

Analysis of the Association Between Basic Scoliosis and Economy in Primary and Secondary Schools in Nine Provinces and Cities in China

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Abstract

In recent years, the scoliosis problem has shown an increasingly serious trend in China's youth population, and its degree of harm has risen to the third place after obesity and myopia, posing a greater threat to students' physical health. In view of the seriousness of this phenomenon, the state attaches great importance to it. The study used the literature method to analyze and organize the relevant literature on the incidence or influencing factors of scoliosis among adolescents and children in China, on the basis of which it reflected the GDP data of nine provinces and cities in China for the year 2024 and scoliosis screening in primary and middle schools for the years 2019-2022, to explore the relationship between the level of economic development and the detection rate of scoliosis, and explain the social behavioral mechanisms behind it, ultimately providing a scientific basis for public health interventions.

Keywords

Scoliosis; primary and secondary schools; basic situation.

1. Overview of the Problem of Scoliosis

1.1. What is scoliosis

Scoliosis, a condition in which the human spine curves in the coronal plane. Scoliosis is sometimes accompanied by rotation of the spine and often results in deformity and distortion of the back. Scoliosis can occur in early childhood, adolescence, puberty and adulthood. Adolescence is a period of rapid growth and a time when scoliosis tends to worsen severely, so adolescent idiopathic scoliosis has become a major focus of research in various medical institutions. When the spine of a healthy person is viewed from the rear, it appears to be a straight line with a consistent appearance on the left and right sides of the body. If there is a difference in the height of the shoulders, or if there is a difference in height between the two sides of the back, it is likely that the spine has developed scoliosis and needs to be taken seriously. In recent years, statistics show that the number of scoliosis patients in China has been on the rise, totaling more than 3 million and growing at a high rate every year.

Scoliosis can be categorized into functional scoliosis and organic scoliosis according to its cause, which can also be referred to as structural scoliosis and non-structural scoliosis. Non-structural scoliosis refers to temporary scoliosis caused by certain reasons, once the cause is cured, it can return to normal, but if the cause is not solved and the scoliosis persists for a long period of time, it is likely to develop into structural scoliosis. We usually talk about structural scoliosis, but it can be further categorized according to the cause, which can be broadly divided into idiopathic scoliosis, congenital scoliosis, neuromuscular scoliosis, etc. Among them, idiopathic scoliosis (congenital scoliosis) can be categorized into neuromuscular scoliosis. The most

common type of scoliosis is idiopathic scoliosis (IS), which accounts for about 80% of all scoliosis cases.

1.2. Predisposing factors of scoliosis

Recognizing the triggers is the key to preventing scoliosis in adolescents. Based on the sources and characteristics of the triggers of scoliosis in adolescents, the triggers can be categorized into endogenous and exogenous factors, of which the intrinsic triggers of scoliosis in adolescents can be divided into genetic factors, physiological and biochemical factors, neurological factors, and biomechanical factors. [1]

With the continuous development of economy and education, heavy school work, improper sitting posture and lack of exercise have become the problems faced by many adolescents, and the prevalence of scoliosis among adolescents and children in China has been rising year by year, with adolescent patients occupying more than half of the total number of scoliosis patients.

