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HOW MUCH WILL IT COST AND WHO WILL PAY?****Paper No. 2004-11****QINGYUE MENG, JIANGBIN QU SUN, SHIXUE LI, YING BIAN
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ABBREVIATIONS AND ACRONYMS

AD	Auto-destruct
AIDS	Acquired Immune Deficiency Syndrome
EPI	Expanded Program of Immunization
FFS	Fee-for-Service
GAVI	Global Alliance for Vaccines and Immunization
GDP	Gross Domestic Product
GIS	Government Insurance Scheme
HBV	Hepatitis B Vaccine
HCV	Hepatitis C Virus Infection
HIV	Human Immunodeficiency Virus
JE	Japanese Encephalitis
JICA	Japan International Cooperation Agency
MOH	Ministry of Health
SARS	Severe Acute Respiratory Syndrome
SSB	State Statistics Bureau
STIs	Sexually Transmitted Infections
TB	Tuberculosis
TST	Time, Steam, Temperature
UNDP	United Nations Development Programme
WHO	World Health Organization
WTO	World Trade Organization

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EXECUTIVE SUMMARY

An Overview of the Problem

Injection safety is a major concern in China and a high priority for the Ministry of Health. The unsafe use and inappropriate disposal of injection materials place patients, health care workers, and entire communities at increased risk for infection and injury. Annually, between 8 to 16 million Hepatitis B infections occur around the world due to unsafe injection practices. The number of Hepatitis C infections each year due to unsafe injections is between 2.3 to 4.7 million worldwide. One in fourteen people with Human Immunodeficiency Virus (HIV) contracted the virus through unsafe injections.

In 1996, the year that the Chinese government launched its National Expanded Program of Immunization (EPI) Safe Injection Plan for 1997-2000, only 30% of all injections were provided according to the national injection standard of one sterile syringe and one sterile needle for each injection. The Government of China, with assistance from its development partners, has made great strides in improving injection safety. The Ministry of Health has issued regulations regarding the safe disposal of medical waste, including injection materials for both immunization and other health (therapeutic) services. However, even today, use of non-sterile syringes, re-use of syringes, and unsafe disposal of syringes is not uncommon. In China's Yunnan Province, 50 to 500 HIV cases result each year from unsafe injections. Likewise, inappropriate disposal of injection materials has harmed many individuals, particularly children. About 65% of eye injuries in China's rural areas have been caused by improperly disposed needles. In 2001, 15.7% of health workers in Wulong of Chongqing were injured due to the improper destruction of injection needles.

While the use of disposable syringes has risen dramatically over the past decade, most of the increase has occurred in urban areas, where over 75% of immunizations are provided with disposable syringes. In rural areas, especially in the western provinces, disposable syringes are used in only 20% of immunizations. This figure is even lower for therapeutic injections, which account for more than 90% of all injections.

China's government aims to achieve safe injection practices in EPI by the year 2005. It has proposed that by the end of 2004 all immunization injections—in both urban and rural areas—be given by approved auto-destruct (AD) syringes.

Since the initiation of economic reforms in the mid-1980s, user fees have been increasingly relied on to finance China's public health programs. Concomitantly, the percentage of public funding covering total operating costs for preventive care services has dropped dramatically. Moreover, financial decentralization in the health sector has had the unintended consequence of widening the gap between public health programs serving rich and poor, particularly rural areas.

Improving injection safety is contingent upon many factors, not least of which is financing. In the short term, before health benefits can accrue, increasing safety means increasing costs—whether to the government, the health care user or both. In a rapidly changing economy and health care system such as China's, cost estimations are sorely needed if the government is to develop practical plans for financing and sustaining safe injection and disposal programs. Consequently, a study was designed, the results of which are the basis for the recommendations that conclude this Executive Summary.

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The Study

The study, carried out in 2003, had the following objectives:

- (i) To review recent changes in immunization financing and identify existing problems;
- (ii) To estimate the number of injections and type of syringe used (reusable vs. disposable) by service type (immunizations vs. curative injections) and level of administration (village, township, county, and city).
- (iii) To project the costs of ensuring an adequate supply of disposable and AD syringes; and,
- (iv) To estimate the costs and investigate the feasibility of alternative strategies of injection material disposal.

The study methodology relied on a combination of literature review, key informant interviews, and facility-based surveys. The interviews and surveys were conducted in the two study areas of Shandong and Shaanxi provinces. Shandong, located in the east, is China's second largest province, whereas Shaanxi is a smaller and less developed western province. In addition to the 216 interviews performed in the two study provinces, officers from relevant national institutions were also interviewed. A total of 95 facilities representing all four administrative levels (village, township, county and city) were surveyed in the two designated provinces.

The Study Findings

Paying for Safe Injections

The research revealed that immunization services in China are mainly financed through user service fees and EPI prepayment schemes. User charges cover labor costs associated with immunizations, injection materials, and other operational

costs related to immunization. The cost of obtaining a vaccination that is not part of the EPI program is borne entirely by the user. Most of the user charge for non-EPI vaccinations goes toward labor costs, with injection materials accounting for only a small portion of the service fee.

Health facilities reported that they did not have access to a specific government fund for ensuring injection safety and safe disposal of injection material. In addition, no specific instructions on the use of user fees for the safe disposal of used injection material exist.

Under the current system, health care providers have no financial incentive to adopt safe injection practices and practice proper disposal of injection material. Without public financial support and the promulgation of strict regulations, health care providers tend to focus on keeping down the costs of purchasing, sterilizing and disposing of injection materials—at the expense of safety.

The Number, Type, and Safety of Injections

Injections in China totaled an estimated 2.5 billion in 2003, with therapeutic injections accounting for 94%. The ratio of therapeutic injections to immunization injections was 15.7 to 1. Over half (58%) of all therapeutic injections provided in 2003 were administered by village clinics. The research team estimates the number of therapeutic/curative injections per outpatient encounter to be 0.46 at village clinics, 0.33 at township health centers, 0.19 at county hospitals, and 0.12 at city hospitals. The number of therapeutic injections per inpatient day is estimated to be 0.21 at township health centers, 0.54 at county hospitals, and 0.66 at city hospitals.

In the poorer province, Shaanxi, nearly a third (31.2%) of immunizations provided through village clinics were given with reusable syringes. Sterilizing conditions for reusable injection materials were generally unsatisfactory, especially in poor counties.

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Current and Future Costs of Injection Material¹

The cost of purchasing syringes for therapeutic injections delivered in 2003 would have been 625.4 million yuan. Syringes for immunizations would have required an expenditure of 35.6 million yuan.

In order to provide the seven recommended immunizations (BCG, DTP, Measles, DT, JE, Hepatitis B, and Meningococcal) by either disposable injection material or AD syringes in 2006, China would need to expend either an additional 65.4 million yuan for disposables, or 147.6 million yuan if only AD syringes are to be used. The incremental cost of replacing disposable syringes with AD syringes in 2006 would be 82.2 million, 10.2 million yuan of which would be for immunizing against Hepatitis B using AD syringes.

If the government were to cover 70% of the cost of AD syringes in each of the 12 western provinces, it would take anywhere from 0.09% to 0.49% of provincial health budgets to do so, or 0.72% to 3.38% of the funds budgeted for disease control and prevention.

Methods and Costs of Disposing of Used Injection Material

None of the recommended technologies—safety boxes, incinerators, or Time, Steam, Temperature (TST) spot indicators—were found at any of the study sites.

Village clinics rarely disinfect and destroy disposable syringes, as required, before burning and burying them. In both provinces, the heads of village clinics cited the combination of burning and burial as their favorite disposal system, most likely because, for them, it is the least expensive method.

¹ The study sites may not be sufficiently representative of all provinces in the country. Data and methodology limitations are discussed in section 2.5.

In Shandong, township, county, and city health facilities indicated a preference for a combination of disinfection/destruction and recycling. In Shaanxi, township health facilities, when given a choice, opted for a combination of safety boxes and burning. County and city health facilities, however, favored a system of disinfection/destruction and recycling, which is free for health facilities in Shaanxi's townships, counties and cities.

The estimated costs of disposing of used injection material vary by administrative level, study province and method or combination of methods employed. In Shandong, the larger province with higher per capita GDP, village clinics need to spend anywhere from 119 to 260 yuan a year. Disposal costs for township health centers range from 1,988 to 3,150 yuan. For county hospitals, costs run between 5,447 yuan and 16,754 yuan. City hospitals can dispose of used injection material at a cost of 79,031 to 141,469 yuan. In Shaanxi, village clinics must budget 32 to 94 yuan to dispose of injection material. Township health centers require 83 to 600 yuan. County hospitals need to expend 1,700 to 3,666 yuan, whereas for city hospitals the amounts are 47,578 to 120,078 yuan.

If the government were to cover 70% of the cost of disposing of used injection material, it would amount to less than 100,000 yuan per county in Shandong, and approximately 20,000 yuan per county in Shaanxi.

Policy Recommendations

Correct Financial Incentives for Public Health Care Providers. Current financial incentives lead public health facilities to neglect less profitable preventive health care services, in general, and injection safety in particular. In order to address this problem, the government should consider:

- Separate accounting systems for free immunization services and for-profit preventive care to assure appropriate use of public monies. The Government needs to clearly

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define the responsibility of public health care providers and regulate the allocation of public funds. Most importantly, EPI funds should not be used for the provision of for-profit health care.

- Establishing a specific fund for the purchase, distribution, and safe disposal of injection material for immunization services. If carefully regulated, such a fund would motivate health care providers to properly use and dispose of injection materials.
- Increasing subsidies to poorer areas to ensure equal access to new, safer injection technologies and encourage the adoption and continued practice of safe injection and disposal practices.

Reassess User Fees. The impact of user fees on the behavior of health care providers and users of immunization services is not yet well understood. On the one hand, increased revenue from user fees could motivate health care providers to expand and improve immunization services. On the other hand, higher fees may dissuade people, particularly the poor, from seeking immunization services. The policy guiding user fees in the public health sector should be revisited to examine its possible negative impact on utilization of immunization programs.

Ensure the Supply of Safe Injection Materials. The government needs to play a leading role in the organization and provision of safe injection materials. Compared to total health expenditures and the resources allocated to tertiary hospital services, the cost of replacing current injection materials is minimal. The government could make safer injection practices financially feasible by:

- Redirecting financial resources away from curative services and toward public health care;
- Increasing public funds for safe injection programs; and
- Requiring central and local governments to share the cost of replacing older technologies with new ones.

Develop and Institute Protocols for Disposal of Used Injection Materials. Methods for disposing of used injection materials vary by setting. Cost-effective methods acceptable to immunization providers in different localities or at different administrative levels should be developed. Based on cost and preferences expressed by those interviewed, the research team suggests:

- At village clinics, burning and burial should be the norm. Recycling, too, should be considered provided it is free of charge to village clinics, as is the case for higher-level facilities.
- At township, county, and city health facilities, disinfection/destruction and recycling should become standard procedure.

Strengthen Training Programs for Safe Injection Practice. Behavior of injection providers is one of the crucial determinants for injection safety. Training programs should be well organized and sufficiently offered to health providers to increase their awareness of risks of the unsafe injection and their skills of using appropriate system for sterilization and destruction of used injection material. Education to the general public is also required to increase awareness of the risks of unsafe injections for the communities.

1. Introduction

Injection safety is a major concern in China and a high priority for its Ministry of Health (MOH). In 2002 alone, about 3 billion injections were provided for both immunization programs and therapeutic services in China [1]. While use of disposable syringes has increased dramatically over the last decade, there is still much variation in use—both across provinces and between urban and rural areas. In urban areas, the coverage of disposable syringes for immunization services (immunizations account for 5% to 10% of all injections) is over 75% on average, while in rural areas, especially in western provinces, use of such syringes only accounts for about 20% of total syringe utilization [2]. For therapeutic injections, the coverage of disposable syringes is even lower [2].

This is a major improvement given that in 1996 only 30% of all injections were provided according to the national injection standard of one sterilized syringe and one sterilized needle for each injection [3]. However even today, use of non-sterile syringes, re-use of syringes and unsafe disposal of syringes is not uncommon. In 2000, in the western provinces of Shanxi, Shaanxi, Qinghai, and Ningxia, 28.1% of immunization injections were provided with shared needles [4]. In these same provinces, nearly 20% of disposable syringes were thrown away after use rather than being disinfected and destroyed [4]. In 2001, in the Puyang Prefecture of Henan Province, 75% of disposable syringes were thrown away in rural health facilities without any appropriate disposal measures being taken [5].

The unsafe use and inappropriate disposal of injection materials increase the risk of patients, health care workers, and the community at large contracting hepatitis B and C, as well as the Human Immunodeficiency Virus (HIV). About 8 to 16 million hepatitis B and 2.3 to 4.7 million hepatitis C infections result every year from unsafe injections worldwide.

Among people with HIV, 1 in 14 became infected through unsafe injections [3, 6]. It is estimated that 50 to 500 HIV positive cases in Yunnan Province each year can be attributed to unsafe injections [7].

Inappropriate disposal of injection materials has also caused serious harm to many communities, especially to children. About 65% of eye injuries in rural areas of China are caused by improperly disposed needles [8]. In 2001, 15.7% of health workers in Wulong of Chongqing city were injured due to the improper destruction of injection needles [9].

The Government of China, with the assistance of its development partners, has made major strides in improving injection safety. In 1996, the government issued the National EPI Safe Injection Plan of Action 1997-2000, which promised to increase coverage of safe injections for immunization programs. The Ministry of Health has also issued regulations on the safe disposal of medical waste, including disposal of injection materials for both immunization and therapeutic services. However, as indicated above, several problems still need to be addressed.

China's government has implemented its action plan with the aim of ensuring safe injection practices in EPI by the year 2005. In the national plan, it was proposed that by the end of 2004 all immunization injections—in both urban and rural areas—should be given by approved auto destruct (AD) syringes. In order to achieve these aims, each province has been asked to develop an implementation plan for transitioning to AD syringes. These plans must address: (i) disposal, including use of safety boxes, collection systems, and methods for destruction; (ii) supply and logistics; (iii) monitoring and supervision; and (iv) procurement and budgeting.

Ensuring injection safety is determined by a number of factors. One important factor in a rapidly changing health care system such as China's, is the mechanism for financing and sustaining safe injection programs. The government needs cost

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estimates in order to develop practical plans for financing and sustaining these programs.

The study attempts to answer three questions: How are immunization services currently being financed? What are the estimated current and future costs of supplying disposable and AD syringes? And, what are the costs of disposing of used injection materials?

The specific objectives of the study were:

- To review recent changes in immunization financing and identify existing problems;
- To estimate the number of injections and type of syringe used (reusable vs. disposable) by service type (immunizations vs. curative injections) and level of administration (village, township, county, and city).
- To project the costs of ensuring an adequate supply of disposable and AD syringes; and
- To estimate the costs and investigate the feasibility of alternative strategies of injection material disposal.

2. The Study Methodology

2.1 Study Sites

The investigators selected two provinces, Shandong and Shaanxi, as study sites based on their discussions with Ministry of Health (MOH) officials and officers from the National Immunization Program and the EPI program (Hepatitis B vaccination) in Shaanxi, which receives support from a GAVI project emphasizing the importance of systemic strategies for safe injections.

GAVI/Vaccine Fund to China is for US\$15.9 million in safe injection commodity assistance, and US\$21.9 million in vaccines (Hepatitis B mono does), plus one-time grant to cover the

costs associated with introducing new technologies.

Shandong is the second largest province in China, with a population of 90 million in 2001. Located in the east, the province is made up of 17 prefectures and 135 counties. Shandong has a relatively strong and rapidly developing economy, with a per capita GDP in 2001 of 8,673 yuan (US\$1,050). Economic development varies widely, however, across counties. Shandong's health system includes a network of 400 hospitals at the county level and above (98% public and 2% private), 10,500 clinics (half public/collective and half private), and 170 anti-epidemic stations (public). Tuberculosis (TB) and Sexually Transmitted Infections (STIs) are the major public health problems.

