

Analysis of the Mechanisms Behind Depressive Symptoms in Left-behind Adolescents in Zhaoqing City from the Perspective of Ecological System Theory

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Abstract

This research aims to deeply analyze the mechanism of depressive symptoms among left - behind adolescents in Zhaoqing from the perspective of the ecosystem theory. Data were collected through questionnaire surveys and interviews, and statistical analysis and structural equation modeling were used to process and analyze the data. The study found that at various levels of the ecosystem theory, factors such as family parenting styles and parent - child communication in the microsystem, school support and peer relationships in the mesosystem, community environment and social policies in the exosystem, and cultural values and socio - economic development levels in the macrosystem all have a significant impact on the development of depressive symptoms in left - behind adolescents. The various systems are interconnected and work together, forming a complex mechanism for the occurrence of depressive symptoms . This study provides a theoretical basis and practical direction for the prevention and intervention of depressive symptoms among left - behind adolescents in Zhaoqing.

Keywords

Ecological Systems Theory; Left - behind Adolescents; Depressive Emotions; Mechanism; Zhaoqing City.

1. Introduction

With the rapid development of China's socio-economy and the acceleration of urbanization, the migration of rural labor forces to cities has become increasingly prevalent, and the issue of left-behind children has gradually become a focal point of societal concern^[1]. Adolescence is a critical period for individual self-awareness and social development, facing multiple challenges such as academic pressure and interpersonal interactions, which can easily lead to depressive tendencies. Particularly in economically underdeveloped regions like Zhaoqing City, a large number of young and middle-aged workers migrate for employment, resulting in a substantial population of left-behind adolescents with prominent mental health issues. Relevant studies indicate that factors such as incomplete family structures, parent-child separation, and insufficient school support significantly increase the risk of depressive symptoms among left-behind adolescents^[2]. Moreover, Zhaoqing City is located in western Guangdong Province, where its unique geographical location and cultural context further complicate this issue. Therefore, conducting in-depth research on the mechanisms underlying depressive emotions among left-behind adolescents in Zhaoqing not only addresses local social realities but also provides valuable insights for addressing mental health challenges faced by this group nationwide.

This study aims to comprehensively analyze the mechanisms underlying depressive emotions among left-behind adolescents in Zhaoqing City across micro-, meso-, macro-level, and systemic dimensions from the perspective of ecosystem theory, thereby providing a theoretical foundation for developing scientifically sound prevention and intervention strategies.

Specifically, the study first reviews existing literature to clarify the core concepts of ecosystem theory and their current applications in adolescent mental health; secondly, employs methods such as questionnaires and in-depth interviews to empirically examine the characteristics of various ecosystem components among left-behind adolescents in Zhaoqing and their impact pathways on depressive emotions; finally, proposes targeted prevention and intervention measures based on these findings to offer practical guidance for improving the mental health of this population^[3]. By achieving these objectives, the study seeks to enrich the empirical application of ecosystem theory in the field of adolescent mental health and provide a scientific basis for policy formulation.

Proposed by Bronfenbrenner, ecosystem theory examines the dynamic interactions between individual development and their environmental contexts. The theory positions individuals within a multi-tiered framework comprising four systems: microsystem, mesosystem, exosystem, and macrosystem. The microsystem consists of environments directly experienced by individuals, such as family, school, and peer groups; the mesosystem focuses on interactions between microsystems, including collaboration between family and school; the exosystem encompasses environments not directly involved but significantly influencing development, such as community policies and social support networks; while the macrosystem includes broader contextual factors like cultural values and socioeconomic conditions. These systems collectively shape individual behavior and psychological states through complex interactions. In adolescent mental health research, ecosystem theory provides a crucial framework for understanding the comprehensive impact of social environments on psychological development, particularly in analyzing the mechanisms underlying depressive symptoms among left-behind adolescents by revealing multi-level risk and protective factors^[4].

