

# Research on the Intervention Effect of the Recovery Period of Pediatric Bronchopneumonia Based on the “Medical-Education Collaboration” Model

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**Abstract:** *Objective:* To explore the application effect of rehabilitation management strategies based on the “medical-education collaboration” model in the recovery period of pediatric bronchopneumonia, providing evidence-based support for optimizing the management of pediatric respiratory diseases during the recovery period. *Methods:* A total of 100 children aged 3–5 years who were discharged from Zhifu District Maternal and Child Health Hospital in Yantai City between June 2025 and March 2026, were in the recovery period of bronchopneumonia, and were enrolled in cooperative kindergartens were selected as the study subjects. They were randomly divided into a control group (n = 50) and an intervention group (n = 50) using a random number table method. The control group received routine discharge guidance and regular kindergarten care; the intervention group received a 3-month “medical-education collaboration” rehabilitation management model on this basis, including establishing an information-sharing platform, formulating personalized rehabilitation plans (covering medication, diet, environment, exercise, and prevention of re-infection), and forming a “medical-education-family” linkage team. The disappearance time of clinical symptoms, re-infection rate of respiratory diseases, health behavior compliance, and parental satisfaction were compared between the two groups. *Results:* After the intervention, the disappearance times of cough and nasal congestion in the intervention group were shorter than those in the control group, with statistically significant differences ( $p < 0.05$ ). During the 3-month follow-up, the incidence of re-infection with respiratory diseases in the intervention group (14.0%) was significantly lower than that in the control group (34.0%), with a statistically significant difference ( $p < 0.05$ ). The health behavior compliance scores of the intervention group in terms of diet, exercise, and psychology were higher than those of the control group ( $p < 0.05$ ). The parental satisfaction score of the intervention group was significantly higher than that of the control group ( $p < 0.05$ ). *Conclusion:* The rehabilitation management strategy based on the “medical-education collaboration” model can effectively promote the recovery process of children in the recovery period of bronchopneumonia, reduce the risk of re-infection, improve their health behaviors, and enhance parental satisfaction. This model achieves the effective integration of medical resources and educational settings, possessing significant clinical promotion value.

**Keywords:** Medical-education collaboration; Children; Bronchopneumonia; Recovery period; Rehabilitation management

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## 1. Introduction

Bronchopneumonia is the most common lower respiratory tract infectious disease in children, with a high incidence and wide impact, posing a serious threat to children's physical and mental health and growth and development <sup>[1]</sup>. Although acute-phase treatment has become increasingly mature with the advancement of medical technology, the management of children during the recovery period after discharge has become a weak link in current clinical work. Although the main symptoms of children in the recovery period have been alleviated, their immune function has not fully recovered, and the barrier function of the respiratory mucosa is impaired. If not managed properly, they are prone to disease recurrence, secondary infection, and even chronic cough or asthma <sup>[2,3]</sup>.

The "Healthy China 2030" Plan Outline clearly proposes to "strengthen medical-education collaboration" and promote in-depth cooperation between schools and medical institutions in the field of health management <sup>[4]</sup>. Currently, there are gaps in the children's health management chain among "hospitals-families-kindergartens": hospitals lack continuous follow-up on children's rehabilitation after discharge; kindergarten teachers find it difficult to provide precise rehabilitation care due to limited professional knowledge; and parents find it difficult to form unified family care strategies due to information asymmetry <sup>[5,6]</sup>. As a comprehensive intervention method <sup>[5,6]</sup> that combines medical technology with educational resources, the "medical-education collaboration" model has been initially proven to effectively improve the rehabilitation effect of special children (such as those with autism and cerebral palsy) <sup>[7,8]</sup>. However, research on its application in the management of children with common respiratory diseases during the recovery period is still blank.

Based on this, this study, building on the previous project "Research on Rehabilitation Management Strategies for Pediatric Respiratory Diseases Based on the 'Medical-Education Collaboration' Model", focuses on children in the recovery period of bronchopneumonia, explores the construction of a trinity rehabilitation management model with hospitals as the leader, kindergartens as the support, and families as the foundation, and systematically evaluates its effects in improving children's rehabilitation outcomes, reducing the risk of re-infection, enhancing health behaviors, and increasing satisfaction through a randomized controlled trial. The aim is to provide a scientific and operable practical plan for optimizing the management of children's respiratory diseases during the recovery period.

