

BMJ Open Moving towards a better path? A mixed-method examination of China's reforms to remedy medical corruption from pharmaceutical firms

Jianwei Shi,^{1,2} Rui Liu,¹ Hua Jiang,³ Chunxu Wang,⁴ Yue Xiao,⁴ Nana Liu,⁴ Zhaoxin Wang,^{1,4} Lei Yu Shi²

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¹Shanghai Tenth People's Hospital, Tongji University School of Medicine, Shanghai, China

²Department of Health Policy and Management, Primary Care Policy Center, Johns Hopkins University, Baltimore, Maryland, USA

³Department of Family Medicine, Shanghai East Hospital, Tongji University School of Medicine, Shanghai, China

⁴Tongji University School of Medicine, Shanghai, China

Correspondence to

Dr Zhaoxin Wang; supercell002@sina.com and Professor Lei Yu Shi; lshi2@jhu.edu

ABSTRACT

Objectives Few studies have systematically examined the effects of the existing regulations for alleviating corruption in China. This study assesses the effectiveness of China's reforms to curb medical corruption.

Methods We used mixed methods for the evaluation of existing countermeasures. First, qualitative informant interviews based on the Donabedian model were conducted to obtain experts' evaluation of various kinds of countermeasures. Second, using data from 'China Judgements Online', we analysed the trend of occurrence and the characteristics of the medical corruption cases in recent years to reflect the overall effects of these countermeasures in China.

Results Since 1990s, China has implemented three main categories of countermeasures to oppose medical corruption: fines and criminal penalties, health policy regulations, and reporting scheme policy. Information from the interviews showed that first the level of fines and criminal penalties for medical corruption behaviours may not be sufficient. Second, health policy regulations are also insufficient. Although the National Reimbursement Drug List and Essential Drug List were implemented, they were incomplete and created additional opportunities for corruption. Moreover, the new programme that centralised the purchase of pharmaceuticals found that most purchasing committees were not independent, and the selection criteria for bidding lacked scientific evidence. Third, the reporting scheme for commercial bribery records by the health bureau was executed poorly. In addition, quantitative online data showed no obvious decrease of institutional medical corruption in recent years, and most criminals have been committing crimes for a long time before getting detected, which further demonstrated the low effectiveness of the above countermeasures.

Conclusions Although existing countermeasures have exerted certain effects according to Chinese experts, more rigorous legislation and well-functioning administrative mechanisms are needed. Fundamentally, financial incentives for hospitals/physicians and the health insurance system should be improved.

INTRODUCTION

Medical corruption is pervasive across cultures and endemic in countries regardless

Strengths and limitations of this study

- This study systematically examined the effects of existing regulations for curbing medical corruption in China.
- Using mainly qualitative data from interviews with experts, supported by the quantitative data from 'China Judgements Online', which releases case verdicts about medical corruption, this study examined the effects comprehensively.
- The main limitations of this study were related to its data collection, since the selected interviewed experts were mostly from Shanghai and the quantitative data from the online system had a small sample size.

of whether they are small or large, poor or rich, or capitalist or socialist.¹⁻³ Although medical corruption is costly for all countries, it seems to be an especially prevalent problem in developing and transitional economies where public resources are scarce, such as China.⁴ Since the China's reform and opening up policy in 1979, public hospitals in urban and rural areas have remained under central government ownership. However, they were required to undertake a large degree of responsibility for financing money and administering institutions. This responsibility for healthcare financing required hospitals to rely more on the sale of services, drug prescriptions and medical examinations to produce revenues.⁵ The National Development and Reform Commission's price guidelines for basic health services (routine examinations, surgeries, standard diagnostic tests and pharmaceuticals in health institutions) required prices to be low enough so services would be affordable for patients. Moreover, hospitals were prohibited from earning more than 15% mark-up from regulated tests and drugs.⁶ However, the

privatisation of healthcare financing combined with price regulation put most public hospitals in China at serious financial risk.^{5 6} To compensate for the retrenchment of government health outlays, many public hospitals in China began to earn revenue illegally through alliances with pharmaceutical firms to procure pharmaceuticals and medical equipment.^{3 7 8} Meanwhile, pharmaceutical companies prefer establishing special arrangements for the hospitals since competition with other pharmaceutical companies is costly. Since the cost of penalty is much lower than the illegal profit, special arrangements with hospitals create a win-win situation for both entities.^{7 9 10} Gradually, medical bribery permeated the health sectors in China.^{7 8}