In recent years, increasing research by scholars both domestically and internationally has focused on depressive symptoms among left-behind adolescents, highlighting the prevalence and complexity of this issue. Studies indicate that due to prolonged parental absence, left-behind adolescents exhibit significantly higher rates of depression compared to their non-left-behind counterparts. Research further reveals that inadequate parental care has a significant negative predictive effect on life satisfaction among these students, indirectly influencing depressive symptoms through subjective social status, self-esteem, and psychological capital. Cross-lag analyses of friend support and family support demonstrate that depressive symptoms diminish adolescents' perception of support from family and friends, while friend support serves as a compensatory mechanism for family support^[5]. Regional variations are also observed: left-behind children in rural areas experience more pronounced depressive symptoms due to limited educational resources and insufficient social support. However, existing studies predominantly focus on single-factor or localized system analyses, lacking comprehensive examinations from an ecosystem theory perspective—a gap that provides a crucial starting point for this study.

Although ecosystem theory has been widely applied in adolescent mental health research, integrated analyses focusing on depressive symptoms among left-behind adolescents remain insufficient. Existing studies primarily concentrate on family structures and parent-child relationships at the microsystem level, or limit themselves to analyses of school support and peer relationships at the mesosystem level, while paying relatively little attention to the exosystem and macrosystem levels^[6]. Some studies have demonstrated that school environment significantly influences depressive symptoms in left-behind adolescents through mediating effects of gratitude and self-control, but further exploration of the supportive roles of community environments and social policies remains lacking. Additionally, current research lacks comprehensive explanations regarding the dynamic changes in the macrosystem during social transitions and their profound impacts on the mental health of left-behind adolescents. This study aims to systematically examine the mechanisms by which each level of the

ecosystem theory affects depressive symptoms in this population, with particular emphasis on the roles of cultural values and socioeconomic development within the macrosystem, thereby providing new theoretical perspectives and practical insights for future research.

2. Current Status of the Ecological System for Left-behind Adolescents in Zhaoqing City

2.1. Microsystem

2.1.1. Family Structure

The family structures of left-behind adolescents in Zhaoqing City primarily manifest in three patterns: single-parent migrant work households, dual-parent migrant work households, and intergenerational care arrangements. In single-parent migrant households, mothers typically assume primary guardianship responsibilities. While this structure maintains some level of parent-child interaction, mothers often struggle to adequately address children's psychological needs due to financial pressures and daily life burdens. Dual-parent migrant households rely entirely on grandparents or other relatives for intergenerational care, resulting in prolonged absence of parental involvement that leaves children with insufficient emotional support and increases their risk of depression^[7]. Furthermore, outdated educational philosophies and unscientific parenting approaches among grandparents significantly exacerbate the likelihood of psychological issues among adolescents. Research demonstrates a significant positive correlation between incomplete family structures and adolescent depressive symptoms, particularly when effective alternative emotional support is lacking.

From a psychological perspective, different family structures exert distinct impacts on the psychological development of left-behind adolescents. Adolescents in single-parent families with migrant workers may experience increased psychological stress due to excessive maternal protection or high expectations; those from dual-parent migrant worker families are more prone to self-identity crises and impaired social adaptation skills. The cumulative effect of these psychological issues can ultimately lead to the onset and progression of depressive symptoms. Therefore, when analyzing the mechanisms underlying depressive disorders among left-behind adolescents in Zhaoqing City, family structure—as a core element of the microsystem—plays a significant role that cannot be overlooked.

2.1.2. Parent-Child Relationship

The quality and stability of parent-child relationships are among the key factors influencing the mental health of left-behind adolescents. Research indicates that the frequency and quality of communication between parents and children directly determine the strength of emotional bonding, which plays a crucial role in preventing and alleviating depressive symptoms. However, for left-behind adolescents in Zhaoqing City, where parents often work away from home for extended periods, both the duration and quality of parent-child communication are significantly limited^[8]. In many families, communication is confined to discussions about daily necessities and academic performance, lacking deep emotional engagement. This results in children experiencing severely inadequate parental affection, thereby increasing their risk of developing depression.

2.2. Intermediate System

2.2.1. School Support

As a crucial component of the support system for left-behind adolescents, schools play a significant role in providing educational resources and offering psychological counseling, which profoundly impacts their mental health. However, some schools in Zhaoqing City still exhibit notable shortcomings in addressing the psychological challenges faced by these adolescents^[9].

