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Research Article

Exploring Families' Perception of Adolescent Mental Health: Using AI to Strengthen Government Social Risk Resilience

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Abstract

This study explores the current state of family mental health awareness among adolescents and its promotion pathways, proposing optimization strategies by integrating artificial intelligence (AI) technology. Based on literature analysis, the research highlights the growing severity of adolescent mental health issues and the critical role of family factors in prevention and intervention. However, existing studies primarily focus on psychological perspectives, lacking economic and management viewpoints, while AI applications mainly target post-hoc interventions rather than daily prevention. Using a mixed-methods design, the study developed the Family Adolescent Mental Health Awareness Questionnaire covering three dimensions: emotional management, behavioral support, and social relationships. Exploratory and confirmatory factor analyses validated its reliability and validity. An empirical survey of 295 parents in Beijing revealed that most possess basic awareness in emotional management and behavioral support but struggle with complex emotion recognition and sudden emotion coping. Notably, 30% of parents did not consider seeking professional help for adolescent depressive symptoms. Gender difference analysis showed significantly higher support willingness among female parents. The research further proposes a three-stage AI application framework: 1) privacy-protected multi-source data collection via blockchain encryption; 2) development of natural language processing-based intelligent chatbots for personalized mental health support; 3) establishment of an online education and early-warning system integrating families, schools, and governments to strengthen early intervention. The marginal contribution lies in optimizing mental health service systems through digital technology, providing data-driven policy recommendations for policymakers, and offering actionable solutions for family awareness improvement. Future research should expand sample geographical representation and explore technological adaptability across diverse scenarios.

Keywords

Adolescent Families, Mental Health, Artificial Intelligence, Questionnaire Scale

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1. Introduction and Literature Review

Adolescence is a crucial stage of transition from childhood to adulthood. Due to characteristic changes in physiological, cognitive, and social-emotional aspects, adolescents are vulnerable to the influence of emotions, behaviors, and education, which may lead to the accumulation of psychological imbalances. They are prone to psychological crises when facing difficult events. Many research results show that the proportion of adolescents with psychological crisis problems such as suicide and self-harm is increasing day by day, and the age of occurrence is showing a downward trend. For example, a 2021 World Health Organization study found that one in seven children aged 10-19 suffers from a mental disorder, accounting for 13% of the global disease burden in this age group; the 2020-2021 Australian National Health Outcomes showed that the proportion of children and adolescents aged 0-14 with mental or behavioral problems was 13%, and that of those aged 15-24 was as high as 28%. Similarly, the mental health status of Chinese adolescents is also not optimistic. The data of the National Mental Health Literacy Survey released in the "Report on the Development of Chinese National Mental Health (2021-2022)" in 2023 shows that the epidemiological survey of mental disorders among school-aged children and adolescents aged 6-16 in 2021 showed an overall prevalence rate of 17.5%, and their mental health literacy level was the lowest among the surveyed population categories. The survey research of Wuhan Mental Health Center also confirmed the above conclusion.

Existing theoretical and literature studies have confirmed that the mental health of adolescents is affected by personal and environmental factors, among which family factors are one of the important factors influencing adolescent mental health [1]. The Interpersonal Acceptance-Rejection (IPAR) theory (a new development of the Parental Acceptance-Rejection theory) and the Family System theory both point out that childhood trauma experiences, family structure, family function, and social support are significantly related to adolescents' depressive emotions, interpersonal relationship sensitivity, and suicidal ideation [2]. This makes parents play a key role in the psychological intervention and prevention of adolescents. In recent years, the state has attached great importance to the health management of children and adolescents, and has put forward specific plans for family mental health prevention at the policy-design level. In the "Special Action Plan for Comprehensively Strengthening and Improving Students' Mental Health Work in the New Era (2023-2025)" issued by 17 departments including the Ministry of Education in 2023, it is proposed to "improve the 'four-in-one' student mental health work system of health education, monitoring and early warning, consultation services, and intervention and treatment, and improve the student mental health work pattern of coordinated linkage among schools, families, society, and relevant departments", further highlighting the important position of family prevention.

However, the mobilization of family prevention forces in China is currently relatively lagging. On the one hand, the mental health prevention awareness and measures of adolescent parents are relatively weak [3]. Some parents have a sense of stigma towards mental illness, and their willingness to actively seek prevention, treatment, and cooperation in prevention and control is low. On the other hand, the publicity and popularization among adolescent families are not extensive enough. Due to the small-group characteristics of families as a social unit, it is difficult to mobilize and manage them. Currently, there is an extreme shortage of mental health professionals, and it is even more difficult to carry out publicity and popularization work in families. To sum up, the phenomenon and development of adolescent psychological crises should indeed attract the high attention of society. As the "first responsible person" for adolescent mental health construction, families should play an important role. Then, under the constraints of limited talent reserves and family awareness, how to better optimize resource allocation and accurately locate the crux of the problem? This is a question worthy of in-depth consideration by society and researchers, and it is also an important issue that the government needs to pay attention to.

