



Addressing antibiotic abuse in China: An experimental audit study[☆]

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ABSTRACT

China has high rates of antibiotic abuse and antibiotic resistance but the causes are still a matter for debate. Strong physician financial incentives to prescribe are likely to be an important cause. However, patient demand (or physician beliefs about patient demand) is often cited and may also play a role. We use an audit study to examine the effect of removing financial incentives, and to try to separate out the effects of patient demand. We implement a number of different experimental treatments designed to try to rule out other possible explanations for our findings. Together, our results suggest that financial incentives are the main driver of antibiotic abuse in China, at least in the young and healthy population we draw on in our study.

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1. Introduction

China has a high rate of antibiotic use and abuse relative to western countries. Study of 230,800 outpatient prescriptions in twenty-eight Chinese cities found that nearly half the prescriptions written between 2007 and 2009 were for antibiotics and that 10% was for two or more antibiotics (Li et al., 2012). Antibiotics were prescribed twice as frequently as recommended by the WHO (Li et al., 2012). One of the most dangerous potential consequences of rampant antibiotic abuse is that it will encourage the rise of antibiotic-resistant “superbugs” and threaten global health. Antibiotic resistance already appears to be higher in China than in western countries and there has been an alarming growth in the prevalence of resistant bacteria (Zhang et al., 2006).

One possible explanation for antibiotic abuse in China is that, as described further below, most Chinese receive outpatient care from hospitals, and hospitals derive a large fraction of their revenues from drug sales. In turn, physicians generally work for hospitals and receive

much of their compensation in the form of bonus which is tied to the revenues that they bring in.

Starting in the early 2000s, China has piloted various reforms intended to reduce the financial incentives to prescribe including the establishment of the National Essential Medicine List in public primary care hospitals and removing pharmacies from hospitals in some secondary and tertiary hospitals (Chen et al., 2010; Cheng et al., 2012; Wagstaff et al., 2009).

To date, these reforms have not proven effective in curbing drug over-prescription (Feng et al., 2012; Yip et al., 2012), and the per capita use of antibiotics in China is still much higher than the recommended level (Yin et al., 2013). There are a number of possible reasons. First, in the absence of any alternative hospital financing method, removing pharmacies from hospitals has often proven infeasible so that perhaps the link between provider financial incentives and prescription has not been broken.

Alternatively, financial incentives may not be the main issue. It is commonly argued that patients demand antibiotics even when they are unlikely to be effective (Bennett et al., forthcoming; Cars and Håkansson, 1995; Sun et al., 2009; Wang et al., 2013a). Alternatively, physicians may believe that patients want antibiotics. Or the over-prescription of antibiotics could be due to the lack of professional knowledge about proper antibiotic usage among physicians (Dar-Odeh et al., 2010; Sun et al., 2009; Yao and Yang, 2008). To the extent that patient demand, provider beliefs about patient demand, or provider ignorance are important drivers of antibiotic abuse, then policies reducing providers' financial incentives to prescribe will not solve the problem.

This paper investigates these issues using a large-scale audit study in China featuring students whom we trained to act as patients with identical mild flu-like symptoms. Our audits were designed to investigate

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the effects of reducing financial incentives to prescribe, and to distinguish between the effects of financial incentives and the effects of other competing explanations for overuse of antibiotics.

We conducted two experiments. In the first experiment, we sent teams of four well-matched simulated patients to a single physician at each audited hospital. We considered one student to be the baseline (Patient A). This student did not ask for antibiotics. But if the doctor prescribed antibiotics he/she would have assumed that the patient would buy them at the hospital given that this is the general practice. The remaining three students all deviated from this baseline scenario in a specific way: Patient B directly asked the doctor for an antibiotic prescription. This treatment is intended to eliminate uncertainty about whether the patient wants or expects antibiotics to be prescribed. Patient C asked for a prescription (not specifically antibiotics) but indicated that he/she would buy any drugs prescribed in another pharmacy, thereby eliminating the possibility that the hospital would receive a payment for the sale. Patient D both asked specifically for antibiotics and indicated that he/she would buy any drugs prescribed elsewhere.

Overall, 55% of physicians prescribed antibiotics when the patient neither asked for antibiotics nor indicated that he/she would purchase elsewhere. The fraction rose to 85% when patients specifically requested antibiotics, *but only if the doctor expected the prescription to be filled in the hospital pharmacy*. If the patient indicated that he/she would purchase the drugs elsewhere, only 14% of doctors prescribed antibiotics, even when specifically requested to do so by the patient. This rate is not statistically significantly different from the 10% prescription rate among patients who did not request antibiotics in the treatment in which patients indicated that they would buy elsewhere. Thus, our first experiment suggests that high rates of antibiotic abuse are unlikely to be driven by patient demand or provider ignorance, and that a reform that effectively reduced providers' financial incentives to prescribe could dramatically reduce antibiotic prescription rates.