The illicit bribery from pharmaceutical firms to hospitals and health professionals or officials can lead to medical corruption. Usually, certain practices of pharmaceutical firms corrupt medical research, the production of medical knowledge, the practice of medicine, drug safety, the administration's oversight of pharmaceutical marketing and so on.¹¹ It was estimated that in the USA, the pharmaceutical industry spent up to \$42 billion in promotion every year, or on average \$61 000 per physician, to influence their prescribing habits and generate profits.¹² In China in the 2000s, numerous medical corruption incidents emerged and exposed the severity of corruption in China's healthcare industry.⁷ For instance, in 2013, all public hospitals in Zhangzhou, Fujian Province, were reported to be involved in medical corruption. A total of 1088 doctors and 133 administrators from 73 hospitals in Zhangzhou were found to be taking bribes and kickbacks from pharmaceutical firms that amounted to \$3.34 million.¹³ In this study, we focused on the type of medical corruption resulting from pharmaceutical firm practices. Usually, the interactions between pharmaceutical companies and hospitals or physicians are guided by their financial interests, and can be in the form of drug or device promotion, kickbacks, and/or financial incentives to influence physician prescribing behaviours.^{14 15} Studies showed that medical corruption negatively impacts the healthcare system by undermining the quality of healthcare, leading to inappropriate treatments, raising the cost of care and damaging physician-patient relationships.^{6-8 8-18}

Confronted with severe medical corruption, many countries have implemented various anticorruption strategies, such as fines and penalties,¹⁹ reform of tax policy for pharmaceutical companies,²⁰ health regulations by insurance institutions (ie, new forms of prescription drug pricing),^{10 21 22} and improvement of accreditation, certification and rating systems.^{23 24} However, due to the varying characteristics of health systems and severity of medical corruption in different countries, the solutions usually differ by country. In China, the government began implementing a wave of activities to combat medical corruption as early as 1990s. In detail, there are three categories of solutions: fines and criminal penalties, health policy regulations, and reporting scheme policy, specifically (1) the

fines and criminal penalties created by legal and regulatory bodies, such as the 'Penal Law' (amended, 2006), 'Anti-unfair Competition Law' (1993) and 'Interim Provisions on Anti-commercial bribery' (1996),²⁵ as part of its healthcare reforms; and (2) there are health policies that aim to reduce possible corruption in the process of drug selection and procurement, including the establishment of the National Reimbursement Drug List (NRDL, 2000) and the Essential Drug List (EDL, 2009). The NRDL was established by a national medicine selection system. Drugs on the NRDL have a subsidised price, but are also highly scrutinised. As part of the national reimbursed drug list, the essential drugs are selected to ensure the accessibility and quality of basic drugs available in health institutions.²⁶ The second regulation by the health department is the new programme required by the China Food and Drug Administration since 2009.²⁷ The programme centralises purchase of pharmaceuticals and controls costs by public tenders, bidding and auction processes. (3) Finally, the National Health Bureau created a reporting scheme for commercial bribery records. Regional health bureaus must blacklist 'manufacturers, operators or distributors' involved in commercial bribery and instruct health administrations to discipline responsible persons in the health institutions and pharmaceutical companies.²⁸

Although much information has been accumulated on how to develop regulations and countermeasures that restrain medical corruption in various countries,^{1 2 4 9 11} there is little research that systematically examines the effects of these regulations on the elimination or alleviation of medical corruption from pharmaceutical firms specifically. Thereby, with the understanding that Chinese leadership is combating rampant corruption within its society, this study sought to assess whether China's reforms to curb medical corruption were effective in the procurement of medicines and devices. This study can help improve and foster better therapeutic and practical innovations to combat medical corruption in the Chinese health sector. Additionally, we think this study may provide recommendations to other low-income/middle-income countries that may be suffering from similar problems during economic and social transition periods.

METHODS

Analytical framework

Through literature review, we collected various forms of countermeasures. Additionally, we consulted with health system experts to reveal other regulations for medical corruption in China that were not exposed through the literature review to ensure the completeness of these countermeasures. These measures were then classified into three categories, with help from experts, based on the rigidity of implementation. Fines and criminal penalties were executed by the law sectors in which the punishments were very strict. Health policy regulations were issued by the national or local health departments and usually provided guidance. The reporting scheme for the

medical corruption was not strict and its execution was loosely implemented.