From the current research perspective, on the one hand, although there are discussions from different disciplinary perspectives such as psychiatry, psychology, education, and sociology on the mechanisms, influences, and coping strategies between adolescent families and parental rearing styles, there is a lack of solutions proposed by economics and management disciplines to the above-mentioned problems. On the other hand, although artificial intelligence technology has been widely studied in the application of adolescent mental health-related work, most of them are carried out around specific mental health classes and analyze the solution effects after students have mental health-related problems. There are few studies on how to apply artificial intelligence to the daily lives of families and the learning processes of adolescents to nip adverse psychological states such as anxiety in the bud. Research in this area is of positive significance for overall improving the family's mental health awareness level. In addition, the existing mental health support systems in primary and secondary schools mainly focus on treating and dealing with the mental health problems of primary and secondary school students, while paying less attention to preventive measures. Providing preventive support can help primary and secondary school students establish healthy coping strategies before mental health problems occur. At the same time, the existing mental health support systems rarely make full use of modern technology. Artificial intelligence and data-driven methods can also improve the efficiency and effectiveness of mental health support. Machine learning based on data can identify potential signs of mental health

problems, which is helpful for preventing the further exacerbation of primary and secondary school students' mental health problems and providing broader and more effective mental health support.

The marginal contributions of this paper may be reflected in three aspects: First, this paper is guided by classical measurement theory and modern measurement theory to optimize the questionnaire design, trying to avoid statistical measurement biases such as social desirability bias, anchoring effect, and overconfidence. Second, in the analysis of questionnaire samples, artificial intelligence models are used for reliability, internal consistency, and validity tests. The Naive Bayes and principal component analysis models are used to identify and classify the questionnaire samples, so as to more accurately identify the key links of families' cognitive deficiencies in adolescent mental health. Third, relying on digital economy technology, this paper analyzes the application scenarios of technologies such as the Internet of Things, big data, artificial intelligence, and blockchain in the whole-process links of family mental health construction, including prevention, identification, assessment, and disposal, and proposes specific construction plans and paths.

2. Compilation of the Questionnaire Survey Scale

2.1. Existing Measurement Methods

There is currently no targeted standard measurement scale for the survey of families' cognition of adolescent mental health. For example, Kuhlman K R's [4] survey of family cognition in the Saudi region and Sakurako Kusaka's [5] survey and analysis of Japanese junior and senior high school students' families were both carried out based on self-constructed questionnaires. The existing research tools that can be used for reference mainly include the Short-form Egna Minnen av Barndoms Uppfostran (SEMBU-C) and the Middle School Students' Mental Health Scale (MMHI). From a statistical perspective, the main problems of the above-mentioned questionnaires are that it is difficult to ensure the reliability of measurement by using a single-question item to evaluate the mental health cognition level of families with adolescents. Although some use multi-item questionnaires, the compilation is relatively arbitrary. In addition, standardized scales have obvious biases in question design, so it is difficult to overcome the randomness and specific psychological tendencies of questionnaire respondents. This study develops a personalized scale for the questionnaire based on the multi-dimensional assessment model of adolescent mental health [6]. Mainly considering the cross-verification between questions and the design of scenario-based questions, it can better evaluate parents' cognition level of adolescent mental health. It specifically includes the following aspects: First, pay attention to the overall cognition of adolescent mental health, and evaluate parents' observation and understanding of adolescents' emotional states and behavioral performances, so as to reflect parents' cognitive level of the overall mental health status of adolescents. Second, measure the cognition of different mental health factors [7]. By evaluating parents' understanding of different aspects such as adolescents' learning pressure, social relationships, and family relationships, it reflects the depth of parents' understanding of multiple dimensions of adolescent mental health. Third, by evaluating parents' ability to identify specific manifestations of adolescent mental health (such as anxiety symptoms, depressive symptoms, self-harm behaviors, etc.), it reflects parents' cognitive level of each specific mental health problem. Fourth, evaluate parents' coping attitudes towards adolescent mental health problems and their willingness to seek help, so as to reflect parents' action tendencies when facing adolescent mental health problems. Also, understand parents' channels for obtaining adolescent mental health knowledge and their learning needs, providing a basis for carrying out targeted mental health education for parents in the future.

