Effects of the New Cooperative Medical Scheme on village doctor's prescribing behaviour in Shandong Province

Xiaoyun Sun, Sukhan Jackson*, Gordon Carmichael and Adrian C. Sleigh, School of Economics Discussion Paper No. 354, January 2008, School of Economics, The University of Queensland. Australia.

Abstract

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Conclusion: Over-prescribing is common in villages with and without health insurance, with grave concerns for service quality and drug-use safety. Policy implications are NCMS should be redesigned to exert more influence on health providers, with incentives for cost containment and service quality. Stricter regulatory environment for prescriptions is necessary to counter irrational drug-use and ensure people's access to effective care at reasonable cost.

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1. Introduction

Economic theory predicts that health insurance encourages opportunistic behaviour from healthcare providers. We are interested to know if this was occurring among health workers in China's village health stations following the implementation of a new community-based health insurance scheme for farmers. Known as the new co-operative medical scheme (hereafter NCMS), it began in 305 pilot counties in 2003 but the government hopes to extend coverage to all rural areas by 2010.

The ending of China's agricultural communes in 1982 caused the collapse of community-funded healthcare for farmers. Market-oriented reforms of the health sector in the 1980s and 1990s had led to privatization of healthcare providers (de Geyndt *et al.* 1992; Meng *et al.* 2000), and government spending fell from 36.2% of total health expenditure in 1980 to 15.2% in 2002 (Centre for Health Statistics and Information Ministry of Health 2004). Now most rural residents pay out-of-pocket for medical care which is provided on a fee-for-service basis. As rural health is run under a separate system from urban health, farmers cannot benefit from such improvements in health financing as the national basic medical insurance scheme for urban employees set up in 1998. and many poor farmers cannot seek medical treatment because of inability to pay (*China Daily* 2002).

There was an early attempt to provide financial protection for farmers when the government in 1994 piloted a rural community-based medical scheme, an insurance scheme pooled from the whole population (10,000-50,000) of the township (Carrin *et al*. 1999). Many of these early insurance schemes closed down mainly because of inadequate funding and dwindling political interest, although some survived to the new millennium (Jackson *et al.* 2005). However, Chinese interest in community-based health financing continues because the government recently launched a new rural community-based medical scheme (NCMS) with some important changes. The new insurance scheme draws from the larger population pool (500,000-1 million) of a whole county and financial commitments from both provincial and central governments (Sun *et al*. 2007).

As NCMS is to be extended to the whole of rural China eventually, the question confronting Chinese policy makers is what effect has this insurance scheme on healthcare providers? Earlier works (Dong, Bogg, Rehnberg *et al.* 1999; Dong, Bogg, Wang *et al.* 1999) on rural China reported an association between health insurance

and prescribing antibiotics. However, they were conducted before the introduction of NCMS and were concerned with outpatient care in the township hospitals (also called township health centres). Another study (Zhang *et al.* 2003) on prescriptions was also about township hospitals, and it reported over-prescription and other malpractices. This study also focuses on prescribing behaviour but is different in three ways. It is firstly concerned with village health stations, the level of delivery below the township hospitals; and the most frequently used by farmers because there is a village health station in every village. It should be noted that the rural health system comprises three levels of healthcare provision – village health stations, township hospitals (or township health centres), and county hospitals (the highest level and relatively inaccessible to poor farmers). Secondly, this research conducted in 2005 in Shandong Province is perhaps the first field study to collect primary data on China's new community-based medical scheme (NCMS); we collected first-hand information from a sample of 30 village health stations. Thirdly, we are unaware of any previous study that reports on the effects of the new medical scheme using comparison of a county with NCMS and a non-NCMS county. Our study compares Linyi (with NCMS) and Qihe (without NCMS).

2. Methods

2.1 Study setting

Linyi (with NCMS) is a typical agricultural county in Shandong with 519,300 population, 81% were farmers. The average net income of farmers was 3,031yuan in 2003 (Bureau of Statistics of Linyi County 2004). In 2003, infant mortality was 12.91 per 1,000 live births and maternal mortality 37.4 per 100,000 live births.

