
Depression Among Chinese Left-Behind Children: A Cross-Temporal Meta-Analysis, 2006-2018

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Abstract: With the steady increase of rural-to-urban migrant laborer over the past decades in China, a growing number of rural children and adolescents has been left at home, called children left-behind, by one or both parents who cannot afford to bring their families to the cities where they work. And the mental health of them has gradually received widespread attention especially in depression. The study uses the method of cross-temporal meta-analysis to analyze 26 studies that used the Child Depression Inventory (CDI), ranging from 2006 to 2018 and covering 17498 left-behind children, to explore the changes in depression levels of left-behind children in Chinese rural areas over the years. The results showed that there was a significant positive correlation between the total average scores of the CDI and the years ($r = 0.42$). The total average scores of the CDI have increased by 0.68 standard deviations for the past 12 years ($d = 0.68$). Besides, the socioeconomic indicators from 5 years ago and the present year, including the urbanization level, resident consumption level, and consumer price index of China, significantly positively correlated with the total average scores of the CDI ($r = 0.33 \sim 0.35$). The results suggested that the depression level of the left-behind children has been increasing year by year in recent 12 years, and the standard deviation of the left-behind children's depression level has also been increasing year by year. Furthermore, these socioeconomic factors were likely to be important factors in predicting the depression level of left-behind children. The risk of mental health problems among this large number of left-behind children indicates the urgent need for families, schools and society to work together and provide sufficient care to improve their mental status and cultivate good qualities.

Keywords: Left-Behind Children, Depression, Cross-Temporal Meta-Analysis

1. Introduction

Over the past 40 years of reform and opening up, Chinese economic, political and cultural development has been remarkable to the world. Due to China's unbalanced regional economic growth and the continuous promotion of urbanization, many young and middle-aged rural laborers have begun to move to big cities. Many of them have formed families, and raised children. However, because of the restriction of China's dual urban and rural structure system, these families have to leave their children in their hometown to be adopted by their parents or other relatives when they go out to work, this has led to the creation of a unique group of children left behind in rural areas in contemporary China. "There are about 240 million migrant workers in our country

and about 60 million left-behind children, including more than 24 million children in the compulsory education stage, accounting for more than one-fifth of the total," said Yuan, Minister of Education, in a question-and-answer session of the 12th National People's Congress [32]. Left-behind children commonly have psychological problems such as depression, anxiety, and impulsivity due to lack of communication with family members, poverty and lack of affection, among which depression is particularly prominent [10]. So how does the level of depression of left-behind children change over time? This is a matter of concern to this research.

In general, left-behind children are children under 18 years old who do not live with their parents for at least 6 months because one or both of their parents have moved away from the child's household registration and living area for work [28].

Children are usually left in the care of family members, such as grandparents, relatives and neighbors. In this environment, lacking parental protection would lead to psychological maladjustment, also known as Left-behind children syndrome, which includes some behavioral problems such as declining academic performance, school weariness, truancy, and even dropping out of school, as well as the development of inner personality in the direction of isolation, vulnerability and moral vacuum [23]. And depression is also one of the most prominent psychological problems in left-behind children because of their family and economic problems [6, 10]. Depression is a generic term used by the media, the general public and health care professionals to refer to negative mood symptoms that range in severity from unhappy psychological states to major depressive disorder (MDD). Depression is widely recognized as the most common psychiatric disorders affecting children and adolescents [5]. Studies indicated that depression made individuals sensitive to pain and affected their cognitive function, mood, thinking, behavior, physical functioning, learning, and social activities, which damaged their physical and mental development, school performance and peer relationships, and even caused suicidal thoughts [7, 12, 16]. Besides, suicide has become the leading cause of death among adolescents, and depression is a major risk factor for suicide [14].

