

# Effects of New Rural Cooperative Medical Scheme on Medical Service Utilization and Medical Expense Control of Inpatients: A 3-year Empirical Study of Hainan Province in China

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## Abstract

**Background:** The New Rural Cooperative Medical Scheme (NCMS) has been further adjusted and optimized to reduce the financial burden of rural residents and to achieve universal coverage for them. In this study, we aimed to explore the impact of NCMS on medical service utilization and medical expense of inpatients in recent years.

**Methods:** The research data of Hainan Province were extracted from the Chinese NCMS platform from 2012 to 2014. Detailed information included total expenditure, average inpatients costs, average out-of-pocket payments, actual reimbursement rate, and average annual growth rate of the above indicators. Descriptive analysis was used to gauge the effects of NCMS.

**Results:** In the utilization of medical services, NCMS inpatients in tertiary hospital decreased from 25.49% in 2012 to 20.39% in 2014, inpatients in county hospitals increased from 39.49% to 55.92%, simultaneously. The total expenditure in county hospitals rose steadily from 28.46% to 46.66%, meanwhile, the total expenditure in tertiary hospitals fell from 60.44% to 44.51%. The average out-of-pocket costs of rural inpatients remained stable over the years. Furthermore, the compensation fund of NCMS inpatients grew significantly. The actual inpatient reimbursement rate at township health centers increased from 76.93% to 84.04%. Meanwhile, the rate at county hospitals and tertiary hospitals increased slightly from 59.37% and 46.10% to 61.25% and 47.71%, respectively.

**Conclusions:** With the improvement of the reimbursement ability, especially after the new health care reform in 2009, the NCMS have been playing a prominent role in alleviating the economic burden of farmers' medical treatment. Meanwhile, more patients go to primary hospitals than tertiary hospitals, and the capability of primary hospitals has been greatly improved.

**Key words:** Hainan Province; Medical Expense Control; Medical Service Utilization; New Cooperative Medical Scheme

## INTRODUCTION

The medical expenses of inpatients are being used as one of the indicators measuring whether out-of-pocket payments disrupt people's standard of living. Data show out-of-pocket payments for medical services are very high in most developing countries.<sup>[1-3]</sup> To secure access to adequate health care for all at an affordable price, it is necessary to increase the extent of prepayment, thus reduce the reliance on out-of-pocket payment,<sup>[4]</sup> which is one of the objectives of a health policy. The State Council and the Central Committee of the Communist Party of China initiated the New Rural Cooperative Medical Scheme (NCMS) in 2003 to reduce the financial burden of rural residents and to achieve universal coverage. The NCMS policy priority has shifted since the new health care reform was implemented in 2009

when the Chinese government injected additional funding to the NCMS, which greatly improved its financing and reimbursement capacity. The central government takes the overall responsibility to monitor the scheme while the policy implementation responsibilities are decentralized to county level governments.<sup>[5]</sup> To assess the impact of the new policy, we have studied the effects of NCMS on medical service utilization and medical expense of inpatients after 2009.

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**Received:** 30-12-2015 **Edited by:** Li-Min Chen

**How to cite this article:** Dai T, Hu HP, Na X, Li YZ, Wan YL, Xie LQ. Effects of New Rural Cooperative Medical Scheme on Medical Service Utilization and Medical Expense Control of Inpatients: A 3-year Empirical Study of Hainan Province in China. *Chin Med J* 2016;129:1280-4.

### Access this article online

#### Quick Response Code:



**Website:**  
www.cmj.org

**DOI:**  
10.4103/0366-6999.182842

This paper aimed to assess the effects of NCMS on medical service utilization and medical expense of inpatients from 2012 to 2014 to provide up-to-date information. We used 3 years' continuous data in NCMS platform of Hainan province, China, which was selected as a provincial representative of NCMS in 2011. Our findings provided evidence for the further evolution of NCMS.