Second, to examine the effects of existing countermeasures for curbing medical corruption, we formulated an interview instrument based on the Donabedian model.²⁹ The Donabedian model provides a framework to evaluate the effects of countermeasures on curbing medical corruption in three categories: structure, process and outcomes. Questions designed for experts were related to the design of the regulations (structure), their implementation (process) and their effectiveness (outcomes). The main discussion question about the evaluation was ‘How would you describe each kind of regulation for curbing medical corruption, including its design, execution/implementation and effectiveness in China?’

To quantitatively support the evaluation, we analysed released online data of current medical corruption cases in China to reflect the overall effects of the countermeasures. In addition, experts were also asked to identify any countermeasures in other countries that can help end medical corruption in China.

Data source

Qualitative data

To evaluate the current countermeasures for medical corruption in China, we chose experts who attended a professional forum in Shanghai on preventing and curbing medical corruption. All 16 interviewees were experts in the field of health economics and health policy. However, only 12 of the experts agreed to participate. Eight experts were from universities in the city of Shanghai, and four experts were officers in drug procurement agencies in Shanghai and Beijing. Interviews were conducted from 1 March 2017 to 9 April 2017.

Quantitative data

Currently, there is no specific and sound reporting system for medical corruption in China. Therefore, to reflect the current state of medical corruption in China, we referred to ‘China Judgements Online’, a national online database of case verdicts. The database, established in 2010 by the Supreme People’s Court, contains case verdicts from every field. When the system was initially established, only the serious verdicts released by the Supreme People’s Court were required to be released. As of 2013, the local and intermediate courts in different provinces were also encouraged to send verdicts to this system.³⁰ We retrieved case verdicts related to medical corruption that occurred from 1 January 2010 to 31 December 2016 using the keywords ‘medical’, ‘corruption’ and ‘health institution’. We collected data starting from 2010, the year in which the online system was launched. However, since the government did not require verdicts to be uploaded into the system until 2013, we discarded data before 2013 and used data from 2013 to 2016. We found a total of 856 related verdicts, and after selection 336 verdicts relating to the procurement of drugs and devices were kept. Although the sample size of the verdicts online was

relatively small, the data uploaded provided a representative sample from each province.

Data analysis

Two trained researchers analysed the qualitative data using NVivo V.10 to sort the interview answers. The Donabedian model was used as an a priori organisational framework. Using a hierarchical coding structure, the researchers deductively identified all themes, then coded and analysed those that were relevant. In addition, we conducted a literature review of medical corruption governance in both low-income/middle-income and developed countries to search for methods to curb medical corruption in China.

When screening the verdicts from ‘China Judgements Online’, we first eliminated duplicate cases. Second, we asked two of the authors (JS and RL) who are health policy experts to carefully conduct a review of the verdicts. As part of the criteria, verdicts needed to depict institutional medical corruption specifically relating to the procurement of drugs and devices. After conducting two rounds of review, we kept a total of 336 verdicts for a descriptive analysis of the current status of medical corruption in China. In our analysis, we reviewed the year the verdict was released, the level of the court that decided the verdict, the amount of illegal money involved, the institutions bribed and the time period when the corruption took place.

Ethics statement

Verbal consent forms for participation and publication were obtained from all interviewees.

RESULTS

Qualitative evaluation of regulations for institutional medical corruption in China

Evaluation of fines and criminal penalties

As early as 1990s, China has strived to establish more effective laws to curb medical corruption. In the 2000s, China implemented more health reforms to restructure the healthcare system. The experts interviewed stated that there were currently three major categories of countermeasures to oppose medical corruption in China (table 1). The experts agreed that imposing fines and criminal penalties was the easiest and best preventative measure to curb institutional medical corruption.