## 2. Subjects and methods

### 2.1. Study subjects

Children aged 3–5 years who were hospitalized in Zhifu District Maternal and Child Health Hospital in Yantai City between June 2025 and March 2026, were clearly diagnosed with bronchopneumonia, and were enrolled in cooperative kindergartens after discharge were selected as the study subjects. This study has been

approved by the Medical Ethics Committee of Zhifu District Maternal and Child Health Hospital in Yantai City (Ethics Number: ZFFYLL-20250001). All parents of the children and teachers in their kindergartens have signed informed consent forms.

### **2.1.1. Inclusion criteria**

- (1) Meet the diagnostic criteria for bronchopneumonia in Zhu Futang's Practical Pediatrics (9th edition) and are in the recovery period, that is, the main clinical symptoms (such as fever and cough) have been significantly alleviated, intravenous antibiotic treatment has been discontinued, but they are still within 1–4 weeks after discharge;
- (2) Aged 3–5 years and enrolled in cooperative kindergartens;
- (3) Parents voluntarily participate in the study and sign informed consent forms;
- (4) Teachers in the kindergartens agree to cooperate with the implementation of the study protocol.

### **2.1.2. Exclusion criteria**

- (1) Those with severe heart, liver, kidney, or other organ dysfunction or congenital diseases;
- (2) Those with immunodeficiency diseases, asthma, or other chronic respiratory diseases;
- (3) Those in the acute exacerbation period of respiratory diseases;
- (4) Those whose parents or kindergarten teachers do not cooperate with the study.

## **2.2. Study methods**

A total of 100 children who met the inclusion criteria were randomly divided into a control group ( $n = 50$ ) and an intervention group ( $n = 50$ ) using a random number table method. There were no statistically significant differences in general data such as gender, age, disease course, and disease severity between the two groups ( $p > 0.05$ ), indicating comparability.

### **2.2.1. Intervention protocol for the control group**

Children in the control group received routine discharge guidance, including informing parents to take medication on time, have a reasonable diet, and avoid going to crowded places. After discharge, the children returned to the kindergarten for regular study and life. The kindergarten teachers did not receive additional special training on the management of children in the recovery period of bronchopneumonia and only provided care according to daily health care norms.

### **2.2.2. Intervention protocol for the intervention group**

On the basis of the control group, a 3-month “medical-education collaboration” rehabilitation management model was implemented for the intervention group, with the following specific contents:

- (1) Construct a medical-education collaboration management platform  
Establish a “medical-education-family” linkage team composed of pediatricians, nurses, kindergarten health care doctors, and class teachers. Use the WeChat platform to establish a “Children's Rehabilitation Management Group” and establish a shared “Health Ledger” based on Tencent Docs to record children's health status, diet, activities, and medication reactions at the kindergarten and at home in real time, achieving seamless information connection among hospitals, kindergartens, and families.

(2) Formulate and implement personalized rehabilitation plans

A multidisciplinary team (pediatricians, dietitians, rehabilitation therapists, teachers) jointly formulated personalized rehabilitation plans for each child and guided their implementation through WeChat groups and offline regular meetings: a. Medication guidance: Clarify the medication plan for children in the recovery period (such as oral medications and nebulization inhalation). Teachers assist in supervising the medication time and method, record adverse reactions, and doctors adjust them in a timely manner. b. Diet management: Guide the kindergarten canteen and families to provide children with easily digestible foods rich in protein and vitamins, such as lean meat, fish, eggs, and fresh vegetables, avoid greasy, cold, and sweet foods, and ensure sufficient water intake. c. Environment management: Guide the kindergarten to keep classrooms ventilated at least twice a day for no less than 30 minutes each time; maintain a room temperature of 22–24°C and a humidity of 50–60%; and regularly disinfect toys, tableware, and bedding. d. Rehabilitation exercise: Formulate a progressive exercise plan according to children’s recovery conditions. In the initial stage, walking and slow-paced rhythmic exercises are the main activities, avoiding strenuous activities; in the later stage, the amount of activity can be appropriately increased. Teachers observe and record the reactions after exercise, such as shortness of breath and aggravated cough, and stop and report immediately if such situations occur. e. Prevention of re-infection: Strengthen hand hygiene education, and teachers guide children to wash their hands correctly in the kindergarten. Formulate and strictly implement the “Home/Hospital Isolation System for Sick Children”, clarifying that children in the acute phase are not allowed to enter the kindergarten, children in the recovery phase need to be evaluated by health care doctors before entering the kindergarten, and establish a system for checking return-to-school certificates.

