

# A Study on the Design and Pricing of Adolescent Mental Health Insurance Products Based on Adjusted Rates

Yixin Zhou<sup>1</sup>, Meng Bi<sup>2</sup>, Peixuan Chen<sup>3</sup>, Wenjing Wang<sup>1</sup>, Yiyi Zhou<sup>1, \*</sup>

<sup>1</sup>School of Economics, Ocean University of China, China

<sup>2</sup>School of Management, Ocean University of China, China

<sup>3</sup>School of Mathematical Sciences, Ocean University of China, China

\*Corresponding author: zhouyiyi@stu.ouc.edu.com

**Abstract.** In recent years, with the frequent occurrence of adolescent suicide, the topic of adolescent mental health has attracted special attention. The insurance products against this risk need to be studied. In this paper, based on an investigation of students and parents in five junior and senior high schools in Shandong Province, we design the adolescent mental health insurance product that meets the market demand and design additional insurance to protect against the risk induced by sudden accidents. The premium pricing system based on mental health status (MHSBI) is constructed with adjusted rates. The total premiums are in line with the applicants' willingness to pay. This paper improves the deficiencies of insurance research about adolescent mental health, and provides theoretical support for the introduction of such insurance products.

**Keywords:** Adolescent, Mental Health Insurance, Rate Adjustment.

## 1. Introduction

The recent incident of Hu Xinyu, a high school student in Jiangxi, who hanged himself, touched the heartstrings of millions of netizens and once again aroused the public's concern about the mental health of adolescents [1]. The Chinese National Mental Health Development Report (2019-2020) released by the Institute of Psychology of the Chinese Academy of Sciences shows that the detection rate of major depression is 7.4%, and adolescent psychological problems show a trend of low age [2]. In July 2021, the General Office of the Ministry of Education issued the Notice on Strengthening the Management of Students' Mental Health, clearly proposing "to do a good job of mental health assessment" [3], it is urgent to ensure the mental health of adolescents with the power of all sectors of society.

According to our survey, Chinese insurance industry has formed two main types in the market, personal health insurance and property insurance. However, adolescent mental health insurance products are still in a blue ocean market. Considering that the current domestic psychological counseling fees are too confusing and an industry standard system has not yet been formed [4]. It is important to design adolescent mental health insurance to reduce the risk of families bearing high psychological treatment costs and to provide diversified insurance services to enhance policyholders' awareness and prevention of mental illness [5].

## 2. Current situation of adolescent mental health and psychological education

### 2.1 Investigation implementation

This paper conducted an in-depth questionnaire survey on students and their parents in five middle and high schools, including Gaozhuang Central Middle School in Laiwu District, Jinan City, Shandong Province, Experimental Middle School, Fengcheng High School, and Gaotang County Second Middle School in Liaocheng City, Shandong Province, respectively. Among them, 713 questionnaires were collected from the investigation of adolescents, and 710 were valid, with an effective rate of 99.58%. A total of 564 questionnaires were collected from the survey of parents, and 559 were valid, with an effective rate of 99.11%.

## 2.2 Investigation results and analysis

The survey used SPSS 10.0 software to clean the questionnaire data, and used descriptive statistics, correlation coefficient and variance to conduct statistical analysis.

According to the investigation results, one quarter of adolescents have poor psychological self-awareness. And the treatment of psychological discomfort is limited to self-healing with low effectiveness.

Meanwhile, parents pay insufficient attention to the mental health of adolescents. And the mental health education in schools fails to achieve full coverage.

In terms of parents' views on mental health insurance, parents have a strong desire to adolescent mental health insurance, expecting to pay 270 RMB.

## 2.3 Design inspiration

In terms of premium setting, based on parents' willingness to take out mental health insurance and the expected payment, the basis of premium design is derived as 250-300 RMB. In terms of insurance service content design, based on the research results, the insurance is designed around "daily psychological care and aftercare psychological treatment" [6], and this insurance considers home school-enterprise cooperation to jointly support insurance to create value for adolescents.

## 3. Product Design of Youth Mental Health Insurance

### 3.1 Applicable objects

According to the World Health Organization's definition of adolescents (i.e. 10-19 years old)[7] which shows that the prevalence of mental illness is significantly higher in junior and senior high school individuals than in other stages, 13 to 18 years old is chosen as the applicable age range. Also, the insured should mental healthy tested after MMHI-60.

### 3.2 Coverage

Considering that there are many major risk events that may induce mental health disorders in addition to illnesses, the insurance is divided into primary and additional insurance to cover medical expenses and unexpected event losses respectively for one year.

## 4. Pricing of adolescent mental health insurance product

Based on the actuarial principles of non-life insurance, according to the principle of matching insurance companies' underwriting costs, risk taking and insurance rates, and with the introduction of the pricing idea of rate adjustment by UBI [8] (commercial auto insurance based on driving behavior), the MHSBI (Mental health status based insurance) pricing model is used for adolescent mental health insurance.