2.2. Scale Compilation Process

According to the psychological measurement theory [8], the compilation of a questionnaire mainly goes through three stages: (1) collecting original materials through methods such as web crawlers; (2) coding and sorting the collected original materials to initially form a closed-ended questionnaire; (3) conducting a small-scale pre-test using the initially compiled questionnaire, and making qualitative and quantitative revisions and tests to the questionnaire to finally form a formal questionnaire. The compilation process of the Family Adolescent Mental Health Cognition Questionnaire is as follows:

First, collect original materials. First, use web crawler technology to collect discussion content and parental views on adolescent mental health from relevant social media platforms, parent forums, and mental health websites. These data can reflect parents' actual cognition and concerns about adolescent mental health. Second, search domestic and foreign academic databases to collect research literature on adolescent mental health and parental cognition. Focus on existing methods and scales for measuring parents' cognition of adolescent mental health. Third, by crawling the official websites of mental health institutions and schools, collect the adolescent mental health guidelines and parent education materials they provide, and understand the expectations of professional institutions for parental cognition. Finally, use natural language processing technology to conduct a preliminary analysis of the large amount of text data collected, extract keywords and themes, such as emotion recognition, communication quality, support system, and help-seeking behavior, providing a basis for subsequent questionnaire design.

Second, compile the initial questionnaire. Classify and summarize the materials obtained from interviews and open-ended questionnaires, extract problem items related to parents' cognition of adolescent mental health, and sort them by frequency. After deleting items with low frequencies, an initial questionnaire containing 17 items was formed. Ask parents and educators to rate the initial questionnaire, and make revisions based on the degree of conformity between the questionnaire content and the actual family situation and the readability of the questionnaire. Then, ask mental health experts and education experts to evaluate the scientificity and appropriateness of the questionnaire. Combine some items with repeated meanings, and finally form a pre-test questionnaire containing 15 items.

Third, conduct a pre-test. Conduct the questionnaire pre-test through the Internet method, distribute 230 questionnaires, and recover 196. The analysis of the pre-test results shows that the questionnaire has a clear multi-dimensional structure. However, the communality of some items is low (less than 0.40), indicating that these items have weak explanatory power for the factors they belong to, so they are deleted. The final Adolescent Mental Health Cognition Questionnaire consists of 12 items (the initial questionnaire and the item deletion process are shown in the appendix table). Each item requires respondents to recall their own experiences and evaluate their cognitive and understanding levels of various aspects of adolescent mental health at that time. The more comprehensive and accurate the cognition of mental health, the higher the mental health literacy; conversely, the literacy needs to be improved.

3. Empirical Test of the Family Adolescent Mental Health Cognition Questionnaire

3.1. Test Process and Subjects

This study takes parents as the research subjects and conducts a questionnaire survey on parents of families with middle-school-aged children in Beijing through an online questionnaire system. All participants were informed that they would receive a 20-yuan cash reward if their questionnaires were valid. In addition to basic demographic variables, all subjects also participated in filling out a Family Adolescent Mental Health Cognition Questionnaire. A sample item is "Please recall carefully. How important do you think adolescent mental health is?" The response options are scored on a Likert 5-point scale, with 1 point for "very unimportant", 2 points for "not very important", 3 points for "uncertain", 4 points for "relatively important", and 5 points for "very important".

Table 1. *Distribution of Demographic Variables of Survey Subjects.*

Characteristics	Categories	Proportions
Gender	Male	45.60%
	Female	54.40%
Age	25 years old and below	20.50%
	26-45 years old	30.40%
	46 years old and above	49.10%
Educational Attainment	High school and below	15.20%
	Undergraduate	55.00%
	Master's degree and above	29.80%
Annual Household Income	Less than 5000 yuan	20.50%
	5000-20000 yuan	25.40%
	20000 yuan and above	54.10%

A total of 300 questionnaires were sent out, 300 were recovered, and 295 were valid. The distribution of the sample is as follows: In terms of gender, males account for 45.6% and females account for 54.4%; in terms of age, those under 25 years old account for 20.5%, those aged 26-45 account for 30.4%, and those 46 years old and above account for 49.1%; in terms of educational attainment, those with a high-school education or below account for 15.2%, those with a bachelor's degree account for 55.0%, and those with a master's degree or above account for 29.8%; in terms of family in-

come, those with an annual income of less than 5,000 yuan account for 20.5%, those with an annual income of 5,000-20,000 yuan account for 25.4%, and those with an annual income of 20,000 yuan and above account for 54.1%.

3.2. Questionnaire Analysis

Item discrimination analysis. The method of this study is to sum up the scores of each subject on each item of the Adolescent Mental Health Cognition Questionnaire, rank them from high to low, take the top 27% of the total score as the high-score group, and the bottom 27% as the low-score group, and conduct a significance test on the difference in the average scores of the two groups on each item to finally determine whether each item has a significant difference between the high-score group and the low-score group. If the significant difference is reached ($P < 0.05$), the item has a certain discriminatory power and should be retained; otherwise, it should be deleted [9]. The results of the discrimination analysis show that each question item reaches a significant level (see Table 1), indicating that the questions in this questionnaire have the ability to distinguish between the high-score group and the low-score group.

