

# Maternal and infant health prepayment schemes in Shandong, China: a survey of demand and supply

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## Abstract

*Maternal and infant prepayment schemes (MIPSs) appeared in China in the early 1980s, as a way of helping women to set aside adequate funds for childbirth. The responsibility for design was devolved to the county level, and many different approaches have been applied. For this and other reasons, there has been no consensus on important matters such as the level of prepayment, the range of covered services, and whether township health centres or family planning stations should operate the schemes.*

*We aimed to clarify some of the uncertainty by conducting combined analyses of cost, willingness to pay, and willingness to supply. We used structured survey instruments to interview 4271 households with children aged under one year, and 18 township health institutions. Our analyses suggest that the ideal prepayment should be higher and the range of covered services should be wider than the current average, and that health centres rather family planning stations should operate the schemes.*

## The policy setting

In 1990, China had a population of 1.3 billion. 41% of this total (533 million) comprised women of childbearing age (15-49) and children under the age of 7 (State Statistical Bureau 1997). Women and children are vulnerable groups and face particular barriers to health care for social, economic, cultural and political reasons. Improving their access to services and their health status has become an increasing concern for the government, in the interests of socio-economic development. However, in reality there has been continual underfunding of these services from government budgets (Yu Peng 1998; He Xing 1990; Jiasheng He 1988).

The introduction of market-oriented economic reforms in the early 1980s provided the opportunity to introduce a variety of new methods of financing, including the MIPS model. Its aims are to encourage target women (those at risk of being unable to access childbirth services) to insure themselves so they are able to afford adequate services, and to increase the willingness of relevant agencies to deliver such services – and hence to improve health status of both women and children.

A MIPS involves voluntary enrolment of families, whereby they pay a fixed amount in advance and thereby become eligible for a specified range of services. The most common form of MIPS involves prepayment of 20 to 80 Yuan

for a package of antenatal and postnatal services. (The current exchange rate is about 4 Yuan per \$1 Australian.) The fees for hospital delivery are normally excluded from the MIPS (Li Ke et al 1992; Liangfa Yan 1997).

There is typically one MIPS in each township, operated either by the township health centre (THC) or the township family planning station (TFP). The township health centre is directly under the control of the county health bureau or township government, and is more closely linked to other kinds of health services. In contrast, the township family planning station is typically not organisationally connected with other services: although under the control of the township government, its activities are tightly focussed on family planning and the links with other health and welfare services are usually weak.

National and provincial governments have given only general directions on the establishment and operation of MIPSs, and each county government therefore has many options with respect to details. Once an approach is decided, it normally applies to all the townships in the county. It follows that consumers seldom have any choice of MIPS providers.

The main objective of this study was to provide a basis for determination of appropriate types of services. This would involve measuring the costs of provision of various mixes of services (service packages), and relating the costs to willingness to purchase on the part of the target consumers and willingness to supply on the part of the two types of potential providers.

## Methodology

### Sampling method

We categorised all the prefectures in Shandong Province into three groups (low, medium, and high) according to average household incomes, and randomly selected one from the middle group. Three counties were randomly chosen from the prefecture, and six townships were randomly selected from each sampled county. Finally, all households in the sampled townships with children between the ages of 0 and 1 were interviewed, and all the township health institutions were investigated by using a structured survey instrument.

### Measurement of willingness to pay

We investigated families' willingness to pay for various MIPS services by use of a questionnaire. Five categories of services were defined, and they are listed in the last part of Table 1.

**Table 1: structure of part of the interview questionnaire for households**

Do you know what is a MIPS?	Yes or No		
	If no, the interviewer explains the idea of a MIPS before continuing.		
Are you interested in a MIPS?	Yes or No		
	If no, no further questions.		
If yes, give your preferences by selecting from the following:			
Service category	Preference	Desired quantity	Desired payment (Yuan)
Antenatal Examinations	Yes No	1, 2, 3, 4, 5, 6, 7, 8, 9	1,2,3,4
Antenatal Health Education	Yes No	1, 2, 3, 4, 5, 6, 7, 8, 9	1,2,3,4
Hospital Delivery	Yes No	1	150, 200, 250, 300, 350 & more
Postnatal Examination	Yes No	1, 2, 3, 4	1,2,3,4
Postnatal Health Education	Yes No	1, 2, 3, 4	1,2,3,4

For each of the five service categories, respondents were asked about the desired quantity (for example, between zero and nine antenatal examinations) and the amount they were willing to pay (for example, from 1 to 4 Yuan per examination).