However, many experts also pointed out that this type of regulation was poorly structured. Punitive policies for medical corruption, including fines and imprisonment, did not effectively restrain bribers, nor were they uniformly rigorous. For example, the fine amount set by the Anti-unfair Competition Law (1993), ¥10 000 (approximately \$1450) and ¥200 000 (approximately \$29 000), was too small to effectively restrain bribers. Although the Anti-unfair Competition Law was newly amended in February 2017 to increase

Table 1 Experts' evaluation on existing countermeasures for restraining institutional medical corruption

	Countermeasures	Content	Structure	Process	Outcome
1	Fines and criminal penalties ruled by the 'Penal Law' (amended, 2006), the 'Anti-unfair Competition Law' (1993) and the 'Interim Provisions on Anti-commercial bribery' (1996)	Financial fines, imprisonment and cancellation of physician licences	(1) The fines are not high enough to effectively restrain bribery. (2) The punishment differs strikingly when bribers or bribees are in different institutions.	(1) It is well implemented.	(1) Imposing fines and criminal penalties is the easiest and most direct way to restrain medical corruption.
2	Health policy regulations, especially those regarding drugs				
2.1	The establishment of the National Reimbursement Drug List (NRDL, 2000) and the Essential Drug List (EDL, 2009)	To select the most therapeutic and economical drugs by the government	(1) The initial lists are incomplete. The adjustment of the lists may induce corruption.	(1) Many of the drugs on the NRDL can still be sold at prices higher than the purchasing price. (2) Hospitals will only purchase drugs that are not on the NRDL if they generate profits.	(1) It makes the drugs on the lists under the government's high supervision. (2) The 'zero-profit drug' policy for the EDL can shrink the benefit space.
2.2	The new centralised purchase policy (2009)	Public tenders, bidding and auction processes relating to the purchase of drugs are mostly operated by provincial governments.	(1) Usually, the purchasing committee is affiliated with the health bureau, and purchasing decision is not made independently. Additionally, many areas have one purchasing institute, leading to monopoly of drug procurement. (2) There are many defects in the selection criteria.	(1) From 2009 according to the strict regulation by the National Health Bureau, the purchasing of drugs or equipment has formal process for execution.	(1) Shifting purchasing power from public hospitals to governments can reduce medical corruption to a large extent.
3	Reporting scheme for medical corruption (2013)	Establishment of a reporting and record-keeping scheme of commercial bribery records	(1) The reporting scheme focuses on adverse behaviours. A comprehensive rating system to rating the companies' reputation should be established.	(1) The reporting scheme is poorly implemented.	(1) The public can be a constraint force for the corruption.

the fine amount from 10% to 30% of illegal revenue obtained, experts believe that this fine is still too small to be effective. Moreover, because firms usually pay these fines, bribers are not effectively deterred from conducting illegal activities. Additionally, penalties imposed on those making and accepting bribes are strikingly different depending on their affiliation to different types of institutions. Penalties are usually milder for parties associated with multinational firms compared with those associated with domestic firms. Lastly, individuals working in public health institutions (ie, physicians) receive greater punishment than individuals working in private health institutions, as they are regarded as civil servants of China.

Evaluation of related health policy regulations

The establishment of the NRDL and the EDL

The government created the NRDL so it could select the highest therapeutic and cost-efficient drugs. Although being listed on the NRDL is a positive development for drug producers, being listed also means that there is higher scrutiny of its prices because listed drugs are paid completely or at least in part by China's Health Insurance Department. The EDL, as part of the NRDL, was established in 2009 with the purpose of selecting essential drugs to be made available in all public health facilities, with particular emphasis on grassroots health institutions.²⁶ Additionally, health institutions are required to obey the 'zero-profit drug' policy, meaning the EDL drugs must be

sold at purchasing prices.⁵ Experts said that this policy helped proper prescription of drugs and further reduce the space for medical corruption to a certain extent.

Most experts noted that the main problem with this policy design was that the initially established lists contained limited drugs (ie, for the EDL, there were only 307 kinds of drugs) for the whole nation and varied widely between provinces. However, the selection of drugs in various provinces lacked scientific criteria. The experts proposed that revising the list by province created opportunities for new corruption. Since the provincial selection was set by leaders in the health bureau without necessary scientific processes and criteria or effective supervision, it was easy for the pharmaceutical firm to interfere. For example, the selection of drugs was corrupt because pharmaceutical firms were able to bribe experts. Many of the drugs on the NRDL that are not on the EDL can still be sold at prices 15% higher than the purchasing price, which means health institutions, particularly hospitals, have opportunities to create alliances with pharmaceutical firms for illegal profits. Usually, hospitals will purchase drugs that are not on the NRDL if they generate profits.