In comparison, Shaanxi Province is an economically underdeveloped province, located in the west of China. Shaanxi has a population of 36 million with a per capita GDP in 2001 of 4,549 yuan (US\$530). There are 91 hospitals at the county level and above, 80 anti-epidemic stations, 2,026 township hospitals and 28,530 village clinics, with a public-private mix similar to Shandong's health system. Hepatitis B and TB are the chief public health problems in this province.

Table 2.1 presents some indicators for the counties in Shandong and Shaanxi that were selected for inclusion in the study. Average per capita net income for the three Shandong counties closely approximates the average for the province as a whole. The two Shaanxi counties, which are recognized as among China's poorest, reflect the less developed status of the province.

According to the national population census in 2000, 74% of population were residing in rural areas and 36% were in urban areas. In 2002, per capita GDP was 7972 yuan for the country and per capita net income for rural people was 2476 yuan. Reported immunization coverage for EPI programs was 98% in 2001.

Table 2.1: Major Indicators for the Counties Studied, 2002

Indicators	Shandong			Shaanxi	
	Sishui	Weishan	Zhoucheng	Xunyi	Bin
<i>Economic development</i>					
Population (10,000)	59.5	68.5	110	26.8	31.2
% of rural (%)	11.0	17.6	36.3	95.0	95.0
% of urban (%)	89.0	82.4	63.7	5.0	5.0
No. of township	12	14	17	17	20
No. of village	574	580	883	280	325
Per capita GDP (yuan)	7200	6276	14319	1732	1958
Per capita net income (yuan)	2454	3700	3313	1324	1498
Gov't revenue (million)	240	330	712	41	52
Per capita Gov't revenue (yuan)	403	482	650	153	167
<i>Health care system</i>					
No. of village clinics	360	742	691	243	298
No. of township health centers	12	14	20	14	16
No. of county health facilities	8	5	7	5	4
<i>Immunization coverage of EPI</i>					
Reported coverage (%)	98	98	98	95	95
Estimated coverage (%)	85	85	95	75	75

However, there is no country-wide data indicating the actual immunization coverage.

2.2 Sources of Data

The main sources of information for the study were reviews of existing literature and reports, key informant interviews, and results from a facility-based survey. Documents reviewed include policy documents, World Bank and World Health Organization (WHO) mission reports, statistical reports, and published literature. Key informant interviews were used to explore problems and challenges relevant to financing immunization programs, including injection safety measures, and to assess feasibility of strategies for disposing of used injection materials. A facility-based survey was conducted for information on financing immunization injections and disposal of injection materials, for estimating the number and proportion of immunization injections, and for information on methods currently used to dispose of used injection materials.

2.3 Sampling and Data Collection Methodology

Key words used for literature searches included: immunization, disposable syringes, AD syringes, financing, costs, user fees, immunization coverage, and injection safety. Policy documents were collected from national and provincial authorities including health departments and disease control institutions. The WHO Beijing Office provided most of the mission reports. A Chinese literature search was conducted using the Qinghua University and Weipu databases, which are the largest in China.

Interviews were conducted in the two provinces of Shandong and Shaanxi. The study sites included the capital cities (Jinan in Shandong and Xi'an in Shaanxi) of each province, two counties in Shaanxi Province (Xunyi County and Bin County), and three counties in Shandong Province (Sishui County, Weishan County, and Zhoucheng County). For each of the counties in Shaanxi, two townships and

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three villages in each township were selected. For each of Shandong's three counties, two townships and five villages in each township were selected. Local officials and experts, together with the investigators, decided jointly on the selection of the counties, townships, and villages, based on the coverage of disposable syringes and the level of economic development. Interviews were carried out in each province with provincial and county officers responsible for safe injection management and regulation, as well as with the health managers and heads of each health facility selected (**Table 2.2**). Officers from relevant national institutions were also selected for interviews. The investigators developed a question or topic guide for these interviews (**see Annex 1**) and conducted them at the workplaces of those

individuals selected for interview.

For the facility-based survey, a total of 95 facilities at four levels in the two provinces were selected. In the capital cities of Jinan and Xi'an, the biggest provincial hospital and biggest municipal hospital in each were selected from among 10 such hospitals per city. In each of the five selected counties, the largest general hospital was surveyed. All the health centers in each of the selected townships were studied. About 29% of village clinics in Shandong, and 20% of village clinics in Shaanxi, within the selected townships were surveyed. All clinic heads were interviewed (each village clinic had 2-3 health workers). Institutional records were the main source of data. The survey was conducted in all the facilities selected for study.

Table 2.2: Samples for Investigations in the Two Provinces

Study Sites	No. of Facilities	No. of Interviewees on Current Immunization Financing and Problems (Objective 1)	No. of Interviewees on Costs and Feasible Methods of Disposal (Objective 4)
City: 2 in Shaanxi; 2 in Shandong	4 tertiary hospitals	9 officers	5 hospital managers
County: 2 in Shaanxi; 3 in Shandong	5 county hospitals	8 officers and CDC managers	10 hospital managers
Township: 4 in Shaanxi; 6 in Shandong	10 health centers	16 health managers	16 health managers
Village: 12 in Shaanxi; 64 in Shandong	76 clinics	76 heads of clinics	76 heads of clinics
Total	95	109	107

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2.4 Information Collected

Five categories of information were collected, either through direct investigation or literature review:

Financing of Immunization Programs

- Changes in immunization financing mechanism;
- Coverage and arrangement of EPI prepayment scheme;
- Percentage of immunization program costs financed by public funding, user fees or other;
- Distribution of expenditures on immunization services by injection materials and labor and other; and
- Difficulties in sustaining immunization programs financially.

Numbers of Injections

- Number of immunization injections by disposable and reusable syringes, and by level of administration; and
- Number of therapeutic injections by disposable and reusable syringes, and by level of administration.

Costs of Syringes

- Cost of syringes for immunization services;
- Cost of syringes for therapeutic services; and
- Future costs for ensuring adequate supply of disposable and AD syringes.

Costs of Disposal of Syringes and Needles

- Cost of various methods currently being used for disposal of syringes

and needles, by level of administration; and

- Estimated costs of alternative methods recommended for safe disposal of syringes and needles.

Viability of Methods for Disposal of Syringes and Needles

The viability of each disposal method was examined by taking into consideration the following five factors:

- Costs;
- Community safety;
- Health care provider safety;
- Environmental regulations; and
- Acceptability to health care providers.

2.5 Methodology and Data Limitations

At least three limitations have been identified in this study.

(i) The parameters for projecting the number of injections and costs of syringes, derived from the study sites, may be insufficiently representative for generalizing to the country as a whole. Estimates used to project the number of injections and the costs of syringes included: the number of injections per outpatient encounter and per inpatient day, the proportion of disposable versus reusable syringes, and the unit price of syringes. In poor areas, the number of injections per outpatient encounter and per inpatient day may be lower than average because inhabitants are less able to afford health care services. Similarly, the proportion used of more costly disposable syringes and the unit price of syringes may be lower than average. As mentioned previously, the two counties in Shaanxi are among the poorest in the country. In Shandong, two of the three counties studied — Zhoucheng being the exception — are less developed on average than

other counties in that province. Consequently, the estimates for the number of injections and the costs of disposable syringes for the country, in general, and economically advanced provinces, in particular, may have been under estimated. A similar problem arose when estimating costs for disposing of used injection materials. The costs of disposal may also be under estimated given that supplies and labor are less costly in poor areas, and that incinerators were not found at the study sites. One way to overcome these problems would be to expand the study to include more representative sites. Another option would be to adjust the results according to some estimates arrived at in future work.

(ii) The drop outs—children who do not complete a vaccination regimen— and overprovision of injections were not accurately estimated. Even if we were to redefine immunization coverage (see **Section 3.3.1**) for the purposes of this study, trying to reflect the numbers of injections provided to children without completing the whole standard immunization procedure and the numbers of children receiving too many immunizations, we still would not be able to guarantee the accuracy of the estimates used for immunization coverage because of a lack of empirical data. Given that it's not realistic to get the data from a population-based survey, one way of possibly improving the data's reliability would be to ask for more comments from a wide range of immunization officers and experts. Any changes in immunization coverage can be used for generating new projections with the existing software program.

(iii) This study only estimates actual costs of disposal of used injection materials; it does not establish standard costs. Disposal methods at study sites varied and were limited by the level of the health facility; estimates of actual costs were made for available methods only. For example, because village clinics used burial and burning only, we were not able to estimate costs of other methods at village clinics. In addition, the actual costs may not be used

to extrapolate the standard required costs, if the procedures used for disposal are not standard ones. The estimates are useful in that they reveal the least costly methods of supporting the current disposal system.

3. Findings

3.1 *Immunization Program Financing*

In this section, recent changes in health care financing are summarized. The mechanisms for financing immunization services at study sites are described, including a short review of the EPI prepayment scheme. The problems associated with immunization financing, and suggestions offered by study interviewees for redressing them are also presented.

3.1.1 Major Changes in Health Care Financing

In recent years, China's health care financing system has undergone several changes. Prior to the economic reform initiated in the 1980's, health care was financed for nearly 90% of the rural population by a community-based cooperative medical system supported by the government and the collective economy. Pre-payment schemes were underwritten by pooling together village communal funds, member contributions, and government subsidies. The urban population, on the other hand, was covered mainly by government health insurance and labor health insurance plans. Public hospitals and clinics were primarily funded through government budgets, and the costs of medical care were highly subsidized. With economic reform, which led to the collapse of the collective economy, the cooperative medical system in most rural areas was dismantled. As a result, about 90% of people in rural areas now pay the full cost of their own medical care [10]. In urban areas, the rapid rise in medical costs has made government and labor health insurance plans unsustainable [11, 12]. The percentage of public hospital costs covered by government budgets has decreased. User fees, which are mainly

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out-of-pocket-payments by households, and earnings from the sale of medicine, have become the major source of finance for public hospitals, accounting for about 90% of hospital revenues.

User fees for public health programs, including preventive care services, were introduced in the mid-1980s to meet the gap between costs and government budget allocations. In 2000, over 50% of the funding for disease control and prevention programs came from user charges [13]. Out-of-pocket payments made by individuals constitute more than half of total health expenditures since 1995 [14].

In 1995, about 226 billion yuan were spent in China's health sector, accounting for 3.9% of gross domestic products (GDP) [15]. A breakdown by source of payment reveals that 17% came from the government, 33% from employers, and 50% from out-of-pocket payments by individuals. About 6.8% of total health expenditures went to public health programs [15]. By 2001, national health expenditure had increased to 515 billion yuan, accounting for 5.4% of GDP [16]. Of total health expenditures, 15.6% came from government, 24.0% from employers, and 60.4% from out-of-pocket payments. About 5.3% of total health expenditures in 2001 were for public health programs. Between 1995 and 2001, the proportion of health expenditures attributable to out-of-pocket payments increased and the proportion of health expenditures for public health programs decreased.

Decentralization in health care financing, also initiated in the mid-1980s, has played a leading role in driving health sector reforms in China. Health funding and management responsibilities have been transferred from central and provincial governments to county and township governments. While decentralization can

strengthen the leadership capacity of local health facilities and encourage local support for developing the community health sector, it has, in this case, led to escalating medical costs and diminished access to medical services, especially for the rural poor. The research indicates that the rural health care system in poor areas, including the sustainability of the three-tier system, and promotion of health technologies has been negatively affected by financial decentralization [17]. Localities in poor areas, without support from richer areas or cross subsidies, have been facing difficulties in financing essential health services. A study that examined the relationship between financial decentralization and the performance of tuberculosis control programs found that tuberculosis programs in poorer counties performed more poorly than those in wealthier counties [18]. The chief problem related to decentralization is that low-level health facilities in poor areas are not adequately supported under the current fiscal system because a system of transferring payments has not been effectively established. The decision-makers are proposing strategies for addressing these problems, either by re-centralizing the rural health care system or strengthening the transfer payment system.

The study uncovered large variation in the financial capability of local governments to support social development programs between Shandong and Shaanxi (see **Table 2.1**). Per capita government revenue in the selected counties of Shandong was more than double that of the counties of Shaanxi. In addition, the net income of Shandong residents was much higher than among inhabitants of Shaanxi. **Table 3.1** shows the allocation of public funding for disease control centers by selected provinces.

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Table 3.1: Allocation of Public Funding for Disease Control Centers, 1999

Provinces	Expenditures (10,000 yuan)	Public Funding (10,000 yuan)	Public Funding as % of Total Expenditure	Public Funding per Capita (yuan)
Beijing	29034	6243	21.50	4.63
Shanghai	37692	14387	38.17	8.77
Liaoning	43984	16847	38.30	4.03
Jiangsu	55338	20057	36.24	2.75
Shandong	56985	20554	36.07	2.28
Hubei	42755	13091	30.62	2.20
Anhui	22321	11934	53.46	2.02
Henan	37251	15110	40.56	1.66
Sichuang	37021	14699	39.70	1.78
Guizhou	8845	6355	71.84	1.80
Shaanxi	11683	6192	53.00	1.72
Gansu	9023	6262	69.40	2.49
Qinghai	3345	2383	71.25	4.94

Data Source: Ministry of Health, Health Accounting Report, 2000.

Three major health financing reforms are being proposed or implemented at present in China. First, a rural health insurance system is being proposed. Based on the experience of the rural medical insurance system, the government is planning to establish a new health insurance system which would include coverage for catastrophic diseases and protect against the financial risks of disease. As of 2003, the central government allocates a 10-yuan specific subsidy for poor people, and the local government allocates a 10-yuan matching fund per person per year for initiating and sustaining the establishment of the insurance scheme [19]. In wealthy areas, the local government will be responsible for providing part of the financial support for operating the scheme. Second, urban health insurance reform is already under way. Employee-based urban health insurance, combining government health insurance and labor health insurance schemes, was widely established by the end of 2002, with about 940 million employees in urban areas covered [20]. Premiums for this insurance scheme call for 8% of total salaries — 2% contributed by employers and 6% by employees [21].

Basic curative services and essential drugs were provided in the service package. Third, funding policy for public health programs is being reoriented. This reform was initiated largely due to the outbreak of SARS in the first half of 2003. Rural health infrastructures for delivering public health programs will be strengthened by government support. In urban areas, specific departments for dealing with infectious diseases within hospitals are being set up, and municipal hospitals specializing in infectious disease are being updated. A total of 11 billion yuan have been budgeted for those activities [22].

3.1.2 Immunization Program Financing

Since their introduction in the mid-1980s, user fees have been increasingly relied on for covering the cost of immunization services, including EPI programs. Even though vaccines are still free for the users of the EPI program, fees are charged to cover the costs of labor and injection materials. There are two collection mechanisms: fee-for-service, where users are charged each time when they receive a vaccination; and the EPI prepayment

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scheme, where users pay premiums for a defined package of immunization services.

The EPI prepayment scheme was initiated in China in 1984, and its coverage has expanded to most of the country since then. Under the EPI prepayment scheme health care providers (insurers) established a set package of immunization services, as well as a compensation plan in case of inoculation accident, immunization failure, or disability and death due to any of the diseases for which immunizations were administered. By defining the services and compensating users for failings in service delivery, the EPI prepayment scheme gives providers incentives to immunize children according to established procedures and a recognized schedule of vaccines.

The EPI prepayment scheme has the following characteristics [23-35] (see details in Annex 2):

- Coverage—in most areas, children ages 0-7 were covered by the scheme, while in a few areas, it only covered children ages 0-4;
- Premiums—there are three types of premiums collected: whole period (0-7 years or 0-4 years); per year; and per vaccination. Premium levels varied from place to place and at different time periods. In general, premiums were higher in richer areas than in poorer areas;
- Service package—in almost all areas, EPI programs were covered through a prepayment scheme. In some counties, Meningococcal and Japanese Encephalitis (JE) were also covered. Some counties have included Hepatitis B immunization in recent years;
- Administration—in most cases, the fund was collected by township health facilities and administered by the county health authorities. The fund was

allocated to county, township, and village health institutions based on proportions agreed upon by the relevant parties;

- Use of the premiums—the premiums collected were spent on a range of costs related to immunization services, including labor, injection materials, and compensation; and
- Compensation—the amount of compensation varied depending on the location and type of vaccination. About 200 to 1000 yuan are provided for each case of polio. About 60 to 500 yuan are awarded for each case of epidemic cerebrospinal meningitis. A measles case is compensated with 30 to -500 yuan.