Qihe County (non-NCMS) was selected for similar geographical, cultural and socioeconomic conditions. Total population was 609,100, 83.9% were farmers. The average net income of farmers was 3,028 yuan in 2003 (Bureau of Statistics of Qihe County 2003). Infant mortality and maternal mortality were 13.89 per 1,000 live births and 37.5 per 100,000 live births.

2.2. Sampling of village health stations

A sample of 30 village health stations (VHS) was selected through stratified sampling. All townships in both study counties were divided into three tiers of socio-economic status (SES): high SES, middle SES and low SES townships, according to SES grading by local officials. From each SES stratum, one township was randomly chosen. From each of the six selected townships, five villages were randomly chosen and all village health stations in the 30 selected villages were investigated. Total number of village health stations sampled was 30 because each village had only one village health station. Approval was obtained from the Shandong Provincial Bureau of Health.

2.3. Data collection in village health stations

Village doctors do not usually keep formal medical records of patients. In order to obtain information on patient visits, a patient visit record form was designed to collect data on patients' age, sex, NCMS membership, diagnosis, treatment and medical costs. The 30 chief village doctors were asked to record every patient visit on the form, beginning the day after they received the record forms and continuing for two consecutive weeks. These forms were distributed and collected by researchers. The field investigation lasted from the end of March 2005 to the end of April 2005.

2.4. Indicators and Data Analysis

Village doctors' prescription behaviour was assessed in four aspects:

(1) the number of drugs per patient visit;

(2) whether the prescription included antibiotics;

(3) the method of drug administration (oral/external or injection); and

(4) total medical costs per patient visit.

We compared these indicators between NCMS and non-NCMS village health stations to reflect the difference in prescribing behaviour. Within the NCMS villages in Linyi, NCMS members and non-NCMS members were compared to reflect difference in prescribing behaviour for the insured and uninsured. All data were analyzed using SPSS version 12.0.1.

3. Results

Background of new community-based medical scheme (NCMS) in Linyi County

NCMS in Linyi began in 2003 with a coverage of 93.5% and rose to 94.6% in 2004. Per capita funding of NCMS was 23 yuan (10 yuan from individual and a total of 13 yuan from various levels of government).

NCMS benefits cover pharmaceuticals, ambulatory services in village health stations, outpatients and inpatients in township hospitals (or township health centres) and in county or above level hospitals. Patients at village health stations receive 20% discount for medical expenses; village doctors normally keep a record of their prescriptions showing the discounts given to patients for which they received reimbursements from the NCMS office. Hospital outpatients also directly pay at prices discounted at 20%. Inpatients receive 20-75% reimbursement for medical expenses, higher reimbursement rates for higher expenses; there is a ceiling of 20,000 yuan per person per year.

Of the total available NCMS funds, 70% was allocated to inpatient reimbursements and 30% to ambulatory and outpatient services including capitation payments to township health centres and village health stations. Each NCMS had contractual agreements with various health facilities (e.g. village health stations) relating to payment system and delivery of health services.

3.1. Description of NCMS and non-NCMS patients at 30 village health stations

In 2005, we recorded 2,271 patient visits in two weeks at the 30 village health stations (VHSs): 1,025 to NCMS and 1,246 to non-NCMS VHSs. There were no significant differences ($p>0.05$) in gender distribution, visit status or age group distribution between patients in NCMS and non-NCMS villages (Table 1). Average age was 37.3 years in NCMS villages and 35.5 years in non-NCMS villages. Generally, about half were females, and 70% were first visits for the health condition treated.

Table 1 Patients at 30 village health stations (VHSs) in Linyi and Qihe, 2005

		NCMS VHSs		Non-NCMS VHSs		p value
		Count	%	Count	%	
Gender	Male	486	47.4	619	49.8	0.258
	Female	539	52.6	624	50.2	
	Total	1,025	100	1,243	100	
First visit	Yes	635	70.4	780	68.2	0.294
	No	267	29.6	363	31.8	
	Total	902	100	1,143	100	
NCMS Member	Yes	947	92.5	0	0	n.a.
	No	77	7.5	1,246	100	
	Total	1,024	100	1,246	100	
Age Group	0-4	79	7.9	108	8.7	0.170
	5-14	126	12.6	196	15.8	
	15-34	247	24.8	303	24.4	
	35-59	388	38.9	436	35.1	
	60+	157	15.7	198	16.0	
	Total	997	100.0	1,241	100.0	

Note: Information for some patients was missing. Therefore, total number of patients for each measured indicator varies a little.

