

**FIELD STUDY REPORT OF
A POLIO EXPERT TRAINING COURSE
IN PEOPLE'S REPUBLIC OF CHINA**

March 1994

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LIST OF PARTICIPANTS

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SCHEDULE OF FIELD STUDY

- 15 March Arrival at Beijing
 Briefing at JICA China Office
- 16 March Visit Ministry of Public Health
- 17 March Briefing at Chinese Academy of Preventive Medicine
 Visit WHO Office and UNICEF Office in China
- 18 March Leave Beijing for Shandong
- 19 March Briefing at Shandong Provincial Epidemic Prevention Station
 Inspection of Polio Surveillance Center
- 20 March Briefing at Epidemic Prevention Station of Qufu City
 Inspection of Zhou Hospital
 Inspection of Township Health Center and Village Clinics at
 Liu Zhuang Village and Dong Village
- 21 March Briefing at Epidemic Prevention Station of Jining City
 Renchang District
 Inspection of Shandong Jining The First Hospital
- 22 March Briefing at Epidemic Prevention Station of Dong Ping County
 Inspection of Dong Ping People's Hospital
- 23 March Inspection of Bang Jiudian Hospital and Huuhe Village
- 24 March Arrival in Guangdong
- 25 March Briefing at Guangdong Provincial Epidemic Prevention
 Station
 Inspection of Nanhai County Epidemic Prevention Station
- 26 March Inspection of Department of Pediatrics, Nanhai Hospital
 Inspection of Township Health Centers in Xinsha and Seijyo
- 27 March Inspection of Laboratory in Nanhai
- 28 March Leave Guangdong for Beijing
- 29 March Briefing at Ministry of Public Health
 Briefing at JICA China Office
- 30 March Leave Beijing for Tokyo

OVERVIEW OF THE COUNTRY

YOSHIHIRO TAKASHIMA, M.D.

I. General Information

Introduction

China is one of the largest countries in the world with a total area of 9.6 million km² and a total population of 1.19 billion in 1993. The country is administratively divided into 30 provinces, in which population ranges from 2 million in the sparsely populated provinces to over 100 million in the most densely populated provinces.

From the capital, Beijing, the Chinese Government rules 22 provinces and the five "autonomous regions" of Inner Mongolia, Ningxia, Xinjiang, Guangxi and Xizang. Beijing, Tianjin and Shanghai are administered directly by the central government.

Geography & Climate

China is the third-largest country in the world, after Russia and Canada, with a total area of 9.6 million km². Only half of China is occupied by Han Chinese; the rest is inhabited by Mongols, Tibetans, Uigurs, and a host of other "national minorities" who occupy the periphery of Han China, in the strategic border areas. The Han Chinese, who first built their civilization around the Yellow River (Huang He), moved south and east towards the sea. The Han did not develop as a maritime people so expansion was halted at the coast; they found themselves in control of a vast plain cut off from the rest of world by oceans, mountains, and deserts.

China's topography varies from mountainous regions with towering peaks to flat, featureless plains. The land surface is a bit like a staircase descending from west to east (Figure 1). At the top of the staircase are the plateaus of Tibet and Qinghai in the southwest, averaging 4,500 meters above sea level. Tibet is referred to as the "Roof of the World". At the southern rim of the plateau is the Himalayan mountain range, with peaks averaging 6,000 meters high; 40 peaks rise 7,000 meters or more. Mount Everest, known to the Chinese as Qomolangma Feng, lies on the China-Nepal border.

Melting snow from the mountains of western China and the Tibet-Qinghai Plateau provides the headwaters for many of the country's largest rivers: the Yangzi (Chang Jiang), Yellow (Huang He), Mekong (Lancang Jiang), and Salween (Nu Jiang) rivers. At 6,300 km long, the Yangzi River is the longest in China and the third longest river in the world after the Nile and the Amazon. The Yellow River, approximately 5,460 km long and the second-longest river in China, is the birthplace of Chinese civilization.

China experiences great diversity in climate (Figure 2). Spread over such a vast area, the country is subject to the worst extremes in weather, from the bitterly cold to the unbearably hot. The warmest regions in winter are found in the south and south-west in areas such as Xishuangbanna, the south coast, and Hainan Island.

Winters in the north fall between December and March are incredibly cold. Beijing's temperature doesn't rise above 0 °C although it will generally be dry and sunny. North of the Great Wall, into Inner Mongolia or Heilongjiang, it's much colder with temperatures dropping down to -40 °C. Summer in the north is around May to August. Beijing temperatures can rise to 38 °C or more. In the north-west, it gets hot in summer, but at least it's dry. The desert regions can be scorching in the daytime. Turpan deserves the title of the "hottest place in China" with maximums of around 47 °C.

In the Yangzi River valley area (including Shanghai), summers are long, hot and humid. Wuhan, Chongqing and Nanjing have been dubbed "the three furnaces" by the Chinese. In the far south, around Guangdong, the hot, humid periods last from around April through September, and temperatures can rise to 38 °C as in the north. This is also the rainy season. Typhoons are liable to hit the south-east coast between July and September.

Demography & Birth Control

The official figures for 1992 show mainland China (excluding Taiwan, Hong Kong, and Macau) with a population of 1.171 billion people. Around a quarter of the total population lives in the cities and towns; the rest live in the villages, some of which are getting so large that they may soon have to be reclassified as cities (Figure 3). The birth rate, mortality rate, and population growth rate are shown in Figure 4. As late as 1971 the annual rate of population increase stood at 23 per 1,000 population, which would have doubled the population again in another 30 years. Currently the rate is down to 12 per 1,000 population, though this will still double the population in 48 years.

More than a quarter of the population is rated by the census as illiterate (people 12 years of age and over who cannot read or who can only read a few words). Those who have been to school number a respectable 600 million, but more than half of them have been to primary school only. There are 4.4 million university graduates and two million undergraduates.

Birth-control programmes instituted by the Communist government in the 1950s met with some success, but were abandoned during the Cultural Revolution according to the policy of Mao Zedong. It was not until 1973 that population growth targets were again included in China's economic planning, and campaigns like "Longer, Later, and Fewer" were launched. The current plan is to limit population growth to 1.25 million people by the year 2000. Recent projections, however, indicate that China's population will be close on 1.5 billion by the year 2010. All methods of birth-control are free; the most common ones are the IUD, female sterilization, and abortion.

In recent years the main thrust of the campaign in the cities is to encourage couples to sign a one-child pledge by offering them an extra month's salary per year until the child is 14, plus housing normally reserved for a family of four. If the couple have a second child then the privileges are rescinded, and penalties such as demotion at work or even loss of job are imposed.

The birth-control measures appear to be working in the cities, but it is difficult to say what is happening in the villages or if the target of zero growth can ever be attained or not. The catch is that Chinese agriculture still relies on human muscle and farmers find it desirable to have many children. The Chinese press has often talked about "birth guerrillas" - pregnant women who hide out in the countryside until the child is born. Such births may not even be officially recorded or registered. If these women are discovered after she has already given birth, she can expect to face a steep fine, loss of employment, and other penalties.

Provincial Demography & Economy (Table 1)

China consists of 22 provinces, 5 autonomous regions, and 3 municipalities which are directly administrated by the central government (Figure 6). Provincial population (including 5 autonomous regions and 3 municipalities) ranges from 2 million in the sparsely populated provinces to over 100 million in the most densely populated provinces, and provincial area ranges from less than ten thousand km² such as Shanghai to over 1.6 million km² such as Xinjiang. From the viewpoint of population and area, some provinces are much larger than some countries in Asia.

Although all provincial governments are politically and administratively under the central Chinese Government, each province is situated in very different geographic, demographic, economic, and social conditions, which may make provincial public health conditions and activities vary widely. Figures 7, 8, and 9 also indicate some demographic, economic, and social data and features by province.

Comparison with Other Asian Countries

For deeper understanding on China, some statistical figures are shown in Table 2 for comparison with other Asian countries.

II. Health and Medical Services

Introduction

China is one of the largest countries in the world. In spite of the country with a vast area and a huge population, the People's Republic of China has continuously made strenuous efforts to establish and develop a well-organized health and medical service system since its foundation. Although the organizational structure for health and medical administration system in China is also enormous to provide health and medical service to all of its people, it is not complicated but simple because of its multi-tier structure of similarly organized administration body at any administrative level; central, provincial, prefectural, and county. While a system for notifying central regulations to peripheral levels has been already set up, it means that it is not easy for the national level to obtain real information on peripheral conditions because of a vastly wide base of a pyramid or multi-tier of its administrative structure.

Organizational Structure of Health Administration (Figure 10)

China is administratively divided into 22 provinces, 5 autonomous regions, and 3 municipalities. These are further divided into 339 prefectures, 2,833 counties, 58,000 townships, and finally divided into 766,500 villages.

Each provincial, prefectural, and county government has Public Health Bureau (PHB). *Provincial* PHBs consist of department of medical service, department of epidemic prevention, department of MCH, department of Chinese medicine, etc.. *Prefectural* PHBs have same organizational structures as provincial PHBs, in which hospitals are managed by departments of medical service, MCH stations by departments of MCH, and epidemic prevention stations (EPSs) by departments of epidemic prevention. *County* PHBs have hospitals, MCH stations, and EPSs under the same organizational structure as provincial and prefectural level. County PHBs also regulate *township* health centers whose functions will be mentioned later. At *village* level, village doctors have responsibilities for primary medical care, epidemic prevention, MCH, technical guidance on family planning, and community health promotion in their villages.

Data and information on the 36 notifiable diseases are collected from doctors of hospitals or MCH stations at any levels and sent to PHBs at each level. This is the routine surveillance system for epidemic prevention and control. On the other hand, data and information on acute flaccid paralysis are collected from doctors of hospitals or MCH stations at any levels or by active surveillance teams of EPSs and sent to EPSs at each level.

Health Facilities and Personnel

In 1949, there were only 3,670 health and medical institutions, 80,000 hospital beds (Figure 11) and 541,000 professional health and medical workers including 505,000 technical personnel (Figure 12). Since the founding of PRC, great progress has been made in the health services in China. By 1991, health and medical institutions have grown to around 209,000 in number including 63,000 hospitals, 129,000 outpatient departments and clinics, 3,652 epidemic prevention stations, and 2,854 MCH centers.

According to statistics of 1992, China has 2,774,000 beds and 3,692,000 professional health and medical worker distributed in more than 15,000 hospitals at the county level or above and in more than 40,000 health centers at the township level. Among the all hospitals, 47 are affiliated to the Ministry of Public Health (MOPH), 76 to the municipalities of Beijing, Tianjin, and Shanghai, and 62 are placed at the capitals of provinces or autonomous regions to which they are affiliated.

The number of medical colleges or schools in China is 121. China has more than 330 schools of secondary medical education, 1,047 training schools at the county level for junior health professionals, and 41 medical colleges and 174 medical schools of medium grade of adult education for health professionals

Health Services in Rural Area (Figure 10)

Since 80% of its population live in the rural areas, the Chinese Government has given one of top priorities to the health services in rural areas. The government has tried to provide improved health and medical services to residents in rural areas through the improvement of three-tier health and medical networks embracing counties, townships, and villages.

There are 1,986 *counties* in the whole country, which have 2,199 general hospitals, 1,893 EPSs, and 1,722 MCH stations in total in 1991. The counties also have secondary health schools, vocational health technical schools, drug quality control institutions, and specialized diseases control institutions. Health and medical institutions at county level have played, as the centers for diseases prevention and control for the whole country, one of the most significant roles in disease prevention and control, development of primary health care, reinforcement of technical guidance to health and medical facilities at township and village levels, and training of health workers from the grass-roots level.

At the *township* level, health centers have been set up, with one third of which are run by the states and the reminder by the collectivities. In the whole country, 38,248 health centers are run with 432,452 beds (11.3 beds per center) and 560,000 professional health workers (14.8 workers per center). The health center is a multifunctional health

institution in charge of health administrative management, technical service delivery on medical care, epidemic prevention, family planning, etc..

At present, 87.7% of administrative *villages* have set up village health organizations in diverse forms, which are mainly run by the village communities. The village doctors have responsibilities for primary medical care, epidemic prevention, MCH, technical guidance on family planning, and community health promotion in their villages. The number of village doctors and health aids (called "barefoot doctor"s) has reached 1.25 million, of which 777,000 village doctors have, through training, acquired a level equivalent to that of an intermediate medical school graduate.

Maternal and Child Health Care

Women and children in the country make up two thirds of the total population and to ensure their health is one of the most important tasks of the health and medical services in China. Due to the establishment and perfection of the three-tier MCH network in both urban and rural areas, over 90% of lying-in women have their babies delivered with sterile methods. The quality of perinatal care has been improved year by year with emphasis on the systematic management of high risk pregnant women and hospitalized delivery. Due to the safe motherhood programme implemented in the whole country, the maternal mortality rate has been reduced from 1,500 per 100,000 delivery in the early days of the foundation of PRC to 94.7 per 100,000 delivery at present.

Other great progress has been made in the field of the child health care since the establishment of PRC. Due to the successful implementation of the Expanded Programme on Immunization, many infectious diseases seriously threatening children's life have been brought under control. "National Control Programme for Four Common-seen Diseases among Children (i.e. rickets, anemia, pneumonia, and diarrhea)" and the plan of action have been formulated by the MOPH to provide guidance to various localities to implement the control programme in a planned way. In those ways, according to the statistics released by the State Statistics Administration, the infant mortality rate had been reduced from 200 per 1,000 live birth in 1940's to 35 per 1,000 live birth in 1990.

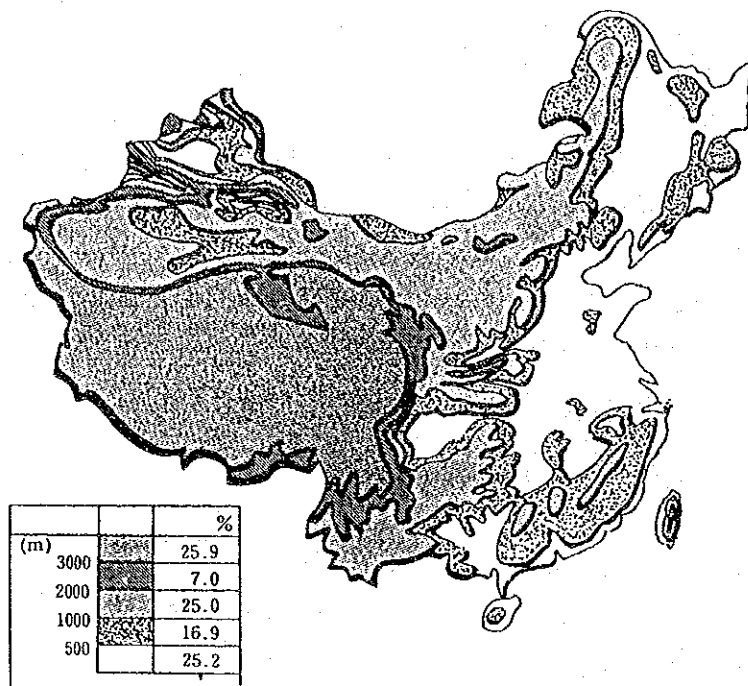


Figure 1. China's Topography

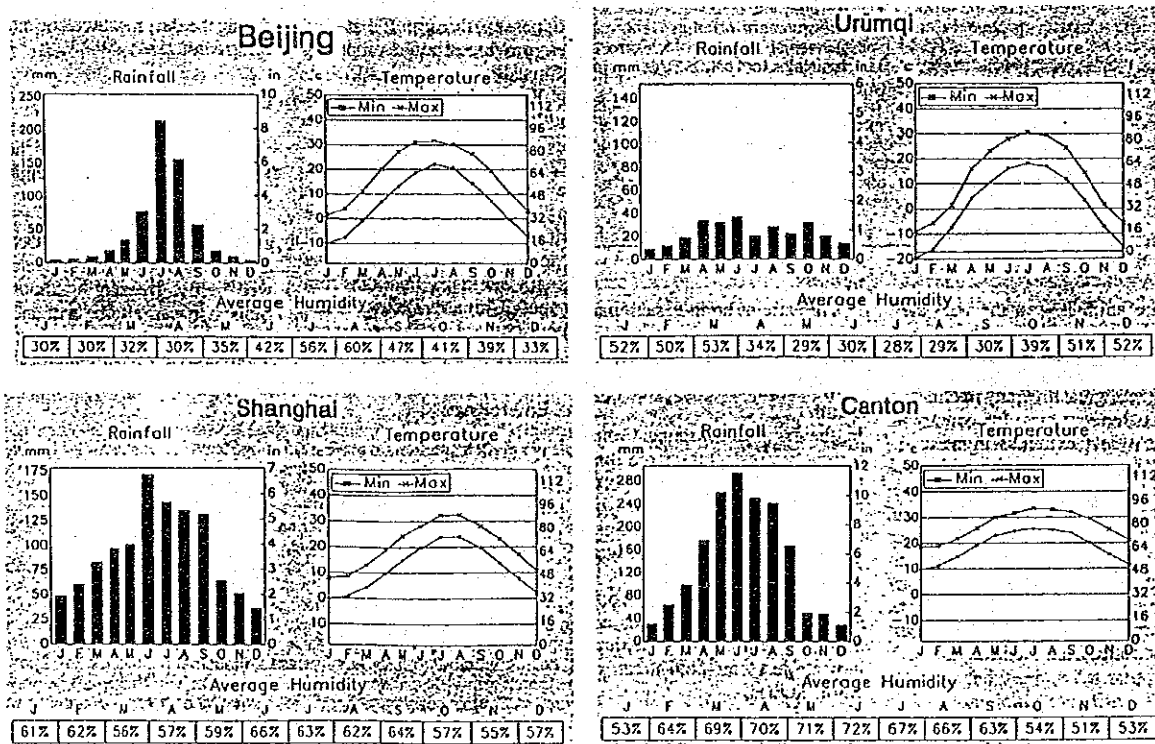


Figure 2. China's Climate

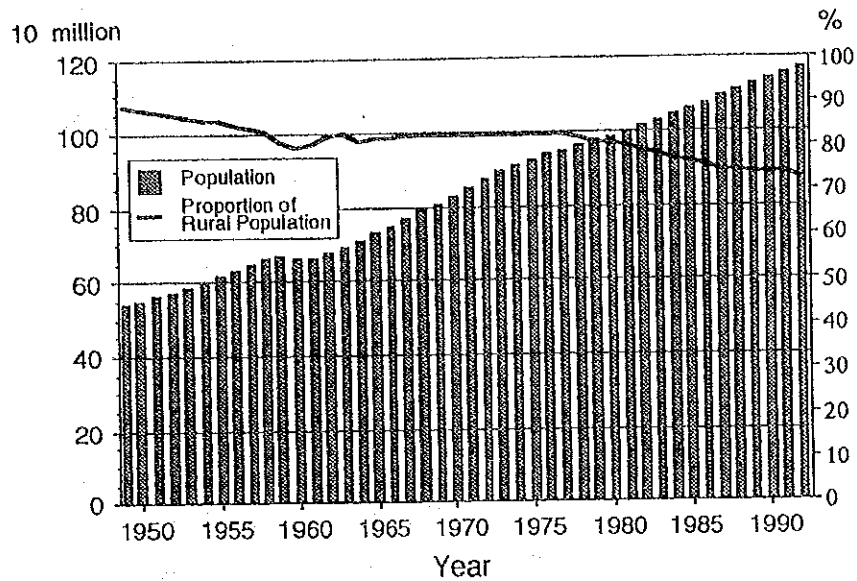


Figure 3. Population Growth & Proportion of Rural Population in China

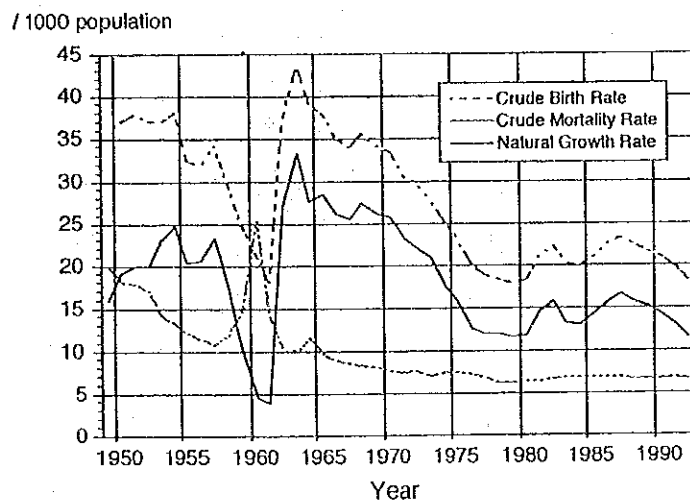


Figure 4. Crude Birth Rate, Crude Mortality Rate, & Natural Growth Rate in China

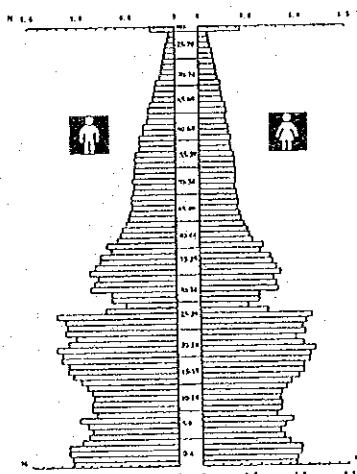


Figure 5. Population Pyramid of China (1990)