The research on left-behind children lags behind in China. Only in 1993 did some scholars raise concerns about left-behind children. After 2004, academic research on left-behind children began to appear. In China, there are many tools to measure the depression level of left-behind children, including the Children's Depression Inventory (CDI), Center for Epidemiologic Studies Depression Scale (CES-D), Depression Self-rating Scale for Children (DSRSC) and so on. The most commonly used scale is the child depression scale. Although this scale was the most used, it yielded different results on the depression levels of left-behind children. Some researchers concluded that compared with the non-left-behind children and the norm, left-behind children had higher levels of depression [6, 11, 20]. For example, Wang (2012) found that the detection rate of depression among left-behind children was higher than that of non-left-behind children in an area of Anhui Province. But other researchers found that there was no significant difference in depression levels between left-behind children and non-left-behind children [3, 29, 30]. For example, researchers found that levels of depression and antisocial behavior were not significantly higher in left-behind children than in non-left-behind children [29]. In recent years, the country has paid more attention to the education of left-behind children. From 2013 to 2016, the government issued "Opinions on the care and protection of left-behind children" and the "Opinions on strengthening the care and protection of left-behind children in rural areas" respectively, both aimed to provide direction for solving the problem of left-behind children. So whether the depression levels of the left-behind children in such an environment change, and how will their depression levels change as the years change, whether they are alleviated with the help of national policies

or show unique patterns of change. This is the major concern of this study.

To solve this problem, we use a special meta-analysis method-"Cross-temporal meta-analysis". This method was first developed by Jean M. Twenge in San Diego, USA [18]. This method is a way to meta-analyze their variation over time by arranging and linking previously isolated studies on similar topics in chronological order and using these studies as cross-temporal samples [24]. Researchers in China have used the cross-temporal meta-analysis method to study the mental health of high school and college students, the mental health of poor college students, and the social anxiety of college students, respectively, and have achieved a series of valuable research results [25, 17, 27, 31]. In contrast to the general meta-analysis, which treats the chronological effect as an error item, the cross-temporal meta-analysis method focuses on the chronological effect and the tendency of the individual's psychological quantity over time, and it also takes a macroscopic view of trends in variables. In addition, the cross-temporal meta-analysis can also link the macro-variables of social change and the micro-variables of individual psychological development, and can explain the influence of social change on individual psychological development by the relationship between psychological quantity and social indicators, and explain the nature of the influence by lagged correlation analysis. For example, if it is the social environment that changes people's psychological quantity, then the current year's psychological quantity should be significantly correlated with the social indicators 5 or 10 years ago; in contrast, if it is people's psychological quantity that influences social change, then the current year's psychological quantity should be significantly correlated with social indicators 5 or 10 years later [18]. Based on the relevant studies, the current social factors that may affect the depression level of left-behind children may be mainly concentrated on the economic situation of the country, because the generation of left-behind children is ultimately due to the unbalanced development of China's economy after the reform and opening up, which has led to a surge in the demand for urban labor and thus the movement of labor to cities [2]. With the continuous improvement of the modernization level of society, an individual's psychological state and values will inevitably change, and then affect the individual's psychology and behavior [8].

In sum, this study intends to conduct a cross-temporal meta-analysis on the characteristics of the changes of left-behind children's depression level (as defined by CDI scores) over the years, and analyze the influence of social change factors on the depression level of left-behind children. The study is interesting because this year is the final year of the fight against poverty, we can know how economic indicators change each year, but we don't know how people's psychology changes. Therefore, our question is, how have the depression levels of left-behind children in China changed since the reform and opening up? This research will use the method of cross-temporal meta-analysis to answer this question.

2. Method

2.1. Research Tools

Children’s Depression Inventory (CDI): It was compiled by Kovacs and Beck in 1977. There are 27 items in the scale, including 5 dimensions: negative emotion, interpersonal problems, low efficacy, lack of pleasure and negative self-esteem. The frequency of "Occasional", "Often" and "Always" in the corresponding questions was represented by 0, 1 and 2 levels, respectively. The total scores ranged from 0 to 54 points, among which 13 questions were scored in reverse. The higher the final scores was, the higher the degree of depression was.

2.2. Literature Search

In this study, we used the principles of Xin and Zhang (2009) in the literature collection and screening and adopted the following criteria: (1) the research must use the same measurement tool, namely the CDI scale; (b) the target group to be studied must be the Chinese left-behind children in rural China (i.e. minors under the age of 18 who are left in the rural areas of their household registration places while both or one of their parents are outside the household for work); (3) the study was published between January 1, 1990, and December 31, 2020. (4) the results of the study provided the sample size, the mean and standard deviation of the CDI scale or data that could be calculated indirectly.