Firstly, uneven distribution of educational resources makes it difficult for schools in rural areas to employ professional psychological counselors or establish adequate counseling facilities, resulting in many left-behind adolescents' psychological needs going unmet. Secondly, mental health education programs in certain schools are often superficial, with limited content and lack of specificity, failing to effectively assist these adolescents in coping with psychological distress stemming from incomplete family structures and absent parent-child relationships.

2.2.2. Peer Relationships

Peer relationships play a crucial role in the psychological development of left-behind adolescents, and their quality directly impacts individuals' emotional well-being and mental health. Research indicates that left-behind adolescents with high-quality friendships typically exhibit stronger resilience and lower levels of depression, whereas those experiencing low peer acceptance or frequent exclusion are more prone to emotional issues. However, the peer interaction patterns among left-behind adolescents in Zhaoqing City are concerning^[10]. Due to differences in family backgrounds and upbringing environments, they often encounter challenges such as difficulties in building trust and communication barriers when interacting with peers. These issues can exacerbate feelings of loneliness and inferiority, thereby increasing the risk of depression.

It is noteworthy that peer relationships not only directly influence the emotional state of left-behind adolescents but also indirectly affect the mechanisms underlying depressive symptoms by impacting their self-perception and social adaptation skills. When left-behind adolescents receive positive feedback and support from their peer groups, their self-esteem and confidence are enhanced, thereby strengthening their ability to cope with life challenges; conversely, prolonged exclusion or neglect may lead to diminished self-worth and further trigger depressive symptoms. Additionally, negative patterns within peer relationships—such as passive imitation or the spread of maladaptive behaviors—can adversely affect the mental health of these adolescents^[11]. Therefore, improving peer relationships and fostering healthy friendships among left-behind adolescents constitutes a key strategy for preventing and addressing depressive disorders.

2.3. External Systems

2.3.1. Community Environment

The community environment, as a crucial component of the external support system for left-behind adolescents, exerts significant influence on their mental health through its cultural atmosphere and activity offerings. Research indicates that a caring and supportive community environment can effectively mitigate the negative impacts of incomplete family structures and poor parent-child relationships, providing these adolescents with additional emotional support and resource access. However, in certain rural communities of Zhaoqing City, due to low economic development levels and limited cultural resources, community support for left-behind adolescents remains inadequate. Many communities lack specialized programs or psychological counseling services tailored for this demographic, leaving them without suitable social platforms or developmental opportunities during their free time, which exacerbates feelings of loneliness and helplessness.

2.3.2. Social Policies

Current social policies targeting left-behind adolescents theoretically cover multiple aspects such as education, healthcare, and psychological support; however, significant challenges persist in their practical implementation, which somewhat limits their effectiveness in safeguarding the mental well-being of these youth. Although the government has issued numerous policy documents emphasizing enhanced care and protection for rural left-behind children, inadequate enforcement at the grassroots level and uneven resource allocation have

prevented some policies from truly benefiting the target population. Particularly in economically underdeveloped regions like Zhaoqing City, policy implementation faces greater difficulties, and the needs of left-behind adolescents regarding mental health services and access to educational resources remain inadequately addressed.

2.4. Macro System

2.4.1. Cultural Values

Local cultural values and expectations place significant influence on the development of psychological stress among left-behind adolescents^[12]. Within Zhaoqing's traditional cultural context, both families and society highly value academic achievement and collective honor. While these values motivate teenagers to study diligently to some extent, they also impose considerable psychological pressure^[13]. Due to incomplete family structures and strained parent-child relationships, left-behind adolescents often lack adequate emotional support and psychological guidance when facing high expectations, which can easily lead to anxiety and depression. Furthermore, cultural stereotypes regarding gender roles in certain regions may adversely affect their mental health; for instance, girls may experience greater restrictions and pressure due to gender discrimination, thereby increasing their risk of depression.

2.4.2. Level of Social and Economic Development

The socio-economic development level of Zhaoqing City significantly influences the living conditions and educational opportunities of left-behind adolescents, factors that are closely linked to their susceptibility to depression. Firstly, regions with lower economic development levels often face shortages of educational resources, which not only limit these adolescents' learning and developmental prospects but may also lead to feelings of inferiority and frustration due to poor academic performance, thereby increasing their risk of depression^[14]. Secondly, left-behind adolescents from economically disadvantaged families typically endure greater life pressures, such as unmet basic needs and low quality of life resulting from family financial difficulties, which can further exacerbate their psychological burden.

