

# Analysis of Insurance Coverage for Adverse Reactions Following Immunizations in Banan District of Chongqing, 2019–2023

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**Abstract:** *Objective:* This study analyzes the application of compensation for adverse reactions following immunizations in Banan District, Chongqing. *Methods:* Compensation cases for adverse reactions following immunizations from 2019 to 2023 were collected and subjected to descriptive epidemiological analysis. *Results:* The coverage rate of supplementary insurance was relatively low, at only 3.78%, with a higher coverage rate of 12.94% for children under 12 months. A total of 684 cases were compensated, with a total compensation amount of 1.21091 million yuan, averaging 11.55 thousand yuan per case. Of these, one case received basic insurance compensation, amounting to 80 yuan. Basic and supplementary insurance compensated 1 case and 683 cases, respectively, with average compensations of 80 yuan and 11.47 thousand yuan per case. In the compensation insurance, the male-to-female ratio was 1.5:1 (413/270), and 55.5% of the cases were for children under 1 year old. The number of PPCV13, DTaP, and HepB cases was 14.9%, 12.6%, and 10.7%, respectively. Fever, upper respiratory tract infection, and pneumonia cases accounted for 31.2%, 28.8%, and 23.0% of cases, respectively, with total compensation amounts accounting for 22.4%, 18.8%, and 46.3% of the total compensation. Additionally, 96.5% of the compensation was paid within 30 days after the appraisal conclusion. *Conclusion:* The scope and efficiency of compensation for adverse reactions following immunization insurance have significantly improved in Banan District, Chongqing. It is necessary to continue promoting the compensation work for adverse reactions following immunization insurance.

**Keywords:** Vaccine; Immunizations; Adverse reaction; Insurance; Compensation

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## 1. Introduction

Before implementing the insurance compensation scheme for adverse reactions to vaccination, the national fiscal budget compensated for adverse reactions to vaccines under the Expanded Program on Immunization (EPI), while enterprises compensated for non-EPI vaccines<sup>[1]</sup>. With the improvement of public health and safety awareness, the advantages of insurance in risk control management and risk loss compensation have gradually been recognized<sup>[2]</sup>. The willingness to purchase insurance has also increased<sup>[3]</sup>. To promote the smooth

implementation of compensation for adverse reactions to vaccination, Chongqing City implemented insurance compensation for adverse reactions to vaccination throughout the city starting July 1, 2018, and introduced a commercial insurance compensation scheme. The government purchases basic insurance for EPI vaccine recipients who experience adverse reactions and encourages them or their guardians to purchase supplementary insurance in an informed and voluntary manner.

Article 56 of Chapter 6 of the Vaccine Management Law of the People’s Republic of China, which took effect on December 1, 2019, stipulates that “the state encourages compensation for adverse reactions to vaccination recipients through various forms such as commercial insurance,” providing legal protection and support for commercial insurance<sup>[4]</sup>. To understand the current situation of compensation for adverse reactions to vaccination in Banan District, further improve the insurance compensation scheme, and promote the smooth and efficient implementation of insurance compensation work, this study analyzed the compensation situation for adverse reactions to vaccination in Banan District from 2019 to 2023.

## 2. Materials and methods

### 2.1. Sources

Suspected adverse events following immunization (AEFI) cases were collected through the National Immunization Information System. The Chongqing Immunization Information Management System was used to collect data on the number of vaccine recipients and the number of vaccination doses in Banan District from 2019 to 2023. Insurance and compensation information for completed compensation cases in Banan District from 2019 to 2023 was collected through the Chongqing Branch of Ping An Property and Casualty Insurance Co., Ltd. (referred to as the insurance company). The vaccination status of the vaccine recipients and the clinical diagnosis information of adverse events following immunization were derived from the investigation diagnosis certificate issued by the disease prevention and control agency or the appraisal certificate of adverse events issued by the provincial, municipal, and district medical associations.