The two counties in Shaanxi used the EPI prepayment scheme with a premium of 12 yuan per child, for which the child's household was entirely (out-of-pocket) responsible. According to those interviewed, the EPI prepayment premium in Shaanxi, which is largely unaffordable to users, remained unchanged between 1995 and 2002 (Table 3.2). The premiums from the EPI prepayment scheme in Shaanxi were allocated in the following manner: 6 yuan went to village clinics where the immunization services were provided; 3 yuan went to township health centers; and 3 yuan to the county disease control center. According to the village clinic heads, these premiums do not cover the operating costs of providing immunization services, since the average premium is based on predicted birth rates, which are higher than the actual numbers. In Shandong Province, all counties studied used the fee-for-service method. Between 1995 and 2002, average user fees per vaccination increased only nominally, from 1.83 yuan to 5.17 yuan.

Donor funding — GAVI and JICA in Shaanxi and JICA in Shandong — was mainly used for purchasing vaccines. In theory, other costs including salaries of

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health providers and supplies should be covered by the government matching budget. However, in practice, user fees were the source for covering those costs. In 2002, in the study counties of Shandong

and Shaanxi, the cost of syringes for immunization services accounted for only 7%, and 21%, respectively, of total expenditures.

Table 3.2: Collection and Distribution of Revenues from User Charges for Immunization Services

Province	1995	2000	2002
Shandong			
Form of charges	Fee-for service	Fee-for-service	Fee-for service
Fee level	1.83 yuan per vaccination	4.5 yuan per vaccination	5.17 yuan per vaccination
Fee distribution			
Syringe	-	-	0.32 yuan
Labor and others	-	-	4.85 yuan
Shaanxi			
Form of charges	EPI Insurance	EPI Insurance	EPI Insurance
Fee level	12 yuan per child	12 yuan per child	12 yuan per child
Fee distribution			
Syringe	-	-	2.53 yuan
Labor and others	-	-	9.47 yuan

3.1.3 *Identified Problems in Financing of Immunization Programs*

Field interviews were conducted as part of the study to collect comments and suggestions about the financing of immunization services including: (i) problems in the current financing policy; (ii) possible alternative sources of financing for immunization programs; and (iii) suggestions for improving the financing of such services.

Most interviewees indicated that the role of government in financing immunization services has diminished since the introduction of user fees for public health programs. This causes at least three problems:

- The health care provider has no financial incentive to provide services with low profit margins, such EPI programs, when other services provide greater revenue. There is too much emphasis by providers on revenue generation, which is understandable given that most health facilities depend on revenues from user fees to survive.
- The responsibilities of public health facilities are unclear under the dual financing system, by which public health services are financed by both government subsidies and user fees. Many interviewees identified the dual financing system as a problem in itself. Public health facilities tend to use public resources to generate market revenues because the use of and outputs produced by public subsidies are not clearly defined and regulated. Some interviewees stressed that even if limitations on the use of public funds were put into place, it would still be difficult to control the behavior of health care providers who channel all resources given them so as to maximize revenues.
- Health officers in Shaanxi observed that an increase in fees would place children of poor families at risk for not using immunization services. Also given financial constraints, some poor families are only immunizing their male children.

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Interviewees identified several sources that could be explored for increasing support to immunization programs, including:

- *Larger Budget Allocations from the Government.* Additional government funding was the most frequently mentioned source for immunization services. Even though most of the interviewees recognize the efforts the government has made to support the immunization program, they think the government could do more by redirecting resources for public health programs.
- *Health Insurance Plans.* Support for immunization programs under the planned rural health insurance schemes could be considered. According to the current design of the rural health insurance schemes, only curative health care is included in the package. Essential public health programs, including immunization programs, could also be included.
- *Subsidies from the Department of Civil Affairs.* The current medical assistance programs focus only on medical services provided to families under the poverty line. The assistance programs might consider also including support for immunization programs targeted to children in poor families.
- *Donations from Enterprises and Wealthy Individuals.* In Shaanxi, donations were mentioned as a way of supporting immunizations not currently included in EPI. Manufacturers of injection material could help with the costs of disposal of by paying for the transportation of used injection materials to be recycled. This is being done for upper level health facilities and could be expanded to include lower level health units.

The main recommendations from the interviews were:

- The role of government in financing and organizing immunization programs should be strengthened. Government budgets, together with international financial aid, could fully cover the operating costs of EPI immunization services including labor costs and injection materials. The government needs to pay more attention to immunization programs in poor areas to ensure that their financial needs are met. The government can also recommend cost effective procedures for authorized immunization services.
- Financial incentives for safe injection practices and appropriate disposal of used injection materials should be established. In the government budget, a specific line item for encouraging appropriate disposal of used injection materials could be set up. This budget item could be used by health facilities to purchase disposal equipment and to cover related labor costs. Village clinics that are not reimbursed by regular government budgets could, with financial support from local collectives or upper level health facilities, establish standard procedures for disposal of used injection materials. A bonus can be given to reward village clinics that have adopted appropriate disposal methods.
- Use of public funding for public health programs should be regulated. Public funding allocated to preventive health care must be used for the provision of public health services. The government should establish regulations including accounting procedures and management

information systems to help monitor and evaluate the disbursement and use of public funds for health programs. Periodical reports on the use of public funding from health facilities should be provided to and assessed by the health authorities. Regulators should ensure timely correction of any abuse of public finances.

3.2 *The Overall Situation of Injection Safety*

This section presents three aspects of safe injection practices in study areas: utilization of disposable and reusable syringes; disinfection of reusable syringes; and disposal of syringes. **Annex 3** presents the injection safety situation as documented in the literature.

3.2.1 *Utilization of Syringes for Immunization and Therapeutic Services*

In Shandong province, 73% of village clinics, 67% of township health facilities, and all county and city health centers used only disposable syringes. In Shaanxi Province, 33% of village clinics used only disposable syringes. All county and township health facilities in Shaanxi used a mix of disposable and reusable syringes. One city hospital in Shaanxi used only disposable syringes while the other used a mix of disposable and reusable syringes.

Table 3.3 presents the proportion of disposable syringes used for both immunization and therapeutic services in Shandong and Shaanxi. Except for village clinics in Shaanxi, all other health facilities used only disposable syringes for immunization services. Village clinics in Shaanxi, which are the main providers of immunization injections in the province, used glass syringes for nearly one third of immunization injections.

At study sites in Shandong province, therapeutic injections were mainly provided using disposable syringes. Less than 10% of injections were given with reusable syringes in village clinics and township health centers, and no reusable syringes were used in county and city hospitals. In Shaanxi, on the other hand, reusable syringes were widely used in township health centers and county hospitals. Village clinics used a lower percentage of reusable syringes than was expected, however. This finding could be due to a bias in the selection of health facilities or to under reporting by staff in the clinics investigated. The difference between Shandong and Shaanxi most likely can be explained by economic differences between the two provinces, with Shandong health care users being better able to afford the more expensive disposable syringes. In addition, disposable injection material has been more widely promoted in Shandong Province.

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Table 3.3: Proportions of Syringes used for Immunization and Therapeutic Services

Study Site	Immunization		Therapeutic services	
	% of Disposable Syringes	% of Reusable Syringes	% of Disposable Syringes	% of Reusable Syringes
Shandong				
City	100	0	100	0
County	100	0	100	0
Township	100	0	95.6	4.4
Village	100	0	90.7	9.3
Shaanxi				
City	100	0	99.8	0.2
County*	-	-	66.9	33.1
Township	100	0	48.4	51.6
Village	68.8	31.2	90.8	9.2

*Immunization services are not provided

Table 3.4: Methods of Disinfecting Reusable (Glass) Syringes

Study site	No. of Facilities using Reusable Syringes	Steamed	Boiling	Washing
Shandong				
City	0	-	-	-
County	0	-	-	-
Township	2	2	0	0
Village	17	13	4	0
Shaanxi				
City	1	1	0	0
County	2	2	0	0
Township	4	4	1	1
Village	8	6	2	0

3.2.2 Sterilization of Reusable Syringes

Table 3.4 presents the methods used for sterilizing reusable syringes and needles. Steam was the most common method of sterilization for all health facilities that used reusable syringes. It was noted that two townships in Shaanxi still used a mix of boiling and washing methods. Another observation by the investigators is that the procedures and apparatuses used for sterilizing injection materials varied across

study areas.

All study sites in Shandong disinfecting by steam used high pressure pots, while in Shaanxi, 3 of 6 village clinics used common cooking pots for disinfection. All of the health facilities reported taking 30 minutes or more to disinfect by steam. **Figure 3.1** was taken in a village clinic in Bin County. It shows the apparatus used for sterilizing reusable injection materials.

Figure 3.1: Apparatus used for Sterilizing Reusable Injection Materials in a Village Clinic of Bin County



3.2.3 Disposal of Disposable Injection Materials

Table 3.5 indicates the methods for disposing of disposable syringes at study sites. Among village clinics in Shandong, a little more than half disinfect and destroy injection materials before disposal, while only 2 out of 12 clinics do so in Shaanxi. Burning and burial were the main methods of disposal in both provinces. Three out of the 63 village clinics in Shandong, and 1 of the 12 village clinics in Shaanxi, disposed of injection materials without prior disinfection and destruction.

At township health centers, all the facilities in Shandong burned material after disinfection and destruction, but without properly disposing of the residue (burial). In Shaanxi, two of the four township centers disinfected and destroyed injection materials, while only one center buried the residue.

Recycling after disinfection and destruction was mainly carried out, in both provinces, by county and city level hospitals. Manufacturers collected disposable injection material from hospitals for recycling, at no cost to these hospitals.

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Table 3.5: Methods of Disposing of Disposable Syringes

Study Site	No. of Facilities using Disposable Syringes	Disinfection/ Destruction	Burning	Burial	Recycling	Reuse	Throw
Shandong							
City	2	2	0	0	2	0	0
County	3	3	1	0	2	0	0
Township	6	6	6	0	0	0	0
Village	63	33	48	28	5	0	3
Shaanxi							
City	2	2	0	0	2	0	0
County	2	2	2	0	0	0	0
Township	4	2	4	1	0	0	0
Village	12	2	5	11	0	0	1

Figure 3.2: Containers for containing Medical Wastes in a Village Clinic in Xunyi County



Figure 3.3: The Stove used for Burning Medical Wastes in a County Hospital



Safety boxes were not used for storing used injection materials in either province. Medical wastes were stored in common paper boxes. **Figure 3.2** demonstrates the use of such containers in a village clinic in Xunyi county.

Incinerators were not present at any of the health facilities studied. Injection materials were burned over open fires. **Figure 3.3** shows the stove used in Xunyi Chinese traditional hospital for burning medical wastes including used injection materials.

A review of safe injection practice from empirical studies is presented in **Annex 3**. Combined the information from this study and the literature review, it can be conclude that the overall practice of safe injection is much better in wealthier provinces than that in poorer provinces. This can be clearly linked to the economic development situations for both health care users and suppliers. While the practice of safe injection can be further improved, more attentions for improving safe injection practice in poorer province should be paid by the government. Besides financial reasons that may cause the

differences in safe injection practice between the two types of areas, other determinants including capacity of health workers in implementing safe injection measures, education to the health users, monitoring and regulating systems could be the focus of the work.

3.3 Current Utilization and Cost of Syringes

Estimates of costs including cost of syringes (**this section and section 3.4**) and cost of disposal methods (**section 3.5**) are direct costs. Costs for supporting the implementation such as training activities, and costs for monitoring and evaluation of the safe injection practice, were not included. This means when a planning is developed, cost information provided from this study is just part of the total cost for the safe injection programme.

The method for estimating the costs of purchasing syringes is presented first, followed by estimates of the number of injections in 2003, for both immunization and therapeutic services. **Section 3.3.3** applies the costing methodology described below to the number of injections in 2003

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to arrive at the estimated costs of purchasing syringes for that year.

3.3.1 *Method of Costing Syringes for Injections*

Equation (1) was used for estimating the cost of syringes for therapeutic services.

$$(1) \text{ Cost} = \text{Volume of health services in 2003} \times \text{Number of injections per outpatient visit/per inpatient day} \times \text{Proportion of disposable/reusable syringes} \times \text{Unit price of syringes.}$$

The volume of health services was broken down into the number of visits for outpatient services and the number of hospital inpatient days. Data on outpatient visits and inpatient days was obtained from the National Health Services Survey and Statistical Yearbooks. The number of injections per outpatient visit or per inpatient day was obtained from the facility-based survey. Information on the proportion of disposable versus reusable syringes was obtained from literature review and the facility-based survey. The unit price of syringes was obtained from the facility-based survey.

Equation (2) was used for estimating the cost of syringes for immunization services.

$$(2) \text{ Cost} = \text{Number of target children for immunization by age group (<1 year; 1-7 years) in 2003} \times \text{Estimated immunization coverage by antigen in 2003} \times \text{Number of injections per child as programmed by age group (<1 year; 1-7 years)} \times \text{Proportion of disposable/reusable syringes} \times \text{Unit price of syringes.}$$

The number of children targeted to receive immunizations was determined by the immunization programs. All children under 7 years of age were covered in this study. The data came from the 2000 National Demographic Census. Children under 7 years old were divided into two groups: less than 1 year and 1-7 years, according to the availability of demographic data.

In addition to the immunizations prescribed by the EPI program, public health specialists recommend Meningococcal and Japanese Encephalitis vaccines (JE). Given their wide use and importance in disease prevention, they were included in cost estimations along with EPI vaccines. **Table 3.6** presents the seven immunization programs and the number of injections required to complete each program by the two age groups.

Table 3.6: Number of Injections for the Immunization Programs

Immunization programs	<1 year old	1-7 years old
BCG	1	0
DTP	3	1
Measles	1	1
DT	0	1
JE	0	3
Hepatitis B	3	0
Meningococcal	2	1
Total	10	7

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Table 3.7: Estimated Volume of Service and Injection Ratio in China in 2003

Indicators	Country			
	Village	Township	County	City
Number of outpatient visits (million)	2902.5	1286.4	704.5	510.6
Number of inpatient days (million)	0	181.0	280.2	257.2
Number of injections per outpatient visit	0.46	0.33	0.19	0.12
Number of injections per inpatient day	-	0.21	0.54	0.66
Percent of disposable syringes for therapeutic service	65	72	85	100
Percent of reusable syringes for therapeutic service	35	28	15	0
Number of injections for defined immunization (million)		146.87		
Percent of disposable syringes for immunization		78		
Percent of reusable syringes for immunization		22		

Table 3.8: Estimated Volume of Service and Injection Ratio in Shandong in 2003

Indicators	Shandong			
	Village	Township	County	City
Number of outpatient visits (million)	212.3	49.9	42.0	91.8
Number of inpatient days (million)	0	21.0	22.2	7.8
Number of injection per outpatient visit	0.61	0.53	0.18	0.12
Number of injection per inpatient day	0	0.30	0.69	0.70
Percent of disposable syringes for therapeutic service	90.7	95.6	100	100
Percent of reusable syringes for therapeutic service	9.3	4.4	0	0
Number of injections for defined immunization (million)		11.52		
Percent of disposable syringes for immunization		95		
Percent of reusable syringes for immunization		5		

Table 3.9: Estimated Volume of Service and Injection Ratio in Shaanxi in 2003

Indicators	Shaanxi			
	Village	Township	County	City
Number of outpatient visits (million)	79.7	30.4	19.8	25.8
Number of inpatient days (million)	0	4.9	8.1	7.0
Number of injections per outpatient visit	0.31	0.12	0.20	0.11
Number of injections per inpatient day	-	0.12	0.38	0.63
Percent of disposable syringes for therapeutic service	90.8	48.4	66.9	99.8
Percent of reusable syringes for therapeutic service	9.2	51.6	33.1	0.2
Number of injections for defined immunization (million)		3.53		
Percent of disposable syringes for immunization		60		
Percent of reusable syringes for immunization		40		

In this study the term “immunization coverage” reflects the number of immunization injections that are actually given — including unnecessary immunizations (over-provision) — to children under 7 years old. According to this definition, immunization coverage includes: (i) the percentage of children who are fully immunized, receiving the required number of injections for each antigen; (ii) the percentage of children who receive only some of the required vaccinations; and (iii) the percentage of children who are given unnecessary immunization vaccinations. Information for deriving the first proportion is available, but not for the latter two. The proportions of children who were “under-vaccinated” and “over-vaccinated” were determined based on input from provincial and county experts responsible for immunization programs. **Tables 3.14 to 3.16** present estimates for immunization coverage in 2003, as well as projections for 2004-2010. **Table 3.14** provides estimated figures for the economically advanced provinces, including Shandong, and **Table 3.16** gives estimates for undeveloped provinces such as Shaanxi.

