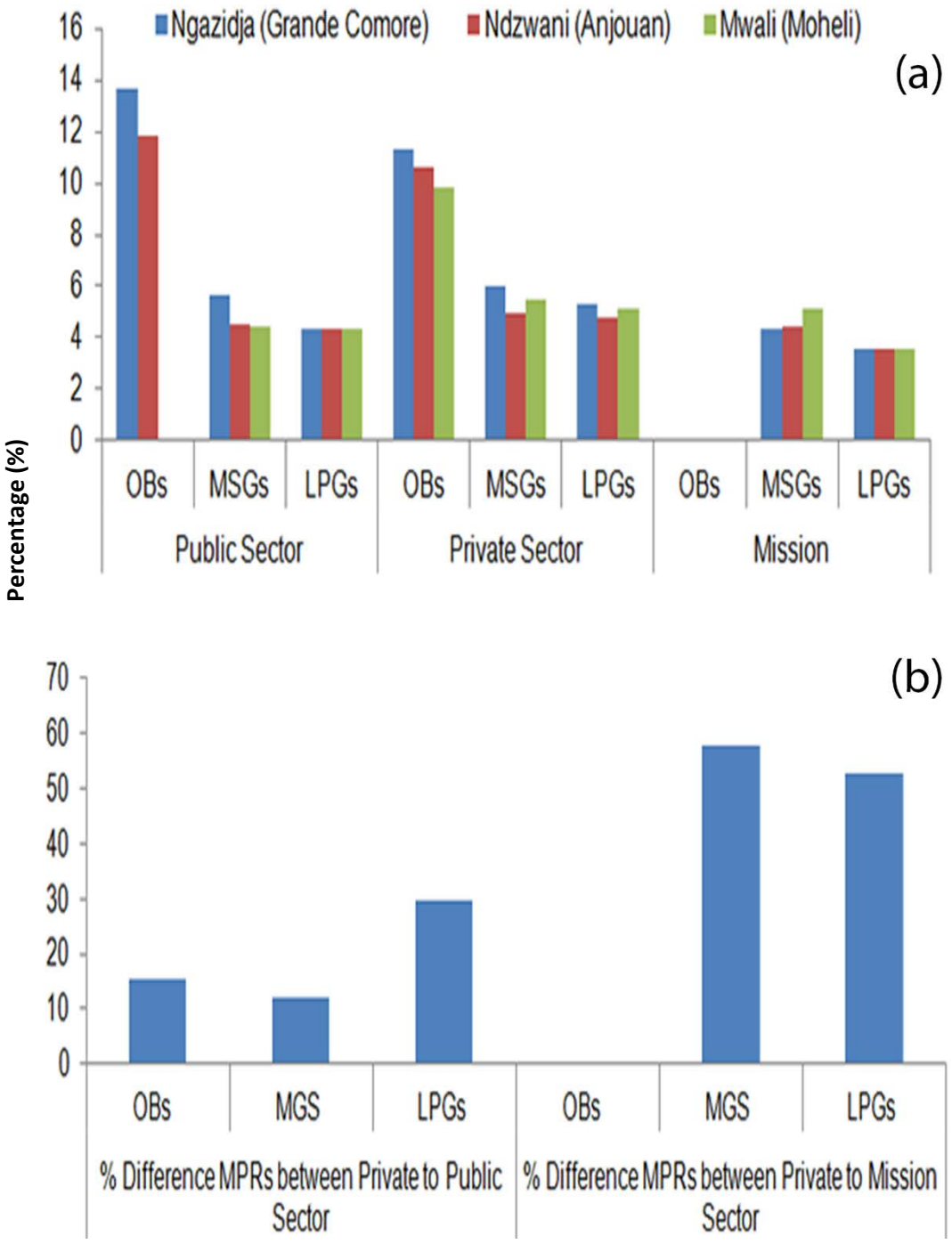

Figure 7. (a) Variation of MPRs per survey area and by sector; (b) Variation of MPR by product type between private sector and others.

health facilities. And also it was realized that more the 30% of them were innovator brands (Figure 7).