The standard deviation reflects the range of the scores of the subjects. A large standard deviation of an item indicates that the scores of the subjects on this item are widely distributed, and the item can distinguish individual differences; conversely, if the standard deviation is small, it indicates that the scores of the subjects on this item fluctuate little, and the item has a low ability to distinguish differences [10]. Based on this theoretical basis, items and factors with a standard deviation lower than 0.50 should be excluded. After inspection, the standard deviations of all items of the compiled questionnaire are greater than 0.50 (see Table 1), indicating that the discriminatory power of each item of the questionnaire is good. The correlation between each item and the total score also reached a significant level of 0.01, and the correlation coefficients are between 0.54 and 0.73, all higher than 0.50, indicating a high internal consistency among the items.

3.3. Exploratory Factor Analysis

In order to conduct exploratory factor analysis and confirmatory factor analysis on the data, this study randomly divided the 342 valid parent samples obtained from the empirical survey into two parts. One part of the samples was used for exploratory factor analysis ($n = 171$), and the other part was used for confirmatory factor analysis ($n = 171$). The difference test shows that there are no significant differences between the two parts of the samples in terms of gender, age, education level, family income, etc. In order to test whether the survey data is suitable for factor analysis, a Bartlett's sphericity test was performed on the data. The test value is 2161.90 ($P < 0.000$), indicating the possibility of shared factors among the items. At the same time, the KMO value of the sample is 0.84, indicating that the data sample is suitable for factor analysis.

First, conduct a first-order factor analysis on the 13 items of the questionnaire. Extract factors with eigenvalues greater than 1 through principal component analysis, and then perform a maximum orthogonal rotation on the factor analysis results. Combining with the scree plot, a total of 3 common factors were extracted. In past studies, different researchers usually used factor loadings as the deletion criterion when compiling questionnaires. Usually, 0.40 is a commonly used critical value. If the factor loading of an item on all factors is less than 0.40, or the factor loadings on two or more factors are greater than 0.40 (cross-factor), then the item should be deleted. In this study, the factor loadings of all items are greater than 0.40, but the item "Understanding of Emotion Management" has factor loadings of 0.52 and 0.47 on two dimensions respectively, with a small difference, indicating that this item has an overlap on two dimensions, so it was deleted. The final factor analysis is shown in Table 2. The cumulative variance contribution rate of the 3 common factors is 63.16%, which is relatively ideal. The results show that the structure of parents' cognition of adolescent mental health mainly includes 3 dimensions. Combining the meanings expressed by the items of each factor, we named them respectively:

Factor 1 is "Understanding of Emotion Management", Factor 2 is "Cognition of Behavioral Support", and Factor 3 is "Cognition of Social Relations", with each dimension containing 4 items. According to the suggestions of Hinkin [11], the optimal number of items for each dimension when compiling a scale is 4-6, which proves that the number of items in the scale we compiled is relatively reasonable.

Understanding of Emotion Management refers to parents' cognition of adolescents' emotion recognition and management. If parents believe that they are confident in understanding and helping adolescents manage their emotions, it indicates a high level of ability in emotion management cognition; otherwise, the ability is low. This dimension includes 4 items: "Ability to Identify Adolescents' Emotions", "Strategies for Coping with Adolescents' Emotional Changes", "Skills for Regulating Emotions", and "Opportunities for Adolescents to Express Emotions Positively".

Cognition of Behavioral Support refers to the degree of parents' cognition of providing behavioral support and guidance to adolescents. If parents are confident in providing appropriate support and positive behavioral guidance, it indicates a high level of cognition in this aspect; otherwise, it is low. This dimension consists of the following 4 items: "Ability to Provide Positive Behavioral Feedback", "Depth of Understanding Adolescents' Behavioral Motives", "Ability to Guide Correct Behavioral Choices", and "Skills for Evaluating and Reflecting on Behavioral Results".

Cognition of Social Relations refers to parents' cognition of adolescents' social interactions and relationship handling.

If parents believe that adolescents can handle social relations well, it indicates a high level of cognition in this dimension; otherwise, it is low. This dimension includes the following 4 items: "Quality of Relationships with Peers", "Frequency of Communication with Family Members", "Enthusiasm for Participating in Social Activities", and "Ability to Handle Conflicts".