Table 2 Patient visits to 15 village health stations (VHSs) in Linyi, 2005

		Members		Non-members		p value
		Count	%	Count	%	
Gender	Male	452	47.7	34	44.2	>0.5
	Female	495	52.3	43	55.8	
	Total	947	100.0	77	100.0	
First visit	Yes	577	70	57	74	>0.5
	No	247	30	20	26	
	Total	824	100.0	77	100.0	
Age Group	0~4	71	7.7	9	12.3	<0.05
	5~14	112	12.1	14	19.2	
	15~34	232	25.1	15	20.5	
	35~59	335	36.3	30	41.1	
	60~	174	18.8	5	6.8	
	Total	924	100.0	73	99.9	

As for the NCMS villages in Linyi, 92.5% of patient visits were NCMS members. There were no significant differences in gender distribution and visit status between the insured and uninsured, but age group distribution was significantly different (Table 2). Uninsured patients were generally younger than the insured, suggesting that there might be adverse selection in joining the NCMS in Linyi County.

3.2. Drug prescribing behaviour of village doctors

3.2.1 Number of drugs per patient visit

NCMS village health stations tended to prescribe and sell more drugs than the non-NCMS (Table 3). NCMS village doctors prescribed an average number of 4.6 drugs per patient visit, and 56.5% of patient visits had four or more kinds of drugs. Non-NCMS village doctors averaged 3.1 drugs per patient visit, and only 26.9% prescriptions contained four or more kinds of drugs. The frequency of prescribing seven or more drugs was 10 times higher in Linyi than in Qihe. The tendency of NCMS village doctors to prescribe more drugs was statistically significant, whether measured as the average number of drugs per patient visit ($t=-17.908$, $p<0.001$) or as proportion of patient visits involving four or more drugs ($z=14.277$, $p<0.001$).

Table 3 Number of drugs per patient visit at 30 village health stations (VHSs) in Linyi and Qihe, 2005

Number of Drugs per patient visit	NCMS VHSs		Non–NCMS VHSs	
	Count	%	Count	%
0	2	0.2	4	0.3
1	42	4.1	102	8.2
2	143	14.1	360	29.0
3	255	25.1	443	35.6
4	111	10.9	166	13.4
5	135	13.3	92	7.4
6	114	11.2	50	4.0
≥ 7	215	21.1	26	2.1
Total	1,017	100.0	1,243	100.0

Table 4 Number of drugs per patient visit for insured and non-insured patients at 15 village health stations (VHSs) in Linyi, 2005

Number of drugs	NCMS member		Non–NCMS member	
	Count	%	Count	%
0	2	0.2	0	0.0
1	40	4.3	2	2.6
2	119	12.7	23	29.9
3	237	25.2	18	23.4
4	100	10.6	11	14.3
5	126	13.4	9	11.7
6	109	11.6	5	6.5
≥ 7	206	21.9	9	11.7
Total	939	100.0	77	100.0

Table 5 Number of antibiotics per patient visit at 30 village health stations (VHSs) in Linyi and Qihe, 2005

Number of antibiotics per patient visit	NCMS VHSs		Non–NCMS VHSs	
	Count	%	Count	%
0	282	27.6	506	40.7
1	508	49.7	499	40.1
2	179	17.5	193	15.5
≥ 3	54	5.3	45	3.6
Total	1,023	100.0	1,243	100.0

Table 6 Number of antibiotics per patient-visit for insured and non-insured at 15 village health stations (VHSs) in Linyi, 2005

Kinds of Antibiotics	NCMS member		Non–NCMS member	
	Count	%	Count	%
0	263	27.8	18	23.4
1	464	49.1	44	57.1
2	165	17.5	14	18.2
≥ 3	53	5.6	1	1.3
Total	945	100.0	77	100.0

As for the NCMS village health stations in Linyi, village doctors prescribed more drugs to insured patients. Average number of drugs dispensed for the insured was 4.7, significantly higher than 3.9 for the uninsured ($t=3.038$, $p<0.01$). For NCMS members, 57.6% of patient visits resulted in four or more kinds of drugs being prescribed, compared to 44.2% for non-NCMS members ($z=2.281$, $p<0.05$) (Table 4).