As shown in **Table 3.6**, children under the age of one need to receive 10 injections to be fully immunized, while children ages 1-7 years can expect to receive 7 injections per year. For children aged 1-7 years, an average of 1 injection is given per child per year. The proportion of disposable and reusable syringes used for immunization services was obtained from the facility-based survey. As mentioned previously, the unit price of syringes was obtained from the facility-based survey.

3.3.2 Number of Injections

Data from the National Health Service Survey and the demographic census were used to estimate the number of expected outpatient visits and inpatient days for 2003. It was estimated that there would be

a total of 5,040 million outpatient visits and 718 million inpatient days in 2003. About 53.7%, 23.8%, 13.7%, and 8.8% of the total outpatient visits would be at the village, township, county, and city health facilities, respectively. Township, county, and city hospitals would deliver 25.2%, 39.0%, and 35.8% of the total inpatient days, respectively. The expected numbers of injections, for both therapeutic services and immunizations, to be provided by different level health facilities are presented in **Table 3.7**.

The total number of injections for immunization services is not disaggregated by type of service because information on the distribution of immunization services among the different levels of health facilities is lacking.

In Shandong, it was estimated that there would be a total of 396 million outpatient visits to health providers in 2003, 53.6% of which would be to village clinics, 12.6% to township health centers, 10.6% to county health facilities, and 23.2% to city health facilities. A total of 51 million inpatient days was expected to occur in 2003, with 41.3% in township health centers, 43.5 % in county hospitals and 15.2 % in city hospitals. A total of 11.5 million immunization injections would, therefore, have been provided in Shandong in 2003, with 95% using disposable syringes and 5% using reusable syringes (**Table 3.8**).

In Shaanxi, outpatient visits were expected to total 156 million in 2003, with 51.2%, 19.5%, 12.7%, and 16.6% going to village, township, county, and city health facilities, respectively. The total number of inpatient days would have been 20 million, with 24.4%, 40.5%, and 35.1% being at township, county, and city health facilities, respectively. About 3.53 million immunization injections would have been provided in Shaanxi in 2003, 60% of them given with disposable syringes (**Table 3.9**).

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The total estimated numbers of injections in 2003 for all of China are presented in **Tables 3.10 and 3.11**, by administrative level and type of syringe:

- About 2.3 billion injections would have been given for therapeutic services;
- About 146.8 million injections would have been provided for defined immunization services;
- The number of injections for both therapeutic and defined immunization services would have totaled 2.5 billion in 2003; and
- The ratio of therapeutic injections to defined immunization injections is 15.7:1.

Table 3.10: Estimated Number of Therapeutic Injections in 2003 (million)

Country	Therapeutic Injections		Total
	Disposable	Reusable	
City	230.3	0	230.3
County	242.4	42.5	284.9
Township	333.0	129.5	462.5
Village	867.8	467.3	1335.1
Total	1673.5	639.3	2312.8
Shandong			
City	16.5	0	16.5
County	22.9	0	22.9
Township	31.3	1.4	32.7
Village	117.5	12.0	137.5
Total	188.2	13.4	201.6
Shaanxi			
City	2.8	0.01	2.81
County	3.7	2.3	6.0
Township	2.1	2.2	4.3
Village	22.4	2.3	24.7
Total	31.0	6.81	37.81

Table 3.11: Estimated Number of Immunization Injections in 2003 (million)

Country	Immunization Injections		Total
	Disposable	Reusable	
Country	114.56	32.31	146.87
Shandong	10.94	0.58	11.52
Shaanxi	2.12	1.41	3.53

3.3.3 *Cost of Injection Syringes*

Tables 3.12 and 3.13 give estimates for the cost of syringes in China. The prices of disposable syringes for the country were estimated using field data from Shandong and Shaanxi. The costs of reusable syringes are based on 120 injections per syringe, as estimated by the health providers interviewed.

China would have needed 625 million yuan in 2003 to purchase syringes (disposable and reusable) for therapeutic injections. Nearly half the cost (44%) of purchasing syringes for therapeutic injections is generated by village clinics. Disposable syringes account for 98% of total purchasing costs. In Shandong, the purchase of syringes for village clinics accounts for more than 50% of total costs,

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with the remainder of costs shared by health facilities at the other three levels. In Shaanxi, two thirds of the total cost of purchasing syringes for therapeutic services is attributable to village clinics (Table 3.12).

For immunization services, China would have been required to spend 35.6 million

yuan on the purchase of syringes (disposable and reusable), with Shandong province accounting for approximately 10% of costs. In Shaanxi, half a million yuan would have been spent for purchasing syringes for immunization services. Again, nearly all of the costs can be ascribed to the purchase of disposable syringes.

Table 3.12: Cost of Syringes for Therapeutic Injections in 2003 (million yuan)

	No. of disposable syringes (million)	Unit price (yuan)	Cost (million yuan)	No. of reusable syringes (million)	Unit price (yuan)	Cost (million yuan)	Total Cost (million yuan)
Country							
City	230.3	0.69	158.91	0	-	-	158.91
County	242.4	0.34	82.42	0.35	2.50	0.89	83.31
Township	333.0	0.31	103.23	1.08	1.53	1.65	104.88
Village	867.8	0.31	269.02	3.89	2.38	9.27	278.29
Total	1673.5		613.57	5.33		11.81	625.38
Shandong							
City	16.5	0.80	13.20	0	-	-	13.20
County	22.9	0.40	9.16	0	-	-	9.16
Township	31.3	0.33	10.33	0.01	1.05	0.01	10.34
Village	117.5	0.34	39.95	0.10	2.92	0.29	40.24
Total	188.2		72.64	0.11		0.30	72.94
Shaanxi							
City	2.8	0.58	1.62	0	-	-	1.62
County	3.7	0.27	1.00	0.02	2.50	0.05	1.05
Township	2.1	0.29	0.61	0.02	2.00	0.04	0.65
Village	22.4	0.28	6.27	0.02	1.83	0.04	6.31
Total	31.0		9.50	0.06		0.13	9.63

Table 3.13: Cost of Syringes for Immunization Injections in 2003 (million yuan)

	No. of disposable syringes (million)	Unit price (yuan)	Cost (million yuan)	No. of reusable syringes (million)	Unit price (yuan)	Cost (million yuan)	Total Cost (million yuan)
Country	114.56	0.31	35.51	0.0503	2.13	0.107	35.62
Shandong	10.94	0.32	3.50	0.0048	2.15	0.010	3.51
Shaanxi	2.12	0.23	0.48	0.0009	2.11	0.002	0.48

3.4 Costs of Ensuring Adequate Supply of Disposable and AD Syringes

This section describes the method used for projecting the number of children under one year old, and between 1-7 years old, for 2004 to 2010, as well as the method for estimating the number of immunization injections for each of those years. Then, using current unit prices for disposable syringes, costs per immunization program, including Hepatitis B, are projected. The incremental cost of replacing disposable syringes with AD syringes for immunization services in 2006 is presented, followed by the incremental cost by province of using only AD syringes for Hepatitis B immunizations.

3.4.1 Method of Estimating Costs of Ensuring Adequate Supply of Disposable and AD syringes

Cost projections for supplying disposable and AD syringes were determined using the following assumptions and equations. All future costs are presented in present value terms.

(1) Projected Population

Data from the fifth National Demographic Census for the year 2000 was used in the equation below to make population projections.

$$P_n = P_0(1+r)^n$$

Where:

P_n = Number of population in project year;

P_0 = Number of population in 2000;

r = Growth rate of population; and

n = years from 2000 to the project year

(2) Projected Number of Children Less than One (1) Year Old and 1-7 Years Old

Projected number of target children = $P_n \times$
Proportions of children in total population.

The proportions of children under one year, and between one and seven years old, were obtained from demographic census figures for each province; it is assumed that the proportions remain fixed over the projected period.

(3) Immunization Coverage

As previously mentioned, immunization coverage is the percentage of children out of all those targeted who received all, some of, or too many of the required immunizations. Predictions for future immunization coverage relied on the following assumptions: (i) projected trends in immunization coverage are based on trends in recent years; (ii) current policy governing immunization program financing will remain unchanged for the years being projected; and (iii) no large-scale changes will be made to immunization programs during the years in question.

Immunization coverage, which was projected on the basis of information from the literature review (see Annex 4) and predictions from experts, was used to estimate the number of injections for defined immunization services in the projected years. Three different predictions of immunization coverage were made corresponding to three different levels of economic development. The criteria for classifying the areas included per capita GDP and baseline immunization coverage. The provinces categorized as economically advanced are: Beijing, Shanghai, Tianjin, Guangdong, Jiangsu, Zhejiang, and Shandong. The middle provinces are: Fujian, Hubei, Sichuan, Liaoning, Jilin, Heilongjiang, Shanxi, Jiangxi, Hunan, Hainan, Hebei, Xizang, Anhui, and Chongqing. The underdeveloped provinces are: Guizhou, Shaanxi, Gansu, Yunnan, Neimeng, Henan, Guangxi, Qinghai, Ningxia, and Xinjiang.

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Tables 3.14 to 3.16 show projected immunization coverage for the three types of areas.

(4) Unit Prices of Syringes

It was assumed that the prices of syringes in project years in real terms would be the same as present prices. This means we took current prices of syringes to estimate the costs in projected years.

GDP growth rate was used for correcting the inflation for project years. It was assumed that the GDP growth rate in recent years (8% annually) will be constant in the projected time period

(2004-2010). Prices of syringes in each of project years were adjusted using GDP growth rate taking the value in 2003 as the base.

(5) Estimation of Cost

The equation below was used to arrive at projected costs of syringes for immunization services.

Cost = Number of target children in a given year × Number of injections for each child as programmed × Immunization coverage as predicted × unit price of syringes.

Table 3.14: Projected Immunization Coverage for Advanced Provinces

Programs	2003	2004	2005	2006	2007	2008	2009	2010
BCG	80	80	80	85	85	90	90	95
DTP	75	80	80	85	85	90	90	95
Measles	80	80	85	85	85	95	95	95
DT	75	75	80	80	85	85	90	95
JE	60	65	65	65	70	70	75	80
Hepatitis B	40	55	60	65	70	70	75	85
Meningococcal	60	65	65	65	70	70	75	80

Table 3.15: Projected Immunization Coverage for Mid-Income Provinces

Programs	2003	2004	2005	2006	2007	2008	2009	2010
BCG	75	75	75	80	85	85	85	90
DTP	70	75	80	80	80	85	85	90
Measles	75	75	80	80	85	90	90	90
DT	70	70	75	75	80	85	85	90
JE	50	55	55	55	60	60	65	70
Hepatitis B	25	25	30	45	45	65	70	80
Meningococcal	50	55	55	55	60	60	65	70

Table 3.16: Projected Immunization Coverage for Underdeveloped Provinces

Programs	2003	2004	2005	2006	2007	2008	2009	2010
BCG	70	70	75	75	80	80	85	85
DTP	65	65	70	75	75	80	80	85
Measles	75	75	75	80	85	85	85	85
DT	65	65	70	75	75	80	80	85
JE	45	45	45	50	50	50	60	60
Hepatitis B	10	15	15	40	40	55	60	70
Meningococcal	45	45	45	50	50	50	60	60

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3.4.2 Number of Injections for Immunization Programs

The number of target children in a given year, the number of injections for each child as programmed (Table 3.6), and predicted immunization coverage (Tables 3.14 to 3.16), together generate the numbers of injections for 2004 to 2010.

Table 3.17 presents the number of injections in China for each of the seven years by immunization programs. In 2005, about 155 million immunization injections will be given, and that number will increase to 211 million by 2010. The largest increases in coverage are expected to occur in Hepatitis B, DT, Meningococcal, and JE.

Table 3.17: Projected Numbers of Injections for Defined Immunization Programs (million)

Programs	2004	2005	2006	2007	2008	2009	2010
BCG	10.59	10.91	11.47	12.12	12.37	12.71	13.30
DTP	42.55	45.11	47.08	47.43	50.80	51.16	54.60
Measles	22.76	23.97	24.61	26.00	27.58	27.78	27.98
DT	10.93	11.80	12.11	12.77	13.50	13.80	14.68
JE	25.68	25.86	26.73	28.62	28.82	32.17	34.13
Hepatitis B	12.19	13.71	20.74	21.39	27.60	30.02	34.70
Meningococcal	23.91	24.08	24.96	26.68	26.90	30.09	31.88
Total	148.61	155.44	167.70	175.01	187.57	197.73	211.27

3.4.3 Projected Costs of Syringes

The projected numbers of injections combined with the unit price of disposable syringes provide the projected costs of

purchasing disposable syringes in 2004 to 2010, as shown in Table 3.18. The assumption for this table is that only disposable syringes will be used as of 2004.

Table 3.18: Projected Cost of Injections using Disposable Syringes for Defined Immunization Programs (million yuan)

Programs	2004	2005	2006	2007	2008	2009	2010
BCG	3.49	3.93	4.47	5.09	5.57	6.23	7.05
DTP	14.04	16.24	18.36	19.92	22.86	25.07	28.94
Measles	7.51	8.63	9.60	10.92	12.41	13.61	14.83
DT	3.61	4.25	4.72	5.36	6.08	6.76	7.78
JE	8.47	9.31	10.42	12.02	12.97	15.76	18.09
Hepatitis B	4.02	4.94	8.09	8.99	12.42	14.71	18.39
Meningococcal	7.89	8.67	9.73	11.21	12.11	14.74	16.90
Total	49.04	55.96	65.40	73.50	84.41	96.89	111.97

Table 3.19 shows the costs of giving immunization injections using AD syringes exclusively, beginning in 2006. According to the findings of this study, the unit price of an AD syringe is 0.70 yuan. Other assumptions, including number of target children, immunization coverage,

and number of injection per child remain the same as in subsection 3.4.2. In 2006, 147.6 million yuan will be required for the purchase of AD syringes for use in defined immunization programs. By 2010, 251.4 million yuan, at present monetary value, will be needed.

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Table 3.19: Projected Cost of Injections using AD Syringes for Defined Immunization Programs (million yuan)

Programs	2006	2007	2008	2009	2010
BCG	10.09	11.51	12.74	14.11	15.83
DTP	41.43	45.06	52.32	56.79	64.97
Measles	21.66	24.70	28.41	30.84	33.30
DT	10.66	12.13	13.91	15.32	17.47
JE	23.52	27.19	29.68	35.71	40.61
Hepatitis B	18.25	20.32	28.43	33.32	41.29
Meningococcal	21.96	25.35	27.71	33.40	37.94
Total	147.58	166.26	193.20	219.48	251.41

Table 3.20: Projected Incremental Cost of Injections using AD Syringes replacing Disposable Syringes for Defined Immunization Programs (million yuan)

Programs	2006	2007	2008	2009	2010
BCG	5.62	6.42	7.17	7.88	8.78
DTP	23.07	25.14	29.46	31.72	36.04
Measles	12.06	13.78	15.99	17.22	18.47
DT	5.93	6.77	7.83	8.56	9.69
JE	13.10	15.17	16.72	19.95	22.53
Hepatitis B	10.16	11.34	16.01	18.61	22.90
Meningococcal	12.23	14.14	15.60	18.66	21.04
Total	82.17	92.76	108.79	122.59	139.44

Based on the cost estimates for disposable and AD syringes presented in **Tables 3.18 and 3.19**, the incremental cost of immunization programs switching to AD syringes was calculated. **Table 3.20** shows that in 2006, it will cost China 82.2 million yuan to replace disposable syringes with AD syringes for injections given under the seven immunization programs, with 10.2 million yuan of that

amount needed for Hepatitis B.