The new programme for centralised purchase of pharmaceuticals

Centralised purchase policy was proposed in 2000 as a means of restraining health institutions' power to directly negotiate and purchase drugs from pharmaceutical companies. This policy set a separate third-party committee as the purchasing entity that was usually affiliated with the health bureau. However, the policy was not properly executed and many hospitals were still able to buy drugs directly. A new centralised purchase policy was not released until 2009, when China's Ministry of Health made specific regulations to shift purchasing power from public hospitals to the governments. Specifically, it is the provincial committees' obligation to select suppliers through a competitive bidding process and then distribute the products to all hospitals under their jurisdiction. According to the new policy, drugs are competitively offered at the provincial levels. Central purchasing programmes at the provincial level have reduced drug prices by 30% in Beijing,³¹ 41% in Hebei³² and 46% in Shandong.³³

Although studies show that decreasing the cost of medicines might reduce corruption, experts pointed out there were still two problems with the purchasing committees. First, in many provinces, the committees that manage the purchasing platforms are not independent. Most of these committees are affiliated with the health bureau. In some areas, there is an informal committee in which the responsibilities are assumed by different departments under the health bureau. In this case, buck passing would occur between various departments and could easily lead to a monopoly. Experts proposed that if a central selection committee had the monopoly power, then medical firms may easily bribe key decision-makers in the selection process. Second, experts indicated that there were defects

in the criteria for bidding. Many indexes were difficult for bidding judges to quantify and evaluate. The lack of scientific and quantified standards provides chances for bidding judges to participate in corruption. Another major problem with the bidding criteria is that they usually overemphasise the weight of price. Sometimes, in order to win, bidding companies set bidding prices lower than the actual cost of drugs. This may lead to the bidding companies reducing the quality of their drugs. For example, the cost price per kilo of the drug *radix isatidis* was ¥3.7, but the bidding price was only ¥1.4—far lower than the actual cost. Thus, the company used apple peel instead of *radix isatidis*. Requiring companies to bid for the lowest price may artificially lower prices and share profits afterwards, leading to a disruption of the competitive market.

Evaluation of reporting scheme for medical corruption in China

In late 2013, the Chinese central government stated that ethical regulations should be used to curb medical corruption. The government created the 'Establishment of Commercial Bribery Records in the Purchase and Sale of Medicines and Devices'.²⁸ This reporting scheme for commercial bribery records blacklists 'manufacturers, operators or distributors' involved in commercial bribery and instructs health administrative departments to discipline responsible persons, including physicians, who may lose their licences.

However, experts noted that the biggest problem with this reporting scheme was that it was poorly executed. Only a few provinces have released the records of illegal commercial bribery, and of which many were outdated. It remains to be seen if this policy will have real impact at the provincial and local levels from an ethical perspective.

Quantitative evaluation of regulations on institutional medical corruption in China

As shown in [table 2](#), although the Supreme People's Court of China required courts to report verdicts to the online system since 2010, until 2013, there were only a small number of released verdicts. However, there was no obvious decrease of institutional medical corruption from 2013 to 2016. Most of the verdicts (80.06%) were from the Basic People's Courts. In most cases, bribes were above ¥100 000 (74.11%), and in 11.31% of the cases bribes were more than ¥1 000 000. Usually, more of the individuals (physicians, directors, deans of departments) who took bribes were from hospitals (91.37%). In addition, most of the criminal activities reported had been undetected for a long time, with 58.63% of corruption behaviours lasting 5 years or more before being detected.

DISCUSSION

Our evaluation of the experts' interviews, supported by the quantitative data from 'China Judgements Online',

Table 2 Verdicts involving institutional medical corruption from 'China Judgements Online' (n=336)

Variable	Classification	n	(%)
Year of verdicts	2013	15	4.46
	2014	105	31.25
	2015	64	19.05
	2016	152	45.24
Level of the court	Supreme People's Court	4	1.19
	Intermediate People's Court	63	18.75
	Basic People's Court	269	80.06
Amount of money involved in the bribery(¥)	14 900–100 000	87	25.89
	100 000–500 000	164	48.81
	500 000–1 000 000	47	13.99
	1 000 000–2 000 000	16	4.76
	2 000 000–6 959 000	22	6.55
Institutions of individuals taking bribes	Hospitals	307	91.37
	Health bureaus	33	9.82
Time span of the committed corruption (year)	1–2	15	4.47
	2–5	124	36.90
	5–10	158	47.02
	10–15	39	11.61