## METHODS

### Data collection

All data collected from the Chinese New Cooperative Medical Scheme Platform (CNCMSP),<sup>[6]</sup> before analysis were carried out anonymous. The NCMS of Hainan Province was one of the first provinces connected with the CNCMSP and has a high quality of uploaded data,<sup>[7]</sup> which made it possible to obtain the data with accuracy and integrity. The inpatient number of Hainan Province from the CNCMSP, totaling 893,283, from January 01, 2012, to December 30, 2014, was included in the study. The Procedural Language/ Structured Query Language (PL/SQL) Developer was used to select the interesting variables which included number of inpatients, medical institution, total expenditure, compensation and out-of-pocket payment which equal to total expenditure minus compensation from Oracle database of the CNCMSP and saved in a Comma-Separated Values file (CSV).

### Data analysis

The medical institution was classified into tiers, i.e., the township health center, county hospital and tertiary hospitals. Six indicators, including total expenditure, out-of-pocket payment, average inpatients costs, average out-of-pocket costs of inpatients, average and actual inpatient reimbursement rate and average annual growth rate, were analyzed to measure the influence of NCMS on inpatient care utilization. We compared the differences across the three tiers of medical institutions and changes over the years. We calculated the average annual growth rate with the following Equation (1):

$$y = n \cdot \sqrt[n]{\frac{B}{A}} - 1. \quad (1)$$

Where  $B$  is the data of the latest year,  $A$  is the data of the 1<sup>st</sup> year, and  $n$  is the number of years.

## RESULTS

### New Rural Cooperative Medical Scheme reimbursement policy in Hainan province

The essential rules about implementation of NCMS, including the deductible, the maximum inpatient expenditure and policy reimbursement rate, the priority order for the reimbursement of essential drugs or Chinese traditional herbal medicine, were all designed by the provincial government. Therefore, the benefit package was usually the same for the participants in one province. However, it varied depending on financing levels of NCMS in different areas.<sup>[8,9]</sup>

According to the comparison with NCMS reimbursement policy in 2012–2014,<sup>[10,11]</sup> it was obvious that deductible amount decreased. However, reimbursement rate stayed at the same level. As we can see in Table 1, township level medical institution's reimbursement rate was at 90%, county level's rate was at 75%, and tertiary hospital level's rate was at 65%. The tiered reimbursement structure sets a higher reimbursement rate either for incurring a higher medical expenditure or for choosing a primary level medical institution.

### Medical service utilization

Since 2012, the number of NCMS inpatients in tertiary hospital decreased from 25.49% in 2012 to 20.39% in 2014, meanwhile, inpatients in county hospitals increased from 39.49% to 55.92%. There was an annual growth of 19.00% for NCMS inpatients who went to county hospital. Yet, it's worth mentioning that the number NCMS inpatients at township health center and tertiary hospital decreased by 17.68% and 10.63%, respectively [Table 2].

### Medical expenditure of inpatients

#### Total expenditure

Table 3 showed that there was a substantial growth of the total expenditure of NCMS inpatients in Hainan from 2012 to 2014. Such expenditure grew by 60.34% annually at county hospitals, 11.71% at township health centers and 7.46% at tertiary hospitals. The total expenditure in county hospitals rose steadily from 28.46% to 46.66%, meanwhile, the total expenditure in tertiary hospitals fell from 60.44% to 44.51%. The total NCMS inpatients expenditure in all medical institutions stayed at about the same level from 2013 to 2014 [Table 3].

#### Reimbursement

From 2012 to 2014, the compensation fund of NCMS inpatients in Hainan grew significantly. County hospitals benefitted the most and saw an annual average increase of 62.87%, followed by the township health centers with an average annual growth rate at 16.76%, and tertiary hospitals at 9.31%. The distribution of reimbursement fund shifted from 2012 to 2014. County hospitals increased its share from 31.7% to 49.94%, whereas tertiary hospitals had their share from 52.28% to 37.1% [Table 4].