Table 3.21 presents the incremental cost (from 2006 to 2010) of replacing disposable syringes with AD syringes for defined immunization programs by province. In most of the western provinces, an increase of less than 3 million yuan will be enough for replacing disposable syringes with AD syringes in 2006.

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Table 3.21: Projected Incremental Cost of AD Syringes replacing Disposable Syringes for Defined Immunization Program by Province (million yuan)

Province	2006	2007	2008	2009	2010
TOTAL	82.17	92.76	108.79	122.59	139.44
Beijing	0.63	0.71	0.81	0.89	1.01
Tianjin	0.52	0.59	0.67	0.74	0.84
Shanghai	0.71	0.80	0.90	1.00	1.13
Jiangsu	4.14	4.68	5.31	5.91	6.71
Zhejiang	3.12	3.52	4.00	4.45	5.06
Shandong	6.31	7.13	8.11	9.03	10.28
Guangdong	6.76	7.68	8.78	9.83	11.23
Hebei	4.33	4.93	5.87	6.55	7.50
Shanxi	2.47	2.82	3.37	3.77	4.34
Liaoning	2.15	2.44	2.89	3.22	3.67
Jilin	1.38	1.57	1.87	2.08	2.38
Heilongjiang	1.85	2.10	2.49	2.78	3.17
Anhui	3.93	4.49	5.36	5.99	6.88
Fujian	2.00	2.27	2.70	3.01	3.44
Jiangxi	3.31	3.78	4.53	5.07	5.83
Hubei	2.96	3.38	4.00	4.45	5.09
Hunan	3.87	4.40	5.23	5.82	6.66
Hainan	0.62	0.70	0.85	0.95	1.10
Chongqing	1.87	2.13	2.52	2.80	3.20
Sichuan	5.25	5.99	7.11	7.93	9.08
Xizang	0.28	0.32	0.39	0.44	0.51
Neimenggu	1.30	1.44	1.69	1.95	2.18
Henan	6.13	6.77	7.98	9.21	10.34
Guangxi	3.09	3.42	4.03	4.65	5.22
Guizhou	3.40	3.78	4.49	5.21	5.89
Yunnan	3.73	4.14	4.91	5.68	6.41
Shaanxi	1.96	2.16	2.52	2.91	3.26
Gansu	1.77	1.96	2.31	2.67	3.00
Qinghai	0.40	0.45	0.54	0.61	0.69
Ningxia	0.47	0.52	0.62	0.72	0.81
Xinjiang	1.47	1.63	1.93	2.23	2.52

The government is planning to cover at least 70% of the cost of purchasing AD syringes for the western provinces. **Table 3.22** shows the amount the twelve provincial governments would have to spend on AD syringes for immunization (costs for purchasing AD syringes in 2006 were used). The costs to be covered by government budgets are also presented as a percentage of the total government health budget in each province, and as a percentage of the budget for disease

control and prevention in each province. Government health budget and budget for disease control were adjusted using the GDP growth rate (8% annually) taking the value in 2000 as the base.

If the government were to cover 70% of the cost of AD syringes in each of the 12 western provinces, it would take 0.09 to 0.49% of provincial health budgets, and 0.72 to 3.38% of the budgets for disease control and prevention.

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Table 3.22: Estimates of Government Budgets allocated to Purchasing of AD Syringes and Costs as a Proportion of Health Budgets in Western Provinces in 2006

Provinces	Cost of AD Syringes covered by Government Budget (10,000 yuan)	Total Government Health Budget (10,000 yuan)	Percent	Government Health Budget for Disease Control and Prevention (10,000 yuan)	Percent
	(1)	(2)	(1)/(2)	(3)	(1)/(3)
Chongqing	234.7	68305.7	0.34	8203.8	2.86
Gansu	222.4	71334.1	0.31	11588.8	1.92
Guangxi	388.7	91406.2	0.43	13058.6	2.98
Guizhou	427.5	86860.9	0.49	12632.3	3.38
Neimenggu	163.7	83907.9	0.20	18819.2	0.87
Ningxia	59.1	24735.7	0.24	3816.3	1.55
Qinghai	50.5	23069.2	0.22	4642.2	1.09
Shaanxi	245.8	80702.1	0.30	12568.2	1.96
Sichuan	659.7	182606.5	0.36	24900.9	2.65
Xinjiang	184.8	100709.2	0.18	13159.5	1.40
Xizang	35.1	40743.0	0.09	4895.5	0.72
Yunan	468.8	164892.7	0.28	27950.3	1.68

3.5 Cost of Disposal Methods

The method for estimating the cost of disposing of used injection materials appears below, followed by the estimated costs of various disposal methods, including disinfection/destruction, burning, burial, and safety box.

3.5.1 Method for Estimating the Cost of Disposing of Used Injection Materials

A two-step procedure was used for estimating costs to dispose of injection materials. First, the primary cost components of disposal were identified; and then the method for estimating the cost of each component was developed.

(1) Methods of Collection, Disinfection, and Destruction of Syringes and Needles

This is based on a review of documents on disposal practices in developing countries, interviews with immunization officers, and observations in the field. A health facility's system of disposal may, in fact, include one or more of the following methods or practices:

- Use of safety box(es)
- Disinfection/destruction
- Recycling
- Burning including incineration
- Burial.

(2) Estimating Costs

In order to estimate costs, each method had to be broken down into the following inputs: capital, labor, transportation, and supplies. Below are equations for costing each input.

(i) Capital

- Safety box: pieces used per year \times unit price;
- Incinerator: price per piece \times pieces per year/duration of years usable (annualized cost); and
- Open burning: cost per piece a year.

(ii) Labor

- Working days used for disposal of injection materials a year \times daily income;

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- (iii) Transportation
 - Cost per trip × number of trips per year (Travel to places for collection or recycling); and
- (iv) Supplies
 - Supplies include fuel or other types of material for burning and sterilization.

The total cost of each disposal system (a method or combination of methods) was calculated as the sum of the input costs.

3.5.2 *Costs of Disposal Methods*

Cost of disinfection and destruction of disposable syringes is reported in **Table 3.23**. In the study sites of Shandong Province, disinfection and destruction at the village level requires 135 yuan a year, 23% of which is spent on labor and 77% on supplies. Costs for disinfecting and destroying used injection material at township health centers and county hospitals are considerably higher in Shandong than in Shaanxi. This is likely attributable to the difference in volume of health services between the two areas. The difference in costs between the two provinces is much smaller for city hospitals. Labor costs in city hospitals account for about 31% of the total cost of disinfection and destruction in each province.

Costs for burning disposable injection material were low because incinerators were not used. Burning injection material costs less than 100 yuan a year in both

provinces. Township health centers in Shandong spend about 1,000 yuan a year to burn disposable material, which is 882 yuan more than in township health centers in Shaanxi. Labor in county hospitals comprises 44% of total burning costs in Shaanxi, and 63% in Shandong (**Table 3.24**).

In Shandong, burial is used only in village clinics, whereas in Shaanxi it is performed in township health centers as well. Labor costs for burial ranged from 18.5 to 36.6 yuan in the facilities that used this method of disposal. As previously mentioned, health facilities that participate in recycling, pay nothing for those services.

The investigators were shown samples of safety boxes that are to be introduced for Hepatitis B immunization services in Shandong and Jinan Centers for Disease Control. No other types of safety boxes were found at the study sites. The cost of a safety box was estimated based on the sample safety box. It is assumed that a safety box contains 500 disposable needles, and the time for cutting a needle is 30 seconds. Based on these assumptions and the estimated number of injections at study sites, the cost of using a safety box was calculated (the current unit price per safety box is 20 yuan in Shandong, and is assumed to be the same for Shaanxi where no safety boxes were found). The results are presented in **Table 3.25**. The total cost for using safety boxes is much greater in Shandong than in Shaanxi, mainly due to the higher number of injections in the former, as well as higher labor costs.

Table 3.23: Cost of Disinfection and Destruction of Disposable Syringes in 2002 (yuan)

Sites	Total Cost	Labor	Supply	Depreciation
Shandong				
Village	134.9	31.3	103.6	0
Township	1988.8	346.7	1642.1	0
County	13274.6	3897.8	7908.1	1469.7
City	141469.0	44229.0	91615.0	5625.0
Shaanxi				
Village	-	-	-	-
Township	254.0	34.0	220.0	0
County	2156.1	836.1	1320.0	0
City	120077.5	37277.5	82300.0	500.0

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Table 3.24: Cost of Burning Disposable Syringes in 2002 (yuan)

Sites	Total cost	Labor	Supply	Depreciation
Shandong				
Village	81.9	56.3	20.6	5.0
Township	1003.4	281.4	683.9	38.0
County	2299.9	1459.9	720.0	120.0
City	-	-	-	-
Shaanxi				
Village	43.9	31.0	12.9	-
Township	343.9	227.2	110.8	6.0
County	1964.5	836.1	1095.0	33.3
City	-	-	-	-

Table 3.25: Cost of Safety Boxes for Disposable Syringes per Year (yuan)

Sites	Total Cost	Cost of Safety Box	Labor	No. of Safety Boxes/Year	No. of Injections
Shandong					
Village	141.9	107.9	34.0	5.4	2696.1
Township	3150.1	1783.3	1366.8	89.2	44583.3
County	16754.0	7365.9	9388.1	368.3	184148.7
City	79031.4	19528.0	59503.4	976.4	488200.0
Shaanxi					
Village	32.4	28.0	4.4	1.4	698.9
Township	83.4	52.4	31.0	2.6	1309.0
County	1701.2	867.5	833.7	43.4	21688.0
City	47578.1	18724.9	28853.2	936.2	468122.5

Table 3.26: Cost of Combined Methods for Disposal of Syringes (yuan)

	SB+BN+BR	SB+BN	DD+BN+BR	DD+RC	DD+BR	BN+BR
Shandong						
Village	260.4	223.8	171.5	134.9	171.5	118.5
Township	-	4153.5	-	1988.8	-	-
County	-	19053.9	-	5447.3	-	-
City	-	79031.4	-	141469.0	-	-
Shaanxi						
Village	94.8	76.3	-	-	-	62.4
Township	462.1	427.3	597.9	254.0	288.8	378.7
County	3665.7	3665.7	-	2156.1	-	-
City	-	47578.1	-	120077.5	-	-

Safety Box (SB); Burning (BN); Burial (BR); Recycling (RC); Disinfection/Destruction (DD)

Table 3.26 shows total costs for feasible alternative systems, derived by combining the costs for the methods previously described. The combination of burning and burial is the most cost-effective method of disposal for village clinics in both Shandong and Shaanxi. At township

and county health facilities in both provinces, a system of disinfection/destruction and recycling is least costly. For city hospitals in Shandong and Shaanxi, the use of safety boxes, together with burning, is cheaper than disinfection/destruction and recycling.

3.6 Viability of Disposal Methods

WHO has recommended a series of strategies for the development of safe injection policy and practice [36]. These strategies include education and training of health providers on safe injection and disposal of used material, and the establishment of monitoring and supervision systems to ensure that proper procedures are followed. WHO strongly recommends placing used injection material in safety boxes or puncture-proof containers [37]. A collection system for disposing of full safety boxes or sharps containers should be available. The best practice is to have these containers transported to county level health facilities where incinerators for burning them are available. In remote areas where safety boxes or puncture-proof containers are not available, used injection materials should be burned and buried in deep pits.

The disposal of used injection material at study sites was rarely carried out according to WHO-recommended best practices. For instance, none of the health facilities participating in the study used safety boxes or puncture-proof containers. Investigators conducted interviews with health officials and personnel concerning the viability of various methods. Interviewees were asked to consider five factors that influence viability: costs;

community safety; health care provider safety; environmental regulations; and acceptability to health care providers. Interviewees were then told to rate the viability of each disposal practice. Interviewees gave one point to the practice or component they thought was most viable. Five points were given to the practice they deemed least viable.

Table 3.27 presents the average points for each practice rated by the interviewees. Even though each of the five factors influencing viability was explained to the interviewees, it seems that most of the interviewees gave extra weight to perceived costs and practicality. At village clinics in Shandong and Shaanxi, burning and burial were the preferred choices, mainly because interviewees thought those methods were easier to manage. They did not realize that burning and burial must be preceded by disinfection and destruction. Interviewees from health facilities in Shandong tended not to favor safety boxes because they thought they might be too costly. At the county and city level, Shaanxi interviewees opted for recycling because it is offered to them free of charge. This seems to imply that if recycling services were expanded through public funding, health facilities would widely embrace recycling as a method of disposal.

Table 3.27: Average Points given to Each Disposal Practice/Component

	Burial	Safety Box	Burning	Disinfection/ Destruction	Recycling
Shandong					
Village	3.18	3.97	1.98	2.81	3.06
Township	3.83	4.83	2.00	1.33	3.00
County	4.67	4.33	2.33	1.00	2.67
City	5.00	2.50	3.00	1.50	3.00
Shaanxi					
Village	2.18	3.82	2.27	2.91	3.82
Township	4.25	1.50	3.00	3.25	3.00
County	4.50	3.00	3.00	3.50	1.00
City	5.00	2.50	2.50	3.50	1.50

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Scores were also calculated for the alternative systems of disposal (first presented in **Table 3.26**), which represent feasible and effective combinations of methods. Every combined method was given a score by averaging together the 1-5 ratings of each component involved, with 1 being the most viable and 5 the least. **Table 3.28** presents the feasibility ranking for each of the combined methods by level of health facility.

The combination of burning and burial scored best among village clinics in both provinces. In township, county, and city hospitals in Shandong, the winning combination was disinfection/destruction and recycling. Among Shaanxi township facilities, the combination of safety boxes and burning outperformed other combined methods. However, this method's winning rank was in part due to the assumption—based on the availability of free recycling to Shaanxi health facilities higher than village clinics—that the safety boxes would be collected and taken to an incinerator free of charge. At the county level in Shaanxi, the combination of disinfection/destruction and recycling had the best ranking. For city health facilities in Shaanxi, two methods tied for most feasible: safety boxes and burning; and disinfection/destruction and recycling.

Combining the cost information presented in **Table 3.25** and the rankings shown in **Table 3.28**, the least costly and most acceptable disposal systems under present conditions would be: (i) burning and burial for village clinics; and (ii) disinfection/destruction and recycling for township, county, and city health facilities.

Table 3.29 presents the estimated costs of disposing of used injection material in each of the five counties studied. Costs were calculated by using the combined disposal method with the best ranking at each health level. There are two steps for calculating the costs for each county. First, a unit cost for the disposal method preferred at each level of health facility (e.g., burning and burial at village clinics) was established and then multiplied by the total number of health facilities at that level. Secondly, the totals for each level were added together to give the total cost for each county to dispose of all used injection material. The table also shows the reduction in costs to each county if the government were to underwrite a significant proportion of disposal costs. With the government covering 70% of costs, each county in Shandong could safely dispose of all of its injection material for less than 100,000 yuan a year. Under the same scenario, Shaanxi's two counties would need less than 21,000 yuan each.