Figure 6. Provinces, Autonomous Regions, and Municipalities in China

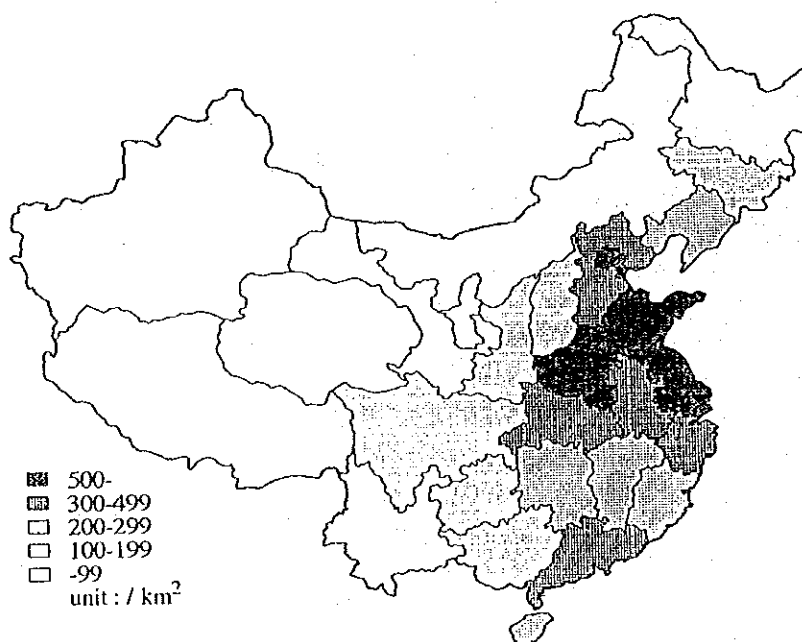


Figure 7. Population Density by Province in China (1992)

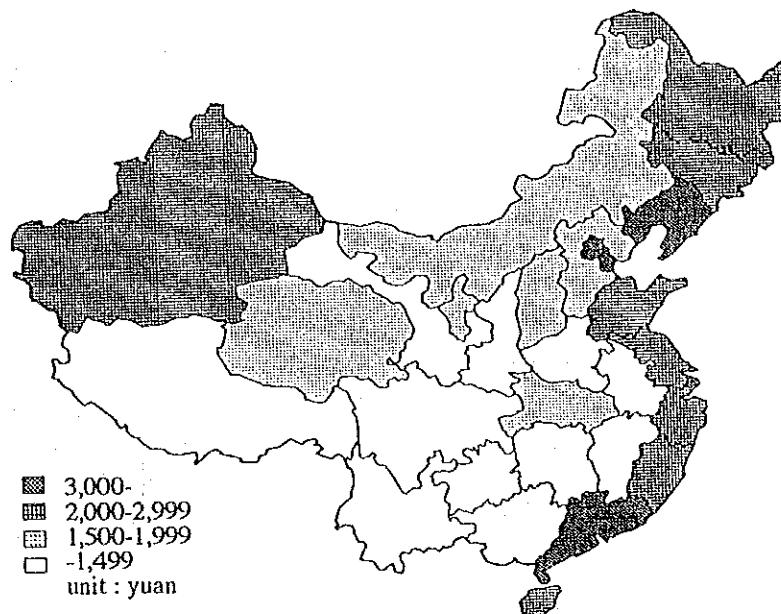


Figure 8. GNP per capita by Province in China (1992)

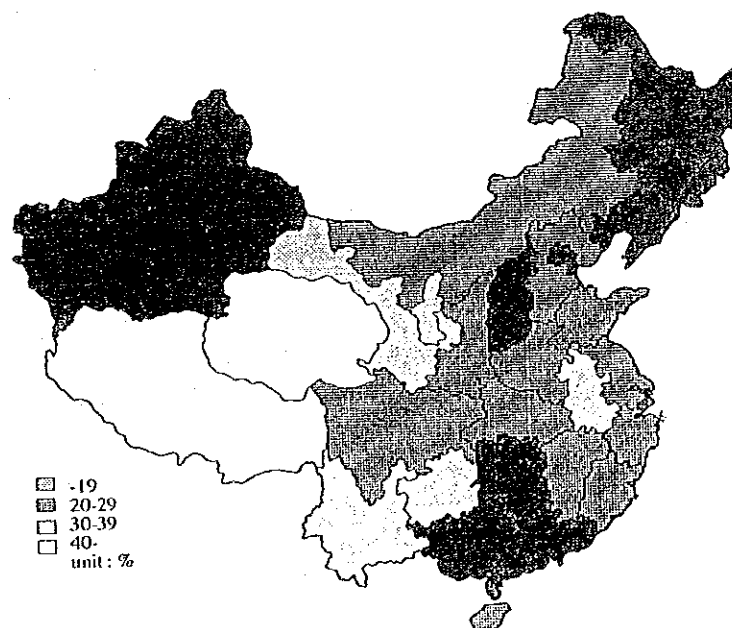


Figure 9. Proportion of Illiterate Population aged 15 years or over by Province in China (1990)

Table 1. Provincial Socioeconomic Data

Province	Number of Prefecture	Population (x10,000, 1992)	Area (x10,000 squ. km)	Population Density (/squ. km, 1992)	GNP (x100 million yuan)	GNP per capita (US\$, 1992)
Beijing	-	1,102	1.68	656	709.0	1,167
Tianjin	-	920	1.13	814	411.2	811
Hebei	18	6,275	18.77	334	1,156.1	334
Shanxi	12	2,979	15.63	191	518.2	316
Nei Mongol	12	2,207	118.30	19	378.4	311
Liaoning	14	4,016	14.59	275	1,297.7	586
Jilin	9	2,532	18.74	135	514.8	369
Heilongjiang	14	3,608	45.46	79	855.9	430
Shanghai	-	1,345	0.63	2,135	1,065.9	1,437
Jiangsu	11	6,911	10.26	674	1,977.9	519
Zhejiang	11	4,236	10.18	416	1,220.7	523
Anhui	16	5,834	13.96	418	724.9	225
Fujian	9	3,116	12.14	257	705.2	410
Jiangxi	11	3,913	16.69	234	558.0	259
Shandong	17	8,610	15.67	549	1,980.0	417
Henan	17	8,861	16.70	531	1,213.2	248
Hubei	14	5,580	18.59	300	1,003.6	326
Hunan	14	6,267	21.18	296	920.1	266
Guangdong	20	6,525	17.79	367	2,293.5	637
Guangxi	13	4,380	23.60	186	572.3	237
Hainan	2	686	3.39	202	141.7	375
Sichuan	21	10,998	57.00	193	1,492.4	246
Guizhou	9	3,361	17.60	191	331.7	179
Yunnan	17	3,832	39.40	97	510.0	241
Xizang	7	228	122.84	2	33.3	265
Shaanxi	10	3,405	20.56	166	494.5	263
Gansu	14	2,314	45.40	51	301.9	237
Qinghai	8	461	72.12	6	84.3	332
Ninxia	4	487	5.18	94	78.6	293
Xinjiang	15	1,581	165.00	10	382.3	438
Total	339	117,171	960.18	122	24,036.2	372

Table 2. Comparison of Selected Asian Countries

Country / Region	Area (x 1,000 square km)	Population (x million, 1992)	Population Growth Rate (% , 1985-92)
China	9,602	1,171.7	1.5
India	3,288	883.5	2.1
N South Korea	99	43.7	1.0
I Taiwan	36	20.8	1.1
E Singapore	1	2.8	1.8
S Hong Kong	1	5.8	0.9
A Indonesia	1,905	184.3	1.8
S Philippine	300	64.2	2.3
E Thailand	513	58.0	1.7
A Malaysia	330	18.6	2.5
N			
Japan	378	124.3	0.4

Country / Region	GNP (x million US\$, 1992)	GNP per capita (US\$, 1992)	Illiteracy Rate (%, 1990)
China	442,346	372	27
India	271,638	310	52
N South Korea	296,349	6,790	4
I Taiwan	210,886	10,215	-
E Singapore	44,315	15,750	-
S Hong Kong	89,274	15,380	-
A Indonesia	122,825	670	23
S Philippine	49,462	770	10
E Thailand	106,559	1,840	7
A Malaysia	51,917	2,790	22
N			
Japan	3,507,841	28,220	-

Country / Region	Life Expectancy (at birth, 1992)	Mortality Rate < 5 y.o. (per 1,000 live birth)	Maternal Death Rate (per 100,000 live birth)
China	71	38	154
India	60	90	-
N South Korea	71	16	26
I Taiwan	74	-	-
E Singapore	75	6	10
S Hong Kong	85	7	4
A Indonesia	60	74	450
S Philippine	65	41	74
E Thailand	69	27	37
A Malaysia	71	15	26
N			
Japan	79	5	-

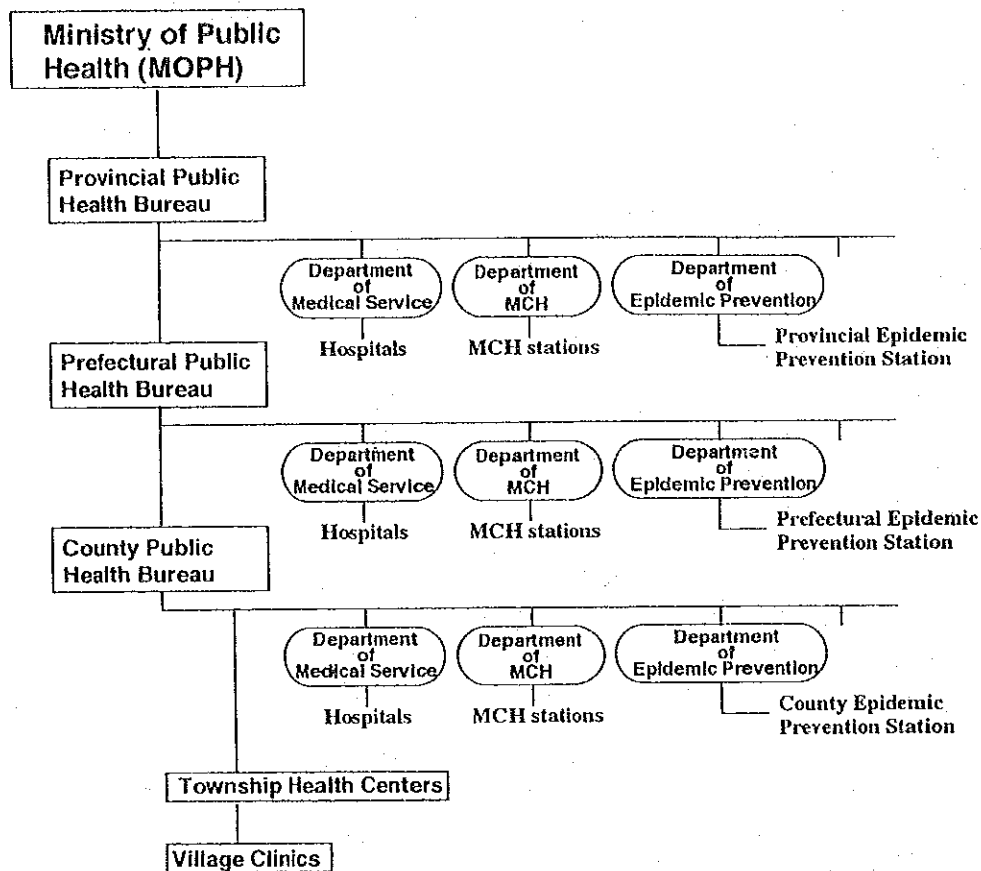


Figure 10. Organizational Structure of Health System in China

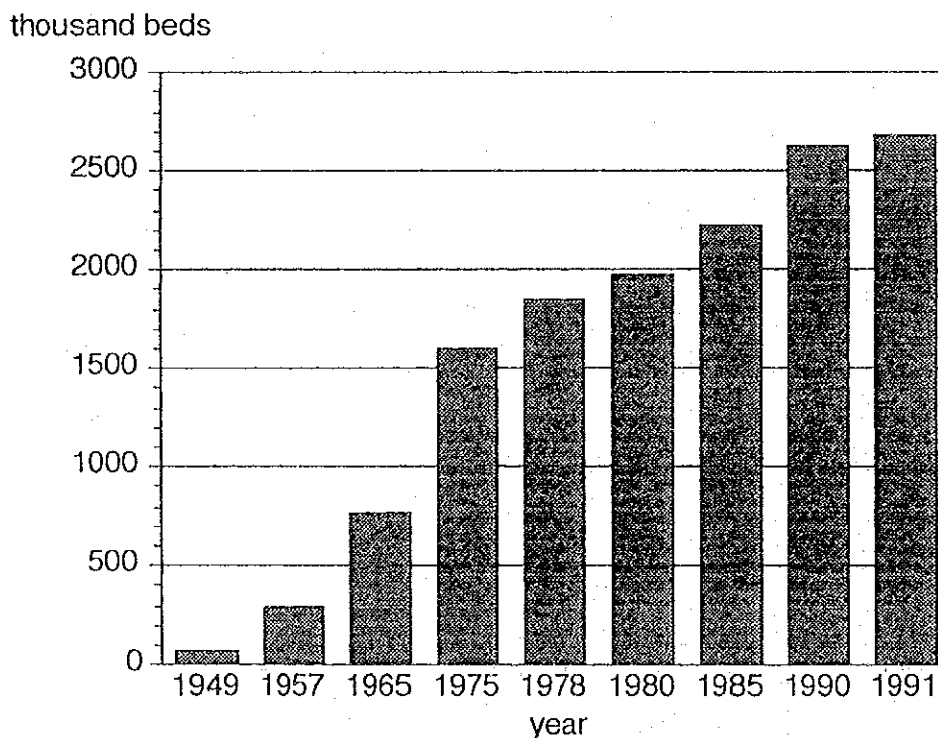


Figure 11. Number of Hospital Beds in China

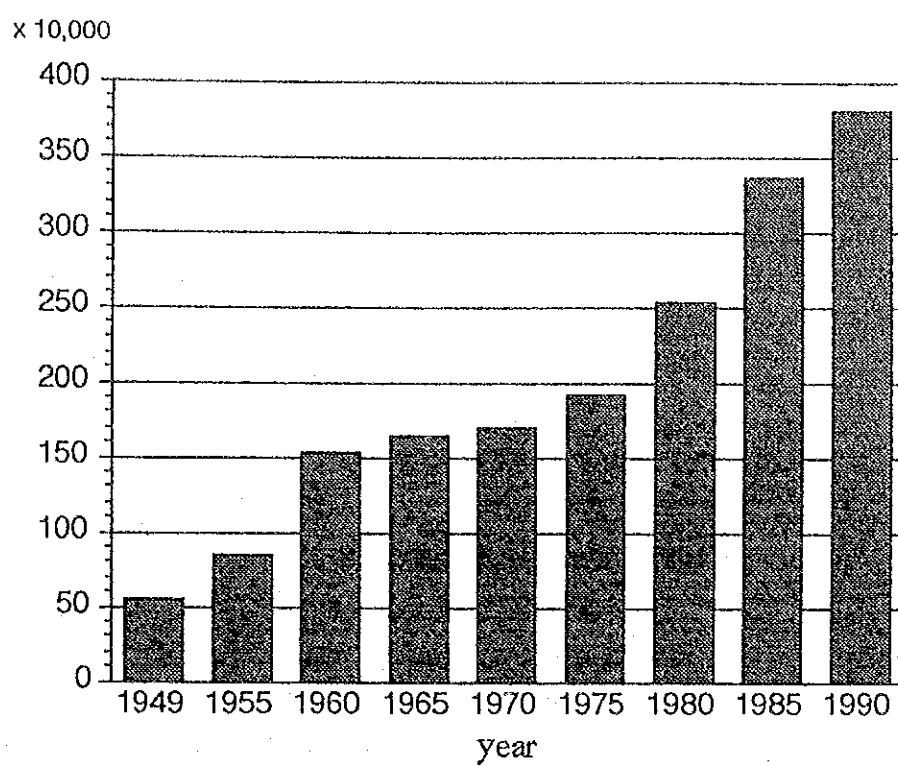


Figure 12. Number of Professional Health and Medical Workers in China

EPI AND POLIO ERADICATION PROGRAMME IN CHINA

YOSHIHIRO TAKASHIMA, M.D.

I. Introduction

In 1974, the World Health Assembly initiated the global immunization effort under the banner of the Expanded Programme on Immunization (EPI) against diphtheria, pertussis, tetanus, tuberculosis, polio, and measles, diseases estimated to kill five million children and to cause the same number of long-term disabilities in each year. Since 1977, the Programme has laid the groundwork for greatly extended coverage and most countries have introduced their own programmes. Immunization services which had reached less than 5% of children in the developing countries when the Programme had been established are now reaching approximately 80% in 1990.

Due to the remarkable improvement of EPI infrastructures i.e. development of cold chain, heat stable vaccines, public concerns, social mobilization, etc. and the world-wide achievement of high immunization coverage, in May 1985, the Pan American Health Organization (PAHO) launched an initiative to eradicate the indigenous transmission of wild polio virus from the Americas by 1990 and it has attained significant achievements in these projects up to now. In May 1988, the Forty-first World Health Assembly adopted resolution WHA 41.28 on the Global Eradication of Poliomyelitis by the Year 2000. In September 1988, the Regional Committee for the Western Pacific, at the thirty-ninth session, adopted resolution WPR/RC39.R15 on the eradication of poliomyelitis in the Region by 1995.

Following the resolutions, the Chinese Governments also set the goal of polio eradication by 1995 and started development of a national plan of action for eradication of polio. In 1988, the Ministry of Public Health (MOPH) of China promulgated "the National Plan on Polio Eradication, 1988-1995".

II. Expanded Programme on Immunization in China

Historical Background

Prior to the establishment of the People's Republic of China (PRC) in 1949, the general health condition of China was extremely poor and vaccination programmes were largely non-existent. From 1938 to 1949, the number of BCG vaccinations was scarcely over 7,500 in the whole country. Smallpox, plague and cholera were rampant and caused from between 10,000 to over 100,000 deaths annually. The annual number of cases of diphtheria, measles, pertusis and polio surpassed 10 million and constituted the major causes of death among children. The infant mortality rate was as high as 200 per 1,000 live birth and the average life expectancy was 35 years. Hence, since the foundation of PRC, the Chinese central government have given serious attention to child health care and epidemic prevention and control. The government has formulated the important principle of "prevention first" and given the first priority to the prevention and control of the acute communicable diseases that seriously endanger the people's health.