Premium components: total premium = adolescent mental health medical premium + adolescent accident premium.

### 4.1 Determination of MHSBI premium

Youth mental health medical premium = base premium  $\times$  rate adjustment factor. The formula is  $E_{medical} = E_{basic} \times \beta$ , where  $E_{medical}$  is the youth mental health medical premium,  $E_{basic}$  is the base premium, and  $\beta$  is the rate adjustment factor.

#### 4.1.1 Base premium

The base premium is the amount of insurance multiplied by the base premium rate, i.e.  $E_{basic} = P \times Pr_{basic}$ , where  $E_{basic}$  represents the base premium,  $P$  represents the amount of insurance, and  $Pr_{basic}$  represents the base premium rate.

(1) Amount of insurance

The insurance amount consists of the medical benefit  $P_{hospital}$  and the service value  $P_{service}$ , i.e.

$$P = P_{hospital} + P_{service}$$

Among them, the medical benefit can be divided into two parts: the cost of psychological testing  $P_{test}$  and the cost of treating psychological problems  $P_{cure}$ .

The cost of psychological testing is determined by looking up the package cost of psychological counseling for adolescents by Qingdao psychological counseling institutions on the Meituan software and taking the average value of 570 yuan as the cost of a single test, i.e.  $P_{test} = 570$ .

For the cost of treatment of psychological problems, a total of 1666 cases with complete information on the first visit to a hospital's child and adolescent psychological clinic [9] between 2001 and 2010 were selected by searching the literature, and those cases aged 12 to 18 were selected for diagnostic classification by the International Classification of Diseases standard ICD-10 [10]. Then according to the serious problem of mental illness, all the symptoms are divided into severe, moderate, mild three categories. 6.9 per cent were classified as severe, 34.2 per cent as moderate and 58.9 per cent as mild.

The formula for calculating the cost of treatment for psychological problems is  $P_{cure} = Pr_{light} \times E_{light} + Pr_{medium} \times E_{medium} + Pr_{severe} \times E_{severe}$ , which is the sum of the product of the probability of each disease category and its average treatment cost, and the result is calculated as RMB 15,329.77. Then the medical benefit is RMB 15,899.77.

The cost of special services provided by this product mainly includes real-time psychological assessment, two psychological counseling sessions, hospital green channel and school lectures during the one-year insurance period. It is estimated that the cost of two psychological counseling sessions is roughly RMB 1,000 and the cost of other services is RMB 200 per person, totaling RMB 1,200. Then the total insurance amount is RMB 17,099.77.

(2) Determination of the benchmark premium rate

The benchmark premium rate is determined by the benchmark pure premium rate and the additional cost rate, i.e.  $Pr_{basic} = \frac{Pr_{pure}}{(1-Pr_{addition})}$ , where  $Pr_{pure}$  is the benchmark pure premium rate and  $Pr_{addition}$  is the additional cost rate.

The benchmark pure premium rate can be calculated from the formula  $Pr_{pure} = Pr_{ill} \times Pr_{cure} \frac{Pr_{light} \times E_{light} + Pr_{medium} \times E_{medium} + Pr_{severe} \times E_{severe}}{E_{light} + E_{medium} + E_{severe}}$ , where  $Pr_{ill}$  is the prevalence of psychological problems among adolescents and  $Pr_{cure}$  is the proportion of adolescents with psychological problems who seek medical treatment. By looking at the results of the National Child and Adolescent Mental Disorders Flow Survey Report for 2021 and data from related literature, we can obtain  $Pr_{ill} = 17.5\%$ ,  $Pr_{cure} = 61.2\%$ . Then the benchmark pure premium rate is 0.0148.

The additional cost rate is uniformly 0.35 during the pilot period. Therefore, the calculated benchmark premium rate is determined to be 0.0228.

#### 4.1.2 Determination of rate adjustment factor

The rate adjustment factor is multiplied by the no-claims preference factor, the independent underwriting factor and the independent channel factor, i.e.  $\beta = \beta_1 \times \beta_2 \times \beta_3$ .

The no-claims preference factor  $\beta_1$  is risk-graded according to the historical number of teenagers' insurance occurrences, and each level corresponds to the corresponding no-claims preference factor as shown with a floating range of [0.8,2.0]. No claims preference factor set to 0.8 if no previous claims have been incurred; in case of one previous claim, the no-claims preference factor is set to 1.0; in case of two previous claims, the no-claims preference factor is set to 1.5; for more than two prior claims, the no-claims preference factor is set to 2.0.

The independent underwriting coefficient  $\beta_2$  was determined by the hierarchical analysis method to assess the psychological state of the insured. Among them, the psychological scale was Chinese Middle School Students' Mental Health Scale (MMHI-60). The weights of each index were determined by the hierarchical analysis method as shown in Table 1.