Prices

Compared to international prices it was established that the public sector procured drugs were also priced at up to 11.60, 4.74 and 3.83 times the international price for OBs, MSG and LPGs, respectively. Although the overall purchasing efficiency is indicated to be poor it was noted that the government procurement agency is purchasing a little bit efficiently when buying generics but not OBs which overall were very highly priced. The inter quartile

range does not show substantial variation in median price ratios across individual medicines. In public sector patient pricing, the MSGs were generally sold at 5.62 times their international reference prices. It should be noted the variation in MPRs across individual MSGs in public sector of the inter quartile ranged from 5.22 to 5.74. LPGs were generally sold at 4.45 times their IRP. Half of the LPGs were priced at 4.20 to 4.62 times their international reference prices; similarly therefore minimal variation in MPRs across individual generic medicines in the public sector. For OBs, the MPRs were at 13.69 times than IRP. The inter quartile variation was between 13.23 to 14.40 times than IRP.

Several reasons might explain this variation of MPRs in public facilities; first there are no national guidelines on how medicines prices are fixed in the public sector. This is why the prices patients are charged for medicines varied from facility to facility in the public sector. The medicines were higher multiples of the international reference price in both MSGs and LPGs, indicating the influence of the fact that all medicines are imported and none is manufactured within the country or region, since the liquidation of National Autonomous Comoros Pharmacy (PNAC). In the private sector, prices were a bit higher than or same in public sector. Compared with the public sector, for the medicines found in both public and private sector medicines outlets a specific analysis to allow for the comparison of prices between the two sectors was carried out and results showed that final patient prices in the private sector were higher for all the medicines individually varying as differences, private patient charged at 15.55, 12.28 and 29.49% higher for OBs, MSGs and LPGs, respectively for all medicines found. However, the average MPR patients' prices in the private sector were lower at 17.60% than in the public sector for all OBs found in both sectors. Both MSGs and LPGs, the average MPRs in private price was at 5.96 and 5.34 higher than the MSH international reference price, indicating higher mark-up rates but the study could not reveal whether the variation was related to high procurement pricing or high add-on costs, or a combination (lack of information from private sector).

The mission sector mainly gets its medicine supply and other public health services by humanitarian non-governmental organizations. From the survey it was noted that OBs were not availed by these organizations and but their generic products were priced at lower prices than both the public and private sectors. For instance the MPR values were at 4.31 and 3.55 for MSGs and LPGs, respectively than the international reference price. Compared to public and private sector, the average median MPRs prices for MSGs were at 27.68 and 23.31% lower than private and public sector, respectively. For LPGs in mission sector, the MPRs price was at 33.52 and 20.22% lower than LPGs in both sectors. This is opposite to the expectation since the mission sector is presumed to be largely sponsored by international bodies hence expectation of their pricing to be at the same level with international prices. In addition, a high variation of MPRs price medicines from Islands to Island is noted. This wide variation of MPRs might be attributed more to licensed pharmacies being located in Ngazidja than other Islands and also Ngazidja had the highest average purchasing power in Comoros.

In Comoros, the price charged to patients for both LPGs and MSGs was found to be on average 3.55 and 5.96 times higher than the international reference prices across sectors, and OBs was found to be 11.28 and 13.69 times higher than international reference. Unlike the patients in the 7 African Low Income countries (2013), the price charged to patients in both public or private sectors are higher than neighboring countries. This is therefore an indication of lack of relevant policies for price control in Comoros which are here witnessed to have direct impact on medicines and hence accessibility. It is illustrated that the price charged to patients in both Public and Mission sector for any products were found at 5 to 50% lower than the private sector.

Affordability of standard treatment regimens

In the public sector, the affordability of lowest priced generics proved adequate for some conditions, with standard treatment costing 2 days' wage or less. For instance in the treatment of diabetes, Glibenclamide 5 mg capsule/tablet or Metformin 500 mg cap/tab, the lowest government wage earner spends 0.73 or 1.23 days' wage for paying for the treatment. For adult respiratory infection with Mebendazole or Amoxicillin 500 mg cap/tab, the lowest paid government worker purchasing the lowest price generic would invest 0.67 or 1.25 days' wages. However, in the treatment for asthma using Salbutamol 0.5 mg when lowest priced generic is used, the cost is equivalent to 7.08 days' wage for the lowest paid government worker.