1.3. Hazards of scoliosis

The prevalence of scoliosis among adolescents is generally 2% to 3%, according to data reported in the literature at home and abroad. Previous studies have shown that, globally, more than 66.7% of minors have mild curvature of the spine at an early stage of skeletal development. It has been observed that about one in ten of these patients will progress to a more severe form of scoliosis. This progressively worsening spinal deformity can cause persistent compression of the peripheral nerve tissue, leading to a range of clinical symptoms including, but not limited to, thoracic and back pain, low back discomfort, and physical symptoms such as sleep disturbances (e.g., difficulty falling asleep or excessive sleepiness). It is important to note that these patients are often accompanied by significant mental health problems, manifested by negative psychological states such as depressed mood, social avoidance, reduced sense of self-identity, and in severe cases, even self-injury. These pathologic changes have a significant negative impact on the physiological developmental process and mental health of the minor population. [2] Abnormalities of spinal curvature may induce a variety of psychological problems in adolescents, affecting social adaptability and lowering the quality of life. [3] In China, postural spinal curvature abnormalities are mainly found in children and adolescents,[4] which are caused by postural abnormalities, nutritional deficiencies, and physical inactivity, etc. In other countries, adolescent idiopathic spinal curvature abnormalities are mainly found in children and adolescents,[5] with adolescent idiopathic scoliosis being the most common one. Many children and parents do not know enough about scoliosis, so they are not very motivated to participate in screening. Under such circumstances, many children's scoliosis problems are not detected in time, and their condition gradually worsens, which not only affects their daily study life, but also may cause problems in their interpersonal interactions.

2. The Current Status and Economic Situation of Scoliosis in Primary and Secondary Schools in Various Provinces and Cities in China

2.1. Current status of scoliosis

2.1.1. Scoliosis detection rate

The prevalence of scoliosis is estimated to be 1% to 3% worldwide. According to the results of the 2019 National Surveillance of Common Diseases and Health Influencing Factors in Students, 2.8% of primary and secondary school students in China have abnormal spinal curvature. [6] The results of a Meta-analysis of a study of scoliosis in primary and secondary school students in China's mainland from 1980 to 2020 showed that the initial screening positive rate and confirmed diagnosis rate of scoliosis were 4.40% and 1.23% on average, respectively, and that the age of 13-15 years old was the high prevalence age of scoliosis. The prevalence of scoliosis

was higher in females than in males, with an average of 1.74 times that of males. The prevalence of idiopathic scoliosis averaged 1.16%, with 79.5% of patients having mild scoliosis, and the prevalence of scoliosis in the eastern region was lower than that in the central region. Since 2008, the prevalence of scoliosis has been climbing, however, it did not constitute a linear correlation with regional demographic and social indicators, latitudinal zones, and altitudinal differences.[7] Epidemiologically, scoliosis showed a distribution pattern of more females than males, and more urban than rural areas in most regions. [8]

From 2019 to 2022, scoliosis screening in primary and secondary schools carried out in all regions of the country showed large differences in scoliosis detection rates. In the municipal study, the scoliosis detection rate in primary and secondary schools in Shanghai reached 9.2%; in the provincial study, the scoliosis detection rates in primary and secondary schools in Henan Province, Guangdong Province, and Tibet Autonomous Region were 3.82%, 3.73%, and 1.17%, respectively, and the scoliosis detection rates in Zhejiang Province, Sichuan Province, Anhui Province, Inner Mongolia Autonomous Region, and Gansu Province ranged from 1.91% to 3.46% Between.

2.1.2. Gender distribution of scoliosis

Compared with boys of the same age, females have a higher percentage of body fat but less muscle mass, which may weaken the muscle support to the spine, thus triggering scoliosis. [9] In terms of gender distribution of scoliosis, the scoliosis rate of female students is higher than that of male students. In Shanghai, the scoliosis detection rates were 10.23% in girls and 8.33% in boys, in Guangdong Province, the scoliosis detection rates were 4.9% in girls and 2.66% in boys, in Zhejiang Province, the scoliosis detection rates were 4.24% in girls and 2.75% in boys, in Sichuan Province, the scoliosis detection rates were 3.86% in girls and 2.98% in boys, and in Gansu Province, the scoliosis detection rates were 3.86% in girls and 2.98% in boys. In Gansu Province, the detection rates of scoliosis were 1.98% for girls and 1.92% for boys.

2.1.3. Distribution of scoliosis among school years

Compared with primary school students and junior high school students, high school students are more likely to have scoliosis problems. High school students generally have insufficient physical activity, 39.7% of adolescents' weekly exercise time is less than 1h, and 60.5% of girls' exercise habits are not good, and high school students are facing the realities of high pressure of exams and lack of physical training, which triggers the endurance and flexibility of the lumbar and back muscles to deteriorate, and easy to form scoliosis.

