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SHORT RESEARCH REPORT

Medicine prices, availability, and affordability in the Shaanxi Province in China: implications for the future

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Abstract *Background* In 2009, China implemented the National Essential Medicines System (NEMS) to improve access to high-quality low-cost essential medicines. *Objective* To measure the prices, availability and affordability of medicines in China following the implementation of the NEMS. Setting 120 public hospitals and 120 private pharmacies in ten cities in Shaanxi Province, Western China. *Method* The standardized methodology developed by the World Health Organization and Health Action International was used to collect data on prices and availability of 49 medicines. *Main outcome measures* Median price ratio; availability as a percentage; cost of course of treatment in days' wages of the lowest-paid government workers. *Results* In the public hospitals, originator brands (OBs) were procured at 8.89 times the international reference price, more than seven times higher than the lowest-priced generics (LPGs). Patients paid 11.83 and 1.69 times the international reference prices for OBs and generics respectively. A similar result was observed in the private pharmacies. The mean availabilities of OBs and LPGs were 7.1 and 20.0 % in the public hospitals, and 12.6 and 29.2 % in the private pharmacies. Treatment with OBs is therefore largely unaffordable, but the affordability of the LPGs is generally good. *Conclusion* High prices and low availability of survey medicines were observed. The affordability of generics, but not OBs, is reasonable. Effective measures should be taken to reduce medicine prices and improve availability and affordability in Shaanxi Province.

Keywords Affordability · Availability · China · Essential medicine · Pharmacoepidemiology · Prices · WHO/HAI methodology

Impact of findings on practice

- Low availability of medicines may affect patients' timely use of appropriate medicines to some extent.
- In China, the high prices of originator brand medicines have severely influenced the affordability of medicines for low-income families.
- For some chronic diseases, even a generic course of treatment can cost several days' wages in China.

Introduction

Essential medicines are those that satisfy the priority healthcare needs of the population [1]. The World Health Organization (WHO) has estimated that one-third of the world's population lacks access to the most basic essential medicines [2]. There are many different obstacles to access, with high prices often rendering medicines unaffordable for poor people [3]. In China in 2011, the pharmaceutical cost accounted for an average of 51.5 % of medical expenses associated with outpatient visits, and 42.0 % of inpatient costs in public hospitals [4]. High

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prices of medicines are a major concern for policy-makers, insurers and patients.

In 2009, China launched a new round of healthcare reform, aiming to achieve universal access to health care by 2020. There were five main priorities of this reform, but the establishment of the National Essential Medicines System (NEMS) to meet basic needs for treatment and prevention and ensure drug safety, quality, and supply was particularly emphasized. The provincial government in Shaanxi implemented triple-unification (unified bidding, unified distribution, and unified pricing) and drug zero mark-up policies to expand the coverage of essential medicines [5]. A provincial-level platform for the centralized procurement of essential medicines was established to seek procurement tenders from producers. All essential medicines are listed by their generic names, and drug producers compete to supply essential medicines through public procurement. Distribution costs are set at 5 % of drug procurement prices. By the end of 2011, all primary healthcare institutions in Shaanxi Province had implemented the zero mark-up policy. For retail pharmacies, priority use and supply of essential medicines was also encouraged.

Aim of the study

This study aimed to evaluate the effects of the NEMS on medicine prices, availability and affordability in public hospitals and private pharmacies in Shaanxi Province. Previous research had revealed low availability and high prices of surveyed medicines there [6]. This follow-up study was conducted to find out whether such problems still existed, and to identify issues about the NEMS 3 years after implementation.

Ethical approval

Xi'an Jiaotong University Health Science Centre, Shaanxi Provincial Department of Health and Shaanxi Food and Drug Administration approved the study prior to data collection. The participants were informed of the aims of our study prior to participation. All participants provided signed informed consent forms.

Methods

This study was undertaken in 120 public hospitals and 120 private pharmacies in ten cities (Xi'an, Yulin, Yan'an, Baoji, Xianyang, Weinan, Hanzhong, Tongchuan, Ankang, and Shangluo) in Shaanxi Province, Western China from March to May in 2012, using the standardized methodology developed by the World Health Organization/Health Action International (WHO/HAI) [7]. 49 medicines were included, 35 of which were essential medicines. Of these, 27 were on global and regional core lists, and 22 were from a supplementary list. The supplementary medicines were selected based on local importance, the national essential medicines list and the disease burden, and finalized after feedback from international experts (from HAI and WHO). For each medicine, data on price and availability of originator brand (OB) and lowest-priced generic (LPG) were collected. Prices paid by patients were recorded on the day of the survey, and procurement prices were obtained from the Shaanxi government procurement office. The unit prices were carefully calculated and entered into the WHO–HAI Workbook using a double entry technique.