(3) Regular training and linkage meetings

Pediatricians provide basic medical skill training for teachers and health care doctors in cooperative kindergartens once a month, covering symptom identification of common respiratory diseases, first aid treatment (such as the Heimlich maneuver), and key points of rehabilitation care. At the same time, hold a joint regular meeting attended by doctors, teachers, and parent representatives once a month to review typical cases, sort out problems, and continuously improve the management plan.

## **2.3. Observation indicators**

### **2.3.1. Rehabilitation process indicators**

Record and compare the disappearance times (days) of cough and nasal congestion symptoms in the two groups of children after discharge. Parents record the data, and the research team verifies it through weekly telephone follow-ups.

### **2.3.2. Re-infection incidence**

Record the re-infection of respiratory diseases in the two groups of children within 3 months of follow-up. Re-infection is defined as children again presenting with acute respiratory infection symptoms such as fever, cough, and expectoration and being clearly diagnosed by a doctor.

### **2.3.3. Health behavior compliance**

Use the “Children’s Health Behavior Compliance Questionnaire” self-made by the research group to rate children’s daily performance by parents after the intervention. The questionnaire includes three dimensions of

diet, exercise, and psychology, with a total of 15 items. It adopts a Likert 5-point scoring method (1 = never, 5 = always), with a higher score indicating better health behavior compliance. The Cronbach's  $\alpha$  coefficient of this questionnaire is 0.86.

### 2.3.4. Parental satisfaction

Use the "Parental Satisfaction Questionnaire" self-made by the research group to evaluate the overall rehabilitation management services by parents after the intervention. The questionnaire has a total of 10 items, including satisfaction with information communication, health guidance, and rehabilitation effects. It is scored on a 100-point scale, with a higher score indicating higher satisfaction.

## 2.4. Statistical analysis

Use SPSS 26.0 statistical software for data analysis. Measurement data are expressed as mean  $\pm$  standard deviation ( $\bar{x} \pm s$ ), and independent sample *t*-tests are used for comparison between groups; count data are expressed as number of cases (percentage) [n (%)], and  $\chi^2$  tests are used for comparison between groups. A *p*-value  $< 0.05$  is considered statistically significant.

## 3. Results

### 3.1. Comparison of rehabilitation process indicators between the two groups of children

As shown in **Table 1**, the disappearance times of cough and nasal congestion in the intervention group were shorter than those in the control group, with statistically significant differences ( $p < 0.05$ ).

**Table 1.** Comparison of the disappearance times of clinical symptoms between the two groups of children ( $\bar{x} \pm s, d$ )

Group	Number of cases	Cough resolution time (days)	Nasal congestion resolution time (days)
Control group	50	9.64 $\pm$ 2.31	6.28 $\pm$ 1.92
Intervention group	50	7.12 $\pm$ 2.05	4.56 $\pm$ 1.67
<i>t</i> value		5.827	4.769
<i>p</i> value		$< 0.001$	$< 0.001$

### 3.2. Comparison of re-infection rates between the two groups of children

During the 3-month follow-up, the re-infection rate of respiratory diseases in the intervention group (14.0%) was significantly lower than that in the control group (34.0%), with a statistically significant difference ( $\chi^2 = 5.386, p = 0.020$ ). See **Table 2**.

**Table 2.** Comparison of re-infection of respiratory diseases between the two groups of children [n (%)]

Group	Number of cases (n)	Number of reinfection cases (n)	Incidence rate (%)
Control group	50	17	34.0
Intervention group	50	7	14.0

### 3.3. Comparison of health behavior compliance between the two groups of children

After the intervention, the health behavior compliance scores and total scores of the children in the

intervention group across the three dimensions of diet, exercise, and psychology were all higher than those in the control group, with statistically significant differences ( $p < 0.05$ ). See **Table 3**.

**Table 3.** Comparison of health behavior compliance scores between the two groups of children ( $\bar{x} \pm s$ , points)

Group	Number of cases	Diet dimension	Exercise dimension	Psychological dimension	Total score
Control group	50	18.46 ± 3.21	16.72 ± 3.58	17.94 ± 3.42	53.12 ± 8.91
Intervention group	50	22.58 ± 2.87	21.36 ± 3.14	21.88 ± 2.95	65.82 ± 7.63
<i>t</i> value		6.821	6.903	6.208	7.615
<i>p</i> value		< 0.001	< 0.001	< 0.001	< 0.001

### 3.4. Comparison of parental satisfaction

Between the Two Groups The satisfaction score of parents in the intervention group ( $90.54 \pm 5.21$  points) was significantly higher than that in the control group ( $75.36 \pm 8.43$  points), with a statistically significant difference ( $t = 10.768, p < 0.001$ ).