Following the promulgation by the government on smallpox vaccination in the early 1950's, the nationwide immunization programme resulted in a decrease in the number of smallpox cases from 6,154 in 1951 to 315 in 1957 and the achievement of its eradication in early 1960's. Since the 1960's, China has successfully produced its own polio and measles vaccines. The MOPH has also formulated and promulgated "Measures for Implementing Vaccination Programme", which has initiated BCG, DPT and polio vaccination programme in major cities as Beijing and Shanghai.

With the development of the cooperative medical system in 1970's, the infrastructure of primary health care services has been further strengthened to provide favorable conditions for implementation of the EPI activities in rural areas. Following the promulgation of "Circular on strengthening the EPI Programme" by the MOPH in 1978, the vaccination record systems have been established in some provinces and autonomous regions. Minimum cold chain facilities for storage and transportation of vaccines have been installed for providing immunizations in a regular manner. The morbidity and mortality rates of the target diseases have been decreased remarkably. The morbidity and mortality rates in 1978, for instance, have decreased from 1959 by 82.6% and 97.5% for measles, by 90.6% and 93.3% for diphtheria, by 47.4% and 92.1% for pertusis, by 58.1% and 72.7% for poliomyelitis respectively.

In 1980's, the further infrastructure development for the EPI activities in China was achieved. The National EPI Advisory committee was established in 1982. The MOPH introduced the standard immunization schedule (Table 1) and the immunization certificate system. The cooperative project for cold chain between China and UNICEF was

implemented in selected areas. Social mobilization and training activities were carried out. All of them contributed to the further development of the EPI activities in China.

In 1985, the Chinese Government declared that China would achieve the goal of nationwide child immunization programme in the following two steps; to immunize 85% of children in every province by 1988 and to immunize 85% of children in every county by 1990. With the expansion of the cold chain coverage through the cooperative project between China and UNICEF and the further strengthening of the leadership and social mobilization activities for EPI, vaccinations have been provided gradually on the daily, weekly, monthly, bimonthly and quarterly bases. Methods for evaluation of the immunization coverage and standards for supervision of the EPI activities were established and constantly improved.

In 1988, the MOPH promulgated "the National Plan on Polio Eradication, 1988-1995", which set a target for eradicating polio in the country by the following two steps; to decrease polio morbidity to under 0.01 per 100,000 population and to eradicate paralytic polio cases caused by the wild poliovirus by 1995.

Organizational Structure for EPI (Figure 1)

At the central level, the national EPI activities in China is cooperatively administered by the following main bodies: the National EPI Coordination Group, the Ministry of Public Health (MOPH), the National EPI Advisory Committee, and the Chinese Academy of Preventive Medicine.

The National EPI Coordination Group is responsible for coordination and organization of social mobilization activities at the national level, which is comprising senior officials from the MOPH, the State Education Commission, the National Women's Federation, the State Nationality Affairs Commission, the Ministry of Broadcasting, Film, and TV, the Ministry of Foreign Economic Relations and Trade, the National Federation for the Handicapped, the State Religious Affairs Bureau, and the Central Committee of the Communist Youth League. The MOPH is in charge of the formulation, supervision, and evaluation of the national EPI activities. The National EPI Advisory Committee comprising EPI experts has been established to provide technical advice to the MOPH. The Chinese Academy of Preventive Medicine has responsibilities for providing information and technical guidance to provincial Epidemic Prevention Stations (EPSs) as well as sending information to the National EPI Advisory Committee and the Department of Epidemic Prevention under the MOPH.

At any local level, each provincial, prefectural (municipal), or county (district) government has the Public Health Bureau (PHB), which is responsible for organizing and leading the EPI activities in respective administrative areas. Under the PHBs at any local level, the EPSs are organized to provide technical advice and guidance, to train

medical and health personnel, to supply vaccines, to manage and maintain cold chains, and to conduct surveillance activities in areas under their jurisdiction. Immunization services in rural areas are provided by township health care workers at the township health centers or by village doctors at the village clinics while the services in urban areas by anti-epidemic and health care workers at all types of medical facilities.

Vaccine Supply and Cold Chain

There are 7 vaccine manufacturers and a national vaccine quality control institute in China. With the support from both international organizations and the Chinese government, vaccine manufacturers have improved the quality of EPI vaccines and, to date, the quality of some vaccines has already met or is approaching the WHO requirements. Presently, the annual supply of vaccines in China is around 114.2 million doses of BCG, 181 million doses of DPT, 153.7 million doses of polio, and 123 million doses of measles. China is going to be self-sufficient with vaccines for the EPI activities.

With the cooperation of UNICEF, a pilot cold chain project was initiated in 1982 in some provinces and autonomous regions covering 80 million population. The cooperative project was expanded in 1985 to cover a population of 180 million in 14 provinces and autonomous regions and, then, further developed in 1986 to cover all 30 provinces, autonomous regions, and municipalities. The cold chain facilities have been made available to 2,600 counties (districts) covering a total population of 1,030 million.

Surveillance System

In China, 36 notifiable diseases including polio should be reported through routine surveillance system. Data and information on the notifiable diseases are collected at hospitals at any level, monthly summarized by county at provincial level, and sent to the national level. The AFP surveillance system, which will be mentioned after, is independent of this routine reporting system for the 36 notifiable diseases.

Immunization Coverage and Morbidity for EPI Diseases

China's EPI activities have made unprecedented progress as mentioned in its historical background. The national EPI review jointly conducted by the China's MOPH, UNICEF and WHO in 1989 stated that China had achieved its target of immunizing 85% of children in every province by 1988 and many counties would achieve the target of immunizing 85% their children by 1990 in advance (Figure 2).

In 1988, morbidity rates per 100,000 population for polio, diphtheria, pertussis and measles were 0.06, 0.02, 2.95, and 8.42 respectively. Comparison with 1978, polio

morbidity rate was decreased by 94.36%, diphtheria by 98.67%, pertusis by 97.37%, and measles by 96.19% (Figure 3). Correspondingly, the number of deaths caused by above four EPI target diseases was dropped by 96.15% from 12,478 in 1978 to 481 in 1988.

III. Polio Eradication Programme in China

Poliomyelitis in China

According to statistics on reported cases of poliomyelitis in China, the annual number of the cases was around 10,000 to 40,000 in 1960's and around 5,000 to 20,000 in 1970's. The peaks of incidence of reported polio cases in 60's and 70's were found in 1964 with 43,156 cases and in 1972 with 23,271 cases respectively. In the 1980's, after the third peak of incidence was observed in 1981 with 9,625 reported cases, large outbreaks of polio in China became infrequent and the annual incidence had been constantly declining until 1988 due to the widespread routine administration of OPV with the development of the national EPI activities. Consequently, in 1988, the number of reported cases of polio in the whole country was only 667 and the incidence reached to approximately 0.05 cases per 100,000 population (Figure 4).

In 1989 and 1990, polio epidemic recurred throughout the country and created the fourth peak of incidence with 4,628 cases in 1989 and 5,065 cases in 1990. In the subsequent years, however, chiefly due to introduction of supplementary vaccination activities by the increasing number of the provincial PHBs, the number of reported cases of polio decreased, 1,926 cases were reported in 1991, and 1,372 cases in 1992.

The outbreak of polio in 1989 to 1990 concentratedly occurred in the six provinces located in the middle-eastern part of the country; Shandong, Henan, Jiangsu, Anhui, Hubei, and Hebei, in which the total number of the reported cases was 5,340, 55.1% of the whole number of the cases in China in this two years. In 1991, Shanxi Province, located in the middle-northern part of the country, and Guangxi Province, located in the southern part of the country, had the peak of incidence of polio in 1988 to 1992 and the total number of the cases in the two provinces was 507, 26.3% of the whole cases in the country. In 1992, two provinces located in the southern part, Jiangxi and Guangdong, accounted for 38.5% of the 1,372 polio cases in the country, with 301 cases in Jiangxi and 227 cases in Guangdong.

While most of the ten provinces above mentioned are densely populated areas, a very high incidence of polio cases was observed in the sparsely populated provinces. Xinjiang Autonomous Region, a western province with one of the lowest population density in the country, had one of the highest incidence rate of confirmed polio cases in 1990 and 1991. In 1992, Qinghai Province, a middle-western province with 6 population density (pop./km²), had one of the highest incidence rate. The two provinces have minority populations and the immunization coverages were low (Table 2).

Polio Eradication Programme and Supplemental Immunization

In May 1988, the Forty-first World Health Assembly adopted resolution WHA 41.28 on the Global Eradication of Poliomyelitis by the Year 2000, and in September 1988, the Regional Committee for the Western Pacific, at the thirty-ninth session, adopted resolution WPR/RC39.R15 on the eradication of poliomyelitis in the Region by 1995. Following these resolutions, the Chinese Government set the goal of polio eradication by 1995 and accordingly initiated the development of a national plan of action for the eradication. In 1988, the MOPH promulgated "the National Plan on Polio Eradication, 1988-1995", which set a target for eradicating polio in the country by the following two steps; to decrease polio morbidity to under 0.01 per 100,000 population and to eradicate paralytic polio cases caused by the wild poliovirus by 1995.

On the other hand, as mentioned before, the routine immunization activities conducted in China was proved to have insufficient efficiency for control of polio epidemic by the polio outbreak recurring in 1989-1990. Therefore, for the purpose of rapid interruption of wild poliovirus transmission, some provincial governments have introduced supplemental vaccination activities since 1991.

The supplemental vaccination activities in China have been conducted in addition to the routine vaccination of children with three doses of OPV at ages 2, 3, and 4 months. These activities have included administration of one or two extra doses of OPV to young children (aged <4 years in general) at 1-2 month intervals during the low-incidence season for polio (i.e., December to April). The number of provinces conducting the WHO-recommended two rounds of supplemental vaccination activities during low-incidence season increased from six provinces during 1991-92 to 25 provinces during 1992-93.

As a consequence, the number of supplemental doses of OPV administered during the low-incidence season increased from 71 million during 1990-91 to 186 million during 1992-93. During January to August 1993, 348 poliomyelitis cases were reported through the notifiable diseases reporting system, compared with 877 cases during January to August 1992 (Figure 5); in addition, there was no characteristic summertime seasonal increase in reported cases during 1993 (Figure 6).

In November 1993, the State Council of China adopted every December 5-6 and January 5-6 during 1993 to 1995 as the National Immunization Days (NIDs). The target population for NIDs is all children less than 4 years of age regardless of prior vaccination history. For the first round of NIDs conducted in December 1993, President Jiang Zemin and other state leaders participated in this largest public health event of its kind in history and administered OPV to children.

The plan for implementing National Immunization Days in China has been based on three factors: 1) the success of the provincial supplemental vaccination activities, 2) concerns about the potential accumulation of susceptible children since the nationwide poliomyelitis outbreak during 1989-1990 in parts of China still not adequately covered by previous provincial supplemental vaccination activities, and 3) the goal of eradicating poliomyelitis from the WPR of WHO by 1995.

Surveillance

Up to now China has two surveillance systems reporting polio cases. One is the routine notifiable diseases reporting system in which the provincial PHBs collect data, monthly summarize information on 36 notifiable diseases by county, and send them to the MOPH. The other system is the Acute Flaccid Paralysis (AFP) reporting system, in which the WHO standard cases definition has been used for diagnosis of suspected and confirmed polio cases.

The AFP reporting system composed of the EPSs in all levels of PHBs has been established since 1991. There are designated staff responsible for the AFP surveillance at each level of EPSs who are required to gather information on AFP in their jurisdiction areas and to submit AFP reports to upper levels of EPSs or the MOPH every ten days. The contents reported in the system are AFP case's age, sex, vaccination status, stool collection, etc. Since July 1993, to standardize and systematize the AFP surveillance activities, computer terminals in most provincial EPSs have been connected with computer terminals of the Chinese Academy of Preventive Medicine in Beijing.

Through the AFP surveillance system, 2,488 AFP cases were reported in 1992, among which 1,372 cases were confirmed and 1,116 cases discarded. From January to November 1993, 1,609 AFP cases have been totally reported, among which 252 cases have been confirmed, 297 cases discarded, and 1,060 cases pending. Since there are approximately 313 million children aged 0-14 years in China, the rate of non-polio AFP cases was 0.43 in 1992 and 0.40 in 1993 per 100,000 children under 15 years old. The rate of non-polio AFP cases varies by provinces and has not reached to 1 non-polio AFP case per 100,000 children under 15 years old in most of provinces (Table 2).

Vaccine Supply and Quality Control

In China, two vaccine manufactures produce trivalent OPV and annual supply of OPV is approximately 325 million doses in total. Although the provincial governments purchased a total of 250 million doses of OPV for both routine and supplementary immunization activities by their own budgets in 1993, a total of 75 million doses of OPV could not be afforded by domestic organizations due to budget shortages. Rotary

International and UNICEF provided 2.2 million US\$ to the Chinese Government for purchasing OPV. Japanese Government, JICA, and Agency for Cooperation in International Health provided 32 million doses of imported OPV in total for the NID in China.

A national center for vaccine quality control has the responsibility for checking OPV quality produced at the two domestic polio vaccine manufactures. While all the vaccine produced by the domestic manufactures meet national standards, they have not yet met the WHO requirements due to poor thermostability or lack of GMP.

Laboratory Network

In order to strengthen capability of laboratory diagnosis of polio, a laboratory network composed of a national laboratory and all provincial laboratories has been established and proficient testings have been conducted in 29 provincial laboratories excluding Tibet Autonomous Region since 1991. Almost provincial laboratories are capable of isolating and serotyping poliovirus. By the active surveillance for AFP in each county, the stool collection rate and the proportion of confirmed polio cases by virus isolation will be expected to increase. The national laboratory, at present, has been identified whether the isolated virus is from wild strain or vaccine strain.

Discussion

In May 1988, the World Health Organization committed itself to the eradication of poliomyelitis from the world by the year 2000. "Eradication" means that there will be no wild poliovirus, not just elimination of the clinical disease. Although this goal may seem impossibly difficult, much progress such as the achievement of a worldwide high coverage of immunization for poliomyelitis under the EPI activities has been made (nearly 80 % of infants in the world were fully immunized against polio in 1993). As a matter of fact the Pan American Health Organization launched the polio eradication initiative in 1985 prior to the WHO's adoption of the resolution on the global eradication of poliomyelitis in 1988 and may have been achieved the eradication of poliomyelitis from the countries of North and South America; the last case of laboratory confirmed poliomyelitis due to wild poliovirus in the Americas was reported in Peru in 1991. Most countries of Europe are reporting no cases and many countries in North Africa, the Middle East, Southern Africa and East Africa are reporting zero cases. It can certainly be said that the end of poliomyelitis is clearly in sight.

In September 1988, the Regional Committee for the Western Pacific of WHO adopted the resolution on eradication of poliomyelitis from the Region by 1995 following the major public health achievements by the EPI in terms of both increased immunization coverage and disease reduction. Nevertheless, as of 1991 in this Region, poliomyelitis is still endemic in six countries: Cambodia, China, the Lao People's Democratic Republic, Papua New Guinea, the Philippines, and Viet Nam. Since approximately 80% of 1.5 billion population in total in the Region are living in China, a success in the battle against poliomyelitis in the Region largely depends upon whether China can achieve the eradication of wild poliovirus from the country or not.

China has had polio epidemics every 8 to 9 years since the outbreak of poliomyelitis in 1963-1965, and the outbreak in 1989-1990 may be considered the fourth one in this period. These periodic outbreaks of poliomyelitis in China may be caused by the potential accumulation of susceptible population. It may be possibly presumed that the outbreak in 1989-1990, in spite of a high immunization coverage by the routine EPI activities, was caused by the introduction of wild poliovirus into increasing clusters of susceptible children, especially "unregistered children" who had never been given a chance to be regularly immunized.

However, in addition to well-managed EPI activities in the country under the multi-tier health and medical administration system, high coverage of the routine immunization service against poliomyelitis, and herd immunity strengthened after the polio outbreak in 1989-1990, the introduction of supplemental vaccination activities since 1991 have rapidly decreased annual polio incidence of the country in 1990s. Introduction of the National Immunization Days since December 1993 is expected to accelerate the country to accomplish its polio eradication initiative within a few years.

Thus, at least from a viewpoint of the national level, China seems to go well to the goal of its initiative, but we should not forget the fact that China is one of the largest countries in the world, each province is also huge, and some provinces are much larger than some countries in the Western Pacific Region of WHO. Since each province of China is situated in different geographic, demographic, economic, and social condition and, therefore, provincial public health conditions and activities vary in a wide range, the polio eradication programme in provincial level should be also arranged according to public health condition and activities of each province. Actually, while the pattern of the national incidence of poliomyelitis had a peak in 1989-90, the patterns of provincial incidences vary in different provinces.

To identify provincial features of polio endemic and its eradication programme, I have tried to classify 22 provinces, 5 autonomous regions, and 3 municipalities into 4 groups by polio incidence in the previous years and by non-polio AFP rate in 1993 as follows;

Group A: provinces with polio incidence* < 0.1 in 1989-93

Group B: provinces with polio incidence decreasing 1991 to 93 and < 0.1 in 1992-93

Group C: provinces with polio incidence decreasing 1991 to 93 and < 0.1 in 1993

Group D: others

* per 100,000 population

Group A, B, and C are further divided into two sub-group by non-polio AFP rate per 100,000 children under 15 y.o. as follows;

Sub-group 1: provinces with non-polio AFP rate > 0.5 in 1993

Sub-group 2: provinces with non-polio AFP rate < 0.5 in 1993

Group D is divided into;

Group D-1: provinces with polio outbreak in 1992 and high polio incidence in 1993

Group D-2: provinces with increasing polio incidence in 1992 to 1993

According to this classification, all provinces are grouped as follows (Figure 7);

Group A-1: Beijing, Xizang, and Liaoning

Group A-2: Shanghai, Tianjin, Heilongjiang, Nei Mongol, Jilin, and Sichuan

Group B-1: Shandong, Jiangsu, Henan, Anhui, and Hebei

Group B-2: Zhejiang, Shaanxi, Gansu, Hubei, and Hunan

Group C-1: Ningxia

Group C-2: Guangxi, Shanxi, Yunnan, and Guizhou

Group D-1: Qinghai, Guangdong, and Jiangxi

Group D-2: Hainan, Fujian, and Xinjiang

Geographical distribution of provinces in this classification are also shown in Figure 8.

In provinces belonging to Group A, no remarkable epidemic of poliomyelitis has been observed in the last five years. Only Sichuan had not epidemic but sporadic cases in 1990 to 1992. While six provinces of the group are located in the north-eastern part of the country and economically well-off, Sichuan and Xizang are located in the western part of the country with a vast area and lower GNP per capita. For the provinces of Group A, it is important to maintain a high level of herd immunity by the regular EPI activities. It is also a crucial task to improve the AFP surveillance system (especially for Group A-2) and to increase sensitivity of the surveillance by conducting an active surveillance in communities for the purpose of detecting a few cases.

All of five provinces belonging to Group B-1 located in the eastern part of China caused the 1989-90 polio outbreak in the country. While they are so densely populated that poliovirus may be easily circulating and transmitted, a high level of herd immunity might be acquired after the rampant outbreak in 1989-90. Non-polio AFP rates of these five provinces have been improved and maintained at higher level than ones of other provinces by cooperative effort of JICA Team and provincial EPSs. For the provinces of Group B-1, the supplemental immunization as well as the routine EPI activities is

indispensable to keep a herd immunity at higher level. These provinces can also disseminate experiences and lessons obtained from their improvement of the AFP surveillance to other provinces. Although polio incidences of all of five provinces belonging to Group B-2 have continuously declined in the previous three years, non-polio AFP rates of these provinces are still seriously low. Improvement of the AFP surveillance is an urgent task for the provinces of Group B-2

Polio incidences in provinces belonging to Group C have also continuously decreased in the last three years but were higher than ones in provinces of Group B, over 0.1 in 1992. By conducting the supplemental immunization as well as strengthening of the routine immunization activities, polio incidences can be expected to reduce furthermore in these provinces. Since AFP surveillance dose not work actively in the provinces of Group C-2, more effort should be made to obtain full participation and positive cooperation from health and medical personnel at hospitals and MCH stations in prefectural and county levels.