3.2.2 Whether prescription included antibiotics

In NCMS village health stations, average number of antibiotics prescribed per visit was 1.01 compared with 0.83 in non-NCMS ($t=-5.173$, $p<0.001$). For NCMS village doctors, 72.4% of prescriptions included antibiotics (Table 5), significantly higher than 59.3% for non-NCMS ($z=6.515$, $p<0.001$). The difference in the proportion of prescriptions containing three or more kinds of antibiotics between NCMS and non-NCMS village doctors (5.6% against 3.6%) was also significant at the 0.05 level ($z=1.970$).

For the NCMS village health stations in Linyi, more than 70% of patient visits by both the insured and uninsured resulted in prescriptions with antibiotics. Average number of antibiotics prescribed was similar for the insured and uninsured (1.01 against 0.97, $t=0.404$, $p>0.05$). Difference in the frequency of prescribing three or more antibiotics was 5.6% for the insured and 1.3% for uninsured (Table 6), but this difference was of borderline statistical significance ($z=1.623$, $p=0.05$) owing to the small number of uninsured recorded.

3.3. Method of drug administration

The method of drug administration is an important indicator of service quality because of the problem of unsafe injections (Zhuo *et al.* 2002). In both study counties, 60.2% of patient visits resulted in injections; and 42.6% of patients received intravenous administration of drugs.

Nevertheless, the method of drug administration used by NCMS and non-NCMS village doctors was significantly different (Table 7). More patients (65.1%) in NCMS village health stations received injections than patients (56.3%) in non-NCMS ($z=4.232$, $p<0.001$). Intravenous injections were significantly more frequent in NCMS villages health stations (45.2% of patient visits) than 33.6% of patient visits in non-NCMS ($z=5.604$, $p<0.001$).

Table 7 Method of drug administration at 30 village health stations (VHSs) in Linyi and Qihe, 2005

Method of drug administration	NCMS VHSs		Non–NCMS VHSs	
	Count	%	Count	%
Oral / External	349	34.9	543	43.7
Intravenous injection	452	45.2	417	33.6
Muscle injection	76	7.6	195	15.7
Mixed methods	123	12.3	87	7.0
Total patients	1,000	100.0	1,242	100.0

For the NCMS village health stations in Linyi, the method of drug administration for insured and uninsured patients was different, but not statistically significant (Table 8). More insured patients than the uninsured (65.7% against 58.4%; z=1.291, p=0.098) were administered by injections. Prescriptions administered by intravenous injections occurred more often for the insured than the uninsured (50.4% against 40.3%; z=1.703, p=0.443).

Table 8 Method of drug administration for insured and non-insured patients at 15 village health stations in Linyi, 2005

Method of drug administration	NCMS member		Non-NCMS member	
	Count	%	Count	%
Oral / External	316	34.3	32	41.6
Intravenous injection	425	46.1	27	35.1
Muscle injection	74	8.0	2	2.6
Mixed methods	107	11.6	16	20.8
Total patients	922	100.0	77	100.0

3.4. Total medical costs per patient visit at village health stations

Average total medical costs per patient visit were significantly different between NCMS and non-NCMS village health stations. In NCMS villages they averaged 18.1 yuan, 3.0 yuan higher than the non-NCMS villages (t=-2.911, p<0.001). Drug costs in the NCMS villages averaged 16.9 yuan, 2.6 yuan higher than in the non-NCMS villages (t=-2.694, p< 0.001).

For the NCMS village health stations in Linyi, average total medical costs for the insured (n=879) and uninsured (n=76) were significantly different (t=5.655, p<0.001). The insured averaged 18.7 yuan compared to 11.3 yuan for the uninsured. The difference in average total drug costs for the insured (17.4 yuan) and uninsured (10.7 yuan) was of similar magnitude (t=5.527, p<0.001).

4. Discussion

Our comparison of village health stations with and without health insurance suggests a positive relationship between health insurance and opportunistic behaviour of health providers. Our results show that the effect of NCMS was to exaggerate the problem of over-prescription and excessive injections that was already occurring in rural Shandong. Indeed, malpractices were common in all 30 villages, for example, 65.2% of patient visits were prescribed with antibiotics and about 20% of patients had two or more kinds of antibiotics.