showed that while many of China's regulations on medical corruption operate well, problems persist. Compared with other countries implementing policies to curb medical corruption, China implements relatively mild penalties that do not abide by a strict 'zero-tolerance' policy. In the USA, if pharmaceutical firms promoted drugs unlawfully, they would receive great fines. For instance, we can look at cases concerning typical antipsychotics. In 2010, the multinational pharmaceutical company AstraZeneca paid \$520 million for illegally marketing the drug Seroquel for uses not approved by the Food and Drug Administration by paying kickbacks to physicians. In 2012, Johnson & Johnson settled for \$1.2 billion on charges of off-label promotion and failure to disclose information on adverse reactions to the drug Risperdal.¹⁹ According to Public Citizen,³⁴ from 1991 to 2012, drug companies have paid \$30 billion in criminal fines in the USA for Medicare fraud, unlawful drug promotion, kickbacks, monopoly practices and the concealment of study findings. In China, the fines for medical corruption are much smaller. Even the shocking multinational case of GSK's bribery in 2013 ended with the highest fine being ¥30 billion (approximately US\$4.36 billion).³⁵ If the fine amounts are not significantly increased, it will remain profitable for drug companies to engage in corruption practices that undermine public health.³

Although the Chinese government strived to reduce medical corruption by establishing the NRDL and the EDL, our evaluation showed that without scientific and fair criteria for drug selection, it is difficult to resolve problems related to modifying these lists and the flawed bidding process. In many developed countries, health

technology assessment has also been used to select drug plans by comparing drug costs with their therapeutic benefits. This has become central in determining the prices of pharmaceutical products. Health technology assessment was also proved to be effective in establishing the modalities for access and reimbursement of drugs.²² This technology makes evidence-based medicine (rather than marketing-based medicine) central to the architecture of the pharmaceutical market because it directly aligns financial incentives with improving health outcomes. Thereby, health technology assessment should be applied to facilitate Chinese governments' decision-making as soon as possible.

Our results showed that problems with the central purchasing programme were related to the lack of independent committees and the monopolies created by local health bureaus. To effectively solve these problems, many developed countries use marketisation management of pharmaceutical products purchasing. Created in the USA, an entity called group purchasing organisation (GPO) is one kind of purchasing platform in the market. The GPO leverages the purchasing power of a group of businesses to obtain discounts from vendors based on the collective buying power of the GPO members. The GPOs are intermediary agencies, and health organisations can voluntarily sign up to be a member of any GPO. It was found that GPOs can help effectively prevent medical corruption.³⁶ However, while many large cities in China such as Shanghai and Beijing have tried to establish independent GPOs,³⁷ their efforts are still immature and thereby insufficient to curb medical corruption.

Miller in 2013 notes that companies initiate most corporate social responsibility initiatives to avoid negative reputational consequences due to the illegally earned profits. Accreditation, certification and rating systems have proven useful in curbing medical corruption to a certain extent, as these systems help align market forces with trustworthy practices.²³ However, since its execution is not supervised, the reporting system for medical corruption is not properly executed. To improve this situation, we suggest that companies should be required to be open and transparent to the public about the adverse results of their illegal activities.

As revealed by much of the literature, the root of difficulties to curb medical corruption may first lie in the financial pressure on public hospitals. The privatisation of healthcare financing combined with price regulation put most public hospitals in China at serious financial risk. Under this condition, hospitals/physicians' remuneration is set at a low level in China.^{38 39} Meanwhile, the financial subsidies for the public health institutions were not sufficient. For instance, the EDL was established to curb medical corruption and health institutions are required to obey the 'zero-profit drug' policy on essential drugs. Fiscal policy also required local governments to provide enough subsidies to public health institutions. However, the fiscal subsidies were not sufficient or not provided by the local government in many parts of China.⁴⁰ All in all, although many of the countermeasures were proposed and implemented, under the background of financial pressure, the consistent low compensation may lead to hospitals/physicians receiving bribes from pharmaceutical companies, since the penalty cost for both of them is much lower than the illegal profit.^{7 9 10} Second, the weak Chinese insurance market may fuel medical corruption and weaken current countermeasures. The insurance market in China is composed of the social medical insurance provided by the government (90% coverage) and the private insurance (<10% coverage).⁴¹ However, because many of the drugs, especially the imported drugs from multinational corporations, are not on the NRDL and are not covered by the social medical insurance, and exacerbated by the weak private insurance in China, there is room for corrupt pay-offs to be added into the price of many of these drugs. For instance, usually, patients are willing to pay more for foreign drugs than for ones from domestic suppliers.³ Therefore, these issues must be tackled by improving the proper financial incentives for hospitals/physicians and perfecting the health insurance system within China's health reform.