Among four provinces belonging to Group D located in the southeastern part of China which are densely populated and economically well-off areas, Jiangxi had polio outbreaks in both 1989 and 1992 and Guangdong has continuously had a high incidence of poliomyelitis in the last five years. Although Guangdong Province has administered supplemental immunizations to some selected cities with a high polio incidence in the previous years in 1990 to 91 and/or in 1991 to 92, polio outbreaks occurred in some of them such as Huizhou, Shanwei, and Zangjiang City. In addition, another outbreak occurred in Meizhou City in 1993. These facts may mean that some of the previous supplemental immunizations were not sufficient to interfere transmission or circulation of poliovirus in the province. The reason of these inappropriate supplemental immunization activities should be analyzed as soon as possible.

Careful attention should be paid to three provinces belonging to Group D-2 i.e. Hainan, Fujian, and Xinjiang because incidence of poliomyelitis in these provinces has been increasing in the past two years. There may be the potential accumulation of susceptible population clusters and, therefore, rapid check-up of the routine immunization system and active introduction of other supplemental immunization activities such as mopping-up operation are seriously important.

AFP reporting system has not yet worked well in many provinces. In the field study in Shandong and Guangdong, we recognized many medical doctors in prefectural or county hospitals knew the concept of AFP but few of them knew the importance of reporting all AFP cases. To strengthen a surveillance system reporting all AFP cases and timely collecting stool specimens is one of crucial tasks for both detection of wild poliovirus in areas with low polio incidence and certification of polio eradication. For obtaining active cooperation and full participation from health and medical personnel of hospitals and MCH stations, an AFP surveillance team / committee had better consist of

staff not only from EPSs but also from both department of medical service and department of MCH in both prefectural and county PHBs.

The routine immunization activities may collapse due to existence of unregistered children who have no chance to be immunized according to the regular vaccination schedule and are clustered as a susceptible population. In case that the supplemental immunization activities including NIDs are served not only for registered children but also unregistered children, these activities are indispensable for interfering circulation and transmission of poliovirus among susceptible children. In fact, according to Dr Zhao Shili, Director of Shandong Provincial EPS, the EPS of Shandong Province is trying to immunize not only registered children but also unregistered.

In conclusion, although China is one of the largest countries in the world in terms of both population and area and facing some obstacles such as the existence of unregistered children, a high rate of illiteracy among the rural population, a huge and multi-tier administration system, etc., achievement of a high coverage of the routine immunization, completion of the cold chain network, introduction of the supplemental immunization including NIDs, and improvement of the AFP surveillance system are accelerating its efforts to attain the national eradication of poliomyelitis. In addition, an appropriate classification of provinces by immunization coverage, epidemic condition, surveillance potency, level of laboratory diagnosis is indispensable at rearrangement of the national plan for polio eradication with the most suitable polio-eradicating strategy in each province.

Acknowledgment

Thanks to the well-managed field trip in Shandong and Guangdong arranged by JICA Experts, Staff of Shandong Provincial EPS, Staff of Guangdong Provincial EPS, and the MOPH of China, I could obtain a comprehensive and profound understanding on the EPI and polio eradication programme from national to village level. Especially I would like to express my sincere appreciation to Dr Kusumoto, Dr Hikita, Dr Hara, and Dr Nishimura for their generous support and field-oriented instruction. I was also strongly encouraged by their strenuous efforts in China to commit myself in the field of applied epidemiology and international health. Last, but by no means least, I would like to thank Dr Isao Arita and JICA for giving the opportunity to conducting the field study in China.

Table 1. Routine Immunization Schedule in China

Vaccines	Age	0 m.o.	2 m.o.	3 m.o.	4 m.o.	5 m.o.	8 m.o.	1.5-2 y.o.	4 y.o.	7 y.o.	12 y.o.
BCG		BCG1								BCG2	BCG3*
Polio			TOPV1	TOPV2	TOPV3				TOPV4		
DPT				DPT1	DPT2	DPT3			DPT4		
Measles							MV1			MV2	

* in rural area

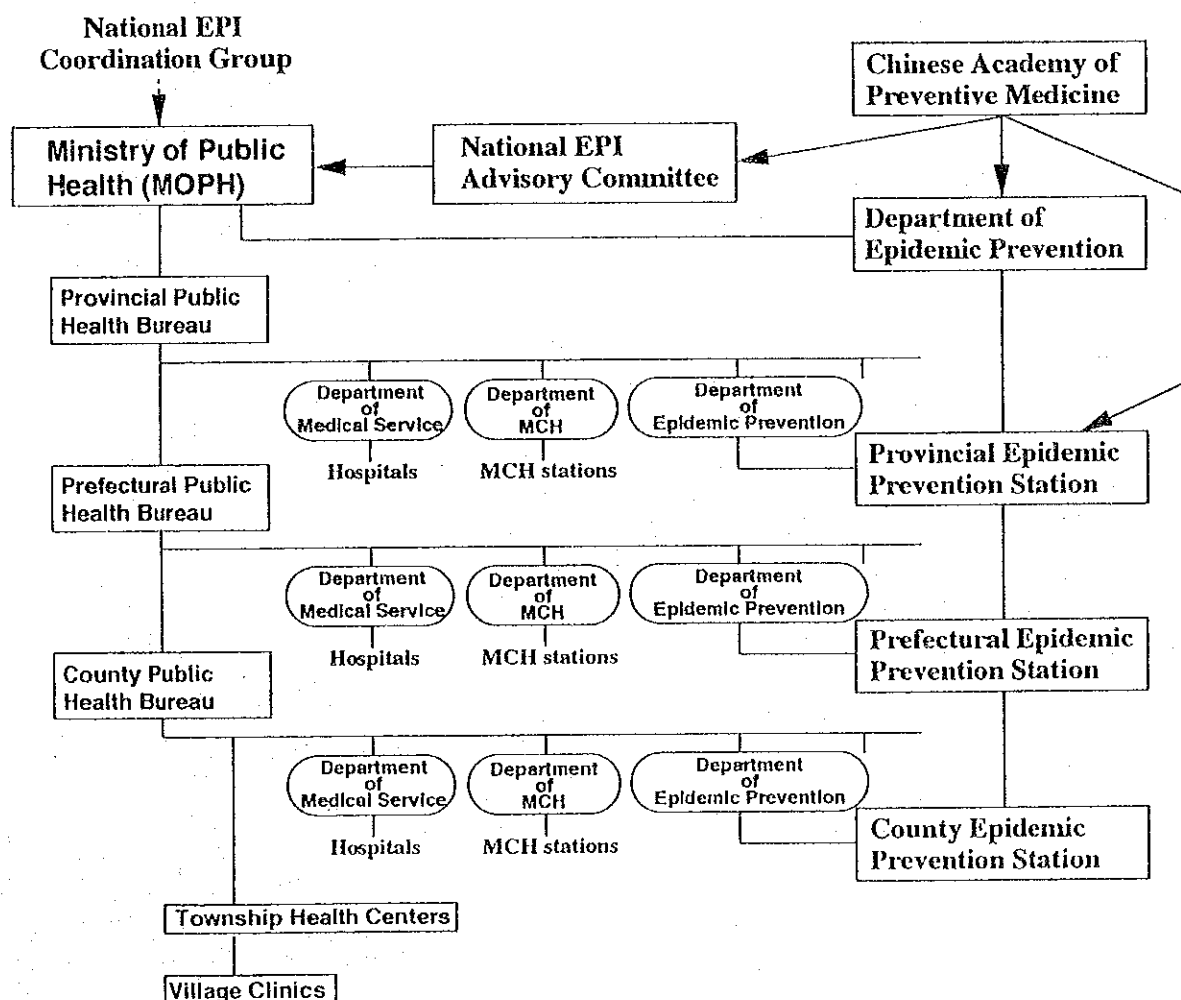


Figure 1. Management and Implementation System of EPI in China

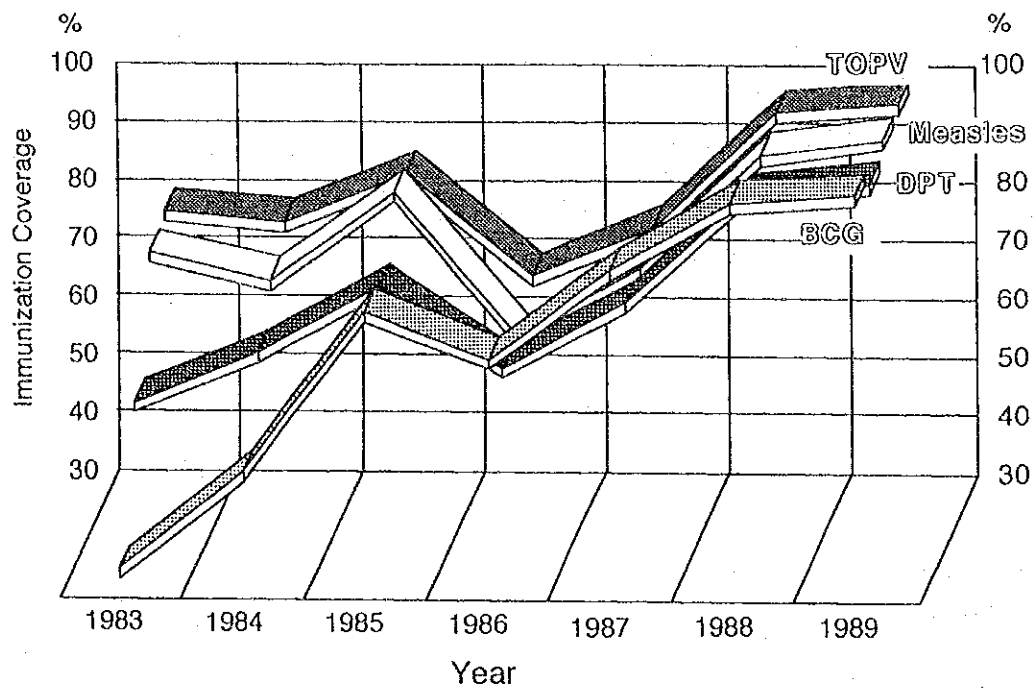


Figure 2. Immunization Coverage with BCG, DPT, Measles, and Polio in China, 1983-1989

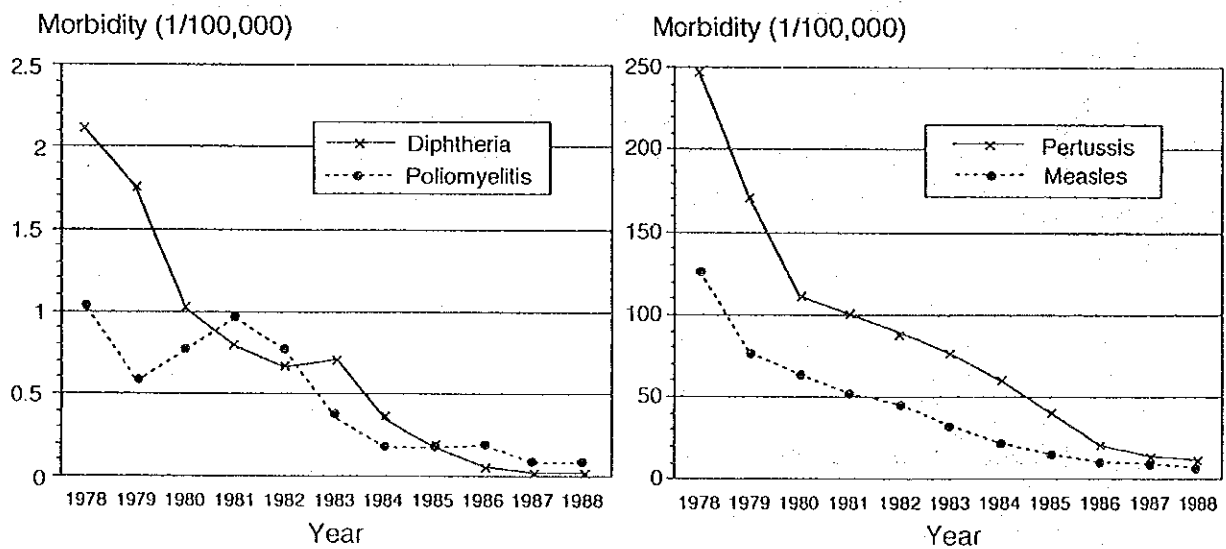


Figure 3. Morbidity of Diphtheria, Poliomyelitis, Pertussis, and Measles in China, 1978-1988

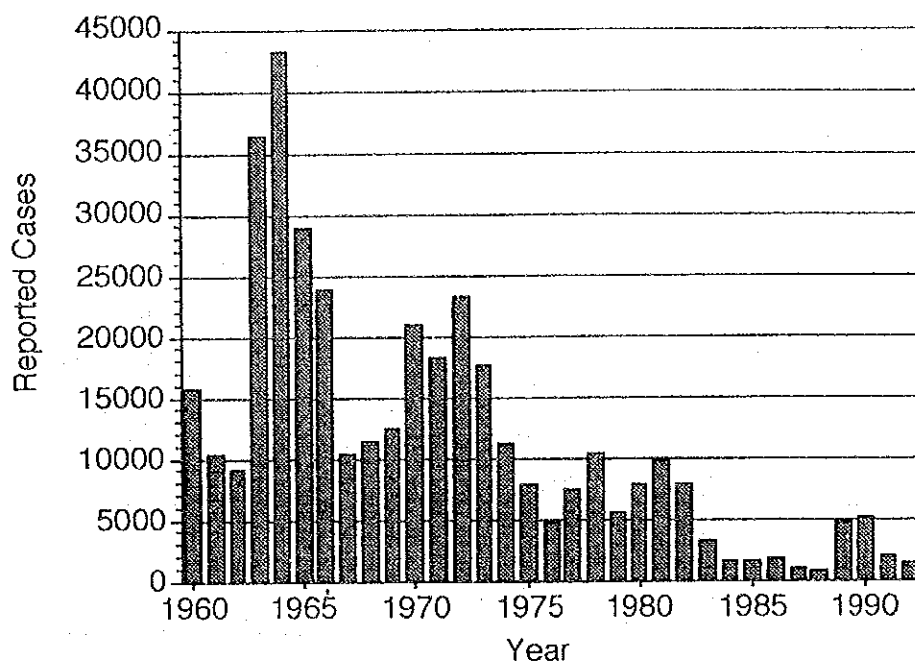


Figure 4. Reported Cases of Poliomyelitis in China, January 1960-August 1993

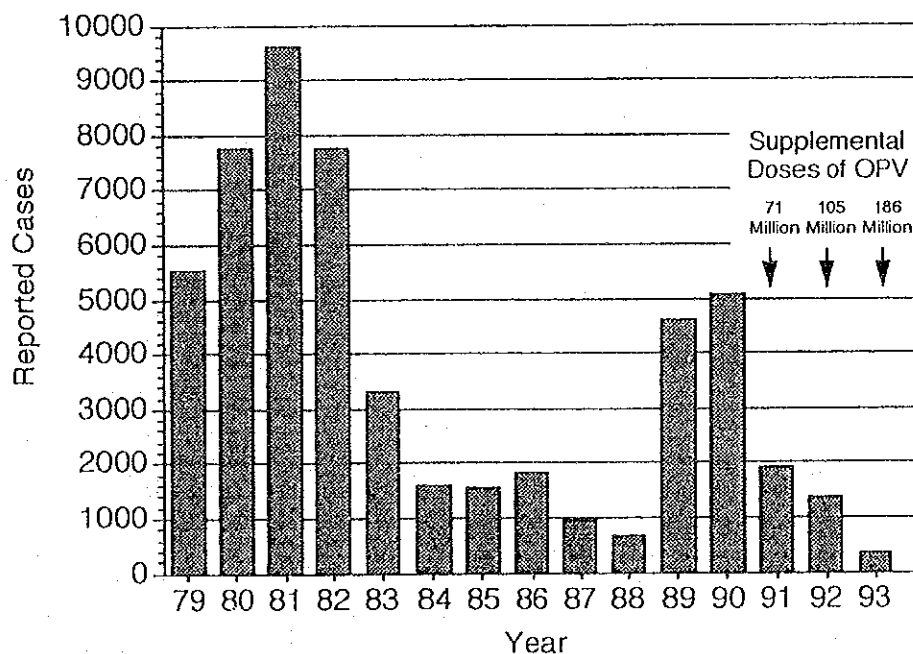


Figure 5. Reported Cases of Poliomyelitis and Supplemental Doses of Vaccine Administered in China, January 1979-August 1993

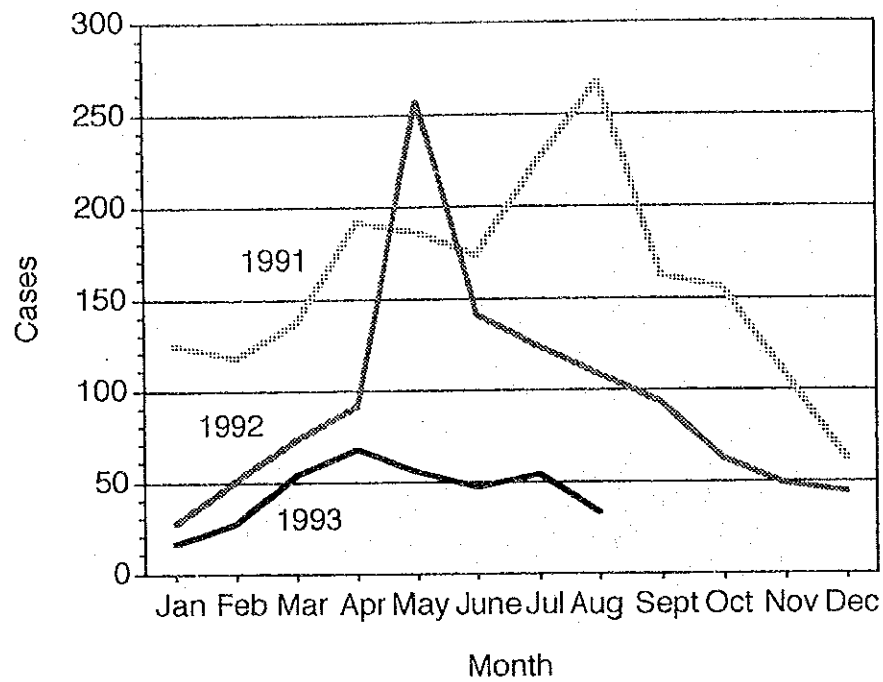


Figure 6. Reported Cases of Poliomyelitis by Month in China, January 1991-August 1993

Table 2. Confirmed Polio Cases, Polio Incidence (per 100,000), and Non-Polio AFP Rate (per 100,000 under 15 y.o.) by Province in China, 1989-1993