The questionnaire was administered by village doctors, under the supervision of field investigators. The latter group consisted of teaching staff from the Institute of Social Medicine and Health Policy, and senior students from Faculty of Public Health of Shandong University.

There were two main reasons for employing village doctors as interviewers. One was a practical consequence of the large sample size. The other was that we believed the village doctors' familiarity with circumstances and rapport with villagers would improve compliance and accuracy of responses. However, we checked for possible bias by requiring the field investigators to perform independent checks on the answers of a subsample of respondents.

The questionnaire was pretested in another part of Shandong Province outside the sampled prefecture. Both the field investigators and the village doctors were carefully trained.

The completed questionnaires were carefully checked and missing answers and other queries referred back to the field. Before data analysis, the data were rechecked for internal consistency by computer. If the validity of some data were suspect, they were compared with the original contents of the questionnaire.

### **Measurement of willingness to supply**

The measurement approach was similar to that for willingness to pay. Again, a pretested questionnaire was employed, and answers subjected to completeness and consistency checks. However, in this case the interviewees were care providers rather than families and the questionnaires were administered by field investigators.

### **Measurement of costs of service provision**

It was relatively easy to obtain production and cost data from the care provider institutions. We provided them with a questionnaire for completion by appropriate staff (usually accounting personnel), and then followed up missing or questionable data by site visit. Most of the data were in fact available from standardised routine information systems. Cost and production data were obtained for the most recent one-year accounting period.

We defined six categories of cost, based on work by Xingzhu Liu et al (1997): labour, public affairs (administration and management), facility operation (mainly utilities), depreciation of capital assets, consumables, and low-value assets. The costs of fixed assets were estimated by use of depreciation rates for various types of assets from a study by Xingzhu Liu et al (1997).

We separated total costs (TC) into direct and indirect components. Indirect costs (IDC) consisted of the labour cost of overhead offices (LCO), public affairs costs (PAC) and business costs (BC) of health institutions, and depreciation costs of commonly used fixed assets (DCFA) within overhead offices (see Formula 1). We allocated a share of these costs (A) to MIPSs mainly by using the proportion of total staff engaged in operating the MIPS.

$$IDC = (LCO+PAC+BC+DCFA)*A \quad (\text{Formula 1})$$

The direct cost of MIPS services was defined to comprise the labour cost for MIPS service providers (LCM), depreciation cost of fixed assets (DCFA), service material costs (SMC) and the costs of low-value products (CLP), as shown in Formula 2.

$$DC=LCM+DCFA+SMC+CLP \quad (\text{Formula 2})$$

### **Measurement of average total cost (ATC) per point**

Data were available on the number of MIPS services provided by category of service. However, there were no data on the costs of the categories. We therefore obtained judgements of cost relativities from a panel of experts in maternal and child health. The cost relativities (called 'points' in this paper) are shown in Table 2. Note that the first five are components of MIPSs and the remainder are not.

Table 2: experts' point scores (relative costs) for each service type

Service category	Equivalent points
Antenatal examination	1
Antenatal health education	1
Hospital delivery	6
Postnatal interview	1
Postnatal health education	1
Hospital inpatient day, other services	3
Outpatient visits, other services	1

These weights were then applied to service volumes data to give a cost-weighted total quantity (TQ) of MIPS services for each care provider agency. The average total cost per point (ATC) is then given by

$$ATC = TC / TQ \quad (\text{Formula 3})$$

Then the average total cost per package (ATCP) can be computed by

$$ATCP = ATC * \sum P_i \quad (\text{Formula 4})$$

where  $P_i$  is the cost weight for service category  $i$ . For example, if a package only includes 5 antenatal examinations and 1 delivery, then  $\sum P$  is 11 ( $5 + 1 * 6 = 11$ ).

## Results

In this study, 4271 families with a child aged under one year were surveyed. 2051 families had access to MIPSs and 2220 did not.