### 2.2. Types of vaccines

**Table 1** includes all EPI and non-EPI vaccines that can be administered to children of appropriate age in Banan District.

**Table 1.** Types of EPI vaccines and non-EPI vaccines in Banan District

Vaccine types	
EPI vaccine	Non-EPI vaccines
BCG	Acellular diphtheria, tetanus, pertussis, and Haemophilus influenzae type b combined vaccine (DTaP-Hib)
Hepatitis B vaccine (HepB)	Acellular diphtheria, tetanus, pertussis, and inactivated poliovirus and Haemophilus influenzae type b combined vaccine (DTaP-IPV-Hib)
Inactivated polio vaccine (IPV)	Group A and C meningococcal polysaccharide conjugate vaccine (MPCV-AC)
Bivalent oral polio vaccine (bOPV)	Haemophilus influenzae type b vaccine (Hib)
Acellular diphtheria, tetanus, and pertussis vaccine (DTaP)	23-valent pneumococcal polysaccharide vaccine (PPV23)
Measles-rubella combined live attenuated vaccine (MR)	13-valent pneumococcal polysaccharide conjugate vaccine (PPCV13)

**Table 1 (Continued)**

Vaccine types	
EPI vaccine	Non-EPI vaccines
MMR vaccine	Enterovirus 71 inactivated vaccine (EV71V)
Japanese encephalitis live attenuated vaccine. (JE-L)	Varicella live attenuated vaccine (VarV)
Hepatitis A live attenuated vaccine (HepA-L)	Oral rotavirus vaccine (ORV)
Hepatitis A inactivated vaccine (HepA-I)	AC group meningococcal (combined) and Haemophilus influenzae type b (combined) combined vaccine (MPCV-AC-Hib)
Meningococcal polysaccharide vaccine (MPV-A)	Mumps live attenuated vaccine (MuV)
Group A and C meningococcal polysaccharide vaccine (MPV-AC)	Vibrio cholerae inactivated vaccine (CholV)
	Influenza vaccine (InfV)

## 2.3. Insurance compensation methods and objects

### 2.3.1. Basic insurance compensation

For recipients of non-EPI vaccines in Banan District from 2019 to 2023 who were diagnosed with an abnormal reaction to vaccination and did not receive one-time compensation, the insurance company shall provide compensation according to the “Chongqing Basic Insurance Compensation Measures for Abnormal Reaction to Vaccination (Trial).”

### 2.3.2. Supplementary insurance compensation

The insurance company will provide supplementary insurance compensation based on the supplementary insurance category voluntarily purchased by the vaccine recipient or guardian. This compensation will cover abnormal reactions to vaccination caused by EPI and non-EPI vaccines, abnormal reactions that cannot be ruled out, coincidental diseases, and so on.

## 2.4. Compensation standards

The compensation standards for 2019–2022 followed the 2018 “Chongqing City First Class Vaccine Immunization Adverse Reaction Compensation Insurance Implementation Plan (Trial),” while compensation in 2023 was based on the standards stipulated in the 2022 “Chongqing City Immunization Program Vaccine Immunization Adverse Reaction Compensation Insurance Implementation Plan.”

## 2.5. Statistical analysis

Data from 2019 to 2023 were organized using Excel 2019 software, and descriptive epidemiological methods were used for analysis.

## 3. Results

### 3.1. Insurance coverage

From 2019 to 2023, 384 AEFI cases were reported in Banan District, including 292 general reactions, 4 coupled reactions, and 88 abnormal reactions. According to the basic insurance compensation principles, general reactions and coupled reactions are not eligible for compensation. The expert group diagnosed that 2 abnormal reactions needed compensation, namely angioedema (compensation amount: 82.7 yuan) and an allergic reaction such as measles and scarlet fever-like rash (currently under the insurance company’s compensation process).