#### Overall benefit

There's also an increase in the average fee of NCMS inpatients in Hainan from 2012 to 2014. Among all medical institutions, county hospitals had the most rapid annual growth of 13.60%, followed by the township health centers of 12.81%, and then by tertiary hospitals which had the minimum annual growth of 0.66%. The average out-of-pocket costs of rural inpatients have remained stable. Costs at township health centers and tertiary hospitals fell, respectively at an average rate of 5.51% and 0.85%/year. However, costs at county hospitals rose at an annual average rate of 10.16%.

The actual inpatient reimbursement rate of medical institutions varied at different levels of medical institutions. The actual inpatient reimbursement rate at township health centers increased most, from 76.93% in 2012 to 84.04% in 2014.

**Table 1: NCMS reimbursement policy in Hainan province**

| Medical institution    | 2012              |                        | 2013              |                        | 2014              |                        |
|------------------------|-------------------|------------------------|-------------------|------------------------|-------------------|------------------------|
|                        | Deductible (Yuan) | Reimbursement rate (%) | Deductible (Yuan) | Reimbursement rate (%) | Deductible (Yuan) | Reimbursement rate (%) |
| Township health center | 0                 | (If ≤¥300) 60; else 90 | 0                 | (If ≤¥200) 60; else 90 | 0                 | (If ≤¥200) 60; else 90 |
| County hospital*       | 400               | 75                     | 300               | 75                     | 300               | 75                     |
|                        | 800               | 65                     | 600               | 65                     | 600               | 65                     |
| Tertiary hospital      | 1000              | 60                     | 800               | 60                     | 800               | 60                     |

\*: There are two reimbursement standards of NCMS policy in different hospital at County hospital level. NCMS: New Rural Cooperative Medical Scheme.

**Table 2: NCMS in patients at different levels of medical institutions**

| Medical institution    | 2012                           |                | 2013                           |                | 2014                           |                | Average annual growth rate* (%) |
|------------------------|--------------------------------|----------------|--------------------------------|----------------|--------------------------------|----------------|---------------------------------|
|                        | Number of inpatients, <i>n</i> | Percentage (%) | Number of inpatients, <i>n</i> | Percentage (%) | Number of inpatients, <i>n</i> | Percentage (%) |                                 |
| Township health center | 79,535                         | 35.02          | 79,561                         | 23.26          | 76,900                         | 23.73          | -17.68                          |
| County hospital        | 89,706                         | 39.49          | 192,433                        | 56.26          | 181,244                        | 55.92          | 19.00                           |
| Tertiary hospital      | 57,895                         | 25.49          | 70,025                         | 20.47          | 65,984                         | 20.36          | -10.63                          |
| Total                  | 227,136                        | 100.00         | 342,019                        | 100.00         | 324,128                        | 100.00         |                                 |

\*Average annual growth rate (%) represents the percentage change of medical institution. NCMS: New Rural Cooperative Medical Scheme.

**Table 3: Total expenditure of NCMS in patients at different levels of medical institutions**

| Medical institution    | 2012                                     |                | 2013                                     |                | 2014                                     |                | Average annual growth rate (%) |
|------------------------|--|----------------|--|----------------|--|----------------|--------------------------------|
|                        | Total expenditure (in million RMB, Yuan) | Percentage (%) | Total expenditure (in million RMB, Yuan) | Percentage (%) | Total expenditure (in million RMB, Yuan) | Percentage (%) |                                |
| Township health center | 153.71                                   | 11.10          | 182.28                                   | 8.43           | 191.81                                   | 8.83           | 11.71                          |
| County hospital        | 394.26                                   | 28.46          | 988.67                                   | 45.70          | 1013.62                                  | 46.66          | 60.34                          |
| Tertiary hospital      | 837.28                                   | 60.44          | 992.49                                   | 45.88          | 966.83                                   | 44.51          | 7.46                           |
| Total                  | 1,385.25                                 | 100.00         | 2,163.44                                 | 100.00         | 2,172.26                                 | 100.00         | 25.23                          |

NCMS: New Rural Cooperative Medical Scheme.