## 4. Discussion

### 4.1. The “medical-education collaboration” model effectively promotes the recovery process of children and reduces the risk of re-infection

The results of this study indicate that after implementing the “Medical-Education Collaboration” model, the disappearance times of cough and nasal congestion in children in the intervention group were significantly shorter than those in the control group, and the incidence of re-infection during the 3-month follow-up period was significantly reduced. This result suggests that the model effectively fills the gap in traditional post-discharge management by constructing a support network involving hospitals, kindergartens, and families<sup>[9]</sup>. Professional rehabilitation plans provided by hospitals are precisely implemented in kindergartens and families, including personalized dietary adjustments, environmental control, and exercise guidance, creating external conditions conducive to children’s recovery. More importantly, through systematic symptom monitoring and health education, teachers and parents can promptly identify and intervene in potential health risks, effectively blocking the chain of disease recurrence and cross-infection<sup>[10]</sup>.

### 4.2. The “medical-education collaboration” model significantly improves health behavior compliance in children

The cultivation of healthy behaviors in children relies on professional guidance from hospitals and daily reinforcement by educational institutions. In this study, the health behavior compliance of the intervention group in terms of diet, exercise, and psychology was significantly better than that of the control group. The reasons may be that the “Medical-Education Collaboration” model transforms boring health knowledge into interesting activities in kindergarten daily life (such as hand-washing songs and rhythmic exercises) and specific practices at home (such as reasonable meal planning), and helps children internalize healthy behaviors through continuous supervision and positive feedback from both medical and educational parties<sup>[11]</sup>. This is consistent with the behavior intervention concept emphasized in the rehabilitation of special children through “Medical-Education Integration”<sup>[12]</sup>. The improvement in the psychological dimension benefits from the joint attention and active guidance of teachers and parents on children’s emotional states in kindergarten

and home environments, reducing anxiety and fear caused by diseases and promoting simultaneous physical and mental recovery.

### **4.3. The “medical-education collaboration” model enhances parental satisfaction and promotes multi-party collaboration**

The study shows that parental satisfaction in the intervention group was significantly higher than that in the control group. The sources of satisfaction may lie in the following aspects: Firstly, the model breaks the information isolation of parents in children’s rehabilitation management, allowing parents to understand their children’s health status in real-time and obtain professional guidance through WeChat groups and records, enhancing their sense of control and security. Secondly, regular meetings and communication among doctors, teachers, and parents have built an equal and mutually supportive cooperative relationship, making parents feel dual support from medical institutions and kindergartens and alleviating caregiving pressure<sup>[13]</sup>. From a systems theory perspective, this child-centered, tripartite collaborative management model optimizes resource allocation and improves overall service efficiency, with significant social benefits.

### **4.4. Innovativeness and limitations of the study**

The innovativeness of this study lies in the first application of the “Medical-Education Collaboration” model to the management of children with bronchial pneumonia during the recovery period, achieving positive results and providing a new theoretical framework and practical path for the rehabilitation management of common children’s diseases. The study design is rigorous, adopting a randomized controlled trial to ensure the credibility of the results. However, this study also has certain limitations: Firstly, the sample size is small, and only some kindergartens in Zhifu District, Yantai City are selected, which may lead to selection bias; Secondly, the intervention period is only 3 months, and the long-term effects need further observation; Thirdly, health behavior compliance and satisfaction are both subjective evaluation indicators, and objective indicators (such as activity monitoring and humoral immune indicators) can be considered for comprehensive evaluation in the future.

## **5. Conclusion**

The rehabilitation management strategy based on the “Medical-Education Collaboration” model can effectively promote the recovery process of children with bronchial pneumonia during the recovery period, shorten the duration of clinical symptoms, reduce the risk of re-infection, improve children’s health behavior compliance, and significantly enhance parental satisfaction. This model fully integrates medical and educational resources and constructs a continuous care system involving hospitals, kindergartens, and families, which is of great significance for improving the full-cycle health management of children’s respiratory diseases and is worthy of wider promotion and application.

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## Disclosure statement

The authors declare no conflict of interest.

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