Literature need to be excluded from the database if it has one of the following characteristics: (1) Excluding those selecting subjects according to special criteria, for example, left-behind children are caused by external factors such as single-parent families, natural disasters, etc. (2) Excluding studies that were measured at specific times, for example, the time to conduct the survey is in the middle school entrance examination, college entrance examination, or in the epidemic “SARS”, "New coronavirus" isolation period. (3) Excluding studies in which the underlying data (N, M, SD) are not clearly presented or where significant errors exist. (4) If the same data of the same author is republished, the later one is deleted.

According to the above selection and screening criteria, we searched in CNKI, WHIP Consulting, Wan fang database, excellent master's thesis, and doctoral thesis databases, with the Chinese and English subject words of “Left-behind children”, "Depression", "CDI" and “Child Depression Scale”, and searched the literature from 1990 to 2020, and obtained a total of 862 documents, and 26 articles were found to meet the criteria, with a total sample size of 17408, with a maximum sample size of 4181 and a minimum of 57. The time of data collection (hereafter collectively referred to as “Years”) was included in this study. If it was not explicitly stated in the original text, the data were coded by subtracting 2 years from the time of publication, and the result represents the time of data collection [25]. Therefore, this study was conducted from 2006 to 2018. The number of literature and sample size for each year are shown in Table 1.

Table 1. Literature quantity and sample size from 2007 to 2020.

Date of publication	2007	2008	2009	2010	2011	2013	2014	2015	2016	2017	2018	2019	2020
Number of papers	1	1	1	2	3	1	2	3	2	5	2	1	2
Samples size	357	400	592	632	1326	1580	394	973	767	6601	1121	1256	1409

2.3. Variables’ Coding and Data Collation

Based on literature collection and screening, the coding table is made, and the obtained literature is coded and entered. The contents of the coding table include the type of journal, and the region of the sample (see Table 2 for details). It should be noted that the classification of core journals and general journals is based on the 2018 edition of the “Peking University Chinese core journals catalogue”. As for the code of the area where the sample is located, the existing literature on left-behind children is mainly concentrated in Shandong, Hubei, and Henan provinces, so to better control the corresponding variables, this study is no longer coded in general terms by region, but finely coded by province. The coding order is in accordance with the "7th five-year plan" adopted by the State in 1986 at the Fourth Session of the Sixth People's Congress. At the Fifth Session of the Eighth National People's Congress in 1997 and in the strategy for the great development of the Western Region formulated in 2000, the three regions of the east, the middle and the west were coded sequentially, and those of the same region were coded in alphabetical order. For example, Shandong and Fujian belong to the Eastern Region, and the first letter of

Fujian is in front, then the code of Fujian is "1", Shandong is "2", and so on. Eastern region of China includes Beijing, Tianjin, Hebei, Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, and Hainan, and other 11 provinces (cities); The central region includes Shanxi, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei and Hunan Provinces; The western region includes 12 provinces and autonomous regions, including Sichuan, Chongqing, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang, Guangxi, and Inner Mongolia.

In the process of coding, if the literature contains more than just the data needed for this study, then we make a partial selection based on the needs of this study. If the literature only reported gender, grade, and other partial data of the literature, then the total mean and standard deviation are synthesized by using the following formula. (\bar{X} , S_T , x_i , n_i , S_i represent: mean and standard deviation after synthesis, mean, sample size, and standard deviation of a study, respectively).

$$\bar{X} = \sum x_i n_i / \sum n_i \tag{1}$$

$$S_T = \sqrt{[\sum n_i s_i^2 + \sum n_i (x_i - \bar{x}_i)^2] / \sum n_i} \tag{2}$$

Table 2. Coding table for cross-temporal meta-analysis variables.