18 township health institutions were also surveyed, comprising 10 township health centres and 8 township family planning stations. Six of the township health centres (60%) had MIPS services, and 5 of the township family planning stations (62.5%) had MIPS services.

### Willingness to pay (WTP) for MIPS

The results of the survey of women are summarised in Tables 4 and 5. The first column of Table 3 lists the combinations of the five service categories that were most commonly chosen by the respondents. The most popular package, selected by 40.76% of women, included all five services. The next most popular, selected by 12.77% of women, included antenatal visits and delivery care only. Nearly all women wanted antenatal and delivery medical services. Fewer women were interested in educational services.

**Table 3: consumers' preferences and willingness to pay for each package**

Packages*	Percent of total women (n = 4190)	Mean price consumers are willing to pay for each package (Y)
A+B+C+D+E	40.76% 2	62.34
A+C	12.77%	240.12
A+C+D	7.40%	246.69
A+B+C+D+E	40.76%	262.34
C	6.11%	223.00
A+B+C+D	4.87%	256.21
A+B+C+E	3.03%	255.77
A+C+D+E	3.01%	252.82
A+C+E	2.55%	246.25
A	1.80%	17.12
A+B	1.38%	26.24
Other	9.28%	—
<b>Total</b>	<b>100.00%</b>	<b>—</b>

\* A=antenatal examinations B=antenatal health education C=delivery services  
D=postnatal interview E=postnatal health education

Table 4 shows the mean quantity of each of the five service categories. For example, the respondents wanted an average of 5.35 antenatal examinations. Also shown are the amounts that the respondents were willing to pay per episode. For example, they were willing to pay a mean of 3.20 Yuan for each antenatal examination.

The willingness to pay for each of the most popular packages is shown in the rightmost column of Table 3. These results are derived from Table 4 by multiplying the average number of episodes by willingness to pay. For example, the average number of antenatal examinations desired (5.35) is multiplied by the willingness to pay (3.20 Yuan) to determine the willingness to pay for antenatal examinations (17.12 Yuan). The respondents were willing to pay an average of 262 Yuan for the largest package that included all five service categories.

**Table 4: desired quantity and willingness to pay for MIPS services, per episode**

	Mean desired quantity of episodes	Willingness to pay per episode (Y)
Antenatal examination	5.35	3.20
Antenatal health education	4.12	2.31
Hospital delivery	1.00	223.00
Postnatal examination	2.70	2.76
Postnatal health education	2.27	2.38

We undertook a variety of additional analyses. For example, multivariate analysis of willingness to pay for MIPS services showed that the family's income, the woman's health knowledge score, and previous participation in a MIPS had significant positive effects on the amount women were willing to pay for MIPS services. The age of the husband, the wife's health status, and the number of children had significant negative effects on willingness to pay.

## Willingness to supply MIPS services

All of the surveyed agencies were willing to deliver MIPS services. Table 5 lists the average quantities that they were willing to supply. There were similarities between the two types of service providers. The main difference was that township family planning stations were less willing to provide antenatal and postnatal health education. It follows that the township health centres are more willing to supply the most popular MIPS package.

**Table 5: quantities of services that providers were willing to supply**

Service Items	Township Health Centre (n = 10)	Township Family Planning Station (n = 8)	Overall Mean
	Mean	Mean	
Antenatal examinations	7.7	7.0	7.37
Antenatal health education	5.1	2.4	3.92
Hospital delivery	1.0	1.0	1.00
Postnatal interview	4.0	2.8	3.47
Postnatal health education	1.9	2.0	1.94

The financial willingness to supply of the health institutions is summarised in Table 6. The two types of agencies had nearly identical views.

**Table 6: prices at which providers were willing to supply**

Service Items	Township Health Centre (n = 10)	Township Family Planning Station (n = 8)	Overall mean (Y)
	Mean (Y)	Mean (Y)	
Antenatal Examinations	3.25	3.20	3.23
Antenatal Health Education	2.89	2.14	2.56
Hospital Delivery	203.50	198.50	201.28
Postnatal Interview	2.14	2.05	2.10
Postnatal Health Education	1.89	1.91	1.90

Based on the information from Tables 5 and 6, we can calculate willingness to supply for each package (see Table 7). The method of calculation is similar with that for willingness to pay for each package.