There were a few limitations to this study. First, there may be selection bias since the selected experts were mostly from Shanghai. Second, although the quantitative data from the online system 'China Judgements Online' were helpful in supporting the qualitative data, the small sample size of the released verdicts about medical corruption may not accurately reflect the

effects of the current countermeasures. More data are needed to conduct a more robust evaluation.

CONCLUSIONS

Our study found that although China has made efforts to tackle institutional medical corruption in drug procurement for many years, corruption issues continue to be a concern. In analysing the qualitative material on the subject by Chinese health policy experts and quantitative data from the online database, we found that existing countermeasures such as fines, imprisonment penalties, health policy regulations and reporting schemes still have many defects. We suggest creating more rigorous legislation and well-functioning administrative mechanisms to select drugs for the NRDL or the EDL and to establish prices using scientific criteria. To address the root of medical corruption, however, we suggest improving the financial incentives for hospitals/physicians and the health insurance system within China's health reform.

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Contributors Conceived and designed the experiments: JS, ZW and LS. Analysed the data: JS, RL and CW. Contributed reagents/materials/analysis tools: HJ, YX and NL. Wrote the paper: JS and LS. Revised the paper: JS and LS.

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Competing interests None declared.

Patient consent Obtained.

Ethics approval All research activities were conducted with integrity and in line with generally accepted ethical principles.

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Data sharing statement All relevant data from the 'China Judgements Online' can be shared to the public.

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REFERENCES

1. Chattopadhyay S. Corruption in healthcare and medicine: why should physicians and bioethicists care and what should they do? *Indian J Med Ethics* 2013;10:153–9.
2. Godlee F. Medical corruption in the UK. *BMJ* 2015;350:h506.
3. Rose-Ackerman S, Tan YQ. Corruption in the procurement of pharmaceutical and medical equipment in China: The incentives facing multinationals, domestic firms and hospital official. *UCLA Pac Basin Law J* 2014;32:1–53.
4. Vian T. Corruption and the health sector. USAID and Management Systems Internationals. 2002.