Variable	Code	Number of articles	Sample size
Journal type	1 = core journals	10	6073
	2 = General periodicals	5	2702
	3 = Master's thesis	5	2363
	4 = Foreign Journals	6	6270
	0 = no explicit region information	2	1506
Area	1 = Fujian	5	3299
	2 = Shandong	1	227
	3 = Anhui	6	3091
	4 = Henan	4	1273
	5 = Hubei	1	590
	6 = Chongqing	2	5245
	7 = Guizhou	3	1228
	8 = two or more regions	2	949

2.4. Social Indicators

In this study, the Gini index, the index of consumption level, the index of consumer price, and the level of urbanization are selected from the indicators describing the state of the national economy, as indicators reflecting the changes in the social environment in which Chinese left-behind children live. And the lagged analysis was conducted to examine the relationship between these social indicators and the changes of the depression level of left-behind children in China, so as to reveal the "impact" of the social and cultural environment changes on the left-behind children's depression. These social indicators come from China Statistical Yearbook, in which the "urbanization level" is calculated by the proportion of the urban population.

3. Results

3.1. The Depression Level of Left-Behind Children Changed with the Years

To investigate the corresponding changes in the depression level of left-behind children during the years change, we used

the mean of the total scores of CDI scale as the dependent variable, and the data collection period as the independent variable to establish a scatter plot. Through the scatter plot, we found that the mean of the total scores increased gradually with the change in years (see Figure 1).

To explore whether the trend described in the scatter plot has reached a significant level, we used the cross-temporal meta-analysis method of Xin and Zhang (2009), and correlation analysis and regression analysis were conducted between years and total scores mean of CDI. In addition, cross-temporal meta-analysis method can also examine trends in the extent of variation (variance or standard deviation) of psychological quantities over time [25]. Therefore, the relationship between the standard deviation (SD) of the total mean scores of the CDI scale and the years was also analyzed in this study (see Table 4). The results showed that the year was positively correlated with the total mean scores of the scale as well as the variance of the scale. This indicates that the depression level of the left-behind children not only showed a gradual increase over the years, but also the degree of variation of their depression level increased significantly, and their depression level no longer became the same as before, but started to become differentiated.

Table 3. The correlation between the mean of CDI total scores and the year.

Variable	The sample size was not controlled		After controlling the sample size			
	R_1	R_2	β_1	R_1^2	β_2	R_2^2
Mean CDI total scores	0.42***	0.37***	0.42***	0.18	0.12***	0.29

Note: * $p < 0.05$, ** $p < 0.05$, *** $p < 0.01$. r_1 is the correlation coefficient of the total mean scores with age when the sample size is not controlled, r_2 is the correlation coefficient of the total mean scores with age when the sample size is not controlled, and β_1 is the standardized regression coefficient of the control sample size, β_2 is the standardized regression coefficient for the control sample size and additional variables (region, journal type).

Compared with meta-analysis, cross-temporal meta-analysis may be also influenced by the characteristics of the literature, such as the type of journal, the source (region) of the subjects [19], in addition to the chronological effect. In order to control the influence of these factors, the mean of CDI total scores was taken as the dependent variable, and the data collection date, region and journal type were taken as independent variables to conduct

hierarchical regression. Regions and journal types are placed in the first tier, and data collection dates are placed in the second tier. The results showed that (Table 3), after controlling for sample size, region and journal type, the chronological effect of total scores of CDI was still significant, so the relationship between the mean of total scores and the years was not affected by journal type and the source of subjects.

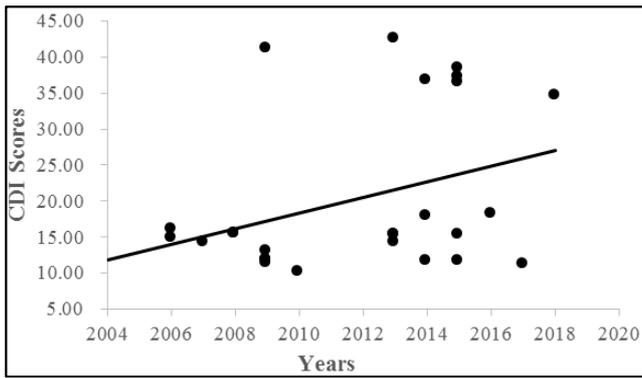


Figure 1. The relationship between the mean of CDI total scores and years.