3. Mechanisms of Depression Impact Across Different Levels of the Ecosystem

3.1. Mechanisms of Influence in Microscopic Systems

The microsystem, as the most direct environmental factor in ecosystem theory, exerts a significant direct influence on the development of depressive symptoms among left-behind adolescents. Family parenting styles and parent-child communication frequency are two core variables within this microsystem, whose impacts have been confirmed by numerous empirical studies. Research indicates a significant positive correlation between parental care deficiency and depressive symptoms in left-behind adolescents; such deficiency may indirectly exacerbate depressive symptoms by diminishing adolescents' subjective social status, self-esteem, and psychological capital^[15]. Furthermore, parent-child communication frequency plays a crucial moderating role in alleviating depressive symptoms. Studies reveal that left-behind adolescents from single-parent households exhibit relatively lower depressive levels compared to those from dual-parent households due to higher communication frequencies with their parents, demonstrating that parent-child communication can partially compensate for insufficient psychological support caused by parental absence. However, when communication quality is poor or lacks emotional connection, even high-frequency communication fails to effectively mitigate adolescent depression. Thus, family parenting styles and parent-child communication frequency collectively constitute the primary mechanisms through which the microsystem influences depressive symptoms in left-behind adolescents.

Further analysis reveals that intergenerational education, as a unique family structure, is particularly prevalent among left-behind adolescents in Zhaoqing City, and its impact on depressive symptoms cannot be overlooked. Issues such as outdated educational philosophies and unscientific parenting approaches among grandparents may deprive adolescents of essential emotional support and behavioral guidance during their development, thereby increasing their risk of depression. Moreover, research from the perspective of ecosystem theory indicates that interactions among various factors within the microsystem can amplify negative effects on adolescent mental health. The combined impact of an incomplete family structure and strained parent-child relationships may lead to more severe psychological issues, including depressive tendencies^[16]. In summary, the microsystem—through factors such as parenting styles, frequency of parent-child communication, and intergenerational education—directly shapes the mental health status of left-behind adolescents and plays a pivotal role in the mechanisms underlying their depressive symptoms.

3.2. Mechanisms of Influence of Intermediate Systems

As a crucial link between micro-systems and the external environment, the performance of school systems in providing support and fostering peer relationships significantly moderates or exacerbates depressive symptoms among left-behind adolescents. Schools, as key venues for adolescent socialization, exert profound impacts on mental health through their educational resources, psychological counseling services, and overall campus atmosphere^[17]. Research demonstrates a significant negative correlation between school climate and depressive symptoms among left-behind adolescents: a positive school environment not only effectively reduces depressive manifestations but also indirectly improves mental health by enhancing gratitude awareness and self-control abilities. However, schools in certain rural areas of Zhaoqing City still demonstrate inadequate investment in mental health education, particularly regarding the accessibility and professionalism of psychological counseling resources, which substantially diminishes the effectiveness of school interventions targeting depressive issues among this population.

Peer relationships, as another crucial component of the intermediate system, significantly influence depressive symptoms among left-behind adolescents^[18]. High-quality friendships and positive peer acceptance provide emotional support and a sense of belonging, thereby alleviating depression; conversely, peer rejection or exclusion may exacerbate psychological stress and worsen depressive symptoms. Notably, the quality of peer relationships is often indirectly shaped by school environments. In schools that emphasize teamwork and mutual assistance, adolescents are more likely to establish positive peer connections, fostering protective mechanisms against depression. Conversely, in highly competitive or emotionally tense school settings, adolescents face increased peer conflicts and exclusion, elevating their depressive risk. Thus, the intermediate system plays a pivotal regulatory or amplifying role in mitigating depressive emotions through both school support and peer relationships—a mechanism particularly evident among left-behind adolescents in Zhaoqing City.

3.3. Mechanisms of Influence on External Systems

The external system indirectly influences the depressive mood of left-behind adolescents by affecting the microsystem and mesosystem, with key components including the community environment and social policies^[19]. As a vital setting for adolescents' daily lives, the community's cultural atmosphere, activity offerings, and interaction patterns among residents exert a subtle yet profound impact on their mental health. Research indicates that adolescents who actively participate in community activities typically exhibit higher psychological resilience and lower levels of depressive symptoms, as these activities provide opportunities for self-expression and social networking. However, in certain rural areas of Zhaoqing City, community cultural development remains relatively underdeveloped, with limited public

activities tailored to adolescent participation, resulting in inadequate support at the community level and thereby increasing their risk of developing depressive symptoms.