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Table 3.28: Feasibility of Combined Methods for Disposal of used Injection Materials

	SB+BN+BR	SB+BN	DD+BN+BR	DD+RC	DD+BR	BN+BR
Shandong						
Village (Score)	3.04	2.98	2.66	2.94	3.00	2.58
Order	6	4	2	3	5	1
Township (Score)	3.55	3.42	2.39	2.17	2.58	2.92
Order	6	5	2	1	3	4
County (Score)	3.78	3.33	2.67	1.84	2.84	3.50
Order	5	4	2	1	3	5
City (Score)	3.50	2.75	3.17	2.25	3.25	4.00
Order	5	2	3	1	4	6
Shaanxi						
Village (Score)	2.76	3.05	2.45	3.37	2.55	2.23
Order	4	5	2	6	3	1
Township (Score)	2.92	2.25	3.50	3.13	3.75	3.63
Order	2	1	4	3	6	5
County (Score)	3.50	3.00	3.67	2.25	4.00	3.75
Order	3	2	4	1	6	5
City (Score)	3.33	2.50	3.67	2.50	4.25	3.50
Order	3	1	5	1	6	4

Safety Box (SB); Burning (BN); Burial (BR); Recycling (RC); Disinfection/Destruction (D/D)

Table 3.29: Costs of Preferred Methods of Disposal of used Injection Materials in the Study Counties in 2002

	Total Cost (yuan)	50% of Cost covered by Government Budget (yuan)	70% of Cost covered by Government Budget(yuan)
Shandong			
Sishui	82868	41434	58008
Weishan	123075	61538	86153
Zhoucheng	138001	69000	96600
Shaanxi			
Yunyi	25458	12729	17821
Bin	29744	14872	20821

4. Discussion

The China's health care financing reform has led to the increasing importance of user fee in covering costs of public health programs including immunization programs. Costs of labor and injection materials for EPI were covered by users and costs of disposal of used injectables were covered by the health care providers. In the poorer province, a proportion of health facilities still used re-usable syringes for both immunization and therapeutic services. Modern steam sterilizers were not widely used by lower level health providers, especially in the poorer province. Incinerators and safety box recommended by WHO and MOH for disposal of used injection materials were not widely used in both wealthier and poorer provinces. To ensure supplies of disposable and AD syringes for immunization programs in the future years will cost a small portion of health expenditures.

International studies have provided lots of evidences on prevalence of unsafe injection practice and its consequences. Besides the problem in provision of unnecessary injections with an estimate of 70% in total injections, more than 50% of the injections were unsafe in developing countries [38]. Unsafe injections result in tremendous burdens of both diseases and costs. About 33% of HBV infections and 42% of HCV infections in developing and transitional countries are caused by unsafe injections [39]. In South Asia up to 9% of new HIV cases may be caused by unsafe use of injections [39]. It was estimated that 80,000 to 160,000 HIV/AIDS cases may be caused by reuse of syringes and needles without sterilization annually in the world [40]. Unsafe injections also lead to a direct cost of 535 million US\$ a year [41].

China is a high endemic country with HBV and HCV and is facing increasing threats of HIV/AIDS. Even though there is no evidence to clearly clarify the contributing factors to high prevalence of HBV and HCV, unsafe injections would play a crucial role for the prevalence as

demonstrated in other developing countries. Large proportion of HIV/AIDS cases utilize injections for drug abuse in China, which shows the importance of improving practice of safe injections for this special population group. Shi reported that about 18 billion Chinese yuan was spent on treating hepatitis B patients and the ratio of benefit over cost of AD syringes replacing disposable syringes ranged 32.5 to 07.4 in 2001 [1].

This study focuses on the issues of financial elements in relation to support of immunization programs. However, this does not mean financing issue is the only determinant affecting implementation of immunization programs. Source of finance is one of the preconditions for delivering public health programs, but not automatically lead to better practice of public health services. How health resources can be reasonably allocated to strengthen capacity of health workers in delivering health care, and to increase affordability of health care users in use of public health programs, is more important. While the situation of shortage of resources for financing essential public health programs should be seriously aware, appropriate use of resources including training for both health care workers and users should be considered.

WHO has identified three main reasons for unsafe injections: lack of awareness of the risks of reuse of syringes; shortages of syringes and needles; and the absence of facilities for the safe collection of used injection equipment [42]. Making of a national plan of actions towards safe injection practice and monitoring and evaluation of the plan implementation are strongly recommended [43]. The financial reasons for constrain expansion of immunization programs and supplies of safer injection materials were presented in the result section. We below discuss the lack of awareness of the risks of unsafe injections and absence of facilities for disposal of injection equipment.

Lack of awareness of the risks resulted from unsafe injections could be for both

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injection users and providers. From user side, education about health consequences of safe injections may not be delivered sufficiently to the general public which affects the needs of users for safer injection materials. In rural areas, health education programs were not carried out effectively. Mixed use of reusable and disposable syringes in some village clinics in this study provided choice for users. However, it might be that only information on price of disposable syringes was informed to the users. There might lack explanations about the advantages of disposable syringes for ensuring safety to the users. From injection provide side, training of the safe injection practice may not be enough or absent. Training programs for health providers usually focused on therapeutic knowledge and skills. Training on safe injection practice may be ignored. This would especially happen for rural health facilities. The injection providers without education may underestimate the potential risks for both themselves and the communities.

Both wealthier and poorer provinces in this study showed limited use of standard incinerators and safety box for disposal of used injection equipment. This could imply that financial reason can not be the only explanation for choice of disposal methods. One possible factor influencing use of disposal system is lack of coordination for collective disposal of used injection materials. Health facilities, especially small-scale ones, usually have limited quantities of medical wastes within certain time period. Expensive equipment for disposal of the medical wastes can not be efficiently utilized. This would not encourage health facilities to purchase the equipment. If incinerators can be installed in a certain point and shared by a number of health facilities in rural areas, use of appropriate equipment could be increased. Limited use of safety box could be mainly contributed to the complexity of its utilization, besides price matter. Another reason may be that health providers do not realize the advantages to use of safety box. This needs introductory training to health care providers to use this type of products.

Even if the China's government has developed action plan for improving practice of safe injection, no evidence is found about the monitoring and evaluation of implementation of the plan. Regular and reasonable evaluation of the plan implementation is necessary for identifying priorities of problems for intervention in safe injection practice.

5. Policy Recommendations

Correct Financial Incentives for Public Health Care Providers. Current financial incentives lead public health facilities to neglect less profitable preventive health care services, in general, and injection safety in particular. In order to address this problem, the government should consider:

- Separate accounting systems for free immunization services and for-profit preventive care to assure appropriate use of public monies. The Government needs to clearly define the responsibility of public health care providers and regulate the allocation of public funds. Most importantly, EPI funds should not be used for the provision of for-profit health care;
- Establishing a specific fund for the purchase, distribution, and safe disposal of injection material for immunization services. If carefully regulated, such a fund would motivate health care providers to properly use and dispose of injection materials; and
- Increasing subsidies to poorer areas to ensure equal access to new, safer injection technologies and encourage the adoption and continued practice of safe injection and disposal practices.

Reassess User Fees. The impact of user fees on the behavior of health care providers and users of immunization services is not yet well understood. On the one hand, increased revenue from user fees could motivate health care providers

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to expand and improve immunization services. On the other hand, higher fees may dissuade people, particularly the poor, from seeking immunization services. The policy guiding user fees in the public health sector should be revisited to examine its possible negative impact on utilization of immunization programs.

Ensure the Supply of Safe Injection Materials. The government needs to play a leading role in the organization and provision of safe injection materials. Compared to total health expenditures and the resources allocated to tertiary hospital services, the cost of upgrading current injection materials is minimal. The government could make safer injection practices financially feasible by:

- Redirecting financial resources away from medical services and toward public health care;
- Increasing public funds for safe injection programs. The China's government has made substantial increase of budget in public health programs. Budget for programs for improving safe injection practice should be reasonably considered; and
- Requiring central and local governments to share the cost of replacing older technologies with new ones.

Develop and Institute Protocols for Disposal of Used Injection Materials. Methods for disposing of used injection materials vary by setting. Cost-effective methods acceptable to immunization providers in different localities or at different administrative levels should be developed. Based on cost and preferences expressed by those interviewed, the research team suggests:

- At village clinics, burning and burial should be the norm. Recycling, too, should be considered provided it is free of charge to village clinics, as is the case for higher-level facilities; and
- At township, county, and city health facilities, disinfection/ destruction and recycling should become standard procedure.

Strengthen Training Programs for Safe Injection Practice. Behavior of injection providers is one of the crucial determinants for injection safety. Training programs should be well organized and sufficiently offered to health providers to increase their awareness of risks of the unsafe injection and their skills of using appropriate system for sterilization and destruction of used injection material. Education to the general public is also required to increase awareness of the risks of unsafe injections for the communities.

References

1. Shi G, Xie YF, Zhang Y, Liu XY. Cost-Benefit Analysis of AD Syringes. *Chinese Journal of Epidemiology*, 2003, 24(3): 180-183.
2. Yu J. Review of Unsafe Injection in China. Unpublished document, Shandong University, 2003.
3. Department of Disease Control of Ministry of Health. Baseline Survey for Health VIII Project. *China Immunization Journal*, 1998, 4 (1): 1-9.
4. Li YX. Investigation on Current Status of Safe Injection of Preventive Inoculation in Five Provinces of Western China and the Affecting Factors. *Chinese Journal of Vaccines and Immunization*; 2002, 8 (6): 241-243.
5. Zhang YH. An Investigation on the Safety Injection Status of EPI Immunization of Grass-roots of Puyang City in Henan Province. *Chinese Journal of Epidemiology*; 2003, 24 (3): 175.
6. Unsafe Use of Injections and The Transmission of HIV. *Network for Infectious Diseases*, 2002, (4): 3.
7. Yuan JH, Loni G. Projection of HIV/AIDS: Situation in Yunan Province. *Chinese Journal of STI & HIV*, 2002 8(2): 78-81.
8. Luo Y, Sun X. Children's Eye Injuries. *Journal of Eye Injuries*, 2000, 22 (3): 268-269.
9. Li Q, Ou JM, etc. Investigation on Safe Injection Status of Medical Organizations in Wulong County in Chongqing City. *Chinese Journal of Epidemiology*; 2003, 24 (3): 176-179.
10. United Nations Task Force on Health. Report on Health in China. Unpublished report, Beijing, 2000.
11. Cai, R. A Review of Reforming China's Employee Basic Health Insurance System. In Proceedings of Reforming Health Services for Equity and Efficiency in Urban China held in Beijing on 4-6 December 2001.
12. Gao, J. and Tang S. Health Insurance and Hospitalization in Urban China: Bending to the Wind of Change. *World Hospitals and Health Services*, 2000, Vol. 36. No.3: pp23-26.
13. Ministry of Health. Health Finance Report. Unpublished report, Beijing, 2001, p129.
14. China Institute of Health Economics. Health Expenditure Report 1992-2000. Beijing, 2000.
15. Institute of Health Economics, Ministry of Health. Report on Health Expenditures 1990-1995. Unpublished data.
16. Zhao YX, Wan Q, Gao G, Du L. Health Expenditures in China 2001. *Chinese Journal of Health Economics*, 2003, 3(22):1-3.
17. Tang S and Bloom G. Decentralizing Rural Health Services: A Case Study in China. *International Health Planning Management*, 2000,15:189-200.
18. Meng Q, Li R, Cheng G, and Blas E. Provision and Financial Burden of TB Services in a Financial Decentralized System: A Case Study from Shandong, China. 2003 (Submitted manuscript).
19. Xinhua News Agency. Chinese Communist Part Committee and the State Council: Decision About Developing Rural Health Care and Financing Systems. 2002.
20. Ministry of Labor and Social Security and State Bureau of Statistics. Labor and Social Security Report, 2002.

Making Injections Safe in China: How Much Will It Cost and Who Will Pay?

21. China State Council. Decision About The Urban Health Insurance Reform. Economics Press, 2000.
22. Ministry of Health. Planning for Strengthening Public Health Programs. Unpublished document, 2003.
23. Zhang MC, Zhu B. The Content and Assessment of Immunization Insurance System [J]. Chinese Health Economics, 1989, (6) : 52-54.
24. Yuan LT, Yu JC, Qin CK. The Management and Benefit Evaluation of Immunization Insurance Fund in Dafeng County[J]. Jiangsu Preventive Medicine, 1994, 2: 38-39.
25. Gao Y. The Problem and Solution of Compensation After Pursuing Immunization Insurance System [J]. Jiangsu Preventive Medicine, 1994, 1: 22-23.
26. Bao LB. The Analysis of Relationship Between Immunization Insurance System and Immunization Coverage Rate of Four Kind of Vaccines in Chengdong Town of Qingyang County[J]. Anhui Preventive Medicine, 1996, 2 (4) : 76.
27. Wang X, Tian YB. Some Experience of Pursuing Immunization Insurance System[J]. Neimenggu Preventive Medicine, 1997, 22 (3) : 133-134.
28. <http://www.gdaw.gov.cn/new/fzgh/f5.htm>
29. Huang RL. Primary Exploration of Pursuing Immunization Insurance System in Chenghai County[J]. Chinese Rural Health Service Administration, 1991 (11) : 39-41.
30. Liu LQ, Jiang ZH, Wang XY. Immunization Insurance System Is An Important Measure to Confirm the Harvest of Planning Immunization[J]. Chinese Journal of Epidemiology, 1997, 18 (6): 181-183.
31. Meng XJ, Fang ZZ, Zang SB. Applying Immunization Insurance System and Promoting The Quality of Our Job Thoroughly[J]. Modern Preventive Medicine, 1998, 25 (3) : 358-359.
32. Zhang XQ, Pu ZL, Zou YX, etc. State Analysis of Immunization Insurance System in Rushan County [J]. Literature and Information of Preventive Medicine, 1999, 5 (4) :394.
33. Zhao XJ, Du JL. The Administration and Usage of Immunization Insurance Fund [J]. Chinese Journal of Public Health Mangement:Supplement, 1992,8(A08) : 32,28.
34. Xu YF, Cao YS, Tian W, etc. Primary Exploration of Using Children Immunization Insurance Fund Reasonably[J]. Chinese Journal of Public Health Management, 1991, 7(4):231-232.
35. Yao Y, Xie ZL, Zheng F, etc. The Effect Appraisal of Practicing Immunization Insurance System in Taining County[J]. Strait Journal of Preventive Medicine, 1995, 1 (1) : 48-49.
36. Battersby A., Feilden R., Stoeckel P., et. al. Strategies for Safe Injections. Bulletin of the World Health Organization, 1999, 77(12):996-998.
37. Yvan Hutin, Anja Hauri, Linda Chiarello, Mary Catlin, Barbara Stilwell, Tesfamicael Ghebrehiwet, Julia Garner, and the Members of the Injection Safety Best Practices Development Group. Best Infection Control Practices for Intradermal, Subcutaneous, and Intramuscular Needle Injections, 1999.
38. Simonsen, L., Kane, A., Lloyd, J. and Kane, M. Unsafe Injections in The Developing World and Transmission of Blood Borne Pathogens: A Review. Bulletin of the World Health Organization, 1999, 77:789-800.
39. The World Health Organization. Fact Sheet: Injection Safety. Fact sheet No. 231, 2002.

Making Injections Safe in China: How Much Will It Cost and Who Will Pay?

40. Hutin, Y., Chen, R.T. Injection Safety: A Global Challenge. Bulletin of the World Health Organization. 1999, 77: 787-788

41. Miller, M., Pisani, E. The Cost of Unsafe Injections. The Bulletin of the World Health Organization. 1999, 77:808-811.

42. The World Health Organization. Improving Immunization Safety in the Region. Combating Communicable Diseases, Geneva.

43. Maher, C. Progress in Improving the Safety of Injections in the EPI Western Pacific Region. 1998, WHO/EPI/TECHNET.98/WP.20.

Question Guide For Interviewing Key Informants

1. About the Financing of Immunization Services

- What are the policies for financing each component of the inputs (vaccine, disposable syringes, capital, labor, and other) for immunization?
- What are the problems in financing immunization?
- What do you think about the association between charges (user fees) and the use of immunization services?
- What solutions would you like to recommend for the problems you identified?
- Do you think providers are reasonably (adequately) reimbursed for the immunization services they provide?
- If reimbursement is inadequate, which inputs are not being covered (vaccine, disposable syringes, capital, labor, and other)?

- What are the mostly likely additional sources of financing (government, and user fees)?
- Which sources of financing would you recommend in order to assure adequate immunization coverage?

2. About the Prediction of Immunization Coverage

In our study, the term “immunization coverage” takes into account three categories of children: the proportion of children who are fully immunized using standard procedure out of the total number who need immunizations; the proportion of children who receive only some of all required vaccinations; and the proportion of children who are given unnecessary immunization vaccinations or more than the required doses. Could you please predict coverage for each antigen in the table below, using our definition of immunization coverage? (Classify coverage by three levels of economic development: advanced, middle, and undeveloped).