In terms of the detection rate of scoliosis in various school segments, the results of the study in Guangdong Province, Zhejiang Province, Sichuan Province, Anhui Province, and Gansu Province showed that the detection rate of scoliosis in elementary school, junior high schools, and senior high schools increased sequentially, and the detection rate of scoliosis in Guangdong Province was 1.35% in elementary school, 4.50% in junior high schools, and 5.94% in senior high schools, while that in Zhejiang Province was 1.40% in elementary school, 4.12% in junior high schools, and 5.51% in senior high schools. In Zhejiang Province, the detection rates of scoliosis were 1.40% in elementary schools, 4.12% in junior high schools, and 5.51% in senior high schools. In Gansu Province, the detection rate of scoliosis was 0.63% in elementary school, 2.22% in junior high schools and 4.40% in senior high schools.

2.1.4. Urban and rural distribution of scoliosis

The detection rate of scoliosis among urban adolescents is significantly higher than that of suburban and rural groups, or it may originate from the fact that urban adolescents have a larger academic burden, accompanied by bad habits such as sitting for too long and using the screen for too long, etc. It has been shown that rural and urban students are worried about their physical fitness in comparison with their rural counterparts in terms of strength and endurance, etc.[10]

In terms of urban and rural distribution, data from Guangdong Province, Zhejiang Province, Sichuan Province, and Anhui Province show that the prevalence of scoliosis in urban areas is higher than the prevalence in rural areas. In Guangdong Province, the detection rate was 4.51% in urban areas, higher than 2.79% in rural areas; in Zhejiang Province, the detection rate was 4.49% in urban areas, higher than 2.10% in rural areas; and in Sichuan Province, the detection rate was 4.54% in urban areas, higher than 2.57% in rural areas. The risk of detecting positive scoliosis among primary and secondary school students in suburban areas was lower than that of primary and secondary school students in urban areas, which was consistent with the findings of Sun Yi [11] et al.

2.1.5. Distribution of types of scoliosis

In terms of the distribution of the type of scoliosis detected, in Shanghai, among the positive subjects, the distribution of the maximum scoliosis angle in the segments was different, with lumbar > thoracic > thoracolumbar segments; [12] in the study in the Tibet Autonomous Region, the number of thoracic scoliosis was 41, with a detection rate of 0.22%; the number of lumbar-thoracic scoliosis was 50, with a detection rate of 0.26%; the number of lumbar scoliosis was 59, with a detection rate of 0.31%; and the number of anterior-posterior bending abnormalities numbered 118, with a detection rate of 0.62% [13].

2.2. Economic situation of Chinese provinces and cities

According to the GDP data in 2024, Guangdong Province, Zhejiang Province, Sichuan Province, Henan Province, and Shanghai Municipality ranked 1st, 4th, 5th, 6th, and 9th in the GDP ranking of all provinces and cities in China in 2024, respectively; Anhui Province, Inner Mongolia Autonomous Region, Gansu Province, and Tibet Autonomous Region ranked 11th, 21st, 27th, and 31st; Guangdong Province tops the list with a GDP of 1,416.338 billion yuan, equivalent to as much as 51 times that of the last-ranked Tibet Autonomous Region (276.49 billion yuan), showing the unevenness of China's regional economic development. The gap between Shanghai (5,392.67 billion yuan), Zhejiang (901,000,000,000,000 yuan) and Guangdong is obvious, but it is still about 1.5 times that of Sichuan (64,697,000,000,000 yuan) and Henan (6,359,000,000,000 yuan). The total GDP of Inner Mongolia Autonomous Region (2,631.46 billion yuan), Gansu Province (1,300.29 billion yuan) and Tibet Autonomous Region (276.49 billion yuan) did not exceed 3 trillion yuan.