**Table 7: prices at which providers were willing to supply preferred packages**

Packages	Price at which service providers are willing to supply (Y)
A+B+C+D+E	246.11
A+C	225.09
A+C+D	232.38
A+B+C	235.13
C	201.28
A+B+C+D	242.42
A+B+C+E	238.82
A+C+D+E	236.07
A+C+E	228.78
A	23.81
A+B	33.85
Other	—

### Institutional cost analysis

By using the cost measurement methods described earlier, we were able to produce the statistics summarised in Table 8. It shows that efficiency as measured by ATC is significantly higher in township health centres with MIPS than in those without MIPS (10.17 and 18.41 Yuan per point respectively). The difference is 81.02% [ $(18.41-10.17) / 10.17 = 81.02\%$ ].

**Table 8: cost and efficiency measures by type of care provider (Yuan)**

Cost Items	Township Health Centre		Township Family Planning Station	
	With MIPS	No MIPS	With MIPS	No MIPS
DC	58233	27175	41624	38438
IDC	21980	12720	51190	26457
TC	80213	39895	92814	64895
TQ	7884	2167	5081	2173
ATC	10.17	18.41	18.27	29.86

Efficiency as measured by ATC is also significantly higher in township family planning stations with MIPS than in those without MIPS (18.27 and 29.86 Yuan respectively). The difference is 63.44%.

Finally, MIPSs in township health centres are more efficient than MIPSs in township family planning stations. If the MIPS services moved from township family planning stations to township health centres, an efficiency improvement of about 80% might be expected.

It might be argued that, if the two institutions were combined into one, further efficiency gains could be anticipated. From our results, a rough estimate of the potential savings from merging township family planning station with township health centre-MIPS is about 194% [ $(29.86-10.17) / 10.17$ ]. By merging, we mean the creation of a single service provider by joining together a township family planning centre without a MIPS and a township health centre with a MIPS.

At least, there is good reason to conclude that MIPS services lead to improved efficiency of health institutions to some extent. The examination of opportunities for merging and moving the locations of MIPS services should be a high priority.

### Joint analysis of costs, willingness to pay and willingness to supply

A summary of our analyses is presented in Table 9. Additional statistics have been derived from the same results.

**Table 9: joint analysis of WTP, ATCP and WTS**

Coding	Packages	Total points <sup>(1)</sup>	ATCP of THC <sup>(2)</sup>	ATCP of TFP <sup>(3)</sup>	WTP <sup>(4)</sup>	WTS <sup>(5)</sup>
A	A+B+C+D+E	22.70	230.86	414.73	262.34	246.11
B	A+B+C+D	20.76	211.13	379.29	256.21	242.42
C	A+B+C+E	19.23	195.57	351.33	255.77	238.82
D	A+C+D+E	18.78	190.99	343.11	252.82	236.07
E	A+B+C	17.29	175.84	315.89	249.64	235.13
F	A+C+D	16.84	171.26	307.67	246.69	232.38
G	A+C+E	15.31	155.70	279.71	246.25	228.78
H	A+C	13.37	135.97	244.27	240.12	225.09
I	C	6.00	61.02	109.62	223.00	201.28
J	A+B	11.29	114.82	206.27	26.64	33.85
K	A	7.37	74.95	134.65	17.12	23.81

(1) Total points per package (sums of values in Table 5 weighted from Table 2).

(2) Average total cost per package, THC (column 3 multiplied by ATC per point from Table 8).

(3) Average total cost per package, TFP (column 3 multiplied by ATC per point from Table 8).

(4) Willingness to pay (from Table 3).

(5) Willingness to supply (from Table 7).