Province	Year	Cases	Incidence	Non-AFP Rate
Beijing	1989	3	0.03	
	Population	1990	4	0.04
	1102	1991	1	0.01
	Pop. Density	1992	0	0.00
	656	1993	0	0.00
Tianjin	1989	4	0.04	
	Population	1990	3	0.03
	920	1991	0	0.00
	Pop. Density	1992	1	0.01
	814	1993	0	0.00
Hebei	1989	161	0.26	
	Population	1990	152	0.24
	6275	1991	43	0.07
	Pop. Density	1992	23	0.04
	334	1993	18	0.03
Shaanxi	1989	39	0.13	
	Population	1990	64	0.21
	2979	1991	235	0.79
	Pop. Density	1992	59	0.20
	191	1993	6	0.02
Nei Mongol	1989	0	0.00	
	Population	1990	1	0.00
	2207	1991	13	0.06
	Pop. Density	1992	4	0.02
	19	1993	17	0.08
Liaoning	1989	13	0.03	
	Population	1990	23	0.06
	4016	1991	23	0.06
	Pop. Density	1992	7	0.02
	275	1993	1	0.00
Jilin	1989	8	0.03	
	Population	1990	11	0.04
	2532	1991	4	0.02
	Pop. Density	1992	5	0.02
	135	1993	0	0.00
Heilongjiang	1989	4	0.01	
	Population	1990	4	0.01
	3608	1991	14	0.04
	Pop. Density	1992	3	0.01
	79	1993	4	0.01
Shanghai	1989	0	0.00	
	Population	1990	0	0.00
	1345	1991	0	0.00
	Pop. Density	1992	0	0.00
	2135	1993	0	0.00
Jiangsu	1989	802	1.16	
	Population	1990	138	0.20
	6911	1991	67	0.10
	Pop. Density	1992	25	0.04
	674	1993	20	0.03
Zhejiang	1989	71	0.17	
	Population	1990	72	0.17
	4236	1991	42	0.10
	Pop. Density	1992	20	0.05
	416	1993	12	0.03
Anhui	1989	738	1.26	
	Population	1990	285	0.49
	5834	1991	69	0.12
	Pop. Density	1992	25	0.04
	418	1993	22	0.04
Fujian	1989	347	1.11	
	Population	1990	39	0.13
	3116	1991	58	0.19
	Pop. Density	1992	39	0.13
	257	1993	68	0.22
Jiangxi	1989	533	1.36	
	Population	1990	63	0.16
	3913	1991	45	0.12
	Pop. Density	1992	301	0.77
	234	1993	24	0.06
Shandong	1989	484	0.56	
	Population	1990	284	0.33
	8610	1991	95	0.11
	Pop. Density	1992	25	0.03
	549	1993	22	0.03
Henan	1989	480	0.54	
	Population	1990	984	1.11
	8861	1991	227	0.26
	Pop. Density	1992	38	0.04
	531	1993	56	0.06
Hubei	1989	87	0.16	
	Population	1990	745	1.34
	5580	1991	32	0.06
	Pop. Density	1992	5	0.01
	300	1993	12	0.02
Hunan	1989	73	0.12	
	Population	1990	49	0.08
	6267	1991	148	0.24
	Pop. Density	1992	37	0.06
	296	1993	7	0.01
Guangdong	1989	130	0.20	
	Population	1990	129	0.20
	6525	1991	106	0.16
	Pop. Density	1992	227	0.35
	367	1993	110	0.17
Guangxi	1989	43	0.10	
	Population	1990	193	0.44
	4380	1991	272	0.62
	Pop. Density	1992	83	0.19
	186	1993	48	0.11
Hainan	1989	233	3.40	
	Population	1990	82	1.20
	686	1991	20	0.29
	Pop. Density	1992	24	0.35
	202	1993	66	0.96
Sichuan	1989	8	0.01	
	Population	1990	76	0.07
	10998	1991	93	0.08
	Pop. Density	1992	73	0.07
	193	1993	16	0.01
Guizhou	1989	65	0.19	
	Population	1990	370	1.10
	3361	1991	115	0.34
	Pop. Density	1992	45	0.13
	191	1993	33	0.10
Yunnan	1989	7	0.02	
	Population	1990	163	0.43
	3832	1991	41	0.11
	Pop. Density	1992	54	0.14
	97	1993	10	0.03
Xizang	1989	0	0.00	
	Population	1990	0	0.00
	228	1991	2	0.09
	Pop. Density	1992	0	0.00
	2	1993	0	0.00
Shaanxi	1989	270	0.79	
	Population	1990	178	0.52
	3405	1991	18	0.05
	Pop. Density	1992	15	0.04
	166	1993	22	0.06
Gansu	1989	122	0.53	
	Population	1990	41	0.18
	2314	1991	25	0.11
	Pop. Density	1992	15	0.06
	51	1993	7	0.03
Qinghai	1989	0	0.00	
	Population	1990	0	0.00
	461	1991	0	0.00
	Pop. Density	1992	14	0.30
	6	1993	11	0.24
Ninxia	1989	0	0.00	
	Population	1990	0	0.00
	487	1991	6	0.12
	Pop. Density	1992	6	0.12
	94	1993	4	0.08
Xinjiang	1989	3	0.02	
	Population	1990	142	0.90
	1581	1991	132	0.83
	Pop. Density	1992	19	0.12
	10	1993	34	0.22

1) Population
x 10,000
2) Pop. Density
1/squ. km

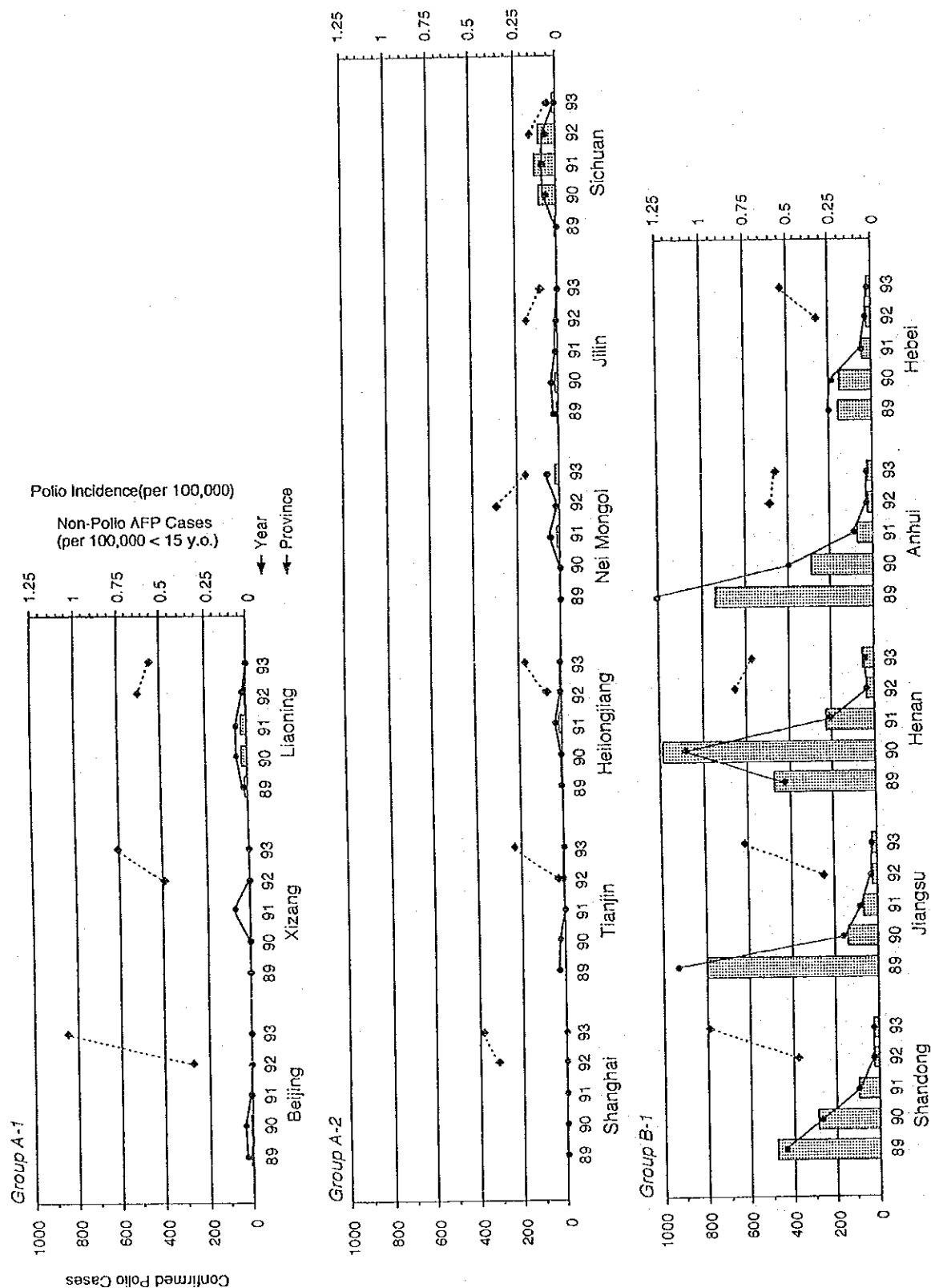


Figure 7-1. Confirmed Polio Cases, Polio Incidence per 100,000 Population, and Non-Polio AFP Cases per 100,000 Children under 15 years old by Province in China, 1989-1993

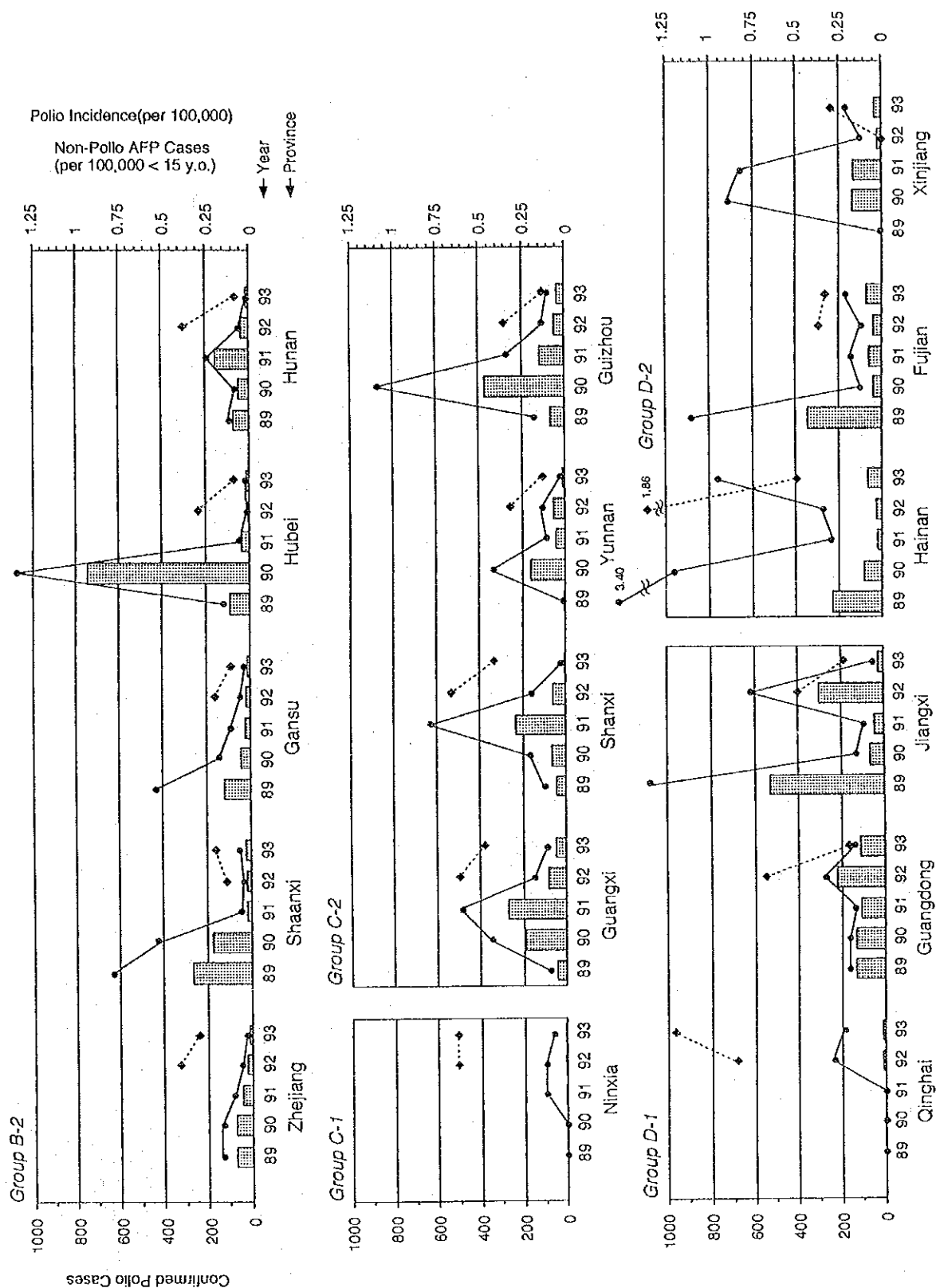


Figure 7-2. Confirmed Polio Cases, Polio Incidence per 100,000 Population, and Non per 100,000 Children under 15 years old by Province in China, 1989-1993

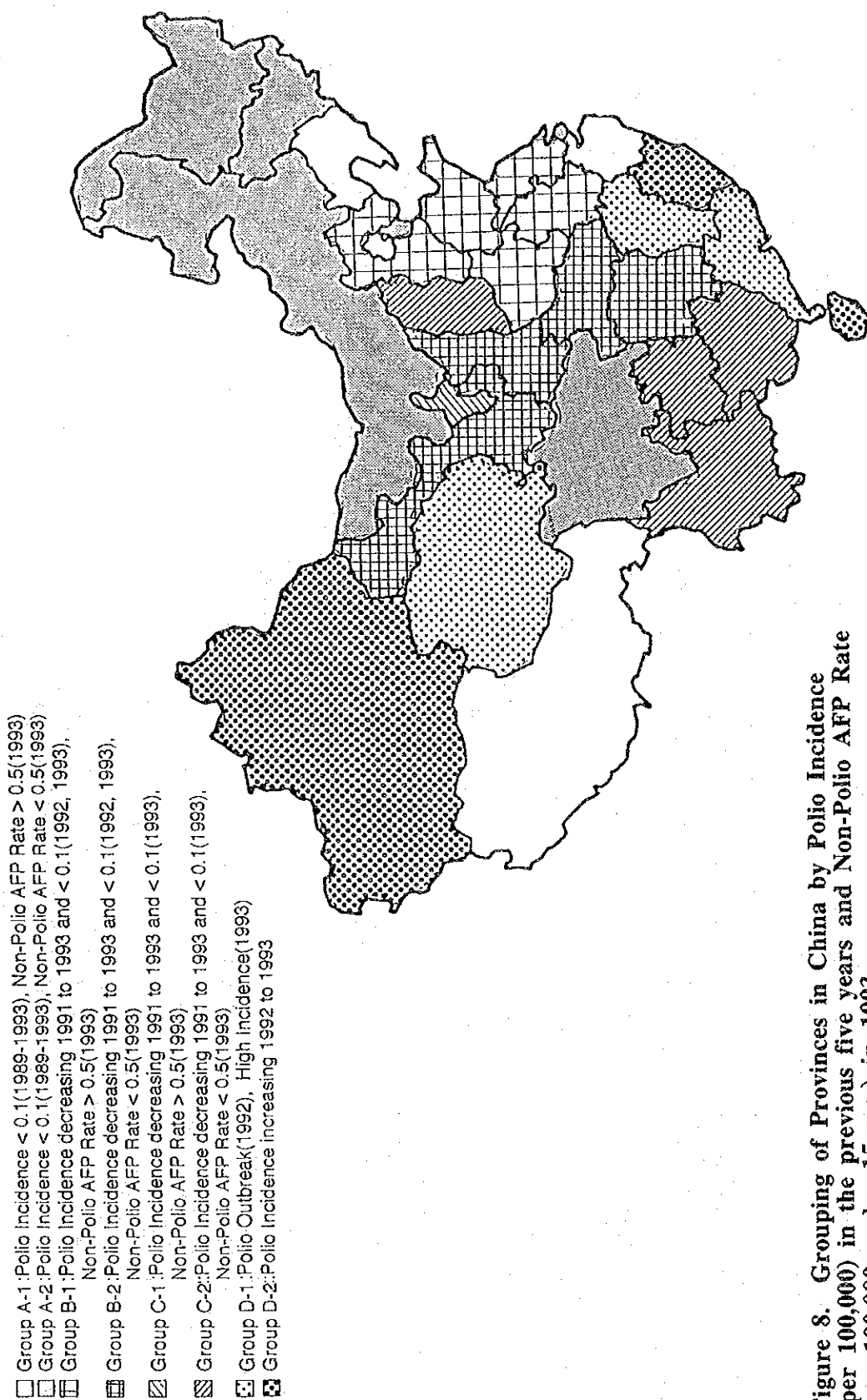


Figure 8. Grouping of Provinces in China by Polio Incidence (per 100,000) in the previous five years and Non-Polio AFP Rate (per 100,000 under 15 y.o.) in 1993

POLIO FIELD STUDY IN SHANDONG PROVINCE

CHUSHI KUROIWA, M.D.

I. Poliomyelitis in Shangdong province

Background

Located on the east coast of central China, Shangdong province is surrounded by Hebei, Henan, Anhui and Jiangsu provinces. There are 16 administrative regions (prefectures), each of which has about 5 to 10 counties comprising 134 counties in total. The population was about 87,600,000 in 1993 and more than 70% of the people live in villages in rural areas. EPI networks including the cold chain system had been completed by 1987. In 1986 and 1987, only about 70 and 71 paralytic poliomyelitis cases were reported respectively (Fig. 1) to the Provincial Epidemic Prevention Station (EPS). In 1988, however, a polio outbreak began in Dezhou prefecture in the northwest of the province and in the following 2 years it had spread widely to the counties in the western half of the province. Supplemental emergency immunization with trivalent oral polio vaccine (OPV) was implemented immediately. However, the outbreak did not subside. Besides, lack of adequate polio surveillance system had made it difficult to obtain adequate information on polio to control the outbreak. Thus, at the end of 1990, the Chinese government requested a team of JICA consultants to join Shandong provincial EPS in order to initiate cooperation for establishing a polio surveillance system and promoting overall EPI as part of the polio eradication program.

Incidence of poliomyelitis in the early 1980's

The number of polio cases had declined quickly from 934 cases in 1980 to 51 cases in 1984 due to the introduction of OPV and the development of the Expanded Program on Immunization (EPI) (Fig. 1).

OPV coverage and paralytic poliomyelitis between 1985 and 1989

OPV3 coverage under one year old had been more than 90% since 1987 when the EPI cold chain network was established in Shandong province. From 1985 to 1989, only about 80 cases were reported annually, but in 1988, despite the high coverage of OPV, polio cases increased to 223 (0.26/100,000), which was 30% of all the cases in China. In 1989 the number further increased to 484 (0.58/100,000), which was 10% of the total cases of the country.

OPV mass administration and incidence of polio 1990 to 1993

Monthly pattern of polio cases for the year 1990 and 1991 in Shandong province are shown in Fig. 2. An outbreak began in January in Heze prefecture in the southwest of the province. The local EPS carried out urgent immunization in April, 1990 in case-occurring counties and their neighboring counties. OPV mass administration was also done in possible high risk areas (counties and townships) of other prefectures in subsequent months. However, another outbreak occurred in Ningyang county of Taian prefecture peaking in July. About 5.6 million doses of OPV were administered to control the epidemic in 1990, but the number of cases remained at 284 (6% of all the cases in China) in 1990.

In 1990, the first OPV mass immunization campaign was implemented in the whole of Shandong province with 13 million doses of OPV in two sessions on the recommendation of the JICA consultants team. The first session was held in January, 1990, and OPV was given to all children under 4 years old, regardless of previous immunization. In the second session in April, 1990, 93 polio endemic counties (69% of total counties) were selected as target areas and all children under 36 months old in those areas were fed OPV. As a result, polio cases decreased by about 60% from 284 in 1990 to 95 in 1991.

As shown in Fig. 1, OPV mass immunization campaign was continued in 1992 and 1993, as a result of which the number of polio cases declined to 25 in 1992 and to 22 in 1993. On December 5 and 6, 1993 and on January 5 and 6, 1994, nationwide mass immunization activity to be carried out on National Immunization Days (NIDs) was finally introduced for the first time in China.

Polio surveillance

Through routine disease notification system, more than 90% of county EPS regularly reported acute flaccid paralysis (AFP) cases including zero cases at the prefectural level EPS in the later half of 1991, however, it took at least one month for the information to reach the provincial surveillance team.

The number of AFP cases through 1991-1993 is shown in Tab. 1. AFP reporting system was established in early 1991, and 231 AFP cases were reported through this system in 1991. Out of the 231 cases, 95 cases were confirmed as poliomyelitis, while 136 cases were discarded. The provincial surveillance team makes an effort to examine as many as discarded cases at county level so as not to miss very mild polio cases. Of the 136 non polio cases, 23 patients were Guillain-Barre Syndrome (GBS) and 10 out of them were myelitis. In 1992, 130 AFP cases were reported. Of them, 25 cases were confirmed poliomyelitis, and 105 cases were other diseases. In 1993, 22 were confirmed polio and 225 were other diseases out of 245 AFP cases.