**Table 4: Compensation found of NCMS in patients at different levels of medical institutions**

| Medical institution    | 2012                                      |                | 2013                                      |                | 2014                                      |                | Average annual growth rate (%) |
|------------------------|---|----------------|---|----------------|---|----------------|--------------------------------|
|                        | Reimbursement fund (in million RMB, Yuan) | Percentage (%) | Reimbursement fund (in million RMB, Yuan) | Percentage (%) | Reimbursement fund (in million RMB, Yuan) | Percentage (%) |                                |
| Township health center | 118.25                                    | 16.02          | 154.26                                    | 12.29          | 161.20                                    | 12.97          | 16.76                          |
| County hospital        | 234.07                                    | 31.70          | 611.17                                    | 48.71          | 620.89                                    | 49.94          | 62.87                          |
| Tertiary hospital      | 385.99                                    | 52.28          | 489.36                                    | 39.00          | 461.23                                    | 37.10          | 9.31                           |
| Total                  | 738.31                                    | 100.00         | 1,254.79                                  | 100.00         | 1,243.32                                  | 100.00         | 29.77                          |

NCMS: New Rural Cooperative Medical Scheme.

Meanwhile, county hospitals and tertiary hospitals' rate increased slightly from 59.37% and 46.10% to 61.25% and 47.71%, respectively. The annual average growth rate of the actual inpatient reimbursement rate at township health centers of 4.52% was higher than those at county hospitals and tertiary hospitals, which were 1.58% and 1.73%, respectively [Table 5].

## DISCUSSION

The implement of NCMS reduced financial burden of the rural residents in China. With the increasing reimbursement rate of the NCMS, more patients are able to seek care at

county hospital in order to obtain more convenient and targeted medical services. After the revision of the NCMS policy in Hainan Province (raising the reimbursement percentage and decrease the gap of reimbursements every year), the actual reimbursement rate increased substantially during the last 3 years. The reimbursement rate at township, county and higher levels medical institution has reached into 84.04%, 61.25% and 47.71% respectively by the end of 2014. However, there is a significant gap between actual reimbursement rate and NCMS policy guidelines. Analysis of its causes, there are limited drugs listed on the national essential drug reimbursement list and limited services

**Table 5: Average inpatients' fee of NCMS in patients at different levels of medical institutions**

| Medical institution    | 2012                           |                                       |   | 2013                           |                                       |   | 2014                           |                                       |   | Average annual growth rate (%) |                                |                                     |
|------------------------|--------------------------------|---------------------------------------|---|--------------------------------|---------------------------------------|---|--------------------------------|---------------------------------------|---|--------------------------------|--------------------------------|-------------------------------------|
|                        | Average inpatients' fee (Yuan) | The average out-of-pocket cost (Yuan) | Actual inpatient reimbursement rate (%) | Average inpatients' fee (Yuan) | The average out-of-pocket cost (Yuan) | Actual inpatient reimbursement rate (%) | Average inpatients' fee (Yuan) | The average out-of-pocket cost (Yuan) | Actual inpatient reimbursement rate (%) | Average inpatients' fee        | The average out-of-pocket cost | Actual inpatient reimbursement rate |
| Township health center | 1,932.62                       | 445.84                                | 76.93                                   | 2,291.01                       | 352.18                                | 84.63                                   | 2,494.25                       | 398.04                                | 84.04                                   | 13.60                          | -5.51                          | 4.52                                |
| County hospital        | 4,394.97                       | 1,785.72                              | 59.37                                   | 5,137.75                       | 1,961.74                              | 61.82                                   | 5,592.59                       | 2166.89                               | 61.25                                   | 12.81                          | 10.16                          | 1.58                                |
| Tertiary hospital      | 14,462.00                      | 7,794.98                              | 46.10                                   | 14,173.42                      | 7,185.05                              | 49.31                                   | 14,652.51                      | 7662.50                               | 47.71                                   | 0.66                           | -0.85                          | 1.73                                |