Buyers purchase supplementary insurance through vaccination units. From 2019 to 2023, a total of 14,612 people in the district purchased supplementary insurance, with a purchase rate of 3.78% (14,612/386,727), distributed across 26 towns and streets, with a purchase coverage rate of 96.15% (25/26). Buyers who chose 396 yuan, 600 yuan, 900 yuan, and other categories accounted for 25.52%, 35.68%, 38.53%, and 0.27%, respectively. Of these, 99.48% (14,536/14,612) were made within 12 months of age, with a purchase rate of 12.94% (14,536/112,291). The largest purchases were made within 1 month of age, accounting for 93.82% (13,638/14,536). Purchasers aged 1 to 6 years accounted for 0.46% (67/14,612), and purchasers aged 6 and above accounted for 0.06% (9/14,612).

### 3.2. Overall insurance compensation

From 2019 to 2023, a total of 684 cases were compensated, with a total compensation amount of 1.21091 million yuan, averaging 11,550 yuan per case. Basic insurance compensation accounted for 0.15% (1/684) of the cases and 0.007% (0.008/121.091) of the total compensation amount. Supplementary insurance compensation accounted for 99.85% (683/684) of the cases and 99.993% (121.083/121.091) of the total compensation amount, with an average of 11,470 yuan per case. The highest compensation was 53,840 yuan, and the lowest was 79.5 yuan. The total medical expenses were 1.38303 million yuan, and the total medical insurance reimbursement was 429.57 million yuan (Table 2).

**Table 2.** Compensation amount for adverse reactions to vaccination in Banan District from 2019 to 2023

Compensation	Years	Compensation cases		Compensation amount (ten thousand yuan)				
		Number of cases	Composition ratio (%)	Lowest	Highest	Average	Total	Composition ratio (%)
Basic insurance compensation	2019	1	100	0.008	0.008	0.008	0.008	100
	2019	60	8.8	0.012	1.744	0.314	18.848	15.6
	2020	104	15.2	0.009	5.384	0.275	28.556	23.6
Supplementary insurance compensation	2021	62	9.1	0.008	2.829	0.332	20.576	17.0
	2022	133	19.5	0.002	0.795	0.106	14.065	11.6
	2023	324	47.4	0.005	4.920	0.121	39.038	32.2
	Total	683	100	0.035	15.671	0.177	121.083	100

### 3.3. Gender and age distribution

One case of basic insurance compensation was for a male, with an amount of 0.008 million yuan, between the ages of 2 and 6. In the supplementary insurance compensation, the male-to-female ratio of compensated cases was 1.5:1 (413/270), accounting for 62.6% (75.783/121.083) and 37.4% (45.300/121.083) of the total compensation amount, respectively. The number of compensated cases for children aged < 1 year, 1 year, 2–6 years, and ≥ 6 years accounted for 55.5% (379/683), 34.7% (237/683), 9.4% (64/683), and 0.4% (3/683), respectively. The total compensation amount accounted for 68.1% (82.493/121.083), 24.4% (29.508/121.083), 7.2% (8.764/121.083), and 0.3% (0.318/121.083), respectively (Table 3).

**Table 3.** Gender and age distribution of insurance compensation for adverse reactions to vaccination in Banan District from 2019 to 2023

Variable	Basic insurance compensation			Supplementary insurance compensation		
	Number of cases (% composition)	Total amount/10,000 yuan (composition ratio %)	Average amount /10,000 yuan	Number of cases (% composition)	Total amount/10,000 yuan (composition ratio %)	Average amount /10,000 yuan
Gender						
Male	1 (100)	0.008 (100)	0.008	413 (60.5)	75.783 (62.6)	0.183
Female				270 (39.5)	45.300 (37.4)	0.168
Age						
< 1 year old				379 (55.5)	82.493 (68.1)	0.218
1 year old				237 (34.7)	29.508 (24.4)	0.125
2–6 years old	1 (100)	0.008 (100)	0.008	64 (9.4)	8.764 (7.2)	0.137
> 6 years old				3 (0.4)	0.318 (0.3)	0.106
Total	1 (100)	0.008 (100)	0.008	683 (100)	121.083 (100)	0.177