Monitoring of polio surveillance

The quality of AFP surveillance has been evaluated by the use of the following indicators:

1. Morbidity rate of non AFP case

The morbidity of non AFP case under 15 years old, it was 0.61 per 100,000 population in 1991, 0.41 in 1992 and the rate has reached 1.00 in 1993 (Tab.1).

2. Case report timing

Interval between AFP case arrival at hospital and notification is shown in Fig.3. The percent of AFP cases reported within 7 days of the arrival at hospitals has been almost the same for the past 4 years, ranging between 45.1% (128 of 284 AFP cases) in 1990, 49.8% (115 of 231 AFP cases) in 1991, 50% (65 of 130 AFP cases) in 1992, and 46.8% (116 of 247 AFP cases) in 1993.

3. Case investigation timing

As shown in Fig. 4, the percentage of AFP cases investigated within 2 days of local notification has increased from 62.8% (145 of 231 AFP cases) in 1991 to 88.4% (168 of 247 AFP cases) in 1993.

4. Stool collection timing

The percentage of AFP cases in which at least one stool specimen was collected within 7 days of onset of paralysis is shown in Fig. 5. The percentage has not improved remarkably for the past 3 years, ranging between 21.6% (50 cases) in 1991, 27.7% (36 cases) in 1992, and 23.5% (58 cases) in 1993. The percentage of total number of AFP cases for which stool specimen was collected has not increased significantly, 41.1% (95 cases) in 1991, 26.9% (35 cases) in 1992, and 41.3% (102 cases) in 1993.

Age distribution and OPV history of polio cases 1990 to 1993

In the past 4 years, most of polio cases (ranging 89.5% to 91.9%) were aged under 3 years old (Fig. 6). However, when the number of cases under 1 year old is considered, the percentage of the polio cases has increased remarkably to 81.8% (18 cases of 22 polio cases) in 1993, compared to 34.5% in 1990, 31.6% in 1991, and 40% in 1992.

OPV history shows that 68% to 85.2% of the polio cases received incomplete doses of OPV (less than 3 doses) for four consecutive years (Fig. 7). In 1992 and in 1993 the percentage of the cases not receiving OPV has declined sharply to 16% and to 18.2% respectively, compared to 50.7% in 1990, and 24.2% in 1991.

Vaccine supply

Because of the introduction of mass immunization of OPV in 1989, the quantity of OPV supply has increased. Besides, approximately 7 million doses of OPV have used annually for the routine immunization. The doses of mass campaign are shown as follows:

1st+2nd session=total	target age	unit: 10,000 doses
1990; 390	(0-35 months)	
1991; 810+470=1280	(0-47, 0-35)	
1992; 690+390=1080	(0-47, 0-35)	
1993; 597+293= 890	(0-47, 0-35)	
1993; 437+437= 874	(0-47, 0-47)	
(1994);		

Discussion

Although, as a response to the outbreak in 1989, supplemental emergency immunization totaling about 5.6 million doses of OPV was distributed, the outbreak did not subside satisfactorily (Fig. 1,2), which suggests that such outbreak response immunization alone is not enough to interrupt wild polio virus transmission unless geographical areas and target population are taken into account epidemiologically, because wild polio virus spreads very rapidly (less than 1% of polio infections result in paralysis). Since the introduction of OPV mass immunization on the province wide scale, the polio cases have decreased dramatically. Thus this mass campaign seems to be very effective to control or to eradicate poliomyelitis as has already proven in the Americas. Because of the success of mass immunization campaign in Shandong province, China has decided to introduce OPV mass campaign on the scale of National Immunization Days.

Until the establishment of AFP reporting system, polio cases had been reported only through the routine disease notification system so that the sensitivity of reporting of poliomyelitis might not have been good, that is to say, some very mild polio cases might have been overlooked, which may have been one of main reasons why polio outbreaks had been difficult to control. The initiation of NIDs and AFP reporting system have made great progress in polio eradication not only in Shandong province but also in the whole of China.

The morbidity of non AFP case under 15 years old has reached 1.00 per 100,000 population in 1993 (tabl. 1), which is the same rate as in those countries where polio eradication has almost been achieved, such as The Central and South Americas, England and so on. Thus the quality of AFP surveillance system in Shandong province is thought to be quite good.

Interval between AFP case arrival at hospital and notification has not improved for the past 4 years (Fig. 3), which suggests that among anti-epidemic department staff and doctors at hospitals, the awareness of the system has not improved very much. However, more and more AFP cases have been investigated within 2 days of local notification (Fig. 4), suggesting that awareness of AFP reporting system is improving among EPS staff at prefectural and county levels who are responsible for investigation of cases.

Both the total number of AFP cases in which stool specimen was collected and AFP cases in which at least one stool specimen was collected within 7 days of onset of paralysis have not improved (Fig. 5). Final classification of cases is not possible without laboratory examination of a properly collected stool specimen and Shandong province

seems to advance towards polio eradication rapidly, therefore the province should put much more emphasis on stool collection timeliness.

Most of polio cases were aged under 3 years old (Fig. 6), so mass immunization should keep covering at least 0 to 35 month-old children. In 1993, the percentage of polio cases under 1 year old has increased dramatically to 81.8%, which might have been a reflection of OPV mass immunization in the past 2 years, that is to say, children above one year old had already gained immunity against polio virus through mass campaigns, so in 1994, the similar tendency could be expected.

The percentage of polio cases not receiving OPV has decreased sharply in the past 2 years (Fig. 7), theoretically, however, unimmunized children are more likely to be infected with polio than immunized children, which suggests that more and more false positive OPV history could have been reported and that the routine immunization system could be collapsing despite the high coverage reported officially, ie, children who had not received OPV were included into the category of OPV1, OPV2, or OPV3 thus resulting in a false low incidence of polio in the category of unimmunized children.

About 7 million doses of OPV for the routine immunization and about 9 million doses for mass immunization will be required in Shandong province for the year 1994. However, it is not certain whether these doses are enough to immunize all eligible children because there are many unregistered children, especially in rural areas, owing to the one child per family policy in China. It is almost impossible to make these so called out-of plan children register because families are afraid of the fine for breaking the law. The grass-root health workers in villages, such as village doctors, are thought to know the precise number of these children in their villages, so it is important that these health workers are motivated to give OPV to all of these children without forcing them to register.

II. Active Surveillance in Shandong province

Period: 19 March, 1994 to 23 March, 1994

Purpose

We undertook active surveillance in Qufu City, Jining City Renchang District, and Dong Ping County in order to inspect EPI activity, examine AFP cases, and give some advice to health center staff through the results of our inspection.

Schedule

19 March, arrival at Qufu City

20 March, briefing at Epidemic Prevention Station (EPS) of Qufu City.

Inspection of Zhou Hospital (township health center) and field visit to Liu Zhuang and Dong Xiahou villages.

21 March, briefing at Epidemic Prevention Station of Jining City Renchang District and investigation of Acute Flaccid Paralysis (AFP) cases.

Inspection of Shandong Jining The First Hospital.

22 March, briefing at Epidemic Prevention Station of Dong Ping County and investigation of AFP cases.

Inspection of Dong Ping People's Hospital.

23 March, Inspection of Bang Jiudian Hospital and field visit to Huuhe village.

Results

1. Qufu City

1-1. Outline

The population of Qufu City is 610,000, and 22,280 are aged under 4 years old. there are 13 townships and 495 villages.

Every township of Epidemic Prevention Station has an EPI group, and the staff responsible for poliomyelitis are adequate in number.

The last case of poliomyelitis was reported in 1982. After that there has been no cases. The coverage of OPV3 is more than 95%, and on National Immunization days (NIDs) in 1993, the OPV coverage reached 99% of eligible population.

1-2. Inspection of Zhou Hospital (township committee health center)

The population of the township is 48,000 and that of under 4 years old is 2000. There are 33 villages and 38 village hospitals in which 96 village doctors are present.

During the NIDs, the number of population receiving OPV was 2,000 in 1992 and 2,035 in 1993, so the OPV coverage on NIDs was 100% in both the years.

At Zhou Hospital, the following villages were chosen for inspection.

1-3. Inspection of Liu Zhuang village

The population of the village is 800, and 30 children are under 4 years of age. According to an interview with a village doctor, OPV coverage was 100% and he had knowledge of AFP and AFP reporting system.

Interview with a mother: her child was born in September, 1991, 2 years and 6 month old girl, and registered. She received OPV every year, totaling 8 OPV fed. The mother received an education of EPI from the village doctor when the child was 7 day old and also got information on NIDs from TV, handbills and posters. She knew the diseases against which EPI was available, such as pertussis, measles, diphteria, BCG, and tetanus.

1-4. Inspection of Dong Xiahou village

In this village, the population is 2000 and 65 are under 4 years old. A village doctor said that 100% of eligible children received OPV. AFP reporting system was working well according to the doctor.

Mothers who had young children were not available because most of them were in rice paddy fields. Instead, we got a grandmother with a 3 year old boy. The boy received OPV but further information was not able to be obtained.

2. Jining City Rencheng District

2-1. Outline

The population of this district is 650,000 and 33,901 are under 4 years old. There are 12 townships and 565 villages.

No polio cases has been reported since 1986. The coverage of OPV3 was more than 95%. On mass immunization days, a total of 542,900 children have received OPV and the immunization coverage has reached 99.98%. Two AFP cases were reported in 1991, 3 AFP cases in 1993, and 3 AFP cases in 1994. Of 8 AFP cases, 6 were discarded and 2 were waiting for the results of virus isolation. Out of 8 AFP cases stool specimens, 7 stool specimens were taken (87.5%).

2-2. AFP case investigation at the Epidemic Prevention Station in Jining City Rencheng District

Case 1: Xie Xing, female, born 17 Dec, 1988, History of OPV not known.

Past history: Nothing significant.

Onset of paralysis and clinical course:

Fever first occurred on 9 Aug, 1993 and cough developed. She visited hospital and received 4 injections (antipyretics and penicillin). On 12 Aug, left leg paralysis occurred and she was not able to walk because of pain. One month later, she started to walk gradually.

Symptoms at onset of paralysis:

Three days of fever, cough, swelling of left heel.

Physical examination:

Normal gait (tendency of left foot to deviate out).

No paralysis, no atrophy.

Normal knee jerk, normal ankle jerk.

No Babinski reflex, no clonus.

Relevant item:

Dr. Hikita (JICA expert) examined this case in September, 1993.

Result and problem:

Non polio case. Onset of the swelling of the left heel and slight deviation of the left foot outwards suggests that there was phlegmon on the left heel.

Case 2. Li Yanfei, female, born March, 1987, received 5 or 6 doses of OPV.

Past History:

Nothing significant.

Onset of paralysis and clinical course:

Fever first occurred on 11 Jan, 1994 and 5 intramuscular injections were received on the buttocks. At 7:30pm, on 12 Jan. she was injected on the buttock. On the following day, 13 Jan, right leg paralysis accompanied by numbness and sensory loss over a small region of the dorsum of the right foot developed.

Symptoms at onset of paralysis:

Fever, sensory loss.

Physical examination:

Gait disturbance: limping (the right leg).

Paralysis in the lower right leg (foot drop), slight atrophy of the right

peroneal muscle.

Normal knee jerk, normal ankle jerk.

Sensory loss on the lateral and posterior part of the right leg and the dorsal surface of the right foot (the lateral part of right leg was most affected).

Results and problem:

Non polio case. There was possibility of injection palsy, but sensory loss at posterior part of leg may not be compatible with injection palsy.

2-3. Inspection of Shandong Jining The First Hospital

This is the main hospital of Jining city and serves 7,500,000 residents in this area. The hospital was established in 1986 and there are 700 beds, 1245 staff, 892 technicians, 46 professors and 258 doctors. This also functions as medical research center. The hospital gets 2,100 outpatients per day and 12,000 admission per year.

Anti-epidemic and health care workers in the hospital collect reports of infectious diseases filed by doctors in each department every day, and report the AFP cases to an EPS immediately after it is detected. In addition, they give immunization to children visiting the hospital.

3. Dong Ping County

3-1. Outline

Situated in the southwest part of Shandong province, Dong Ping County covers an area of 1269km². There are 17 townships and 675 villages. The population is 750,000 and 28,792 are under 4 years of age.

There are 17 health centers, 72 township health care workers and 1777 village doctors. This county was awarded for its good activity on EPI.

In 1989, 8 polio cases were reported, and after that no polio case has been reported. From 1990 to 1993, 24 routine immunization were carried out and the coverage was more than 95%. Nine programs on mass administration of OPV have been done and a total of 545,747 children have received OPV. The OPV coverage on NIDs reached 95%. Before NIDs, the information about mass campaign was distributed to local people through advertisement on TV and through distribution of 25000 handbills, 700 posters and 20 slogans. Besides, 10 meetings and 85 training programs were held for village doctors.

In 1993, 7 AFP cases were found. One of them went back to his home town, and 6 were non polio cases. Of 6 cases, 4 stool specimens were collected. Although WHO has recommended that AFP reporting system should start immediately wherever AFP cases

are detected, including villages, in practice, it starts working after patients visit hospitals.

3-2. Inspection of Dong Ping People's Hospital

This used to be a township hospital and was upgraded to the second biggest county hospital in 1976 and became the People's hospital in 1991. There are 11 clinical departments and 212 beds, 242 medical staff and 63 chief doctors work for the hospital. It receives an average of 310 outpatients per day and 5,2000 inpatient admission per year. Anti-epidemic and health department:

AFP cases are written correctly in the record of infectious diseases.

Internal medicine:

AFP cases are written correctly in the inpatient record.

Pediatrics:

AFP cases are written correctly in the inpatient record. The record showed that there were many measles cases and measles pneumonia admitted in 1993 and the chief pediatrician agreed with this.

3-3. Investigation of AFP case at the EPS of Dong Ping County

Case 1. Yin Maoxia, female, born 10 Nov, 1989, OPV history not known.

Past History: Nothing significant.

Onset of paralysis and clinical course:

Fever and cough began on 23 March, 1993 and lasted for 4 to 5 days.

On 30 March, paralysis of both legs occurred, and 3 to 4 days later paralysis of both upper limbs and respiratory distress occurred.

Constipation was also present. For 2 months, the patient was unable to walk, then started to recover gradually. Five months after onset, she was able to walk.

Symptoms at onset of paralysis

fever, cough, constipation.

Physical examination:

Gait disturbance: limping of the right leg.

Muscle power of both legs seemed to be normal. No significant atrophy.

Loss of both knee jerks, loss of both ankle jerks.

No sensory loss detected.

No Babinski sign. No clonus.

Relevant item:

The surveillance team of Shandong province examined this case.

Stool specimen:

collected in April, 1993.

Results and Problem:

Non polio case. Though sensory loss could not be detected, the above data suggests the possibility of Guillain-Barre Syndrome.

3-4. Inspection of Houhe Village

We visited the Bangniu Dian Hospital (a township committee health center) without announcement of our visit to the health center staff in advance, and chose the Houhe village for our inspection. There are 1015 villagers and 5 mothers who have children under 5 years old were available for the interview.

Child 1: girl, born 4 Oct 1993, vaccination history is registered, 3 OPV.

Child 2: girl, born 20 Jul 1991, vaccination history is registered, 7-8 OPV

Child 3: girl, born 25 May 1992, vaccination history is registered, 3 OPV

Child 4: boy, born 19 Jan 1990, vaccination history is registered, 5 OPV

Child 5: boy, born 24 Sep 1989, vaccination history is registered, 5-6 OPV

Mothers were informed about the knowledge of EPI as well as NIDs through a village doctor's explanation and announcements using loudspeakers.

After the inspection, we held a meeting with the health center staff and gave them some advice which I wrote down later.

Conclusions

We undertook active surveillance at Qufu City, Jining City Rencheng District and Dong Ping County and the following issues were found:

1. EPI activity

According to official reports, the coverage of routine immunization was over 95% and the OPV coverage of mass immunization on NIDs reached 95 to 100% in each region. The inspection at Liu Zhuang, Dong Xiahou and Houhe villages showed that 7 out of 8 (87.5%) children received OPV completely (more than 3 doses) suggesting that the announced official data are reliable.

At prefectural and county hospitals, AFP cases were recorded correctly both in infectious disease reports of anti-epidemic and health departments and in inpatient records of internal medicine and pediatric departments, which suggests that anti-epidemic and health departments of hospitals are assuming their responsibilities well. There were many measles cases in inpatient record of 1993 at the pediatric department, the Dong Ping

People's Hospital, suggesting that the routine immunization of EPI diseases was not functioning well.

2. AFP reporting system

According to the interviews with village doctors, it was assumed that the concepts of AFP were not so clear although they knew the terminology of AFP. So far, the system has been working from the hospital level instead of the village level.

Advice

We advised the staff at the EPS in Dong Ping county of the following items:

1. Because of the outbreak of measles, we pointed out that the coverage of routine immunization must be much lower than those officially reported, so we explained the importance of routine immunization, especially for measles.
2. The results of village inspections on OPV coverage suggest that the high coverage of OPV on NIDs is quite reliable. Thus, we encouraged them to try to maintain this in the future.
3. Stool specimens were not collected from 2 AFP cases out of 6 cases reported in 1993, so we emphasized the importance of collecting stool specimens within 7 days of onset of paralysis to upgrade the quality of polio surveillance.

Acknowledgment

Concerning the first part of my report, I referred to Dr. Chiba's epidemiological report titled OUTBREAKS OF PARALYTIC POLIOMYELITIS AND POLIO SURVEILLANCE IN SHANDONG PROVINCE IN CHINA, published in 1992.

Through this field trip, I was able to understand how active polio surveillance was working in practice and how important it was. I am going to Laos to join polio eradication project this July and I would like to make an effort to transfer the system of the active surveillance established in Shandong province.

I was also able to build up my confidence on what I have to do in Laos, so I would like to acknowledge the people who helped me in this field study, such as Dr. Zhao Shili of Director of Shandong Provincial Epidemic Prevention Station, Dr. Xu Aigiang, Dr. Kaku and Dr. Li Li of Provincial Polio Surveillance Center, and other EPS staff as well as health workers and doctors at each hospital level. I also thank Dr. Kusumoto, Dr. Hikita, Dr. Hara, and Dr. Nishimura, JICA experts on China Polio Control Project, together with the staff in JICA China Office for organizing this field study filled with the essence of active polio surveillance.