NCMS: New Rural Cooperative Medical Scheme.

covered, the hospital hardware problems and personnel issues, etc. Furthermore, for patients who require advanced healthcare services, a transfer from designated township/county hospitals to county/tertiary hospitals is difficult. Partial NCMS participates usually did not go through the process stipulated by the transferal policy because they could not afford the long waiting time, which led to a decline in actual reimbursement rate. Further effort is needed to improve the comprehensive NCMS benefit package by broadening the catalogue of drugs and reimbursement covered, and increasing the reimbursement ratio, and modifying health providers' behaviors by payment reform.<sup>[12-14]</sup>

It is clear that the accessibility of health care services has been improved and the risk of the financial catastrophe might have been reduced as a result of the reduction in out-of-pocket expenditure.<sup>[15,16]</sup> Due to the higher average annual growth rate of reimbursement than total expenditure in all levels of medical institutions, the percentage of out-of-pocket payments decreased year by year. And the average annual growth rate of average out-of-pocket payment also decreased in the township health centers and tertiary hospitals, however, costs at county hospitals were still growing rapidly at a rate of 10.16%. The government needs to pay more attention to modify the basic medical policy, to improve the county hospital medical facilities, to attract excellent medical personnel to work in the countryside, it is the key to let the inpatients stay in county hospital for diagnosis and treatment, since the poor is impacted the most by out-of-pocket expenditures.

Since the implement of NCMS, more patients went to county hospitals than tertiary hospitals. However, there is still a gap between the actual medical service utilization and the policy target. Although annually there were 4.52% increase of actual reimbursement rate coupled with 5.51% annual decline in average out-of-pocket payment at township level medical institutions, most inpatients still choose county hospitals or higher level medical institutions with higher out-of-pocket payment and lower growth in reimbursement rate. The most plausible reason of this phenomenon is that the basic medical institutions have difficulty to provide sufficient medical services demanded by inpatients. As the basic medical institutions lack advanced medical equipment and experienced doctors who have high clinical skills and rich medical knowledge, which also leads to inferior treatment outcomes in township health centers. More preferential policies are needed from the government to attract more medical staff of tertiary hospitals to township medical centers to improve the medical skills of the inexperienced physicians. With better skills, the village and township hospitals could treat more patients for their first visits and enhance their confidence in these local hospitals' capability. In addition, the village and township hospitals could take advantage of their low prices and good services to attract more patients.<sup>[17]</sup> This will also effectively facilitate the implementation of the two-way referral system, and speed up the process of achieving health care reform objectives.



The current study has several limitations. Firstly, even though the CNCMS has achieved the interoperability with the NCMS of Hainan province, we still have missing data from few counties in Hainan. Therefore, the results could not completely represent the real situation of the entire province. Secondly, as we only focused our study in Hainan province, and the NCMS policies could be somehow different from area to area, some of our findings should be applied to provinces sharing similar policies.

In conclusion, for patients, it is essential that the cost of healthcare should be affordable.<sup>[18-20]</sup> The evaluation of the NCMS come with the conclusion that the reform has achieved some success in financial protection of the catastrophic health care expenses.<sup>[21-23]</sup> With the improvement of the reimbursement ability, especially after the new health care reform in 2009, the NCMS have been playing a prominent role in alleviating the economic burden of farmers' medical treatment. Meanwhile, more patients went to primary hospitals than tertiary hospitals, and the capability of primary hospitals has been greatly improved.

The NCMS reimbursement policies should be improved in the future to make reimbursement procedures more equity-oriented and to attract excellent medical staff of superior hospitals to township medical centers for the sake of improving the medical skills of the inexperienced doctors in primary level. Further in-depth studies should be carried out in indifferent areas to explore the effects of NCMS on medical service utilization and medical expense of inpatients and to get more hints for further policy making.

### Financial support and sponsorship

This article is supported by the National Natural Science Foundation of China (No. 71273280).

### Conflicts of interest

There are no conflicts of interest.

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