3.2. The Change of Depression Level with Age and the Explanation Rate of Age in Left-Behind Children

As mentioned above, the level of depression in left-behind children is increasing year after year. Using the approach of previous studies [25], the effect size *d* and *r*² were calculated as follows (formula 3 and 4), with average SD of 14 years.

From Table 4, CDI scores for left-behind children increased by 4.73 points and decreased by 0.68 SD between 2006 and 2018. Cohen considers the effect size (absolute value) between 0.2 and 0.5 as a "Small effect", between 0.5 and 0.8 as a "Medium effect", and above 0.8 as a "Large effect"[1]. So this factor belongs to medium effect, and the explanation rate of age is 10%. On the whole, the depression level of left-behind children in China has increased gradually in the past 12 years, and the range of change is moderate.

$$d = (M_{2018} - M_{2006}) / SD \tag{3}$$

$$r^2 = d^2 / (d^2 + 4) \tag{4}$$

Table 4. The change of mean CDI total scores from 2006 to 2018.

	M ₂₀₀₆	M ₂₀₁₈	ΔM	M _{SD}	d	r ²
CDI total mean scores	19.23	23.96	4.73	6.91	0.68	0.10

Note: ΔM = M₂₀₁₈-M₂₀₀₆, M_{SD} is the mean standard deviation of each factor in 12 years, *d* = (M₂₀₁₈-M₂₀₀₆)/SD, *r*² = *d*² / (*d*² + 4).

3.3. The Depression Level of Left-Behind Children Was Correlated with Social Indicators

From the above results, the depression level of left-behind children increased year by year from 2006 to 2018, but why does this trend exist? What is the impact of social change on left-behind children? Fundamentally speaking, the generation of left-behind children is due to the unbalanced development of the regional economy after China's reform and opening-up, which leads to a surge in the demand for urban labor and the influx of rural labor to the cities. Therefore, this can be explained by the correlation between the total mean scores of CDI and such socioeconomic indicators. According to Table 5, the correlation between CDI scores of left-behind children and several social indicators in that year was marginally significant, and except for a negative correlation with the Gini coefficient, the others were positive correlation. This shows that with the increase of China's urbanization level, resident consumption level, and resident price consumption index, the left-behind children's depression level is also rising.

In order to further explain the relationship between psychological quantity and social environment-whether the social and cultural environment influences people's psychology and behavior more or whether people's psychological behavior has a greater impact on the social and cultural environment, the idea of lag analysis can be adopted [24]. In this study, the total average of CDI scales over the years were matched with and correlated with the socioeconomic indicators 5 years ago, the present year and 5 years later respectively. The total mean CDI for 2006-2018 was correlated with the socioeconomic indicators for the 2001 to 2013 and 2011 to 2013, respectively. Because the data for these indicators were from 2001 to 2019, the post-analysis five years later actually found a correlation between the total average CDI scores for 2006-2018 and the social indicators for 2011-2019. If the social indicators 5 years ago are significantly correlated with the total mean scores of CDI, it means that the economic changes in China will have some impact on the left-behind children's depression level. If the economic indicators after 5 years are significantly correlated with the total average scores of CDI, it indicates that the change of depression level of left-behind children can predict the change of economic development in China.

Table 5. The correlation between the total mean scores of CDI and the social indicators.

Socio-economic indicators	Time		
	5 years ago	The present year	5 years after
Urbanization level	0.35 [#]	0.34 [#]	0.27
Gini index	0.19	-0.35 [#]	-0.13
Consumption level	0.34 [#]	0.35 [#]	-0.28
Consumer price index	0.33 [#]	0.35 [#]	0.28

Note: [#] indicates a marginally significant

Table 5 shows that the urbanization level, the consumption level and the consumer price index five years ago are positively correlated with the total mean scores of CDI. The urbanization level, consumption level and consumer price index after 5 years have no correlation with the total average

scores of CDI. It shows that the level of urbanization, the level of consumption and the consumer price index five years ago are important factors to predict the degree of depression in left-behind children. However, the depression level of left-behind children did not significantly predict changes in

these factors. Based on the above results, we can conclude that urbanization level, consumption level and consumer price index may be some of the factors that affect the depression level of left-behind children. Chinese economic development in the past 12 years can better explain the increase of left-behind children's depression level.