### 3.4. Vaccine distribution

Among the basic insurance compensations, there was one EPI vaccine, DTaP. Among the supplementary insurance compensations, 357 cases involved 10 EPI vaccines, and 326 cases involved 13 non-EPI vaccines. The top three vaccines in terms of the number of compensation cases were PPCV13, DTaP, and HepB, accounting for 14.9% (102/683), 12.6% (86/683), and 10.7% (73/683), respectively. The top three vaccines in terms of total compensation amount were DTaP, IPV/bOPV, and HepB, accounting for 19.9% (24.154/121.083), 16.6% (20.139/121.083), and 13.9% (16.813/121.083), respectively (**Table 4**).

**Table 4.** Distribution of vaccines covered by insurance compensation for adverse reactions to vaccination in Banan District from 2019 to 2023

Vaccine	Basic insurance compensation			Supplementary insurance compensation		
	Number of cases (% composition)	Total amount/10,000 yuan (composition ratio %)	Average amount /10,000 yuan	Number of cases (% composition)	Total amount/10,000 yuan (composition ratio %)	Average amount /10,000 yuan
BCG				17 (2.5)	4.258 (3.5)	0.250
HepB				73 (10.7)	16.813 (13.9)	0.230
IPV/ bOPV				72 (10.5)	20.139 (16.6)	0.280
DTaP	1 (100)	0.008 (100)	0.008	86 (12.6)	24.153 (19.9)	0.281
MR				6 (0.9)	0.463 (0.4)	0.077
MMR				48 (7.0)	6.357 (5.3)	0.132
JE-L				19 (2.8)	1.299 (1.1)	0.068
HepA-L/ HepA-I				9 (1.3)	1.445 (1.2)	0.161
MPV-A				22 (3.2)	3.791 (3.1)	0.172
MPV-AC				5 (0.7)	0.372 (0.3)	0.074
DTaP-Hib				9 (1.3)	2.177 (1.8)	0.242

**Table 4 (Continued)**

Vaccine	Basic insurance compensation			Supplementary insurance compensation		
	Number of cases (% composition)	Total amount/10,000 yuan (composition ratio %)	Average amount /10,000 yuan	Number of cases (% composition)	Total amount/10,000 yuan (composition ratio %)	Average amount /10,000 yuan
DTaP-IPV-Hib				40 (5.9)	4.255 (3.5)	0.106
MPCV-AC				18 (2.6)	1.965 (1.6)	0.109
Hib				6 (0.9)	0.483 (0.4)	0.080
PPV23				3 (0.4)	0.114 (0.1)	0.038
PPCV13				102 (14.9)	15.136 (12.5)	0.148
EV71V				54 (7.9)	4.747 (3.9)	0.088
V				34 (5.0)	3.874 (3.2)	0.114
ORV				32 (4.7)	6.668 (5.5)	0.208
MPCV-AC-Hib				4 (0.6)	0.431 (0.4)	0.108
MuV				1 (0.1)	0.076 (0.1)	0.076
CholV				2 (0.3)	0.426 (0.4)	0.213
VxV				21 (3.1)	1.641 (1.4)	0.078
Total	1 (100)	0.008 (100)	0.008	683 (100)	121.083(100)	0.177

### 3.5. Clinical diagnosis distribution

One case of basic insurance compensation was for angioedema. In the supplementary insurance compensation, the top three clinical diagnoses were fever, upper respiratory tract infection, and pneumonia, accounting for 31.2% (213/683), 28.8% (197/683), and 23.0% (157/683), respectively. The top three clinical diagnoses in terms of total compensation amount were pneumonia, fever, and upper respiratory tract infection, accounting for 46.3% (56.073/121.083), 22.4% (27.154/121.083), and 18.8% (22.705/121.083), respectively. The top three clinical diagnoses in terms of average compensation amount were Kawasaki disease (17,900 yuan), whooping cough (85,100 yuan), and perianal abscess (66,500 yuan) (**Table 5**).