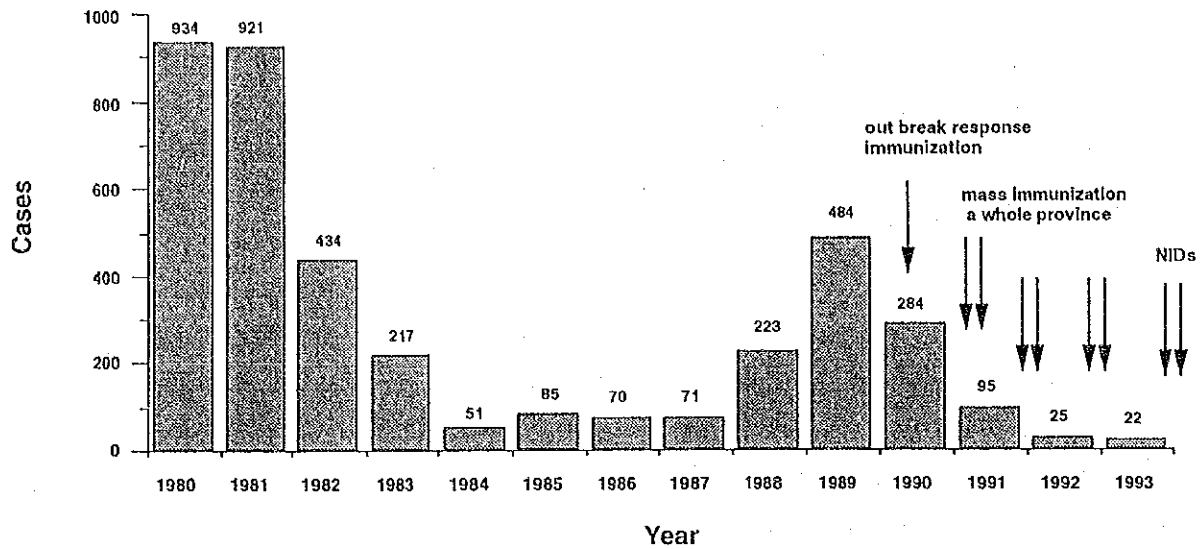


Figure 1 Polio Cases in Shandong Province, 1980 to 1993

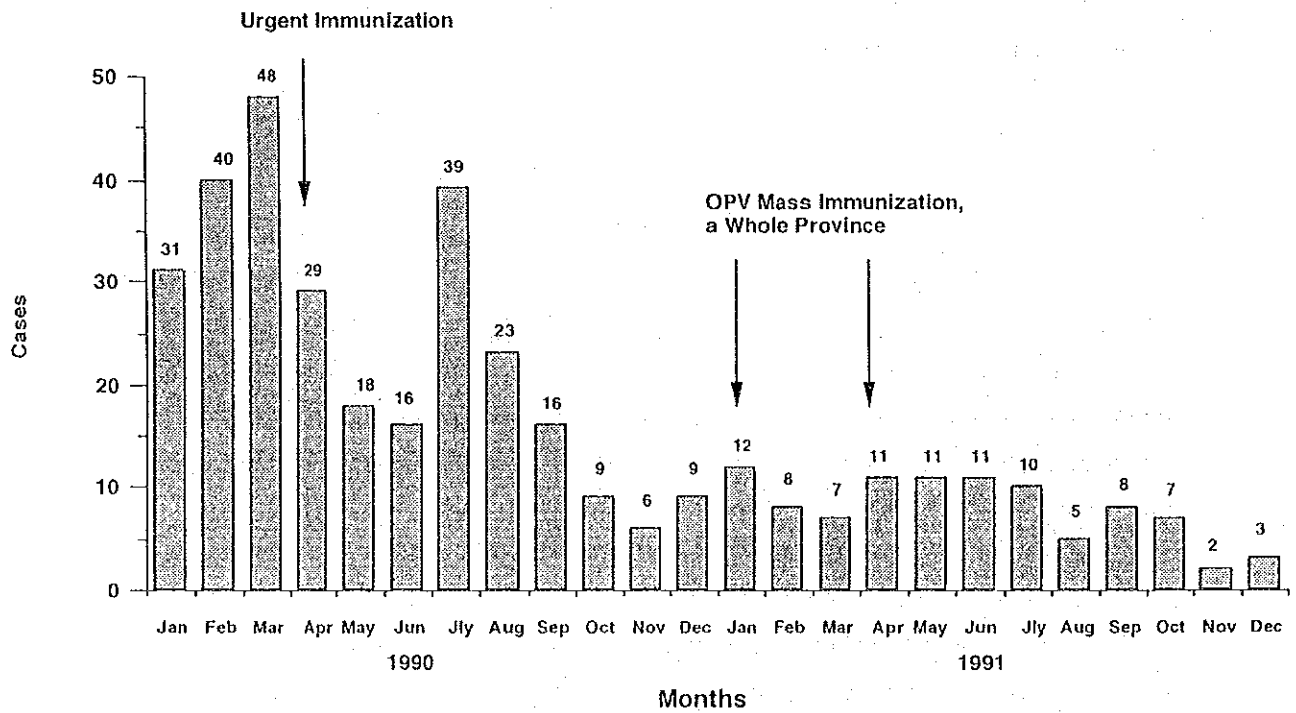


Figure 2. Paralytic Poliomyelitis by Month and OPV Administration in Shandong Province, in 1990 and 1991

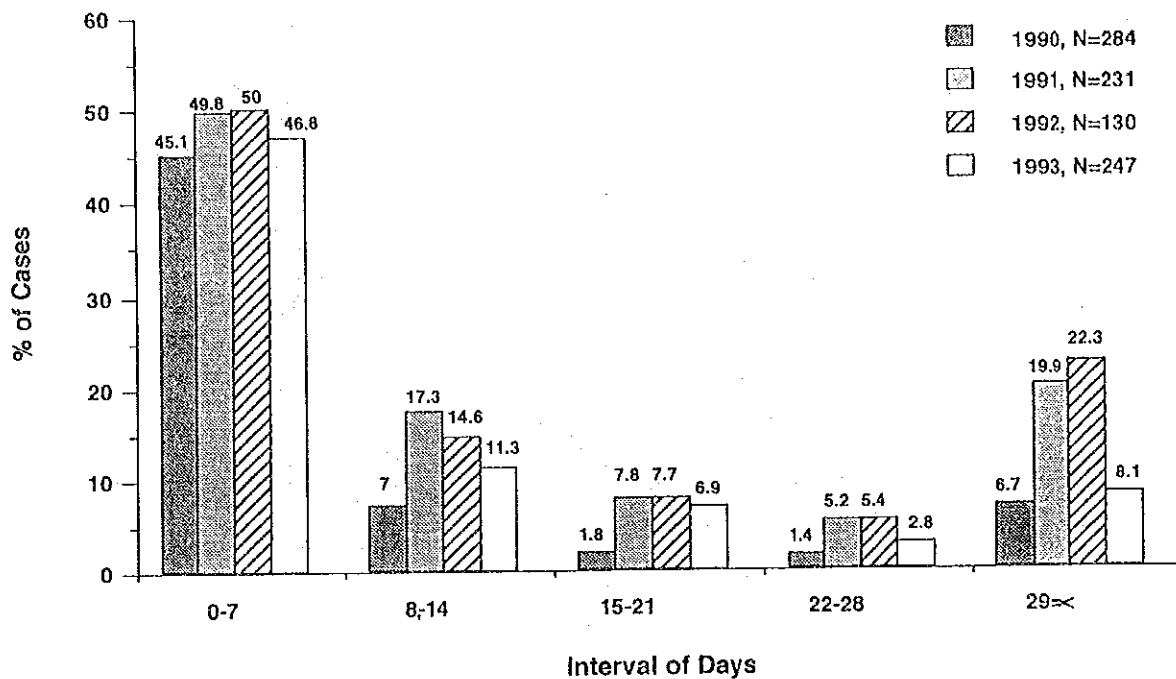


Figure 3. Interval between AFP Arrival at Hospital and Notification in Shandong Province, 1990-1993

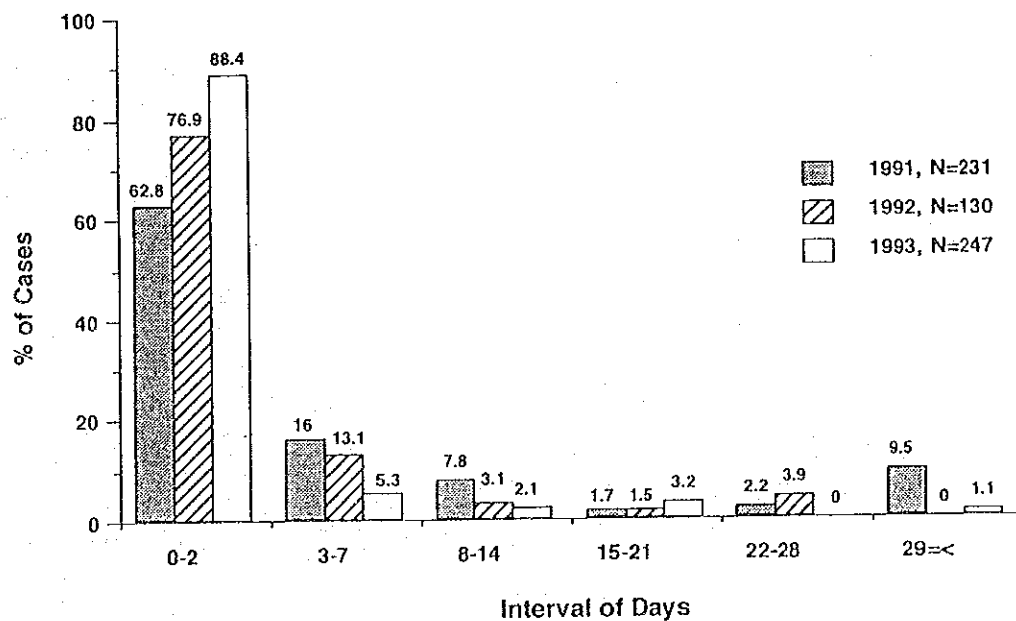


Figure 4. Interval between Notification and Investigation in Shandong Province, 1991-1993

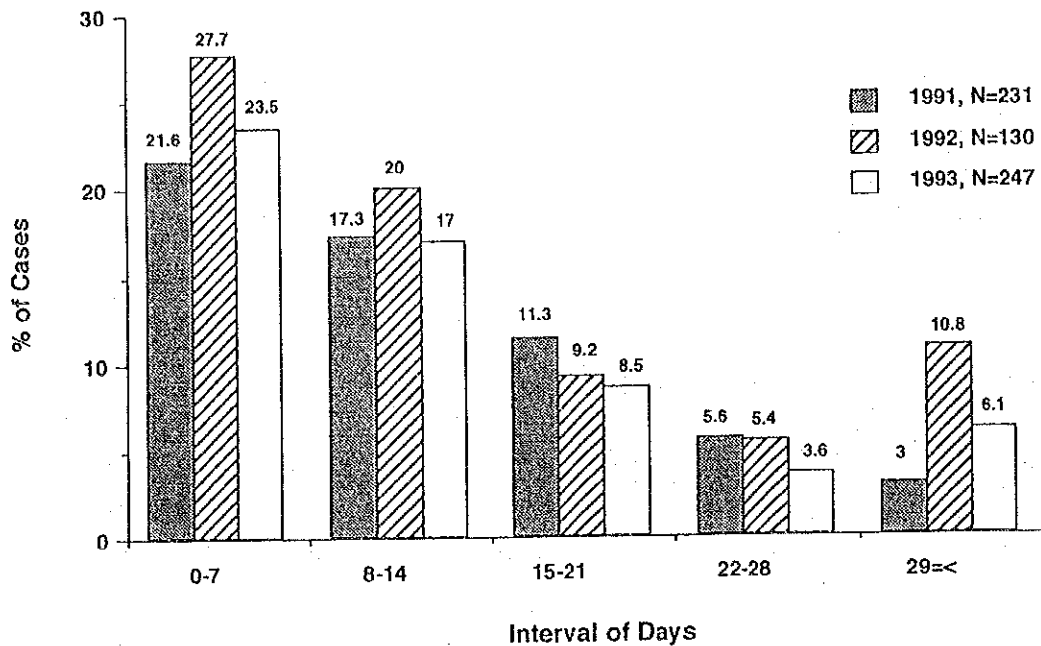


Figure 5. Interval between Stool Collection and Onset of Paralysis in Shandong Province, 1991-1993

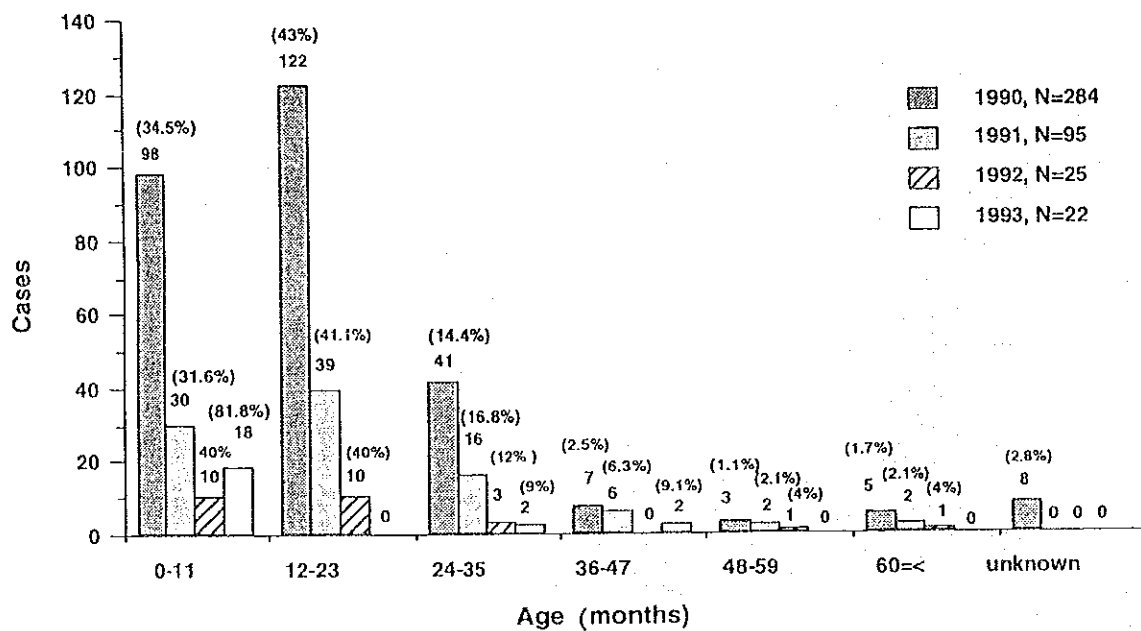


Figure 6. Age Distribution of Poliomyelitis in Shandong Province, 1990-1993

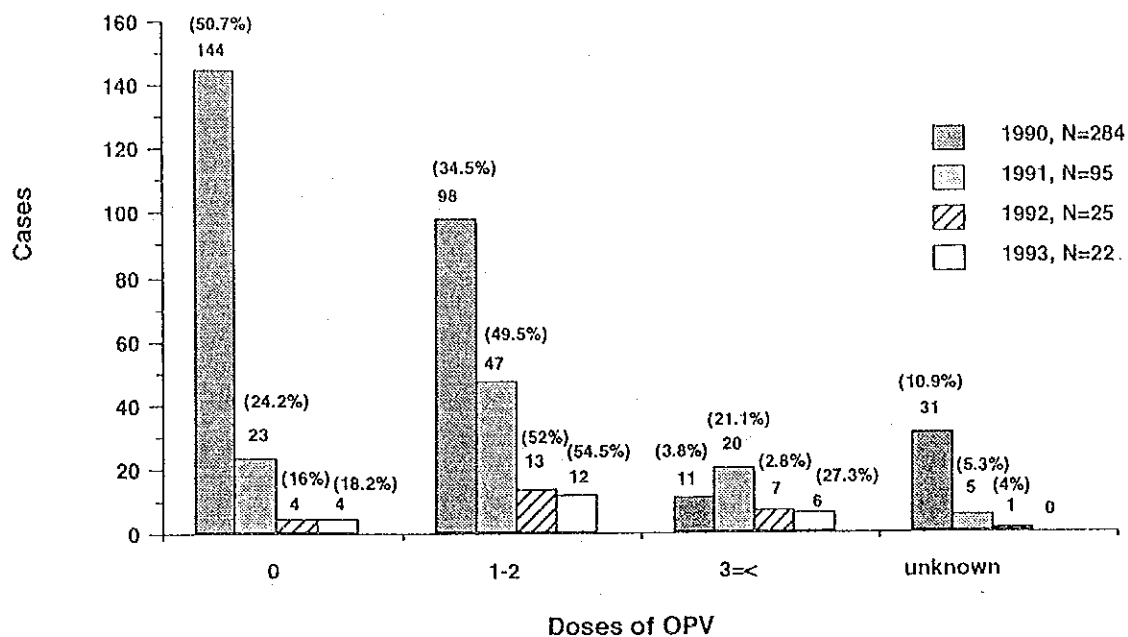


Figure 7. OPV History of Poliomyelitis Cases in Shandong, 1990-1993

Table 1. AFP Cases in Shandong Province, 1991-1993

	AFP	Polio	non-Polio	Rate of non-Polio(/100,000)
1991	231	95	136	0.61
1992	130	25	105	0.47
1993	247	22	225	1

AFP cases under 15 years old

REPORT OF FIELD STUDY IN GUANGDONG PROVINCE

Noriko Kohagura, M.D.

I. Schedule of Field Study

24(Thu)15:40	Arrived in Guangdong by 3U151
25(Fri) 09:00-11:30	Visit to Health and Epidemic Prevention Station of Guangdong Province
14:00-15:00	Visit to County Anti-epidemic Station of Nanhai
26(Sat) 09:00-09:30	Visit to Department of Pediatrics Nanhai Hospital
11:00-12:00	Visit to Rural township Health Center in Xinsha, Examination of two AFP patients
14:00-14:30	Visit to Rural township Health Center in Seijyo
15:00-16:00	Examination of two AFP patients
27(Sun) 09:00-11:00	Visit to Laboratory in Nanhai
28(Mon)12:35	Leave to Guangdong

II. Outline

Guangdong province is located in the southern part of China facing the South China Sea with an area of some 210,000 square kilometers. The province covers an area of 17.8 km² and the north part of the province has mountains and hill country, it accounts for 76.6% of the province. The main transportation networks consist of roads, it is possible to visit the rural areas by car. The weather of the Guangdong province is subtropical. The average annual temperature is 21.8°C, the coldest month is January, although there are hot seasons

for half the year. In these hot seasons, the average monthly temperature is 28~29°C. The amount of rainfall expected is more than 1500mm. The total population of the province is 65.25 million and the birth rate is 19.31‰. The administrative unit is divided into 20 prefectures including 18 cities (the county level) and 60 counties. Under each county unit, there are 40 rural townships and 1875 residents' committees.

III. Situation of Poliomyelitis

Outline

The cases of poliomyelitis have been reported every year, between 1978 through 1993, 1553 cases of poliomyelitis were reported. In 1980 the morbidity rate was 2.71 / 100,000 population. However 18 cases were reported in 1988 and the morbidity rate was only 0.03 / 100,000 population. There had been a major outbreak each three or four years before EPI was carried out. But a major outbreak has not happened since EPI and the cold chain covered all areas of the province. Now there are 130~283 cases of poliomyelitis annually. (Fig.1)

1990~1993

- 1) Morbidity rate :0.17~0.43/100,000 population (Table 1)
- 2) Regional Distribution : The current cases have been reported by 19 prefectures and 70 counties. Four prefectures, Meizhou, ZangJiang, Shanwei and MaoMing have reported more than 50 cases, these accounted for 59.03 % of the total cases. (Table 2)
- 3) Monthly Distribution :The peak period of outbreak was from April to August in 1990~1992 and this period corresponded to the periods of past outbreak seasons. But in 1993, the outbreak was concentrated from January to April. (Table 3)
- 4) Age Distribution : Among the four years, most cases occurred in children less than 36 months. 48.63% of the cases were in children less than 24 months, 33.56% of the cases were in children less than 12 months. (Table 4)
- 5) Immunization history : 60.98% of polio cases had received zero,one dose or two doses. On the other hand, only 9.47% had received more than three doses.(Table 5)

IV. Surveillance

1. Current status (1992~1993) : Guangdong province has carried out AFP surveillance since 1990. The AFP surveillance system is composed of Epidemic Province Stations in every county and has been established since 1992.

1-1. Status of AFP surveillance : 360 AFP cases were reported in 1992, and 150 AFP cases were reported in 1993, among which 283 cases and 111 cases confirmed respectively, 77 cases and 39 cases discarded respectively. The rate of non-polio AFP was 1.18 per 100,000 and 0.06 per 100,000 children less than five years respectively. The sensitivity of the surveillance system in 1993 was very low.

1-2. Reported time interval of AFP cases : The cases who went to a doctor within 7 days after onset of paralysis were 76.39% in 1992, and were 84.56% in 1993. (The cases were reported less than 2 days after going to a doctor were 43.05% in 1992 and were 56.30% in 1993.) The cases who were reported county to province less than 2 days were 53.61% and 61.08%. (Table 6)

1-3. Time interval of surveillance : The cases who were investigated less than 2 days after reporting by the staff of the health center to the statistics, the cases were investigated after onset of paralysis were only 21.77%.