Irrational prescribing practices often lead to serious consequences. Multi-drug use may increase the risk of undesirable drug interaction since every drug has its own side-effects. Excessive and unnecessary prescription of drugs for medical purposes will increase the economic burden of patients and waste limited resources. Most seriously, overuse of antibiotics can lead to antimicrobial resistance and overuse of injections runs the risk of unsafe needles that can increase transmission of AIDS, hepatitis B and C, and other blood-borne diseases (Zhuo *et al.* 2002; Holloway and Ivanovska 2003).

In our study of both NCMS and non-NCMS villages the average number of drugs prescribed per patient visit was 3.8 which was higher than the average of 2.2 per patient visit found in a study of 17 developing countries (Pavin *et al.* 2003) where the highest recorded was 3.8 found in Indonesia and Nigeria. Furthermore, our study found that 65.2% of patients were prescribed antibiotics and 61.2% given injections, higher than the 43.1% and 28.7% respectively found among primary health care physicians in rural Uzbekistan (Pavin *et al*. 2003). For China, we found antibiotic use in village health stations to be similar to the above-mentioned study by Zhang *et al.* (2003) on township hospitals where 68.3% of prescriptions contained antibiotics. The

implication is that irrational drug use is common in rural China in both the village and township levels of healthcare.

Generally, there is no recognised proper number of drugs per patient visit or pattern of drug administration since it depends on medical needs. Unnecessary prescription of drugs (particularly antibiotics) and use of injections are widespread throughout the world (Holloway and Ivanovska 2003). The significance of our study is it highlights the problem in rural China as among the world's most severe. Indeed, we found that about 10% of all patient visits were prescribed seven or more different kinds of drugs; the highest number was 15 drugs for a single patient visit.

How representative is our study? This question is relevant as each county-based NCMS is autonomously run on a variation of the NCMS model. We consider Linyi to be representative of Shandong because its economy ranks in the middle amongst Shandong's counties. Secondly, funding resources available to Linyi's NCMS were around the middle level for the seven Shandong pilot counties. Thirdly, the benefits package of Linyi's NCMS was similar to most other counties not only in Shandong but also in other parts of China, covering pharmaceuticals, ambulatory services in village health stations, and hospital outpatient and inpatient services.

4.1 Explaining over-prescribing behaviour of Chinese village doctors

Apart from the effects of NCMS to be discussed later, there are important factors that could influence village doctors' prescribing behaviour from the demand and supply side of medical care.

Demand side

Patient's income, age, sex, occupation, insurance coverage and cultural background may influence willingness to accept a particular drug or a method of drug administration, which in turn influence the village doctor's prescribing behaviour. It is known that farmers often ask for injections because they believe injections help them recover sooner. Anecdotal evidence suggest that to meet to patient demand, village doctors often prescribe multiple medications for simple, self-limited illnesses (such as colds) and use intravenous antibiotics for upper respiratory tract infections.

Supply side

For China, we think that over-prescription and overuse of injections are more likely to be initiated by village doctors themselves. There are two main reasons.

First, inadequate training and medical knowledge of village doctors could lead to irrational drug use. Many doctors are former "barefoot doctors" of the early 1980s (de Geyndt *et al.* 1992) with 6-12 months' training as paramedics (Jackson *et al*. 1996). Indeed they are not formally recognised as medical professionals by the Chinese Ministry of Health. Government policy is that in future they will be replaced by formally registered medical professionals; for the present, they should be gradually retrained to become assistant doctors with accreditation. Indeed, many have improved their medical knowledge and skills through in-service training and more and more have education up to middle school (9 years' schooling). But a substantial proportion still have extremely low technical competence (de Geyndt *et al.* 1992), lacking the medical knowledge to engage in rational prescribing and proper administration of drugs. Our results imply village doctors urgently need more training on rational drug use.

Secondly, the rural healthcare market provides strong incentives for village health stations to sell drugs. Among China's total 551,600 village health stations in 2004, 30.2% were privately owned (Centre for Health Statistics and Information Ministry of Health 2005). Although 59% of them were supposedly owned by village committees or jointly with village doctors, most in fact were run as private clinics because village committees do not normally provide any financial support.