3.4. Confirmatory Factor Analysis

Confirmatory factor analysis was carried out using a sample of 171 subjects to further test whether the three-dimensional structure obtained from the exploratory factor analysis could be supported by another set of sample data. The data of confirmatory factor analysis was processed by AMOS 20.0. The specific results are shown in Figure 1 and Table 3. The overall fit of the model is good. Among them, the absolute fit index $\chi 2/df$ is 2.01, the root mean square residual (RMR) is less than 0.05, the root mean square error of approximation (RMSEA) is also close to the ideal level of 0.05, the goodness-of-fit index (GFI) reaches above 0.95, and the parsimonious goodness-of-fit index (PGFI) is greater than 0.50, indicating excellent parsimony of the model. The relative fit indices such as the comparative fit index (CFI), the normed fit index (NFI), and the Tucker-Lewis index (TLI) all reach the ideal level above 0.90. It can be seen that all the goodness-of-fit indices are within the acceptable range, indicating that the structure of the set model is reasonable [12]. The validity can be further tested through the factor loadings.

The variable loadings in the confirmatory factor analysis are shown in Figure 1. The results show that the standardized loading coefficients of each observed variable on the corresponding latent variable are between 0.5 and 1, and all passed the t-test, being significant at the $P < 0.001$ level. The errors of each item are less than 0.70. This indicates that each variable in this study has sufficient convergent validity.

3.5. Reliability Analysis

To ensure that all items in the questionnaire have a high degree of consistency within their respective dimensions, this study then conducted a Cronbach's α reliability analysis. If the reliability value of a certain dimension is very low, it means that there are obvious inconsistencies in the respondents' expected attitudes towards these items. Therefore, this study conducted a reliability analysis on the items of these 3 dimensions, and according to the standards in past exploratory studies, dimensions with a Cronbach's α internal consistency value greater than 0.60 were retained. At the same time, if it is found that deleting a certain item will improve the internal consistency of the dimension, then this item should be deleted [13]. The results of the reliability analysis show that deleting any item did not improve the reliability of each sub-scale, and the internal consistency of the 3 dimensions in the questionnaire is higher than 0.70, indicating that the self-compiled questionnaire has good reliability. Among these 3 dimensions, the Cronbach's α coefficients of Understanding of Emotion Management, Cognition of Behavioral Support, and Cognition of Social Relations are 0.84, 0.79, and 0.75 respectively.

4. Results of the Family Adolescent Mental Health Cognition Survey

4.1. Factor 1

The questions cover the following aspects: the ability to identify adolescents' emotions, strategies for coping with adolescents' emotional changes, skills for regulating emotions, and opportunities for adolescents to express emotions positively. These questions require parents to answer based on their own cognitive and confidence levels, and the options include "very confident", "relatively confident", "average", "not very confident", and "not confident at all".

In this sample, the internal consistency (Cronbach's alpha) of the 4 questions is 0.84, showing good reliability. Figure 1 shows the score distribution of parents on the questions of Understanding of Emotion Management. The average score is 3.2 (full score is 5; standard deviation = 0.9). Approximately 10.5% of parents showed low confidence in all questions (average score less than 2 points); 38.7% of parents showed medium or high confidence in more than half of the questions (average score greater than 3 points). Table 2 summarizes the proportion of parents who showed a high level of confidence (choosing "very confident" or "relatively confident") in each question. The proportion is relatively low in the following questions: the ability to identify complex emotions of adolescents (52.3%), strategies for coping with sudden emotional changes of adolescents (57.8%), teaching adolescents skills for regulating emotions (59.4%), and creating opportunities for adolescents to express emotions positively (61.2%). These results indicate that although most parents have a certain level of confidence in adolescent emotion management, there is still a considerable number of parents who feel less confident in some specific aspects, especially in identifying complex emotions and coping with sudden emotional changes.

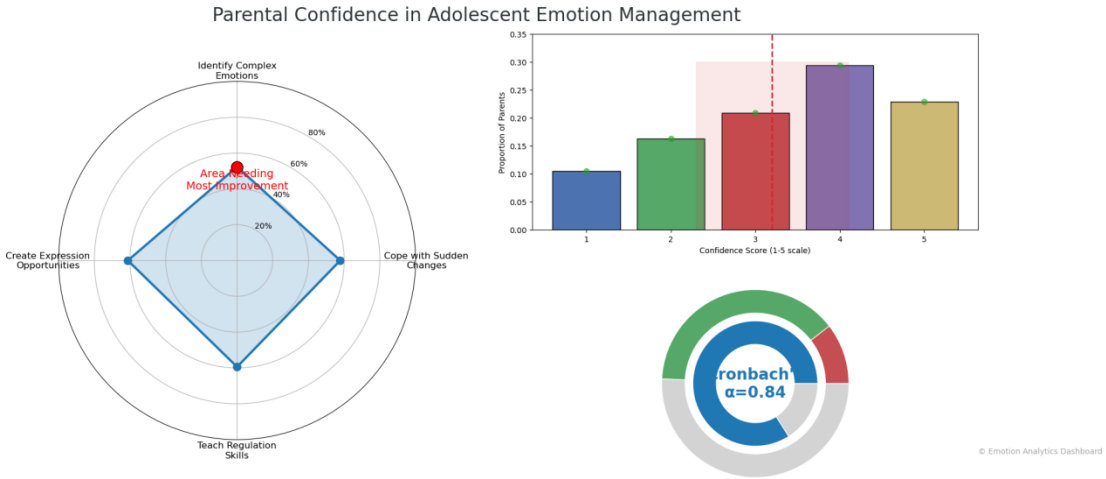

Figure 1. *Score Distribution of Parents on the Questions of Understanding of Emotion Management.*