**Table 5.** Distribution of clinical diagnoses of adverse reactions to vaccination in Banan District from 2019 to 2023

Compensation type	Clinical diagnosis	Number of cases (proportion %)	Compensation amount (10,000 yuan)	
			Total (composition ratio %)	Average
Basic insurance compensation	Angioedema	1 (100)	0.008 (100)	0.008
Supplementary insurance compensation	Fever	213 (31.2)	27.154 (22.4)	0.127
	Upper respiratory tract infection	197 (28.8)	22.705 (18.8)	0.115
	Pneumonia	157 (23.0)	56.073 (46.3)	0.357
	Gastrointestinal disorders	58 (8.5)	4.918 (4.1)	0.085
	Allergic rash	25 (3.7)	1.368 (1.1)	0.055
	Febrile seizures	4 (0.6)	0.895 (0.7)	0.224
	Hand, foot and mouth disease	4 (0.6)	0.639 (0.5)	0.160
	Pertussis	2 (0.3)	1.701 (1.4)	0.851
	Abnormal blood test	2 (0.3)	0.429 (0.4)	0.215

**Table 5 (Continued)**

Compensation type	Clinical diagnosis	Number of cases (proportion %)	Compensation amount (10,000 yuan)	
			Total (composition ratio %)	Average
	BCG lymphadenitis	1 (0.1)	0.508 (0.4)	0.508
	Kawasaki disease	1 (0.1)	1.79 (1.5)	1.790
	Perianal abscess	1 (0.1)	0.665 (0.5)	0.665
	Lymphadenitis (non-BCG)	1 (0.1)	0.056 (0.05)	0.056
	Immune thrombocytic purpura	1 (0.1)	0.564 (0.5)	0.564
	Myocarditis	1 (0.1)	0.404 (0.3)	0.404
	Other	15 (2.2)	1.214 (1.0)	0.081
	Total	683 (100)	121.083 (100)	6.256

### 3.6. Compensation time interval

In one case of basic insurance compensation, the time interval from issuing the appraisal conclusion to paying compensation was 40 days. For supplementary insurance compensation, the time interval from the issuance of the appraisal conclusion to the payment of compensation was less than 31 days, 31–60 days, 61–180 days, 181–365 days, and more than 365 days, accounting for 96.5% (659/683), 1.8% (12/683), 0.9% (6/683), 0.4% (3/683), and 0.4% (3/683), respectively.

## 4. Discussion

On July 1, 2018, Chongqing’s vaccination adverse reaction compensation scheme transitioned from fiscal compensation to insurance compensation, evolving from a single compensation scheme to one where the government, society, enterprises, and families share responsibility and risk [5–7]. The compensation review standards have been relaxed, the maximum compensation amount significantly increased, and the compensation period greatly shortened. This change ensures compensation for coincidental diseases and general reactions after vaccination, making protection more comprehensive, which is crucial for increasing vaccination rates and public confidence in vaccination.

Before the implementation of the insurance compensation, 726 AEFI cases were reported, including 597 general reactions, 7 coincidental diseases, 1 psychogenic reaction, and 121 abnormal reactions. According to expert diagnosis, 4 cases required financial compensation, totaling 245,180 yuan. However, the high cost of treating some diseases meant that one-time compensation funds were insufficient. Thus, the compensation scheme for abnormal reactions to vaccination needs improvement.

This study found that the purchase rate of supplementary insurance was low (3.78%), and the purchase rate for children ≤ 12 months old was 12.94%, higher than in Dazu District (5.99%) but lower than in Changsha City and Nanjing City (49.72% and 52.97%, respectively) [8–9]. The advantages of the insurance compensation system in Banan District were relatively low, possibly due to low parental awareness and poor promotion by birth hospitals and vaccination units.