5. Chen Y, Dai T. International experience and revelation of the compensation mechanism reform of public hospitals. *Chinese Hospital* 2011;15:16–19.
6. Chen Y, Zhu XL, Xiao LH. The theoretical and practical analysis on the finance compensation mechanism of public hospitals in China. *Medicine and Society* 2010;23:36–8.
7. Zhang Y, Yu YS, Tang ZH, et al. Crack down on medical corruption: an urgent matter in China. *Eur J Intern Med* 2014;25:e2–e3.
8. Editor. Doctors and pharma in China. *Lancet* 2013;382:102.
9. Manea T. Medical bribery and the ethics of trust: the Romanian case. *J Med Philos* 2015;40:26–43.
10. Elliott C. *White coat, black hat: Adventures at the dark side of medicine*. Boston: Beacon Press, 2010.
11. Rodwin MA. Introduction: Institutional corruption and the pharmaceutical policy. *J Law Med Ethics* 2013;41:544–52.
12. Gagnon MA, Lexchin J. The cost of pushing pills: a new estimate of pharmaceutical promotion expenditures in the United States. *PLoS Med* 2008;5:e1–33.
13. Yan A. 1100 medical staff held over drug kickbacks in Zhangzhou. <http://www.scmp.com/news/china/article/1290060/1100-medical-staff-held-overdrug-kickbacks-zhangzhou> (accessed 2 Apr 2017).
14. Rodwin MA. *Conflicts of interest and the future of medicine. Institute of Medicine, Conflicts of Interest in Medical Research, Education, and Practice*. Oxford; Washington, DC: Oxford University Press, 2011; National Academies Press, 2009.
15. Mintzes B, Lexchin J, Sutherland JM, et al. Pharmaceutical sales representatives and patient safety: a comparative prospective study of information quality in Canada, France and the United States. *J Gen Intern Med* 2013;28:1368–75.
16. Dyer O. New report on corruption in health. *Bull World Health Organ* 2006;84:81–160.
17. Berger D. Corruption ruins the doctor-patient relationship in India. *BMJ* 2014;348:g3169.
18. Hesketh T, Wu D, Mao L, et al. Violence against doctors in China. *BMJ* 2012;345:e5730.
19. Gagnon MA. Corruption of pharmaceutical markets: addressing the misalignment of financial incentives and public health. *J Law Med Ethics* 2013;41:571–80.
20. Baumol WJ. On taxation and the control of externalities. *Am Econ Rev* 1972;62:307–22.
21. Lee JL, Fischer MA, Shrank WH, et al. A systematic review of reference pricing: implications for US prescription drug spending. *Am J Manag Care* 2012;18:e429–37.
22. Gorry P, Montalban M, Smith A. When medical science meets economics & politics: The institutionalization of health technology assessment within the European government of pharmaceuticals. *GEDI working paper* 2011.
23. Miller JE. From bad pharma to good pharma: aligning market forces with good and trustworthy practices through accreditation, certification, and rating. *J Law Med Ethics* 2013;41:601–10.
24. Transparency International. Global corruption report 2006: Corruption and health. http://www.transparency.org/whatwedo/pub/global_corruption_report_2006_corruption_and_health (accessed 2 Apr 2017).
25. Song DL. The defect of the current centralized pharmaceuticals purchase system and improvement. Southwest University of Political Science and Law. Master's Thesis(China). 2013.
26. National Health and Family Planning Commission. Notification on implementing the national essential drug system. <http://www.sda.gov.cn/WS01/CL0056/51391.html> (accessed 2 Apr 2017).
27. China Food and Drug Administration. Notification on further standardizing the centralized drug purchasing in medical institutions. <http://www.sda.gov.cn/WS01/CL0056/35597.html> (accessed 2 Apr 2017).
28. National Health and Family Planning Commission. Provision on establishing adverse record of medical corruption in the health sector. <http://www.nhfpc.gov.cn/fzs/s3577/201312/ef92cb05dee341a18fff7b3e00eb1156.shtml> (accessed 2 Apr 2017).
29. Donabedian A. The quality of care. How can it be assessed? *JAMA* 1988;260:1743–8.
30. China Judgements Online. <http://wenshu.court.gov.cn/> (accessed 1 May 2017).
31. Wen R. The price of 519 drugs will be reduced 30% in Beijing and the central purchasing for EDL will take action. Sohu News. 2012 <http://news.sohu.com/20120922/n353726981.shtml> (accessed 1 May 2017).
32. Geng J. Hebei's initiative central purchasing online made the price reduce significantly. Xinhua News. 2010 http://news.xinhuanet.com/health/2010-12/16/c_12888150.htm (accessed 1 May 2017).
33. Wang K. Shandong's regular drugs in hospitals in counties reduced an average of 46.7%. Phoenix News (Jul 19, 2013). http://sd.ifeng.com/news/fengguangqilu/detail_2013_07/19/1010704_0.shtml (accessed 1 May 2017).
34. Almashat S, Wolfe S. Pharmaceutical industry criminal and civil penalties: an update report for public citizen. 2012;27:1–50.
35. Neville S. GlaxoSmithKline fined 3bn after bribing doctors to increase drugs sales. The Guardian. 2012 <https://www.theguardian.com/business/2012/jul/03/glaxosmithkline-fined-bribing-doctors-pharmaceuticals> (accessed 1 May 2017).
36. DeBenedette V. The evolution of group purchasing organizations. Drug Topics. 2016 <http://drugtopics.modernmedicine.com/drug-topics/news/evolution-group-purchasing-organizations> (accessed 1 May 2017).
37. Liu ZY. Dispute on the drug purchase by using GPO. Health News Chinese Newspaper. 2017 <http://www.jkb.com.cn/news/depth/2017/0411/407607.html> (accessed 1 May 2017).
38. Chen XY. Defensive medicine or economically motivated corruption? A confucian reflection on physician care in China today. *J Med Philos* 2007;32:635–48.
39. Vian T, Nordberg C. Corruption in the health sector. www.u4.no/publications/corruption-in-the-health-sector-2/.2008 (accessed 1 May 2017).
40. YH L. *Evaluation on the implementation of zero-profit essential medicines in health care institutions of one province in China*: Dalian Medical University. Master's thesis(China), 2015.
41. Li J. *A Research on the model of the private insurance companies' participation in administrating social medical insurance*. Southwestern University of Finance and Economics: Master's thesis(China), 2012.