Programs	2003	2004	2005	2006	2007	2008	2009	2010
BCG								
DTP								
Measles								
DT								
JE								
Hepatitis B								
Meningococcal								

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3. About the viability of disposal methods for used injection materials

When judging the viability of a method of disposing of used injection material, consider the following five criteria: (i) costs; (ii) community safety; (iii) health care provider safety; (iv) environmental regulations; and (v) acceptability to health care providers. The interviewer will explain the criteria in greater depth when

he or she is interviewing you. Please do not hesitate to ask if you have any problems understanding.

Once you are certain you understand the meaning of the variables determining viability, please give one point to the most viable method and five points to the least viable method. And please give points to other methods accordingly (the fewer the points, the more viable the method).

Burial	Safety Box	Burning	Disinfection/ Destruction	Recycling
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Review of EPI Health Insurance System

Tables A2-1 and A2-2 summarize the major findings from the literature review regarding the EPI prepayment scheme. In the literature, the premiums varied by study site and year, ranging from 7.5 to 115 yuan.

Table A2-1 shows the distribution of EPI insurance expenditures on major service items. Nine of the 14 studies report that labor costs constituted 25% or less of expenditures. In Taining of Fujian Province, 64% of expenditures went to labor costs. Materials, including injection materials and maintenance of cooling

systems for vaccines, accounted for 20% or less of expenditures in eight of the studies. Two studies indicate that 40% of total insurance expenditures were used in the purchase of materials. Large differences in reimbursement were found between the studies. Ten of the 14 studies state that reimbursement of enrollees accounted for around 20% of total expenditures. Other studies show a very small proportion of expenditures being dedicated to reimbursement. In 9 of the 14 study sites, a surplus fund amounting to about 20% of insurance expenditures existed.

Table A2-1: Level of Premium Collected for EPI Prepayment Scheme (yuan)

Study sites	Time	Premium	Ref.
Henan	1988	16	[1]
Dafeng, Jiangsu	1993	28	[2]
Pei county, Jiangsu	1994	30	[3]
Qingyang, Anhui	1996	32	[4]
Sunite, Neimeng	1996	115	[5]
Nanhai, Guangdong	1997	85	[6]
Chenghai, Guangdong	1991	25	[7]
Changping, Beijing	1995	30	[8]
Huaiyin, Jinan	1998	35	[9]
Lushan, Shandong	1994	4/per vaccine	[10]
Lanxi, Zhejiang	1992	7.5	[11]
Fenghua, Zhejiang	1991	20	[12]
Taining, Fujian	1995	28	[13]
Guilin, Guanxi	1998	30	[14]

Table A2-2: Distribution of EPI Insurance Expenditures (%)

Study sites	Labor	Materials	Other Operating	Reimburse	Surplus	Ref.
Linyungang	48	12	8	12	20	[15]
Dafeng	11.17	40.12	22.70	0.52	25.01	[2]
Zuzhou	25.90	15.61	22.83	1.38	34.28	[16]
Rugao	25	18	17	20	20	[17]
Zhongshan	23.33	33.33	10	33.33	—	[18]
Chenghai	21	35	14	30	—	[7]
Wangyuan	42	20	18	20	—	[19]
Ranxi	25	40	5	20	10	[12]
Fenghua	24	20.2	18	15	22.8	[13]
Songjiang	19	19.5	18	23.5	20	[20]
Changping	17.36	11.86	5.15	0.024	66.60	[9]
Huaining	30	30	25	15	—	[21]
Taining	64	25	11	—	—	[14]
Guipin	20	20	25	15	20	[14]

References

1. Zhang MC, Zhu B. The Content and Assessment of Immunization Insurance System[J]. Chinese Health Economics, 1989, (6) : 52-54.
2. Yuan LT, Yu J.C., Qin, C.K. The Management and Benefit Evaluation of Immunization Insurance Fund in Dafeng County[J]. Jiangsu Preventive Medicine, 1994, 2: 38-39.
3. Gao, Y. The Problem and Solution of Compensation After Pursuing Immunization Insurance System[J]. Jiangsu Preventive Medicine, 1994, 1: 22-23.
4. Bao, L.B. The Analysis of Relationship between Immunization Insurance System and Immunization Coverage Rate of Four Kind of Vaccines in Chengdong Town of Qingyang County[J]. Anhui Preventive Medicine, 1996, 2 (4) : 76.
5. Wang X., Tian Y.B. Some Experience of Pursuing Immunization Insurance System[J]. Neimenggu Preventive Medicine, 1997, 22 (3) : 133-134.
6. <http://www.gdaw.gov.cn/new/fzgh/f5.htm>
7. Huang R. L. Primary Exploration of Pursuing Immunization Insurance System in Chenghai County[J]. Chinese Rural Health Service Administration, 1991, (11) : 39-41.
8. Liu L.Q., Jiang Z. H., Wang X.Y. Immunization Insurance System Is An Important Measure to Confirm the Harvest of Planning Immunization[J]. Chinese Journal of Epidemiology, 1997, 18 (6) : 181-183.
9. Meng X.J., Fang Z. Z., Zang SB. Applying Immunization Insurance System and Promoting the Quality of Our Job Thoroughly[J]. Modern Preventive Medicine, 1998, 25 (3) : 358-359.
10. Zhang X. Q., Pu Z. L. ,Zou Y.X., etc. State Analysis of Immunization Insurance System in Rushan County[J]. Literature and Information of Preventive Medicine, 1999, 5 (4) :394.
11. Zhao X. J., Du J.L. The Administration and Usage of Immunization Insurance Fund[J]. Chinese Journal of Public Health Mangement: Supplement, 1992,8(A08): 32,28.
12. Xu Y. F., Cao Y. S., Tian W, etc. Primary Exploration of Using Children Immunization Insurance Fund Reasonably[J]. Chinese Journal of Public Health Management, 1991, 7(4):231-232.
13. Yao Y., Xie Z. L. ,Zheng F., etc. The Effect Appraisal of Practicing Immunization Insurance System in Taining County[J]. Strait Journal of Preventive Medicine, 1995, 1 (1) : 48-49.
14. Luo L.B.,Huang Y. N., Zhang Q. Z. The Effect of Pursuing Children Immunization Insurance System in Guilin City[J]. Guangxi Preventive Medicine,1999, 5 (5) : 297-298.
15. Hao J. H. The Effect Observation of Pursuing Children Immunization Insurance System in City Zone[J]. Occupational Health and Emergency Rescue, 1997, 15 (2) : 101-102.
16. Liu J., Hu C. F., Bai Z. Y. Compensation Status Analysis of Immunization Insurance System in Xuzhou City. Jiangsu Preventive Medicine, 1997, 2: 54-55.

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17. Xu X. Y. ,Ren Z. L. ,Li X. D. Modus Operandi and Effect of Enforcing Children Immunization Insurance System Management in Rugao County. Chinese Primary Health Care, 1996,10(5):33.
18. Zhao W. Y .The Experience of Practicing Children Immunization Insurance System[J]. Chinese Journal of Vaccines and Immunization, 1995, 1 (2) : 38.
19. Deng H., He Z. Z. How to Administrate and Use Immunization Insurance Fund Efficiently[J]. Chinese Primary Health Care, 1996, 10 (1) : 40.
20. Shen S. L. ,Zhang Z.C. The Exploration and Practice of Planning Immunization[J]. Chinese Primary Health Care, 1999, 13 (3) : 31-33.
21. Hu H. W., Xu H., Li Q. The Discussion of Immunization Insurance System's Result in Huaining County[J].Anhui Preventive Medicine, 1999, 5 (2) : 203-20.

Documented Situation of Injection Safety

Nine studies were examined for the purpose of describing the types of syringes used, as summarized in **Table A3-1**. The following impressions were gathered from those studies:

- Time effect. Even though there were no cohort studies available for mapping changes over time in the type of syringe used, it seems that reusable (glass) syringes are increasingly being replaced by disposable syringes. In Anhui, a mid-income province, 12% of rural health facilities in the study used only disposable syringes in 1996. In Shaanxi, a poorer province, 21% of rural health facilities used only disposable syringes in 2000;
- Geographic variation. It seems that study sites in the wealthier provinces used a higher proportion of disposable syringes than less wealthy provinces during the same time period. In 1999, the study in Liaoning reported that 80% of health facilities were using only disposable syringes for immunization services, while Gansu, a poorer western province, reported only 3% of health facilities using disposable syringes for immunization programs; and
- Wider use of disposable syringes for immunization services. In most of the studies that included both immunization and therapeutic services, disposable syringes were far more likely to be used for immunization services than for therapeutic services.

Table A3-2 presents methods of disinfecting reusable syringes based on nine (9) studies. In rural areas, the proportion of health facilities using the boiling method for disinfection was higher than in urban areas in general. In Shanxi and Shaanxi, more than 60% of the rural health facilities studied used the boiling method in 1998. In Wulong county of Chongqing City, nearly 80% of health facilities still used the boiling method for syringe disinfection in 2002. In a study of five western provinces in 2000, more than 20% of health facilities wiped the needles with an alcohol solution while more than 10% of health facilities disinfected the needles by washing them with water.

Nine studies on methods of destroying disposable syringes are summarized in **Table A3-3**. All the studies for 1999, except in Gansu, reported burning a high proportion of disposable syringes and needles. However, there was no report on burial after burning. It was noted that more than 80% of health facilities studied in Gansu, and nearly 26% of health facilities studied in Liaoning, simply threw away disposable injection material after use, without taking any measures to disinfect and destroy material (1999). Studies in 2000 reported an increase in the proportion of disposable injection material that was buried. Recycling was also seen in about 20% of township health facilities in the five western provinces. In 2001 and 2002, the studies in Henan and Wulong of Chongqing indicated that a high proportion of health facilities in rural areas threw away disposable injection materials.

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Table A3-1: Proportions of Syringes used for Immunization/Therapeutic Services

Study Sites	Time	Location	Service	Proportion %			Ref.
				Disposable	Reusable	Mixed	
Anhui	1996	Rural	Immu.	12.12	51.52	36.36	[1]
Shanxi	1998	Urban	Immu.	92.00	8.00	—	[2]
			Therap.	67.70	32.30	—	
Hubei	1999	Rural	Immu.	72.81	27.19	—	[3]
			Therap.	46.37	53.63	—	
			Immu.	26.37	14.29	59.34	
Liaoning	1999	Rural	Immu.	80.49	0	19.51	[4]
			Immu.	61.3	6.5	32.2	[5]
			Therap.	3.03	28.28	68.69	
Fujian	1999	Rural & Urban	Immu.	72.5	7.5	20.0	[6]
Sichuan	1999	Rural & Urban	Immu.	45.64	54.36		[7]
Shaanxi	2000	Rural	Immu.	21.2	24.0	54.8	[8]
			Therap.	24.2	16.8	59.0	
Shanxi, Shaanxi,	2000	Village	Immu.	15.6	32.9	51.5	[4][9]
			Therap.	16.5	30.7	52.8	
Gansu, Qinghai, Ningxia		Township	Immu.	64.4	7.9	27.7	
			Therap.	49.3	11.7	39.0	

Rural and Urban (R & U)

Table A3-2: Methods of Disinfection for Reusable (Glass) Syringes

Study sites	Time	Location	Proportion %				Ref.
			Steamed	Boiling	Alcoholic	Washing	
Anhui	1996	Rural	62.5	37.5	0	0	[1]
Hebei	1997	Rural	25.4	73.0	0	1.6	[10]
Shanxi	1998	Urban	91.69	8.31	0	0	[2]
		Rural	36.04	62.77	0	1.19	
Henan	1998	Rural	26.4	69.4	4.2	0	[11]
Fujian	1999	Rural & Urban	75.8	24.2	0	0	[6]
Gansu	1999	Urban	80.6	19.4	0	0	[12]
		Rural	77.8	19.0	0	3.1	
Shanxi, Shaanxi, Gansu, Qinghai, Ningxia	2000	Township	77.0	15.0	20.4	9.7	[9]
		Village	77.8	41.7	23.1	12.4	
Hubei	2001	Rural	77.78	22.22	0	0	[3]
Chongqing	2002	Rural	21.7	78.3	0	0	[13]

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Table A3-3: Methods of Destruction of Disposable Syringes

Study Sites	Time	Location	Proportion %						Ref.
			Burning	Burial	D/D	Recycling 收	Reuse	Throw	
Hubei	1999	Rural & Urban	65.00			5.83		25.83	[14]
Fujian	1999	Rural & Urban	91.89			7.21*	0.83		[6]
Liaoning	1999	Village	100.0		0	0	0	0	[4]
Gansu	1999	Rural & Urban						>80.0	[12]
Shaanxi	2000	Rural	73.8	66.1	47.5	6.3	1.3	18.9	[8]
Ningxia	2000	Urban	76			24			[15]
Shanxi,	2000	Township	64.9	27.2	42.4	21.0	0	13.6	
Shaanxi,		Village	55.4	33.3	28.6	3.9	2.7	21.3	[9]
Gansu,									
Qinghai,									
Ningxia									
Henan	2001	Urban	6.67	0	86.67	0	0	6.67	[16]
		Rural	17.61	7.04	0	0	0	75.35	
Chongqing	2002	Rural	27.3	6.1	0	3.0	0	63.6	[13]

Rural and Urban (R & U); Disinfection/Destruction (D/D)

References

1. Shen YG, He ZM. An Investigation On the Safety of Injection in Immunization Service in Partial Rural Areas of Anhui Province. *Chinese Journal of Vaccines and Immunization*; 1998, 4 (30) : 159-160.
2. Zhang JS, M ZQ. Investigation On Safe Injection Status of Medical and Preventive Organizations in Shanxi (the capital is Taiyuan) Province. *Journal of Preventive Medicine Information*; 2001, 17 (3) : 174-176.
3. Jiang XQ. Investigation on Safe Injection Status of 120 Urban and Rural Grass-roots EPI Immunization Spots in Hubei Province. *Chinese Journal of Vaccines and Immunization*; 2002, 4, 8 (2) : 95-97.
4. Pang FS. An Investigation On the Safety of Injection in Immunization Service in Partial Rural Areas of Liaoning Province. *Chinese Journal of Vaccines and Immunization*; 2000, 6 (3) : 157-159.
5. Li H, He GS, C FQ. An Investigation on Present Situation of Safe Injection of Immunization Service in Different Economic Areas in Gansu Province. *Chinese Journal of Vaccines and Immunization*; 2001, 7 (4) : 218-220.
6. Yang Y, Zhou Y, etc. Present Situation and Affecting Factors of Safe Injection in Immunization Program In Fujian Province. *Chinese Journal of Vaccines and Immunization*; 2002, 8 (3).
7. Liu QL, Fang G, etc. An Analysis on the Safety Injection in Immunization Service in Sichuan Province. *Modern Preventive Medicine*; 2001, 28 (1) : 51-52.
8. Xia XQ, He HL, etc. Analysis on the Investigation of Safety Injection Status of Rural Grass-roots in Shanxi (the capital is Xi'an) Province. *Chinese Journal of Vaccines and Immunization*; 2001, 7 (6) : 352-355.
9. Li YX. Investigation on Current Status of Safe Injection of Preventive Inoculation in Five Provinces of Western China and the Affecting Factors. *Chinese Journal of Vaccines and Immunization*; 2002, 8 (6) : 241-243.
10. Cao YH, Li LJ. Investigation on Medicine and Immunization Injection Status in Rural Areas of Zunhua City. *Chinese Journal of Vaccines and Immunization*; 1997, 3 (5) : 231.
11. Nie ZP. Analysis on the Safety Injection Status of EPI Immunization of Puyang City. *Chinese Primary Health Care*; 1999, 13 (4) : 39.
12. He DP. Evaluation on the Quality of Immunization Service in Dingxi Areas in 2001. *Chinese Medical Theory and Practice. Chinese Journal of Vaccines and Immunization*; 2002, 2002 (4) : 517-518.
13. Li Q, Ou JM, etc. Investigation On Safe Injection Status of Medical Organizations in Wulong County in Chongqing Ciy. *Chinese Journal of Epidemiology*; 2003, 24 (3) : 176-179.
14. Jiang XQ. Investigation on Safe Injection Status of 120 Urban and Rural Grass-roots EPI Immunization Spots in Hubei Province. *Chinese Journal of Vaccines and Immunization*; 2002, 4, 8 (2) : 95-97.
15. Zhao R, Huang GM. Investigation on Safety Injection Status of Immunization Service in Three Districts of Shizuishan City. *Journal of Ningxia Medical College*. 2001, 23 (5) : 359-360.
16. Zhang YH. An Investigation on the Safety Injection Status of EPI Immunization of Grass-roots of Puyang City in Henan Province. *Chinese Journal of Epidemiology*; 2003, 24 (3) : 175.