Table 2. *Proportion of Parents' Scores on the Questions of Understanding of Emotion Management.*

Question	Response Proportion (Very Confident or Relatively Confident)
Ability to Identify Adolescents' Emotions	52.30%
Strategies for Coping with Adolescents' Emotional Changes	57.80%
Skills for Regulating Emotions	59.40%
Opportunities for Adolescents to Express Emotions Positively	61.20%

4.2. Factor 2

In Factor 2, we evaluated parents' cognitive levels of providing behavioral support and guidance to adolescents. This part contains four key items, aiming to measure parents' confidence levels in providing appropriate support and positive behavioral guidance. First, approximately 65% of parents said they were confident or very confident in providing positive behavioral feedback. Second, 55% of parents believed that they could understand the motives behind adolescents' behaviors well, but 30% sometimes felt confused. In addition, in guiding adolescents to make correct behavioral choices, 70% of parents felt confident or very confident, while 20% said they were occasionally unsure. Finally, approximately 60% of parents said they were confident in helping adolescents evaluate and reflect on the results of their behaviors, but 25% thought they needed to improve their skills in this regard. Overall, most parents showed medium to high levels of confidence in Cognition of Behavioral Support, but a considerable proportion of parents still recognized the need for further improvement in some aspects. These results highlight the importance of providing more support and training for parents to enhance their abilities and confidence in guiding adolescents' behaviors.

Table 3. *Proportion of Parents' Scores on Providing Behavioral Support and Guidance to Adolescents.*

Question	Response Proportion (Confident or Very Confident)
Ability to Provide Positive Behavioral Feedback	48%
Depth of Understanding Adolescents' Behavioral Motives	55%
Ability to Guide Correct Behavioral Choices	70%
Skills for Evaluating and Reflecting on Behavioral Results	60%

4.3. Factor 3

Table 3 summarizes parents' cognition of adolescents' ability to handle social relations and their intentions to support them when the adolescents they care for are in a situation similar to that of Adolescent A in the illustration. Most parents said that they believed that adolescents' social relation problems were not just manifestations of individual

weaknesses and agreed that higher-level guidance was needed. Regarding the intention to support adolescents in improving their social relation abilities, most parents said they would / might listen to adolescents' ideas, consult information about adolescents, and participate in positive social activities. Most parents (95.4%) said they would / were likely to support and help adolescents deal with difficulties related to social relations (not shown in the table here). Parents were asked, "If the adolescent you care for has difficulties in handling social relations, what is your attitude towards this situation?" The possible answers to this question include "I can accept the current situation", "I may be able to accept the current situation", "I may not be able to accept the current situation", or "I cannot accept the current situation". When the answer is "I can accept the current situation" or "I may be able to accept the current situation", it indicates that parents can understand and are willing to support the social development needs of adolescents. Supplementary Table 1 summarizes the proportion of correct / expected answers by gender and age. No significant age differences were observed in any question or item. By gender, in the items of "Adolescents' social problems are manifestations of individual weaknesses", "I will consult information about adolescents", and "I will participate in positive social activities", the proportion of female parents seems to be higher than that of male parents; these differences are statistically significant (odds ratios are 2.5, 4.0, and 2.2 respectively, all $P < 0.001$, with male as the reference value), and have been adjusted for age, current / previous work experience related to social relations, and participation in relevant seminars.

Table 4. *Parents' Cognition of Adolescents' Ability to Handle Social Relations.*

Question	Response Proportion (Very Confident or Relatively Confident)
Quality of Relationships with Peers	52.30%
Quality of Relationships with Peers	43.60%
Enthusiasm for Participating in Social Activities	42.10%
Ability to Handle Conflicts	48.30%

4.4. Summary

This study investigated the mental health cognition levels of adolescent caregivers in Beijing families. Most parents have an ideal attitude towards potential mental health problems of adolescents, especially showing activeness in actively listening and communicating. However, at the same time, most parents still lack knowledge in mental health. Although many parents are prepared to take basic steps to help adolescents and are willing to participate in helping behaviors, 30% of parents did not consider seeking professional help for potential depressive symptoms. This situation is consistent with previous studies, showing that the same proportion of parents will not actively seek medical help when facing adolescents' depressive symptoms. This may be related to adolescents' resistance to seeking medical treatment.