For the treatment of paediatric respiratory infection using Co-trimoxazole (200+40 mg/5 ml) suspension or Erythromycin for 7 days, when lowest priced generics are used, the cost incurred would be equivalent to 2.72 or 9.22 days' wage of the lowest paid government worker. These high treatment costs for the lowest paid government worker, could be a reason for high rate of mortality in children under 5 years from 122/1000 live births in 1990 to 50/ 1000 live births in 2012. In other words, in Comoros, about one in twenty births dies before reaching the age 5 (Union of Comoros, National Health Development Plan 2010/2014).

The pharmaceutical business in Comoros is still being considered like any other business, the Comorian government applies the *laissez aller* of the market (uncontrolled market), which explains the raising of medicines prices to mark up for both sectors. Like most of the developing countries the poor people in Comoros

cannot afford the drugs that could improve, extend, or save their lives. Price is not the only reason why people do not get the medicines they need, but it is a major barrier, as was indicated by Médecins Sans Frontières (MSF), in most developing countries (Pecoul et al., 1999). Secondly, in private pharmacies, often the MSG was the most generic available (54%) so it was also the LPG in that particular facility. Generally, the domestic market has many other generic equivalents that are less expensive than the MSGs. Often the retailers do not sell these lower priced generics, possibly because health care practitioners prescribe only MSGs and/or profit margins are higher.

The study has also shown differences in prices of OBs and generic equivalent medicines. In public procurement, the difference in MPR of OBs and LPGs was 310.73%. For patient prices in the public sector, the MPR difference between OBs and LPGs was 294.35%, compared to 110.45% between OBs and LPGs in private sector. This implies that the public procurement purchased inefficiently OBs. This article should be useful to government health policy makers in providing a broad picture of the present situation regarding essential medicines and suggesting ways to strengthen the national essential medicines scheme and hence bring benefits to patients. For example, a price monitoring system would be useful for supervising and controlling the availability and price of essential medicines for the population.

Limitations of the study

The main limitation is with the number of medicines selected for the study. The study was also based on the epidemiological profile of Union of Comoros, thus the essential medicines list. This could differ from one country to another.

CONCLUSION AND RECOMMENDATIONS

This survey has shown poor availability (31.11%) and high MPRs price at more than 4 times than IRP of all medicines surveyed across sectors. So even if patients visit public facility they end up buying medicines from private retail pharmacies. The disparity of availability and high pricing of medicines between Islands created some inequality in the populace of Comoros. Many people in Comoros lose their lives trying to cross 70 km of sea to Mayotte to getting free treatment (The World Bank, Comoros, 2014; Ellen, 2013). Such situation is a call on the Government to develop policies that allow for generic substitution and generic prescribing. Regular training workshops in generic substitution should also be conducted for doctors, pharmacists and patients and for awareness on the cost-effective medicines in the same therapeutic class and for the same molecule in order to achieve the lowest possible price for essential medicines (Ghislandi, 2011; Kaiser et al., 2014).

A multifaceted approach is required for medicine price regulation in the market, the first step being establishment of transparency in the supply chain. A regular publication of medicine prices of different generics by some reputed NGO/research team will increase public awareness and empowerment of consumers. Consumer consciousness about medicine price will be helpful in bringing down the prices of medicines in the market. The Government can decrease medicines prices by decreasing the margins (profits) of all actors of supply chain, by abolishing taxes on essential medicines and by promoting generics. The prices and availability of medicines in the public and private sectors should be regularly monitored, and price data published so that people are informed about medicines prices.

Competing interests

The authors declare that there are no competing interests regarding this study.

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REFERENCES

Cameron A, Ewen M, Ross-Degnan D, Ball D, Laing R (2009). Medicine prices, availability, and affordability in 36 developing and middle-income countries: a secondary analysis. Lancet 373(9659):240-249.

Chrysantus A (2008). Situation Critical. The Anjouan Political Crisis. Institute for Security Studies, Situation Report. http://dspace.africaportal.org/jspui/bitstream/123456789/31189/1/SITREPANJOUANMAR08.pdf?1.

Ellen FM't H (2013). Access to medicines should not be a luxury for the rich but a right for all. [Online] Available at: http://www.npojip.org/jip_semina/semina_no3/ellen-e.pdf.

François T (2008). L'île d'Anjouan figure de la balkanisation de l'archipel des Comores. EchoGeo [online]. Available at: http://echogeo.revues.org/7223.

Ghislandi S (2011). Competition and the Reference Pricing Scheme for pharmaceuticals. J. Health Econ. 30(6):1137-1149.