The median price ratio (MPR), or the ratio of one medicine's median unit price to the international reference price (IRP), was used for price evaluation. The availability of each medicine was reported as the percentage of outlets in which the medicine was found on the day of data collection. To assess affordability, standard treatments for each of 11 common diseases (asthma, diabetes, hypertension, hypercholesterolaemia, depression, adult respiratory infection, paediatric respiratory infection, arthritis, ulcer, epilepsy, and viral infection) were included. If the standard treatment cost 1 day's wages or less, it was considered to be affordable. To calculate this, we used the average daily wage of the lowest-paid unskilled government workers in Shaanxi Province, which was RMB 29.5833 (USD 4.7021) at the time of this survey.

Results

Medicine prices

In the public sector, the median MPRs of procurement prices for 19 OBs and 35 LPGs were 8.89 and 1.49 times the IRPs. For 15 medicines available as both OB and generic, OBs cost 7.17 times more to procure than did the LPGs. The final patient prices were 33.0 and 13.4 % higher than the procurement prices for 19 OBs and 35 LPGs. The median patient price for the 19 OBs was 11.83 times the IRP. The public hospitals sold OB fluoxetine and OB omeprazole at extremely high prices, with MPRs of 146.10 and 75.69, respectively. The MPRs for nine OBs and six LPGs were more than 15 times their IRPs.

In the private pharmacies, the median MPRs of 20 OBs and 41 LPGs were 10.72 and 1.86 times the IRPs. For 16 medicines available as both OB and generic, OBs cost 1.36

Table 1 MPR and availability of individual medicines in the public and private sectors

	MPR						Availability (%)			
	OBs			LPGs			OBs		LPGs	
	Procurement	Public	Private	Procurement	Public	Private	Public	Private	Public	Private
Aciclovir	–	–	–	0.35	0.41	1.86	0	0.8	4.2	22.5
Albendazole	5.43	6.35	6.35	1.61	1.69	3.93	24.2	60.8	8.3	4.2
Aminophyline	–	–	–	0.25	0.47	0.44	–	–	70.8	65.8
Amitriptyline	–	–	–	2.91	3.49	3.56	0	0.8	10.0	9.2
Amlodipine	24.41	28.18	25.52	6.29	6.72	6.66	30.8	51.7	16.7	32.5
Amoxicillin	–	–	–	2.60	3.56	2.92	0	0	35.8	75.0
Atenolol	–	–	–	–	–	–	0	0.8	0	0
Atorvastatin	23.07	27.04	21.86	15.39	19.16	4.59	30.8	53.3	5.0	7.5
Azithromycin	8.89	10.29	10.25	0.50	0.79	1.46	3.3	10.0	47.5	75.8
Beclometasone	2.69	3.13	2.98	–	–	–	9.2	10.0	0	0
Captopril	–	–	–	0.33	0.44	0.40	0	0	73.3	80.8
Carbamazepine	8.28	11.83	11.20	–		0.51	3.3	10.8	2.5	10.0
Cefalexin	–	–	–	0.47	0.67	0.86	0	0	10.8	26.7
Cefradine injection	–	–	–	–	–	1.59	0	0	1.7	6.7
Ceftazidime injection	1.90	2.18	–	0.41	0.45	0.17	10.0	1.7	35.8	10.8
Ceftriaxone injection	13.16	15.13	–	0.33	0.60	0.58	20.8	1.7	55.0	30.8
Cimetidine	–	–	12.11	–	–	–	0	3.3	0	2.5
Ciprofloxacin	–	–	–	–	–	0.52	0	0	0.8	6.7
Co-trimoxazole	–	–	–	0.94	1.12	1.05	0.8	0.8	31.7	59.2
Diazepam	–	–	–	–	–	–	0	0	0.8	0
Diclofenac	–	–	36.96	20.05	27.57	29.57	2.5	6.7	3.3	20.8
Digoxin	–	–	–	1.51	1.74	1.59	0.8	0	57.5	53.3
Enalapril	–	–	–	8.28	10.60	10.60	0	0	55.8	75.0
Erythromycin	–	–	–	–	–	0.52	0	0	0	14.2
Fluconazole	–	–	–	21.82	25.83	20.44	0	0	5.0	19.2
Fluoxetine	119.40	146.10	33.87	–	–	–	4.2	19.2	2.5	1.7
Glibenclamide	–	–	–	–	–	–	0	0	1.7	1.7
Gliclazide	2.55	2.99	2.61	0.88	1.00	0.83	16.7	35.0	24.2	45.0
Hydrochlorothiazide	–	–	–	0.43	0.71	0.52	0	0	63.3	55.8
Ibuprofen	–	–	–	–	–	13.51	0.8	0.8	0.8	3.3
Isosorbide mononitrate	–	–	0.64	2.31	2.65	2.10	0.8	7.5	35.0	49.2
Ketoconazole	6.34	7.17	6.62	–	–	–	16.7	46.7	0	0.8
Lisinopril	–	–	–	–	–	7.08	0	0	1.7	5.8
Loratadine	22.37	25.31	22.37	17.54	15.01	15.31	9.2	42.5	23.3	60.0
Losartan	35.76	42.19	37.55	28.96	34.86	32.45	12.5	19.2	8.3	11.7
Lovastatin	–	–	–	26.33	33.80	33.79	0	0	10.8	39.2
Metformin	19.04	22.10	20.44	2.00	2.04	8.53	18.3	30	3.3	20.0
Metronidazole	–	–	–	0.71	0.92	0.86	0.8	0	76.7	60.8
Miconazole nitrate	7.63	8.86	7.89	1.38	1.46	5.22	56.7	78.3	6.7	11.7
Nifedipine retard	31.08	36.53	9.15	4.44	4.81	4.48	4.2	23.3	18.3	39.2
Ofloxacin	–	–	–	–	–	–	0	0	0	2.5
Omeprazole	62.06	75.69	67.90	1.22	3.16	3.41	17.5	30.0	63.3	75.8
Paracetamol	–	–	–	1.84	2.23	5.89	0.8	1.7	3.3	5.8
Phenytoin	–	–	–	0.52	0.61	0.28	0	0	6.7	3.3
Ranitidine	–	–	–	0.60	0.58	0.66	0	0	39.2	68.3
Rifampicin	–	–	–	0.09	0.10	0.09	0.8	0	22.5	43.3