It has been noted (Bloom *et al.* 2000; Bloom and Fang 2003) that the private status of village health stations and fee-for-service system provide strong incentives for health workers to induce demand for services. Without financial help from the government or the village collective, health workers are expected make a living from selling drugs and fee-for-service payments. Most village doctors do not charge consultation fees (in NCMS villages they receive a small capitation) and they can earn money from only a limited number of services including injections, acupuncture, massage. Thus, village doctors rely heavily on selling drugs. Under China's drug mark-up policy they can sell drugs at higher prices, marked up from wholesale prices, to make a profit. Whenever possible they would prescribe more drugs and expensive drugs. Our results imply that the drug mark-up policy by which village doctors sell drugs to make a living should be changed.

4.2 Effect of NCMS on village doctors' prescribing behaviour

Our study of village health stations that came under China's newest rural health insurance in 2003, support the findings of the earlier studies of township hospitals (Dong, Bogg, Rehnberg *et al.* 1999; Dong, Bogg, Wang *et al.* 1999) that reported an association between health insurance and prescribing behaviour. Importantly, we found that incentives for over-prescribing did not decline with introduction of the NCMS payment method (including capitation payment). On the contrary, NCMS village health stations tend to over-prescribe more often than non-NCMS. But this need not have to happen.

Theoretical and empirical literature suggest that a pro-active policy on healthcare purchasing could improve performance - both the efficiency and quality of providers (Perrot 2004). Purchasing healthcare under NCMS covers three key issues: what to purchase, from whom to purchase (contracting), and how to pay providers? NCMS's contracting network of purchasing healthcare consists of county-level hospitals, township hospitals and village health centres. NCMS contracts are important to these health facilities because "money follows patients", and their funding resources depend greatly on the ability to attract patients. We think that NCMS could more forcefully define their quality requirements in the contracts, similar to those for "managed care" in the USA. Then Chinese health providers are forced to improve service quality to meet contract requirements. The implication of our findings is that the NCMS could be given a more influential role on the behaviour of health providers. It should have the capacity to design, monitor and enforce contracts that compel providers pay attention to quality improvements.

Provider payment methods can contribute to quality improvement with the right incentives for health providers, and the NCMS should have enough financial clout on providers. However, our study found that NCMS payments to providers were too small to be influential for two reasons. First, NCMS village health stations received a capitation payment which was a fixed amount based on the size of the population they served. At 3 yuan/person it was too low to overcome the systemic incentives to over-prescribe. Secondly, NCMS patients had a high rate of co-payment of about 80% and thus NCMS's power over health providers was weak.

Even if NCMS's provider payment method is improved, we believe it would not work without reforming the existing incentives for selling drugs across the rural health

system. Excessive prescriptions and unnecessary injections can only be stopped when the undesirable incentives disappear in a radical reform of the rural health system.

5. Conclusions

Introduction of China's newest health insurance scheme had adversely influenced prescribing behaviour in village health stations, but irrational drug prescription also occurred in those without insurance. We draw two conclusions.

First, the NCMS had unintentionally encouraged village doctors to prescribe more drugs, use more antibiotics, and they were more likely to use injections than those in non-NCMS villages. The cost per patient visit in NCMS villages was higher than non-NCMS; even within the NCMS village health stations the difference between insured and uninsured patients was the higher cost for the insured. Thus, health providers under the NCMS seemed to have raised the cost of patient visit, especially through supplying more drugs, costly drugs and administration by injections. If unchecked, there would be cost escalation in NCMS areas.

Secondly, irrational drug prescription behaviour also occurred in village health stations without NCMS. Our evidence from village health stations with and without health insurance showed that multi-drugs were prescribed too often, and antibiotics and injections used in high proportions. The incentive to sell more drugs and expensive drugs exists because of (1) government policy on drug sales and (2) private status of village health stations which are left to run without any public funding.

We have three policy recommendations. First, the NCMS should be designed so that it could exert stronger financial influence over the health providers to motivate them to improve service quality and contain costs. Second, to counter irrational drug use there should be improved medical training for village doctors. Lastly, the present systemic incentives for selling and over-prescribing drugs in village health stations could be removed through a radical reform of the rural health system. This task is not impossible but requires much effort; we think the NCMS can work for the good of the rural population but only if this is carried out. Health service quality and drug safety in the rural areas should be a public concern in China.

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