The number of AEFI reports decreased before and after the implementation of insurance compensation. However, except for 2021, the number of compensation cases showed an increasing trend from 2019 to 2023. Supplementary insurance compensation increased year by year, averaging 137 cases per year. This increase may be related to the public’s growing attention to insurance compensation, the increased disease burden, and rising

health requirements<sup>[10]</sup>. However, it was lower than the level of Chongqing from 2018 to 2021<sup>[3]</sup>. This may be due to differences in the coverage rate of supplementary insurance across various districts and counties and the number of vaccination doses.

In supplementary insurance compensation, the average compensation for each adverse reaction to vaccination was 17,700 yuan, higher than the average basic compensation amount. This may be related to changes in compensation standards and items<sup>[11–12]</sup>. Since there was no relevant data on compensation items and damage levels in this study, it was impossible to analyze the differences in medical expenses, accompanying work loss, transportation expenses, and so on, at the national level and in other provinces. This study found that the total amount of actual expenditure was lower than the total amount of one-time compensation, indicating that the insurance company's compensation strength was guaranteed to a certain extent. The average compensation amount per case was lower than the level of 19,200 yuan per case in Yancheng City, which may be related to the different distributions of the insurance rate, insurance amount, and damage level of the supplementary insurance<sup>[13]</sup>. It can be seen that after implementing supplementary insurance compensation, the compensation items and amounts are more relaxed compared with fiscal compensation and basic insurance compensation standards. Banan District should further promote supplementary insurance to reduce the economic burden of AEFI on families.

In insurance compensation, the number of compensation cases and the total amount of compensation for males were higher than those for females, similar to the distribution trend of compensation for abnormal reactions to vaccination in Henan Province and the insurance compensation data in Dazu District, Chongqing, possibly related to the different levels of attention parents pay to their children<sup>[1, 10]</sup>. Among the cases compensated by supplementary insurance, 55.5% were younger than 1 year old, possibly because children in this age group received more types and doses of vaccines. The overall level was lower than that of Chongqing (78.5%), indicating that the average age of supplementary insurance compensation cases in Banan District was older<sup>[7]</sup>.

This study found that the top three vaccines in terms of the number of compensation cases were PPCV13, DTaP, and HepB, which corresponded to the top three vaccines in terms of the total compensation amount. The clinical diagnoses of the compensated cases were mainly fever, upper respiratory tract infection, and pneumonia, all common childhood diseases<sup>[14]</sup>. Since these diseases' occurrence is closely related to the time of vaccination, they are easily misunderstood as abnormal reactions to vaccination. These diseases are not covered by financial compensation, and vaccination unit staff must repeatedly explain the reasons to the recipients' guardians. However, after introducing the compensation insurance scheme, the compensation time in this study shows that the time interval between the investigation, diagnosis, or appraisal conclusion of the compensation insurance and the payment of compensation is shorter than that of the basic insurance compensation. This indicates that the relaxation of compensation inclusion standards and the shortening of compensation time intervals by compensation insurance are conducive to the timely handling of conflicts and disputes and improving people's trust in vaccines<sup>[15]</sup>.

Financial compensation and government-insured basic insurance for adverse reactions to vaccination must align with economic and social development and financial affordability. It is challenging to fully meet the demands of patients with abnormal reactions. After introducing the insurance compensation scheme in Banan District, the scope and efficiency of compensation for adverse reactions to vaccination have greatly improved. However, there are still individual cases where compensation could be more timely, and there are few compensation items. It is necessary to further improve the insurance compensation scheme, actively guide recipients and their families to cultivate and establish insurance awareness, encourage voluntary purchase of insurance, adjust the scope and standards of compensation promptly, and gradually establish a multi-level insurance compensation system involving the government, society, enterprises, and families.



## Disclosure statement

The authors declare no conflict of interest.

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