Table 1 continued

	MPR						Availability (%)			
	OBs			LPGs			OBs		LPGs	
	Procurement	Public	Private	Procurement	Public	Private	Public	Private	Public	Private
Salbutamol inhaler	1.91	2.23	2.23	1.49	0.92	0.56	25.8	25.8	4.2	14.2
Simvastatin	8.12	9.67	9.28	4.78	5.32	5.08	17.5	30.8	10.0	52.5
Sodium valproate	–	–	–	0.27	0.26	0.26	0	0.8	21.7	50.0

MPR median price ratio, *OBs* originator brands, *LPGs* lowest-priced generics

times more than their generics. Even some of the LPGs cost more than 15 times the IRPs, with lovastatin being the highest at 33.79 times the IRP Table 1.

17 OBs and 35 LPGs were found in both public hospitals and private pharmacies, allowing patient price comparisons between the two sectors. The patient prices of OBs in the private pharmacies were 13.4 % lower than in the public hospitals, while generics cost 24.2 % more in the private pharmacies.

Availability

In the public hospitals, the mean availabilities of OBs and LPGs were 7.1 and 20.0 %, whereas in the private pharmacies the equivalent figures were 12.6 % for OBs and 29.2 % for LPGs. Only 22 medicines were available as both in both sectors. Overall, the mean availability of the surveyed medicines was low in Shaanxi Province.

Table 1 shows the availability of medicines in each sector. In the public hospitals, 21 OBs (43.8 %) and six LPGs (12.2 %) were completely unavailable, falling to 19 OBs and three LPGs in the private pharmacies. Atenolol, cimetidine, erythromycin and ofloxacin were unavailable as either OBs or generic equivalents in the public hospitals.

Affordability

Table 2 shows the affordability of 22 standard treatments for 11 common acute and chronic conditions in both sectors. All the OB treatments cost more than 1 day's wages except salbutamol for asthma. If patients chose treatment with the LPGs, the medicines would be much more affordable. For example, 1 month's treatment with nifedipine retard (20 mg twice daily) for hypertension purchased from public hospitals required 9.9 days' wages for the OB, but just 1.3 days' wages for its generic equivalent. The treatment of chronic disorders was generally more expensive than acute conditions, and the difference was especially marked for hypertension and hypercholesterolaemia.