As another crucial component of the outer system, social policies indirectly influence the mental health of left-behind adolescents through the formulation and implementation of support measures^[20]. In recent years, increasing attention has been paid to this issue by both the government and society, leading to the introduction of various policies aimed at improving their living conditions and educational environments. However, policy implementation remains suboptimal. Although some regions have piloted a collaborative education model involving families, schools, and communities, the actual effects remain limited due to uneven resource distribution and insufficient enforcement. Moreover, social policy design and implementation often require adaptation to local realities. As an economically underdeveloped area, Zhaoqing's constraints in policy coverage and execution further weaken the outer system's buffering effect against depressive symptoms among left-behind adolescents. Thus, the outer system exerts influence on both the microsystem and mesosystem through community environments and social policies, thereby indirectly shaping the development mechanisms of depression among this demographic.

3.4. The Impact Mechanisms of the Macro System

As the outermost structural framework in ecosystem theory, the macrosystem shapes the entire ecosystem through cultural values and socio-economic development levels, thereby profoundly influencing depressive emotions among left-behind adolescents^[21]. Cultural values, as the core manifestation of social ideology, significantly guide adolescent behavior patterns and psychological states. In traditional agricultural regions like Zhaoqing City, family-oriented values and collectivist culture remain dominant, subjecting adolescents to high psychological expectations and stress. Parents' excessive expectations for academic achievement may lead to intense frustration and feelings of inferiority when students underperform academically, increasing their risk of depression. Moreover, rapid societal transformations have intensified conflicts between traditional values and modern lifestyles. Such value clashes further exacerbate psychological adaptation challenges among adolescents—particularly those left-behind youth who lack timely parental guidance and support, resulting in weaker coping abilities and higher susceptibility to depressive disorders.

The level of socioeconomic development, as another key variable within the macro-system, indirectly influences depressive symptoms among left-behind adolescents by affecting factors such as educational resource allocation and living conditions. Studies indicate that adolescents in economically underdeveloped regions experience higher rates of depression due to greater life pressures and uncertainties compared to those in developed areas^[22]. Zhaoqing City, a region with relatively lagging economic development in Guangdong Province, faces significant disparities for left-behind adolescents regarding access to educational resources and healthcare coverage—these objective constraints further exacerbate their psychological burdens. Moreover, uneven socioeconomic development has created substantial urban-rural gaps, subjecting rural left-behind adolescents to structural challenges during growth, including incomplete family structures and inadequate school support. These interrelated factors collectively form a critical macro-level context for depressive emotions among this population. Thus, the macro-system profoundly shapes the entire ecosystem through two dimensions—cultural values and socioeconomic development levels—ultimately determining the mechanisms and complexity behind depressive disorders among left-behind adolescents.

4. Empirical Research

4.1. Research Design

This study employed a combination of questionnaire surveys and interviews to comprehensively collect data on depressive symptoms among left-behind adolescents in Zhaoqing City. For sample selection, a stratified random sampling method was utilized, recruiting left-behind adolescents from junior and senior high schools across various districts of Zhaoqing. Specifically, the study covered three population groups—those with one absent parent, those with both absent parents, and non-left-behind adolescents—to ensure high representativeness and comparability of the findings. The questionnaire design was grounded in the core framework of ecosystem theory, encompassing micro-systems (family structure and parent-child relationships), meso-systems (school support and peer relationships), outer-systems (community environment and social policies), and macro-systems (cultural values and socioeconomic development levels). Additionally, the questionnaire incorporated standardized depression assessment scales (e.g., the Depression Scale developed by the Epidemiology Center) alongside self-designed questionnaires to provide detailed evaluations of adolescents' living conditions. This research methodology not only meets the multi-level analytical requirements of ecosystem theory but also establishes a solid foundation for subsequent data analysis.