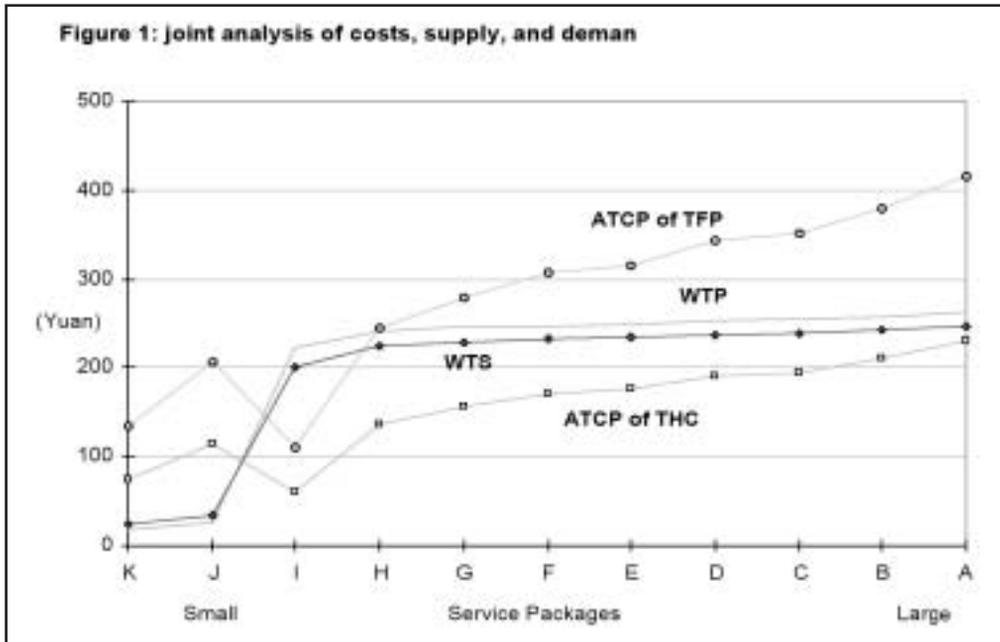
The packages are listed in order of willingness to pay, and we have added another coding system in the first column. The third column shows the total points of each package, which were calculated by using average desired quantities from supply side in Table 5 but weighted using the data in Table 2.

The fourth and fifth columns are the average total costs per package for the township health centres and township family planning centres respectively. The calculation of ATCP makes use of formula 5. For example, package 'A' in township health centres has a total point score of 22.70 (from column 3) and the ATC per point is 10.17 Yuan (from Table 8), and therefore the ATCP is  $(22.70 \times 10.17 = 230.86)$  Yuan.

The relationships between service costs (ATCP), willingness to supply (WTS) and willingness to pay (WTP) are illustrated in Figure 1. The left vertical axis represents monetary values of willingness and cost, and the service packages are shown on the horizontal axis. There are four curves: ATCP for township family planning centres, WTP, WTS and ATCP of township health centres from top to bottom.

There are three interesting results. First, for the low-cost packages only providing antenatal services (K and J), the ATCPs in township health centres and in township family planning centre are greater than both WTP and WTS. We can therefore infer that neither service provider would provide a cost-effective service if limited in this way.

Second, for hospital delivery only (package I), ATCPs in township health centres and in township family planning centres are smaller than both WTP and WTS. We conclude that both township health centres and township family planning centres would be good providers.



Third, for the remaining packages, the costs for township family planning centres are higher than both WTP and WTS. In contrast, the township health centre costs are lower than both WTP and WTS. In other words, township health centres appear to be better service providers.

In summary, township health centres appear to be suitable service providers for nearly all the packages excepting antenatal care alone, whereas township family planning stations would be suitable only for hospital delivery. Thus we concluded that township health centre-based large-package MIPS are feasible and popular, and that the prepayment should be between 230 to 262 Yuan.

## Discussion

### Implications of the study

Selection of the township health institution to provide MIPS services and determination of the amount of prepayment are painful decisions for policy makers for several reasons. First, the national government only issued guidelines for MIPS practice, and failed to give advice on selection of the provider and level of prepayment. Second, MIPS methods vary greatly from place to place, and the lack of a common framework for comparison means that little could be learned through the sharing of experiences. Third, few reports have been presented in scientific journals, and hardly any provide an adequate basis for decision-making.

We therefore believe the results of this study are potentially important, even if our estimates of interest and the potential benefits of reorganisation are imprecise. At least, we believe our results indicate there is good reason to conduct reforms on a pilot basis.