3. Analysis of Possible Ways in Which Economic Factors Influence Scoliosis Detection Rates

By analyzing the 2024 GDP data and scoliosis detection rates of nine provinces and cities, Guangdong Province, Zhejiang Province, Sichuan Province, Henan Province, and Shanghai Municipality, which were ranked in the top 10 of the 2024 GDP list of provinces and cities in China, had higher scoliosis detection rates than Anhui Province, Inner Mongolia, which were ranked 11th, 21st, 27th, and 31st in the 2024 GDP list of provinces and cities in China, and Anhui Province and Inner Mongolia, which were ranked 11th, 21st, 27th, and 31st in the 2024 GDP list of provinces and cities. Anhui Province, Inner Mongolia Autonomous Region, Gansu Province, and Tibet Autonomous Region, which ranked 11th, 21st, 27th, and 31st, respectively, in the 2024 national GDP ranking of provinces and municipalities, suggesting that there may be some kind of positive correlation between the level of economic development and scoliosis detection rates.

Socioeconomic factors are major health-related factors, and socioeconomic status (SES) may be considered one of the main reasons for health disparities among different populations. Recently, health literacy (HL) has been proposed as one of the potential links between SES and health. According to Sorensen and colleagues, health literacy is related to literacy and can be defined

as "the ability of people to access, understand, evaluate, and apply health information to make judgments and decisions about health care, disease prevention, and health promotion in their daily lives, in order to maintain or improve the quality of life over the course of the life course." Thus, health literacy appears to be closely related to socioeconomic determinants and health outcomes.

On the one hand, the higher level of education in economically developed regions may result in increased parental attention to student health, but the phenomenon of "educational involution" is particularly pronounced in economically developed regions, where factors such as prolonged sedentary time, increased use of electronic screens, and poor sitting postures may contribute to the higher number of scoliosis cases being detected. The findings of scoliosis have been summarized in the following table. Compared with foreign countries, China's youth and children are under greater pressure to study, and the phenomena of sedentary behavior and lack of exercise are more obvious than in foreign countries.[14] The study of scoliosis in primary and secondary school students in Suzhou City showed that arranging physical education courses three times a week can effectively reduce the incidence of thoracolumbar scoliosis, and shortening the sedentary time can reduce the risk of scoliosis. Zhao Xiufa[15] and others found that sedentary habits directly harm postural health and may trigger the development of scoliosis. Gu Fang [16] et al. found that prolonged close eye contact was also a risk factor for scoliosis, which was consistent with the findings of Sun Yi et al. These two risk factors may lead to changes in the biomechanical structure of the spine and induce scoliosis, which suggests that primary and secondary school students should minimize the frequency of prolonged homework or reading and writing, and develop good study habits.

4. Summary

Based on the 2024 GDP data and 2019-2022 GDP scoliosis screening of primary and secondary schools in nine provinces and cities in China, this study systematically analyzed the possible relationship between the regional economic development level and the scoliosis detection rate of primary and secondary school students. The scoliosis detection rate showed obvious regional differences, with economically developed regions (e.g., 9.2% in Shanghai, 3.73% in Guangdong Province) significantly higher than less developed regions (e.g., 1.17% in Tibet Autonomous Region, 1.91% in Gansu Province), and the present study analyzed that there is indeed an association between the level of economic development and scoliosis detection rate, which not only provides new references to understand epidemiological features of scoliosis, but also provides an opportunity to develop targeted preventive and intervention measures provides a scientific basis. In the future, further attention should be paid to the impact of economic and educational policies on the physical health of primary and secondary school students, to optimize the allocation of healthcare resources, and to improve the screening and diagnosis of scoliosis and other health problems in order to promote the healthy growth of adolescents. However, there are limitations to this study: the sample size was limited and did not include all provinces and cities; biological factors such as genetics could not be controlled; and differences in screening criteria may affect the comparability of results.

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