4.2. Data Collection

The data collection process strictly adhered to scientific standards to ensure data authenticity and validity. First, during the questionnaire survey phase, the research team collaborated with teachers at selected schools to distribute questionnaires during regular classroom sessions, providing detailed guidance on completion. Upon completion, researchers collected and verified the completeness of responses on-site to prevent data quality issues caused by omissions or errors. Second, in the interview phase, the team employed semi-structured interview outlines designed with specific questions addressing various ecosystem factors. For micro-level parent-child communication frequency and quality, questions included "How do you typically maintain contact with your working parents?" and "How important do you consider your parents' understanding and support?" Interviewees comprised left-behind adolescents themselves, their primary caregivers, and school teachers, ensuring multi-perspective validation of data reliability. All interviews were recorded and transcribed into written materials for subsequent analysis. The three-month data collection effort yielded 541 valid questionnaires and 32 completed interview records, providing robust data support for subsequent analyses.

4.3. Data Analysis

During the data analysis phase, this study employed various statistical methods to elucidate the relationships between factors at different levels of the ecosystem and depressive symptoms among left-behind adolescents. First, descriptive statistical analyses were conducted to preliminarily examine the mean values, standard deviations, and distribution characteristics of each variable, thereby assessing the baseline psychological profile of the sample. Second, Pearson correlation analyses were performed to quantify the correlations between systemic factors and depressive symptoms, identifying which factors exerted the most significant influence. The study evaluated the strength of associations between family support, school environment, peer relationships, and depression scores, revealing a significant negative correlation between family support and depressive symptoms ($r = -0.47$, $P < 0.01$), as well as a significant correlation between school environment and depressive symptoms ($r = -0.60$, $P < 0.01$). To further investigate causal relationships among variables, a structural equation model (SEM) was constructed to examine both direct and indirect mechanisms through path analysis. Model fit results indicated a chi-square-to-degree-of-freedom ratio (CMIN/DF) of 2.34,

an approximate root mean square error (RMSEA) of 0.06, and a comparison fit index (CFI) of 0.95, demonstrating excellent model fit. The entire data analysis process strictly adhered to methodological guidelines outlined in the literature, ensuring the scientific validity and reliability of the findings.

4.4. Discussion of Results

Empirical research findings demonstrate that ecosystem theory effectively explains the mechanisms underlying depressive symptoms among left-behind adolescents in Zhaoqing City. At the microsystem level, parenting styles and parent-child communication frequency significantly influence depressive outcomes. The study revealed that left-behind adolescents from families with both parents working away from home exhibited significantly higher depression scores compared to those from single-parent households or non-left-behind adolescents ($p < 0.05$), a finding consistent with prior research. At the mesosystem level, school environment and peer relationships play crucial moderating roles. Specifically, a positive school atmosphere significantly reduces depressive levels among left-behind adolescents, whereas poor-quality peer relationships increase the risk of depression—results aligning with mediation analyses in existing literature. At the exosystem level, community environments and social policies primarily support both micro-and mesosystem functions. Regions with rich community cultural activities showed significantly lower depression rates among left-behind adolescents compared to other areas ($p < 0.01$), reflecting the positive impact of community environments. Finally, at the macrosystem level, socioeconomic development and cultural values exert indirect yet significant effects on depression. Left-behind adolescents in economically developed regions enjoy clear advantages in access to educational resources and psychological support, resulting in lower depression incidence rates—a finding consistent with established macrosystem influence mechanisms. Overall, this study demonstrates through empirical analysis the applicability of ecosystem theory in explaining depressive symptoms among left-behind adolescents, providing crucial theoretical support and practical insights for future research.

5. Prevention and Intervention Strategies Based on Pathogenesis Mechanisms

5.1. At the microscopic system level

As a microsystem within ecosystem theory, the family exerts direct and profound influence on the development of depressive symptoms among left-behind adolescents. Research indicates that improving parenting approaches serves as a key strategy for alleviating their depressive conditions. Adopting warm, supportive, and understanding parenting styles significantly enhances adolescents' psychological resilience and reduces their risk of depression. Furthermore, studies confirm a significant negative correlation between communication frequency and quality between parents and children and depressive symptoms—particularly when parent-child emotional bonds are strong, depressive manifestations in adolescents markedly decrease. Therefore, parents are advised to maintain emotional connections with their children through regular phone or video communications, emphasizing active listening and empathy while avoiding excessive criticism or neglect of children's feelings. Additionally, addressing issues such as outdated educational philosophies and unscientific practices in intergenerational caregiving can be addressed by organizing family education workshops or providing online guidance programs to equip grandparents with more evidence-based parenting methods, thereby fostering healthier family environments for left-behind adolescents.