### Willingness to pay

Willingness is an essential prerequisite to membership, even though the evidence from similar studies suggests it is likely to overestimate actual behaviour. Our results show that 75% pregnant women are willing to join an MIPS. One reason for the enthusiasm is the widespread recognition among pregnant women that services of all types, including education, are likely to provide them with significant benefits. Another reason is that the prepayment is not a big burden in comparison with the costs likely to be incurred in the absence of scheme membership.

However, there are good reasons to be cautious. Poor experiences with existing services have been widely reported, both in our study and in the literature. The most common complaint has been that the service providers failed to make available some kinds of services – and especially postnatal services – that consumers had been given reason to expect. Other complaints include difficulties of service access, and poor skills of MIPS providers in some health institutions.

### **Willingness to supply**

Our study also showed that there are few apparent economic constraints to the supply MIPS services in rural areas. However, penetration has not been high in Shandong. A recent census in the province found that coverage by township-based MIPS is only 38.4% (Mei Zhao, et al 1999), which is much lower than that in Jiangsu and Fujian provinces (Jiangsu Department of Public Health 1998; Maternal and Child Health Office of Fujian Department of Public Health 1998).

There may be two significant constraints. First, there have been unclear and imprecise guidelines on the operation of MIPSs, and this has led to poor management in some cases. For example, there appears to have been widespread competition between health centres and family planning stations, which has resulted in poor services and poor coordination of care.

The second concerns attitudes and beliefs of policymakers. It has been widely regarded that women would not be willing to pay for adequate services due to rural poverty, and that the cost-benefit of MIPSs was low. It appears however that attitudes have been changing of late as a consequence of increased publicity including the emphasis given in the National Health Conference of 1997.

### **Costs**

In this study, cost was defined to include only those incurred by the township health institutions themselves, and relevant costs of upper levels of administration were excluded. It follows that efficiency must be lower than we have estimated. However, we have no reason to believe this would affect our general conclusion that township health centres are the better type of provider.

### **Conclusions**

We have concluded that the township health centre-based large-package model is feasible and popular, but many aspects of service operation will need to be managed effectively if such a service is to be successful. In particular, local government agencies will need to refine their policies and establish adequate audit mechanisms. They should ensure that MIPS providers are aware of their responsibility to deliver services that they have promised to enrolees. Finally, they should ensure there is collaboration between MIPS service providers and other social welfare institutions including – but not restricted to – the health department and the family planning committees.

In general, our study appears to illustrate a few important aspects of all kinds of health services. One is that assumptions may be made about willingness to pay that have little relevance to the consumers' views. Second, there are risks in allowing market forces to operate, especially where neither the consumers nor the suppliers are experienced in market operations and where the government fails to exercise adequate control. Finally, there are serious risks in failing to inform consumers of their rights, and to establish mechanisms whereby their views are solicited and taken into account.

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## References

- He Xing 1990, Developing fee-based maternal and child health services in Qinghai Province, *Maternal and Child Health Care of China*, vol 5 no 1, pp17-18.
- Jiangsu Department of Public Health 1998, *Maternal and Child Health Care of China*, vol 13 no 1, pp11-12.
- Jiesheng He 1988, A speech on the national health meeting of managers from provincial health department, *Maternal and Child Health Care of China*, vol 3 no 3, p2.
- Li Ke et al 1992, Developing different MIPSs positively, *Maternal and Child Health Care of China*, vol 7 no 5, pp5-6.
- Liangfa Yan et al 1997, Making effort to develop various MIPSs in Jiangxi Province, *Maternal and Child Health Care of China*, vol 12 no 6, pp332-334.
- Maternal and Child Health Office of Fujian Department of Public Health 1998, *Maternal and Child Health Care of China*, vol 13 no 1, pp11-12.
- Mei Zhao, Lingzhong Xu et al 1999, The coverage and its determinants of maternal and infant prepayment scheme in Shandong province. *Maternal and Child Health Care of China*, vol 14 no 9, pp554-555.
- State Statistical Bureau 1997, *China Statistical Yearbook, 1997*, China Statistical Publishing House.
- Xingzhu Liu et al 1997, Methodology for cost accounting for medical services, Nanhai Publishing House, 1997.
- Yu Peng 1998, Promoting further development of maternal and child health care system reform in China, *Maternal and Child Health Care of China*, vol 13 no 1, pp4-6.