However, it is possible that the results in Experiment 1 are driven by some other mechanism. Perhaps doctors are concerned that patients who buy drugs in free-standing pharmacies are more likely to be harmed by counterfeit drugs. Or perhaps doctors are offended by the patient's suggestion that he or she will buy elsewhere. The second experiment explores these alternative explanations using several additional treatments. First, in the script used in the second experiment, patients indicate that they will buy their drugs from a close relative when they are not shopping at the hospital pharmacy. This change may reduce any fears that the physician may have about the patient receiving counterfeit or harmful drugs, and may also make it seem less offensive that the patient wishes to purchase elsewhere. We find that this change in the script has little impact on the results.

In a second treatment, patients tell doctors that they know (because they have read on the Internet) that antibiotics are inappropriate for simple cold/flu symptoms. We find that this treatment also reduces the prescription of antibiotics, though by less than the removal of the financial incentive. Given that second guessing the doctor in this way is likely to be at least as offensive as saying that the patient will buy elsewhere (particularly if elsewhere is the store of a close relative), this result suggests that financial incentives are more important than breaches of patient etiquette in determining antibiotic prescription rates.

In a third treatment, we have patients attempt to establish rapport with a physician by offering a token gift, something that is not uncommon in China. If physicians "punish" aggressive patients by being less likely to prescribe antibiotics, then they ought to "reward" nice patients by being more likely to prescribe. Instead, we find that physicians are slightly less likely to prescribe to patients who have offered a small gift.

These results suggest that financial incentives are indeed the most important determinant of the over-prescription of antibiotics, at least

in the hospital markets and in the population of young, healthy patients that we analyze. The rest of the paper is organized as follows: [Section 2](#) provides some background information, [Section 3](#) describes the study design, [Section 4](#) explains the empirical model, [Section 5](#) presents the results of the study, and [Section 6](#) marks the conclusion.

2. Background

In China, most outpatients are seen by doctors in hospital clinics.¹ The central government sets hospital fees at a low level, and historically provided direct transfers to hospitals to cover operating expenses (Eggleston et al., 2008; Hsiao, 1996). Starting in the early 1980s, the government began decreasing financial support to hospitals but did not allow them to increase fees (Yip and Hsiao, 2008). Hence, revenues from drug sales have become more important to hospitals over time.

In 2009, China commenced an extensive health-sector reform including the establishment of the National Essential Medicine List to improve population access to, and reduce the cost of, essential medicines. The official policy as of 2013 is that all public primary care hospitals are required to sell the 520 drugs on the National Essential Medicine List at zero profit and local governments are supposed to make up the resulting shortfall in hospital revenues (Ministry of Health PRC, 2013; State Council PRC, 2013a; State Council PRC, 2013b). However, this requirement amounts to an unfunded mandate on local governments which have not received any new sources of revenue that can be used to cover hospital costs. To date, despite the zero-profit policy, income for most health-care providers has not been separated from prescribing medications (Yip et al., 2012; Zhu, 2011).

Moreover, only public primary care hospitals are required to sell drugs from the Essential Medicine List at cost. Chinese hospitals are divided into primary, secondary, and tertiary care levels, with the tertiary care hospitals providing the most sophisticated care. A majority of secondary and tertiary hospitals still maintain pharmacies, and it is estimated that 80 to 85% of prescriptions are filled in hospital pharmacies (Sun et al., 2008; Wang, 2006; Yu et al., 2010). Free-standing pharmacies often offer lower prices, especially for generics (Sun, 2005; Yang et al., 2010) but may lack qualified pharmacists (Fang et al., 2013). Thus, it would be quite reasonable for a patient to ask for a prescription from a hospital, but to try to fill it at a lower price in a free-standing pharmacy, especially if it was a commonly available drug that did not require any specialized formulation or dispensing.

While hospitals have clear incentives to sell drugs, prescriptions are written by individual doctors who are generally salaried employees of the hospitals. The average bonus, calculated on the basis of the revenue that they bring in, accounts for 30% to 40% of physicians' total salary (Wang et al., 2013b; Yip and Hsiao, 2008; Yip et al., 2010). Kickbacks from pharmaceutical companies can provide further economic incentives for physicians to prescribe medication, with physicians receiving payments of up to 20% of the value of the prescription (Eggleston and Yip, 2004; Liu et al., 2000; Yip and Hsiao, 2008).

A recent systematic review based on data from 57 studies of antibiotic utilization in China has shown that, although it has fluctuated with changes in national healthcare policies, use of antibiotics in China is still much higher than the recommended level. The overall percentage of outpatients prescribed antibiotics during 2010–2012 was 45.7% (Yin et al., 2013).

Previous research in other countries suggests that doctors are likely to be influenced by financial incentives. For example, Iizuka (2007, 2012) examines the prescription drug market in Japan and finds that doctors' prescribing patterns are influenced by the size of the markup that they are allowed to charge on drugs. On the other hand, financial

¹ In 2009, only 5.3% of practicing physicians in China were family physicians (Dai et al., 2013). The equivalent of a U.S. primary care physician does not really exist, so a visit to a hospital or clinic is often the counterpart to a visit to a physician's office in the U.S. (Hsiao and Liu, 1996; Yip, 1998; Eggleston et al., 2008).

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