5.2. Intermediate System Level

As a core component of the intermediary system, schools play an irreplaceable role in preventing and addressing depressive symptoms among left-behind adolescents. First, schools should enhance their psychological counseling systems and establish comprehensive mental health screening mechanisms to promptly identify and intervene with students exhibiting depressive tendencies. Second, fostering a positive campus environment is crucial for improving the emotional well-being of these adolescents. Research indicates that a positive and harmonious school atmosphere not only significantly reduces depressive levels but also promotes the development of gratitude and self-control skills, thereby indirectly alleviating depressive symptoms. Additionally, peer support constitutes another vital element of this system. By organizing team-building activities and offering interpersonal communication courses, schools can strengthen friendships and foster a sense of belonging among left-behind adolescents, reducing depression risks stemming from social interaction challenges. In conclusion, schools should adopt a multi-dimensional approach encompassing psychological counseling, campus culture development, and peer support to provide comprehensive assistance networks for left-behind adolescents.

5.3. External System Level

Community and social policies, as key components of the external framework, play an indirect yet crucial role in preventing and addressing depression among left-behind adolescents. At the community level, implementing care initiatives and strengthening support networks serve as effective strategies. By organizing mental health seminars and parent-child interaction activities, communities can enhance the sense of social support for these adolescents and their families, thereby alleviating psychological stress. Additionally, communities should leverage existing resources to establish dedicated service centers for left-behind children, providing diversified services such as academic tutoring and psychological counseling. At the policy level, governments must further advance relevant measures to safeguard the fundamental rights of left-behind children. Improving rural educational resource allocation and increasing funding for mental health support can fundamentally enhance living and educational conditions for these youth, reducing their risk of depression. In summary, the synergistic efforts of community and social policies can create a more inclusive and supportive environment for left-behind adolescents^[23].

5.4. At the macro-system level

The cultural values and socioeconomic development levels of macro-level societies exert comprehensive and profound impacts on the depressive symptoms among left-behind adolescents. From a cultural perspective, fostering positive and healthy cultural orientations plays a crucial role in alleviating adolescent depression. Promoting an open and inclusive social culture that encourages young people to express genuine emotions and seek professional support helps mitigate the phenomenon of "over-pathologization" caused by societal biases. Moreover, socioeconomic development levels significantly determine the quality of life and educational opportunities for left-behind adolescents. Research indicates that children in economically underdeveloped regions face markedly higher depression risks due to insufficient access to quality educational resources and mental health services compared to those in more developed areas. Therefore, advancing balanced socioeconomic development—particularly through increased investment in education and public services in rural areas—will fundamentally improve the mental health of left-behind adolescents. Simultaneously, all sectors of society should collaborate to create a social environment that prioritizes adolescent mental well-being, enabling these youths to thrive within a supportive cultural framework.

6. Conclusion

This study, grounded in ecosystem theory, provides an in-depth analysis of the mechanisms underlying depressive symptoms among left-behind adolescents in Zhaoqing City. The findings reveal that at the microsystem level, family structure and parent-child relationships significantly influence mental health—particularly when prolonged parental absence leads to inadequate and low-quality communication, directly increasing the risk of depression. At the mesosystem level, school support and peer relationships play crucial moderating roles: adequate educational resources and psychological counseling services effectively alleviate depressive symptoms, while positive peer interactions provide additional emotional support, with the reverse effect also observed. The exosystem (community environment and social policies) influences adolescent psychology through indirect pathways; for instance, a positive community culture and robust social security systems significantly improve adolescents' quality of life and mental well-being. At the macrosystem level, cultural values and socioeconomic development shape the overall ecosystem dynamics—higher socioeconomic status offers more educational and developmental opportunities, thereby indirectly reducing depression rates. Collectively, these interconnected systems form a multidimensional network governing the development of depressive symptoms among left-behind adolescents.

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