Discussion

This investigation measured medicine prices and availability in Shaanxi Province, Western China, 3 years after healthcare reform. The results confirmed that high procurement and patient prices still existed in both public hospitals and private pharmacies, especially for OBs. Surprisingly, OBs cost more than seven times their generic equivalents in public hospitals, which exceeded the legal requirement of no more than 35 % more by more than 20 times [8]. According to the notice from the National Development and Reform Commission in China, patient prices should be no more than 15 % greater than procurement prices in public hospitals [9]. However, the actual mark-up was 33.0 % for OBs. Because of measures taken by the Chinese government to limit maximum retail price and to reduce prices, the patient prices for LPGs seemed relatively acceptable.

The study revealed that there were outrageous price differences between public and private facilities and that some medicines had very high procurement prices, e.g. atorvastatin, loratadine, and losartan, even though a zero mark-up policy has been implemented in public hospitals. We speculate that this finding occurred because the recently-centralised pharmaceutical bidding system remains inefficient. The results were contrary to previous studies in India, where more efficient procurement and pricing in the public sector were found to exist [10, 11].

We found low availability of medicines in both sectors, particularly for OBs with high retail prices in the public hospitals. Some common and older drugs like atenolol, cimetidine, erythromycin, and ofloxacin were reported unavailable in the public hospitals, which is probably due to the inefficient pricing mechanism, and procurement and distribution system for these medicines. Therapeutic alternatives or alternate dosage forms were not accounted for in the survey methodology [7], which may exaggerate the severity of conditions.

Treatment with OBs was nearly unaffordable for most low-income families. Although the affordability of LPGs

Table 2 Number of days' wages of the lowest paid government worker needed to purchase standard treatments

Condition	Drug name	Strength	No. of units/day	Duration days	Day's wages to pay for treatment			
					Public sector		Private sector	
					OBs	LPGs	OBs	LPGs
Asthma	Salbutamol	0.1 mg/dose	200	As needed	0.8	0.3	0.8	0.2
	Beclometas	0.05 mg/dose	200	As needed	1.6	–	1.5	–
Diabetes	Metformin	500 mg	3	30	1.5	0.1	1.4	0.6
	Gliclazide	80 mg	1	30	1.3	0.4	1.1	0.4
Hypertension	Amlodipine	5 mg	1	30	5.5	1.3	5.0	1.3
	Captopri	25 mg	2	30	–	0.1	–	0.1
	Lisinopril	10 mg	2	30	–	–	–	3.5
	Losartan	50 mg	1	30	6.8	5.6	6.1	5.3
	Nifedipine retard	20 mg	2	30	9.9	1.3	2.5	1.2
Hypercholesterolaemia	Simvastatin	20 mg	1	30	3.6	2.0	3.5	1.9
	Atorvastatin	20 mg	1	30	10.7	7.6	8.6	1.8
Depression	Amitriptyline	25 mg	3	30	–	0.5	–	0.5
	Fluoxetine	20 mg	1	30	11.4	–	2.6	–
Adult respiratory infection	Ciprofloxacin	500 mg	2	7	–	–	–	0.0
	Amoxicillin	500 mg	3	7	–	0.5	–	0.4
	Ceftriaxone	1 g/vial	1	1	2.2	0.1	–	0.1
Paediatric respiratory infection	Co-trimoxazole	(80 + 400) mg/ml	2	7	–	0.0	–	0.0
Arthritis	Diclofenac	50 mg	2	30	–	1.5	2.0	1.6
Ulcer	Omeprazole	20 mg	1	30	14.5	0.6	13.0	0.7
	Ranitidine	150 mg	2	30	–	0.1	–	0.2
Epilepsy	Carbamazepine	100 mg	2	30	2.2	–	2.1	0.1
Viral infection	Aciclovir	200 mg	5	5	–	0.1	–	0.4

OBs originator brands, *LPGs* lowest-priced generics

seems good, concerns have been expressed about the quality of generics [12]. In most public hospitals, doctors prefer to prescribe OBs because the structure of financial incentives tends to promote inappropriate prescribing and overuse of medicines. Some doctors prescribe excessively for personal benefit, which can also aggravate the cost burden on patients [13]. However, wider use of social health insurance may improve affordability. It is therefore necessary to enhance social health insurance coverage and improve the reimbursement ratio.

Conclusion

After the implementation of NEMS in Shaanxi Province, the availability of essential medicines was low. The high prices of originator brand medicines have severely influenced the affordability of medicines for low-income families. For some chronic diseases, even a generic course of treatment can cost several days' wages. The existing high prices and low availability should be addressed with effective policy interventions to ensure the Chinese people have better access to more affordable essential medicines.

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Conflicts of interest None.

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