**Table 1.** Hierarchical analysis method comprehensive evaluation index weights

Guideline layer	Weight	Indicator layer	Weight	Combined weight
Household	0.6232	Household composition	0.3092	0.1927
		Only child or not	0.1096	0.0683
		Annual psychoeducational costs	0.5813	0.3623
Individual	0.1373	Grade	0.1066	0.0146
		Academic achievement	0.6999	0.0961
		Psychological scale mean score	0.1935	0.0266
School	0.2395	Type of school	0.2	0.0479
		Availability of counseling room	0.8	0.1916

The above indexes of the insured are scored with 1, 2 and 3 points respectively. The higher the score is, the better the situation is. The comprehensive score of the insured is the sum of the product of each index score and weight. The mental health status of the applicant is determined according to the comprehensive score, so as to determine the independent underwriting coefficient. Table 2 shows the corresponding relationship between the comprehensive score and the independent underwriting coefficient.

**Table 2.** List of independent underwriting coefficients

The comprehensive score	Independent underwriting coefficient
0~1 score (including 1)	1.15
1~2 score (including 2)	1
2~3 score (including 3)	0.75

The independent channel coefficient  $\beta_3$  is related to the sales channel of the insurer. If the insured buys through the school group, then  $\beta_3 = 0.85$ ; If the insured purchases it by himself, then  $\beta_3 = 1$ .

#### 4.2 Determination of adolescent accident premium

The additional insurance covers psychological problems caused by major accidents of teenagers. Its premium pricing can refer to other one-year children's accident insurance on the market. For this product, the one-year quotation of children's accident insurance issued by some insurance companies with similar insurance liability is selected as reference to determine the premium. And the average value of 65.25 yuan is taken as the premium of additional insurance of this product.

In summary, the total premium is determined as shown in Table 3.

**Table 3.** Table of total adolescent mental health premiums under different rate adjustment factors

$\beta_1$	$\beta_2$	$\beta_3$	
		0.85	1
0.8	0.75	264.406	299.551
	1	330.792	377.652
	1.15	370.623	424.512
1.0	0.75	314.195	358.127
	1	397.177	455.752
	1.15	446.966	514.328
1.5	0.75	438.668	504.565
	1	563.141	651.004
	1.15	637.824	738.867
2.0	0.75	563.141	651.004
	1	729.104	846.255
	1.15	828.682	963.406

## 5. Conclusions

Based on an investigation of students and parents, this paper designs the content of adolescent mental health insurance products. Combining the clinic data of Xiao Lijun et al. from 2001 to 2010, a mental health status-based premium pricing system (MHSBI) is constructed with a setting of adjusted rates to determine the total premium for each category.

## References

- [1] GBD 2019 Mental Disorders Collaborators. Global, regional, and national burden of 12 mental disorders in 204 countries and territories, 1990–2019. A systematic analysis for the Global Burden of Disease Study 2019 [J]. *Lancet Psychiatry*, 2022, 9(2):137–150.
- [2] Fu Xiaolan, Zhang Kan, Chen Xuefeng, et al. China's national mental health development report (2019–2020). Beijing: Social Science Literature Press, 2021. 143–164.
- [3] Liu, Chao. Complicity and disorder: the "pan-disease" of adolescent depression [J]. *Contemporary Youth Studies*, 2023(02):74–84.
- [4] Zhang Ailian, Wang Zongmo, Huang Xiting. A survey on the current status of domestic psychological counseling and treatment fees [J]. *Chinese Journal of Mental Health*, 2017, 31(01):40–45.
- [5] Program Cong, Zhu Yanlu, Pan Qiaoyun. Design of a blockchain technology-based mental health insurance scheme for adolescents [J]. *Consumer Guide*, 2021(42):277–278.
- [6] Ren Yifei, Cheng Taijiao, Zhang Ruiyun. Research on long-term care insurance product design in the context of population aging [J]. *Old brand marketing*, 2022(12):94–96.
- [7] WHO. Adolescent and young adult health [EB/OL]. (2022-08-10). <https://www.who.int/zh/news-room/fact-sheets/detail/adolescents-health-risks-and-solutions>.
- [8] Guo Ji. Exploring the construction of UBI auto insurance pricing model in the insurance industry under the big data environment [J]. *Price Monthly*, 2022, No.545(10):45–51.
- [9] Xiao LJ, Luo L, Zhang Qian et al. Analysis of disease spectrum composition of child psychology clinics in general hospitals from 2001–2010 [J]. *Chinese Journal of Child Health*, 2011, 19(08):710–712.
- [10] WHO. The International Statistical Classification of Diseases and Related Health Problems 10th Revision [EB/OL]. (2020-02-01). <https://icd.who.int/browse10/2019/en>.