4. Discussion

4.1. *The Depression Level of Left-Behind Children Has Been Rising Slowly*

In this study, the cross-temporal meta-analysis was used to find that in the recent 12 years, the CDI scores of left-behind children in China showed a significant positive correlation with the age. CDI scale scores showed an overall upward trend, with the scores increasing by 0.68 SD. This result was not influenced by the literature source and the sample size. The results of this study indicate that the depression level of left-behind children in China is increasing year by year, which is consistent with the view that the depression of left-behind children in China is worrisome [21, 26]. This study provides quantitative evidence for this. The study also found that not only the total mean scores of CDI was significantly correlated with age, but also the standard deviation was significantly correlated with age (see Table 3). This suggests that the degree of variability in depression of left-behind children has also increased over the past 12 years. The difference in depression levels among left-behind children is increasing, which means that many left-behind children may have more serious depression, which should be paid attention to by schools, families, and relevant departments.

4.2. *The Social Causes of Depression in Left-Behind Children*

The cross-temporal meta-analysis study can not only solve the problem of age effect in meta-analysis, but also relate individual's psychological quantity to social indicators. It assumes that the sociocultural environment can partly explain changes in individual psychological quantity [18], and that the sociocultural environment can be reflected in social indicators. As Twenge points out, the high crime rate itself may not be important, but to some extent it reflects the instability of society, which will make individuals feel insecure. Therefore, the influence of "social" on mental health can be explained by analyzing the correlation between representative social indicators and depression.

This study found that the current rise in depression level of left-behind children is mainly caused by changes in economic status due to social changes. Compared to the correlation between the total mean scores of the CDI scale of left-behind children and the four socioeconomic indicators after 5 years, the correlation between it and the socioeconomic indicators before 5 years is more significant. This shows that the current level of depression of China's left-behind children is mainly caused by the economic changes brought about by social changes. However, the results of this study differ from

people's common sense. We generally think that with the development of the national economy, the government's support for left-behind children will increase, and children's mental health also rises. But the results of this study suggest that as the country's economy grows, the number of left-behind children suffering from depression also rises. This may be because, with the rapid development of the economy, the level of urbanization is rising, which makes big cities such as first-tier cities and new first-tier cities more attractive to labor while the demand for labor increases. The progress of technology and the popularity of the Internet have made it possible for people in small places to see what a big city looks like, which has undoubtedly strengthened their yearning for a big city. As a result, the outflow of labor is exacerbated. Some studies have shown that the level of depression of left-behind children has a significant negative correlation with their social support, so social support is an important depressive factor of left-behind children's depression. In other words, the more social support left-behind children received, the lower their depression level. This social support included social support from parents, teachers, and friends [15, 22]. The most important of these is the social support from parents, so parents working outside the home has become an important risk factor for depression of left-behind children [4]. This has led to the fact that although the state's support for left-behind children is growing, it cannot offset the impact of their parents' absence.

4.3. *Limitations*

The results of this study on the depression level of left-behind children were obtained through cross-temporal meta-analysis method based on the CDI scale. Thus, the limitations of the CDI itself may have influenced the results of the study. Moreover, there are other tools for measuring depression of left-behind children, such as the Center for flow study depression scale (CES-D), the self-rating depression scale for children (DSRSC), and so on. Only one instrument cannot represent all the results, so future studies may consider combining different scales for analysis. In addition, the normative research on left-behind children started late, so the literature collected in this study is very limited, which affects the reliability and validity of this study to some extent.

5. Conclusion

Based on a cross-temporal meta-analysis of 26 relevant articles, this study examined the trend of CDI scores of 17408 left-behind children from 2006 to 2018. Our findings support that the depression level of the left-behind children has been increasing year by year in recent 12 years, and the standard deviation of the left-behind children's depression level has also been increasing year by year. Besides, the level of urbanization, the level of consumption and the consumer price index are the important factors to predict the depression level of left-behind children.

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