The research results show that emotional acceptance of diagnosis is not the main obstacle; most parents said they could accept that adolescents were diagnosed with mental illness. Not recognizing depression and its symptoms as a medical disease is also not the main obstacle to seeking treatment; most parents believed that adolescents were in a state that required medical care. Therefore, it is necessary to further study the reasons why parents do not seek professional help for adolescents.

Most parents have insufficient knowledge of mental health / illness. Some parents (10%) only answered one or zero questions correctly; one-third of parents answered less than half of the questions correctly. Specifically, half of the parents did not know that suicide is a major cause of death among adolescents in Beijing, and they were also unclear about the 20% lifetime prevalence of mental illness and its relationship with academic achievement. They also lacked knowledge about adolescents' healthy lifestyle, for example, they did not know that the appropriate amount of sleep is 8-10 hours.

Although knowledge plays a certain role in predicting healthy behaviors, knowledge alone cannot predict or change behaviors; on the contrary, health-related beliefs (such as attitudes or intentions) may be the key predictors. Future intervention measures should include some key steps, such as understanding the nature of the problem, considering possible action plans, and developing parents' intentions to encourage adolescents to seek mental health services.

This study did not observe significant differences in the impact of age or gender on knowledge. However, there are multiple potential confounding factors in the path from improving parents' mental health cognition levels to improving adolescents' mental health prognosis. The diversity of adolescent mental health manifestations may make mental illness difficult to identify. Stigma and systemic and structural problems in accessing mental health services may also affect service access. In addition, since schools are one of the most common places for adolescent mental health care, future research should investigate parents' attitudes and behaviors towards obtaining services from schools. Improving the access to welfare resources in schools may help with effective intervention before medical services are needed.

Although there is no significant difference in the mental health knowledge levels between male and female parents, female parents' beliefs and expected attitudes towards adolescent mental health problems are significantly higher than those of male parents. This is consistent with previous re-

search results; females usually have a more positive attitude towards mental health problems. However, the proportion of male participants in this study is low (15.2%), so a more balanced gender sample is needed in future research to draw more robust conclusions.

The advantage of this study lies in its high response rate (85.8%). The questionnaire was conducted at the school entrance ceremony of students, ensuring a wide range of participants, including not only parents interested in mental health but also those with less knowledge, thus limiting the bias in the characteristics of participants. However, this study also has limitations. First, the participants are from families in a certain area of Beijing, so the results may need to be adjusted when generalized to other regions. Second, the nature of the relationship between parents and adolescents was not evaluated; most parents who participated in the school entrance ceremony were biological parents. It would be meaningful to study parents and other caregivers separately in future research. Finally, the current situation assessment used a single case. In the future, it is necessary to use more scenarios and tools covering other mental health problems to obtain a more comprehensive understanding.

5. Applications of Artificial Intelligence to Enhance Families' Cognition of Adolescent Mental Health

5.1. The First Stage: Information Collection and Data Encryption

1. Information Collection with the Aid of Artificial Intelligence Technology

In the face of big data, all behaviors can be transformed into data. With the help of multiple channels such as social media, school records, and psychological tests, we can comprehensively collect relevant data on adolescents' behaviors, emotions, and social interactions, and conduct in-depth mining and analysis. Using natural language processing, sentiment analysis and other technologies, we can monitor potential psychological problems of adolescents. Introduce dynamic data monitoring to continuously track the changes in adolescents' mental states and provide data support for accurate assessment [14]. In addition, artificial intelligence-based monitoring tools can use sensors and algorithms to monitor users' emotional states and mental health conditions in real-time, which can help users detect psychological problems in a timely manner and take effective intervention measures. For example, by monitoring users' physiological signals (such as heart rate, blood pressure, etc.) and behavioral signals (such as sleep quality, exercise volume, etc.), we can assess users' levels of anxiety and depression and provide corresponding psychological interventions and treatment suggestions.

2. Blockchain Encryption and Assetization Promotion of Data Information

Traditional mental health assessment software lacks technical guarantees for protecting users' privacy information. To solve the many pain points of traditional mental health assessment systems, especially considering the privacy-protection issues that adolescents are more concerned about when taking psychological tests, blockchain algorithms and homomorphic encryption technology are adopted. Each user has a separate key, which provides an innovative and powerful solution for the privacy protection of mental health data.

On the one hand, all primary and secondary school students' data is encrypted during transmission and storage to avoid unauthorized access. The system uses protocols such as SSL/TLS to protect data transmission and encrypts system data to protect the data stored on the server. The system implements strict access control measures to limit access to student data to authorized personnel only. In addition, the system establishes a detailed permission hierarchy to ensure that each user can only access the data they need. Through AI, we can analyze large-scale student mental health data, helping researchers deeply understand the trends and influencing factors of student mental health problems [15].