Reported and Actual Coverage of Immunization Programs

1. The present situation in the country as a whole

According to the data from China's Health Ministry, the reported coverage rate for four kinds of vaccines included in routine immunization is summarized in **Table A4-1**.

Table A4-1 seems to indicate that except for in 1995, immunization coverage rates

for the four kinds of vaccines were all above 97% in 1990, 1999 and 2001.

This is not the case, however, as can be seen in **Table A4-2**. If we look at OPV, for example, we find that actual immunization coverage rates in different provinces were between 50% and 96.8% from 1997 to 2001 (inferred from the immunization information of children supplied by the AFP Inspecting System).

Table A4-1: Summary of Reported Routine Immunization Coverage Rate in China (%)

	1990	1995	1999	2001
BCG	99	92	98	98
OPV	98	94	98	98
DPT	97	92	97	98
MV	98	93	98	98

Data Source: [1].

Table A4-2: Distribution of Actual Immunization Coverage Rate of OPV, 1997- 2001

Actual Immunization Coverage Rate (%)	Province
0~60	Neimenggu, Xizang, Yunnan, Hubei, Jiangxi
60~70	Xinjiang, Guizhou, Hunan, Guangxi, Chongqing
70~80	Qinghai, Shaanxi (the capital is Xi'an), Henan, Ningxia
80~90	Gansu, Hainan, Guangdong, Fujian, Zhejiang, Liaoning, Anhui, Shanxi (the capital is Taiyuan), Heilongjiang
90~100	Beijing, Tianjin, Hebei, Shandong, Jiangsu, Jilin

Data Source: [2].

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2. The Difference between Reported Immunization Coverage Rate and Actual Immunization Coverage Rate among Some Provinces

In China the data gotten through monitoring and evaluation of reported immunization coverage rates are very rich. In order to further compare reported coverage rates with actual coverage rates, we provide in **Table A4-3** a summary of data from some typical provinces.

The data on Reported Coverage Rates (RCR) are drawn from the report forms on

routine immunization made by the Departments for Disease Control and Prevention in some provinces. The data on population and birthrate are from the local statistics department or the local Police. In Guizhou the birthrate data is obtained through spot checks. In Fujian, the effect of children of the floating population is taken into consideration when the actual coverage rate is computed.

The main causes for the difference between reported coverage rates and the actual coverage rates include:

Table A4-3: Comparison between Reported Routine Immunization Coverage Rate and Actual Immunization Coverage Rate in Some Provinces (%)

Province	Year		Immunization Programs					Ref.
			BCG	OPV	DPT	MV	HBV	
Neimeng	1999	RCR	98.47	98.70	98.56	98.45	97.6	[3]
		ACR	62.87	71.03	70.08	68.81	51.23	
		Gap	36	27	28	30	46	
Hubei	2000	RCR	98.92	97.61	97.17	96.76	86.55	[4]
		ACR	51.10	62.72	62.01	64.12	28.63	
		Gap	48	35	35	29	58	
Guizhou	1999	RCR	94.9	98.4	96.3	98.1	89.5	[5]
		ACR	70.2	76.9	72.9	83.7	6.6	
		Gap	25	22	23	14	83	
Hunan	2000	RCR	97.5	97.1	96.9	96.6	-	[6]
		ACR	80.1	79.8	79.6	79.3	-	
		Gap	17	17	17	17	-	
Hainan	2000	RCR	94.63	96.33	95.92	93.37	-	[7]
		ACR	92.55	91.66	88.76	83.36	-	
		Gap	2	5	7	10	-	
Zhejiang	1999	RCR	97.6	98.0	97.4	97.1	-	[8]
		ACR	78.8	82.7	83.4	82.7	-	
		Gap	19	15	14	14	-	
Liaoning	1999	RCR	-	99.2	100.8	100	99.8	[9]
		ACR	-	89.0	89.5	88.1	73.5	
		Gap	-	10	11	12	26	
Anhui	1998	RCR	90.5	94.9	95.1	92.7	90.2	[10]
		ACR	63.4	79.0	75.1	85.0	13.7	
		Gap	27	16	20	8	77	
Fujian	2001	RCR	96.9	98.1	98.3	97.2	97.8	[11]
		ACR	95.7	96.4	95.4	95.6	90.4	
		Gap	1	2	3	2	7	

Reported Coverage Rate (RCR); Actual Coverage Rate (ACR).

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- The population that should be immunized according to the Immunization Planning Department's figures is different from the birth population given by the local statistics department or the local Police.
- China's system of monitoring routine immunizations depends on source material from towns and villages. This type of grass roots data can be affected by subjective factors such as failing to report all cases or fabricating false reports.
- The method currently used to compute actual immunization coverage rates is somewhat flawed.

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References

1. Chinese Health Ministry, Chinese Health Statistics Abstract, 2002.
2. Zuo SY, Wang XJ, etc. Quality of Reports of Routine Immunization Coverage and Its Affecting Factors. Chinese Journal of Vaccines and Immunization; 2002, 8 (6): 337-340.
3. Wang HX, Li ZZ etc. Situation and Evaluation on Reports of the Routine Immunization Coverage Rate in Huhehaote City. Chinese Journal of Vaccines and Immunization; 2001, 7(5): 287-289.
4. Cheng SQ, ZH JS, etc. The Inspecting Report of Routine Immunization in Hubei Province in 2000. Hubei Journal of Preventive Medicine; 2001, 12(4): 2-4.
5. Zhou H, Zhu Q, etc. The Inspecting Evaluation of Routine Immunization Coverage Rate in Guizhou in 1999. Chinese Journal of Vaccines and Immunization; 2000, 6(5): 273-275.
6. Xie C, Li F, etc. Quality Evaluation on Reports of Routine Immunization Coverage Rate in Hunan Province and Its Influencing Factors. Practical Preventive Medicine; 2001, 8(4): 283-284.
7. Shi JR, Sun LY, etc. Monitoring the Status and Quality of the Report on Conventional Immunization Program in Hainan Province in 2000. China Tropical Medicine; 2002, 2(3): 401-403.
8. Ling LY, Li Q, etc. Analysis on Running Effect of the Surveillance System on EPI Routine Immunization in Zhejiang Province. Chinese Journal of Vaccines and Immunization; 2001, 7(3): 168-170.
9. Yu HJ, Yao WQ, etc. Analysis on New and Old Scheme <the Surveillance Scheme of Routine Immunization Coverage Rate> in Liaoning Province. Chinese Journal of Vaccines and Immunization; 2001, 7(6): 355-358.
10. Lu ZJ, Sheng YG, etc. Evaluation on the Routine Immunization Reporting System in Anhui Province in 1998. Chinese Journal of Vaccines and Immunization; 2000, 6(2):101-104.
11. Cheng QP, Liu WH, etc. Analysis on Running Effect of the Surveillance System on EPI Routine Immunization in Longyan City. Literature and Information of Preventive Medicine; 2002, 8(6):703-704.

Projected Numbers of Children, Injections, and Costs

Table A5-1: Projected Number of Children Below 7 Years of Age (million)

	2004	2005	2006	2007	2008	2009	2010
TOTAL	123.8	124.7	125.6	126.5	127.4	128.4	129.3
Beijing	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Tianjin	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Shanghai	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Jiangsu	6.1	6.1	6.1	6.2	6.2	6.2	6.2
Zhejiang	4.2	4.2	4.3	4.3	4.3	4.3	4.3
Shandong	8.5	8.5	8.5	8.6	8.6	8.7	8.7
Guangdong	9.4	9.5	9.6	9.7	9.8	9.9	10.0
Hebei	6.5	6.6	6.6	6.7	6.7	6.8	6.8
Shanxi	3.6	3.7	3.7	3.7	3.8	3.8	3.9
Liaoning	3.5	3.5	3.6	3.6	3.6	3.6	3.6
Jilin	2.2	2.2	2.2	2.2	2.3	2.3	2.3
Heilongjiang	3.1	3.1	3.1	3.1	3.2	3.2	3.2
Anhui	5.9	6.0	6.0	6.1	6.1	6.2	6.2
Fujian	3.1	3.1	3.1	3.1	3.2	3.2	3.2
Jiangxi	4.6	4.6	4.7	4.7	4.8	4.8	4.9
Hubei	5.0	5.0	5.1	5.1	5.1	5.1	5.2
Hunan	5.9	5.9	6.0	6.0	6.0	6.1	6.1
Hainan	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Chongqing	3.1	3.1	3.1	3.1	3.2	3.2	3.2
Sichuan	8.5	8.6	8.6	8.7	8.7	8.8	8.9
Xizang	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Neimenggu	2.2	2.2	2.2	2.3	2.3	2.3	2.3
Henan	9.3	9.4	9.5	9.5	9.6	9.7	9.8
Guangxi	4.8	4.8	4.8	4.9	4.9	5.0	5.0
Guizhou	5.0	5.0	5.1	5.2	5.2	5.3	5.4
Yunnan	5.4	5.4	5.5	5.6	5.6	5.7	5.8
Shaanxi	3.4	3.4	3.4	3.4	3.4	3.5	3.5
Gansu	2.8	2.8	2.8	2.8	2.9	2.9	2.9
Qinghai	0.6	0.6	0.6	0.6	0.6	0.6	0.7
Ningxia	0.7	0.7	0.7	0.7	0.7	0.8	0.8
Xinjiang	2.2	2.2	2.3	2.3	2.3	2.3	2.4

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Table A5-2: Projected Numbers of Injections for Defined Immunization Program (million)

	2004	2005	2006	2007	2008	2009	2010
TOTAL	148.61	155.44	167.7	175.01	187.57	197.73	211.27
Beijing	1.22	1.25	1.29	1.34	1.39	1.44	1.53
Tianjin	1.01	1.04	1.07	1.12	1.16	1.20	1.28
Shanghai	1.38	1.41	1.45	1.51	1.56	1.62	1.71
Jiangsu	7.95	8.18	8.45	8.83	9.16	9.54	10.17
Zhejiang	5.96	6.14	6.36	6.64	6.90	7.18	7.67
Shandong	12.05	12.41	12.87	13.45	13.98	14.57	15.57
Guangdong	12.80	13.24	13.79	14.49	15.13	15.85	17.02
Hebei	7.93	8.38	8.83	9.30	10.12	10.56	11.37
Shanxi	4.49	4.76	5.04	5.32	5.81	6.08	6.57
Liaoning	3.99	4.20	4.39	4.61	4.99	5.19	5.56
Jilin	2.55	2.69	2.82	2.97	3.22	3.35	3.60
Heilongjiang	3.42	3.60	3.77	3.97	4.30	4.48	4.81
Anhui	7.19	7.61	8.03	8.48	9.24	9.66	10.42
Fujian	3.68	3.88	4.08	4.29	4.66	4.85	5.21
Jiangxi	6.02	6.38	6.76	7.13	7.81	8.17	8.83
Hubei	5.49	5.78	6.05	6.38	6.89	7.18	7.71
Hunan	7.14	7.52	7.90	8.31	9.02	9.39	10.09
Hainan	1.12	1.19	1.26	1.33	1.46	1.53	1.66
Chongqing	3.45	3.64	3.81	4.01	4.34	4.52	4.85
Sichuan	9.67	10.20	10.71	11.30	12.26	12.79	13.76
Xizang	0.50	0.54	0.57	0.61	0.67	0.71	0.77
Neimenggu	2.20	2.29	2.66	2.72	2.91	3.14	3.31
Hennan	10.26	10.71	12.50	12.78	13.76	14.85	15.67
Guangxi	5.18	5.40	6.31	6.45	6.94	7.50	7.91
Guizhou	5.61	5.89	6.94	7.14	7.74	8.41	8.93
Yunnan	6.18	6.48	7.61	7.82	8.46	9.16	9.71
Shaanxi	3.31	3.45	3.99	4.07	4.35	4.70	4.94
Gansu	2.96	3.09	3.61	3.70	3.98	4.31	4.55
Qinghai	0.66	0.70	0.82	0.84	0.91	0.99	1.05
Ningxia	0.78	0.82	0.96	0.99	1.07	1.16	1.23
Xinjiang	2.44	2.56	3.00	3.08	3.33	3.60	3.82

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Table A5-3: Projected Cost of Disposable Syringes (million yuan)

	2004	2005	2006	2007	2008	2009	2010
TOTAL	49.0413	55.9584	65.403	73.5042	84.4065	96.8877	111.9731
Beijing	0.4026	0.45	0.5031	0.5628	0.6255	0.7056	0.8109
Tianjin	0.3333	0.3744	0.4173	0.4704	0.522	0.588	0.6784
Shanghai	0.4554	0.5076	0.5655	0.6342	0.702	0.7938	0.9063
Jiangsu	2.6235	2.9448	3.2955	3.7086	4.122	4.6746	5.3901
Zhejiang	1.9668	2.2104	2.4804	2.7888	3.105	3.5182	4.0651
Shandong	3.9765	4.4676	5.0193	5.649	6.291	7.1393	8.2521
Guangdong	4.224	4.7664	5.3781	6.0858	6.8085	7.7665	9.0206
Hebei	2.6169	3.0168	3.4437	3.906	4.554	5.1744	6.0261
Shanxi	1.4817	1.7136	1.9656	2.2344	2.6145	2.9792	3.4821
Liaoning	1.3167	1.512	1.7121	1.9362	2.2455	2.5431	2.9468
Jilin	0.8415	0.9684	1.0998	1.2474	1.449	1.6415	1.908
Heilongjiang	1.1286	1.296	1.4703	1.6674	1.935	2.1952	2.5493
Anhui	2.3727	2.7396	3.1317	3.5616	4.158	4.7334	5.5226
Fujian	1.2144	1.3968	1.5912	1.8018	2.097	2.3765	2.7613
Jiangxi	1.9866	2.2968	2.6364	2.9946	3.5145	4.0033	4.6799
Hubei	1.8117	2.0808	2.3595	2.6796	3.1005	3.5182	4.0863
Hunan	2.3562	2.7072	3.081	3.4902	4.059	4.6011	5.3477
Hainan	0.3696	0.4284	0.4914	0.5586	0.657	0.7497	0.8798
Chongqing	1.1385	1.3104	1.4859	1.6842	1.953	2.2148	2.5705
Sichuan	3.1911	3.672	4.1769	4.746	5.517	6.2671	7.2928
Xizang	0.165	0.1944	0.2223	0.2562	0.3015	0.3479	0.4081
Neimenggu	0.726	0.8244	1.0374	1.1424	1.3095	1.5386	1.7543
Henan	3.3858	3.8556	4.875	5.3676	6.192	7.2765	8.3051
Guangxi	1.7094	1.944	2.4609	2.709	3.123	3.675	4.1923
Guizhou	1.8513	2.1204	2.7066	2.9988	3.483	4.1209	4.7329
Yunnan	2.0394	2.3328	2.9679	3.2844	3.807	4.4884	5.1463
Shaanxi	1.0923	1.242	1.5561	1.7094	1.9575	2.303	2.6182
Gansu	0.9768	1.1124	1.4079	1.554	1.791	2.1119	2.4115
Qinghai	0.2178	0.252	0.3198	0.3528	0.4095	0.4851	0.5565
Ningxia	0.2574	0.2952	0.3744	0.4158	0.4815	0.5684	0.6519
Xinjiang	0.8052	0.9216	1.17	1.2936	1.4985	1.764	2.0246

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