2. Laboratory surveillance : The isolation and typing of polio virus, determination of IgM antibody and neutralizing antibody, the study of vaccine efficacy and the study of the immunization coverage have been carried out in the laboratory of the provincial anti-epidemic station.

The results of isolation and typing polio virus for 1990~1993 :

199 strains were isolated from 344 stool samples. The positive rate was 57.9%. Polio viruses were 173 strains(86.9%), and type1 viruses were 139 strains(69.8%). (Table 7)

V. Strategy of Immunization

Guangdong province has conducted routine immunization simultaneously during spring and winter seasons in the high risk prefectures. Therefore the outbreaks were not controlled until 1992. The intensive activities in all provinces of Guangdong have started since 1993. The efficacy of this action has made primary progress. (Table 8)

VI. Analysis of Outbreak

Shortage of immunization

Outbreaks of poliomyelitis have occurred because of the shortage of immunizations, the developing economic status, the weakness and low quality of teamwork, insufficient EPI networking and the shortage of knowledge about vaccination. That means not only low coverage of routine immunization but also a low immune response against polio viruses. 82.2% of cases in the last four years were children less than one year old.

Weakness of simultaneous immunizations

The simultaneous immunizations has started based on the plan for National Immunization Day since 1993. After the simultaneous immunizations during February and March, the cases have decreased remarkably.

Sensitivity, timeliness of the surveillance system

The difference between ideal and the reality, is that the surveillance has made some mistakes at the time of examining the samples. The rate of cases who were diagnosed by virus isolation has been very low.

Floating population and out of plan children

Efficacy of TOPV in subtropicals and mutation of the antigen

VII. AFP Case Reports

Case 1 4 years old female

OPV history: zero

Onset of fever: unknown

Onset of paralysis: September, 1992

Present Illness: She was injected with some drugs for high fever before the onset of paralysis. The diagnose was pyelonephritis. One day later, she had Acute Flaccid Paralysis of the right leg and the paralysis lasted about ten days. She did not have convulsions, muscle pain, nausea, vomiting, and dyspnea without bladder disturbance. She was admitted to the Nanhai hospital in Guangdong, and her blood and stool samples was examined.

Present Physical Examination: She could stand up and walk spotty by herself, her right femoral muscle was atrophic and right lower extremity rotated exterior. She does not have sensory disturbance and Babinski's sign, although right knee reflex was reduced.

Diagnosis: She was diagnosed as having poliomyelitis by her neutralizing antibody and the isolation of polio viruses from her stool.

Case 2 1 year old male

OPV history: OPV 1 (early April, 1993)

Onset of fever: April 24, 1993

Onset of paralysis: April 27, 1993

Present Illness: High fever lasted for three days, after that he displayed signs of paralysis with nausea and vomiting. He was injected pain killers twice at hips for high fever. The most severe paralysis appeared at lower extremities(Left>Right), in addition the paralysis of upper extremities developed.(Left>Right)

Present Physical Examination: He could not stand and walk by himself, and he could not lift his upper extremities. In addition his muscle was atrophic and weak. His bilateral lower extremities rotated exterior. His DTR's reflexes reduced, however Babinski's sign was negative.

Diagnosis: He was diagnosed as having poliomyelitis by serological examinations.

Case 3 4 years old female

OPV history: zero

Onset of paralysis: November, 1992

Present Illness: He was afebrile, therefore he did not have injections history. After the accident which he fell from his bed, he had paralysis of right lower extremities, the paralysis developed to left lower extremities and finally to bilateral upper extremities within four days. He did not have any other symptoms without paralysis. He admitted Children's Hospital in Guangdong, and blood, stool and CSF were examined. However polio viruses were not only isolated, but also neutralizing antibody of polio viruses did not rise.

Present Physical Examinations: She could stand up and walk by herself. She did not have muscle weakness and atrophy, paralysis, sensory disturbance and exterior rotation of lower extremities. Her DTR's reflexes were normal, and Babinski's reflex was negative.

Diagnosis: We diagnosed the patient Guillain-Barre syndrome.

Case 4 5 years old female

OPV history: zero

Onset of fever: May 11, 1990

Onset of paralysis: May 13, 1990

Present Illness: Her early symptoms consisted of high fever, convulsion, muscle pain and clouding of consciousness. After two days, the paralysis of left lower extremities developed. The paralysis has lasted until now.

Present Physical Examination: She could stand up by herself, however she limped left leg. Her left muscles were weak and atrophic. Her DTR's reflexes were normal, Babinski's reflex was negative. The results of her laboratory examinations were unknown.

Diagnosis: She was diagnosed as having poliomyelitis by clinical manifestations

VIII. Comment

After the introduction of the EPI system, the outbreak of poliomyelitis in China had declined to 600 cases annually since the 1980's, however the outbreak has relapsed since 1989. Poliomyelitis spread to all over China, for instance Shandong, Anhui, Henan, Fujian, Hubei, Guangxi, and Guizhou. The number of polio cases in 1989 was 4,600, in 1990 the number was more than 5,000.

Although China's polio eradication activities has made remarkable progress in recent years by introducing NID (National Immunization Day). Two doses OPV administered to all children less than four years of age estimated about 100 million, in December 1993 and January 1994. It was my surprise to have carried out NID in this huge country where 1.13 billion people live with 80% living in rural areas.

The above-mentioned was knowledge I acquired from a seminar on polio eradication, its theory and practice in Kumamoto.

In this field study, we had a chance to visit two provinces, Shandong and Guangdong. I would like to discuss some problems concerning the polio eradication program throughout this trip.

1. System of EPI

The system of EPI has been arranged since the 1980s, although the development has been uneven in different parts of the country. In practice, each province is responsible for EPI activities, vaccine supply is controlled by the economic status of the province.

2. NID

According to the success of polio eradication in PAHO, the efficacy of NID was certified. Vaccine supply has to assist by UNICEF, JICA, Rotary International for NID.

3. Out of Plan Children

This issue is the major problem in China to succeed in polio eradication. The village doctor has to report to the township health center the number of babies who were born in the village every two months. The township health center issues on EPI card to their mother and the province supplies polio vaccine based on the number of children registered. Therefore out of children can not take OPV, they may be the focus of outbreak. Unfortunately, another program named floating people has occurred. Village people have moved to the south part of China where has remarkable progress economically in recent years for earn cash. (In Guangdong province, there are 12 million migrant workers.) Their

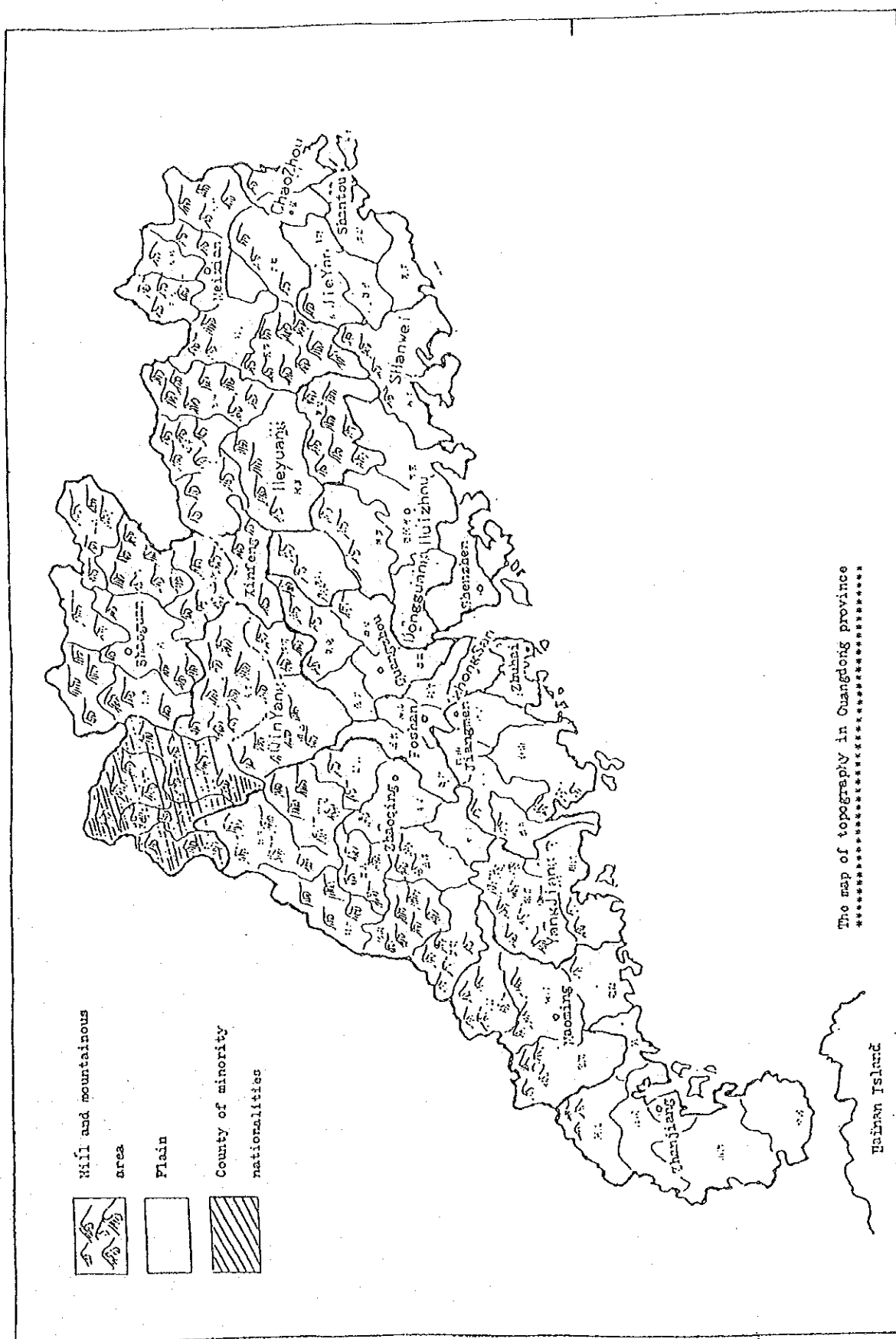
children will not be registered same as out of plan children. NID play a significant role in this situation to increase the immunization coverage.

4. Active Surveillance

The surveillance system of AFP are not still in many provinces. It dose not achieve a rate of 1 non-polio AFP cases per 100,000 children less than 15 years excluding Beijing, Shandong and Xinjiang. The area where has developed economically, non-polio AFP rate was very low in 1993. I expect that active surveillance will be carry out in another provinces like Shandong province.

IX. Acknowledgment

I would like to express our sincere appreciation to all the person who assisted our field study in China, especially Dr. Kusumoto, Dr. Hikita, Dr. Nishimura, Dr. Hara and staff of EPI Department and polio surveillance center in Shandong. Ministry of public health P.R. China and Japan International Cooperation Agency (JICA) in Beijing and Japan supported us sufficiently. The EPI staff in Guangdong province arranged our schedule in spite of our sudden visit. We could discuss about some problems concerning polio eradication program in China.



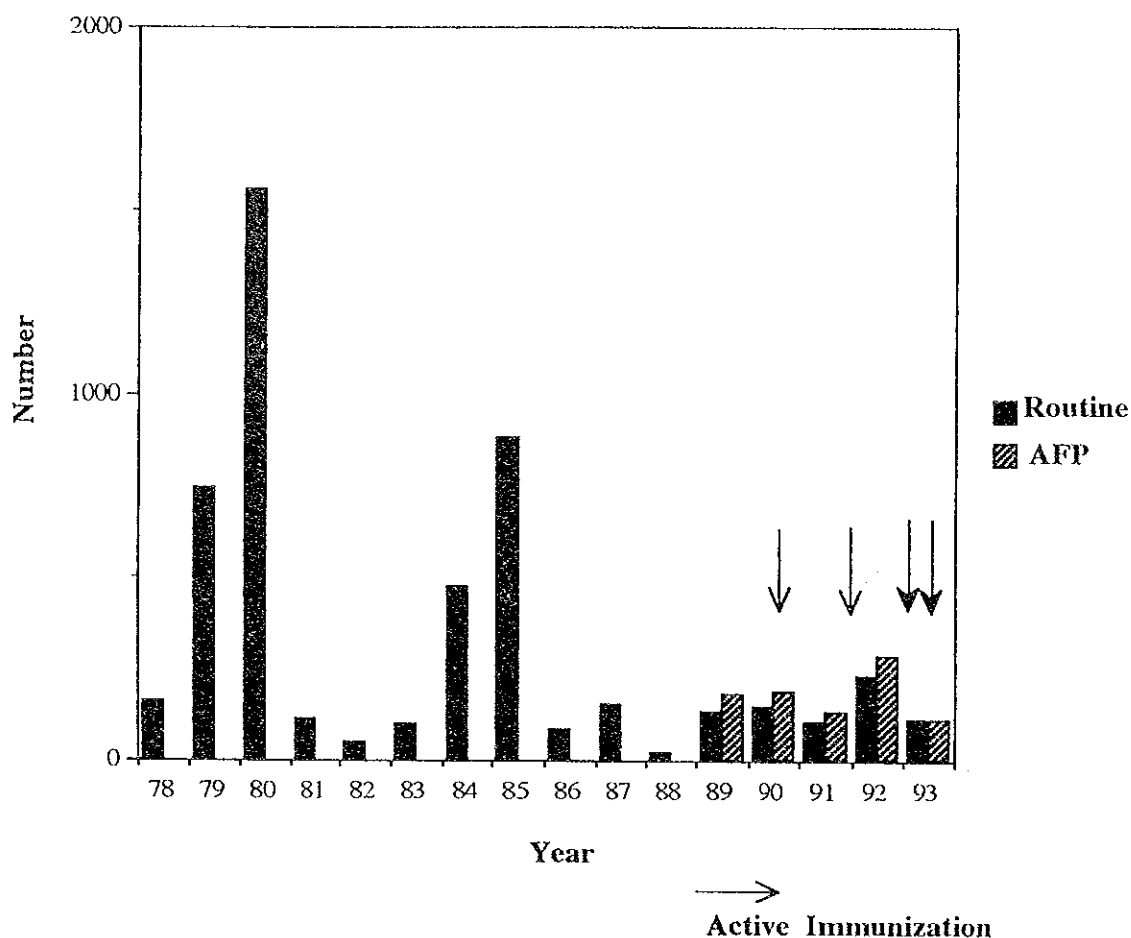


Figure 1. Reported Polio Cases by Year
Guangdong Province, 1978-1993

Table 1. Diagnosis of AFP Guangdong, 1990-1993

	1990		1991		1992		1993	
	No.of cases	%	No.of cases	%	No.of cases	%	No.of cases	%
Polio	169	74.1	134	75.7	283	78.61	111	74
Non-Polio	59	25.9	43	24.3	77	21.4	39	26
Total	228	100	177	100	360	100	150	100

Table 2. Distribution of Polio Cases by City
Guangdong 1990-1992

City	1990	1991	1992	1993	Total
Guangzhou	9	9	7	4	29
Shengheng	2	3	0	0	5
Shuhai	0	0	0	0	0
Shantuo	1	31	7	2	41
Shaoguang	11	1	0	0	12
Heyuang	2	17	3	0	22
Meizhou	1	14	7	61	83
Huizhou	14	7	20	6	47
Shanwei	2	5	62	9	78
Dongguang	1	1	0	0	2
ZhongSan	1	0	1	0	2
JianMen	4	4	2	0	10
FuSang	3	2	5	1	11
YangJiang	4	1	3	2	10
ZangJiang	64	26	88	5	183
MaoMing	46	1	13	8	68
SaoQin	2	0	15	9	26
QinYang	2	2	26	3	33
ChaoZhou	0	7	11	0	18
JieYan	0	3	13	1	17
Total	169	134	283	111	697

Table 3. Distribution of Polio Cases by Month, in Guangdong, 1990-1993

Year	Month												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
1990	14	14	18	22	21	21	18	7	8	10	11	5	169
1991	2	3	6	15	26	13	20	7	8	8	14	12	134
1992	17	35	17	32	21	26	20	27	28	36	13	11	283
1993	15	25	19	22	8	4	11	2	2	1	2	0	111
Total	48	77	60	91	76	64	69	43	46	55	40	28	697
%	6.7	11.1	8.6	13.1	10.9	9.2	9.9	6.2	6.6	7.9	5.7	4.0	100

Table 4. Age Distribution of Polio Cases Guangdong, 1990-1993

Age	1990		1991		1992		1993		Total	
	No. of cases	%	No. of cases	%	No. of cases	%	No. of cases	%	No. of cases	%
0-	9	5.3	10	7.5	23	8.1	11	9.9	53	25.7
1/2-	45	26.6	27	20.2	83	29.3	26	23.4	181	7.6
1-	85	50.3	82	61.2	127	44.9	45	40.5	339	48.6
2-	21	12.43	9	6.7	33	11.7	20	18.0	83	11.9
3-	3	1.8	2	1.5	8	2.8	6	5.4	19	2.7
4-	3	1.8	2	1.5	4	1.4	3	2.7	12	1.7
5-	3	1.8	2	1.5	3	1.1	0	0	8	1.2
15-	0	0	0	0	2	0.7	0	0	2	0.3
Total	169	100	134	100	283	100	111	100	697	100

Table 5. Immunization History of Polio Cases in Guangdong, 1990-1993

Immunization history	0		1~2		>3		Unidentified		Total	
	No.of cases	%	No.of cases	%	No.of cases	%	No.of cases	%	No.of cases	%
1990	110	65.1	41	24.7	14	8.3	4	2.4	169	100
1991	79	59.0	36	26.9	17	12.7	2	1.5	134	100
1992	174	61.5	74	26.2	25	8.8	10	3.4	283	100
1993	62	55.9	32	28.3	10	9.0	7	6.3	111	100
Total	425	61.0	183	26.3	66	9.5	23	3.3	697	100

Table 6. Reported Time Interval of AFP Cases in Guangdong, 1992-1993

year	Time (day)	Onset of paralysis → go to a doctor		Go to a doctor → Report		Report → Survey		Report county to province	
		No.of cases	%	No.of cases	%	No.of cases	%	No.of cases	%
1992	0~2	219	60.8	155	43.1	312	86.7	193	53.6
	3~7	56	15.6	74	20.6	26	7.2	92	25.6
	8~14	21	5.8	37	10.3	9	2.5	36	10.0
	15~21	4	1.1	18	5.0	1	0.3	23	6.4
	22~28	4	1.1	5	1.4	2	0.6	9	2.5
	>29	2	0.6	17	4.7	0	0	7	2.0
1993	0~2	78	57.4	76	56.3	138	93.2	91	61.2
	3~7	37	27.2	20	14.8	5	3.4	23	15.4
	8~14	14	10.3	11	8.5	3	2.0	29	19.5
	15~21	2	1.5	4	3.0	0	0	2	1.3
	22~28	1	0.7	4	3.0	2	1.4	0	0
	>29	4	3.0	20	14.8	0	0	4	2.7

Table 7. Isolation and Identification of Polio Virus in 1990-1993

Year	No.of cases	No.of positive	%	Type of polio virus						NPV
				I	II	III	I + III	II + III	I + II + III	
1990	44	24	54.5	15	1	1	2	1	1	3
1991	67	40	59.7	24	3	0	1	3	1	0
1992	161	100	62.5	73	2	7	0	0	3	15
1993	72	35	48.6	27	6	2	0	0	0	0
Total	344	199	57.9	139	12	10	3	4	5	26
%	0	0	0	69.8	6.0	5.0	1.5	2.0	2.5	13.1

Table 8. Polio Intensive Activities in Guangdong, 1990-1993

Year	Area		Population (10,000)	Age (Year)	Dose	Time Interval (Month)	Amounts of vaccine (10,000)
	No.of city	No.of county					
90/91	6	49	2401	0~4	1	90.12~91.4	398.0
91/92	9	29	2199	0~1	1~2	12~3	660.5
1993	20	118	6525	0~2	2	2~3	1370.5
93/94	20	118	6525	0~3	2	93.12~94.1	1415.7

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