Graham F, Geoff R, Jacqueline G (2013). Assessment of Facilities for Health Improvement in the Comoros Islands. Australian Doctors for Africa. Available at: http://ausdocafrica.org/doc/Comoros.pdf.

Kaiser U, Mendez SJ, Ronde T, Ullrich H (2014). Regulation of pharmaceutical prices: evidence from a reference price reform in Denmark. J Health Econ. 36:174-187.

National Millennium Development Goals (MDGs) Reports –Comoros (2013). Objectifs Du Millenaire pour le Developpement (OMD) Rapport National Des Comores 2013. Available at: http://www.km.undp.org/content/dam/comoros/docs/omd/UNDP-km--omd-report-2013.pdf.

Niens LM, Brouwer WB (2009). Better measures of affordability required. Lancet 373(9669):1081.

Niens LM, Cameron A, Van de Poel E, Ewen M, Brouwer WB, Laing R (2010). Quantifying the impoverishing effects of purchasing medicines: a cross-country comparison of the affordability of medicines in the developing world. PLoS Med. 7(8).

Ouledi A, Toyb M, Aubry P, Gauzere B (2012). Histoire sanitaire et enjeux sanitaires de l'Union des Comores en 2012 (Health history and health challenges in the Union of Comoros in 2012). Medicine et Santé Tropicales 22:346-354.

Pecoul B, Chirac P, Trouiller P, Pinel J (1999). Access to essential drugs in poor countries: a lost battle? JAMA 281(4):361-367.

The World Bank (2013). Comoros Data world Development Indicator Available at: http://data.worldbank.org/country/comoros.

The World Bank Comoros Data (2014). Out of pocket health expenditure in Comoros. Available at: http://data.worldbank.org/indicator/SH.XPD.OOPC.ZS/countries.

Thierry V (2007). The Internationalized State New Form of Globalization in Africa. Published dans Etude. http://www.diplomatie.gouv.fr/fr/IMG/pdf/0902_Vircoulon_AN.doc.pdf.

Union of the Comoros, National Health Policy (NHP) (2005). Available: http://www.nationalplanningcycles.org/sites/default/files/country_docs/Comoros/politique_nationale_de_sante_vf_signee_07_en.pdf. Accessed 11 Dec 2013.

Union des Comores and United of Nations (2008). Priority Plan for peace building in the Comoros. [online]. http://www.km.one.un.org/pages/documentation/documentation/programmes/doc/fcp/pbf_comoros_final_en.pdf. Accessed 4 Dec 2014.

Union of Comoros, National Health Development Plan 2010/2014 (2010). Available at: http://www.nationalplanningcycles.org/sites/default/files/country_docs/Comoros/pnds_05_mai_2010_documentvf_en.pdf.

Wagstaff A, van Doorslaer E (2003). Catastrophe and impoverishment in paying for health care: with applications to Vietnam 1993-1998. Health Econ. 12(11):921-934.

World Health Organization (2002). Moroni. Saïd Omar Ben Achirafi, Dr Younoussa Assoumani; Health System Financing, Master plan for assisting the UNS Agencies in Development in Comoros.

World Health Organization /Health Action International (2003). Reflecting the global burden of disease, Medicine prices, a new approach to measurement.

World Health Organization (2006). Comoros, the country Cooperation Strategy at a glance. Available at: http://www.who.int/countryfocus/resources/ccsbrief_comoros_com_06_en.pdf.

World Health Organization/Health Action International (2008). Measuring medicine prices, availability, affordability and price components. Geneva: World Health Organization/Health Action International.

World Health Organization /Health Action International. (2009). Medicine prices, availability, affordability and price components: a synthesis report of medicine price surveys undertaken in selected countries of the WHO Eastern Mediterranean Region, Cairo, WHO Regional Office for the Eastern Mediterranean.

World Health Organization and Management Science for Health (2013) International Drug Price Indicator Guide 2013 Edition. Available at: http://erc.msh.org/dmpguide/pdf/DrugPriceGuide_2013_en.pdf.

World Health Organization (2014). Comoros Country Cooperation Strategy at a glance; update. Available at: http://www.who.int/countryfocus/cooperation_strategy/ccsbrief_com_en.pdf.

Xu K, Evans DB, Kawabata K, Zeramdini R, Klavus J, Murray CJ (2003). Household catastrophic health expenditure: a multicountry analysis. Lancet 362(9378):111-117.