On the other hand, the system designs an appropriate ethical framework and privacy-protection mechanism to ensure the data security of families and students and respect individual rights and differences. Ensure that the data is only used for the purpose of mental health support and services and cannot be used for advertising or other commercial purposes. When designing and using an artificial-intelligence-based mental health service system, an ethical review should be carried out to ensure that the operation of the system will not pose potential ethical or psychological risks to students. Schools and service providers should be transparent, explain to students and parents how the data is collected and used, and assume corresponding responsibilities to ensure the confidentiality of the data.

5.2. The Second Stage: Development and Optimization of Professional Model Analysis Tools

Build an artificial-intelligence-based mental health service system, whose physical form is a chatbot. Using artificial intelligence natural language processing (NLP) technology and sentiment analysis technology that can professionally analyze human language, the system can understand the text input of primary and secondary school students and analyze their emotional states, which helps the system better understand users' needs and emotional conditions [16]. Through continuous data collection and model training, using machine-learning algorithms, the system can provide personalized mental health suggestions based on users' inputs and historical data.

In terms of functions, the system can provide graphical

and multimedia content, such as relaxation audio, videos, or animations, to help users perform relaxation exercises. The communicative chatbot is the core of the system. This bot can have natural conversations with users, providing support and advice [17]. The system can offer various self-learning modules, including content about emotion management, stress-coping, and self-esteem improvement. The system can also provide various relaxation exercises, such as meditation, breathing exercises, and progressive muscle relaxation. At the same time, it helps primary and secondary school students identify and change unhealthy thinking and behavior patterns, and provides personalized suggestions and activity recommendations according to users' inputs and emotional states.

Meanwhile, the progress and feedback of users are recorded and tracked, and the system can adjust its suggestions as needed. Regularly monitor the system performance, including user satisfaction, the effectiveness of suggestions, and the technical operation status.

5.3. Stage 3: Developing Comprehensive Online Mental Health Services Using Analysis Results

For students, the system provides personalized psychological counseling suggestions according to the assessment results. The system monitors students' emotional states and conducts early interventions when abnormal situations are detected to provide timely psychological support. By using machine-learning algorithms to analyze student data, it can study mental health trends and the effectiveness of interventions, and monitor students' emotional states and mental health indicators in real-time for timely intervention.

For families, the system provides targeted and scientific family education training. The main purpose is to enable parents to better understand the mental health of children and adolescents and suggest appropriate and scientific parenting methods to promote family mental health. Internet-based communication-style lectures are used, and the lecture content mainly involves promoting communication between parents and children, parenting guidance, understanding children's mental health, and preventing self-harm and suicide issues [18]. For example, public welfare organizations can enter the platform to conduct online communication-style lectures on topics such as how to promote communication between parents and children, how to understand children's mental health, and how to deal with children's adverse psychological conditions.

For schools, this intelligent system can analyze the abnormal behaviors in the current scene by analyzing the surveillance images collected in real-time and without interference through setting up streaming media servers in the campus surveillance local area network [19]. Through AI-based intelligent behavior analysis, it can timely detect the fluctuations in students' mental health, providing early warnings for schools and families to promptly grasp students' mental dynamics.

For the government, it is necessary to improve policy guidance, supervision, and relevant incentive systems. First, determine pilot schools. After the emotional health of students and the mental health awareness of families have been improved, these schools can serve as a reference for other schools to introduce similar services, gradually increasing the utilization rate of the platform and gradually gaining the recognition of all sectors of society. At the same time, the collection and protection of student data are important issues. The government needs to guide the establishment of a solid legal and ethical framework to ensure the security and privacy of data.

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Appendix

Questionnaire on Adolescent Mental Health (for Parents) I. Basic Information

1. Your gender A. Male B. Female

2. Your age is A. 25 years old and below B. 26-45 years old C. 46 years old and above

3. Your educational attainment is A. High school and below B. Bachelor's degree C. Master's degree and above

4. Your family's annual income is A. Less than 5,000 yuan B. 5,000-200 million yuan C. 200 million yuan and above

Cognition of Mental Health Please recall carefully and rate the following questions one by one according to the actual situation (the degree increases from 1 to 5, 1 point for having no confidence at all, and 5 points for having full confidence)

(A) Understanding of Emotional Management

1. Ability to identify adolescents' emotions

2. Strategies for dealing with adolescents' emotional changes

3. Skills in regulating emotions

4. Opportunities provided for adolescents to express their emotions positively

(B) Cognition of Behavioral Support

5. Ability to provide positive behavioral feedback

6. Depth of understanding of adolescents' behavioral motivation

7. Ability to guide the choice of correct behaviors

8. Skills in evaluating and reflecting on behavioral outcomes

(C) Cognition of Adolescents' Social Relations

9. Quality of relationships with peers

10. Frequency of communication with family members

11. Enthusiasm for participating in social activities

12. Ability to handle conflicts

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